

2017 STEERING

Steering Wheel and Column - Impala

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE:

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

Application	Specification
	Metric (English)
Intermediate Steering Shaft Lower Bolt	34 N.m (25 lb ft)
Intermediate Steering Shaft Upper Bolt	36 N.m (27 lb ft)
Steering Column Bracket Bolt	3 N.m (27 lb in)
Steering Column Nut	22 N.m (16 lb ft)
Steering Column Telescope Actuator Bolt	5 N.m (44 lb in)
Steering Column Telescope Actuator Pivot Bolt	18 N.m (13 lb ft)
Steering Column Tilt Wheel Actuator Bolt	5 N.m (44 lb in)
Steering Column Tilt Wheel and Telescope Control Module Bolt	3 N.m (27 lb in)
Steering Wheel Bolt	45 N.m (33 lb ft)
Steering Wheel Vibration Dampener Fastener	3.5 N.m (31 lb in)
Turn Signal Switch Bracket Bolt	15 N.m (11 lb ft)

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

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

SCHEMATIC WIRING DIAGRAMS

STEERING WHEEL WIRING SCHEMATICS

Heated Steering Wheel (UVD)

DTC B285A: STEERING COLUMN POSITION

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 Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.

2. Verify that DTC B285A 4B is not set.

- **DTC B285A 4B is set**

1. Perform the Steering Column Tilt Wheel and Telescope Control Module Learn. Refer to [Steering Column Tilt Wheel and Telescope Control Module Learn](#)

2. Verify that DTC B285A 4B does not reset.

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

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

3. All OK

- **DTC B285A 4B is not set.**

3. Verify the scan tool Steering Column Direction Switch parameter changes between Inactive, Forward, Rearward, Up, and Down when exercising the S71 Steering Column Tilt and Telescope Switch.

- **If the parameter does not change**

Refer to Circuit/System Testing - Switch Malfunction.

- **If the parameter changes**

4. Verify the operation of the M68 Steering Column Tilt Motor while commanding the Steering Column Tilt Up and Steering Column Tilt Down Command with a scan tool.

- **If the Steering Column Tilt Up or Steering Column Tilt Down Command does not work**

Refer to Circuit/System Testing - Tilt Motor Malfunction

- **If the Steering Column Tilt Up and Steering Column Tilt Down Command works**

5. Verify the M65 Steering Column Telescope Motor while commanding the Steering Column Telescope Forward and Steering Column Telescope Rearward with a scan tool.

- **If the Steering Column Telescope Forward and Steering Column Telescope Rearward does not work**

Refer to Circuit/System Testing - Telescope Motor Malfunction

- **If the Steering Column Telescope Forward and Steering Column Telescope Rearward works**

6. Verify that DTC B285A 39 is not set.

- **DTC B285A 39 is set**

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

Replace the K99 Steering Column Position Control Module.

- **DTC B285A 39 is not set.**

7. All OK.

Circuit/System Testing

Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch. It may take up to 2 min for all vehicle systems to power down.

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

- **If 10 Ω or greater**

1. Ignition OFF.

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

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

- **If less than 10 Ω**

3. Ignition ON.

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

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

- **If less than B+**

1. Ignition OFF, disconnect the X4 harness connector at the K99 Steering Column Control Module.

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

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

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

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

- **If B+**

5. Ignition OFF, disconnect the X4 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 2
- Terminal 3
- Terminal 4
- Terminal 5

- **If greater than 1 V**

Repair the short to voltage on the circuit

- **If less than 1 V**

8. Ignition OFF, connect the X4 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 1 and terminal 2.

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

- If the M65 Steering Column Telescope Motor operates

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 telescopes FORWARD and REVERSE to the soft stop.
 - Terminal B
 - Terminal C
 - **If the M68 Steering Column Tilt Motor does not operate**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 1 - 2.5 Ω between terminal 1 and terminal 2.
 - If not within the specified range, replace the M68 Steering Column Tilt Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **If the M68 Steering Column Tilt Motor operates**
12. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Tilt Motor Malfunction

1. Ignition OFF, disconnect the X1 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 1
 - Steering Column Tilt Motor Up Control - terminal 2
 - Steering Column Tilt Motor Signal - terminal 4
 - **If 1 V or greater**
Repair the short to voltage on the circuit.
 - **If less than 1 V**
3. Ignition OFF.
4. Test for infinite resistance between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.
 - Steering Column Tilt Motor Down Control - terminal 1
 - Steering Column Tilt Motor Up Control - terminal 2
 - Steering Column Tilt Motor Signal - terminal 4
 - **If less than infinite resistance**
Repair the short to ground on the circuit.
 - **If Infinite resistance**
5. Replace the M68 Steering Column Tilt Motor.

Telescope Motor Malfunction

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module, ignition ON.
2. Test for less than 1 V between each K99 Steering Column Position Control Module harness connector terminals listed below and ground.
 - Steering Column Telescope Motor Forward - terminal 1
 - Steering Column Telescope Motor Rearward - terminal 2
 - Steering Column Telescope Motor Signal - terminal 4

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

3. Ignition OFF.

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

- Steering Column Telescope Motor Forward - terminal 1
- Steering Column Telescope Motor Rearward - terminal 2
- Steering Column Telescope Motor Signal - terminal 4
- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **If Infinite resistance**

5. Replace the M65 Steering Column Telescope Motor.

Component Testing

Steering Column Tilt/Telescope Switch Test

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

- **If less than infinite resistance**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If infinite resistance**

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

- **If 2 Ω or greater**

Replace the S71 Steering Column Tilt and Telescope Switch.

- **If less than 2 Ω**

4. All OK.

Steering Column Telescope Motor Test

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

- **If not within the specified range**

Replace the M65 Steering Column Telescope Motor.

- **If within the specified range**

3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
2. Test for 1 - 2.5 Ω between terminal 1 and terminal 2.

- **If not within the specified range**

- If within the specified range

3. All OK.

Repair Instructions

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

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

SYMPTOMS - STEERING WHEEL AND COLUMN

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

Visual/Physical Inspection

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

Symptoms List

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

- [Steering Column Tilt/Telescoping Malfunction \(N38\)](#)
- [Steering Column Tilt Function Inoperative \(N37\)](#)
- [High Telescoping Effort \(N37\)](#)
- [Noise While Driver Adjusting Column](#)
- [Noise in Steering Column](#)
- [Looseness in Steering Column](#)

HEATED STEERING WHEEL INDICATOR MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

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

Circuit/System Description

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

steering wheel control module that steering wheel heat is requested. When the request is seen, the heated steering module supplies voltage to the indicator lamp and supplies voltage to the heating elements, which are internal to the steering wheel.

Reference Information

Schematic Reference

Steering Wheel Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON, heated steering wheel OFF.
2. Verify the steering wheel heater indicator on the S70L Steering Wheel Controls Switch - Left is not illuminated and the steering wheel is not warm.
 - **If the steering wheel is warm**
Refer to **Heated Steering Wheel Malfunction**
 - **If the steering wheel is not warm and the steering wheel heater indicator is illuminated**
Refer to Circuit/System Testing
 - **If the steering wheels heater indicator is not illuminated and the steering wheel is not warm**
3. Verify the steering wheel heater indicator turns ON and OFF and the left and right sides of the steering wheel become warm when pressing and releasing the steering wheel heater switch on the S70L Steering Wheels Controls Switch - Left.
 - **If the steering wheel does not become warm**
Refer to **Heated Steering Wheel Malfunction**
 - **If the steering wheel becomes warm, but the steering wheel heater indicator does not turn ON and OFF**
Refer to Circuit/System Testing
 - **If the steering wheel becomes warm and the steering wheel heater indicator turns ON and OFF**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X5 harness connector at the X85 Steering Wheel Airbag Coil.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
 - **If 10 Ω or greater**

1. Ignition OFF.
2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
- **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 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**.
 - If 2 Ω or greater
 3. Verify the in-line fuse is OK and there is voltage at the fuse.
 - If the in-line fuse is open, replace the K32 Steering Wheel Heating Control Module.
 - If the in-line fuse is OK, repair the open/high resistance in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K32 Steering Wheel Heating Control Module.
 - **If the test lamp illuminates**
5. Ignition OFF, connect the X5 harness connector at the X85 Steering Wheel Airbag Coil. Disconnect the harness connector at the S70L Steering Wheel Control Switch - Left. Ignition ON.
6. Test for B+ between the control circuit terminal 8 and ground.
 - **If less than B+**
 1. Ignition OFF, disconnect the harness connector at the S70R Steering Wheel Control Switch - Right.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the S70R Steering Wheel Control Switch - Right.
 - **If B+**
7. Ignition OFF, connect the harness connector at the S70L Steering Wheel Control Switch - Left. Disconnect the harness connector at the K32 Steering Wheel Heating Control Module.

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

8. Install a 3 A fused jumper wire between the control circuit terminal B and ground. Ignition ON.
9. Verify the steering wheel heat indicator is illuminated.
 - **If the steering wheel heat indicator does not illuminate**

Replace the S70L Steering Wheel Control Switch - Left
 - **If the steering wheel heat indicator illuminates**
10. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- [Cruise Control Switch Replacement](#)
- [Control Module References](#) for steering wheel heating control module replacement, programming and setup.

HEATED STEERING WHEEL MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

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

Circuit/System Description

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

Diagnostic Aids

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

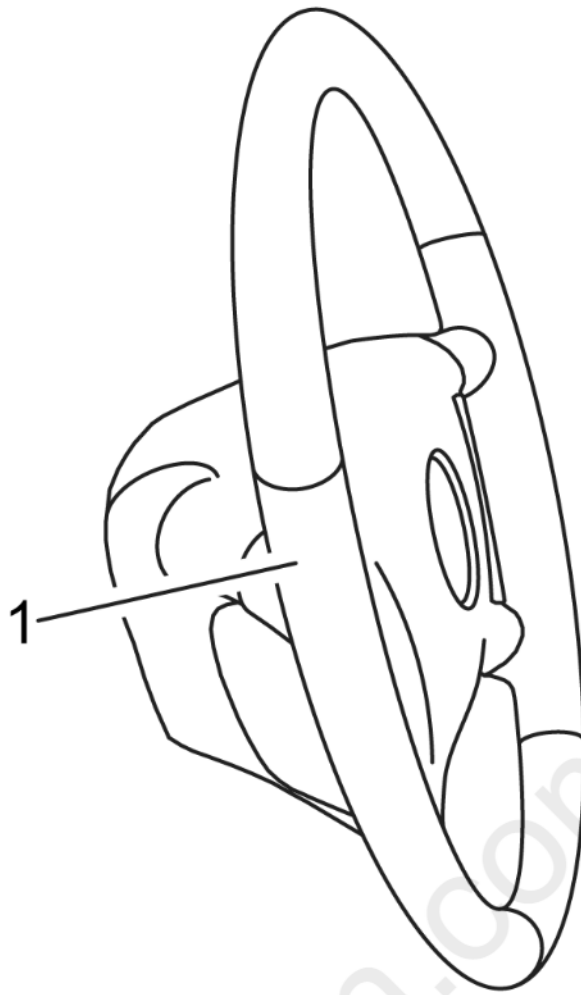


Fig. 3: Steering Wheel Rim Infrared Measurement Point
Courtesy of GENERAL MOTORS COMPANY

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

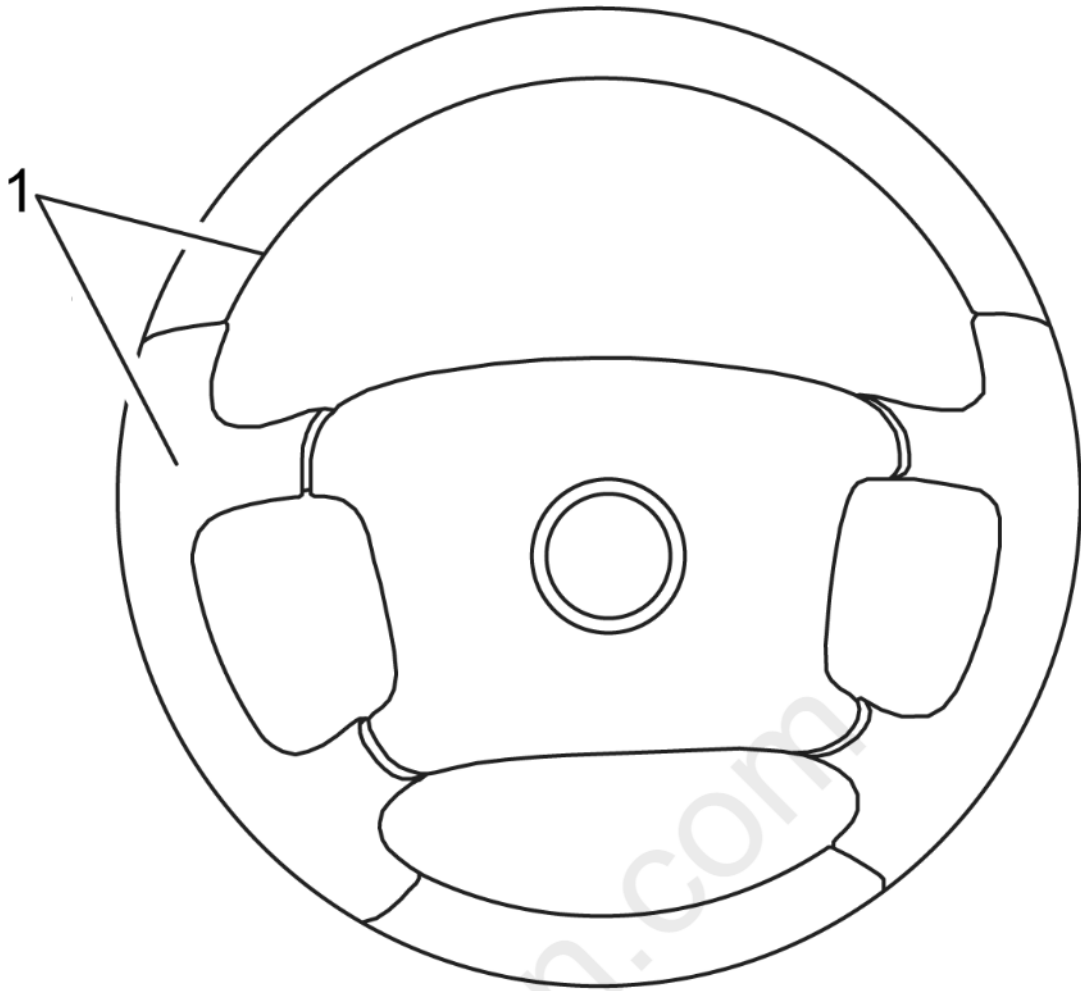


Fig. 4: Temperature Measurement Points
Courtesy of GENERAL MOTORS COMPANY

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

Reference Information

Schematic Reference

Steering Wheel Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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

Electrical Information Reference

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

Circuit/System Verification

1. Engine running, all accessories OFF.
2. Verify the steering wheel heater switch is OFF and the steering wheel heater indicator should not be illuminated.
 - **If the heater indicator is illuminated**

Refer to [Heated Steering Wheel Indicator Malfunction](#)
 - **If the heater indicator is not illuminated**



Fig. 5: Steering Wheel Rim Infrared Measurement Point
Courtesy of GENERAL MOTORS COMPANY

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

3. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).
4. Verify that the steering wheel temperature is 25°C (77°F) or below.
 - **If the steering wheel temperature is greater than 25°C (77°F)**

Allow the steering wheel to cool before proceeding to next step.
 - **If the steering wheel temperature is 25°C (77°F) or below**
5. Press and release the steering wheel heater switch. The steering wheel heater indicator should illuminate. Allow the steering wheel to heat for a minimum of 10 min so that the temperature stabilizes.
 - **If the heater indicator does not illuminate**

- If the heater indicator illuminates

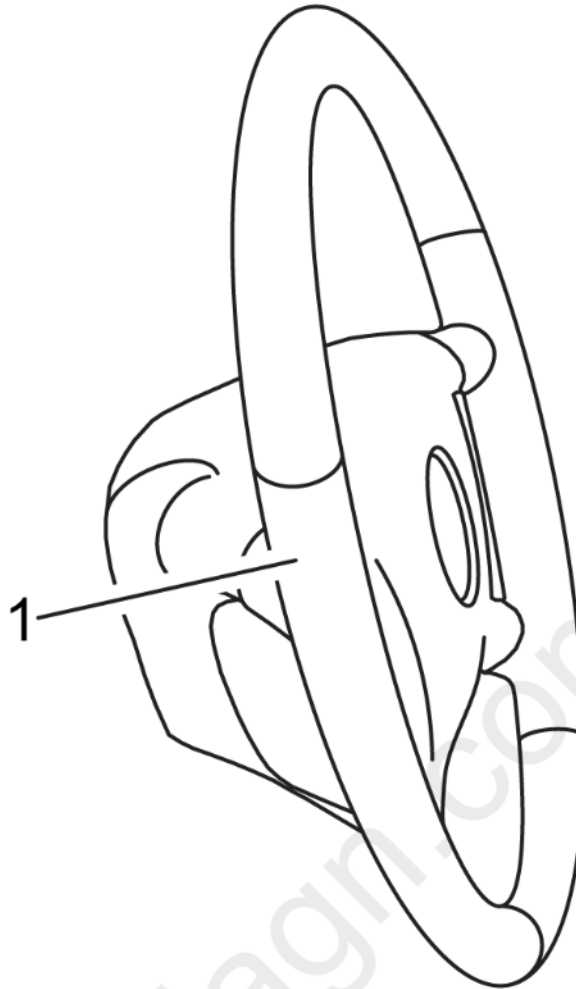


Fig. 6: Steering Wheel Rim Infrared Measurement Point

Courtesy of GENERAL MOTORS COMPANY

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

6. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).
7. Verify that the steering wheel temperature is greater than 28°C (82.4°F) within 20 min.
 - If after 20 minutes the measured temperature is less than 28°C (82.4°F)

Refer to Circuit System Testing.

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

Circuit/System Testing

1. Ignition OFF, disconnect the X5 harness connector at the X85 Steering Wheel Airbag Coil.
2. Test for less than $10\ \Omega$ between the ground circuit terminal 2 and ground.
 - If $10\ \Omega$ or greater
 1. Ignition OFF.
 2. Test for less than $2\ \Omega$ in the ground circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.

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

- **If less than 10 Ω**

3. Ignition ON.

4. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.

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

1. Ignition OFF, remove the test lamp.

2. Test for less than 2 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](#).
- If 2 Ω or greater

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

- If the in-line fuse is open, replace the K32 Steering Wheel Heating Control Module.
- If the in-line fuse is OK, repair the open/high resistance in the circuit.

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

1. Ignition OFF.

2. Test for infinite resistance between the ignition voltage circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K32 Steering Wheel Heating Control Module.

- **If the test lamp illuminates**

5. Ignition OFF, connect the X5 harness connector at the X85 Steering Wheel Airbag 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.

- **If less than 10 Ω**

7. Ignition ON.

8. Test for B+ between the signal circuit terminal 2 and ground.

- **If less than B+**

1. Ignition OFF, disconnect the in-line harness connector at the K32 Steering Wheel Heating Control Module.

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

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K32 Steering Wheel Heating Control Module.

- **If B+**

9. Test for infinite resistance between the S70L Steering Wheel Control Switch - Left signal terminal 2 and the ground terminal 1 with the steering wheel heater switch released.

- **If less than infinite resistance**

Replace the S70L Steering Wheel Controls Switch - Left.

- **If infinite resistance**

10. Test for less than 40 Ω between the S70L Steering Wheel Control Switch - Left signal terminal 2 and the ground terminal 1 with the steering wheel heater switch pressed.

- **If 40 Ω or greater**

- **If less than 40 Ω**

11. Connect the harness connector at the S70L Steering Wheel Control Switch - Left. Disconnect the harness connector at the E15 Steering Wheel Heater.

12. Test for less than 10 Ω between the ground circuits listed below and ground.

- Terminal A
- Terminal D
- **If 10 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 10 Ω**

13. Test for 1.5 - 3.0 Ω between the control circuit terminal B and the ground terminal A.

- **If not within the specified range**

Replace the E15 Steering Wheel Heater.

- **If within the specified range**

14. Test for 9 - 11k Ω between the signal circuit terminal C and the ground terminal D.

- **If not within the specified range**

Replace the E15 Steering Wheel Heater.

- **If within the specified range**

15. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

- [Cruise Control Switch Replacement](#)
- [Control Module References](#) for steering wheel heating control module replacement, programming and setup.

STEERING COLUMN TILT/TELESCOPING MALFUNCTION (N38)

Diagnostic Instructions

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

Diagnostic Fault Information

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

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

Circuit/System Description

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

Two position sensors are hall effect sensors and are used by the steering column position control module. The steering column position control module provides a 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.

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

Diagnostic Aids

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

Reference Information

Schematic Reference

Tilt/Telescoping Steering Column Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation (N38)

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.

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

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

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

- M65 Steering Column Telescope Motor
- M68 Steering Column Tilt Motor
- **If the M65 Steering Column Telescope Motor moves for only.5 s FORWARD or REARWARD**

1. Wait 5 s.

2. Operate the S71 Steering Column Tilt and Telescope Switch FORWARD and REARWARD.

- If the M65 Steering Column Telescope Motor moves for only.5 s FORWARD or REARWARD, replace the M65 Steering Column Telescope Motor
- **If the M65 Steering Column Telescope Motor does not operate FORWARD and REARWARD**

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

- **If the M68 Steering Column Tilt Motor moves for only.5 s UP and DOWN**

1. Wait 5 s.

2. Operate the S71 Steering Column Tilt and Telescope Switch UP and DOWN.

- If the M68 Steering Column Tilt Motor moves for only.5 s UP or DOWN, replace the M68 Steering Column Tilt Motor.
- **If the M68 Steering Column Tilt Motor does not operate UP and DOWN**

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

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

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

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

3. All OK.

Circuit/System Testing

Steering Column Telescope Motor Control Circuit Test

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

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

- **If 10 Ω or greater**

1. Ignition OFF.

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

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

- **If less than 10 Ω**

3. Ignition ON.

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

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

1. Ignition OFF, disconnect the X4 harness connector at the K99 Steering Column Control Module.
2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
- **If B+**

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 1 and terminal 2.
 - If not within the specified range, replace the M65 Steering Column Telescope Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **If the M65 Steering Column Telescope Motor operates**
6. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Steering Column Tilt Motor Control Circuit Test

1. Ignition OFF, disconnect the harness connector at the S71 Steering Column Tilt and Telescope Switch.
2. Test for less than 10 Ω between the low reference circuit terminal G and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
 - **If less than 10 Ω**
3. Ignition ON.
4. Test for B+ between the signal circuits listed below and ground:
 - Terminal B
 - Terminal C
 - **If less than B+**
 1. Ignition OFF, disconnect the X4 harness connector at the K99 Steering Column Position Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.

- If B+

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

5. Install a 3 A fused jumper wire between the signal circuits listed below and the low reference circuit terminal G. Verify the steering column tilts UP and DOWN to the soft stop.
 - Terminal B
 - Terminal C
 - **If the M68 Steering Column Tilt Motor does not operate**
 1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
 2. Test for 0.6 - 1.0 Ω between terminal 1 and terminal 2.
 - If not within the specified range, replace the M68 Steering Column Tilt Motor.
 - If within the specified range, replace the K99 Steering Column Position Control Module.
 - **If the M68 Steering Column Tilt Motor operates**
6. Test or replace the S71 Steering Column Tilt and Telescope Switch.

Steering Column Tilt and Telescope Motor Control Circuit Test

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

1. Ignition OFF.
2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K99 Steering Column Position Control Module.
- **If less than 10 Ω**
7. Replace the K99 Steering Column Position Control Module.

Component Testing

Steering Column Tilt/Telescope Switch Test

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

Replace the S71 Steering Column Tilt and Telescope Switch.
 - **If infinite resistance**
3. Test for less than 2 Ω between the ground terminal G and each signal terminal with the S71 Steering Column Tilt and Telescope Switch in the pressed position.
 - **If 2 Ω or greater**

Replace the S71 Steering Column Tilt and Telescope Switch.
 - **If less than 2 Ω**
4. All OK.

Steering Column Telescope Motor Test

1. Ignition OFF, disconnect the X2 harness connector at the K99 Steering Column Position Control Module.
2. Test for 0.6 - 1.0 Ω between terminal 1 and terminal 2.
 - **If not within the specified range**

Replace the M65 Steering Column Telescope Motor.
 - **If within the specified range**
3. All OK.

Steering Column Tilt Motor Test

1. Ignition OFF, disconnect the X1 harness connector at the K99 Steering Column Position Control Module.
2. Test for 0.6 - 1.0 Ω between terminal 1 and terminal 2.
 - **If not within the specified range**

Replace the M68 Steering Column Tilt Motor.
 - **If within the specified range**
3. All OK.

Repair Instructions

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

- [Steering Column Tilt Wheel and Telescope Switch Replacement](#)
- [Steering Column Tilt Wheel Actuator Replacement](#)

- [Steering Column Telescope Actuator Replacement](#)
- [Control Module References](#) for steering column position control module replacement, programming and setup.

STEERING COLUMN TILT FUNCTION INOPERATIVE (N37)

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
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 (N37)

Checks	Action
The steering shaft assembly is bent or damaged.	If necessary, replace the steering column. Refer to Steering Column Replacement (N37) .

NOISE WHILE DRIVER ADJUSTING COLUMN

Checks	Action

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
5	If equipped, inspect the lock plate retaining ring for correct installation. Is the lock plate retaining ring installed incorrectly?	Go to Step 12	Go to Step 6
6	Inspect the steering column upper and lower bearings for the following conditions: - Damage - Lubrication - Wear - Proper seating Are the bearings in need of repair or replacement?	Go to Step 13	Go to Step 7
7	Does the steering column tilt joint need to be lubricated?	Go to Step 14	Go to Step 8
8	NOTE: Inspect the intermediate steering shaft for noise while driving the vehicle, turning the steering wheel, and applying the brakes. Inspect the intermediate steering shaft for noise. Is the intermediate steering shaft noisy?	Go to Step 15	Go to Step 9

Step	Action	Yes	No
9	NOTE: For vehicles equipped with a telescoping steering column, perform this step. If not equipped, go to next step. Inspect the steering column for noise while telescoping the column. Is the steering column noisy while telescoping?	Go to Step 16	Go to Step 17
10	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement (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	-
15	Replace the appropriate intermediate steering shaft component. Did you complete the repair?	Go to Step 17	-
16	Redistribute or add lubricant to the steering column lower jacket with the column telescoped to its end of outward travel. Did you complete the repair?	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

LOOSENESS IN STEERING COLUMN

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

Step	Action	Yes	No
3	Inspect the steering column mounting features for the following conditions. - The steering column mounting fasteners are loose. - The steering column mounting features are sheared. Are the steering column mounting features loose or sheared?	Go to Step 5	Go to Step 4
4	Inspect the upper and/or lower bearings for looseness. Are any of the bearings worn or loose?	Go to Step 6	Go to Step 7
5	NOTE: If the steering column mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement (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.

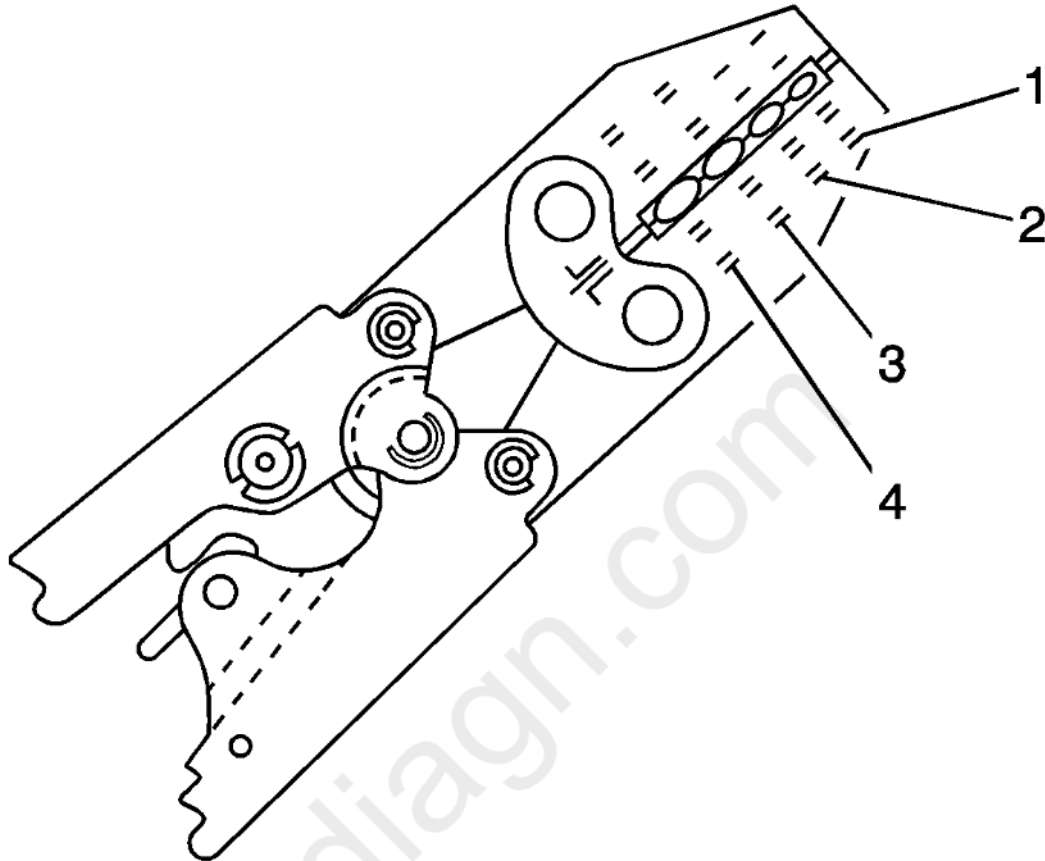


Fig. 7: Splice Sleeve Crimping Tool With 4 Crimp Nests
Courtesy of GENERAL MOTORS COMPANY

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

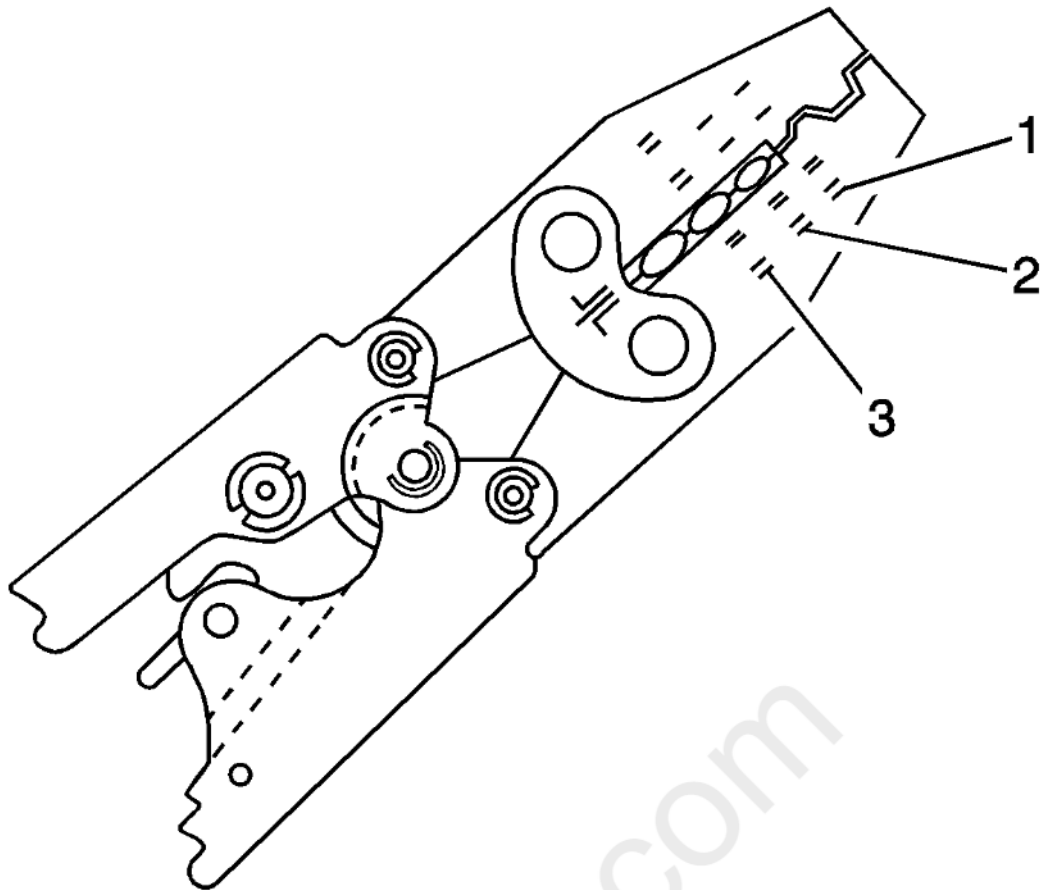


Fig. 8: Splice Sleeve Crimping Tool With 3 Crimp Nests
Courtesy of GENERAL MOTORS COMPANY

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

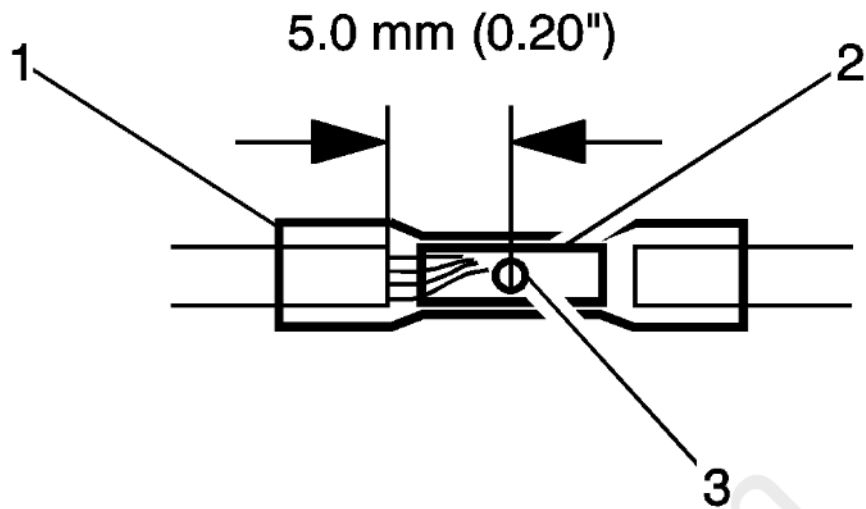


Fig. 9: Identifying Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

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



Fig. 10: Crimped Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

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



Fig. 11: Crimped Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

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.

Weatherpack™ Wiring Repair

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

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

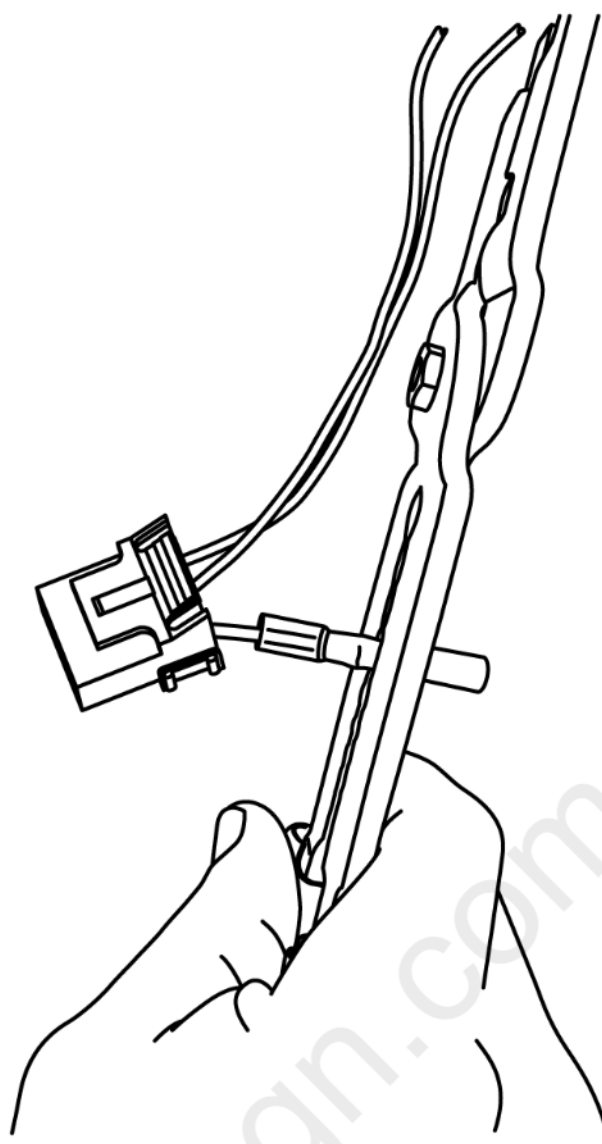


Fig. 12: Tightly Close Handles Of Crimp Tool

Courtesy of GENERAL MOTORS COMPANY

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

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

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

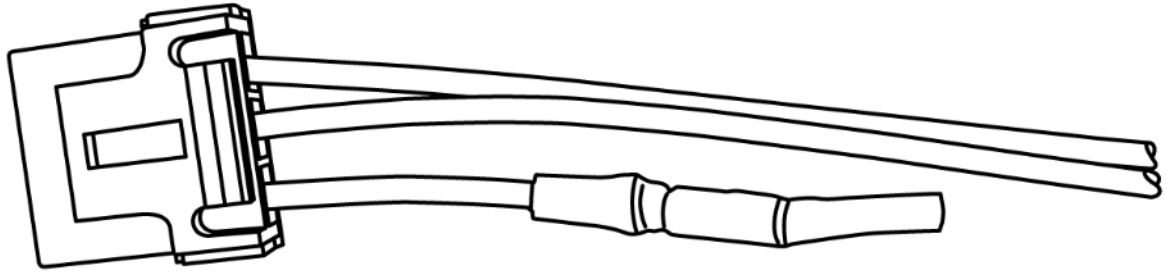


Fig. 13: Crimped Area Of Barrel

Courtesy of GENERAL MOTORS COMPANY

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.

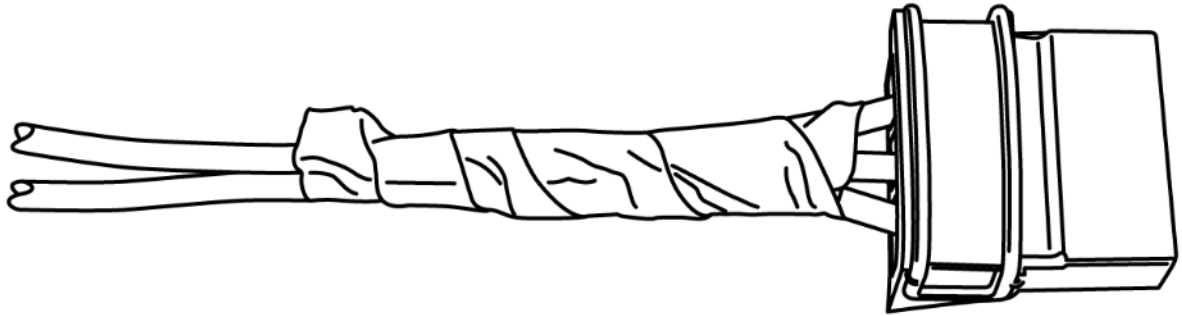


Fig. 14: Taping Extra Terminated Leads Back Into Harness
Courtesy of GENERAL MOTORS COMPANY

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 Schematics](#) .
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Ground Distribution Schematics](#) .

Temperature Sensitivity

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

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

Electromagnetic Interference and Electrical Noise

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

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

Incorrect Control Module

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

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

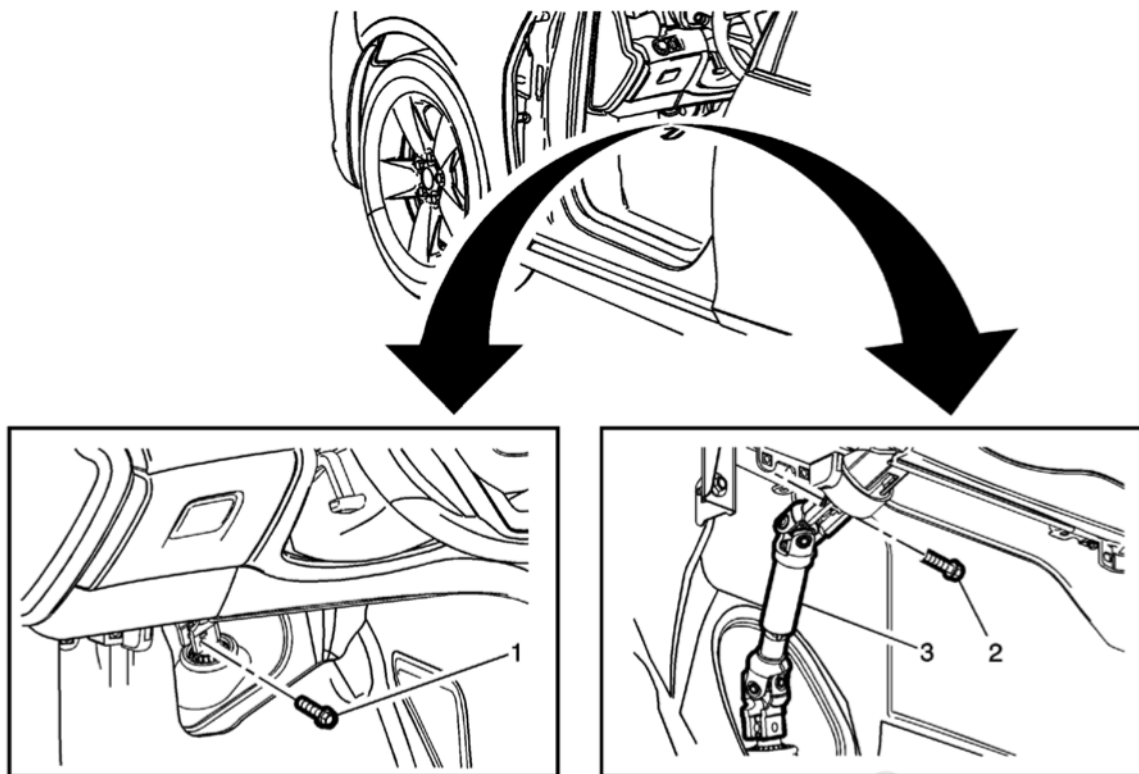


Fig. 15: Intermediate Steering Shaft

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
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. Preliminary Procedures 1. With the wheels of the vehicle in the straight ahead position, LOCK the steering column. 2. Instrument Panel Insulator Replacement - Left Side 3. Floor Front Air Outlet Duct Replacement - Left Side 4. Place match marks on the steering column shaft and the intermediate steering shaft. 5. Place match marks on the steering gear pinion shaft and the intermediate steering shaft.	

Callout	Component Name
1	Intermediate Steering Shaft Lower Bolt CAUTION: Refer to Fastener Caution . 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. Adhesives, Fluids, Lubricants, and Sealers Tighten 34 N.m (25 lb ft)
2	Intermediate Steering Shaft Upper 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. Adhesives, Fluids, Lubricants, and Sealers Tighten 36 N.m (27 lb ft)
3	Intermediate Steering Shaft Procedure If replacing the intermediate steering shaft, copy the match marks from the old shaft to the NEW shaft. NOTE: Ensure the steering column dash inner and outer seals are positioned properly on the dash panel.

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N38)

Inspection Procedure

1. Remove the turn signal switch bracket. Refer to [Turn Signal Switch Bracket Replacement \(With BTM\)](#)[Turn Signal Switch Bracket Replacement \(Without BTM\)](#).

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

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

2. Remove the steering column from the vehicle. Refer to [Steering Column Replacement \(N38\)](#).
3. Rotate the steering column shaft. Verify the shaft turns freely and without interference.

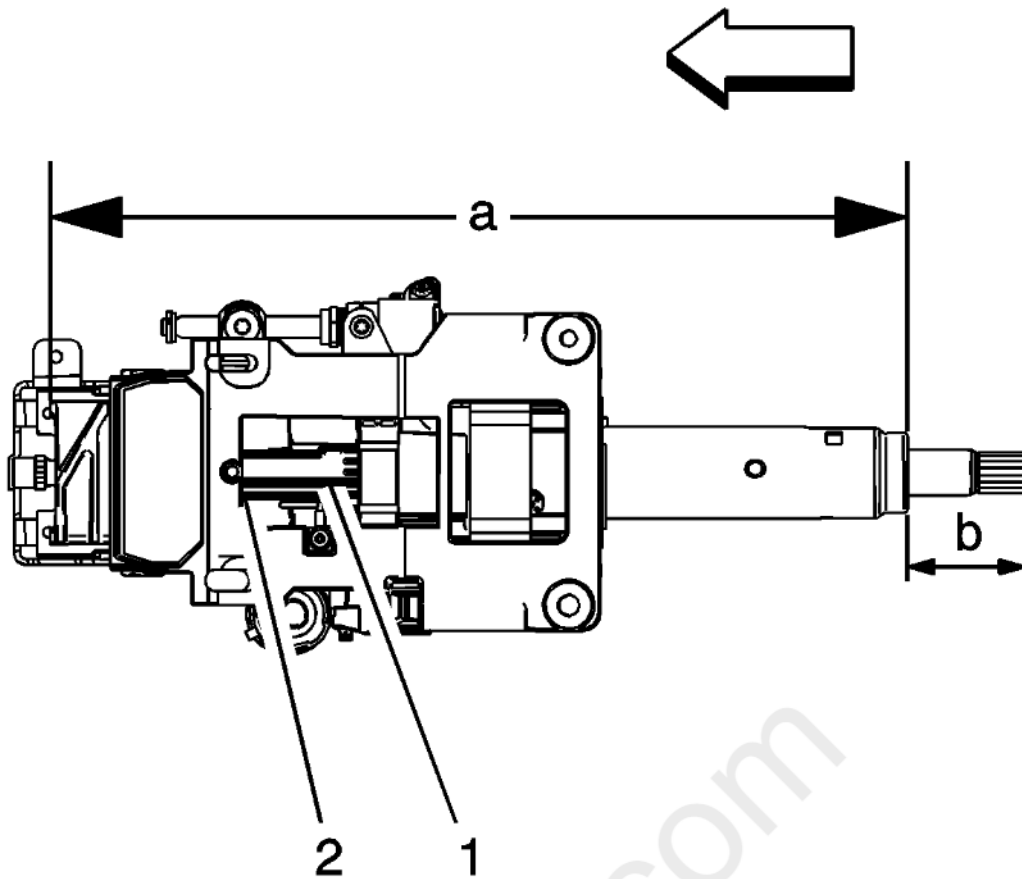


Fig. 16: E/A Strap & Retainer

Courtesy of GENERAL MOTORS COMPANY

4. Verify the E/A strap retainer (1) is firmly seated on the jacket.
5. Verify there is no visual damage to the E/A strap (2).
6. Measure the length of the upper shaft (b) from the end of the upper jacket to the tip. The length of the upper shaft must not be less than 60 mm (2.36 in).
7. Measure the length of the upper and lower jacket assembly (a). The length of the upper and lower jacket assembly must not be less than 449 mm (17.68 in).
8. If the steering column does not meet the specifications, the steering column is damaged. Discard the damaged steering column. Install a NEW steering column.
9. If the steering column meets the specifications, install the steering column. Refer to [Steering Column Replacement \(N38\)](#).
10. Install the turn signal switch bracket. Refer to [Turn Signal Switch Bracket Replacement \(With BTM\)](#)[Turn Signal Switch Bracket Replacement \(Without BTM\)](#).

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (N37)

Inspection Procedure

1. Remove the turn signal switch bracket. Refer to [Turn Signal Switch Bracket Replacement \(With BTM\)](#)[Turn Signal Switch Bracket Replacement \(Without BTM\)](#).

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

- Frame damage
- Major body damage

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

2. Remove the steering column from the vehicle. Refer to [Steering Column Replacement \(N37\)](#).
3. Rotate the steering column shaft. Verify the shaft turns freely and without interference.

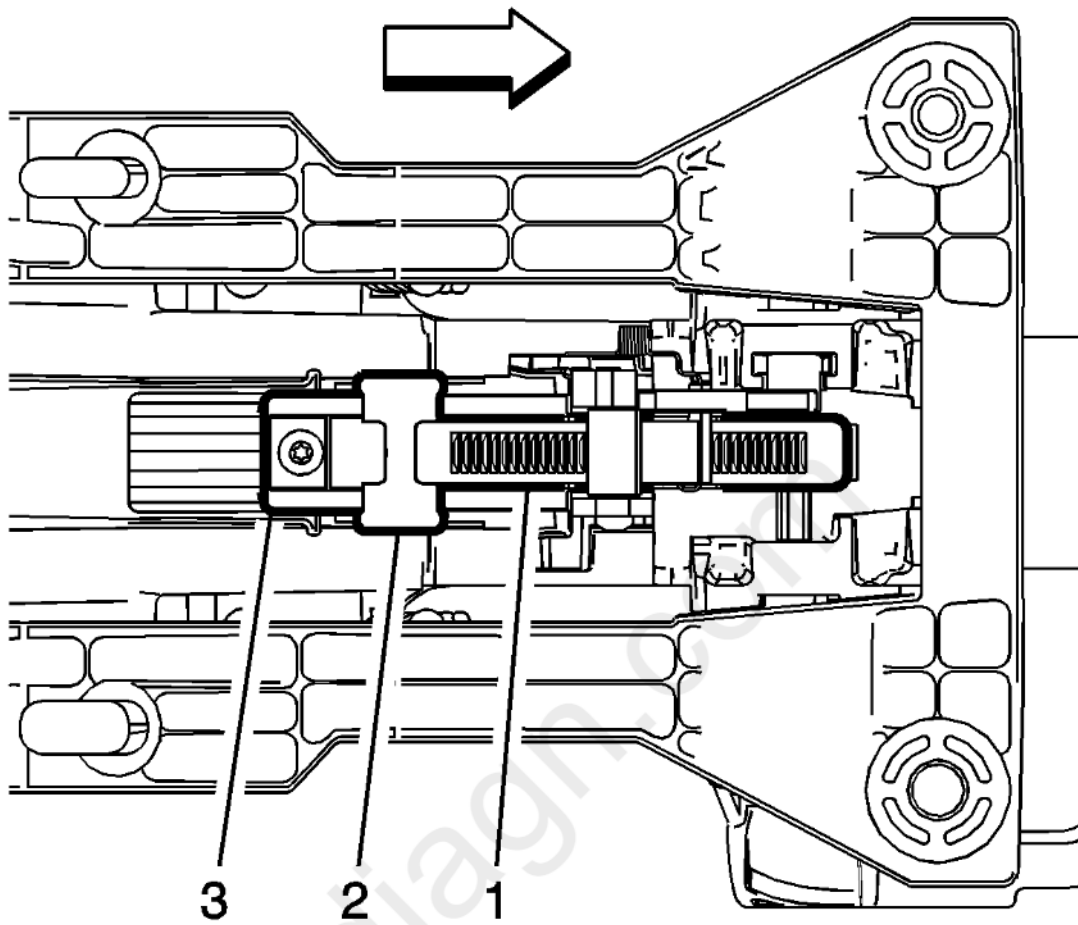


Fig. 17: E/A Strap, Bumper & Retainer

Courtesy of GENERAL MOTORS COMPANY

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

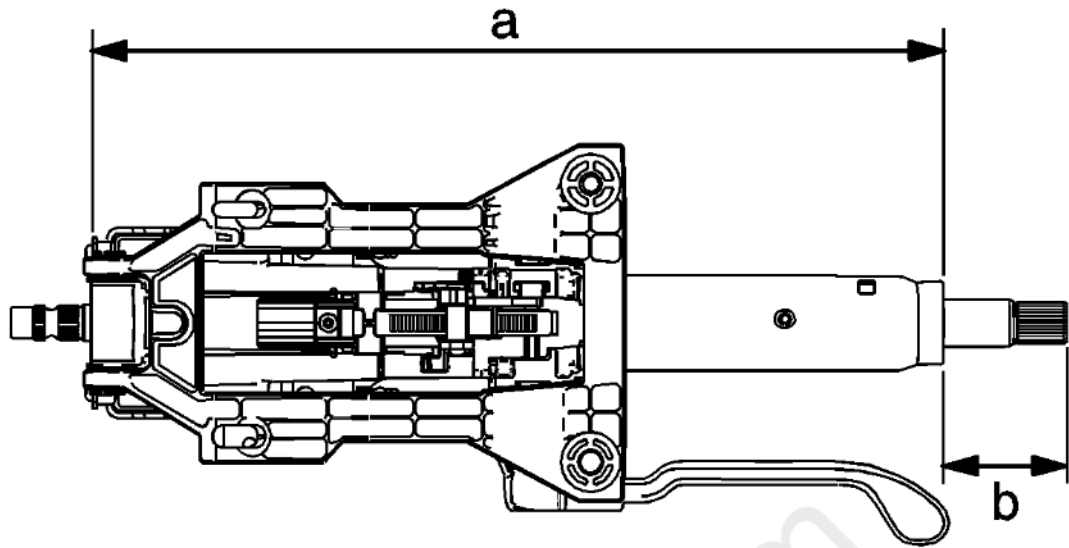


Fig. 18: Upper Shaft & Lower Bearing Adapter Lengths

Courtesy of GENERAL MOTORS COMPANY

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

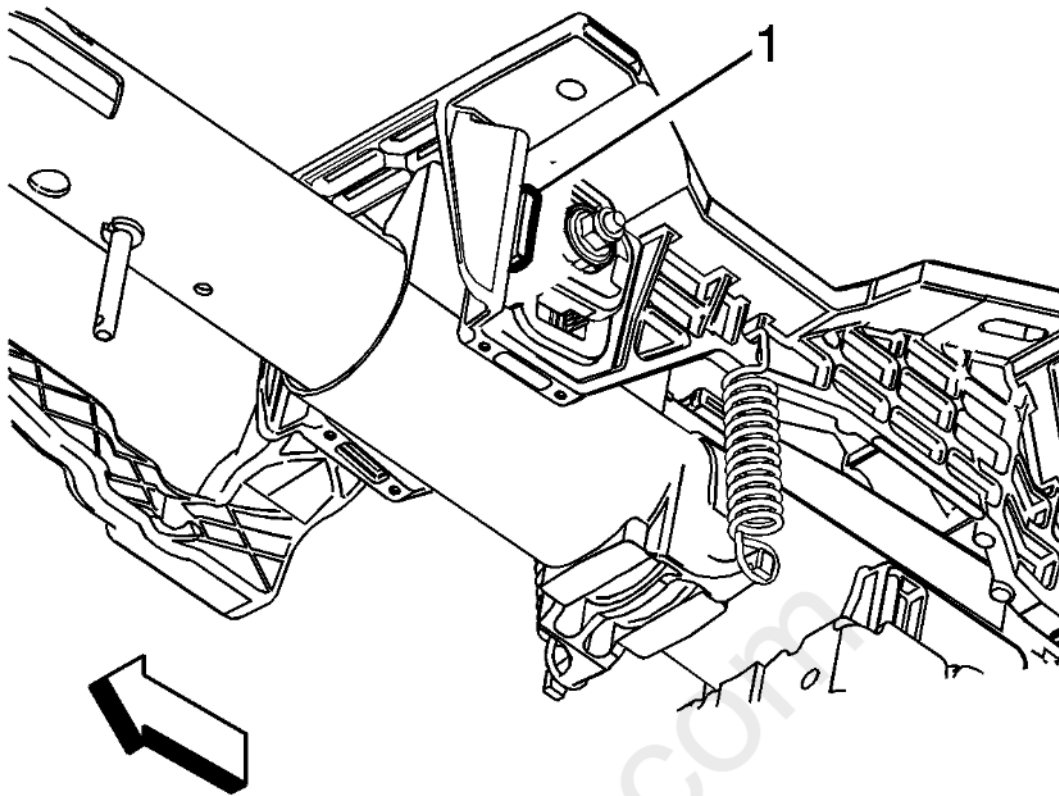


Fig. 19: Left And Right Hand Rake Guides

Courtesy of GENERAL MOTORS COMPANY

7. Verify that both the left and right hand rake guides (1) are not fractured.
8. If the steering column does not meet the specifications, the steering column is damaged. Discard the damaged steering column. Install a NEW steering column.
9. If the steering column meets the specifications, install the steering column. Refer to **Steering Column Replacement (N37)**.
10. Install the turn signal switch bracket. Refer to **Turn Signal Switch Bracket Replacement (With BTM)****Turn Signal Switch Bracket Replacement (Without BTM)**.

STEERING COLUMN UPPER TRIM COVER REPLACEMENT

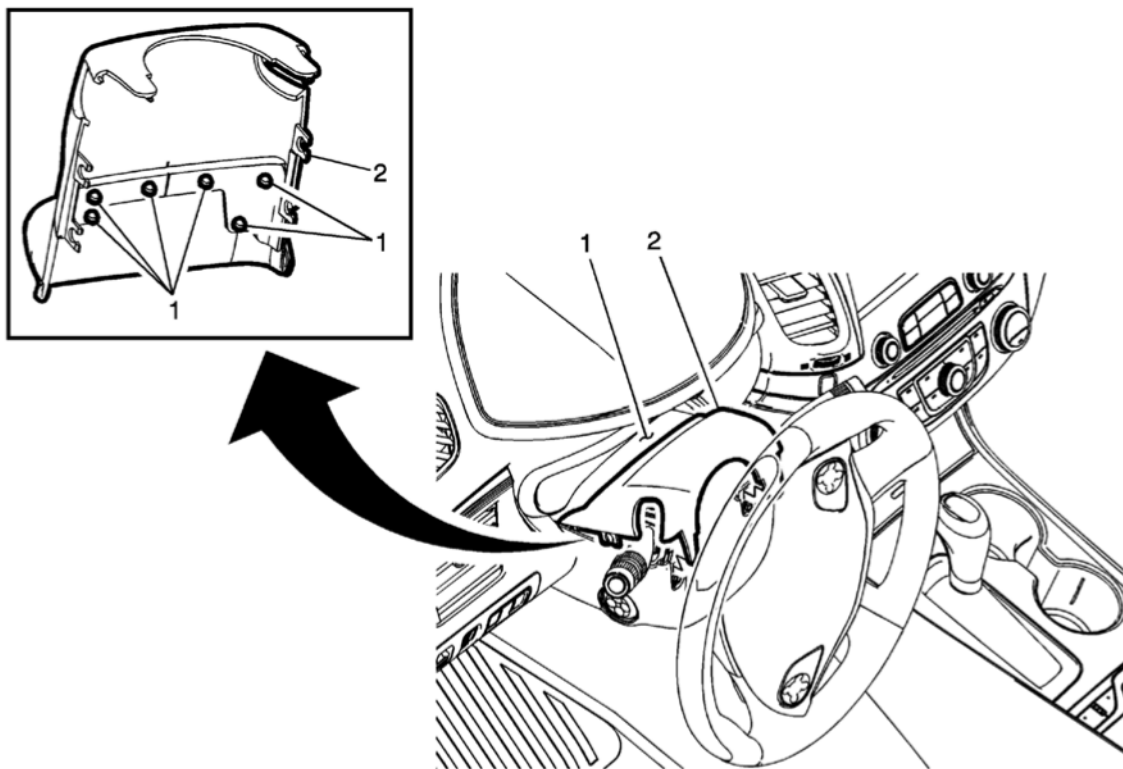


Fig. 20: Steering Column Upper Trim Cover
 Courtesy of GENERAL MOTORS COMPANY

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

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (N38)

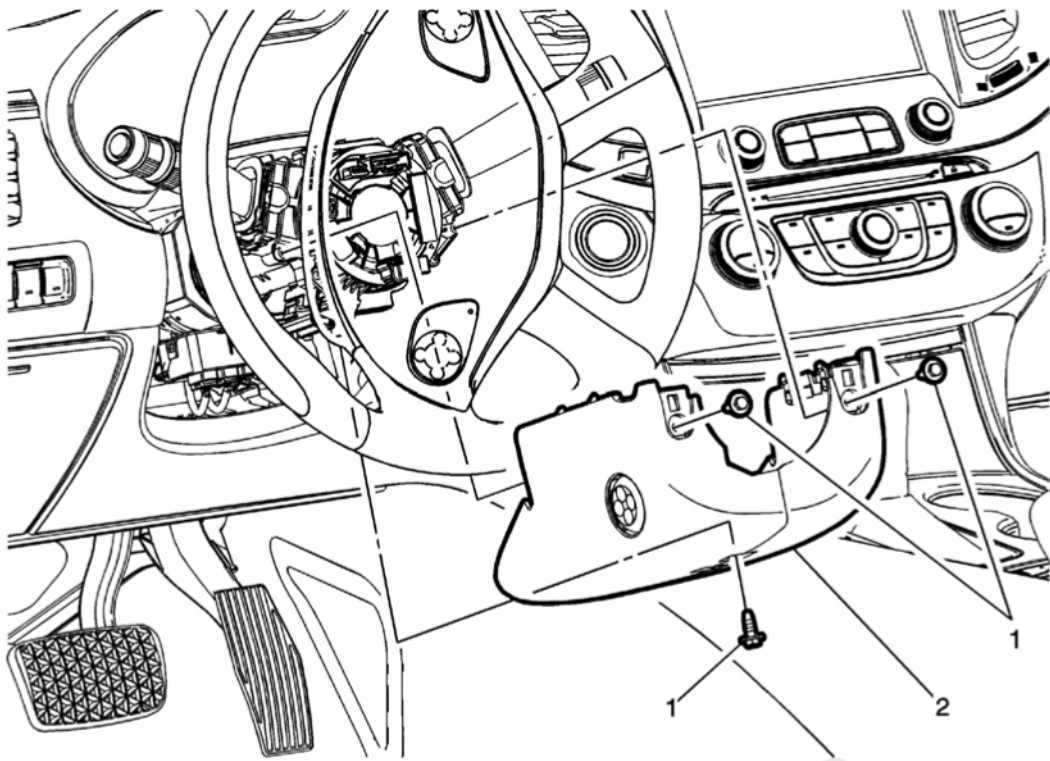


Fig. 21: Steering Column Lower Trim Cover (N38)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the steering column upper trim cover. Refer to Steering Column Upper Trim Cover Replacement .	
1	Steering Column Lower Trim Cover Bolt (Qty: 3) CAUTION: Refer to Fastener Caution .
2	Steering Column Lower Trim Cover Procedure 1. Turn the steering wheel left and right to access the fasteners securing the lower trim cover to the turn signal switch bracket. 2. Disconnect the electrical connection. 3. Transfer parts as necessary.

STEERING COLUMN LOWER TRIM COVER REPLACEMENT (N37)

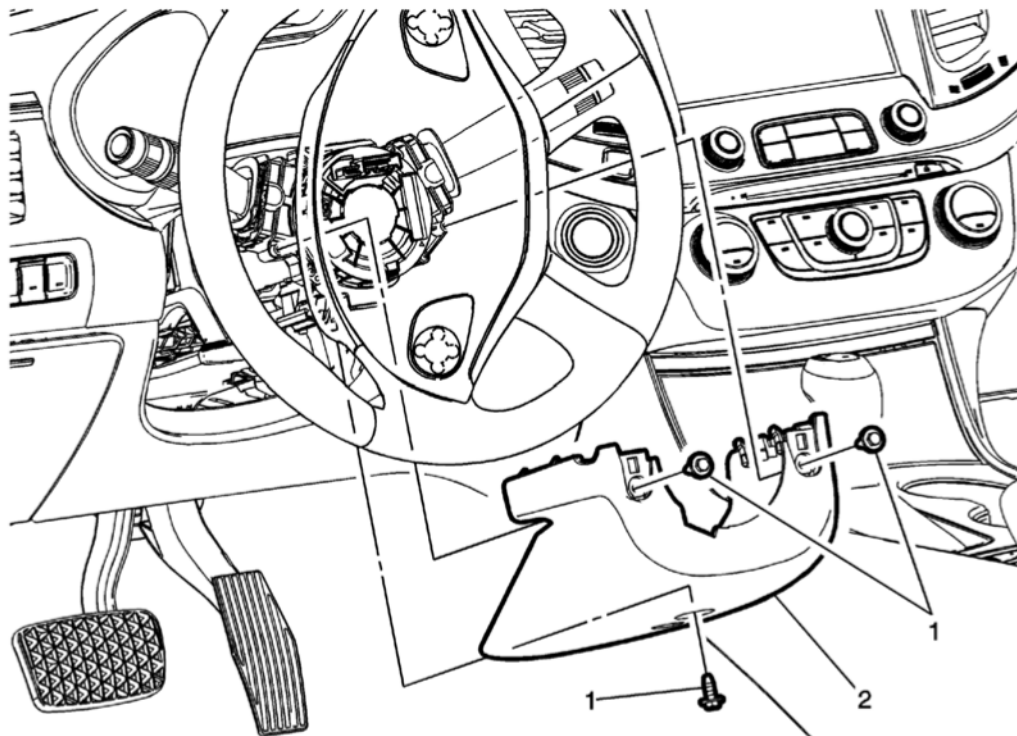


Fig. 22: Steering Column Lower Trim Cover (N37)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the steering column upper trim cover. Refer to Steering Column Upper Trim Cover Replacement .	
1	Steering Column Lower Trim Cover Bolt (Qty: 3) CAUTION: Refer to Fastener Caution .
2	Steering Column Lower Trim Cover Procedure Turn the steering wheel left and right to access the fasteners securing the lower trim cover to the turn signal switch bracket.

STEERING COLUMN TILT WHEEL AND TELESCOPE CONTROL MODULE REPLACEMENT

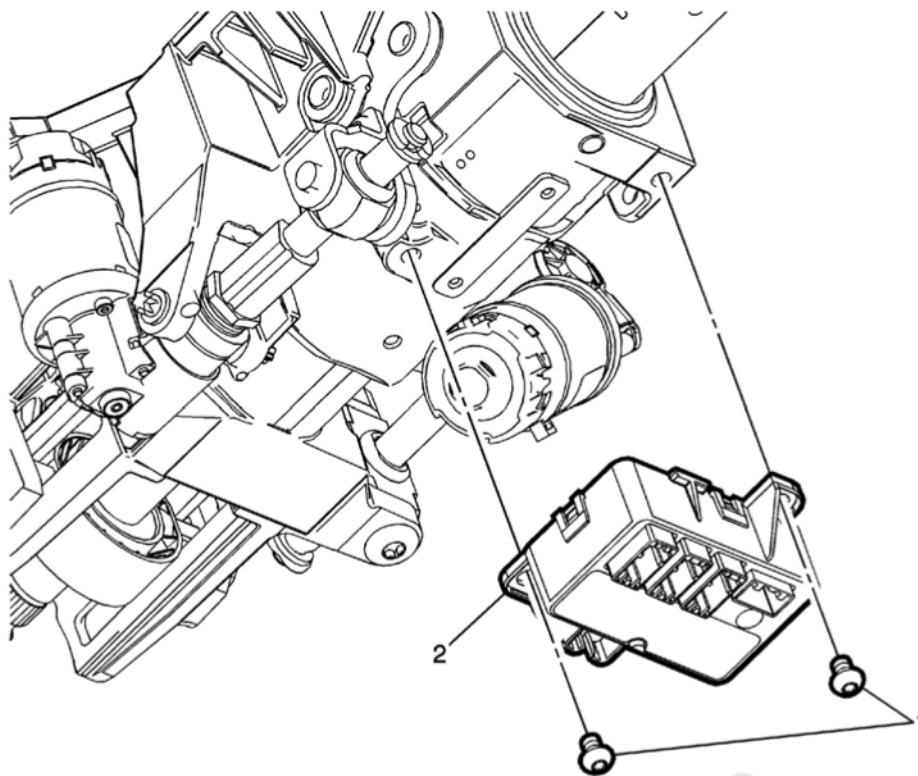


Fig. 23: Steering Column Tilt Wheel & Telescope Control Module

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Steering Column Upper Trim Cover Replacement Steering Column Lower Trim Cover Replacement (N38)Steering Column Lower Trim Cover Replacement (N37) Instrument Panel Knee Bolster Replacement	
1	Steering Column Tilt Wheel and Telescope Control Module Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 3 N.m (27 lb in)
2	Steering Column Tilt Wheel and Telescope Control Module Procedure - Disconnect the electrical connectors. - After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Steering Column Tilt Wheel and Telescope Control Module Learn NOTE: In order to relearn the steering column soft and hard stops, the steering column MUST be mounted and fastened and the steering column upper and lower trim covers CANNOT be installed.

TURN SIGNAL SWITCH REPLACEMENT

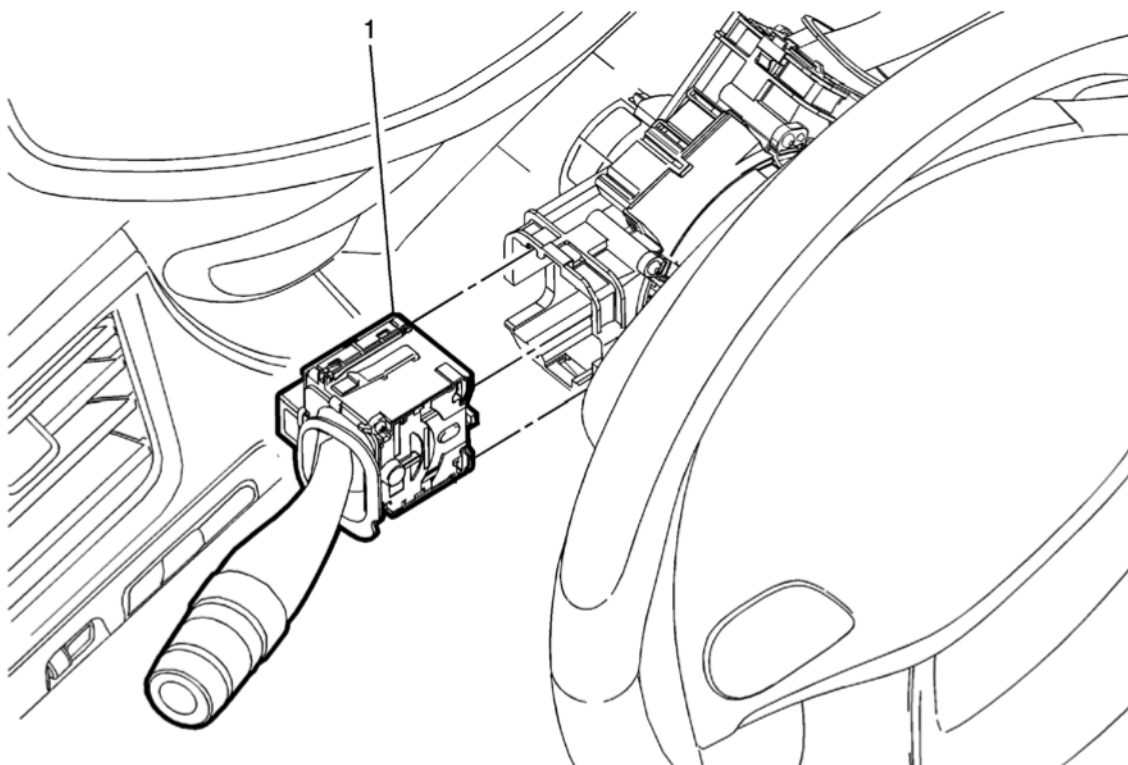


Fig. 24: Turn Signal Switch

Courtesy of GENERAL MOTORS COMPANY

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

TURN SIGNAL SWITCH BRACKET REPLACEMENT (WITH BTM)

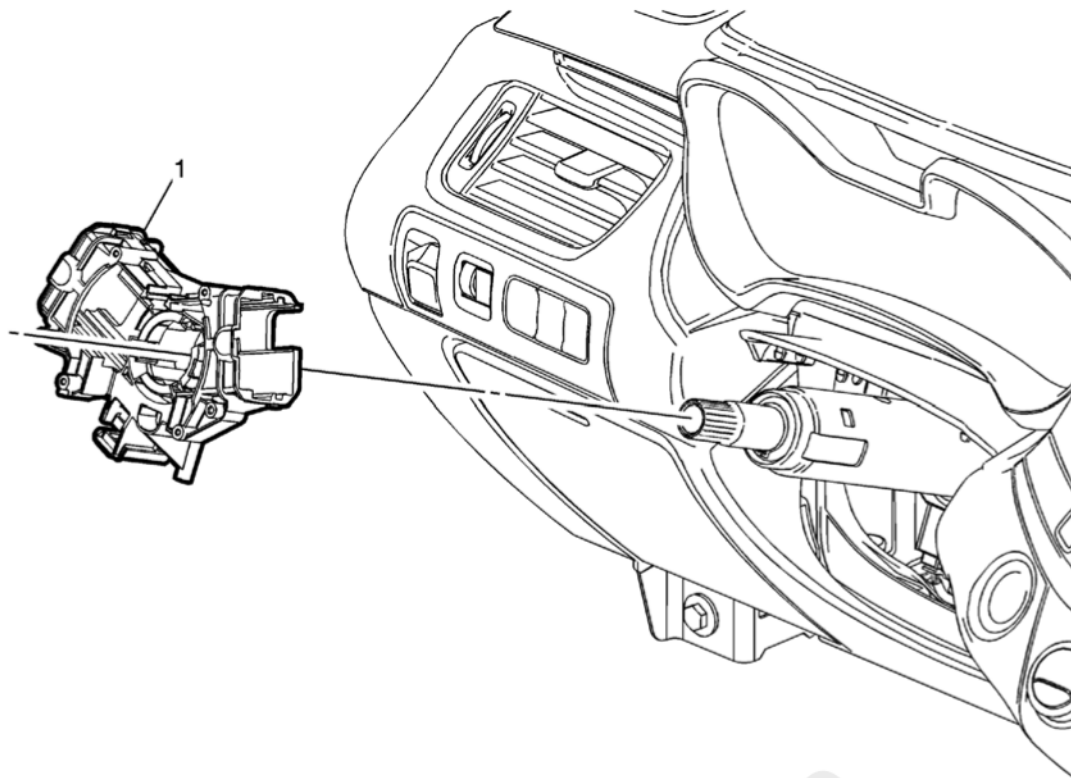


Fig. 25: Turn Signal Switch Bracket (With BTM)
 Courtesy of GENERAL MOTORS COMPANY

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

TURN SIGNAL SWITCH BRACKET REPLACEMENT (WITHOUT BTM)

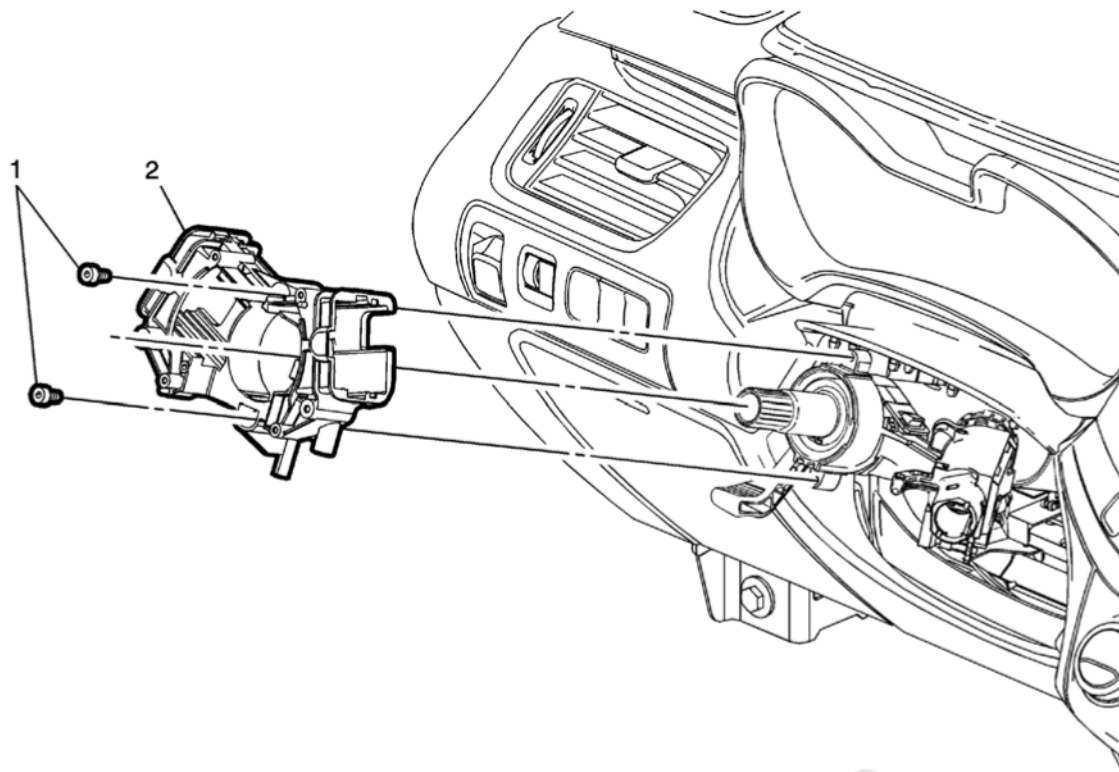


Fig. 26: Turn Signal Switch Bracket (Without BTM)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Steering Wheel Airbag Coil Replacement Turn Signal Switch Replacement Windshield Wiper and Washer Switch Replacement Theft Deterrent Module Replacement (Without BTM)	
1	Turn Signal Switch Bracket Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 15 N.m (11 lb ft)
2	Turn Signal Switch Bracket

STEERING COLUMN TILT WHEEL ACTUATOR REPLACEMENT

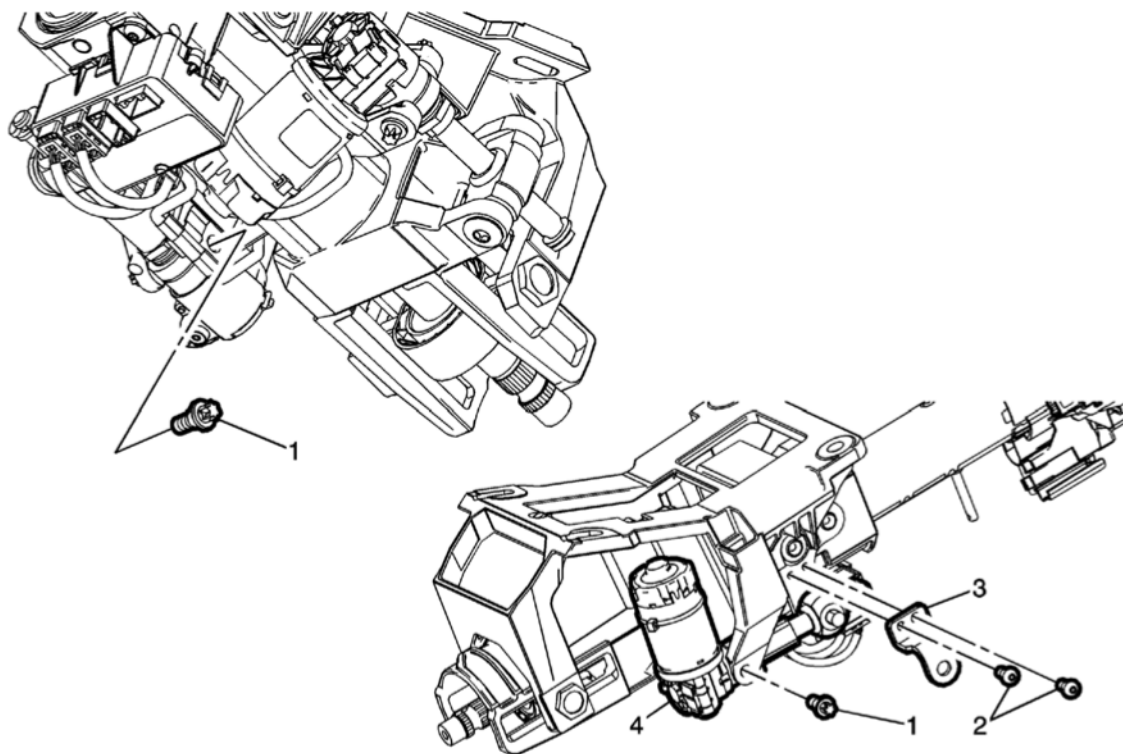


Fig. 27: Steering Column Tilt Wheel Actuator
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Steering Column Replacement (N37) Steering Column Replacement (N38)	
1	Steering Column Tilt Wheel Actuator Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 5 N.m (44 lb in)
2	Steering Column Bracket Bolt (Qty: 2) Tighten 3 N.m (27 lb in)
3	Steering Column Bracket
4	Steering Column Tilt Wheel Actuator Procedure 1. Disconnect the electrical connector. 2. After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Steering Column Tilt Wheel and Telescope Control Module Learn NOTE: In order to relearn the steering column soft and hard stops, the steering column MUST be mounted and fastened and the steering column upper and lower trim covers CANNOT be installed.

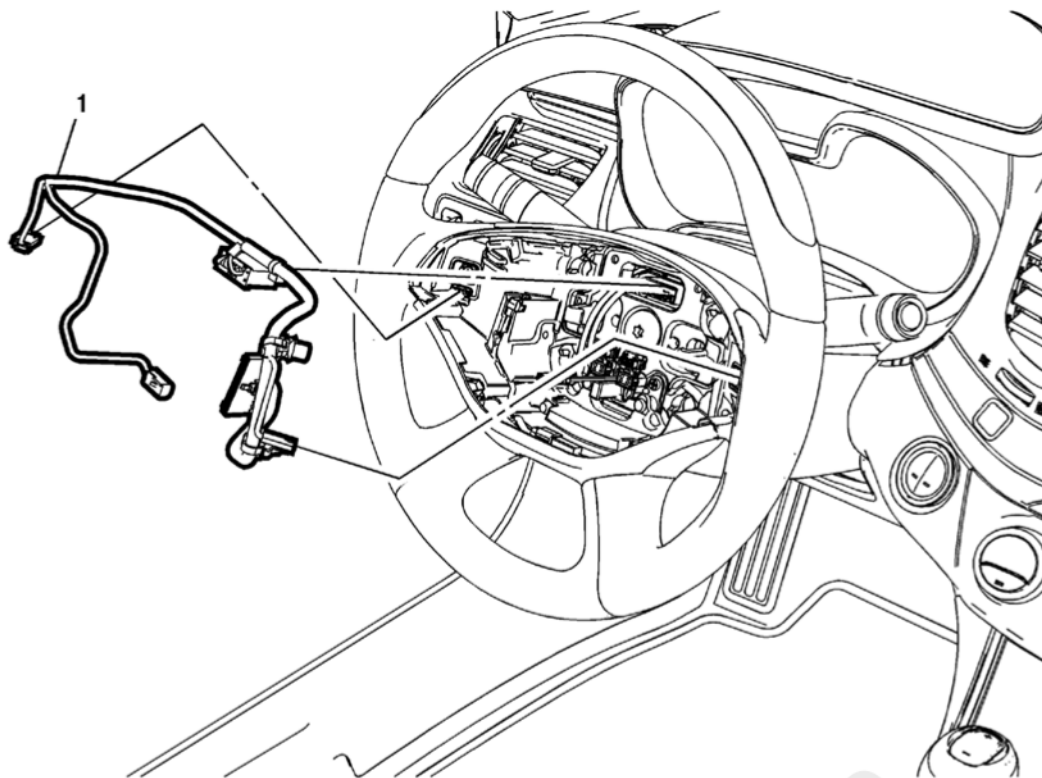


Fig. 28: Steering Wheel Pad Accessory Wiring Harness
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Wheel Heat Control Module Replacement</u>	
1	Steering Wheel Pad Accessory Wiring Harness Procedure 1. Disconnect the electrical connectors. 2. Remove the steering wheel pad accessory wiring harness from the steering wheel.

STEERING WHEEL HEAT CONTROL MODULE REPLACEMENT

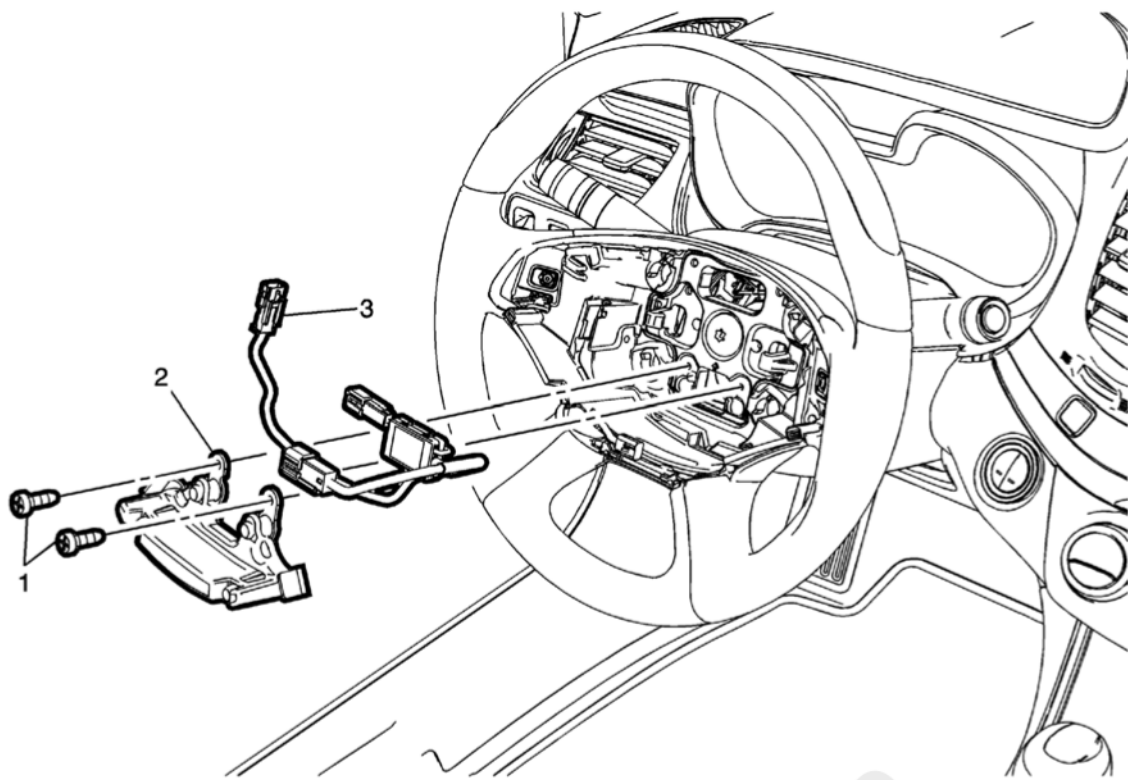


Fig. 29: Steering Wheel Heat Control Module
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Wheel Spoke Cover Replacement</u>	
1	Steering Wheel Mass Damper Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Steering Wheel Mass Damper
3	Steering Wheel Heat Control Module Procedure Disconnect the electrical connectors.

STEERING WHEEL REPLACEMENT

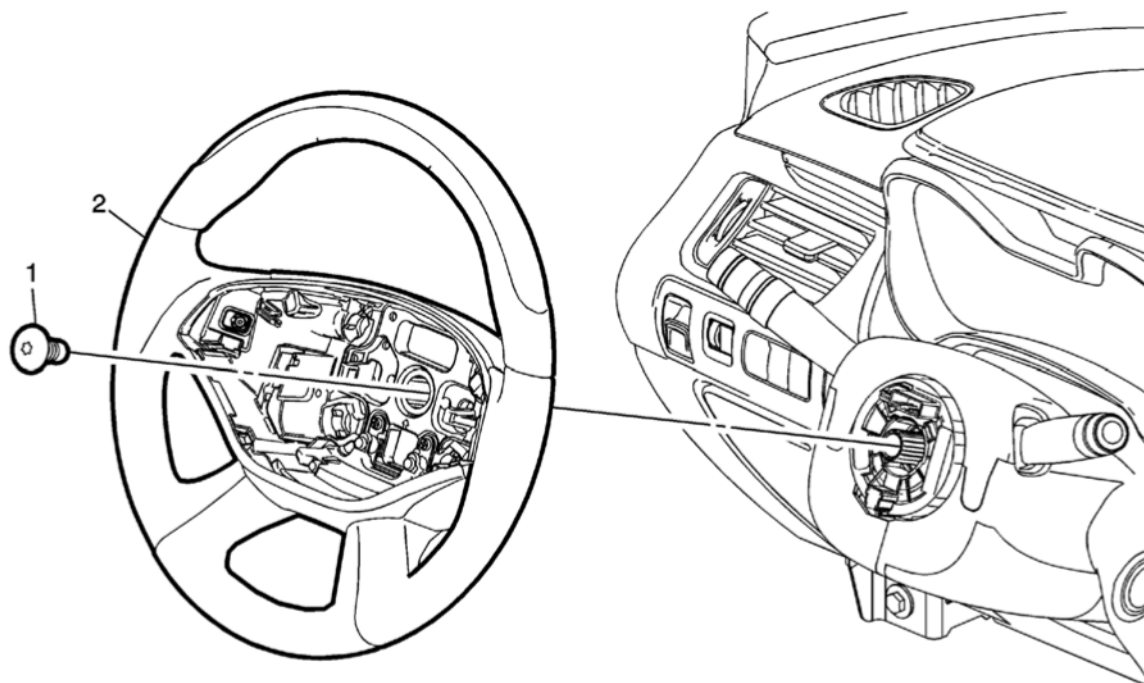


Fig. 30: Steering Wheel

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Steering Wheel Airbag Replacement	
1	Steering Wheel Bolt CAUTION: Refer to Fastener Caution . 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. Adhesives, Fluids, Lubricants, and Sealers 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 VIBRATION DAMPENER REPLACEMENT

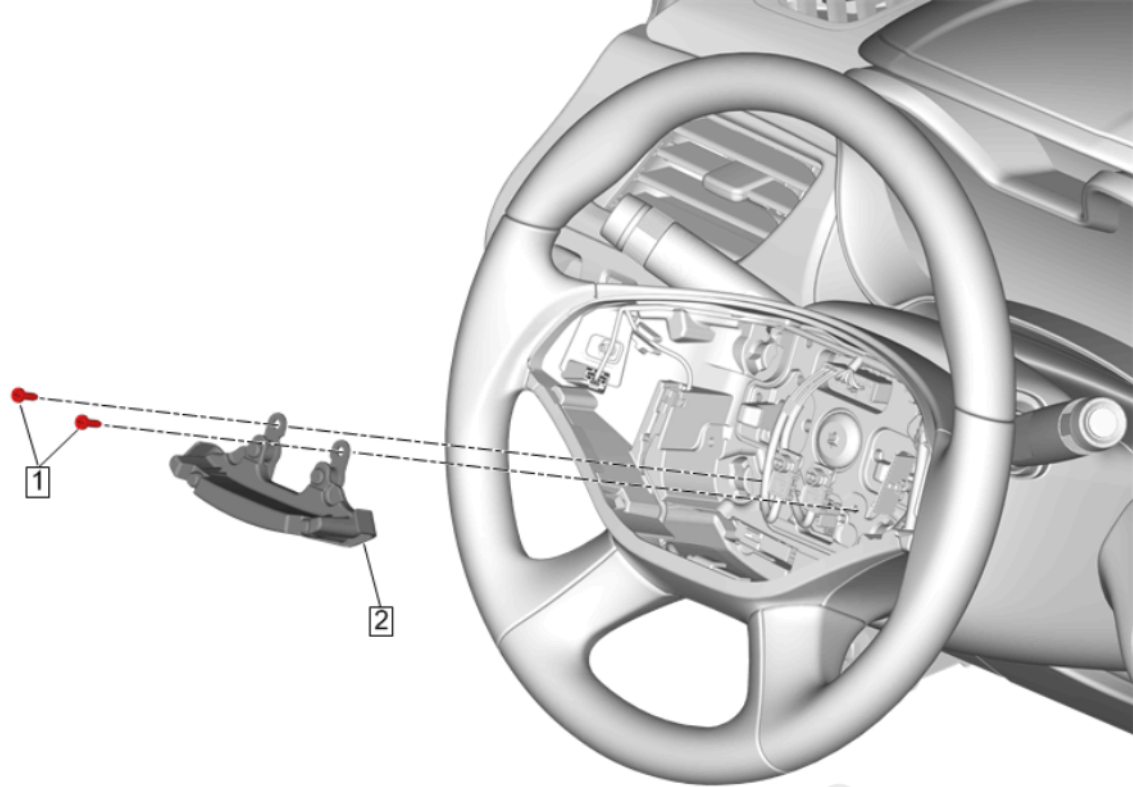


Fig. 31: Steering Wheel Vibration Dampener
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Steering Wheel Spoke Cover Replacement</u>	
1	Steering Wheel Vibration Dampener Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 3.5 N.m (31 lb in)
2	Steering Wheel Vibration Dampener

STEERING WHEEL SPOKE COVER REPLACEMENT

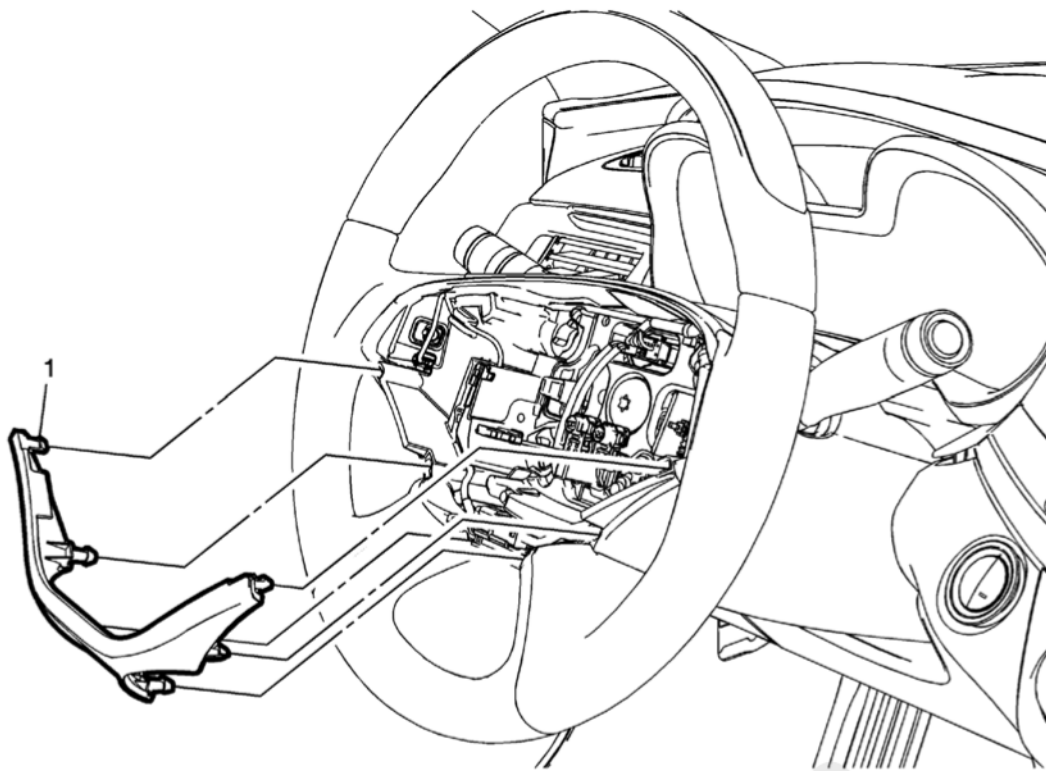


Fig. 32: Steering Wheel Spoke Cover
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Wheel Airbag Replacement</u>	
1	Steering Wheel Spoke Cover Procedure 1. Use a flat bladed plastic tool to remove. 2. Remove the steering wheel heat control module wiring harness from the steering wheel spoke cover, if equipped.

STEERING COLUMN TELESCOPE ACTUATOR REPLACEMENT

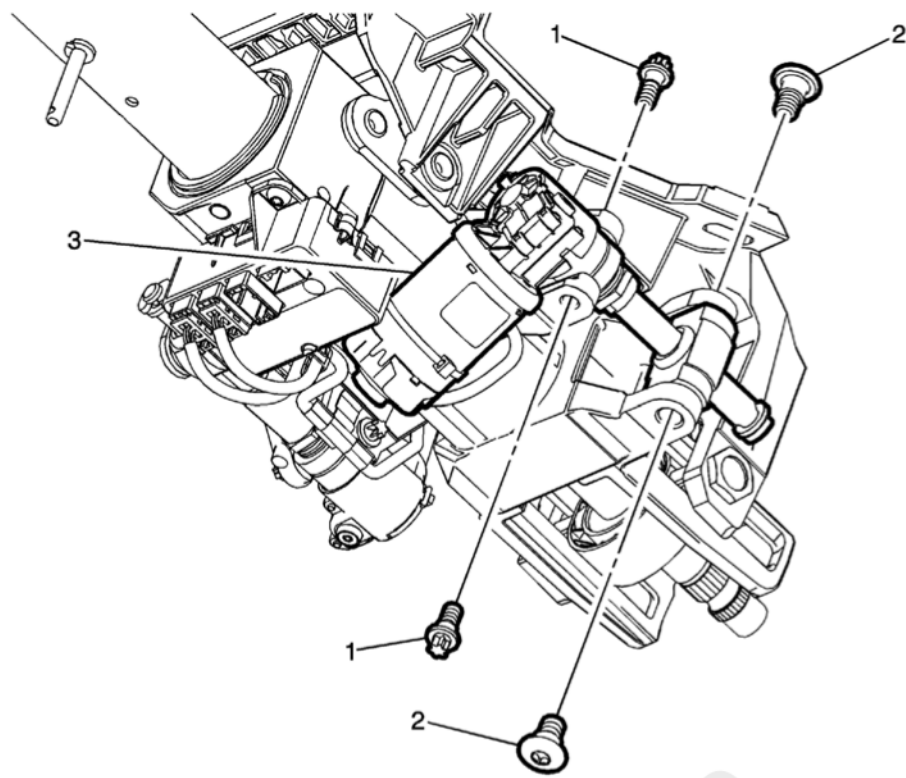


Fig. 33: Steering Column Telescope Actuator
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Replacement (N37)</u> <u>Steering Column Replacement (N38)</u>	
1	Steering Column Telescope Actuator Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 5 N.m (44 lb in)
2	Steering Column Telescope Actuator Pivot Bolt (Qty: 2) Tighten 18 N.m (13 lb ft)
3	Steering Column Telescope Actuator Procedure 1. Disconnect the electrical connectors. 2. After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. <u>Steering Column Tilt Wheel and Telescope Control Module Learn</u> NOTE: In order to relearn the steering column soft and hard stops, the steering column MUST be mounted and fastened and the steering column upper and lower trim covers CANNOT be installed.

STEERING COLUMN TILT WHEEL AND TELESCOPE SWITCH REPLACEMENT

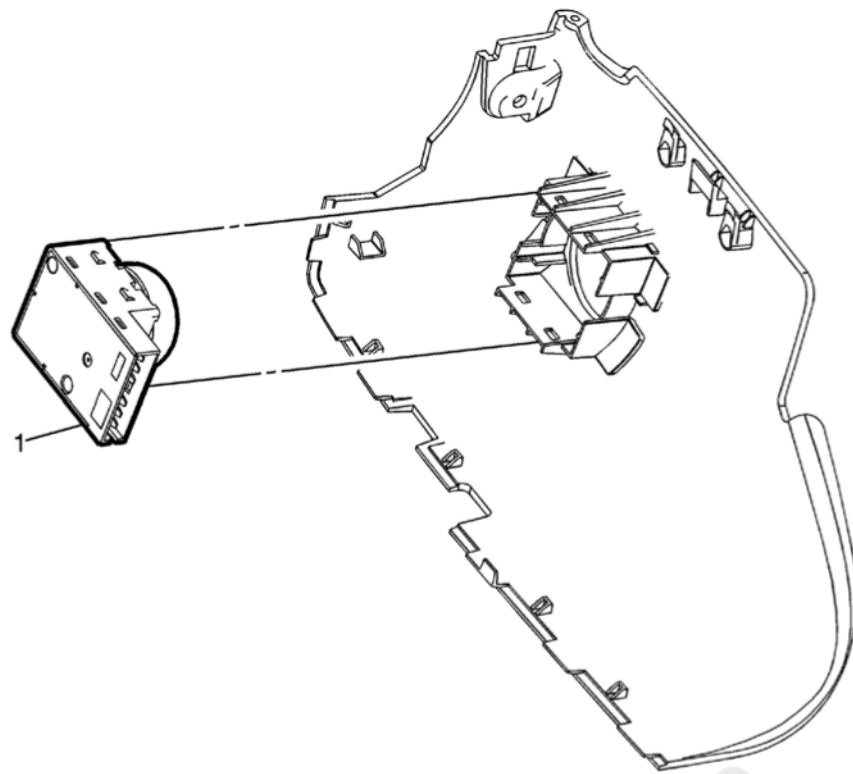


Fig. 34: Steering Column Tilt Wheel & Telescope Switch

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Lower Trim Cover Replacement (N38)</u> <u>Steering Column Lower Trim Cover Replacement (N37)</u>	
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)

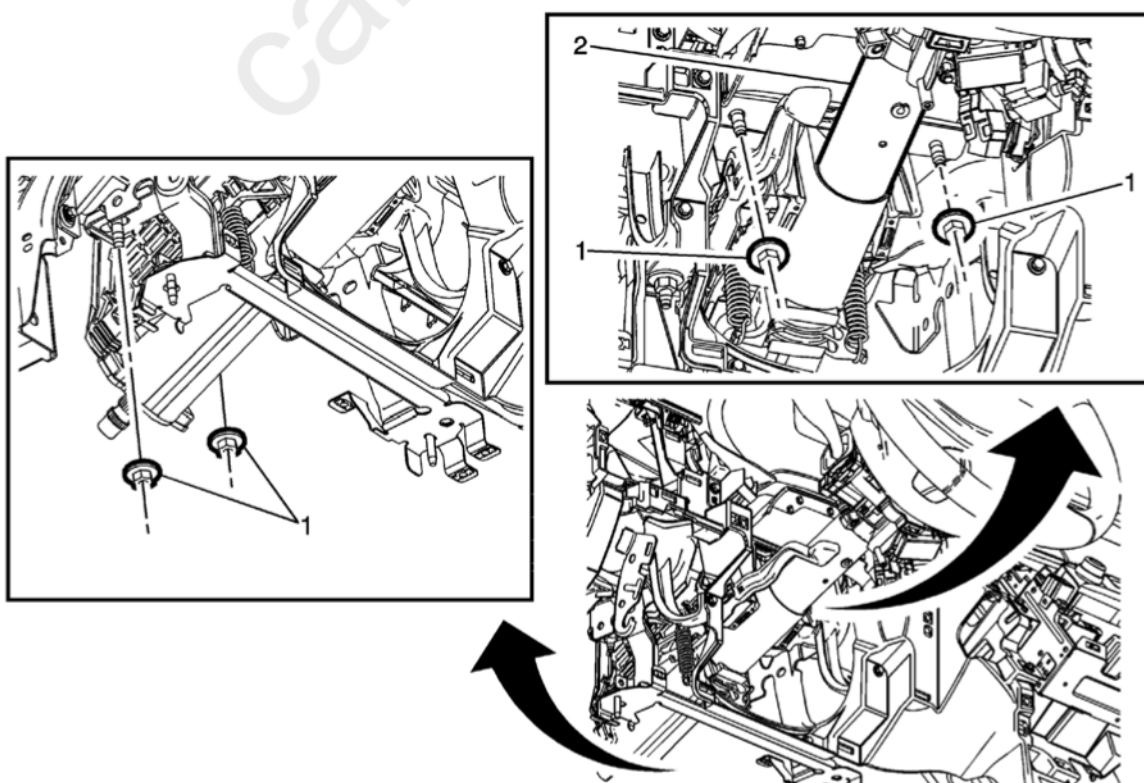


Fig. 35: Steering Column (N37)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Refer to SIR Warning . WARNING: Refer to SIR Inflator Module Handling and Storage Warning . 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. Preliminary Procedures 1. Disable the SIR system. SIR Disabling and Enabling 2. Steering Column Lower Trim Cover Replacement (N37) 3. Instrument Panel Knee Bolster Replacement 4. If replacing the steering column, verify the front wheels are in the straight ahead position and LOCK the steering column using the lock pin from the NEW steering column. 5. If removing and reinstalling the steering column, verify the front wheels are in the straight ahead position and SECURE the steering column as best as possible to prevent any rotation of the steering column shaft and steering wheel. 6. Place match marks on the steering column shaft and the intermediate steering shaft. 7. Intermediate Steering Shaft@Steering Column - Separate - Intermediate Steering Shaft Replacement	
1	Steering Column Nut (Qty: 4) CAUTION: Refer to Fastener Caution . Tighten 22 N.m (16 lb ft)

Callout	Component Name
2	Steering Column 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. Procedure 1. Disconnect the electrical connectors. 2. If replacing the steering column, copy the match marks from the OLD steering column to the NEW steering column. 3. If replacing the steering column, transfer components as necessary. 4. Center the steering angle sensor. Steering Wheel Angle Sensor Centering

STEERING COLUMN REPLACEMENT (N38)

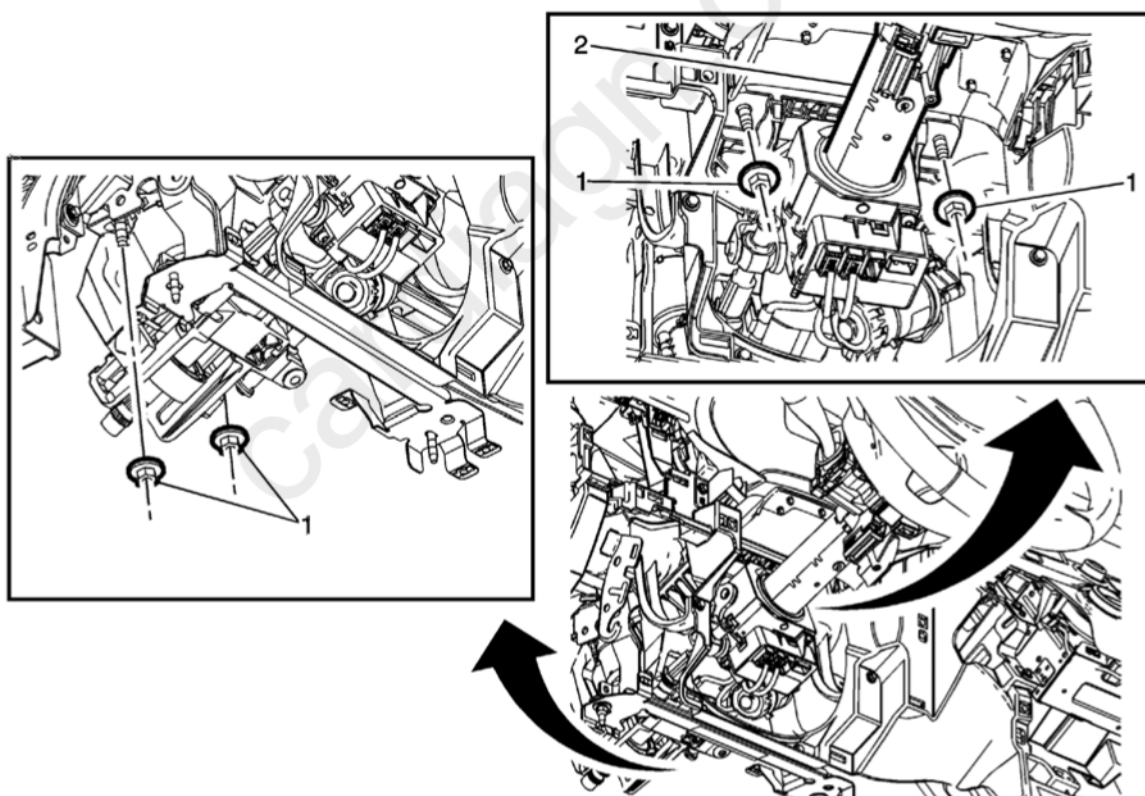


Fig. 36: Steering Column

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
WARNING: Refer to SIR Warning . WARNING: Refer to SIR Inflator Module Handling and Storage Warning . 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. Preliminary Procedures 1. Disable the SIR system. SIR Disabling and Enabling 2. Steering Column Lower Trim Cover Replacement (N38) 3. Instrument Panel Knee Bolster Replacement 4. If replacing the steering column, verify the front wheels are in the straight ahead position and LOCK the steering column using the lock pin from the NEW steering column. 5. If removing and reinstalling the steering column, verify the front wheels are in the straight ahead position and SECURE the steering column as best as possible to prevent any rotation of the steering column shaft and steering wheel. 6. Place match marks on the steering column shaft and the intermediate steering shaft. 7. Separate Intermediate Steering Shaft@Steering Column - Intermediate Steering Shaft Replacement	
1	Steering Column Nut (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 22 N.m (16 lb ft)

Callout	Component Name
2	Steering Column 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. Procedure 1. Disconnect the electrical connectors. 2. If replacing the steering column, copy the match marks from the OLD steering column to the NEW steering column. 3. If replacing the steering column, transfer components as necessary. 4. After installation and before the steering column upper and lower trim covers are installed, relearn the soft and hard stops. Steering Column Tilt Wheel and Telescope Control Module Learn 5. Center the steering angle sensor. Steering Wheel Angle Sensor Centering NOTE: In order to relearn the steering column soft and hard stops, the steering column MUST be mounted and fastened and the steering column upper and lower trim covers CANNOT be installed.

STEERING COLUMN DASH INNER SEAL REPLACEMENT

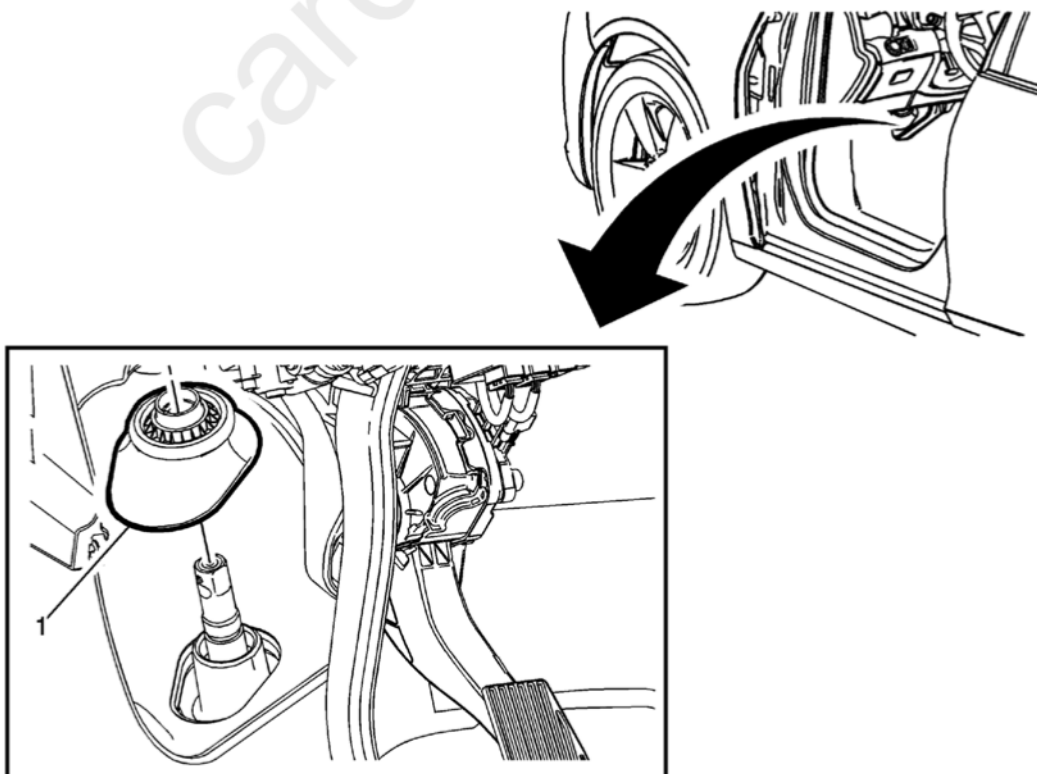


Fig. 37: Steering Column Dash Inner Seal
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Separate Intermediate Steering Shaft@Steering Gear - Intermediate Steering Shaft Replacement	
1	Steering Column Dash Inner Seal Procedure Position the steering column dash inner seal over the steering gear and on the dash panel. Ensure the lip on the seal is positioned correctly.

STEERING COLUMN DASH OUTER SEAL REPLACEMENT (NJ2)

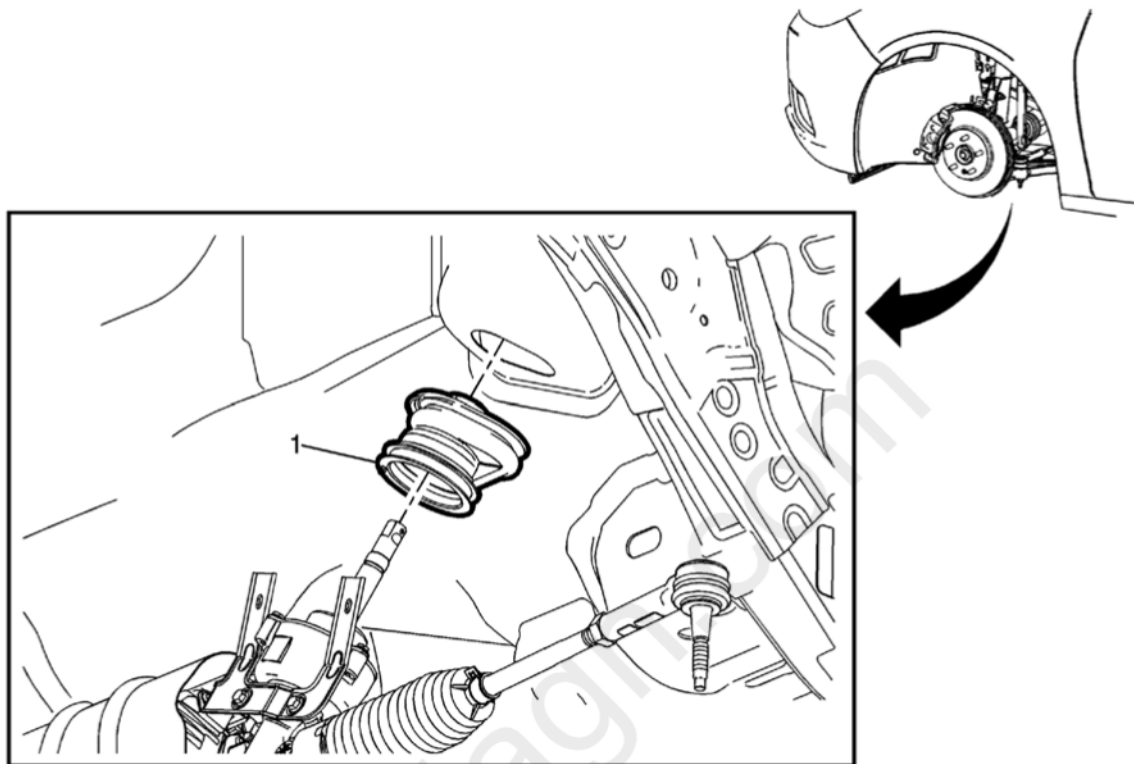


Fig. 38: Steering Column Dash Outer Seal (NJ2)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Steering Column Dash Inner Seal Replacement - Lower the steering gear as necessary to provide enough clearance to remove the steering column dash outer seal. Electric Belt Drive Rack and Pinion Steering Gear Replacement (NJ2)	
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 DASH OUTER SEAL REPLACEMENT (NJ1)

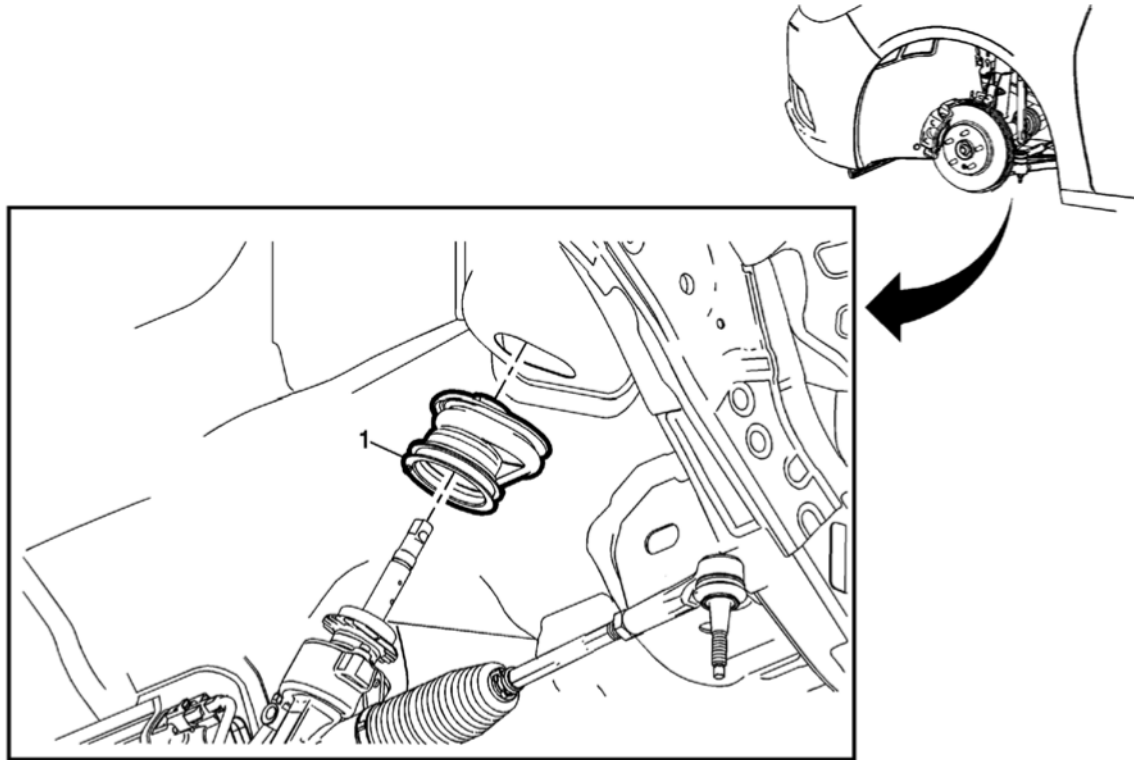


Fig. 39: Steering Column Dash Outer Seal (NJ1)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures <u>Steering Column Dash Inner Seal Replacement</u> - Lower the steering gear as necessary to provide enough clearance to remove the steering column dash outer seal. <u>Electric Dual Pinion Rack and Pinion Steering Gear Replacement (NJ1)</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 the following components are replaced:

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

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

1. Ignition ON, engine OFF.

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

2. Using the steering column tilt and telescope switch, actuate the column to each mechanical hard stop in each direction listed below;
 - Tilt column full up

- Tilt column full down
 - Telescope column full forward
 - Telescope column full rearward
3. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.

DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION (N37)

The steering wheel and column has 4 primary functions:

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

Vehicle Steering

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

The steering column can be adjusted vertically and longitudinally

Vehicle Security

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

- The ignition switch
- The steering column lock
- The ignition cylinder
- The theft deterrent immobilizer module, if equipped

Driver Convenience

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

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

Steering Column Lock

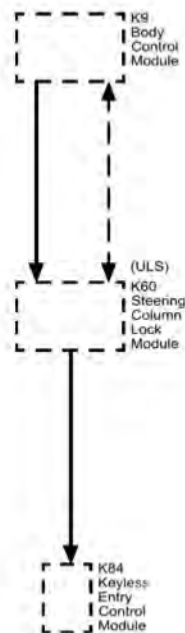


Fig. 40: Steering Column Lock Module Block Diagram

Courtesy of GENERAL MOTORS COMPANY

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

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

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

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

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

Heated Steering Wheel

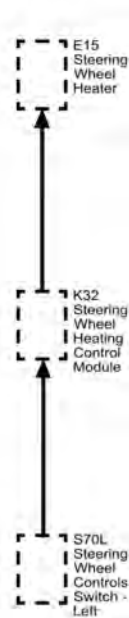


Fig. 41: Heated Steering Wheel Block Diagram
 Courtesy of GENERAL MOTORS COMPANY

The heated steering wheel system consists of a heated steering wheel, a heated steering wheel switch, and a steering wheel heat module. The heated steering wheel includes a non-serviceable heating element and temperature sensor, which both are located in the rim of the steering wheel. The heated steering wheel on/off switch is located in the instrumentation panel. The steering wheel heat module is located on the front-side of the steering wheel center hub.

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

Driver Safety

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

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

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

Electronic Park Lock (EPL)/Ignition Lock Cylinder Control Actuator: If the vehicle is equipped with automatic transmission and a floor mounted console gear shift, it has an ignition lock cylinder control actuator system in the steering column. The ignition lock cylinder control actuator purpose is to prevent the ignition key from being turned to the OFF position when the transmission is in any position other than PARK and the vehicle may still be moving. The column ignition lock system consists of an ignition lock cylinder control actuator, and a park position switch that is located in the automatic transmission shift lock control switch. The ignition lock cylinder control actuator contains a pin that is spring loaded to mechanically prevent the ignition key cylinder from being turned to the lock position

when the vehicle transmission is not in the PARK position. If vehicle power is lost, and/or the transmission is not in the PARK position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column.

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

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

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

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION (N38)

Steering Column Lock

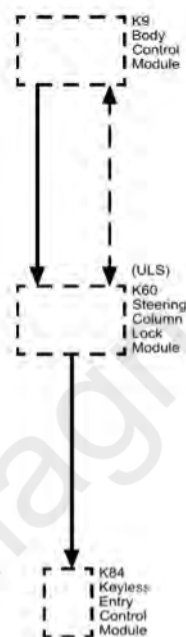


Fig. 42: Steering Column Lock Module Block Diagram

Courtesy of GENERAL MOTORS COMPANY

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

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

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

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

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

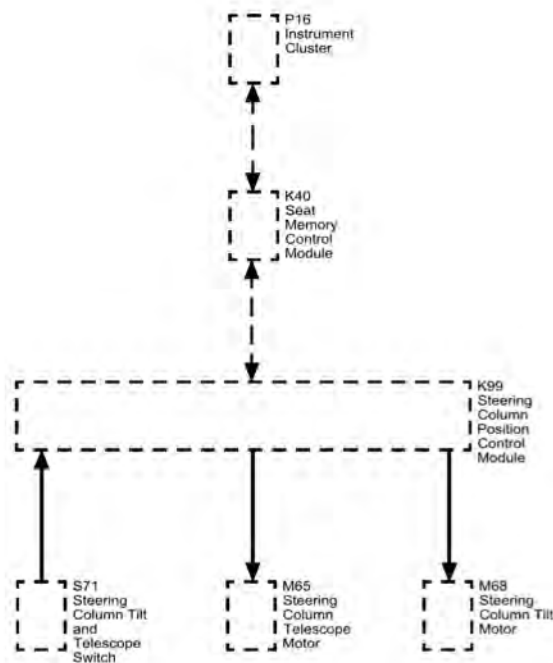


Fig. 43: Tilt/Telescoping Schematic Graph

Courtesy of GENERAL MOTORS COMPANY

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

Column Position Module has two versions of operation:

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

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

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

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

Tilt/Telescoping Switch Operation

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

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

Motors

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

Position Sensors with A45 Memory Seats

Two position sensors are Hall Effect sensors and are used by the column position module. The column position module provides a 5 V reference voltage and a ground to both the tilt and telescoping position sensors. The sensor feedback circuit voltage varies from 0 - 5 V. Each sensor is part of the motor assembly. When the motor rotates, the voltage of the sensor varies on the scan tool. The column position module monitors the feedback voltage to determine the column position.

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

Tilt/Telescoping Memory with A45 Memory Seats

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

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

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

Driver Safety

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

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

Heated Steering Wheel

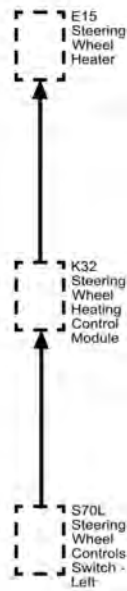


Fig. 44: Heated Steering Wheel Block Diagram
 Courtesy of GENERAL MOTORS COMPANY

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).