

2018 STEERING

Steering Wheel And Column - Traverse

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Intermediate Steering Shaft Lower Bolt	55 N.m (41 lb ft)
Intermediate Steering Shaft Upper Bolt	42 N.m (31 lb ft)
Steering Column Lock Control Module Bolt-Rear	9.5 N.m (7 lb ft)
Steering Column Lock Control Module Bolt-Side	9.5 N.m (7 lb ft)
Steering Column Tilt Wheel and Telescope Control Module Bolt	3 N.m (2 lb ft)
Steering Column Nut	22 N.m (16 lb ft)
Steering Column Tilt Wheel Position Sensor Bolt	0.5 N.m (4 lb in)
Steering Wheel Bolt	45 N.m (33 lb ft)
Steering Wheel Shroud Bolt	2.5 N.m (22 lb in)
Turn Signal Switch Bracket Bolt	9 N.m (80 lb in)

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

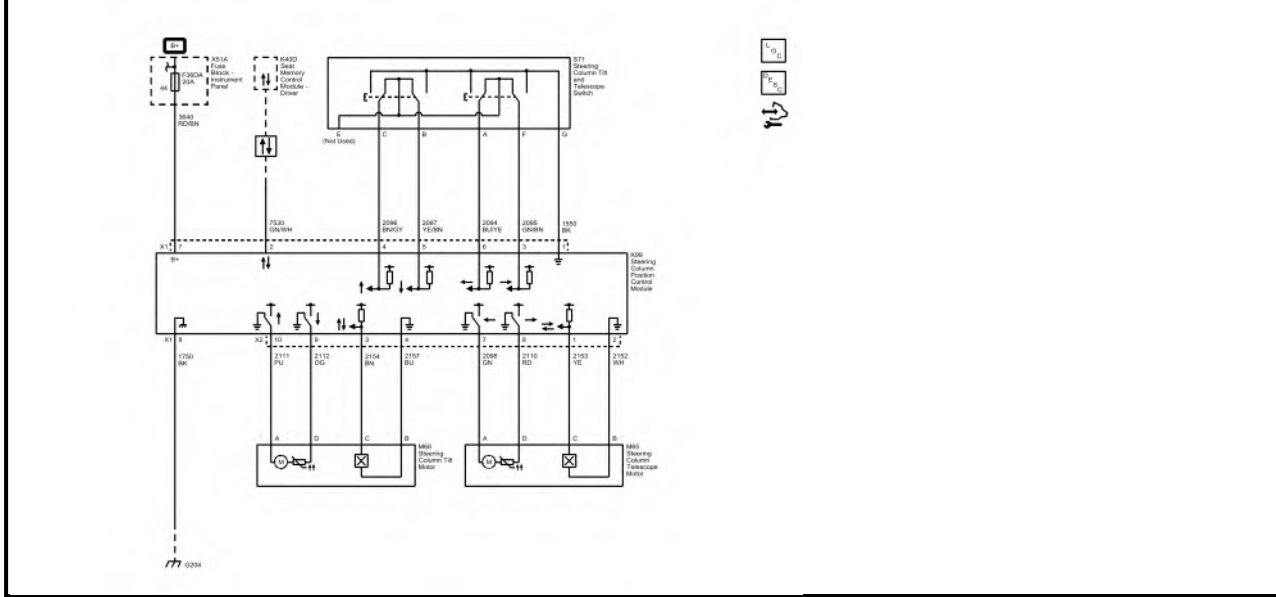
Application	Type of Material	GM Part Number	
		United States	Canada
Intermediate Steering Shaft Lower Bolt	Thread Locking Adhesive	12345382	10953489
Intermediate Steering Shaft Upper Bolt	Thread Locking Adhesive	12345382	10953489
Steering Wheel Bolt	Thread Locking Adhesive	12345382	10953489

SCHEMATIC WIRING DIAGRAMS

STEERING WHEEL WIRING SCHEMATICS

Heated Steering Wheel (X88+UVD)





DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B1023

Diagnostic Instructions

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

DTC Descriptor

DTC B1023

Integral Switch

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

Circuit/System Description

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Conditions for Running the DTC

System Voltage = 9 to 16 V

Conditions for Setting the DTC

Steering Column Lock Status Signal = Invalid

Actions Taken When the DTC Sets

- P9 Driver Information Center Display = Service Column Lock
- Steering Column Lock Indicator = On

Conditions for Clearing the DTC

- Steering Column Lock Status Signal = Valid
- The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

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

[Control Module References](#)

[Circuit/System Verification](#)

1. Ignition - On/Vehicle - In Service Mode
2. Clear the DTCs.
3. Operate the vehicle within the Conditions for Running the DTC. Verify DTC B1023 is not set.
 - **If the DTC is set**

Replace the component: K60 Steering Column Lock Module
 - **Go to next step: If the DTC is not set**
4. All OK.

[Repair Instructions](#)

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

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

DTC B144C

[Diagnostic Instructions](#)

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

[DTC Descriptor](#)

DTC B144C

Inverted Run/Crank Power Relay Circuit

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

[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](#)

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Circuit	Description
Ignition	Supplied from a fuse.

Component	Description
K60 Steering Column Lock Module	Vehicles with keyless entry system have an electric motor to lock the steering column when the engine is turned off and the doors are locked.

Conditions for Running the DTC

- System Voltage = 9 to 16 V
- K60 Steering Column Lock Module = Awake

Conditions for Setting the DTC

DTC B144C 01

K60 Steering Column Lock Module = Short to Voltage - Ignition = Run/Crank

DTC B144C 06

K60 Steering Column Lock Module = Open/Short to Ground - Ignition = Off/Accessory

Actions Taken When the DTC Sets

- Warning Message = Service Column Lock
- Steering Column Lock Indicator = On

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- K60 Steering Column Lock Module = BCM Password - Correct
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Diagnostic Aids

Reference Information

Schematic Reference

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

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify DTC B144B is not set.

- **If DTC B144B is set**

Refer to: [DTC B144B](#)

- **Go to next step: If the DTC is not set**

3. Refer to: Circuit/System Testing

Circuit/System Testing

DTC B144C 01

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: K60 Steering Column Lock Module
3. Ignition - On/Vehicle - In Service Mode
4. Test for less than 1 V between the test points: Ignition circuit terminal 3 & Ground
 - **If 1 V or greater**

Repair the short to voltage on the circuit:

- **Go to next step: If less than 1 V**

5. Replace the component: K60 Steering Column Lock Module

DTC B144C 06

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: K60 Steering Column Lock Module
3. Verify a test lamp turns On between the test points: Ignition circuit terminal 3 & Ground
 - **If the test lamp does not turn On and the circuit fuse is OK**
 1. Ignition/Vehicle - Off & Remove - Test lamp
 2. Test for less than 2 ohms between the test points: Ignition circuit terminal 3 & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Refer to: [Power Mode Mismatch](#)
 - **If the test lamp does not turn On and the circuit fuse is open**
 1. Ignition/Vehicle - Off & Remove - Test lamp
 2. Test for infinite resistance between the test points: Ignition circuit terminal 3 & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: K60 Steering Column Lock Module
 - **Go to next step: If the test lamp turns On**
4. Replace the component: K60 Steering Column Lock Module

Repair Instructions

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

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

DTC B2515

Diagnostic Instructions

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

DTC Descriptor

Steering Column Lock Motor Feedback Circuit - Not Plausible**Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B2515 5A	B2515 5A	B2515 5A	-

Circuit/System Description

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Circuit	Description
Signal	The signal circuit is connected to the following control module: K9 Body Control Module

Component	Description
K60 Steering Column Lock Module	Vehicles with keyless entry system have an electric motor to lock the steering column when the engine is turned off and the doors are locked.

Conditions for Running the DTC

System Voltage = 9 to 16 V

Conditions for Setting the DTC

Steering Column Lock Motor Feedback Circuit = Not Plausible @ K9 Body Control Module

Actions Taken When the DTC Sets

- Warning Message = Service Column Lock
- Steering Column Lock Indicator = On

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Column Lock Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode - Clear All Vehicle DTCs
2. Operate the vehicle within the Conditions for Running the DTC.
3. Verify the DTC does not set.

- **If the DTC sets**

Refer to: Circuit/System Testing

- **Go to next step: If the DTC is not set**

4. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: K60 Steering Column Lock Module
3. Test for less than 3 V between the test points: Control circuit terminal 2 & Ground

- **If 3 V or greater**

1. Disconnect the electrical connector: X1 @ K9 Body Control Module
2. Verify the vehicle is equipped as specified: BTM

- **If equipped as specified**

Refer to: Step 3.3

- **Go to next step: If not equipped as specified**

Go to next step: Refer to: Step 3.5

NOTE:

For the next measurement, the vehicle needs to be On, but that is no longer possible when the harness connector X1 is removed from the control module K9.

3. Remove the terminal from the connector: 18 X1
4. Connect the electrical connector: X1
5. Ignition - On/Vehicle - In Service Mode
6. Test for less than 3 V between the test points: Control circuit terminal 2 & Ground
 - If 3 V or greater - Repair the short to voltage on the circuit.
 - If less than 3 V - Replace the component: K9 Body Control Module
- **Go to next step: If less than 3 V**
4. Ignition - On/Vehicle - In Service Mode
5. Test for battery voltage between the test points: Control circuit terminal 2 & Ground
 - **If less than battery voltage**
 1. Disconnect the electrical connector: K9 Body Control Module
 2. Test for infinite resistance between the test points: Signal circuit terminal 2 & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - Go to next step: If infinite resistance
 3. Test for less than 2 ohms between the test points: Signal circuit terminal 2 & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - Go to next step: If less than 2 ohms
 4. Replace the component: K9 Body Control Module
 - **Go to next step: If battery voltage**
6. Replace the component: K60 Steering Column Lock Module

Repair Instructions

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

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

DTC B285A

Diagnostic Instructions

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

DTC Descriptors

DTC B285A 39

Steering Column Position Module Internal Malfunction

DTC B285A 4B

Steering Column Position Module Calibration Not Learned

Diagnostic Fault Information

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

Circuit/System Description

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

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

Each sensor is part of the motor assembly. The steering column position control module monitors the feedback voltage to determine the column position.

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

Conditions for Running the DTC

None

Conditions for Setting the DTC

B285A 39

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

B285A 4B

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

B285A 39

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

B285A 4B

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

Diagnostic Aids

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

Reference Information

Schematic Reference

Tilt/Telescoping Steering Column Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

1. Ignition ON.
2. Verify the scan tool Steering Column Direction Switch parameter changes between Inactive, Forward, Rearward, Up, and Down when exercising the S71 Steering Column Tilt and Telescope Switch.
 - **If the parameter does not change**

Refer to Circuit/System Testing - Switch Malfunction.
 - **Go to next step: If the parameter changes**
3. Verify the operation of the M68 Steering Column Tilt Motor while commanding the Steering Column Tilt Up and Steering Column Tilt Down Command with a scan tool.
 - **If the Steering Column Tilt Up or Steering Column Tilt Down Command does not work**

Refer to Circuit/System Testing - Tilt Motor Malfunction
 - **Go to next step: If the Steering Column Tilt Up and Steering Column Tilt Down Command works**
4. Verify the M65 Steering Column Telescope Motor while commanding the Steering Column Telescope Forward and Steering Column Telescope Rearward with a scan tool.
 - **If the Steering Column Telescope Forward and Steering Column Telescope Rearward does not work**

Refer to Circuit/System Testing - Telescope Motor Malfunction
 - **Go to next step: If the Steering Column Telescope Forward and Steering Column Telescope Rearward works**
5. Verify that DTC B285A 39 is not set.
 - **DTC B285A 39 is set**

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

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

Circuit/System Testing

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

Switch Malfunction

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

- Terminal A
- Terminal F
- Terminal C
- Terminal B

- **If less than B+**

1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column 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.
- Go to next step: If infinite resistance

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

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

- **Go to next step: If B+**

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

6. Ignition ON.

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

- Terminal 3
- Terminal 4
- Terminal 5
- Terminal 6

- **If greater than 1 V**

Repair the short to voltage on the circuit

- **Go to next step: If less than 1 V**

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

9. Ignition ON.

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

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

- Terminal A
- Terminal F

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

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

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

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

- **Go to next step: If the M65 Steering Column Telescope Motor operates**

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

11. Install a 3 A fused jumper wire between the signal circuits listed below and the ground 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 X2 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 1 - 2.5 Ω between terminal 9 and terminal 10.
 - If not within the specified range, replace the M68 Steering Column Tilt Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **Go to next step: If the M68 Steering Column Tilt Motor operates**
12. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Tilt Motor Malfunction

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

Repair the short to voltage on the circuit.

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

Repair the short to ground on the circuit.

 - **Go to next step: If Infinite resistance**
5. Replace the M68 Steering Column Tilt Motor.

Telescope Motor Malfunction

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

Repair the short to voltage on the circuit.

 - **Go to next step: If less than 1 V**
3. Ignition OFF.

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

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

Repair the short to ground on the circuit.

- **Go to next step: If Infinite resistance**

5. Replace the M65 Steering Column Telescope Motor.

Component Testing

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

Steering Column Tilt/Telescope Switch Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for infinite resistance between the low reference terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the released position.
 - **If less than infinite resistance**
Replace the S71 Steering Column Tilt and Telescope Switch.
 - **Go to next step: If infinite resistance**
3. Test for less than 2 Ω between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.
 - **If 2 Ω or greater**
Replace the S71 Steering Column Tilt and Telescope Switch.
 - **Go to next step: If less than 2 Ω**
4. All OK.

Steering Column Telescope Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 1 - 2.5 Ω between terminal 7 and terminal 8.
 - **If not within the specified range**
Replace the M65 Steering Column Telescope Motor.
 - **Go to next step: If within the specified range**
3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 1 - 2.5 Ω between terminal 9 and terminal 10.
 - **If not within the specified range**
Replace the M68 Steering Column Tilt Motor.
 - **Go to next step: If within the specified range**

Repair Instructions

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

- [Steering Column Tilt Wheel and Telescope Switch Replacement](#)
- [Steering Column Replacement \(N37\)](#)[Steering Column Replacement \(N38\)](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B2897

Diagnostic Instructions

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

DTC Descriptor

DTC B2897

Steering Column Lock Motor Lock Circuit

Diagnostic Fault Information

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

Circuit/System Description

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Circuit	Description
Signal	The signal circuit is connected to the following control module: K84 Keyless Entry Control Module

Component	Description
K60 Steering Column Lock Module	Vehicles with keyless entry system have an electric motor to lock the steering column when the engine is turned off and the doors are locked.

Conditions for Running the DTC

System Voltage = 9 to 16 V

Conditions for Setting the DTC

B2897 02

Steering Column Lock Motor Lock Circuit = Circuit Short to Ground

B2897 01, 05

Steering Column Lock Motor Lock Circuit = Circuit Short To Battery or Open

Actions Taken When the DTC Sets

- Warning Message = Service Column Lock

- Steering Column Lock Indicator = On

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Column Lock Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: K60 Steering Column Lock Module
3. Ignition - On/Vehicle - In Service Mode
4. Test for battery voltage between the test points: Control circuit terminal 4 & Ground
 - **If battery voltage**
Repair the short to voltage on the circuit:
 - **Go to next step: If less than battery voltage**
5. Ignition Off
6. Test for infinite resistance between the test points: Control circuit terminal 4 & Ground
 - **If less than infinite resistance**
 1. Disconnect the electrical connector: X1 @ K84 Keyless Entry Control Module
 2. Test for infinite resistance between the test points: Control circuit terminal 4 @ K60 Steering Column Lock Module & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: K84 Keyless Entry Control Module
 - **Go to next step: If infinite resistance**
7. Disconnect the electrical connector: X1 @ K84 Keyless Entry Control Module
8. Test for less than 2 ohms between the test points: Control circuit terminal 4 @ K60 Steering Column Lock Module & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component: K60 Steering Column Lock Module

Repair Instructions

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

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

DTC B2910

Diagnostic Instructions

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

DTC Descriptor

DTC B2910

Steering Column Lock Password Incorrect

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

Circuit/System Description

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Conditions for Running the DTC

System Voltage = 9 to 16 V

Conditions for Setting the DTC

K60 Steering Column Lock Module = BCM Password - Incorrect

Actions Taken When the DTC Sets

- Warning Message = Service Column Lock
- Steering Column Lock Indicator = On
- Crank Request = Denied

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- K60 Steering Column Lock Module = BCM Password - Correct

Diagnostic Aids

A DTC may set if control module K60 is not programmed after replacing control module K9.

Reference Information

Schematic Reference

Column Lock Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Clear the DTCs.
3. Verify DTC B2910 is not set.
 - **If the DTC is set**
 1. Perform the following learn procedure: [Immobilizer System Component Programming](#) - Select the Body Control Module Immobilizer (IMMO) Function with New Transponder or Remote Key, but use the customer's existing key.
 2. Clear the DTCs.
 3. Ignition/Vehicle & All vehicle systems - Off
 4. Door - All - Closed
 5. Wait for greater than 5 min.
 6. Ignition - On/Vehicle - In Service Mode
 7. Operate the vehicle within the Conditions for Running the DTC.

Verify the DTC does not set.

 - If the DTC sets - Replace the component: K60 Steering Column Lock Module
 - Go to next step: If the DTC is not set
 - 8. All OK.
 - **Go to next step: If the DTC is not set**
4. All OK.

Repair Instructions

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

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

DTC B305A

Diagnostic Instructions

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

DTC Descriptor

B305A 00

No Response From Steering Column Lock Received

Diagnostic Fault Information

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

Circuit/System Description

For an overview of the component/system, refer to: [Steering Wheel and Column Description and Operation](#)

Circuit	Description
Signal	The signal circuit is connected to the following control module: K9 Body Control Module

Component	Description
K60 Steering Column Lock Module	Vehicles with keyless entry system have an electric motor to lock the steering column when the engine is turned off and the doors are locked.

Conditions for Running the DTC

System Voltage = 9 to 16 V

Conditions for Setting the DTC

K9 Body Control Module = No Response - Steering Column Lock Status Signal

Actions Taken When the DTC Sets

- Warning Message = Service Column Lock
- Steering Column Lock Indicator = On

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

[Column Lock Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

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

Scan Tool Reference

[Control Module References](#)

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode - Clear All Vehicle DTCs
2. Verify the scan tool can communicate with the following component: K60 Steering Column Lock Module
 - **If the scan tool cannot communicate with the component**
 1. Verify there are no DTCs set related to the following system/component: Serial Data
 - If a related DTC is set

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - If a related DTC is not set

- **Go to next step: If the scan tool can communicate with the component**

3. Operate the vehicle within the Conditions for Running the DTC. Verify DTC B305A is not set.

- **If the DTC sets**

Refer to: Circuit/System Testing

- **Go to next step: If the DTC is not set**

4. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off

2. Disconnect the electrical connector: K60 Steering Column Lock Module

3. Test for less than 2 ohms between the test points:

- Ground terminal 6 & Ground
- Ground terminal 7 & Ground
- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- Go to next step: If less than 2 ohms

4. Test for less than 3 V between the test points: Signal circuit terminal 2 & Ground

- **If 3 V or greater**

1. Disconnect the electrical connector: X1 @ K9 Body Control Module

2. Verify the vehicle is equipped as specified: BTM

- **If equipped as specified**

Refer to: Step 4.3

- **Go to next step: If not equipped as specified**

Go to next step: Refer to: Step 4.5

NOTE: For the next measurement, the vehicle needs to be On, but that is no longer possible when the harness connector X1 is removed from the control module K9.

3. Remove the terminal from the connector: 18 X1

4. Connect the electrical connector: X1

5. Ignition - On/Vehicle - In Service Mode

6. Test for less than 3 V between the test points: Signal circuit terminal 2 & Ground

- If 3 V or greater - Repair the short to voltage on the circuit.
- If less than 3 V - Replace the component: K9 Body Control Module

- **Go to next step: If less than 3 V**

5. Ignition - On/Vehicle - In Service Mode

6. Test for battery voltage between the test points: Signal circuit terminal 2 & Ground

- **If less than battery voltage**

1. Disconnect the electrical connector: K9 Body Control Module

2. Test for infinite resistance between the test points: Signal circuit terminal 2 & Ground

- If less than infinite resistance - Repair the short to ground on the circuit.
- Go to next step: If infinite resistance

3. Test for less than 2 ohms between the test points: Signal circuit terminal 2 & The other end of the circuit

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- Go to next step: If less than 2 ohms

4. Replace the component: K9 Body Control Module

- **Go to next step: If battery voltage**

7. Replace the component: K60 Steering Column Lock Module

Repair Instructions

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

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

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](#).

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](#)
- [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 steering wheel controls switch - left. When the steering wheel heat switch is pressed, the switch signal circuit is pulled to ground. This indicates to the steering wheel heating control module that steering wheel heat is requested. When the request is seen, the

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

Reference Information

Schematic Reference

Steering Wheel Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify the 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
 - **Go to next step: 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
 - **Go to next step: The steering wheel becomes warm and the heater indicator illuminates**
4. All OK.

Circuit/System Testing

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the B+ terminal 9 and ground.
- **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse. Refer to [Power Mode Mismatch](#).
 - Go to next step: If 2 Ω or greater
 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is 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, 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 K32 Steering Wheel Heating Control Module.
 - **Go to next step: If the test lamp illuminates**
5. Ignition OFF, connect the X2 harness connector at the X85 Steering Wheel Air Bag Coil. Disconnect the in-line harness connector at the S70L Steering Wheel Controls Switch - Left. Ignition ON.
6. Install a 3 A fused jumper wire between the indicator control circuit terminal 2 and ground.
7. Verify the steering wheel heat indicator is illuminated.
- **If the steering wheel heat indicator does not illuminate**
 1. Ignition OFF, disconnect the harness connector at the S70L Steering Wheel Control Switch - Left.
 2. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - Go to next step: If less than 2 Ω
 3. Ignition ON.
 4. Test for B+ between the signal circuit terminal 7 and ground.
 - If B+, replace the S70L Steering Wheel Control Switch - Left.
 - Go to next step: If not B+
 5. Test for less than 2 Ω in the signal circuit terminal 7 end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the S70R Steering Wheel Control Switch - Right.
 - **Go to next step: If the steering wheel heat indicator illuminates**
8. 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 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

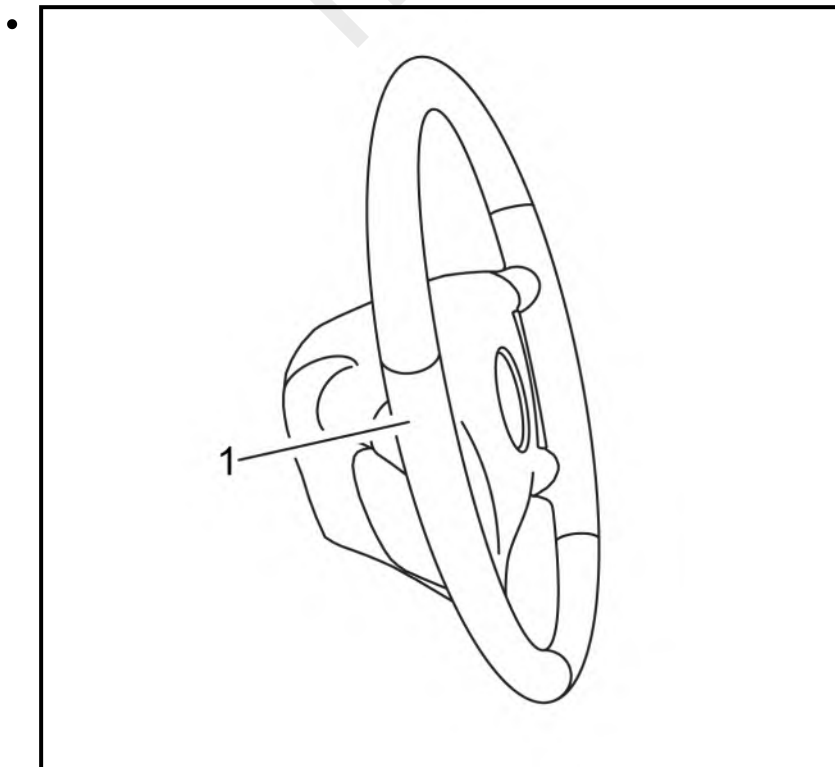
Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	1	1	-	-
Switch Signal	2	1	-	-
Switch and LED Ground	-	1	-	-
Temperature Sensor Signal	3	3	3	-
Temperature Sensor Ground	-	3	-	-
Heater Element Control	3	3	2	-
Heater Element Ground	-	3	-	-
Module Ground	-	1	-	-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

Circuit/System Description

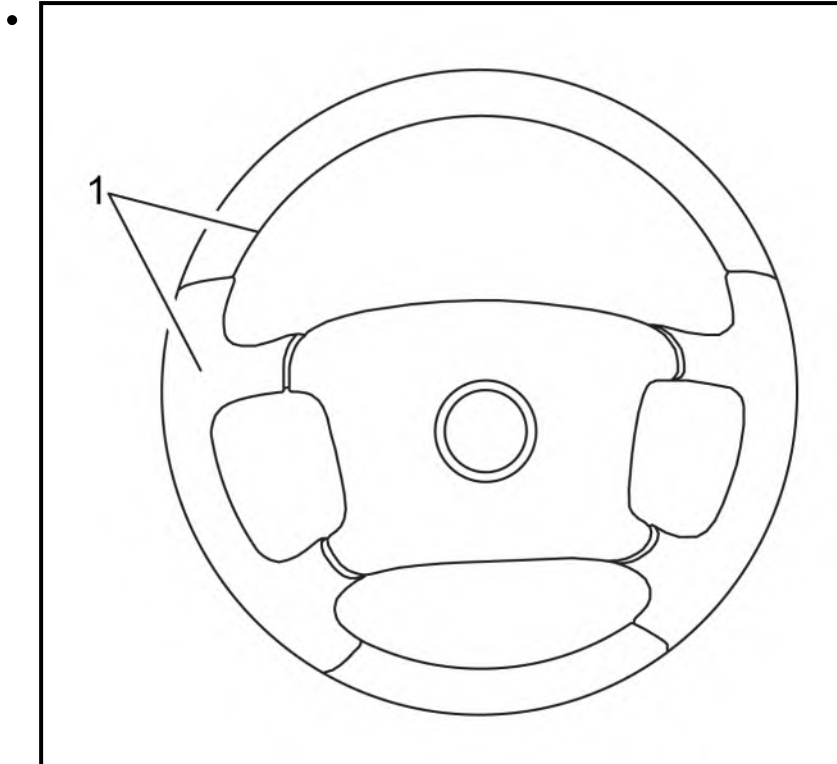
The steering wheel heating control module controls the heated steering wheel and the heated steering wheel ON indicator based on an input from the steering wheel controls switch - left. When the steering wheel heat switch is pressed, the switch signal circuit is pulled to ground. This indicates to the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

Diagnostic Aids

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



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



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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

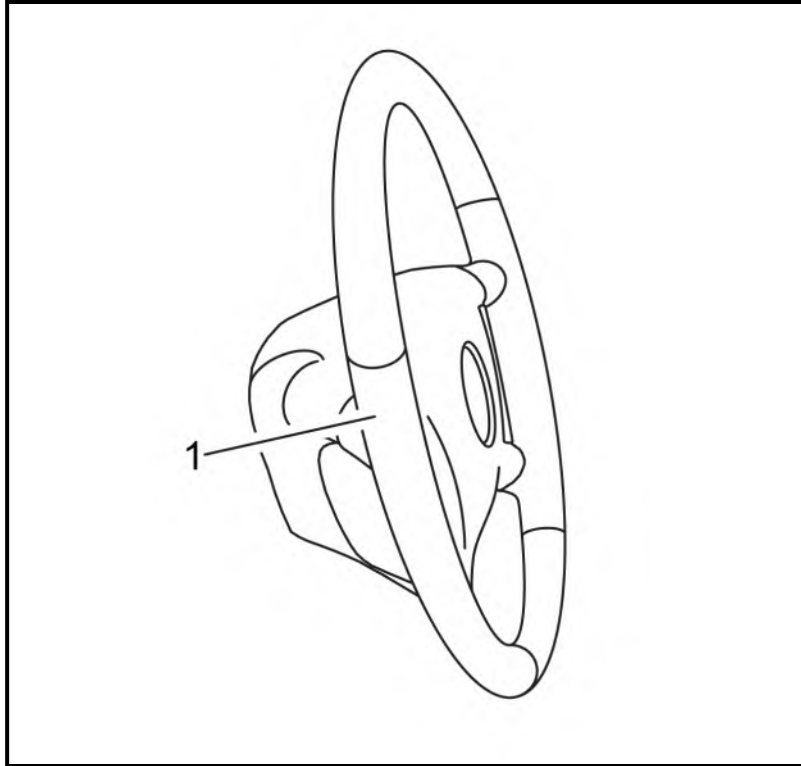
- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

Using an Infrared Temperature Gun

1. Engine running, all accessories OFF.
2. Verify the steering wheel heater switch is OFF and the steering wheel heater indicator should not be illuminated.
 - **If the heater indicator is illuminated**
Refer to Heated Steering Wheel Indicator Malfunction
 - **Go to next step: If the heater indicator is not illuminated**

3.



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

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.

- Go 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.

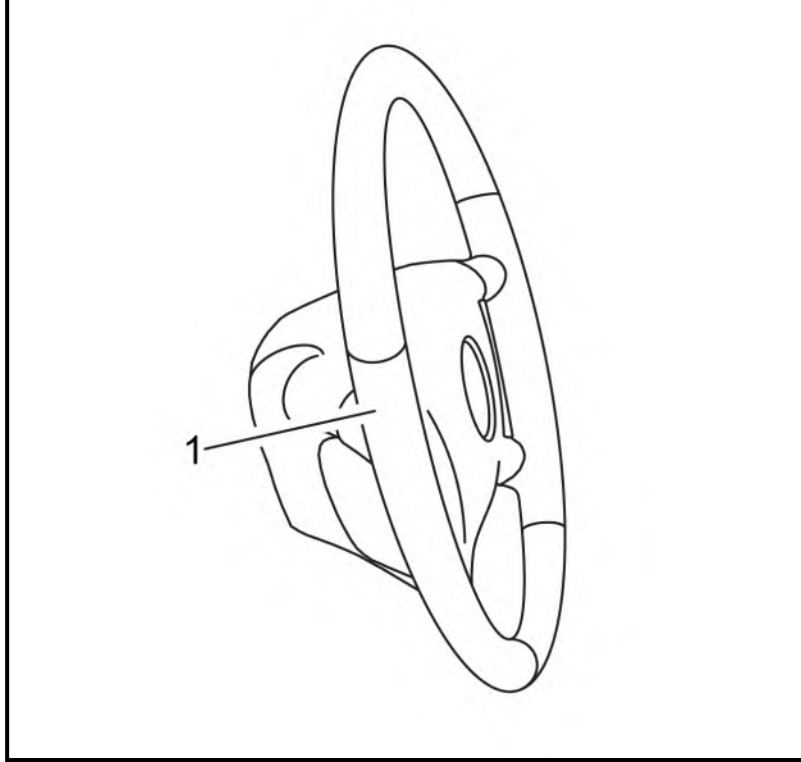
- If the heater indicator does not illuminate

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

- Go to next step: If the heater indicator illuminates

6.





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

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.

- Go to next step: If after 20 minutes the measured temperature is 28°C (82.4°F) or greater

8. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X2 harness connector at the X85 Steering Wheel Air Bag Coil. It may take up to 2 minutes for all vehicle systems to power down.

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

- If 10 Ω or greater

1. Ignition OFF.

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

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

- Go to next step: If less than 10 Ω

3. Ignition ON.

4. Verify a test lamp illuminates between the ignition circuit terminal 9 and ground.

- If the test lamp does not illuminate and the circuit fuse is good

1. Ignition OFF.

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

- If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to [Power Mode Mismatch](#).
- Go to next step: If 2 Ω or greater

3. Verify the in-line fuse is OK and there is voltage at the fuse.

- If the in-line fuse is 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 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.
 - **Go to next step: If the test lamp illuminates**
- 5. Ignition OFF, connect the X2 harness connector at the X85 Steering Wheel Air Bag Coil. Disconnect the harness connector at the S70L Steering Wheel Control Switch - Left.
- 6. Test for less than 10 Ω between the ground circuit terminal 1 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
- 7. Ignition ON.
- 8. Test for B+ between the signal circuit terminal 5 and ground.
 - **If less than B+**
 1. Ignition OFF, disconnect the in-line harness connector at the K32 Steering Wheel Heating Control Module.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K32 Steering Wheel Heating Control Module.
 - **Go to next step: If B+**
- 9. Ignition OFF, disconnect the in-line harness connector at the E15 Steering Wheel Heater.
- 10. Test for less than 10 Ω between the ground circuit terminal 4 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If less than 2 Ω , repair the open/high resistance in the circuit.
 - If 2 Ω or greater, replace the K32 Steering Wheel Heating Control Module.
 - **Go to next step: If less than 10 Ω**
- 11. Test for 1.5 - 3.0 Ω between the signal terminal 3 and the ground terminal 4 at the E15 Steering Wheel Heater.
 - **If not within the specified range**

Replace the E15 Steering Wheel Heater.
 - **Go to next step: If within the specified range**
- 12. Test for 9 - 11 k Ω between the control circuit terminal 2 and the ground terminal 1 on the E15 Steering Wheel Heater.
 - **If not within the specified range**

Replace the E15 Steering Wheel Heater.
 - **Go to next step: If within the specified range**
- 13. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- **Steering Wheel Replacement**
- **Control Module References** for control module replacement, programming and setup

STEERING COLUMN TILT/TELESCOPING MALFUNCTION (N38)

Diagnostic Instructions

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

Diagnostic Fault Information

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

Schematic Reference

Tilt/Telescoping Steering Column Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.

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**

- **Go to next step: If both the M65 Steering Column Telescope Motor and the M68 Steering Column Tilt Motor operate**

3. All OK.

Circuit/System Testing

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

Steering Column Telescope Motor Control Circuit Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Test for B+ between the signal circuits listed below and ground:
 - Terminal A
 - Terminal F
 - **If less than B+**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **Go to next step: 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 Ω between terminal 7 and terminal 8.
 - If not within the specified range, replace the M65 Steering Column Telescope Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **Go to next step: 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 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Test for B+ between the signal circuits listed below and ground:
 - Terminal B
 - Terminal C
 - **If less than B+**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **Go to next step: 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 X2 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 0.6 - 1.0 Ω between terminal 9 and terminal 10.
 - If not within the specified range, replace the M68 Steering Column Tilt Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **Go to next step: 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 X1 harness connector at the K99 Steering Column Position Control Module. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 8 and ground.
 - **If 10 Ω or greater**

1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the B+ circuit terminal 7 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse.
 - Go to next step: If 2 Ω or greater
 3. Verify the fuse is OK and there is voltage at the fuse.
 - If the fuse is open, replace the K99 Steering Column Position Control Module.
 - If the fuse is OK, repair the open/high resistance in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K99 Steering Column Position Control Module.
 - **Go to next step: If the test lamp illuminates**
5. Ignition OFF, connect the X1 harness connector at the K99 Steering Column Position Control Module. Disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
6. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **Go to next step: If less than 10 Ω**
7. Replace the K99 Steering Column Position Control Module.

Component Testing

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

Steering Column Tilt/Telescope Switch Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for infinite resistance between the low reference terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the released position.
 - **If less than infinite resistance**
Replace the S71 Steering Column Tilt and Telescope Switch.
 - **Go to next step: If infinite resistance**
3. Test for less than 2 Ω between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.
 - **If 2 Ω or greater**
Replace the S71 Steering Column Tilt and Telescope Switch.

- Go to next step: If less than 2 Ω

4. All OK.

Steering Column Telescope Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 0.6 - 1.0 Ω between terminal 7 and terminal 8.

- If not within the specified range

Replace the M65 Steering Column Telescope Motor.

- Go to next step: If within the specified range

3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 0.6 - 1.0 Ω between terminal 9 and terminal 10.

- If not within the specified range

Replace the M68 Steering Column Tilt Motor.

- Go to next step: If within the specified range

3. All OK.

Repair Instructions

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

- [Steering Column Tilt Wheel and Telescope Switch Replacement](#)
- [Steering Column Replacement \(N38\)](#)
- [Control Module References](#) for control module replacement, programming and setup.

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 Symptoms - Steering Wheel and Column
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

Step	Action	Yes	No
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 Steering Column Replacement (N37) . 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 Steering Column Replacement (N37) . 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

Checks	Action
The steering shaft assembly is bent or damaged.	If necessary, replace the steering column. Refer to Steering Column Replacement (N38) .

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

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Steering Wheel and Column
2	Verify that noise is present in the steering column during operation. Is noise present in the steering column during operation?	Go to Step 3	System OK
3	Inspect the steering column mounting features for the following conditions: - The steering column mounting fasteners are loose. - The steering column mounting features are sheared. Are the steering column mounting features loose or sheared?	Go to Step 10	Go to Step 4
4	Inspect the SIR/SRS coil for noise. Is the SIR/SRS coil noisy?	Go to Step 11	Go to Step 5

Step	Action	Yes	No
5	If equipped, inspect the lock plate retaining ring for correct installation. Is the lock plate retaining ring installed incorrectly?	Go to Step 12	Go to Step 6
6	Inspect the steering column upper and lower bearings for the following conditions: • Damage • Lubrication • Wear • Proper seating Are the bearings in need of repair or replacement?	Go to Step 13	Go to Step 7
7	Does the steering column tilt joint need to be lubricated?	Go to Step 14	Go to Step 8
8	NOTE: Inspect the intermediate steering shaft for noise while driving the vehicle, turning the steering wheel, and applying the brakes. Inspect the intermediate steering shaft for noise. Is the intermediate steering shaft noisy?	Go to Step 15	Go to Step 9
9	NOTE: For vehicles equipped with a telescoping steering column, perform this step. If not equipped, go to next step. Inspect the steering column for noise while telescoping the column. Is the steering column noisy while telescoping?	Go to Step 16	Go to Step 17
10	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement (N37) Steering Column Replacement (N38). Tighten the steering column mounting fasteners to specification. Refer to Fastener Specifications . Did you complete the repair?	Go to Step 17	-
11	Replace the SIR/SRS coil. Refer to Steering Wheel Airbag Coil Replacement . Did you complete the repair?	Go to Step 17	-
12	Install the lock plate retaining ring correctly. Did you complete the repair?	Go to Step 17	-
13	NOTE: If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement (N37) Steering Column Replacement (N38). Replace the steering column upper and/or lower bearings, if serviceable. Did you complete the replacement?	Go to Step 17	-
14	Lubricate the steering column tilt joint. Did you complete the repair?	Go to Step 17	-

Step	Action	Yes	No
15	Replace the appropriate intermediate steering shaft component. Did you complete the repair?	Go to Step 17	-
16	Redistribute or add lubricant to the steering column lower jacket with the column telescoped to its end of outward travel. Did you complete the repair?	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

LOOSENESS IN STEERING COLUMN

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Steering Wheel and Column
2	Verify that the steering column is loose. Is the steering column loose?	Go to Step 3	System OK
3	Inspect the steering column mounting features for the following conditions. - The steering column mounting fasteners are loose. - The steering column mounting features are sheared. Are the steering column mounting features loose or sheared?	Go to Step 5	Go to Step 4
4	Inspect the upper and/or lower bearings for looseness. Are any of the bearings worn or loose?	Go to Step 6	Go to Step 7
5	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement (N37) Steering Column Replacement (N38). Tighten the steering column mounting fasteners to specification. Refer to Fastener Specifications . Did you complete the repair?	Go to Step 7	-
6	NOTE: If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement (N37) Steering Column Replacement (N38). Replace the upper and/or lower bearings, if serviceable. Did you complete the repair?	Go to Step 7	-
7	Operate the steering column in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

WIRE TO WIRE REPAIR - STEERING

Special Tools

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

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

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

NOTE: If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to repair the internal transmission wires, connectors, or terminals could result in performance issues.

NOTE: Do not splice wires in Door Harness Grommets.

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

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

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

Splice Sleeve Selection

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

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

1. Open the harness by removing any tape:

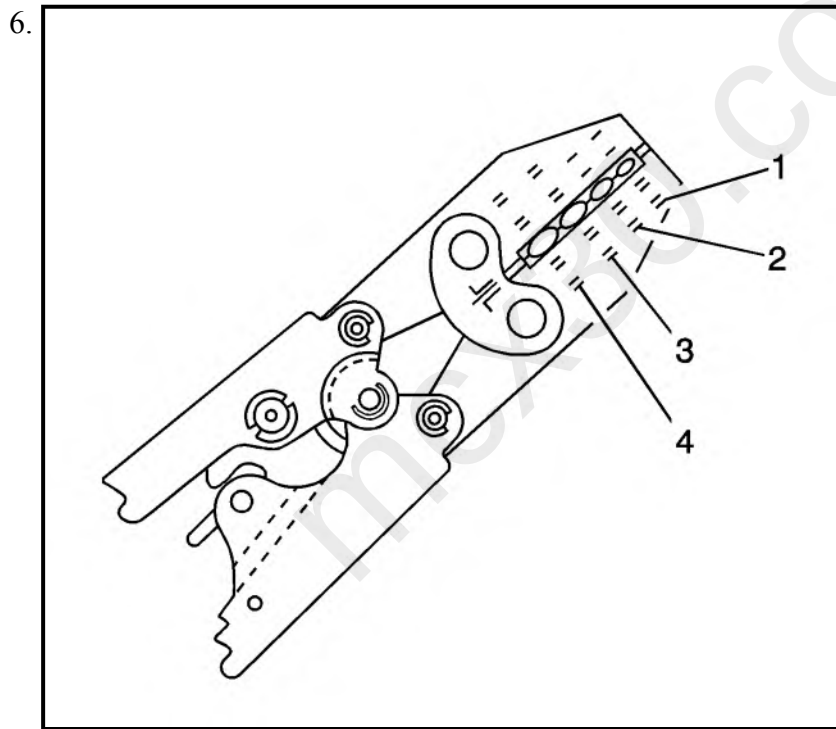
- Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
- Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
- Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.

2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

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

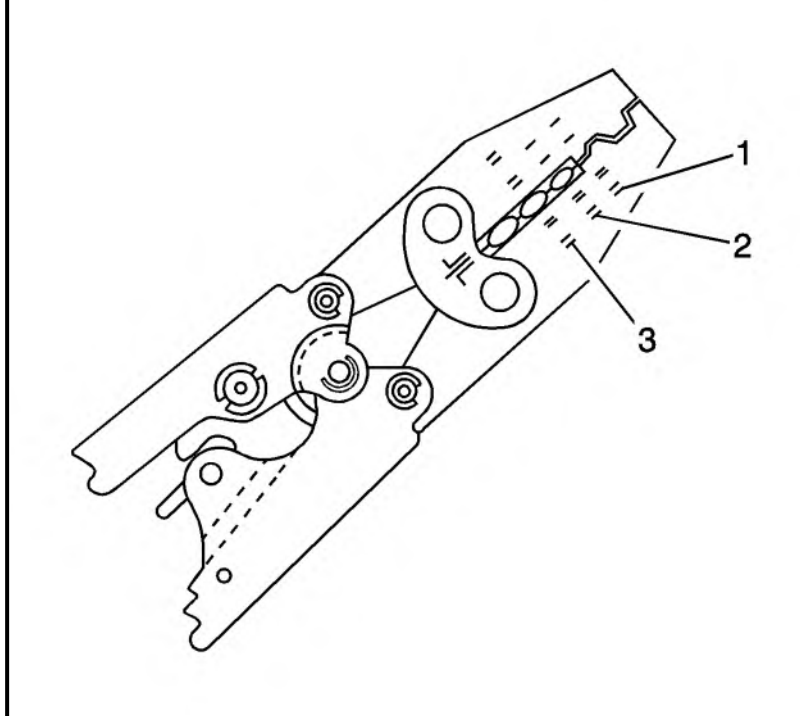
3. Strip the insulation:

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



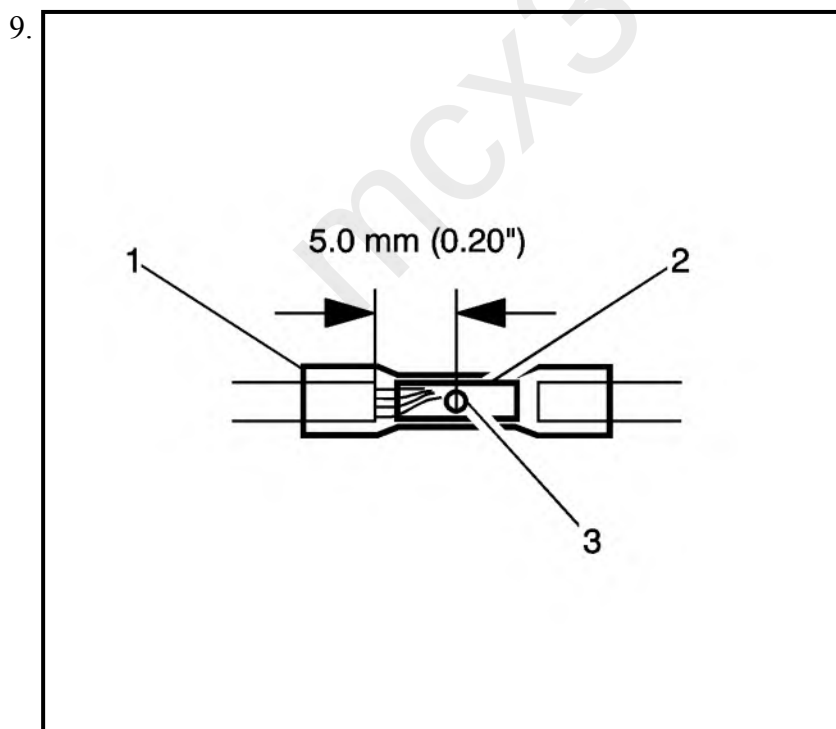
The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.



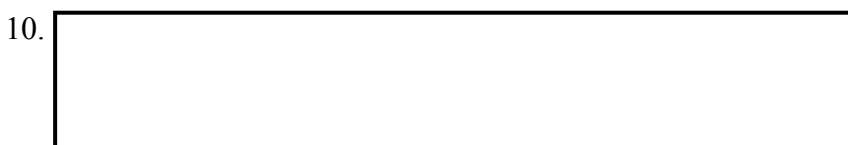


The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests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

8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).



Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.



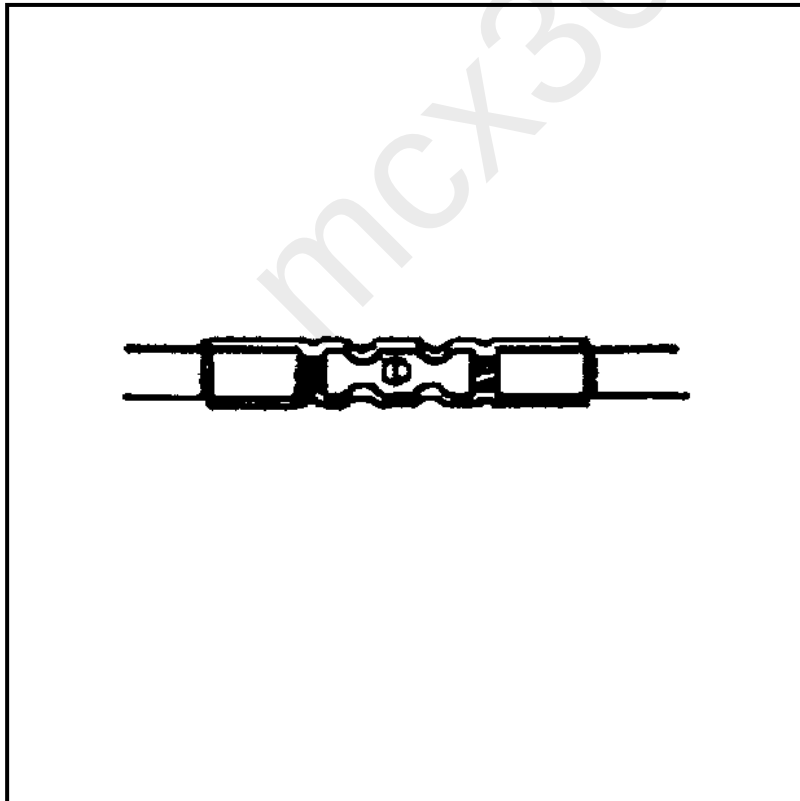


Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

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

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

- 12.

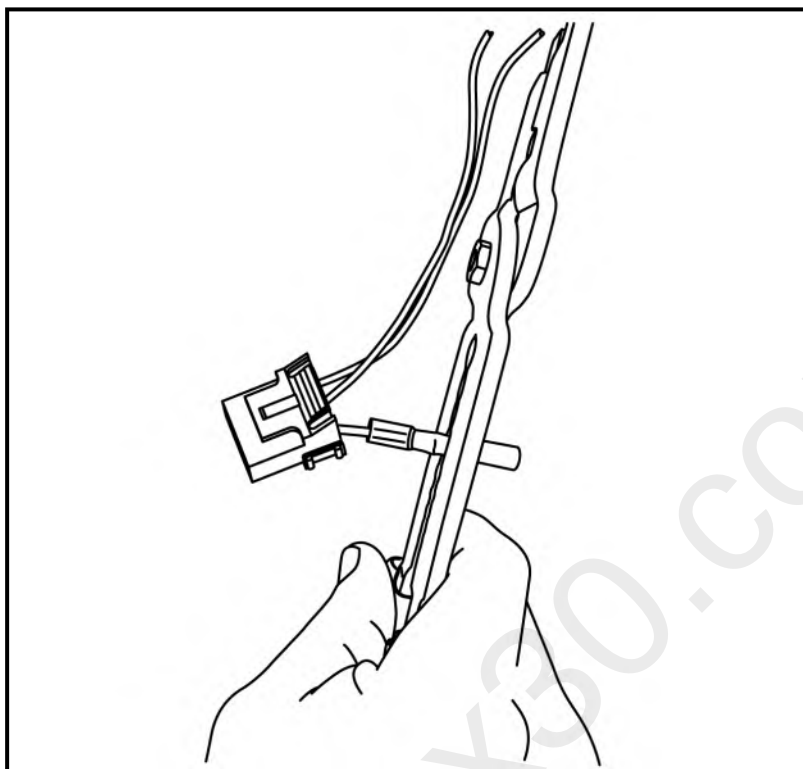


Using the heat torch, apply heat to the crimped area of the barrel.

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

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

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

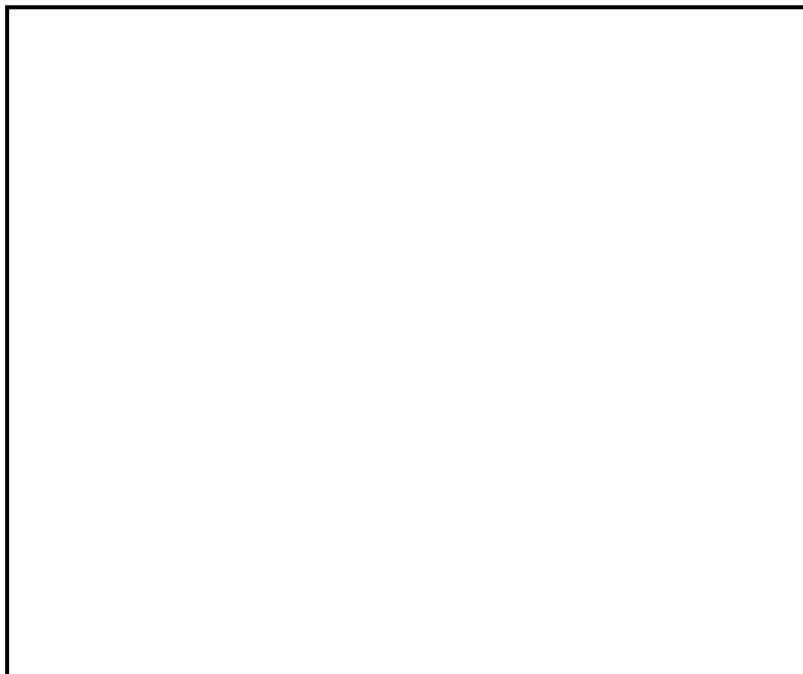


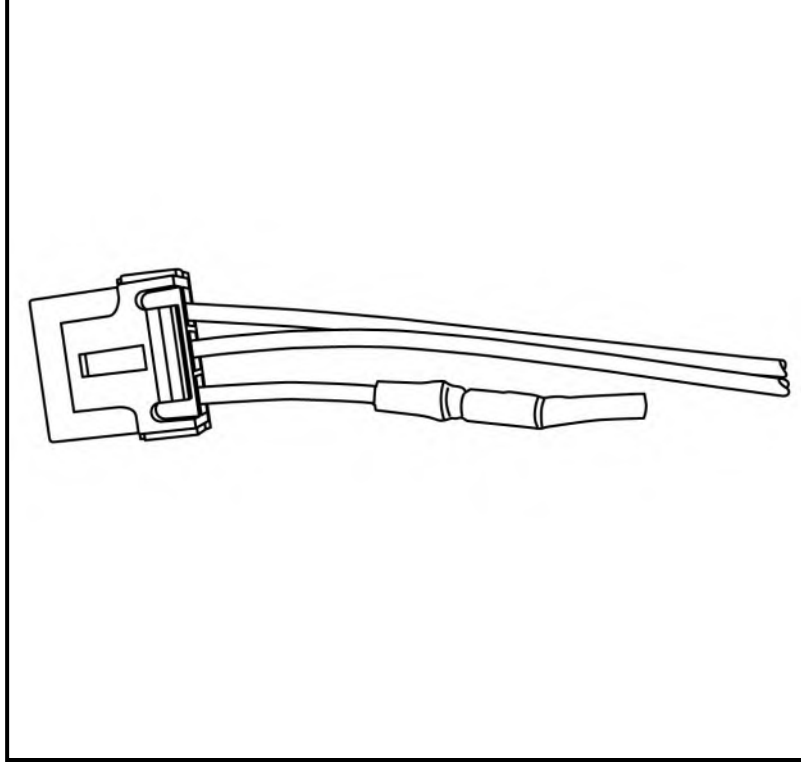
2. Tightly close the handles of the crimp tool until the crimper handles open when released.

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

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

4.

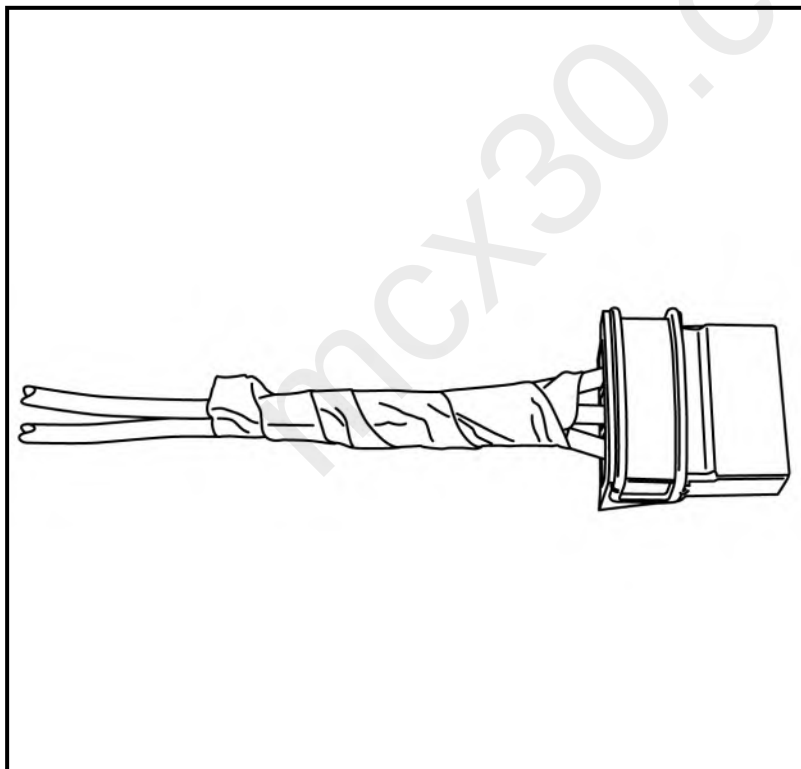




Start in the middle and gradually move the heat barrel to the open ends of the tubing:

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

5.



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

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.

- A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

4. Replace any reflective tape and clips that may have been removed during the repair.

CONNECTOR RECONNECTION - STEERING

Special Tools

EL-35616 Terminal Test Probe Kit

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

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

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

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

Testing for Terminal Fretting

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

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

Testing for Proper Terminal Contact

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

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

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

Testing for Proper Terminal Contact in Bussed Electrical Centers

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

Follow the procedure below in order to test terminal contact:

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

Flat Wire Connectors

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

Follow the procedure below in order to test terminal contact:

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

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

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

be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Ground Distribution Wiring Schematics](#) .

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold, or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot, or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection, or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

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

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

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.

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

- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup, and programming.

INTERMEDIATE STEERING SHAFT REPLACEMENT

Removal Procedure

CAUTION:

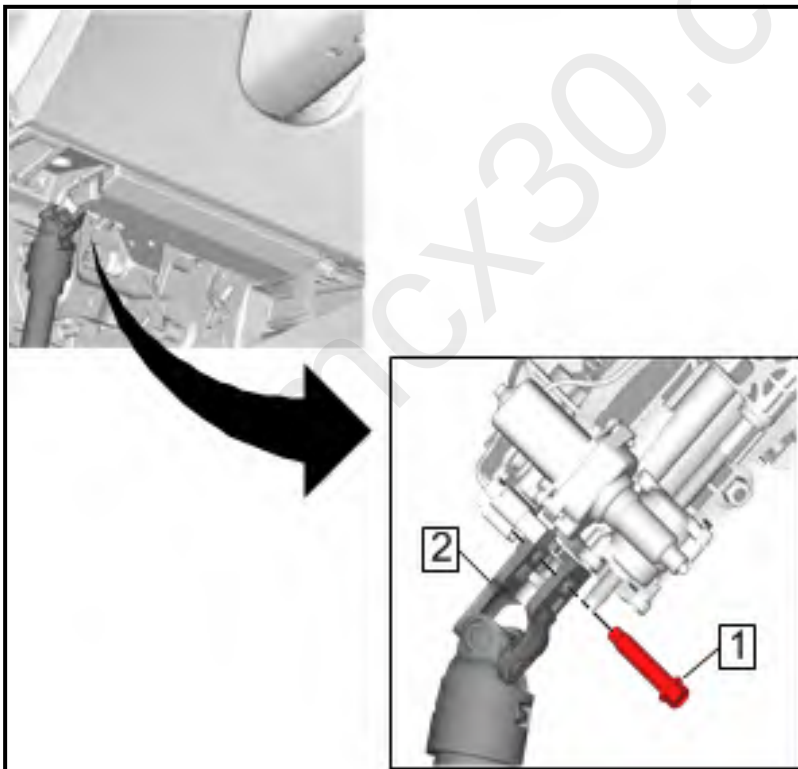
With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured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

1. With the steering wheel in the straight ahead position, LOCK the steering column.

2.

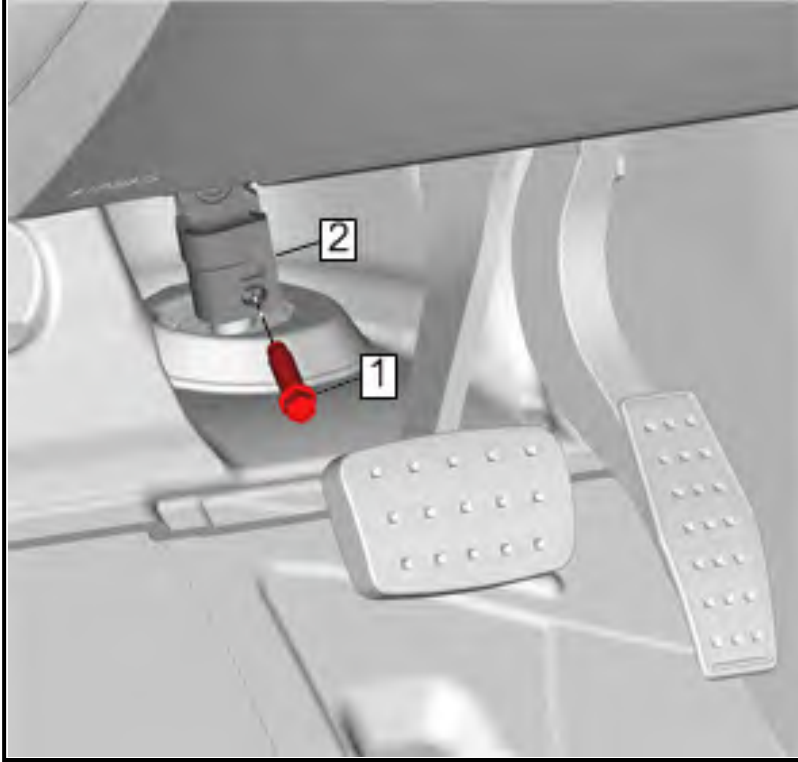


Intermediate Steering Shaft Upper Bolt (1) - Remove

3. Intermediate Steering Shaft (2) @ Steering Column - Separate

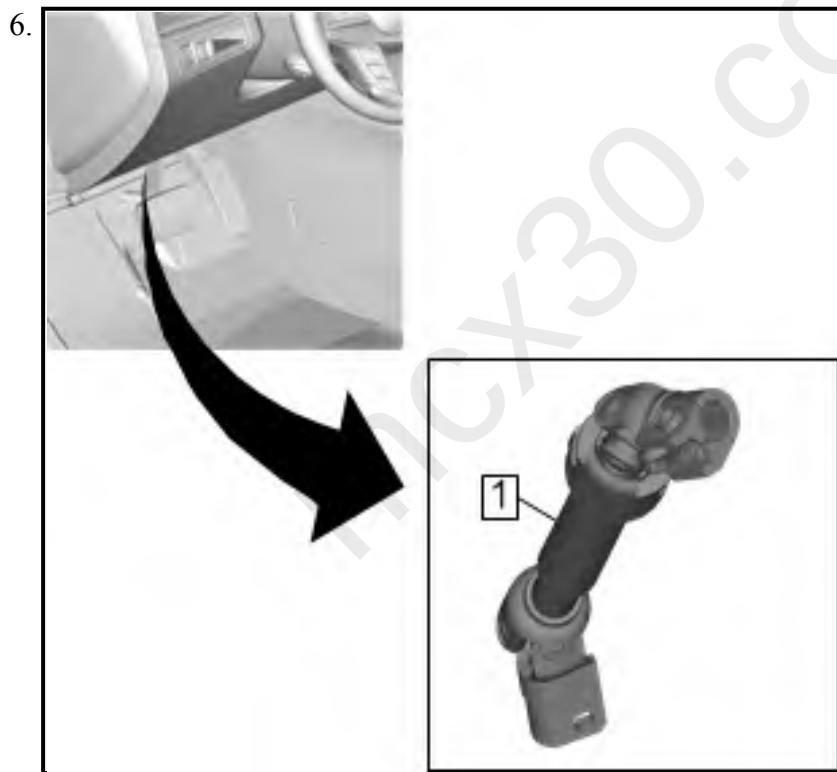
4.





Intermediate Steering Shaft Lower Bolt (1) - Remove

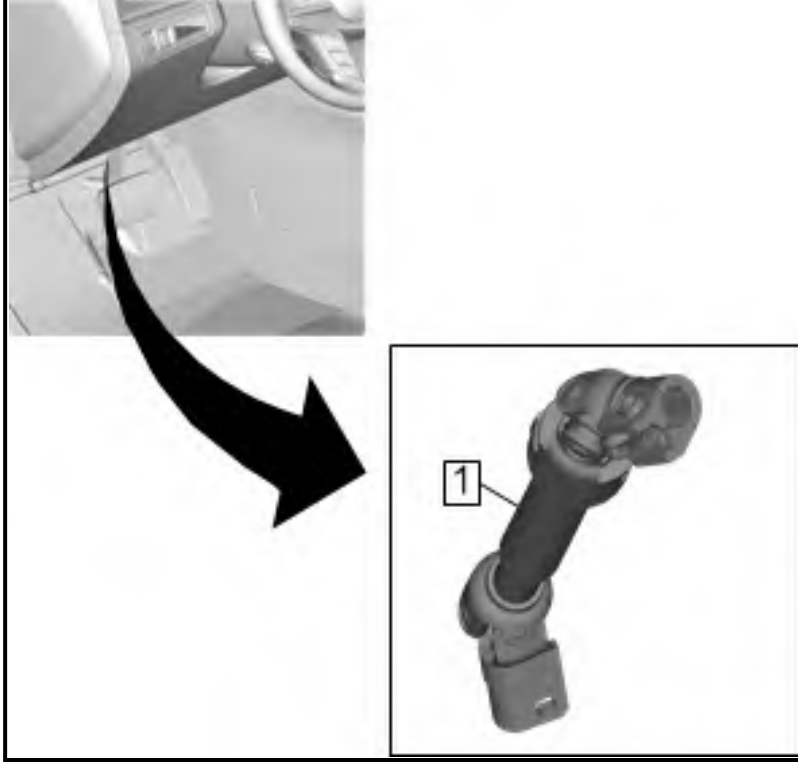
5. Intermediate Steering Shaft (2) @ Steering Gear - Separate



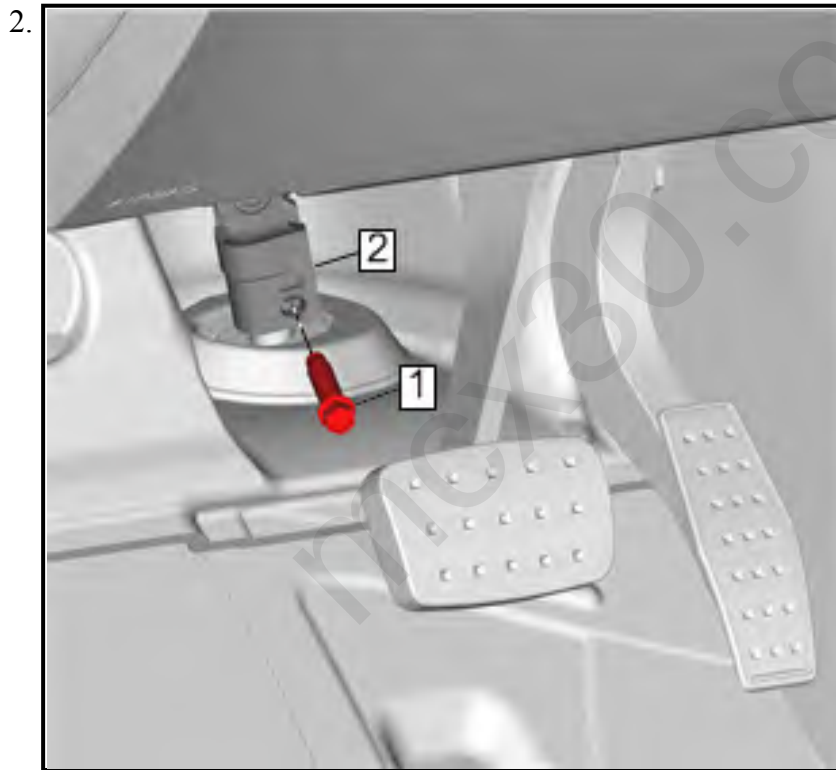
Remove the intermediate steering shaft (1) from the vehicle.

Installation Procedure





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



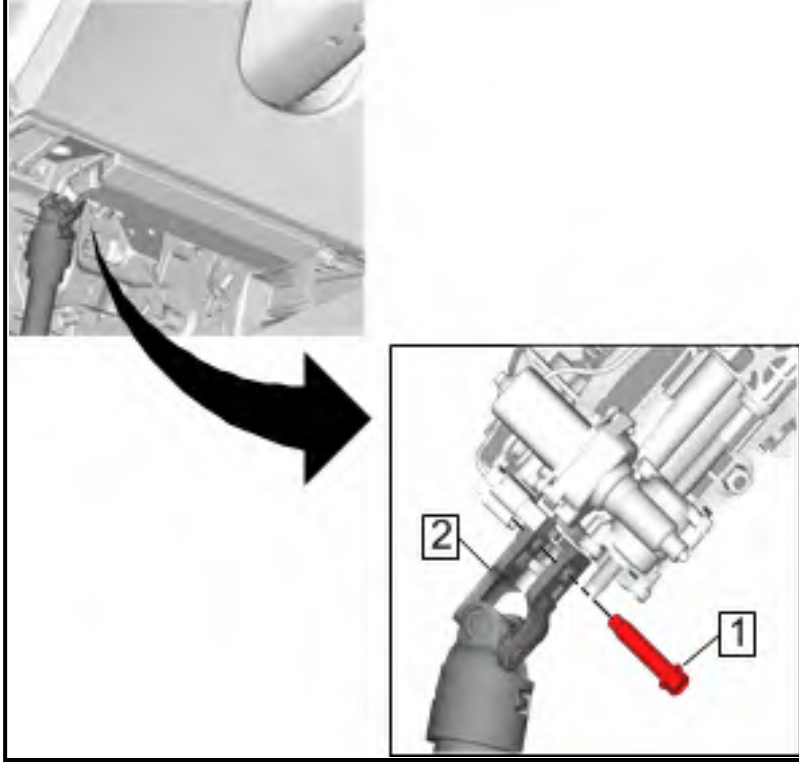
Intermediate Steering Shaft (2) @ Steering Gear - Install

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

3. Intermediate Steering Shaft Lower Bolt (1) - Install and tighten 55 N.m (40 lb ft)

1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
2. Apply thread locking adhesive to the bolt. [Adhesives, Fluids, Lubricants, and Sealers](#)





Intermediate Steering Shaft (2) @ Steering Column - Install

5. Intermediate Steering Shaft Upper Bolt (1) - Install and tighten 42 N.m (31 lb ft)
 1. Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 2. Apply thread locking adhesive to the bolt. [Adhesives, Fluids, Lubricants, and Sealers](#)
6. Center the steering angle sensor. [Steering Wheel Angle Sensor Centering](#)

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N37)

Inspection Procedure

1. [Turn Signal Switch Bracket Replacement](#) - Remove

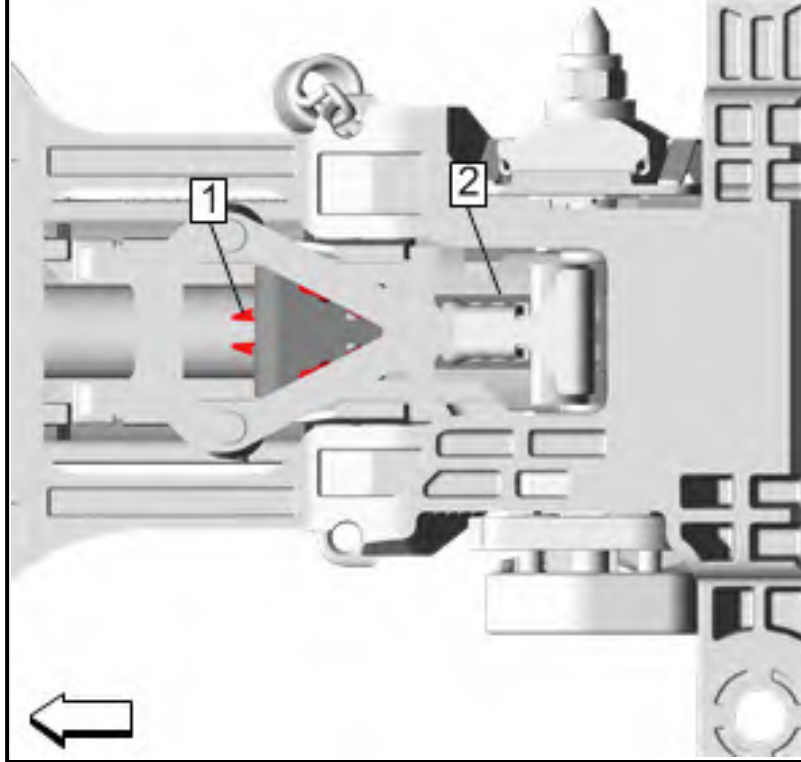
CAUTION: Vehicles involved in accidents that result in any of the following kinds of damage or situations, may also have a damaged or misaligned steering column:

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

2. [Steering Column Replacement \(N37\)](#) - Remove
3. Rotate the steering column shaft and verify the shaft turns freely and without interference during the operation.
4. Telescope the steering column in and out and verify there is NO grinding or binding during the operation.

5.

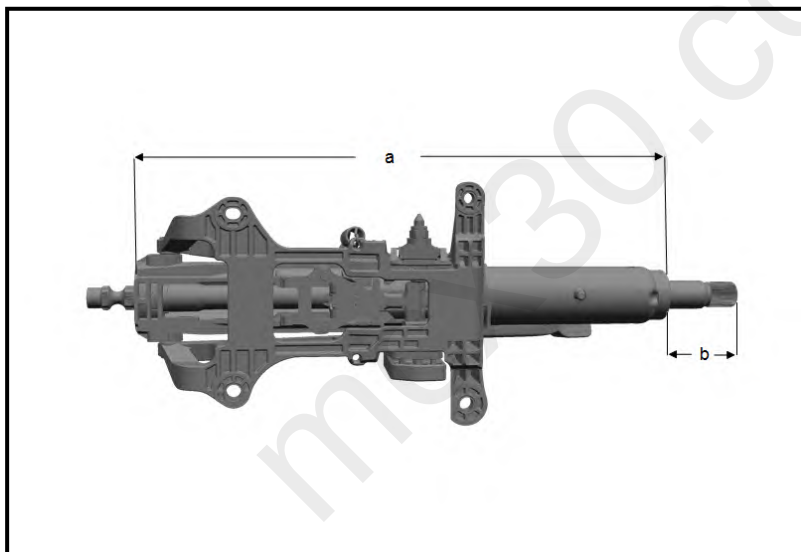




Verify the energy absorbing (E/A) strap retainers (1) are NOT damaged and are fully engaged in the E/A strap.

6. Verify the E/A strap (2) is NOT damaged.

7.



Measure the length (a) of the upper and lower jacket assembly in the fully telescoped position. The length of the upper and lower jacket assembly must NOT be less than 416.4 mm (16.39 in).

8. Measure the length (b) of the upper shaft from the end of the upper jacket to the tip of the shaft. The length of the upper shaft must NOT be less than 62.6 mm (2.46 in).

9. If the steering column does NOT meet the specifications, the steering column is damaged. DISCARD the damaged steering column and install a NEW steering column.

10. If the steering column meets the specifications, install the steering column. [Steering Column Replacement \(N37\)](#)

11. [Turn Signal Switch Bracket Replacement](#) - Install

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N38)

Inspection Procedure

1. Turn Signal Switch Bracket - Remove - [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

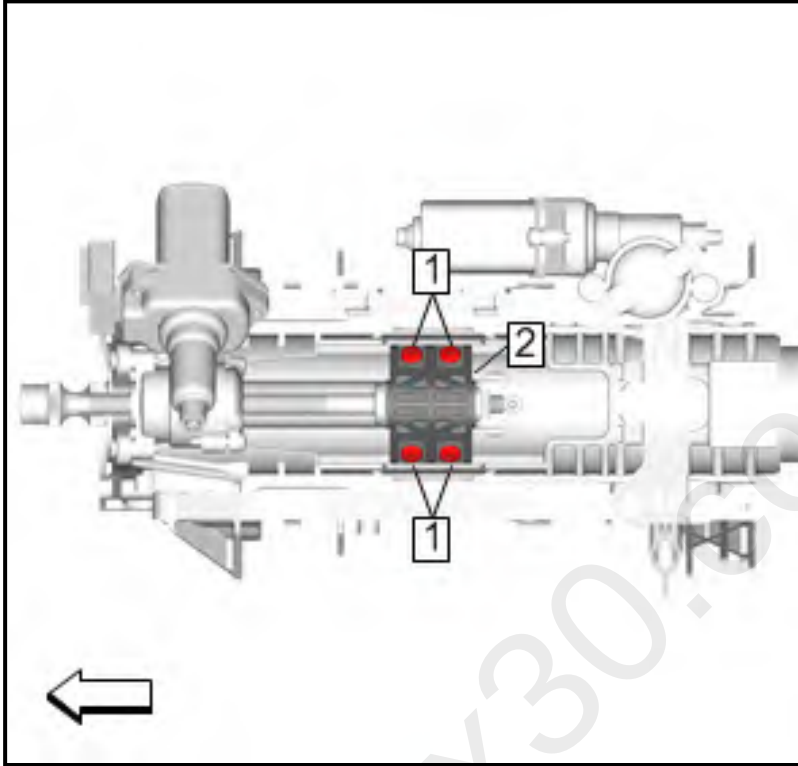
misaligned steering column:

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

2. Steering Column - Remove - [**Steering Column Replacement \(N38\)**](#)

3. Rotate the steering column shaft and verify the shaft turns freely and without interference during the operation.

4.



Verify the energy absorbing (E/A) strap holder rivets (1) are NOT sheared completely.

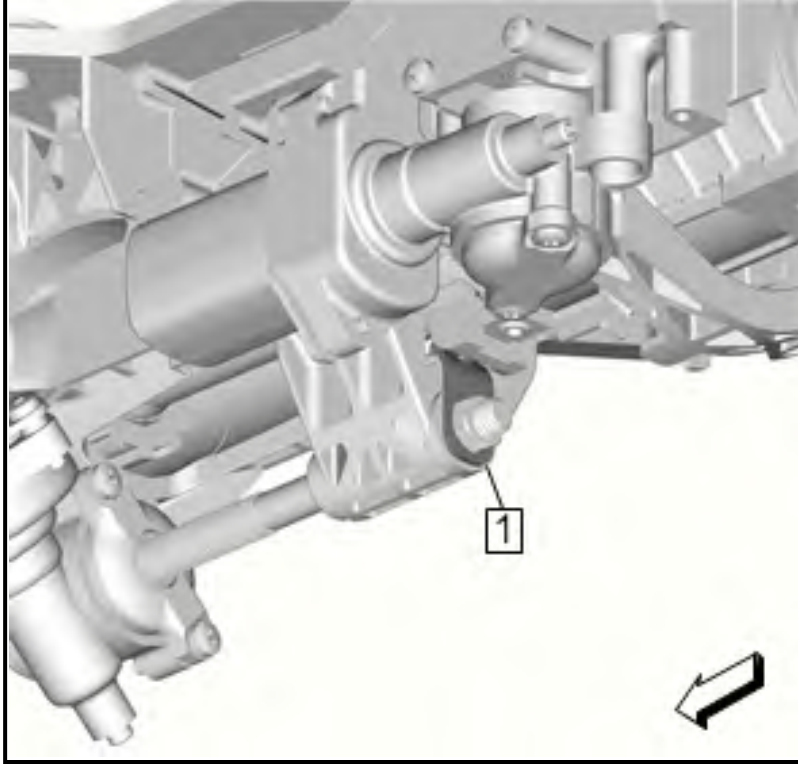
If ANY of the four rivets are sheared, the steering column MUST be replaced.

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

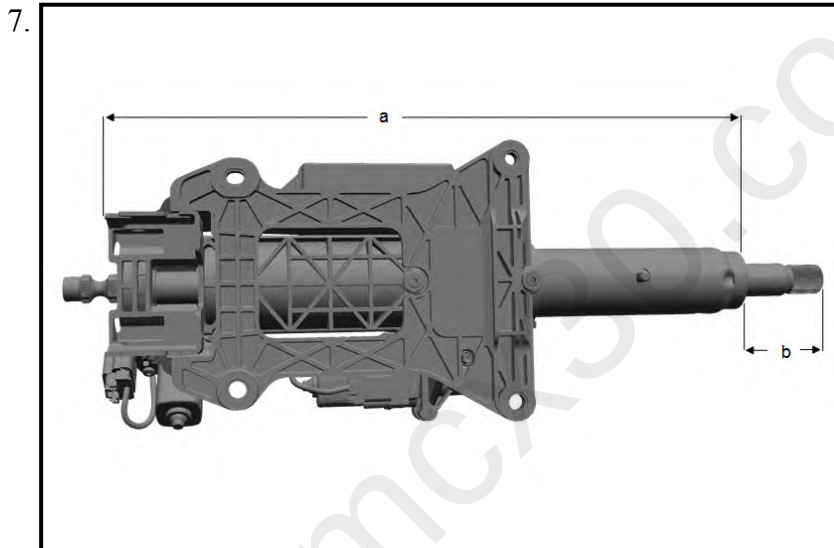
If ANY of the four rivets appear loose or extracted, the steering column MUST be replaced.

6.





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



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

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

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

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

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

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

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

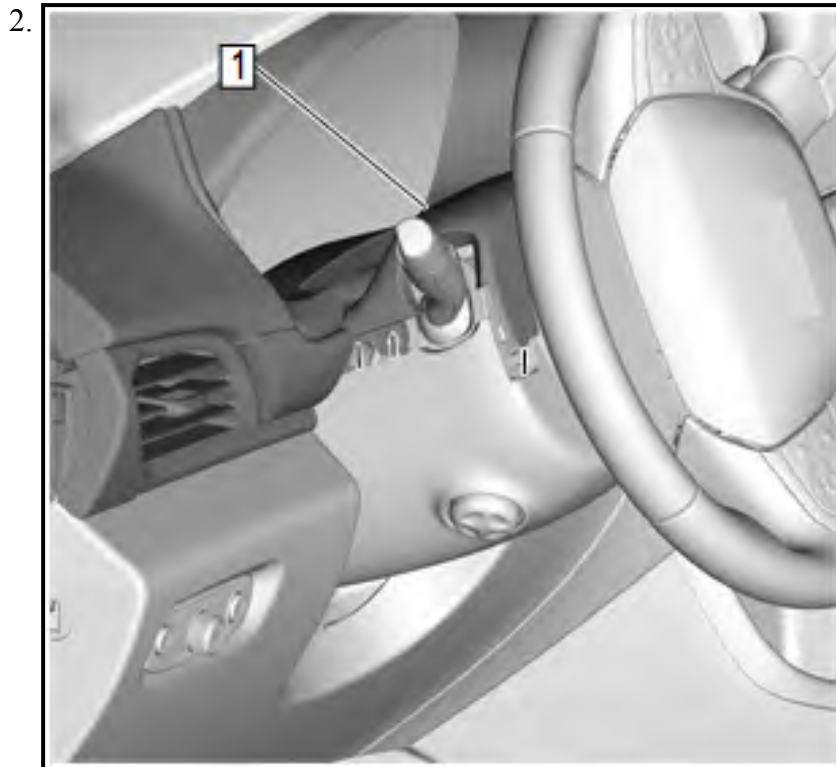
DISCARD the damaged steering column and install a NEW steering column.

11. If the steering column DOES meet the specifications, install the steering column. [Steering Column Replacement \(N38\)](#)

12. Turn Signal Switch Bracket - Install - [Turn Signal Switch Bracket Replacement](#)

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (N37)

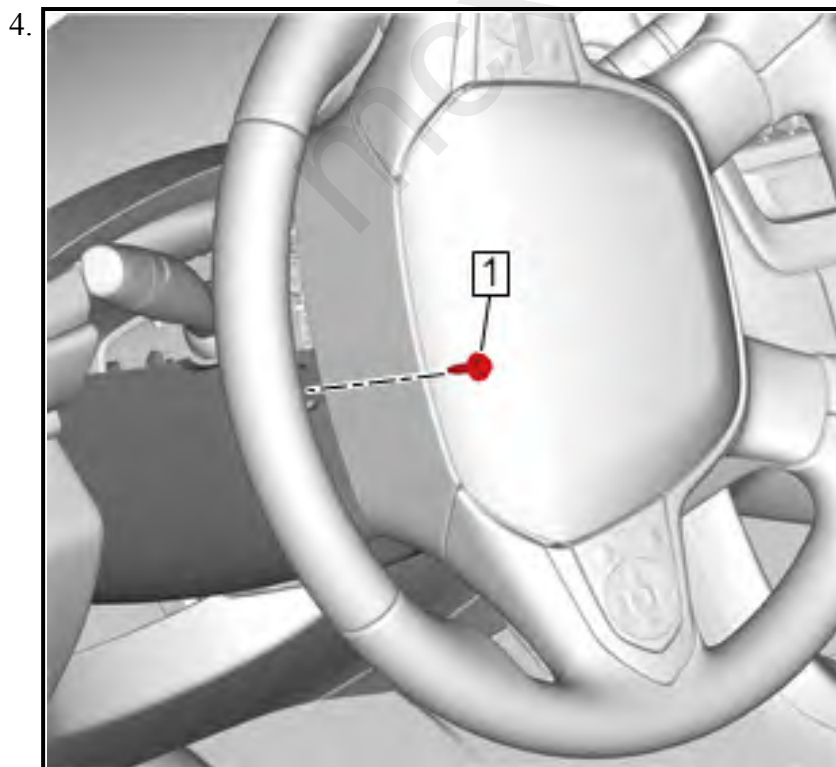
1. Extend the steering column to the fully telescoped position.



NOTE: The Instrument Panel Trim Pad - Left Side does NOT need to be removed, only unclip the Instrument Panel Trim Pad Replacement - Left Side from the steering column lower trim cover.

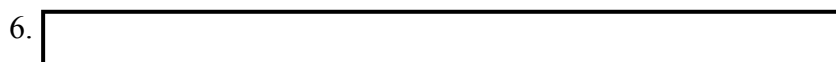
Unclip the Instrument Panel Trim Pad - Left Side (1) from the steering column lower trim cover.
[Instrument Panel Trim Pad Replacement - Left Side](#)

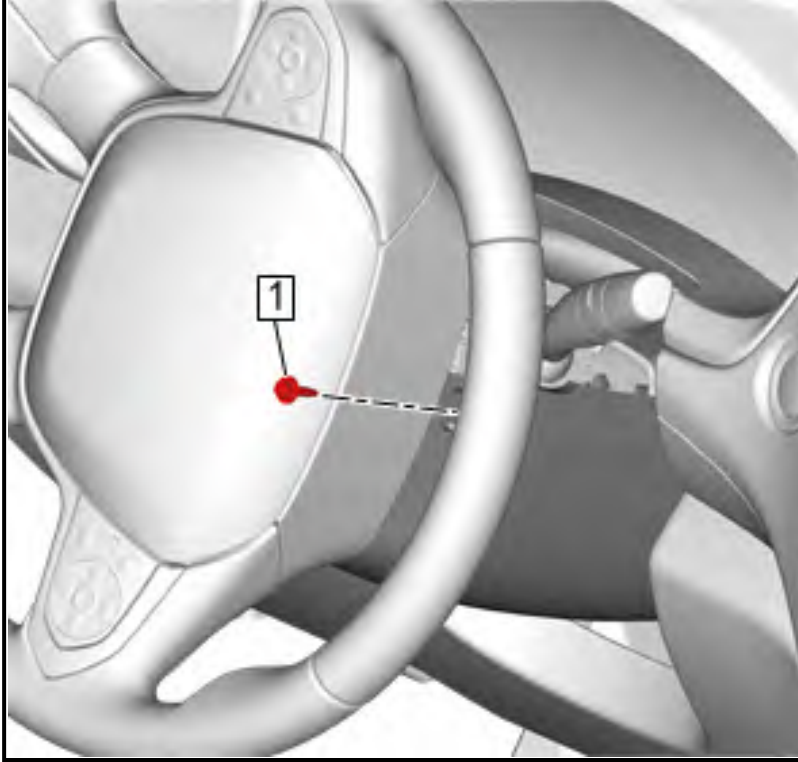
3. Turn the steering wheel approximately 90 degrees to the left of the centered position.



Steering Column Lower Trim Cover Bolt (1) - Remove

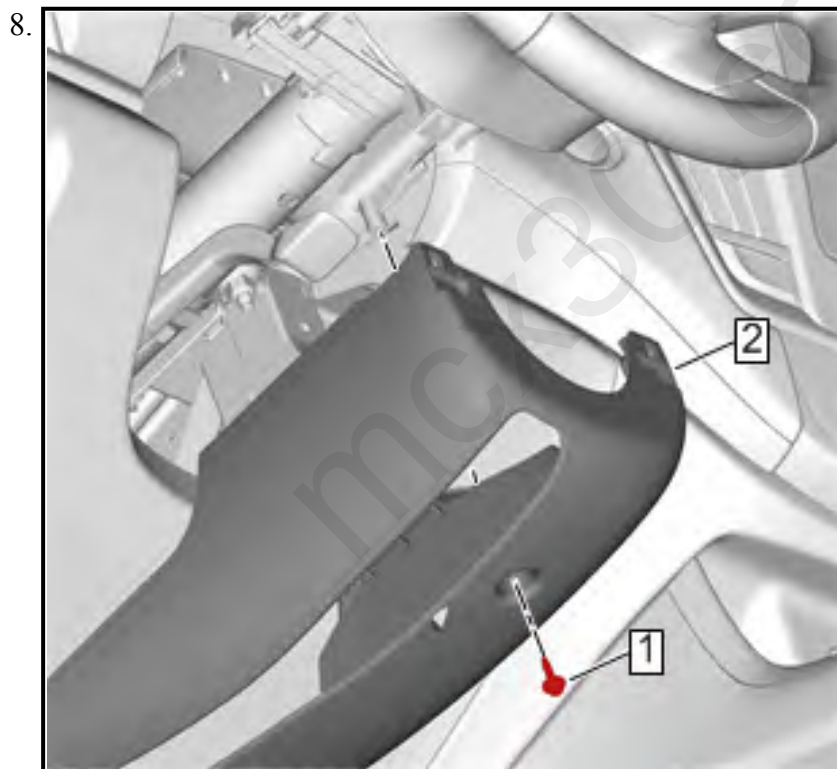
5. Turn the steering wheel approximately 90 degrees to the right of the centered position.





Steering Column Lower Trim Cover Bolt (1) - Remove

7. Turn the steering wheel to the centered position.



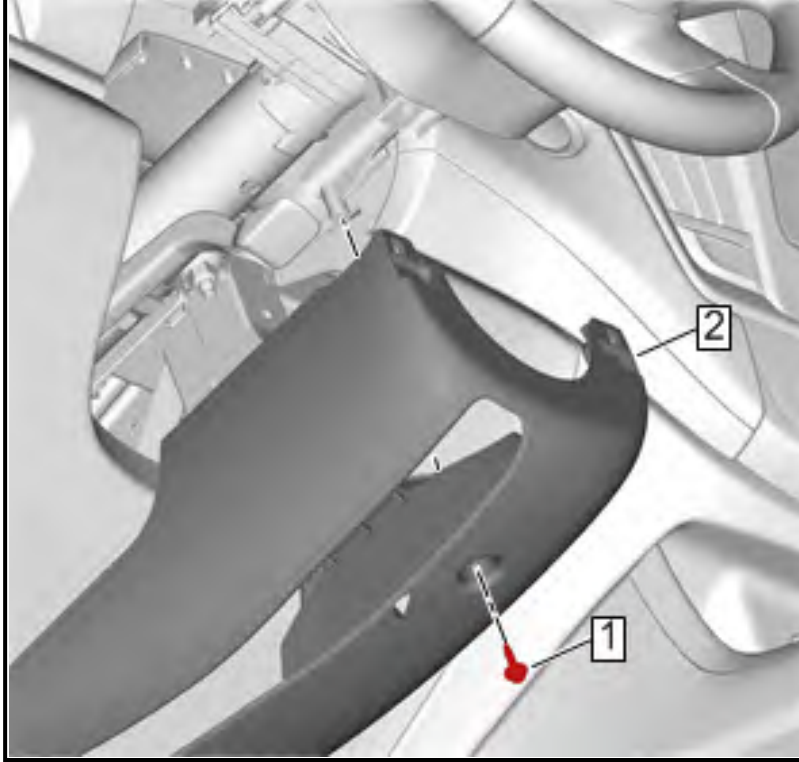
Steering Column Lower Trim Cover Bolt (1) - Remove

NOTE: Maneuver the steering column lower trim cover around the steering column tilt and telescoping lever as necessary.

9. Remove the steering column lower trim cover (2) from the steering column.

Installation Procedure





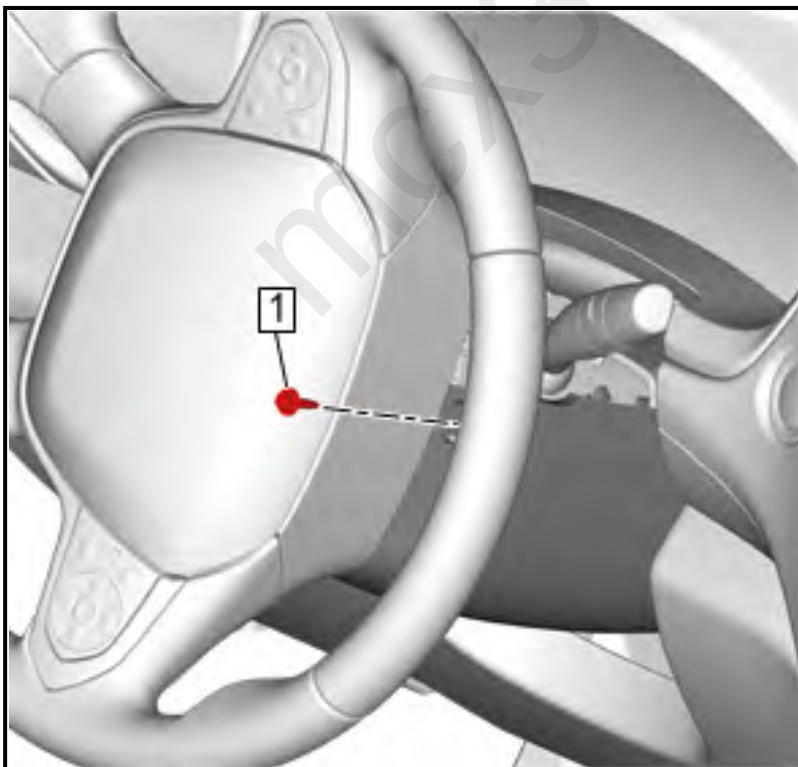
NOTE: Maneuver the steering column lower trim cover around the steering column tilt and telescoping lever as necessary.

Position the steering column lower trim cover (2) on the steering column.

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

2. Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)
3. Turn the steering wheel approximately 90 degrees to the right of the centered position.

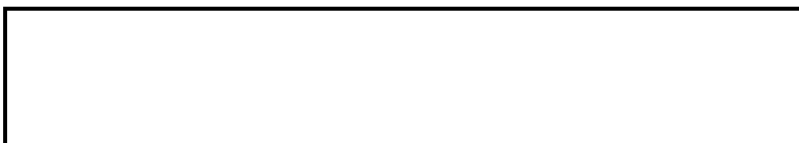
4.

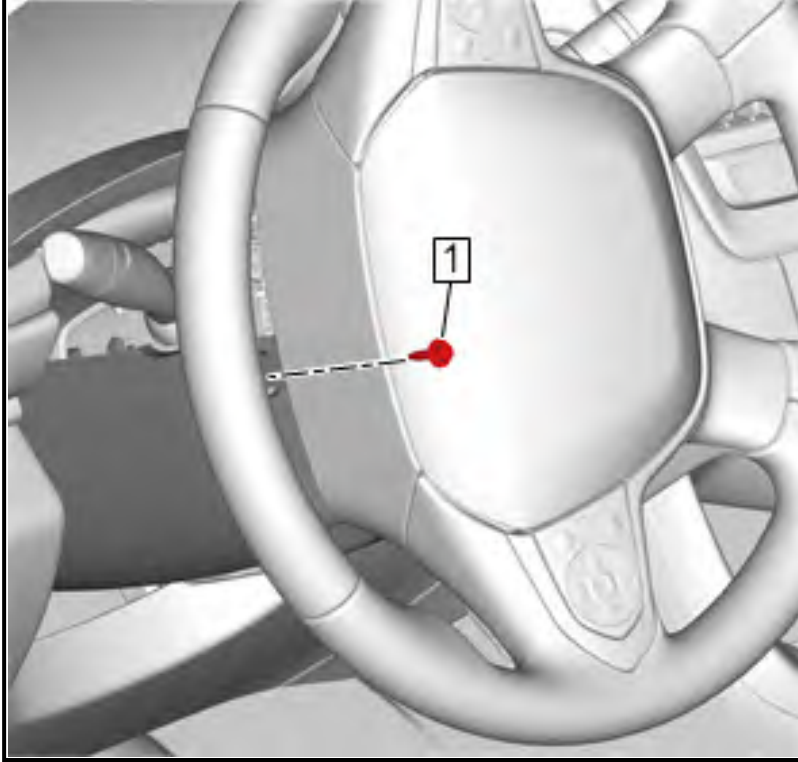


Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)

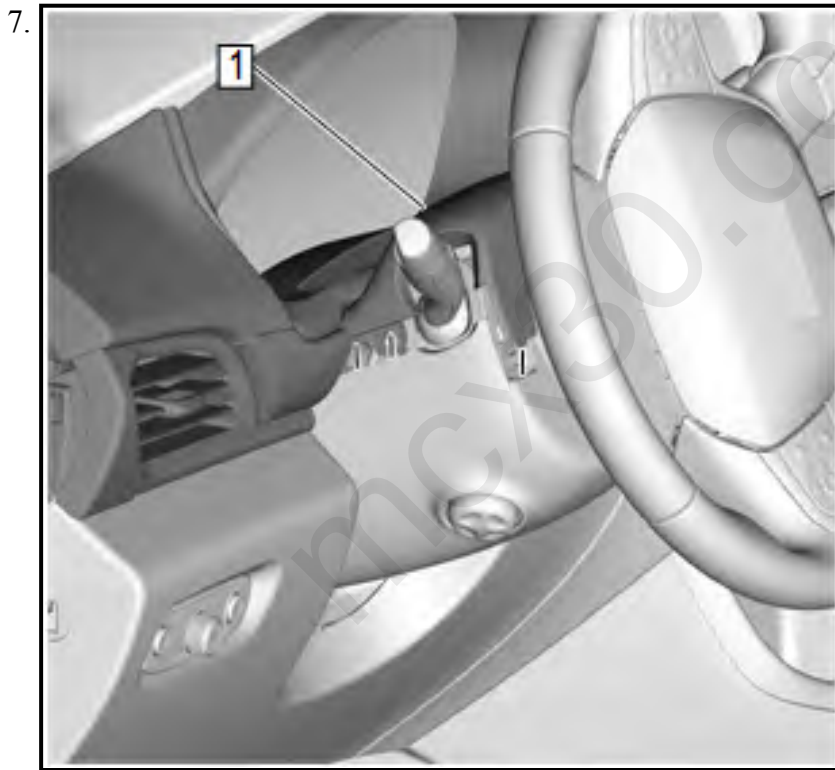
5. Turn the steering wheel approximately 90 degrees to the left of the centered position.

6.





Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)



Install the Instrument Panel Trim Pad - Left Side (1) to the steering column lower trim cover.

Instrument Panel Trim Pad Replacement - Left Side

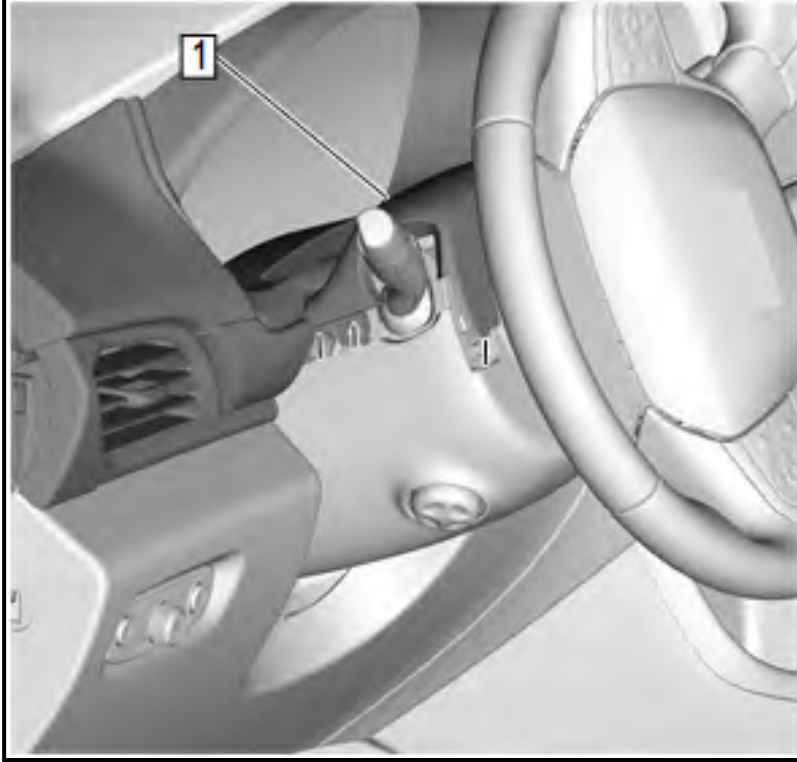
8. Turn the steering wheel to the centered position.

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (N38)

Removal Procedure

1. Extend the steering column to the fully telescoped position.

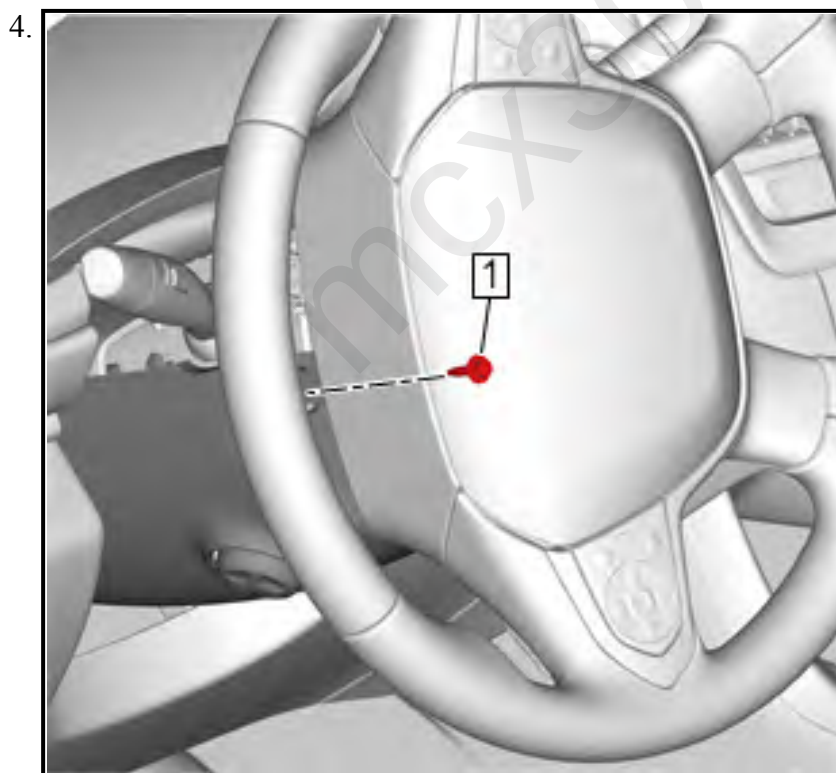




NOTE: The Instrument Panel Trim Pad - Left Side does NOT need to be removed, only unclip the Instrument Panel Trim Pad Replacement - Left Side from the steering column lower trim cover.

Unclip the Instrument Panel Trim Pad - Left Side (1) from the steering column lower trim cover.
[Instrument Panel Trim Pad Replacement - Left Side](#)

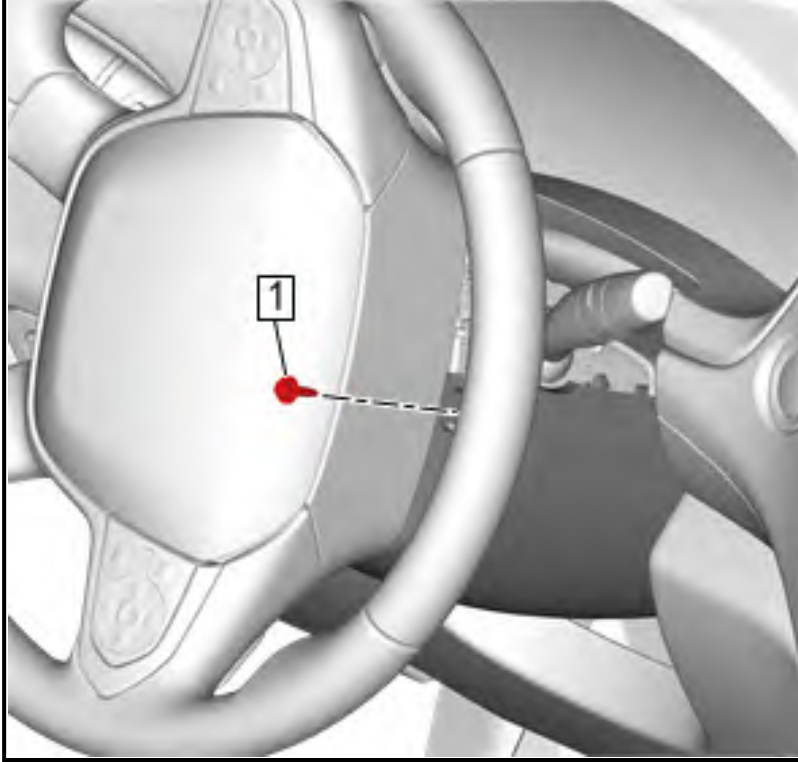
3. Turn the steering wheel approximately 90 degrees to the left of the centered position.



Steering Column Lower Trim Cover Bolt (1) - Remove

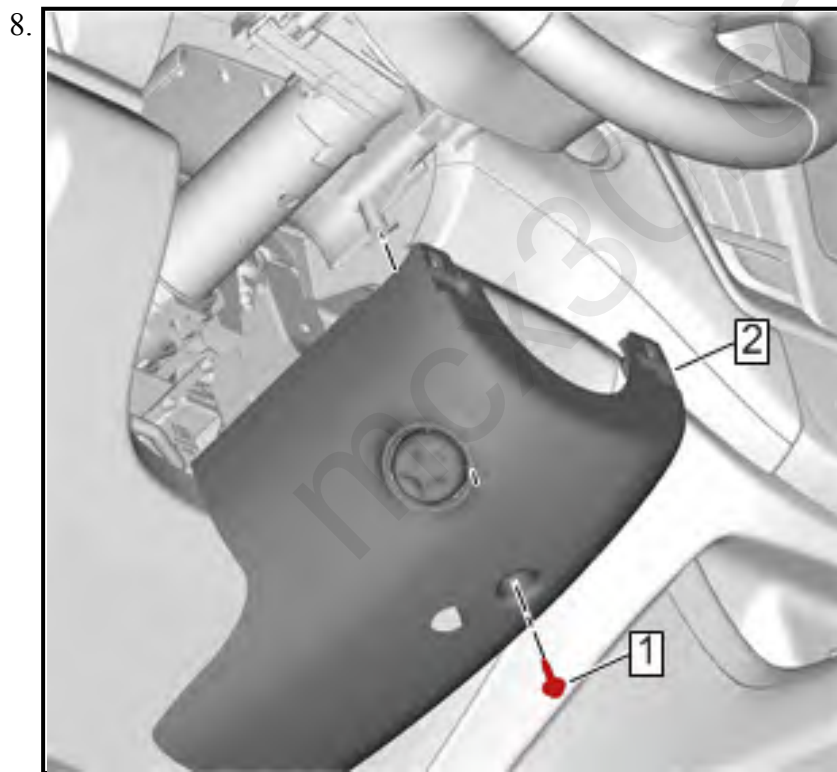
5. Turn the steering wheel approximately 90 degrees to the right of the centered position.





Steering Column Lower Trim Cover Bolt (1) - Remove

7. Turn the steering wheel to the centered position.



Steering Column Lower Trim Cover Bolt (1) - Remove

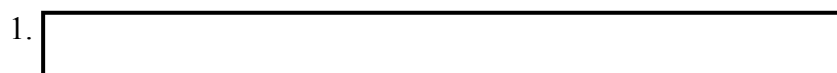
NOTE: Maneuver the steering column lower trim cover around the steering column tilt and telescoping lever as necessary.

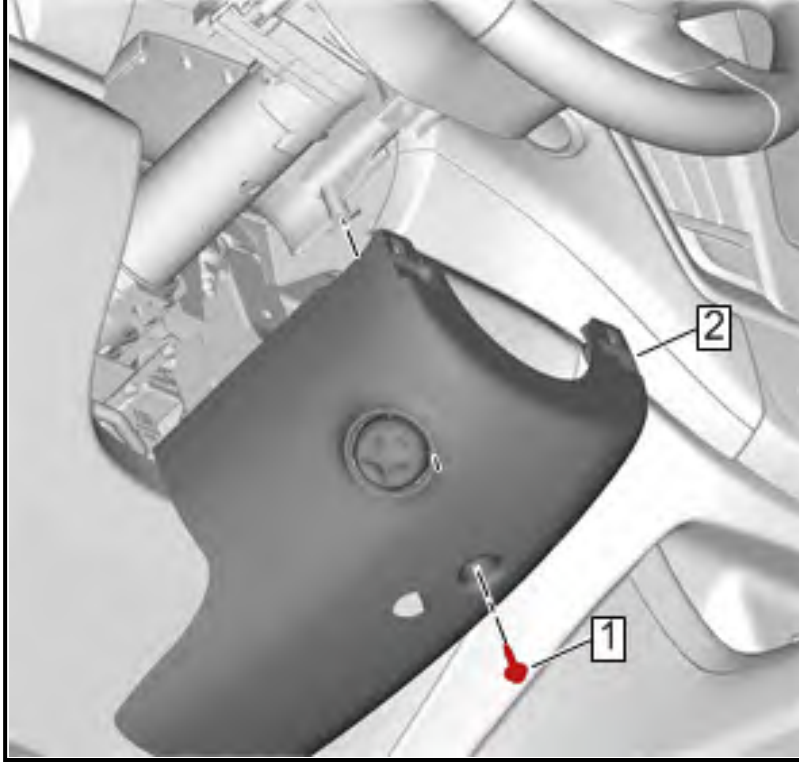
9. Remove the steering column lower trim cover (2) from the steering column.

Disconnect the electrical connector.

10. Transfer components as necessary.

Installation Procedure





NOTE: Maneuver the steering column lower trim cover around the steering column tilt and telescoping lever as necessary.

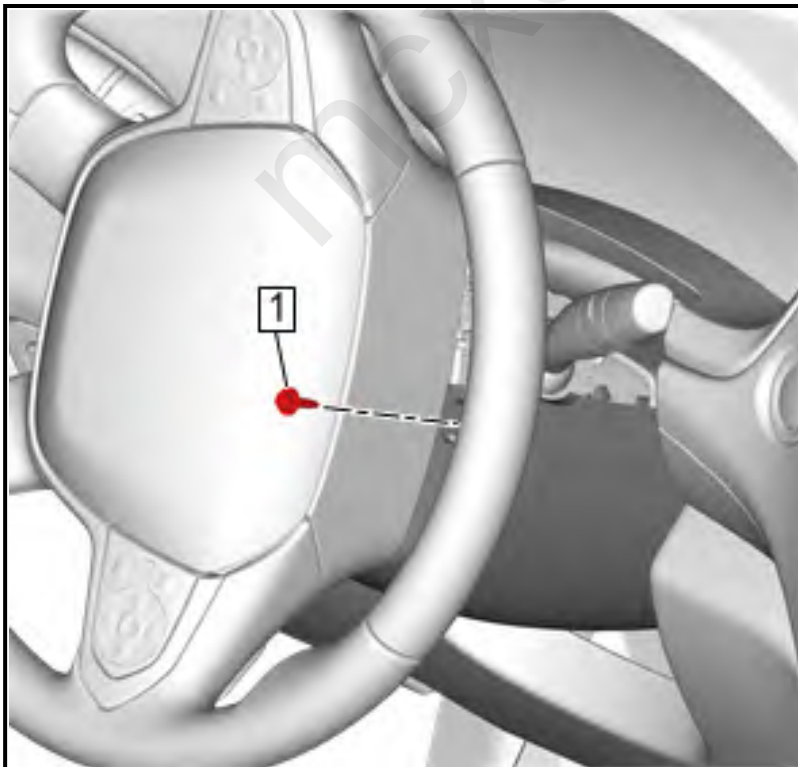
Position the steering column lower trim cover (2) on the steering column.

Connect the electrical connector.

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

2. Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)
3. Turn the steering wheel approximately 90 degrees to the right of the centered position.

4.

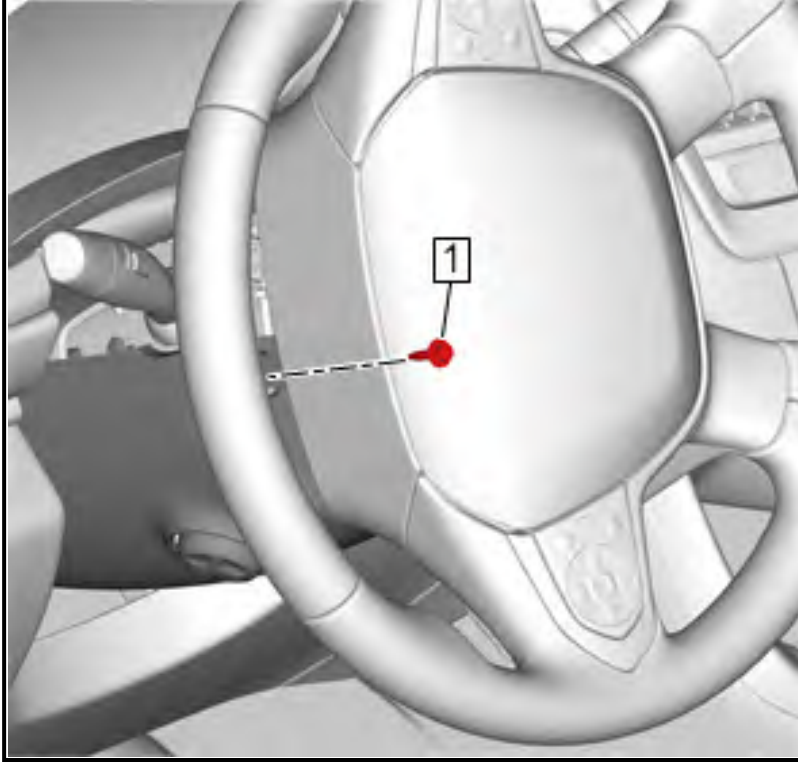


Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)

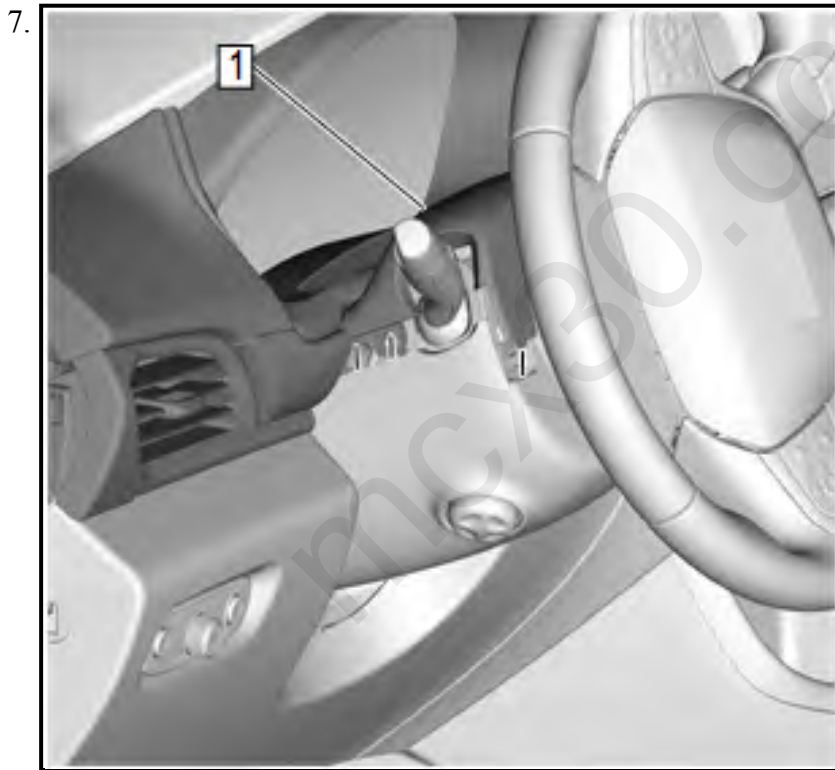
5. Turn the steering wheel approximately 90 degrees to the left of the centered position.

6.





Steering Column Lower Trim Cover Bolt (1) - Install and tighten 2.5 N.m (22 lb in)

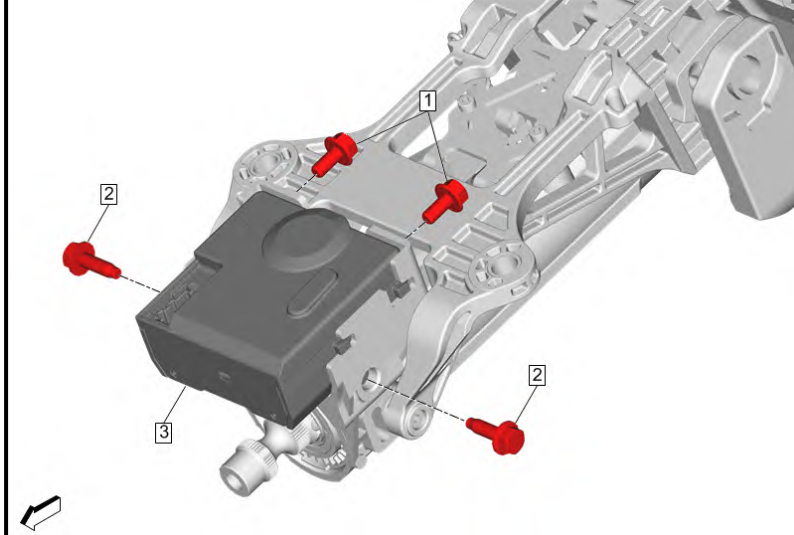


Install the Instrument Panel Trim Pad - Left Side (1) to the steering column lower trim cover.
[Instrument Panel Trim Pad Replacement - Left Side](#)

8. Turn the steering wheel to the centered position.

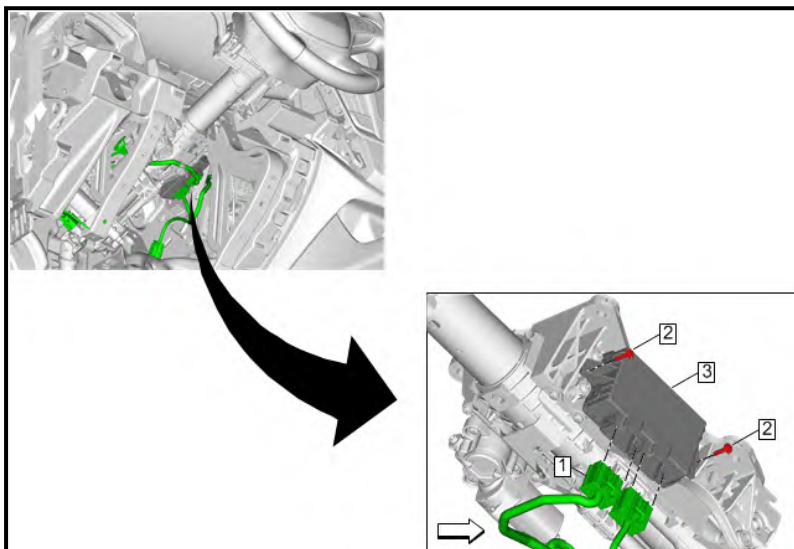
STEERING COLUMN LOCK CONTROL MODULE REPLACEMENT





Callout	Component Name
Preliminary Procedure 1. With the vehicle in accessory mode, remove fuse to unlock the steering column lock control module - Steering Wheel Wiring Schematics 2. Steering Column Replacement (N37)Steering Column Replacement (N38)	
1	Steering Column Lock Control Module Bolt - Rear [2x] CAUTION: Refer to Fastener Caution . Tighten 9.5 N.m (84 lb in)
2	Steering Column Lock Control Module Bolt - Side [2x] Tighten 9.5 N.m (84 lb in)
3	Steering Column Lock Control Module Procedure Program the steering column lock control module. Control Module References

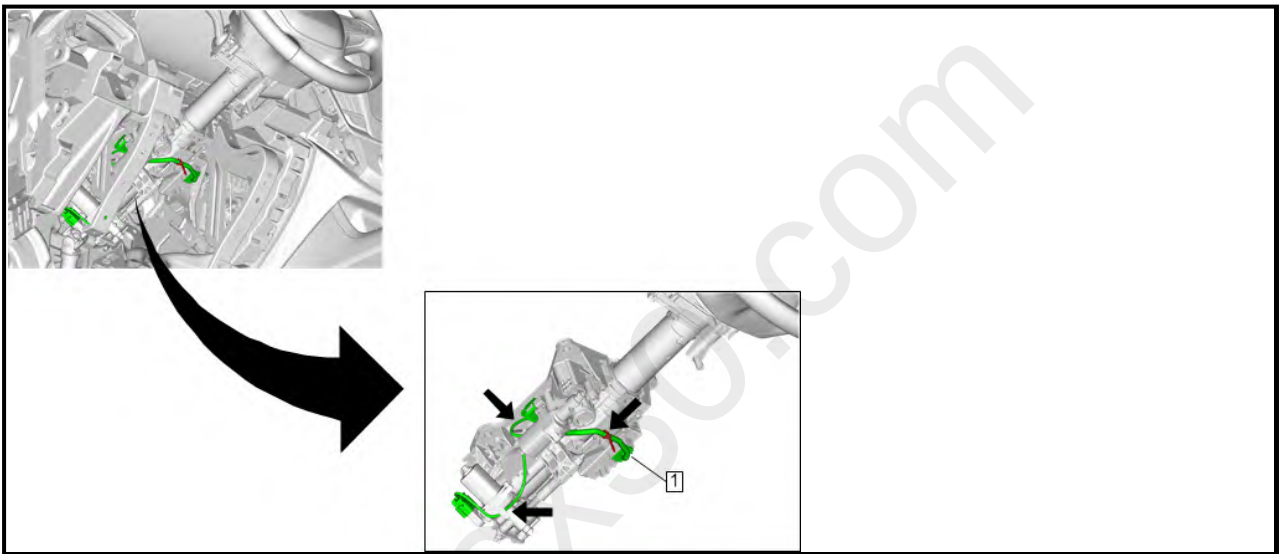
STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE REPLACEMENT



Callout	Component Name
Preliminary Procedure Instrument Panel Knee Bolster Bracket Replacement	

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

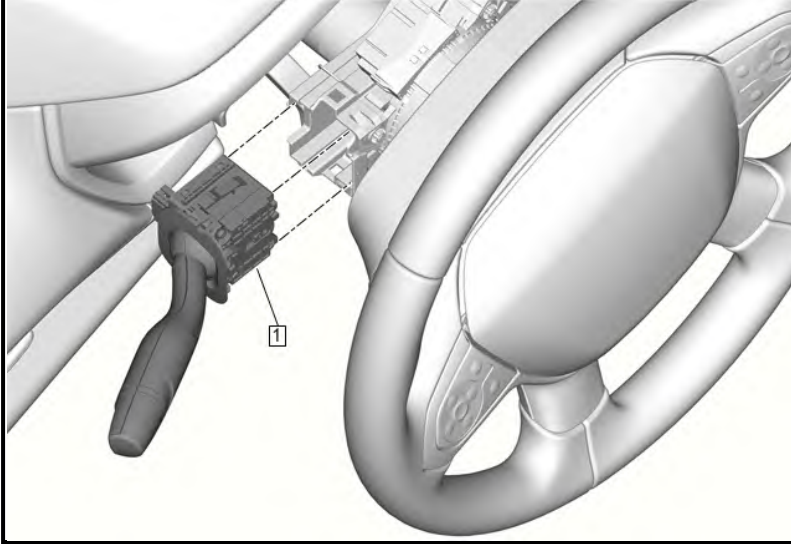
STEERING COLUMN TILT AND TELESCOPE WHEEL ACTUATOR MOTOR HARNESS REPLACEMENT



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

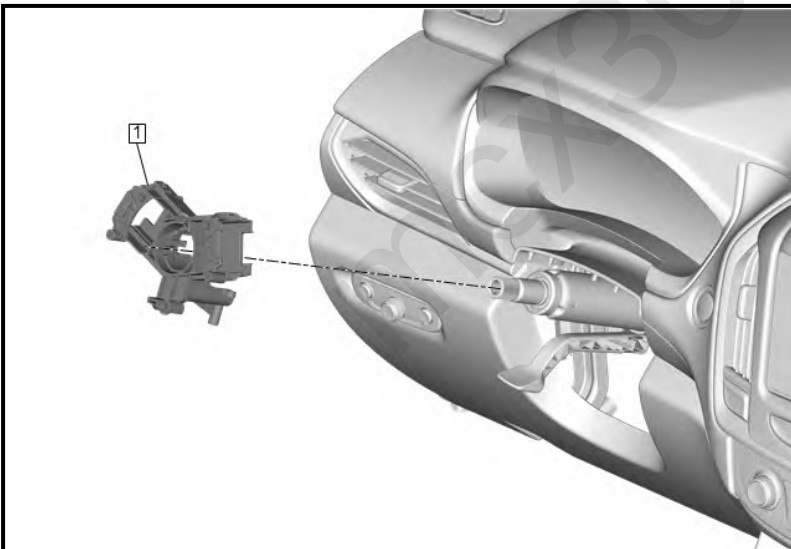
TURN SIGNAL SWITCH REPLACEMENT





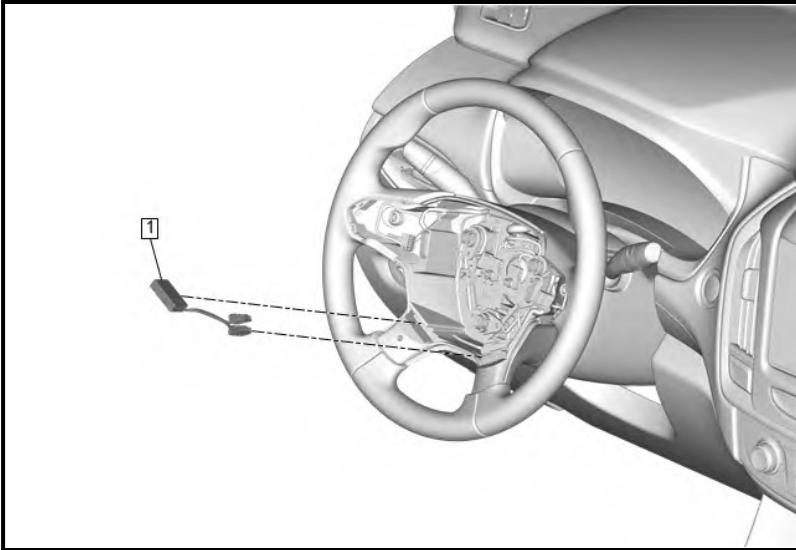
Callout	Component Name
Preliminary Procedure Steering Column Lower Trim Cover Replacement (N37) Steering Column Lower Trim Cover Replacement (N38)	
1	Turn Signal Switch Procedure 1. Disconnect the electrical connector. 2. Release the retaining tabs and remove the turn signal switch from the turn signal switch bracket.

TURN SIGNAL SWITCH BRACKET REPLACEMENT



Callout	Component Name
Preliminary Procedures 1. Steering Wheel Airbag Coil Replacement 2. Turn Signal Switch Replacement 3. Windshield Wiper and Washer Switch Replacement	
1	Turn Signal Switch Bracket Procedure Release the retaining tabs and remove the turn signal switch bracket from the steering column.

STEERING WHEEL HEAT CONTROL MODULE REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Steering Wheel Spoke Cover Replacement</u>	
1	Steering Wheel Heat Control Module Procedure 1. Disconnect the electrical connectors. 2. Use a flat bladed plastic tool to remove.

STEERING WHEEL REPLACEMENT

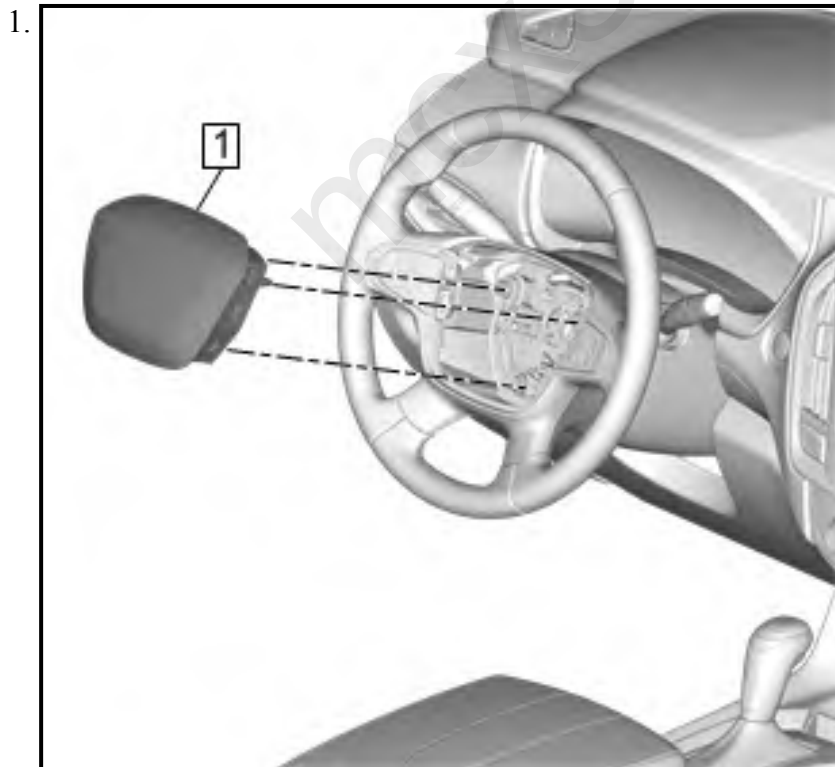


Callout	Component Name
Preliminary Procedure <u>Steering Wheel Airbag Replacement</u>	
Empty space for procedure details	

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

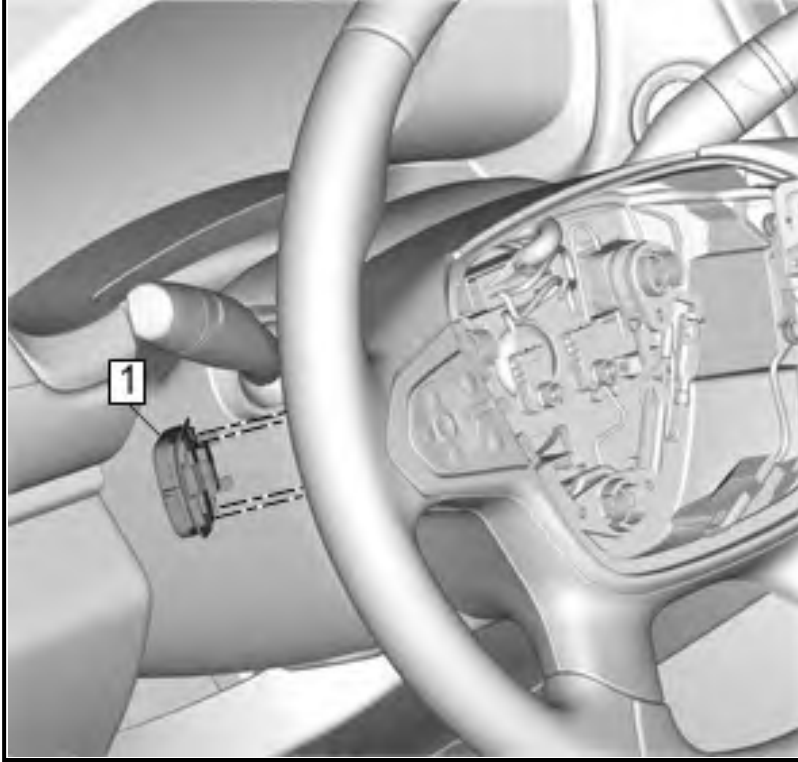
STEERING WHEEL SPOKE COVER REPLACEMENT

Removal Procedure

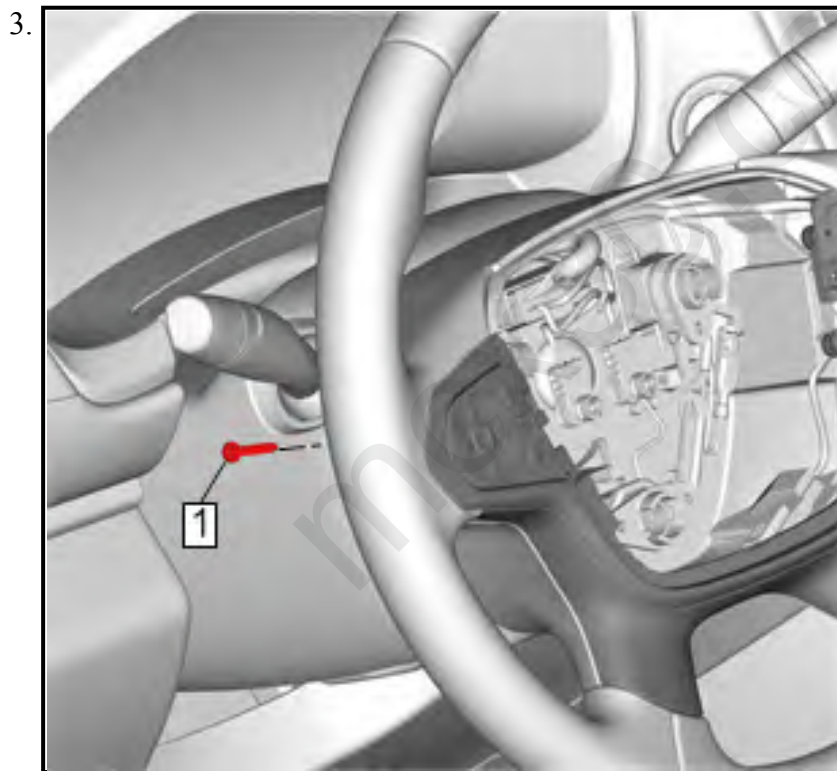


Steering Wheel Airbag (1) - Remove- Steering Wheel Airbag Replacement



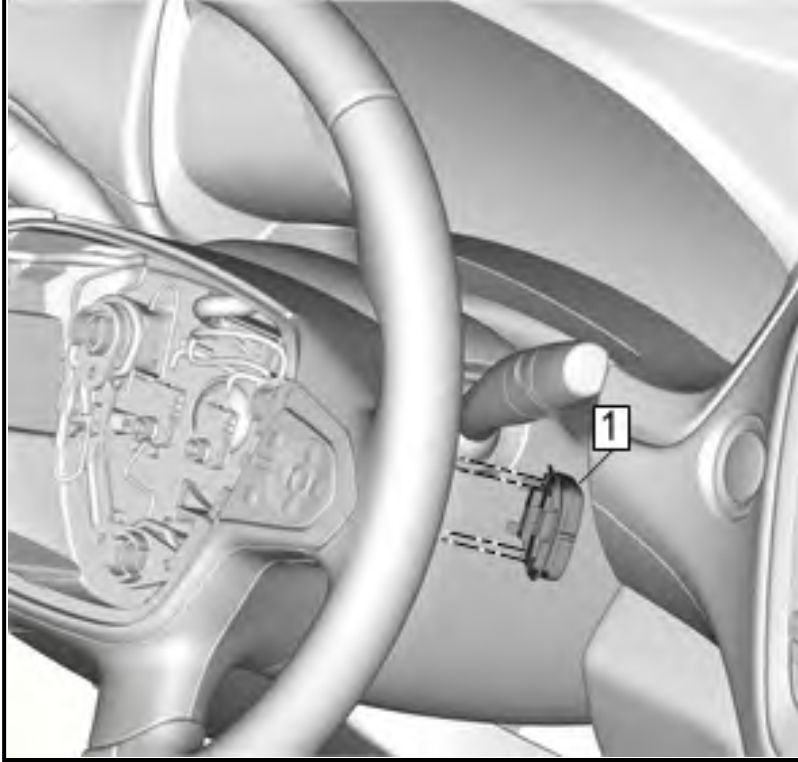


Radio Control Switch - Steering Wheel-Left Rear (1) - Remove - [Radio Control Switch Replacement - Steering Wheel \(Left Rear\)](#).



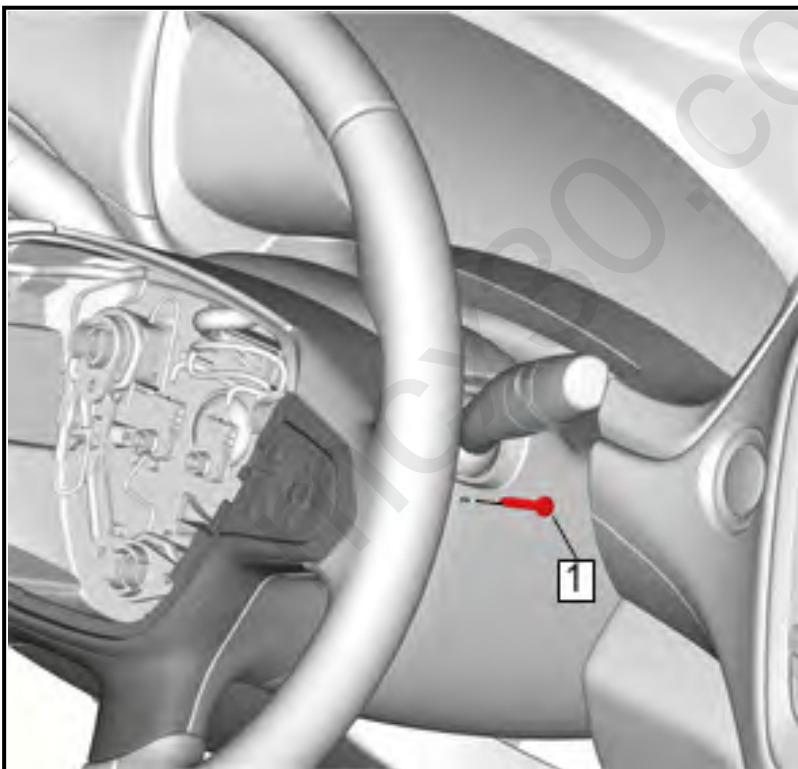
Steering Wheel Spoke Cover Fastener-Left Rear (1) - Remove





Radio Control Switch - Steering Wheel-Right Rear (1) - Remove - [Radio Control Switch Replacement - Steering Wheel \(Right Rear\)](#)

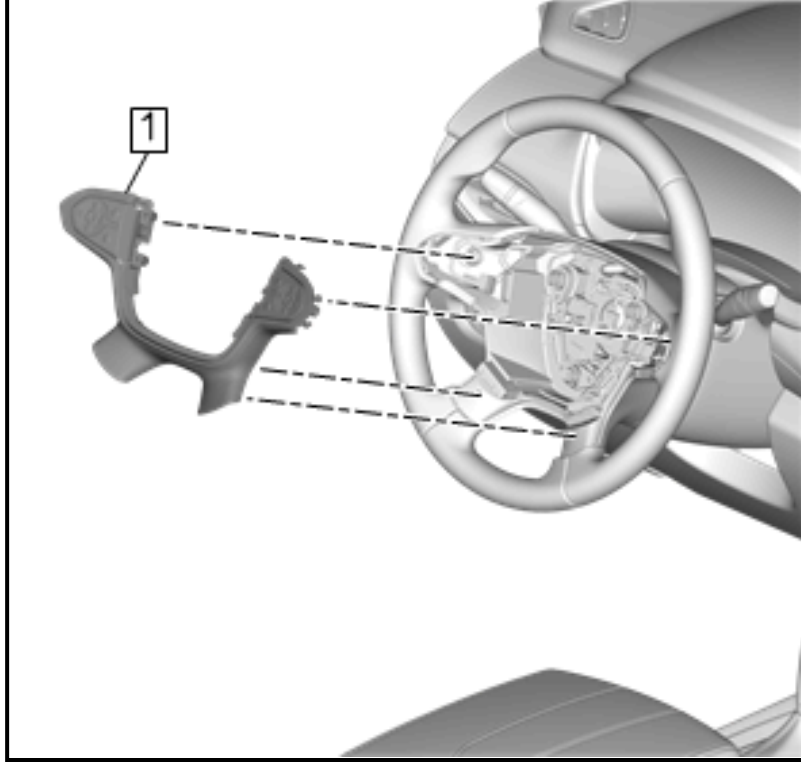
5.



Steering Wheel Spoke Cover Fastener-Right Rear (1) - Remove

6.

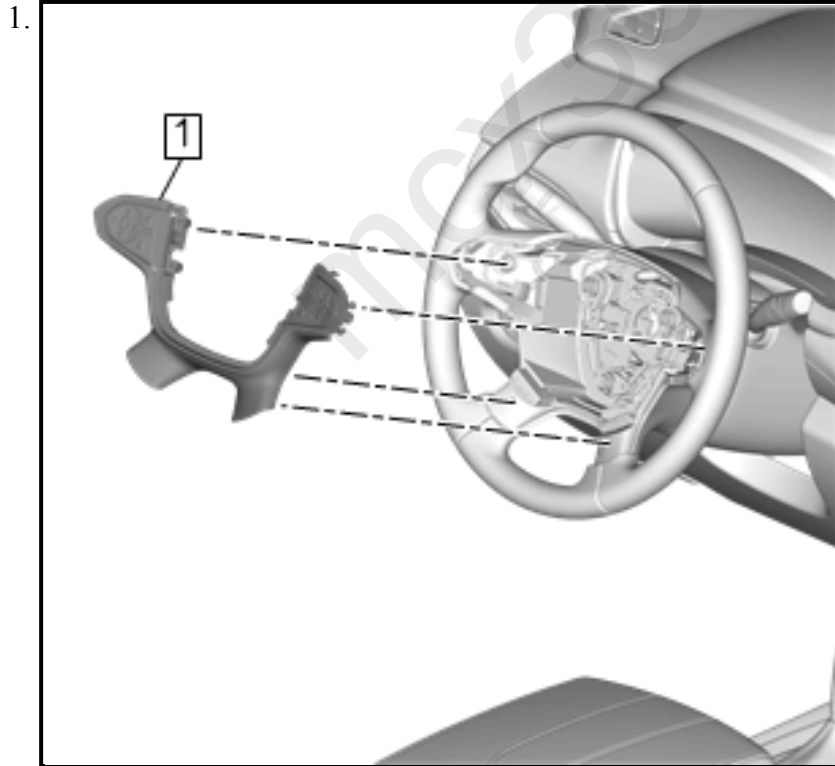




Perform the following steps to remove the steering wheel spoke cover (1):

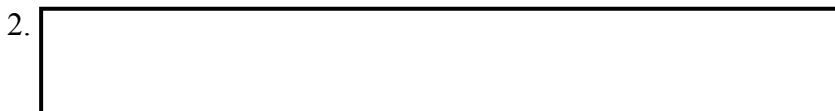
1. Use a flat bladed plastic tool to release the steering wheel spoke cover, cruise control switch, and radio control switch from the steering wheel.
2. Disconnect the electrical connectors.
7. Transfer components as necessary.

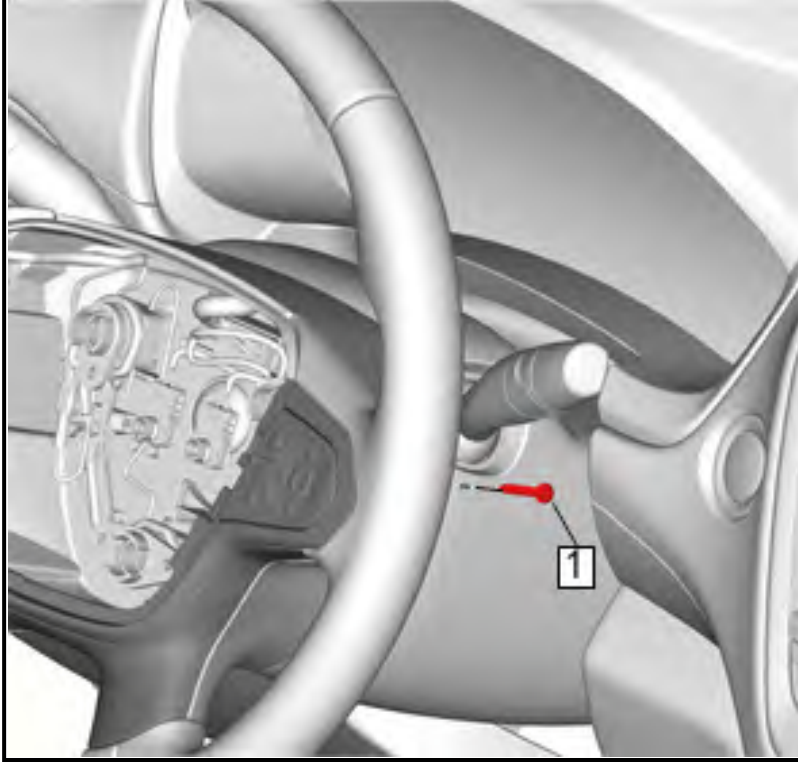
Installation Procedure



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

1. Connect the electrical connectors.
2. Secure the steering wheel spoke cover, cruise control switch, and radio control switch to the steering wheel.

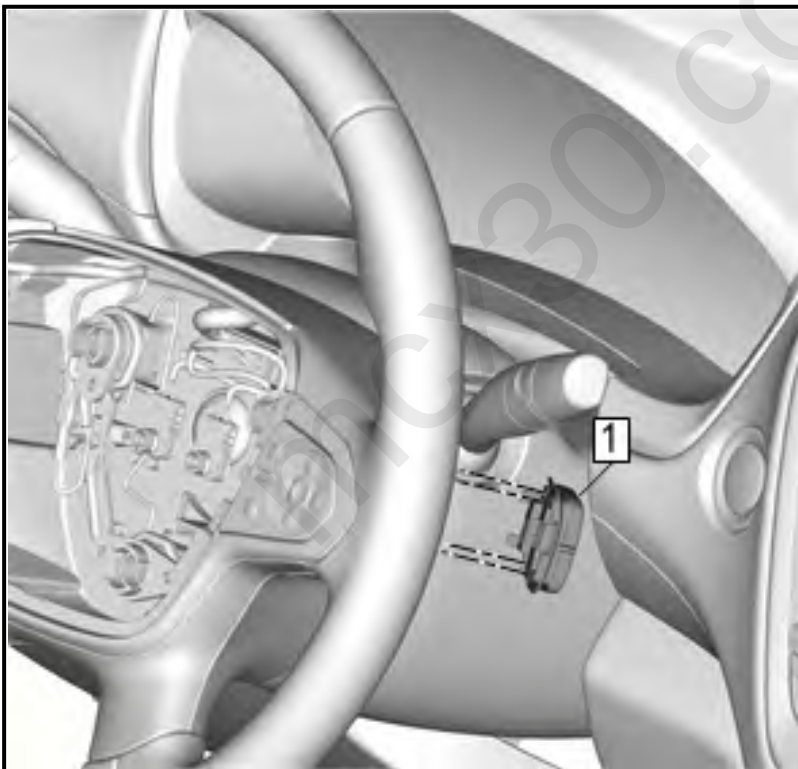




CAUTION: Refer to [Fastener Caution](#) .

Steering Wheel Spoke Cover Fastener-Right Rear (1) - Install and tighten 2.5 N.m (22 lb in)

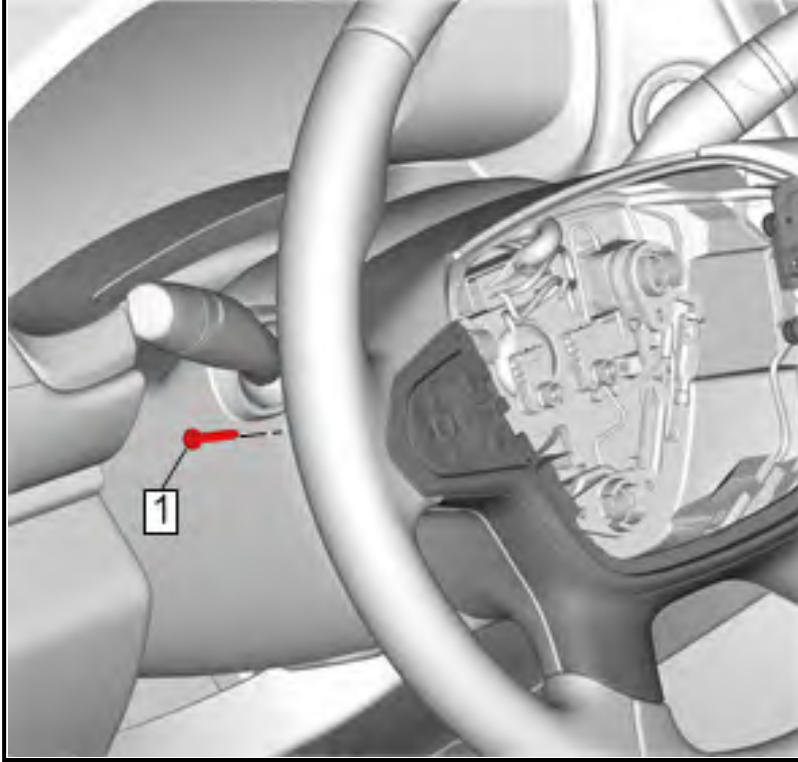
3.



Radio Control Switch - Steering Wheel-Right Rear (1) - Install - [Radio Control Switch Replacement - Steering Wheel \(Right Rear\)](#)

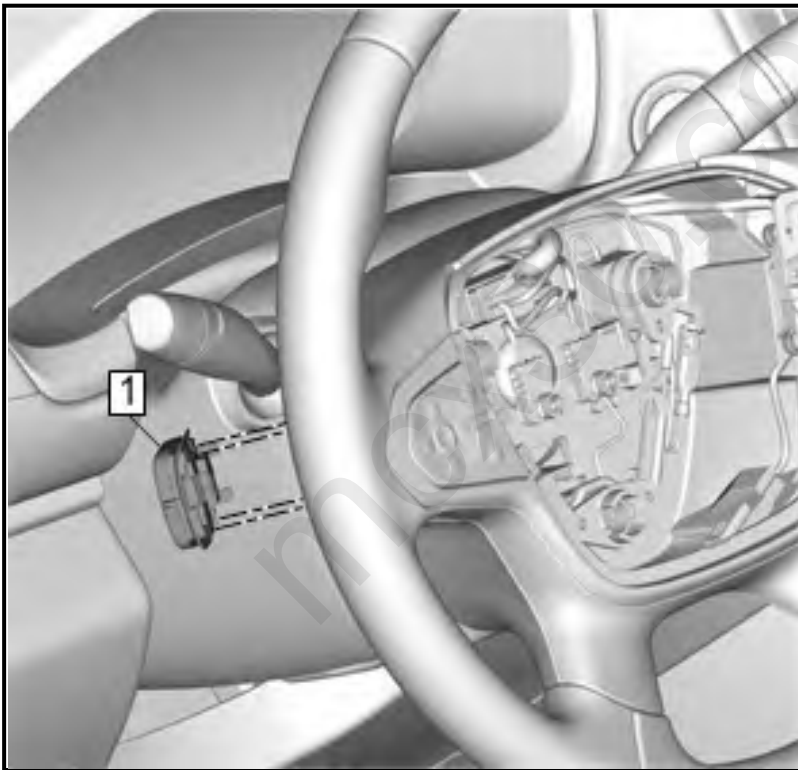
4.





Steering Wheel Spoke Cover Fastener-Left Rear (1) - Install and tighten 2.5 N.m (22 lb in)

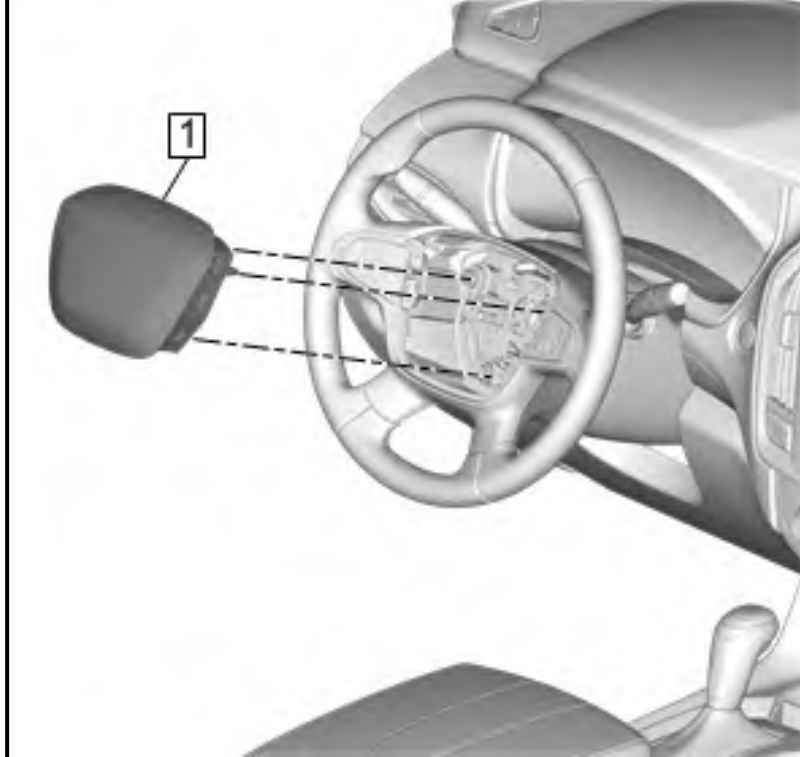
5.



Radio Control Switch - Steering Wheel-Left Rear (1) - Install - [Radio Control Switch Replacement - Steering Wheel \(Left Rear\)](#)

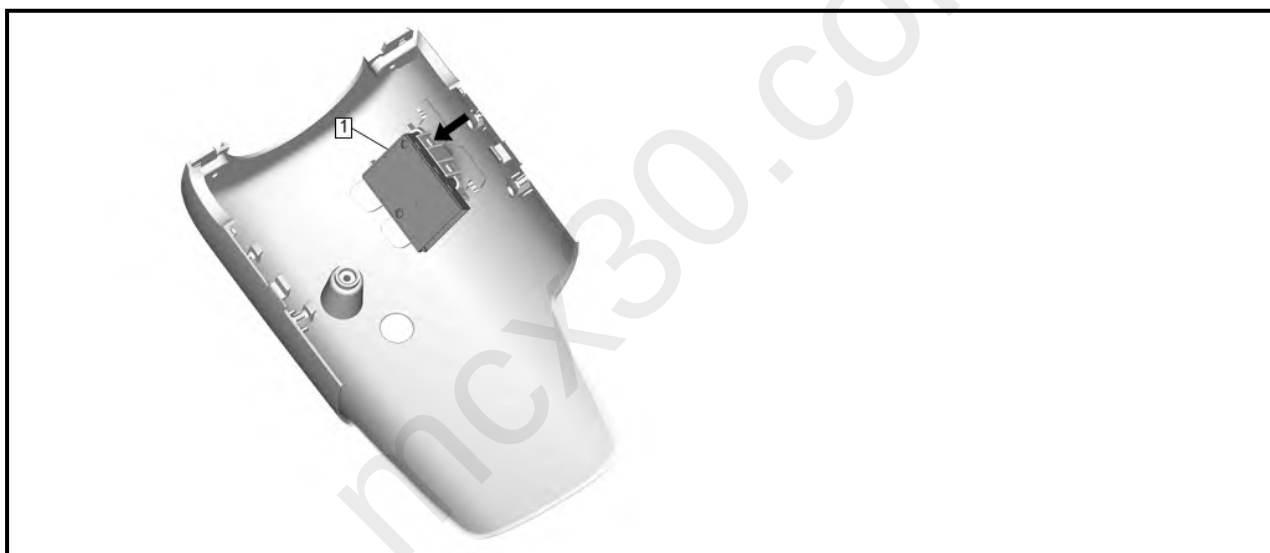
6.





Steering Wheel Airbag (1) - Install- [Steering Wheel Airbag Replacement](#)

STEERING COLUMN TILT WHEEL AND TELESCOPE SWITCH REPLACEMENT



Callout	Component Name
Preliminary Procedure Steering Column Lower Trim Cover Replacement (N38)	
1	Steering Column Tilt Wheel and Telescope Switch Procedure Release the retaining tabs and remove the steering column tilt wheel and telescope switch from the steering column lower trim cover.

STEERING COLUMN REPLACEMENT (N37)

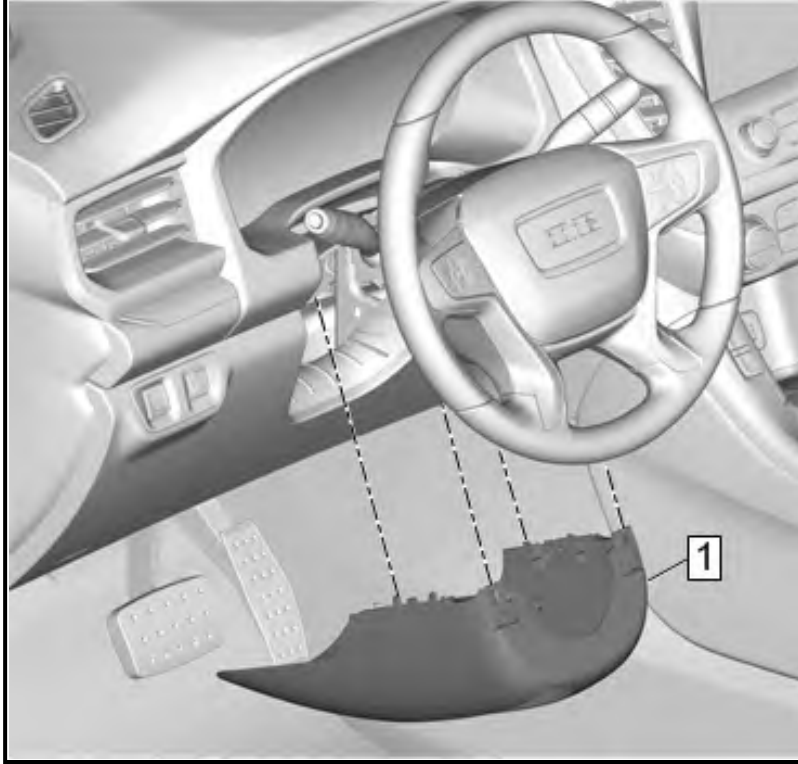
Removal Procedure

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

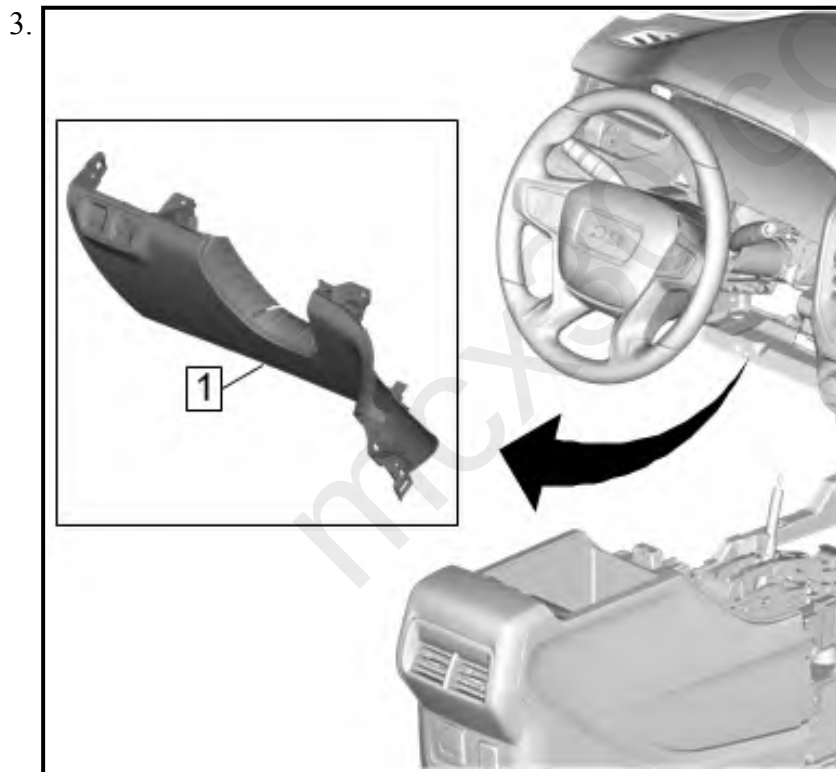
WARNING: Refer to [SIR Inflator Module Handling and Storage Warning](#) .

1. Disable the SIR system. [SIR Disabling and Enabling](#)

2.

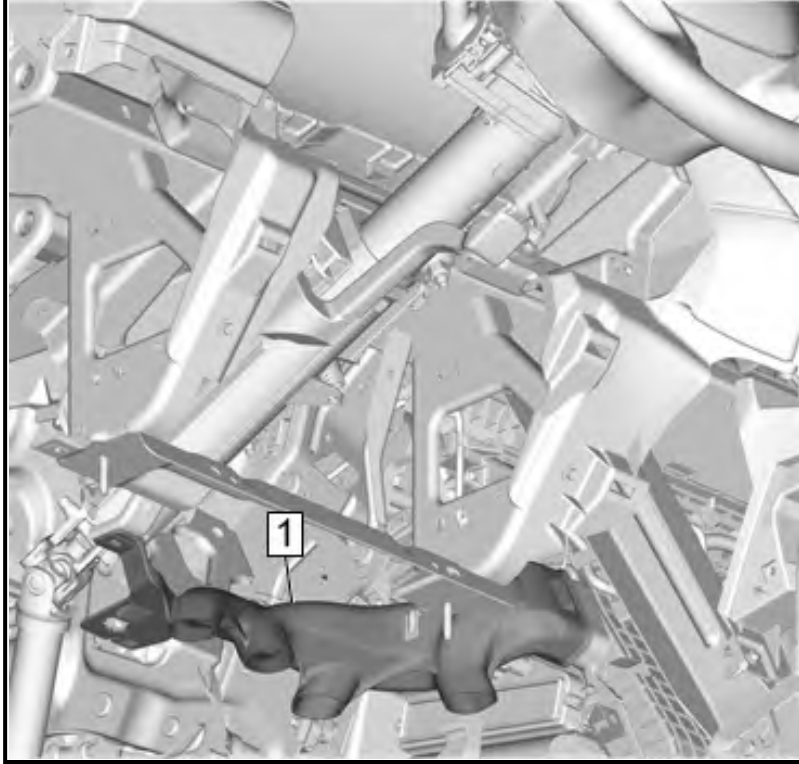


Steering Column Lower Trim Cover (1) - Remove - [Steering Column Lower Trim Cover Replacement \(N37\)](#)



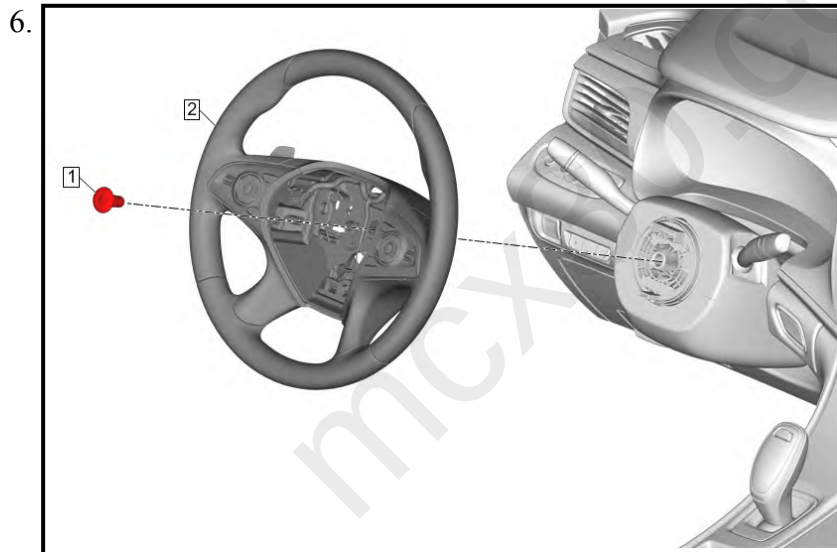
Instrument Panel Knee Bolster (1) - Remove - [Instrument Panel Knee Bolster Replacement](#)





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

5. Disconnect the steering column electrical connectors as necessary.



CAUTION: The anti-rotation pin must be installed AFTER removing the steering wheel bolt. Removal torque of the steering wheel bolt may exceed the threshold of the steering column rivets and damage the steering column rivets, which will disable the telescoping mechanism. If the steering column rivets are damaged, a new steering column must be installed.

Steering Wheel Bolt (1) - Remove - [Steering Wheel Replacement](#)

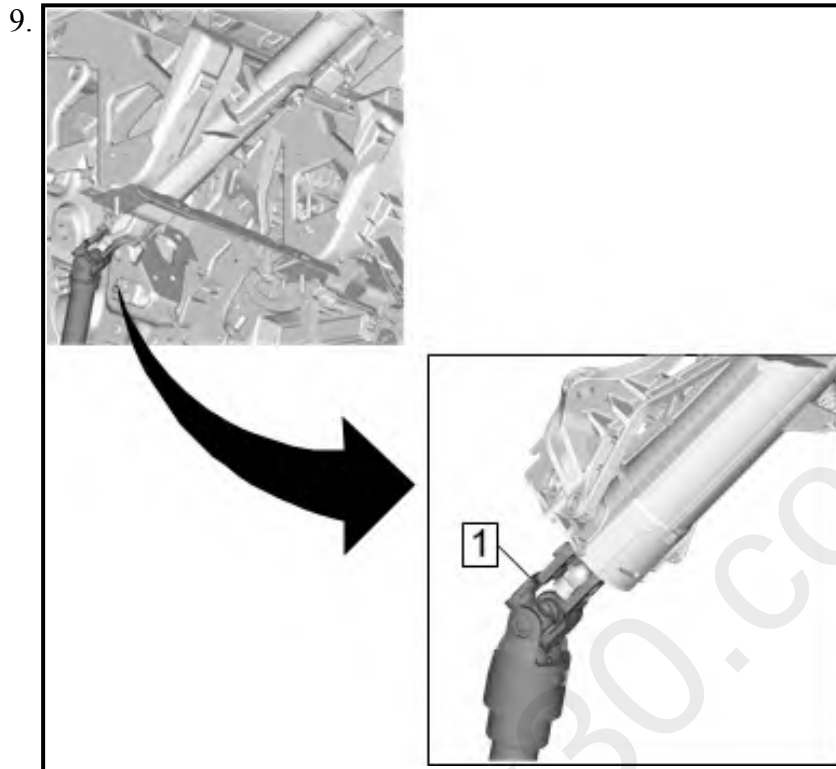
CAUTION: With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must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

- The steering column
- The intermediate shaft(s)

- The steering gear

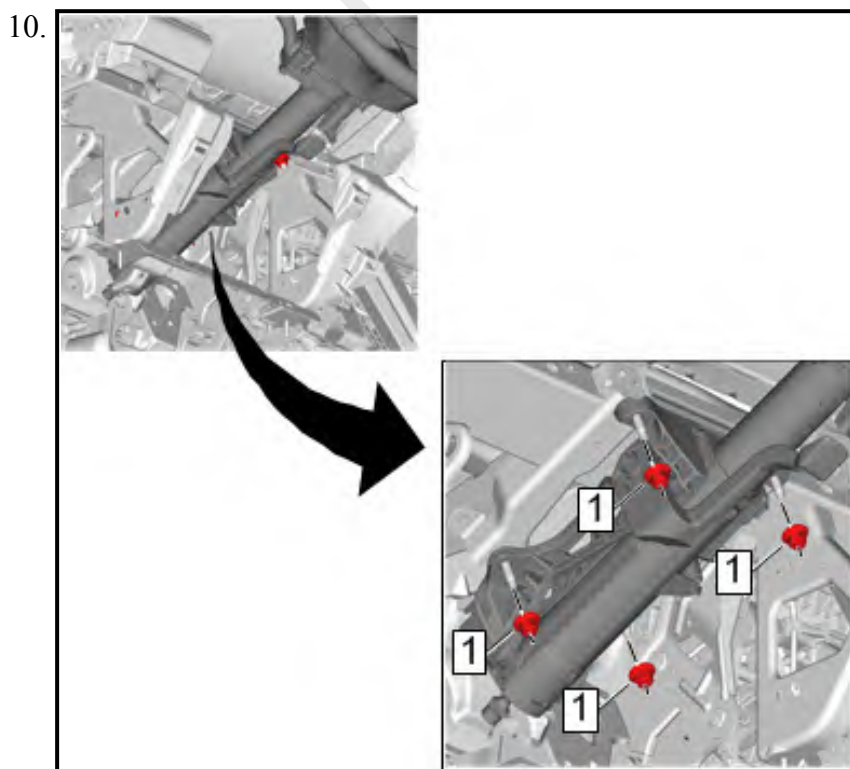
After disconnecting these components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to the SIR coil. If you think the SIR coil has become un-centered, refer to your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

7. Install an appropriate device to prevent the steering column from rotating.
8. Steering Wheel (2) - Remove - [Steering Wheel Replacement](#)



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

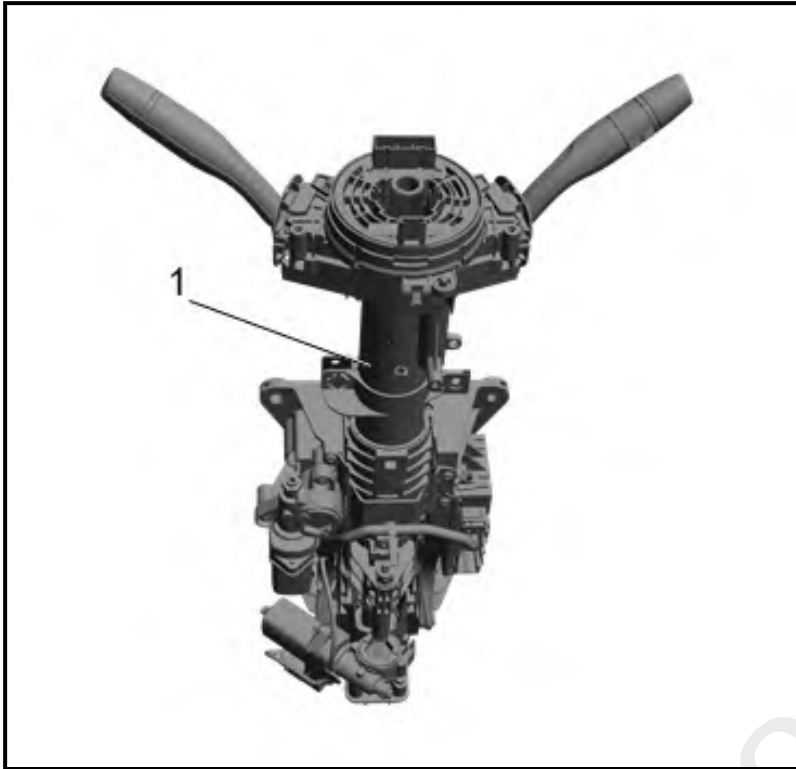
Intermediate Steering Shaft (1) @ Steering Column - Separate - [Intermediate Steering Shaft Replacement](#)



NOTE: Support the steering column while removing the steering column nuts.

Steering Column Nut (1) - Remove [4x]

11.



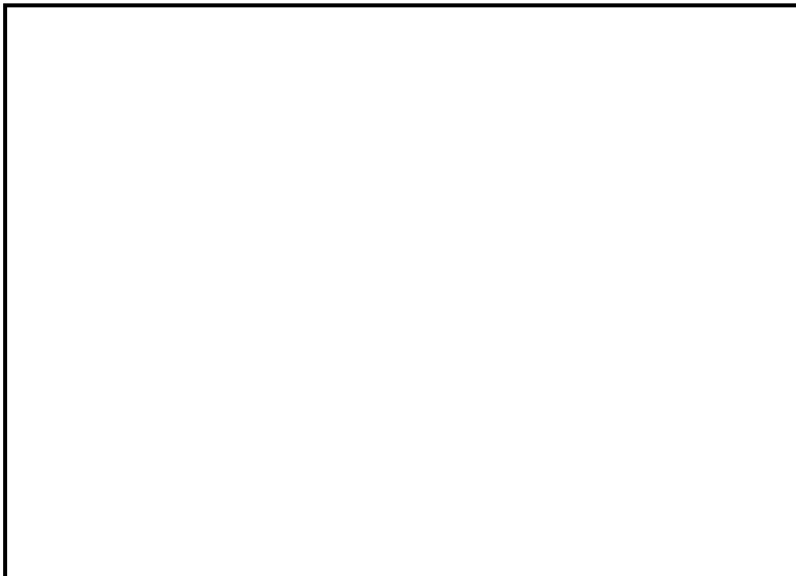
CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on the end could collapse the steering shaft or loosen the plastic injections, which maintain column rigidity. Leaning on the column assembly could cause the jacket 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.

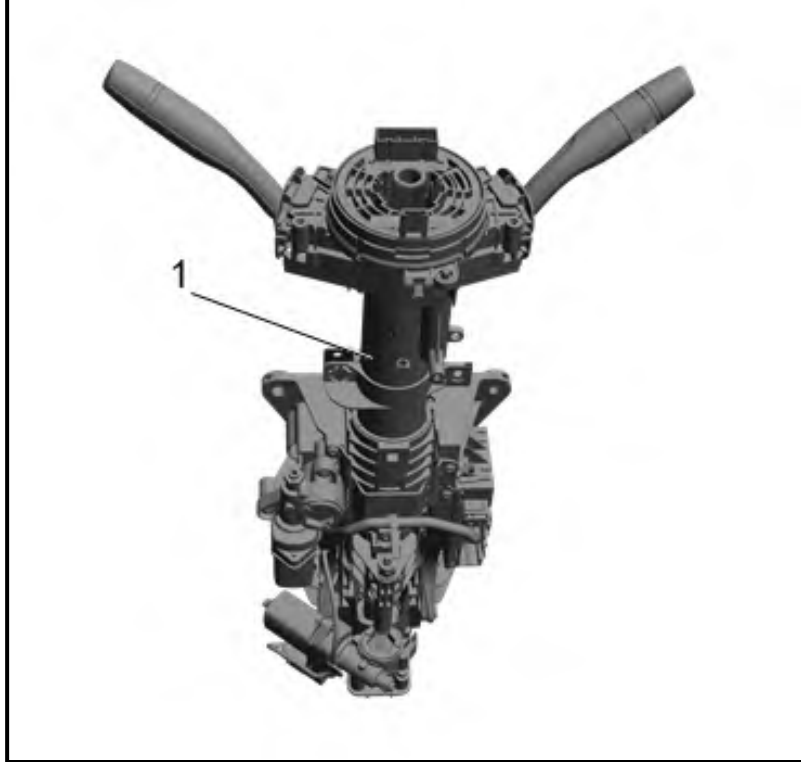
Steering Column (1) - Remove

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

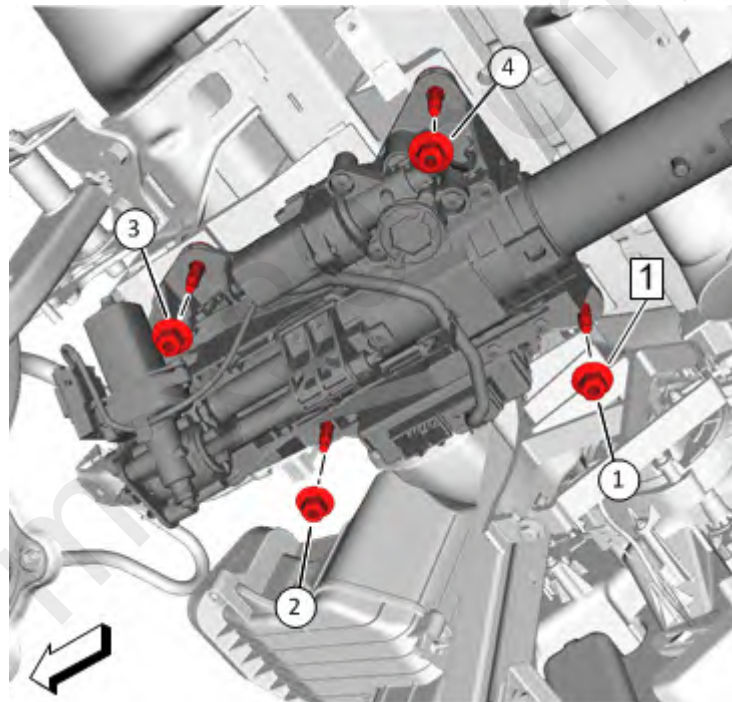
Installation Procedure

1.





Steering Column (1) - Install



2.

Fig. 1: Steering Column Nuts With Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

NOTE: Support the steering column while installing the steering column nuts.

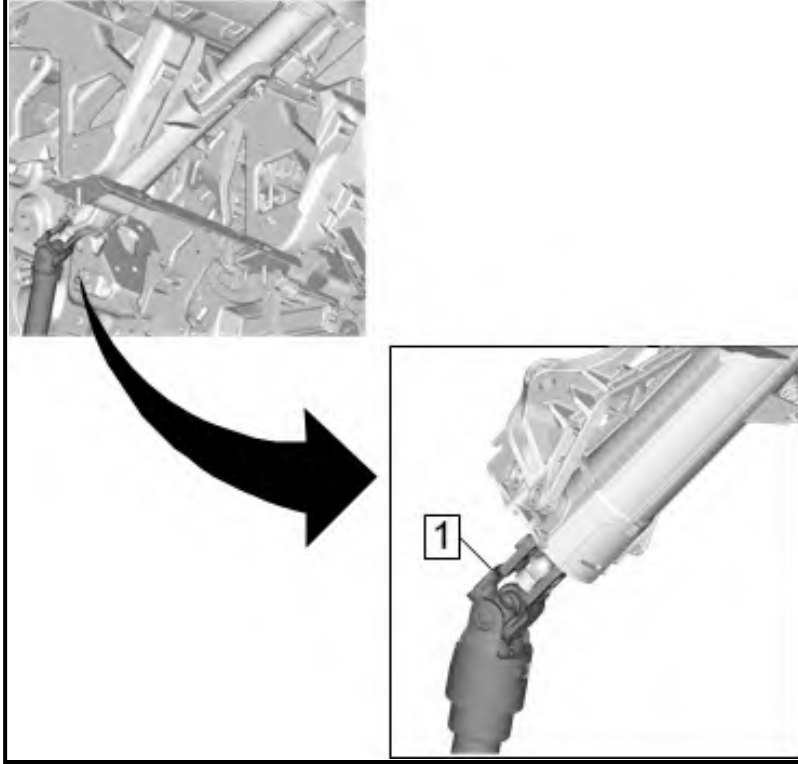
Steering Column Nut (1) - Install and hand tighten [4x]

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

3. Steering Column Nut (1) - Tighten in sequence [4x] 22 N.m (16 lb ft)

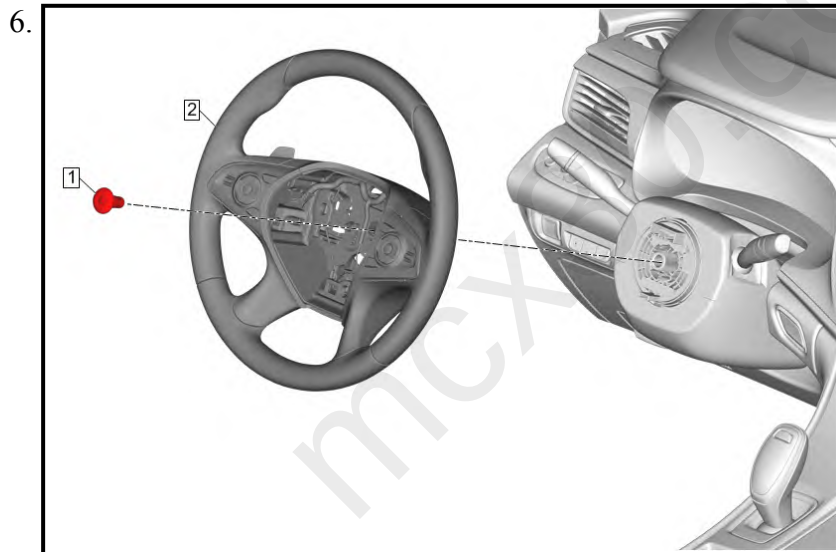
4.





Intermediate Steering Shaft (1) @ Steering Column - Install - [Intermediate Steering Shaft Replacement](#)

5. Connect the steering column electrical connectors.



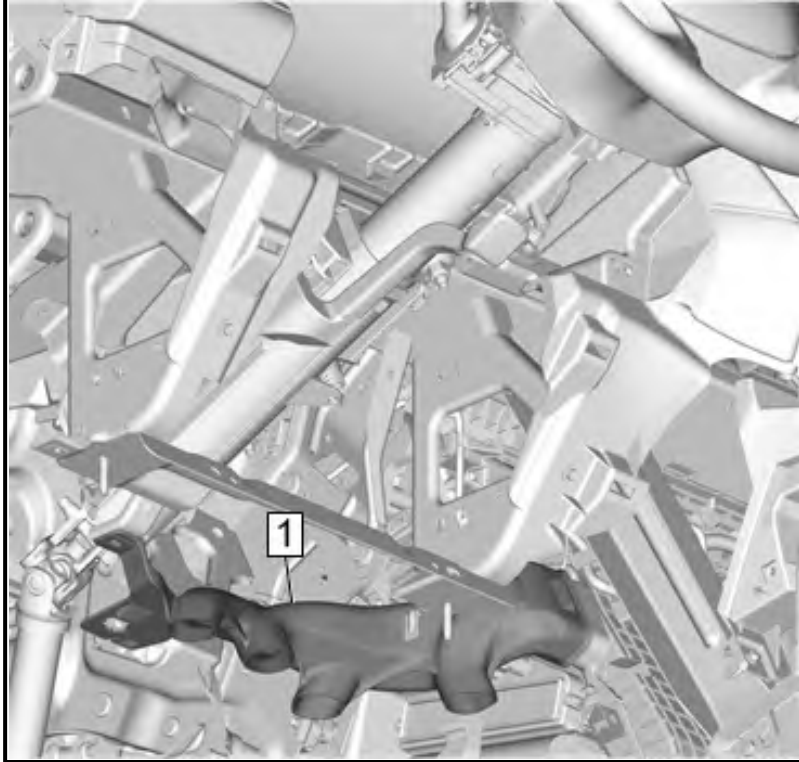
CAUTION:

The anti-rotation pin must be removed from the steering column before installing the steering wheel. Ensure that the steering wheel bolt is torqued to specification during steering wheel installation. Over torquing the steering wheel bolt can result in damage to the steering column rivets which will disable the telescoping mechanism. If the steering column rivets are damaged, a new steering column must be installed.

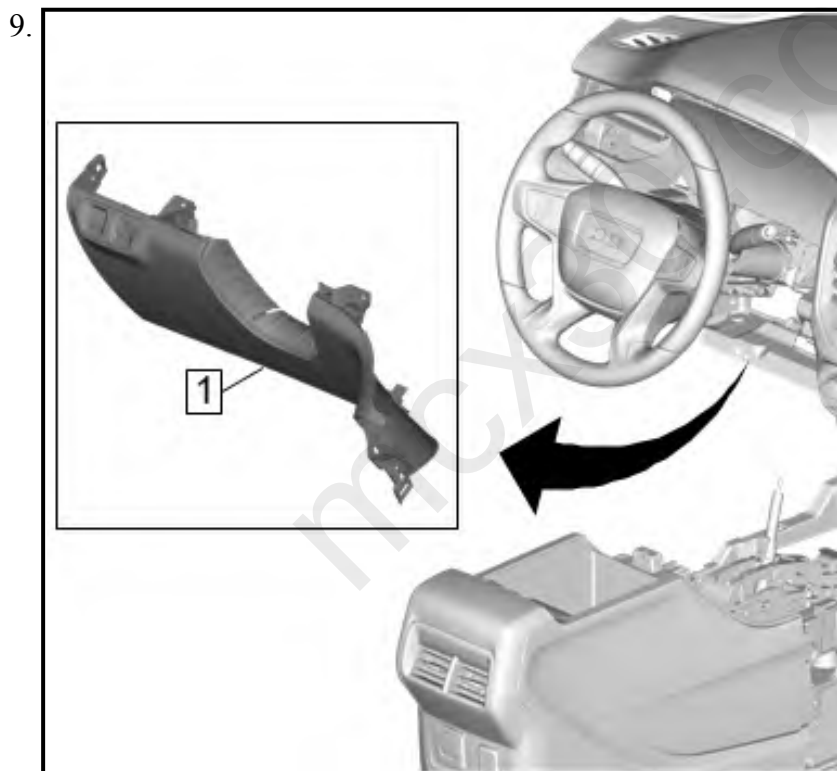
Remove the device used to prevent steering column rotation.

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

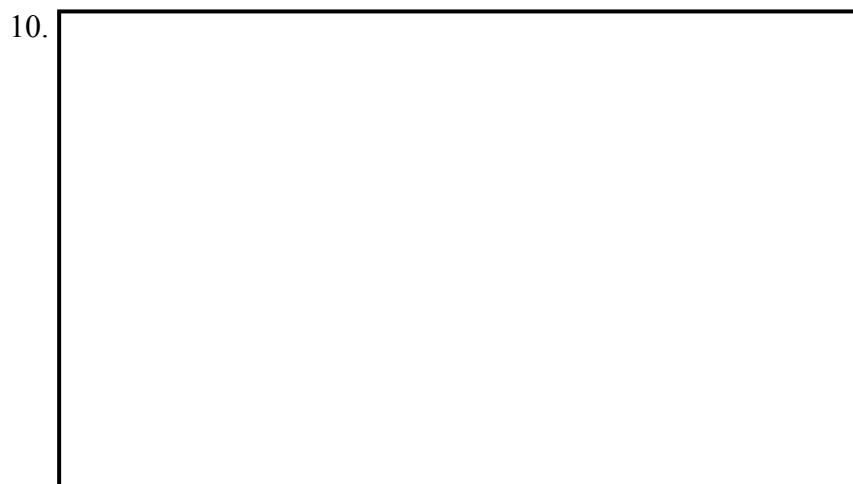


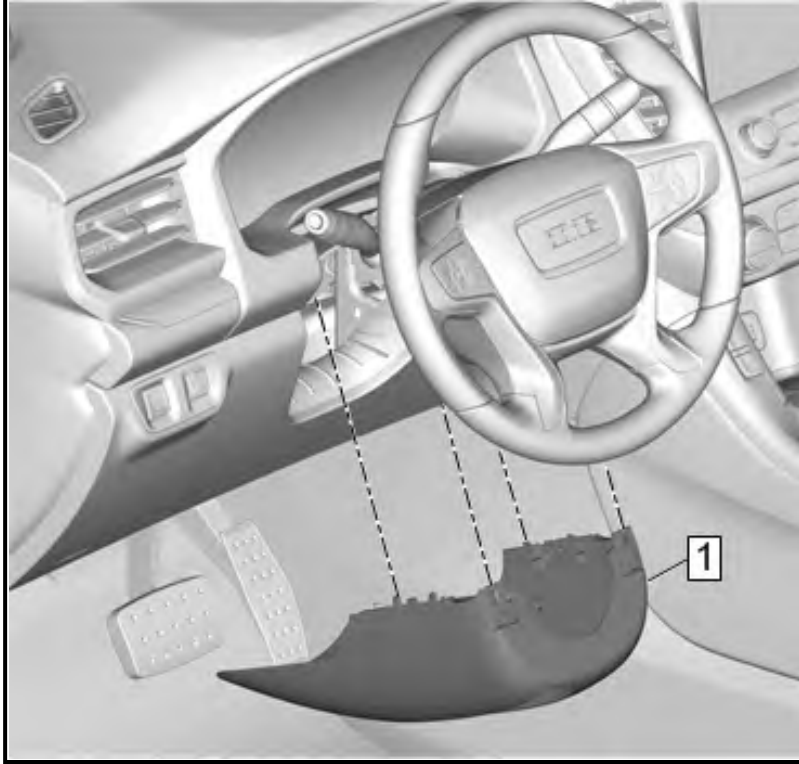


Floor Front Air Outlet Duct - Left Side (1) - Install - [Floor Front Air Outlet Duct Replacement - Left Side](#)



Instrument Panel Knee Bolster (1) - Install - [Instrument Panel Knee Bolster Replacement](#)





Steering Column Lower Trim Cover (1) - Install - [Steering Column Lower Trim Cover Replacement \(N37\)](#).

11. Enable the SIR System. [SIR Disabling and Enabling](#)
12. Center the steering angle sensor. [Steering Wheel Angle Sensor Centering](#)
13. Perform functionality check of tilt and telescoping features.

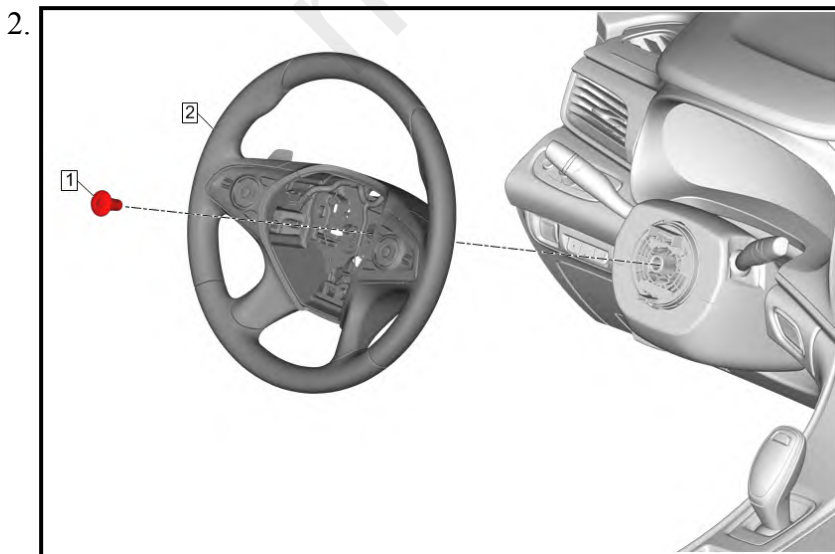
STEERING COLUMN REPLACEMENT (N38)

Removal Procedure

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

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

1. Disable the SIR system. [SIR Disabling and Enabling](#)



CAUTION: The anti-rotation pin must be installed AFTER removing the steering wheel bolt. Removal torque of the steering wheel bolt may exceed the threshold of the steering column rivets and damage the steering column rivets, which will disable the telescoping mechanism. If the steering column rivets are damaged, a new steering column must be installed.

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:

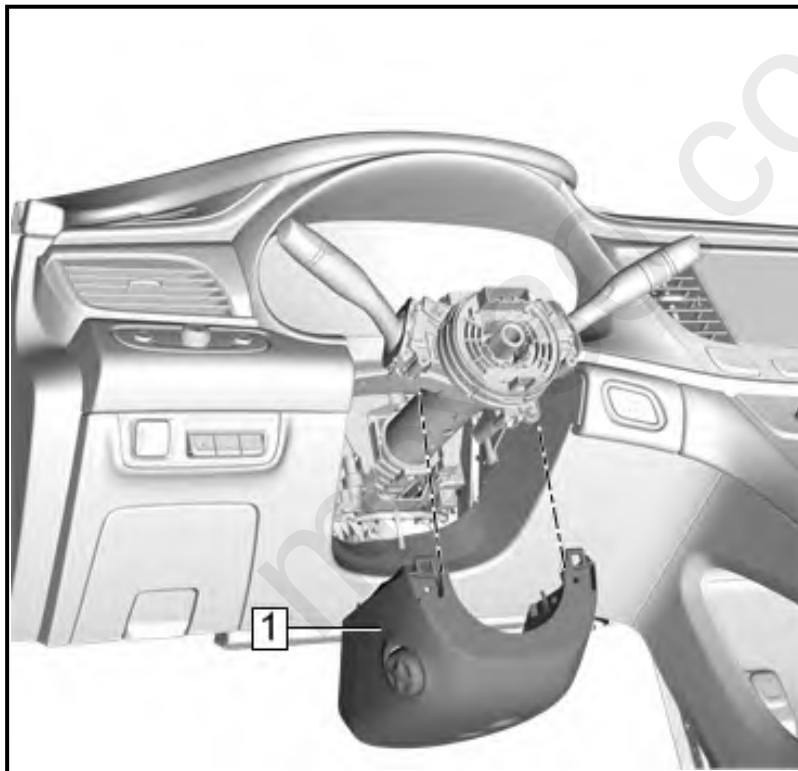
- The steering column
- The intermediate shaft(s)
- The steering gear

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. Install an appropriate device to prevent the steering column from rotating.

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

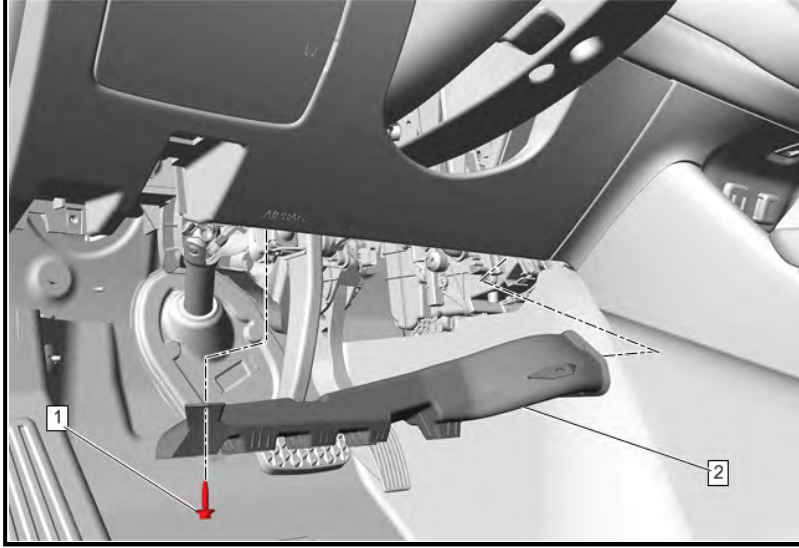
5.



Steering Column Lower Trim Cover (1) - Remove - [Steering Column Lower Trim Cover Replacement \(N38\)](#)

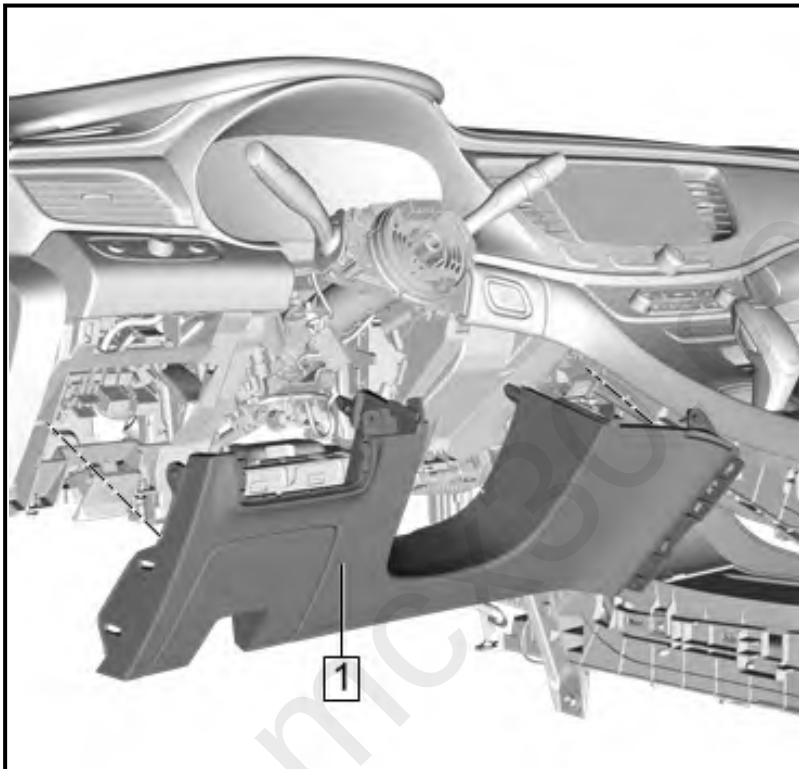
6.





Floor Front Air Outlet Duct - Left Side (2) - Remove - [Floor Front Air Outlet Duct Replacement - Left Side](#)

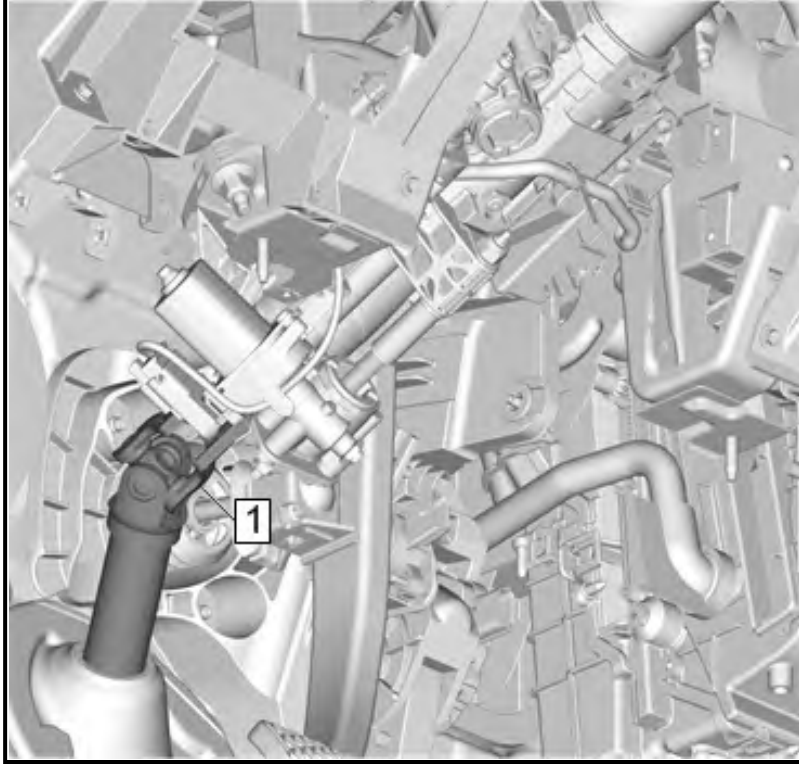
7.



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

8.

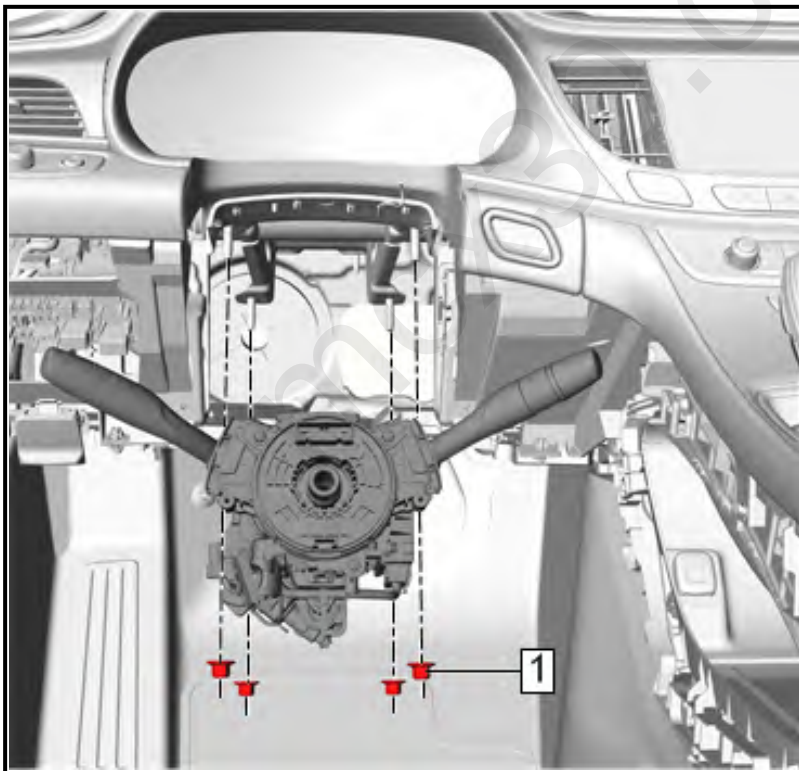




NOTE: Place match marks on the steering column shaft and the intermediate steering shaft to aid in installation.

Intermediate Steering Shaft (1) @ Steering Column - Separate - [Intermediate Steering Shaft Replacement](#)

9.



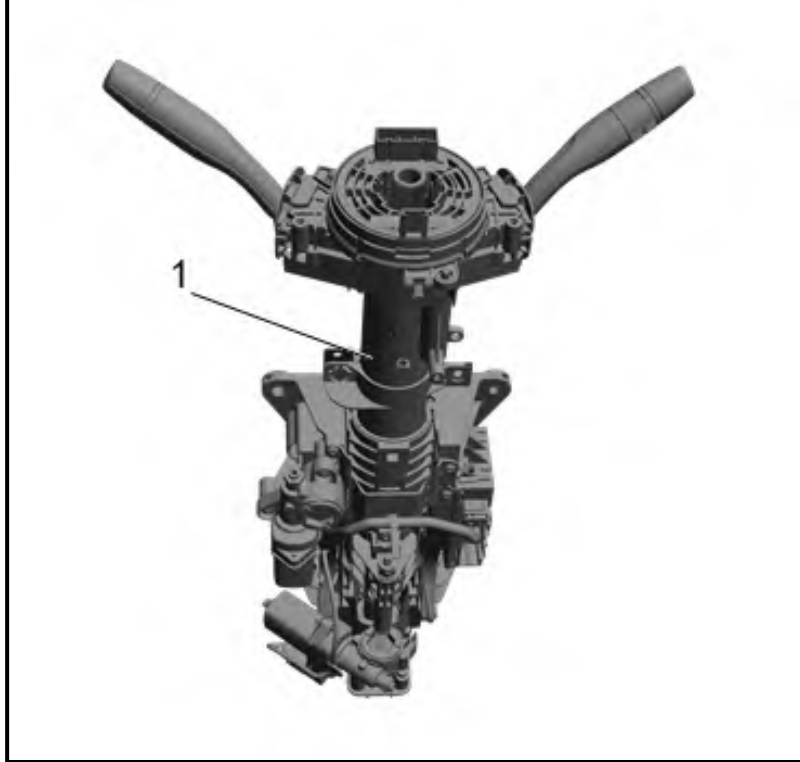
NOTE: Support the steering column while removing the steering column nuts.

Steering Column Nut (1) - Remove [4x]

10. Disconnect the steering column electrical connectors as necessary.

11.





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.

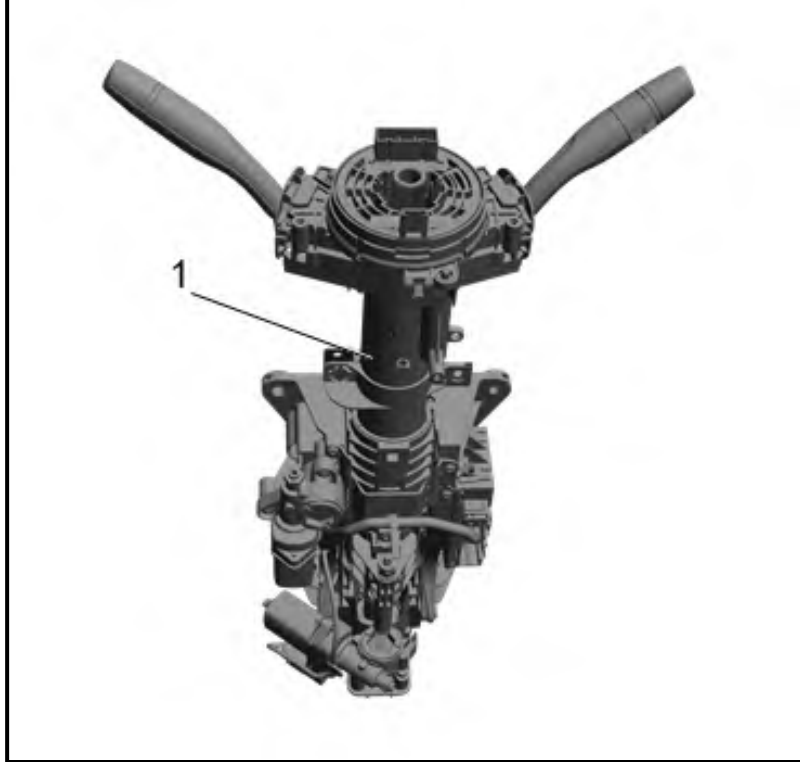
Steering Column (1) - Remove

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

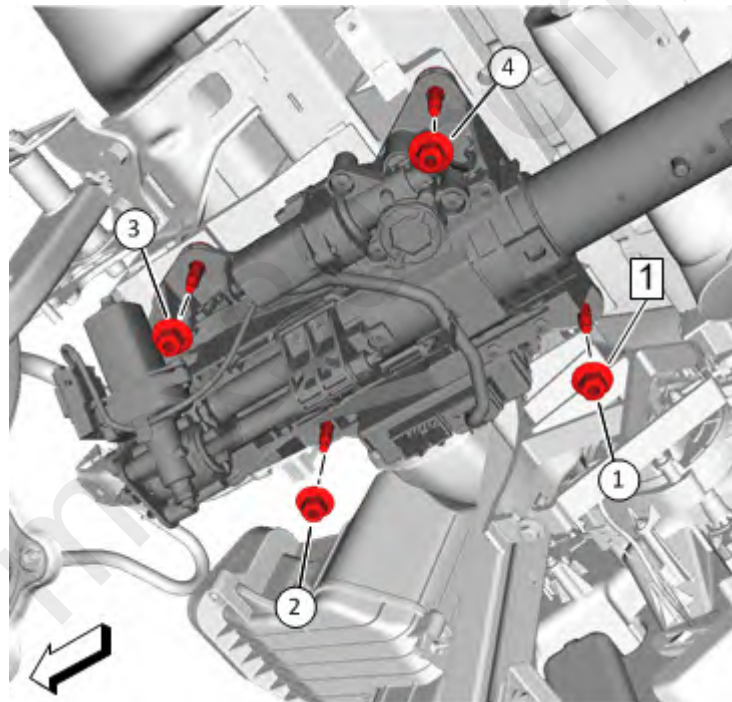
Installation Procedure

1.





Steering Column (1) - Install



2.

Fig. 2: Steering Column Nuts With Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

NOTE: Support the steering column while installing the steering column nuts.

Steering Column Nut (1) - Install and hand tighten [4x]

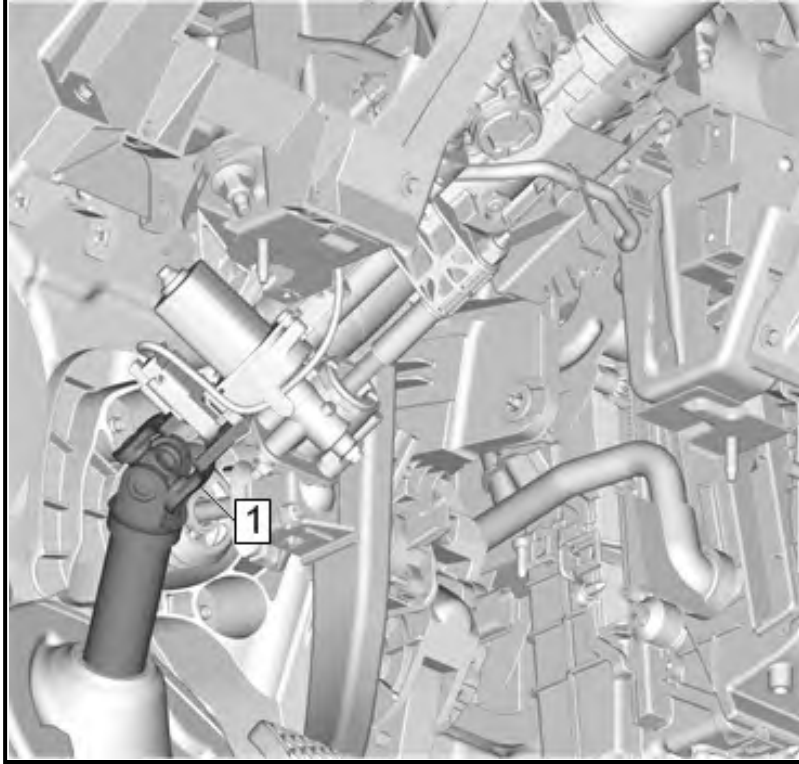
CAUTION: Refer to [Fastener Caution](#) .

3. Steering Column Nut (1) - Tighten in sequence [4x] 22 N.m (16 lb ft)

4. Connect the steering column electrical connectors.

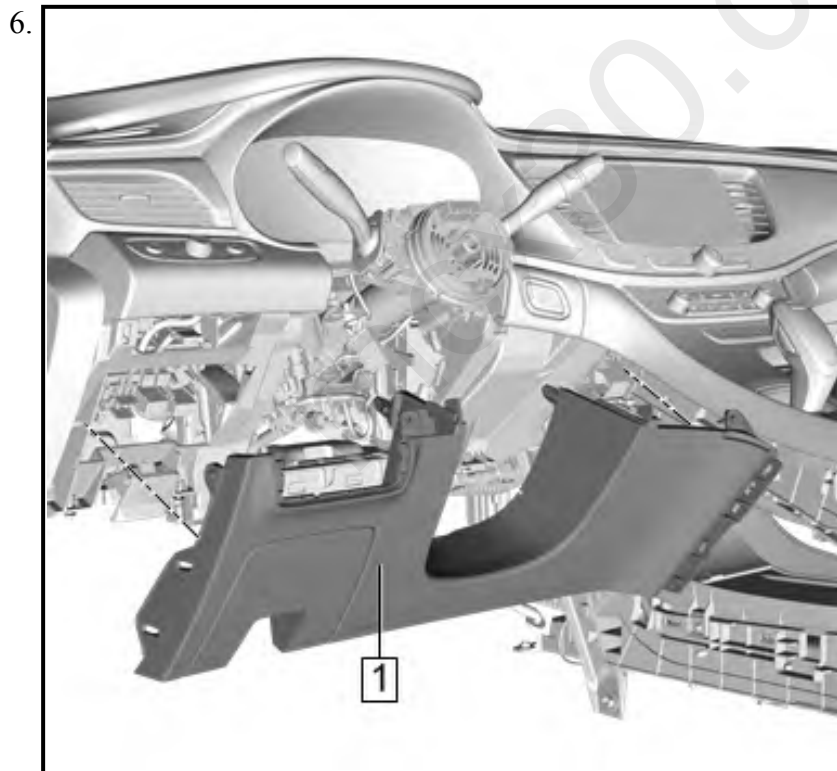
5.





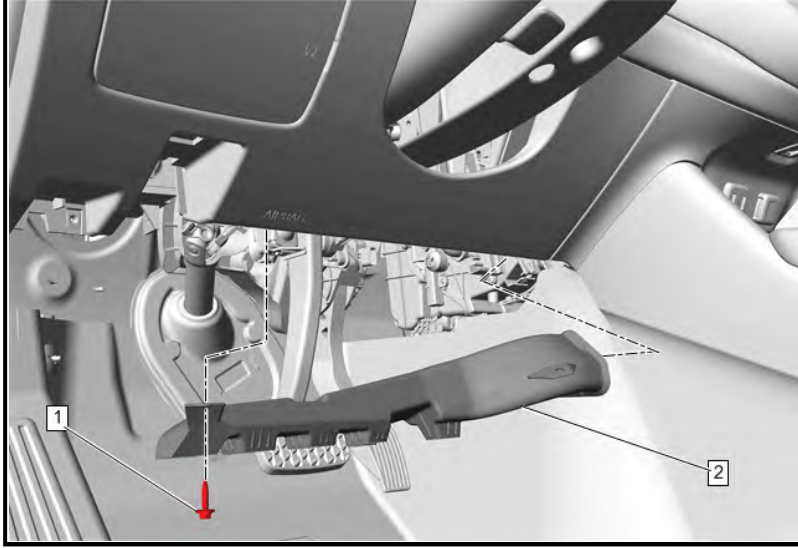
NOTE: Ensure the match marks on the upper intermediate steering shaft and steering column are aligned.

Intermediate Steering Shaft (1) @ Steering Column - Install - [Intermediate Steering Shaft Replacement](#)



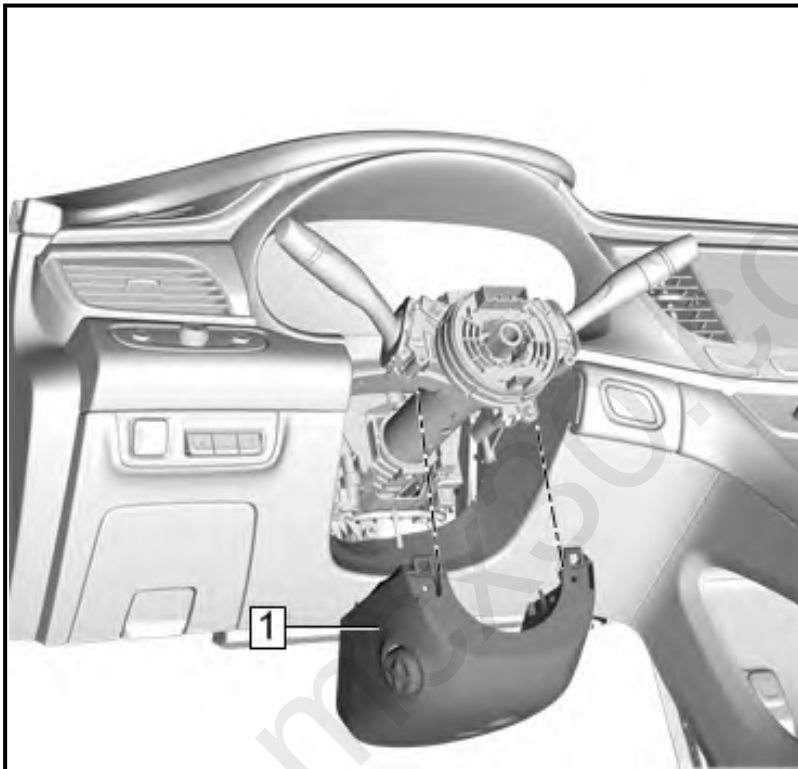
Instrument Panel Knee Bolster (1) - Install - [Instrument Panel Knee Bolster Replacement](#)





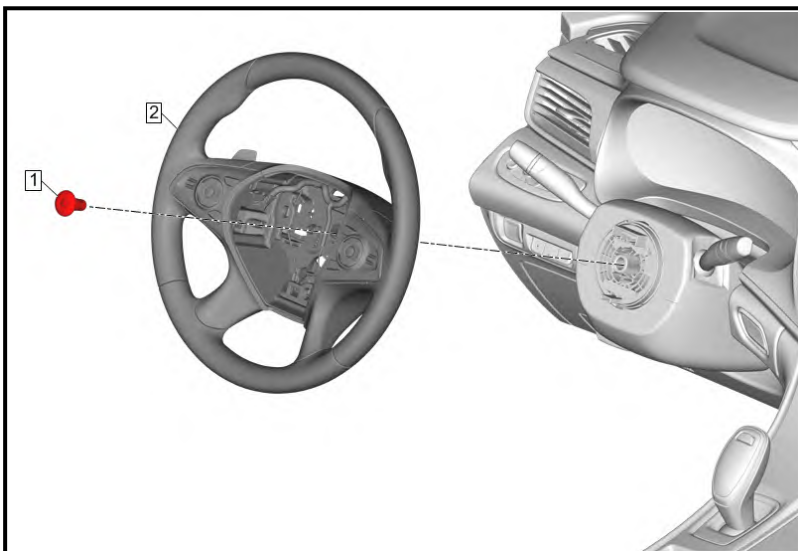
Floor Front Air Outlet Duct - Left Side (2) - Install - [Floor Front Air Outlet Duct Replacement - Left Side](#)

8.



Steering Column Lower Trim Cover (1) - Install - [Steering Column Lower Trim Cover Replacement \(N38\)](#)

9.



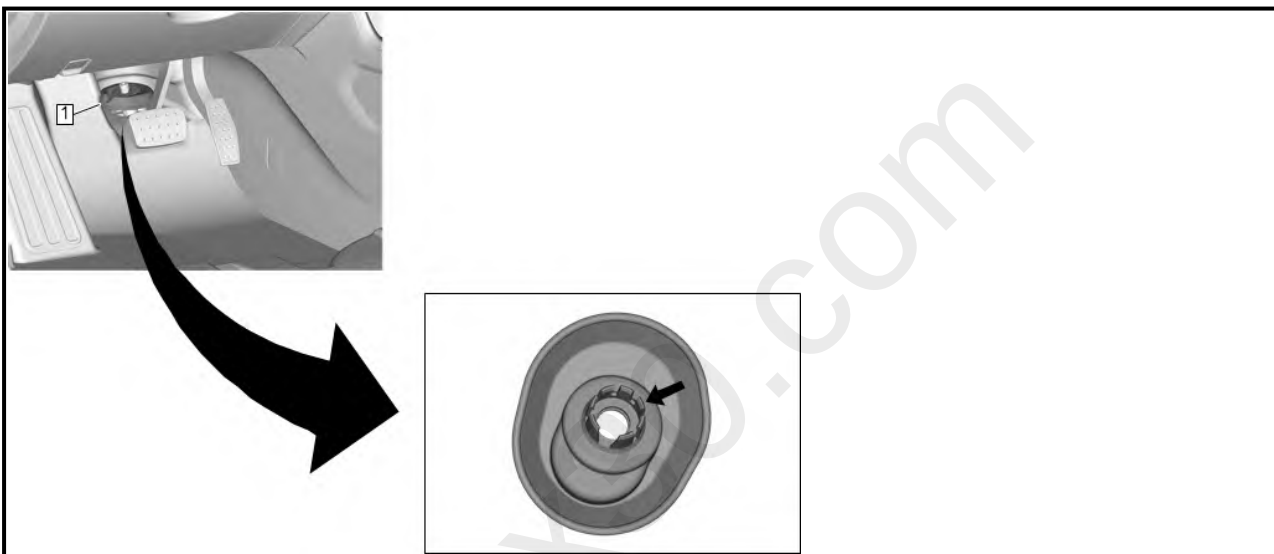
CAUTION: The anti-rotation pin must be removed from the steering column

before installing the steering wheel. Ensure that the steering wheel bolt is torqued to specification during steering wheel installation. Over torquing the steering wheel bolt can result in damage to the steering column rivets which will disable the telescoping mechanism. If the steering column rivets are damaged, a new steering column must be installed.

Remove the device used to prevent steering column rotation.

10. Steering Wheel (2) - Install - [Steering Wheel Replacement](#)
11. Enable the SIR System. [SIR Disabling and Enabling](#)
12. Center the steering angle sensor. [Steering Wheel Angle Sensor Centering](#)
13. If battery was disconnected for steering column replacement, wait for all modules to fall asleep. This can be done by closing all vehicle closures (doors, trunk, hood) and waiting for three minutes without actuating any vehicle functions or pushing any buttons.
14. Perform functionality check of tilt and telescoping features.

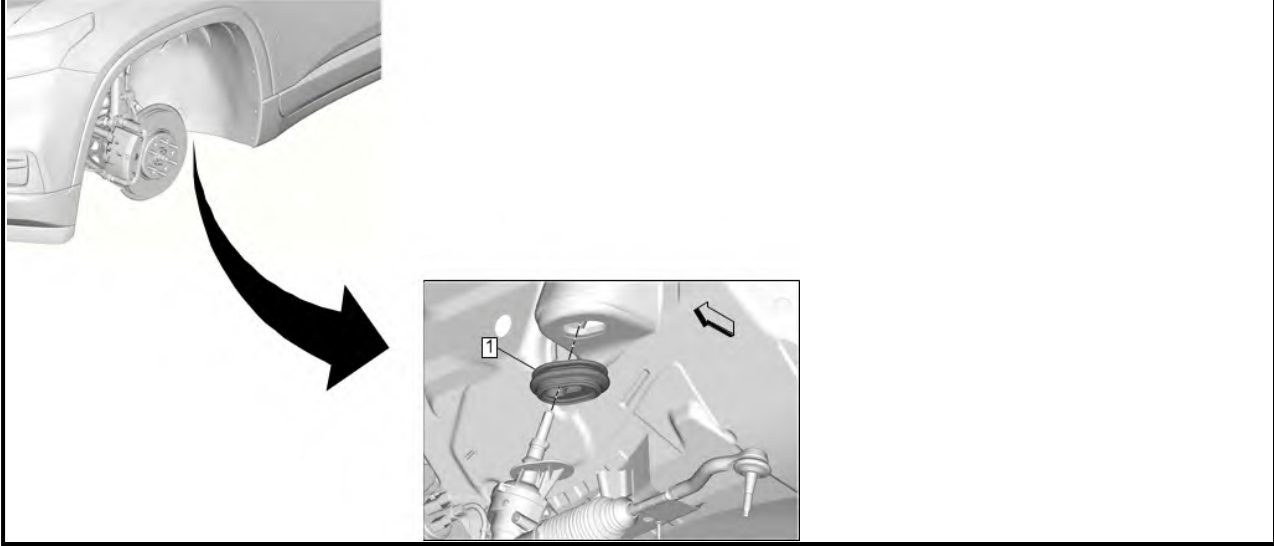
STEERING COLUMN DASH INNER SEAL REPLACEMENT



Callout	Component Name
Preliminary Procedure Intermediate Steering Shaft @ Steering Gear - Separate - Intermediate Steering Shaft Replacement	
	Steering Column Dash Inner Seal
1	Procedure 1. To remove the steering column dash inner seal, lift the edge of the seal and release the plastic retaining tabs from the steering gear input shaft. 2. To install the steering column dash inner seal, push the seal until the plastic retaining tabs engage the steering gear input shaft.

STEERING COLUMN DASH OUTER SEAL REPLACEMENT





Callout	Component Name
Preliminary Procedures 1. <u>Steering Column Dash Inner Seal Replacement</u> 2. Lower the drivetrain and front suspension cradle as necessary to remove the steering column dash outer seal from the steering gear. <u>Drivetrain and Front Suspension Cradle Removal and Installation (All Wheel Drive)</u>, <u>Drivetrain and Front Suspension Cradle Removal and Installation (Front Wheel Drive)</u>	
1	Steering Column Dash Outer Seal Procedure Position the steering column dash outer seal over the steering gear and on the dash panel. Ensure the seal is aligned with the steering gear and dash panel correctly.

STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE LEARN

The Steering Column Tilt Wheel and Telescope Control Module Learn procedure must be completed when there is a column malfunction or when the Steering Column Tilt Wheel and Telescope Control Module is replaced.

When a malfunction occurred or replacing the control module

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

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

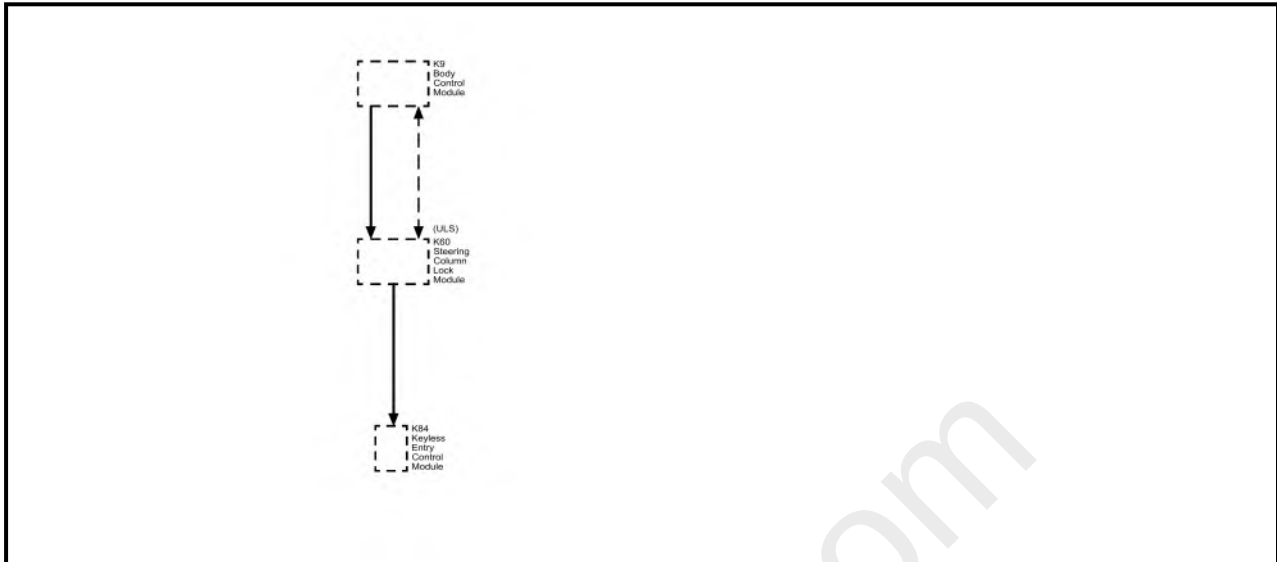
4. Press and hold the tilt-down button for 5 to 8 seconds and then release. If the button press is not between 5 and 8 seconds, restart this step. A stopwatch may be needed.
5. Firmly press and release the telescope-in button.
6. Firmly press and release the tilt-up button.
7. Firmly press and release the telescope-out button.
8. Firmly press and release the tilt-down button.
9. The column should begin to move on its own to learn its soft-stop positions. **Do not** press any buttons or operate any vehicle functions while the column is moving as the relearn sequence will be cancelled.
10. If the column does not begin to move on its own, attempt steps 3 through 8. Three attempts may be required. Ensure that button timing and sequence is correct. If column still does not begin to move, attempt steps 1 through 8 again.
11. If the column tilt and telescope does not function, replace the appropriate component as follows:

- If the Steering Column Tilt Wheel and Telescope Control Module has not been replaced previously, replace the module. Refer to: [Control Module References](#)
- If the control module has already been replaced, replace the steering column. Refer to: [Steering Column Replacement \(N37\)](#)[Steering Column Replacement \(N38\)](#)

DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION

Steering Column Lock



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.

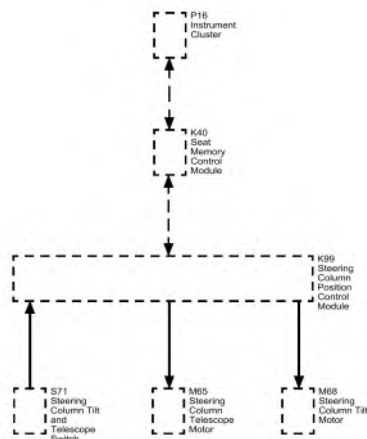
1. The BCM power mode is OFF.
2. The vehicle is stationary based on zero speed reported from all ABS wheel speed sensors.
3. The driver or passenger door is opened reported by the PEPS module.

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





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.

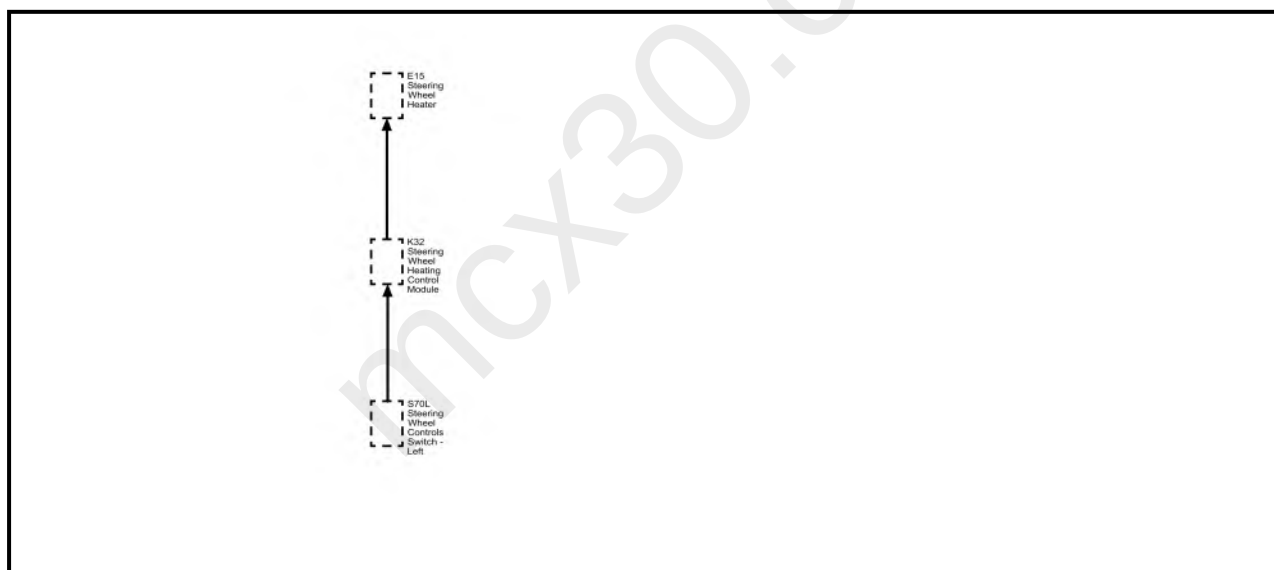
Without the A45 Memory Seat option, memory settings, personalization, and the entry and exit function is not available.

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



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

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

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