

2017 STEERING

Steering Wheel and Column - CT6

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Intermediate Steering Shaft Inner Boot Nut	9 N.m (80 lb in)
Intermediate Steering Shaft Lower Bolt	50 N.m (37 lb ft)
Intermediate Steering Shaft Outer Boot Nut	9 N.m (80 lb in)
Intermediate Steering Shaft Upper Bolt	30 N.m (22 lb ft)
Mid Intermediate Steering Shaft Bolt	30 N.m (22 lb ft)
Steering Column Lock Control Module Bolt-Rear	9.5 N.m (84 lb in)
Steering Column Lock Control Module Bolt - Side	9.5 N.m (84 lb in)
Steering Column Lower Trim Cover Bolt	2.5 N.m (22 lb in)
Steering Column Nut	22 N.m (16 lb ft)
Steering Column Tilt Wheel and Telescope Control Module Bolt	3 N.m (27 lb in)
Steering Wheel Bolt	45 N.m (33 lb ft)
Steering Wheel Spoke Cover Fastener	1 N.m (9 lb in)
Upper Intermediate Steering Shaft Upper Bolt	50 N.m (37 lb ft)

ADHESIVES, FLUIDS, LUBRICANTS AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Intermediate Steering Shaft Lower Bolt	Thread Locking Adhesive	12345382	10953489
Intermediate Steering Shaft Upper Bolt	Thread Locking Adhesive	12345382	10953489
Mid Intermediate Steering Shaft Bolt	Thread Locking Adhesive	12345382	10953489
Steering Wheel Bolt	Thread Locking Adhesive	12345382	10953489
Upper Intermediate Steering Shaft Upper Bolt	Thread Locking Adhesive	12345382	10953489

SCHEMATIC WIRING DIAGRAMS

STEERING WHEEL WIRING SCHEMATICS

Heated Steering Wheel (UVD)

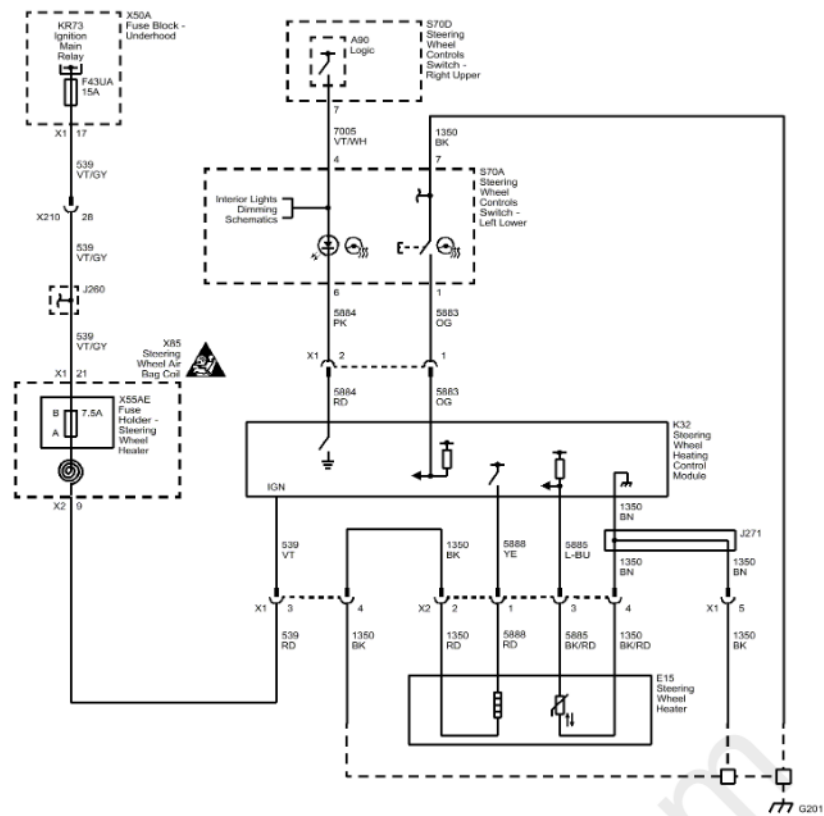


Fig. 1: Heated Steering Wheel (UVD)
Courtesy of GENERAL MOTORS COMPANY

COLUMN LOCK WIRING SCHEMATICS

Steering Column Lock (ULS)

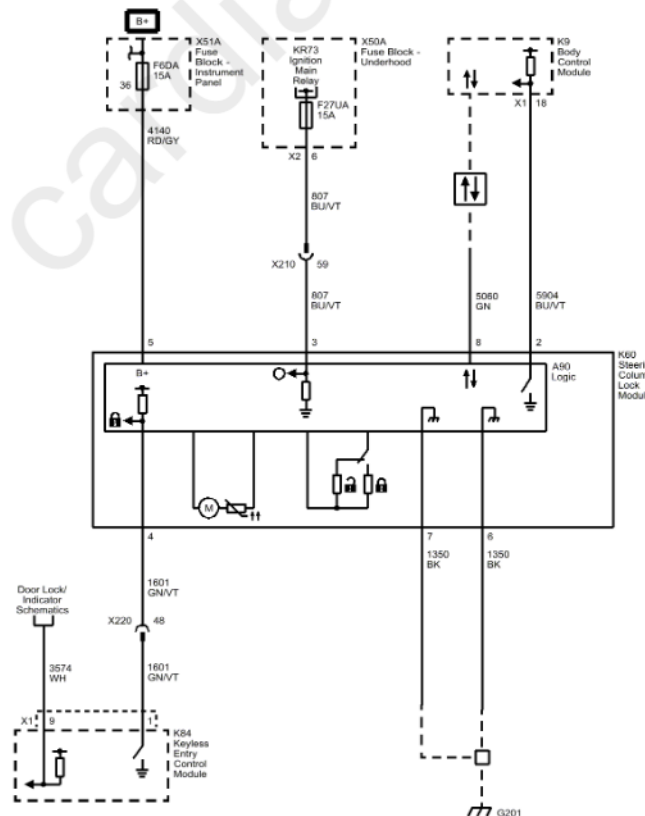


Fig. 2: Steering Column Lock (ULS)
Courtesy of GENERAL MOTORS COMPANY

TILT/TELESCOPING STEERING COLUMN WIRING SCHEMATICS

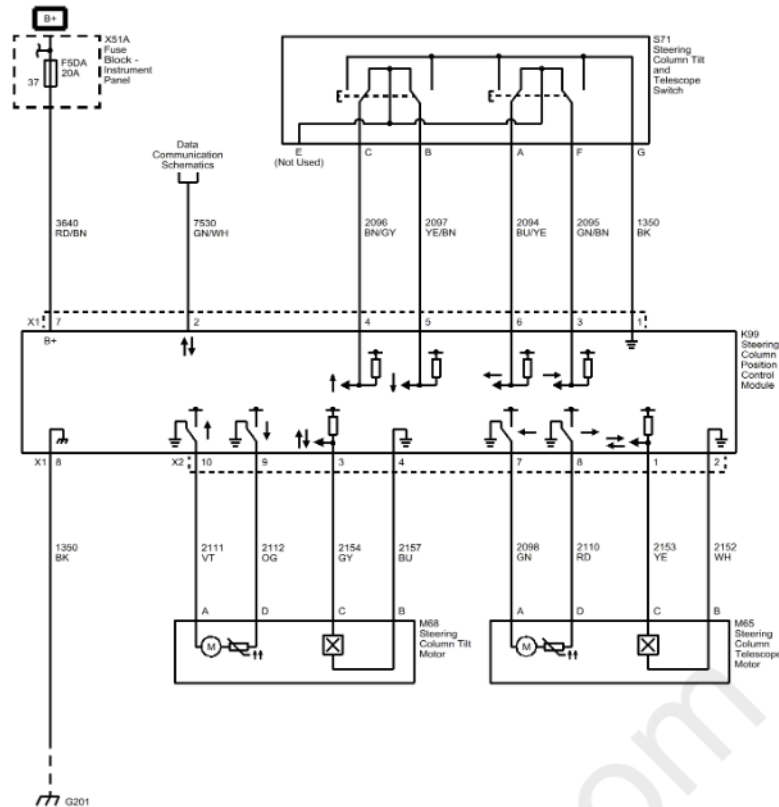


Fig. 3: Power Tilt and Telescoping Steering Column
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B1023: INTEGRAL SWITCH MALFUNCTION

Diagnostic Instructions

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

DTC Descriptor

DTC B1023 00

Integral Switch Malfunction

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9-16 V.

Conditions for Setting the DTC

The steering column lock module detects an internal sensor malfunction resulting in lock status of invalid to be transmitted on serial data.

Action Taken When the DTC Sets

- DTC B1023 is stored in memory.
- The driver information center displays the service column lock system warning message.
- The steering column lock indicator is ON.

Conditions for Clearing the DTC

- No steering column lock module internal sensor malfunction so lock status of valid is transmitted on serial data.
- The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Column Lock Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON. Clear all DTCs.
2. Verify that the DTC does not set while operating the integral switch at the steering column lock within the conditions for running the DTC.
 - **If the DTC sets**

Replace the K60 Steering Column Lock Module.
 - **If the DTC does not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for steering column lock module replacement, programming and setup.

DTC B144C: INVERTED RUN/START POWER RELAY CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC B144C 01

Inverted Run/Start Power Relay Circuit Short to Battery

DTC B144C 06

Inverted Run/Start Power Relay Circuit Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	B144C 06	B144C 06	B144C 01	-

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering column electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The system voltage is between 9-16 V.
- The DTC can only run when the steering column lock module is awake.

Conditions for Setting the DTC

B144C 01

The steering column lock module detects a short to voltage when the power mode is in the RUN or CRANK for greater than 5s.

B144C 06

The steering column lock control detects a short to ground or an open in the ignition circuit when the power mode is in the OFF/ACC for greater than 3s.

Action Taken When the DTC Sets

- The steering column lock module will command the driver information center to display the service column lock warning message.
- The steering column lock module indicator is ON.

Conditions for Clearing the DTC

- The DTC will be current for as long as the fault is present.
- The DTC will be a history DTC when the voltage is present and the power mode is OFF or ACC or when voltage is not present and the power mode is RUN or CRANK.
- A history DTC will clear after 50 ignition cycles.

Reference Information

Schematic Reference

- [Column Lock Schematics](#)
- [Power Moding Schematics](#)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC B144B is not set.
 - **If DTC B144B is set**

Refer to [DTC B144B](#)
 - **If DTC B144B is not set**
3. Refer to Circuit/System Testing.

Circuit/System Testing

B144C 01

1. Ignition OFF, disconnect the harness connector at the K60 Steering Column Lock Module.
Ignition ON.
2. Test for less than 1 V between the ignition circuit terminal 3 and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
3. Replace the K60 Steering Column Lock Module.

B144C 06

1. Ignition OFF, disconnect the harness connector at the K60 Steering Column Lock Module.
Connect a test lamp between the ignition circuit terminal 3 and ground.
2. Verify that a test lamp illuminates between the ignition circuit terminal 3 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , refer to [Power Mode Mismatch \(Without HP9\)](#) and/or [Power Mode Mismatch \(With HP9\)](#).
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K60 Steering Column Lock Module.
 - **If the test lamp illuminates**
3. Replace the K60 Steering Column Lock Module.

Repair Instructions

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

Control Module References for control module replacement, programming and setup.

DTC B2515: STEERING COLUMN LOCK MOTOR FEEDBACK CIRCUIT

Diagnostic Instructions

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

DTC Descriptor

DTC B2515 5A

Steering Column Lock Motor Feedback Circuit Not Plausible

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9-16 V.

Conditions for Setting the DTC

The body control module (BCM) detects a not plausible feedback from the steering column lock module.

Action Taken When the DTC Sets

- DTC B2515 is stored in memory.
- The driver information center displays the service column lock system warning message.
- The steering column lock indicator is ON.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The BCM detects a plausible feedback from the steering column lock module.

Reference Information

Schematic Reference

Column Lock Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON. Clear all DTCs.
2. Verify DTC B2515 does not set while operating the steering column lock module within the conditions for running the DTC.
 - **If DTC B2515 sets**
Refer to Circuit/System Testing.
 - **If DTC B2515 does not set**
3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K60 Steering Column Lock Module. It may take up to 5 minutes for all vehicle systems to power down.
2. Test for less than 3 V between the control circuit terminal 2 and ground.
 - **If 3 V or greater**
 1. Disconnect the harness connector at the K9 Body Control Module. Ignition ON.

NOTE: For vehicles with push button start, it is necessary to back out the terminal for the steering column lock status signal circuit at the K9 Body Control Module harness. When the harness connector is removed, the vehicle cannot be put back into an Ignition ON state.

2. Test for less than 3 V between the control circuit terminal 2 and ground.
 - If 3 V or greater, repair the short to voltage on the circuit.
 - If less than 3 V, replace the K9 Body Control Module.
- **If less than 3 V**
3. Ignition ON.
4. Test for B+ between the control circuit terminal 2 and ground.
 - **If less than B+**
 1. Disconnect the harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit terminal 2 end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 4. Replace the K9 Body Control Module.
 - **If B+**
5. Replace the K60 Steering Column Lock Module.

Repair Instructions

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

[Control Module References](#) for control module replacement, programming and setup.

DTC B285A: STEERING COLUMN POSITION MODULE

Diagnostic Instructions

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

DTC Descriptors

DTC B285A 39

Steering Column Position Module Internal Malfunction

DTC B285A 4B

Steering Column Position Module Calibration Not Learned

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	-	1	-	-
Tilt Switch Signal UP	B285A 39, 4	2	B285A 39, 4	-
Tilt Switch Signal DOWN	B285A 39, 4	2	B285A 39, 4	-
Telescope Switch Signal FORWARD	B285A 39, 5	3	B285A 39, 5	-
Telescope Switch Signal REARWARD	B285A 39, 5	3	B285A 39, 5	-
Tilt Motor Control	-	2	-	-
Telescope Motor Control	-	3	-	-
Tilt Motor Position Signal	B285A 39, 4	B285A39, 4	B285A39, 4	4
Telescope Motor Position Signal	B285A 39, 5	B285A39, 5	B285A39, 5	5
Switch Ground	-	1	-	-
Steering Column Tilt Motor Return	-	B285A39, 4	-	-
Steering Column Telescope Motor Return	-	B285A39, 5	-	-
Module Ground	-	1	-	-
1. Column Tilt and Telescope Inoperative 2. Column Tilt Inoperative 3. Column Telescope Inoperative 4. Column Tilt Motor Inoperative\Erratic 5. Column Telescope Motor Inoperative\Erratic				

Circuit/System Description

The steering column has a tilt/telescoping control system that consists of an steering column position control module capable of serial data communication, a steering column power assembly with positioning motors and sensors and a steering column tilt and telescope switch. The steering column position control module will wake up either by the serial data or by the steering column tilt and telescope switch.

Two position sensors are hall effect sensors and are used by the steering column position control module. The steering column position control module provides a 12 V reference voltage and a ground to both the tilt and telescoping position sensors. The sensor feedback circuit voltage varies from 0-12 V. Each sensor is part of the motor assembly. The steering column position control module monitors the feedback voltage to determine the column position.

All DTCs and data from steering column position control module is communicated through the serial data and stored in the seat memory control module.

Conditions for Running the DTC

None

Conditions for Setting the DTC

B285A 39

The steering column position control module has detected an internal electronic failure or external circuit malfunction.

B285A 4B

The steering column position control module soft stops are not learned.

Action Taken When the DTC Sets

The steering column position control module requests the DTC to be stored in the seat memory control module memory.

Conditions for Clearing the DTC

B285A 39

The external fault has been removed or steering column position control module has been replaced.

B285A 4B

The steering column position control module learn procedure has been completed.

Diagnostic Aids

All DTCs and data from steering column position control module is communicated through the serial data and stored in the seat memory control module. The seat memory control module only reports the DTCs communicated from the steering column position control module. DTCs stored in the memory seat module for the steering column position control module **DOES NOT** affect the operation of the seat or the seat memory. **DO NOT** replace the seat memory control module when DTC B285A is stored because the steering column position control module has detected a fault within it's system.

Reference Information

Schematic Reference

Tilt/Telescoping Steering Column Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- **Circuit Testing**

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

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Steering Column Direction Switch parameter changes between Inactive, Forward, Rearward, Up and Down when exercising the S71 Steering Column Tilt and Telescope Switch.
 - **If the parameter does not change**
Refer to Circuit/System Testing - Switch Malfunction.
 - **If the parameter changes**
3. Verify the operation of the M68 Steering Column Tilt Motor while commanding the Steering Column Tilt Up and Steering Column Tilt Down Command with a scan tool.
 - **If the Steering Column Tilt Up or Steering Column Tilt Down Command does not work**
Refer to Circuit/System Testing - Tilt Motor Malfunction
 - **If the Steering Column Tilt Up and Steering Column Tilt Down Command works**
4. Verify the M65 Steering Column Telescope Motor while commanding the Steering Column Telescope Forward and Steering Column Telescope Rearward with a scan tool.
 - **If the Steering Column Telescope Forward and Steering Column Telescope Rearward does not work**
Refer to Circuit/System Testing - Telescope Motor Malfunction
 - **If the Steering Column Telescope Forward and Steering Column Telescope Rearward works**
5. Verify that DTC B285A 39 is not set.
 - **DTC B285A 39 is set**

NOTE: **DO NOT replace the K40D Seat Memory Control Module - Driver.**

Replace the K99 Steering Column Position Control Module.
 - **DTC B285A 39 is not set.**
6. All OK.

Circuit/System Testing

NOTE: **After all repairs are complete, it is necessary to perform the Steering Column Tilt Wheel and Telescope Control Module Learn procedure.**

Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.

- **If less than 10 Ω**

3. Ignition ON.

4. Test for B+ between the signal circuit terminals listed below and ground:

- Terminal A
- Terminal F
- Terminal C
- Terminal B
- **If less than B+**

1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Control Module.

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

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K99 Steering Column Position Control Module.

- **If B+**

5. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module. It may take up to 2 min for all vehicle systems to power down.

6. Ignition ON.

7. Test for less than 1 v between the signal circuit terminals listed below and ground:

- Terminal 6
- Terminal 3
- Terminal 4
- Terminal 5
- **If greater than 1 V**

Repair the short to voltage on the circuit

- **If less than 1 V**

8. Ignition OFF, connect the X1 harness connector at the K99 Steering Column Position Control Module. It may take up to 2 min for all vehicle systems to power down.

9. Ignition ON.

10. Install a 3 A fused jumper wire between the signal circuits listed below and the ground circuit terminal G. Verify the steering column telescopes FORWARD and REVERSE to the soft stop.

NOTE: When performing the following test, make sure that the steering column is not already in the position the test is attempting to produce.

- Terminal A
- Terminal F
- **If the M65 Steering Column Telescope Motor does not operate**

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.

2. Test for 1-2.5 Ω between terminal 7 and terminal 8.

- If not within the specified range, replace the M65 Steering Column Telescope Motor.
- If within the specified range, replace the K99 Steering Column Position Control Module.

- **If the M65 Steering Column Telescope Motor operates**

11. Install a 3 A fused jumper wire between the signal circuits listed below and the ground circuit terminal G. Verify the steering column telescopes FORWARD and REVERSE to the soft stop.

NOTE: When performing the following test, make sure that the steering column is not already in the position the test is attempting to produce.

- Terminal B
 - Terminal C
 - **If the M68 Steering Column Tilt Motor does not operate**
 1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 1-2.5 Ω between terminal 9 and terminal 10.
 - If not within the specified range, replace the M68 Steering Column Tilt Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **If the M68 Steering Column Tilt Motor operates**
12. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Tilt Motor Malfunction

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module, ignition ON.
2. Test for less than 1 V between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.
 - Steering Column Tilt Motor Down Control - terminal 9
 - Steering Column Tilt Motor Up Control - terminal 10
 - Steering Column Tilt Motor Signal - terminal 3
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
3. Ignition OFF.
4. Test for infinite resistance between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.
 - Steering Column Tilt Motor Down Control - terminal 9
 - Steering Column Tilt Motor Up Control - terminal 10
 - Steering Column Tilt Motor Signal - terminal 3
 - **If less than infinite resistance**

Repair the short to ground on the circuit.
 - **If Infinite resistance**
5. Replace the M68 Steering Column Tilt Motor.

Telescope Motor Malfunction

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module, ignition ON.
2. Test for less than 1 V between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.
 - Steering Column Telescope Motor Forward - terminal 7
 - Steering Column Telescope Motor Rearward - terminal 8
 - Steering Column Telescope Motor Signal - terminal 1
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

3. Ignition OFF.

4. Test for infinite resistance between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.

- Steering Column Telescope Motor Forward - terminal 7
- Steering Column Telescope Motor Rearward - terminal 8
- Steering Column Telescope Motor Signal - terminal 1
- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **If Infinite resistance**

5. Replace the M65 Steering Column Telescope Motor.

Component Testing

NOTE: After all repairs are complete, it is necessary to perform the Steering Column Tilt Wheel and Telescope Control Module Learn procedure.

Steering Column Tilt/Telescope Switch Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for infinite resistance between the low reference terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the released position.

- **If less than infinite resistance**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If infinite resistance**

3. Test for less than 2 Ω between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.

- **If 2 Ω or greater**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If less than 2 Ω**

4. All OK.

Steering Column Telescope Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 1-2.5 Ω between terminal 7 and terminal 8.

- **If not within the specified range**

Replace the M65 Steering Column Telescope Motor.

- **If within the specified range**

3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 1-2.5 Ω between terminal 9 and terminal 10.

- **If not within the specified range**

Replace the M68 Steering Column Tilt Motor.

- If within the specified range

3. All OK.

Repair Instructions

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

[Control Module References](#) for control module replacement, programming and setup.

DTC B2897: STEERING COLUMN LOCK MOTOR LOCK CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC B2897

Steering Column Lock Motor Lock Circuit

For symptom byte information, refer to [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Column Lock Motor Lock Signal	B2897 02	B2897 05	B2897 01, 05	-

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9-16 V.

Conditions for Setting the DTC

B2897 02

The steering column lock enable input circuit is shorted to ground.

B2897 01 or 05

The steering column lock enable input circuit is open or shorted to battery.

Action Taken When the DTC Sets

- DTC B2897 is stored in the steering column lock module memory.
- The steering column lock module will command the driver information center to display the Service Column Lock warning message.
- The steering column lock module indicator is ON.

Conditions for Clearing the DTC

The steering column lock module has received a lock command and detects no longer a malfunction in the steering column lock circuit.

Reference Information

Schematic Reference

Column Lock Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the K60 Steering Column Lock Module.
Ignition ON.
2. Test for less than B+ between the control circuit terminal 4 and ground.
 - **If B+**

Repair the short to voltage on the circuit.
 - **If less than B+**
3. Ignition OFF.
4. Test for infinite resistance between the control circuit terminal 4 and ground.
 - **If less than infinite resistance**
 1. Disconnect the X1 harness connector at the K84 Keyless Entry Control Module.
 2. Test for infinite resistance between the control circuit terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K84 Keyless Entry Control Module.
 - **If infinite resistance**
5. Disconnect the X1 harness connector at the K84 Keyless Entry Control Module.
6. Test for less than 2 Ω in the harness connector control circuit terminal 4 at the K60 Steering Column Lock Module end to end.
 - **If 2 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 2 Ω**
7. Replace the K60 Steering Column Lock Module.

Repair Instructions

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

Control Module References for steering column lock module or keyless entry control module replacement, programming and setup.

DTC B2910: STEERING COLUMN LOCK PASSWORD INCORRECT

Diagnostic Instructions

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

DTC Descriptor

DTC B2910

Steering Column Lock Password Incorrect

For symptom byte information, refer to **Symptom Byte List**.

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9-16 V.

Conditions for Setting the DTC

The steering column lock module has not received the correct password or did not receive a password with the command to unlock the steering column.

Action Taken When the DTC Sets

- DTC B2910 is stored in memory.
- The driver information center displays the Service Column Lock warning message.
- The steering column lock indicator is ON.
- The engine will not crank.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The steering column lock module has received the correct password with the command to unlock the steering column.

Diagnostic Aids

This DTC may set if the BCM was replaced and the steering column lock module was not programmed.

Reference Information

Schematic Reference

Column Lock Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

NOTE: To ensure that the steering column lock password from the BCM is learned: turn ignition ON and then OFF, close all doors and wait 5 minutes.

1. Ignition ON. Clear all DTCs.
2. Verify DTC B2910 does not set while operating the steering column lock module within the conditions for running the DTC.
 - **If DTC B2910 sets**
 1. Program the K60 Steering Column Lock Module.
 2. Ignition ON. Clear all DTCs.
 3. Verify DTC B2910 does not set while operating the steering column lock module within the conditions for running the DTC.
 - If DTC B2910 sets, replace the K60 Steering Column Lock Module.
 - If DTC B2910 does not set
 4. All OK.
 - **If DTC B2910 does not set**
3. All OK.

Repair Instructions

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

[Control Module References](#) for steering column lock module replacement, programming and setup.

DTC B305A: NO RESPONSE FROM STEERING COLUMN LOCK RECEIVED

Diagnostic Instructions

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

DTC Descriptor

DTC B305A 00

No Response From Steering Column Lock Received

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Column Lock Status Signal	B305A 00	B305A 00 B2515 5A	B305A 00 B2515 5A	-

Circuit/System Description

The vehicle theft deterrent subsystem provides the capability to lock or unlock the steering electrically. The steering column lock module is allowed to unlock when power mode transitions to a non off power mode and an authenticated driver identification device is present. Once the column is unlocked, a crank request can be allowed.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9-16 V.

Conditions for Setting the DTC

The body control module (BCM) has not received any response from the steering column lock module.

Action Taken When the DTC Sets

- DTC B305A is stored in the BCM memory.
- The driver information center displays the Service Steering Column Lock message.
- The steering column lock indicator is ON.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The BCM has received response from the steering column lock module.

Reference Information

Schematic Reference

Column Lock Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON. Clear all DTCs.
2. Verify the scan tool communicates with the control module and there are no U codes set.
 - **If the scan tool does not communicate with the control module and there are U codes set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **If the scan tool does not communicate with the control module and there are no codes set**

- **If the scan tool communicates with the control module and there are no codes set**
3. Verify DTC B305A does not set while operating the steering column lock module within the conditions for running the DTC.

- **If DTC B305A sets**

Refer to Circuit/System Testing.

- **If DTC B305A does not set**

4. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K60 Steering Column Lock Module. It may take up to 5 minutes for all vehicle systems to power down.
2. Test for less than 2 Ω between the following terminals and ground.

- Terminal 6
- Terminal 7
- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

3. Test for less than 3 V between the control circuit terminal 2 and ground.

- **If 3 V or greater**

1. Disconnect the harness connector at the K9 Body Control Module. Ignition ON.

NOTE:

For vehicles with push button start, it is necessary to back out the terminal for the steering column lock status signal circuit at the K9 Body Control Module harness. When the harness connector is removed, the vehicle cannot be put back into an Ignition ON state.

2. Test for less than 3 V between the control circuit terminal 2 and ground.

- If 3 V or greater, repair the short to voltage on the circuit.
- If less than 3 V, replace the K9 Body Control Module.

- **If less than 3 V**

4. Ignition ON.

5. Test for B+ between the control circuit terminal 2 and ground.

- **If less than B+**

1. Disconnect the harness connector at the K9 Body Control Module.

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

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

4. Replace the K9 Body Control Module.

- **If B+**

6. Replace the K60 Steering Column Lock Module.

Repair Instructions

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

[Control Module References](#) for control module replacement, programming and setup.

SYMPTOMS - STEERING WHEEL AND COLUMN

IMPORTANT: The following steps must be completed before using the symptom tables:

- Refer to [Diagnostic Starting Point - Vehicle](#) .
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to [Steering Wheel and Column Description and Operation](#) .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the telescoping steering column or the steering wheel theft deterrent lock system. Refer to [Checking Aftermarket Accessories](#) .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to [Testing for Intermittent Conditions and Poor Connections](#) .

Symptom List

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

- [Steering Column Tilt/Telescoping Malfunction \(N38\)](#)
- [Noise in Steering Column](#)
- [Looseness in Steering Column](#)

HEATED STEERING WHEEL INDICATOR MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	1	1	-	-
Switch Signal	2	1	-	-
LED Control	3	3	4	-
Switch and LED Ground	-	1	-	-
Module Ground	-	1	-	-
1. Heated Steering Wheel System Inoperative 2. Heated Steering Wheel Always ON 3. LED Inoperative 4. LED Always ON				

Circuit/System Description

The Steering Wheel Heating Control Module controls the heated steering wheel and the heated steering wheel ON indicator based on an input from the heated steering wheel switch. When the heated steering wheel switch is pressed, the switch signal circuit is pulled to ground. This indicates to the heating steering wheel control module that steering wheel heat is requested. When the request is seen, the heated

steering module supplies voltage to the indicator lamp and supplies voltage to the heating elements, which are internal to the steering wheel.

Reference Information

Schematic Reference

Steering Wheel Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Circuit/System Verification

1. Ignition ON, heated steering wheel OFF.
2. Verify the steering wheel heater indicator on the S70A Steering Wheel Controls Switch - Left Lower is not illuminated and the steering wheel is not warm.
 - **If the steering wheel is warm**
Refer to [Heated Steering Wheel Malfunction](#)
 - **If the steering wheel is not warm and the steering wheel heater indicator is illuminated**
Refer to Circuit/System Testing
 - **If the steering wheels heater indicator is not illuminated and the steering wheel is not warm**
3. Verify the steering wheel heater indicator turns ON and OFF and the left and right sides of the steering wheel become warm when pressing and releasing the steering wheel heater switch on the S70A Steering Wheels Controls Switch - Left Lower.
 - **If the steering wheel does not become warm**
Refer to [Heated Steering Wheel Malfunction](#)
 - **If the steering wheel becomes warm, but the steering wheel heater indicator does not turn ON and OFF**
Refer to Circuit/System Testing
 - **If the steering wheel becomes warm and the steering wheel heater indicator turns ON and OFF**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X2 harness connector at the X85 Steering Wheel Airbag Coil.
2. Test for less than 10 Ω between the ground circuit terminal 3 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.

2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
- **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 9 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse. Refer to [Power Mode Mismatch \(Without HP9\)](#) and/or [Power Mode Mismatch \(With HP9\)](#).
 - If 2 Ω or greater
 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is open, replace the K32 Steering Wheel Heating Control Module.
 - If the in-line fuse is OK, repair the open/high resistance in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K32 Steering Wheel Heating Control Module.
 - **If the test lamp illuminates**
5. Ignition OFF, connect the X2 harness connector at the X85 Steering Wheel Airbag Coil. Disconnect the harness connector at the S70A Steering Wheel Control Switch - Left Lower. Ignition ON.
6. Test for B+ between the control circuit terminal 4 and ground.
 - **If less than B+**
 1. Ignition OFF, disconnect the harness connector at the S70D Steering Wheel Control Switch - Right Upper.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the S70D Steering Wheel Control Switch - Right Upper.
 - **If B+**
7. Ignition OFF, connect the harness connector at the S70A Steering Wheel Control Switch - Left Lower. Disconnect the in-line harness connector at the K32 Steering Wheel Heating Control Module.
8. Install a 3 A fused jumper wire between the control circuit terminal 2 and ground. Ignition ON.

NOTE: Verify the instrument panel dimming control is set to bright.

9. Verify the steering wheel heat indicator is illuminated.
 - **If the steering wheel heat indicator does not illuminate**

Replace the S70A Steering Wheel Control Switch - Left Lower
 - **If the steering wheel heat indicator illuminates**
10. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- [Cruise Control Switch Replacement \(Left Upper\)](#) [Cruise Control Switch Replacement \(Left Lower\)](#)
- [Control Module References](#) for control module replacement, programming and setup.

HEATED STEERING WHEEL MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	1	1	-	-
Switch Signal	2	1	-	-
Switch and LED Ground	-	1	-	-
Temperature Sensor Signal	3	3	3	-
Temperature Sensor Ground	-	3	-	-
Heater Element Control	3	3	2	-
Heater Element Ground	-	3	-	-
Module Ground	-	1	-	-
1. Heated Steering Wheel System Inoperative 2. Heated Steering Wheel Always ON 3. Heated Steering Wheel Inoperative				

Circuit/System Description

The heated steering wheel control module controls the heated steering wheel and the heated steering wheel ON indicator based on an input from the heated steering wheel switch. When the heated steering wheel switch is pressed, the switch signal circuit is pulled to ground. This indicates to the heating steering wheel control module that steering wheel heat is requested. When the request is seen, the heated steering wheel control module supplies voltage to the indicator lamp and supplies voltage to the heating elements, which are internal to the steering wheel.

Diagnostic Aids

- Before replacing the steering wheel for complaints of not getting hot enough, a reliable infrared temperature gun should be used to measure the temperature at various points around the rim. The steering wheel's normal operating temperature is 32°C (89.6°F) and takes approximately 10 min to reach that temperature. It may take up to 20 min for the normal operating temperature to stabilize within the steering wheel rim. There may be spike in temperature during the first 3-4 min before it stabilizes at normal operating temperature. The steering wheel will take longer to heat up if the vehicle temperature is below -21°C (-5.8°F). The steering wheel heater will not operate when the steering wheel temperature is above 32°C (89.6°F).
- The infrared measurements are made at the rim (1) at the 3 and 9 o'clock positions of the steering wheel.

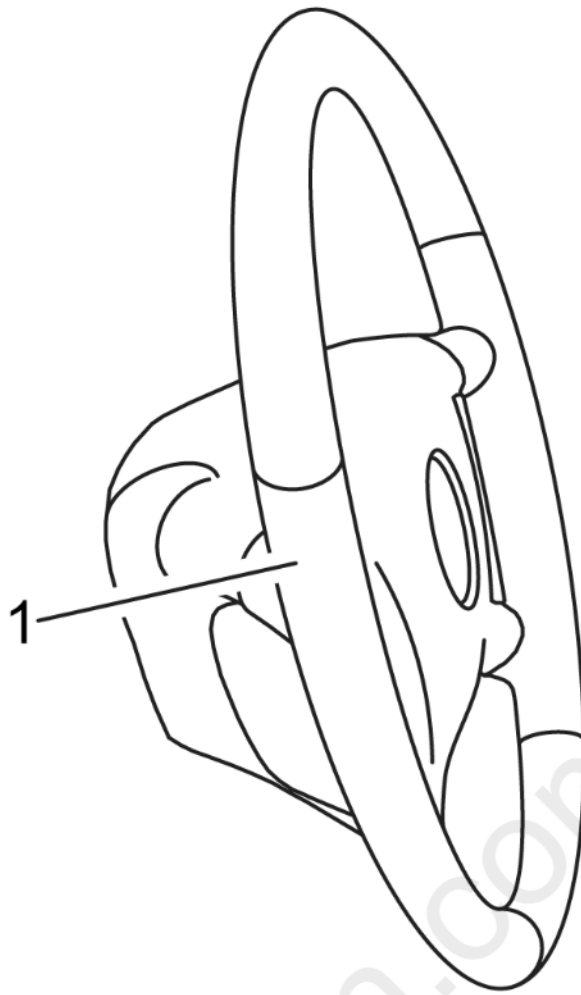


Fig. 4: Steering Wheel Rim Measurement Point
Courtesy of GENERAL MOTORS COMPANY

- The wood sections and the stitching are not heated. Temperature measurements should not be made on the face (1) to insure accurate temperature readings.

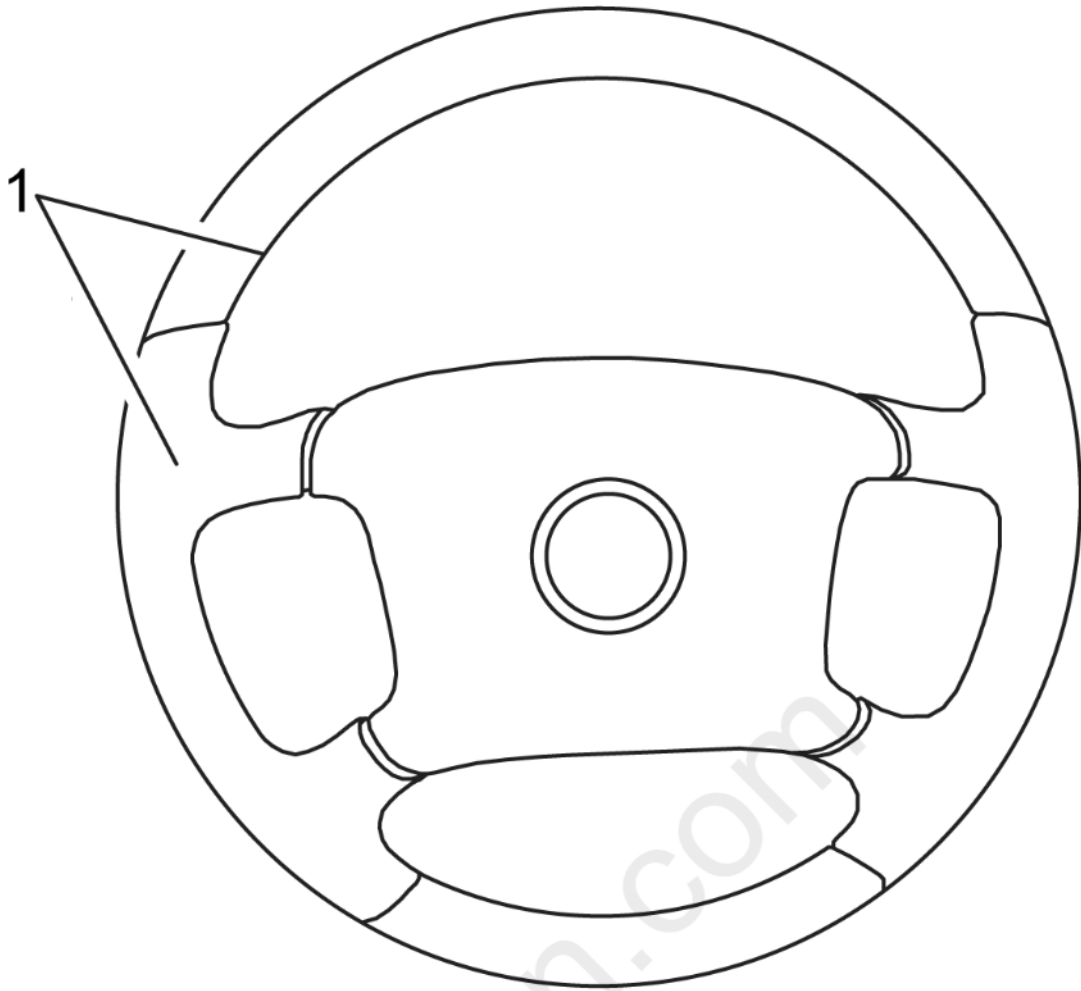


Fig. 5: Temperature Measurement Points
Courtesy of GENERAL MOTORS COMPANY

Reference Information

Schematic Reference

Steering Wheel Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

Using an Infrared Temperature Gun

1. Engine running, all accessories OFF.

2. Verify the steering wheel heater switch is OFF and the steering wheel heater indicator should not be illuminated.

- **If the heater indicator is illuminated**

Refer to [Heated Steering Wheel Indicator Malfunction](#)

- **If the heater indicator is not illuminated**

3. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).

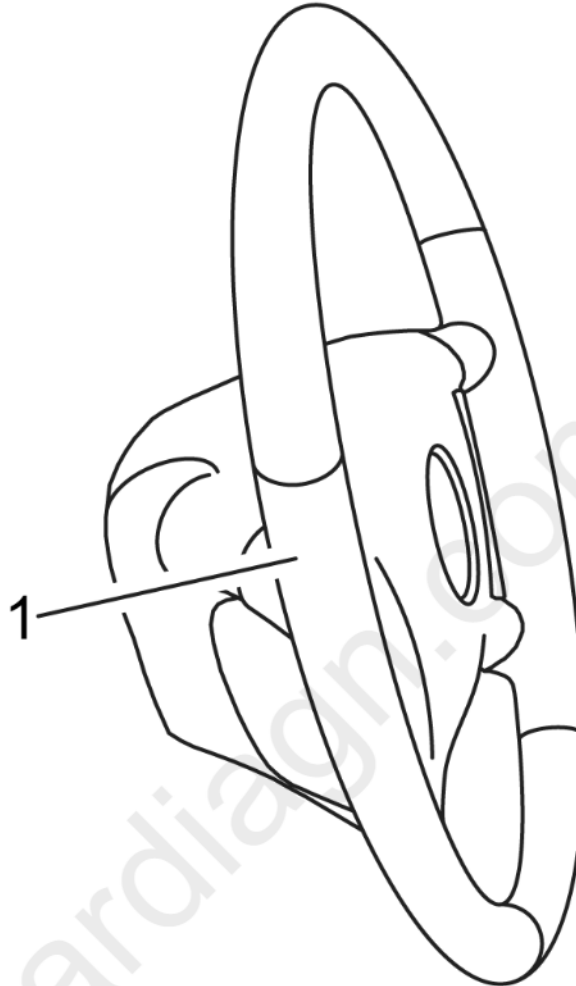


Fig. 6: Steering Wheel Rim Measurement Point

Courtesy of GENERAL MOTORS COMPANY

NOTE: The Infrared Temperature Gun should be within 50.8 mm (2 in) and parallel to the steering wheel rim when taking temperature readings.

4. Verify that the steering wheel temperature is 25°C (77°F) or below.

- **If the steering wheel temperature is greater than 25°C (77°F)**

Allow the steering wheel to cool before proceeding to next step.

- **If the steering wheel temperature is 25°C (77°F) or below**

5. Press and release the steering wheel heater switch. The steering wheel heater indicator should illuminate. Allow the steering wheel to heat for a minimum of 10 min so that the temperature stabilizes.

- **If the heater indicator does not illuminate**

Refer to [Heated Steering Wheel Indicator Malfunction](#)

- If the heater indicator illuminates

6. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).

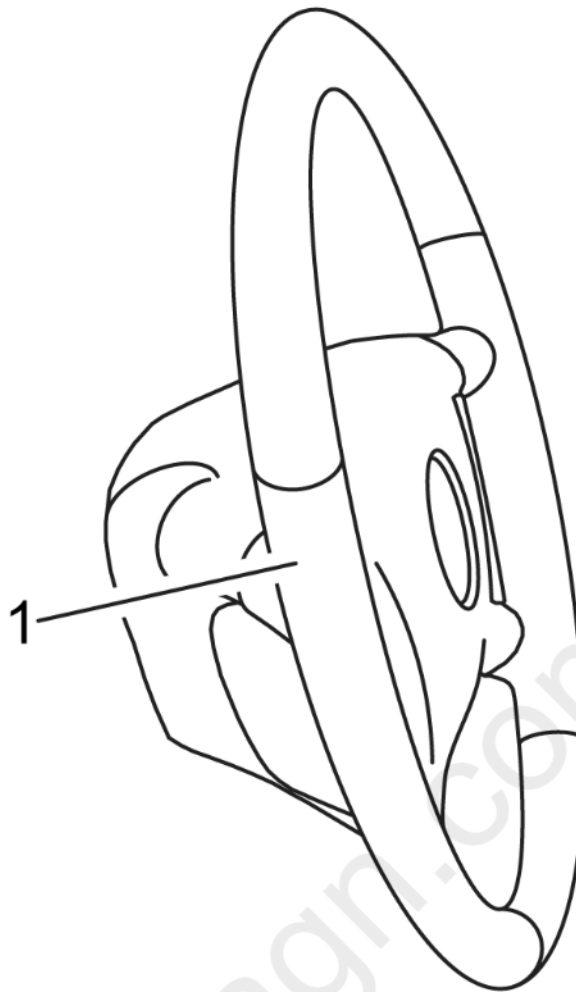


Fig. 7: Steering Wheel Rim Measurement Point

Courtesy of GENERAL MOTORS COMPANY

NOTE: The Infrared Temperature Gun should be within 50.8 mm (2 in) and parallel to the steering wheel rim when taking temperature readings.

7. Verify that the steering wheel temperature is greater than 28°C (82.4°F) within 20 min.

- If after 20 minutes the measured temperature is less than 28°C (82.4°F)

Refer to Circuit System Testing.

- If after 20 minutes the measured temperature is 28°C (82.4°F) or greater

8. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X2 harness connector at the X85 Steering Wheel Airbag Coil.

2. Test for less than $10\ \Omega$ between the ground circuit terminal 3 and ground.

- If $10\ \Omega$ or greater

1. Ignition OFF.

2. Test for less than $2\ \Omega$ in the ground circuit end to end.

- If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
- If less than $2\ \Omega$, repair the open/high resistance in the ground connection.

- If less than $10\ \Omega$

3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 9 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch (Without HP9)** and/or **Power Mode Mismatch (With HP9)**.
 - If 2 Ω or greater
 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is open, replace the K32 Steering Wheel Heating Control Module.
 - If the in-line fuse is OK, repair the open/high resistance in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K32 Steering Wheel Heating Control Module.
 - **If the test lamp illuminates**
5. Ignition OFF, connect the X2 harness connector at the X85 Steering Wheel Airbag Coil.
Disconnect the harness connector at the S70A Steering Wheel Control Switch - Left Lower.
6. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
7. Ignition ON.
8. Test for B+ between the signal circuit terminal 1 and ground.
 - **If less than B+**
 1. Ignition OFF, disconnect the in-line harness connector at the K32 Steering Wheel Heating Control Module.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K32 Steering Wheel Heating Control Module.
 - **If B+**
9. Test for infinite resistance between the S70A Steering Wheel Control Switch - Left Lower signal terminal 1 and the ground terminal 7 with the steering wheel heater switch released.
 - **If less than infinite resistance**

Replace the S70A Steering Wheel Controls Switch - Left Lower.
 - **If infinite resistance**
10. Test for less than 40 Ω between the S70A Steering Wheel Control Switch - Left Lower signal terminal 1 and the ground terminal 7 with the steering wheel heater switch pressed.
 - **If 40 Ω or greater**

Replace the S70A Steering Wheel Controls Switch - Left Lower
 - **If less than 40 Ω**

11. Connect the harness connector at the S70A Steering Wheel Control Switch - Left Lower.
Disconnect the harness connector at the E15 Steering Wheel Heater.
12. Test for less than 10 Ω between the ground circuits listed below and ground.
 - Terminal 2
 - Terminal 4
 - **If 10 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 10 Ω**
13. Test for 1.5-3.0 Ω between the control circuit terminal 1 and the ground terminal 2.
 - **If not within the specified range**

Replace the E15 Steering Wheel Heater.
 - **If within the specified range**
14. Test for 10-12 k Ω between the signal circuit terminal 3 and the ground terminal 4.
 - **If not within the specified range**

Replace the E15 Steering Wheel Heater.
 - **If within the specified range**
15. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- [Cruise Control Switch Replacement \(Left Upper\)](#) [Cruise Control Switch Replacement \(Left Lower\)](#)
- [Control Module References](#) for control module replacement, programming and setup.

STEERING COLUMN TILT/TELESCOPING MALFUNCTION (N38)

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	-	1	-	-
Tilt Switch Signal UP	2	2	-	-
Tilt Switch Signal DOWN	2	2	-	-
Telescope Switch Signal FORWARD	3	3	-	-
Telescope Switch Signal REARWARD	3	3	-	-
Tilt Motor Control	-	2	-	-
Telescope Motor Control	-	3	-	-
Tilt Motor Position Signal	4	4	-	4
Telescope Motor Position Signal	5	5	-	5

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Switch Ground	-	1	-	-
Module Ground	-	1	-	-
1. Column Tilt and Telescope Inoperative 2. Column Tilt Inoperative 3. Column Telescope Inoperative 4. Column Tilt Motor Inoperative\Erratic 5. Column Telescope Motor Inoperative\Erratic				

Circuit/System Description

The steering column has a tilt/telescoping control system that consists of an steering column position control module capable of serial data communication, a steering column power assembly with positioning motors and sensors and a steering column tilt and telescope switch. The steering column position control module will wake up either by the serial data or by the steering column tilt and telescope switch.

Two position sensors are hall effect sensors and are used by the steering column position control module. The steering column position control module provides a 5 V reference voltage and a ground to both the tilt and telescoping position sensors. The sensor feedback circuit voltage varies from 0-5 V. Each sensor is part of the motor assembly. The steering column position control module monitors the feedback voltage to determine the column position.

If the vehicle has memory seat option, all DTCs and data from steering column position control module is communicated through the serial data and stored in the seat memory control module. With the steering column at the Forward and Up soft stops, the steering column position voltage readings will be 5.0 V. With the steering column at the Rearward and Down soft stops, the steering column position voltage readings will be 0 V.

Diagnostic Aids

A bad hall effect will cause a tilt or telescope motor to move for only.5 s.

Reference Information

Schematic Reference

Tilt/Telescoping Steering Column Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Circuit/System Verification

1. Ignition ON.
2. Verify the steering column directional motors listed below operate while operating the S71 Steering Column Tilt and Telescope Switch in all directions.

NOTE: Operate the steering column switch in each direction for more than

NOTE: When performing the following tests, make sure that the steering column is not already in the position the test is attempting to produce.

- M65 Steering Column Telescope Motor
- M68 Steering Column Tilt Motor
- **If the M65 Steering Column Telescope Motor moves for only.5 s FORWARD or REARWARD**
 1. Wait 5 s.
 2. Operate the S71 Steering Column Tilt and Telescope Switch FORWARD and REARWARD.
 - If the M65 Steering Column Telescope Motor moves for only.5 s FORWARD or REARWARD, replace the M65 Steering Column Telescope Motor
- **If the M65 Steering Column Telescope Motor does not operate FORWARD and REARWARD**

Refer to Circuit/System Testing - Steering Column Telescope Motor Control Circuit Test.

- **If the M68 Steering Column Tilt Motor moves for only.5 s UP and DOWN**
 1. Wait 5 s.
 2. Operate the S71 Steering Column Tilt and Telescope Switch UP and DOWN.
 - If the M68 Steering Column Tilt Motor moves for only.5 s UP or DOWN, replace the M68 Steering Column Tilt Motor.
- **If the M68 Steering Column Tilt Motor does not operate UP and DOWN**

Refer to Circuit/System Testing - Steering Column Tilt Motor Control Circuit Test.

- **If both the M65 Steering Column Telescope Motor and the M68 Steering Column Tilt Motor do not operate in any direction**

Refer to Circuit/System Testing - Steering Column Tilt and Telescope Motor Control Circuit Test.

- **If both the M65 Steering Column Telescope Motor and the M68 Steering Column Tilt Motor operate**

3. All OK.

Circuit/System Testing

NOTE: After all repairs are complete, it is necessary to perform the Steering Column Tilt Wheel and Telescope Control Module Learn procedure.

Steering Column Telescope Motor Control Circuit Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **If less than 10 Ω**
3. Ignition ON.
4. Test for B+ between the signal circuits listed below and ground:
 - Terminal A

- Terminal F
- **If less than B+**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
- **If B+**
- 5. Install a 3 A fused jumper wire between the signal circuits listed below and the ground circuit terminal G. Verify the steering column telescopes FORWARD and REVERSE to the soft stop.

NOTE: When performing the following test, make sure that the steering column is not already in the position the test is attempting to produce.

- Terminal A
- Terminal F
- **If the M65 Steering Column Telescope Motor does not operate**
 1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 0.6-1.0 Ω between terminal 7 and terminal 8.
 - If not within the specified range, replace the steering column.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
- **If the M65 Steering Column Telescope Motor operates**
- 6. Test or replace the S71 Ω Steering Column Tilt and Telescope Switch.

Steering Column Tilt Motor Control Circuit Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **If less than 10 Ω**
3. Ignition ON.
4. Test for B+ between the signal circuits listed below and ground:
 - Terminal B
 - Terminal C
 - **If less than B+**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
- **If B+**
5. Install a 3 A fused jumper wire between the signal circuits listed below and the low reference circuit terminal G. Verify the steering column tilts UP and DOWN to the soft stop.

NOTE: When performing the following test, make sure that the steering column is not already in the position the test is attempting to produce.

- Terminal B
 - Terminal C
 - **If the M68 Steering Column Tilt Motor does not operate**
 1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 0.6-1.0 Ω between terminal 9 and terminal 10.
 - If not within the specified range, replace the steering column.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **If the M68 Steering Column Tilt Motor operates**
6. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Steering Column Tilt and Telescope Motor Control Circuit Test

1. Ignition OFF and all vehicle systems OFF, disconnect the X3 harness connector at the K99 Steering Column Position Control Module. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the B+ circuit terminal 1 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse.
 - If 2 Ω or greater
 3. Verify the fuse is OK and there is voltage at the fuse.
 - If the fuse is open, replace the K99 Steering Column Position Control Module.
 - If the fuse is OK, repair the open/high resistance in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K99 Steering Column Position Control Module.
 - **If the test lamp illuminates**
5. Ignition OFF, connect the X3 harness connector at the K99 Steering Column Position Control Module. Disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.

6. Test for less than 10 Ω between the low reference circuit terminal G and ground.

- **If 10 Ω or greater**

1. Ignition OFF.

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.

- If less than 2 Ω , replace the K99 Steering Column Position Control Module.

- **If less than 10 Ω**

7. Replace the K99 Steering Column Position Control Module.

Component Testing

NOTE: After all repairs are complete, it is necessary to perform the Steering Column Tilt Wheel and Telescope Control Module Learn procedure.

Steering Column Tilt/Telescope Switch Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.

2. Test for infinite resistance between the low reference terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the released position.

- **If less than infinite resistance**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If infinite resistance**

3. Test for less than 2 Ω between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.

- **If 2 Ω or greater**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If less than 2 Ω**

4. All OK.

Steering Column Telescope Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.

2. Test for 0.6-1.0 Ω between terminal 7 and terminal 8.

- **If not within the specified range**

Replace the steering column.

- **If within the specified range**

3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.

2. Test for 0.6-1.0 Ω between terminal 9 and terminal 10.

- **If not within the specified range**

Replace the steering column.

- **If within the specified range**

3. All OK.

Repair Instructions

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

- [Steering Column Tilt Wheel and Telescope Switch Replacement](#)
- [Steering Column Replacement](#)
- [Control Module References](#) for control module replacement, programming and setup.

NOISE IN STEERING COLUMN

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Steering Wheel and Column
2	Verify that noise is present in the steering column during operation. Is noise present in the steering column during operation?	Go to Step 3	System OK
3	Inspect the steering column mounting features for the following conditions: • The steering column mounting fasteners are loose. • The steering column mounting features are sheared. Are the steering column mounting features loose or sheared?	Go to Step 10	Go to Step 4
4	Inspect the SIR/SRS coil for noise. Is the SIR/SRS coil noisy?	Go to Step 11	Go to Step 5
5	If equipped, inspect the lock plate retaining ring for correct installation. Is the lock plate retaining ring installed incorrectly?	Go to Step 12	Go to Step 6
6	Inspect the steering column upper and lower bearings for the following conditions: • Damage • Lubrication • Wear • Proper seating Are the bearings in need of repair or replacement?	Go to Step 13	Go to Step 7
7	Does the steering column tilt joint need to be lubricated?	Go to Step 14	Go to Step 8
8	NOTE: Inspect the intermediate steering shaft for noise while driving the vehicle, turning the steering wheel and applying the brakes. Inspect the intermediate steering shaft for noise. Is the intermediate steering shaft noisy?	Go to Step 15	Go to Step 9

Step	Action	Yes	No
9	NOTE: For vehicles equipped with a telescoping steering column, perform this step. If not equipped, go to next step. Inspect the steering column for noise while telescoping the column. Is the steering column noisy while telescoping?	Go to Step 16	Go to Step 17
10	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement. Tighten the steering column mounting fasteners to specification. Refer to Fastener Specifications. Did you complete the repair?	Go to Step 17	-
11	Replace the SIR/SRS coil. Refer to Steering Wheel Airbag Coil Replacement. Did you complete the repair?	Go to Step 17	-
12	Install the lock plate retaining ring correctly. Did you complete the repair?	Go to Step 17	-
13	NOTE: If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement. Replace the steering column upper and/or lower bearings, if serviceable. Did you complete the replacement?	Go to Step 17	-
14	Lubricate the steering column tilt joint. Did you complete the repair?	Go to Step 17	-
15	Replace the appropriate intermediate steering shaft component. Did you complete the repair?	Go to Step 17	-
16	Redistribute or add lubricant to the steering column lower jacket with the column telescoped to its end of outward travel. Did you complete the repair?	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

LOOSENESS IN STEERING COLUMN

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Steering Wheel and Column
2	Verify that the steering column is loose. Is the steering column loose?	Go to Step 3	System OK

Step	Action	Yes	No
3	Inspect the steering column mounting features for the following conditions. - The steering column mounting fasteners are loose. - The steering column mounting features are sheared. Are the steering column mounting features loose or sheared?	Go to Step 5	Go to Step 4
4	Inspect the upper and/or lower bearings for looseness. Are any of the bearings worn or loose?	Go to Step 6	Go to Step 7
5	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement. Tighten the steering column mounting fasteners to specification. Refer to Fastener Specifications . Did you complete the repair?	Go to Step 7	-
6	NOTE: If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement. Replace the upper and/or lower bearings, if serviceable. Did you complete the repair?	Go to Step 7	-
7	Operate the steering column in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

WIRE TO WIRE REPAIR - STEERING

Special Tools

- **EL-38125-10** Splice Sleeve Crimping Tool (non GMNA)
- **J-38125-5A** Ultra Torch Special Tool
- **J-38125-8** Splice Sleeve Crimping Tool (GMNA)

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

WARNING:

In order to reduce the risk of personal injury, loss of high voltage isolation to ground and higher system impedance, do not attempt to repair any HV wiring, connector or terminal that is damaged. High voltage coaxial type cables are not repairable. Never attempt to repair a coaxial type cable. The entire cable/harness or component must be replaced. In order to maintain system integrity and personal safety, never attempt to repair any high voltage wiring, cables or terminals. Performing this procedure on high voltage circuits may result in serious injury or death.

NOTE:

If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to

repair the internal transmission wires, connectors or terminals could result in performance issues.

NOTE: Do not splice wires in Door Harness Grommets.

NOTE: The DuraSeal splice sleeves have the following 2 critical features:

- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except high voltage and specialty cables. Use DuraSeal splice sleeves where there are special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm ² / (AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19300089	Red (1) or Red/Green (1)	Red (2)	0.22-0.8/(18-26)
Blue 19168447	Blue (2)	Blue (3)	1.0-2.0/(14-16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0-5.0/(10-12)

1. Open the harness by removing any tape:

NOTE: You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

- Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
 - Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
 - Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches or connectors.

3. Strip the insulation:

- When adding a length of wire to the existing harness, use the same size wire as the original wire.
 - Perform one of the following items in order to find the correct wire size:
 - Find the wire on the schematic and convert to regional wiring gauge size.
 - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
 - Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
 - Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
 - If the wire is damaged, repeat this procedure after removing the damaged section.
4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice

procedure.

5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.
6. The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

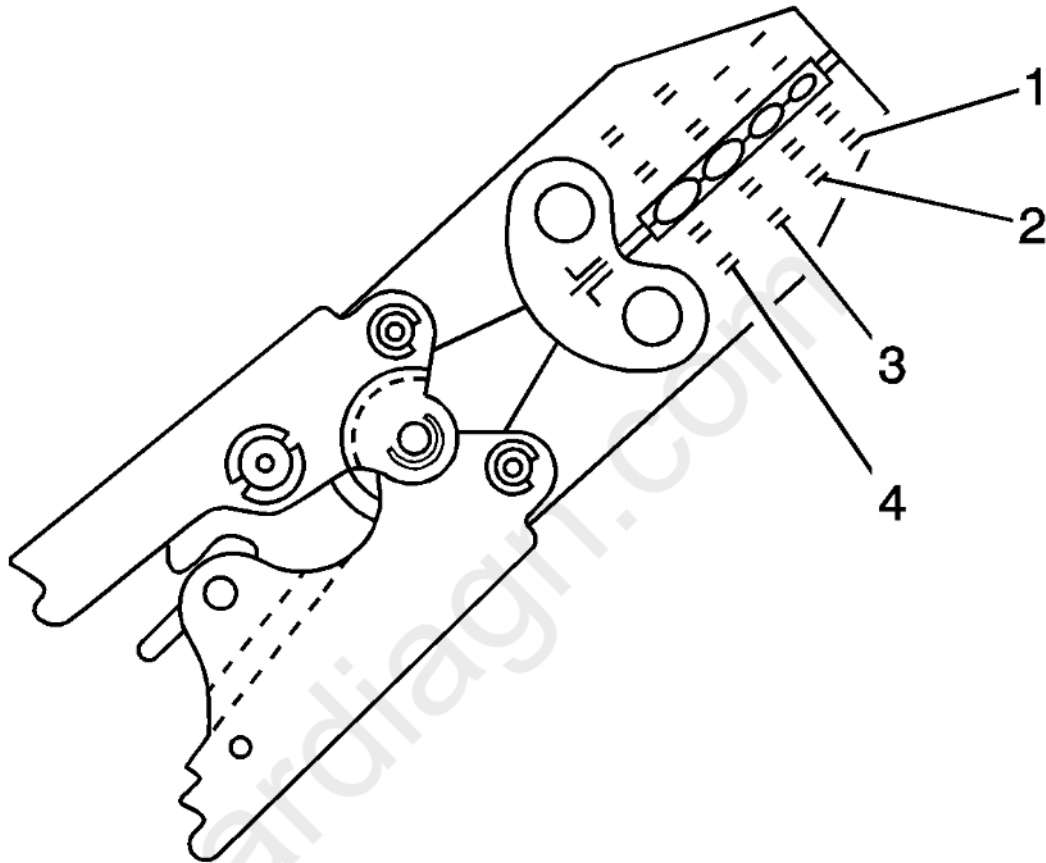


Fig. 8: Crimping Tool

Courtesy of GENERAL MOTORS COMPANY

7. The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

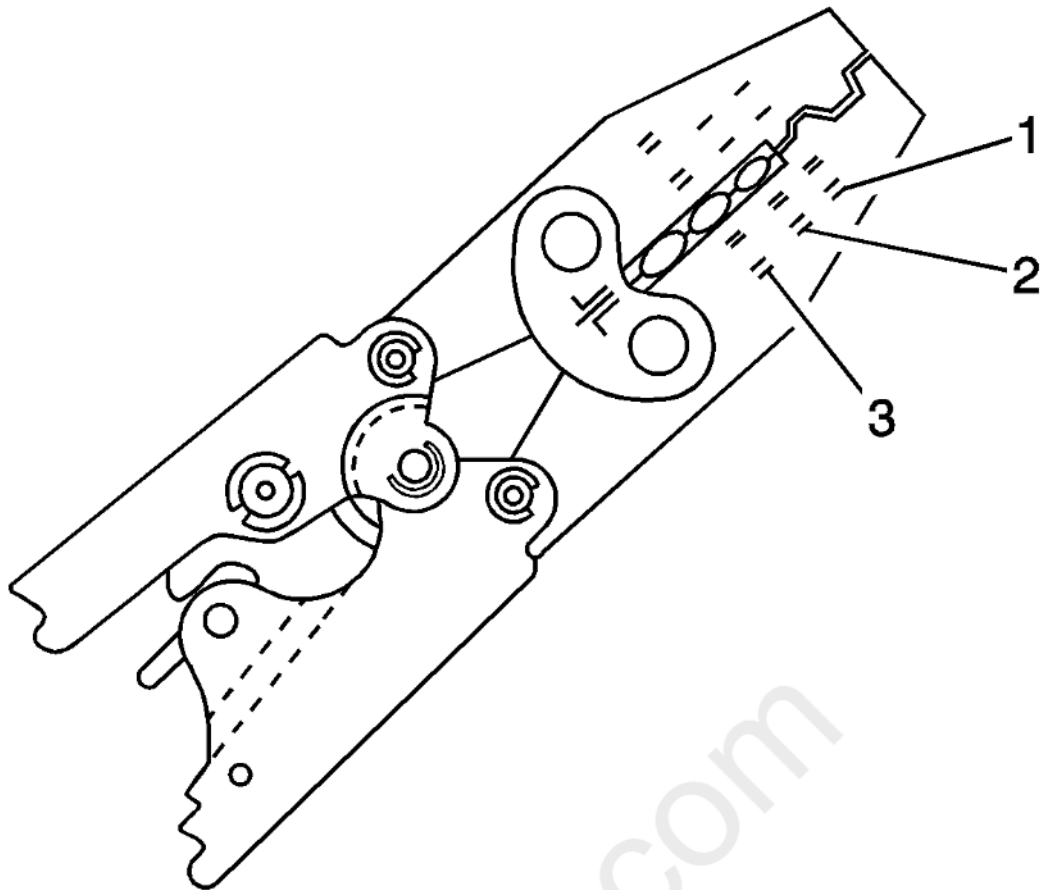


Fig. 9: Identifying Splice Crimp Tool Nests Terminal Identification

Courtesy of GENERAL MOTORS COMPANY

8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).
9. Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.

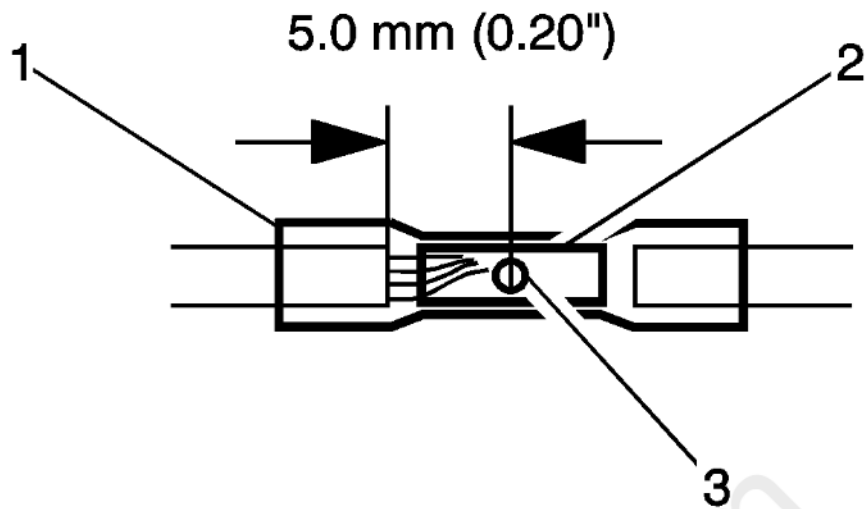


Fig. 10: Identifying Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

10. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.



Fig. 11: Crimped Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

11. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

12. Using the heat torch, apply heat to the crimped area of the barrel.



Fig. 12: Crimped Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

Weatherpack™ Wiring Repair

NOTE: Some replacement pigtail connectors may be delivered without the terminated leads installed into the connector. For Weatherpack™ connectors, all terminated leads included in the package should to be installed into the connector. If the connector end view shows that a terminal is not occupied, the extra terminated lead(s) need to be installed and the end(s) sealed using a DuraSeal splice sleeve and taped back into the harness.

1. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

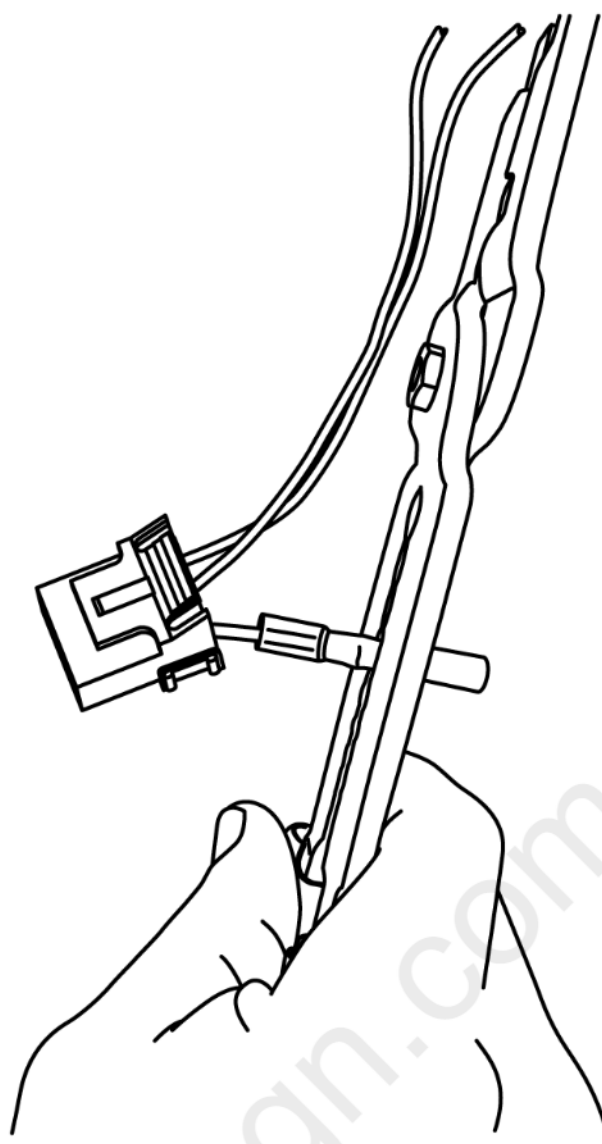


Fig. 13: Tightly Close Handles Of Crimp Tool
Courtesy of GENERAL MOTORS COMPANY

2. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Holding the DuraSEAL with one hand gently tug on the wire to ensure it is crimped in the DuraSeal.

3. Using the heat torch, apply heat to the crimped area of the barrel.
4. Start in the middle and gradually move the heat barrel to the open ends of the tubing:

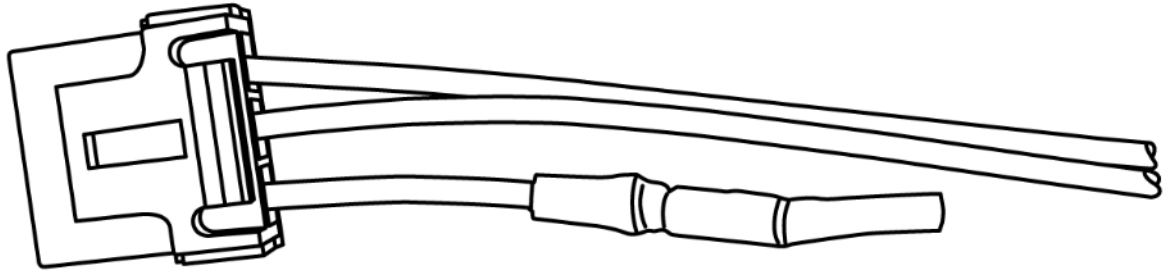


Fig. 14: Heat To Crimped Area Of Barrel

Courtesy of GENERAL MOTORS COMPANY

- The tubing will shrink completely as the heat is moved along the insulation.
- A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

5. Tape the extra terminated lead(s) back into the harness.



Fig. 15: Taping Extra Terminated Leads Back Into Harness
Courtesy of GENERAL MOTORS COMPANY

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
4. Replace any reflective tape and clips that may have been removed during the repair.

CONNECTOR RECONNECTION - STEERING

Special Tools

EL-35616 Terminal Test Probe Kit

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

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Loose, corroded or painted terminal stud/fastener
- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to [**Inducing Intermittent Fault Conditions**](#) in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to [**Testing for Electrical Intermittents**](#) for test procedures to detect intermittent open, high resistance, short to ground and short to voltage conditions.
- Refer to [**Scan Tool Snapshot Procedure**](#) for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease/lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Power Distribution Schematics](#).
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Ground Distribution Schematics](#).

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection or high electrical load

- Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to [Checking Aftermarket Accessories](#).
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.
- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup and programming.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.**

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT (LGW)

Removal Procedure

1. Steering Column (1)» Remove - [Steering Column Replacement](#)

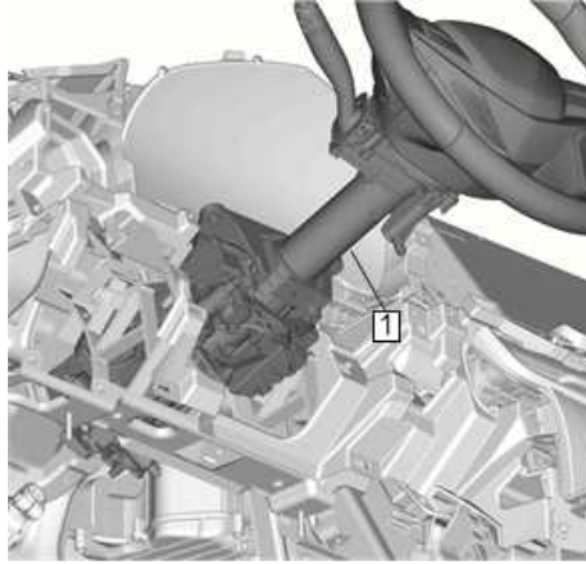


Fig. 16: Steering Column

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1) Remove

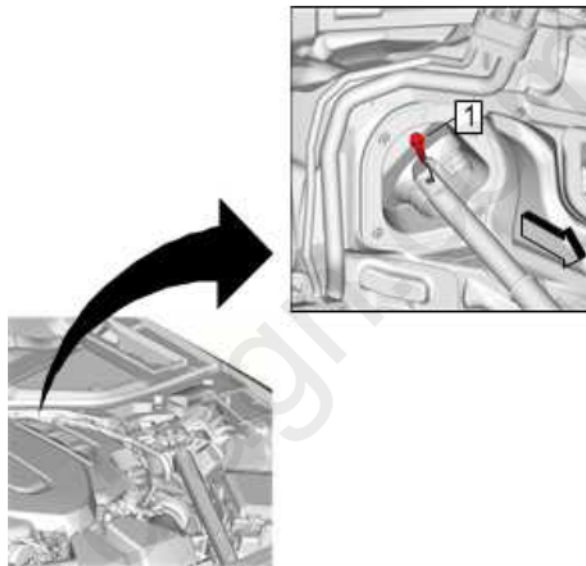


Fig. 17: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

3. Slide the upper intermediate steering shaft (1) upwards out of the mid intermediate steering shaft and through the intermediate steering shaft boots and instrument panel carrier.

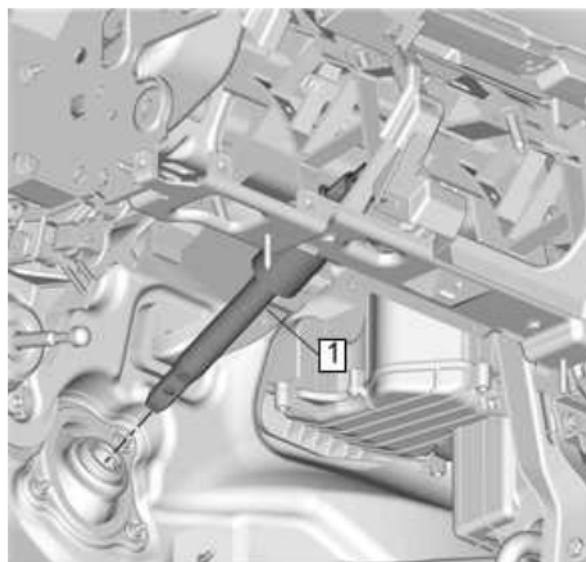


Fig. 18: Upper Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

1. Slide the upper intermediate steering shaft (1) downwards through the instrument panel carrier and intermediate steering shaft boots and into the mid intermediate steering shaft.

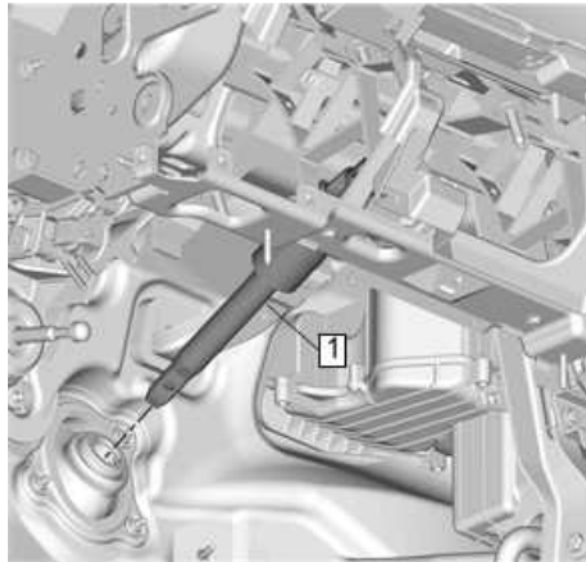


Fig. 19: Upper Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

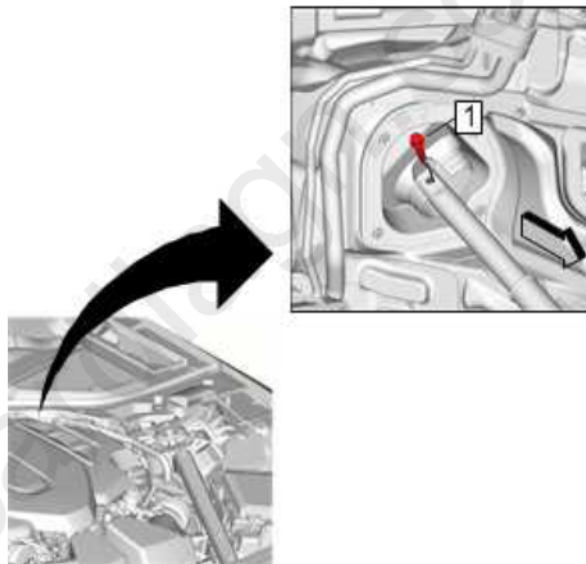


Fig. 20: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to **Adhesives, Fluids, Lubricants and Sealers**
3. Steering Column (1)» Install - **Steering Column Replacement**

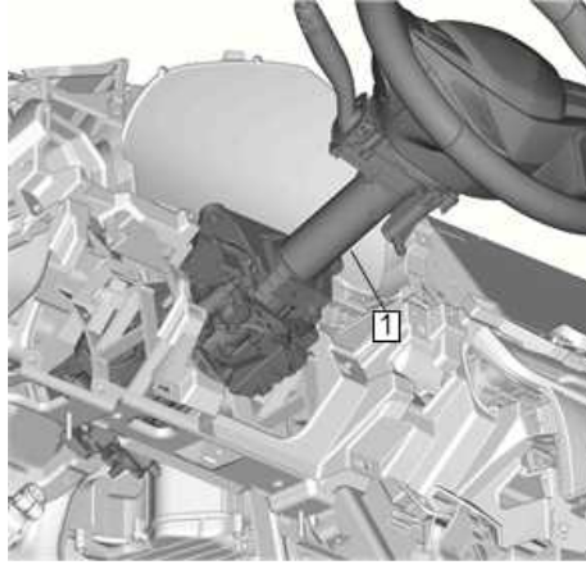


Fig. 21: Steering Column

Courtesy of GENERAL MOTORS COMPANY

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT (LTG)

Removal Procedure

1. Steering Column (1)» Remove - **Steering Column Replacement**

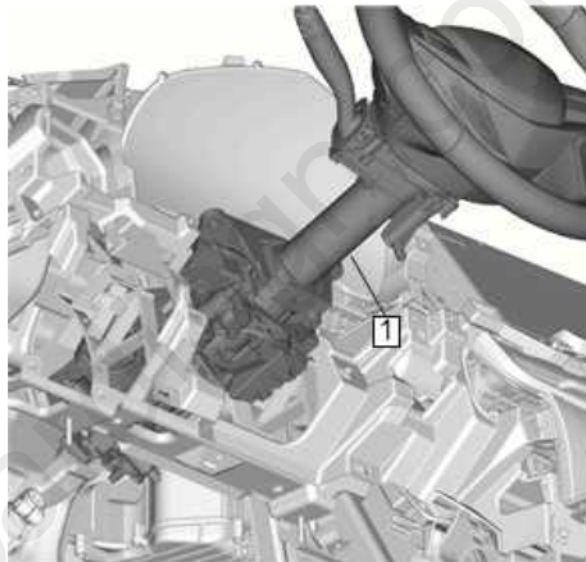


Fig. 22: Steering Column

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1)» Remove

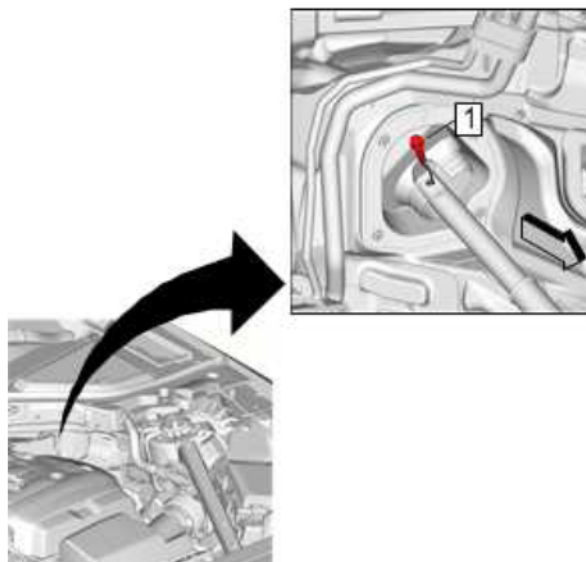


Fig. 23: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

- Slide the upper intermediate steering shaft (1) upwards out of the mid intermediate steering shaft and through the intermediate steering shaft boots and instrument panel carrier.

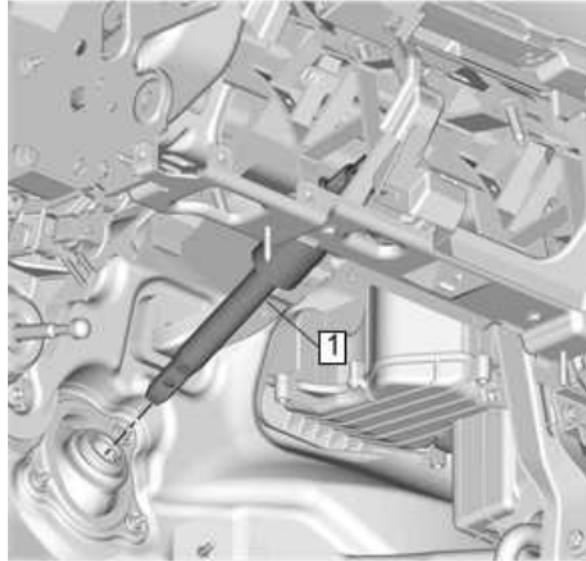


Fig. 24: Upper Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

- Slide the upper intermediate steering shaft (1) downwards through the instrument panel carrier and intermediate steering shaft boots and into the mid intermediate steering shaft.

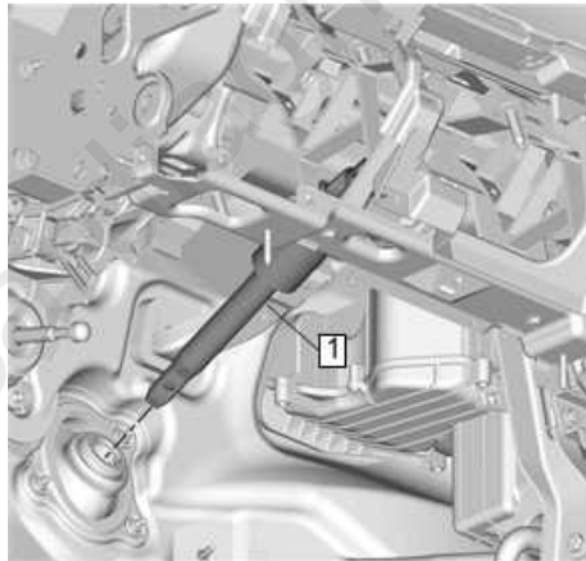


Fig. 25: Upper Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

- Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

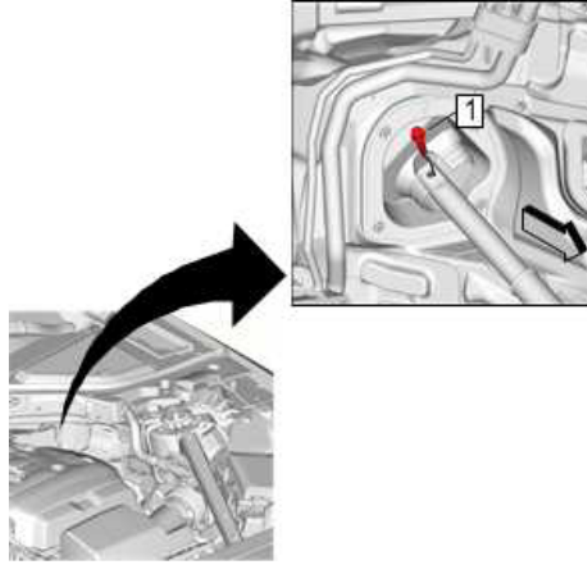


Fig. 26: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to **Adhesives, Fluids, Lubricants and Sealers**
3. Steering Column (1) » Install - **Steering Column Replacement**

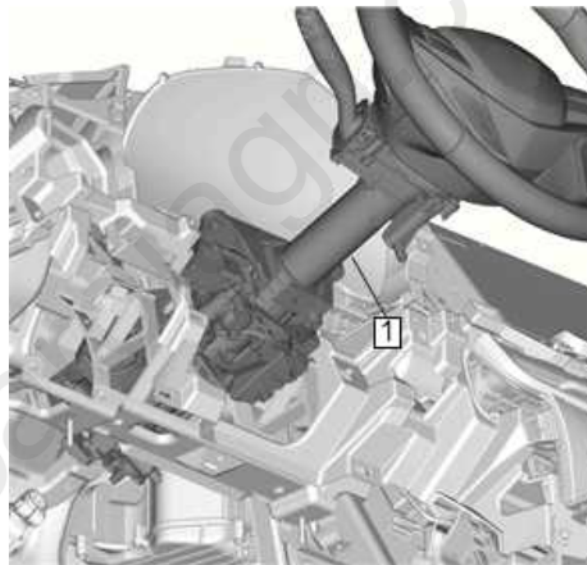


Fig. 27: Steering Column
Courtesy of GENERAL MOTORS COMPANY

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT (LGX)

Removal Procedure

1. Steering Column (1) » Remove - **Steering Column Replacement**

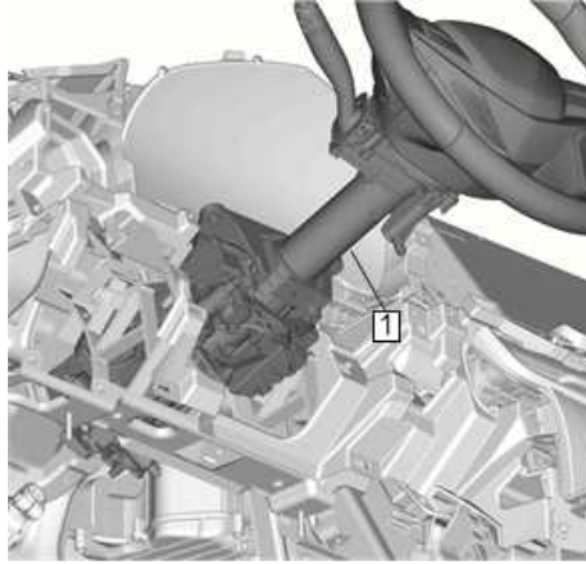


Fig. 28: Steering Column

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1) Remove

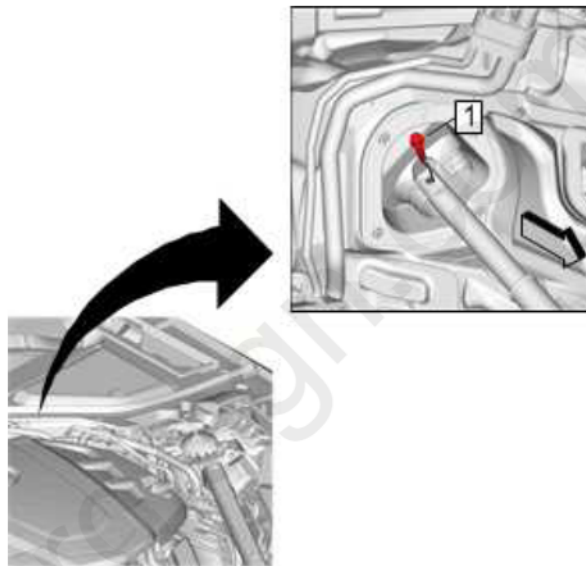


Fig. 29: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

3. Slide the upper intermediate steering shaft (1) upwards out of the mid intermediate steering shaft and through the intermediate steering shaft boots and instrument panel carrier.

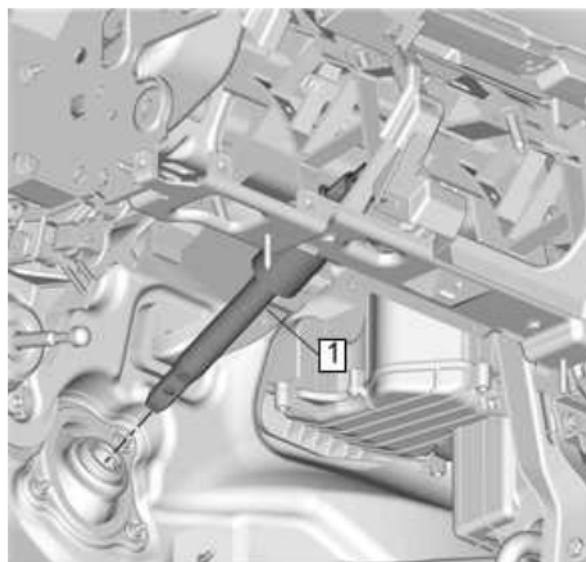


Fig. 30: Upper Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

1. Slide the upper intermediate steering shaft (1) downwards through the instrument panel carrier and intermediate steering shaft boots and into the mid intermediate steering shaft.

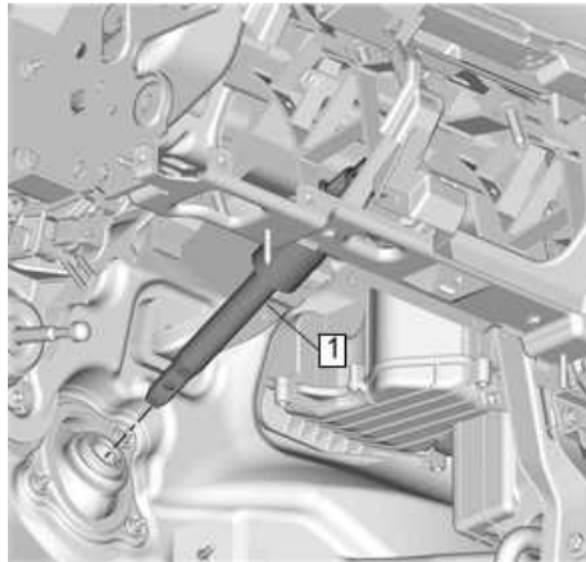


Fig. 31: Upper Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

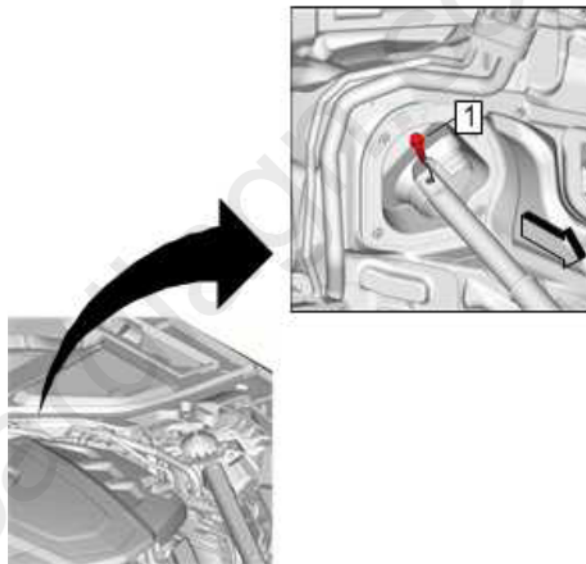


Fig. 32: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to **Adhesives, Fluids, Lubricants and Sealers**
3. Steering Column (1)» Install - **Steering Column Replacement**

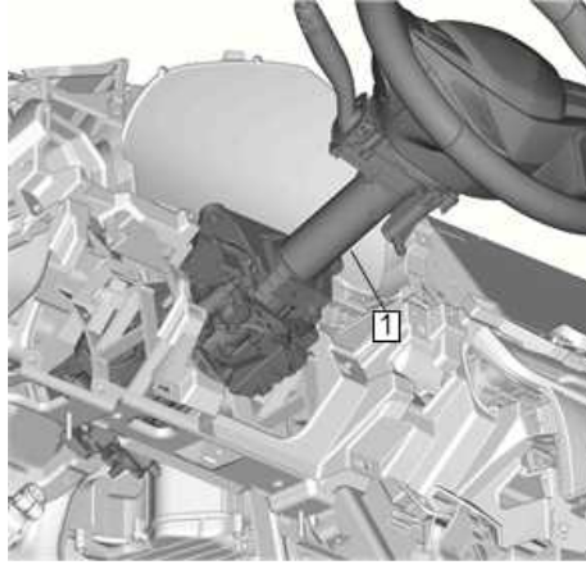


Fig. 33: Steering Column

Courtesy of GENERAL MOTORS COMPANY

MID INTERMEDIATE STEERING SHAFT REPLACEMENT (LTG)

Removal Procedure

1. Intermediate Steering Shaft (1) » Remove - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

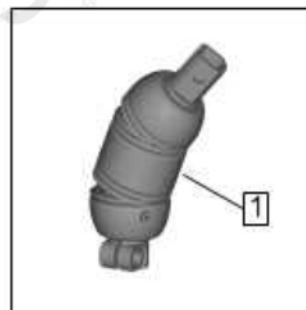


Fig. 34: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1) » Remove

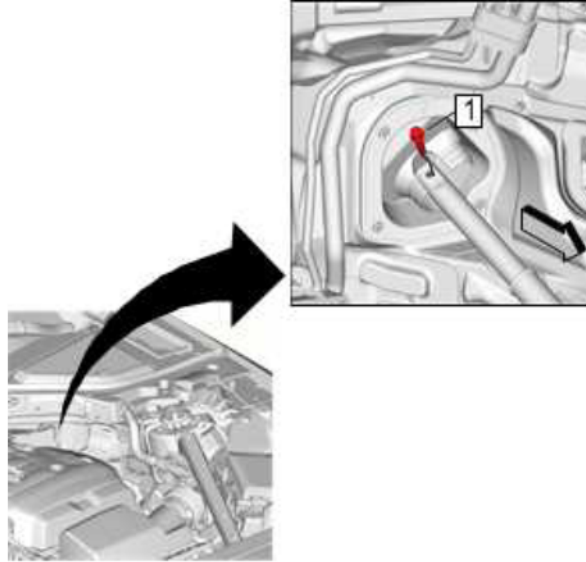


Fig. 35: Mid Intermediate Steering Shaft Bolt
 Courtesy of GENERAL MOTORS COMPANY

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Separate

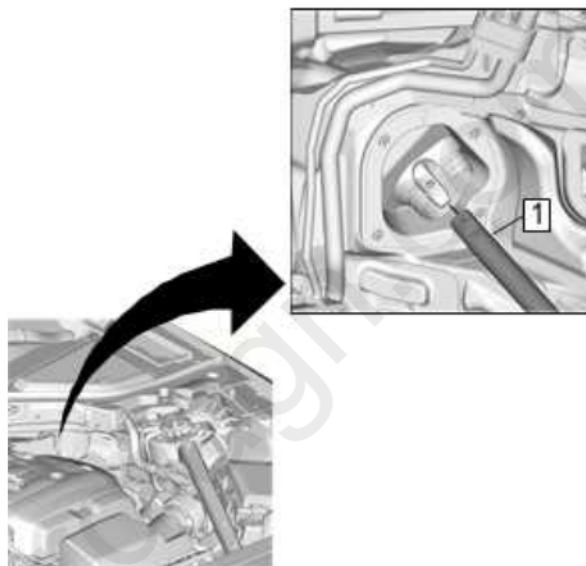


Fig. 36: Mid Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

4. Remove the mid intermediate steering shaft (1) from the vehicle.

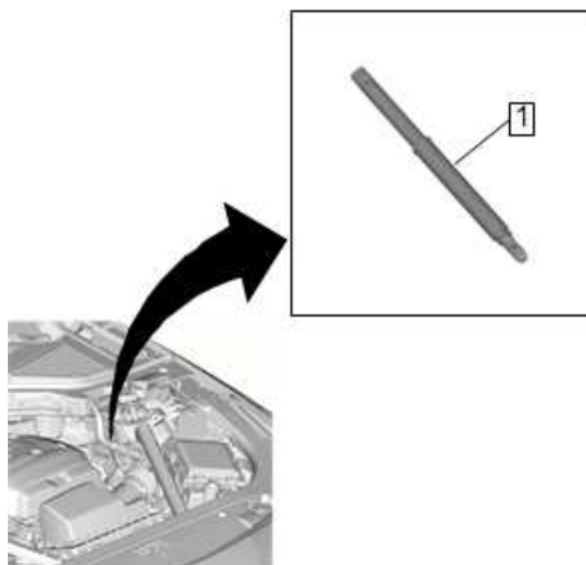


Fig. 37: Mid Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

1. Position the mid intermediate steering shaft (1) on the vehicle.

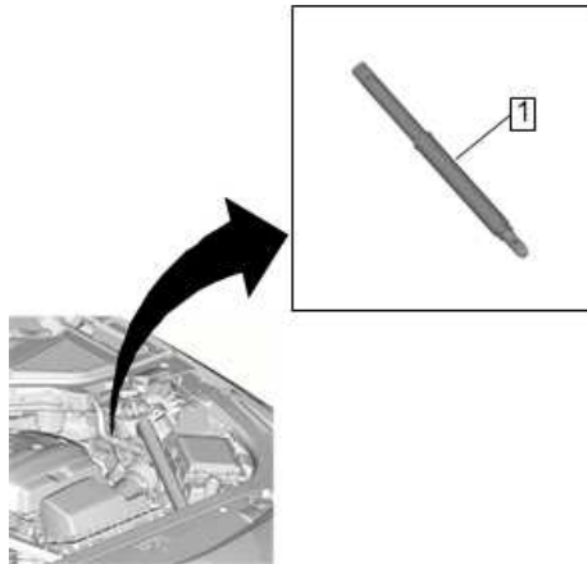


Fig. 38: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install

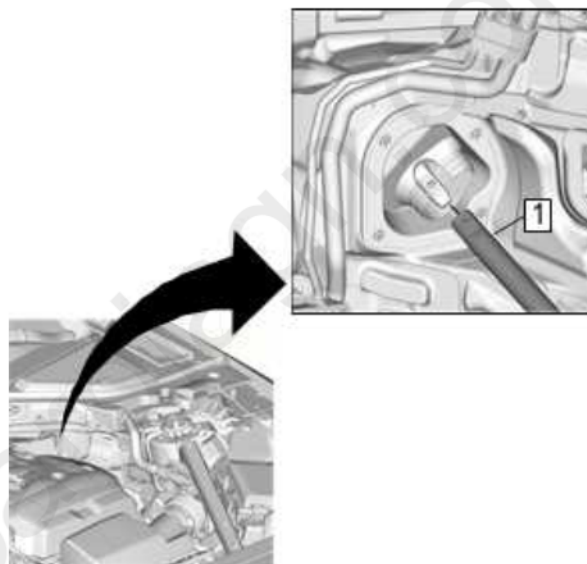
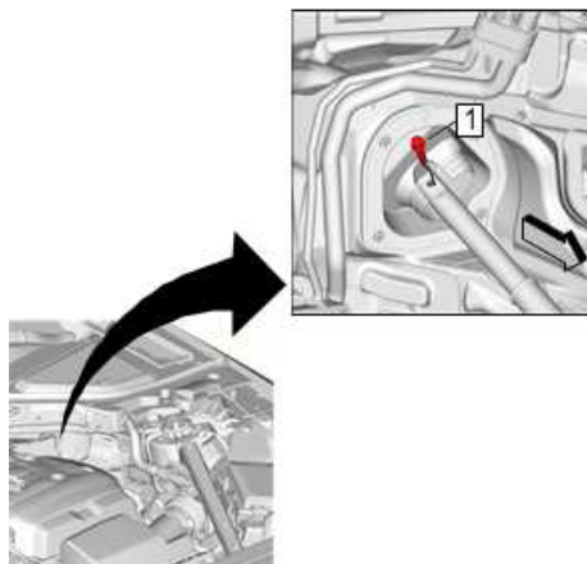


Fig. 39: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

3. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)



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

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
4. Intermediate Steering Shaft (1)» Install - [Intermediate Steering Shaft Replacement \(RWD\)](#)[Intermediate Steering Shaft Replacement \(AWD\)](#)

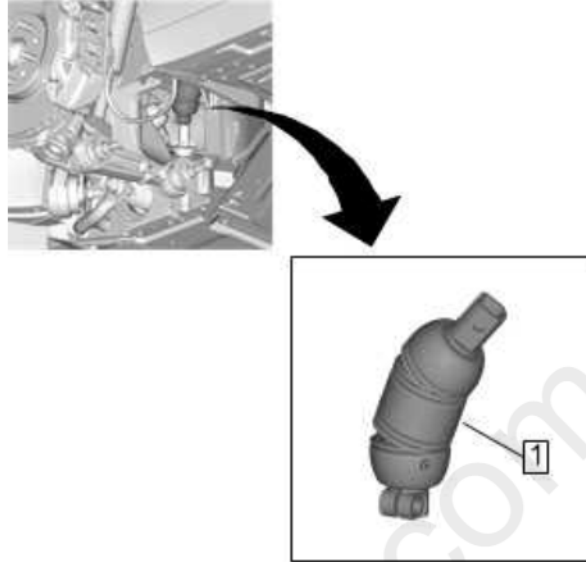


Fig. 41: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

MID INTERMEDIATE STEERING SHAFT REPLACEMENT (LGW)

Removal Procedure

1. Mid Intermediate Steering Shaft Bolt (1)» Remove

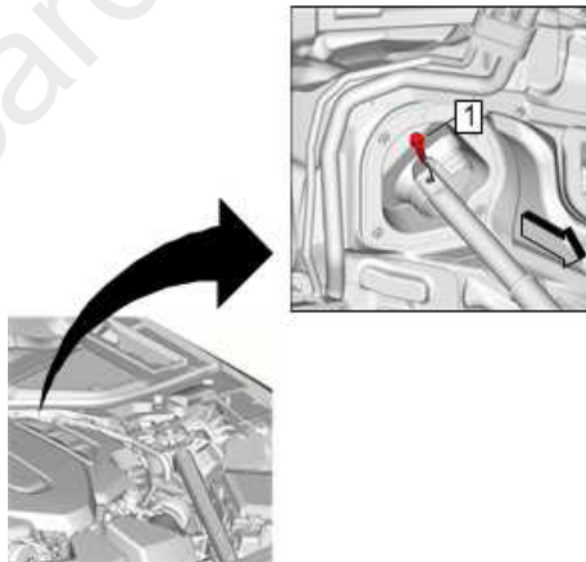


Fig. 42: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

2. Drivetrain and Front Suspension Frame (1)» Remove - [Drivetrain and Front Suspension Cradle Removal and Installation](#)

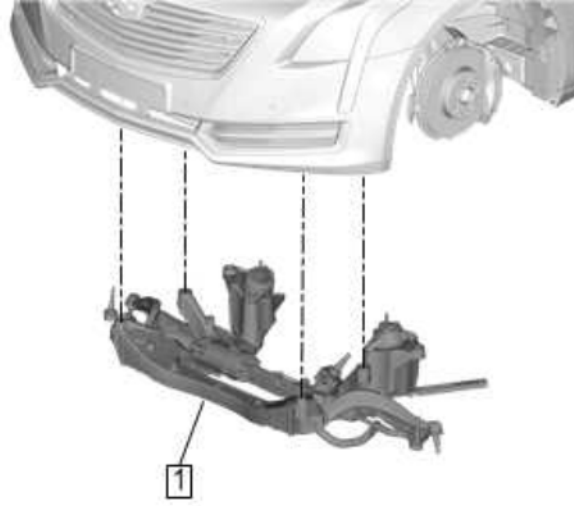


Fig. 43: Drivetrain And Front Suspension Frame

Courtesy of GENERAL MOTORS COMPANY

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Separate

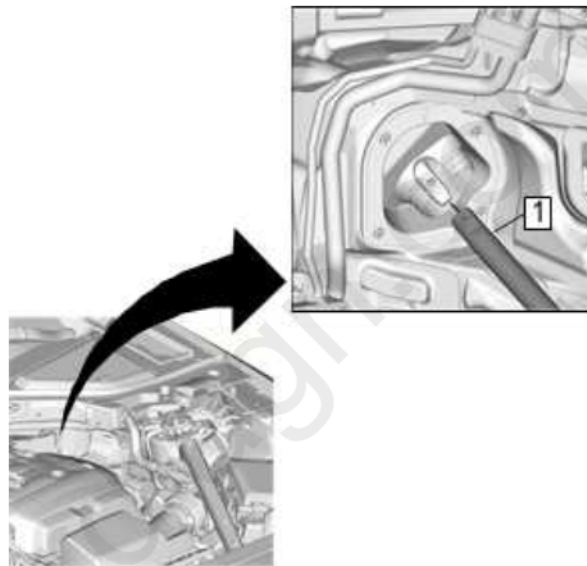


Fig. 44: Mid Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

4. Remove the mid intermediate steering shaft (1) from the vehicle.

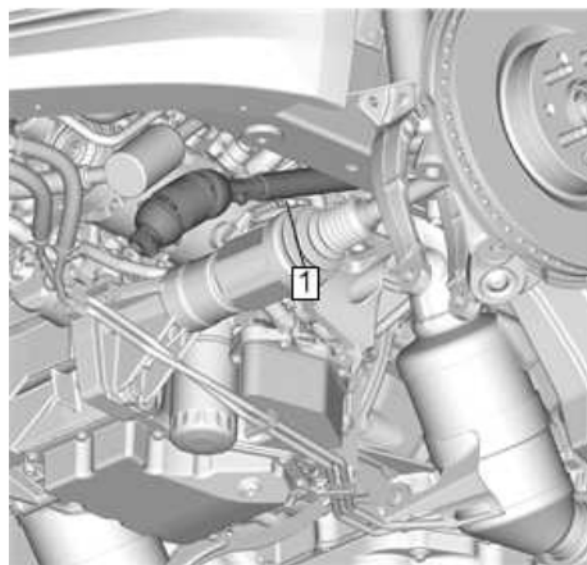


Fig. 45: Mid Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

5. Transfer components as necessary.

Installation Procedure

1. Position the mid intermediate steering shaft (1) on the vehicle.

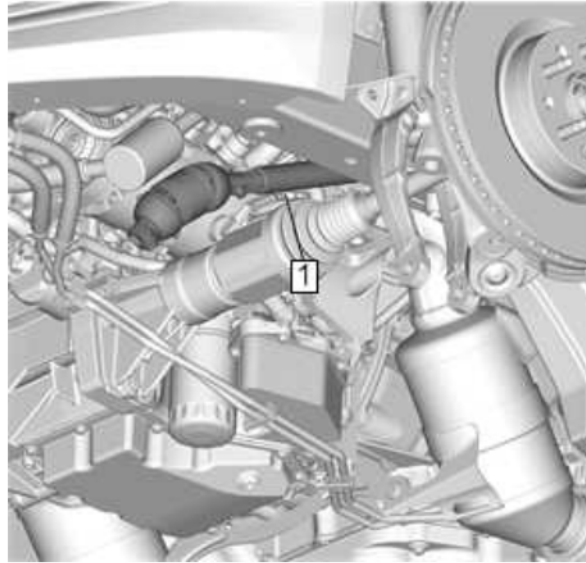


Fig. 46: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install

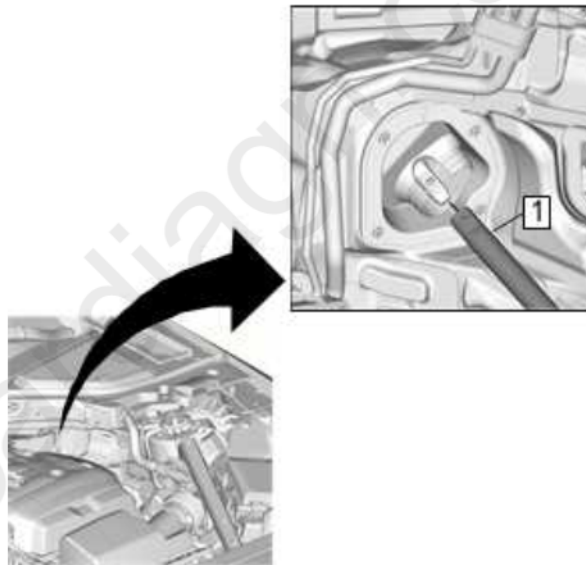


Fig. 47: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

3. Drivetrain and Front Suspension Frame (1)» Install - **Drivetrain and Front Suspension Cradle Removal and Installation**

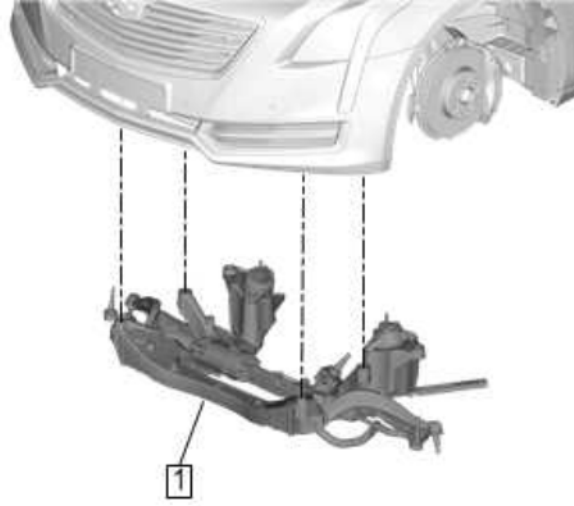


Fig. 48: Drivetrain And Front Suspension Frame

Courtesy of GENERAL MOTORS COMPANY

4. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

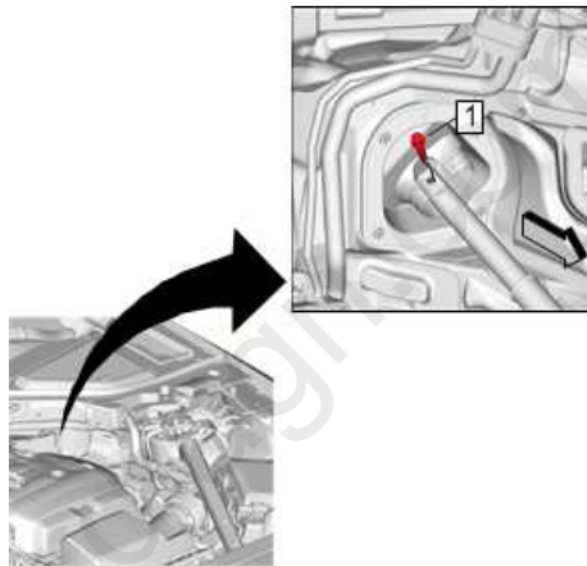


Fig. 49: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to **Adhesives, Fluids, Lubricants and Sealers**

MID INTERMEDIATE STEERING SHAFT REPLACEMENT (LGX)

Removal Procedure

1. Intermediate Steering Shaft (1)» Remove - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

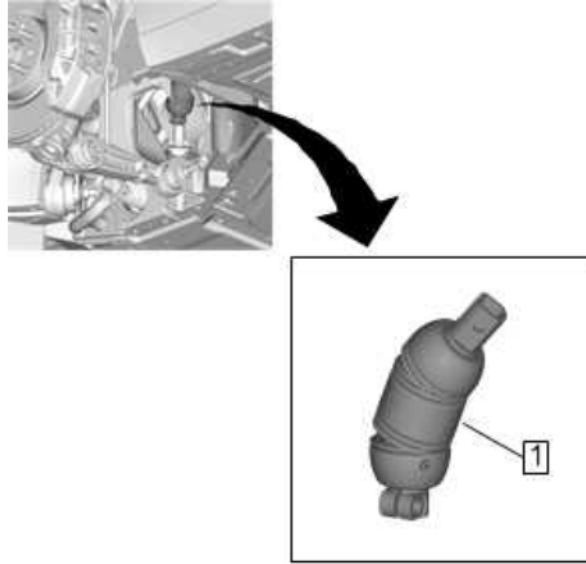


Fig. 50: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft Bolt (1) » Remove

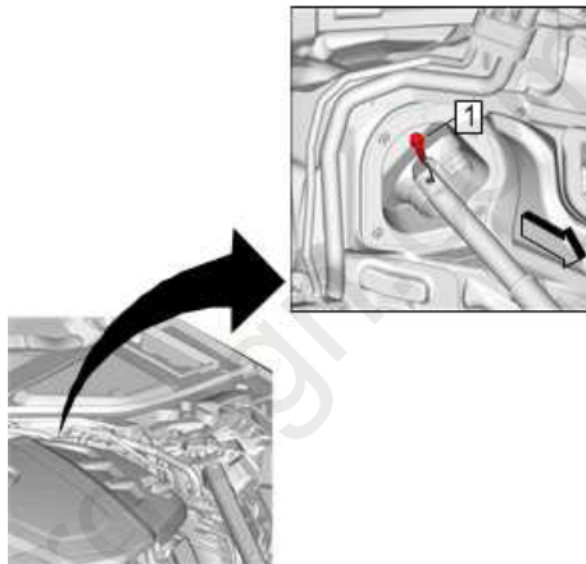


Fig. 51: Mid Intermediate Steering Shaft Bolt

Courtesy of GENERAL MOTORS COMPANY

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft » Separate

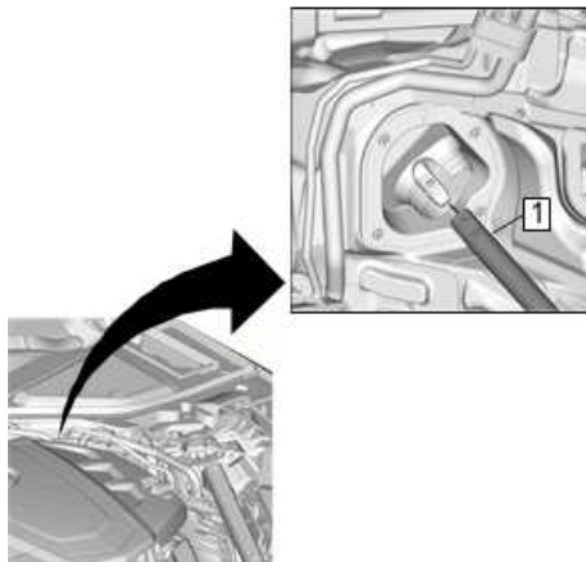


Fig. 52: Mid Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

4. Remove the mid intermediate steering shaft (1) from the vehicle.

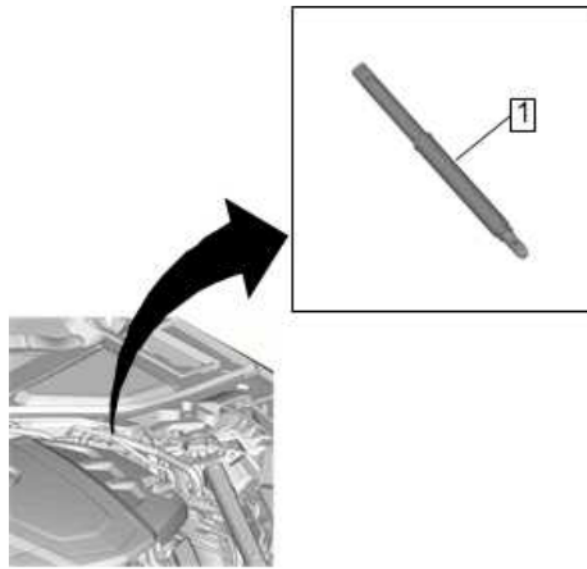


Fig. 53: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Position the mid intermediate steering shaft (1) on the vehicle.

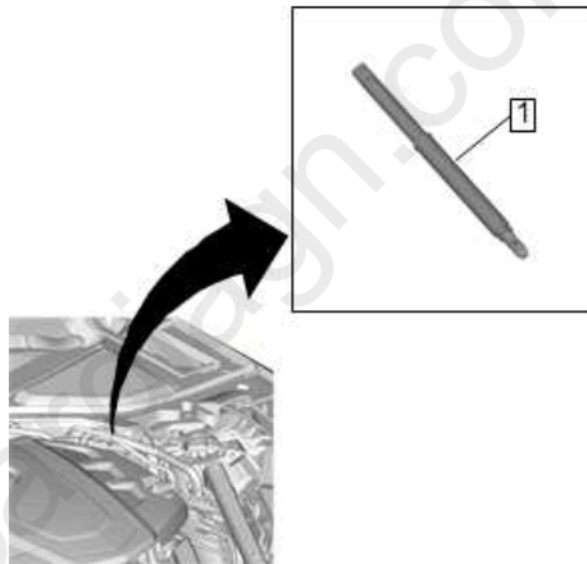
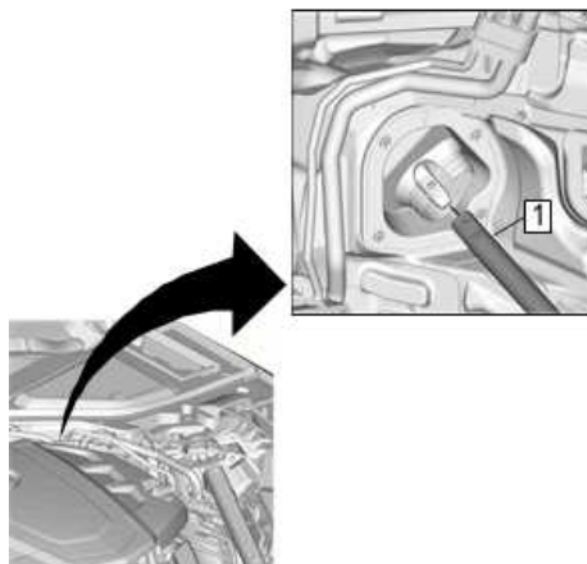


Fig. 54: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

2. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install



3. Mid Intermediate Steering Shaft Bolt (1) » Install and tighten 30 N.m (22 lb ft)

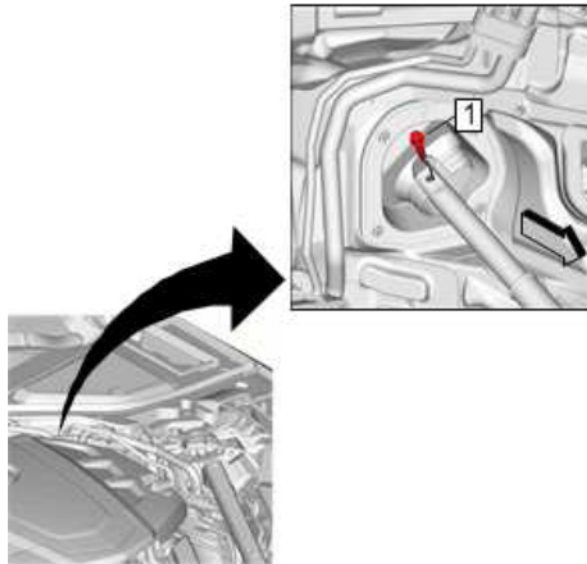


Fig. 56: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to **Adhesives, Fluids, Lubricants and Sealers**
4. Intermediate Steering Shaft (1) » Install - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

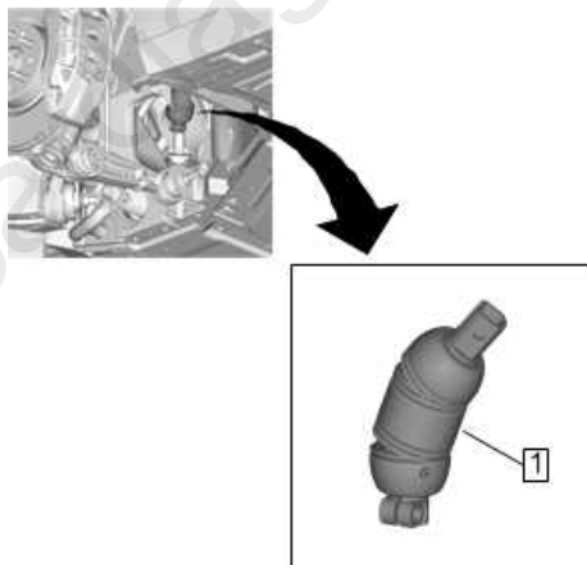


Fig. 57: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT BOOT REPLACEMENT (INNER)

Removal Procedure

1. Upper Intermediate Steering Shaft (1) @ Steering Column » Separate - **Steering Column Replacement**

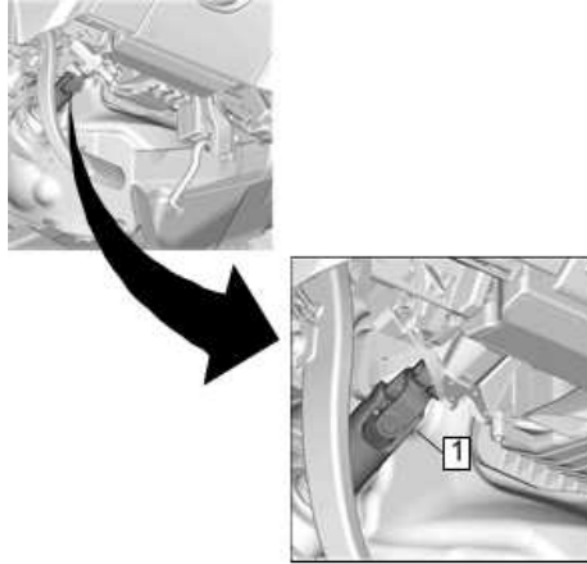


Fig. 58: Upper Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Inner Boot Nut (1) » Remove [3x]

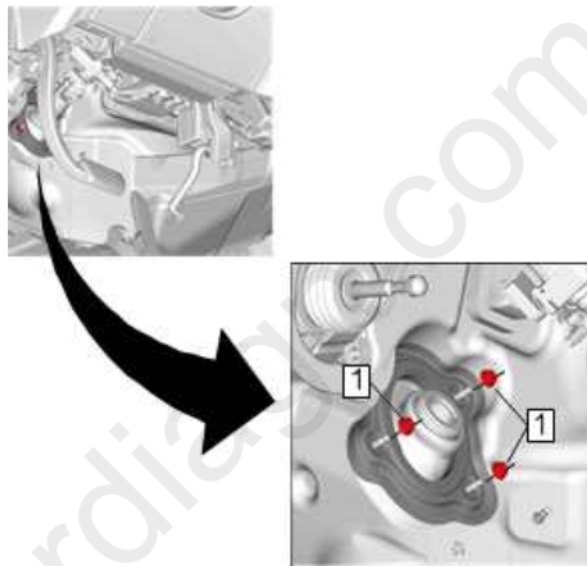


Fig. 59: Intermediate Steering Shaft Inner Boot Nut
 Courtesy of GENERAL MOTORS COMPANY

3. Slide the intermediate steering shaft inner boot (1) upwards over the intermediate steering shaft.

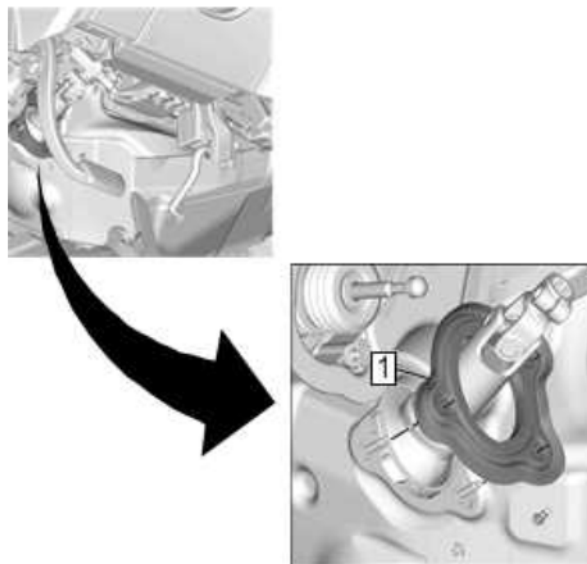


Fig. 60: Intermediate Steering Shaft Inner Boot
 Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Slide the intermediate steering shaft inner boot (1) downwards over the intermediate steering shaft.

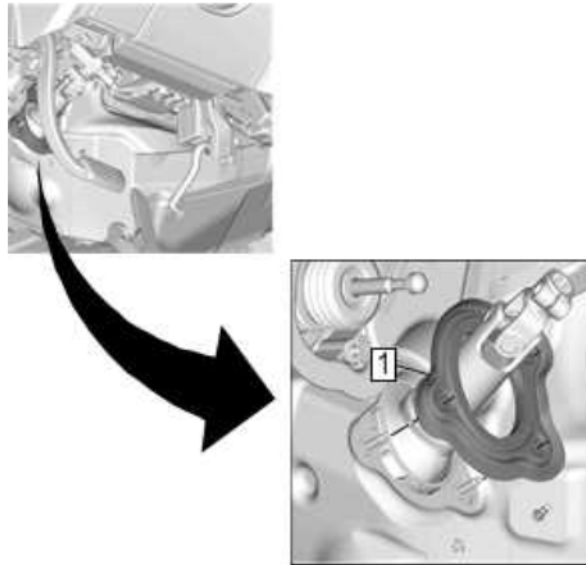


Fig. 61: Intermediate Steering Shaft Inner Boot
Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Inner Boot Nut (1)» Install and tighten [3x] 9 N.m (80 lb in)

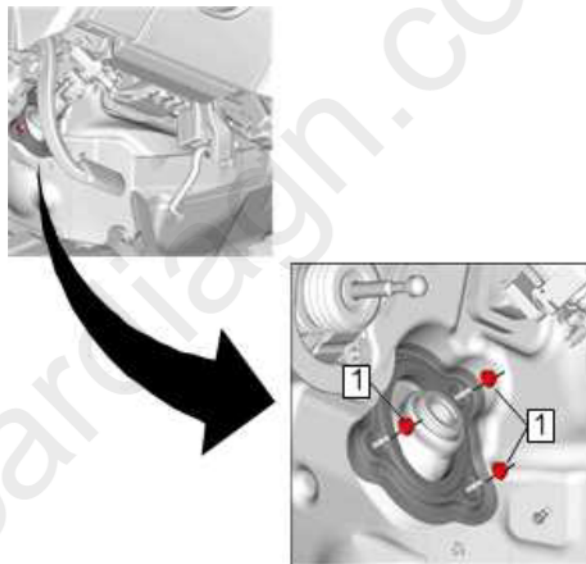


Fig. 62: Intermediate Steering Shaft Inner Boot Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Upper Intermediate Steering Shaft (1) @ Steering Column» Install - Steering Column Replacement

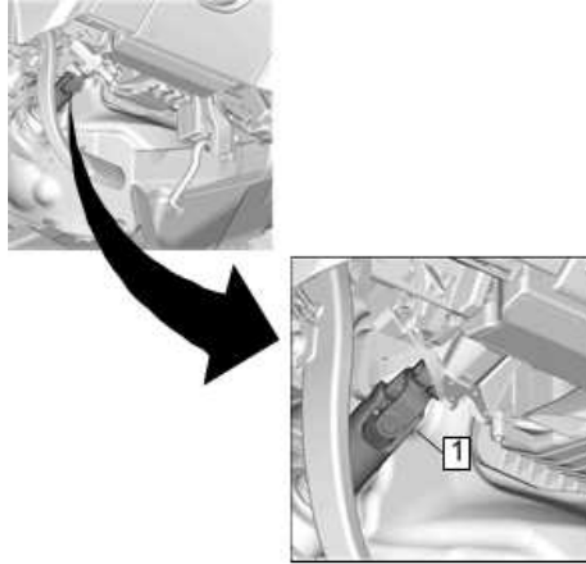


Fig. 63: Upper Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT BOOT REPLACEMENT (OUTER, LTG)

Removal Procedure

1. Intermediate Steering Shaft Inner Boot (1) Remove - **Intermediate Steering Shaft Boot Replacement (Outer, LTG)**

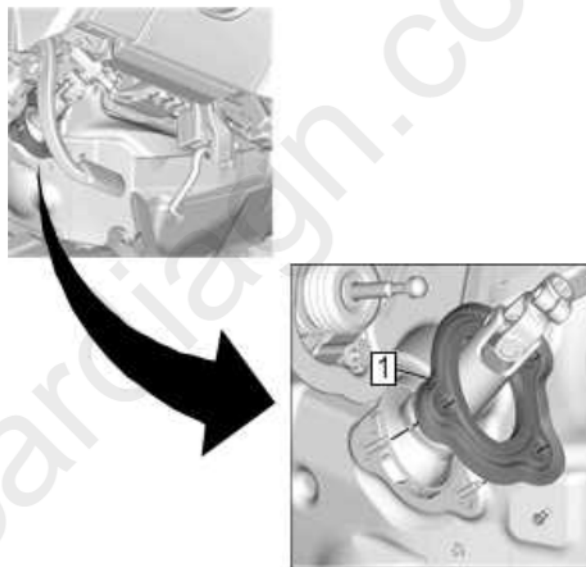


Fig. 64: Intermediate Steering Shaft Inner Boot
Courtesy of GENERAL MOTORS COMPANY

2. Release the plastic clips and push the intermediate steering shaft outer boot (1) out of the vehicle pass through.

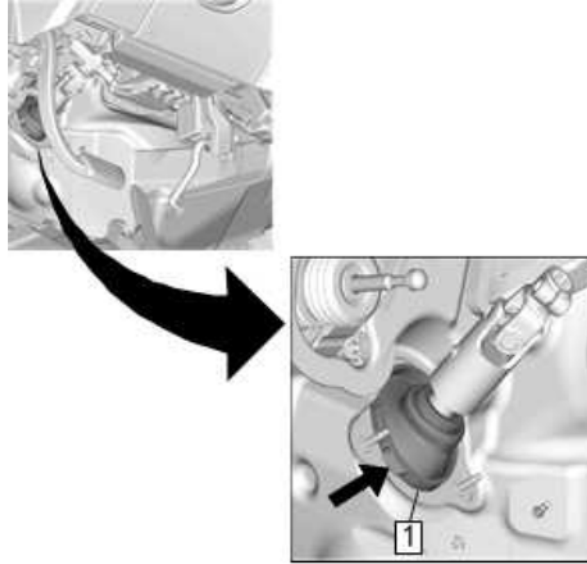


Fig. 65: Intermediate Steering Shaft Outer Boot
 Courtesy of GENERAL MOTORS COMPANY

3. Intermediate Steering Shaft (1) » Remove - [Intermediate Steering Shaft Replacement \(RWD\)](#) [Intermediate Steering Shaft Replacement \(AWD\)](#)

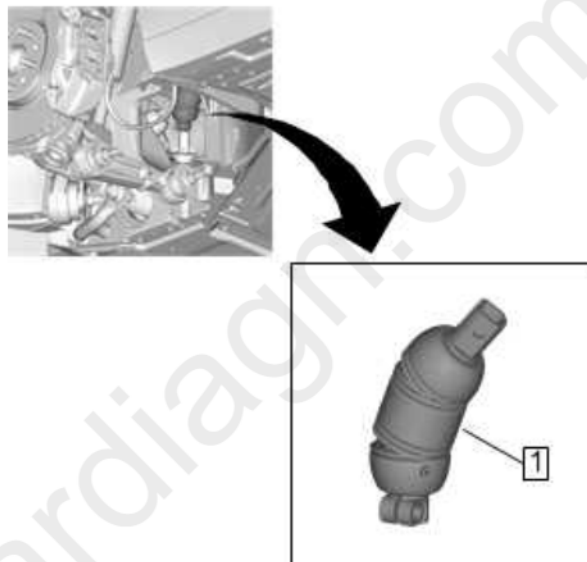


Fig. 66: Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

4. Power Vacuum Brake Booster (1) » Remove - [Power Vacuum Brake Booster Replacement](#)

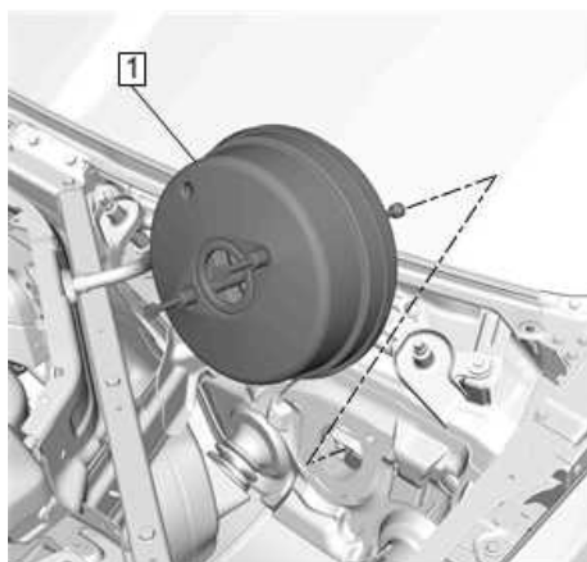


Fig. 67: Power Vacuum Brake Booster
 Courtesy of GENERAL MOTORS COMPANY

5. Mid Intermediate Steering Shaft Bolt (1)» Remove

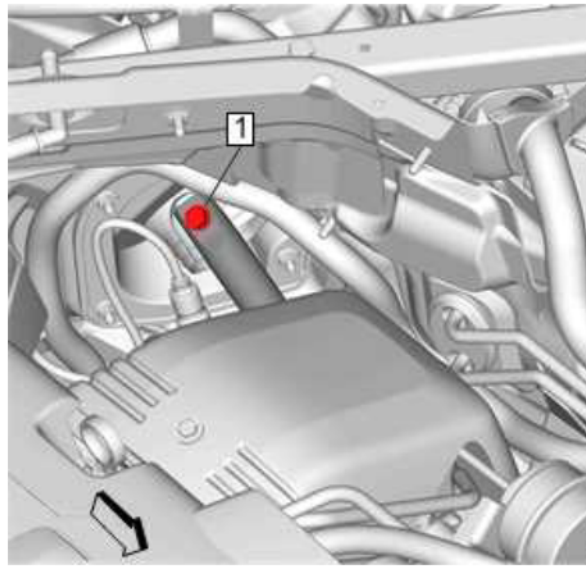


Fig. 68: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Separate

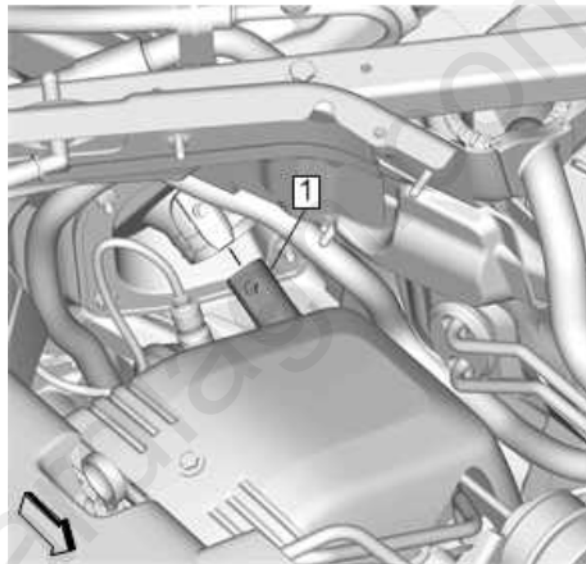


Fig. 69: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

7. Intermediate Steering Shaft Outer Boot Nut (1)» Remove [4x]

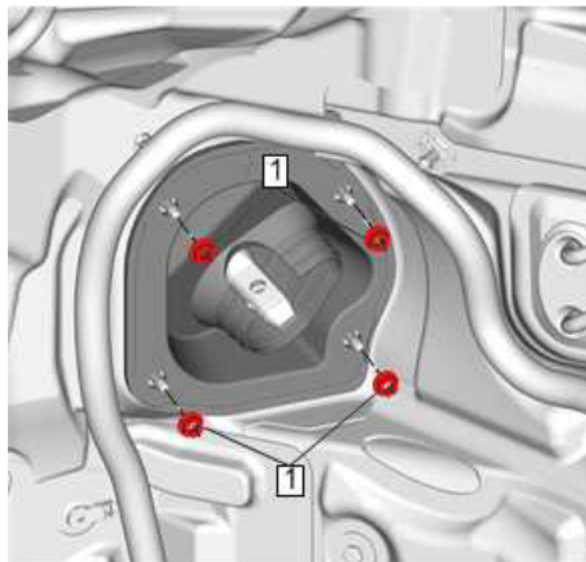


Fig. 70: Intermediate Steering Shaft Outer Boot Nut
Courtesy of GENERAL MOTORS COMPANY

8. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

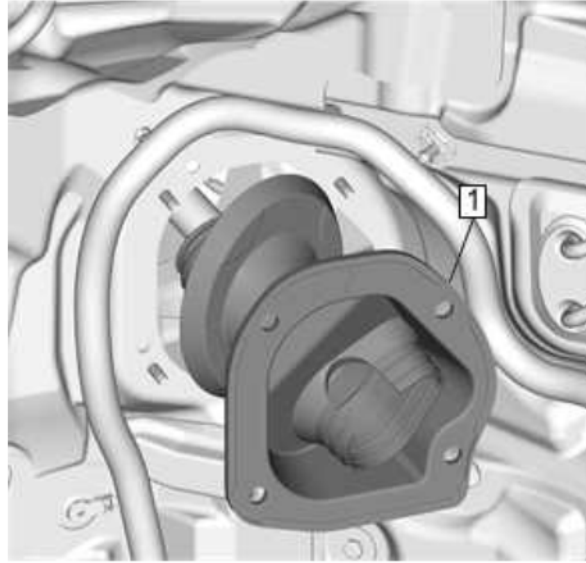


Fig. 71: Intermediate Steering Shaft Outer Boot
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

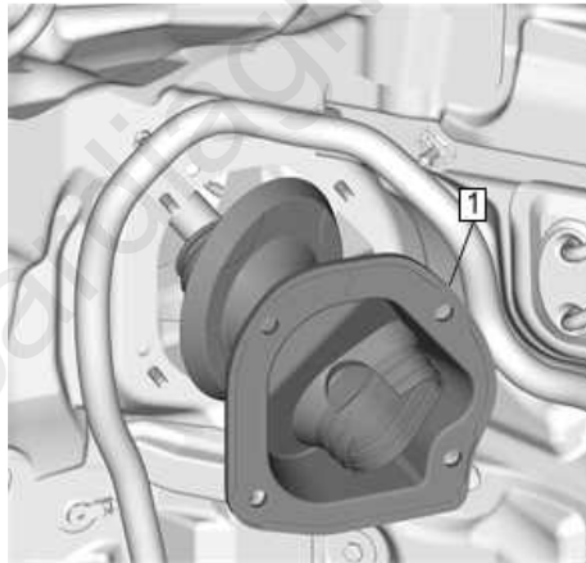


Fig. 72: Intermediate Steering Shaft Outer Boot
Courtesy of GENERAL MOTORS COMPANY

NOTE: When installing the intermediate steering shaft outer boot, ensure the boot is aligned under the hood by using the arrows on the boot as a guide.

2. Intermediate Steering Shaft Outer Boot Nut (1) Install and tighten [4x] 9 N.m (80 lb in)

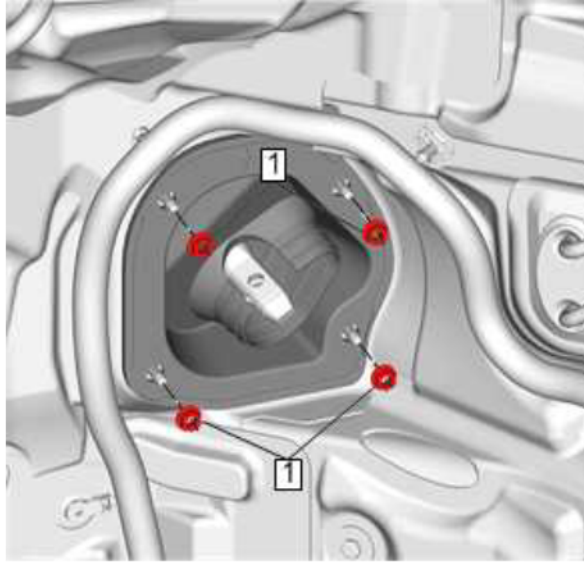


Fig. 73: Intermediate Steering Shaft Outer Boot Nut
 Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install

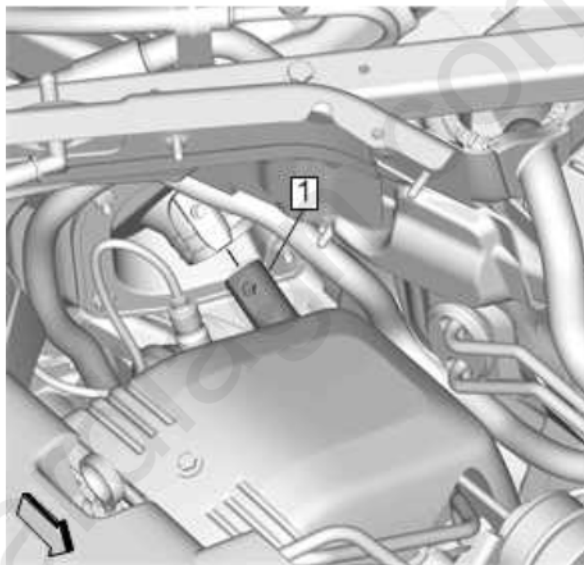


Fig. 74: Mid Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

4. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

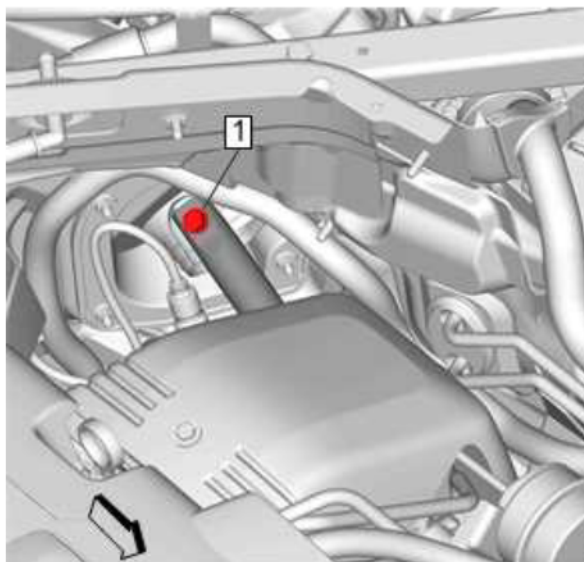


Fig. 75: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
5. Power Vacuum Brake Booster (1)» Install - [Power Vacuum Brake Booster Replacement](#)

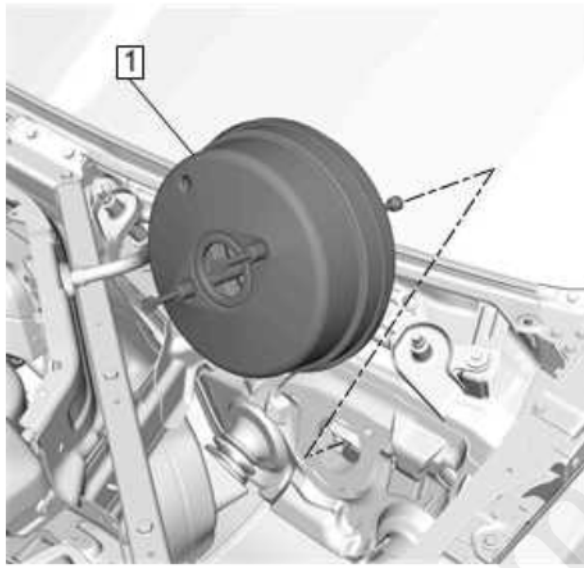


Fig. 76: Power Vacuum Brake Booster
Courtesy of GENERAL MOTORS COMPANY

6. Intermediate Steering Shaft (1)» Install - [Intermediate Steering Shaft Replacement \(RWD\)](#)[Intermediate Steering Shaft Replacement \(AWD\)](#)

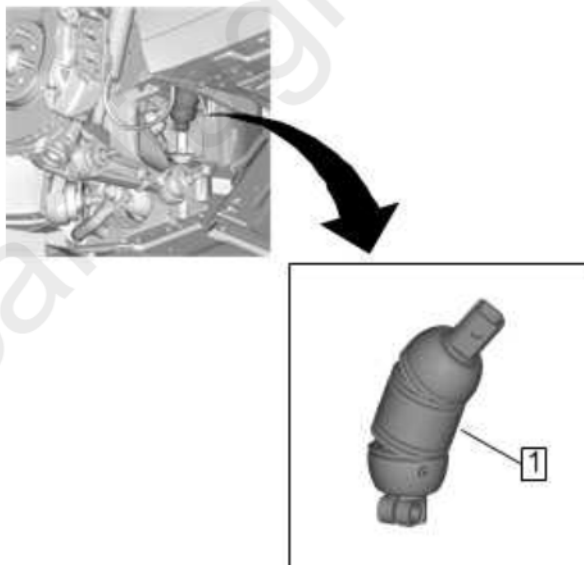


Fig. 77: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

7. Push the intermediate steering shaft outer boot (1) into the vehicle pass through and secure all of the plastic clips.

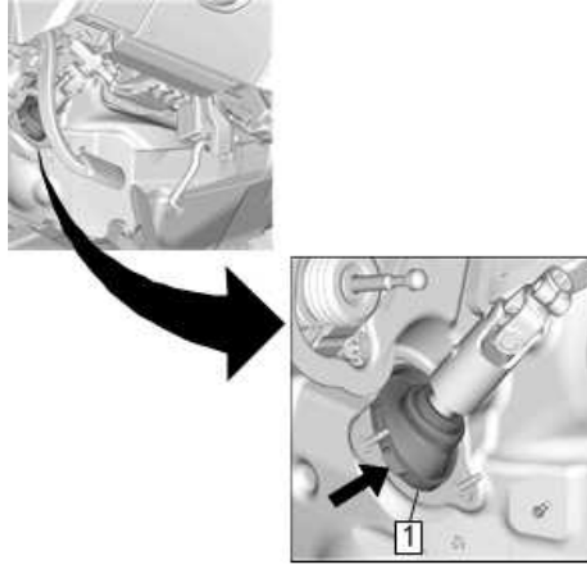


Fig. 78: Intermediate Steering Shaft Outer Boot

Courtesy of GENERAL MOTORS COMPANY

8. Intermediate Steering Shaft Inner Boot (1) » Install - **Intermediate Steering Shaft Boot Replacement (Outer, LTG)**

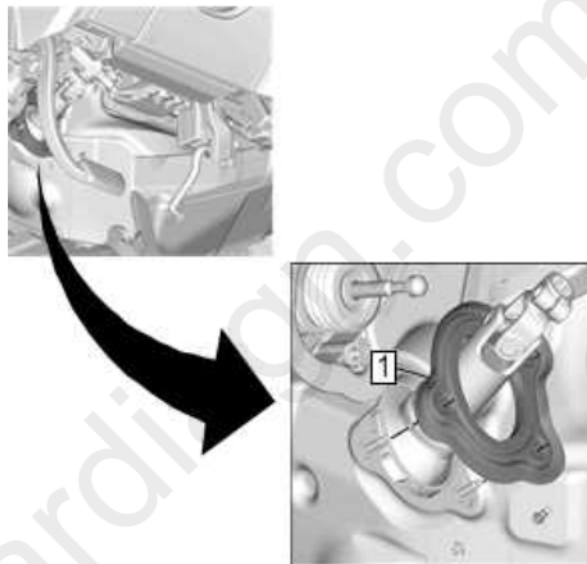


Fig. 79: Intermediate Steering Shaft Inner Boot

Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT BOOT REPLACEMENT (OUTER, LGW)

Removal Procedure

1. Intermediate Steering Shaft Inner Boot (1) » Remove - **Intermediate Steering Shaft Boot Replacement (Outer, LGW)**

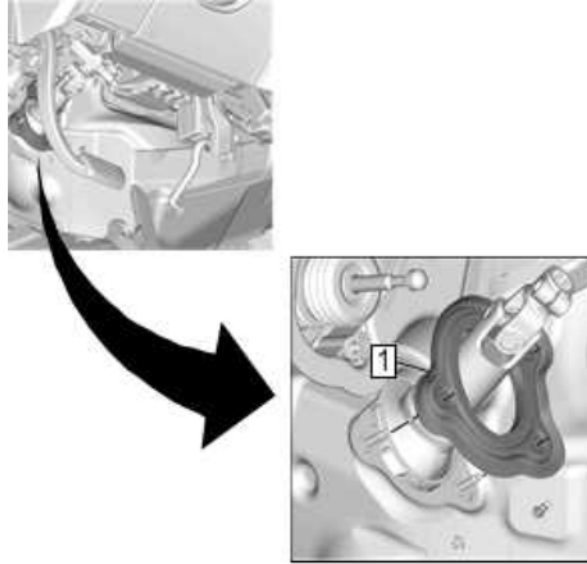


Fig. 80: Intermediate Steering Shaft Inner Boot
 Courtesy of GENERAL MOTORS COMPANY

2. Release the plastic clips and push the intermediate steering shaft outer boot (1) out of the vehicle pass through.

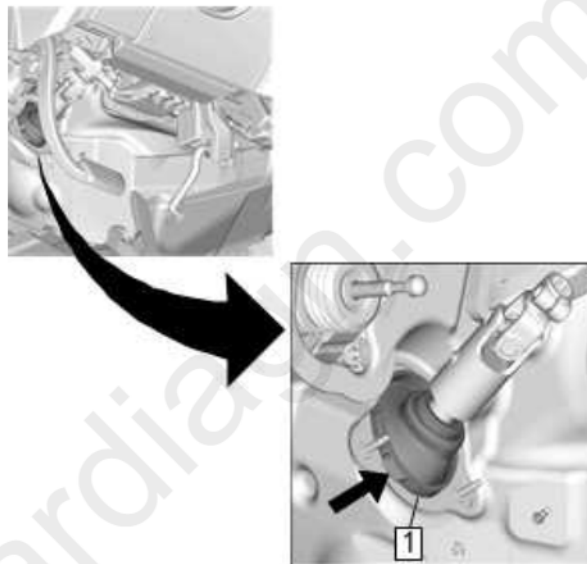
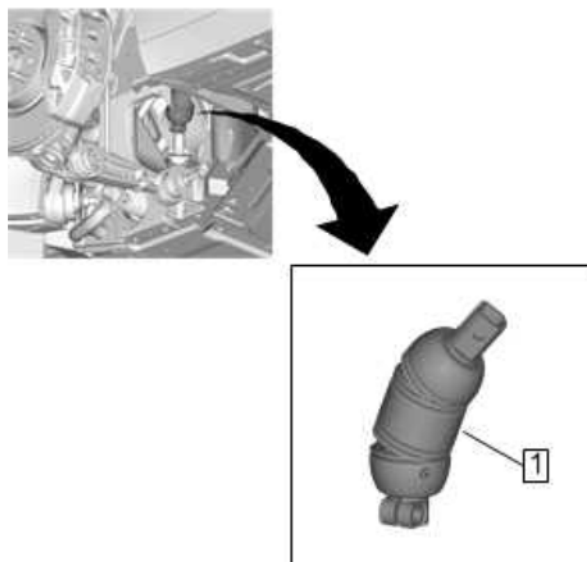


Fig. 81: Intermediate Steering Shaft Outer Boot
 Courtesy of GENERAL MOTORS COMPANY

3. Intermediate Steering Shaft (1) Remove - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**



4. Air Conditioning Refrigerant Heat Exchanger (1) » Remove - **Air Conditioning Refrigerant Heat Exchanger Replacement (LGW, LGX)**

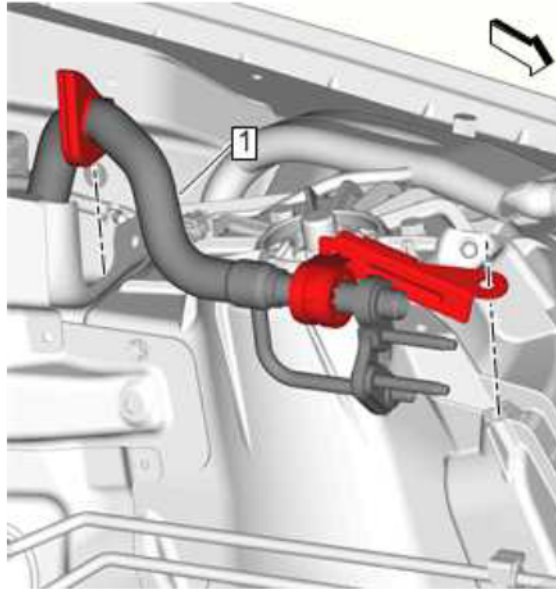


Fig. 83: Air Conditioning Refrigerant Heat Exchanger
Courtesy of GENERAL MOTORS COMPANY

5. Power Vacuum Brake Booster (1) » Remove - **Power Vacuum Brake Booster Replacement**

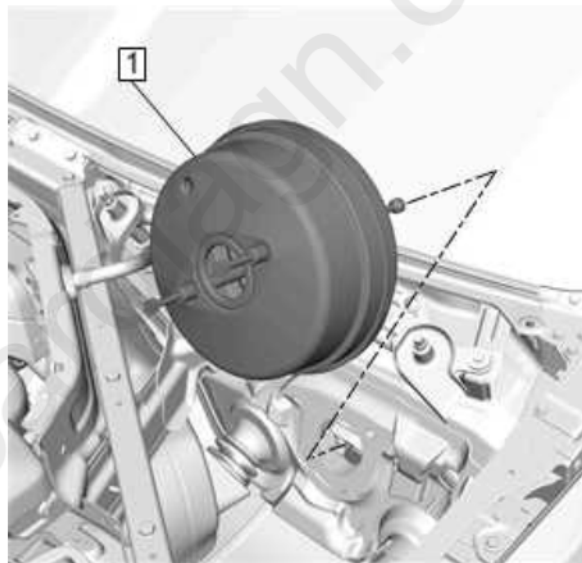


Fig. 84: Power Vacuum Brake Booster
Courtesy of GENERAL MOTORS COMPANY

6. Charge Air Cooler Inlet Air Tube - Left Side (2) » Remove - **Charge Air Cooler Inlet Air Tube Replacement (Left Side)**

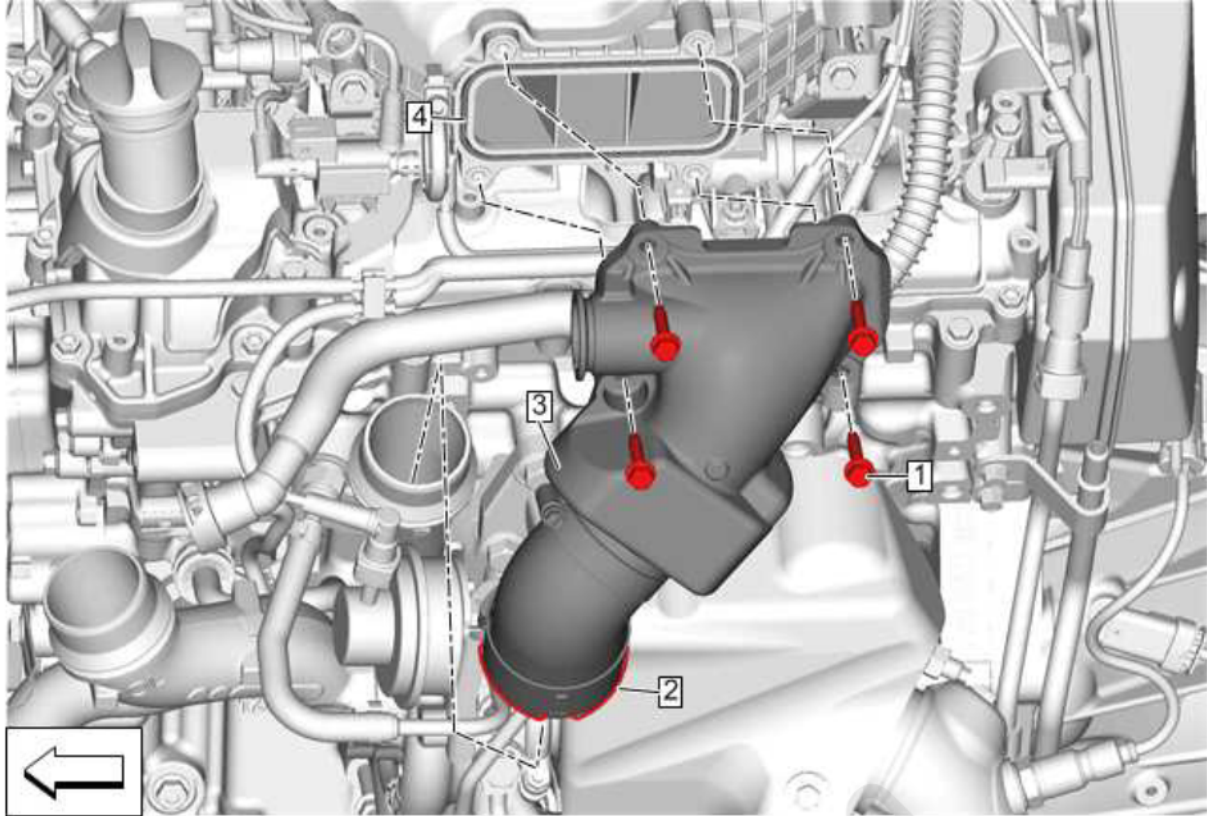


Fig. 85: Charge Air Cooler Inlet Air Tube
 Courtesy of GENERAL MOTORS COMPANY

7. Mid Intermediate Steering Shaft Bolt (1) » Remove

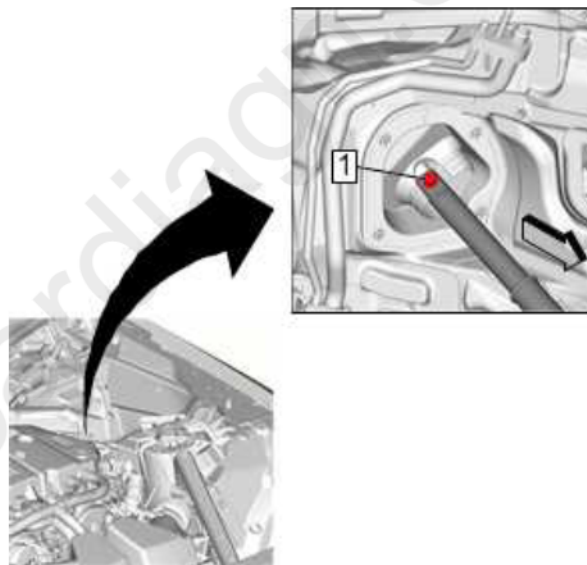


Fig. 86: Mid Intermediate Steering Shaft Bolt
 Courtesy of GENERAL MOTORS COMPANY

8. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft » Separate

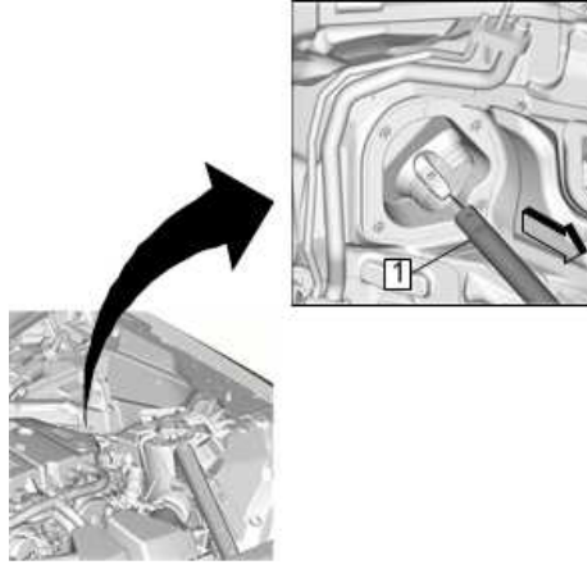


Fig. 87: Mid Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

9. Intermediate Steering Shaft Outer Boot Nut (1) Remove [4x]

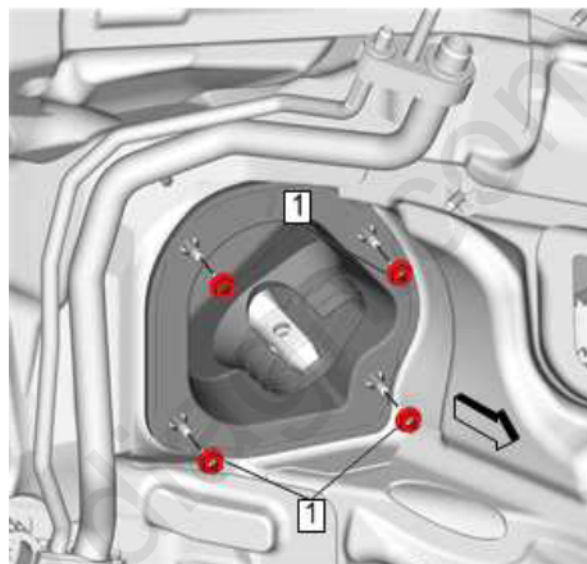


Fig. 88: Intermediate Steering Shaft Outer Boot Nut

Courtesy of GENERAL MOTORS COMPANY

10. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

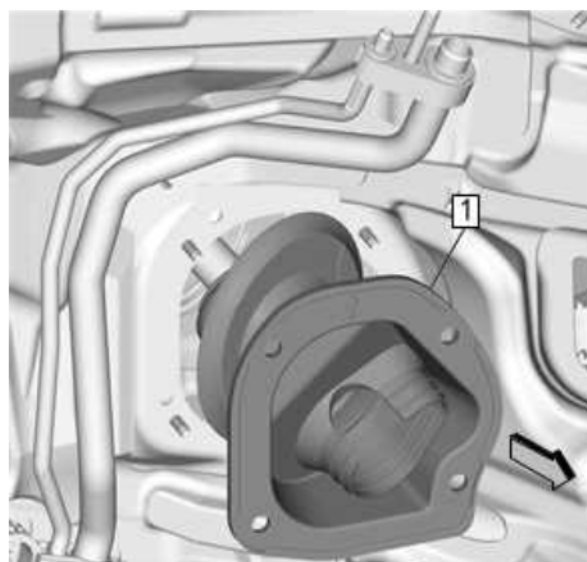


Fig. 89: Intermediate Steering Shaft Outer Boot

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

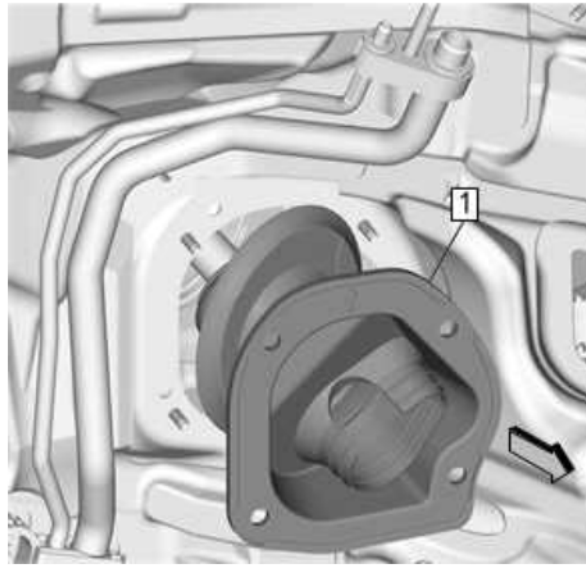


Fig. 90: Intermediate Steering Shaft Outer Boot
Courtesy of GENERAL MOTORS COMPANY

NOTE: When installing the intermediate steering shaft outer boot, ensure the boot is aligned under the hood by using the arrows on the boot as a guide.

2. Intermediate Steering Shaft Outer Boot Nut (1)» Install and tighten [4x] 9 N.m (80 lb in)

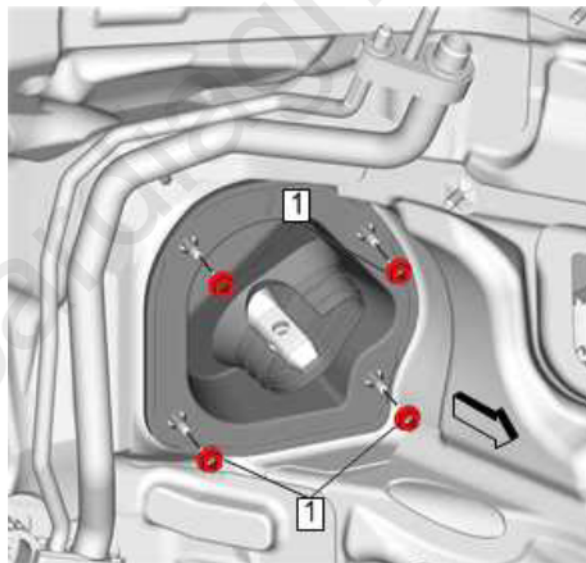


Fig. 91: Intermediate Steering Shaft Outer Boot Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install

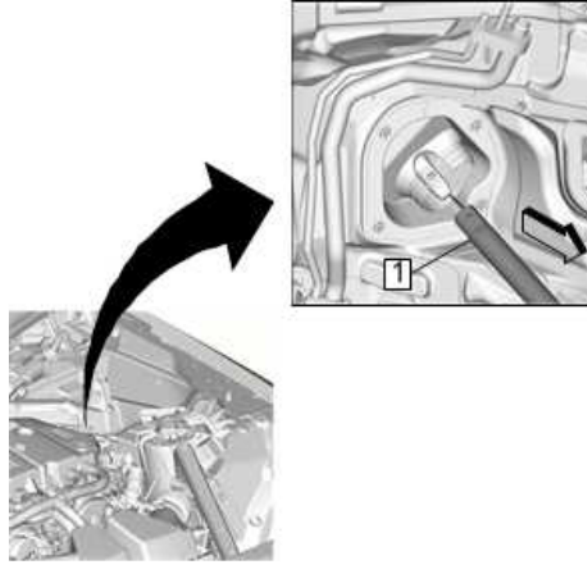


Fig. 92: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

4. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

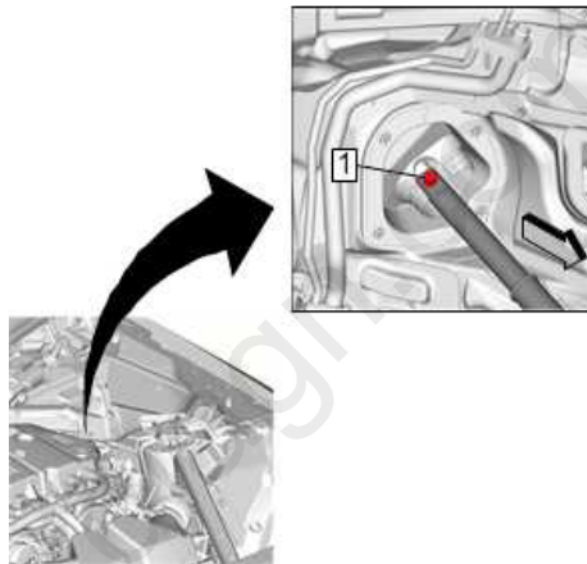


Fig. 93: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
5. Charge Air Cooler Inlet Air Tube - Left Side (2)» Install - [Charge Air Cooler Inlet Air Tube Replacement \(Left Side\)](#)
6. Power Vacuum Brake Booster (1)» Install - [Power Vacuum Brake Booster Replacement](#)

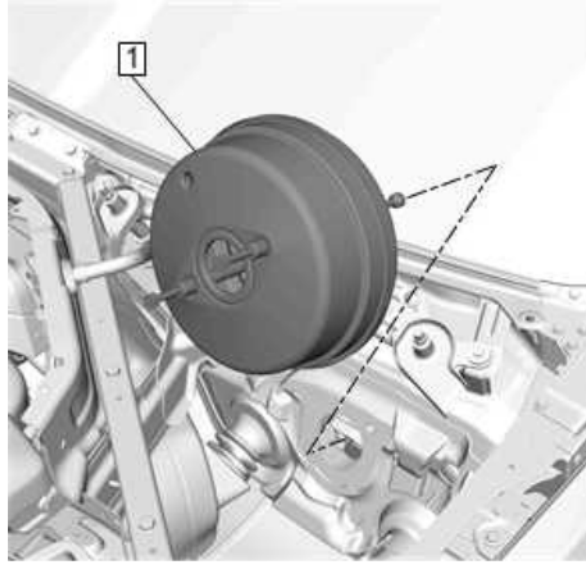


Fig. 94: Power Vacuum Brake Booster

Courtesy of GENERAL MOTORS COMPANY

7. Air Conditioning Refrigerant Heat Exchanger (1) » Install - **Air Conditioning Refrigerant Heat Exchanger Replacement (LGW, LGX)**

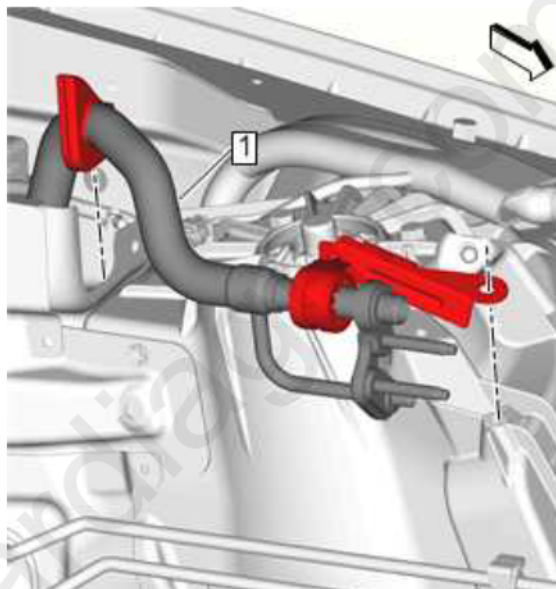


Fig. 95: Air Conditioning Refrigerant Heat Exchanger

Courtesy of GENERAL MOTORS COMPANY

8. Intermediate Steering Shaft (1) » Install - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

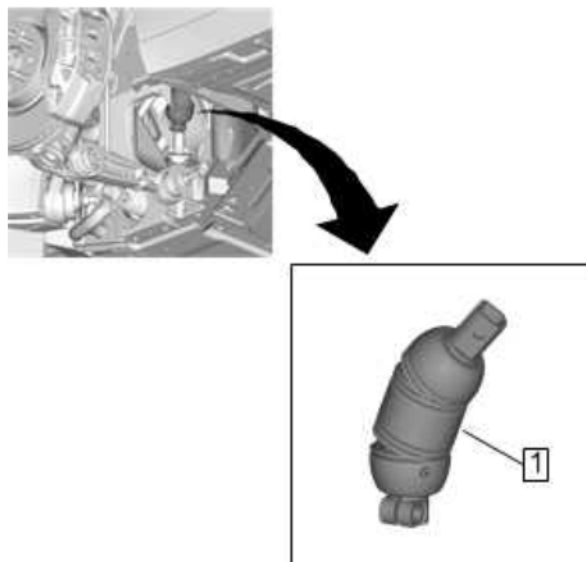


Fig. 96: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

9. Push the intermediate steering shaft outer boot (1) into the vehicle pass through and secure all of the plastic clips.

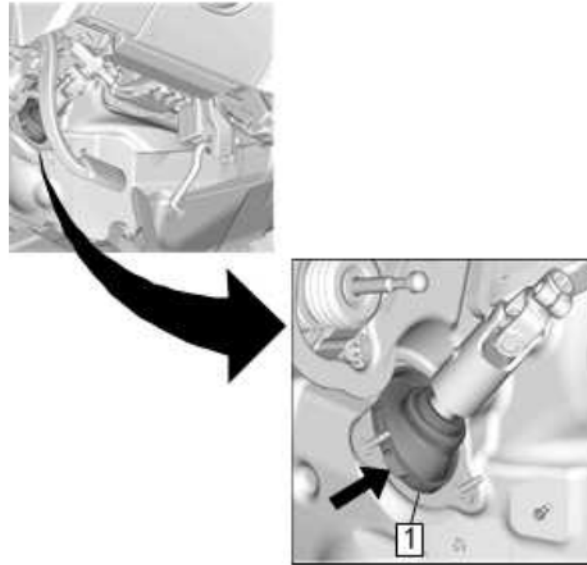


Fig. 97: Intermediate Steering Shaft Outer Boot

Courtesy of GENERAL MOTORS COMPANY

10. Intermediate Steering Shaft Inner Boot (1)» Install - **Intermediate Steering Shaft Boot Replacement (Outer, LGW)**

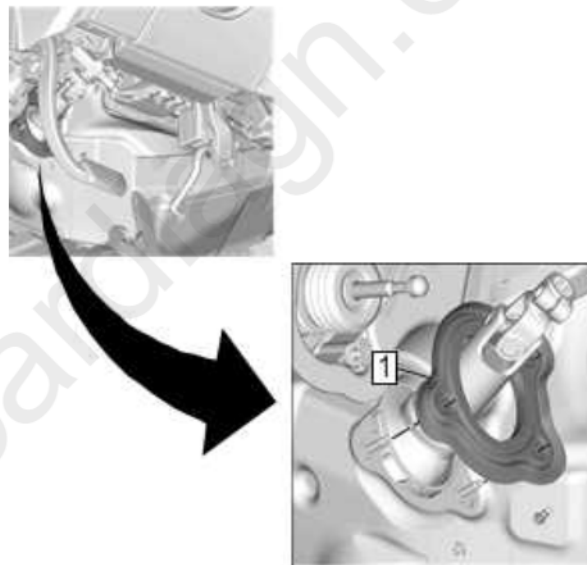


Fig. 98: Intermediate Steering Shaft Inner Boot

Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT BOOT REPLACEMENT (OUTER, LGX)

Removal Procedure

1. Intermediate Steering Shaft Inner Boot (1)» Remove - **Intermediate Steering Shaft Boot Replacement (Outer, LGX)**

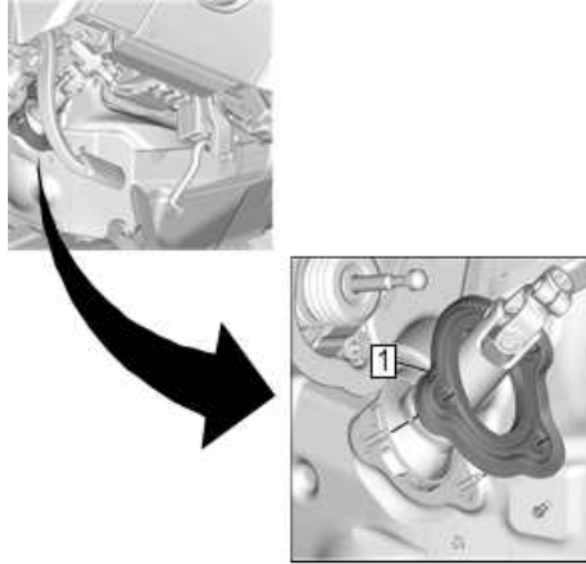


Fig. 99: Intermediate Steering Shaft Inner Boot
 Courtesy of GENERAL MOTORS COMPANY

2. Release the plastic clips and push the intermediate steering shaft outer boot (1) out of the vehicle pass through.

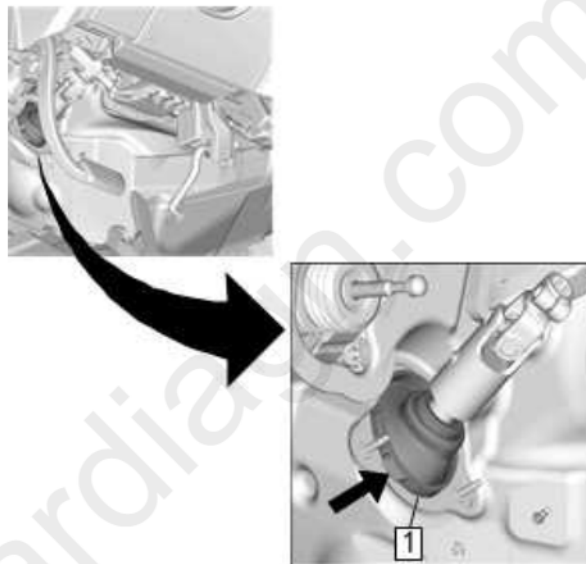


Fig. 100: Intermediate Steering Shaft Outer Boot
 Courtesy of GENERAL MOTORS COMPANY

3. Intermediate Steering Shaft (1) Remove - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

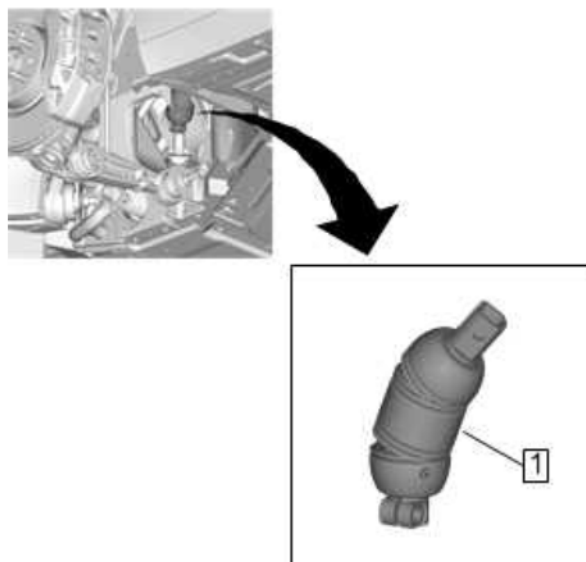


Fig. 101: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

4. Power Vacuum Brake Booster (1) » Remove - **Power Vacuum Brake Booster Replacement**

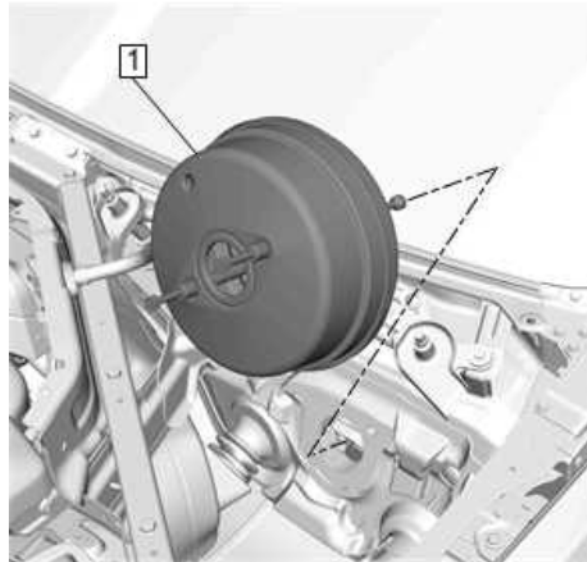


Fig. 102: Power Vacuum Brake Booster
Courtesy of GENERAL MOTORS COMPANY

5. Mid Intermediate Steering Shaft Bolt (1) » Remove

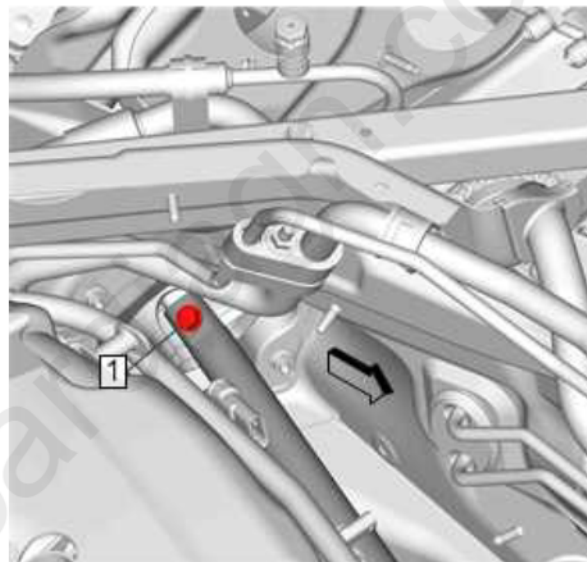


Fig. 103: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft » Separate

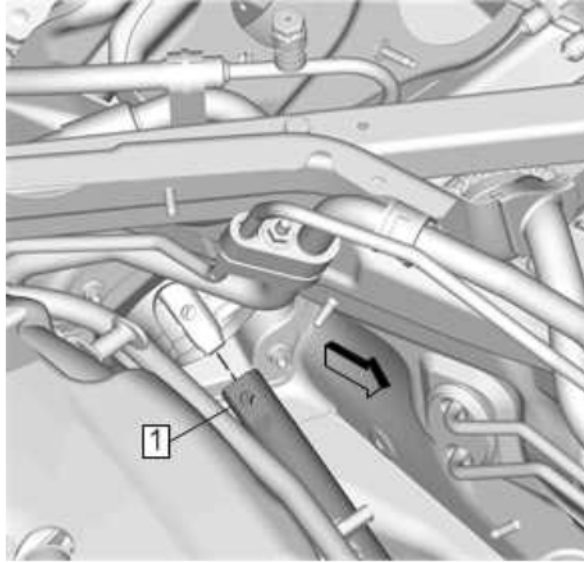


Fig. 104: Mid Intermediate Steering Shaft
 Courtesy of GENERAL MOTORS COMPANY

7. Intermediate Steering Shaft Outer Boot Nut (1) » Remove [4x]

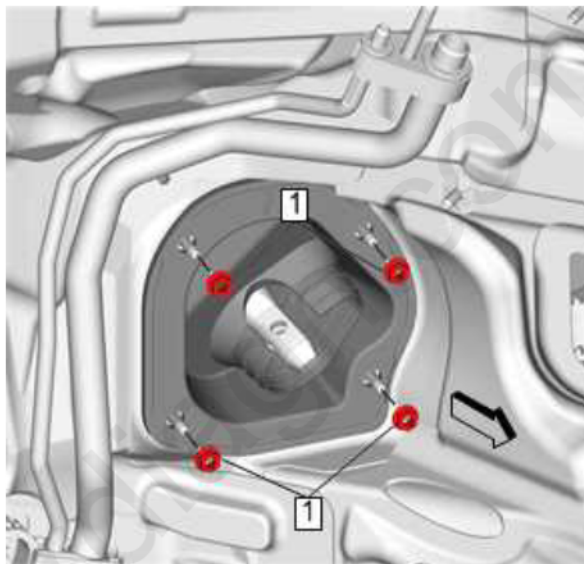


Fig. 105: Intermediate Steering Shaft Outer Boot Nut
 Courtesy of GENERAL MOTORS COMPANY

8. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

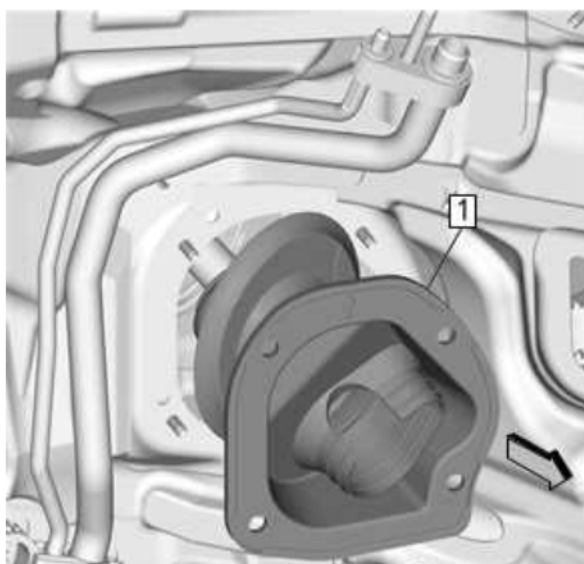


Fig. 106: Intermediate Steering Shaft Outer Boot
 Courtesy of GENERAL MOTORS COMPANY

1. Slide the intermediate steering shaft outer boot (1) over the upper intermediate steering shaft and through the vehicle sheet metal.

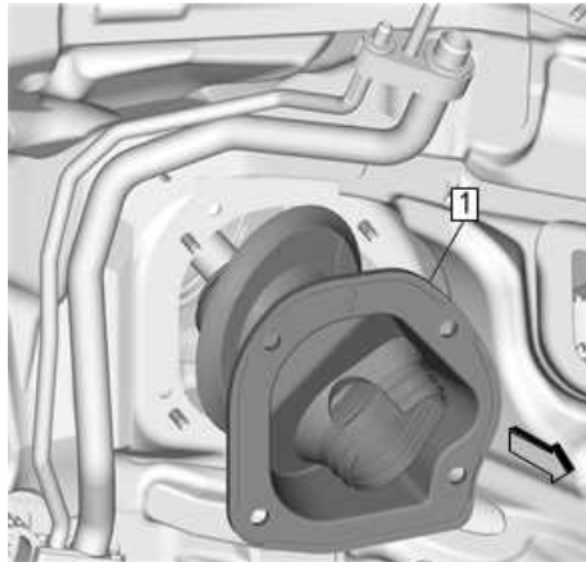


Fig. 107: Intermediate Steering Shaft Outer Boot

Courtesy of GENERAL MOTORS COMPANY

NOTE: When installing the intermediate steering shaft outer boot, ensure the boot is aligned under the hood by using the arrows on the boot as a guide.

2. Intermediate Steering Shaft Outer Boot Nut (1)» Install and tighten [4x] 9 N.m (80 lb in)

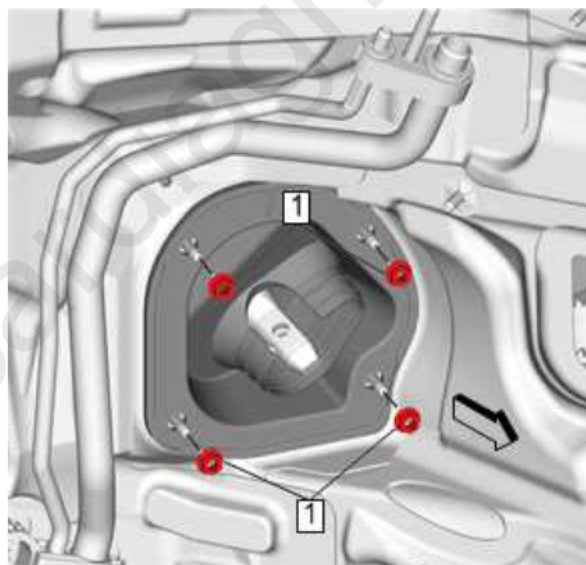


Fig. 108: Intermediate Steering Shaft Outer Boot Nut

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

3. Mid Intermediate Steering Shaft (1) @ Upper Intermediate Steering Shaft» Install

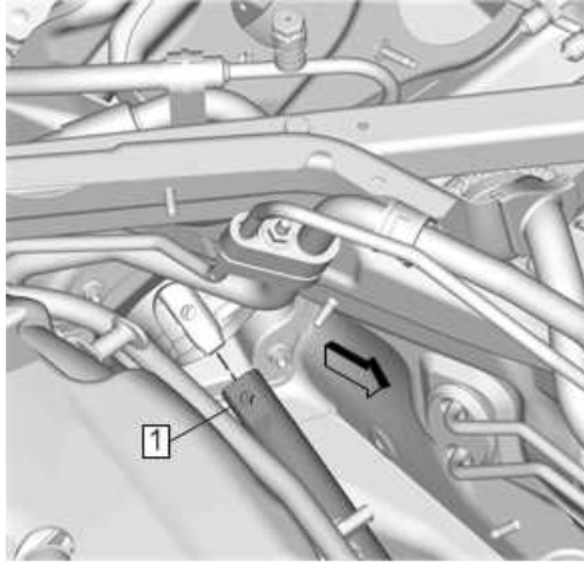


Fig. 109: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

4. Mid Intermediate Steering Shaft Bolt (1)» Install and tighten 30 N.m (22 lb ft)

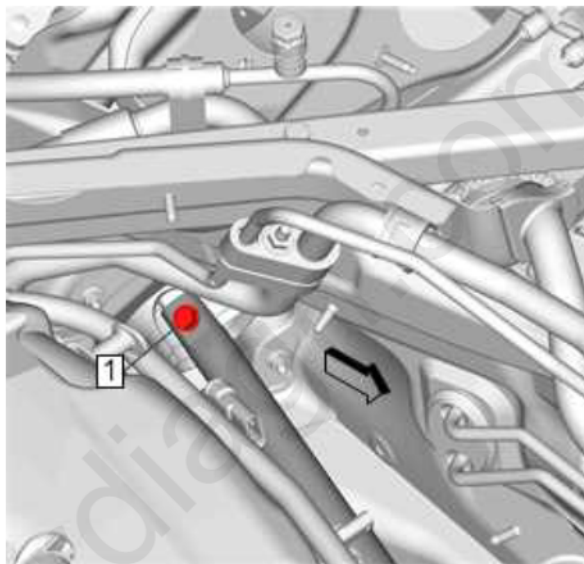


Fig. 110: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
5. Power Vacuum Brake Booster (1)» Install - [Power Vacuum Brake Booster Replacement](#)

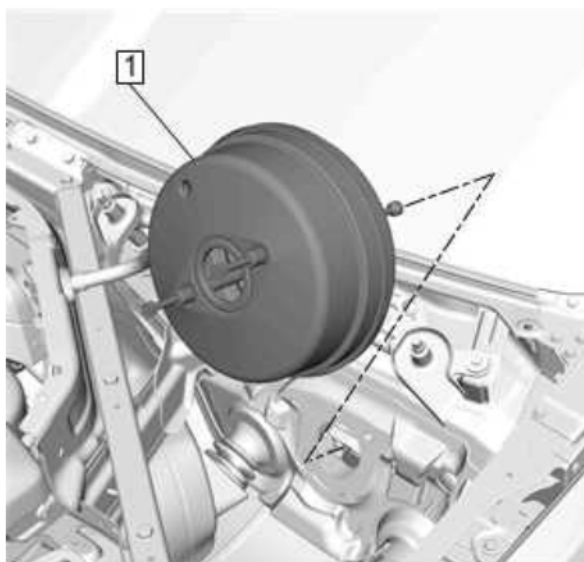


Fig. 111: Power Vacuum Brake Booster
Courtesy of GENERAL MOTORS COMPANY

6. Intermediate Steering Shaft (1)» Install - **Intermediate Steering Shaft Replacement (RWD)****Intermediate Steering Shaft Replacement (AWD)**

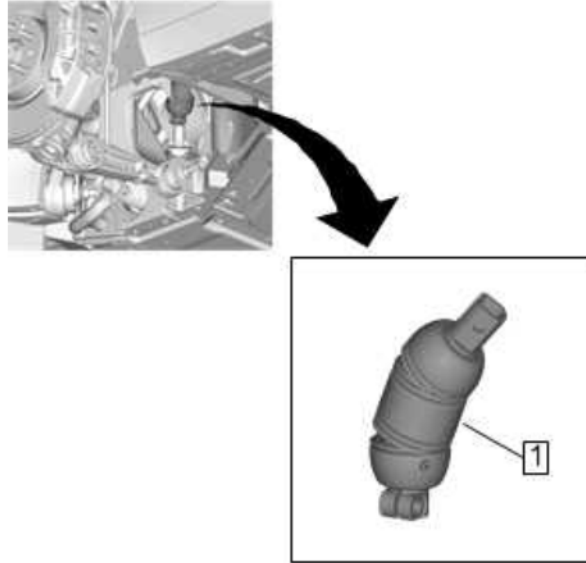


Fig. 112: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

7. Push the intermediate steering shaft outer boot (1) into the vehicle pass through and secure all of the plastic clips.

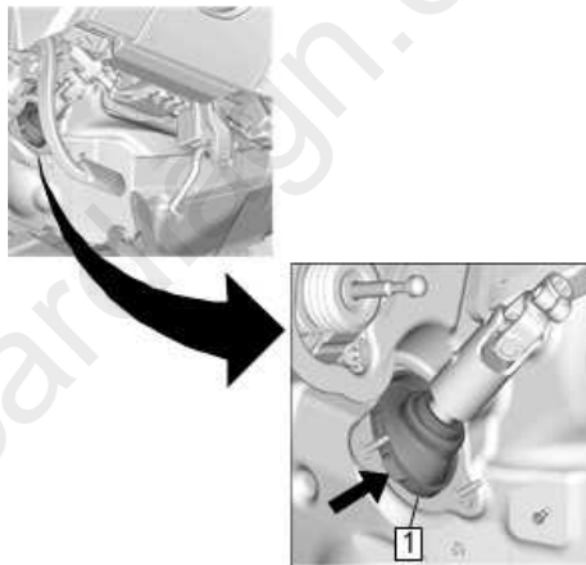


Fig. 113: Intermediate Steering Shaft Outer Boot
Courtesy of GENERAL MOTORS COMPANY

8. Intermediate Steering Shaft Inner Boot (1)» Install - **Intermediate Steering Shaft Boot Replacement (Outer, LGX)**

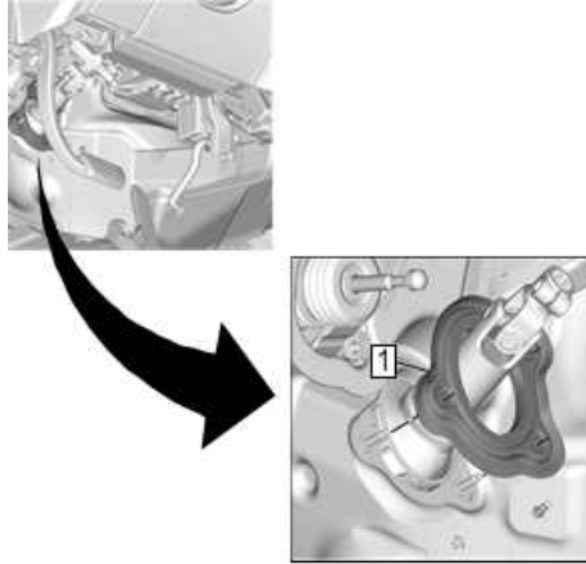


Fig. 114: Intermediate Steering Shaft Inner Boot
 Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Engine Front Splash Shield - Left Side Rear (1) » Remove - **Engine Front Splash Shield Replacement - Left Side (Rear)** **Engine Front Splash Shield Replacement - Left Side (Front)**

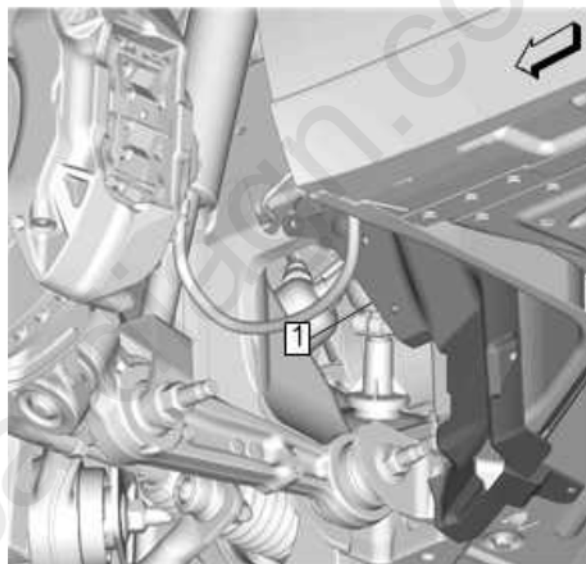


Fig. 115: Engine Front Splash Shield
 Courtesy of GENERAL MOTORS COMPANY

2. Position the intermediate steering shaft so both of the intermediate steering shaft bolts are accessible.
3. Intermediate Steering Shaft Lower Bolt (1) » Remove

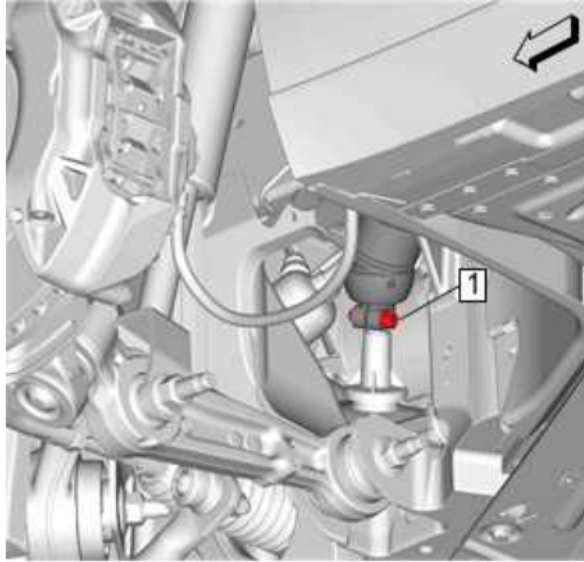


Fig. 116: Intermediate Steering Shaft Lower Bolt

Courtesy of GENERAL MOTORS COMPANY

NOTE: Place match marks on the intermediate steering shaft and the steering gear input shaft to aid in installation.

4. Intermediate Steering Shaft Upper Bolt (1) Remove

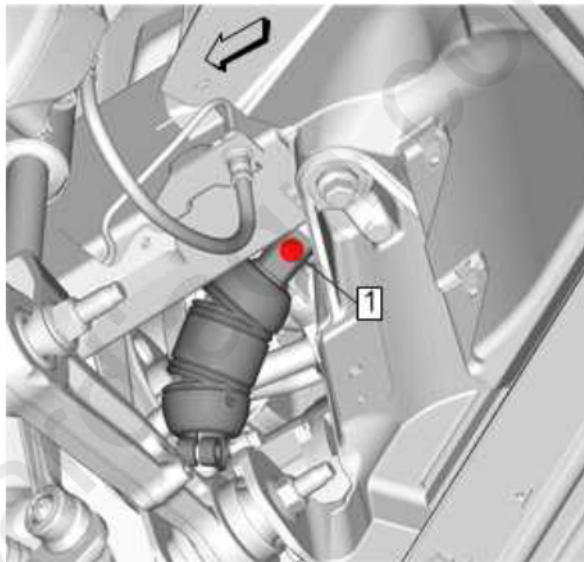


Fig. 117: Intermediate Steering Shaft Upper Bolt

Courtesy of GENERAL MOTORS COMPANY

NOTE: Place match marks on the intermediate steering shaft and the mid intermediate steering shaft to aid in installation.

5. Remove the intermediate steering shaft (1) from the vehicle.

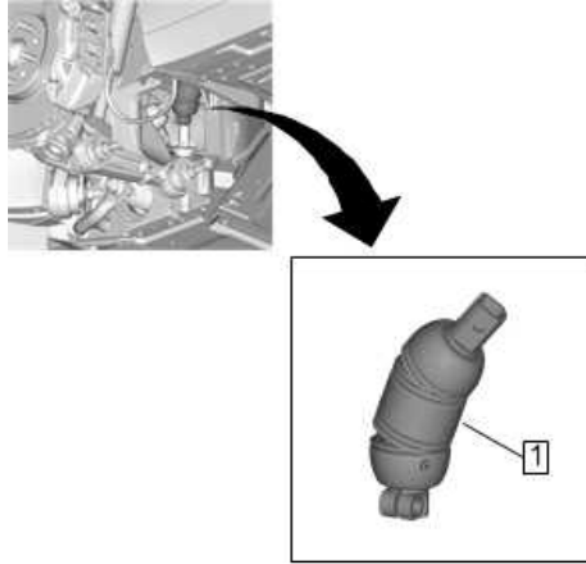


Fig. 118: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Position the intermediate steering shaft (1) on the vehicle.

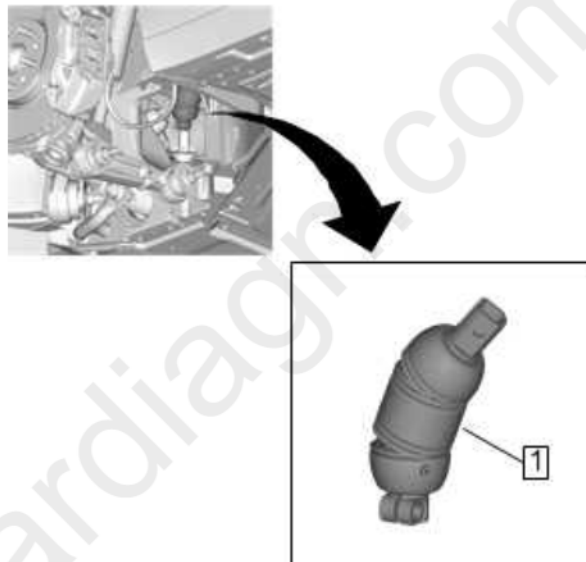


Fig. 119: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

NOTE: Use the match marks previously made on the intermediate steering shaft, the mid intermediate steering shaft and the steering gear input shaft to aid in alignment of the components.

2. Intermediate Steering Shaft Upper Bolt (1)» Install and tighten 30 N.m (22 lb ft)

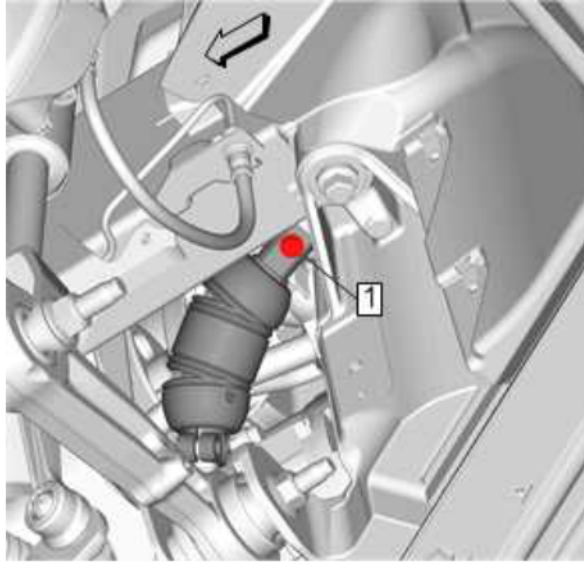


Fig. 120: Intermediate Steering Shaft Upper Bolt

Courtesy of GENERAL MOTORS COMPANY

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

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
3. Intermediate Steering Shaft Lower Bolt (1)» Install and tighten 50 N.m (37 lb ft)

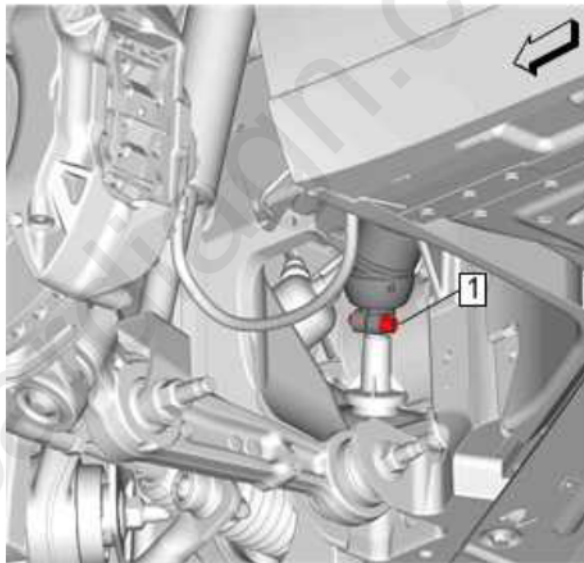


Fig. 121: Intermediate Steering Shaft Lower Bolt

Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
4. Engine Front Splash Shield - Left Side Rear (1)» Install - [Engine Front Splash Shield Replacement - Left Side \(Rear\)](#)

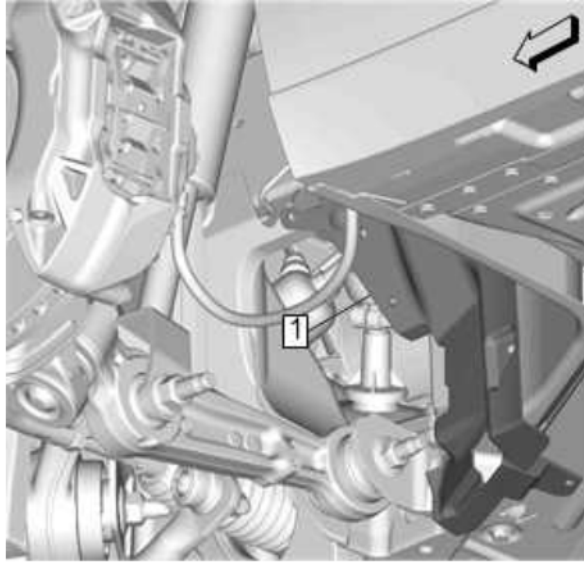


Fig. 122: Engine Front Splash Shield

Courtesy of GENERAL MOTORS COMPANY

INTERMEDIATE STEERING SHAFT REPLACEMENT (AWD)

Removal Procedure

1. Engine Front Splash Shield - Left Side Rear (1) » Remove - **Engine Front Splash Shield Replacement - Left Side (Rear)**

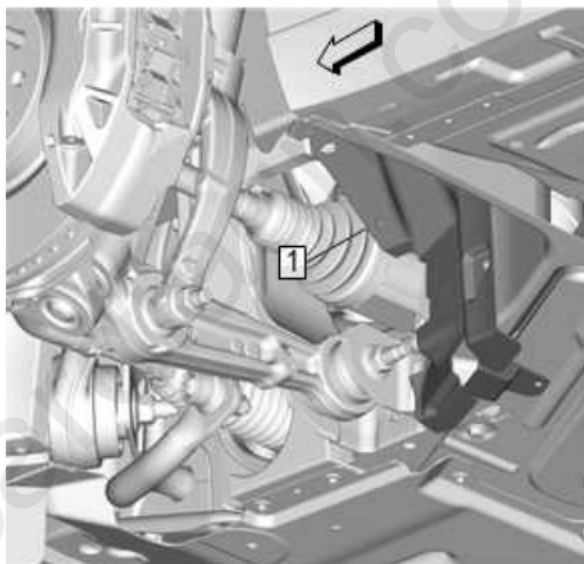


Fig. 123: Engine Front Splash Shield

Courtesy of GENERAL MOTORS COMPANY

2. Front Wheel Drive Shaft - Left Side (1) » Remove - **Front Wheel Drive Shaft Replacement - Left Side**

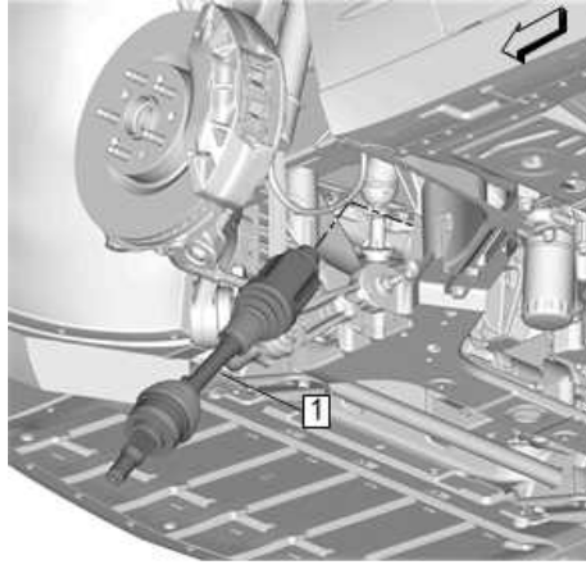


Fig. 124: Front Wheel Drive Shaft - Left Side
 Courtesy of GENERAL MOTORS COMPANY

3. Intermediate Steering Shaft Lower Bolt (1)» Remove

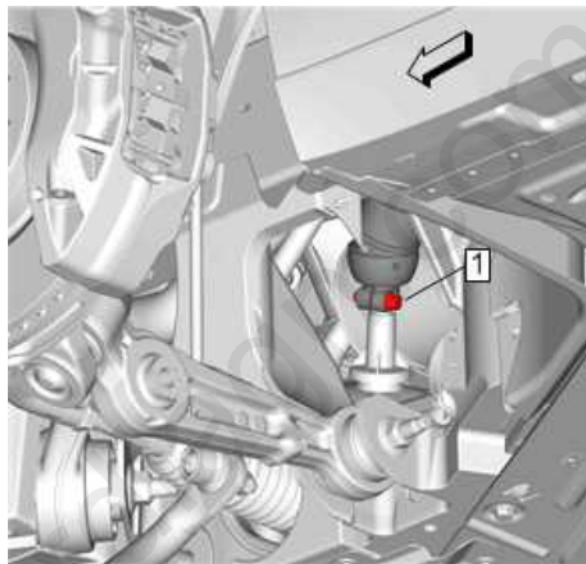


Fig. 125: Intermediate Steering Shaft Lower Bolt
 Courtesy of GENERAL MOTORS COMPANY

4. Intermediate Steering Shaft Upper Bolt (1)» Remove

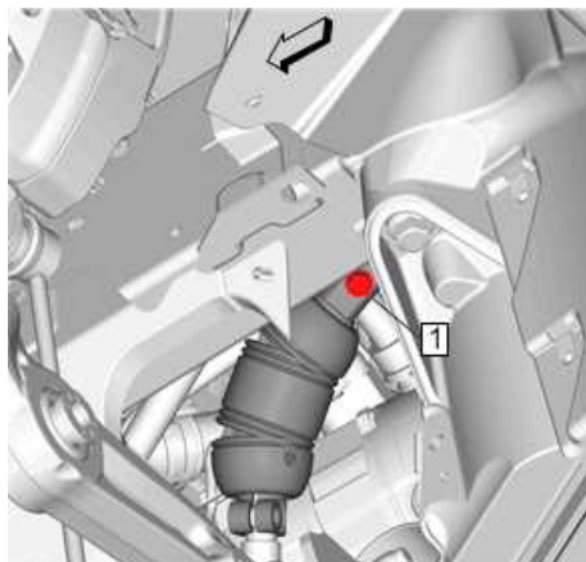


Fig. 126: Intermediate Steering Shaft Upper Bolt
 Courtesy of GENERAL MOTORS COMPANY

5. Remove the intermediate steering shaft (1) from the vehicle.

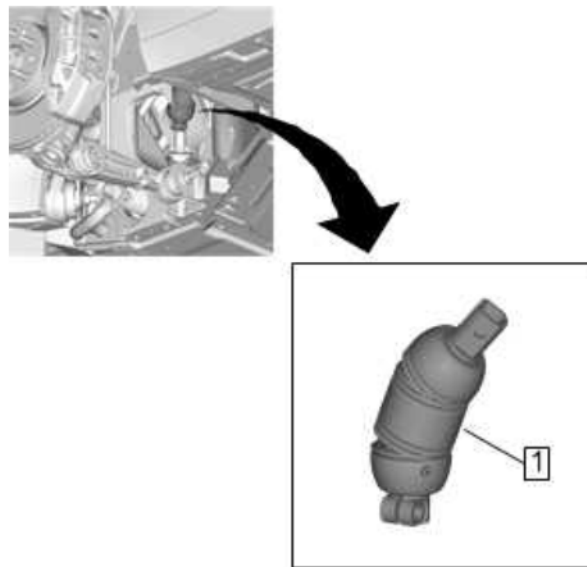


Fig. 127: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Position the intermediate steering shaft (1) on the vehicle.

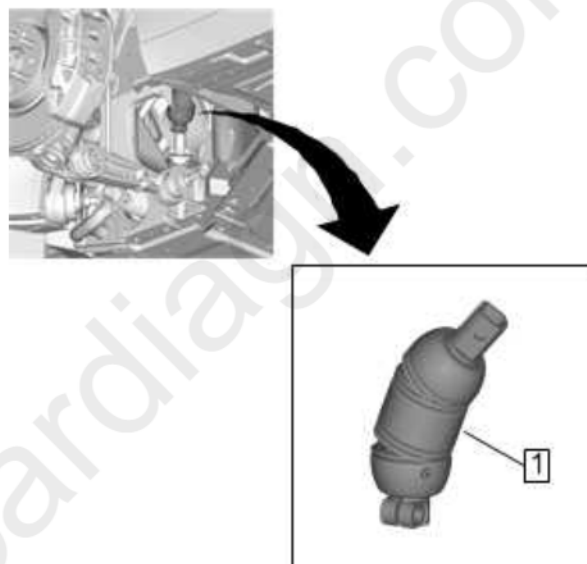
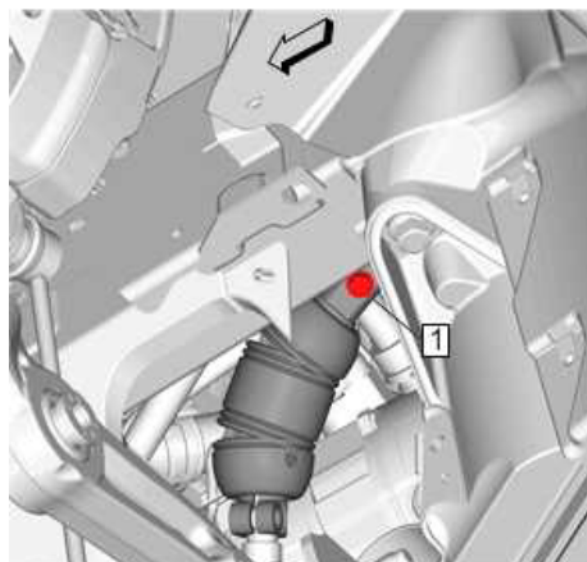


Fig. 128: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Upper Bolt (1)» Install and tighten 30 N.m (22 lb ft)



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

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
3. Intermediate Steering Shaft Lower Bolt (1)» Install and tighten 50 N.m (37 lb ft)

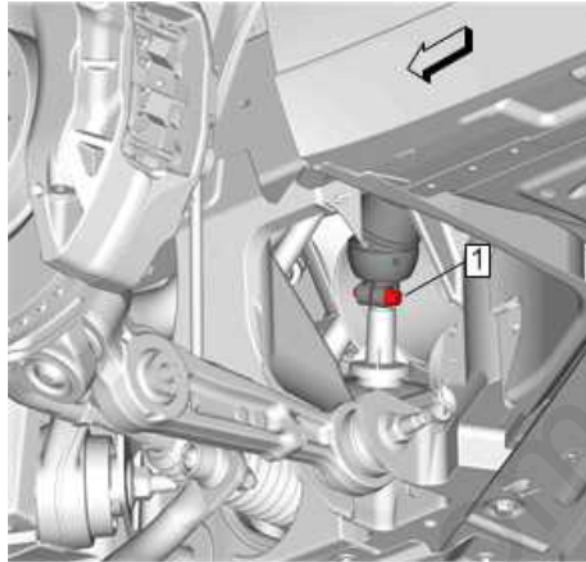


Fig. 130: Intermediate Steering Shaft Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
4. Front Wheel Drive Shaft - Left Side (1)» Install - [Front Wheel Drive Shaft Replacement - Left Side](#)

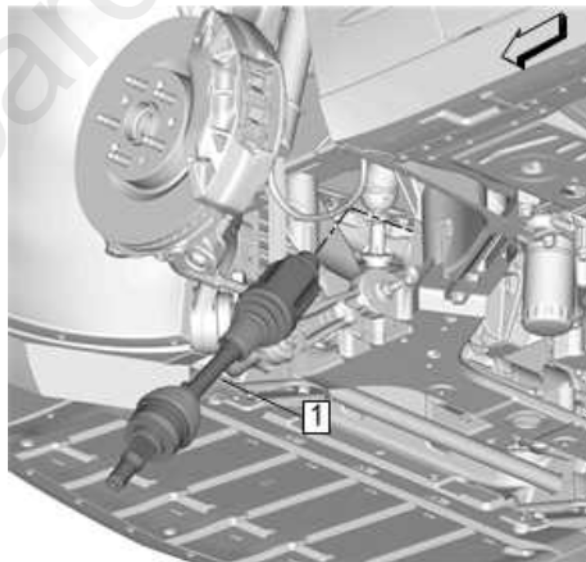


Fig. 131: Front Wheel Drive Shaft-Left Side
Courtesy of GENERAL MOTORS COMPANY

5. Engine Front Splash Shield - Left Side Rear (1)» Install - [Engine Front Splash Shield Replacement - Left Side \(Rear\)](#)

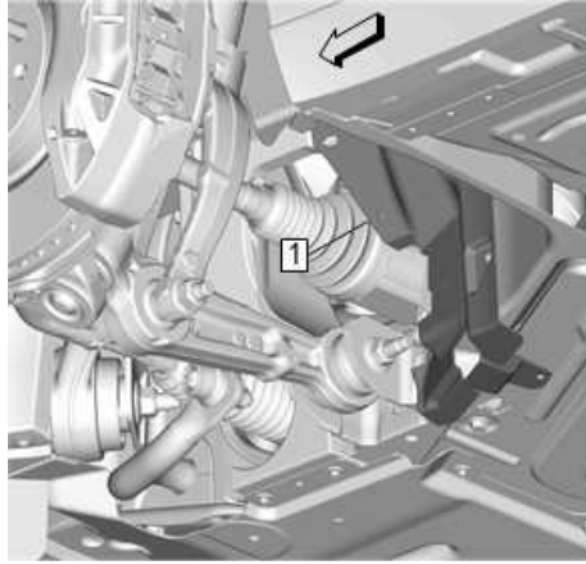


Fig. 132: Engine Front Splash Shield
Courtesy of GENERAL MOTORS COMPANY

STEERING COLUMN ACCIDENT DAMAGE INSPECTION

Inspection Procedure

1. Turn Signal Switch Bracket, & » Remove - [Turn Signal Switch Bracket Replacement](#)
2. Steering Column, & » Remove - [Steering Column Replacement](#)

CAUTION: Vehicles involved in accidents that result in any of the following kinds of damage or situations, may also have a damaged or misaligned steering column:

- Frame damage
- Major body damage
- Sheet metal damage
- If the steering column has been impacted
- If the supplemental inflatable restraints system was deployed

3. Rotate the steering column shaft and verify the shaft turns freely and without interference during the operation.
4. Verify the energy absorbing (E/A) strap holder rivets (1) are NOT sheared completely.

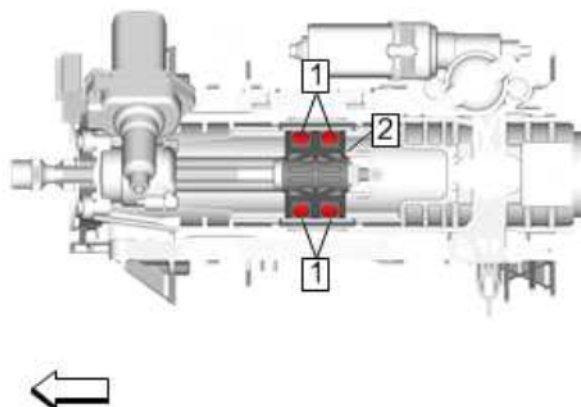


Fig. 133: Energy Absorbing (E/A) Strap Holder Rivets
Courtesy of GENERAL MOTORS COMPANY

If ANY of the four rivets are sheared, the steering column MUST be replaced.

5. If all four E/A strap holder rivets (1) are intact, verify the rivets are sitting against the E/A strap holder (2) firmly and do NOT appear to be extracted or loose in ANY way.

If ANY of the four rivets appear loose or extracted, the steering column MUST be replaced.

6. Verify there is NO damage to the E/A strap (1).

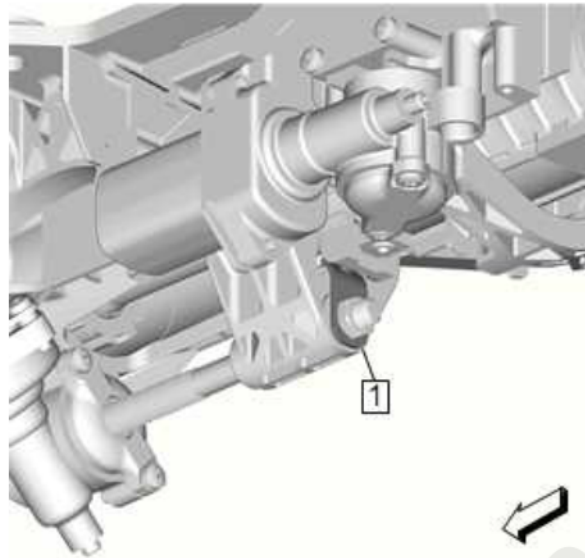


Fig. 134: E/A Strap

Courtesy of GENERAL MOTORS COMPANY

7. Measure the length (a) of the upper and lower jacket assembly in the fully telescoped position.

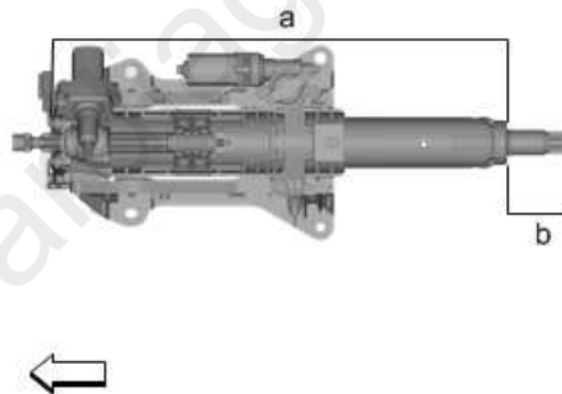


Fig. 135: Measure Length (a) Of Upper And Lower Jacket Assembly

Courtesy of GENERAL MOTORS COMPANY

The length of the upper and lower jacket assembly must NOT be less than 420.19 mm (16.54 in).

8. Measure the length (b) of the upper shaft from the end of the upper jacket to the tip of the shaft.

The length of the upper shaft must NOT be less than 62.6 mm (2.46 in).

9. Actuate the steering column in the radial and axial directions.

The steering column must NOT exhibit ANY grinding or binding or exhibit ANY subjective degradation of noise during column operation.

10. If the steering column does NOT meet the specifications, the steering column is damaged.

DISCARD the damaged steering column and install a NEW steering column.

11. If the steering column DOES meet the specifications, install the steering column. Refer to [Steering Column Replacement](#)
12. Turn Signal Switch Bracket» Install - [Turn Signal Switch Bracket Replacement](#)

STEERING COLUMN UPPER TRIM COVER REPLACEMENT

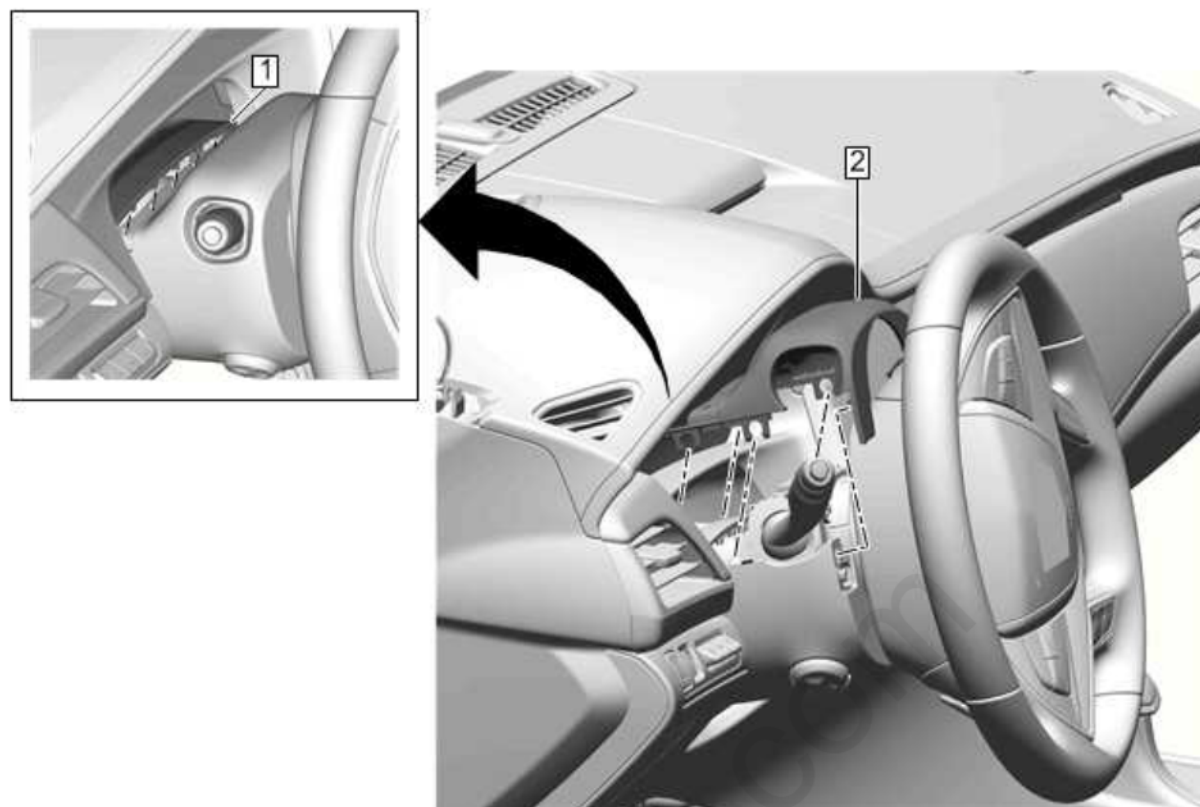


Fig. 136: Steering Column Upper Trim Cover
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Extend the steering column to the fully telescoped position. 2. With the vehicle off, place the ignition system in the ACC/ACCESSORY mode.	
1	Instrument Panel Steering Column Opening Closeout Procedure Use a flat bladed plastic trim tool to disengage the instrument panel steering column opening closeout from the steering column upper trim cover.
2	Steering Column Upper Trim Cover Procedure 1. Rotate the steering wheel to expose the front of the steering column upper trim cover where it engages the steering column lower trim cover. 2. Gently pull the steering column upper trim cover upwards on each side to disengage the cover from the steering column lower trim cover.

STEERING COLUMN LOWER TRIM COVER REPLACEMENT

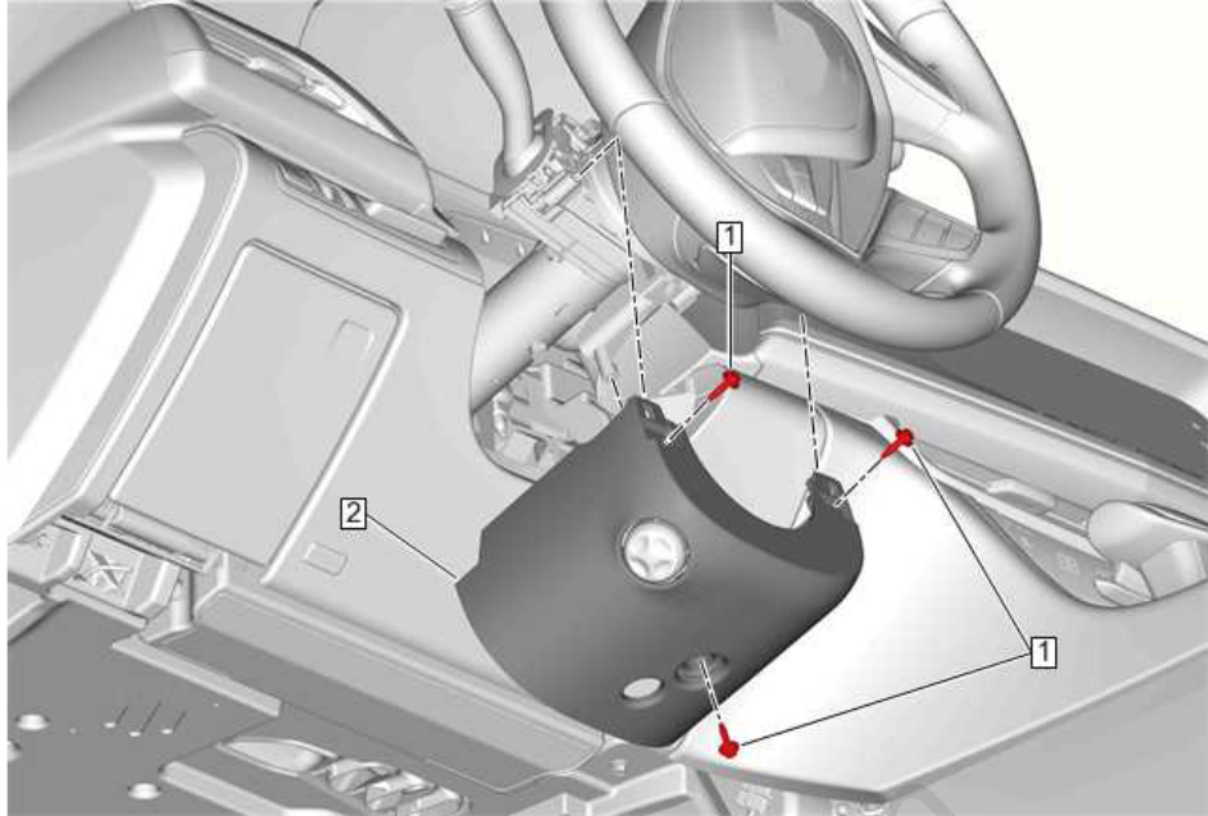


Fig. 137: Steering Column Lower Trim Cover
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Extend the steering column to the fully telescoped position. 2. With the vehicle off, place the ignition system in the ACC/ACCESSORY mode. 3. Disengage the steering column upper trim cover from the steering column lower trim cover. Refer to Steering Column Upper Trim Cover Replacement	
1	Steering Column Lower Trim Cover Bolt [3x] CAUTION: Refer to Fastener Caution . Procedure Rotate the steering wheel left and right to access the fasteners securing the steering column lower trim cover to the turn signal switch bracket. Tighten 2.5 N.m (22 lb in)
2	Steering Column Lower Trim Cover Procedure 1. Disconnect the electrical connector. 2. Transfer components as necessary.

STEERING COLUMN LOCK CONTROL MODULE REPLACEMENT

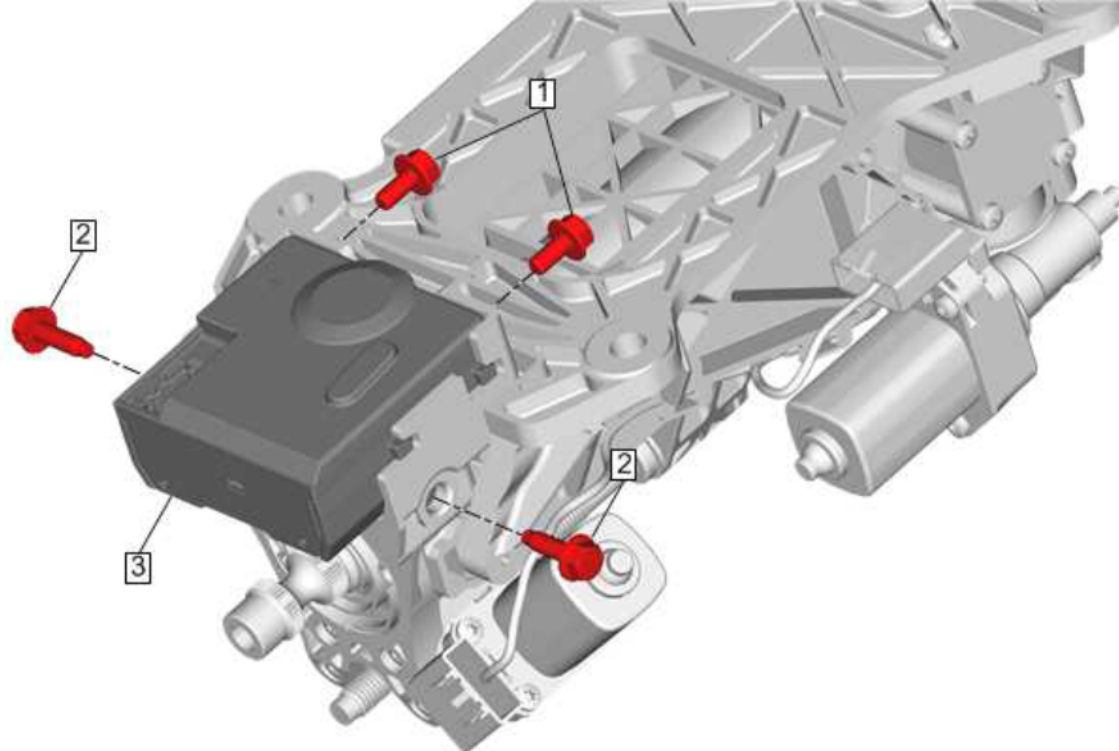


Fig. 138: Steering Column Lock Control Module

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Replacement</u>	
1	Steering Column Lock Control Module Bolt - Rear [2x] CAUTION: Refer to <u>Fastener Caution</u> . NOTE: The rear steering column lock control module bolts are a different length than the side steering column lock control module bolts. The bolts MUST be installed in the appropriate positions. Tighten 9.5 N.m (84 lb in)
2	Steering Column Lock Control Module Bolt - Side [2x] NOTE: The rear steering column lock control module bolts are a different length than the side steering column lock control module bolts. The bolts MUST be installed in the appropriate positions. Tighten 9.5 N.m (84 lb in)
3	Steering Column Lock Control Module Procedure Program the steering column lock control module. <u>Control Module References</u>

STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE REPLACEMENT

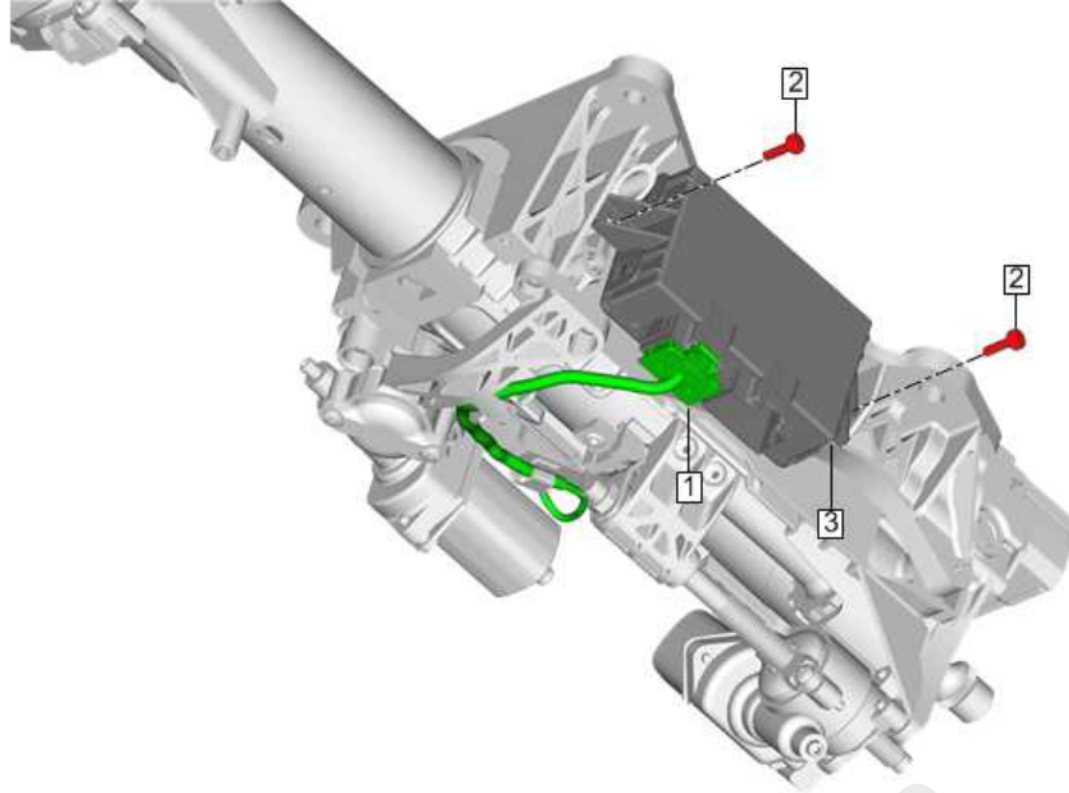


Fig. 139: Steering Column Tilt Wheel and Telescope Control Module

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Replacement</u>	
1	Steering Column Tilt and Telescope Wheel Actuator Motor Harness Procedure Disconnect the electrical connector.
2	Steering Column Tilt Wheel and Telescope Control Module Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 3 N.m (27 lb in)
3	Steering Column Tilt Wheel and Telescope Control Module Procedure Program the steering column tilt wheel and telescope control module. Refer to <u>Control Module References</u>

STEERING COLUMN TILT AND TELESCOPE WHEEL ACTUATOR MOTOR HARNESS REPLACEMENT

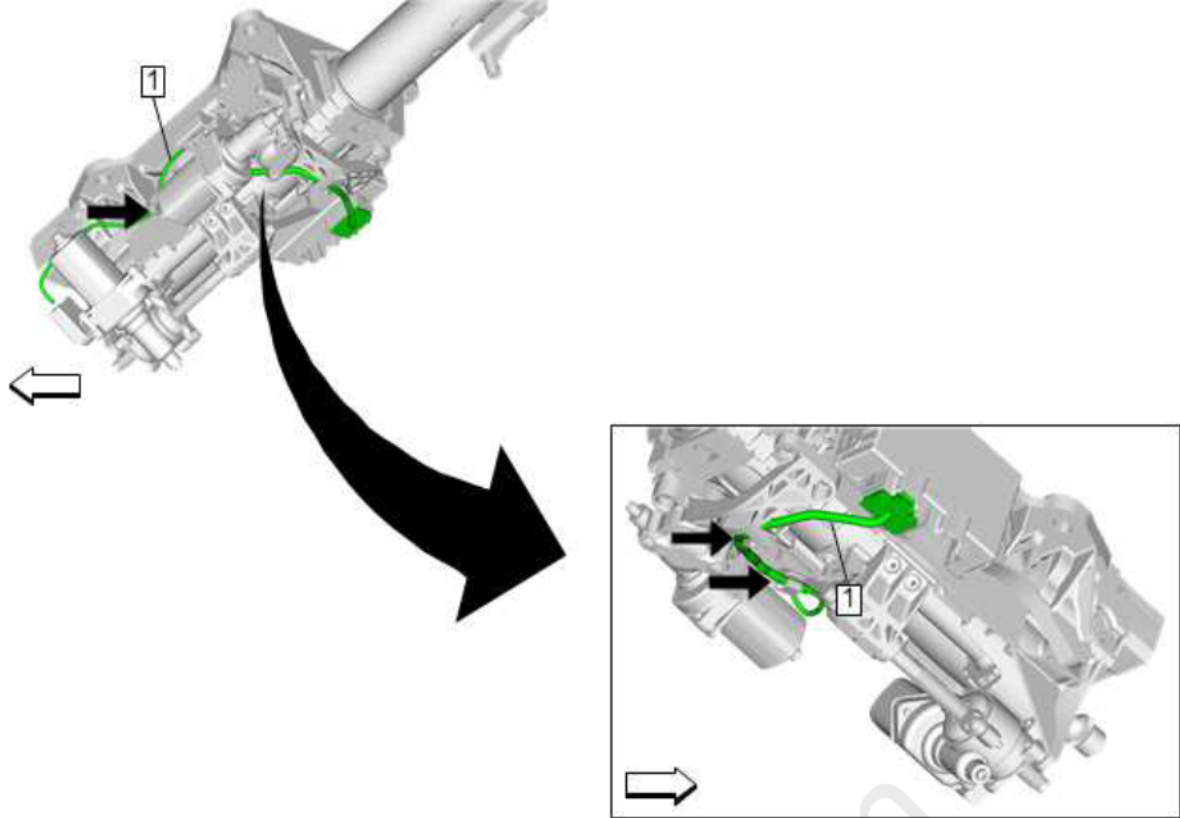


Fig. 140: Steering Column Tilt and Telescope Wheel Actuator Motor Harness
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Replacement</u>	
1	Steering Column Tilt and Telescope Wheel Actuator Motor Harness Procedure Disconnect the electrical connectors. NOTE: The steering column tilt and telescope wheel actuator harness MUST be routed in the same position and in the proper retainers on the steering column as noted before removal.

TURN SIGNAL SWITCH REPLACEMENT

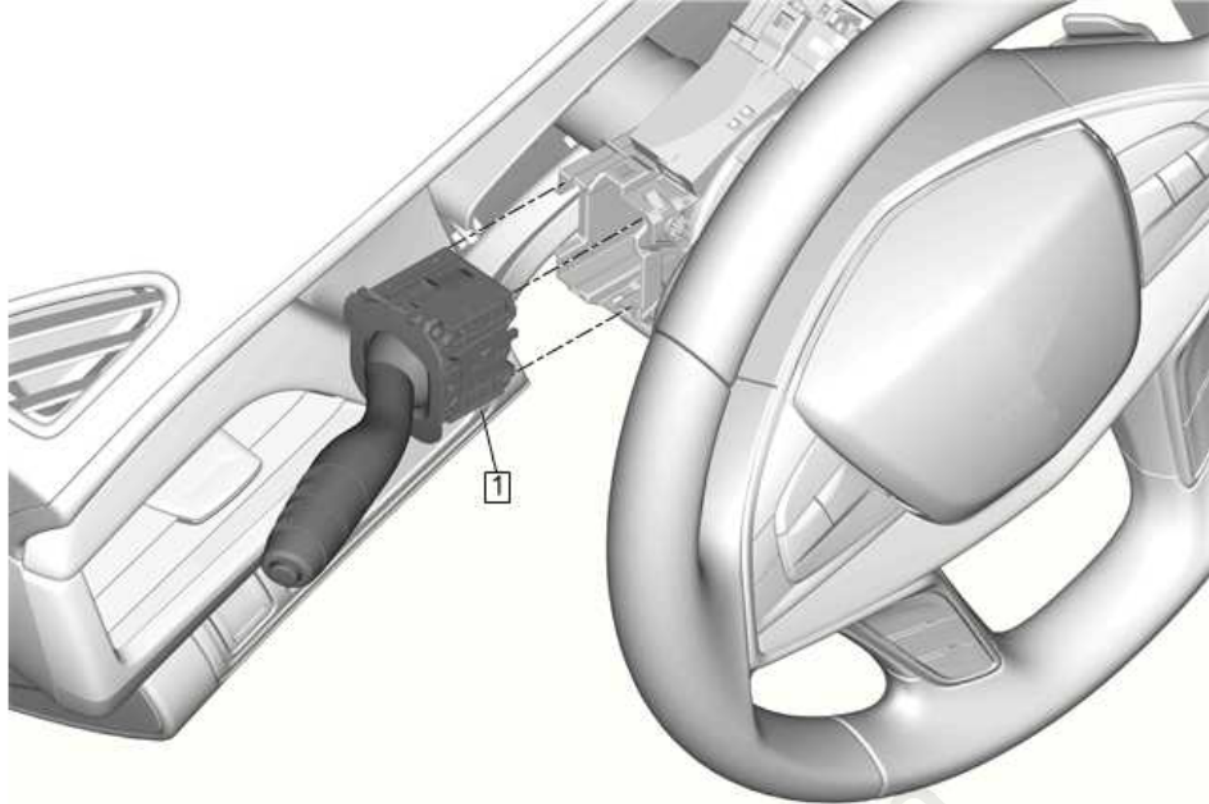


Fig. 141: Turn Signal Switch

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Steering Column Lower Trim Cover Replacement</u>	
1	Turn Signal Switch Procedure 1. Disconnect the electrical connector. 2. Release the retaining tabs and remove the turn signal switch from the turn signal switch bracket.

TURN SIGNAL SWITCH BRACKET REPLACEMENT

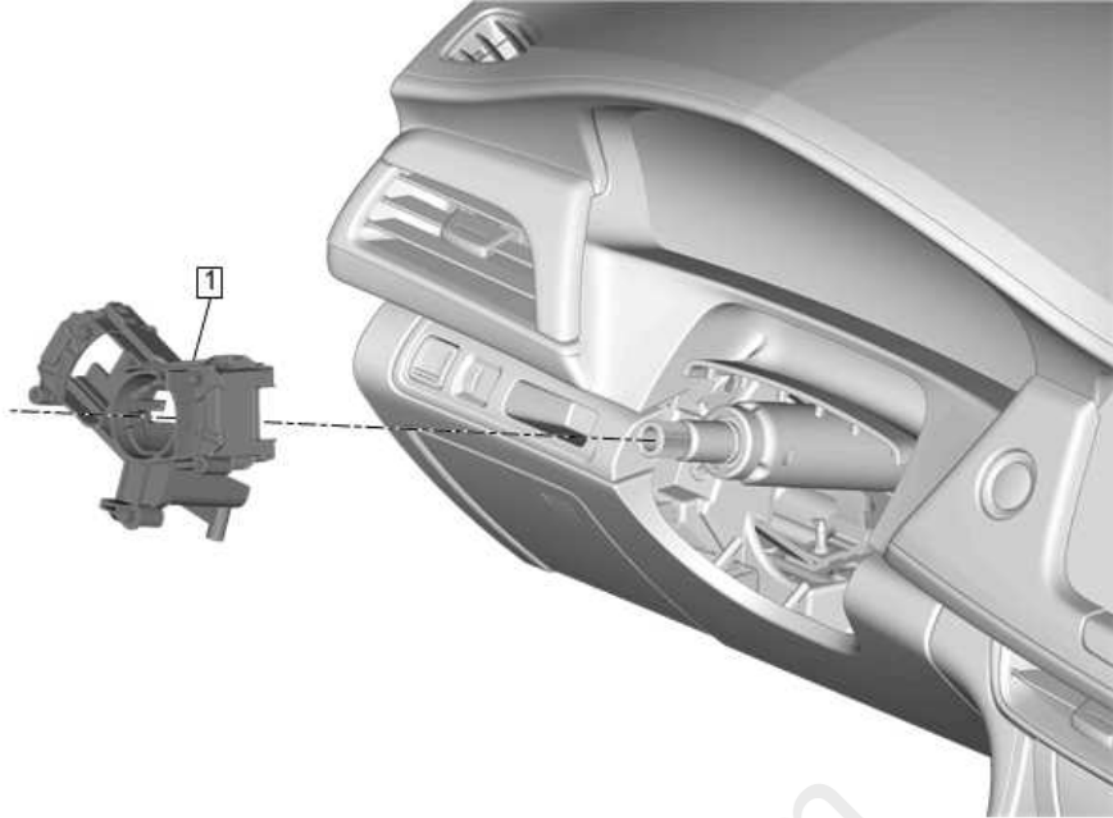


Fig. 142: Turn Signal Switch Bracket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Steering Wheel Airbag Coil Replacement Turn Signal Switch Replacement Windshield Wiper and Washer Switch Replacement	
1	Turn Signal Switch Bracket Procedure Release the retaining tabs and remove the turn signal switch bracket from the steering column.

STEERING WHEEL HORN SWITCH HARNESS REPLACEMENT

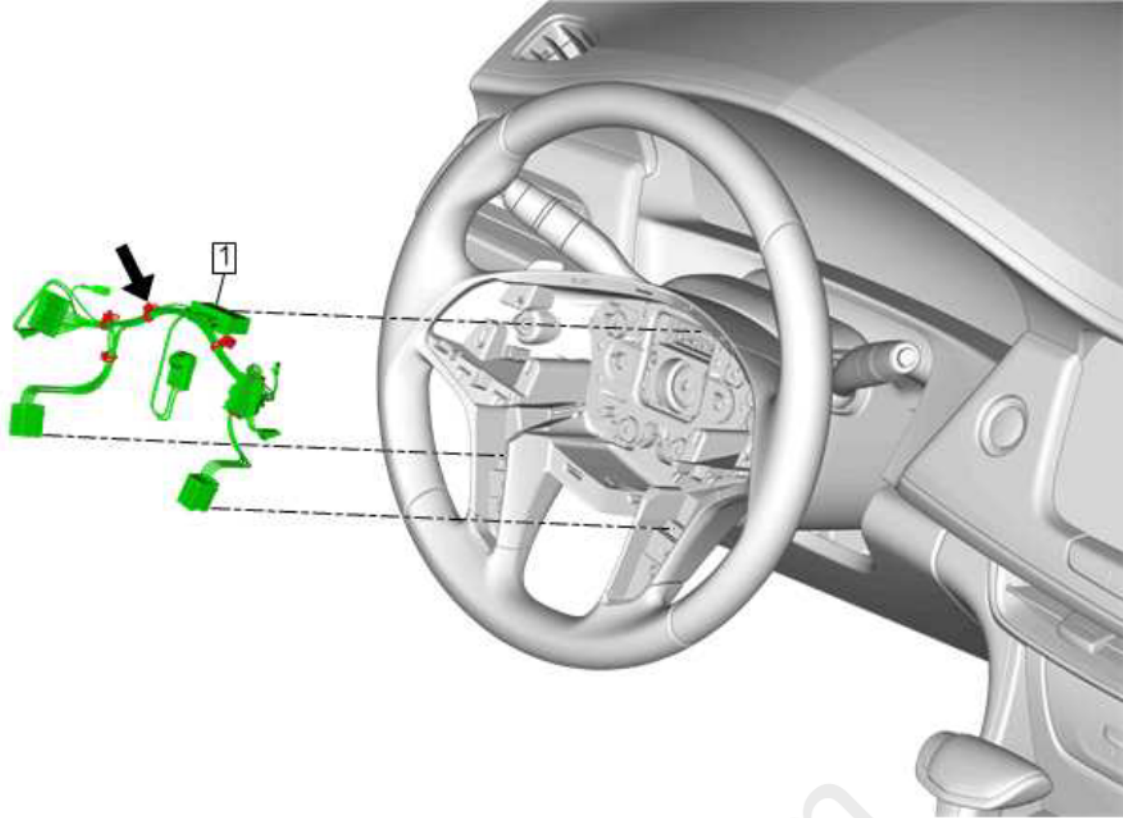


Fig. 143: Steering Wheel Horn Switch Harness
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Steering Wheel Spoke Cover Replacement</u>	
1	Steering Wheel Horn Switch Harness Procedure 1. Disconnect the electrical connectors. 2. Remove the steering wheel horn switch harness retainers from the steering wheel. 3. Remove the steering wheel horn switch harness from the steering wheel.

STEERING WHEEL REPLACEMENT

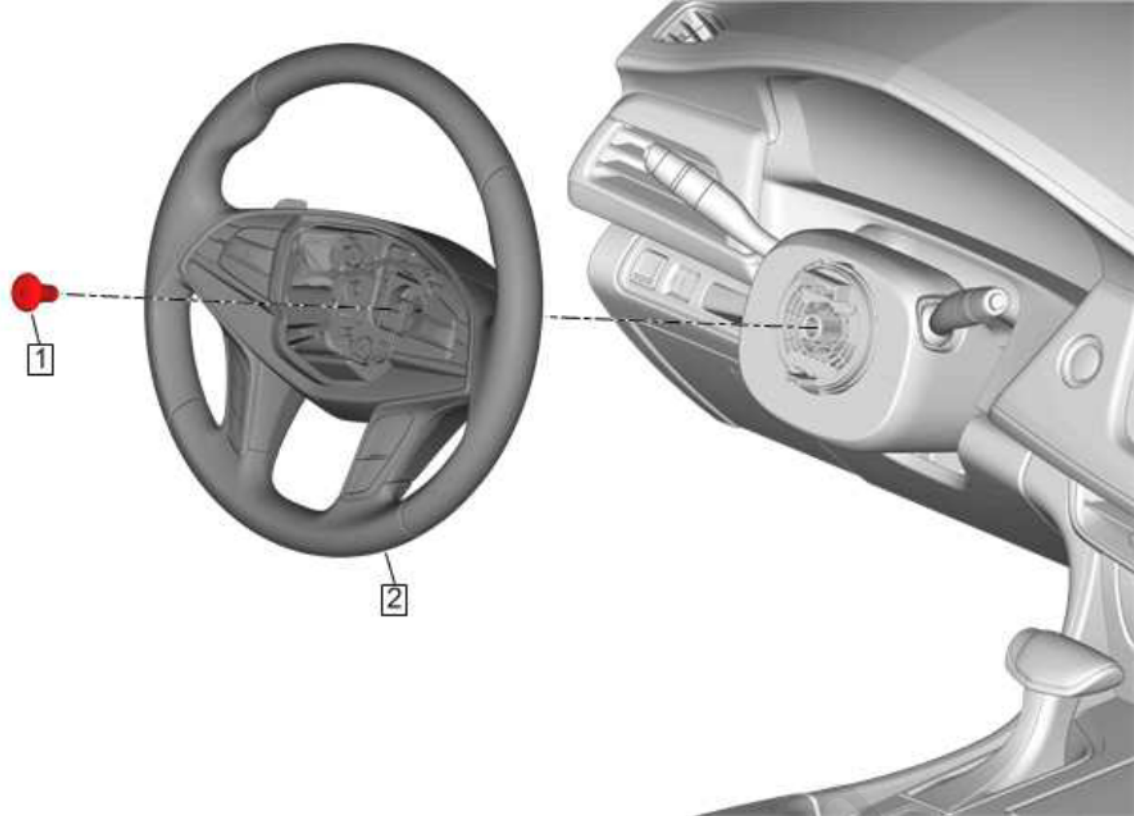


Fig. 144: Steering Wheel

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Wheel Airbag Replacement</u>	
1	Steering Wheel Bolt CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry. 2. Apply thread locking adhesive to the bolt. Refer to <u>Adhesives, Fluids, Lubricants and Sealers</u> Tighten 45 N.m (33 lb ft)
2	Steering Wheel Procedure 1. Disconnect the electrical connectors. 2. Install the steering wheel bolt until 2 to 3 threads are engaged. 3. Wiggle the steering wheel until the wheel disengages completely. 4. Steering Wheel Bolt, » Remove 5. Steering Wheel, » Remove 6. Transfer components as necessary.

STEERING WHEEL SPOKE COVER REPLACEMENT

Removal Procedure

1. Steering Wheel Airbag, A» Remove - [Steering Wheel Airbag Replacement](#)
2. Steering Wheel Spoke Cover Fastener (1)» Remove [2x]

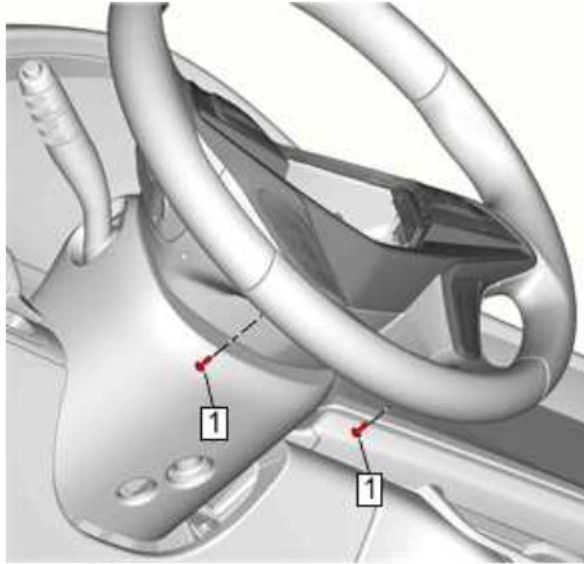


Fig. 145: Steering Wheel Spoke Cover Fastener
Courtesy of GENERAL MOTORS COMPANY

3. Perform the following steps to remove the steering wheel spoke cover (1):

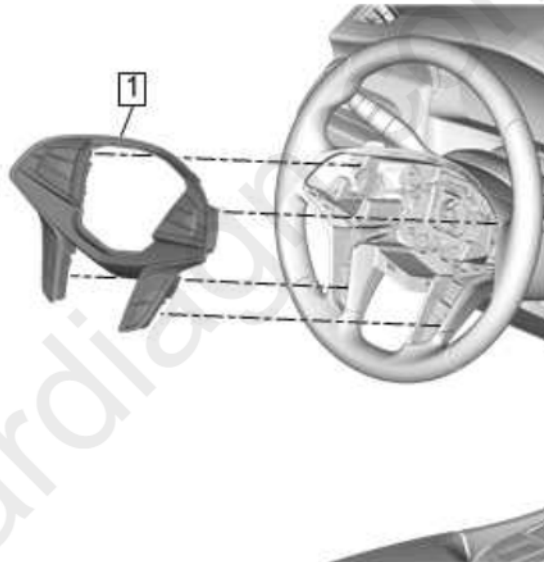


Fig. 146: Steering Wheel Spoke Cover
Courtesy of GENERAL MOTORS COMPANY

1. Use a flat bladed plastic tool to release the steering wheel spoke cover and cruise control and radio control switches from the steering wheel.
2. Disconnect the electrical connectors.
4. Transfer components as necessary.

Installation Procedure

1. Perform the following steps to install the steering wheel spoke cover (1):

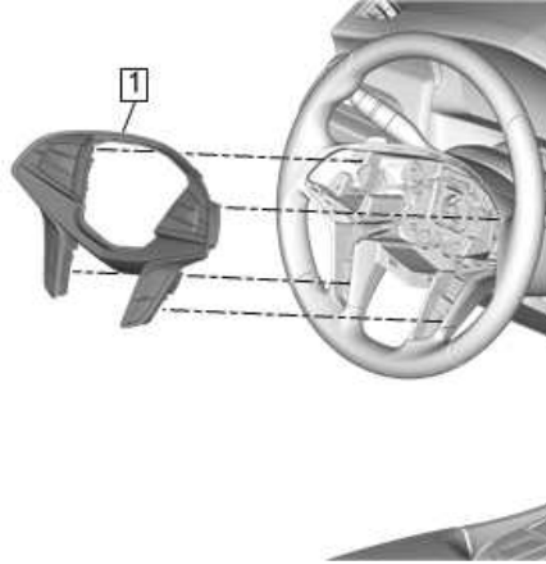


Fig. 147: Steering Wheel Spoke Cover

Courtesy of GENERAL MOTORS COMPANY

1. Connect the electrical connectors.
2. Secure the steering wheel spoke cover and cruise control and radio control switches to the steering wheel.
2. Steering Wheel Spoke Cover Fastener (1) » Install and tighten [2x] 1 N.m (9 lb in)

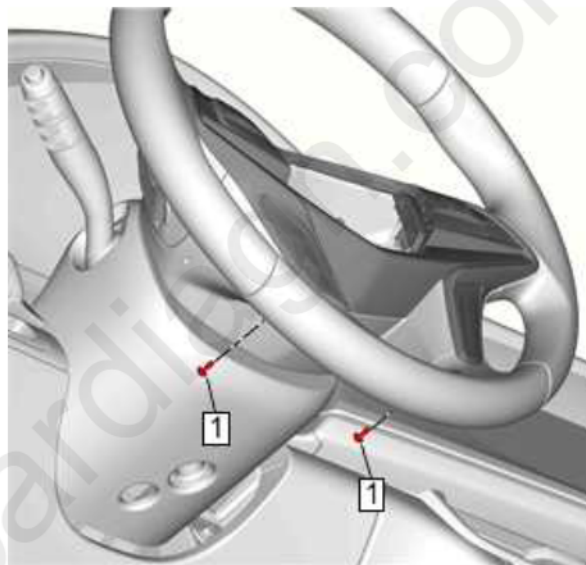


Fig. 148: Steering Wheel Spoke Cover Fastener

Courtesy of GENERAL MOTORS COMPANY

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

3. Steering Wheel Airbag » Install - [Steering Wheel Airbag Replacement](#)

STEERING COLUMN TILT WHEEL AND TELESCOPE SWITCH REPLACEMENT



Fig. 149: Steering Column Tilt Wheel and Telescope Switch

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the steering column lower trim cover fasteners and tilt the cover to access the steering column tilt wheel and telescope switch. Refer to Steering Column Lower Trim Cover Replacement	
1	Steering Column Tilt Wheel and Telescope Switch Procedure 1. Release the retaining tabs and remove the steering column tilt wheel and telescope switch from the steering column lower trim cover. 2. Disconnect the electrical connector.

STEERING COLUMN REPLACEMENT

Removal Procedure

1. If equipped, deactivate the steering column lock control module using the following procedure:
 1. With foot OFF the brake pedal and the shift lever in the PARK position, press the ignition and start switch once. This will place the ignition system in the ACCESSORY mode and unlock the steering column for 5 minutes.
 2. Turn the steering wheel to verify the steering column is NOT locked.
 3. Remove the fuse for the steering column lock control module. The fuse is found in the instrument panel fuse block and is labeled ESCL. Refer to [Electrical Center Identification Views](#) and/or [Electrical Center Identification Views](#)
 4. With foot OFF the brake pedal and the shift lever in the PARK position, press the ignition and start switch once. This will place the ignition system in the OFF mode and leave the steering column unlocked as long as the electrical connectors are disconnected.
2. Disable the SIR system. Refer to [SIR Disabling and Enabling](#)

WARNING: Refer to [SIR Warning](#) .

WARNING: Refer to [SIR Inflator Module Handling and Storage Warning](#) .

3. Steering Column Lower Trim Cover (1) » Remove - [Steering Column Lower Trim Cover Replacement](#)

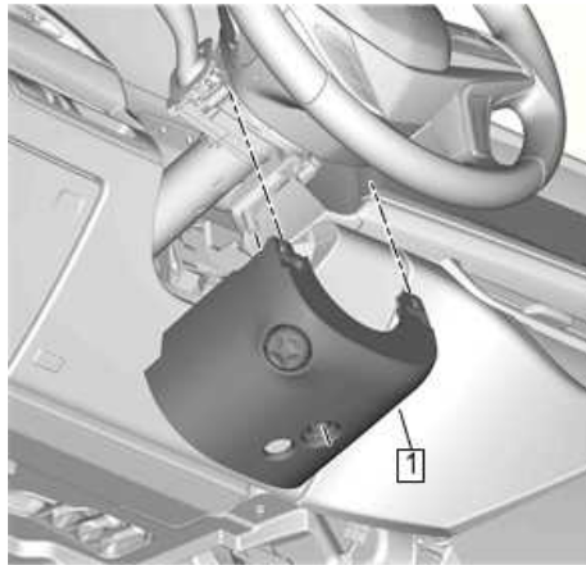


Fig. 150: Steering Column Lower Trim Cover
Courtesy of GENERAL MOTORS COMPANY

4. Instrument Panel Knee Bolster (1) » Remove - [Instrument Panel Knee Bolster Replacement](#)

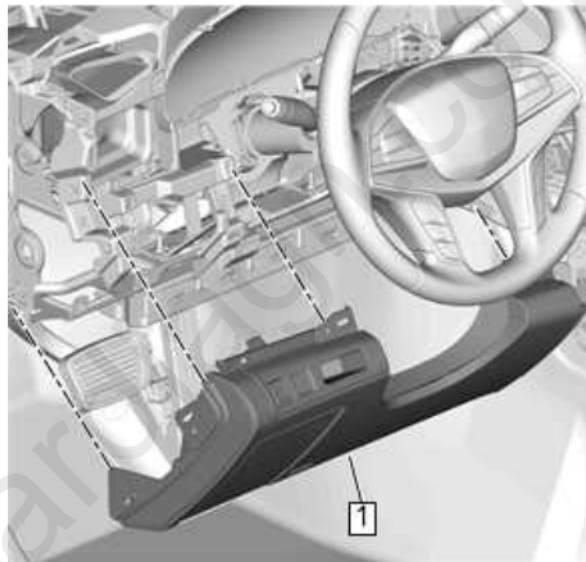
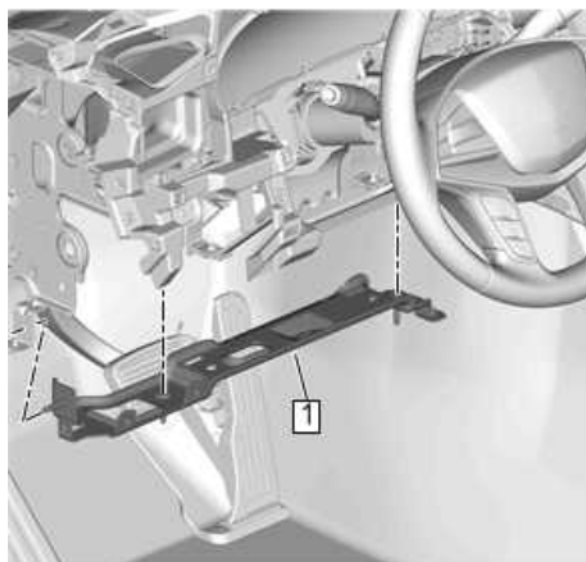


Fig. 151: Instrument Panel Knee Bolster
Courtesy of GENERAL MOTORS COMPANY

5. {If equipped} Instrument Panel Lower Airbag Bracket (1) » Remove - [Instrument Panel Lower Airbag Bracket Replacement](#)



6. Floor Front Air Outlet Duct - Left Side (1)» Remove - [Floor Front Air Outlet Duct Replacement - Left Side](#)

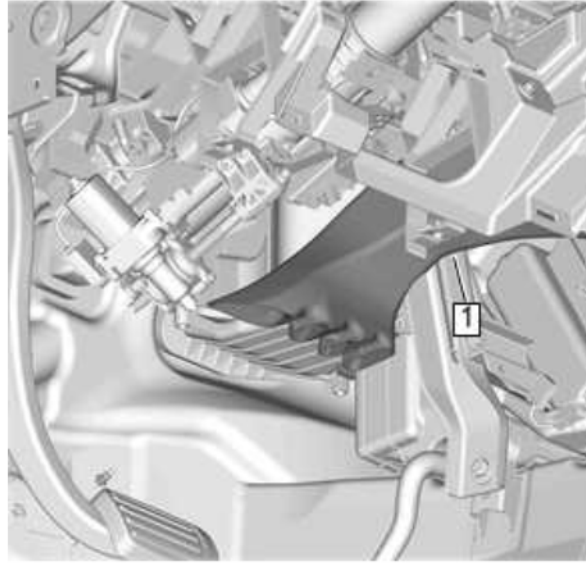


Fig. 153: Floor Front Air Outlet Duct - Left Side
Courtesy of GENERAL MOTORS COMPANY

7. Steering Wheel (2)» Remove - [Steering Wheel Replacement](#)



Fig. 154: Steering Wheel
Courtesy of GENERAL MOTORS COMPANY

CAUTION: With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured in position before disconnecting the following components:

- The steering column
- The intermediate shaft(s)

- The steering gear

After disconnecting these components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to the SIR coil. If you think the SIR coil has become un-centered, refer to your specific SIR coil's centering procedure to re-center SIR Coil.

8. Upper Intermediate Steering Shaft Upper Bolt (1) Remove

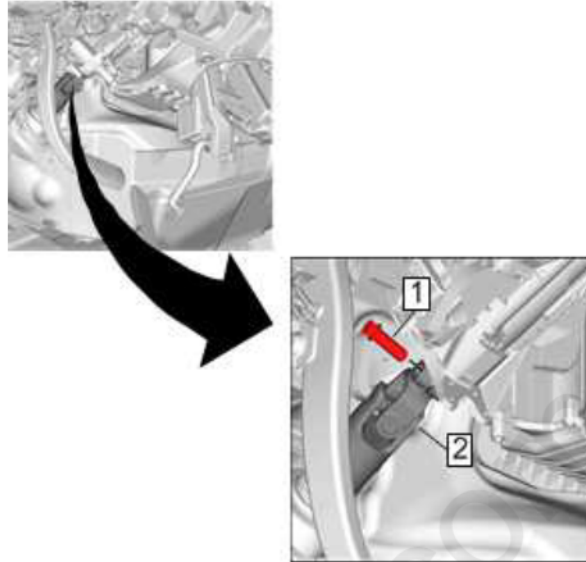


Fig. 155: Upper Intermediate Steering Shaft Upper Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Upper Intermediate Steering Shaft (2) @ Steering Column Separate
10. Disconnect the steering column electrical connectors as necessary.
11. Steering Column Nut (1) Remove [4x]

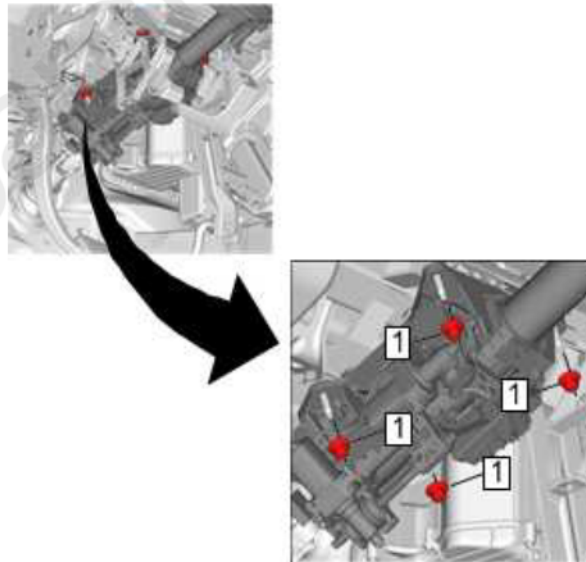


Fig. 156: Steering Column Nuts
Courtesy of GENERAL MOTORS COMPANY

12. Remove the steering column (1) from the vehicle.

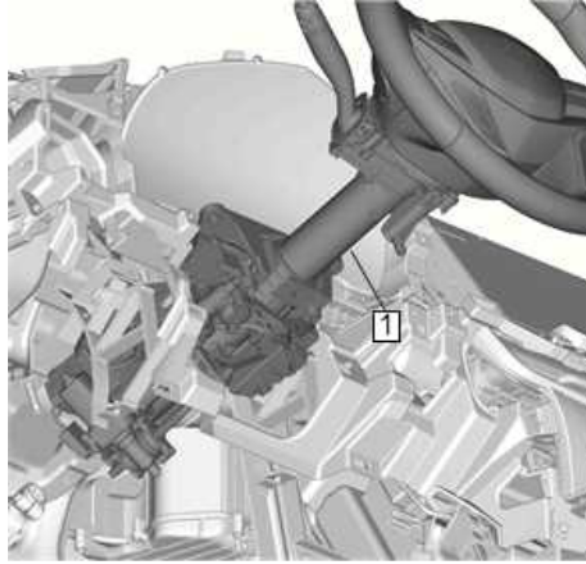


Fig. 157: Steering Column

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on the end could collapse the steering shaft or loosen the plastic injections, which maintain column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the columns collapsible design. Do NOT hammer on the end of the shaft, because hammering could loosen the plastic injections, which maintain column rigidity. If you need to remove the steering wheel, refer to the [Steering Wheel Replacement](#) procedure.

13. If replacing the steering column, transfer components as necessary.
14. If replacing the steering column, copy the match marks from the OLD steering column to the NEW steering column.

Installation Procedure

1. Position the steering column (1) in the vehicle.

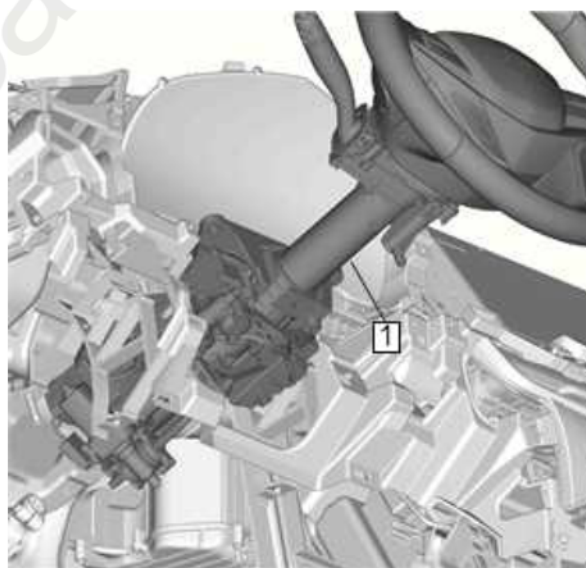


Fig. 158: Steering Column

Courtesy of GENERAL MOTORS COMPANY

2. Steering Column Nut (1) » Install and tighten [4x] 22 N.m (16 lb ft)

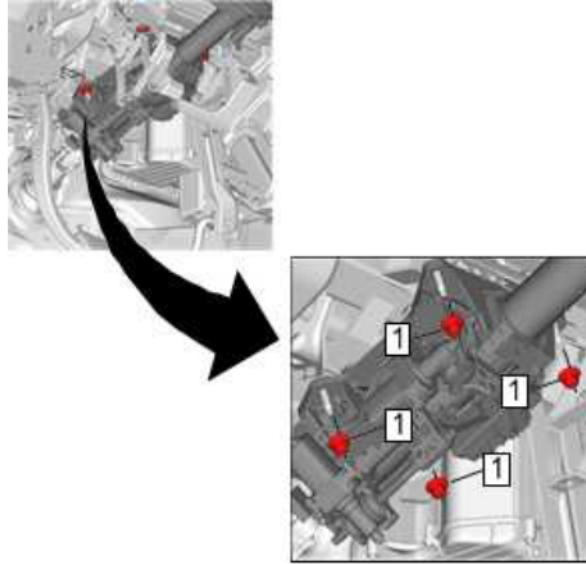


Fig. 159: Steering Column Nuts

Courtesy of GENERAL MOTORS COMPANY

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

3. Connect the steering column electrical connectors.
4. Upper Intermediate Steering Shaft (2) @ Steering Column» Install

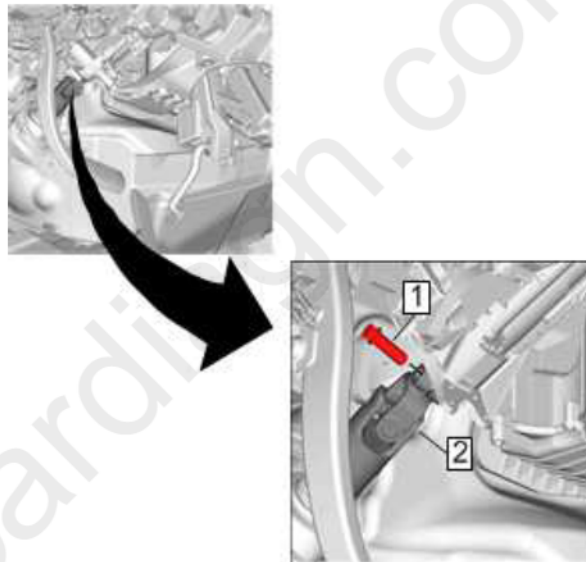


Fig. 160: Upper Intermediate Steering Shaft Upper Bolt

Courtesy of GENERAL MOTORS COMPANY

NOTE: Ensure the match marks on the upper intermediate steering shaft and steering column are aligned.

5. Upper Intermediate Steering Shaft Upper Bolt (1)» Install and tighten 50 N.m (37 lb ft)
 1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 2. Apply thread locking adhesive to the bolt. Refer to [Adhesives, Fluids, Lubricants and Sealers](#)
6. Steering Wheel (2)» Install - [Steering Wheel Replacement](#)

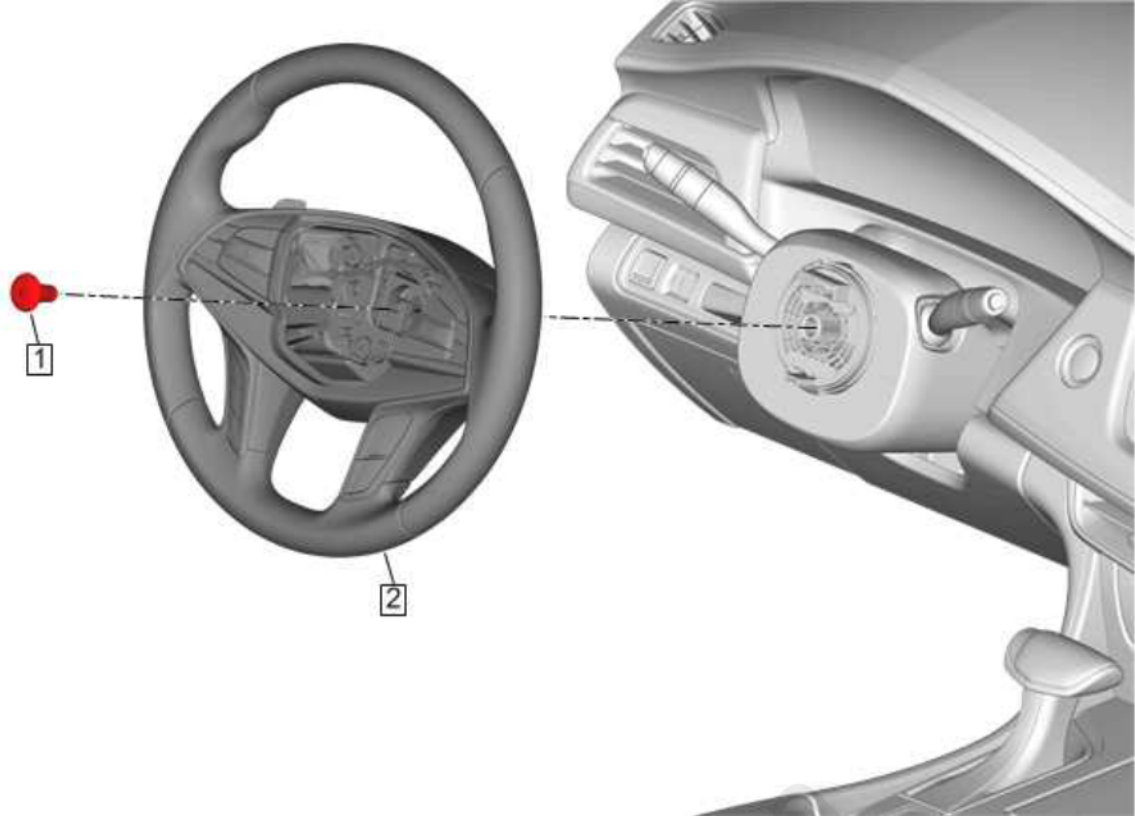


Fig. 161: Steering Wheel

Courtesy of GENERAL MOTORS COMPANY

7. Release the steering wheel from the method that was used to minimize movement.
8. Floor Front Air Outlet Duct - Left Side (1)» Install - **Floor Front Air Outlet Duct Replacement - Left Side**

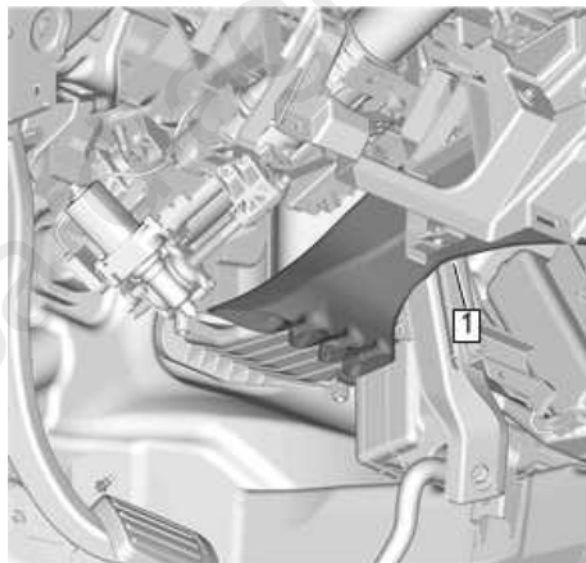


Fig. 162: Floor Front Air Outlet Duct - Left Side

Courtesy of GENERAL MOTORS COMPANY

9. {If equipped} Instrument Panel Lower Airbag Bracket (1)» Install - **Instrument Panel Lower Airbag Bracket Replacement**

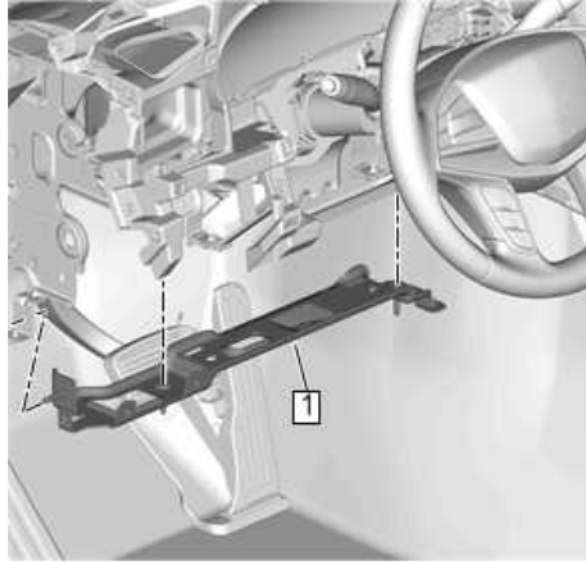


Fig. 163: Instrument Panel Lower Airbag Bracket
Courtesy of GENERAL MOTORS COMPANY

10. Instrument Panel Knee Bolster (1)» Install - **Instrument Panel Knee Bolster Replacement**

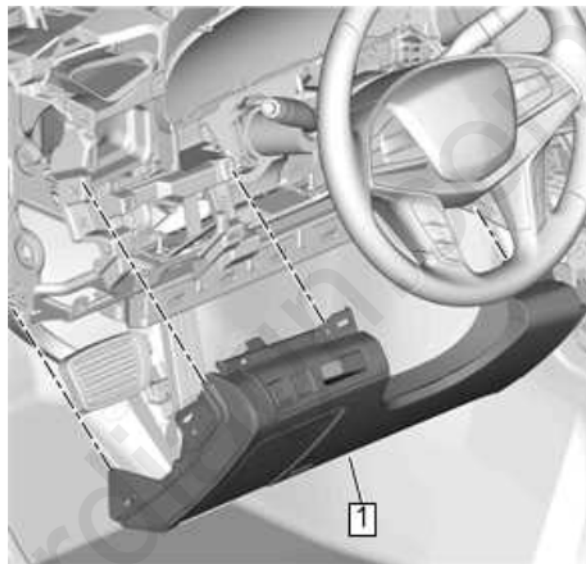


Fig. 164: Instrument Panel Knee Bolster
Courtesy of GENERAL MOTORS COMPANY

11. If equipped, install the fuse for the steering column lock control module. The fuse is found in the instrument panel fuse block and is labeled ESCL. Refer to **Electrical Center Identification Views** and/or **Electrical Center Identification Views**
12. If battery was disconnected for steering column install, reconnect battery and wait for all modules to fall asleep. This can be done by closing all vehicle closures (doors, trunk, hood) and waiting for three minutes without actuating any vehicle functions or pushing any buttons.
13. Perform functionality check of tilt and telescoping features.
14. Enable the SIR System. Refer to **SIR Disabling and Enabling**
15. Steering Column Lower Trim Cover (1)» Install - **Steering Column Lower Trim Cover Replacement**

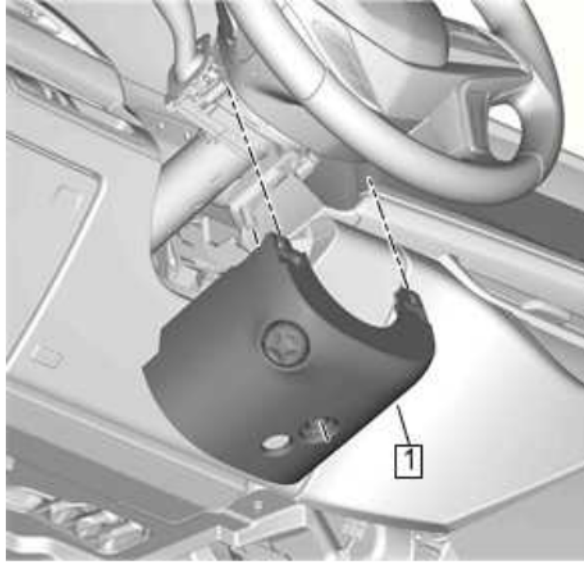


Fig. 165: Steering Column Lower Trim Cover
 Courtesy of GENERAL MOTORS COMPANY

16. {If equipped} Program the steering column lock control module. Refer to [Control Module References](#)
17. Center the steering angle sensor. Refer to [Steering Wheel Angle Sensor Centering](#)

STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE LEARN

The Steering Column Tilt Wheel and Telescope Control Module Learn procedure must be completed when there is a column malfunction, a DTC was set or when any of the following components are replaced:

When a malfunction occurred or replacing the control module

1. Disconnect the battery. Wait 2 minutes. Reconnect the battery and wait 2 minutes. Ensure that all vehicle systems have powered down after battery reconnect.
2. Ensure battery voltage is greater than 12 V. Start engine if possible.
3. Hold the tilt-down button until the column stops moving and then release.
4. Press and hold the tilt-down button for 5 to 8 seconds and then release.

NOTE: The following 5 steps must be completed within 3 seconds of the previous step.

5. Firmly press and release the telescope-in button.
6. Firmly press and release the tilt-up button.
7. Firmly press and release the telescope-out button.
8. Firmly press and release the tilt-down button.
9. The column should begin to move on its own to learn its soft-stop positions. **Do not** press any buttons or operate any vehicle functions while the column is moving as the relearn sequence will be cancelled.
10. If the column does not begin to move on its own, attempt steps 3 through 8. Three attempts may be required. Ensure that button timing and sequence is correct. If column still does not begin to move, attempt steps 1 through 8 again.
11. If the column tilt and telescope does not function, replace the appropriate component as follows:
 - If the Steering Column Tilt Wheel and Telescope Control Module has not been replaced previously, replace the module. Refer to [Control Module References](#)
 - If the control module has already been replaced, replace the steering column. Refer to [Steering Column Replacement](#)

DESCRIPTION AND OPERATION

Steering Column Lock

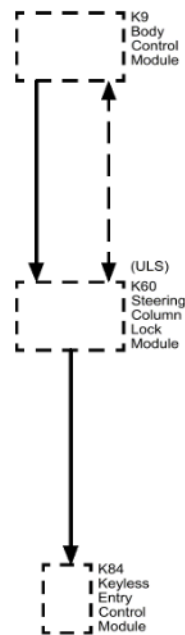


Fig. 166: Steering Column Lock Module Block Diagram

Courtesy of GENERAL MOTORS COMPANY

The Steering Column Lock Module (SCLM) controls the steering wheel theft deterrent lock function, which allows the column to be electronically locked. When a valid key is used to start the vehicle, the BCM recognizes this and will send the encrypted password to the SCLM. The SCLM will compare its own stored password to the encrypted password sent by the BCM. If the data matches, the steering column will be unlocked.

In order for the steering column to be locked the SCLM has to see 3 inputs.

1. The BCM power mode is OFF.
2. The vehicle is stationary based on zero speed reported from all ABS wheel speed sensors.
3. The driver or passenger door is opened reported by the PEPS module.

When the SCLM receives these inputs, the steering column will be locked.

The SCLM monitors the column lock system and will set DTC codes when the module detects malfunctions within the system. When a malfunction occurs the driver information center (DIC) will display the Service Column Lock Now message indicating DTC codes are set within the SCLM.

Driver Safety

The steering wheel and column has safety features to protect the driver. The following components may be mounted on or near the steering column:

Energy-Absorbing Steering Column: The energy-absorbing steering column compresses in the event of a front-end collision, which reduces the chance of injury to the driver. The energy-absorbing feature, collapsible steering shaft and break away mounting features help reduce the injury in the event of an accident.

Heated Steering Wheel

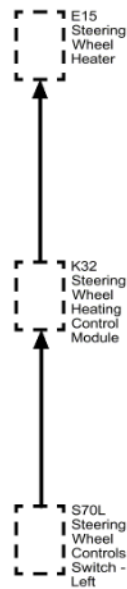


Fig. 167: Heated Steering Wheel Block Diagram
 Courtesy of GENERAL MOTORS COMPANY

NOTE: During a remove vehicle start, the heated steering wheel does not turn on.

The heated steering wheel system consists of a heated steering wheel, a heated steering wheel switch and a steering wheel heat module. The heated steering wheel includes non-serviceable heating elements and a temperature sensor. The heating elements and sensor are located in the left and right sides of the rim of the steering wheel. The heated steering wheel switch is located in the left steering wheel control switch assembly. The steering wheel heat control module is located at the bottom of the steering wheel center hub. When the switch is pressed, the switch signal circuit is grounded and the heat module turns the heated steering wheel on. The system then remains on until the customer turns it off. The wheels normal operating temperature is 32°C (89.6°F). The wheel takes approximately 3 to 4 minutes to reach the normal operating temperature. The wheel will take longer to heat up if the vehicle temperature is below -21°C (-5.8°F). The built-in temperature sensor provides input to the controller to limit the temperature to the normal operating temperature. The wheel will not operate if the vehicle temperature is at or above 32°C (89.6°F).