

STEERING

Steering Wheel and Column - CTS Sedan

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Intermediate Steering Shaft Inner Boot Nut	9 N.m	80 lb in
Lower Intermediate Steering Shaft Bolt	50 N.m	37 lb ft
Mid Intermediate Steering Shaft Bolt	36 N.m	27 lb ft
Mid Lower Intermediate Steering Shaft Bolt	36 N.m	27 lb ft
Steering Column Bracket Bolt	3 N.m	27 lb in
Steering Column Lock Control Module Bolt	9.5 N.m	84 lb in
Steering Column Lower Trim Cover Bolt	1.5 N.m	13 lb in
Steering Column Nut	22 N.m	16 lb ft
Steering Column Telescope Actuator Bolt	5 N.m	44 lb in
Steering Column Telescope Actuator Pivot Bolt	18 N.m	13 lb ft
Steering Column Tilt Wheel Actuator Bolt	5 N.m	44 lb in
Steering Column Tilt Wheel and Telescope Control Module Bolt	3 N.m	27 lb in
Steering Wheel Bolt	45 N.m	33 lb ft
Upper Intermediate Steering Shaft Bolt (With ULS)	30 N.m	22 lb ft
Upper Intermediate Steering Shaft Bolt (Without ULS)	20 N.m	15 lb ft

SCHEMATIC WIRING DIAGRAMS

STEERING WHEEL WIRING SCHEMATICS

Heated Steering Wheel (UVD)

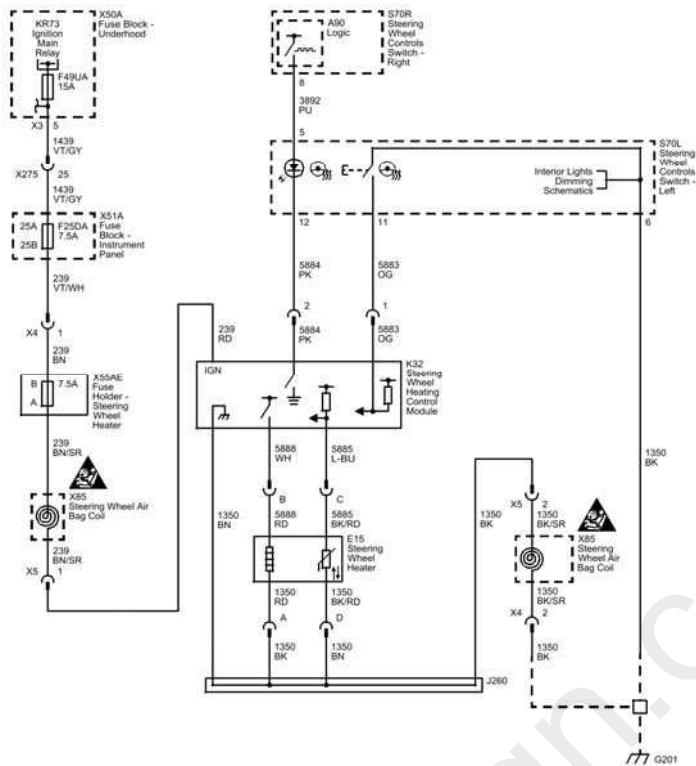


Fig. 1: Heated Steering Wheel (UVD)
Courtesy of GENERAL MOTORS COMPANY

COLUMN LOCK WIRING SCHEMATICS

Steering Column Lock (ULS)

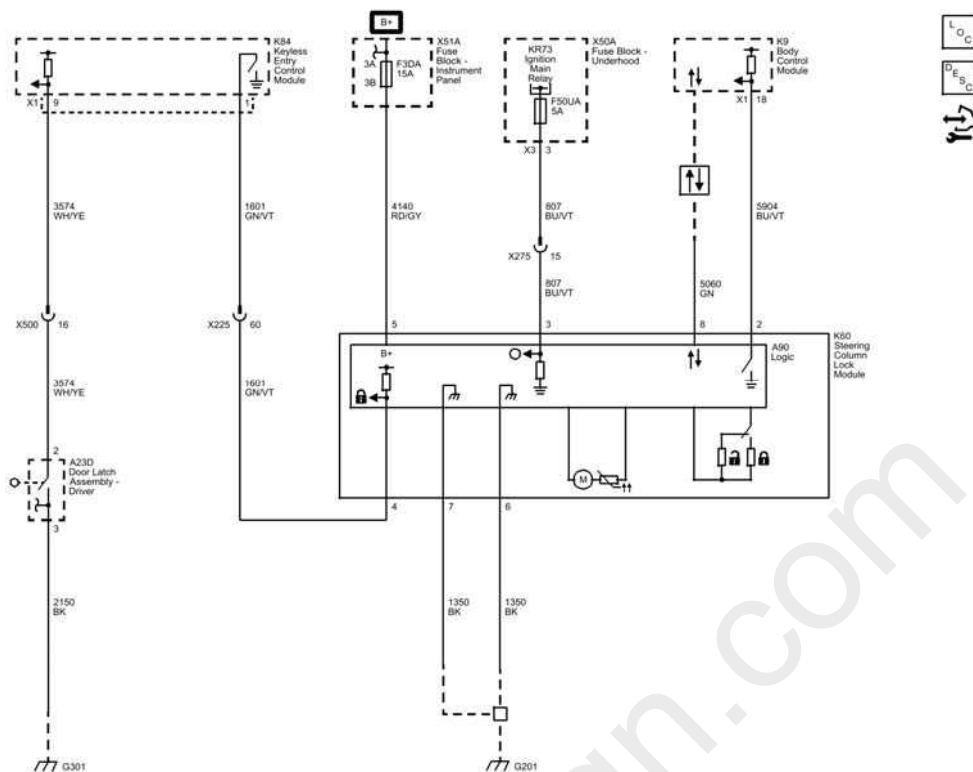


Fig. 2: Steering Column Lock (ULS)

Courtesy of GENERAL MOTORS COMPANY

TILT/TELESCOPING STEERING COLUMN WIRING SCHEMATICS

Power Tilt and Telescoping Steering Column (N38)

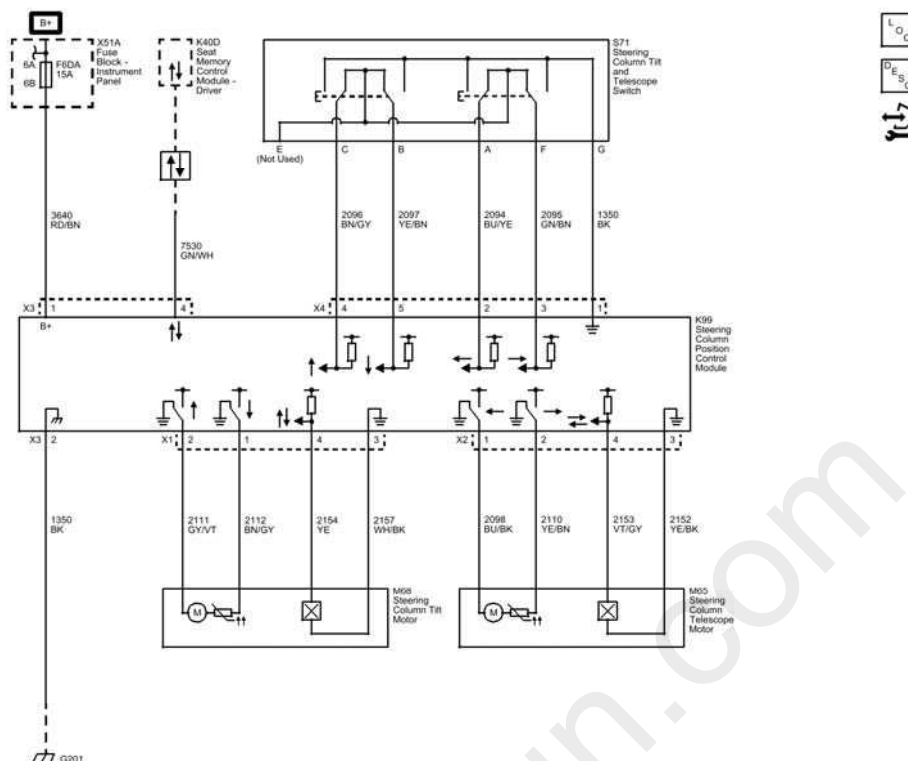


Fig. 3: Power Tilt and Telescoping Steering Column (N38)

Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B1023	DTC B1023 00 Integral Switch Malfunction
DTC B144C	DTC B144C 01 Inverted Run/Start Power Relay Circuit Short to Battery DTC B144C 06 Inverted Run/Start Power Relay Circuit Low Voltage/Open
DTC B2515	DTC B2515 5A Steering Column Lock Motor Feedback Circuit Not Plausible
DTC B285A (N38)	DTC B285A 39 Steering Column Position Module Internal Malfunction DTC B285A 4B Steering Column Position Module Calibration Not Learned
DTC B2897	DTC B2897 Steering Column Lock Motor Lock Circuit
DTC B2910	DTC B2910 00 Steering Column Lock Password Incorrect
DTC B305A	DTC B305A 00 No Response From Steering Column Lock Received

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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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 5 s.

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 3 s.

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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse. Refer to **Power Mode Mismatch**
 - **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 the steering column lock module replacement, programming and setup.

DTC B2515: STEERING COLUMN LOCK MOTOR FEEDBACK CIRCUIT NOT PLAUSIBLE

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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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, disconnect the harness connector at the K60 Steering Column Lock Module.
2. Test for less than 1 V between the control circuit terminal 2 and ground.
 - **If 1 V or greater**
 1. Disconnect the harness connector at the K9 Body Control Module. Ignition ON.
 2. Test for less than 1 V between the control circuit terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K9 Body Control Module.
 - **If less than 1 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 ohms in the signal circuit terminal 2 end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms
- 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 steering column lock control module and body control module replacement, programming and setup.

DTC B285A (N38): 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

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.

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.

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 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 its system.

Reference Information

Schematic Reference

Tilt/Telescoping Steering Column Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N38)

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC B285A 39 or B285A 4B 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 4B is set**
- 1. Perform the Steering Column Tilt Wheel and Telescope Control Module Learn. Refer to **Steering Column Tilt Wheel and Telescope Control Module Learn**
- 2. Verify that DTC B285A 39 does not reset.

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

- DTC B285A 4B is set, replace the **K99 Steering Column Position Control Module** .
- DTC B285A 4B is not set

3. All OK
 - **DTC B285A 39 or B285A 4B is not set.**

3. All OK.

Repair Instructions

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

Control Module References for steering column position 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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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 1 V between the control circuit terminal 4 and ground.
 - **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 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 ohms in the harness connector control circuit terminal 4 at the K60 Steering Column Lock Module end to end.
 - **If 2 ohms or greater**

Repair the open/high resistance in the circuit.
 - **If less than 2 ohms**
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 00

Steering Column Lock Password Incorrect

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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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 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	B305A 00	-

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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description

and Operation (N38)

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 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**

3. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the K60 Steering Column Lock Module.
2. Test for less than 1 V between the control circuit terminal 2 and ground.

- **If 1 V or greater**

1. Disconnect the harness connector at the K9 Body Control Module. Ignition ON.
2. Test for less than 1 V between the control circuit terminal 2 and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K9 Body Control Module.

- **If less than 1 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 ohms in the signal circuit terminal 2 end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms
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 steering column lock module and body control module replacement, programming and setup.

SYMPTOMS - STEERING WHEEL AND COLUMN

Review the system description and operation in order to familiarize yourself with the system functions. Refer to **Steering Wheel and Column Description and Operation (N37)**, **Steering Wheel and Column Description and Operation (N38)**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the steering wheel and column.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Symptoms List

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

- **Steering Column Tilt/Telescoping Malfunction (N38)**
- **Steering Column Tilt Function Inoperative (N37)**
- **High Telescoping Effort (N37)**
- **Noise While Driver Adjusting Column**
- **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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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 S70L Steering Wheel Controls Switch - Left is OFF. The steering wheel heater indicator should not be illuminated and the left and right sides of the steering wheel should not be warm.
 - **The steering wheel is always warm**

Refer to **Heated Steering Wheel Malfunction**
 - **The steering wheel does not become warm and the heater indicator is illuminated**

Refer to Circuit/System Testing
 - **The steering wheel does not become warm and the heater indicator is not illuminated**
3. Press and release the S70L Steering Wheel Controls Switch - Left. The steering wheel heater indicator should illuminate and the left and right sides of the steering wheel should become warm.
 - **The steering wheel does not become warm**

Refer to **Heated Steering Wheel Malfunction**
 - **The steering wheel becomes warm and the heater indicator does not illuminate**

Refer to Circuit/System Testing
 - **The steering wheel becomes warm and the heater indicator illuminates**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X5 in-line harness connector at the K32 Heated Steering Wheel Control Module.
2. Test for less than 10 ohms between the ground circuit terminal 2 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition voltage circuit terminal 1 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 ohms in the ignition circuit end to end.
 - If less than 2 ohms, verify the fuse is OK and there is voltage at the fuse. Refer to **Power**

Mode Mismatch .

- If 2 ohms or greater
- 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is blown, 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 X5 in-line harness connector. Disconnect the harness connector at the S70L Steering Wheel Control Switch - Left. Ignition ON.
- 6. Verify a test lamp illuminates between the signal voltage circuit terminal 5 and ground.
 - **If the test lamp does not illuminate**
- 1. Ignition OFF, disconnect the harness connector at the S70R Steering Wheel Control Switch - Right.
- 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 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the S70R Steering Wheel Control Switch - Right.
 - **If the test lamp illuminates**
- 7. Ignition OFF, connect the harness connector at the S70L Steering Wheel Control Switch - Left. Disconnect the in-line harness connector at the S70L Steering Wheel Control Switch - Left.
- 8. Install a 3 A fused jumper wire between the ground circuit terminal 12 and ground. Ignition ON.
- 9. Verify the steering wheel heat indicator is illuminated.
 - **If the steering wheel heat indicator does not illuminate**
- Replace the S70L Steering Wheel Control Switch - Left
- **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**
- **Control Module References** for steering wheel heating 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).

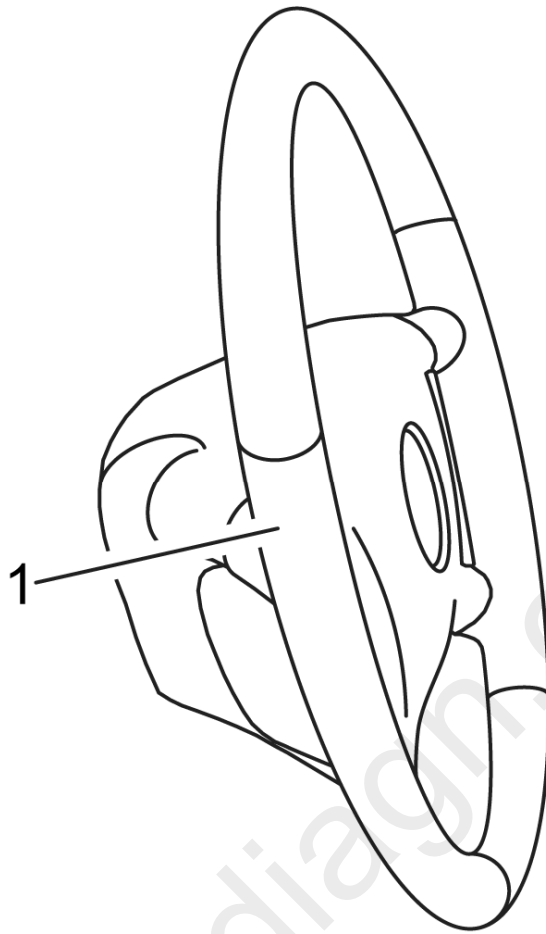


Fig. 4: Steering Wheel Rim Measurement Point
Courtesy of GENERAL MOTORS COMPANY

- The infrared measurements are made at the rim (1) at the 3 and 9 o'clock positions of the steering wheel.

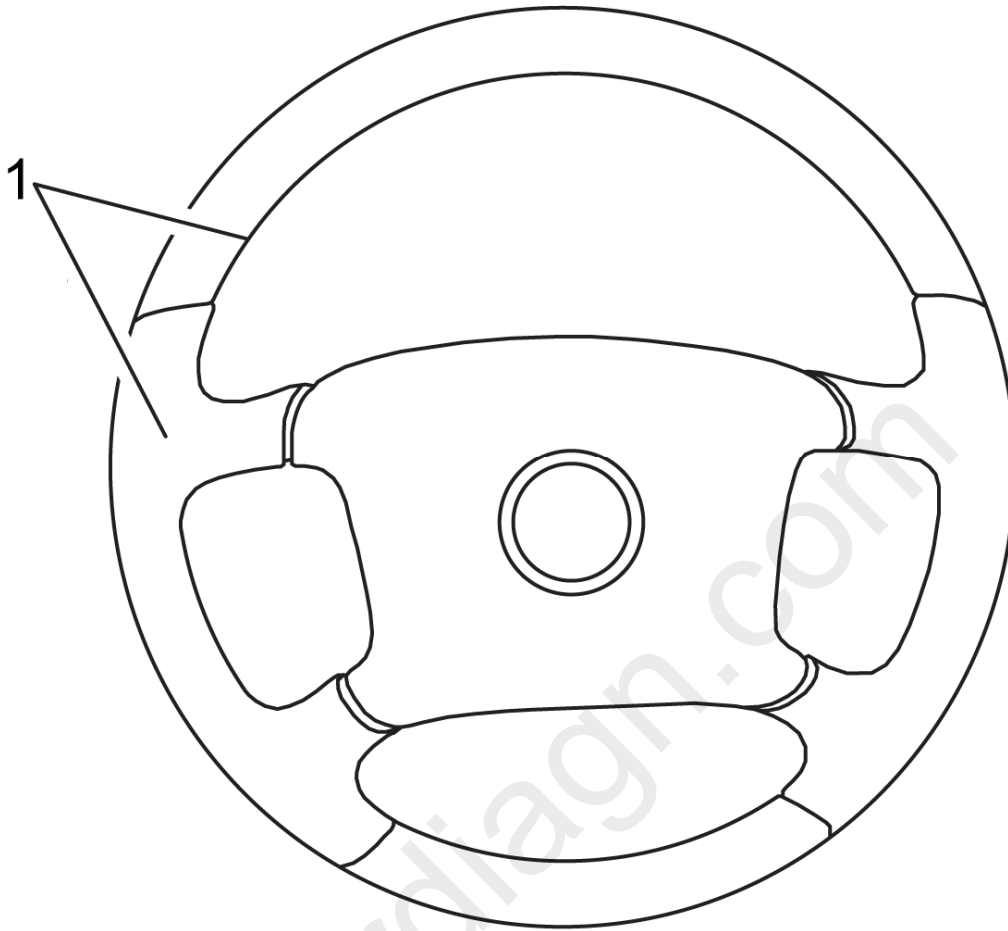


Fig. 5: Temperature Measurement Points
Courtesy of GENERAL MOTORS COMPANY

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

Reference Information

Schematic Reference

Steering Wheel Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N37), Steering Wheel and Column Description and Operation (N38)

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**

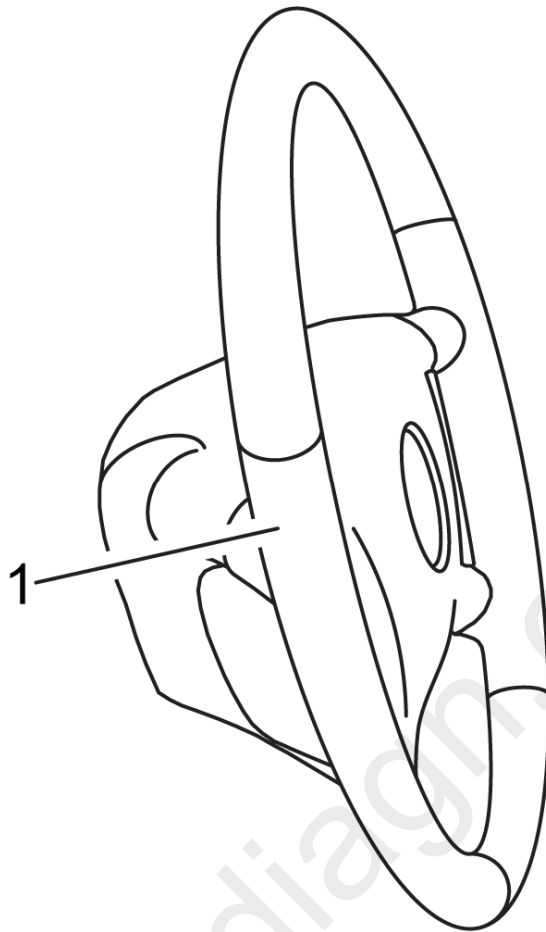


Fig. 6: Steering Wheel Rim Measurement Point
Courtesy of GENERAL MOTORS COMPANY

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

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



Fig. 7: Steering Wheel Rim Measurement Point
Courtesy of GENERAL MOTORS COMPANY

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

6. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).
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 X5 in-line harness connector at the K32 Heated Steering Wheel Control Module.
2. Test for less than 10 ohms between the ground circuit terminal 2 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition voltage circuit terminal 1 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 ohms in the ignition circuit end to end.
 - If less than 2 ohms, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch**.
 - If 2 ohms or greater
 - 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is blown, 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, reconnect the in-line harness connector X5. Disconnect the harness connector at the S70L Steering Wheel Controls Switch - Left.
6. Test for less than 10 ohms between the ground circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**

7. Ignition ON.

8. Test for B+ between the signal circuit terminal 11 and ground.

- **If less than B+**

1. Ignition OFF, disconnect the in-line harness connector at the S70L Steering Wheel Controls Switch - Left.

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 ohms in the control circuit end to end.

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

- If less than 2 ohms, replace the K32 Steering Wheel Heating Control Module.

- **If B+**

9. Place the S70L Steering Wheel Controls Switch - Left in the OFF position.

10. Test for infinite resistance between terminal 11 and terminal 6 at the S70L Steering Wheel Controls Switch - Left.

- **If less than infinite resistance**

Replace the S70L Steering Wheel Controls Switch - Left.

- **If infinite resistance**

11. Place the S70L Steering Wheel Controls Switch - Left in the ON position.

12. Test for less than 40 ohms between terminal 11 and terminal 6.

- **If 40 ohms or greater**

Replace the S70L Steering Wheel Controls Switch - Left

- **If less than 40 ohms**

13. Ignition OFF, disconnect the in-line harness connector at the E15 Steering Wheel Heater.

14. Test for less than 10 ohms between the ground circuit terminal A at the K32 Steering Wheel Heating Control Module and ground.

- **If 10 ohms or greater**

Repair the open/high resistance in the circuit.

- **If less than 10 ohms**

15. Test for 1.5-3.0 ohms between the signal terminal B and the ground terminal A at the E15 Steering Wheel Heater.

- **If not within the specified range**

Replace the E15 Steering Wheel Heater.

- **If within the specified range**

16. Test for 9-11k ohms between the control circuit terminal C and the ground terminal D on the E15 Steering Wheel Heater.

- **If not within the specified range**

Replace the E15 Steering Wheel Heater.

- **If within the specified range**

17. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- **Cruise Control Switch Replacement**
- **Steering Wheel Replacement**
- **Control Module References** for steering wheel heating 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
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 - SEDAN

Description and Operation

Steering Wheel and Column Description and Operation (N38)

Electrical Information Reference

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

- **Wiring Repairs**

Circuit/System Verification

1. Ignition ON.

NOTE: Operate the steering column switch in each direction for more than 1 s.

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

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

- 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

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 ohms between the low reference circuit terminal G and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K99 Steering Column Position Control Module.
 - **If less than 10 ohms**
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 X4 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 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K99 Steering Column Position Control Module.
 - **If B+**

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

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.
 - 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 ohms between terminal 1 and terminal 2.
 - 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**

6. Test or replace the S71 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 ohms between the low reference circuit terminal G and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K99 Steering Column Position Control Module.
 - **If less than 10 ohms**
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 X4 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 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K99 Steering Column Position Control Module.
 - **If B+**

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

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.
 - Terminal B
 - Terminal C
 - **If the M68 Steering Column Tilt Motor does not operate**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 0.6-1.0 ohms between terminal 1 and terminal 2.
 - 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**

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 ohms between the ground circuit terminal 2 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
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 ohms in the B+ circuit end to end.
 - If less than 2 ohms, verify the fuse is OK and there is voltage at the fuse.
 - If 2 ohms 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 ohms between the low reference circuit terminal G and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K99 Steering Column Position Control Module.
 - **If less than 10 ohms**

7. Replace the K99 Steering Column Position Control Module.

Component Testing

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 ohms between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.

- **If 2 ohms or greater**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If less than 2 ohms**

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 ohms between terminal 1 and terminal 2.

- **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 X1 harness connector at the K99 Steering Column Position Control Module.
2. Test for 0.6-1.0 ohms between terminal 1 and terminal 2.

- **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.

- **Steering Column Tilt Wheel and Telescope Switch Replacement**
- **Steering Column Tilt Wheel Actuator Replacement**
- **Steering Column Telescope Actuator Replacement**
- **Control Module References** for steering column position control module replacement, programming and setup.

STEERING COLUMN TILT FUNCTION INOPERATIVE (N37)

Steering Column Tilt Function Inoperative (N37)

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 <u>Symptoms - Steering Wheel and Column</u>
2	Verify that the steering column tilt function is inoperative. Does the steering column tilt function operate normally?	System OK	Go to Step 3
3	If equipped, verify that the following components are not seized or corroded: • Tilt pivot pins • Tilt head lock shoes Are the components seized or corroded?	Go to Step 7	Go to Step 4
4	Inspect the tilt pivot pins for binding. Are the tilt pivot pins binding?	Go to Step 8	Go to Step 5
5	Inspect for a weak or broken steering column tilt spring. Is the steering column tilt spring weak or broken?	Go to Step 9	Go to Step 6
6	Inspect the steering column wiring harness routing for tightness. Was the steering column wiring harness routed correctly?	Go to Step 11	Go to Step 10
7	Replace the steering column. Refer to <u>Steering Column Replacement</u> . Did you complete the repair?	Go to Step 11	-
8	If serviceable, replace the pivot pins. If not serviceable replace the steering column. Refer to <u>Steering Column Replacement</u> . Did you complete the repair?	Go to Step 11	-

9	If serviceable, replace the tilt spring. Did you complete the repair?	Go to Step 11	-
10	Route the steering column wiring harness to the correct location. Did you correctly route the wiring harness?	Go to Step 11	-
11	Operate the steering column tilt function in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

HIGH TELESCOPING EFFORT (N37)

High Telescoping Effort (N37)

Checks	Action
The steering shaft assembly is bent or damaged.	If necessary, replace the steering column. Refer to <u>Steering Column Replacement</u> .

NOISE WHILE DRIVER ADJUSTING COLUMN

Noise While Driver Adjusting Column

Checks	Action
Interference occurs in the column assembly pivot path.	Inspect the column jacket for wear patterns. Ensure that the mounting and the pivot bolts are properly installed and that the column is properly aligned in the vehicle.

NOISE IN STEERING COLUMN

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 <u>Symptoms - Steering Wheel and Column</u>
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?	Go to Step 9	Go to Step 4
4	Inspect the SIR/SRS coil for noise. Is the SIR/SRS coil noisy?	Go to Step 10	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 11	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 12	Go to Step 7
7	Does the tilt joint need to be lubricated?	Go to Step 13	Go to Step 8
8	NOTE: Inspect the intermediate shaft for noise while driving the vehicle, turning the steering wheel, and applying the brakes. Inspect the intermediate shaft for noise. Is the intermediate shaft noisy?	Go to Step 14	Go to Step 15
9	NOTE: If the steering column mounting feature is damaged or sheared, replace the steering column. Refer to <u>Steering Column Replacement</u>. Tighten the steering column mounting fastener to specifications. Refer to <u>Fastener Tightening Specifications</u> . Did you complete the repair?	Go to Step 15	-
10	Replace the SIR/SRS coil. Refer to <u>Steering Wheel Airbag Coil Replacement</u> . Did you complete the repair?	Go to Step 15	-
11	Install the lock plate retaining ring correctly. Did you complete the repair?	Go to Step 15	-
12	NOTE: If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to <u>Steering Column Replacement</u>. Replace the upper and/or lower bearings, if serviceable. Did you complete the replacement?	Go to Step 15	-
	Lubricate the tilt joint.		

13	Did you complete the repair?	Go to Step 15	-
14	Replace the appropriate steering intermediate shaft component. Did you complete the repair?	Go to Step 15	-
15	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

LOOSENESS IN STEERING COLUMN

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
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?	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 feature is damaged or sheared, replace the steering column. Refer to <u>Steering Column Replacement</u>. Tighten the steering column mounting fastener to specifications. Refer to Fastener Tightening 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 <u>Steering Column Replacement</u>. 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
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REPAIR INSTRUCTIONS

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT (AWD)

Removal Procedure

1. Open and secure the hood of the vehicle.
2. Turn the steering wheel so the mid and upper intermediate steering shaft bolts are accessible from the engine compartment and underneath the instrument panel.

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.

3. Secure the steering wheel so it will not turn when the upper intermediate steering shaft and steering column are disconnected.

NOTE: The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle.

4. Remove the steering column. Refer to [Steering Column Replacement](#).

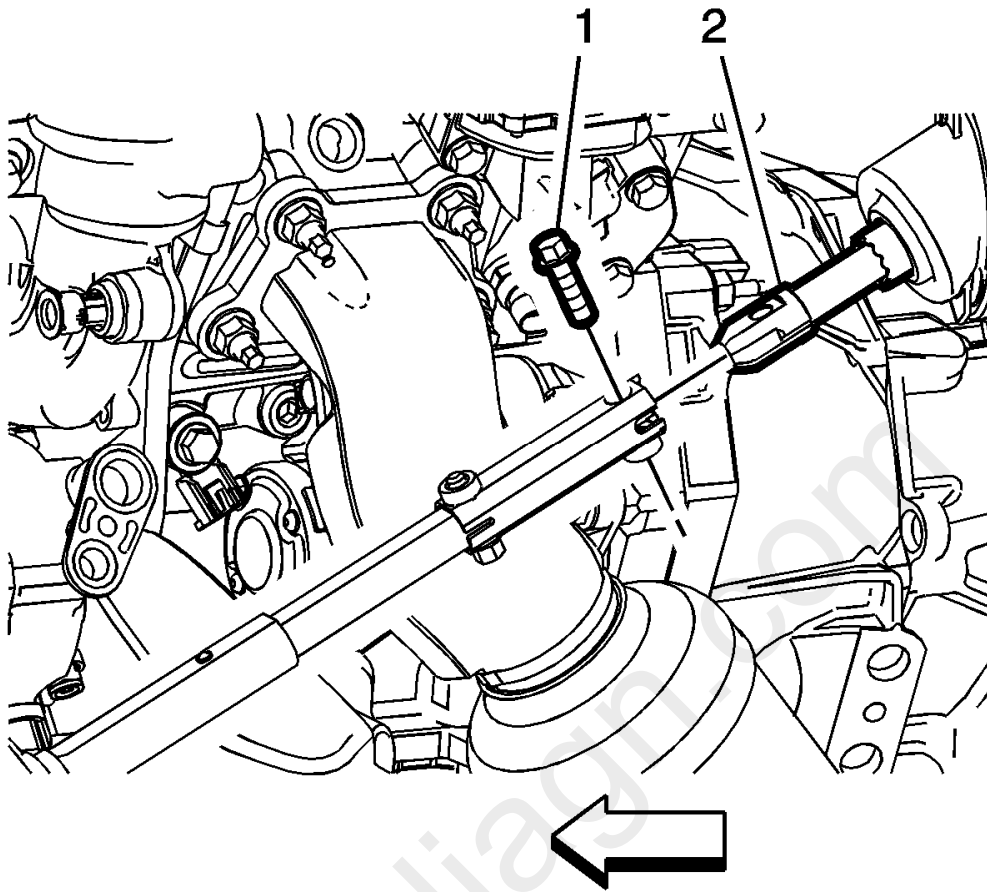


Fig. 8: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Remove the mid intermediate steering shaft bolt (1).
6. Disconnect the upper intermediate steering shaft (2) from the mid intermediate steering shaft and collapse it as far as possible.
7. Carefully slide the upper intermediate steering shaft (2) through the intermediate steering shaft boot and the intermediate steering shaft inner boot and remove it from the inside of the vehicle.

Installation Procedure

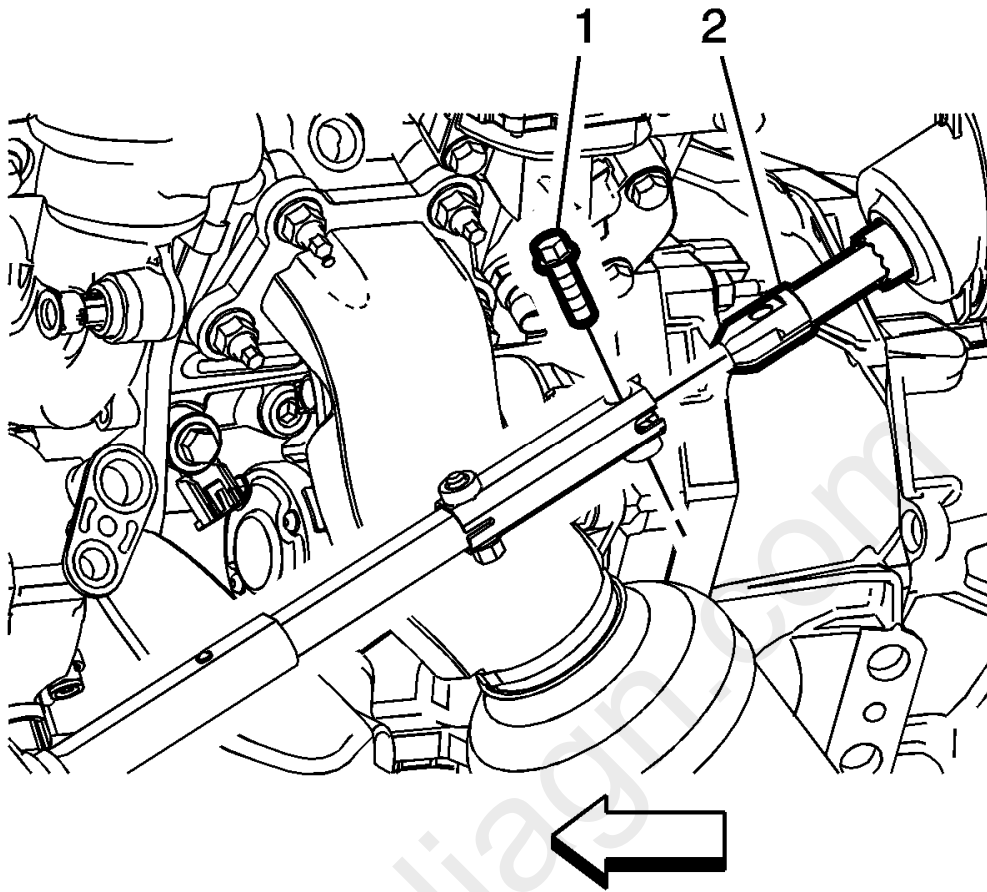


Fig. 9: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Carefully slide the upper intermediate steering shaft (2) through the intermediate steering shaft inner boot and the intermediate steering shaft boot from the inside of the vehicle.
2. Extend the upper intermediate steering shaft (2) as far as possible and connect it to mid intermediate steering shaft.
3. Clean the threads of the mid intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

4. Install the mid intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
5. Close the hood of the vehicle.

NOTE: The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle.

When installing the steering column, align the upper intermediate steering shaft with the steering column shaft while positioning the steering column in the vehicle.

6. Install the steering column. Refer to Steering Column Replacement.

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Open and secure the hood of the vehicle.
2. Turn the steering wheel so the mid intermediate steering shaft bolt is accessible from the engine compartment.

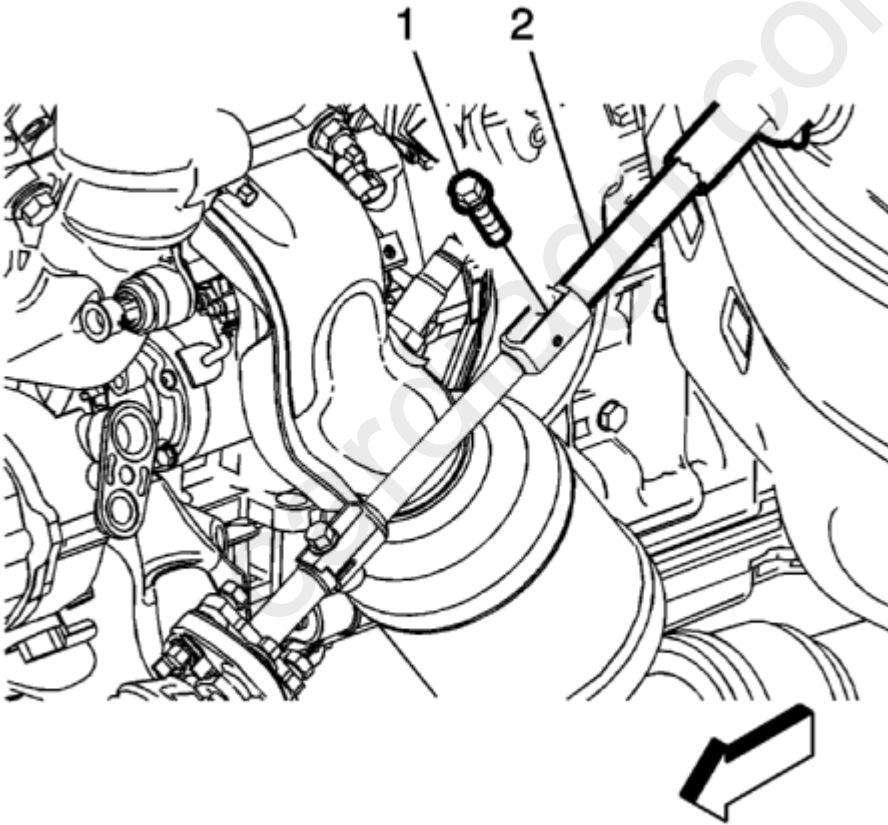


Fig. 10: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove the mid intermediate steering shaft bolt (1) but do not disconnect the steering shafts.

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.

4. Straighten the steering wheel and front tires and secure the steering wheel so it will not turn when the upper intermediate steering shaft and steering column are disconnected.

NOTE: The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle.

5. Remove the steering column. Refer to Steering Column Replacement.

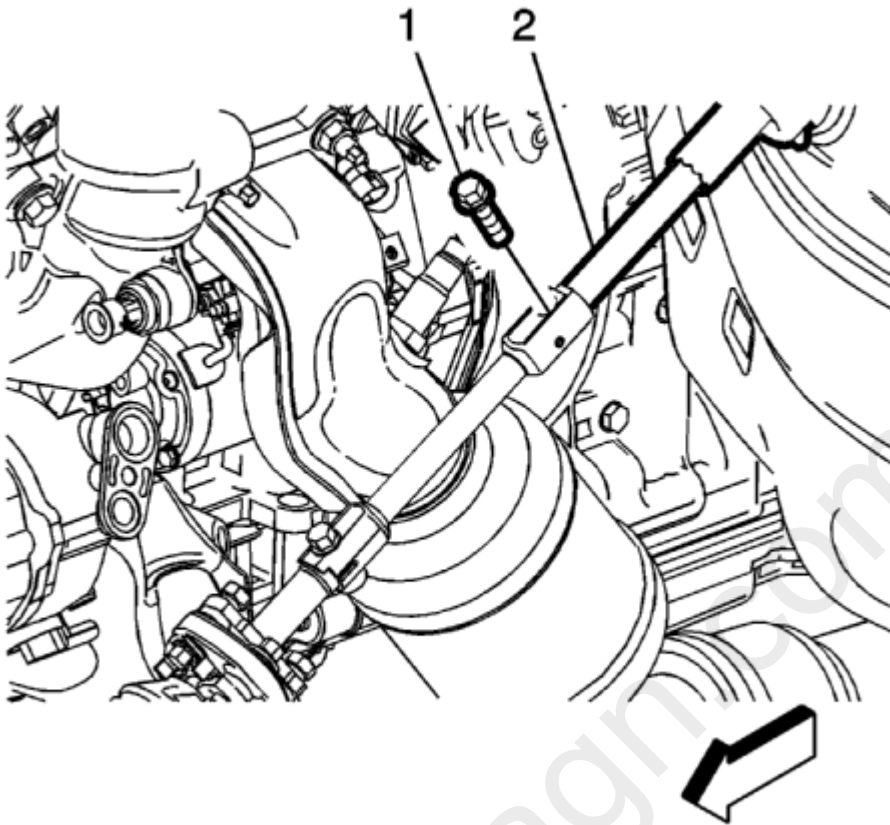


Fig. 11: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the upper intermediate steering shaft (2) from the mid intermediate steering shaft and collapse it as far as possible.
7. Carefully slide the upper intermediate steering shaft (2) through the intermediate steering shaft boot and the intermediate steering shaft inner boot and remove it from the inside of the vehicle.

Installation Procedure

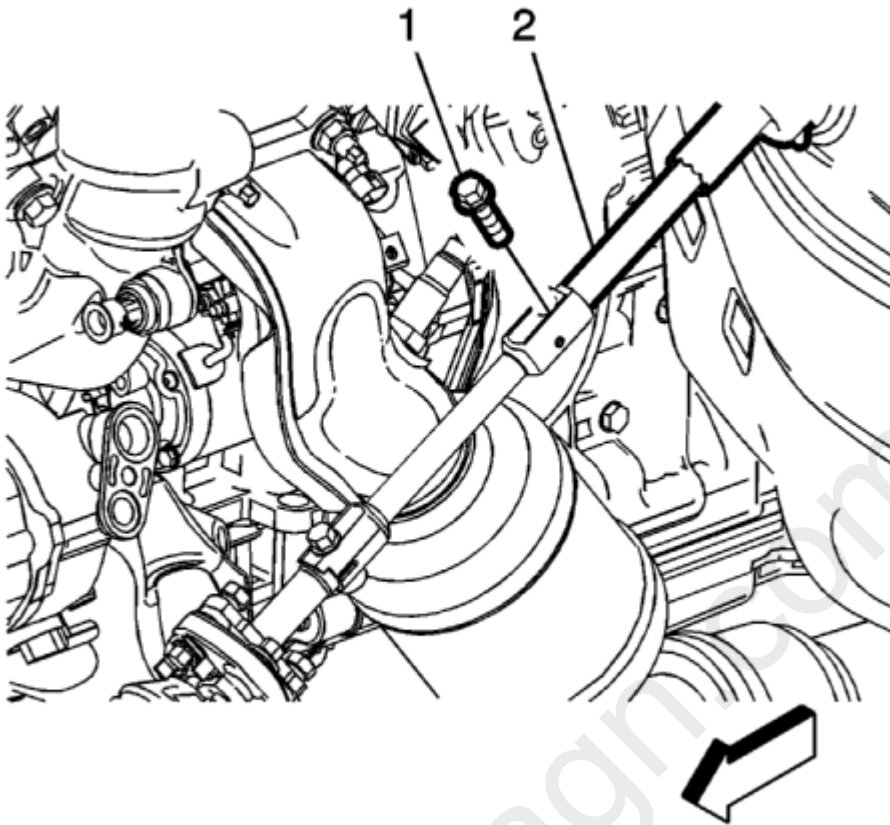


Fig. 12: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Carefully slide the upper intermediate steering shaft (2) through the intermediate steering shaft inner boot and the intermediate steering shaft boot from the inside of the vehicle.
2. Extend the upper intermediate steering shaft (2) as far as possible and connect it to the mid intermediate steering shaft.

NOTE: The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle. When installing the steering column, align the upper intermediate steering shaft with the steering column shaft while positioning the steering column in the vehicle.

3. Install the steering column. Refer to **Steering Column Replacement**.
4. Turn the steering wheel so the mid intermediate steering shaft bolt hole is accessible from the engine compartment.

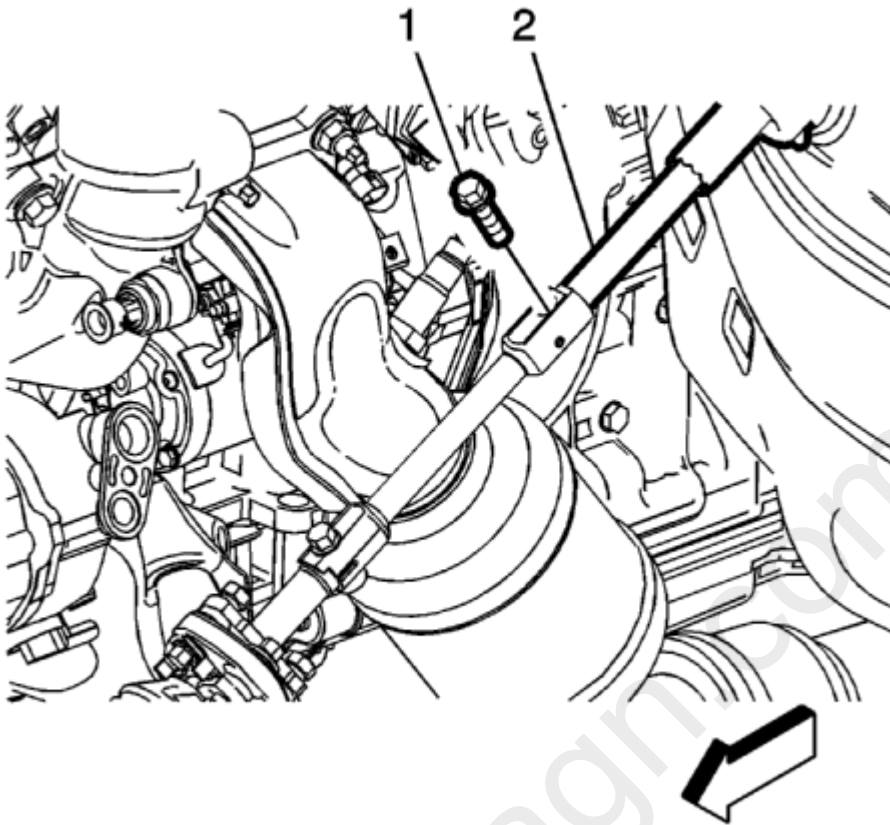


Fig. 13: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Clean the threads of the mid intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

6. Install the mid intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
7. Close the hood of the vehicle.

MID INTERMEDIATE STEERING SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Open and secure the hood of the vehicle.
2. Turn the steering wheel so the mid intermediate steering shaft bolts are accessible from the engine compartment.

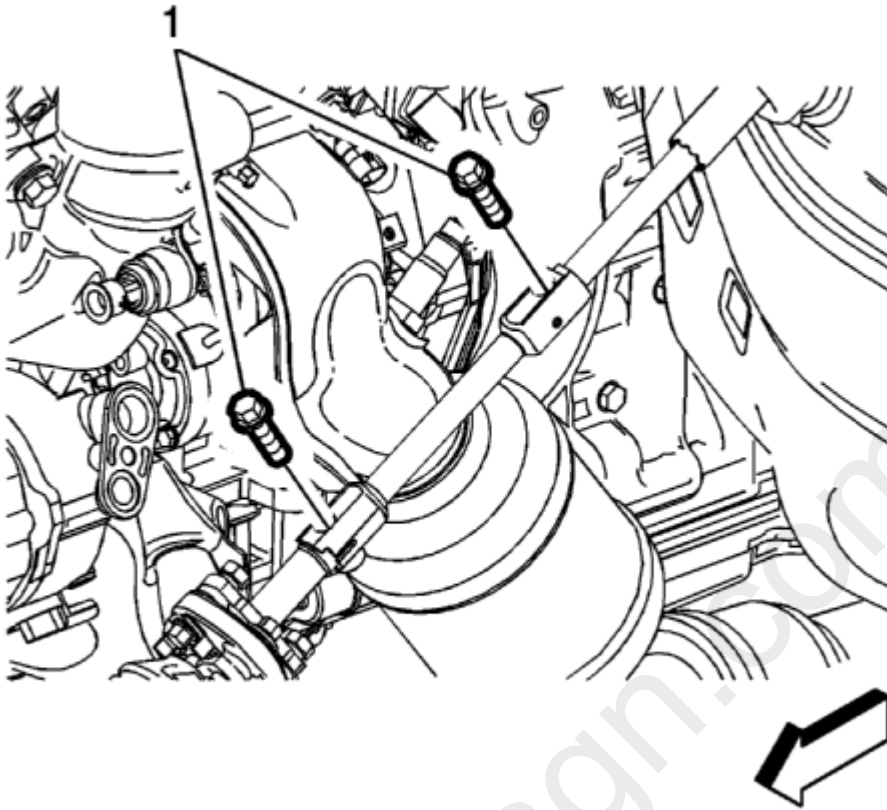


Fig. 14: Mid Intermediate Steering Shaft Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Remove the mid intermediate steering shaft bolts (1).

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.

4. Straighten the steering wheel and front tires and secure the steering wheel so it will not turn when the mid intermediate steering shaft is removed.

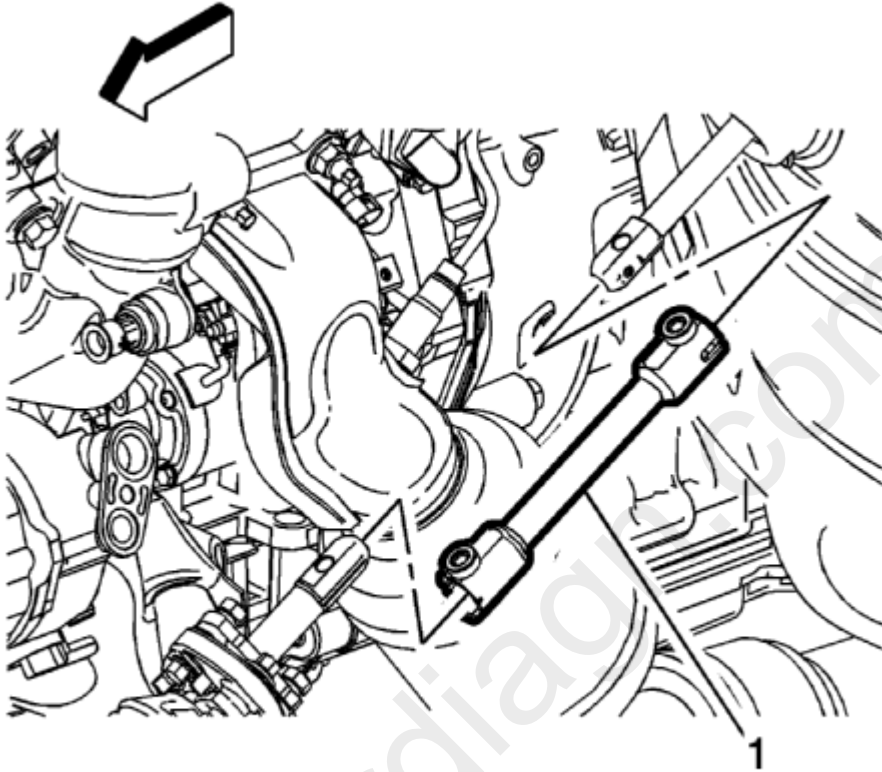


Fig. 15: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the mid intermediate steering shaft (1) from the intermediate steering shaft by pushing upward and rearward along the axis of the upper shaft.
6. Disconnect the mid intermediate steering shaft (1) from the upper intermediate steering shaft by pulling the mid shaft downward and forward along the axis of the upper shaft.
7. Remove the mid intermediate steering shaft (1) from the vehicle.

Installation Procedure

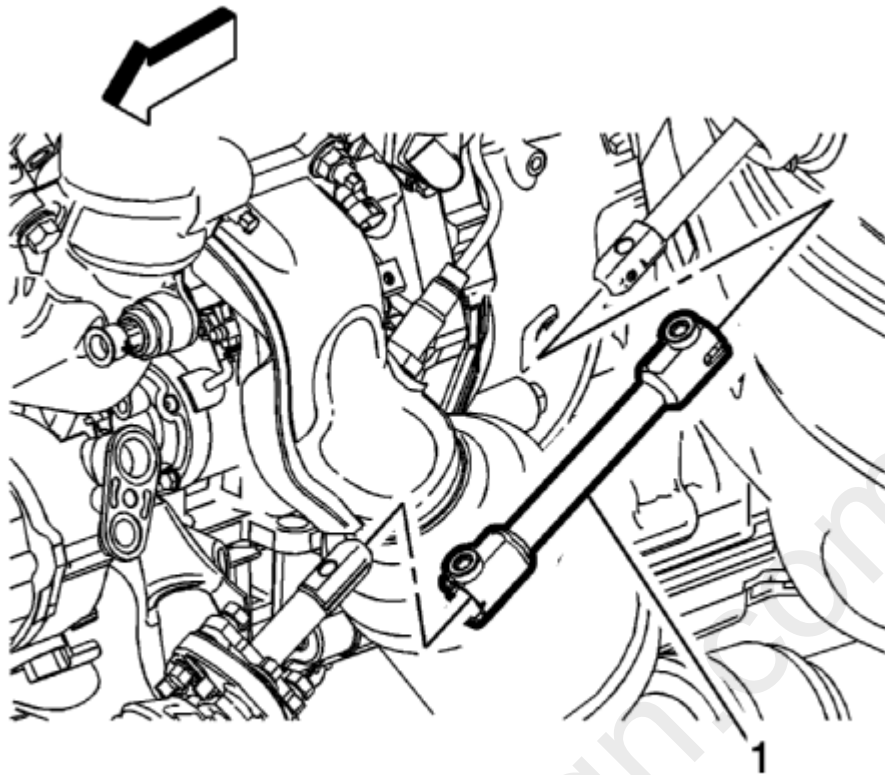


Fig. 16: Mid Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

1. Connect the mid intermediate steering shaft (1) to the upper intermediate steering shaft.
2. Pull the mid intermediate steering shaft (1) downward and forward along the axis of the upper intermediate steering shaft onto the intermediate steering shaft.

NOTE: **The steering wheel can be released to move freely after the mid intermediate steering shaft is connected to the intermediate and upper intermediate steering shafts.**

3. Turn the steering wheel so the mid intermediate steering shaft bolt holes are accessible from the engine compartment.

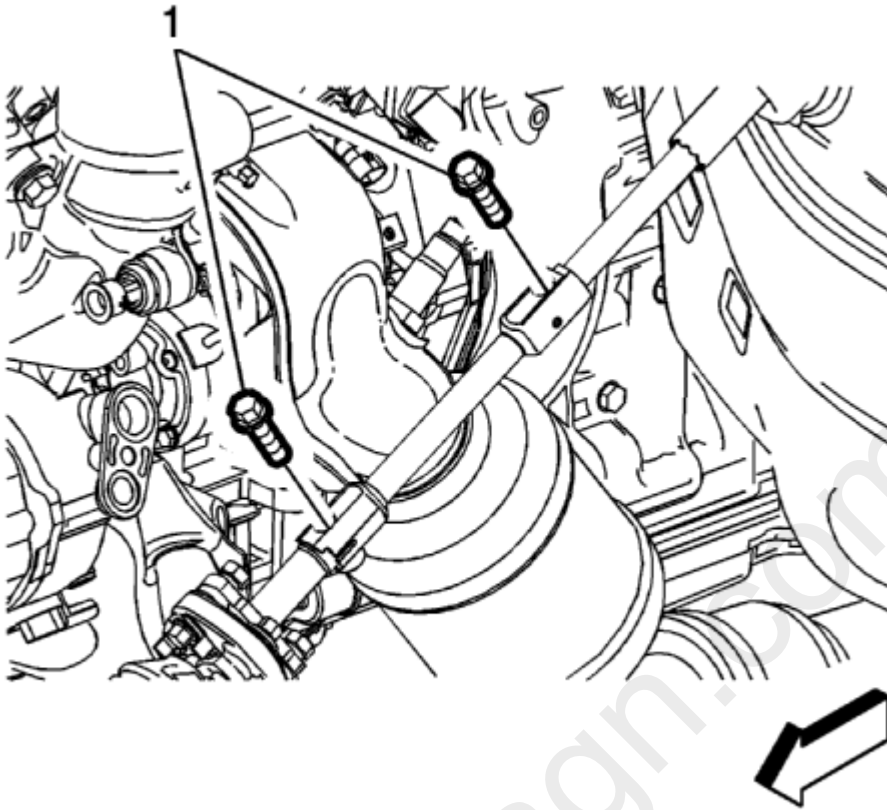


Fig. 17: Mid Intermediate Steering Shaft Bolts
Courtesy of GENERAL MOTORS COMPANY

4. Clean the threads of the intermediate steering shaft bolts (1) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

5. Install the intermediate steering shaft bolts (1) and tighten to 36 N.m (27 lb ft).
6. Close the hood of the vehicle.

MID INTERMEDIATE STEERING SHAFT REPLACEMENT (AWD)

Removal Procedure

1. Open and secure the hood of the vehicle.

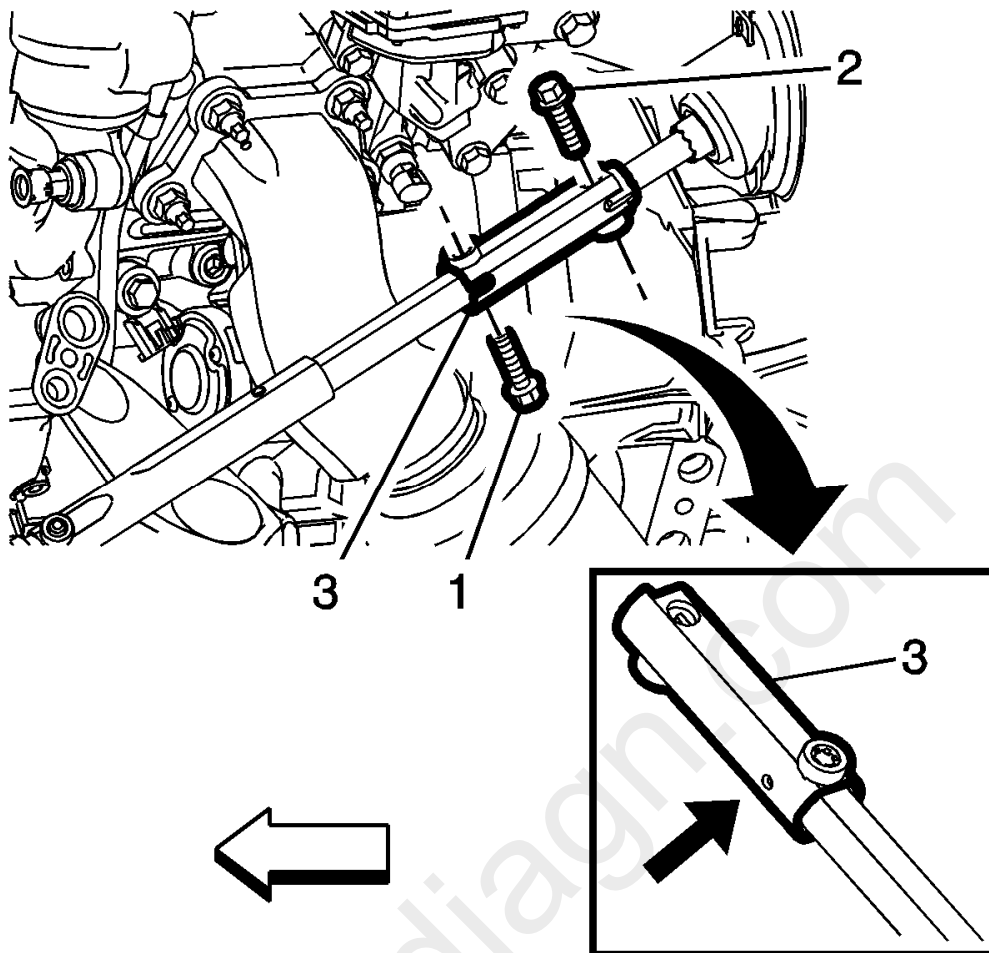


Fig. 18: Mid Intermediate Steering Shaft Bolt
 Courtesy of GENERAL MOTORS COMPANY

2. Turn the steering wheel so the mid intermediate steering shaft bolt (1) at the mid lower intermediate steering shaft is accessible. Remove the bolt but do not disconnect the steering shafts.

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.

3. Straighten the steering wheel and front tires and secure the steering wheel so it will not turn when the mid intermediate steering shaft (3) is removed.
4. Remove the mid intermediate steering shaft bolt (2) at the upper intermediate steering shaft.
5. Press in the lock pin on the mid lower intermediate steering shaft and disconnect the mid intermediate steering shaft (3) by pushing the mid shaft upward and rearward along the axis of the upper intermediate steering shaft.
6. Disconnect the mid intermediate steering shaft (3) from the upper intermediate steering shaft by pulling the mid shaft downward and forward along the axis of the upper shaft.
7. Remove the mid intermediate steering shaft (3) from the vehicle.

Installation Procedure

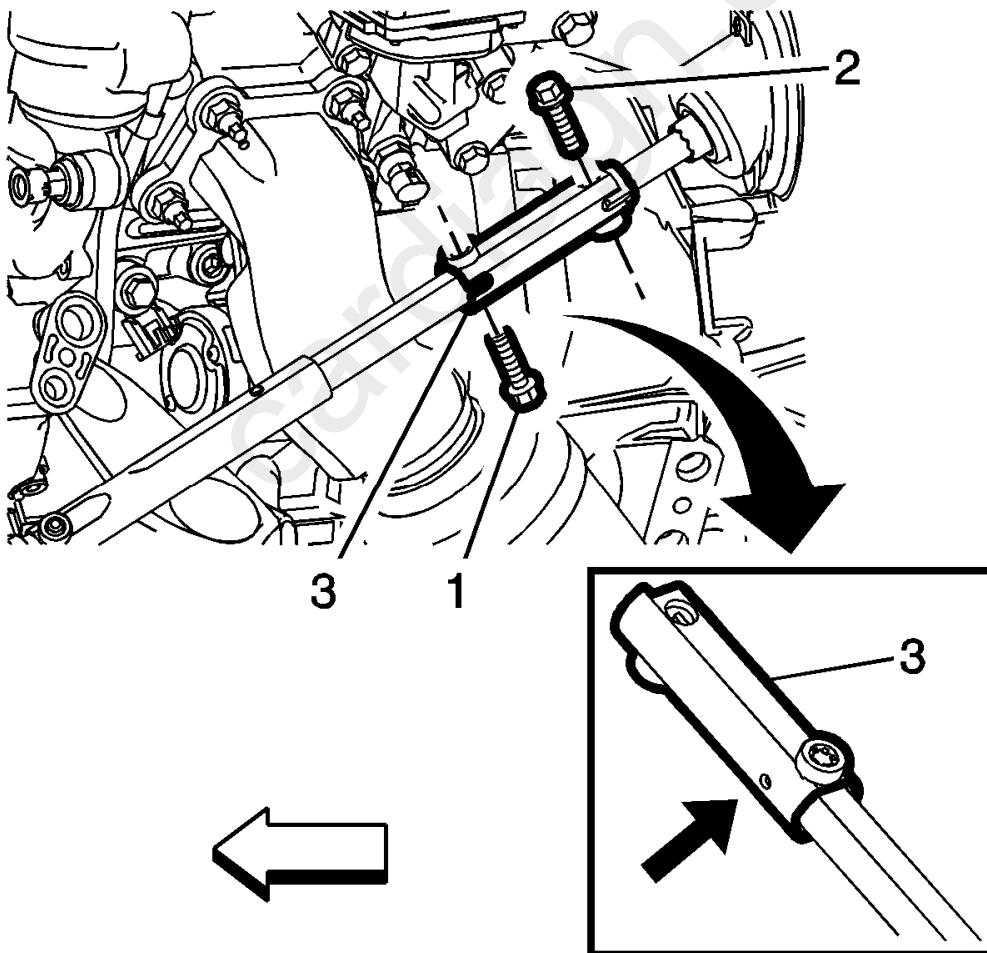


Fig. 19: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Clean the threads of the mid intermediate steering shaft bolts (1, 2) and apply NEW thread locking adhesive.

NOTE: **The steering wheel can be released to move freely after the mid intermediate steering shaft is connected to the mid lower and upper intermediate steering shafts.**

2. Connect the mid intermediate steering shaft (3) to the upper intermediate steering shaft.
3. Start the mid intermediate steering shaft bolt (2) by hand but do not tighten to specification.
4. Press in the lock pin on the mid lower intermediate steering shaft and pull the mid intermediate steering shaft (3) downward and forward along the axis of the upper intermediate steering shaft onto the mid lower shaft. Ensure the lock pin seats correctly.
5. Start the mid intermediate steering shaft bolt (1) by hand but do not tighten to specification.

CAUTION: Refer to Fastener Caution .

6. Tighten the mid intermediate steering shaft bolt (2) to 36 N.m (27 lb ft).
7. Rotate the steering wheel to gain access to the mid intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
8. Close the hood of the vehicle.

MID LOWER INTERMEDIATE STEERING SHAFT REPLACEMENT (AWD)

Removal Procedure

1. Open and secure the hood of the vehicle.
2. Turn the steering wheel so the mid and mid lower intermediate steering shaft bolts are accessible from the engine compartment.

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.

3. Secure the steering wheel so it will not turn when the mid and mid lower intermediate steering shafts are disconnected.

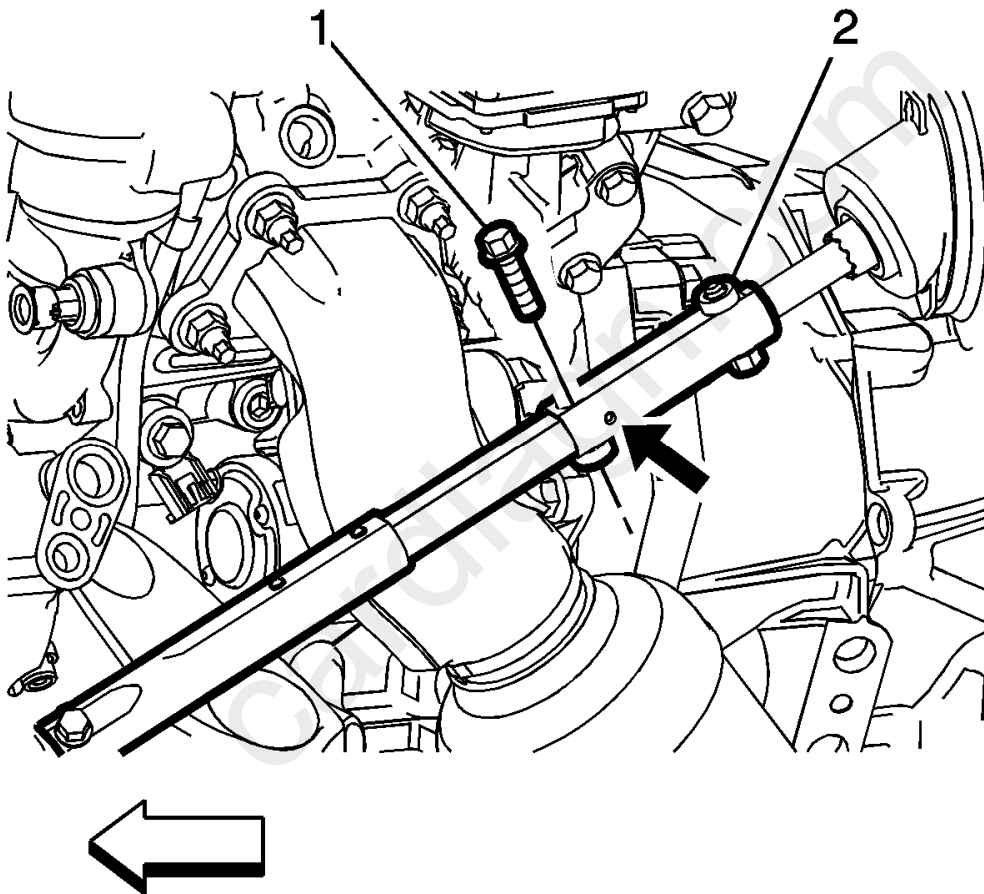


Fig. 20: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Remove the mid intermediate steering shaft bolt (1) at the mid lower intermediate steering shaft (2).
5. Press in the lock pin on the mid lower intermediate steering shaft and disconnect the mid intermediate steering shaft (2) by pushing the mid shaft upward and rearward along the axis of the upper intermediate steering shaft.

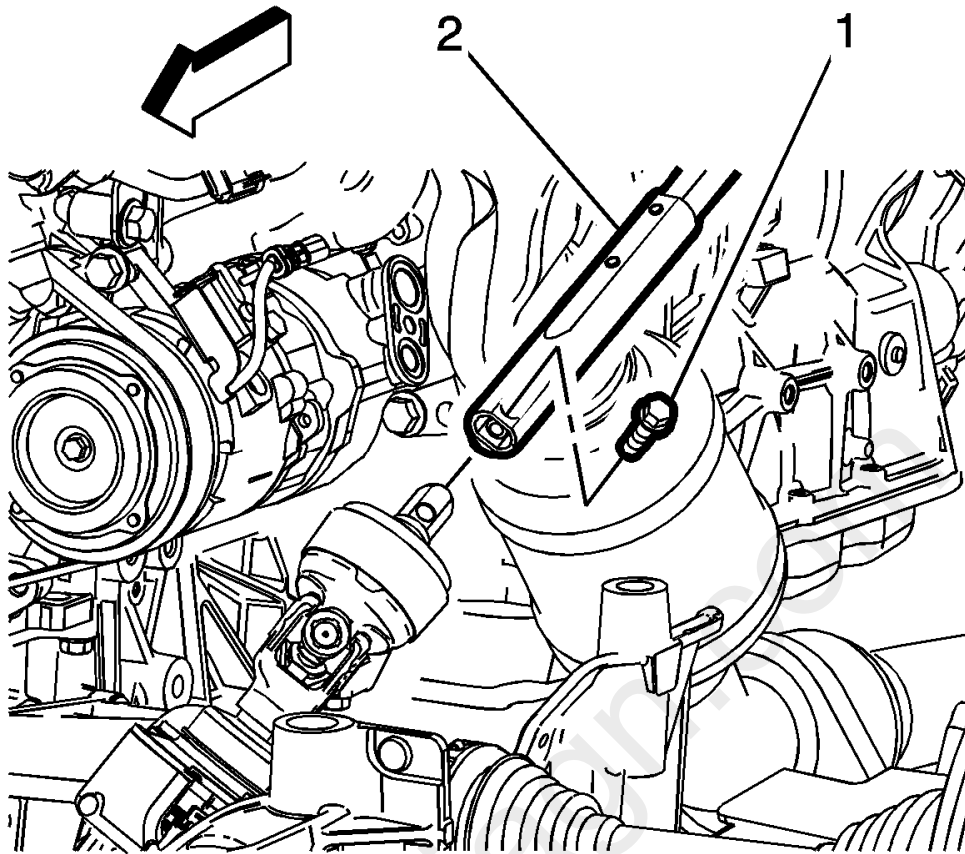


Fig. 21: Mid Lower Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Remove the mid lower intermediate steering shaft bolt (1).
7. Disconnect the mid lower intermediate steering shaft (2) from the intermediate steering shaft and remove it from the vehicle.
8. Inspect the plastic stakes on the mid lower intermediate steering shaft (2). If any of the stakes are damaged or missing, replace the shaft.

Installation Procedure

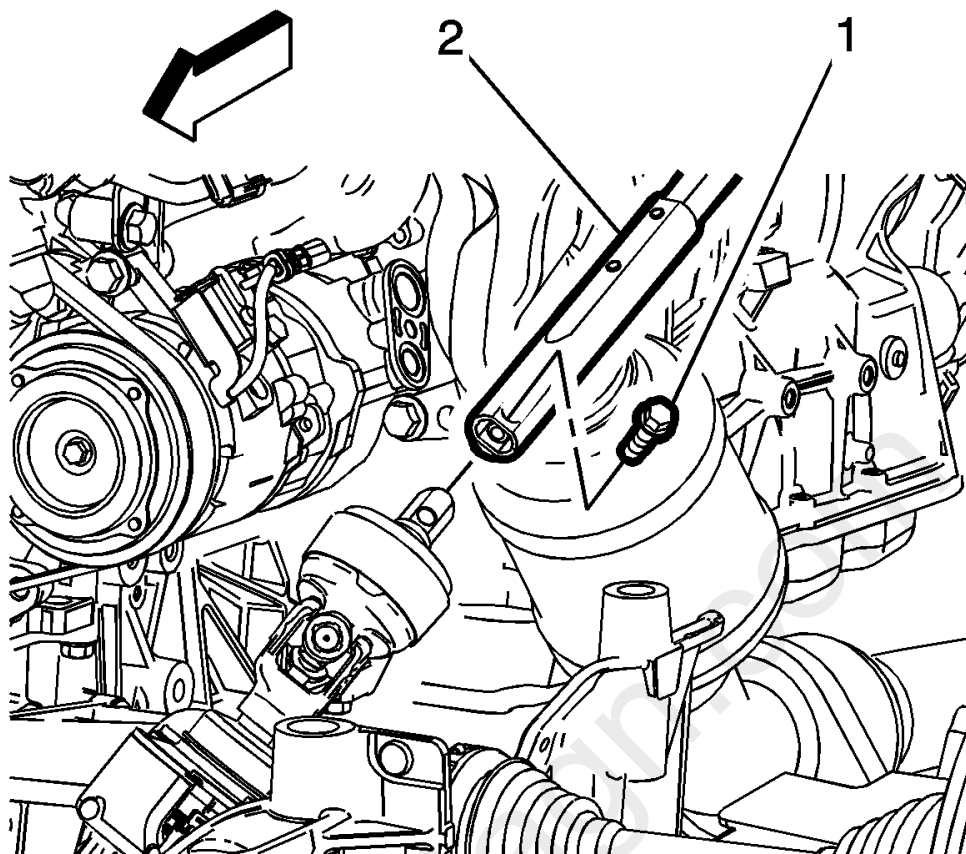


Fig. 22: Mid Lower Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Position the mid lower intermediate steering shaft (2) in the vehicle and connect it to the intermediate steering shaft.
2. Clean the threads of the mid lower intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

3. Install the mid lower intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).

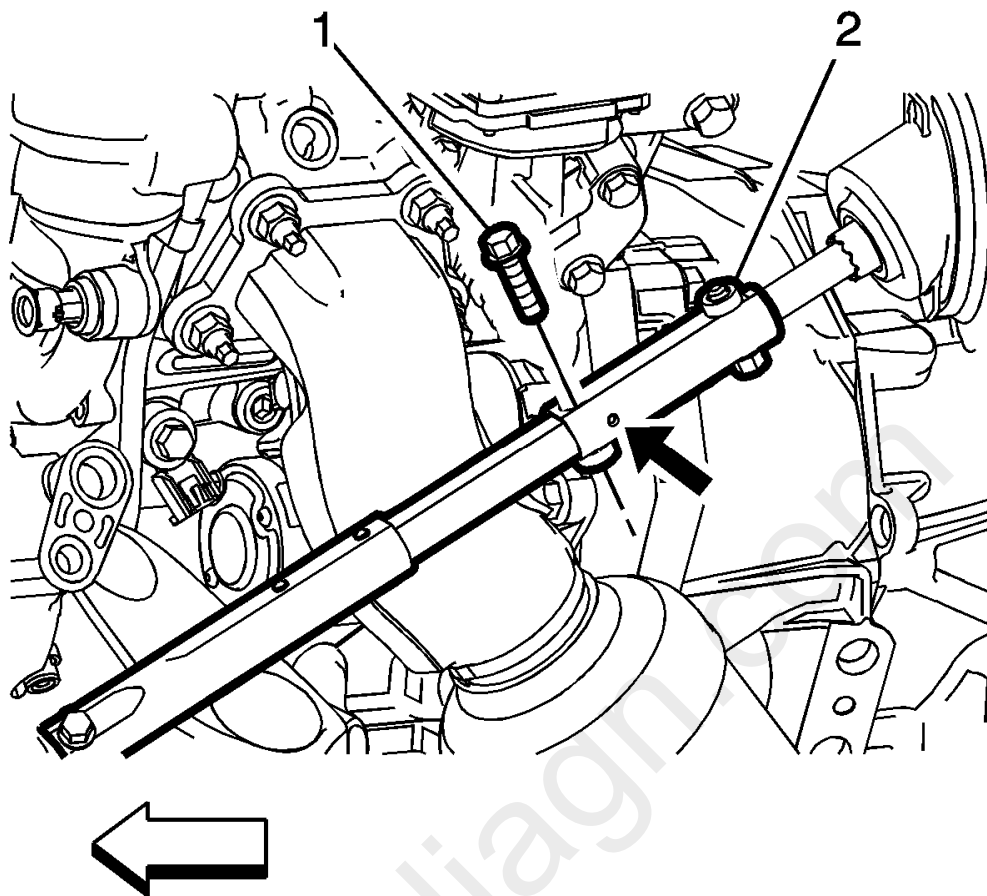


Fig. 23: Mid Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Press in the lock pin on the mid lower intermediate steering shaft and pull the mid intermediate steering shaft (2) downward and forward along the axis of the upper intermediate steering shaft onto the mid lower shaft. Ensure the lock pin seats correctly.
5. Clean the threads of the mid intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.
6. Install the mid intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
7. Close the hood of the vehicle.

INTERMEDIATE STEERING SHAFT BOOT REPLACEMENT

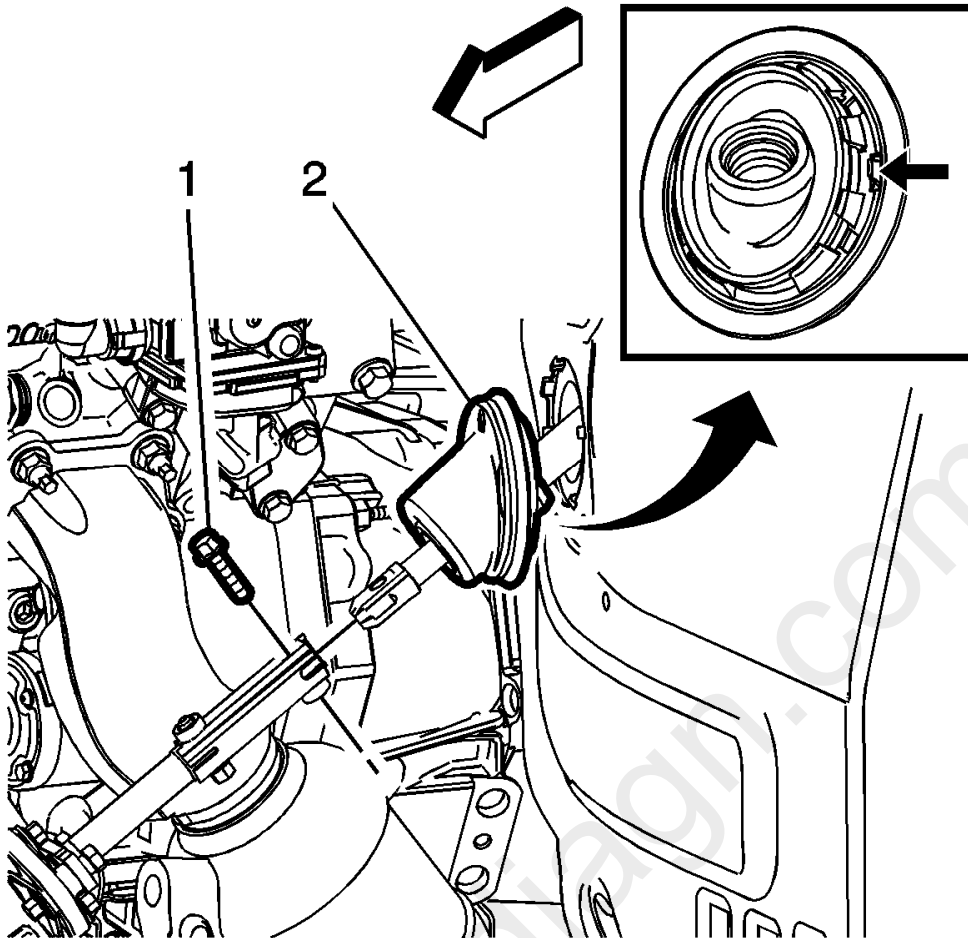


Fig. 24: Intermediate Steering Shaft Boot
 Courtesy of GENERAL MOTORS COMPANY

Intermediate Steering Shaft Boot Replacement

Callout	Component Name
Preliminary Procedures	
1. Open and secure the hood of the vehicle. 2. Remove the left side instrument panel lower trim panel insulator. Refer to <u>Instrument Panel Lower Trim Panel Insulator Replacement - Left Side</u> .	
1	Mid intermediate Steering Shaft Bolt CAUTION: Refer to <u>Fastener Caution</u> . Procedure Clean the threads of the bolt and apply NEW thread locking adhesive.

	Tighten 36 N.m (27 lb ft)
2	Intermediate Steering Shaft Boot Procedure 1. On the inside of the vehicle, lift the lip of the intermediate steering shaft inner boot and use an appropriate tool to release the plastic clips on the intermediate steering shaft boot. 2. Separate the upper intermediate steering shaft from the mid intermediate steering shaft. 3. Slide the intermediate steering shaft boot down and off of the upper intermediate steering shaft. 4. When installing the intermediate steering shaft boot, ensure the boot is aligned under the hood by using the arrow on the boot as a guide.

INTERMEDIATE STEERING SHAFT INNER BOOT REPLACEMENT

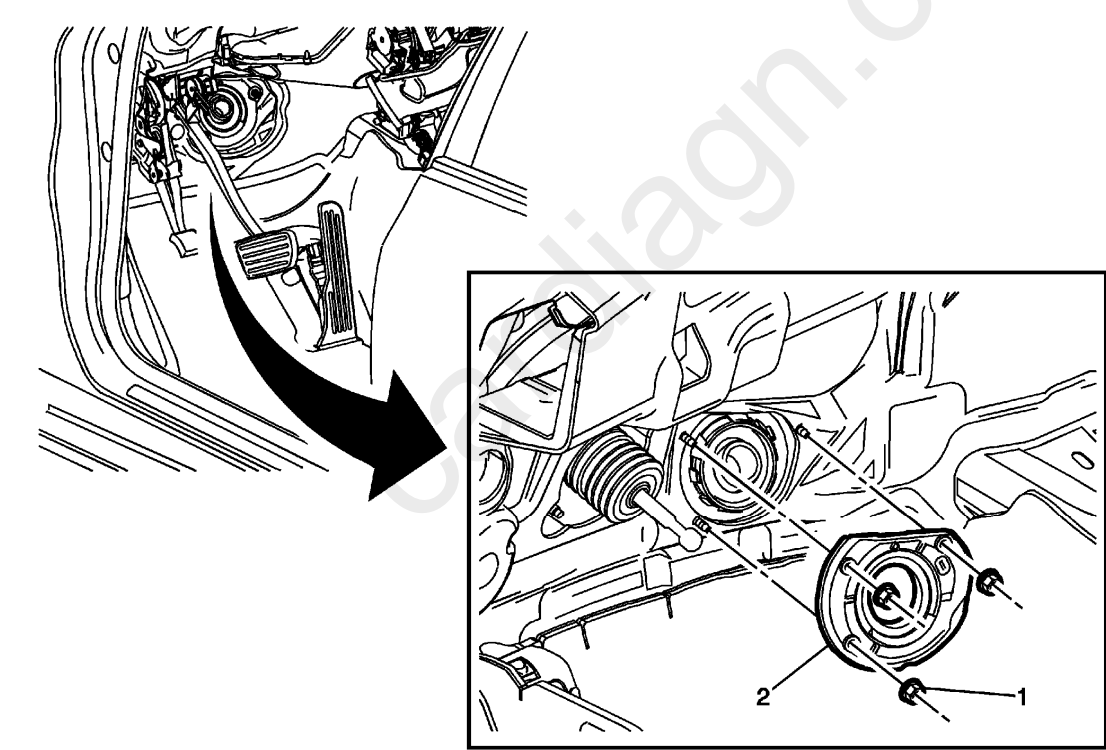


Fig. 25: Intermediate Steering Shaft Inner Boot
Courtesy of GENERAL MOTORS COMPANY

Intermediate Steering Shaft Inner Boot Replacement

Callout	Component Name
Preliminary Procedures	

1. Remove the instrument panel lower extension insulator. Refer to <u>Instrument Panel Lower Extension Insulator Replacement</u> . 2. Remove the instrument panel tie bar. Refer to <u>Instrument Panel Tie Bar Replacement</u> .	
1	Intermediate Steering Shaft Inner Boot Nut (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 N.m (80 lb in)
2	Intermediate Steering Shaft Inner Boot Procedure When installing the intermediate steering shaft inner boot, align the boot using the alignment arrow on the outside of the boot and the alignment tab on the inside of the boot.

INTERMEDIATE STEERING SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Open and secure the hood of the vehicle.
2. Turn the steering wheel so the mid and intermediate steering shaft bolts are accessible from the engine compartment.

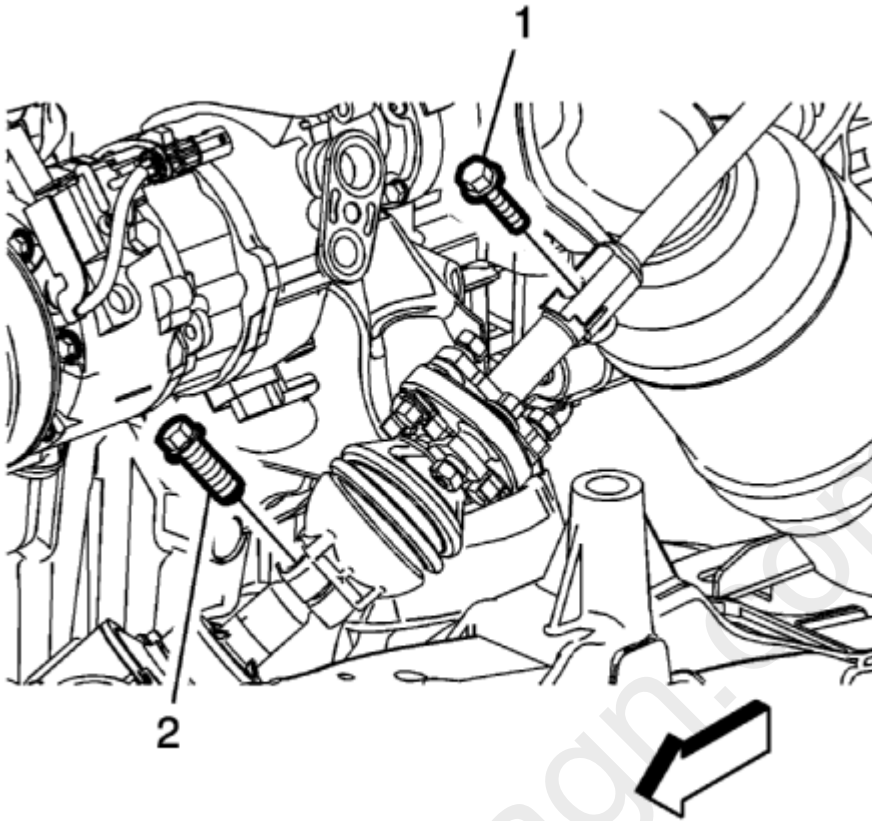


Fig. 26: Mid Intermediate Steering Shaft Bolt And Intermediate Steering Shaft Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove the mid intermediate steering shaft bolt (1) and the intermediate steering shaft lower bolt (2).

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.

4. Straighten the steering wheel and front tires and secure the steering wheel so it will not turn when the mid and intermediate steering shafts are disconnected.

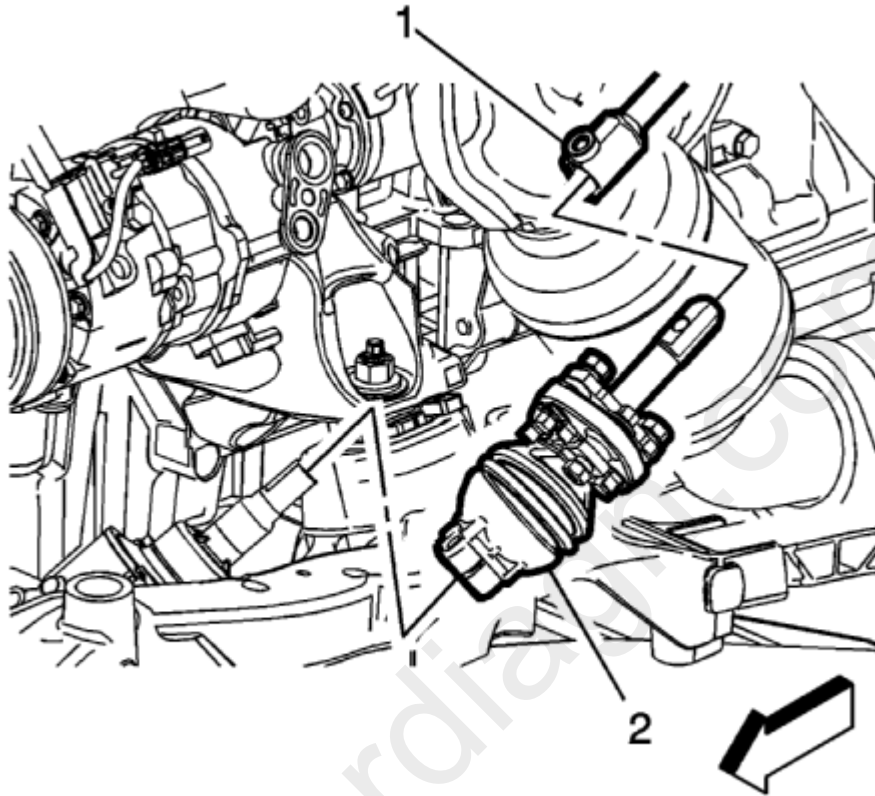


Fig. 27: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the mid intermediate steering shaft (1) from the intermediate steering shaft by pushing the shaft upward and rearward along the axis of the upper intermediate steering shaft.
6. Disconnect the intermediate steering shaft (2) from the steering gear by pushing the shaft upward and rearward along the axis of the steering gear shaft.

Installation Procedure

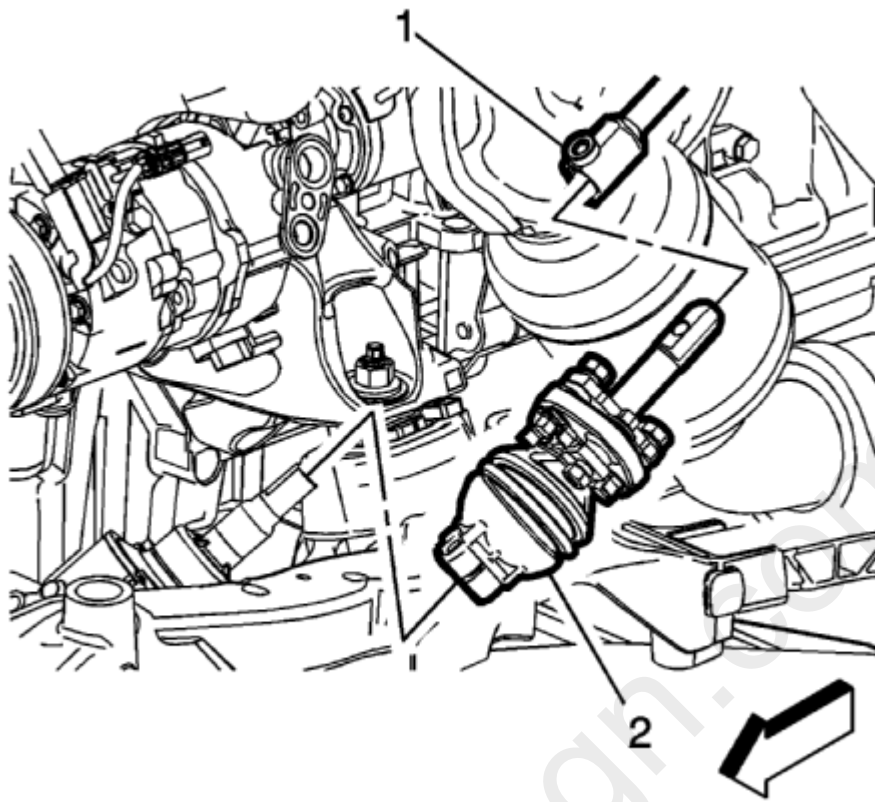


Fig. 28: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

1. Pull the intermediate steering shaft (2) downward and forward along the axis of the steering gear shaft onto the steering gear.
2. Pull the mid intermediate steering shaft (1) downward and forward along the axis of the upper intermediate steering shaft onto the intermediate steering shaft.
3. Turn the steering wheel so the mid and intermediate steering shaft bolt holes are accessible from the engine compartment.

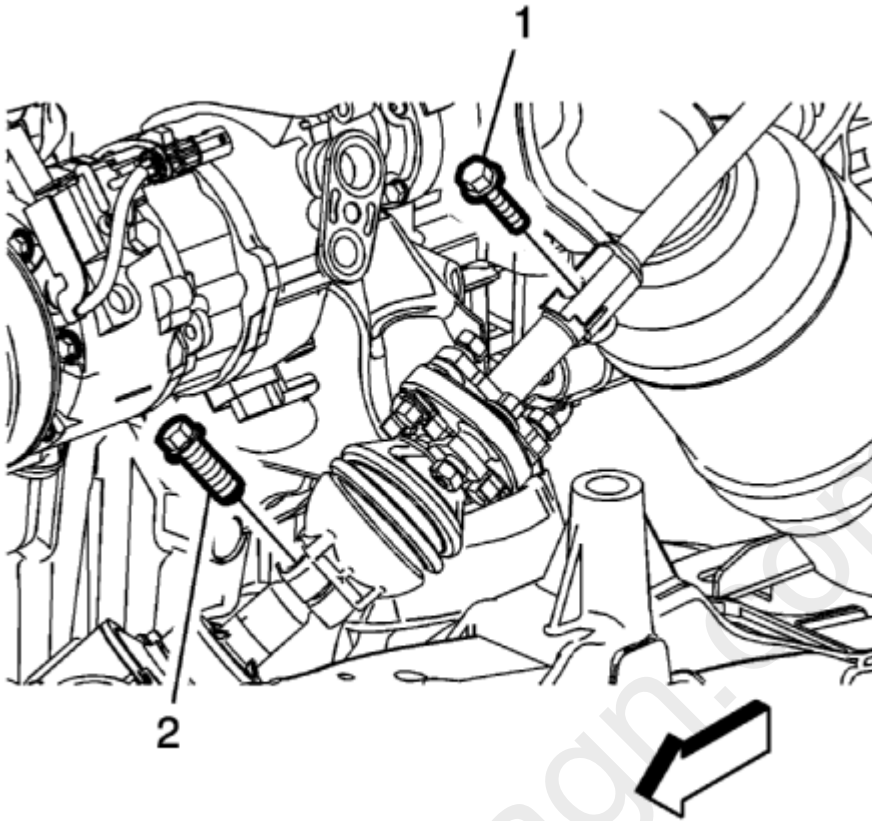


Fig. 29: Mid Intermediate Steering Shaft Bolt And Intermediate Steering Shaft Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Clean the threads of the mid intermediate steering shaft bolt (1) and the intermediate steering shaft lower bolt (2) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

5. Install the intermediate steering shaft bolt (2) and tighten to 50 N.m (37 lb ft).
6. Install the mid intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
7. Close the hood of the vehicle.

INTERMEDIATE STEERING SHAFT REPLACEMENT (AWD)

Removal Procedure

1. Open and secure the hood of the vehicle.

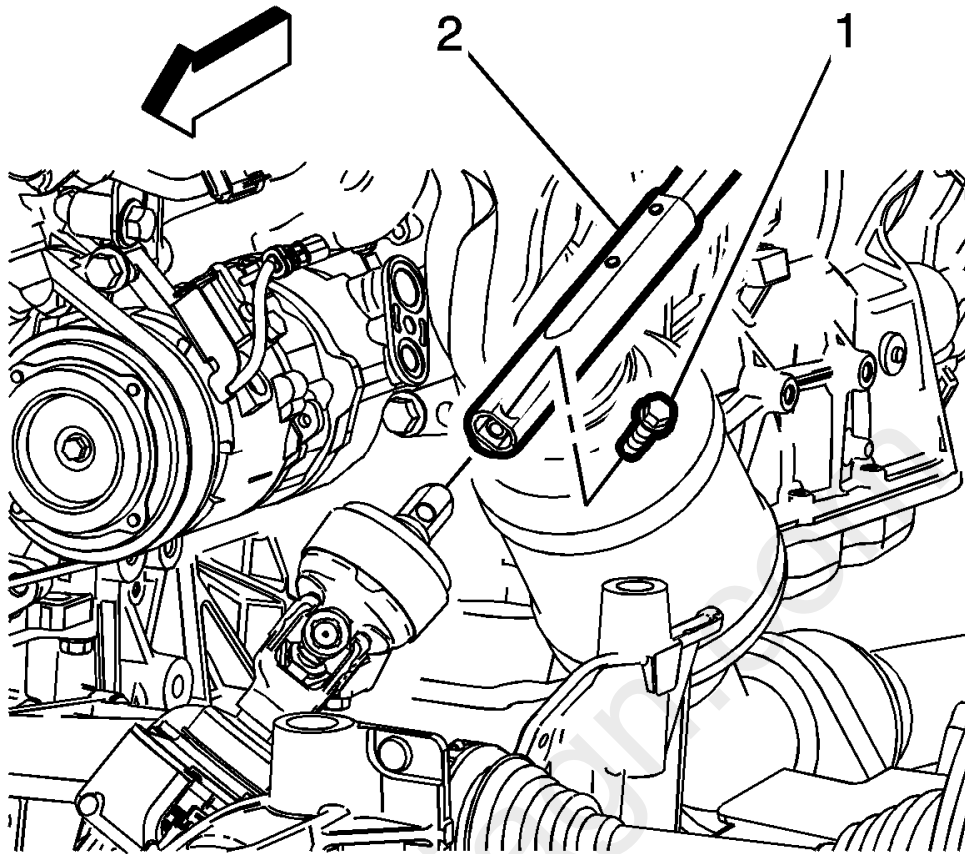


Fig. 30: Intermediate Steering Shaft (AWD)
Courtesy of GENERAL MOTORS COMPANY

2. Turn the steering wheel so the mid lower intermediate steering shaft bolt (1) at the intermediate steering shaft is accessible. Remove the bolt but do not disconnect the steering shafts.

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.

3. Straighten the steering wheel and front tires and secure the steering wheel so it will not turn when the mid lower and intermediate steering shafts (2) are disconnected.
4. Disconnect the mid lower intermediate steering shaft (2) from the intermediate steering shaft by pushing the shaft upward and rearward along the axis of the mid lower intermediate steering shaft.

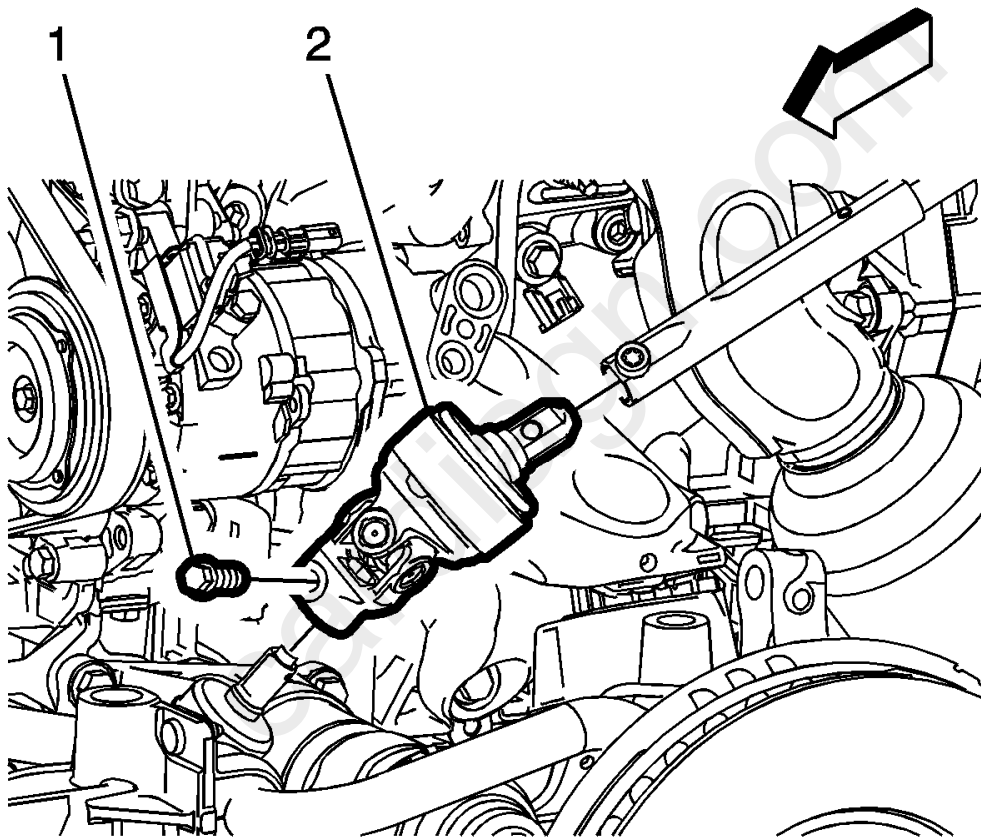


Fig. 31: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

5. Remove the intermediate steering shaft bolt (1) at the steering gear.
6. Disconnect the intermediate steering shaft (2) from the steering gear by pushing the shaft upward and rearward along the axis of the steering gear shaft.

Installation Procedure

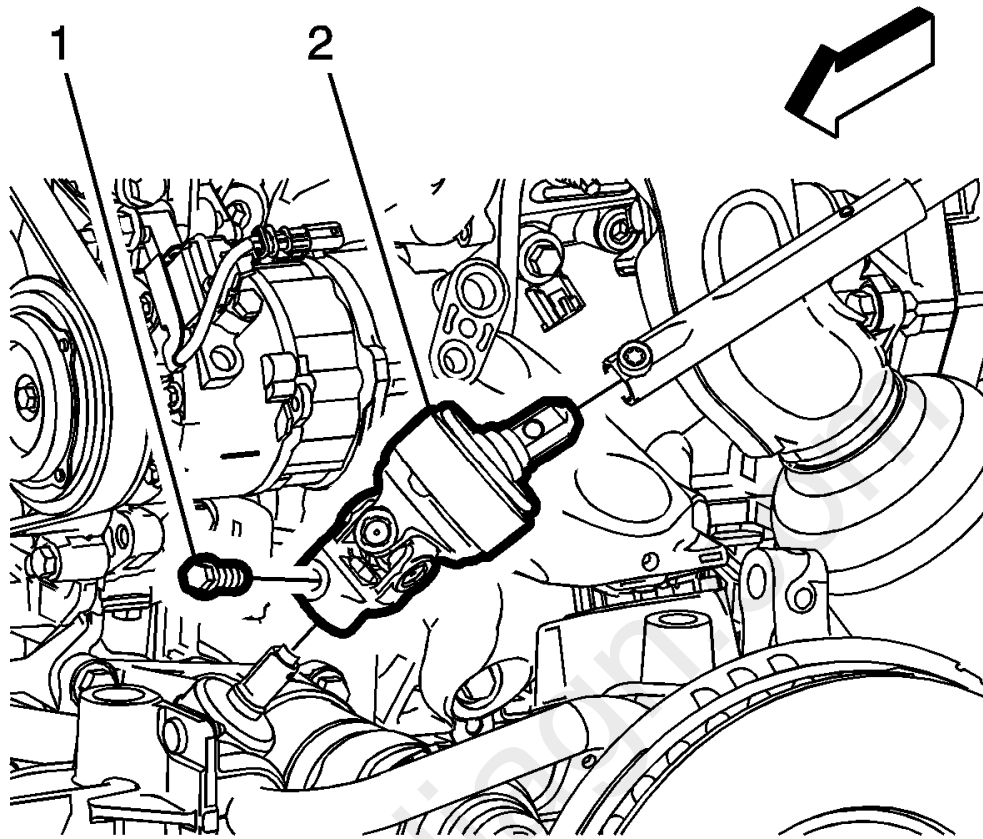


Fig. 32: Intermediate Steering Shaft
Courtesy of GENERAL MOTORS COMPANY

1. Pull the intermediate steering shaft (2) downward and forward along the axis of the steering gear shaft onto the steering gear.
2. Clean the threads of the intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.

CAUTION: Refer to Fastener Caution .

3. Install the intermediate steering shaft bolt (1) and tighten to 50 N.m (37 lb ft).

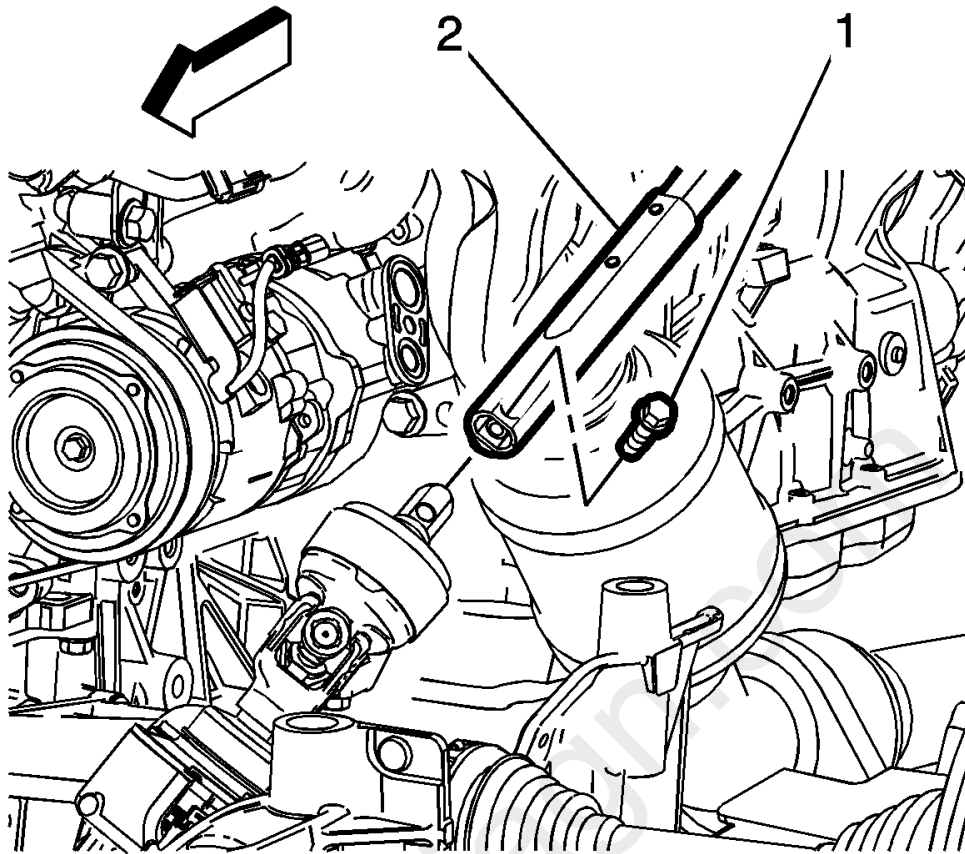


Fig. 33: Intermediate Steering Shaft (AWD)
Courtesy of GENERAL MOTORS COMPANY

4. Pull the mid lower intermediate steering shaft (2) downward and forward along the axis of the mid lower intermediate steering shaft onto the intermediate steering shaft.
5. Rotate the steering wheel to gain clearance to install the mid lower intermediate steering shaft bolt (1).
6. Clean the threads of the mid lower intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.
7. Install the mid lower intermediate steering shaft bolt (1) and tighten to 36 N.m (27 lb ft).
8. Close the hood of the vehicle.

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N37)

Inspection Procedure

1. Remove the turn signal switch bracket. Refer to **Turn Signal Switch Bracket 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

2. Remove the steering column from the vehicle. Refer to Steering Column Replacement.
3. Rotate the steering column shaft. Verify the shaft turns freely and without interference.

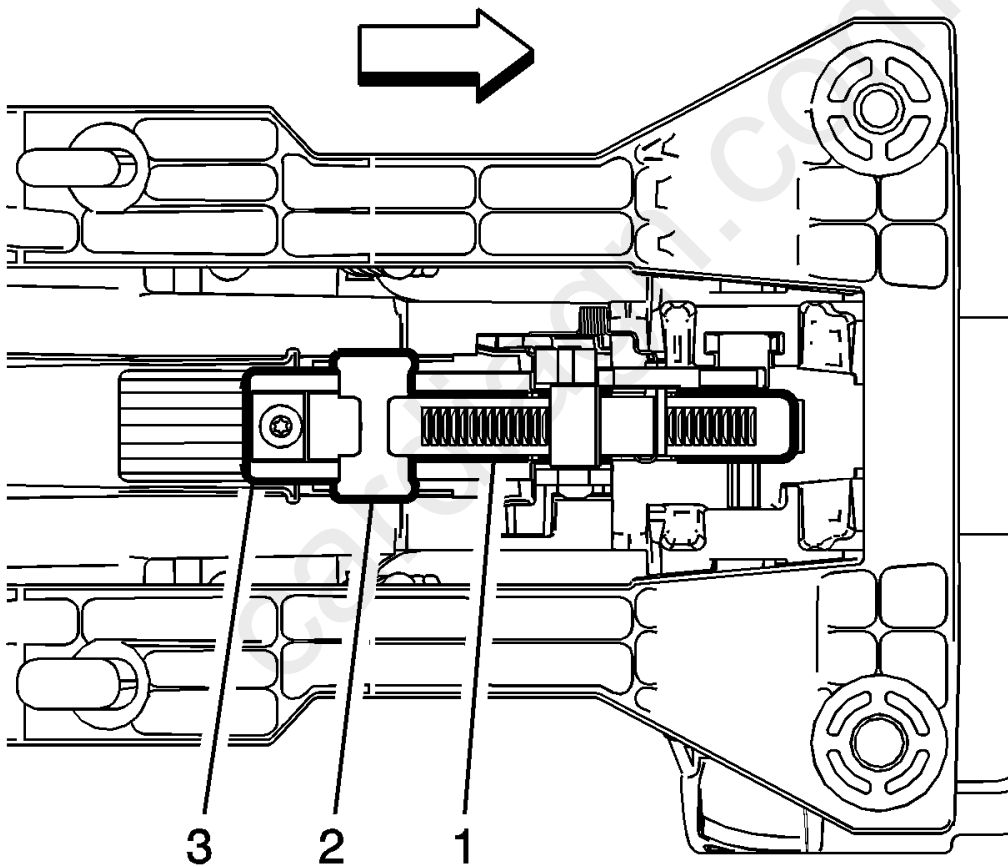


Fig. 34: E/A strap

Courtesy of GENERAL MOTORS COMPANY

4. Verify there is no visual damage to the E/A strap (1) and that the E/A strap is not unrolled. To verify the strap is not unrolled, confirm the bumper (2) is seated against the retainer (3).

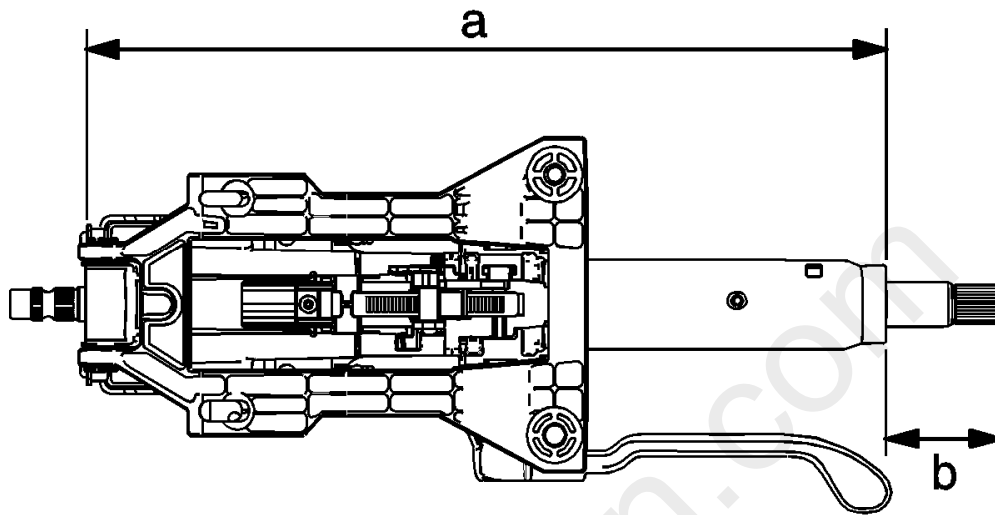


Fig. 35: Measuring Points For Length Of The Upper And Lower Jacket Assembly
Courtesy of GENERAL MOTORS COMPANY

5. Measure the length of the upper shaft (b) from the end of the upper jacket to the tip. The length of the upper shaft must be greater than 60 mm (2.36 in).
6. Unlock the rake lever and telescope the upper jacket to the full telescope in position. Measure the length of the upper and lower jacket assembly including the lower bearing adapter (a). The length of the upper and lower jacket assembly must be greater than 419 mm (16.5 in).

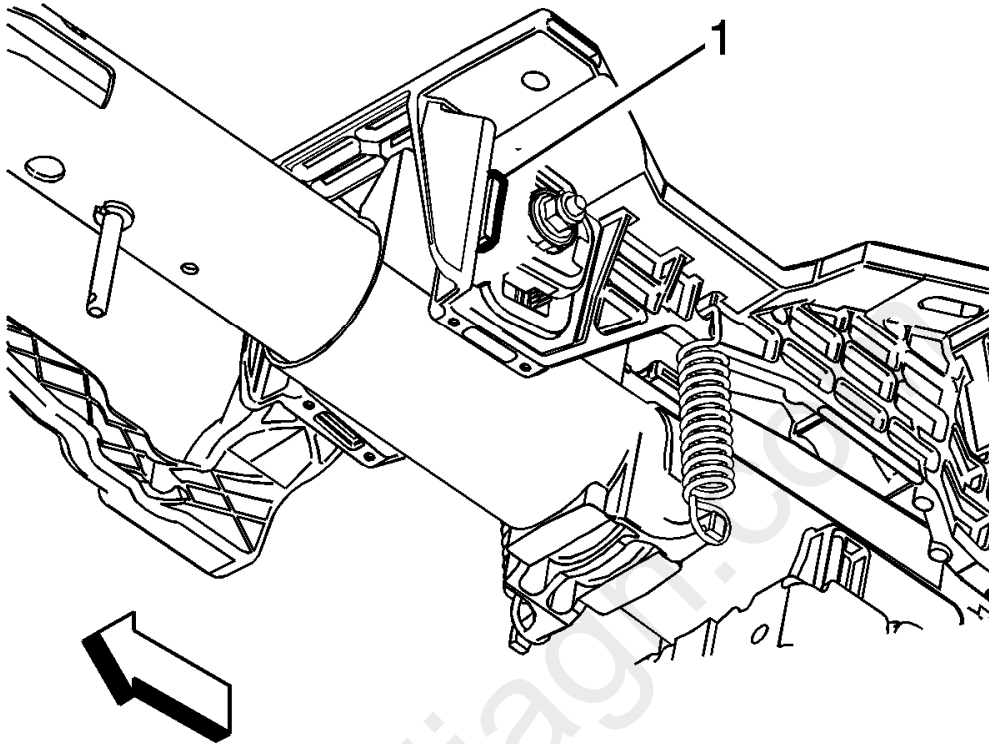


Fig. 36: Left And Right Hand Rake Guides
Courtesy of GENERAL MOTORS COMPANY

7. Verify that both the left and right hand rake guides (1) are not fractured.
8. If the steering column does not meet the specifications, the steering column is damaged. Discard the damaged steering column. Install a NEW steering column.
9. If the steering column meets the specifications, install the steering column. Refer to **Steering Column Replacement**.
10. Install the turn signal switch bracket. Refer to **Turn Signal Switch Bracket Replacement**.

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N38)

Inspection Procedure

1. Remove the turn signal switch bracket. Refer to **Turn Signal Switch Bracket 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**

2. Remove the steering column from the vehicle. Refer to **Steering Column Replacement**.
3. Rotate the steering column shaft. Verify the shaft turns freely and without interference.

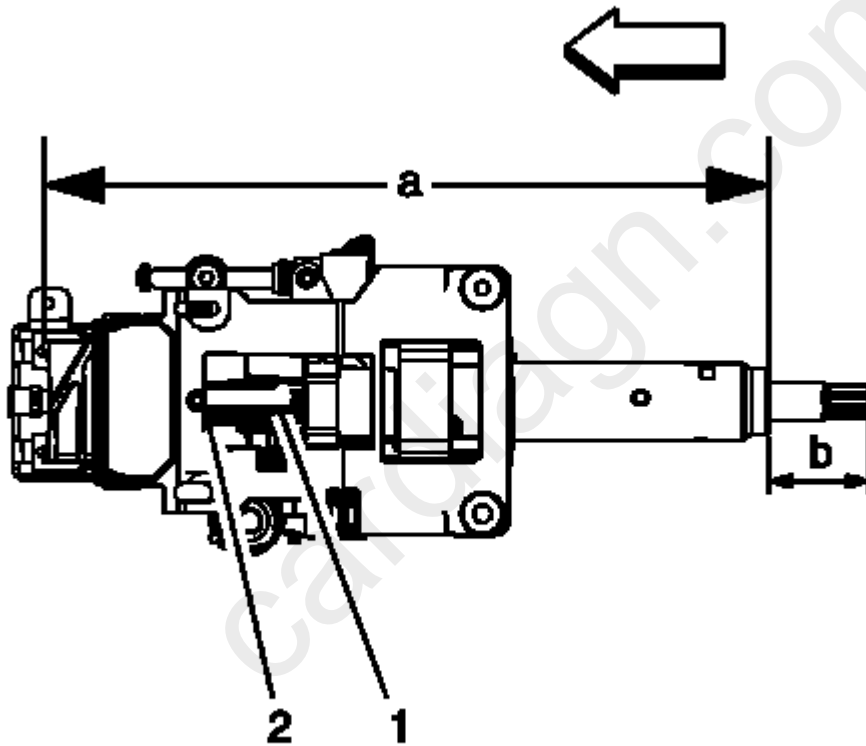


Fig. 37: E/A Strap & Retainer
Courtesy of GENERAL MOTORS COMPANY

4. Verify the E/A strap retainer (1) is firmly seated on the jacket.
5. Verify there is no visual damage to the E/A strap (2).
6. Measure the length of the upper shaft (b) from the end of the upper jacket to the tip. The length of the upper shaft must not be less than 60 mm (2.36 in).
7. Measure the length of the upper and lower jacket assembly (a). The length of the upper and lower jacket

assembly must not be less than 449 mm (17.68 in).

8. If the steering column does not meet the specifications, the steering column is damaged. Discard the damaged steering column. Install a NEW steering column.
9. If the steering column meets the specifications, install the steering column. Refer to **Steering Column Replacement**.
10. Install the turn signal switch bracket. Refer to **Turn Signal Switch Bracket Replacement**.

STEERING COLUMN UPPER TRIM COVER REPLACEMENT

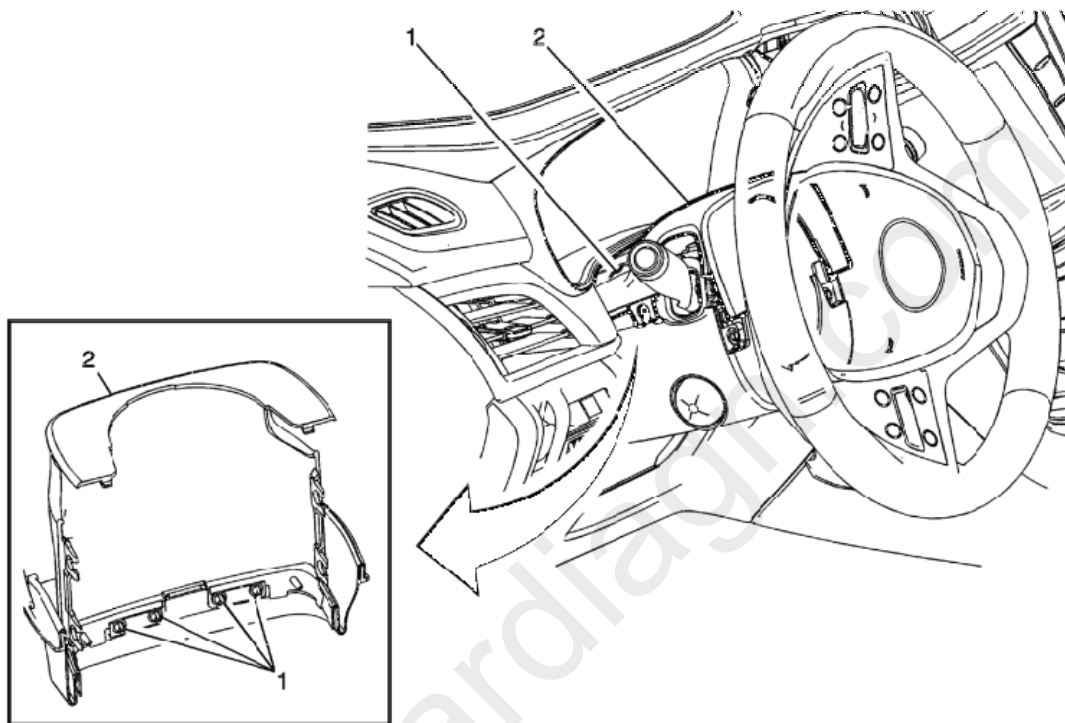


Fig. 38: Steering Column Upper Trim Cover
Courtesy of GENERAL MOTORS COMPANY

Steering Column Upper Trim Cover Replacement

Callout	Component Name
1	Steering Column Housing Cover
2	Steering Column Upper Trim Cover
	Procedures
	1. Use a flat bladed plastic trim tool in order to release the tabs securing the upper trim cover to the lower trim cover. 2. Reposition the upper trim cover to access and release the tabs on the bottom side of the steering column housing cover.

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (WITH N38)

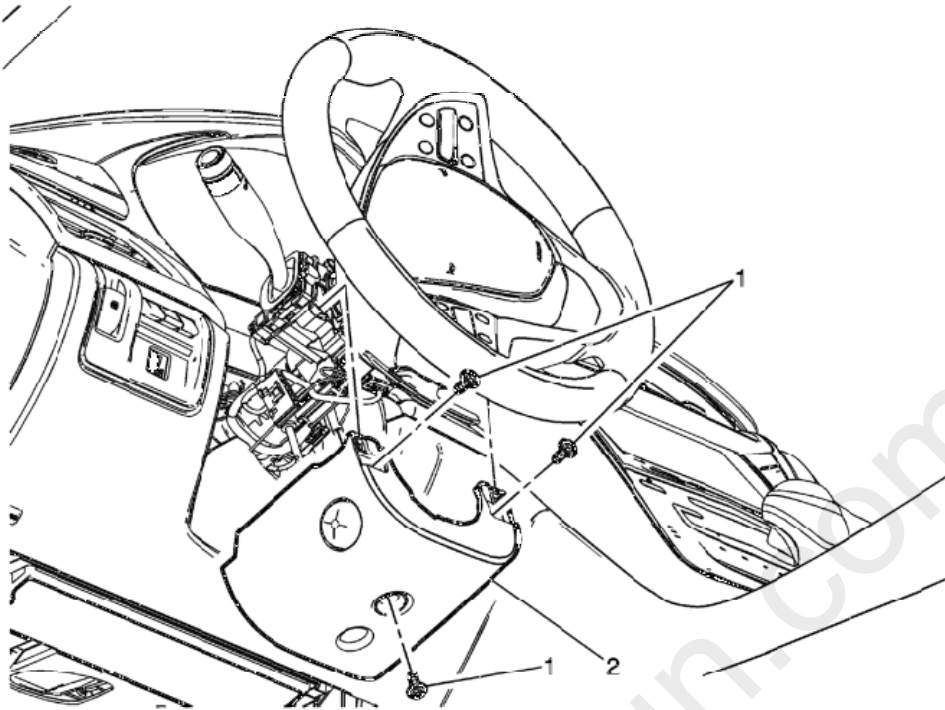


Fig. 39: Steering Column Lower Trim Cover (With N38)

Courtesy of GENERAL MOTORS COMPANY

Steering Column Lower Trim Cover Replacement (With N38)

Callout	Component Name
Preliminary Procedure Remove the steering column upper trim cover. Refer to <u>Steering Column Upper Trim Cover Replacement</u> .	
1	Steering Column Lower Trim Cover Bolt (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.5 (13 lb in)
2	Steering Column Lower Trim Cover Procedures 1. Extended the steering column to its furthest point to clear the instrument panel knee bolster. 2. Turn the steering wheel left and right to access the fasteners securing the lower trim

- cover to the turn signal switch bracket.
3. Disconnect the electrical connector.
4. Transfer components as necessary.

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (WITHOUT N38)

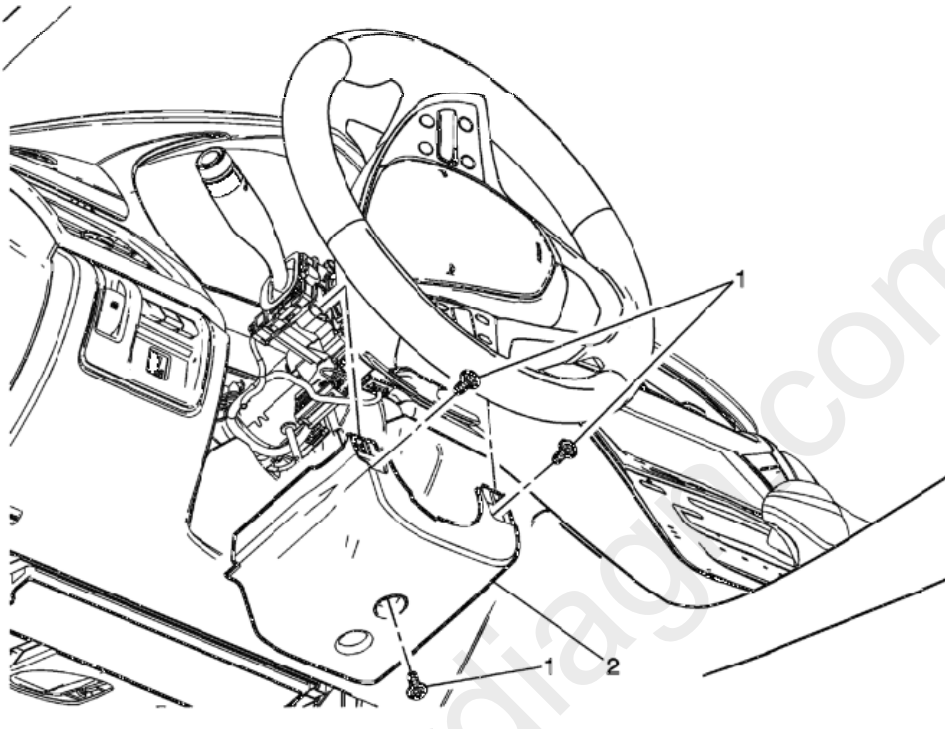


Fig. 40: Steering Column Lower Trim Cover
Courtesy of GENERAL MOTORS COMPANY

Steering Column Lower Trim Cover Replacement (Without N38)

Callout	Component Name
Preliminary Procedure Remove the steering column upper trim cover. Refer to <u>Steering Column Upper Trim Cover Replacement</u> .	
1	Steering Column Lower Trim Cover Bolt (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.5 (13 lb in)
	Steering Column Lower Trim Cover

Procedures

2

1. Extended the steering column to its furthest point to clear the instrument panel knee bolster.
2. Turn the steering wheel left and right to access the fasteners securing the lower trim cover to the turn signal switch bracket.

STEERING COLUMN LOCK CONTROL MODULE REPLACEMENT

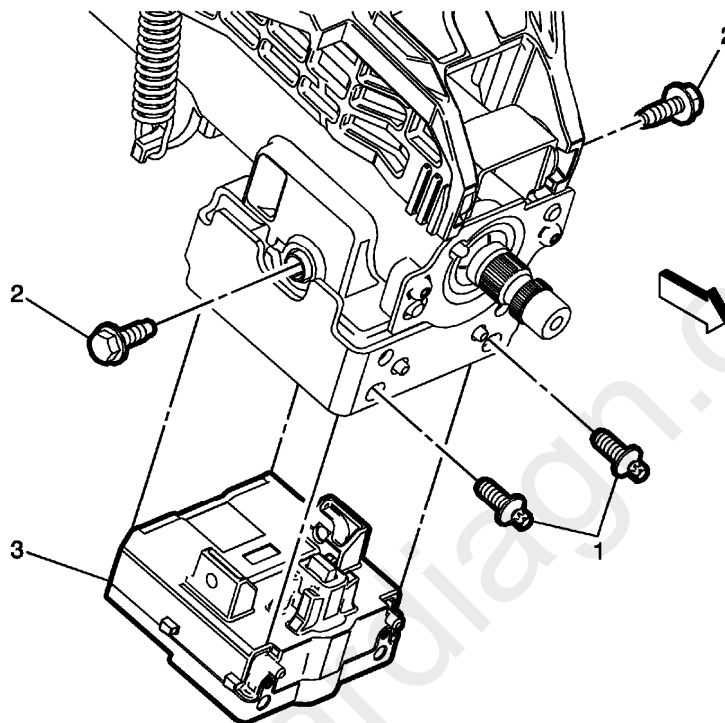


Fig. 41: Steering Column Lock Control Module
Courtesy of GENERAL MOTORS COMPANY

Steering Column Lock Control Module Replacement

Callout	Component Name
Preliminary Procedures	
1. Ensure the steering wheel and the front wheels are in the straight ahead position. 2. Remove the instrument panel knee bolster. Refer to <u>Instrument Panel Knee Bolster Replacement</u> . 3. Remove the front floor air outlet duct-left side. Refer to <u>Floor Front Air Outlet Duct Replacement - Left Side</u> . 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 ACCESSORY (ACC) mode and unlock the steering column for 5 minutes.	

5. Turn the steering wheel to verify the steering column is not locked. 6. Disconnect the steering column lock control module electrical connectors. 7. 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.	
1	Steering Column Lock Control Module Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Remove and discard the old steering column lock control module bolts. 2. Install the NEW steering column lock control module bolts and tighten until the bolt heads break off. NOTE: Start all fasteners by hand before breaking the bolt heads off or misalignment of the steering column lock control module may occur.
2	Steering Column Lock Control Module Bolt (Qty: 2) Tighten 9.5 N.m (84 lb in)
3	Steering Column Lock Control Module Procedure After installation is complete, program and set up the steering column lock control module. Refer to <u>Control Module References</u> .

STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE REPLACEMENT

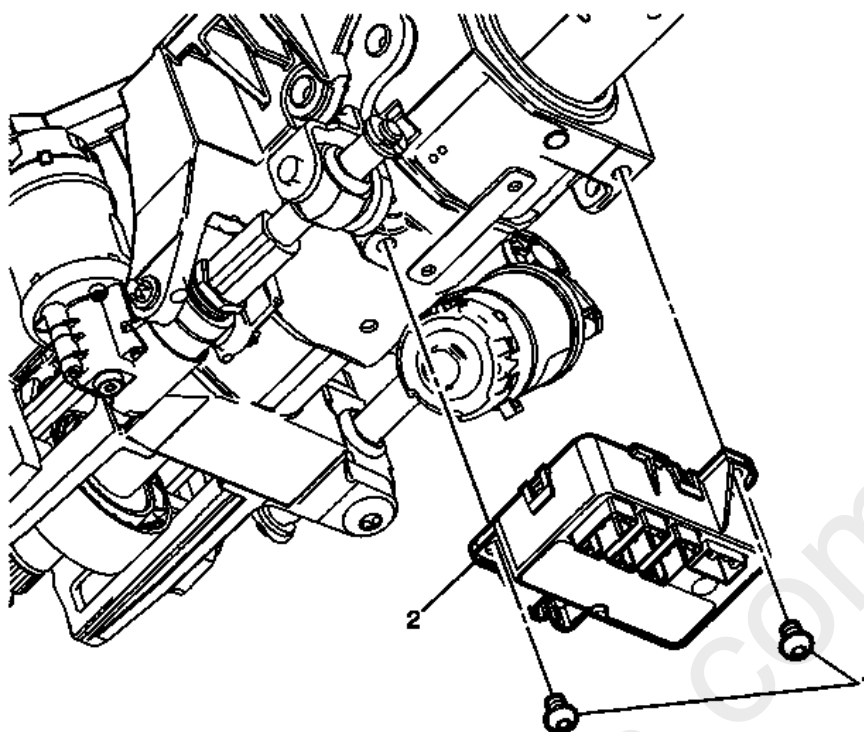


Fig. 42: Steering Column Tilt Wheel & Telescope Control Module & Bolts
 Courtesy of GENERAL MOTORS COMPANY

Steering Column Tilt Wheel and Telescope Control Module Replacement

Callout	Component Name
Preliminary Procedures 1. Remove the steering column upper and lower trim covers. Refer to <u>Steering Column Upper Trim Cover Replacement</u>, and <u>Steering Column Lower Trim Cover Replacement (With N38)</u>, <u>Steering Column Lower Trim Cover Replacement (Without N38)</u>. 2. Remove the instrument panel knee bolster. Refer to <u>Instrument Panel Knee Bolster Replacement</u>. 3. Disconnect any electrical connectors.	
1	Steering Column Tilt Wheel and Telescope Control Module Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 3 (27 lb in)
	Steering Column Tilt Wheel and Telescope Control Module Procedure After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Refer to <u>Steering Column Tilt Wheel and Telescope</u>

Control Module Learn.

2

NOTE:

In order to relearn the steering column soft and hard stops, the steering column must be mounted and fastened and the steering column upper and lower trim covers cannot be installed.

TURN SIGNAL SWITCH REPLACEMENT

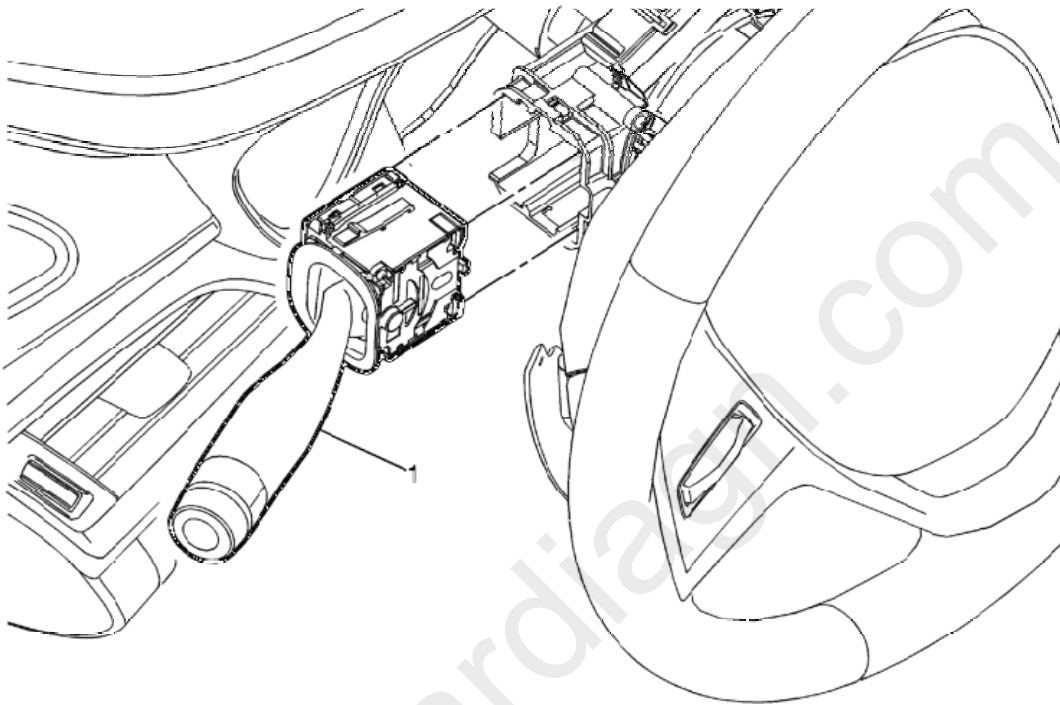


Fig. 43: Turn Signal Switch

Courtesy of GENERAL MOTORS COMPANY

Turn Signal Switch Replacement

Callout	Component Name
Preliminary Procedure Remove the steering column lower trim cover. Refer to <u>Steering Column Lower Trim Cover Replacement (With N38)</u> , <u>Steering Column Lower Trim Cover Replacement (Without N38)</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

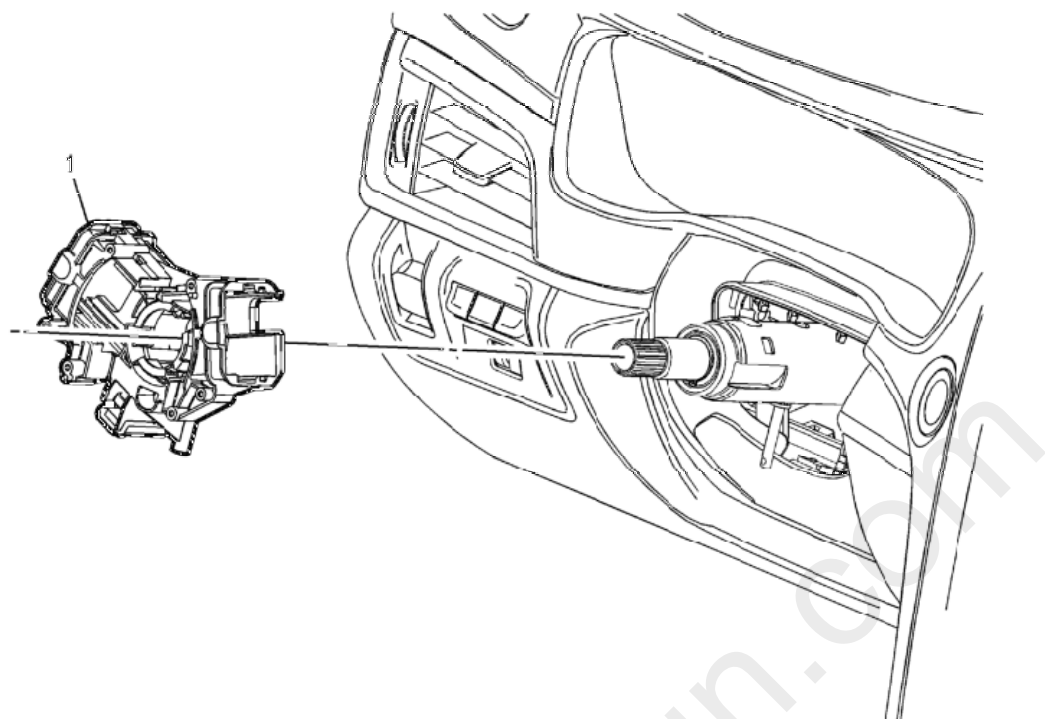


Fig. 44: Turn Signal Switch Bracket
Courtesy of GENERAL MOTORS COMPANY

Turn Signal Switch Bracket Replacement

Callout	Component Name
Preliminary Procedure	
1. Remove the steering wheel airbag coil. Refer to <u>Steering Wheel Airbag Coil Replacement</u> . 2. Remove the turn signal switch. Refer to <u>Turn Signal Switch Replacement</u>. 3. Remove the windshield wiper and washer switch. Refer to <u>Windshield Wiper and Washer Switch Replacement</u> .	
1	Turn Signal Switch Bracket Procedure Release the retaining tabs and remove the turn signal switch bracket from the steering column.

STEERING COLUMN TILT WHEEL ACTUATOR REPLACEMENT

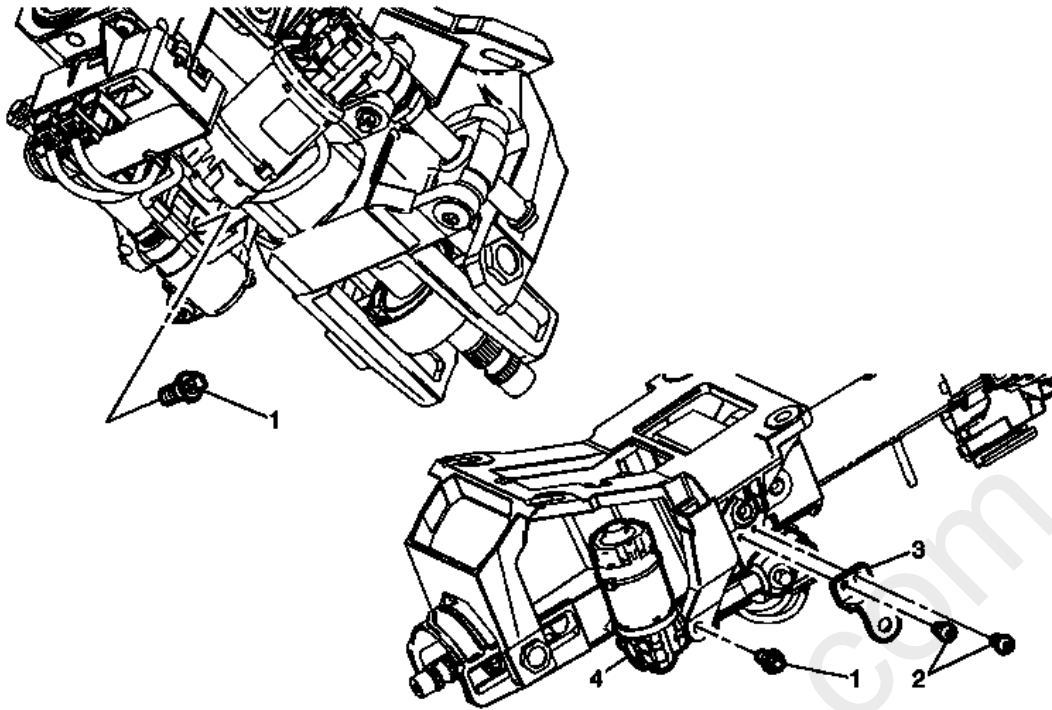


Fig. 45: Steering Column Tilt Wheel Actuator & Mounting Components
 Courtesy of GENERAL MOTORS COMPANY

Steering Column Tilt Wheel Actuator Replacement

Callout	Component Name
Preliminary Procedures	
1. Remove the steering column upper and lower trim covers. Refer to <u>Steering Column Upper Trim Cover Replacement</u>, and <u>Steering Column Lower Trim Cover Replacement (With N38)</u>, <u>Steering Column Lower Trim Cover Replacement (Without N38)</u>. 2. Remove the steering column. Refer to <u>Steering Column Replacement</u>. 3. Disconnect any electrical connectors.	
1	Steering Column Tilt Wheel Actuator Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 5 (44 lb in)
2	Steering Column Bracket Bolt (Qty: 2) Tighten 3 (27 lb in)
3	Steering Column Bracket

4

Steering Column Tilt Wheel Actuator

Procedure

After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Refer to **Steering Column Tilt Wheel and Telescope Control Module Learn**.

NOTE:

In order to relearn the steering column soft and hard stops, the steering column must be mounted and fastened and the steering column upper and lower trim covers cannot be installed until the relearn procedure is completed.

STEERING WHEEL PAD ACCESSORY WIRING HARNESS REPLACEMENT

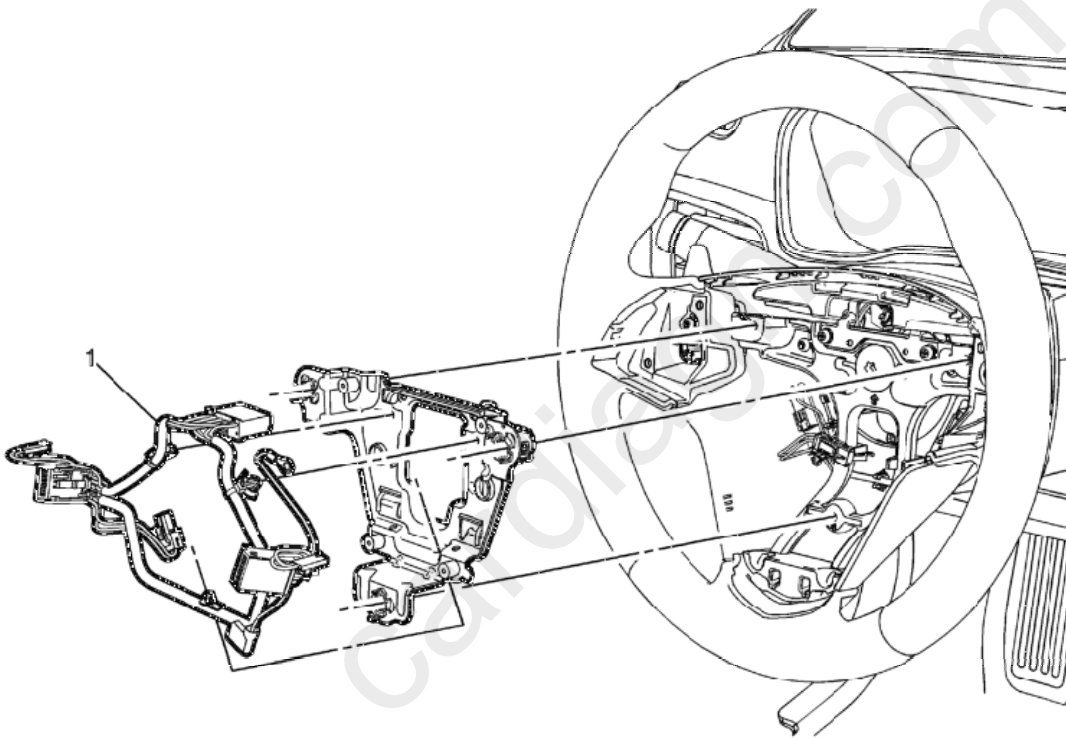


Fig. 46: Steering Wheel Pad Accessory Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

Steering Wheel Pad Accessory Wiring Harness Replacement

Callout	Component Name
Preliminary Procedure	
Remove the steering wheel horn contact. Refer to <u>Steering Wheel Horn Contact Replacement</u> .	
1	Steering Wheel Pad Accessory Wiring Harness Procedure Unclip the harness and disconnect the electrical connector.

STEERING WHEEL HEAT CONTROL MODULE REPLACEMENT

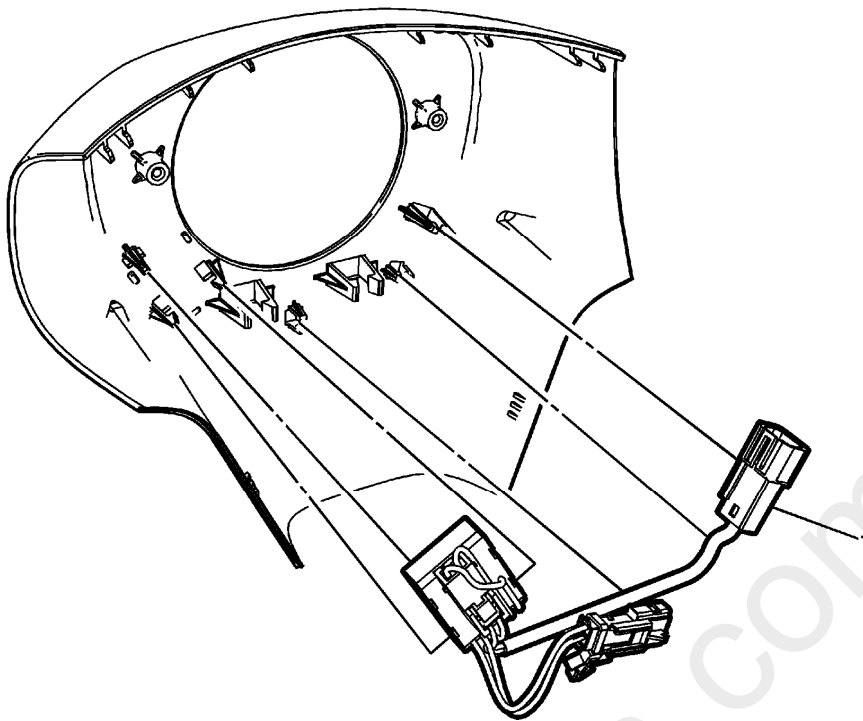


Fig. 47: Steering Wheel Heat Control Module
 Courtesy of GENERAL MOTORS COMPANY

Steering Wheel Heat Control Module Replacement

Callout	Component Name
Preliminary Procedure	
Remove the steering wheel shroud. Refer to <u>Steering Wheel Shroud Replacement</u> .	
1	Steering Wheel Heat Control Module
Procedure	
Gently remove the heat control module from the shroud tabs.	

STEERING WHEEL REPLACEMENT

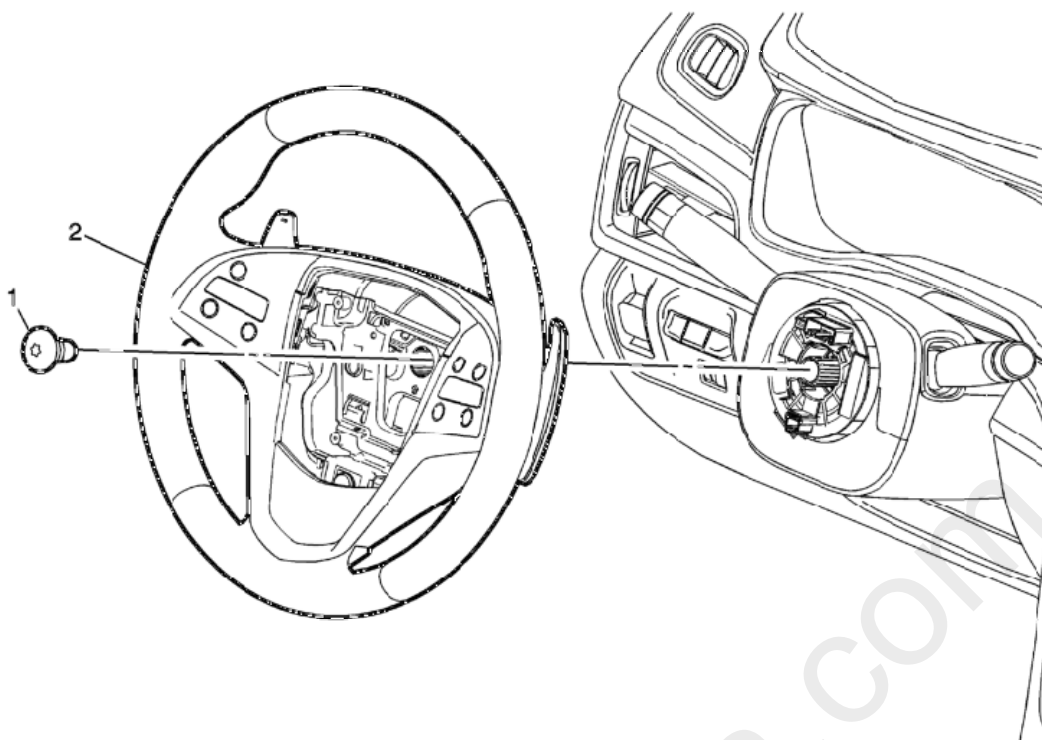


Fig. 48: Steering Wheel

Courtesy of GENERAL MOTORS COMPANY

Steering Wheel Replacement

Callout	Component Name
WARNING: When performing service on or near the SIR components or the SIR wiring, the SIR system must be disabled. Refer to SIR Disabling and Enabling . Failure to observe the correct procedure could cause deployment of the SIR components, personal injury, or unnecessary SIR system repairs.	
Preliminary Procedures Remove the steering wheel airbag. Refer to <u>Steering Wheel Airbag Replacement</u> .	
1	Steering Wheel Bolt CAUTION: Refer to <u>Fastener Caution</u> . Procedure Clean the bolt threads and apply new locking agent. Tighten 45 N.m (33 lb ft)
	Steering Wheel Procedure

2

1. Disconnect the electrical connectors.
2. Loosen the steering wheel bolt until 2 to 3 threads are left engaged.
3. Wiggle the steering wheel until the wheel disengages completely.
4. Remove the steering wheel.
5. Transfer components as necessary.

STEERING WHEEL SPOKE COVER REPLACEMENT

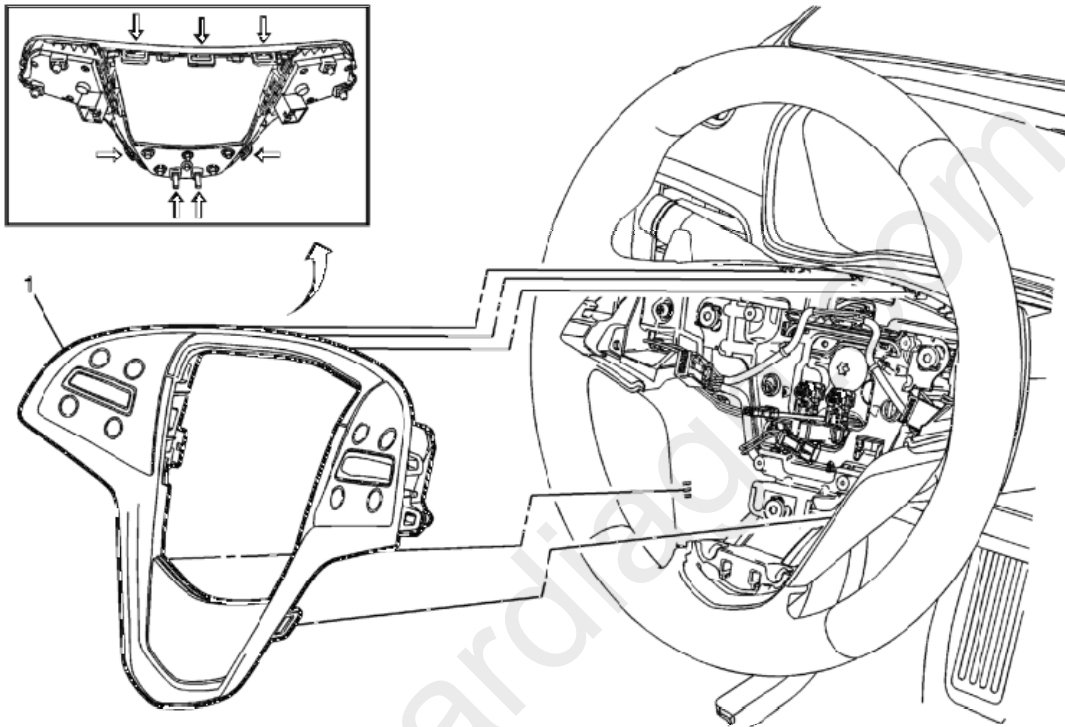


Fig. 49: Steering Wheel Spoke Cover
Courtesy of GENERAL MOTORS COMPANY

Steering Wheel Spoke Cover Replacement

Callout	Component Name
Preliminary Procedure Remove the steering wheel airbag. Refer to <u>Steering Wheel Airbag Replacement</u> .	
1	Steering Wheel Spoke Cover Procedure 1. Use the appropriate tool to release the retaining tabs on the cover. 2. Disconnect the electrical connections. 3. Transfer components as necessary.

STEERING WHEEL SHROUD REPLACEMENT

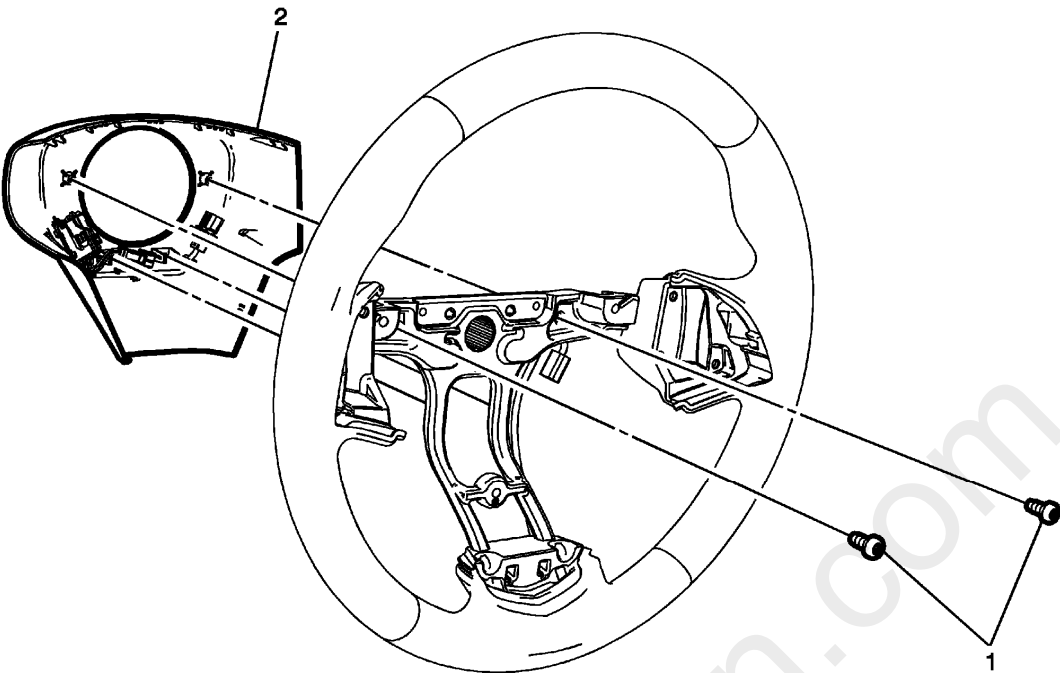


Fig. 50: Steering Wheel Shroud & Fasteners
Courtesy of GENERAL MOTORS COMPANY

Steering Wheel Shroud Replacement

Callout	Component Name
Preliminary Procedures 1. Remove the steering wheel. Refer to Steering Wheel Replacement . 2. Remove the steering wheel horn contact. Refer to Steering Wheel Horn Contact Replacement . 3. Remove the manual shift auxiliary position switches. Refer to Manual Shift Auxiliary Position Switch Replacement - Steering Wheel .	
1	Steering Wheel Fastener (Qty: 2) CAUTION: Refer to Fastener Caution .
2	Steering Wheel Shroud Procedure 1. Disconnect the electrical connectors. 2. Use extra care when removing the steering wheel back cover, push the edges of the back cover downward.

3. Transfer components as necessary.

STEERING COLUMN TELESCOPE ACTUATOR REPLACEMENT

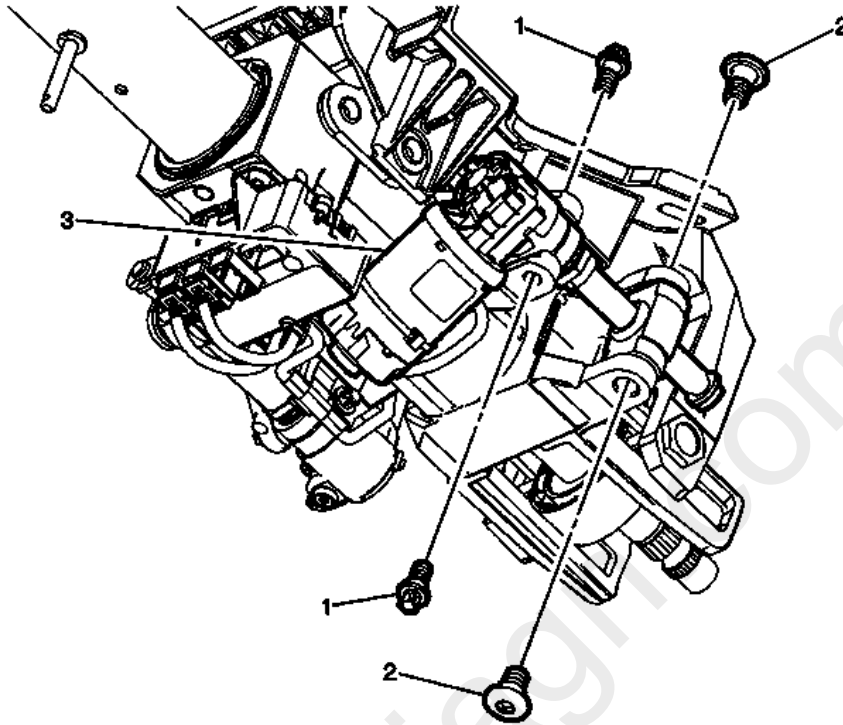


Fig. 51: Steering Column Telescope Actuator & Bolts
Courtesy of GENERAL MOTORS COMPANY

Steering Column Telescope Actuator Replacement

Callout	Component Name
Preliminary Procedures	
1. Remove the steering column upper and lower trim covers. Refer to <u>Steering Column Upper Trim Cover Replacement</u>, and <u>Steering Column Lower Trim Cover Replacement (With N38)</u>, <u>Steering Column Lower Trim Cover Replacement (Without N38)</u>. 2. Remove the steering column. Refer to <u>Steering Column Replacement</u>. 3. Disconnect any electrical connectors.	
1	Steering Column Telescope Actuator Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 5 (44 lb in)

2	Steering Column Telescope Actuator Pivot Bolt (Qty: 2) Tighten 18 (13 lb ft)
3	Steering Column Telescope Actuator Procedure After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Refer to <u>Steering Column Tilt Wheel and Telescope Control Module Learn.</u> NOTE: In order to relearn the steering column soft and hard stops, the steering column must be mounted and fastened and the steering column upper and lower trim covers cannot be installed until the relearn procedure is completed.

STEERING COLUMN TILT WHEEL AND TELESCOPE SWITCH REPLACEMENT

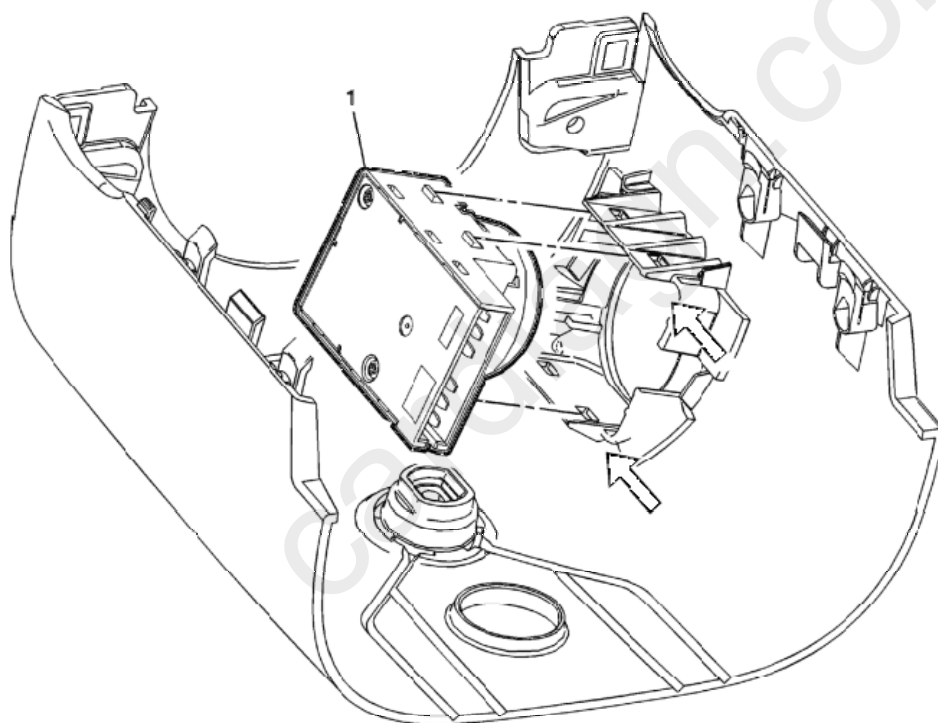


Fig. 52: Steering Column Tilt Wheel and Telescope Switch
Courtesy of GENERAL MOTORS COMPANY

Steering Column Tilt Wheel and Telescope Switch Replacement

Callout	Component Name
Preliminary Procedures	
1.	Remove the steering column upper trim cover. Refer to <u>Steering Column Upper Trim Cover Replacement.</u>

2. 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 (With N38)**, **Steering Column Lower Trim Cover Replacement (Without N38)**.

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

WARNING: Refer to **SIR Inflator Module Handling and Storage Warning** .

WARNING: Refer to **SIR Warning** .

1. Disable the supplemental inflatable restraint (SIR) system. Refer to **SIR Disabling and Enabling** .

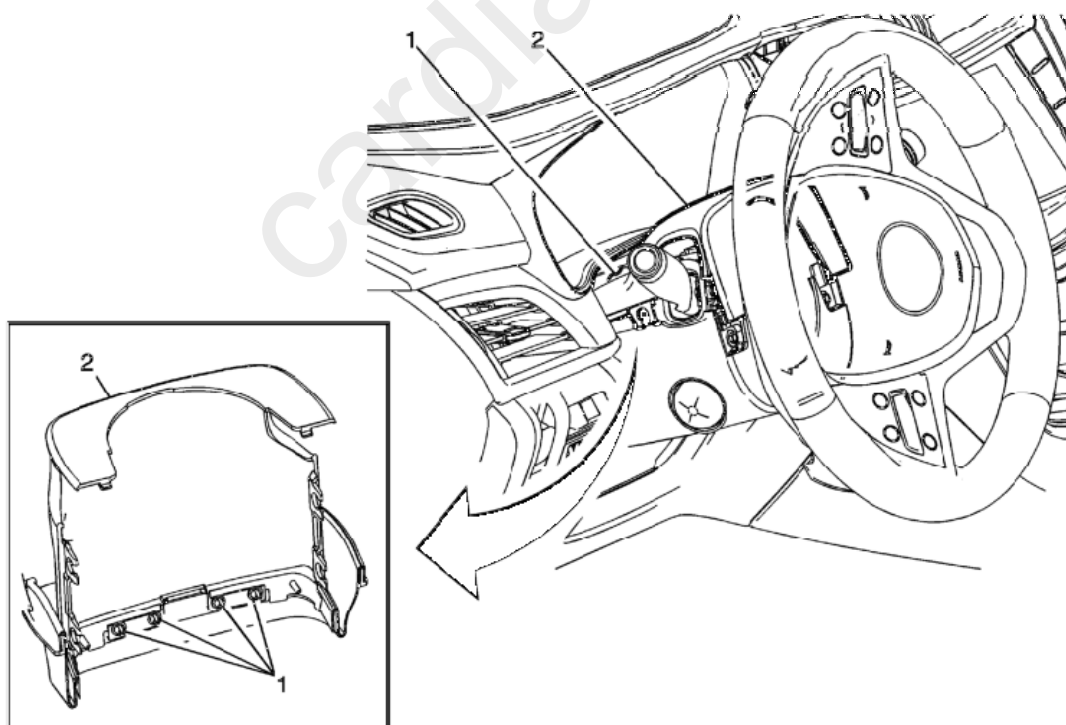


Fig. 53: Steering Column Upper Trim Cover

Courtesy of GENERAL MOTORS COMPANY

2. Remove the steering column upper trim cover (2). Refer to Steering Column Upper Trim Cover Replacement.

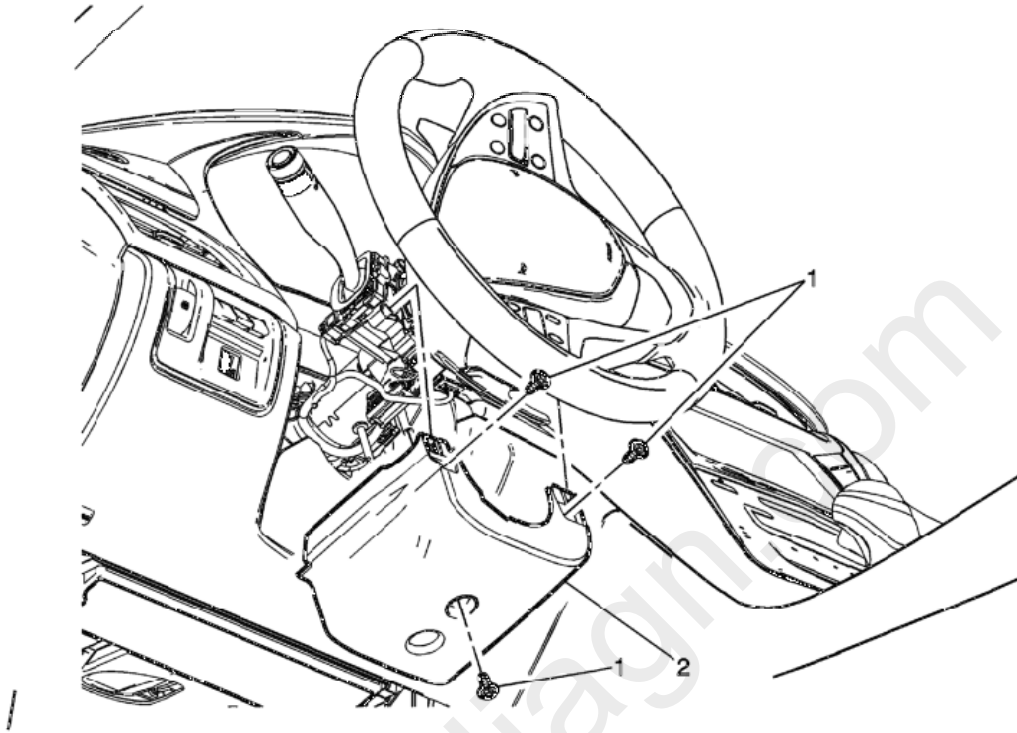


Fig. 54: Steering Column Lower Trim Cover
Courtesy of GENERAL MOTORS COMPANY

3. Remove the steering column lower trim cover (2). Refer to Steering Column Lower Trim Cover Replacement (With N38), Steering Column Lower Trim Cover Replacement (Without N38).

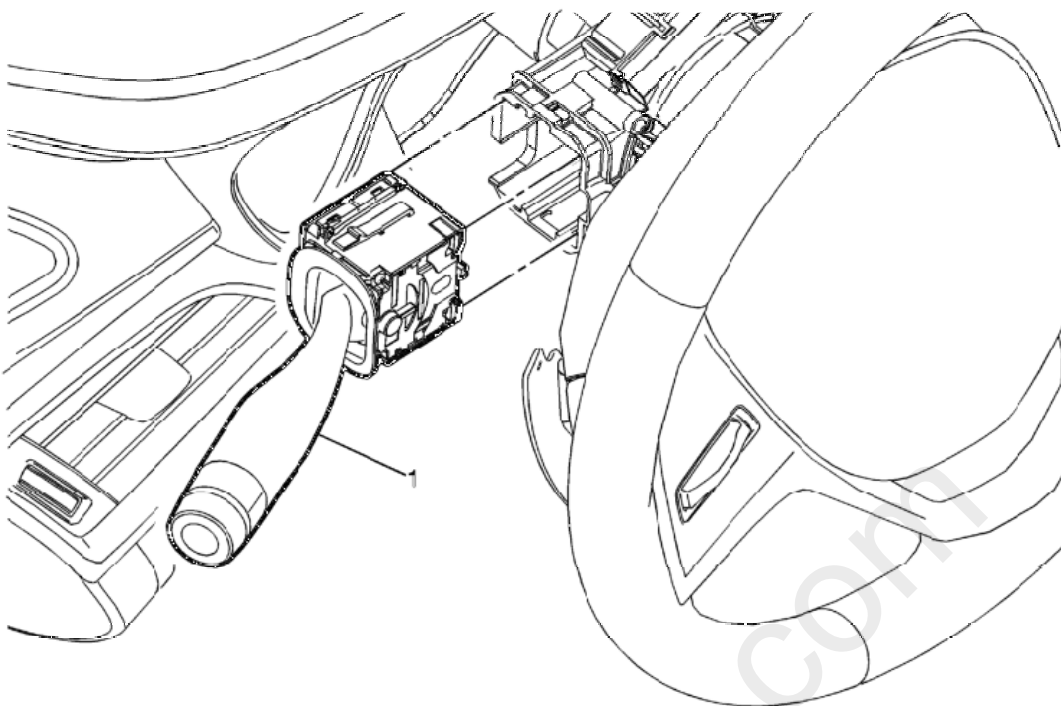


Fig. 55: Turn Signal Switch

Courtesy of GENERAL MOTORS COMPANY

4. Remove the turn signal switch (1). Refer to **Turn Signal Switch Replacement**.

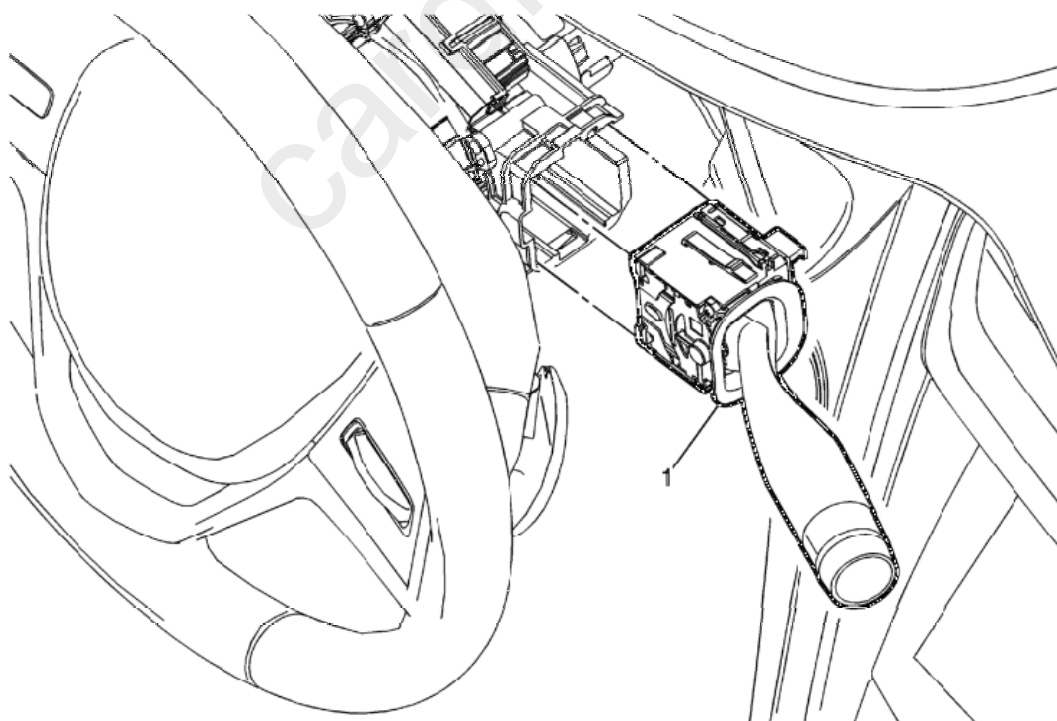


Fig. 56: Windshield Wiper And Washer Switch
Courtesy of GENERAL MOTORS COMPANY

5. Remove the windshield wiper and washer switch (1). Refer to **Windshield Wiper and Washer Switch Replacement** .

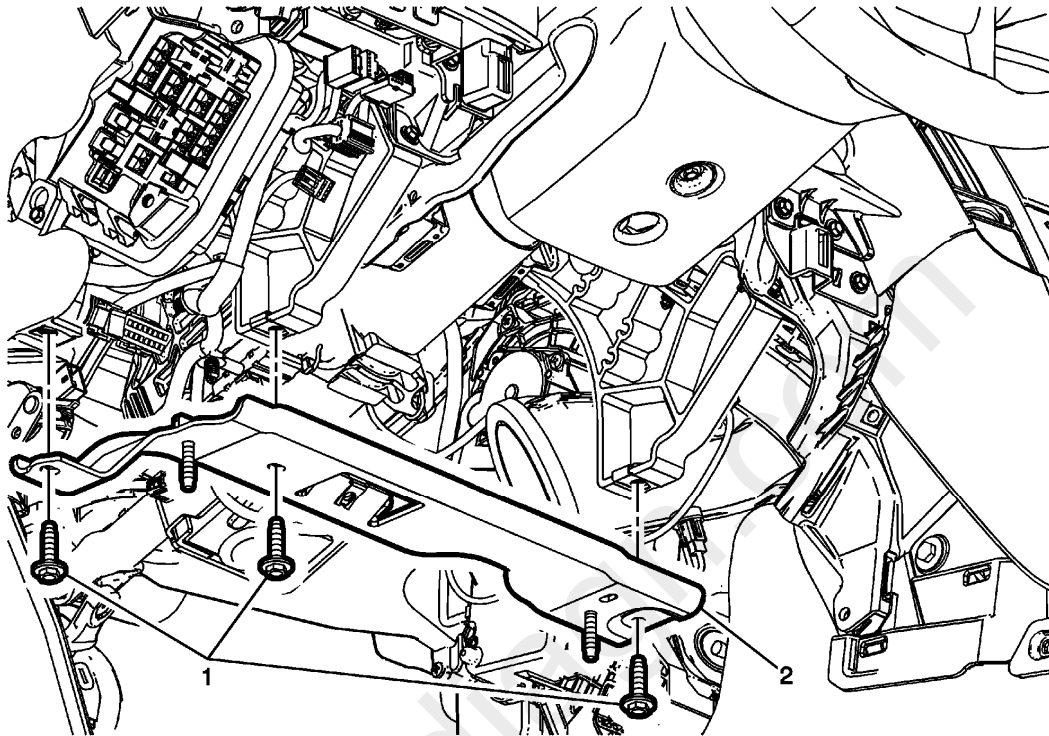


Fig. 57: Instrument Panel Knee Bolster Outer Deflector
Courtesy of GENERAL MOTORS COMPANY

6. Remove the driver knee bolster outer deflector (2). Refer to **Instrument Panel Knee Bolster Outer Deflector Replacement** .

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.

7. If replacing the steering column, verify the front wheels are in the straight ahead position and LOCK the steering column using the lock pin from the new steering column.
8. If removing and reinstalling the steering column, verify the front wheels are in the straight ahead position and SECURE the steering column as best as possible to prevent any rotation of the steering column shaft and steering wheel
9. Place match marks on the steering column shaft and the upper intermediate steering shaft.

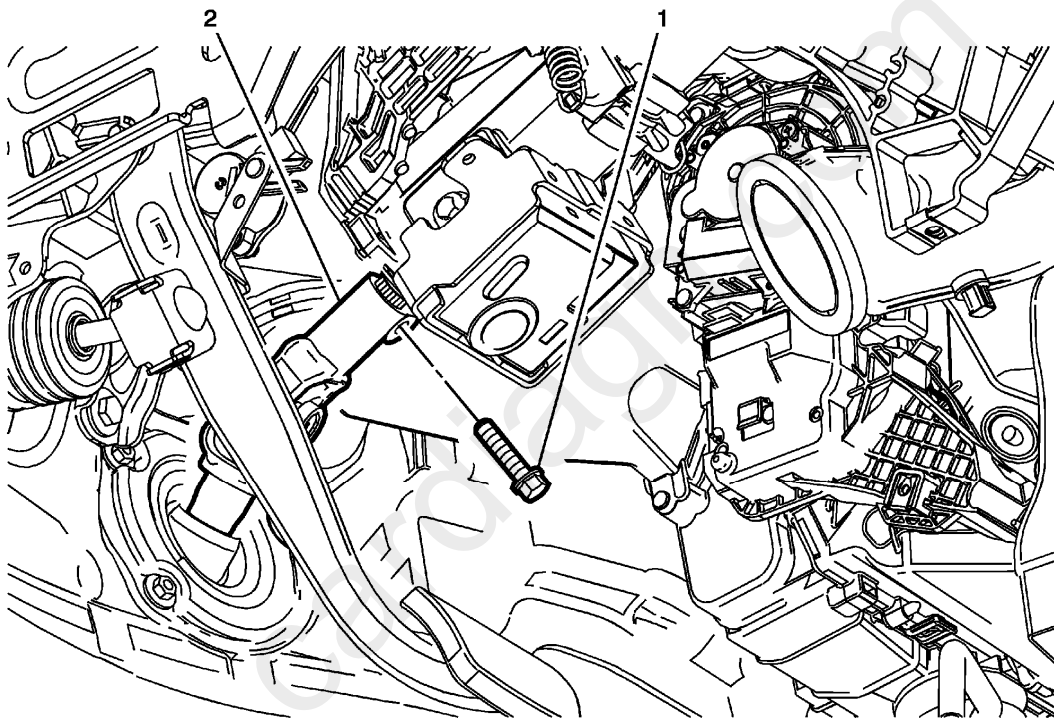


Fig. 58: Upper Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

10. Remove the upper intermediate steering shaft bolt (1).

NOTE: **The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle.**

11. Disconnect the upper intermediate steering shaft (2) from the steering column and collapse it as far as possible.
12. Disconnect all electrical connectors.

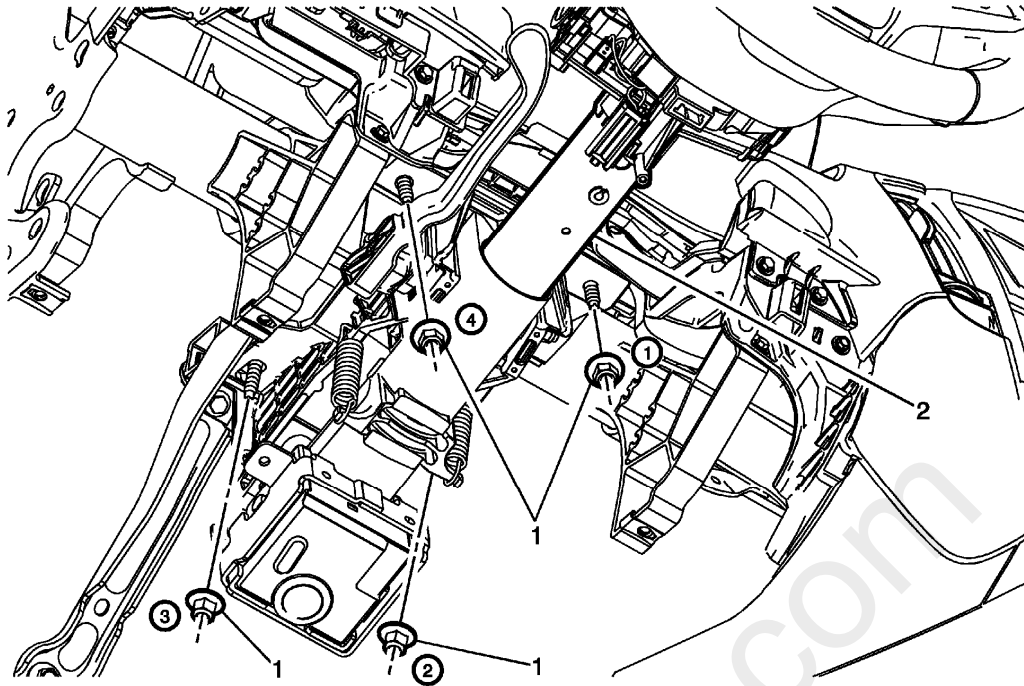


Fig. 59: Steering Column Nuts
 Courtesy of GENERAL MOTORS COMPANY

13. Remove the steering column nuts (1).

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 in this section.

14. Remove the steering column (2) from the vehicle.
15. If replacing the steering column, transfer components as necessary.
16. If replacing the steering column, copy the match marks from the old steering column to the new steering column.

Installation Procedure

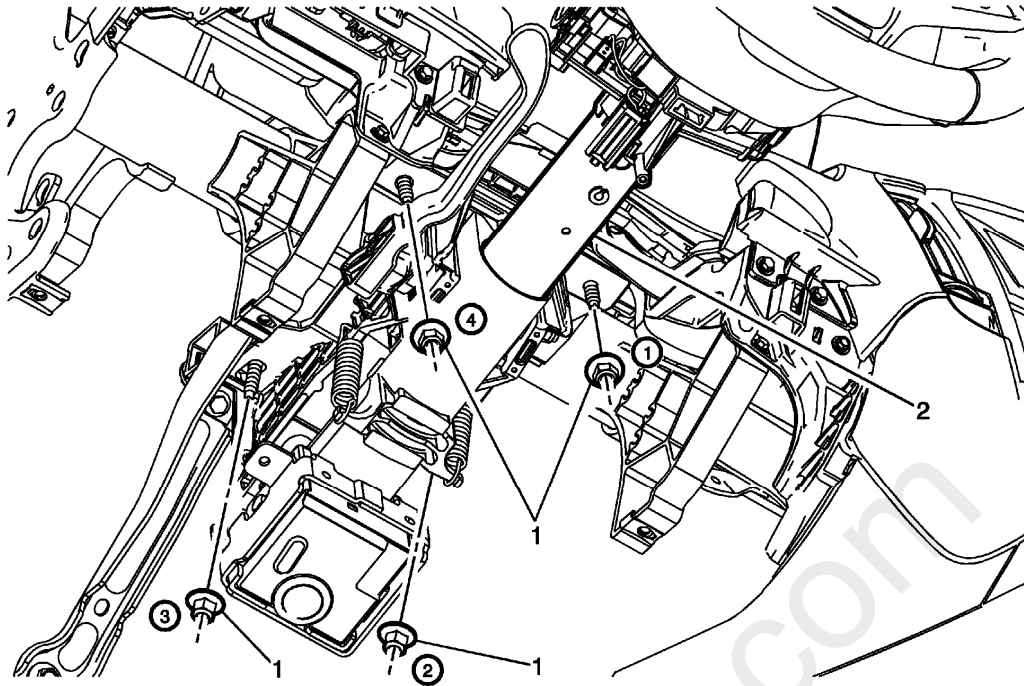


Fig. 60: Steering Column Nuts

Courtesy of GENERAL MOTORS COMPANY

NOTE: The upper intermediate steering shaft will not disengage from the steering column entirely until the steering column is removed from the vehicle. When installing the steering column, align the upper intermediate steering shaft with the steering column shaft while positioning the steering column in the vehicle.

1. Position the steering column (2) in the vehicle. Ensure the match marks on the upper intermediate steering shaft and steering column are aligned.

CAUTION: Refer to Fastener Caution .

2. Install the steering column nuts (1) and tighten in the sequence shown to 22 N.m (16 lb ft).
3. Connect all electrical connectors.

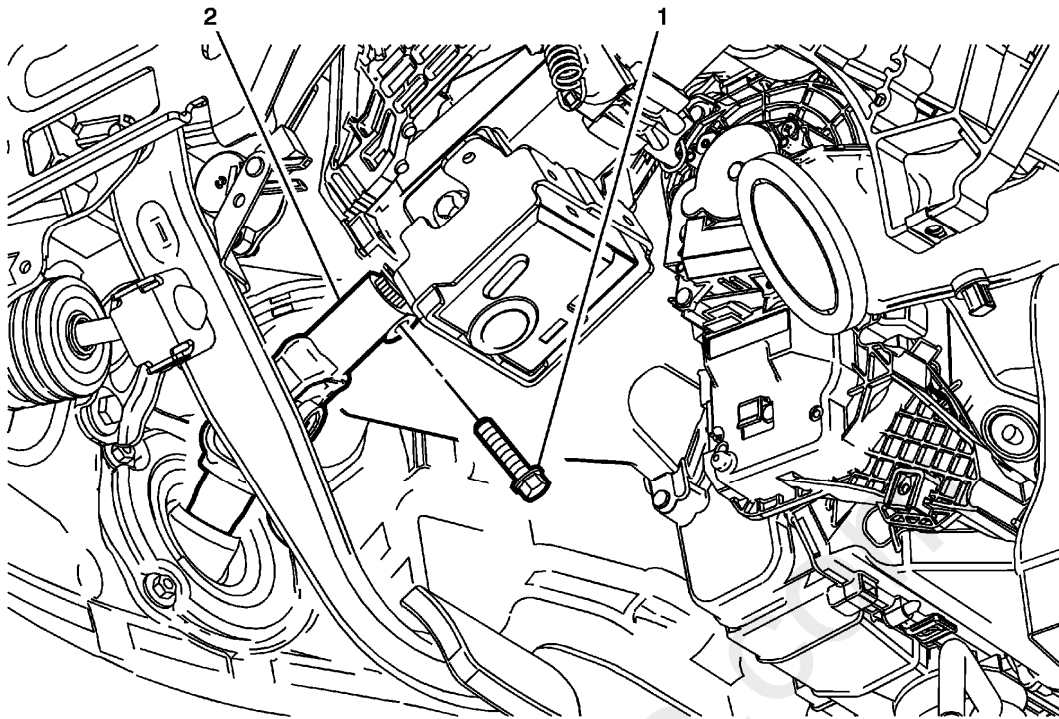


Fig. 61: Upper Intermediate Steering Shaft Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Fully connect the upper intermediate steering shaft (2) to the steering column.
5. Before continuing, ensure the bearings in the intermediate steering shaft boots are positioned correctly and moving freely.
6. Clean the threads of the upper intermediate steering shaft bolt (1) and apply NEW thread locking adhesive.
7. If equipped with ULS, install the upper intermediate steering shaft bolt (1) and tighten to 30 N.m (22 lb ft).
8. If not equipped with ULS, install the upper intermediate steering shaft bolt (1) and tighten to 20 N.m (15 lb ft).
9. Release the steering wheel from the method that was used to minimize movement.

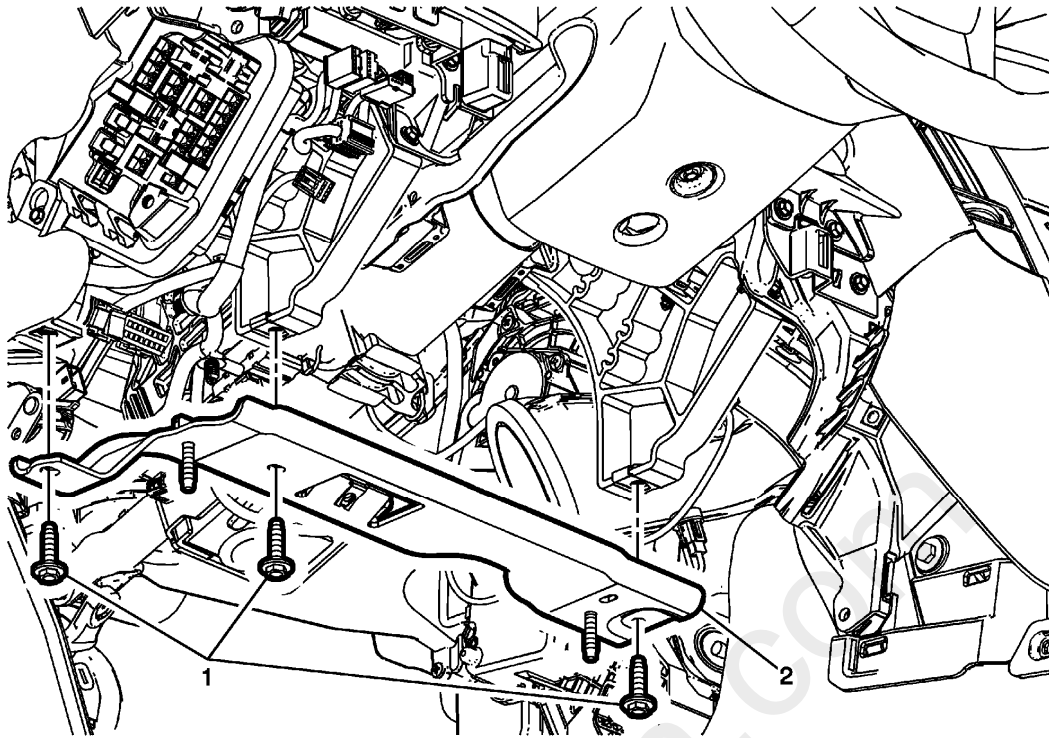


Fig. 62: Instrument Panel Knee Bolster Outer Deflector
Courtesy of GENERAL MOTORS COMPANY

10. Install the driver knee bolster outer deflector (2). Refer to **Instrument Panel Knee Bolster Outer Deflector Replacement** .

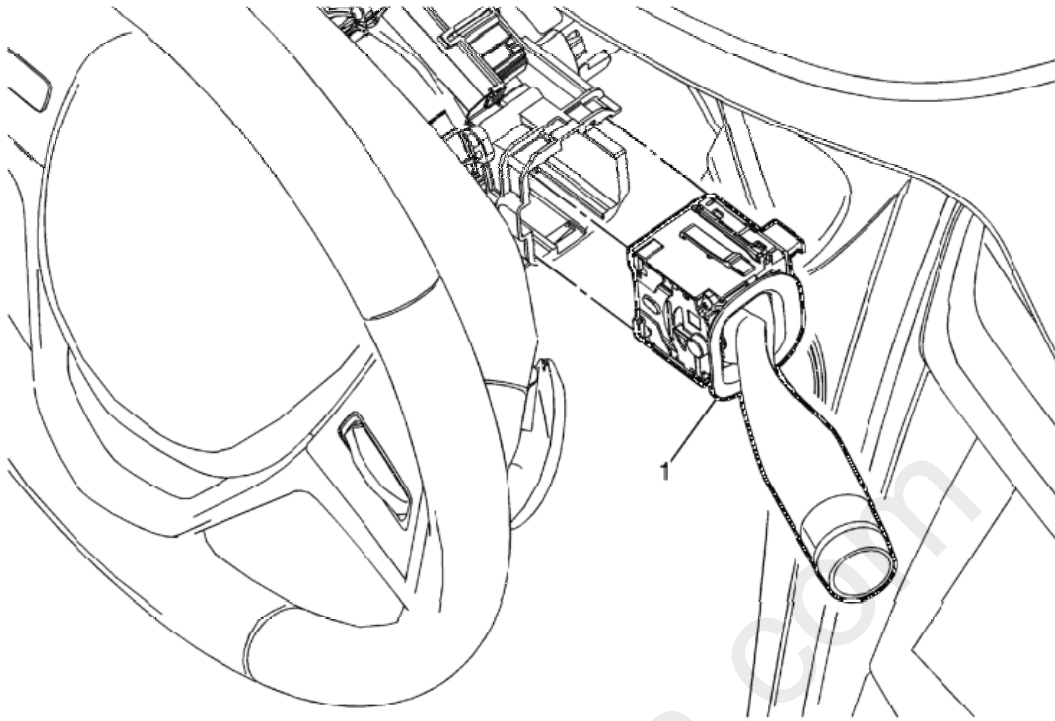


Fig. 63: Windshield Wiper And Washer Switch
Courtesy of GENERAL MOTORS COMPANY

11. Install the windshield wiper and washer switch (1). Refer to **Windshield Wiper and Washer Switch Replacement** .

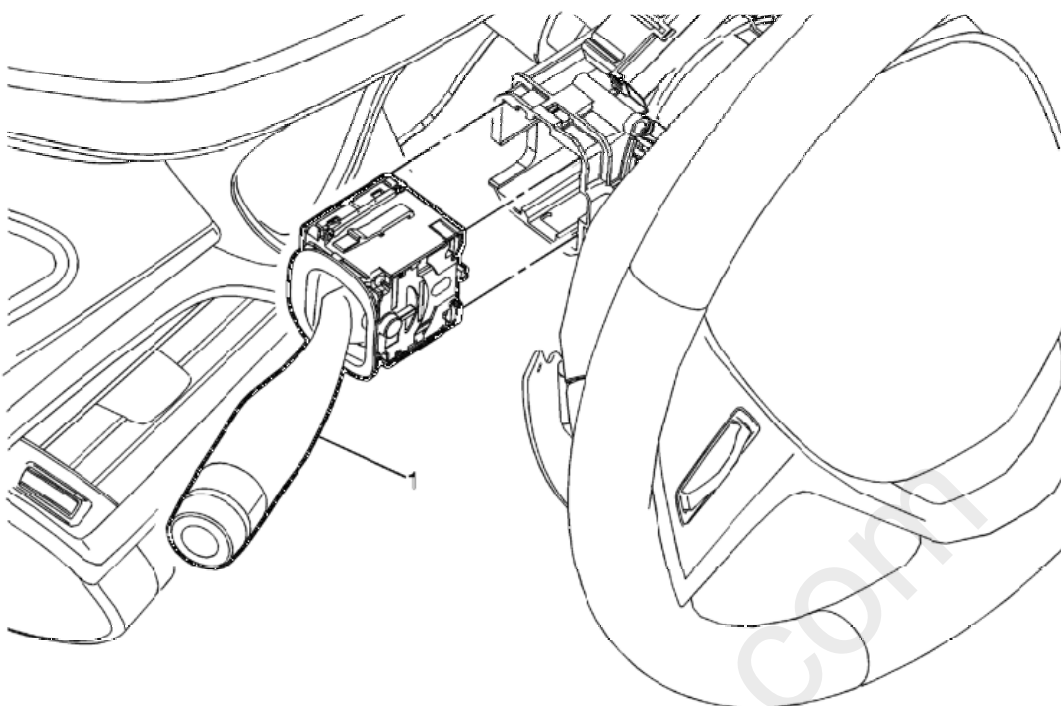


Fig. 64: Turn Signal Switch

Courtesy of GENERAL MOTORS COMPANY

12. Install the turn signal switch (1). Refer to **Turn Signal Switch Replacement**.

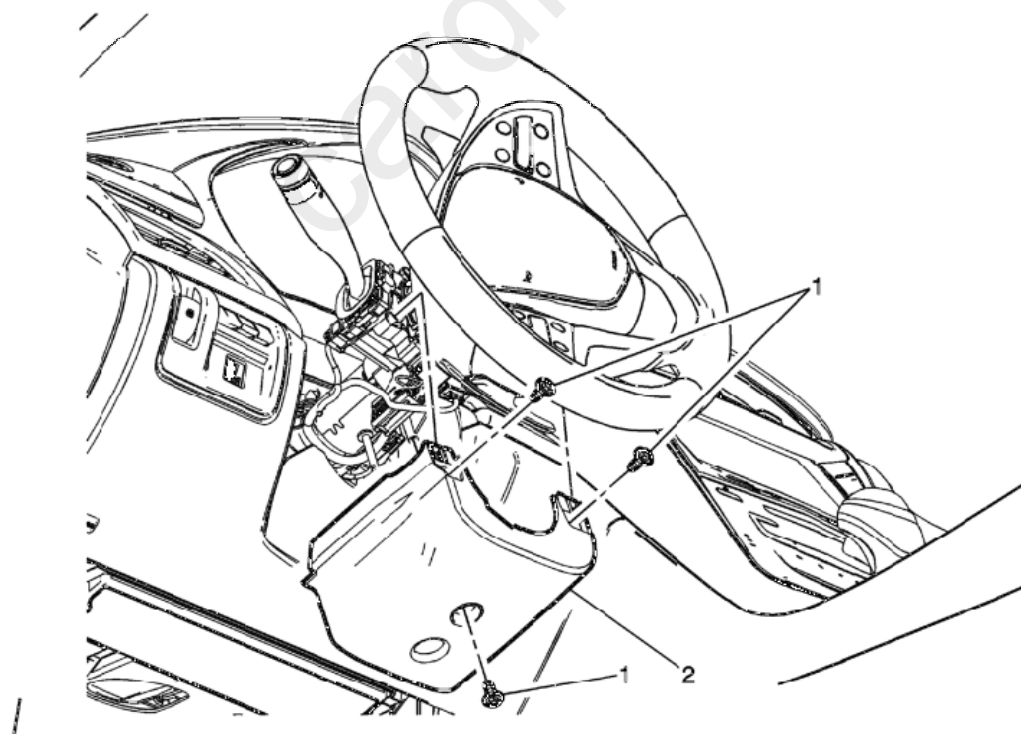


Fig. 65: Steering Column Lower Trim Cover
Courtesy of GENERAL MOTORS COMPANY

13. Install the steering column lower trim cover (2). Refer to **Steering Column Lower Trim Cover Replacement (With N38)**, **Steering Column Lower Trim Cover Replacement (Without N38)**.

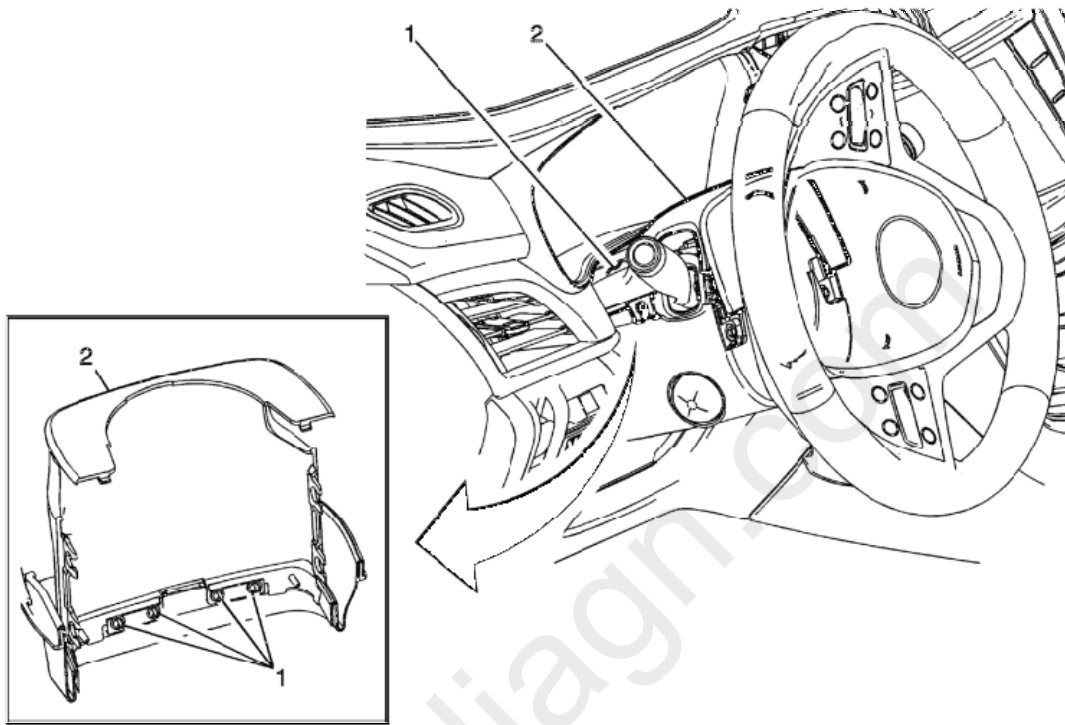


Fig. 66: Steering Column Upper Trim Cover
Courtesy of GENERAL MOTORS COMPANY

14. Install the steering column upper trim cover (2). Refer to **Steering Column Upper Trim Cover Replacement**.
15. Enable the supplemental inflatable restraint (SIR) system. Refer to **SIR Disabling and Enabling**.
16. If equipped with ULS, program and set up the steering column lock control module. Refer to **Control Module References**.
17. Center the steering angle sensor. Refer to **Steering 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 the following components are replaced:

- Steering Column Tilt Wheel and Telescope Control Module
- Steering Column Tilt Motor
- Steering Column Telescope Motor

The Steering Column Tilt Wheel and Telescope Control Module Learn procedure can be completed without a scan tool using the following steps:

1. Ignition ON, engine OFF.

NOTE: To perform the learn procedure, the directional order does not require a specific sequence. Reaching the mechanical hard stop of each direction is the only requirement.

2. Using the steering column tilt and telescope switch, actuate the column to each mechanical hard stop in each direction listed below;
 - Tilt column full up
 - Tilt column full down
 - Telescope column full forward
 - Telescope column full rearward
3. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.

DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION (N37)

The steering wheel and column has 4 primary functions:

- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Vehicle Steering

The steering wheel is the first link between the driver and the vehicle. The steering wheel is fastened to a steering shaft within the column. At the lower end of the column, the intermediate shaft connects the column to the steering gear.

The steering column can be adjusted vertically and longitudinally

Vehicle Security

Theft deterrent components are mounted and designed into the steering column. The following components allow the column to be locked in order to minimize theft:

- The ignition switch
- The steering column lock

- The ignition cylinder
- The theft deterrent immobilizer module, if equipped

Driver Convenience

The steering wheel and column may also have driver controls attached for convenience and comfort. The following controls may be mounted on the steering wheel or column.

- The turn signal switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad
- The redundant radio/entertainment system controls
- The tilt functions
- The telephone system controls
- The DIC controls
- The cruise control functions
- The automatic transmission manual setting function

Steering Column Lock

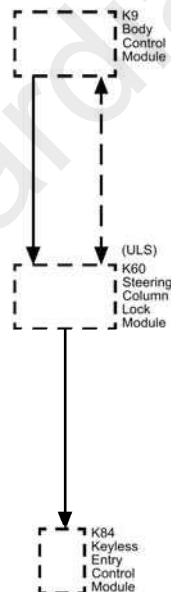


Fig. 67: Steering Column Lock Schematic Graph
 Courtesy of GENERAL MOTORS COMPANY

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.

Heated Steering Wheel

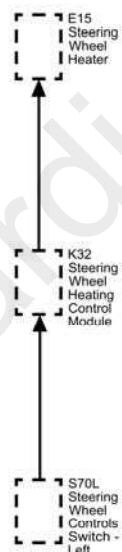


Fig. 68: Heated Steering Wheel Schematic Graph
Courtesy of GENERAL MOTORS COMPANY

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 a non-serviceable heating element and

temperature sensor, which both are located in the rim of the steering wheel. The heated steering wheel on/off switch is located in the instrumentation panel. The steering wheel heat module is located on the front-side of the steering wheel center hub.

When the on/off switch is depressed, a signal is sent to the heat module to command the heated steering wheel to heat up until either the normal operating temperature reaches the limit of 32°C +/- 2.5°C (90°F +/- 4°F) or the customer turns it off via the heated steering wheel switch. The built-in temperature sensor provides input to the controller to limit the temperature of the heated wheel to the normal operating temperature. The heated steering wheel system will also cease to operate if the vehicle temperature is at or above 32°C (89.6°F). The heated steering wheel takes approximately 3 to 4 minutes to reach the normal operating temperature and will take longer to heat up if the vehicle temperature is below -20°C (-4°F).

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.

SIR Coil and Module: For additional information on the operation of the SIR coil and module, refer to **Supplemental Inflatable Restraint System Description and Operation** .

Electronic Park Lock (EPL)/Ignition Lock Cylinder Control Actuator: If the vehicle is equipped with automatic transmission and a floor mounted console gear shift, it has an ignition lock cylinder control actuator system in the steering column. The ignition lock cylinder control actuator purpose is to prevent the ignition key from being turned to the OFF position when the transmission is in any position other than PARK and the vehicle may still be moving. The column ignition lock system consists of an ignition lock cylinder control actuator, and a park position switch that is located in the automatic transmission shift lock control switch. The ignition lock cylinder control actuator contains a pin that is spring loaded to mechanically prevent the ignition key cylinder from being turned to the lock position when the vehicle transmission is not in the PARK position. If vehicle power is lost, and/or the transmission is not in the PARK position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column.

Depending on the implementation, logic might be inverted: Key can be removed by power off.

Steering Wheel Angle Sensor: The steering wheel angle sensor is located somewhere along the steering shaft assembly. The sensor measures the position of the steering wheel and the speed at which it is rotated. A signal representing this measurement is provided to the vehicle stability enhancement system (VSES) in the ABS module and to the variable effort steering (VES) system.

The theft deterrent immobilizer module: The immobilizer module is mounted in the steering column lock on cars without Passive Entry Passive Start system (PEPS). Refer to **Theft Systems Description and Operation** .

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION (N38)

Steering Column Lock

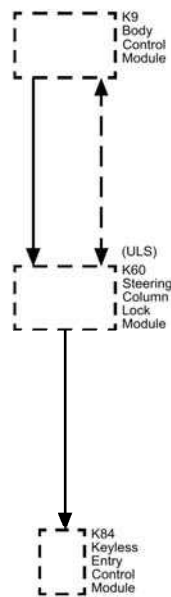


Fig. 69: Steering Column Lock Schematic Graph
 Courtesy of GENERAL MOTORS COMPANY

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.

Tilt/Telescoping Description

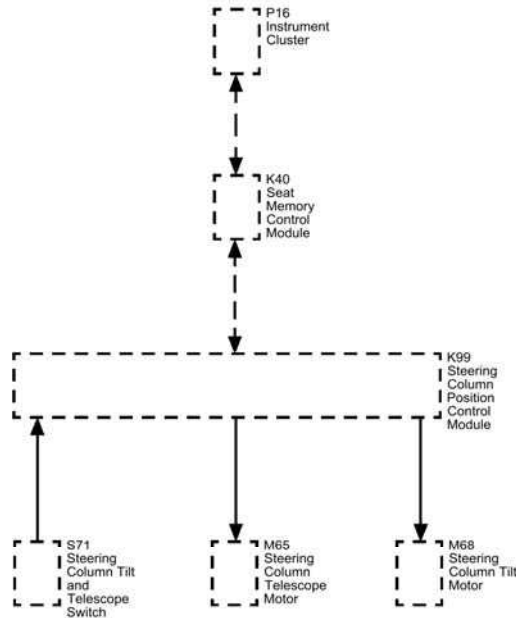


Fig. 70: Tilt/Telescoping Schematic Graph
 Courtesy of GENERAL MOTORS COMPANY

The steering column has a tilt/telescoping control system that consists of an electronic control module capable of LIN message communication, a steering column power assembly with positioning motors and sensors, and a steering column control switch.

Column Position Module has two versions of operation:

1. N38 - Power Steering Column-Tilt/Telescope, and A45 - Memory Seats

The column position module will wake up either by the LIN bus or by the tilt/telescope steering column switch. The memory seat module is the master and column position module is the slave. All DTCs and the data from column position module are reported through the LIN bus and stored in the memory seat module.

2. N38 - Power Steering Column-Tilt/Telescope Only

The column position module will wake up with the tilt/telescope steering column switch. No DTCs or data is available. Vehicle symptoms will cause the customer to bring the vehicle in for service.

Tilt/Telescoping Switch Operation

The tilt/telescope steering column has a four-position switch. The switch may be used to adjust the position of the steering wheel in or out which is telescope and up or down which is tilt. The position of the column may be

changed as follows:

- Press the switch up to tilt the column up.
- Press the switch down to tilt the column down.
- Press the switch forward and the column moves toward the front of the vehicle.
- Press the switch rearward and the column moves toward the rear of the vehicle.

Motors

Both the tilt and telescoping motors are reversible. For example, the tilt motor moves the column both up and down. When the column position module receives an input to move the column up, the column position module supplies battery positive voltage and ground to the tilt motor in order to move the column up. When the column position module receives a column down input, the column position module supplies battery positive voltage and ground to the same motor, but with reverse polarity. When the voltage polarity is reversed, the motor runs in the opposite direction and moves the column down.

Position Sensors with A45 Memory Seats

Two position sensors are Hall Effect sensors and are used by the column position module. The column position 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. When the motor rotates, the voltage of the sensor varies on the scan tool. The column position module monitors the feedback voltage to determine the column position.

Without the A45 Memory Seat option, scan tool data is not available.

Tilt/Telescoping Memory with A45 Memory Seats

Memory settings and the personalization of steering wheel positions are available with the tilt/telescoping steering column only with the A45 Memory Seat option. The data stored consists of entry positions and exit positions. The entry position is the position that the steering column moves in when the ignition is turned ON. The exit position is the direction that the steering column moves in when the ignition is turned OFF and the driver's door is opened. The memory seat module stores memory positions and commands column position module to move motors to specific positions through a LIN message.

An initial memory setting is set in the memory seat module at the assembly plant. This setting may be changed by the customer at any time.

Without the A45 Memory Seat option, memory settings, personalization, and the entry and exit function is not available.

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

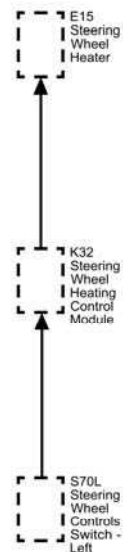


Fig. 71: Heated Steering Wheel Schematic Graph
Courtesy of GENERAL MOTORS COMPANY

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).