

2017 TRANSMISSION**Transfer Case - MP 3713G - CT6****SPECIFICATIONS****APPROXIMATE FLUID CAPACITIES**

Application	Specification	
	Metric	English
Transfer Case - MP 3713G		
Transfer Case Fluid	0.8 liters	0.85 quarts

FASTENER SPECIFICATIONS**Single Use Non-Threaded Fasteners/Components**

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
Application
Transfer Case Four Wheel Drive Actuator O-Ring Seal
Transfer Case Front Output Shaft Seal
Transfer Case Input Shaft Seal
Transfer Case Rear Output Shaft Flange
Transfer Case Rear Output Shaft Flange Retaining Ring
Transfer Case Rear Output Shaft Oil Slinger
Transfer Case Rear Output Shaft Seal

Reusable Threaded Fastener Tightening Specifications

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Transfer Case Four Wheel Drive Actuator Bolt	13 N.m (115 lb in)
Transfer Case Drain Plug	25 N.m (18 lb ft)
Transfer Case Fill Plug	25 N.m (18 lb ft)
Transfer Case Fluid Temperature Sensor	16 N.m (12 lb ft)
Transfer Case @ Transfer Case Adapter Bolt	58 N.m (43 lb ft)

ADHESIVES, FLUIDS, LUBRICANTS AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Transfer Case	Transfer Case Fluid	19331044	19331045
Transfer Case Oil Drain Plug	Sealant	12346004	10953480
Transfer Case Oil Fill Plug	Sealant	12346004	10953480
Transfer Case Front Case Half Stud	Threadlocker	19332211	10953488

TRANSFER CASE INPUT SHAFT WASHER SPECIFICATIONS

Application	Specification

Application	Metric (mm) Specification English (in)	
Transfer Case Rear Flange Input Shaft Washer	Metric (mm)	English (in)
	2.40	0.094
	2.50	0.098
	2.60	0.102
	2.70	0.106
	2.80	0.110
	2.90	0.114
	3.00	0.118
	3.10	0.122
	3.20	0.126
	3.30	0.130
	3.40	0.134
	3.50	0.138
	3.60	0.142

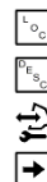
TEMPERATURE VERSUS RESISTANCE - TRANSFER CASE TEMPERATURE SENSOR

Temperature	Resistance
180Â°C (356Â°F)	80.7 to 86.9 Ω
170Â°C (338Â°F)	97.2 to 104.3 Ω
160Â°C (320Â°F)	118.2 to 126.3 Ω
150Â°C (302Â°F)	144.8 to 154.1 Ω
140Â°C (284Â°F)	179.0 to 189.8 Ω
130Â°C (266Â°F)	223.5 to 235.9 Ω
120Â°C (248Â°F)	281.9 to 296.2 Ω
110Â°C (230Â°F)	359.5 to 376.0 Ω
100Â°C (212Â°F)	463.8 to 482.8 Ω
90Â°C (194Â°F)	602.8 to 630.7 Ω
80Â°C (176Â°F)	793.8 to 835.1 Ω
70Â°C (158Â°F)	1.0 Ω to 1.1 k Ω
60Â°C (140Â°F)	1.4 Ω to 1.5 k Ω
50Â°C (122Â°F)	1.9 Ω to 2.1 k Ω
40Â°C (104Â°F)	2.8 Ω to 3.0 k Ω
30Â°C (86Â°F)	4.0 Ω to 4.3 k Ω
20Â°C (68Â°F)	5.8 Ω to 6.4 k Ω
10Â°C (50Â°F)	8.6 Ω to 9.6 k Ω
0Â°C (32Â°F)	13.2 Ω to 14.7 k Ω
-10Â°C (14Â°F)	20.7 k to 23.4 k Ω
-20Â°C (-4Â°F)	33.5 k to 38.2 k Ω
-30Â°C (-22Â°F)	55.9 k to 64.5 k Ω
-40Â°C (-40Â°F)	96.6 k to 113.0 k Ω

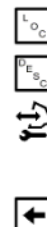
SCHEMATIC WIRING DIAGRAMS

TRANSFER CASE CONTROL WIRING SCHEMATICS

Power, Ground and Serial Data

[illegible]

Fluid Temperature Sensor



Motor and Fluid Temperature Sensor
EL MOTORS COMPANY

LOCATOR

SASSEMBLED VIEW

LOCATOR

SASSEMBLED VIEW

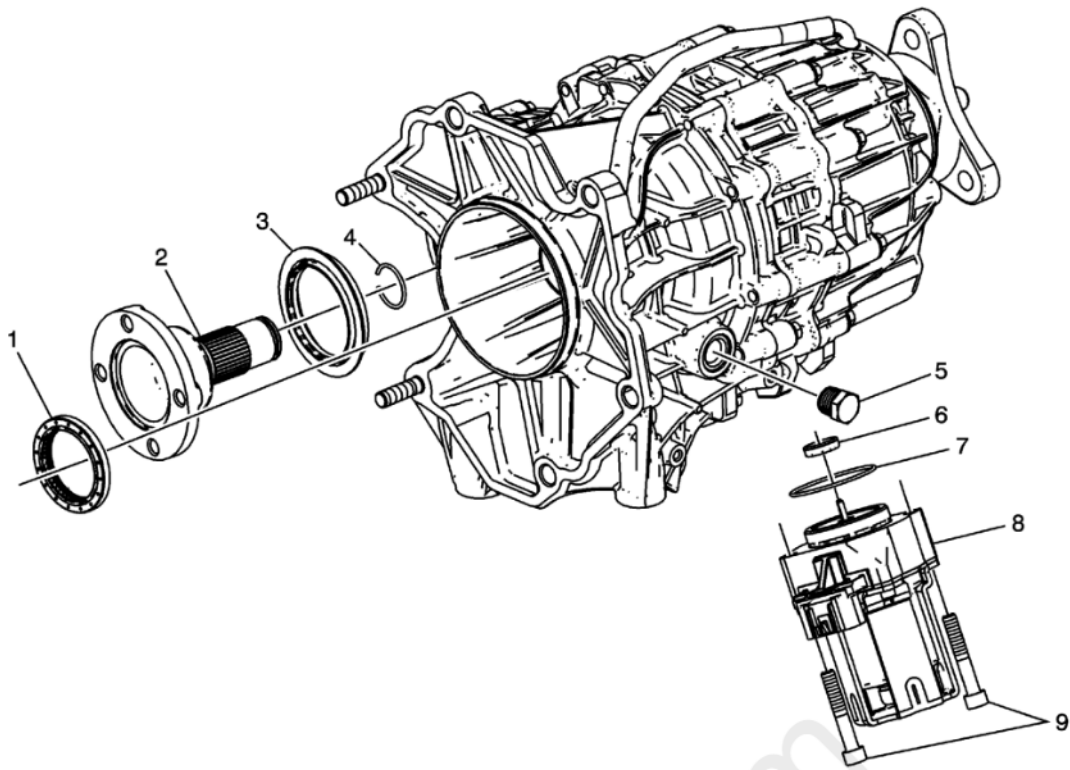


Fig. 3: Transfer Case Front

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Input Shaft Seal
2	Transfer Case Front Output Shaft Flange
3	Transfer Case Rear Output Shaft Oil Slinger
4	Transfer Case Front Output Shaft Flange Retaining Ring
5	Transfer Case Fill Plug
6	Transfer Case Four Wheel Drive Actuator Seal
7	Transfer Case Four Wheel Drive Actuator O-Ring Seal
8	Transfer Case Four Wheel Drive Actuator
9	Transfer Case Four Wheel Drive Actuator Bolt [2x]

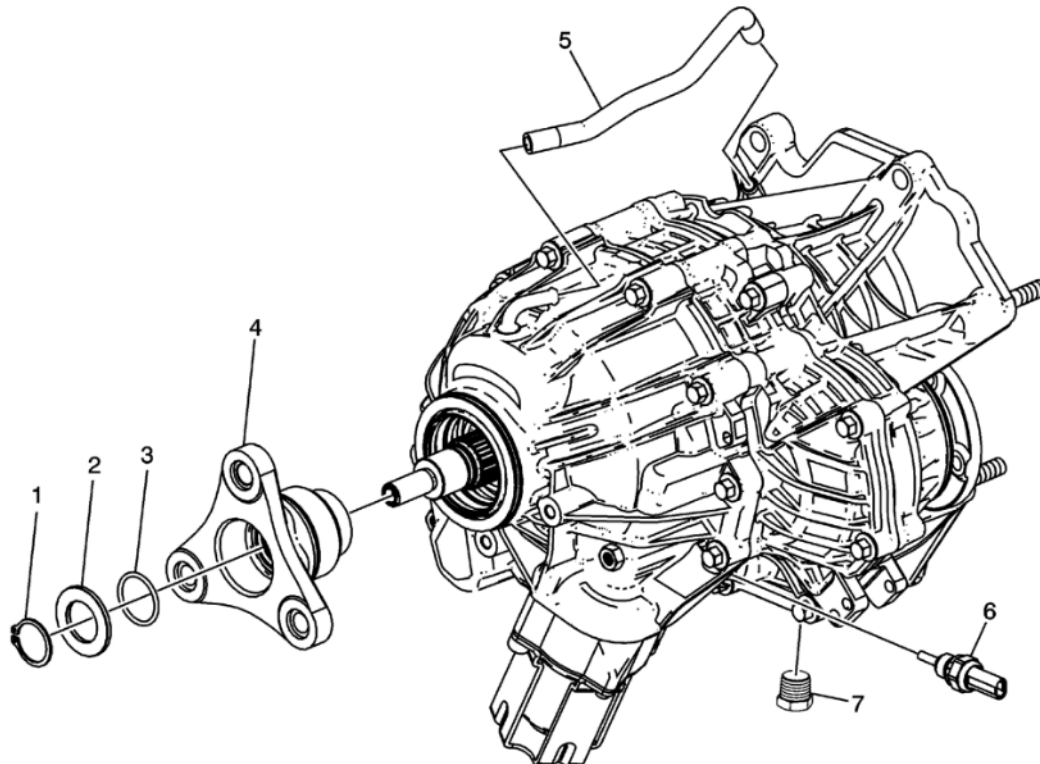


Fig. 4: Transfer Case Rear

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transfer Case Rear Output Shaft Flange Retaining Ring
2	Transfer Case Rear Output Shaft Flange Washer
3	Transfer Case Rear Output Shaft Flange O-Ring
4	Transfer Case Rear Output Shaft Flange
5	Transfer Case Vent Hose
6	Transfer Case Fluid Temperature Sensor
7	Transfer Case Drain Plug

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC C0306: RANGE ACTUATOR CONTROL CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0306

Range Actuator Control Circuit

- Symptom Byte: 01-Short to Battery
- Symptom Byte: 02-Short to Ground
- Symptom Byte: 04-Open
- Symptom Byte: 54-High Temperature
- Symptom Byte: F0-Shorted

Diagnostic Fault Information

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

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control-Terminal 1	C0306 02, C0306 F0	C0306 04	C0306 01	C0306 F0
Control-Terminal 18	C0306 02, C0306 F0	C0306 04	C0306 01	C0306 F0

Circuit/System Description

For an overview of the component/system, refer to [Transfer Case Description and Operation](#)

Circuit	Description
Control-Terminal 1	The output circuit is switched from ground to 12 V to activate the component.
Control-Terminal 18	The output circuit is switched from ground to 12 V to activate the component.

Component	Description
A16 Transfer Case Motor	The motor is bidirectional.
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

C0306 01, C0306 02, C0306 04

- DTC C038D = Not set
- System Voltage = 9 to 17.5 V
- M64 Starter Motor = Not Activated
- Range Actuator Position Sensor = Steady State/Not Moving

Frequency the DTC runs = Continuously - After the running conditions are met - For greater than 1 s

C0306 54

- System Voltage = 9 to 17.5 V
- Engine = Running

Frequency the DTC runs = Continuously - After the running conditions are met - For greater than 1 s

C0306 F0

- System Voltage = 9 to 17.5 V
- Range Actuator Position Sensor = Active

Frequency the DTC runs = Continuously - After the running conditions are met - For greater than 1 s

Conditions for Setting the DTC

C0306 01

Transfer Case Motor Clockwise Control or Transfer Case Motor Counter Clockwise Control = Greater than 5.6 V

C0306 02

Transfer Case Motor Clockwise Control or Transfer Case Motor Counter Clockwise Control = Less than 0.2 V

C0306 04

Transfer Case Motor Clockwise Control = 3.8 to 4.3 V or Transfer Case Motor Counter Clockwise Control = 1.1 to 1.5 V

C0306 54

Calculated System Temperature-K69 Transfer Case Control Module=Warmer than a predefined threshold

C0306 F0

Transfer Case Motor Clockwise Control & Transfer Case Motor Counter Clockwise Control=Shorted or Transfer Case Motor Clockwise Control & Transfer Case Motor Counter Clockwise Control - Current=Greater than 50 A

Actions Taken When the DTC Sets

- All Wheel Drive=Disabled
- Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC C0306, C0381 is not set.
 - **If the DTC is set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **If the DTC is not set**

4. All OK.

Circuit/System Testing

1. Ignition/Vehicle $\hat{A}$ Off
2. Disconnect the electrical connector: A16 Transfer Case Motor
3. Connect a test lamp between the test points: Control circuit terminal A & Control circuit terminal D
4. Ignition $\hat{A}$ On / Vehicle $\hat{A}$ In Service Mode
5. Perform the scan tool control function: Range Actuator

Verify the test lamp state:

Range Actuator $\hat{A}$ Idle=Test lamp Off

Range Actuator $\hat{A}$ Clockwise=Test lamp On

Range Actuator $\hat{A}$ Counterclockwise=Test lamp On

- **If not the specified state**

1. Ignition/Vehicle $\hat{A}$ Off & Remove $\hat{A}$ Test lamp
2. Disconnect the electrical connector: K69 Transfer Case Control Module
3. Ignition $\hat{A}$ On / Vehicle $\hat{A}$ In Service Mode
4. Test for less than 1 V between the test points:
 - Control circuit terminal A @ Component harness & Ground
 - Control circuit terminal D @ Component harness & Ground
 - If 1 V or greater $\hat{A}$ Repair the short to voltage on the circuit.
 - If less than 1 V
5. Ignition/Vehicle $\hat{A}$ Off
6. Test for infinite resistance between the test points:
 - Control circuit terminal A @ Component harness & Ground
 - Control circuit terminal D @ Component harness & Ground
 - If less than infinite resistance $\hat{A}$ Repair the short to ground on the circuit.
 - If infinite resistance
7. Test for less than 2 Ω between the test points:
 - Control circuit terminal A @ Component harness & Terminal 18 @ Control module harness
 - Control circuit terminal D @ Component harness & Terminal 1 @ Control module harness
 - If 2 Ω or greater $\hat{A}$ Repair the open/high resistance in the circuit.
 - If less than 2 Ω $\hat{A}$ Replace the component: K69 Transfer Case Control Module

- **If the specified state**

6. Test or replace the component: A16 Transfer Case Motor

Component Testing

Static Test

1. Ignition/Vehicle $\hat{A}$ Off
2. Disconnect the electrical connector: A16 Transfer Case Motor
3. Test for 0.2 to 0.6 Ω between the test points: Control terminal A & Control terminal D
 - **If not between 0.2 and 0.6 Ω**

Replace the component: A16 Transfer Case Motor
 - **If between 0.2 and 0.6 Ω**
4. Test for infinite resistance between the test points: Each terminal of the component & The component's housing
 - **If less than infinite resistance**

Replace the component: A16 Transfer Case Motor

- **If infinite resistance**

5. All OK.

Dynamic Test

1. Ignition/Vehicle $\hat{\text{A}}$ Off
2. Remove the component: A16 Transfer Case Motor
3. Connect a 30 A fused jumper wire between the test points: Control terminal A & 12 V
4. Momentarily connect a jumper wire between the test points: Control terminal D & Ground

CAUTION: Complete the testing as quickly as possible in order to prevent overheating and damaging the component.

Reverse the jumper wires 2 times between the terminals.

Verify the component works as specified: A16 Transfer Case Motor = Clockwise/Counterclockwise

- **If not the specified state**

Replace the component: A16 Transfer Case Motor

- **If not the specified state**

5. All OK.

Repair Instructions

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

- [Transfer Case Four Wheel Drive Actuator Replacement](#) & A16 Transfer Case Motor
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC C0381: RANGE ACTUATOR SYSTEM PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0381

Range Actuator System Performance

Circuit/System Description

For an overview of the component/system, refer to: [Electronic Component Description](#)

Conditions for Running the DTC

- M64 Starter Motor=Inactive
- System Voltage= 9 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

Calculated System Temperature - A16 Transfer Case Motor=Greater than 137 $\hat{\text{A}}$ °C (278 $\hat{\text{A}}$ °F)

Actions Taken When the DTC Sets

- All Wheel Drive=Disabled
- Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition Â» On / Vehicle Â» In Service Mode
2. Verify DTC C0381 is not set.
 - **If the DTC is set**
Refer to:**DTC C0306**
 - **If the DTC is not set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to:**DTC C0306**

- **If the DTC is not set**

4. All OK.

Repair Instructions

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

For control module replacement, programming and setup, refer to **Control Module References**

DTC C038D OR C1202: RANGE ACTUATOR POSITION

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C038D

Range Actuator Position Not Learned

DTC C1202

Range Actuator Position Calibration Not Learned

Circuit/System Description

For an overview of the component/system, refer to [Transfer Case Description and Operation](#)

Conditions for Running the DTC

System Voltage=6 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

Range Actuator Position=Not Learned

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition $\hat{A}$ » On / Vehicle $\hat{A}$ » In Service Mode
2. Verify DTC C038D, C1202 is not set.
 - If the DTC is set

Refer to [Range Actuator Learn](#)

- If the DTC is not set
3. All OK.

Repair Instructions

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

For control module replacement, programming and setup, refer to [Control Module References](#)

DTC C0390: RANGE ACTUATOR TEMPERATURE SENSOR CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0390

Range Actuator Temperature Sensor Circuit

Symptom Byte Information: [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	C0390 03	C0390 03	C0390 07	-
Signal	C0390 03	C0390 03	C0390 07	-

Typical Scan Tool Data

Range Actuator Temperature Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On			
Parameter Normal Range: 0.50 to 4.50 V			
5 V Reference	0.0 V	0.0 V	0.96 V
Signal	0.0 V	0.0 V	2.14 V

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to ground.

Component	Description
A16 Transfer Case Motor	The motor is bidirectional.

Component	Description
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

- DTC P0698, P0699 = Not set
- Engine=Running-For greater than 1.5 s
- M64 Starter Motor=Inactive
- System Voltage=9 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

C0390 03

Range Actuator Temperature=Less than 0.04 V

C0390 07

Range Actuator Temperature=Greater than 4.55 V

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC C0390 03, C0390 07, P0698, P0699 is not set.
 - If the DTC is set

Refer to: Circuit/System Testing

- **If the DTC is not set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **If the DTC is not set**

4. All OK.

Circuit/System Testing

1. Ignition/Vehicle $\hat{A}$ » Off
2. Disconnect the electrical connector: A16 Transfer Case Motor
3. Ignition $\hat{A}$ » On / Vehicle $\hat{A}$ » In Service Mode
4. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal B & Ground
 - **If less than 4.8 V**
 1. Ignition/Vehicle $\hat{A}$ » Off
 2. Disconnect the electrical connector: X2 @ K69 Transfer Case Control Module
 3. Test for infinite resistance between the test points: 5 V Reference circuit terminal B @ Component harness & Ground
 - If less than infinite resistance $\hat{A}$ » Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω between the test points: 5 V Reference circuit terminal B @ Component harness & Terminal 15 @ Control module harness
 - If 2 Ω or greater $\hat{A}$ » Repair the open/high resistance in the circuit.
 - If less than 2 Ω $\hat{A}$ » Replace the component: K69 Transfer Case Control Module
 - **If greater than 5.2 V**
 1. Ignition/Vehicle $\hat{A}$ » Off
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Ignition $\hat{A}$ » On / Vehicle $\hat{A}$ » In Service Mode
 4. Test for less than 1 V between the test points: 5 V Reference circuit terminal B @ Component harness & Ground
 - If 1 V or greater $\hat{A}$ » Repair the short to voltage on the circuit.
 - If less than 1 V $\hat{A}$ » Replace the component: K69 Transfer Case Control Module
 - **If between 4.8 and 5.2 V**
5. Verify the scan tool parameter: Range Actuator Temperature= 0.0 V
 - **If greater than 0.0 V**
 1. Ignition/Vehicle $\hat{A}$ » Off
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Ignition $\hat{A}$ » On / Vehicle $\hat{A}$ » In Service Mode
 4. Test for less than 1 V between the test points: Signal circuit terminal C @ Component harness & Ground
 - If 1 V or greater $\hat{A}$ » Repair the short to voltage on the circuit.
 - If less than 1 V $\hat{A}$ » Replace the component: K69 Transfer Case Control Module
 - **If 0.0 V**
6. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal C & 5 V Reference circuit terminal B
7. Verify the scan tool parameter: Range Actuator Temperature= 4.8 to 5.2 V
 - **If less than 4.8 V**
 1. Ignition/Vehicle $\hat{A}$ » Off & Remove $\hat{A}$ » Jumper wire(s)

2. Disconnect the electrical connector:K69 Transfer Case Control Module
3. Test for infinite resistance between the test points:Signal circuit terminal C @ Component harness & Ground
 - If less than infinite resistance» Repair the short to ground on the circuit.
 - If infinite resistance
4. Test for less than 2 Ω between the test points: Signal circuit terminal C @ Component harness & Terminal 14 @ Control module harness
 - If 2 Ω or greater» Repair the open/high resistance in the circuit.
 - If less than 2 Ω » Replace the component:K69 Transfer Case Control Module
- **If between 4.8 and 5.2 V**
8. Test or replace the component:A16 Transfer Case Motor

Component Testing

1. Ignition/Vehicle » Off
2. Disconnect the electrical connector:A16 Transfer Case Motor
3. Test for 50 to 150000 Ω between the test points: Signal terminal C & 5 V Reference terminal B
 - **If not between 50 and 150, 000 Ω**

Replace the component:A16 Transfer Case Motor
 - **If between 50 and 150, 000 Ω**
4. Verify the value is within the range listed in the table:[Temperature Versus Resistance - Transfer Case Temperature Sensor](#)
 - **If not in the specified range**

Replace the component:A16 Transfer Case Motor
 - **If in the specified range**
5. Test for infinite resistance between the test points:Each terminal of the component & The component's housing
 - **If less than infinite resistance**

Replace the component:A16 Transfer Case Motor
 - **If infinite resistance**
6. All OK.

Repair Instructions

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

- [Transfer Case Four Wheel Drive Actuator Replacement](#) - A16 Transfer Case Motor
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC C0396 OR C039E: RANGE ACTUATOR POSITION SENSOR CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0396

Range Actuator Position Sensor Circuit

DTC C039E**Range Actuator Position Sensor Direction Signal Circuit****Symptom Byte Information:** [Symptom Byte List](#)**Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0652	P0651	P0653	-
Signal-Range Actuator Position Sensor Direction Signal	C039E 03	C039E 07	C039E 07	-
Signal-Range Actuator Position Sensor	C039E 03	C0396 07	C0396 07	-
Low Reference	-	C0396 07, C039E 07	*	-

*Internal control module or component damage may occur if the circuit shorts to B+.

Typical Scan Tool Data**Range Actuator Position Sensor Direction Signal**

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 0.5 to 4.5 V			
5 V Reference	1.63 V	3.88 V	5.00 V
Signal	0.00 V	4.53 V	5.00 V
Low Reference	-	4.55 V	-

Range Actuator Position Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 0.5 to 4.5 V			
5 V Reference	5.00 V	3.88 V	0.94 V
Signal	0.00 V	4.53 V	5.00 V
Low Reference	-	4.55 V	-

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5 V.
Low Reference	Grounded through the control module.

Component	Description
A16 Transfer Case Motor	The motor is bidirectional.
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

- DTC P0651, P0652, P0653 = Not set
- System Voltage = 6 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

C0396 03

Range Actuator Position Sensor=Less than.1 V

C0396 07

Range Actuator Position Sensor=Greater than 4.4 V

C039E 03

Range Actuator Position Sensor Direction Signal=Less than.1 V

C039E 07

Range Actuator Position Sensor Direction Signal=Greater than 4.4 V

Actions Taken When the DTC Sets

- All Wheel Drive=Disabled
- Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

The control module uses default replacement values.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. IgnitionÂ» On / VehicleÂ» In Service Mode
2. Verify DTC C0396, C039E, P0651, P0652, P0653 is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing

- **If the DTC is not set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **If the DTC is not set**

4. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems Off

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

2. Disconnect the electrical connector: A16 Transfer Case Motor

3. Test for less than 10 Ω between the test points: Low Reference circuit terminal H & Ground

- **If 10 Ω or greater**

1. Disconnect the electrical connector: K69 Transfer Case Control Module

2. Test for less than 2 Ω between the test points: Low Reference circuit terminal H @ Component harness & Terminal 3 @ Control module harness

- If 2 Ω or greater Repair the open/high resistance in the circuit.
- If less than 2 Ω Replace the component: K69 Transfer Case Control Module

- **If less than 10 Ω**

4. Ignition On / Vehicle In Service Mode

5. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal G & Low Reference circuit terminal H

- **If less than 4.8 V**

1. Ignition/Vehicle Off

2. Disconnect the electrical connector: K69 Transfer Case Control Module

3. Test for infinite resistance between the test points: 5 V Reference circuit terminal G @ Component harness & Ground

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

4. Test for less than 2 Ω between the test points: 5 V Reference circuit terminal G @ Component harness & Terminal 17 @ Control module harness

- If 2 Ω or greater Repair the open/high resistance in the circuit.
- If less than 2 Ω Replace the component: K69 Transfer Case Control Module

- **If greater than 2 V**

5. Ignition/Vehicle Off

6. Disconnect the electrical connector: K69 Transfer Case Control Module

7. Ignition On / Vehicle In Service Mode

8. Test for less than 1 V between the test points: 5 V Reference circuit terminal G @ Component harness & Ground

- If 1 V or greater Repair the short to voltage on the circuit.
- If less than 1 V Replace the component: K69 Transfer Case Control Module

- **If between 4.8 and 5.2 V**

6. Verify the scan tool parameter: Range Actuator Position Sensor=Greater than 4 V

- **If less than 4 V**

1. Ignition/Vehicle Off

2. Disconnect the electrical connector: K69 Transfer Case Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal E @ Component harness & Ground
 - If less than infinite resistance » Repair the short to ground on the circuit.
 - If infinite resistance » Replace the component: K69 Transfer Case Control Module
- **If greater than 4 V**
7. Verify the scan tool parameter: Range Actuator Position Sensor Direction Signal = Greater than 4 V
 - **If less than 4 V**
 1. Ignition/Vehicle » Off
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Test for infinite resistance between the test points: Signal circuit terminal F @ Component harness & Ground
 - If less than infinite resistance » Repair the short to ground on the circuit.
 - If infinite resistance » Replace the component: K69 Transfer Case Control Module
 - **If greater than 4 V**
8. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal E & Low Reference circuit terminal H
9. Verify the scan tool parameter: Range Actuator Position Sensor = 4.8 to 5.2 V
 - **If greater than 5.2 V**
 1. Ignition/Vehicle » Off & Remove » Jumper wire(s)
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Ignition » On / Vehicle » In Service Mode
 4. Test for less than 1 V between the test points: Signal circuit terminal E @ Component harness & Ground
 - If 1 V or greater » Repair the short to voltage on the circuit.
 - If less than 1 V
 5. Ignition/Vehicle » Off
 6. Test for less than 2 Ω between the test points: Signal circuit terminal E @ Component harness & Terminal 6 @ Control module harness
 - If 2 Ω or greater » Repair the open/high resistance in the circuit.
 - If less than 2 Ω » Replace the component: K69 Transfer Case Control Module
 - **If less than 4.8 V**
10. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal F & Low Reference circuit terminal H
11. Verify the scan tool parameter: Range Actuator Position Sensor Direction Signal = 4.8 to 5.2 V
 - **If greater than 5.2 V**
 1. Ignition/Vehicle » Off & Remove » Jumper wire(s)
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Ignition » On / Vehicle » In Service Mode
 4. Test for less than 1 V between the test points: Signal circuit terminal F @ Component harness & Ground
 - If 1 V or greater » Repair the short to voltage on the circuit.
 - If less than 1 V
 5. Ignition/Vehicle » Off
 6. Test for less than 2 Ω between the test points: Signal circuit terminal F @ Component harness & Terminal 2 @ Control module harness
 - If 2 Ω or greater » Repair the open/high resistance in the circuit.
 - If less than 2 Ω » Replace the component: K69 Transfer Case Control Module
 - **If between 4.8 and 5.2 V**
12. Test or replace the component: A16 Transfer Case Motor

Repair Instructions

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

- [Transfer Case Four Wheel Drive Actuator Replacement](#) - A16 Transfer Case Motor
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC C0397: TRANSFER CASE CLUTCH

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0397

Transfer Case Clutch

- Symptom Byte: 4B-Calibration Not Learned
- Symptom Byte: 54-High Temperature
- Symptom Byte: 58-Performance
- Symptom Byte: F3-Excessive Clearance
- Symptom Byte: F4-Maximum Travel Exceeded

Circuit/System Description

The transfer case control module monitors the wheel speed sensors for slip. If the transfer case control module detects slip and is unable to correct for a difference between the front and rear speed sensors, it will command the transfer case to apply the clutch (engage front axle). In addition, the transfer case control module tests for clutch pack wear by performing a high side kiss point check at power down and comparing it to the transfer case range actuator position sensor reading.

Conditions for Running the DTC

C0397 4B

- DTC C0306, C0396, C039E, P0651, P0652, P0653 = Not set
- Ignition=On
- M64 Starter Motor=Inactive
- System Voltage= 9 to 17.5 V

Frequency the DTC runs=Once-During control module power down

C0397 54

System Voltage=9 to 17.5 V

Frequency the DTC runs=Continuously-After the running conditions are met

C0397 58

All Wheel Drive=Active

Frequency the DTC runs=Continuously-After the running conditions are met

C0397 F3

System Voltage=9 to 17.5 V

Frequency the DTC runs=Once-During control module power down

C0397 F4

- DTC C0396, C039E, P0651, P0652, P0653 = Not set

- System Voltage=6 to 17.5 V

Frequency the DTC runs=Continuously - After the running conditions are met

Conditions for Setting the DTC

C0397 4B

Calibration/Software=Not Learned-20 times

C0397 54

Calculated Clutch Temperature=Greater than a predefined threshold

C0397 58

Range Actuator Position/Range Actuator Direction=Commanded state does not match the actual state

C0397 F3

Transfer Case Clutch=Worn

C0397 F4

Range Actuator Position=Maximum Travel Exceeded

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

C0397 4B, C0397 54 C0397 F3, C0397 F4

All Wheel Drive=Disabled

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC C0397 4B is not set.

- **If DTC C0397 4B is set**

Program the ECM - Refer to [Transfer Case Control Module Programming and Setup](#)

- **If the DTC is not set**

3. Verify no DTCs are set in the following control module (Ignore DTC C0397):

- K17 Electronic Brake Control Module
- K69 Transfer Case Control Module
- *If other DTCs are set*

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

- *If no other DTCs are set, refer to:*

4. Verify DTC C0397 is not set.

- *If the DTC is set*

Refer to: [No Correction for Slip in All-Wheel Drive Mode](#)

- *If the DTC is not set*

5. Clear DTCs

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

Verify DTC C0397 is not set.

- *If the DTC is set*

Refer to: [No Correction for Slip in All-Wheel Drive Mode](#)

- *If the DTC is set*

7. All OK.

DTC C0401: TRANSFER CASE FLUID TEMPERATURE SENSOR CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0401

Transfer Case Fluid Temperature Sensor Circuit

Symptom Byte Information: [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	C0401 03	C0401 03	C0401 07	-
Signal	C0401 03	C0401 03	C0401 07	-

Typical Scan Tool Data

Transfer Case Fluid Temperature Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 0.5 to 4.5 V			
5 V Reference	0.0 V	0.0 V	0.0 V
Signal	0.0 V	0.0 V	0.0 V

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal>	The control module input circuit has an internal resistance connected to ground.

Component	Description<
B109 Transfer Case Fluid Temperature Sensor	The temperature sensor is a negative temperature coefficient thermistor, a resistor which changes based on temperature. • Low temperature produces a high resistance: 61 kΩ @ -30Â°C (-22Â°F) • High temperature produces a low resistance: 100 Ω @ 170Â°C (338Â°F)
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

- DTC P0642, P0643 = Not set
- Ignition=On - For greater than 1.5 s
- M64 Starter Motor=Inactive
- System Voltage= 9 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

C0401 03

Transfer Case Fluid Temperature Sensor Reference = Less than 0.04 V

C0401 07

Transfer Case Fluid Temperature Sensor Reference = Greater than 4.48 V

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

[Transfer Case Control Schematics](#)

Connector End View Reference

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. IgnitionÂ» On / VehicleÂ» In Service Mode
2. Verify DTC C0401 03, C0401 07, P0642, P0643 is not set.
 - **If the DTC is set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to: Circuit/System Testing
 - **If the DTC is not set**
4. All OK.

Circuit/System Testing

1. Ignition/Vehicle Â» Off
2. Disconnect the electrical connector: B109 Transfer Case Fluid Temperature Sensor
3. IgnitionÂ» On / VehicleÂ» In Service Mode
4. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal 1 & Ground
 - **If less than 4.8 V**
 1. Ignition/Vehicle Â» Off
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Test for infinite resistance between the test points: 5 V Reference circuit terminal 1 @ Component harness & Ground
 - If less than infinite resistanceÂ» Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω between the test points: 5 V Reference circuit terminal 1 @ Component harness & Terminal 16 @ Control module harness
 - If 2 Ω or greaterÂ» Repair the open/high resistance in the circuit.
 - If less than 2 Ω Â» Replace the component: K69 Transfer Case Control Module
 - **If greater than 5.2 V**

1. Ignition/Vehicle » Off
2. Disconnect the electrical connector: K69 Transfer Case Control Module
3. Ignition » On / Vehicle » In Service Mode
4. Test for less than 1 V between the test points: 5 V Reference circuit terminal 1 @ Component harness & Ground
 - If 1 V or greater » Repair the short to voltage on the circuit.
 - If less than 1 V » Replace the component: K69 Transfer Case Control Module
- **If between 4.8 and 5.2 V**
5. Verify the scan tool parameter: Transfer Case Fluid Temperature Sensor = 0.0 V
 - **If greater than 0 V**
 1. Ignition/Vehicle » Off
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Ignition » On / Vehicle » In Service Mode
 4. Test for less than 1 V between the test points: Signal circuit terminal 10 @ Component harness & Ground
 - If 1 V or greater » Repair the short to voltage on the circuit.
 - If less than 1 V » Replace the component: K69 Transfer Case Control Module
 - **If 0 V**
6. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal 2 & 5 V Reference circuit terminal 1
7. Verify the scan tool parameter: Transfer Case Fluid Temperature Sensor = 4.8 to 5.2 V
 - **If less than 4.8 V**
 1. Ignition/Vehicle » Off & Remove » Jumper wire(s)
 2. Disconnect the electrical connector: K69 Transfer Case Control Module
 3. Test for infinite resistance between the test points: Signal circuit terminal 2 @ Component harness & Ground
 - If less than infinite resistance » Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω between the test points: Signal circuit terminal 2 @ Component harness & Terminal 10 @ Control module harness
 - If 2 Ω or greater » Repair the open/high resistance in the circuit.
 - If less than 2 Ω » Replace the component: K69 Transfer Case Control Module
 - **If between 4.8 and 5.2 V**
8. Test or replace the component: B109 Transfer Case Fluid Temperature Sensor

Component Testing

1. Ignition/Vehicle » Off
2. Disconnect the electrical connector: B109 Transfer Case Fluid Temperature Sensor
3. Test for 50 to 150000 Ω between the test points: Signal terminal 2 & 5 V Reference terminal 1
 - **If not between 50 to 150000 Ω**
Replace the component: B109 Transfer Case Fluid Temperature Sensor
 - **If between 50 to 150000 Ω**
4. Verify the value is within the range listed in the table: **Temperature Versus Resistance - Transfer Case Temperature Sensor**
 - **If not in the specified range**
Replace the component: B109 Transfer Case Fluid Temperature Sensor
 - **If in the specified range**
5. Test for infinite resistance between the test points: Each terminal of the component & The component's housing

- **If less than infinite resistance**

Replace the component: B109 Transfer Case Fluid Temperature Sensor

- **If infinite resistance**

6. All OK.

Repair Instructions

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

- [Transfer Case Fluid Temperature Sensor Replacement](#) - B109 Transfer Case Fluid Temperature Sensor
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P0602 OR P064F: CONTROL MODULE NOT PROGRAMMED/UNAUTHORIZED CALIBRATION DETECTED

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0602

Control Module Not Programmed

DTC P064F

Unauthorized Calibration Detected

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Conditions for Running the DTC

Ignition=On

Conditions for Setting the DTC

K69 Transfer Case Control Module=Not Programmed/Calibration Not Programmed/Unauthorized Calibration Detected

Actions Taken When the DTC Sets

K69 Transfer Case Control Module=Disabled

Driver Information Center Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

[Transfer Case Control Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

- [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](#)

[Circuit/System Verification](#)

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC P0602, P064F is not set.
 - **If the DTC is set**
 1. Perform all necessary programming and setup procedures for the control module:K69 Transfer Case Control Module
 2. Verify the DTC does not set.
 - If the DTC sets» Replace the component:K69 Transfer Case Control Module
 - If the DTC is not set
 3. All OK.
 - **If the DTC is not set**
3. All OK.

[Repair Instructions](#)

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

For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P0642 OR P0643: 5V REFERENCE 1 CIRCUIT

[Diagnostic Instructions](#)

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

[DTC Descriptor](#)

DTC P0642

5V Reference 1 Circuit Low Voltage

DTC P0643

5V Reference 1 Circuit High Voltage

[Diagnostic Fault Information](#)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0642	-	P0643	-

[Typical Scan Tool Data](#)

Sensor Reference Voltage 1

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 5.00 V			
5 V Reference	0.10 V	5.00 V	13.00 V

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.

Component	Description
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

System Voltage=6 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC**P0642**

Sensor Reference Voltage 1=Less than 4.66 V

P0643

Sensor Reference Voltage 1=Greater than 5.33 V

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC P0642, P0643 is not set.

- **If the DTC is set**

Refer to [DTC C0401](#)

- **If the DTC is not set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to [DTC C0401](#)

- **If the DTC is not set**

4. All OK.

DTC P0651-P0653: 5V REFERENCE 2 CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0651

5V Reference 2 Circuit

DTC P0652

5V Reference 2 Circuit Low Voltage

DTC P0653

5V Reference 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0652	P0651	P0653	-

Typical Scan Tool Data

Sensor Reference Voltage 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 5.00 V			
5 V Reference	0.10 V	5.00 V	13.00 V

Circuit/System Description

For an overview of the component/system, refer to [Transfer Case Description and Operation](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.

Component	Description
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

System Voltage=6 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

P0651

Sensor Reference Voltage 2=4.88 to 5.88 V & Current=Less than a predefined threshold

P0652

Sensor Reference Voltage 2=Less than 4.88 V

P0653

Sensor Reference Voltage 2=Greater than 5.88 V

Actions Taken When the DTC Sets

- All Wheel Drive=Disabled
- Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition » On / Vehicle » In Service Mode
2. Verify DTC P0651, P0652, P0563 is not set.
 - **If the DTC is set**

Refer to [DTC C0396 or C039E](#)
 - **If the DTC is not set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to [DTC C0396 or C039E](#)

- **If the DTC is not set**

4. All OK.

DTC P0698 OR P0699: 5V REFERENCE 3 CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0698

5V Reference 3 Circuit Low Voltage

DTC P0699

5V Reference 3 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0698	-	P0699	-

Typical Scan Tool Data

Sensor Reference Voltage 3

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On Parameter Normal Range: 5.00 V			
5 V Reference	0.10 V	5.00 V	13.00 V

Circuit/System Description

For an overview of the component/system, refer to [Electronic Component Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.

Component	Description

Component	Description
K69 Transfer Case Control Module	The control module contains a microprocessor used to process input data to control outputs.

Conditions for Running the DTC

System Voltage= 6 to 17.5 V

Frequency the DTC runs=Continuously

Conditions for Setting the DTC

P0698

Sensor Reference Voltage 3=Less than 4.88 V

P0699

Sensor Reference Voltage 3=Greater than 5.88 V

Actions Taken When the DTC Sets

Driver Information Display=Service All Wheel Drive

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify DTC P0698, P0699 is not set.

- **If the DTC is set**

Refer to **DTC C0390**

- **If the DTC is not set**

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

Verify the DTC does not set.

- **If the DTC sets**

Refer to [DTC C0390](#)

- **If the DTC is not set**

4. All OK.

SYMPTOMS - TRANSFER CASE

Strategy Based Diagnostics

Review the system operation in order to familiarize yourself with the system functions. Refer to [Transfer Case Description and Operation](#).

Visual/Physical Inspection

- Inspect the easily accessible or visible system components for obvious damage or for conditions which could cause the symptom.
- Inspect the transfer case for the proper fluid. Refer to [Fill Plug Replacement](#).

Symptom List

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

- [All-Wheel Drive \(AWD\) System Functional Inspection](#)
- [Transfer Case Popping Noise](#)
- [Transfer Case Whine or Rumble Noise](#)
- [Transfer Case Clunk During Acceleration and Deceleration](#)
- [Transfer Case Leak Diagnosis](#)

ALL-WHEEL DRIVE (AWD) SYSTEM FUNCTIONAL INSPECTION

Functional Inspection 1

Functional Inspection 1 is a mechanical and electrical on-hoist inspection to determine if the vehicle AWD system is functioning as designed.

1. Install the MDI interface tool and laptop to the vehicle data connector.
2. Raise the vehicle on a hoist. Lift the vehicle in a manner that will allow all four wheels to rotate during testing.
3. Start the engine.
4. Select one of the three driving modes Sport / Tour / Snow-Ice.
5. Rotate the steering wheel to ensure the front wheels are pointing straight ahead.
6. On the laptop, select [Transfer Case Control Module Scan Tool Information](#).
7. Select the transmission DRIVE position.
8. Release foot from brake.

NOTE: AWD has a pre-emptive torque with the steering wheel straight and front wheels pointing straight ahead. The front wheels will rotate slowly due to the drag within the clutch pack components, AWD mode is not active in this condition.

9. Depress the accelerator pedal to increase rear wheel speed and to engage AWD mode.

NOTE: When the accelerator pedal is depressed, the rear wheels will rotate faster. The TCCM monitors the rotational speed difference between the front and rear

wheels and will engage AWD mode. AWD mode activation will increase the rotational speed of the front wheels to match that of the rear.

10. Confirm four wheel rotation and AWD engagement.
11. Viewing the Transfer Case Control Module Scan Tool Information, the following information can confirm AWD actuation, actuator motor rotation, clutch pack engagement and torque transfer to the front wheels:
 - Range Actuator Direction - Here you can see stationary, clockwise or counter-clockwise rotational direction - upon acceleration you can briefly see this change confirming motor rotation
 - Range Actuator Position Sensor Direction Signal - Here you can see in degrees, the change in motor sensor position, confirming the motor is rotating.
 - Transfer Case Clutch Engagement - Here you can see in degrees, the engagement of the clutch pack. The initial value should be zero degrees, upon accelerating, the value will increase. This confirms the motor is rotating and engaging the clutch pack and AWD.
 - Transfer Case Clutch Torque - Here you can see in LB FT, the amount of torque transferred to the front wheels. Initial value should be zero, upon accelerating, the value should increase. This confirms the clutch pack is engaged, AWD is activated and torque is transferred to the front wheels. Note this test may better be performed when driving the vehicle on ice or a similar condition where a wheel slip condition can be duplicated.
 - AWD ON / OFF - Here you can see either ON / OFF. An OFF indicator may be present when: A DTC is present or an overheat or other condition is present.
 - AWD Disabled - Tire Size - Here you will see either ON / OFF. An OFF indicator may be present when: A spare tire of different size has been installed onto the vehicle and the AWD system has been disabled.

Functional Inspection 2 - Actuator Motor

Functional Inspection 2 is an on-vehicle electrical test to manually rotate the actuator motor. This test is used to determine if the actuator motor can rotate and activate / deactivate the clutch pack and AWD mode.

1. Install the MDI interface tool and laptop to the vehicle data connector.
2. Raise the vehicle on a hoist. Lift the vehicle in a manner that will allow all four wheels to rotate during testing.
3. Start the engine.
4. Select one of the three driving modes Sport / Tour / Snow-Ice.
5. Rotate the steering wheel to ensure the front wheels are pointing straight ahead.
6. Select the transmission NEUTRAL position.
7. On the laptop, select **Transfer Case Control Module Scan Tool Information**.
8. Select Range Actuator
9. When in the Range Actuator selection, the actuator motor can be commanded to rotate either clockwise or counter-clockwise. Rotate the motor in both directions.
 - Range Actuator Direction Command - this is the requested rotational direction of the motor, clockwise or counter-clockwise. Clockwise or Counter-clockwise will be visible.
 - Range Actuator Direction - this is the actual rotational direction of the motor. Stationary, clockwise or counter-clockwise will be visible.
10. The commanded direction should match actual direction.
11. If the motor does not rotate as requested, then go to **DTC C0306** and **DTC C0381** / Component Testing to perform a bench test on the motor.
12. Perform the bench test and if the motor does NOT rotate, replace the actuator motor.
13. If the motor does rotate, there may be a binding condition in the transfer case.
14. Check for transfer case binding condition: Insert a flat-bladed screwdriver into the actuator motor shift shaft. Attempt to rotate the shaft both clockwise and counter-clockwise to check for an internal binding condition. If binding is present, the transfer case must be replaced.

NO CORRECTION FOR SLIP IN ALL-WHEEL DRIVE MODE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**

- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

Circuit/System Description

The Transfer Case Control Module (TCCM) continuously monitors the wheel speed sensors. When a noticeable difference between the front and rear wheel speed is seen the transfer case control module sends a PWM voltage to engage the transfer case in order to correct a slip condition. A slip condition a difference in speed between the front and rear axles. The module has a thermal model based system so when the slip correction can not be made when a large percentage PWM signal has been sent, it will disable the system to prevent damage to the transfer case.

Diagnostic Aids

Refer to [Transfer Case Control Module Scan Tool Information](#) , which includes actual parameter data from a know good vehicle during the following conditions:

- Ignition» On / Vehicle» In Service Mode & Engine » Off
- Engine» Idling - At normal operating temperature
- Engine Running -48 km/h (30 MPH)
- Engine Running -80 km/h (50 MPH)

Reference Information

Schematic Reference

Transfer Case Control Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Transfer Case Disassembled View

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

Circuit/System Verification

1. Ignition» On / Vehicle» In Service Mode
2. Verify the following conditions do not exist: Refer to [Drain Plug Replacement](#)
 - Fill Level - Low
 - Fluid - Poor Condition
 - **If a condition exists**

Repair or replace as necessary.
 - **If no condition exists**
3. Verify no DTCs are set in the following control module (Ignore DTC C0397):
 - K17 Electronic Brake Control Module

- K69 Transfer Case Control Module
- *If other DTCs are set*

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

- *If no DTC is set*

4. Verify the following parameters are within 2 km/h (1 MPH) of each other:

- B5LF Wheel Speed Sensor - Left Front
- B5LR Wheel Speed Sensor - Left Rear
- B5RF Wheel Speed Sensor - Right Front
- B5RR Wheel Speed Sensor - Right Rear
- **If not within 2 km/h (1 MPH) of each other**

Refer to [Symptoms - Antilock Brake System](#)

- **If within 2 km/h (1 MPH) of each other**

5. Ignition/VehicleÂ» Off

6. Verify no mechanical binding is present.

1. Apply the parking brake.
 2. Block the drive wheels - Rear
 3. Lift the right front wheel
 4. Verify that the front propeller shaft turns while turning the right front wheel.
- *If the front propeller shaft does not turn*

Test or replace the component: Transfer Case

- *If the front propeller shaft turns*

7. Program the control module: K69 Transfer Case Control Module

8. Perform the scan tool learn/reset function: Range Actuator Learn

Verify proper AWD operation

- *If AWD concerns still exist*

Replace the component: K69 Transfer Case Control Module

- *If AWD concerns do not exist*

9. All OK.

Repair Instructions

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

- [Transfer Case Assembly Replacement](#)
- For control module replacement, programming and setup, refer to [Control Module References](#)

TRANSFER CASE POPPING NOISE

Cause	Correction

Cause	Correction
Definition: A faulty internal transfer case component that causes a light popping or clicking noise in the transfer case. A light popping or clicking type noise that occurs when engaging AWD and quits after the engagement is completed would be considered normal. 1. Compare the noise to a similar vehicle to see if a normal condition. 2. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 3. Note specifics such as when the noise is present. 4. Note if the noise relative to vehicle speed, is noisy on turns or other specifics. 5. If the source of the noise is the transfer case, inspect for the correct fluid level. Review the Symptoms - Transfer Case and perform the necessary inspections.	
Transfer case low fluid level	Inspect the transfer case for the correct fluid level. Fill as required. Refer to Fill Plug Replacement .
Suspension components worn	Replace the suspension components as required. Refer to Noise Diagnosis - Front Suspension or Noise Diagnosis - Rear Suspension .
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required.
Engine mounts loose or damaged	Repair or replace the mounts as required.
Propeller shaft universal or constant velocity joints worn	A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by worn universal or constant velocity joints. Replace the universal joints as required. Refer to Symptoms - Propeller Shaft
Front Propeller Shaft Retaining Bolts Loose	1. Inspect the front propeller shaft for loose flange retaining bolts. Refer to Symptoms-Propeller Shaft. 2. Retighten or replace as required.
Rear Propeller Shaft Retaining Bolts Loose	1. Inspect the rear propeller shaft for loose flange retaining bolts. Refer to Symptoms-Propeller Shaft. 2. Retighten or replace as required.
Wheel Drive Shaft Noise	Inspect the wheel drive shafts. Refer Symptoms - Wheel Drive Shafts .
Front Axle Noise	Inspect the front axle. • A high pitch whine or low pitch rumble noise that increases as vehicle speed increase may be caused by worn axle bearings. • To determine if the noise is front axle related, remove the front propeller shaft and retest. Refer to Symptoms - Front Drive Axle.
Transmission Noise	Inspect the transmission. Refer to Symptoms - Automatic Transmission.

TRANSFER CASE WHINE OR RUMBLE NOISE

Cause	Correction

Cause	Correction
DEFINITION: A faulty internal transfer case component that causes a high pitch whine or low pitch rumbling noise in the transfer case. Compare the noise to a similar vehicle to see if a normal condition. 1. Identify the source of the noise using chassis ears and refer to the appropriate service manual section. 2. Note specifics such as when the noise is present. 3. Note if the noise relative to vehicle speed, is noisy on turns or other specifics. 4. If the source of the noise is the transfer case, inspect for the correct fluid level. Review the Symptoms - Transfer Case and perform the necessary inspections.	
Transfer case low fluid level	Inspect the transfer case for the correct fluid level. Fill as required. Refer to Fill Plug Replacement .
Tire Noise	A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by tires that are, unevenly inflated, unevenly worn or have an aggressive tread pattern. Rotate or substitute tires and retest. Refer to Tire and Wheel Inspection .
Propeller shaft universal or constant velocity joints worn	A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by a worn center support bearing. Replace the center support bearing as required. Refer to Symptoms - Propeller Shaft .
Wheel Drive Shaft Noise	Inspect the wheel drive shafts. Refer Symptoms - Wheel Drive Shafts .
Front Axle Noise	Inspect the front axle. • A high pitch whine or low pitch rumble noise that increases as vehicle speed increase may be caused by worn axle bearings. • To determine if the noise is front axle related, remove the front propeller shaft and retest. Refer to Symptoms - Front Drive Axle.
Transmission Noise	Inspect the transmission. Refer to Symptoms - Automatic Transmission.
Transmission Case Gear Noise	A whine type noise heard in a coast condition. Compare to a like vehicle to determine if a normal condition.

TRANSFER CASE CLUNK DURING ACCELERATION AND DECELERATION

Cause	Correction
DEFINITION: During acceleration or deceleration, a clunk is heard or felt in the transfer case. A light bump felt during low speed (2-5 mph) tight turn situations is to be considered normal. Review the Symptoms - Transfer Case and perform the necessary inspections.	
Transfer case low fluid level	Inspect the transfer case for the correct fluid level. Fill as required. Refer to Fill Plug Replacement .
Suspension components worn	Replace the suspension components as required. Refer to Noise Diagnosis - Front Suspension or Noise Diagnosis - Rear Suspension .
Transmission or transfer case mounts loose or damaged	Repair or replace the mounts as required.
Engine mounts loose or damaged	Repair or replace the mounts as required.
Propeller shaft universal or constant velocity joints worn	A high pitch whine or low pitch rumble noise that increases as vehicle speed increases may be caused by worn universal or constant velocity joints. Replace the universal joints as required. Refer to Symptoms - Propeller Shaft
Front Propeller Shaft Retaining Bolts Loose	1. Inspect the front propeller shaft for loose flange retaining bolts. Refer to Symptoms-Propeller Shaft. 2. Retighten or replace as required.

Cause	Correction
Rear Propeller Shaft Retaining Bolts Loose	1. Inspect the rear propeller shaft for loose flange retaining bolts. Refer to Symptoms-Propeller Shaft. 2. Retighten or replace as required.
Wheel Drive Shaft Noise	Inspect the wheel drive shafts. Refer to Symptoms - Wheel Drive Shafts .
Front Axle Noise	Inspect the front axle. • A high pitch whine or low pitch rumble noise that increases as vehicle speed increase may be caused by worn axle bearings. • To determine if the noise is front axle related, remove the front propeller shaft and retest. Refer to Symptoms - Front Drive Axle.
Transfer Case Actuator Motor Noise	An electric motor noise heard in an engine shutdown situation is to be considered a cycling or repositioning of the motor and a normal condition.

TRANSFER CASE LEAK DIAGNOSIS

Cause	Correction
DEFINITION: A visible indication of an external fluid leak from the transfer case. Review the Symptoms - Transfer Case and perform the necessary inspections. Special Tools GE-28431-6 Fluorescent Oil Dye GE-28428-E High Intensity Black Light Kit For equivalent regional tools, refer to Special Tools. Fluorescent Dye Method 1. Add GE-28431-6 Fluorescent dye to the transmission or transfer case to determine the source of the leak. 2. Operate the vehicle. 3. Inspect for the presence of dye within the oil leak using the GE-28428-E High Intensity Black Light Kit. A presence or non-presence of dye within the oil leak will indicate which component is the source of the leak. Powder Method 1. Thoroughly clean the suspected leak area using a rag. CAUTION: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings. 2. Apply an aerosol type leak tracing powder to the suspected leak area. NOTE: Do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis. 3. Operate the vehicle for 15-20 minutes under city driving conditions until normal operating temperatures are reached. 4. Shut OFF the engine. 5. Inspect the suspected leak area. 6. Trace the leak path through the powder in order to find the source of the leak.	

Cause	Correction
Transmission-to-Transfer Case Adapter Weep Hole Leak	Transmission fluid is sealed at the rear of the transmission by the transmission rear output shaft seal. Transfer case fluid is sealed at the front of transfer case by the transfer case input shaft seal. The adapter area between the transmission and transfer case is a dry-cavity area. If a leak is present at the weep hole area of the transmission-to-transfer case adapter, fluorescent dye must be added to one of the two components to determine the source of the leak. 1. Inspect for a restricted transfer case vent hose assembly. Repair as required. 2. Add GE-28431-6 Fluorescent dye to the transmission to determine the source of the leak. 3. Operate the vehicle 4. Inspect the adapter weep hole for a fluid leak and for traces of dye within the oil using the GE-28428-E High intensity black light kit. 5. If fluorescent dye is present within the fluid leak, replace the transmission rear output shaft seal. 6. If fluorescent dye is not present within the fluid leak, replace the transfer case input shaft seal. Refer to Input Shaft Seal Replacement.
Transfer Case Vent Hose Leak	1. Inspect for a loose, disconnected, restricted or damaged transfer case vent hose. 2. Replace components as required. Refer to Transfer Case Vent Hose Replacement.
Oil Drain Plug or Oil Fill Plug Leak	1. Inspect for an under-tightened oil fill plug, missing sealant on the threads of the plug or damage to the case threaded hole. 2. Replace the oil fill or oil drain plug as required, refill the unit to the correct fluid level and tighten to the correct torque value. Refer to Fill Plug Replacement and Drain Plug Replacement.
Fluid Temperature Sensor Leak	1. Remove the fluid temperature sensor. Refer to Transfer Case Fluid Temperature Sensor Replacement. 2. Inspect for the following conditions: • Sensor cross threaded into the housing • Damage to the sensor seal • Sensor over tightened causing deformation of the sensor • Damage to the case sealing surface 3. Replace the sensor as required.
Rear Output Shaft Seal Leak	1. Inspect for a leaking rear output shaft seal. 2. Inspect for a restricted vent hose assembly. Repair as required. Refer to Transfer Case Vent Hose Replacement. 3. Inspect the rear output flange sealing surface for excessive wear, rust or other damage. 4. Replace the rear output flange and/or oil seal as required. Refer to Rear Output Shaft Seal Replacement and Transfer Case Rear Flange Oil Seal Replacement.

Cause	Correction
Front Output Shaft Seal Leak	1. Inspect for a leaking front output shaft seal. 2. Inspect for a restricted vent hose assembly. Repair as required. Refer to Transfer Case Vent Hose Replacement. 3. Inspect the front output flange sealing surface for excessive wear, rust or other damage. 4. Replace the front output flange and/or oil seal as required. Refer to Front Output Shaft Seal Replacement.
Actuator Motor and/or Shaft Seal Leak	1. Inspect for a fluid leak at the actuator motor to transfer case interface. Motor removal is required to inspect for a leak at the shaft seal. 2. Replace the actuator motor shaft seal as required. Refer to Transfer Case Four Wheel Drive Actuator Seal Replacement.
Housing leak	1. Inspect for a cracked case, leak at the case sealing surfaces or porosity. 2. Add GE-28431-6 Fluorescent dye to the transfer case to determine the source of the leak. 3. Operate the vehicle. 4. Inspect the location of the oil leak for the presence of dye within the oil using GE-28428-E High Intensity Black Light Kit. 5. Replace the transfer case as required. Refer to Transfer Case Assembly Replacement.

REPAIR INSTRUCTIONS - ON VEHICLE

FOUR WHEEL DRIVE ACTUATOR LEARN (CT6)

Using a Scan Tool

1. Ignition» On / Vehicle» In Service Mode & Engine» Off
2. Perform the following learn procedure: Range Actuator Learn Refer to Scan Tool Control Functions
3. When the Range Actuator Learn procedure is initiated an audible noise from the A16 Transfer Case Motor should occur, indicating a successful learn procedure.

RANGE ACTUATOR LEARN

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

For an overview of the component/system, refer to [Transfer Case Description and Operation](#)

This procedure triggers the control module to learn the values of the component:

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set or customer dissatisfaction.

Perform this procedure when the following component has been serviced:

- A16 Transfer Case Motor

- K69 Transfer Case Control Module
- Transfer Case Assembly

Conditions for Running the Procedure

- Park Brake=Applied
- Tires=Blocked
- Vehicle Speed= 0 km/h (0 MPH)
- Ignition=On
- Engine=Not Running
- Transmission Range=Neutral

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition» On / Vehicle» In Service Mode
2. Select: Module Diagnostics
3. Select: Transfer Case Control Module
4. Select: Configuration/Reset Functions
5. Select: Range Actuator Learn
6. Follow the instructions on the scan tool. - The procedure will complete within 10 s

Verify the scan tool parameter: Range Actuator Learn =Passed

- **If not the specified state**

Refer to Step 1

- **If the specified state**

7. All OK.

Repair Instructions

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

TRANSFER CASE CLUTCH IDENTIFIER

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

For an overview of the component/system, refer to: [Electronic Component Description](#)

This procedure triggers the control module to learn the values of the component: Transfer Case Assembly

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set or customer dissatisfaction.

Perform this procedure when the following component has been serviced:

- K69 Transfer Case Control Module

- Transfer Case Assembly

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Refer to [Transfer Case Identification](#) - To obtain/document the transfer case identification code.
2. Ignition» On / Vehicle» In Service Mode
3. Select:Module Diagnostics
4. Select:Transfer Case Control Module
5. Select:Configuration/Reset Functions
6. Select:Transfer Case Clutch Identifier
7. Enter the clutch calibration identification code in the scan tool and select save changes.

Verify the scan tool parameter:Transfer Case Clutch Identifier Status=Programmed & Transfer Case Clutch Identifier=Matches the clutch calibration identification code on the transfer case identification label

- **If not the specified state**

Refer to Step 1

- **If the specified state**

8. All OK.

Repair Instructions

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

TRANSFER CASE CONTROL MODULE REPLACEMENT

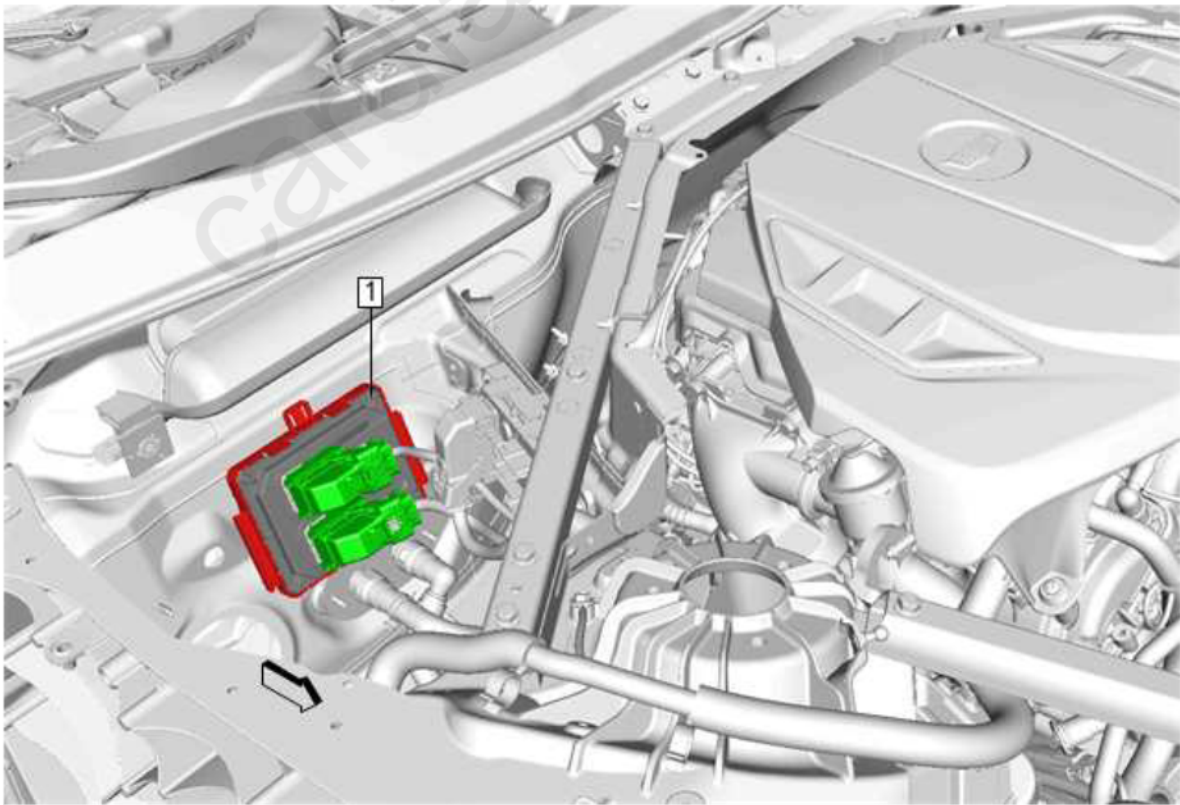


Fig. 5: Transfer Case Control Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure <u>Air Inlet Grille Panel Access Hole Cover Replacement</u>	
1	Transfer Case Control Module Procedure 1. Disconnect the electrical connectors. 2. Remove the module from the module bracket by releasing the retaining tabs. 3. After replacing the transfer case control module, record the clutch calibration identification number. <u>Transfer Case Identification</u> 4. Perform the range actuator learn procedure. <u>Range Actuator Learn</u> 5. Program the transmission control module, if replaced. <u>Control Module References</u>

TRANSFER CASE CONTROL MODULE BRACKET REPLACEMENT

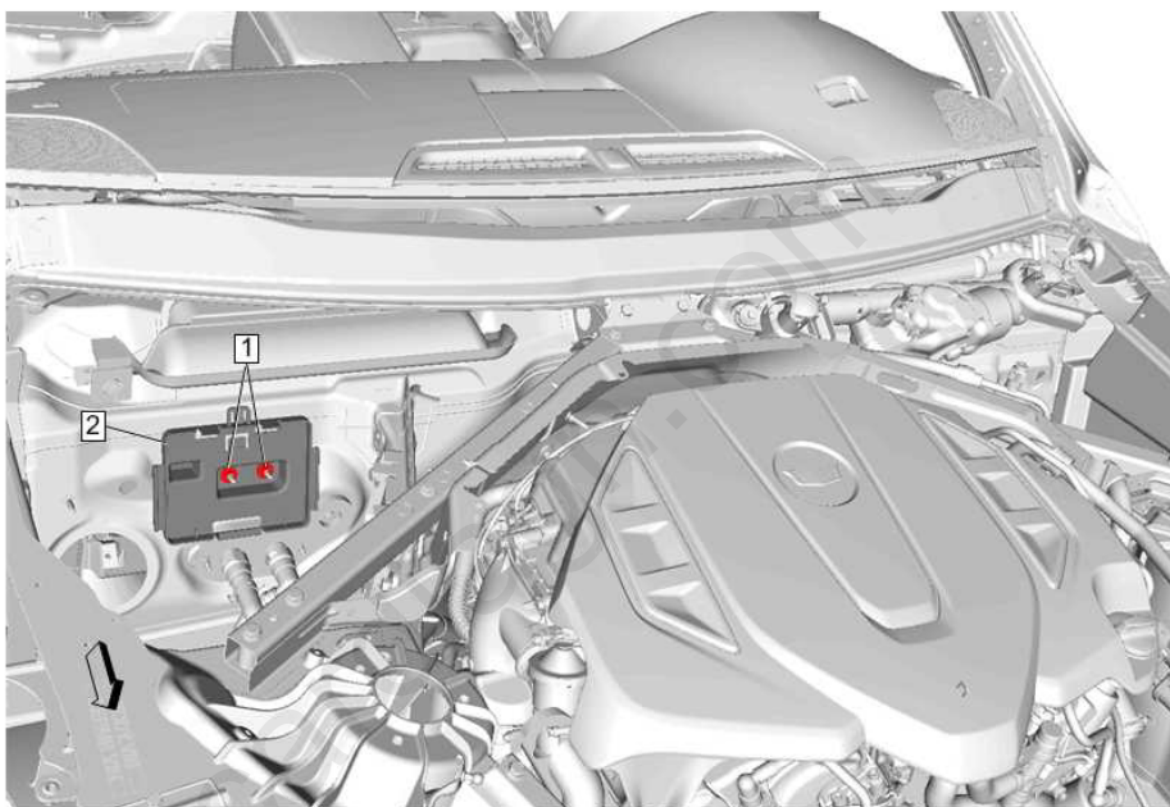


Fig. 6: Transfer Case Control Module Bracket
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Transfer Case Control Module Replacement</u>	
1	Transfer Case Control Module Bracket Fastener [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 N.m (80 lb in)
2	Transfer Case Control Module Bracket

TRANSFER CASE FOUR WHEEL DRIVE ACTUATOR REPLACEMENT

Special Tools

DT-1859-A Steering Wheel Puller

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

Removal Procedure

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

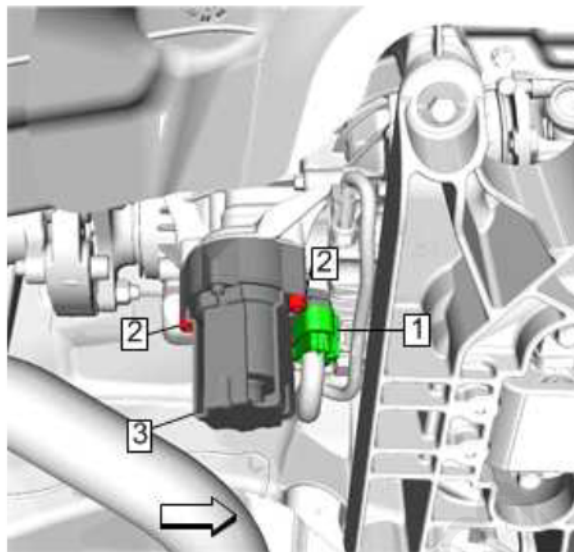


Fig. 7: Electrical Connector And Actuator Motor
Courtesy of GENERAL MOTORS COMPANY

3. Remove the actuator motor bolts (2).
4. Remove the actuator motor (3) from the transfer case.

Installation Procedure

1. Position the actuator motor (3) to the transfer case.

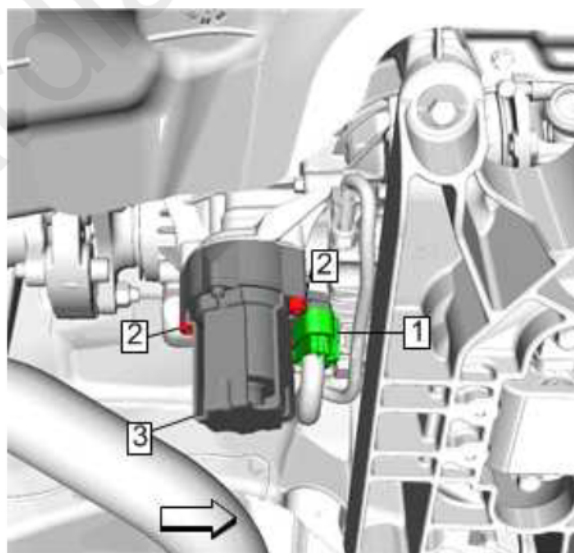


Fig. 8: Electrical Connector And Actuator Motor
Courtesy of GENERAL MOTORS COMPANY

2. Install the actuator motor bolts (2) and tighten to 13 N.m (115 lb in).

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

3. Connect the electrical connector (1).
4. Lower the vehicle.

Special Tools

DT-1859-A Steering Wheel Puller

DT-8107-4 Pilot, Side Bearing Remover

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

Removal Procedure

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

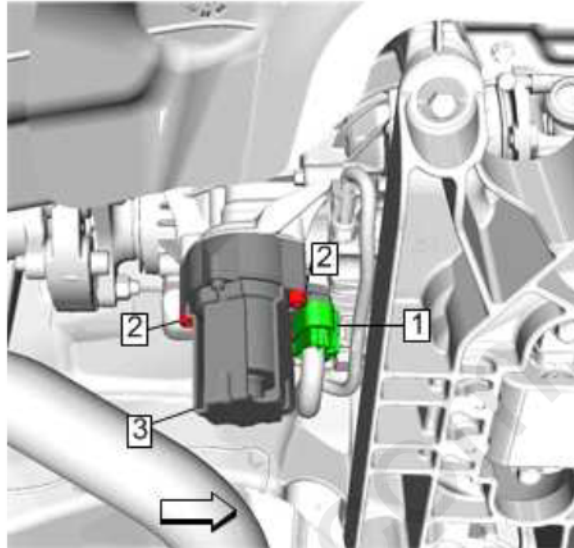


Fig. 9: Electrical Connector And Actuator Motor
Courtesy of GENERAL MOTORS COMPANY

3. Remove the actuator motor bolts (2).
4. Remove the actuator motor (3) from the transfer case.
5. Drill a pilot hole in the body of the seal (2).

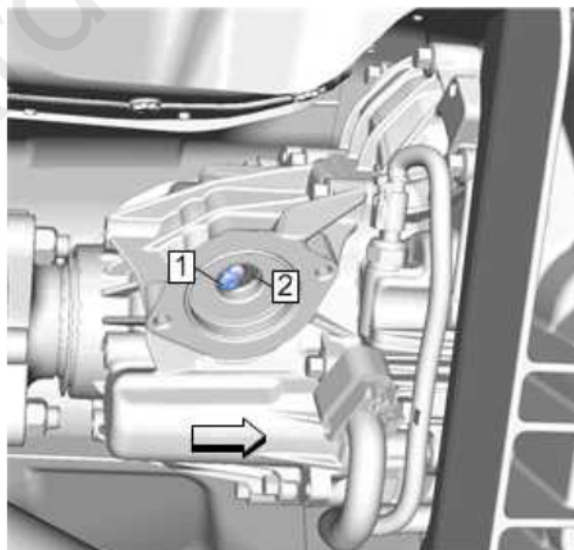


Fig. 10: Seal And Self-Tapping Screw
Courtesy of GENERAL MOTORS COMPANY

6. Insert a self-tapping screw (1) into the seal.
7. Using a set of pliers or slide hammer type tool, remove the seal from the bore and DISCARD.

NOTE: Do Not use a pry tool to remove the seal.

Installation Procedure

1. Select a deep socket with a outside diameter no greater than 21 mm (1 in). Mark the socket 20 mm (1 in) from the open end shown in dimension (A).

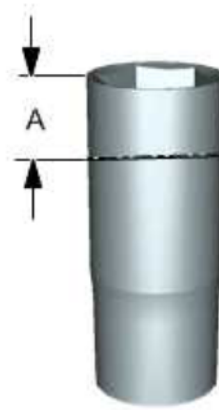


Fig. 11: Mark Socket 20 mm (1 in) From Open End Shown In Dimension A
Courtesy of GENERAL MOTORS COMPANY

2. Position the NEW actuator motor seal into the bore.

NOTE: Use care to prevent the raised surfaces of the shaft to avoid contact with the seal surface lip.

3. Position the socket (3) to DT-1859-A Steering Wheel Puller and DT-8107-4 Pilot, Side Bearing Remover (4).

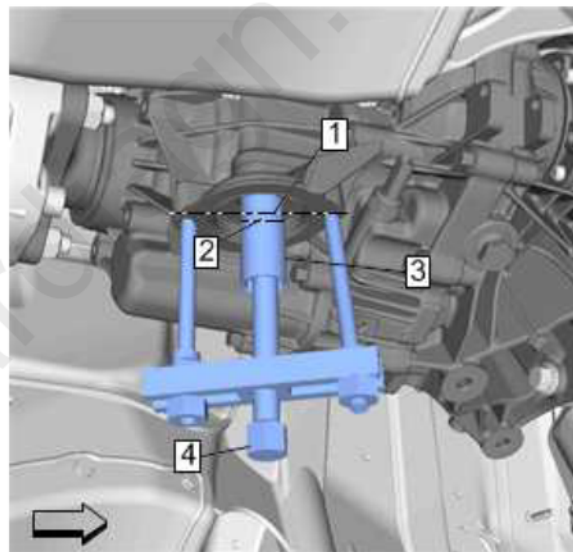


Fig. 12: DT-1859-A Steering Wheel Puller And DT-8107-4 Side Bearing Remover
Courtesy of GENERAL MOTORS COMPANY

4. Install the seal until the mark (2) on the socket is aligned to the actuator motor machined mounting surface (1).

NOTE: The seal is to be installed 20 mm (1 in) below the actuator mounting surface.

5. Position the actuator motor (3) to the transfer case.

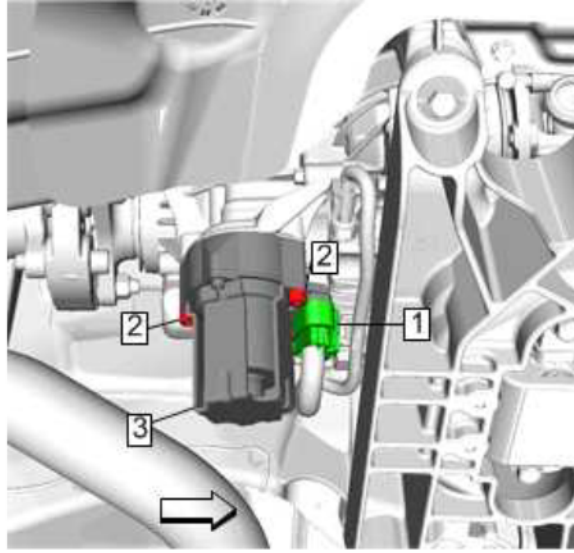


Fig. 13: Electrical Connector And Actuator Motor

Courtesy of GENERAL MOTORS COMPANY

6. Install the actuator motor bolts (2) and tighten to 13 N.m (115 lb in).

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

7. Connect the electrical connector (1).
8. Check the transmission fluid level, fill if necessary. Refer to [Fill Plug Replacement](#).
9. Lower the vehicle.

FRONT OUTPUT SHAFT SEAL REPLACEMENT

Special Tools

CH-1859-A Steering Wheel Puller

GE-2619-A Slide Hammer

DT-3289-20 Holding Fixture Base Assembly

DT-22873 Main Shaft Bushing Installer

DT-36842 Service Fixture

DT-38694 Rear Extension Housing Seal Installer

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

Removal Procedure

1. Remove the transfer case from the vehicle. Refer to [Transfer Case Assembly Replacement](#)

NOTE: When the transfer is removed from the vehicle, DO NOT position the unit on its side or upside down. Transfer case fluid may leak through the center cavity/vent hose going into the front housing/front cavity of the unit. Fluid found in the front cavity area may lead to a un-necessary input shaft oil seal replacement or other repairs due to lost fluid.

2. Install the **DT-36842** Service Fixture to the transfer case assembly.

NOTE: Maintain in-car orientation of the transfer case.

3. Install the service fixture to **DT-3289-20** Holding Fixture Base Assembly.

NOTE: Maintain in-car orientation of the transfer case.

4. Install the **CH-1859-A** Steering Wheel Puller (1), M10 x 1.5 x 40 mm bolts (2) and **GE-2619-A** Slide Hammer (3) to the front output flange (4).

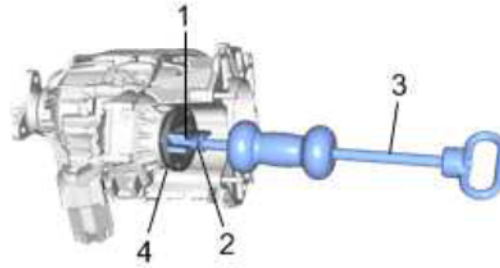


Fig. 14: CH-1859-A Steering Wheel Puller And GE-2619-A Slide Hammer
Courtesy of GENERAL MOTORS COMPANY

5. Remove the flange (4) from the transfer case.
6. Remove the seal (4) from the transfer case and DISCARD.

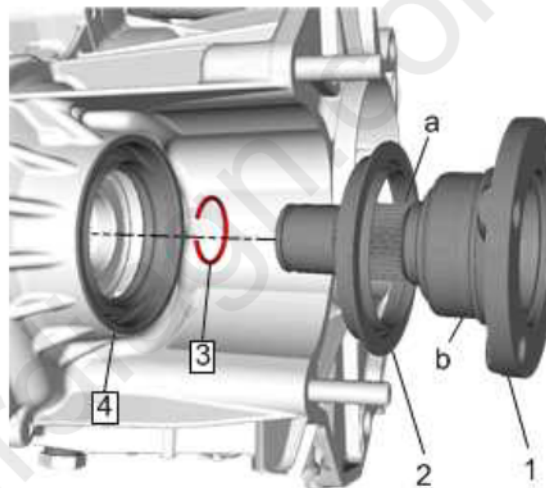


Fig. 15: Seal And Flange Retaining Ring
Courtesy of GENERAL MOTORS COMPANY

7. Remove the flange retaining ring (3) and DISCARD.

Installation Procedure

1. Inspect the deflector (2) for damage. Remove the deflector from the flange (1) only if damaged and DISCARD.

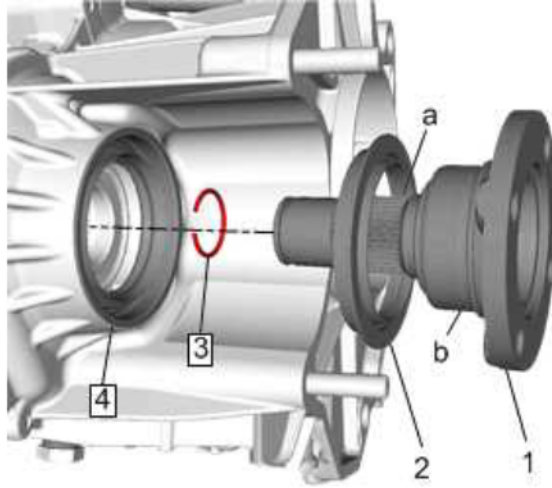


Fig. 16: Seal And Flange Retaining Ring

Courtesy of GENERAL MOTORS COMPANY

2. Install the deflector using **DT-22873** Main Shaft Bushing Installer or equivalent to install a NEW deflector to the flange so that the raised surface (a) on the inside diameter is located to the groove in the flange (b).
3. Install a NEW flange retaining ring (3).
4. Install a NEW seal (2) using **DT-38694** Rear Extension Housing Seal Installer or equivalent (1).

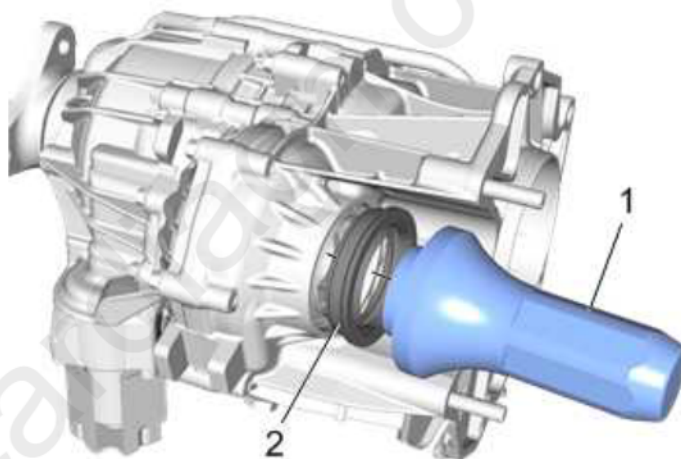


Fig. 17: DT-38694 Rear Extension Housing Seal Installer

Courtesy of GENERAL MOTORS COMPANY

5. Align the flange and gear splines and push the flange inward until the retaining ring engages into the front output gear.
6. Remove the **DT-36842** Service Fixture from the transfer case assembly.

NOTE: Maintain in-car orientation of the transfer case.

7. Install the transfer case to the vehicle. Refer to [Transfer Case Assembly Replacement](#)

TRANSFER CASE FLUID TEMPERATURE SENSOR REPLACEMENT

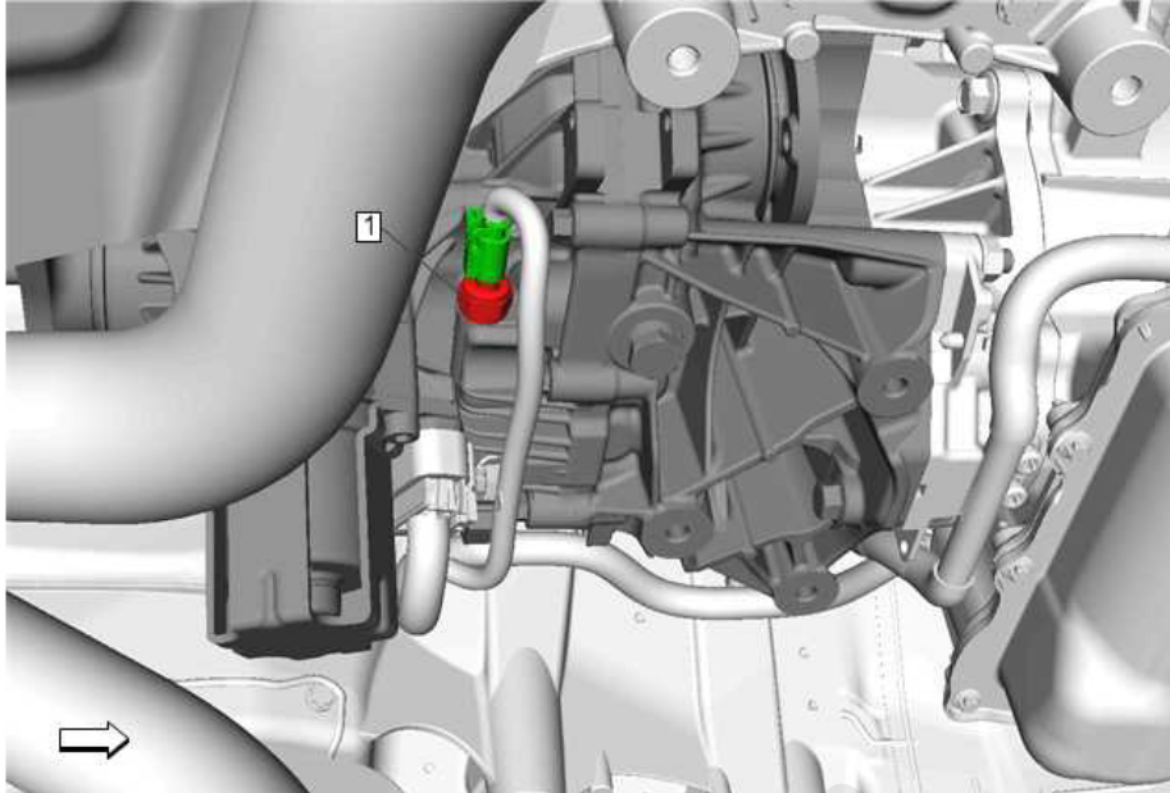


Fig. 18: Transfer Case Fluid Temperature Sensor

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle .	
1	Transfer Case Fluid Temperature Sensor CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. Disconnect the electrical connector from the transfer case fluid temperature sensor. 2. Place a drain pan under the transfer case fluid temperature sensor. 3. After sensor replacement, refill the transfer case with fluid. Refer to Fill Plug Replacement . Tighten 16 N.m (12 lb ft)

REAR OUTPUT SHAFT SEAL REPLACEMENT

Special Tools

DT-22873 Main Shaft Bushing Installer

DT-38694 Rear Extension Housing Seal Installer

DT-45019 Flange Remover

DT-51263 Rear Output Shaft Flange Installer

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

Removal Procedure

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

2. Remove the rear flange retaining ring (1), output shaft washer (2) and O-ring (3). DISCARD the O-ring.

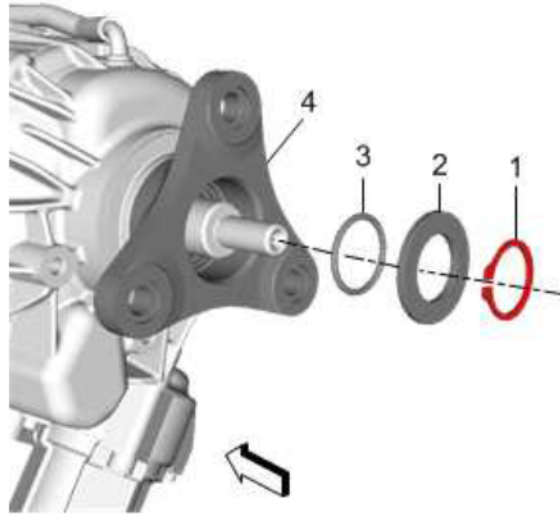


Fig. 19: Rear Flange Retaining Ring

Courtesy of GENERAL MOTORS COMPANY

3. Install the **DT-45019** Flange Remover, M8 x 1.25 mm x 70-80 mm bolts and nuts to remove the rear output flange.



Fig. 20: DT-45019 Flange Remover

Courtesy of GENERAL MOTORS COMPANY

4. Remove the rear output flange from the transfer case.
5. Inspect the deflector (2) for damage. Remove the deflector from the flange (1) only if damaged and DISCARD.

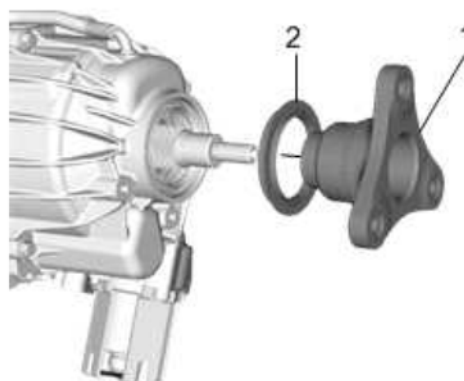


Fig. 21: Deflector And Flange

Courtesy of GENERAL MOTORS COMPANY

6. Remove the seal (1) from the transfer case and DISCARD.



Fig. 22: Seal And Transfer Case

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Install a NEW seal (2) using **DT-38694** Rear Extension Housing Seal Installer (1).

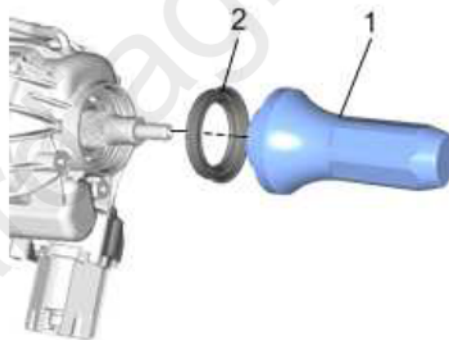


Fig. 23: DT-38694 Rear Extension Housing Seal Installer

Courtesy of GENERAL MOTORS COMPANY

2. Measure the to-be-replaced rear flange height and record the dimension as dimension a.

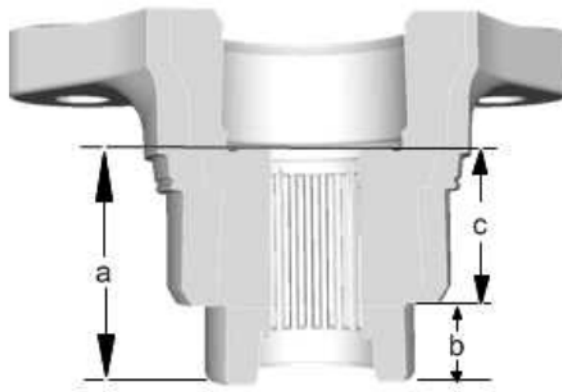


Fig. 24: Rear Flange Height Dimensions

Courtesy of GENERAL MOTORS COMPANY

NOTE: Measure the flange from rear face to input shaft washer contact surface.

3. Measure the to-be-replaced rear flange height and record the dimension as dimension b.

NOTE: Measure the flange from rear face to rear bearing contact surface.

4. Subtract dimension b from dimension a to achieve dimension c. Record dimension c.
5. Measure the to-be-replaced input shaft washer (2) thickness. Record the dimension as d.

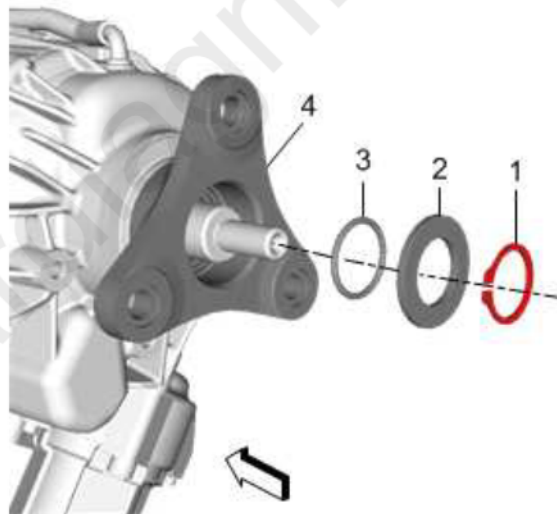


Fig. 25: Rear Flange Retaining Ring

Courtesy of GENERAL MOTORS COMPANY

6. Add the to-be-replaced rear flange calculated dimension c to the input washer thickness d, ($c+d=e$). The total of the to-be-replaced components is to be recorded as dimension e.
7. Measure the NEW/replacement flange in the same manner as the to-be replaced flange and record the calculated dimension as dimension f.
8. Subtract the NEW rear flange measured dimension f from to-be-replaced components dimension e, ($e-f=g$). Record the calculated value as dimension g.
9. Select a new input shaft washer with a value equal to dimension g. Refer to [Transfer Case Input Shaft Washer Specifications](#)
10. Inspect the deflector (1) for damage. Remove the deflector from the flange (1) only if damaged and DISCARD.

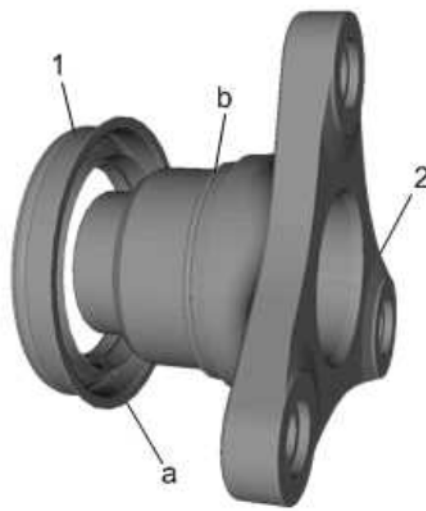


Fig. 26: Deflector And Flange

Courtesy of GENERAL MOTORS COMPANY

11. Install the deflector using **DT-22873** Main Shaft Bushing Installer to install a NEW deflector to the flange so that the raised surface (a) on the inside diameter is located to the groove in the flange (b).
12. Install the **DT-51263-3** Collet Assembly and threaded rod (2) onto the shaft. Position the raised inner surfaces of the collects into the groove (1) of the rear output shaft.

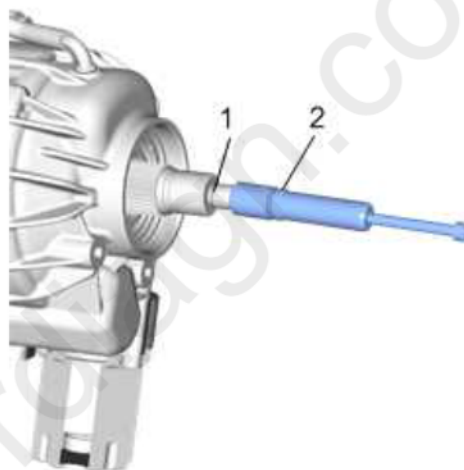


Fig. 27: DT-51263-3 Collet Assembly And Threaded Rod

Courtesy of GENERAL MOTORS COMPANY

NOTE: The axle input flange will be retained to the drive pinion by a snap ring instead of a nut, the splines will have a helical twist, resulting in increased installation force. The flange cannot be hammered or driven into position or the bearings will be damaged and the RDM will have to be replaced. DT-51263 allows the flange to be drawn into position on the pinion without any force being applied to the bearings. The jaws of DT-51263 engage the groove around the centering pilot on the pinion and its sleeve is tightened around the jaws to prevent them leaving the groove. The installation tube of DT-51263 is placed over the stud, & the supplied hardware is used to seat the installer and flange without contacting any qualified surfaces of the pinion and with no external forces on the bearings. This procedure will be required for transfer case rear output shaft seal service. Unapproved methods will damage the RDM or transfer case.

13. Thread the **DT-51263-1** Installer Assembly (1) onto the threaded rod and over the legs until it stops.

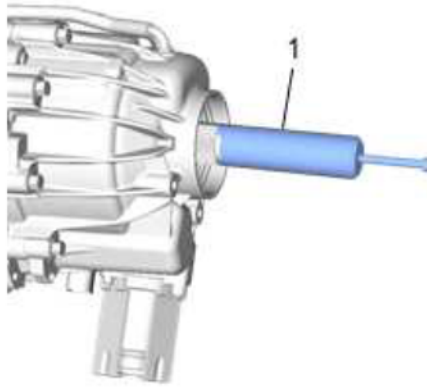


Fig. 28: DT-51263-1 Installer Assembly

Courtesy of GENERAL MOTORS COMPANY

14. Install the rear flange over the tool and onto the shaft. Align the inside diameter splines on the flange with outside diameter splines on the shaft.

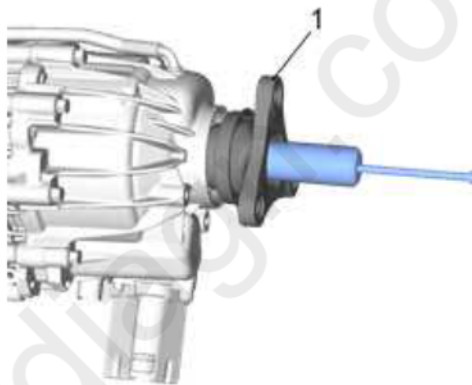


Fig. 29: Rear Flange

Courtesy of GENERAL MOTORS COMPANY

15. Install the DT-51263-2 Receiver (4), bearing (3), washer (2) and the nut (1) onto the threaded rod.

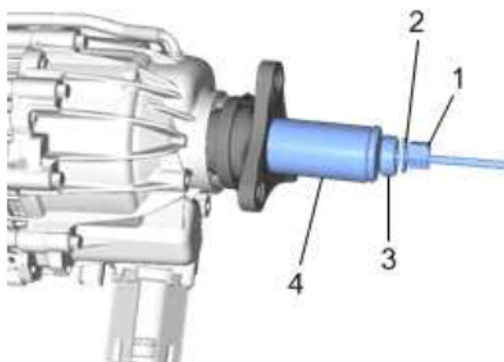


Fig. 30: DT-51263-2 Receiver, Bearing, Washer And Nut

Courtesy of GENERAL MOTORS COMPANY

16. Using one wrench to hold the flat on the threaded rod, rotate the nut (1) clockwise to push the flange onto the shaft until it stops.
17. Install a NEW O-ring (3), output shaft washer (2) and retaining ring (1).

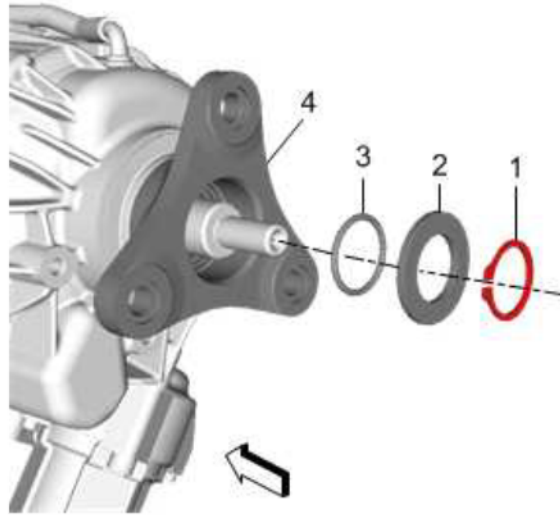


Fig. 31: Rear Flange Retaining Ring

Courtesy of GENERAL MOTORS COMPANY

18. Install the propeller shaft. Refer to [Propeller Shaft Replacement](#)
19. Check the transfer case fluid level. Refer to [Fill Plug Replacement](#)

TRANSFER CASE VENT HOSE REPLACEMENT

Special Tools

DT-3289-20 Holding Fixture Base Assembly

DT-36842 Service Fixture

DT-42738 Seal Installer

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

Removal Procedure

1. Remove the transfer case from the vehicle. Refer to [Transfer Case Assembly Replacement](#)

NOTE: When the transfer is removed from the vehicle, DO NOT position the unit on its side or upside down. Transfer case fluid may leak through the center cavity/vent hose going into the front housing/front cavity of the unit. Fluid found in the front cavity area may lead to a un-necessary input shaft oil seal replacement or other repairs due to lost fluid.

2. Install the **DT-36842** Service Fixture to the transfer case assembly.

NOTE: Maintain in-car orientation of the transfer case.

3. Remove the vent hose (1) from the transfer case.

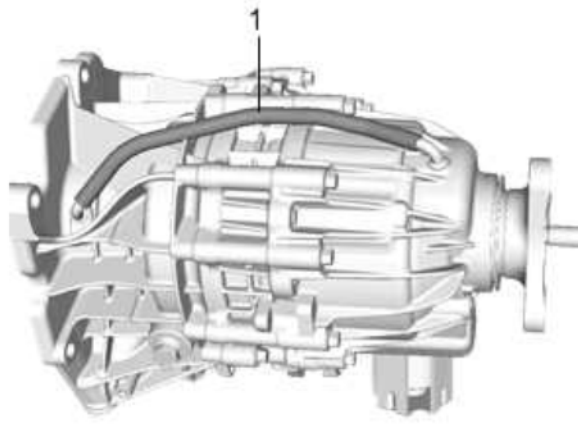


Fig. 32: Vent Hose

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Install the vent hose (1) to the transfer case.

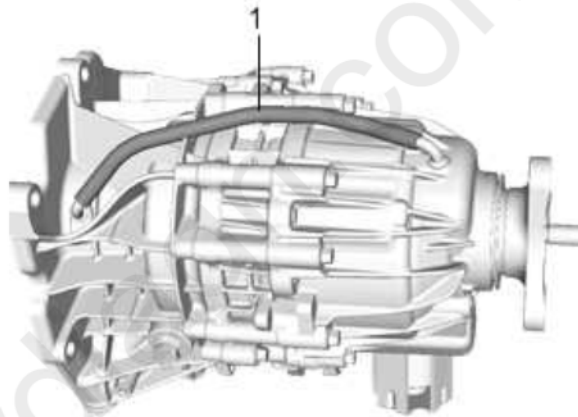


Fig. 33: Vent Hose

Courtesy of GENERAL MOTORS COMPANY

2. Install the transfer case to the vehicle. Refer to [Transfer Case Assembly Replacement](#)

TRANSFER CASE FLUID REPLACEMENT

Removal Procedure

1. Remove the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .
2. Remove the drain plug (1).

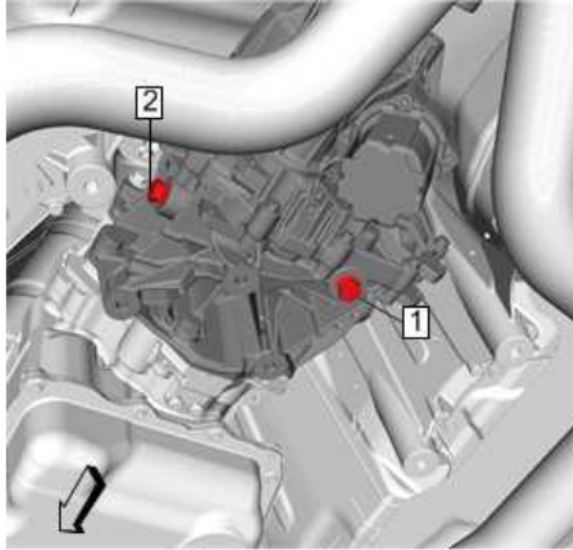


Fig. 34: Drain Plug

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Apply sealant to the threads of the drain plug. Refer to [Adhesives, Fluids, Lubricants and Sealers](#).
2. Install the drain plug (1) and tighten to 25 N.m (18 lb ft)

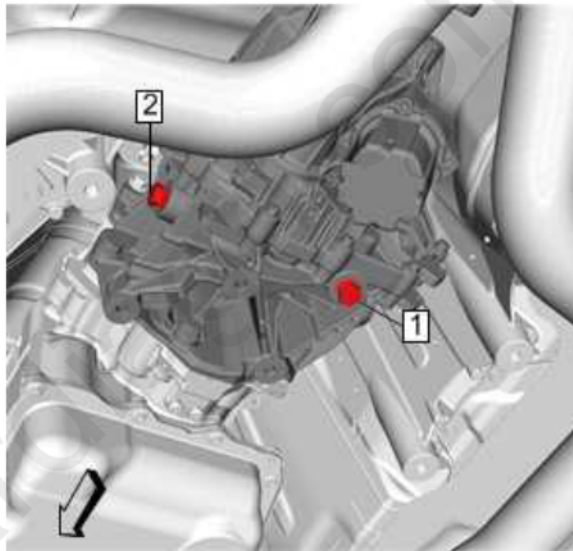


Fig. 35: Drain Plug

Courtesy of GENERAL MOTORS COMPANY

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

3. Remove the fill plug (2).
4. Fill to the transfer case with fluid. Refer to [Adhesives, Fluids, Lubricants and Sealers](#) and [Approximate Fluid Capacities](#).
5. Apply sealant to the threads of the fill plug. Refer to [Adhesives, Fluids, Lubricants and Sealers](#).
6. Install the fill plug (2) and tighten to 25 N.m (18 lb ft)
7. Install the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .

DRAIN PLUG REPLACEMENT

Removal Procedure

1. Remove the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .
2. Remove the drain plug (1).

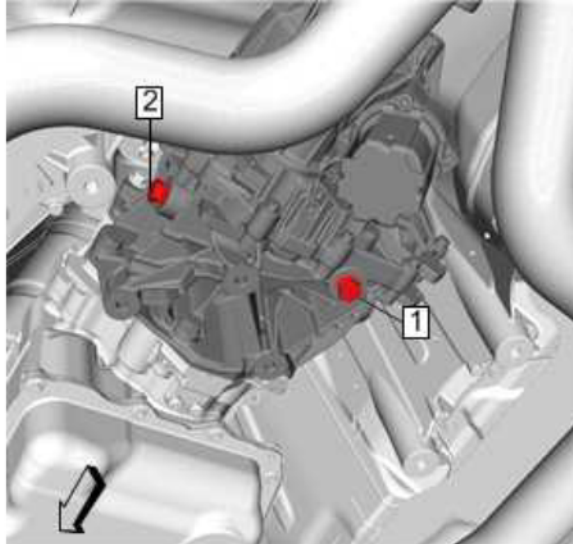


Fig. 36: Drain Plug

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Apply sealant to the threads of the drain plug. Refer to [Adhesives, Fluids, Lubricants and Sealers](#).
2. Install the drain plug (1) and tighten to 25 N.m (18 lb ft)

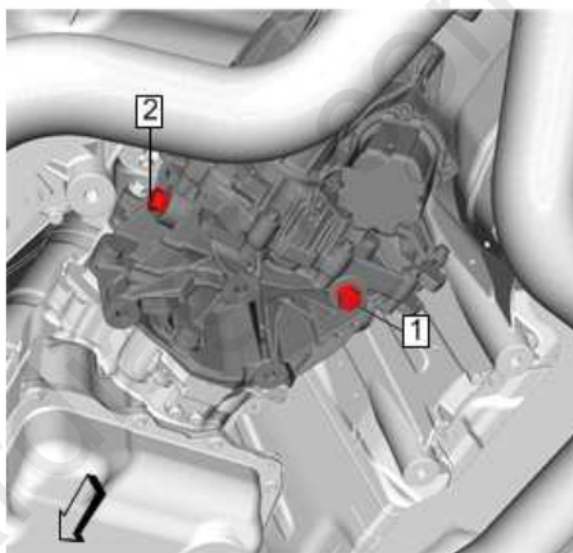


Fig. 37: Drain Plug

Courtesy of GENERAL MOTORS COMPANY

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

3. Remove the fill plug (2).
4. Fill to the transfer case with fluid. Refer to [Adhesives, Fluids, Lubricants and Sealers](#) and [Approximate Fluid Capacities](#).
5. Apply sealant to the threads of the fill plug. Refer to [Adhesives, Fluids, Lubricants and Sealers](#).
6. Install the fill plug (2) and tighten to 25 N.m (18 lb ft)
7. Install the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .

FILL PLUG REPLACEMENT

Removal Procedure

1. Remove the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .
2. Remove the fill plug (2).

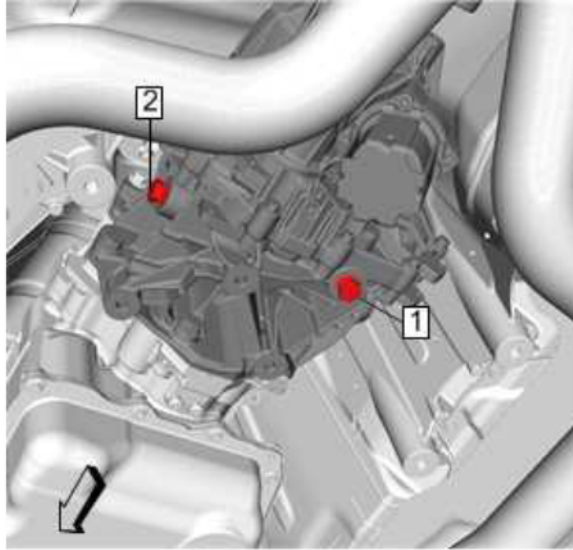


Fig. 38: Drain Plug

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Apply sealant to the threads of the fill plug. Refer to [Adhesives, Fluids, Lubricants and Sealers](#).
2. Install the fill plug (2) and tighten to 25 N.m (18 lb ft)

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

3. Install the transmission support. Refer to [Transmission Support Crossmember Replacement \(LTG\)](#) .

TRANSFER CASE ASSEMBLY REPLACEMENT

Removal Procedure

1. Drain the transfer case fluid, if necessary. Refer to [Transfer Case Fluid Replacement](#)
2. Remove the front propeller shaft (1). Refer to [Front Axle Propeller Shaft Replacement \(LGX, LGW\)](#)

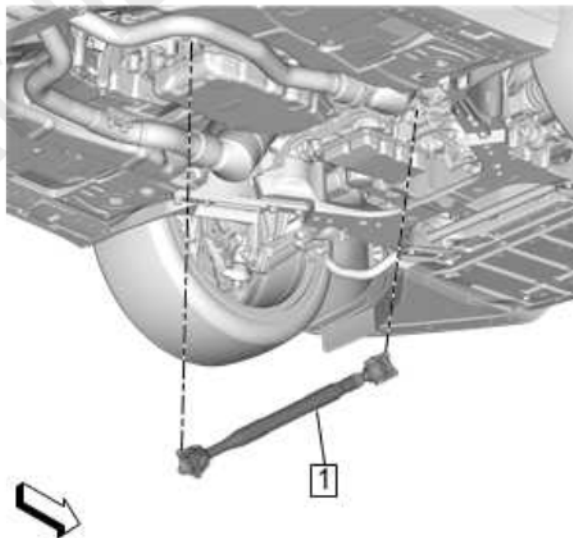


Fig. 39: Front Axle Propeller Shaft

Courtesy of GENERAL MOTORS COMPANY

3. Remove the propeller shaft (1). Refer to [Propeller Shaft Replacement](#)

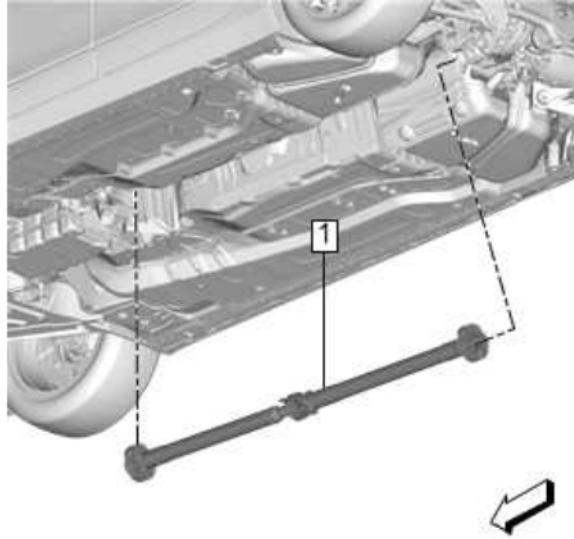


Fig. 40: Propeller Shaft

Courtesy of GENERAL MOTORS COMPANY

4. Support the transmission with a suitable jack.
5. Disconnect the electrical connectors from the transfer case.
6. Remove the transmission mount bracket (2) from the transfer case.

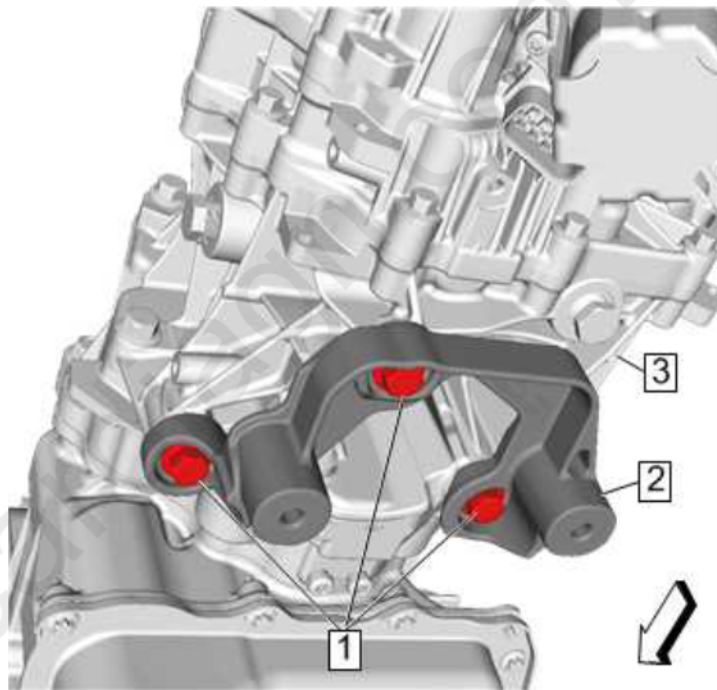


Fig. 41: Transmission Mount Bracket

Courtesy of GENERAL MOTORS COMPANY

7. Using the jack, lower the transmission enough to access the rear transfer case mounting fasteners.
8. Using a suitable transmission jack, support the transfer case.
9. Using suitable straps or chains, secure the transfer case to the transmission jack.
10. Remove the left upper transfer case mounting bolts (1, 2, 3).

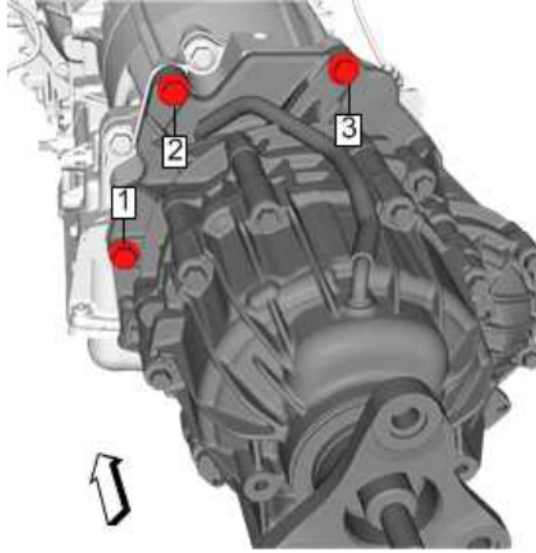


Fig. 42: Left Upper Transfer Case Mounting Bolts
 Courtesy of GENERAL MOTORS COMPANY

11. Remove the lower transfer case mounting bolt and nuts (1, 2, 3).

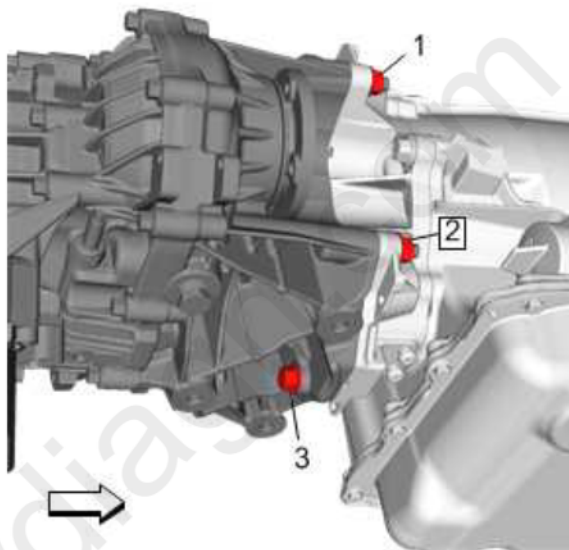
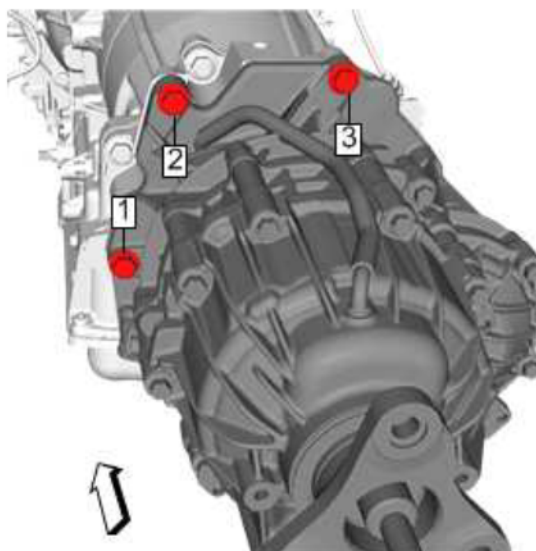


Fig. 43: Lower Transfer Case Mounting Bolt And Nuts
 Courtesy of GENERAL MOTORS COMPANY

12. Lower the transfer case out of the vehicle.

Installation Procedure

1. Position the transfer case to the transmission.
2. Install the transfer case bolts (1, 2, 3) and tighten to 58 N.m (43 lb ft).



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

3. Install the transfer case bolt and nuts (1, 2, 3) and tighten to 58 N.m (43 lb ft).

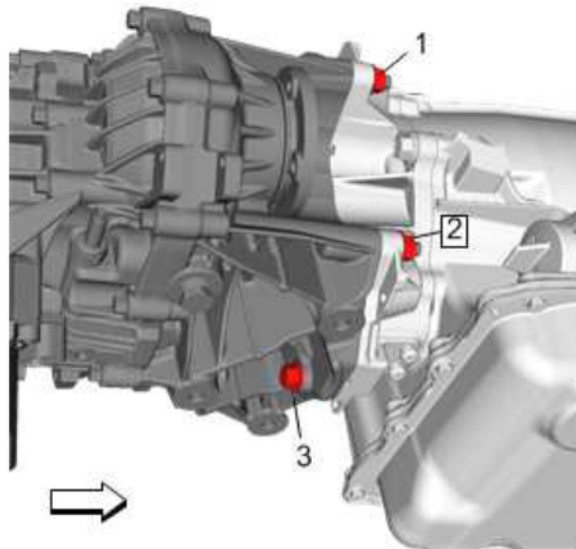


Fig. 45: Lower Transfer Case Mounting Bolt And Nuts
Courtesy of GENERAL MOTORS COMPANY

4. Install the transmission mount bracket (2) to the transfer case and tighten the bolts to 58 N.m (43 lb ft).

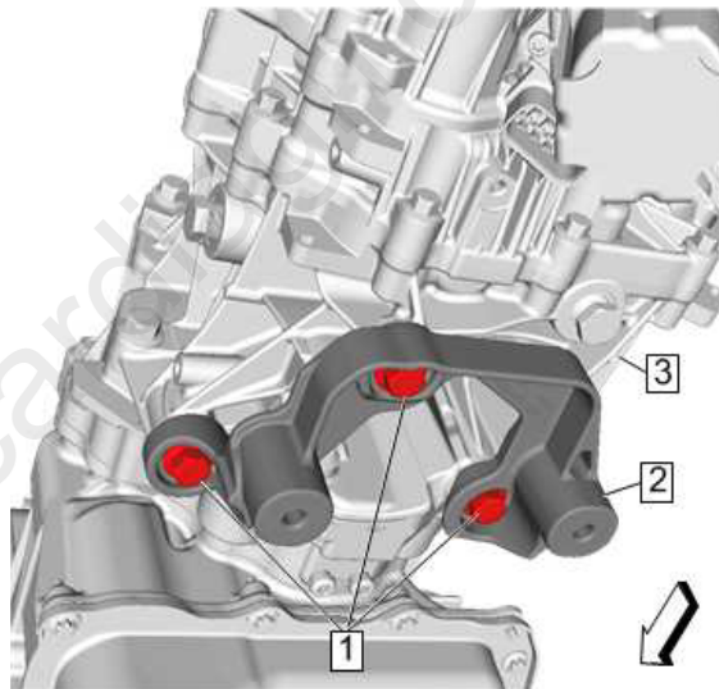


Fig. 46: Transmission Mount Bracket
Courtesy of GENERAL MOTORS COMPANY

5. Remove the transmission jack from the transfer case.
6. Remove the jack from under the transmission.
7. Connect the electrical connectors to the transfer case.
8. Install the front propeller shaft. Refer to [Front Axle Propeller Shaft Replacement \(LGX, LGW\)](#) .

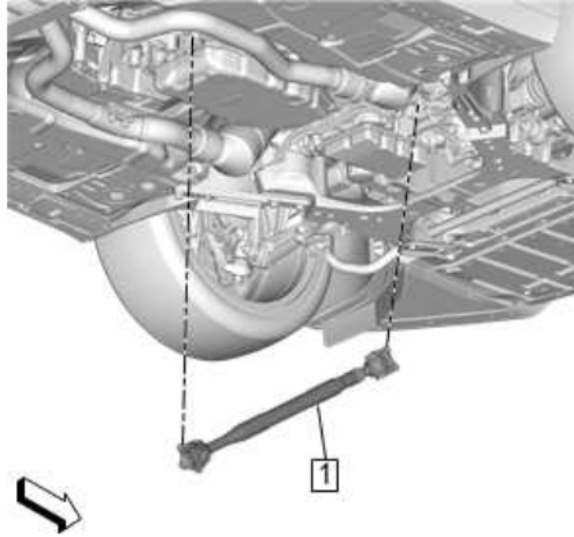


Fig. 47: Front Axle Propeller Shaft

Courtesy of GENERAL MOTORS COMPANY

9. Install the propeller shaft. Refer to [Propeller Shaft Replacement](#).

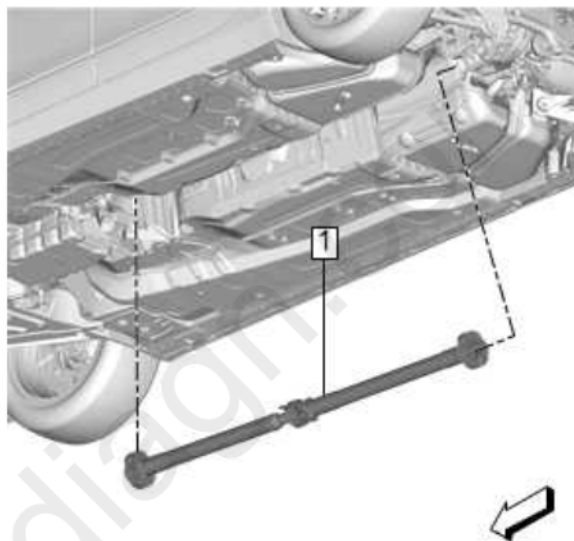


Fig. 48: Propeller Shaft

Courtesy of GENERAL MOTORS COMPANY

10. Refill the transfer case with fluid, if necessary. Refer to [Transfer Case Fluid Replacement](#).
11. Lower the vehicle.
12. After replacing the transfer case control module, record the clutch calibration identification number. Refer to [Transfer Case Identification](#)
13. Perform the transfer case clutch identifier output control function. Refer to [Transfer Case Control Module Programming and Setup](#)
14. Perform the range actuator learn procedure. Refer to [Range Actuator Learn](#)

INPUT SHAFT SEAL REPLACEMENT

Special Tools

DT-3289-20 Holding Fixture Base Assembly

DT-36842 Service Fixture

DT-42738 Seal Installer

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

Removal Procedure

1. Remove the transfer case from the vehicle. Refer to [Transfer Case Assembly Replacement](#)

NOTE:

When the transfer is removed from the vehicle, **DO NOT** position the unit on its side or upside down. Transfer case fluid may leak through the center cavity/vent hose going into the front housing/front cavity of the unit. Fluid found in the front cavity area may lead to a un-necessary input shaft oil seal replacement or other repairs due to lost fluid.

2. Install the **DT-36842** Service Fixture to the transfer case assembly.

NOTE:

Maintain in-car orientation of the transfer case.

3. Install the service fixture to **DT-3289-20** Holding Fixture Base Assembly.

NOTE:

Maintain in-car orientation of the transfer case.

4. Drill a pilot hole in the body of the seal (2).

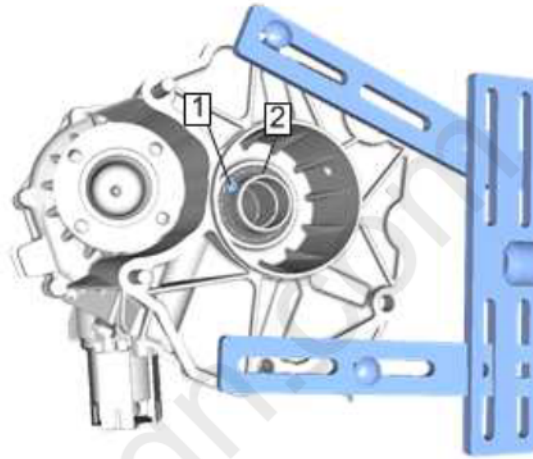


Fig. 49: Seal And Self-Tapping Screw

Courtesy of GENERAL MOTORS COMPANY

5. Insert a self-tapping screw (1) into the seal.
6. Using a set of pliers or slide hammer type tool, remove the seal from the bore and DISCARD.

NOTE:

Do Not use a pry tool to remove the seal.

Installation Procedure

1. Install a NEW seal (1) using **DT-42738** Seal Installer (2).

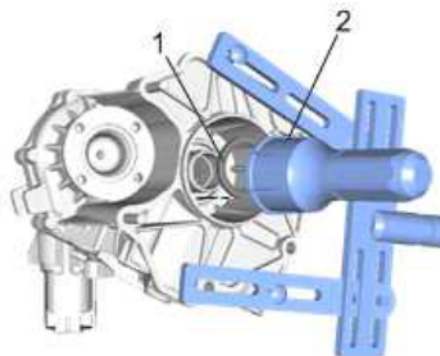


Fig. 50: DT-42738 Seal Installer

Courtesy of GENERAL MOTORS COMPANY

2. Remove the **DT-36842** Service Fixture from the transfer case assembly.

NOTE: Maintain in-car orientation of the transfer case.

3. Install the transfer case to the vehicle. Refer to [Transfer Case Assembly Replacement](#)

DESCRIPTION AND OPERATION

TRANSFER CASE IDENTIFICATION

TRANSFER CASE IDENTIFICATION (MAGNA)

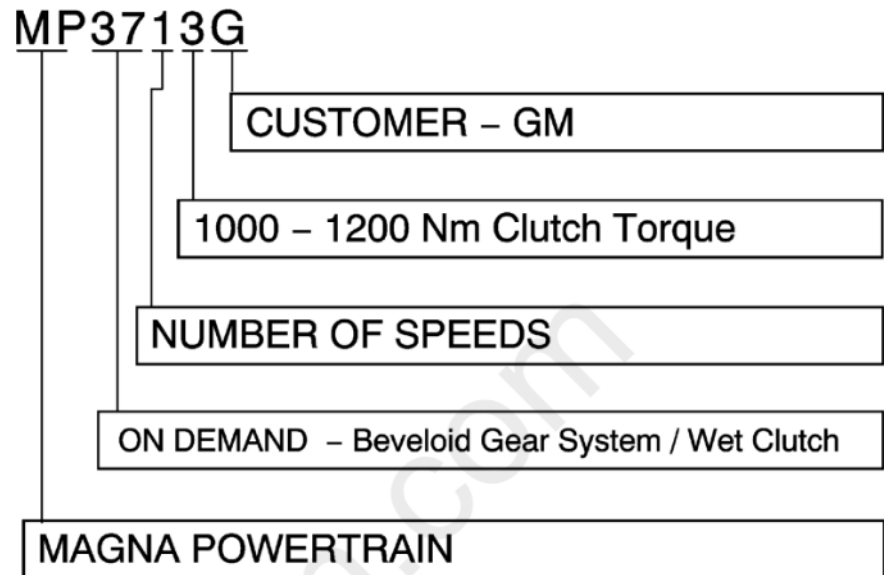


Fig. 51: Transfer Case Identification
Courtesy of GENERAL MOTORS COMPANY

Magna Transfer Case Bar Code Label

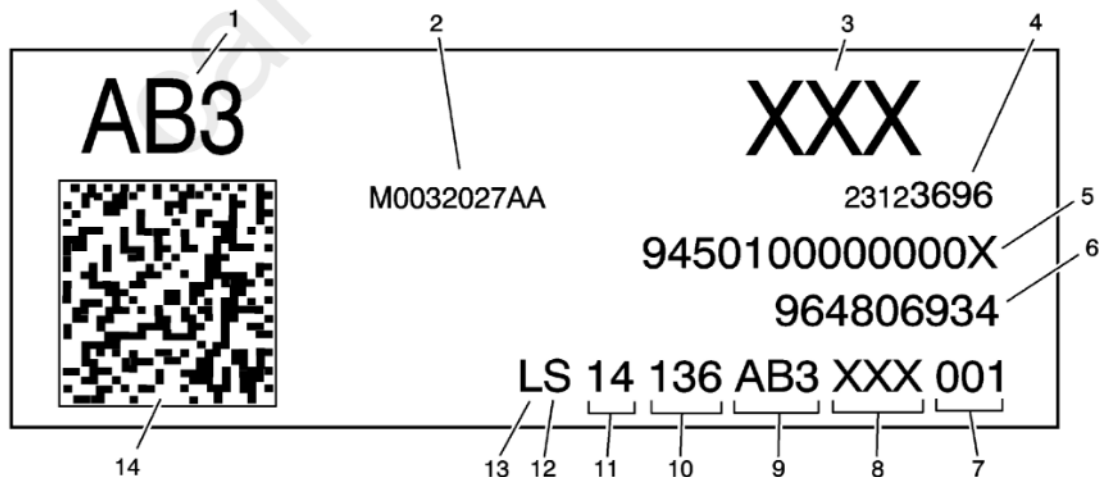


Fig. 52: Magna Transfer Case Bar Code Label
Courtesy of GENERAL MOTORS COMPANY

1. Broadcast Code
2. MPT Part Number
3. Clutch Calibration Identification
4. GM Part Number
5. VPPS Part Number
6. DUNs Number

7. Sequence Number
8. Clutch Calibration Identification
9. Broadcast Code
10. Production Date
11. Production Year
12. Production Shift
13. Production Line
14. Barcode

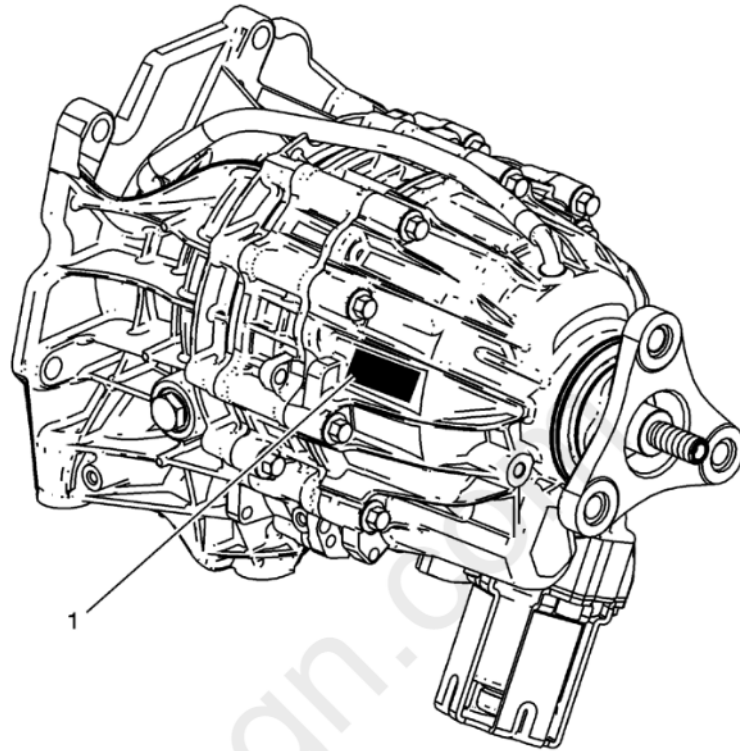


Fig. 53: Transfer Case Identification Label
Courtesy of GENERAL MOTORS COMPANY

The transfer case identification label (1) can be found on the left side of the rear case.

TRANSFER CASE DESCRIPTION AND OPERATION

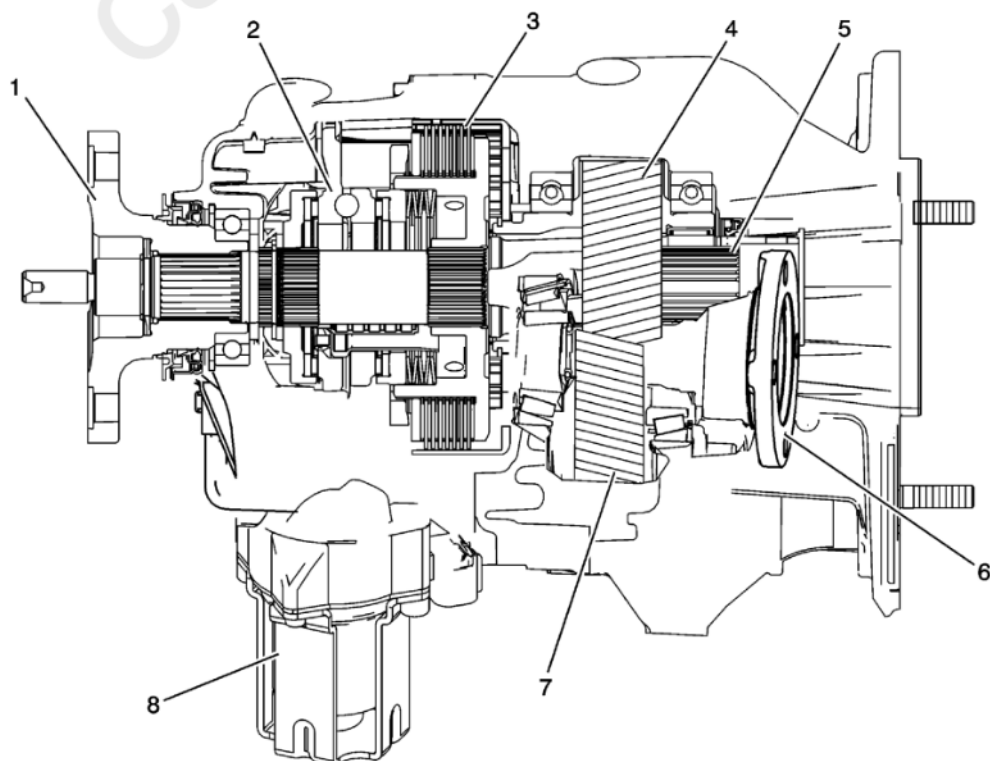


Fig. 54: Transfer Case Components
Courtesy of GENERAL MOTORS COMPANY

1. Rear Output Flange
2. Scissor Mechanism - Clutch Pack Activation
3. Clutch Pack
4. Drive Gear
5. Input Shaft
6. Front Output Flange
7. Driven Gear
8. Actuator Motor

The Magna (MPT) 3713G

The Magna (MPT) model 3713G transfer case is a 1-speed active design.

The MPT 3713G transfer case is designed to provide continuously variable clutch torque throughout the entire speed range of the vehicle. Torque to the front axle is transferred by the clutch and gear system as commanded by the transfer case control module (TCCM). The driver has the ability to select one of three available driving modes (Touring, Sport or Snow). Depending on the mode selected, torque transferred to the front axle varies from 20-50% of the available engine torque. During launch assist, up to 100% clutch torque will be transferred to front axle depending on the driving conditions. The clutch system is calibrated for a smooth transfer of power to the front axle under all operating conditions and enhances vehicle stability.

During normal driving situations, the amount of torque transferred to the front wheels is based on the selected driving mode (Touring or Sport or Snow). The transfer case control module (TCCM) monitors rear wheel slip speed based on the inputs from the wheel speed sensors and/or vehicle speed sensor. When the vehicle experiences a rear wheel slip condition, the TCCM commands the actuator motor to obtain the desired torque output. A TCCM torque request is converted into a desired actuator motor position and that signal is sent to the motor. The actuator motor rotates the shift shaft to activate the scissor mechanism to apply the clutch (3). The clutch design allows delivery of a variable amount of available engine torque to the front wheels via the helical drive gear (4), beveloid driven gear (7) and front output flange (6). The amount of torque transferred depends on the clutch position. Once the slip condition is corrected, clutch torque is reduced. The TCCM continuously monitors the vehicle operating conditions and varies the torque transferred to the front axle as required to enhance the stability of the vehicle.

The case housings are die-cast aluminum. Ball bearings support the drive gear (4) and input shaft (5) and tapered bearings support the driven gear (7) and front output flange (6). Power from the input shaft is transferred to the front output flange via a helical drive gear and beveloid driven gear. The transfer case housings and internal components are not to be serviced. If internal component damage is present, the transfer case must be replaced as an assembly.

The transfer case fluid should be replaced as specified in the maintenance schedule of the owner's manual.

The Magna (MPT) 3713G - Lubrication

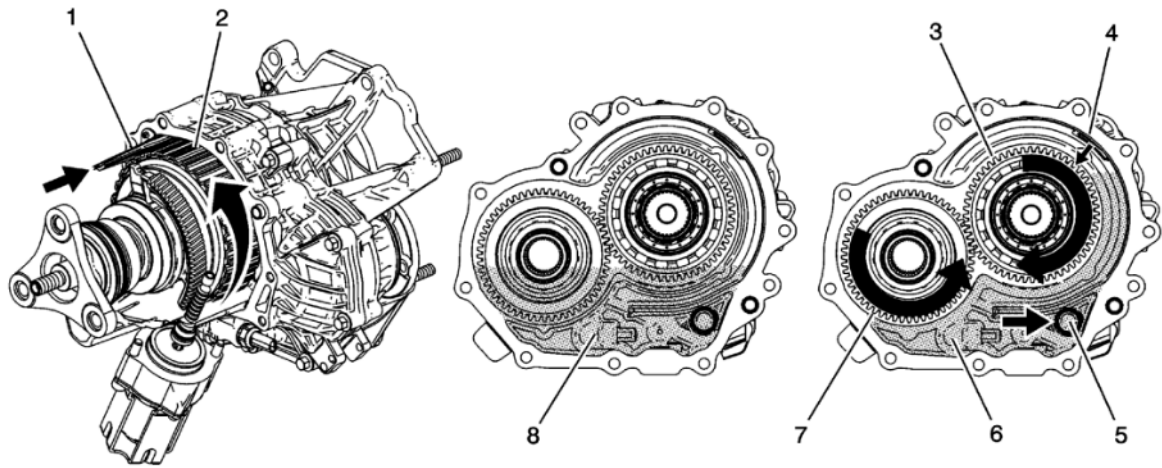


Fig. 55: Magna (MPT) 3713G

Courtesy of GENERAL MOTORS COMPANY

1. Sump Oil - Front Case - Static non-driving Condition
2. Clutch Drum
3. Drive Gear
4. Oil Transfer Slot - Oil path from Deflector
5. Oil Inlet - Oil path to clutch hub / drum
6. Sump Oil - Front Case - Dynamic Driving Condition
7. Driven / Output Gear
8. Oil Deflector - Oil path to front case

There are sump oil areas within both the front (8) and center cases of the assembly. The front case houses the gear set, the center case houses the clutch assembly. During a static non-driving condition, the sump oil in both areas is at an equal level. During transfer case operation, the rotating clutch drum (2) picks up oil from the center case sump and pushes it upward to the oil deflector (1).

Oil is then transferred from the center case to the front case through an oil transfer slot (4). The front case sump level (6) rises to a volume greater than that of the center case sump. With uneven sump levels in the front and center cases, the greater amount of oil and pressure differential within the front sump forces oil into the oil inlet/pickup tube (5). Oil then travels back to the center case through the pickup tube and into the clutch hub. The rotating hub spreads oil to the clutch plates and drum. Oil from the rotating drum is captured in the center case sump area and the cycle repeats as long as the transfer case is in operation.

Service All Wheel Drive

This message displays if a problem occurs with the All-Wheel-Drive (AWD) system. This could be caused by:

- An electronics problem
- Worn out or overheated clutch plates
- Various electrical issues

The system may need service. See your dealer.

All Wheel Drive Off

If the vehicle has the All-Wheel-Drive (AWD) system, this message displays when there is a temporary condition making the AWD system unavailable. The vehicle will run in 2WD. This could be caused by:

- Loss of wheel or vehicle speed
- AWD system overheat
- Certain vehicle electrical conditions

This message turns off when the above conditions are no longer present and the warning message is reset.

Transfer Case Actuator Motor Assembly

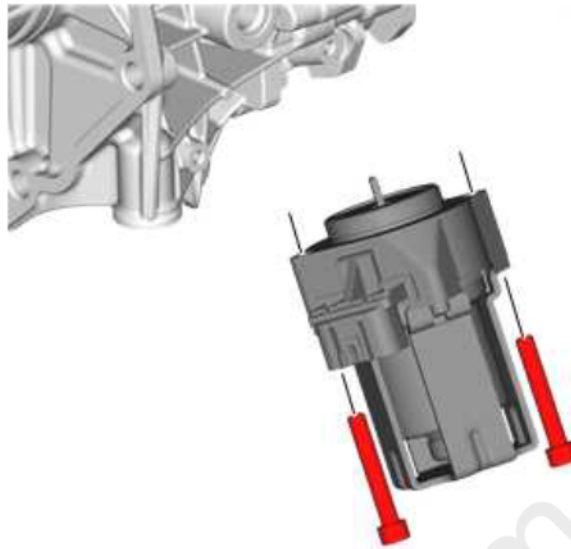


Fig. 56: Transfer Case Actuator Motor Assembly
Courtesy of GENERAL MOTORS COMPANY

The transfer case actuator motor assembly consists of a permanent magnet DC motor assembly. It is located on the bottom side of the transfer case. When activated, it rotates the shift shaft of the transfer case, clockwise or counterclockwise, to apply or un-apply the clutch pack and AWD mode. The actuator motor is controlled with a PWM signal from the TCCM. The actuator motor is bi-directional in order to allow the motor to apply or un-apply the clutch pack. The encoder / rotational position sensor is internal to the actuator motor assembly.

Actuator Motor Encoder / Rotational Position Sensor

The encoder / rotational position sensor is internal to the transfer case actuator motor and is replaced with the motor as an assembly. The sensor converts the motor rotation, into an electrical signal and input to the TCCM. The module detects what position the transfer case is in by monitoring the voltage returned on the rotational / encoder impulse signal circuit.

Transfer Case Shift Control Module

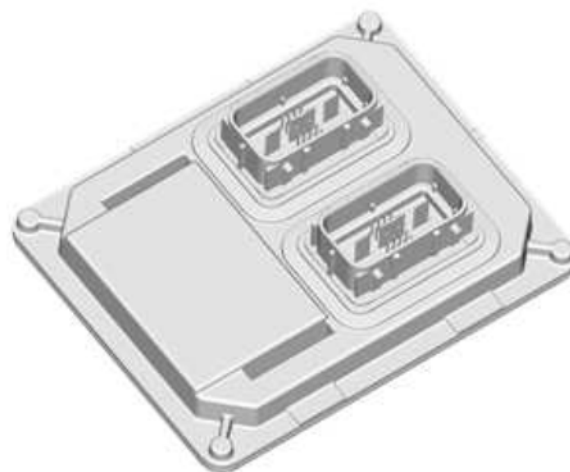


Fig. 57: Transfer Case Shift Control Module
Courtesy of GENERAL MOTORS COMPANY

The transfer case control module (TCCM) uses the vehicle identification number (VIN) information for calculations based on axle ratio, transmission, tire size, engine size and other specifics. When wheel slippage is detected, the

module sends a signal to the actuator motor which applies the clutch pack. The clutch pack sends power to the front propshaft and front axle, transferring torque to the front wheels. When slip is no longer detected by the TCCM, the clutch is reduced.

ELECTRONIC COMPONENT DESCRIPTION

K69 Transfer Case Control Module

The Transfer Case Control Module (TCCM) is a standalone controller mounted under the hood, on the right side under the air inlet grille panel access hole cover. The TCCM has two 18 terminal connectors to interface with the A16 Transfer case Shift Motor, the B109 Transfer Case Fluid Temperature Sensor, the vehicle electrical system / other control modules. The control module uses the vehicle identification number (VIN) information for calculations based on axle ratio, transmission, tire size, engine size and other vehicle specific configuration information. The TCCM uses wheel speed sensor information, which is sent to the module via high speed controller area network (CAN) serial data messages, to determine when to activate all wheel drive (AWD) and how much torque needs to be transferred to the front wheels/axle. When wheel slippage is detected, the module sends a pulse width modulated (PWM) signal to the motor, (via an H-Bridge internal to the module), which engages AWD.

A16 Transfer Case Motor

The A16 Transfer Case Motor assembly consists of a permanent magnet direct current (DC) motor assembly. It is located at the lower rear side of the transfer case. The motor is bi-directional. When activated, it rotates the shift shaft of the transfer case, clockwise or counterclockwise, to apply or un-apply AWD. The motor assembly includes a rotational / directional position sensor and a temperature sensor.

Transfer Case Motor Rotational/Directional Position Sensor

The rotational/directional position sensor is internal to the transfer case motor and is replaced with the motor as an assembly. The TCCM supplies a 5 V signal circuit and a low reference circuit to the sensor. The sensor converts the motor rotation and position, into an electrical signal and inputs the signals to the TCCM. The rotational/directional position sensor is part of the A16 Transfer Case Motor and has no serviceable parts. If the sensor is faulty, then replacement of A16 Transfer Case Motor assembly will be required.

Transfer Case Motor Temperature Sensor

The transfer case motor temperature sensor is a 2 wire negative temperature coefficient thermistor. The TCCM supplies a 5 V signal circuit and a low reference circuit to the transfer case motor temperature sensor. The transfer case motor temperature sensor measures the temperature of the transfer case motor. As the temperature of the transfer case motor increases, the resistance of the sensor decreases, varying the voltage on the signal circuit. The transfer case motor temperature sensor is part of the A16 Transfer Case Motor and has no serviceable parts. If the transfer case motor temperature sensor is faulty, then replacement of A16 Transfer Case Motor assembly will be required.

B109 Transfer Case Fluid Temperature Sensor

The B109 Transfer Case Fluid Temperature Sensor is a 2 wire negative temperature coefficient thermistor. The TCCM supplies a 5 V signal circuit and a low reference circuit to the transmission fluid temperature sensor. The B109 Transfer Case Fluid Temperature Sensor measures the temperature of the fluid the in the transfer case assembly. As the temperature of the fluid increases, the resistance of the sensor decreases, varying the voltage on the signal circuit. The transfer case fluid temperature sensor is located on the case assembly (external).

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description

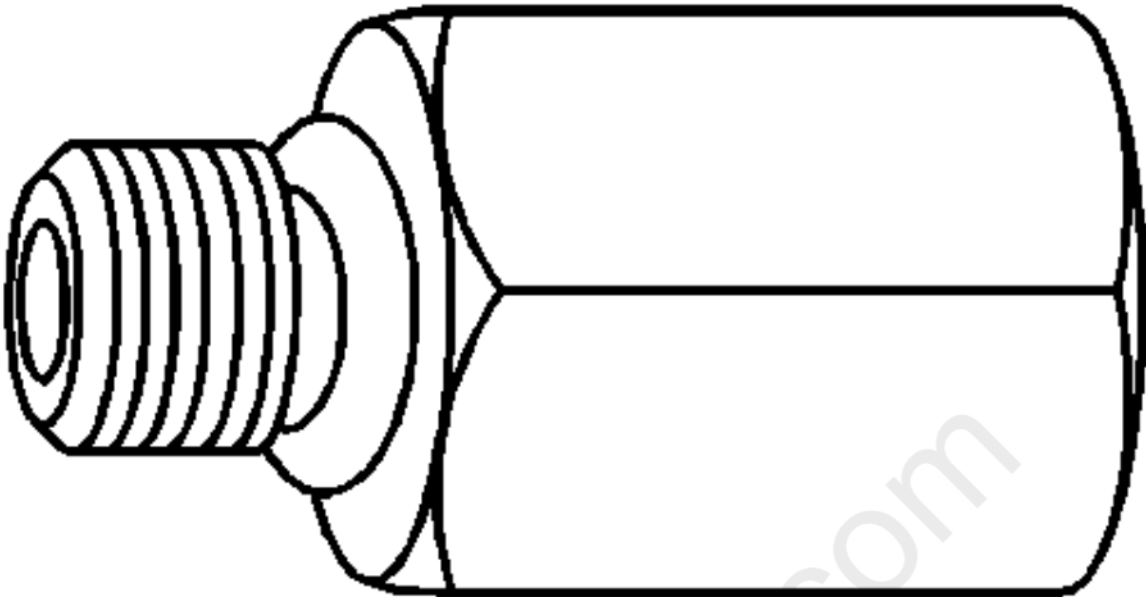
Illustration	Tool Number/Description
	8003 Adapter

Illustration	Tool Number/Description
	DT-3289-20 J-3289-20 Holding Fixture

cardiagn.com

Illustration	Tool Number/Description
	DT-38694 J-38694 Shaft Seal Installer

cardiacen.com

Illustration	Tool Number/Description
 A blue, cylindrical tool with a hexagonal base and a central hole, likely a seal installer. The tool is shown at an angle, highlighting its cylindrical shape and the hexagonal base. A watermark 'cardiagn.com' is visible diagonally across the image.	DT-42738 J-42738 Seal Installer

Illustration	Tool Number/Description
	DT-45019 J-45019 Flange and Pinion Cage Remover

cardiaguide.com

Illustration

Tool
Number/Description



DT-51263
Flange Installer

Illustration	Tool Number/Description
	GE-02619-A J-02619-A Slide Hammer
	GE28431-6 J-28431-6 Fluorescent Oil Dye

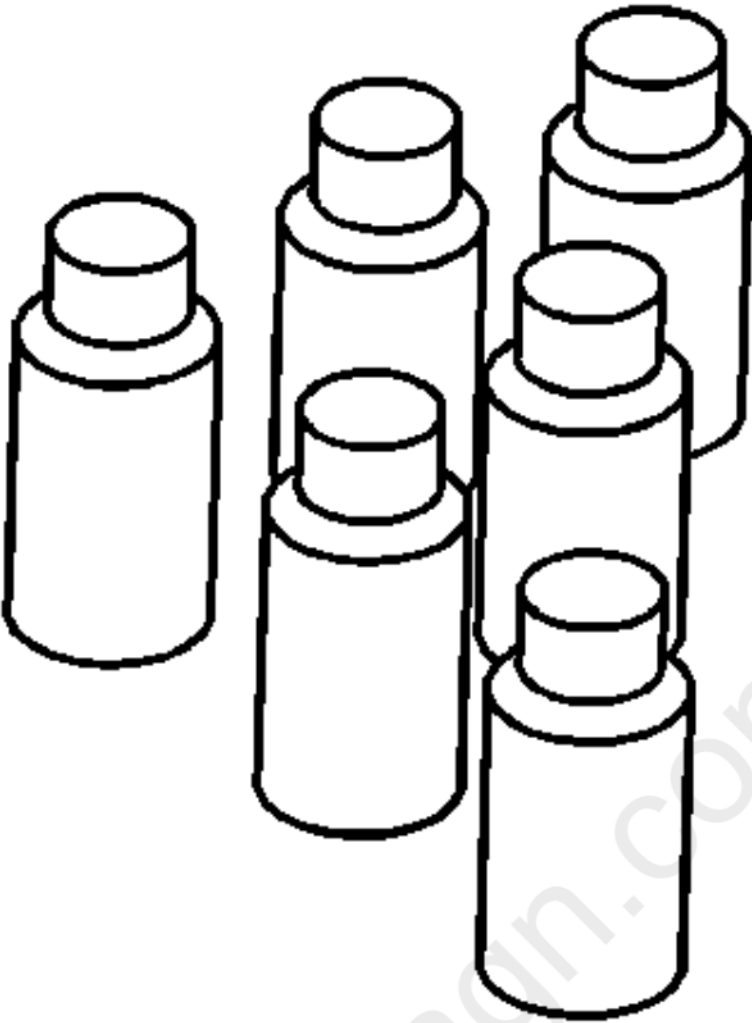
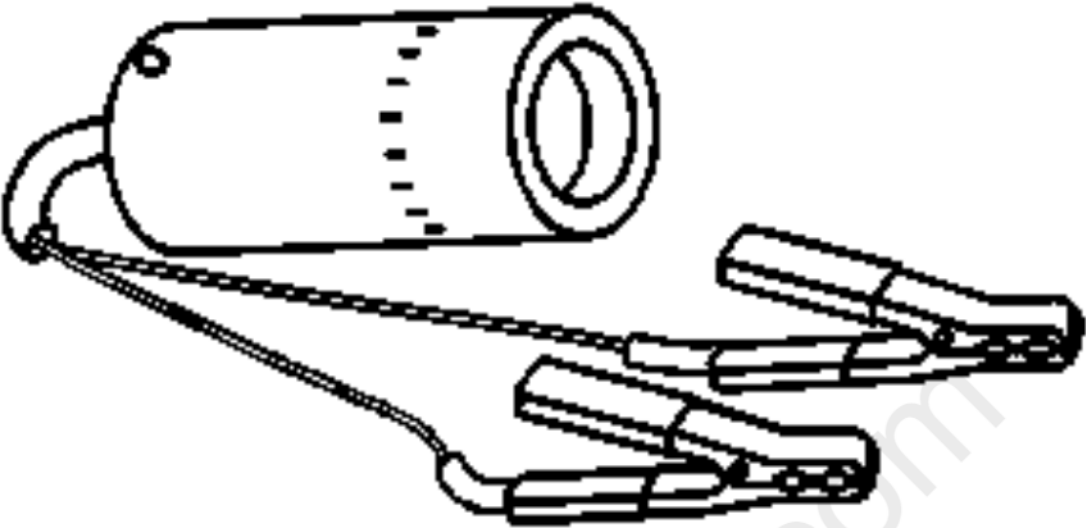
Illustration	Tool Number/Description
	

Illustration	Tool Number/Description
	GE-42220 J-42220 Universal 12V Leak Detection Lamp
	J-1859-A Steering Wheel Puller

Illustration

Tool
Number/Description

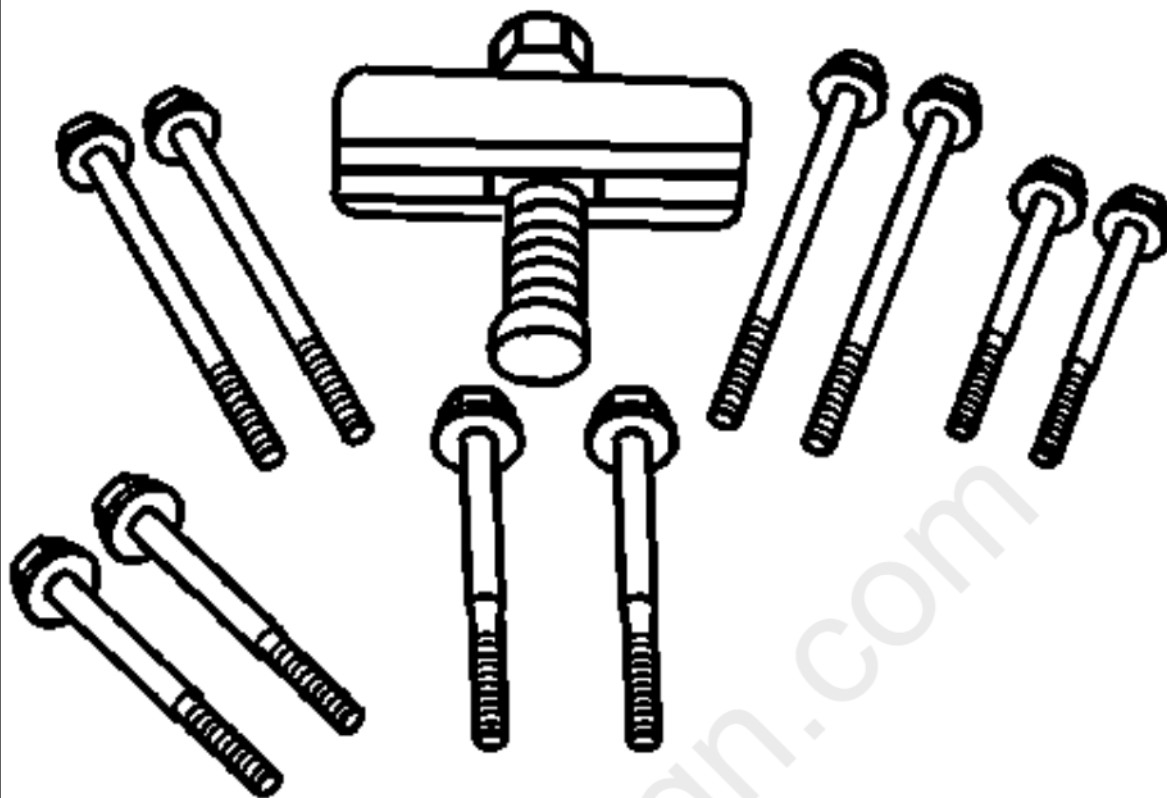
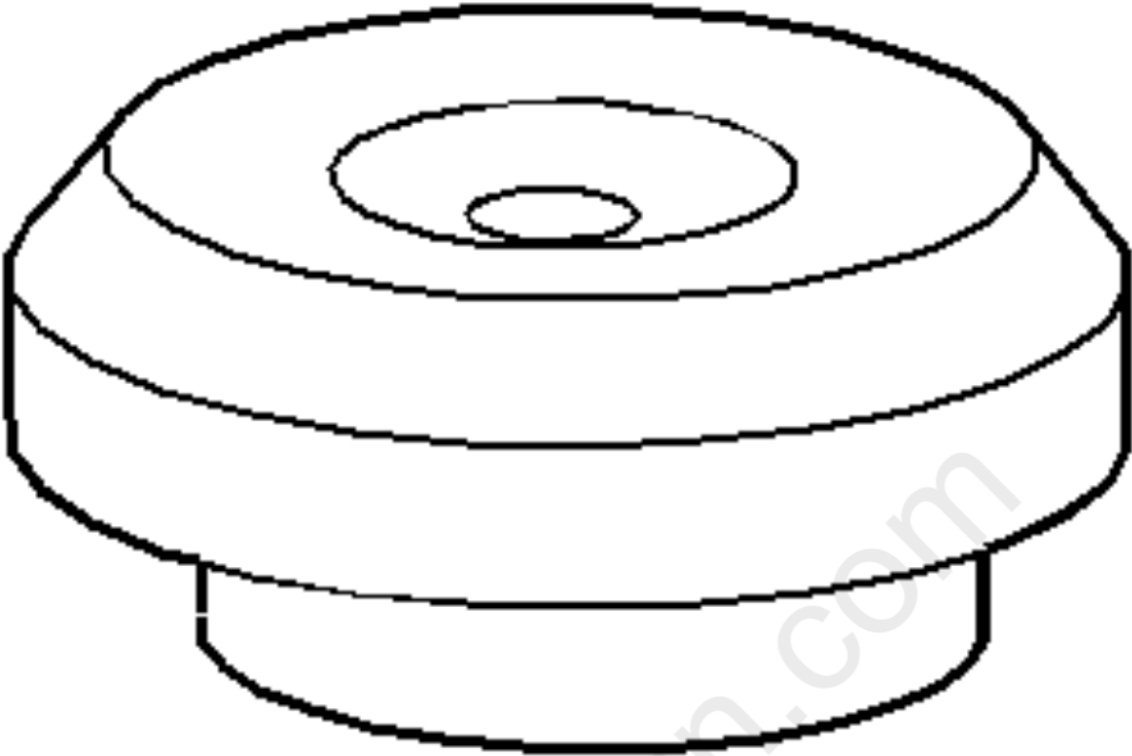


Illustration	Tool Number/Description
	J-8107-4 Side Bearing Puller Pilot