SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

NOTE:
All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.

Application
Steering Shaft Lock Plate Retaining Ring

Reusable Threaded Fastener Tightening Specifications

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

Application	Specification
	Metric (English)
Automatic Transmission Control Bolt	10 N.m (89 lb in)
Automatic Transmission Range Selector Lever Cable Lever Bolt	20 N.m (15 lb ft)
Instrument Panel Knee Bolster Deflector Bolt	9 N.m (80 lb in)
Intermediate Steering Shaft Lower Bolt	45 N.m (33 lb ft)
Intermediate Steering Shaft Upper Bolt	50 N.m (37 lb ft)
Steering Column Bolt	27 N.m (20 lb ft)
Steering Column Nut	27 N.m (20 lb ft)
Steering Column Seal Nut	3 N.m (27 lb in)
Steering Column Shroud Bolt	2.5 N.m (22 lb in)
Steering Wheel Nut	37 N.m (27 lb ft)
Turn Signal Switch Bolt	2.5 N.m (22 lb in)
Upper Intermediate Steering Shaft Nut	62 N.m (46 lb ft)

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number

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		US	Canada
Steering Column Tilt Head Pivot Pin	Lubricant	12346293	992723

SCHEMATIC WIRING DIAGRAMS

STEERING WHEEL WIRING SCHEMATICS

Heated Steering Wheel (UVD)

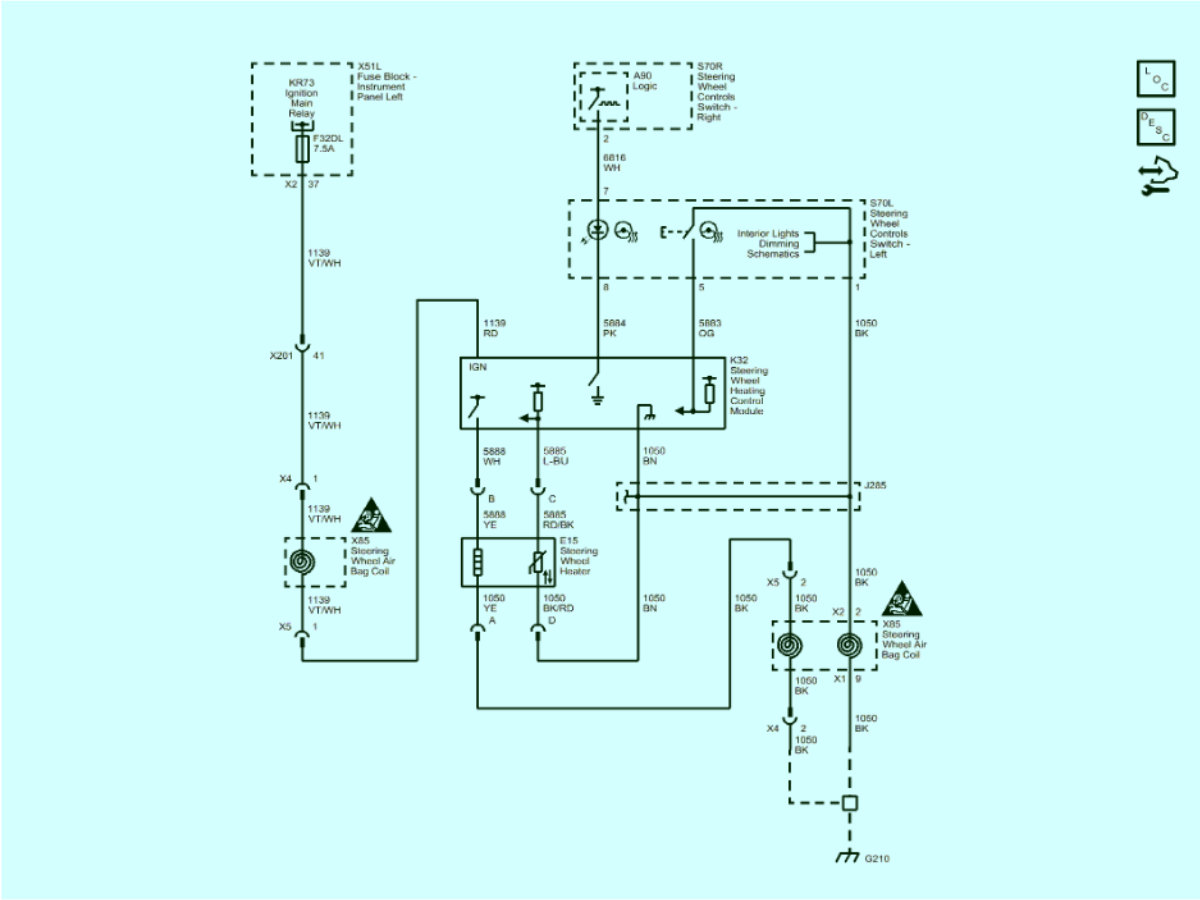


Fig. 1: Heated Steering Wheel (UVD)
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - STEERING WHEEL AND COLUMN

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

Visual/Physical Inspection

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

Symptoms List

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

- **Heated Steering Wheel Indicator Malfunction**
- **Heated Steering Wheel Malfunction**
- **Steering Column Tilt Function Inoperative**
- **High Telescoping Effort**
- **Noise in Steering Column**
- **High Shift Effort**
- **Looseness in Steering Column (Tilt and Telescope)Looseness in Steering Column (Tilt Only)**

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**
- **Interior Lights Dimming Schematics**

Connector End View Reference

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COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

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

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

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

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

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

Circuit/System Testing

1. Ignition OFF, disconnect the X5 in-line harness connector at the X85 Steering Wheel Air Bag 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.

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- **If less than 10 Ω**

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

NOTE: **Once the jumper is installed the module will only ground the circuit for approximately 3 s.**

7. Ignition OFF, install a 3 A fused jumper wire between the signal circuit terminal 5 and ground circuit terminal 1 at the S70L Steering Wheel Controls Switch - Left. Ignition ON.
8. Test for less than 300 Ω between the control circuit terminal 8 and ground.
    - **If 300 Ω or greater**

      Replace the K32 Steering Wheel Heating Control Module.

    - **If less than 300 Ω**
9. Replace the S70L Steering Wheel Controls Switch - Left.

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Repair Instructions

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

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

HEATED STEERING WHEEL MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

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

Circuit/System Description

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

Diagnostic Aids

- Before replacing the steering wheel for complaints of not getting hot enough, a reliable infrared temperature gun should be used to measure the temperature at various points around the rim. The steering wheel's normal operating temperature is 32Â°C (89.6Â°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 -21Â°C (-5.8Â°F). The steering wheel heater will not operate when the steering wheel temperature is above 32Â°C (89.6Â°F).

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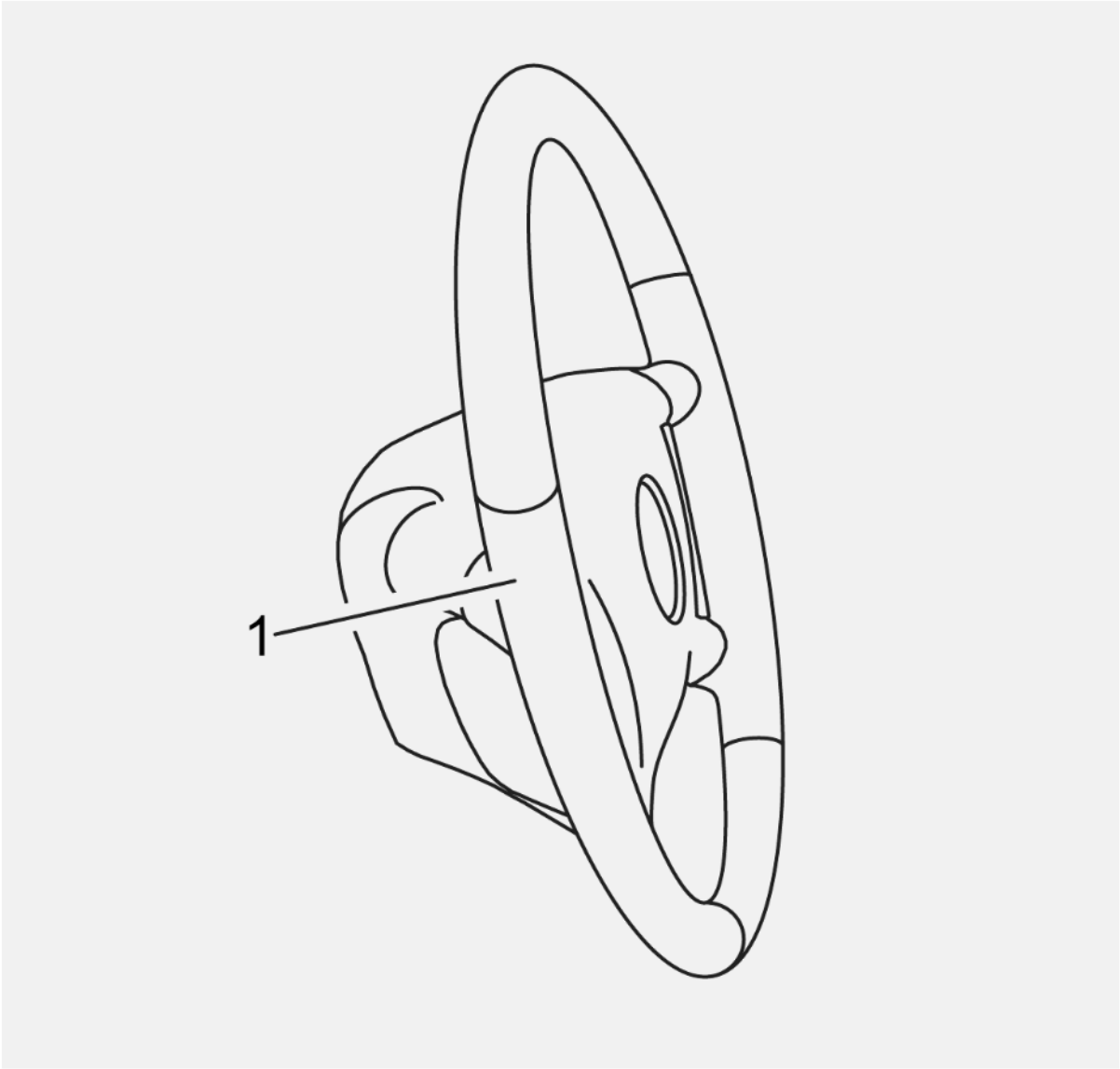


Fig. 2: Steering Wheel Rim Measurement Point
Courtesy of GENERAL MOTORS COMPANY

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

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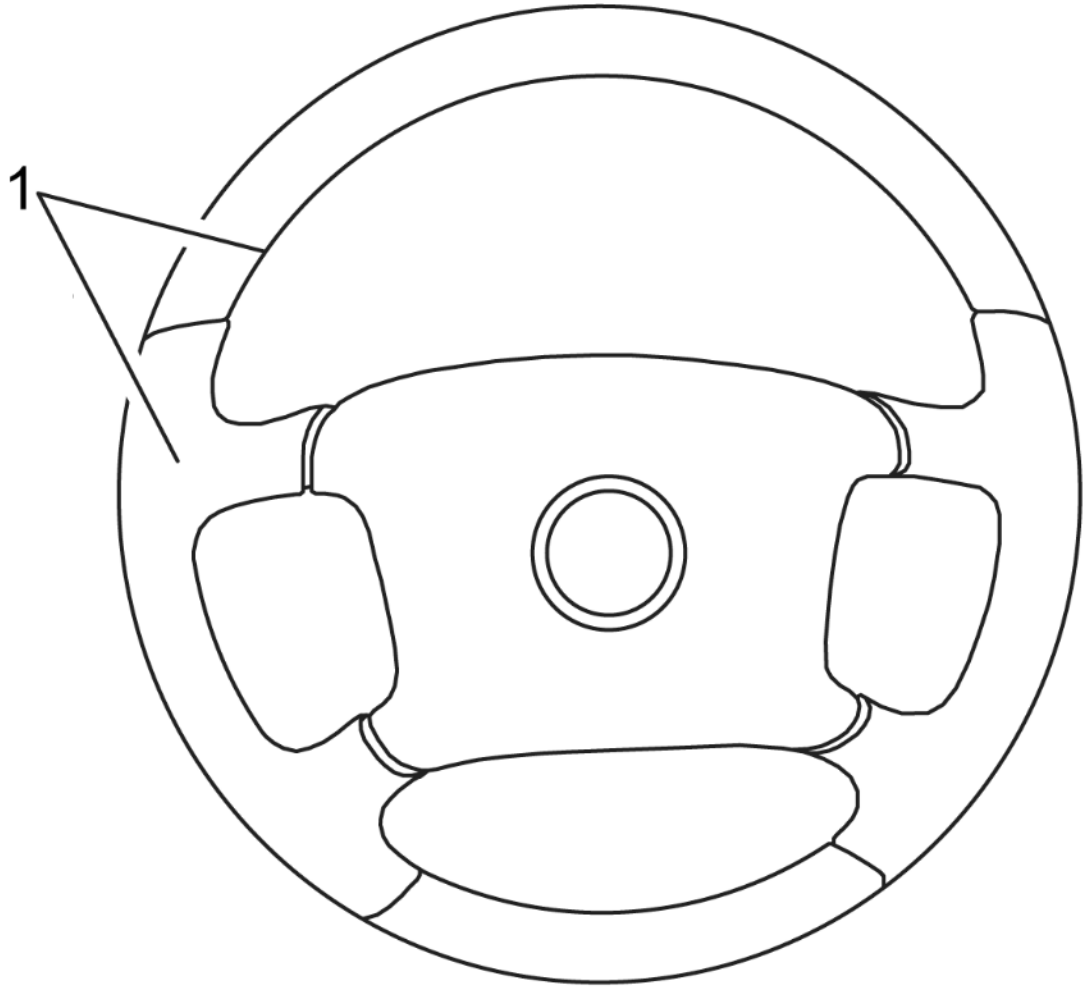


Fig. 3: Temperature Measurement Points
Courtesy of GENERAL MOTORS COMPANY

- 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

Electrical Information Reference

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

Circuit/System Verification

Using an Infrared Temperature Gun

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

      Refer to **Heated Steering Wheel Indicator Malfunction**

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

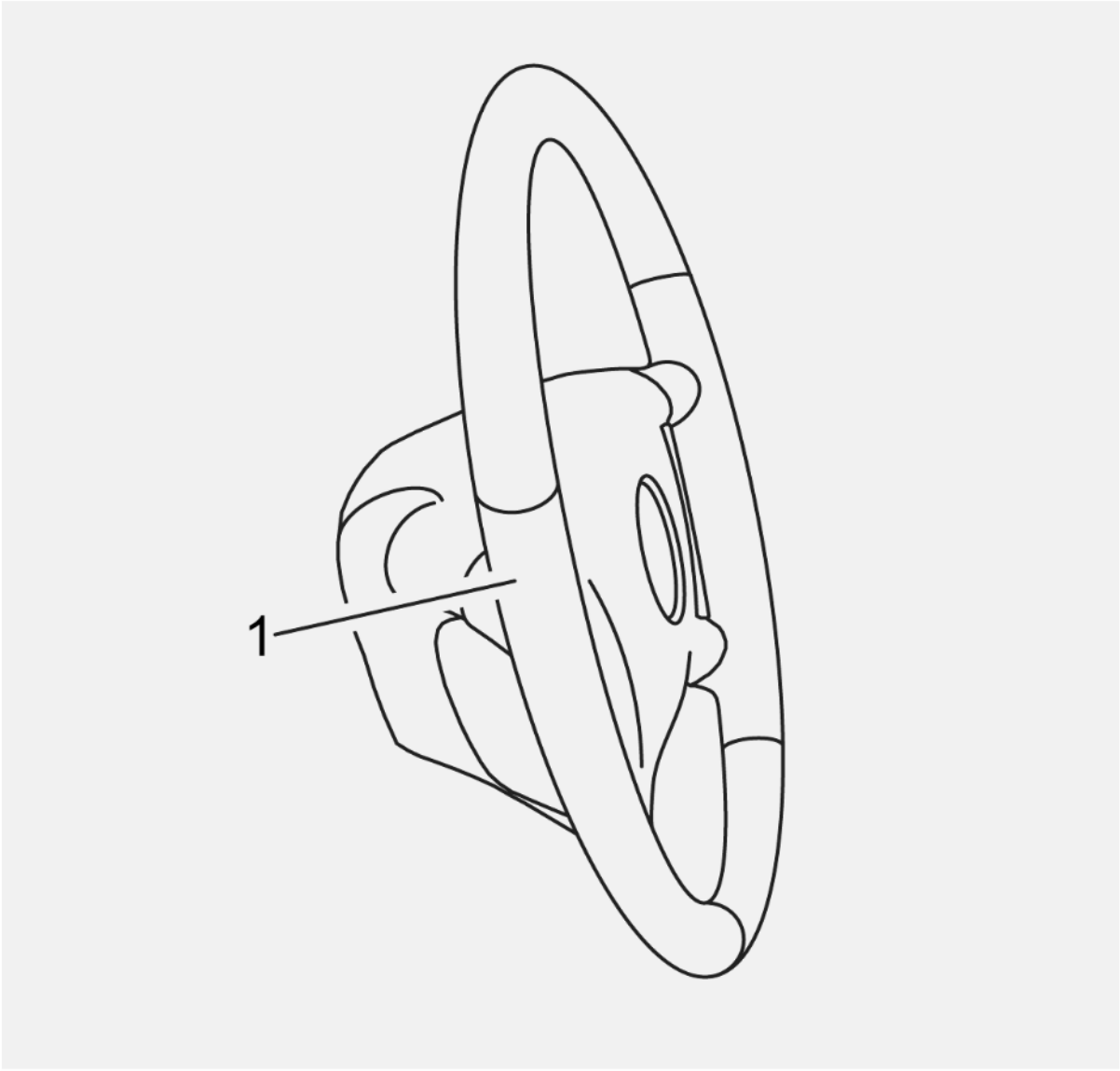


Fig. 4: Steering Wheel Rim Measurement Point

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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.**

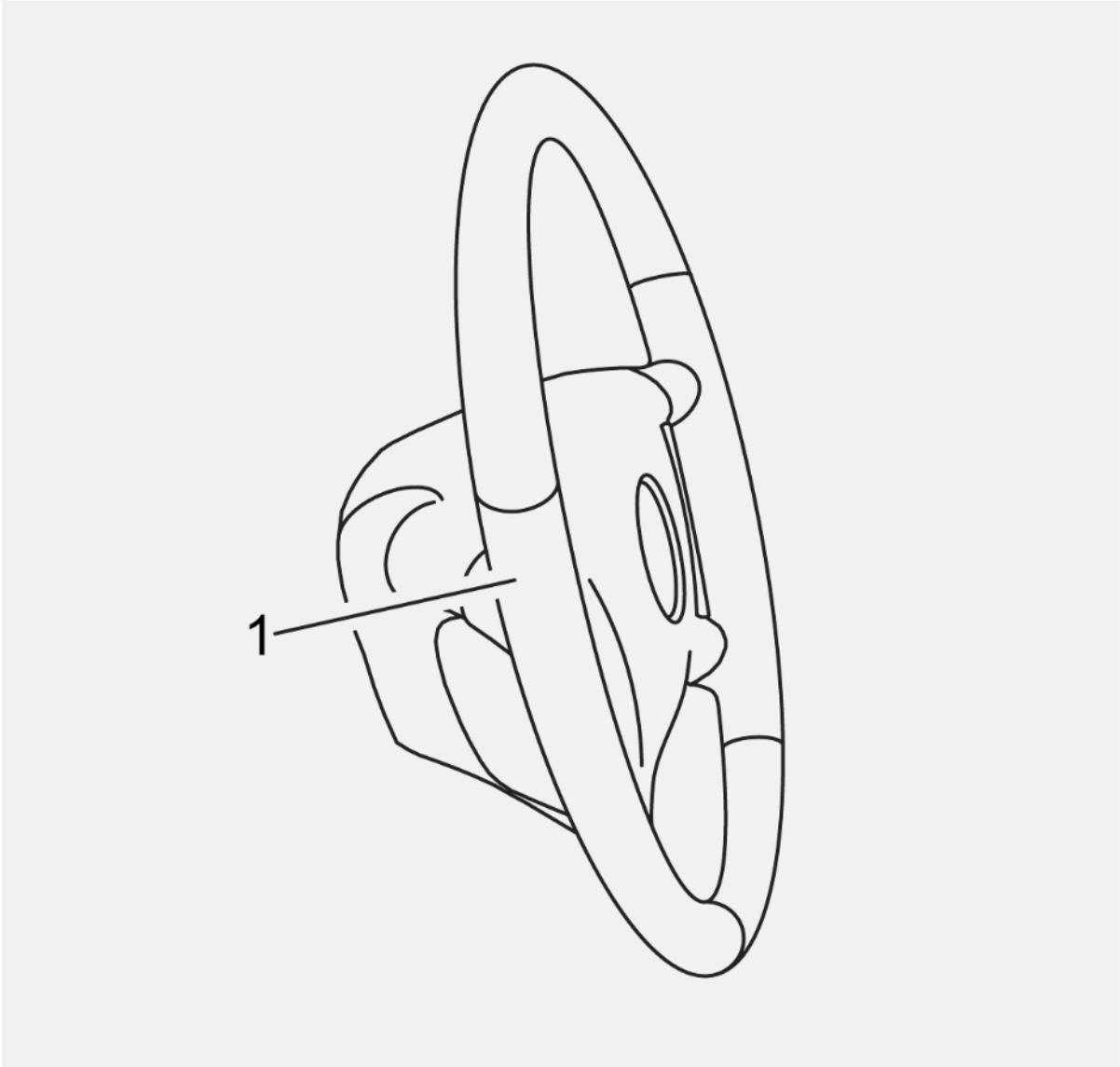
3. Measure the temperature readings at the 3 and 9 o'clock positions on the steering wheel rim (1).
4. Verify that the steering wheel temperature is 25Â°C (77Â°F) or below.
   - **If the steering wheel temperature is greater than 25Â°C (77Â°F)**

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

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

     Refer to **Heated Steering Wheel Indicator Malfunction**

   - **If the heater indicator illuminates**



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

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

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

      Refer to Circuit System Testing.

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

Circuit/System Testing

1. Ignition OFF, disconnect the X5 in-line harness connector at the X85 Steering Wheel Air Bag 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 voltage circuit terminal 1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2 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 fuse is OK and there is voltage at the fuse.
        - If the fuse is blown, replace the K32 Steering Wheel Heating 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 ignition voltage circuit and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K32 Steering Wheel Heating Control Module.
    - **If the test lamp illuminates**
5. Ignition OFF, reconnect the in-line harness connector X5. Disconnect the harness connector at the S70L Steering Wheel Controls Switch - Left.

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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 5 and ground.
    - **If less than B+**

      Replace the K32 Steering Wheel Heating Control Module.

    - **If B+**
9. Place the S70L Steering Wheel Controls Switch - Left in the OFF position.
10. Test for infinite resistance between terminal 5 and terminal 1 at the S70L Steering Wheel Controls Switch - Left.
    - **If less than infinite resistance**

      Replace the S70L Steering Wheel Controls Switch - Left.

    - **If infinite resistance**
11. Place the S70L Steering Wheel Controls Switch - Left in the ON position.
12. Test for less than 40 Ω between terminal 5 and terminal 1.
    - **If 40 Ω or greater**

      Replace the S70L Steering Wheel Controls Switch - Left

    - **If less than 40 Ω**
13. Ignition OFF, disconnect the in-line harness connector at the E15 Steering Wheel Heater.
14. Test for less than 10 Ω between the ground circuit terminal A at the K32 Steering Wheel Heating Control Module and ground.
    - **If 10 Ω or greater**

      Repair the open/high resistance in the circuit.

    - **If less than 10 Ω**
15. Test for 1.5-3.0 Ω between the signal terminal A and the ground terminal B at the E15 Steering Wheel Heater.
    - **If not within the specified range**

      Replace the E15 Steering Wheel Heater.

    - **If within the specified range**
16. Test for 9-11k Ω between the control circuit terminal D and the ground terminal C at the E15 Steering Wheel Heater.

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- **If not within the specified range**

  Replace the E15 Steering Wheel Heater.

- **If within the specified range**

17. Replace the K32 Steering Wheel Heating Control Module.

Repair Instructions

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

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

STEERING COLUMN TILT FUNCTION INOPERATIVE

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**. 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**. Did you complete the repair?	Go to **Step 11**	-

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Step	Action	Yes	No
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

Condition	Action
The telescoping lever assembly adjustment nut is too tight.	The telescoping lever assembly adjustment nut is not adjustable. Replace the steering column. Refer to **Steering Column Replacement**.
The steering shaft assembly is bent or damaged.	If the steering shaft assembly is bent or damaged, replace the steering column. Refer to **Steering Column Replacement**.
The telescoping lever assembly is damaged.	If the telescoping lever assembly is damaged, replace the steering column. Refer to **Steering Column Replacement**.

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**

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Step	Action	Yes	No
6	Inspect the steering column upper and lower bearings for the following conditions: • Damage • Lubrication • Wear • Proper seating Are the bearings in need of repair or replacement?	Go to **Step 13**	Go to **Step 7**
7	Does the steering column tilt joint need to be lubricated?	Go to **Step 14**	Go to **Step 8**
8	**NOTE:** **Inspect the intermediate steering shaft for noise while driving the vehicle, turning the steering wheel, and applying the brakes.** Inspect the intermediate steering shaft for noise.Is the intermediate steering shaft noisy?	Go to **Step 15**	Go to **Step 9**
9	**NOTE:** **For vehicles equipped with a telescoping steering column, perform this step. If not equipped, go to next step.** Inspect the steering column for noise while telescoping the column.Is the steering column noisy while telescoping?	Go to **Step 16**	Go to **Step 17**
10	**NOTE:** **If the steering column**	Go to **Step 17**	-

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Step	Action	Yes	No
	mounting features are damaged or sheared, replace the steering column. Refer to Steering Column Replacement. Tighten the steering column mounting fasteners to specification. Refer to **Fastener Specifications**.Did you complete the repair?		
11	Replace the SIR/SRS coil. Refer to **Steering Wheel Airbag Coil Replacement** . Did you complete the repair?	Go to **Step 17**	-
12	Install the lock plate retaining ring correctly. Did you complete the repair?	Go to **Step 17**	-
13	**NOTE:** **If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement.** Replace the steering column upper and/or lower bearings, if serviceable.Did you complete the replacement?	Go to **Step 17**	-
14	Lubricate the steering column tilt joint. Did you complete the repair?	Go to **Step 17**	-
15	Replace the appropriate intermediate steering shaft component. Did you complete the repair?	Go to **Step 17**	-
16	Redistribute or add lubricant to the steering column lower jacket with the column telescoped to its end of outward travel.	Go to **Step 17**	-

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Step	Action	Yes	No
	Did you complete the repair?		
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

HIGH SHIFT EFFORT

Step	Action	Yes	No
DEFINITION: Abnormally high shift effort is required to shift the transmission out of the Park (P) position.			
1	Did you review the Steering Wheel and Column Description and Operation?	Go to **Step 2**	Go to **Steering Wheel and Column Description and Operation**
2	Verify that a high column shift effort is required in order to shift out of the PARK position. Does the column shifter operate normally?	System OK	Go to **Step 3**
3	Inspect for worn or worn or damaged automatic transmission range selector shift cable. Is the transmission range selector shift cable worn or damaged?	Go to **Step 6**	Go to **Step 4**
4	Inspect the automatic transmission range selector shift cable for binding or mis-adjustment. Is the automatic transmission range selector shift cable binding or mis-adjusted?	Go to **Step 7**	Go to **Step 5**
5	Inspect the column linear shift assembly for damage. Is the column linear shift assembly damaged?	Go to **Step 8**	Go to **Step 9**
6	Replace the automatic transmission range selector shift cable. Did you complete the repair?	Go to **Step 9**	-
7	Adjust the automatic transmission range selector shift cable. Did you complete the repair?	Go to **Step 9**	-
8	IMPORTANT: If the column linear shift assembly is not serviceable, then the steering column will need to be replaced. Refer to **Steering Column Replacement**. Replace the column linear shift assembly, if serviceable.Did you complete the replacement?	Go to **Step 9**	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

LOOSENESS IN STEERING COLUMN (TILT AND TELESCOPE)

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary	Go to **Step 2**	Go to **Symptoms - Steering Wheel and**

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Step	Action	Yes	No
	inspections?		Column
2	Verify that the steering column is loose. Is the steering column loose?	Go to **Step 3**	System OK
3	Inspect the steering column mounting features for the following conditions: • The steering column mounting fasteners are loose. • The steering column mounting features are sheared. Are the steering column mounting fasteners loose or the mounting features sheared?	Go to **Step 6**	Go to **Step 4**
4	Inspect the steering column upper and/or lower bearings for looseness. Are any of the steering column bearings worn or loose?	Go to **Step 7**	Go to **Step 5**
5	**NOTE:** **The steering column telescoping stop feature fastener is located on the underside of the steering column jacket on manual tilt and telescope steering columns.** To inspect the steering column telescoping stop feature fastener for looseness, perform the following steps: 1. Lock the steering column. 2. Try to rotate the steering wheel back and forth in both directions. 3. Note if the steering column assembly rotates with the steering wheel. If the steering column assembly rotates then the fastener is loose. Did the steering column assembly rotate with the	Go to **Step 8**	Go to **Step 3**

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Step	Action	Yes	No
	steering wheel?		
6	**NOTE:** **If any of the steering column mounting features are sheared, replace the steering column. Refer to Steering Column Replacement.** Tighten the steering column mounting fasteners to specification. Refer to **Fastener Specifications**.Did you complete the repair?	Go to **Step 9**	-
7	**NOTE:** **If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement.** Replace the steering column upper and/or lower bearings, if serviceable.Did you complete the repair?	Go to **Step 9**	-
8	**NOTE:** **Do not try to re-tighten the telescoping stop feature fastener. If the fastener is loose the steering**	Go to **Step 9**	-

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Step	Action	Yes	No
	column must be replaced. Replace the steering column. Refer to **Steering Column Replacement**.Did you complete the repair?		
9	Operate the steering column in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

LOOSENESS IN STEERING COLUMN (TILT ONLY)

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Steering Wheel and Column**
2	Verify that the steering column is loose. Is the steering column loose?	Go to **Step 3**	System OK
3	Inspect the steering column mounting features for the following conditions: • The steering column mounting fasteners are loose. • The steering column mounting features are sheared. Are the steering column mounting fasteners loose or the mounting features sheared?	Go to **Step 5**	Go to **Step 4**
4	Inspect the steering column upper and/or lower bearings for looseness. Are any of the steering column bearings worn or loose?	Go to **Step 6**	Go to **Step 7**
5	**NOTE:** **If any of the steering column mounting features are sheared, replace the steering column. Refer to Steering Column Replacement.** Tighten the steering column mounting fasteners to	Go to **Step 7**	-

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Step	Action	Yes	No
	specification. Refer to **Fastener Specifications**.Did you complete the repair?		
6	**NOTE:** **If the steering column upper and/or lower bearings are not serviceable, replace the steering column. Refer to Steering Column Replacement.** Replace the steering column 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**

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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

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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.

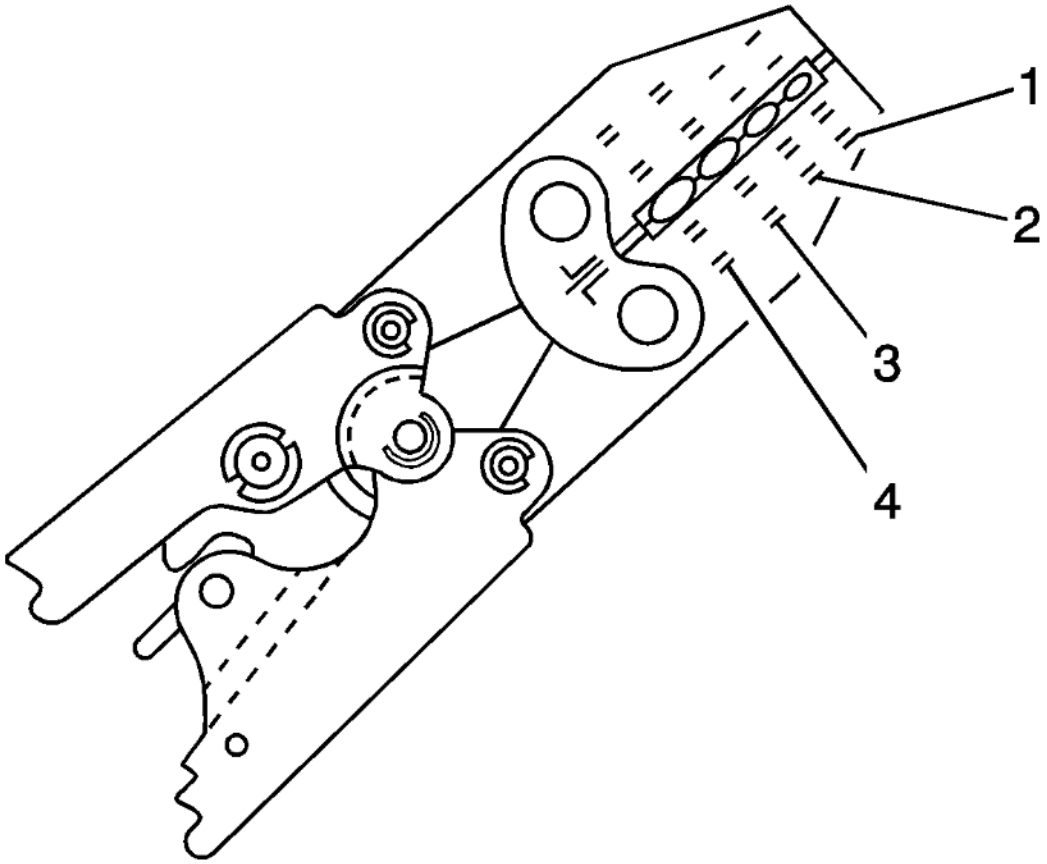


Fig. 6: Crimping Tool
Courtesy of GENERAL MOTORS COMPANY

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.

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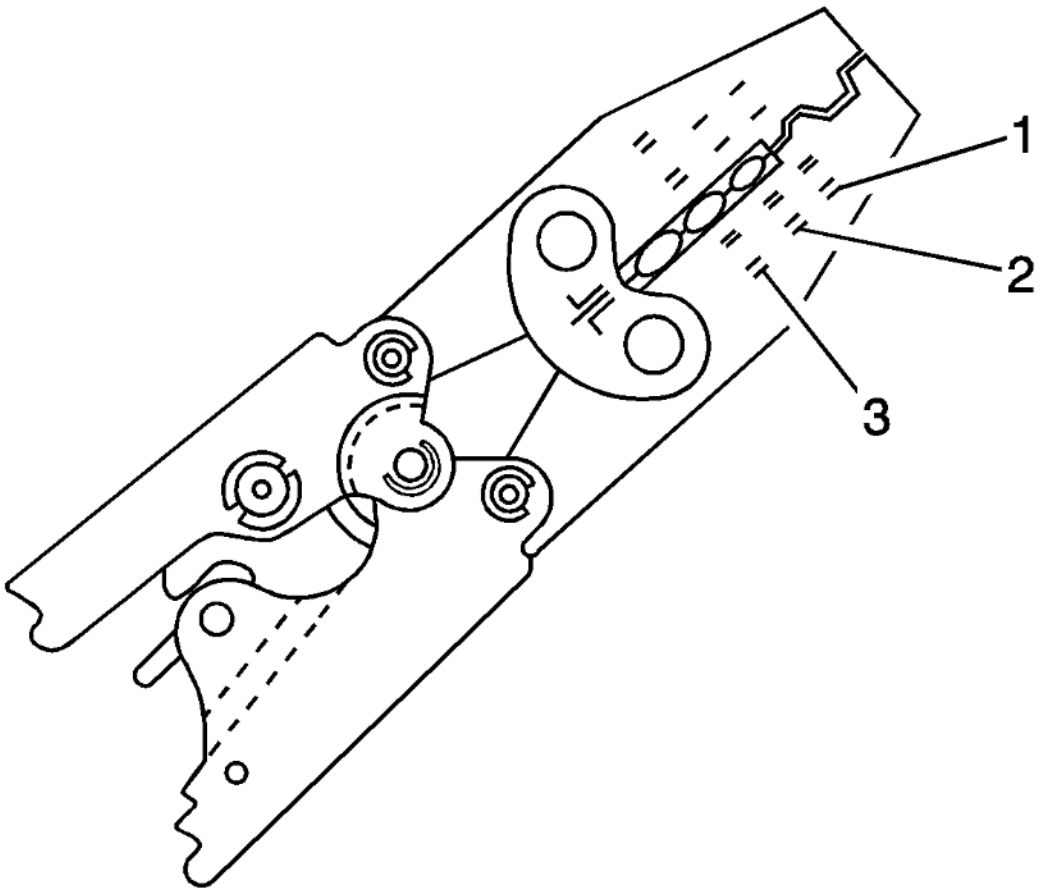


Fig. 7: Identifying Splice Crimp Tool Nests Terminal Identification
Courtesy of GENERAL MOTORS COMPANY

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).

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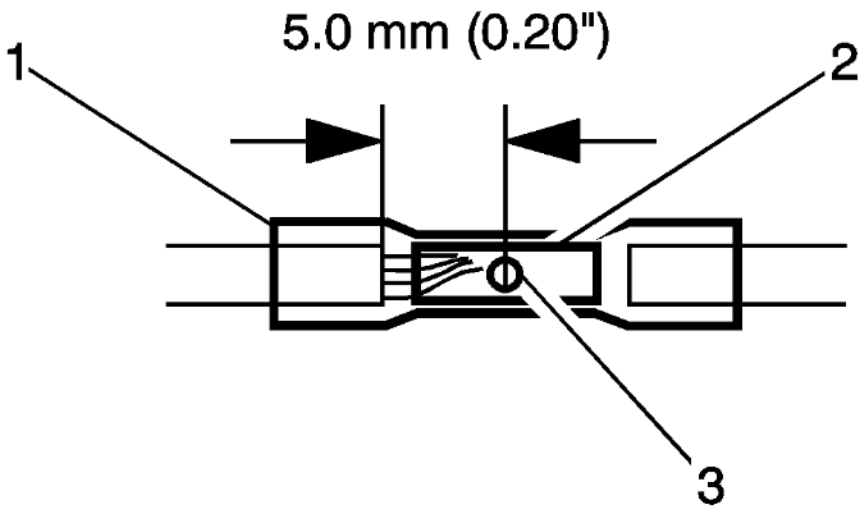


Fig. 8: Identifying Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

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.

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Fig. 9: 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.

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Fig. 10: 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.**

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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.

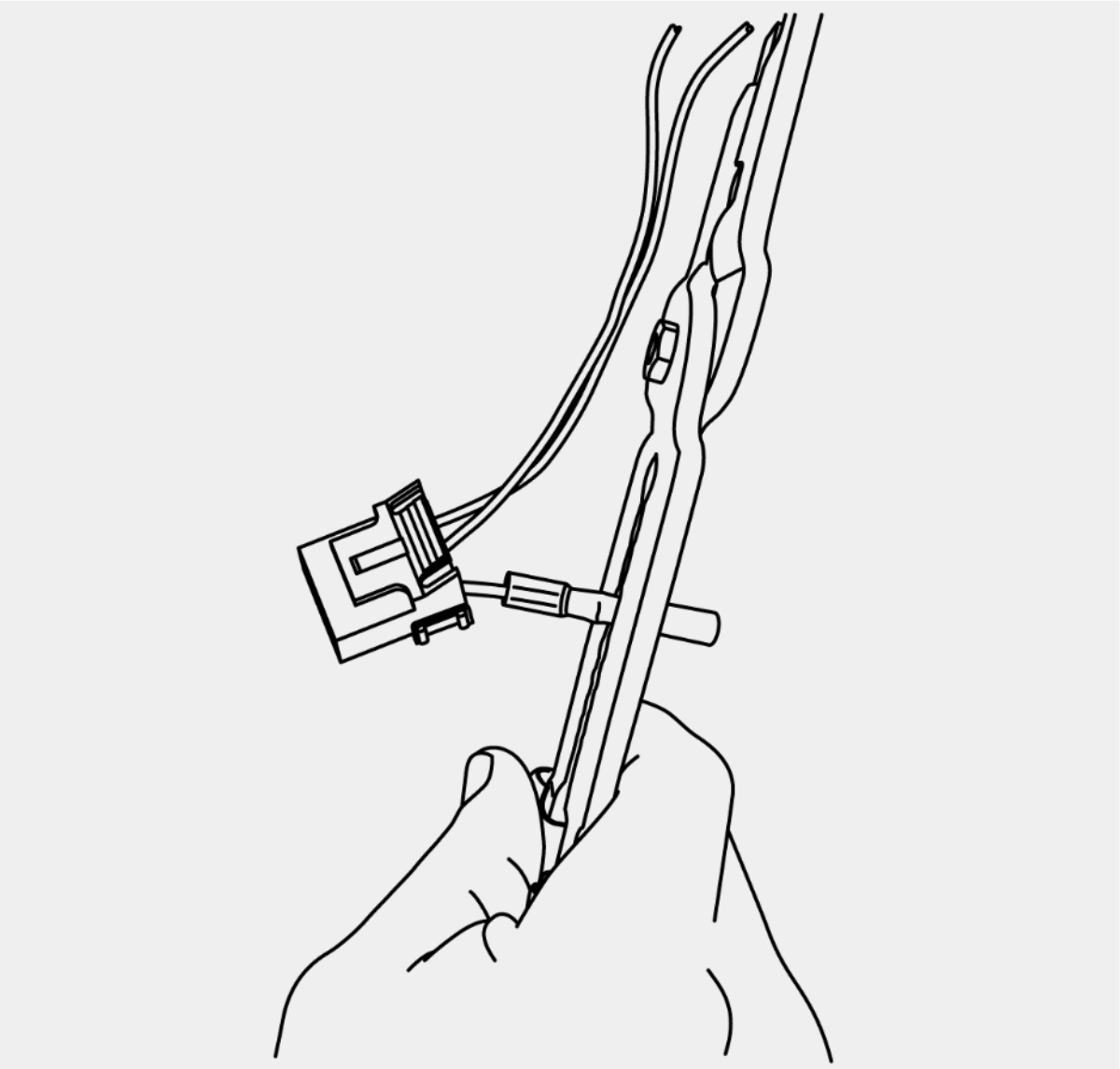


Fig. 11: Tightly Close Handles Of Crimp Tool
Courtesy of GENERAL MOTORS COMPANY

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.

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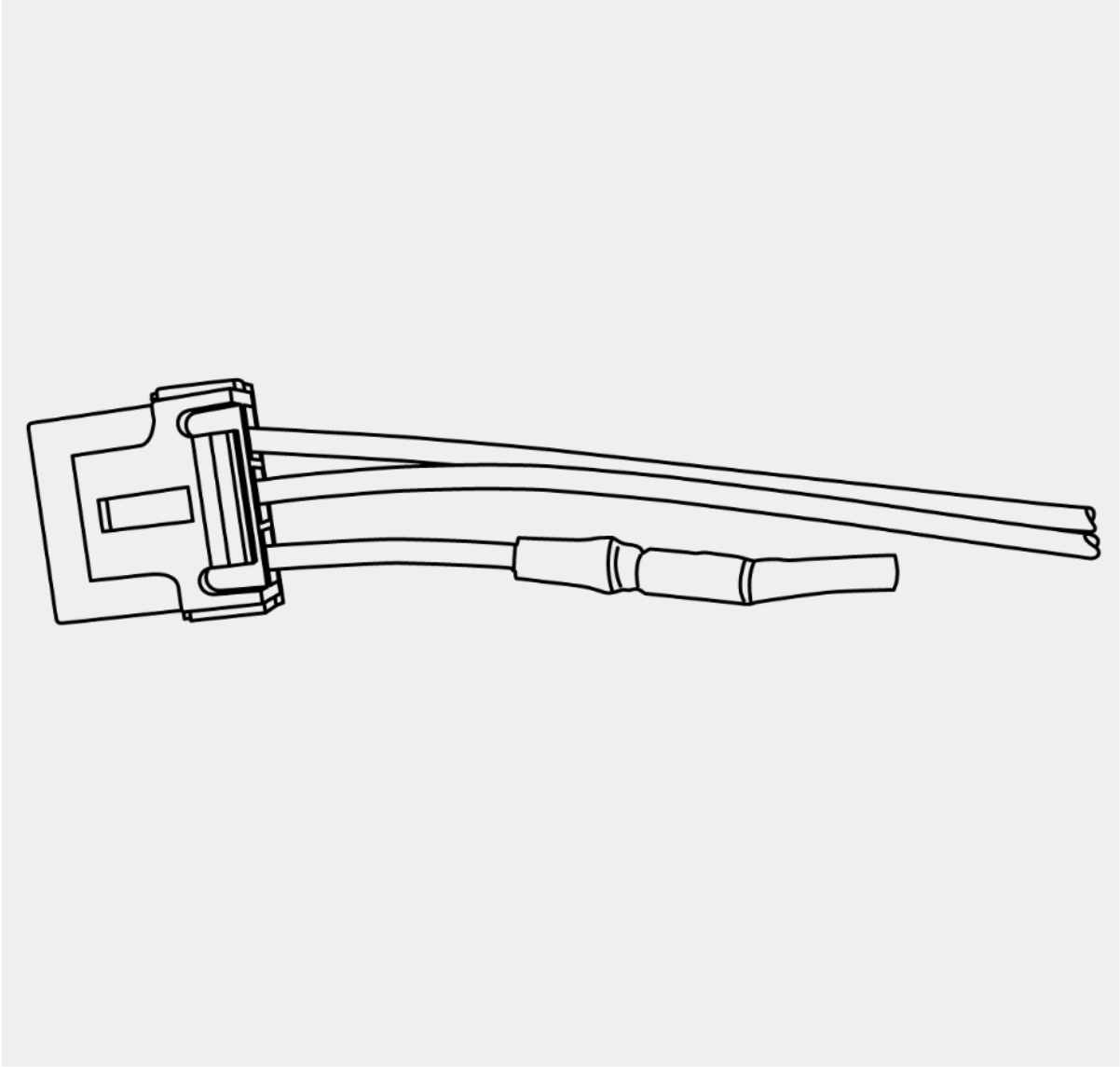


Fig. 12: Heat To Crimped Area Of Barrel
Courtesy of GENERAL MOTORS COMPANY

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.

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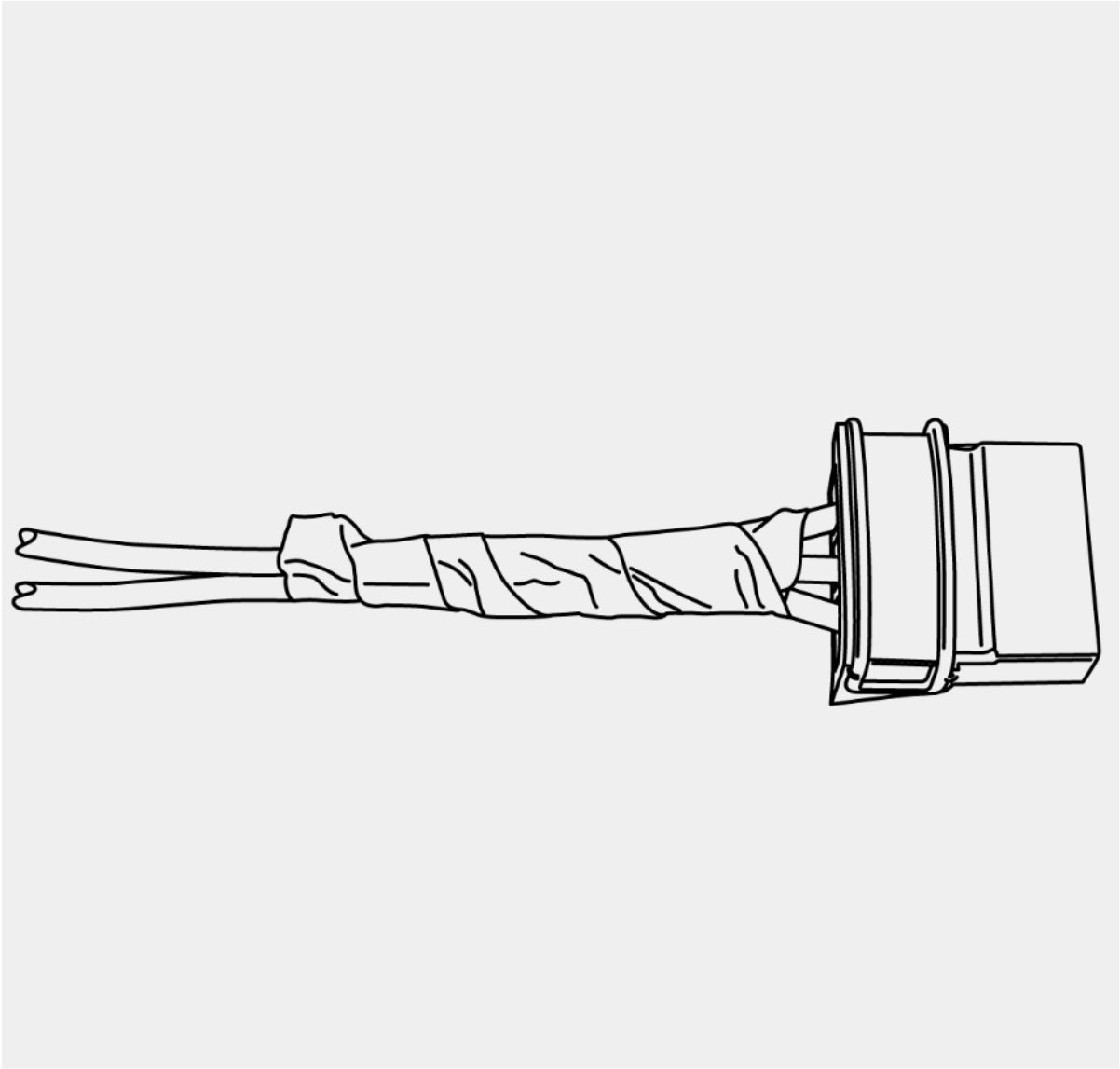


Fig. 13: Taping Extra Terminated Leads Back Into Harness
Courtesy of GENERAL MOTORS COMPANY

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

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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.

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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

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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 (1500)** **Power Distribution Schematics ((2500/3500))** .

- 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 (1500)** **Ground Distribution Schematics ((2500/3500))** .

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

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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.

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT

Special Tools

CH-42640 Steering Column Anti-Rotation Pin

Equivalent regional tools:**Special Tools**

Removal Procedure

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

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

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

CAUTION: **Do not lubricate the upper intermediate shaft for any condition. This upper intermediate shaft is not designed to be lubricated. If you add lubricant to this upper intermediate shaft in order to correct a front end noise, the upper intermediate shaft will develop a stick/slip condition. Failure to**

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follow these instructions may cause damage to the upper intermediate shaft.

1. With the front wheels of the vehicle in the straight ahead position, use the **CH-42640** anti-rotation pin to lock the steering column.

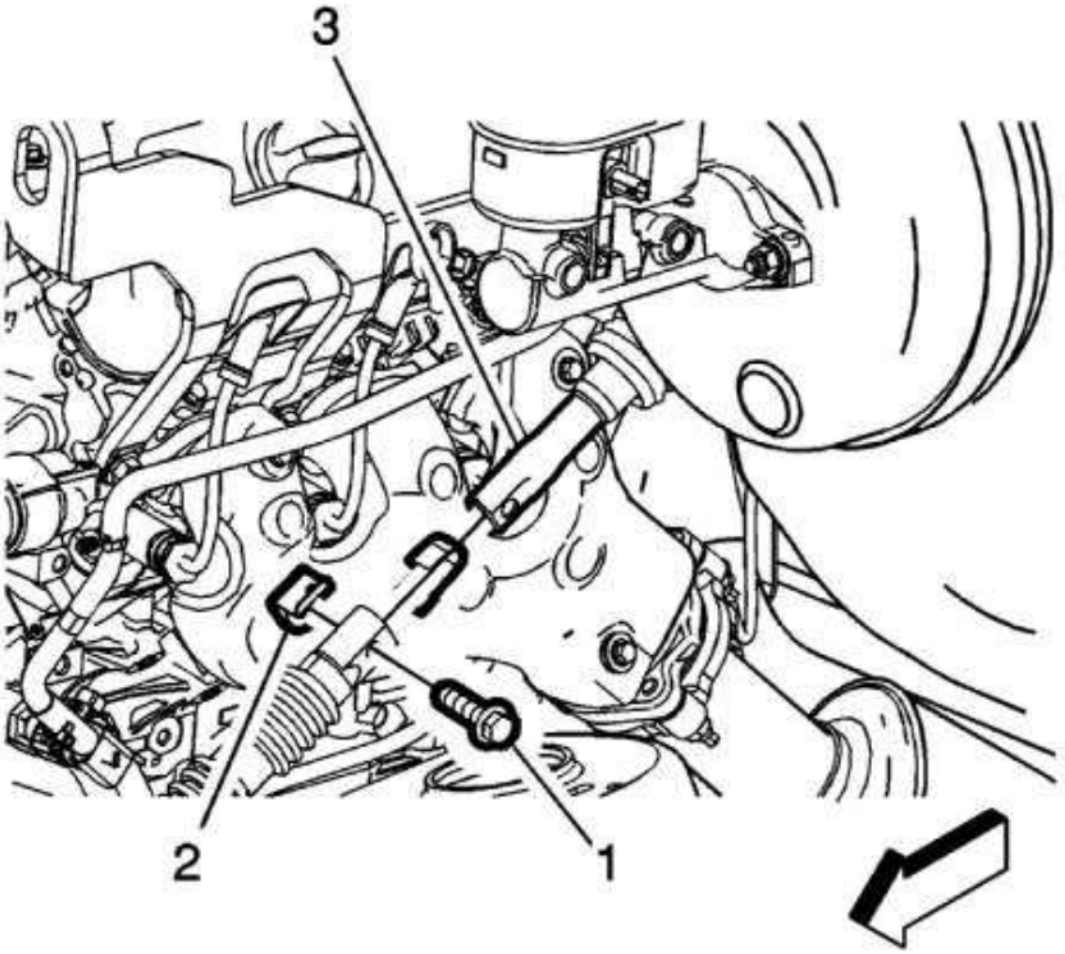


Fig. 14: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Upper Bolt 1 - Remove
3. Intermediate Steering Shaft Upper Nut 2 - Remove
4. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Separate
5. Steering Column Seal - Remove - **Steering Column Seal Replacement**

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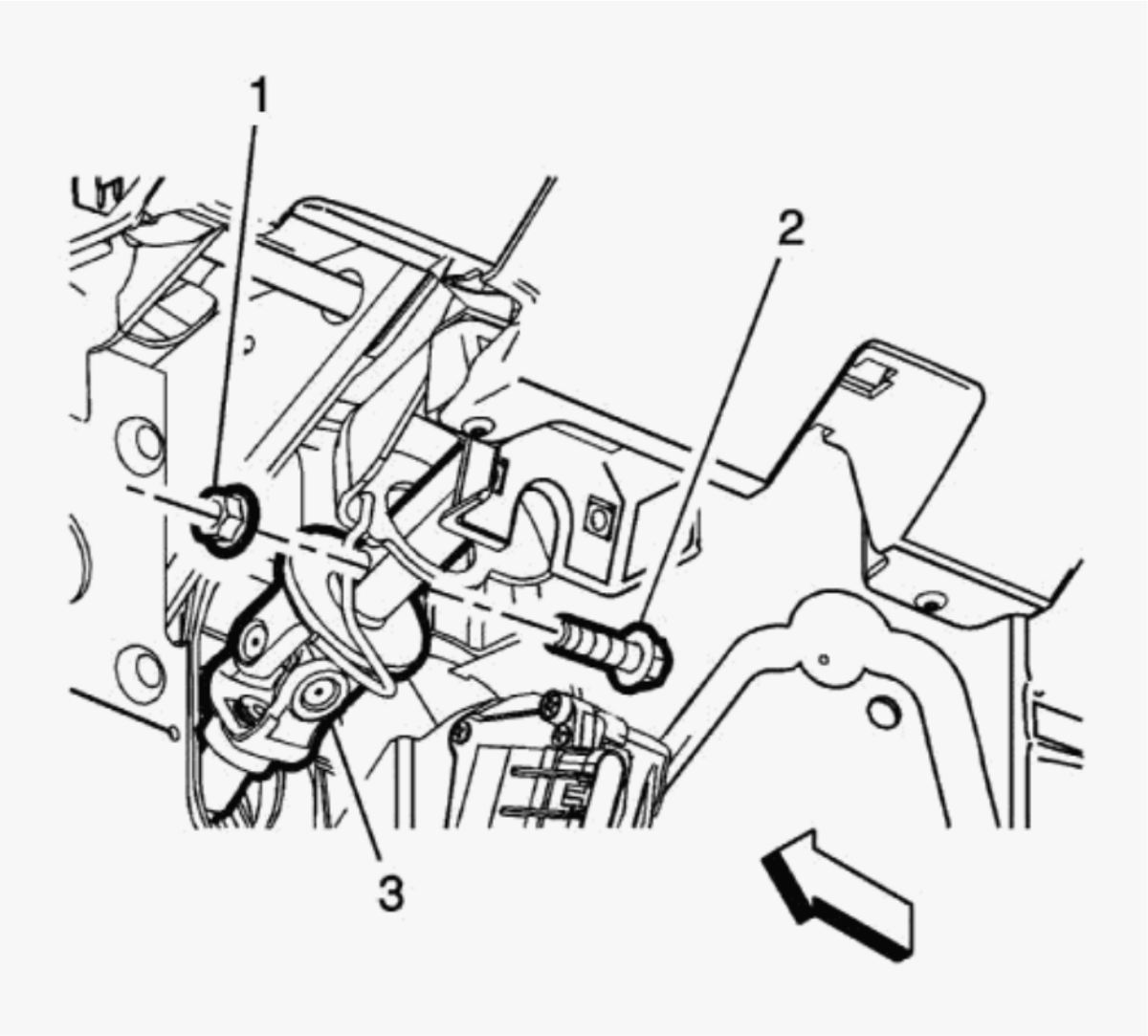


Fig. 15: Upper Intermediate Steering Shaft And Steering Column
Courtesy of GENERAL MOTORS COMPANY

6. Upper Intermediate Steering Shaft Nut 1 - Remove
7. Upper Intermediate Steering Shaft Bolt 2 - Remove
8. Upper Intermediate Steering Shaft 3 @Steering Column - Separate
9. Remove the upper intermediate steering shaft (3) from the engine compartment side of the vehicle.

Installation Procedure

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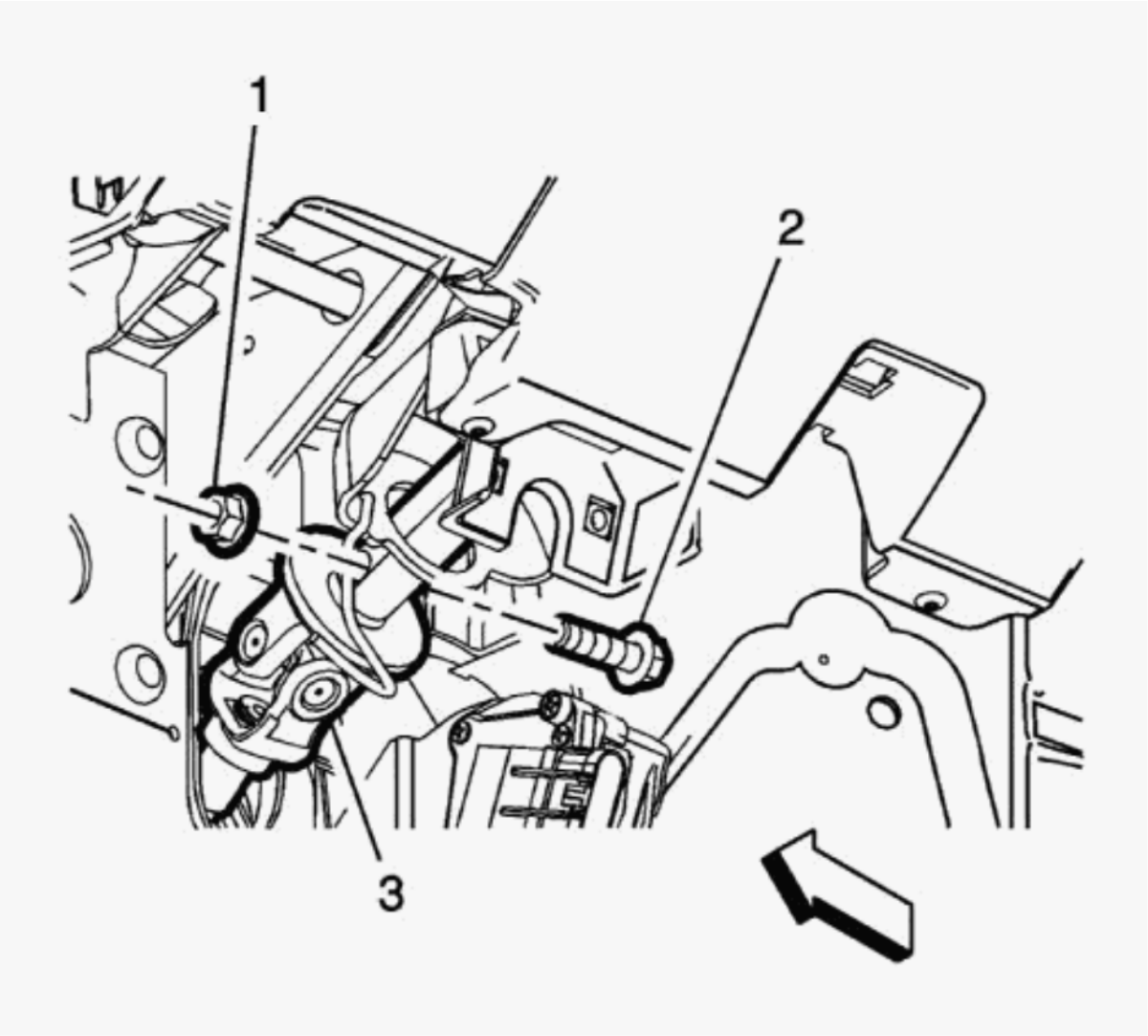


Fig. 16: Upper Intermediate Steering Shaft And Steering Column
Courtesy of GENERAL MOTORS COMPANY

1. Position the upper intermediate steering shaft (3) on the vehicle from the engine compartment side.

WARNING: When installing the (upper) intermediate steering shaft to the steering column, do NOT overextend the shaft or force the shaft onto the steering column. Overextending or forcing the intermediate steering shaft could damage the shaft and/or the steering column resulting in a loss of steering and possible bodily injury.

2. Upper Intermediate Steering Shaft 3 @Steering Column - Install
3. Upper Intermediate Steering Shaft Bolt 2 - Install

CAUTION: Refer to Fastener Caution .

4. Upper Intermediate Steering Shaft Nut 1 - Install and tighten 62 N.m (46 lb ft)
5. Steering Column Seal - Install - **Steering Column Seal Replacement**

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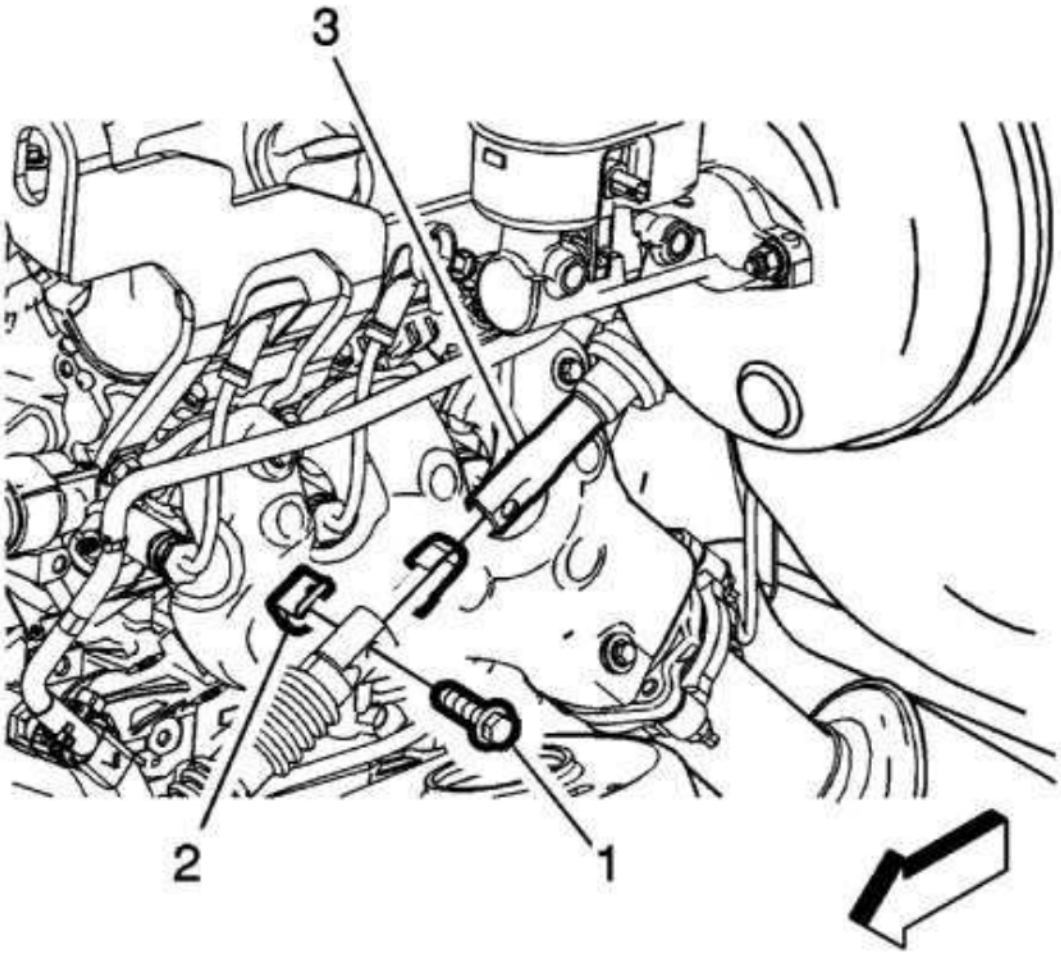


Fig. 17: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

6. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Install
7. Intermediate Steering Shaft Upper Nut 2 - Install
8. Intermediate Steering Shaft Upper Bolt 1 - Install and tighten 50 N.m (37 lb ft)

INTERMEDIATE STEERING SHAFT REPLACEMENT (LIGHT DUTY)

Special Tools

CH-42640 Steering Column Anti-Rotation Pin

Equivalent regional tools:**Special Tools**

Removal Procedure

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

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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 became un-centered, refer to your specific SIR coil's centering procedure to re-center SIR Coil.

1. With the front wheels of the vehicle in the straight ahead position, use the **CH-42640** anti-rotation pin to lock the steering column.

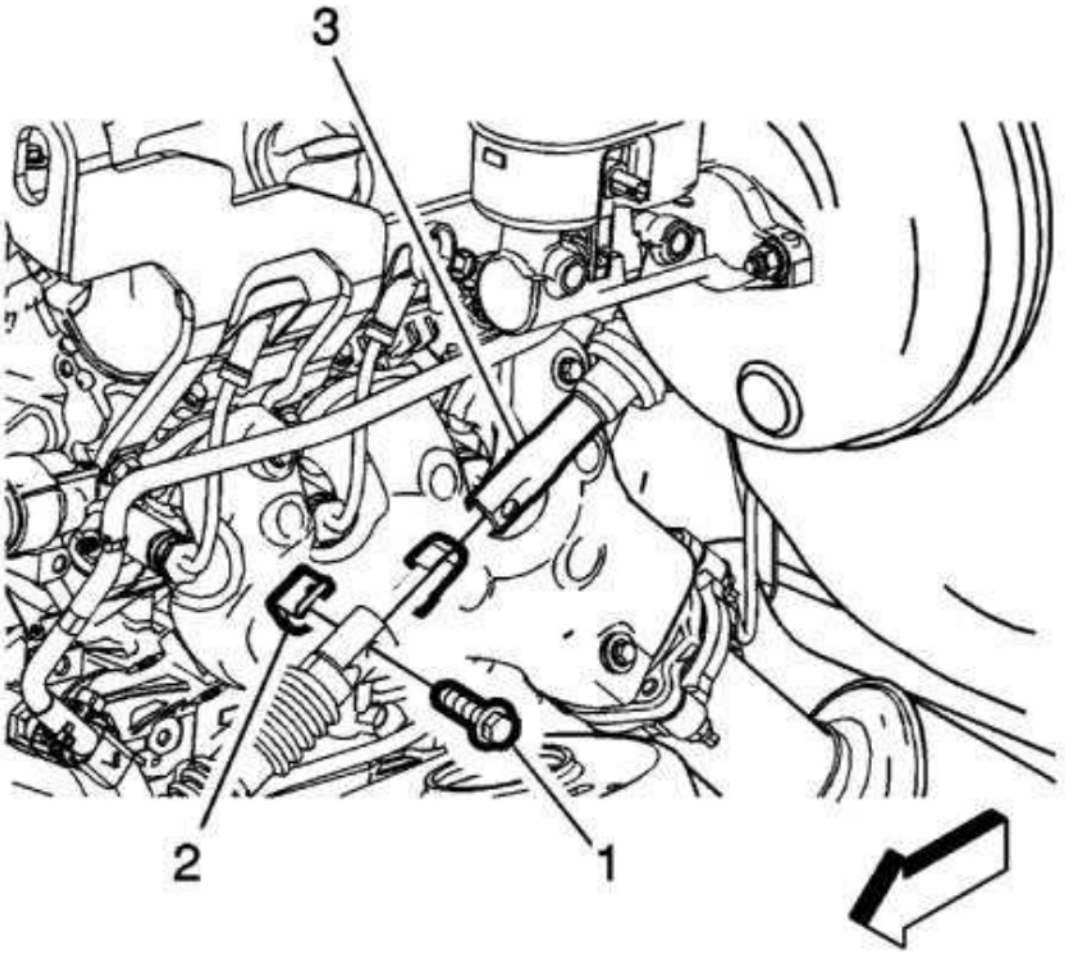


Fig. 18: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Upper Bolt 1 - Remove
3. Intermediate Steering Shaft Upper Nut 2 - Remove

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4. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Separate

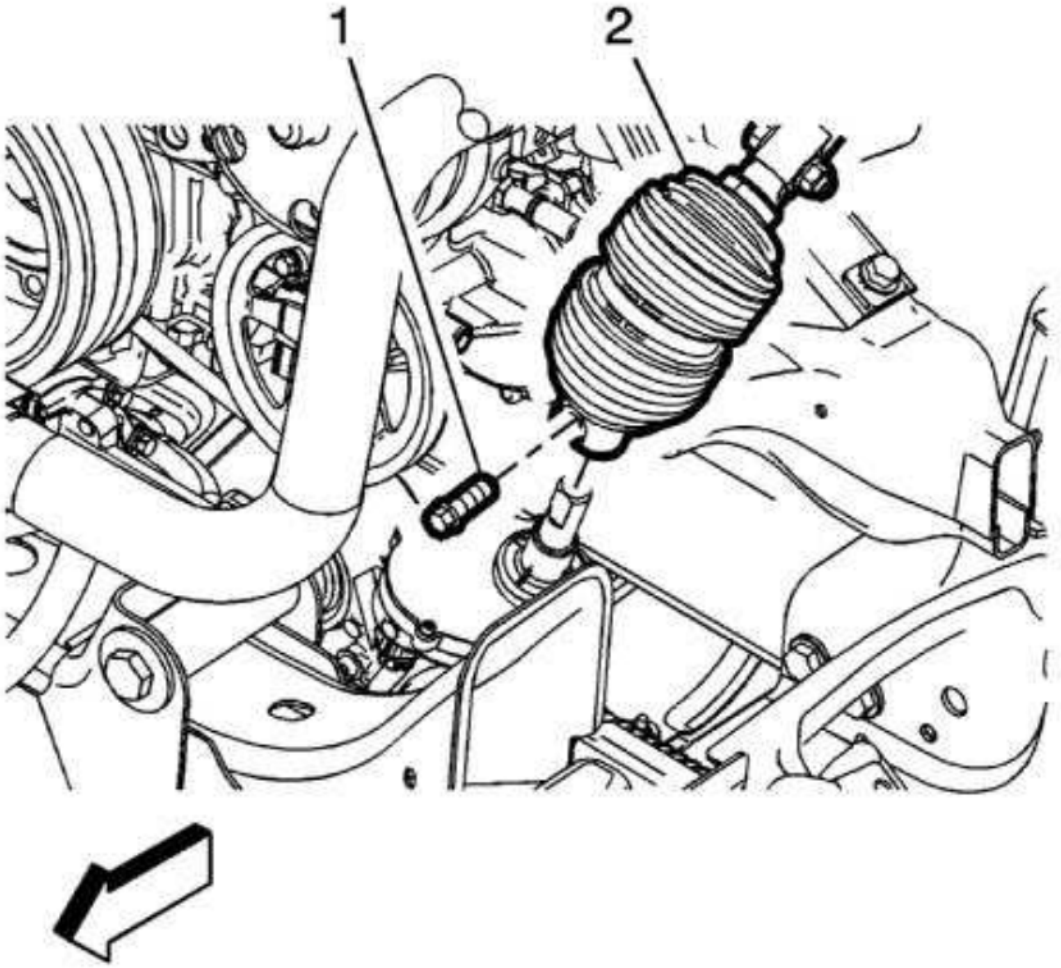


Fig. 19: Intermediate Steering Shaft Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Intermediate Steering Shaft Lower Bolt 1 - Remove

NOTE: **Do NOT pull on the intermediate steering shaft to separate the shaft from the steering gear.**

6. Intermediate Steering Shaft 2 @Steering Gear - Separate
7. Remove the intermediate steering shaft (2) from the vehicle.

Installation Procedure

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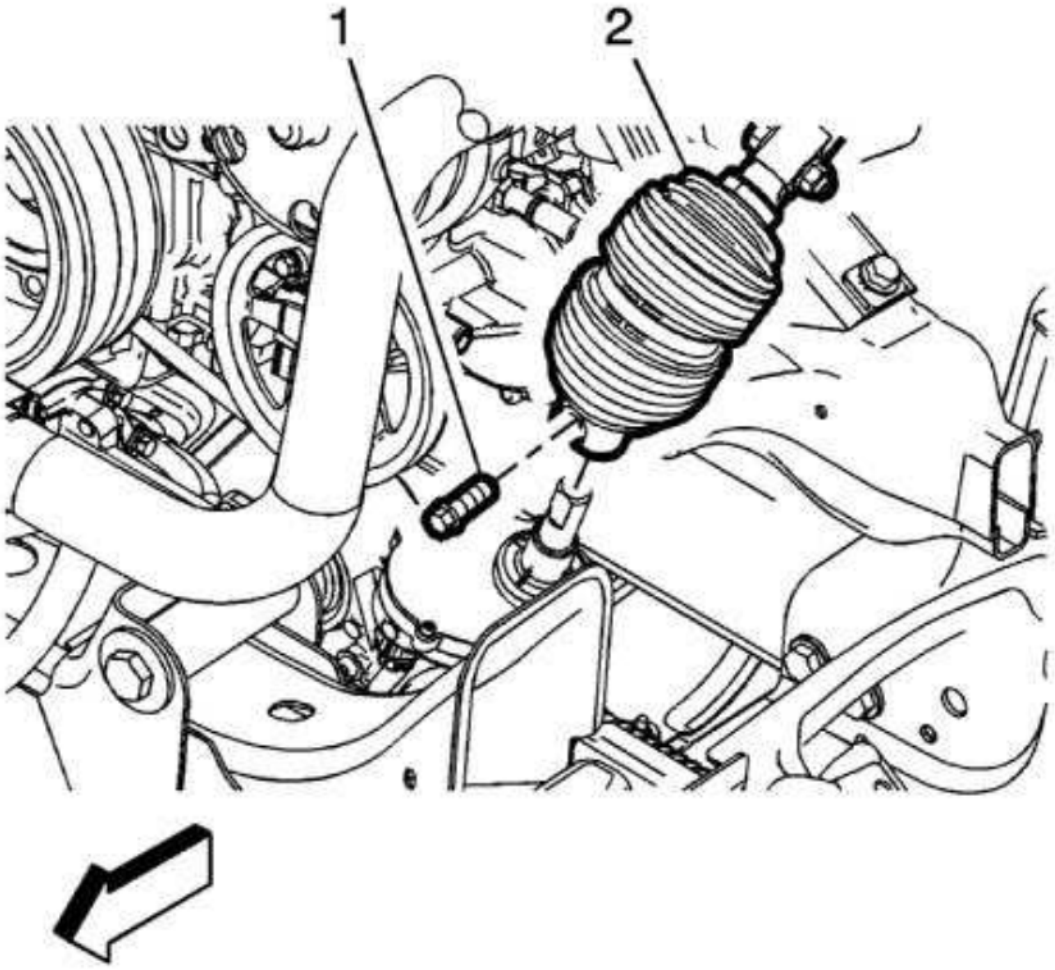


Fig. 20: Intermediate Steering Shaft Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Position the intermediate steering shaft (2) on the vehicle.
2. Intermediate Steering Shaft 2 @Steering Gear - Install

CAUTION: Refer to Fastener Caution .

3. Intermediate Steering Shaft Lower Bolt 1 - Install and tighten 45 N.m (33 lb ft)

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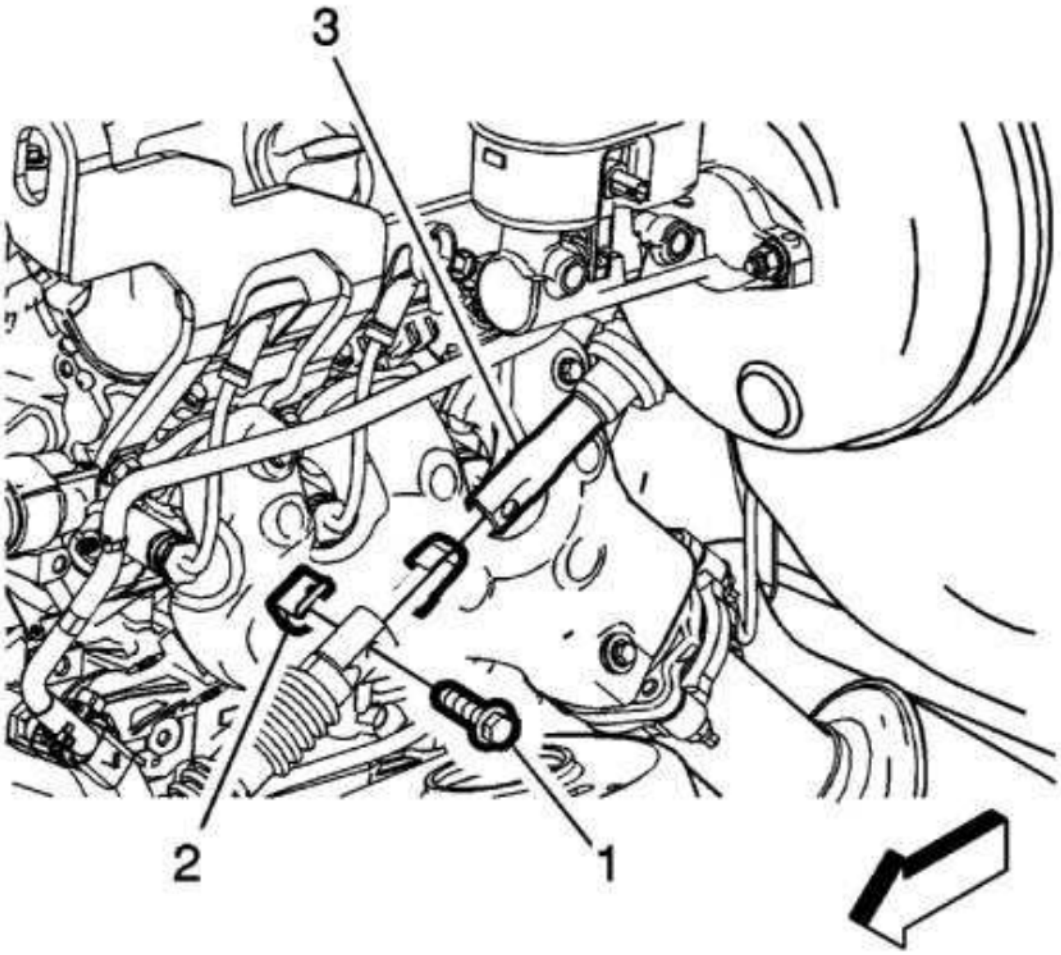


Fig. 21: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

4. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Install
5. Intermediate Steering Shaft Upper Nut 2 - Install
6. Intermediate Steering Shaft Upper Bolt 1 - Install and tighten 50 N.m (37 lb ft)

INTERMEDIATE STEERING SHAFT REPLACEMENT (HEAVY DUTY)

Special Tools

CH-42640 Steering Column Anti-Rotation Pin

Equivalent regional tools:**Special Tools**

Removal Procedure

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

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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 became un-centered, refer to your specific SIR coil's centering procedure to re-center SIR Coil.

1. With the front wheels of the vehicle in the straight ahead position, use the **CH-42640** anti-rotation pin to lock the steering column.

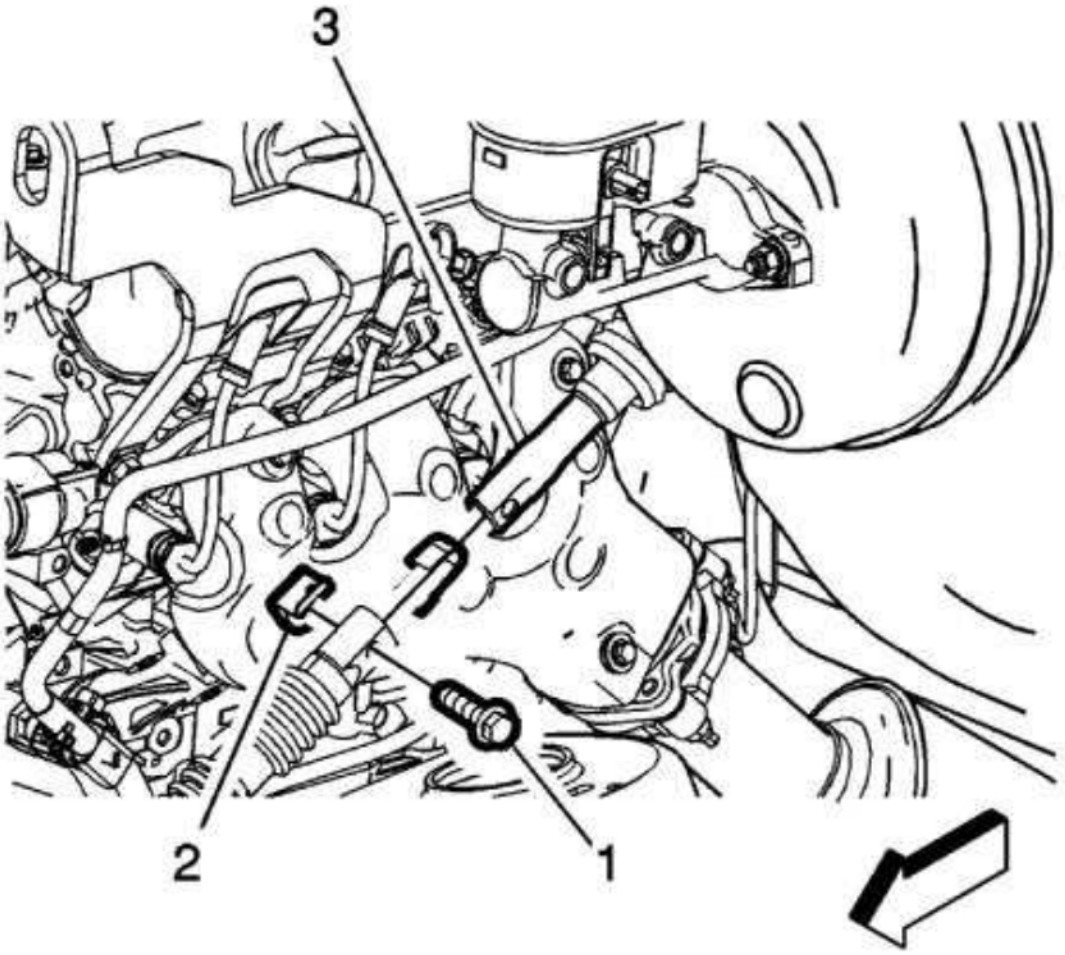


Fig. 22: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

2. Intermediate Steering Shaft Upper Bolt 1 - Remove
3. Intermediate Steering Shaft Upper Nut 2 - Remove

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4. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Separate

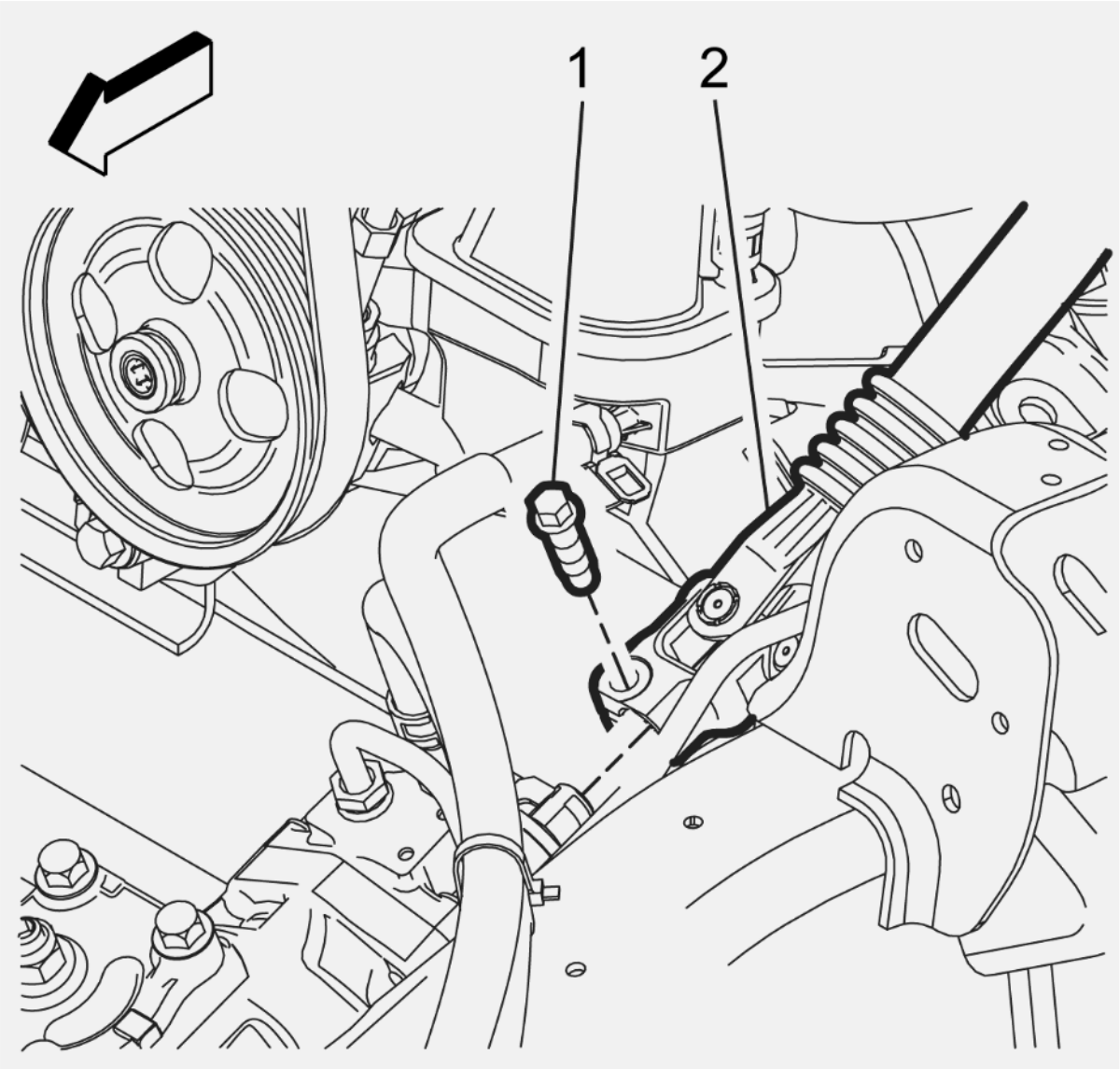


Fig. 23: Intermediate Steering Shaft And Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Intermediate Steering Shaft Lower Bolt 1 - Remove

NOTE: **Do NOT pull on the intermediate steering shaft to separate the shaft from the steering gear.**

6. Intermediate Steering Shaft 2 @Steering Gear - Separate
7. Remove the intermediate steering shaft (2) from the vehicle.

Installation Procedure

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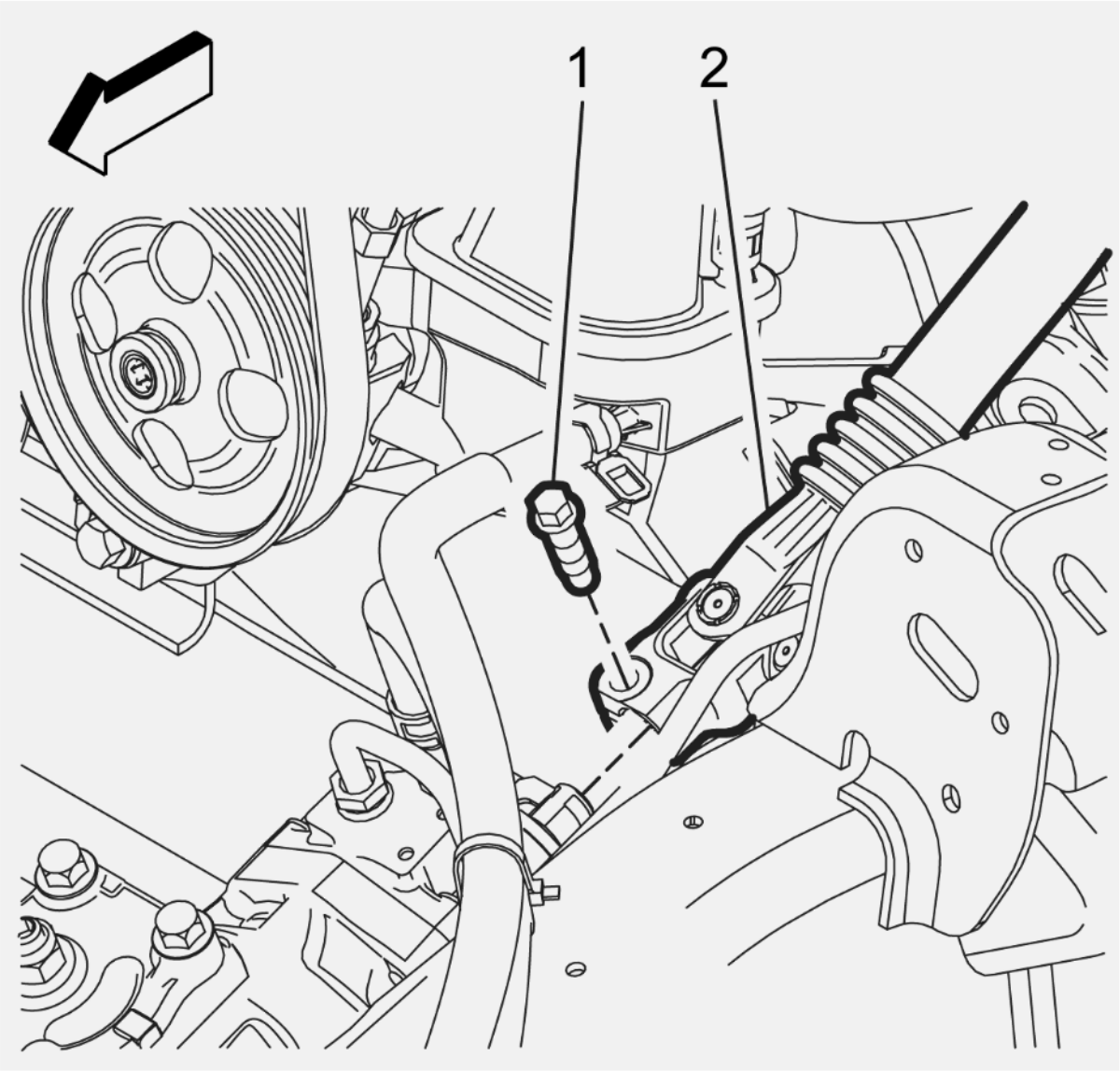


Fig. 24: Intermediate Steering Shaft And Lower Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Position the intermediate steering shaft (2) on the vehicle.
2. Intermediate Steering Shaft 2 @Steering Gear - Install

CAUTION: **Refer to Fastener Caution .**

3. Intermediate Steering Shaft Lower Bolt 1 - Install and tighten 45 N.m (33 lb ft)

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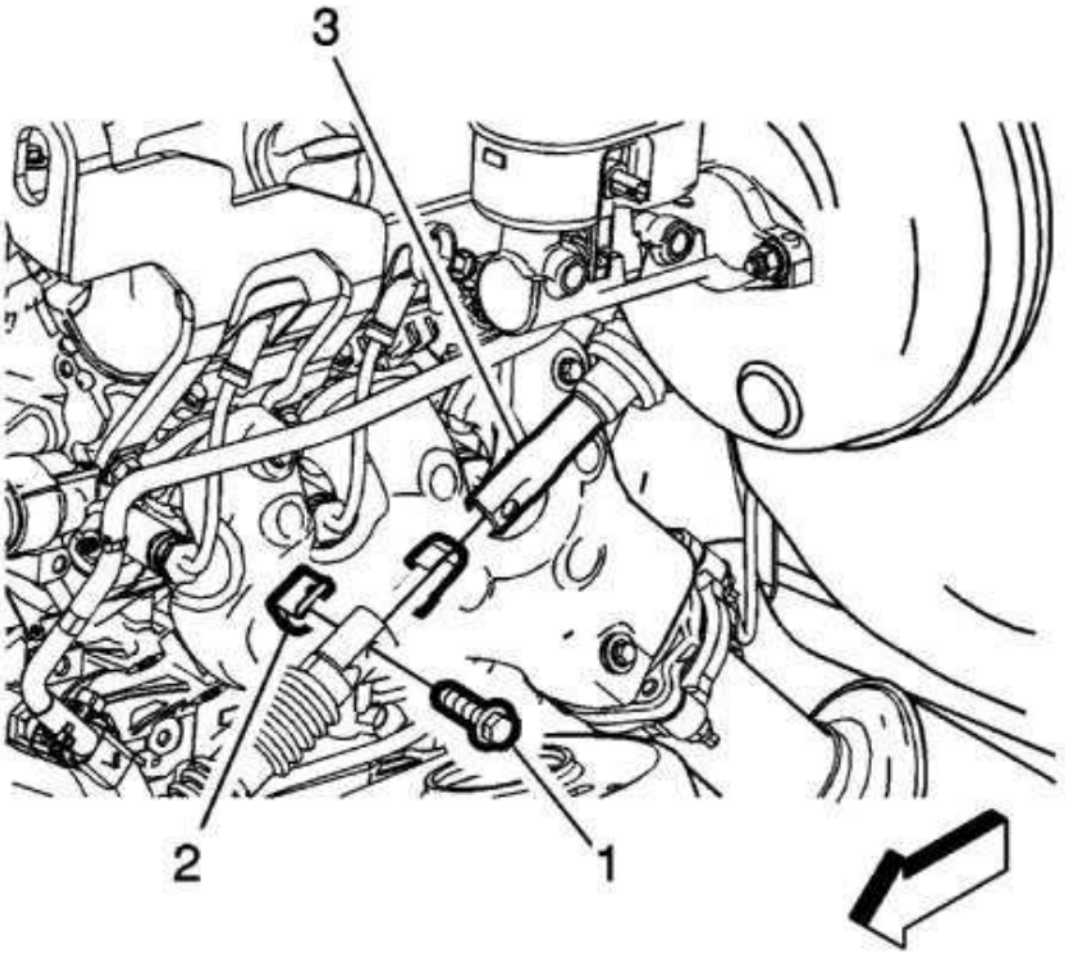


Fig. 25: Intermediate Steering Shaft Upper Bolt And Nut
Courtesy of GENERAL MOTORS COMPANY

4. Upper Intermediate Steering Shaft 3 @Intermediate Steering Shaft - Install
5. Intermediate Steering Shaft Upper Nut 2 - Install
6. Intermediate Steering Shaft Upper Bolt 1 - Install and tighten 50 N.m (37 lb ft)

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (MANUAL TILT)

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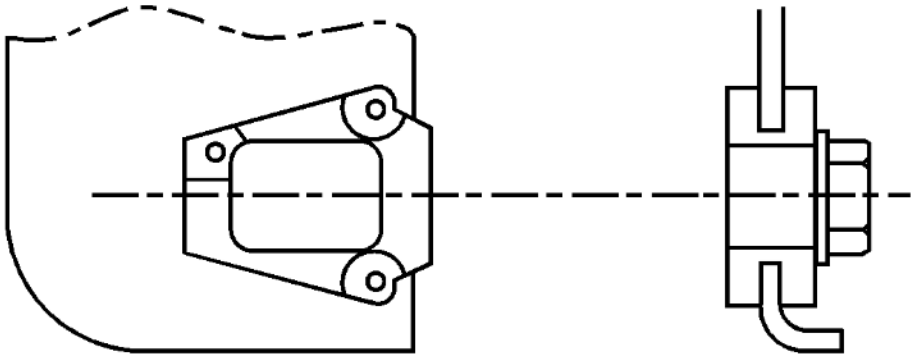


Fig. 26: Inspecting Capsules On Steering Column Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

- Vehicles involved in accidents which result in the following conditions may also have a damaged or misaligned steering column:
  - Frame damage
  - Major body or sheet metal damage
  - Where the steering column has been impacted
  - Where supplemental inflatable restraint systems deployed
- Inspect the capsules on the steering column bracket assembly. All capsules must be securely seated in the bracket slots and checked for any loose conditions when pushed or pulled by hand. If not, the bracket should be replaced if bolted to the jacket assembly. If the bracket is welded to the jacket assembly then replace the jacket assembly.

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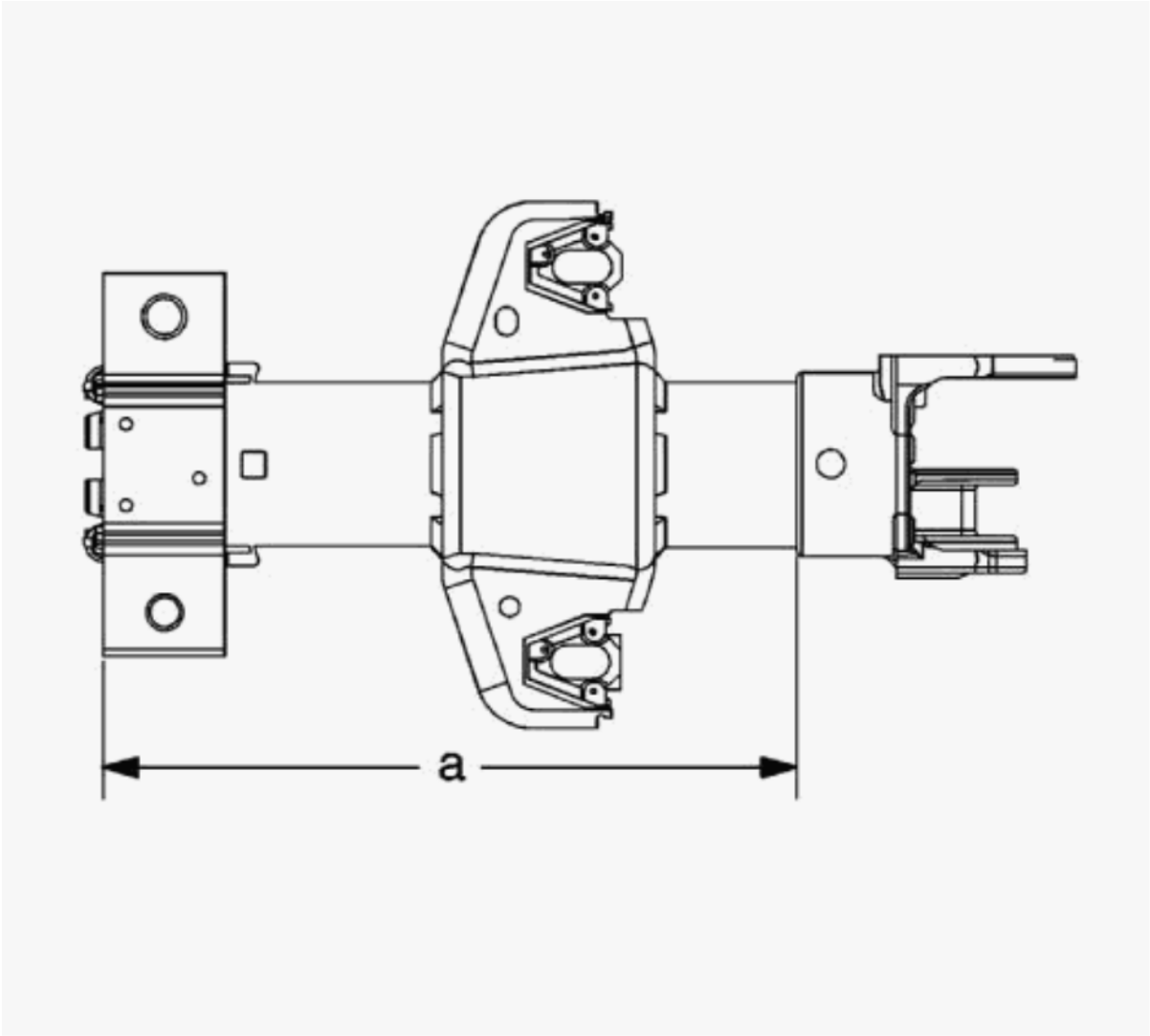


Fig. 27: Inspecting For Jacket Assembly Collapse By Measuring Distance
Courtesy of GENERAL MOTORS COMPANY

NOTE: **On manual tilt and telescope columns, it will be necessary to remove the closeout shroud to measure the jacket.**

- Inspect for jacket assembly collapse by measuring distance (a) from the steering column support bracket mounting plate to the lower edge of the jacket lower bracket. Replace the steering column assembly if the measured dimensions is less than 286 mm.

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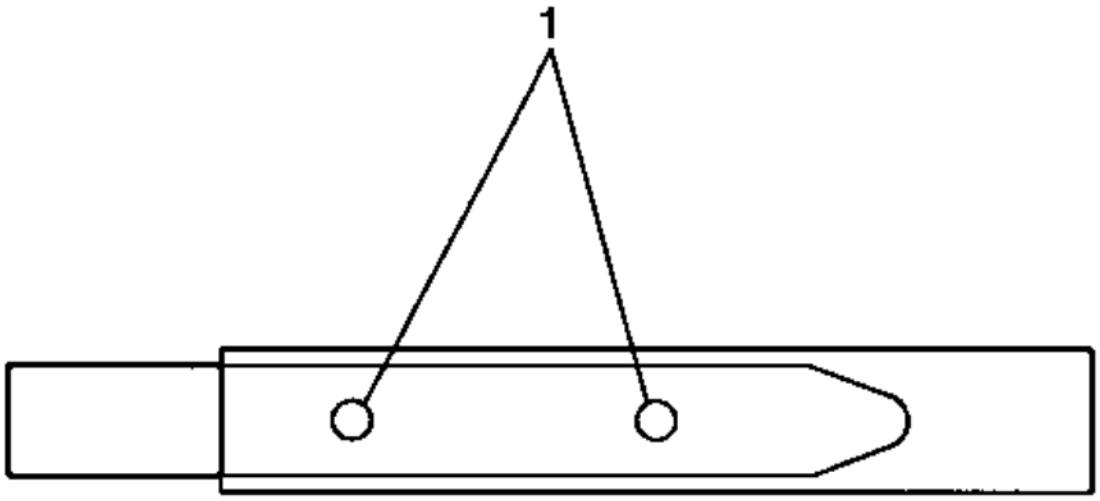


Fig. 28: Inspecting Steering Shaft For Sheared Injected Plastic
Courtesy of GENERAL MOTORS COMPANY

- Remove the SIR coil from the steering column and allow the coil to hang freely before the steering shaft is rotated. Refer to **Steering Wheel Airbag Coil Replacement** .
- Visually inspect the steering shaft for sheared injected plastic (1). If the steering shaft shows sheared plastic, replace the steering shaft.
- Inspect the steering shaft runout for any frame damage that could cause a bent steering shaft. Using a dial indicator at the lower end of the steering shaft, rotate the steering wheel. The runout must not exceed 1.60 mm (0.0625 in).

STEERING COLUMN ACCIDENT DAMAGE INSPECTION (MANUAL TILT AND TELESCOPE)

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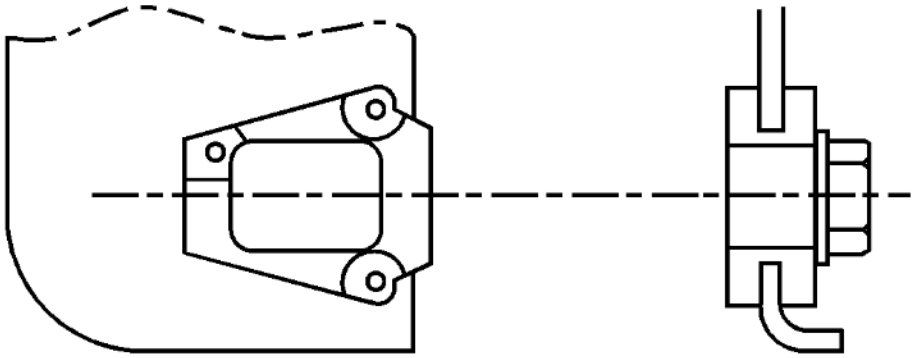


Fig. 29: Inspecting Capsules On Steering Column Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

- Vehicles involved in accidents which result in the following conditions may also have a damaged or misaligned steering column:
  - Frame damage
  - Major body or sheet metal damage
  - Where the steering column has been impacted
  - Where supplemental inflatable restraint systems deployed
- Inspect the capsules on the steering column bracket assembly. All capsules must be securely seated in the bracket slots and checked for any loose conditions when pushed or pulled by hand. If not, the bracket should be replaced if bolted to the jacket assembly. If the bracket is welded to the jacket assembly then replace the jacket assembly.

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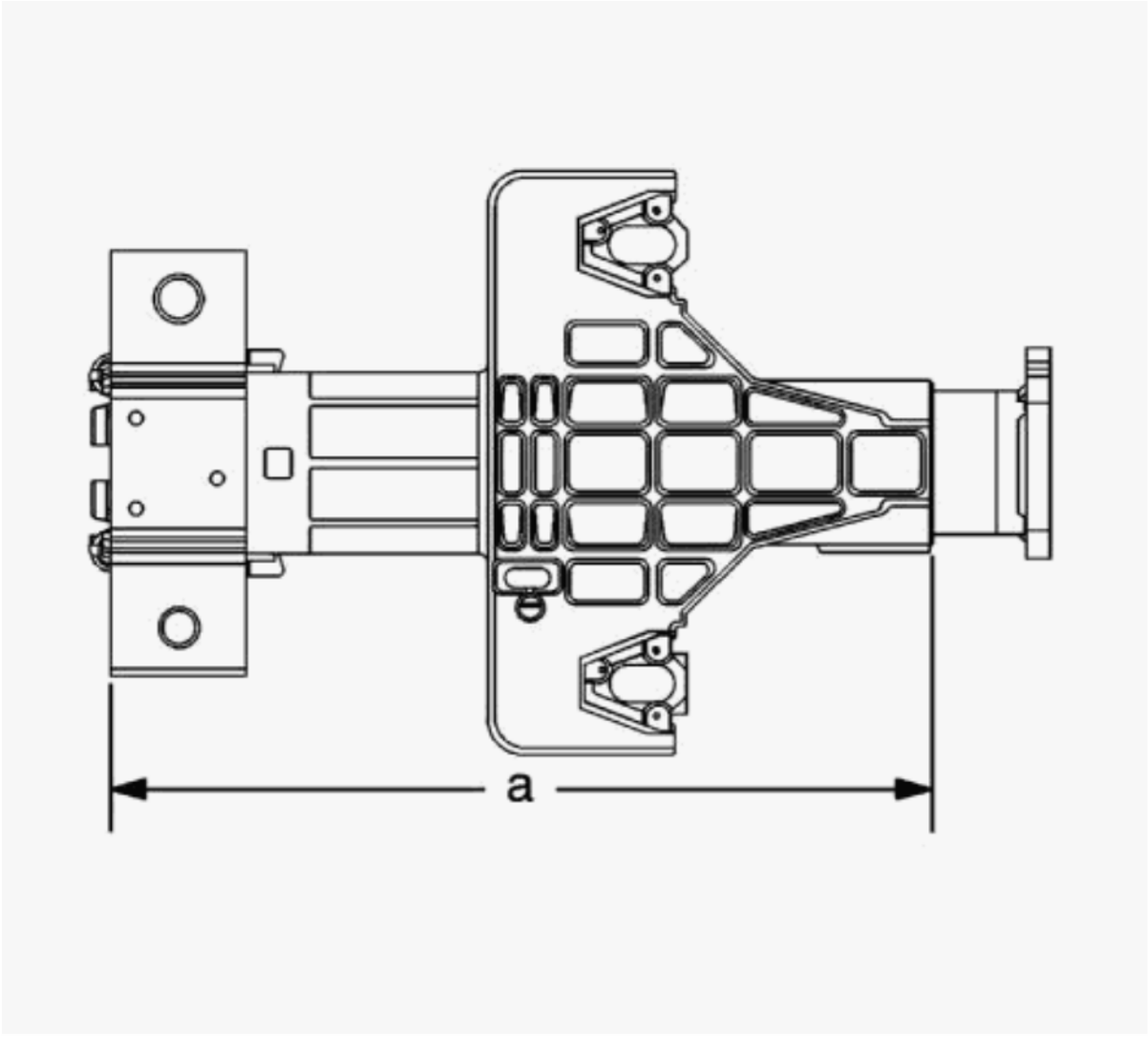


Fig. 30: Inspecting For Jacket Assembly Collapse By Measuring Distance
Courtesy of GENERAL MOTORS COMPANY

- Inspect for jacket assembly collapse by measuring distance (a) from the steering column support bracket mounting plate to the lower edge of the jacket lower bracket. Replace the steering column assembly if the measured dimensions is less than 286 mm.

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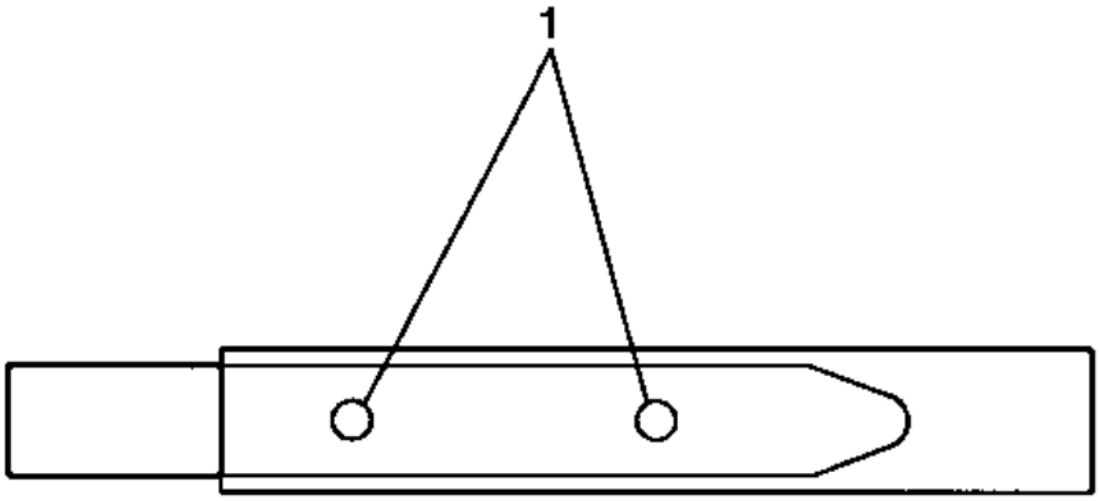


Fig. 31: Inspecting Steering Shaft For Sheared Injected Plastic
Courtesy of GENERAL MOTORS COMPANY

- Remove the SIR coil from the steering column and allow the coil to hang freely before the steering shaft is rotated. Refer to **Steering Wheel Airbag Coil Replacement** .
- Visually inspect the steering shaft for sheared injected plastic (1). If the steering shaft shows sheared plastic, replace the steering shaft.
- Inspect the steering shaft runout for any frame damage that could cause a bent steering shaft. Using a dial indicator at the lower end of the steering shaft, rotate the steering wheel. The runout must not exceed 1.60 mm (0.0625 in).

STEERING COLUMN SHROUD REPLACEMENT (MANUAL TILT)

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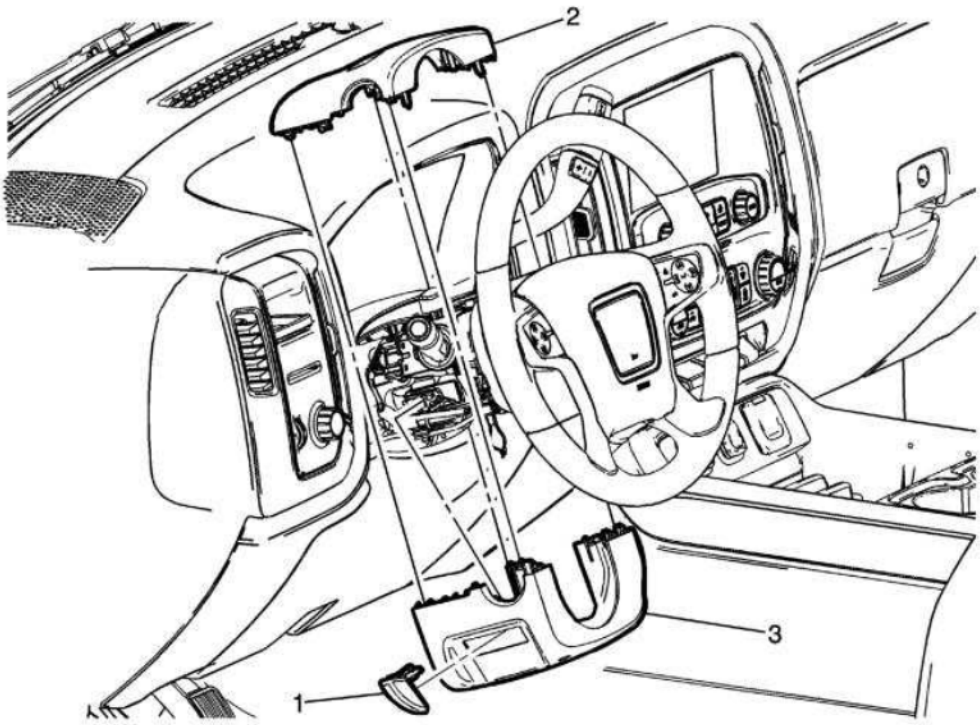


Fig. 32: Steering Column Shroud (Manual Tilt)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Steering Column Tilt Wheel Release Lever **Steering Column Tilt Wheel Release Lever Replacement**
2	Steering Column Shroud - Upper **Procedure** Use a flat bladed plastic trim tool to release the tabs securing the upper steering column shroud cover to the lower steering column shroud cover.
3	Steering Column Shroud - Lower

STEERING COLUMN SHROUD REPLACEMENT (MANUAL TILT AND TELESCOPE)

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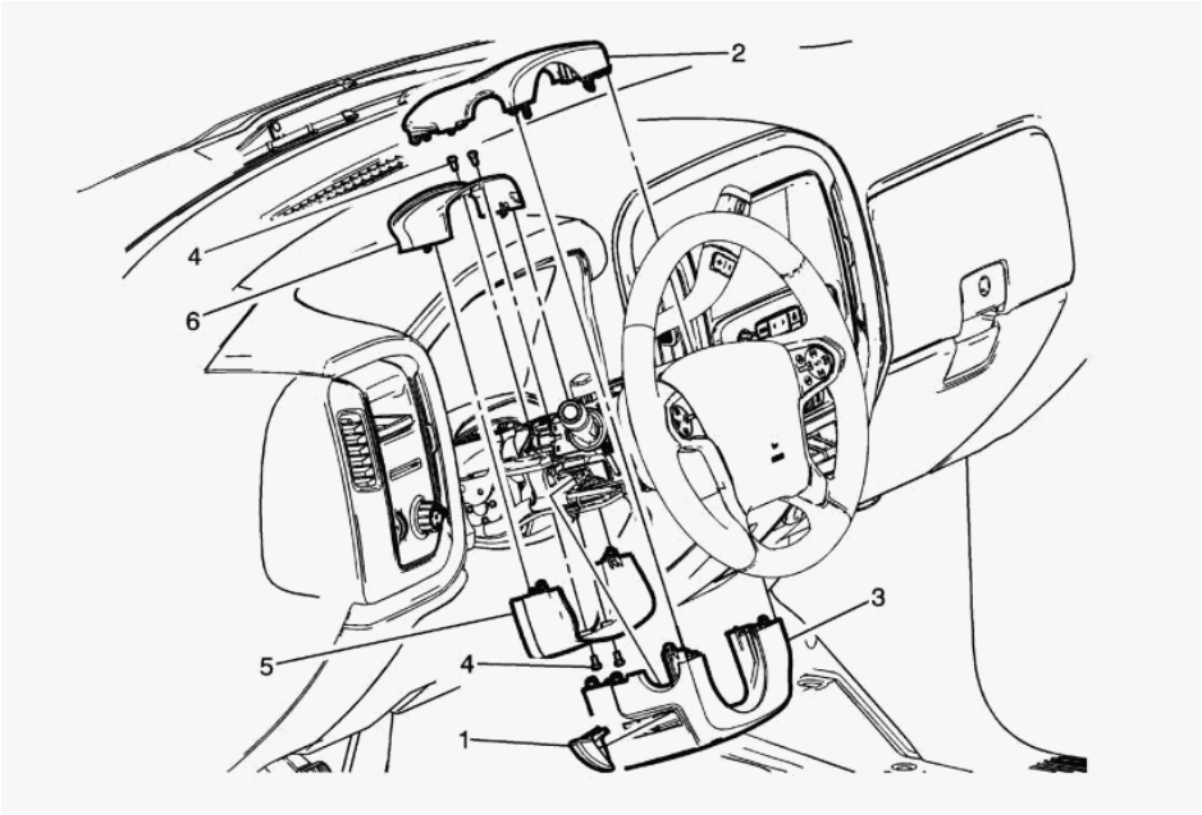


Fig. 33: Steering Column Shroud (Manual Tilt and Telescope)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure **Instrument Panel Knee Bolster Replacement**	
1	Steering Column Tilt Wheel Release Lever **Steering Column Tilt Wheel Release Lever Replacement**
2	Steering Column Shroud - Upper **Procedure** Use a flat bladed plastic trim tool to release the tabs securing the upper steering column shroud cover to the lower steering column shroud cover.
3	Steering Column Shroud - Lower
4	Steering Column Shroud Bolt **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 2.5 N.m (22 lb in)
5	Steering Column Shroud Closeout - Lower
6	Steering Column Shroud Closeout - Upper **Procedure** Use a flat bladed plastic trim tool in order to release the tabs securing the upper steering

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Callout	Component Name
	column shroud closeout to the lower steering column shroud closeout.

TURN SIGNAL SWITCH REPLACEMENT

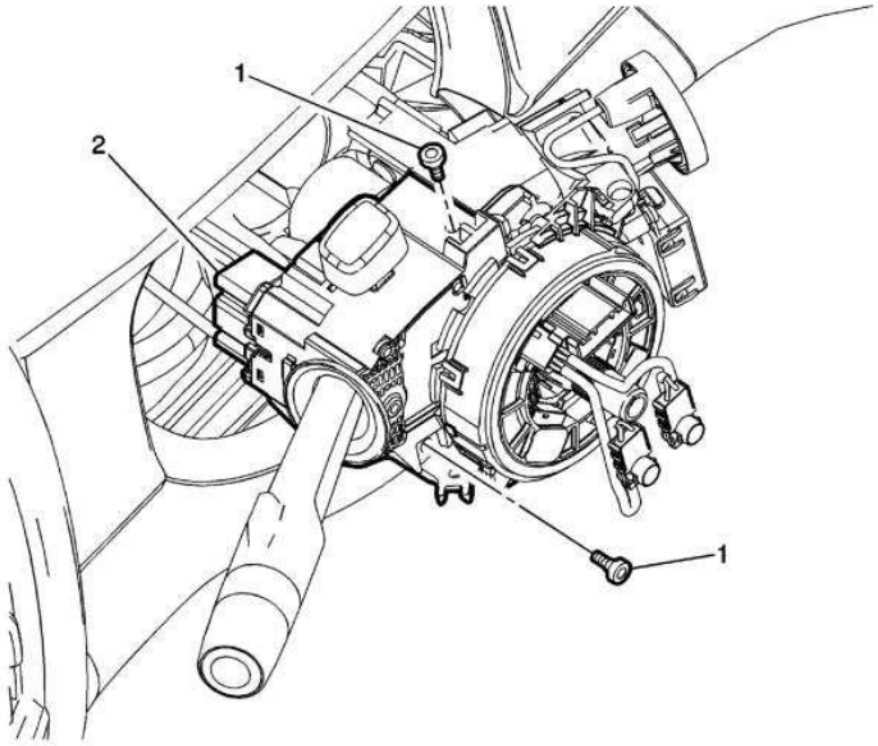


Fig. 34: Turn Signal Switch
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. **Steering Wheel Replacement** 2. **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**	
1	Turn Signal Switch Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten** 2.5 N.m (22 lb in)
2	Turn Signal Switch **Procedure**

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Callout	Component Name
	1. Disconnect the electrical connectors. 2. Press in the pin on the front of the turn signal switch to avoid interference with the turn signal switch cancel cam position plate.

RANGE SELECTOR LEVER CABLE LEVER REPLACEMENT

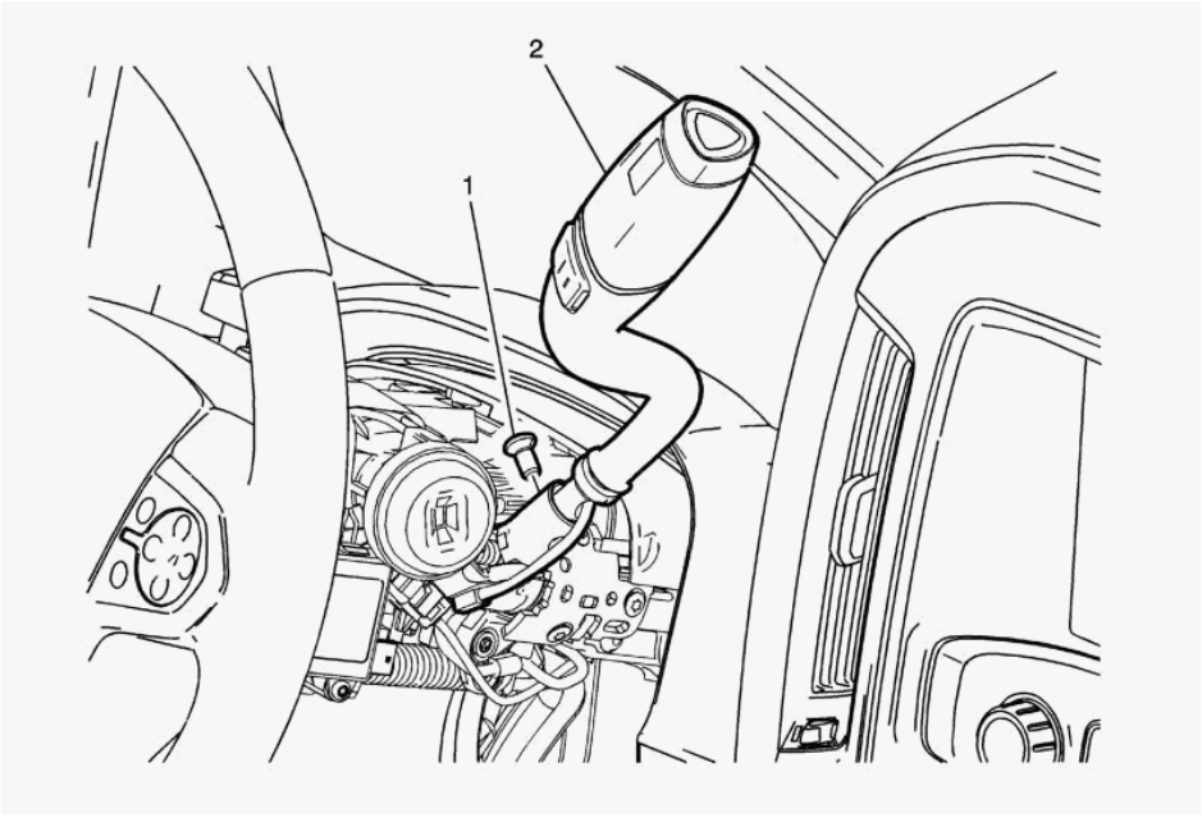


Fig. 35: Automatic Transmission Range Selector Lever Cable Lever
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. **Instrument Panel Knee Bolster Replacement** 2. Remove the steering column shroud and the steering column lower shroud closeout. **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**	
1	Automatic Transmission Range Selector Lever Cable Lever Bolt **CAUTION:** **Refer to Fastener Caution .**

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Callout	Component Name
	Procedure Move the automatic transmission control lever seal, as necessary, to access the automatic transmission range selector lever cable lever bolt. **Tighten** 20 N.m (15 lb ft)
2	Automatic Transmission Range Selector Lever Cable Lever **Procedure** 1. Disconnect the electrical connector. 2. Disconnect the automatic transmission range selector lever cable lever wiring harness from any mounting points. 3. Transfer components as necessary. **NOTE:** • **Note the routing of the automatic transmission range selector lever cable lever wiring harness before removing the cable lever.** • **When installing the automatic transmission range selector lever cable lever, ensure the wiring harness is installed in the same routing and mounting positions as noted before removal.**

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TRANSMISSION CONTROL REPLACEMENT

Removal Procedure

1. Steering Column - Remove - **Steering Column Replacement**
2. Range Selector Lever Cable Lever - Remove - **Range Selector Lever Cable Lever Replacement**

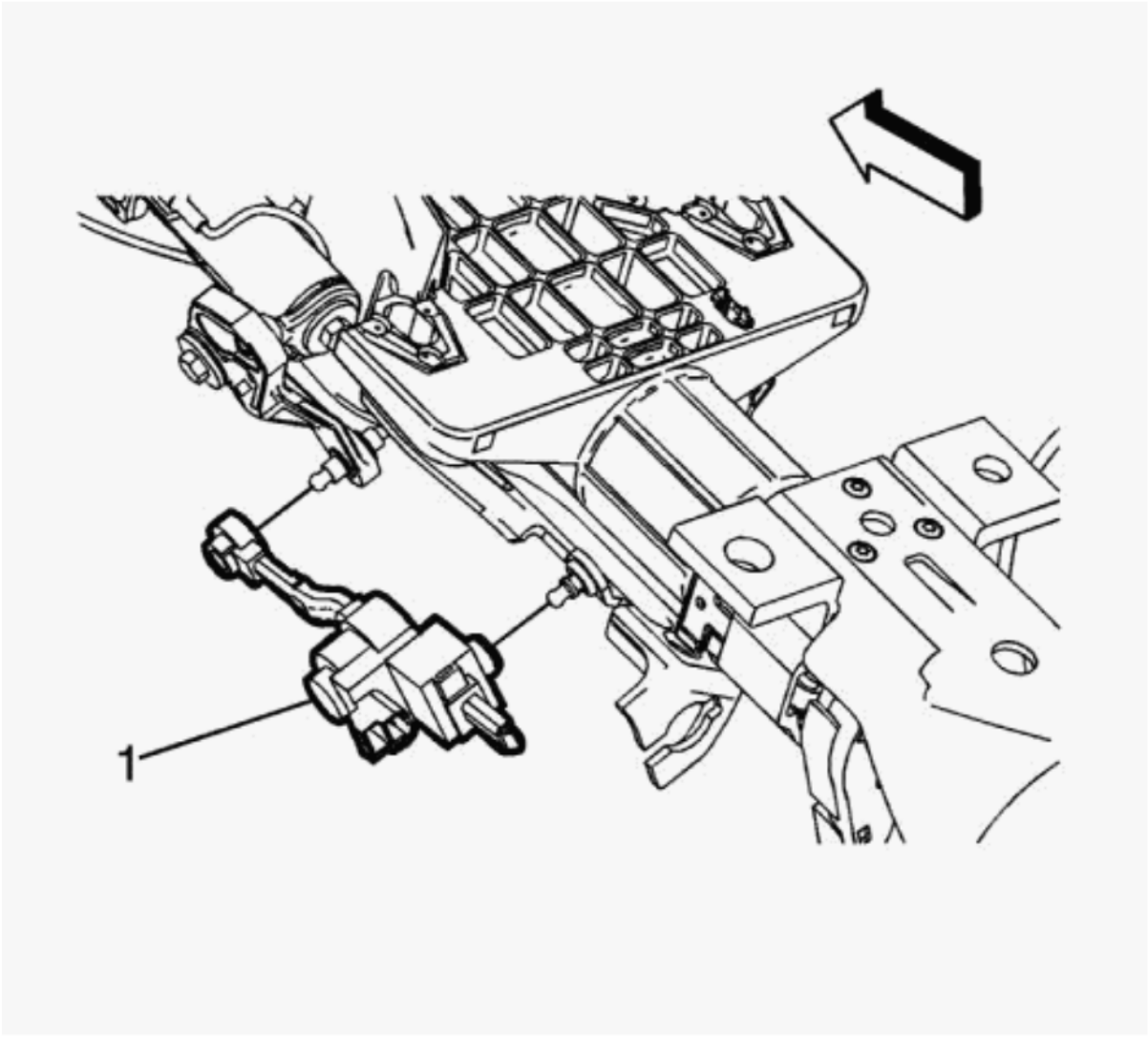


Fig. 36: Automatic Transmission Shift Lock Control Solenoid
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Do not use excessive force when removing the automatic transmission shift lock control from the steering column. Using excessive force may cause damage to the automatic transmission shift lock control and/or the steering column.

3. Remove the automatic transmission shift lock control solenoid (1) from the automatic transmission control bracket. **Automatic Transmission Shift Lock Control Actuator Replacement**

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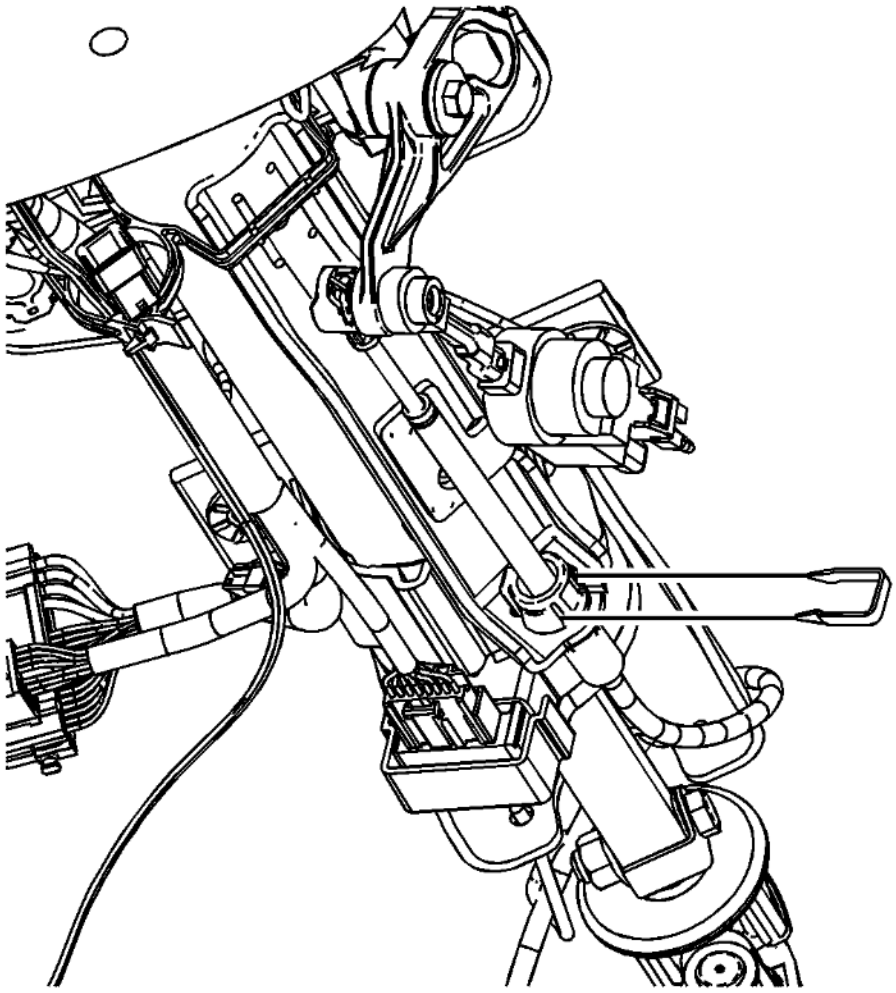


Fig. 37: View Of Steering Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the range selector lever cable and set aside. **Range Selector Lever Cable Replacement**

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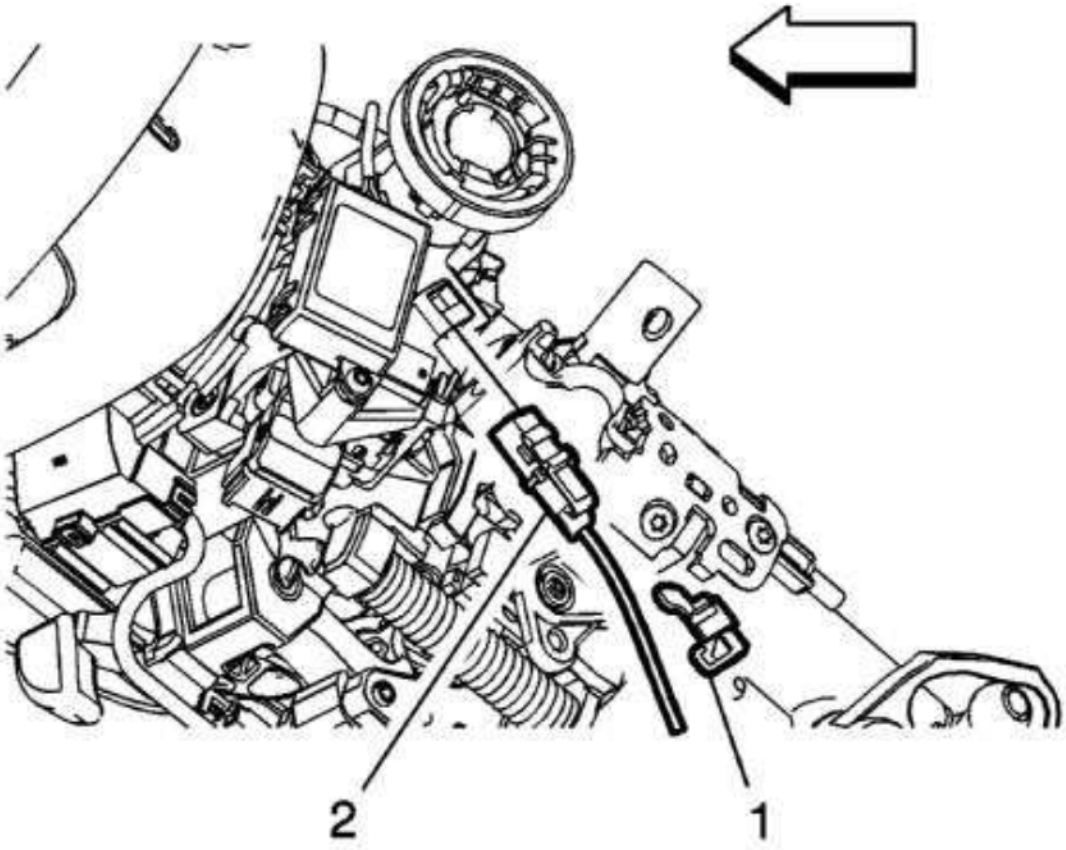


Fig. 38: Automatic Transmission Park Lock Cable Retainer
Courtesy of GENERAL MOTORS COMPANY

NOTE: **The ignition lock cylinder should be in the OFF-LOCK position.**

5. Remove the automatic transmission park lock cable retainer (1).
6. Disconnect the automatic transmission park lock cable (2) from the ignition lock cylinder case.

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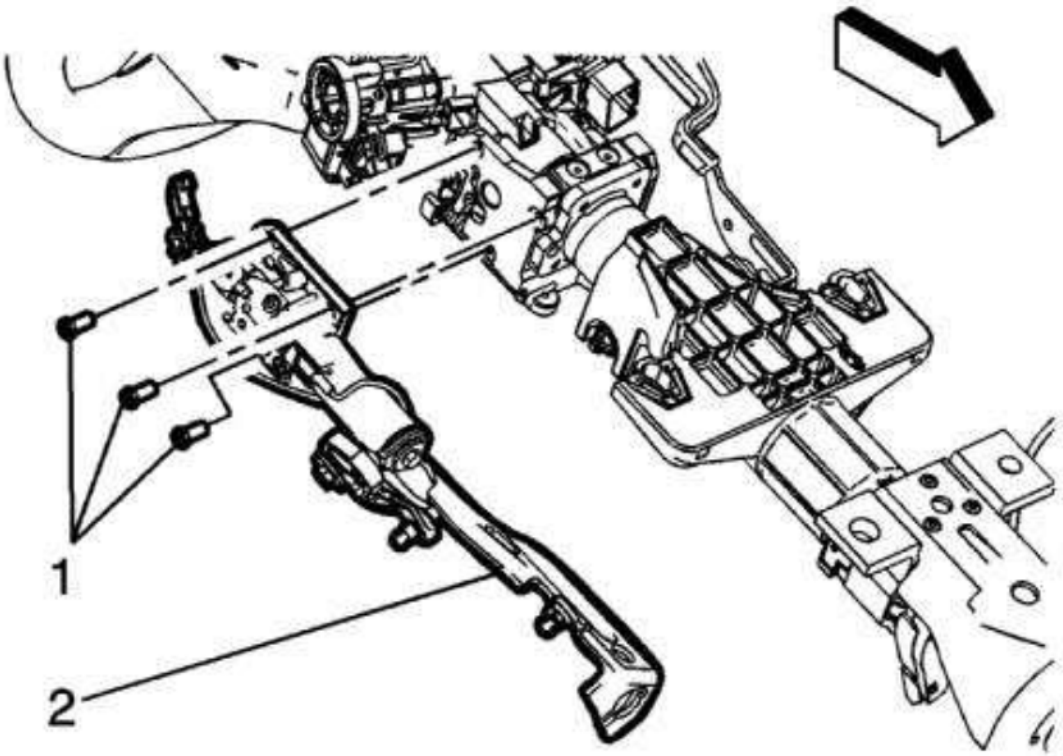


Fig. 39: Automatic Transmission Control Bolts
Courtesy of GENERAL MOTORS COMPANY

7. Remove the automatic transmission control bolts (1).
8. Remove the automatic transmission control (2) from the steering column.

Installation Procedure

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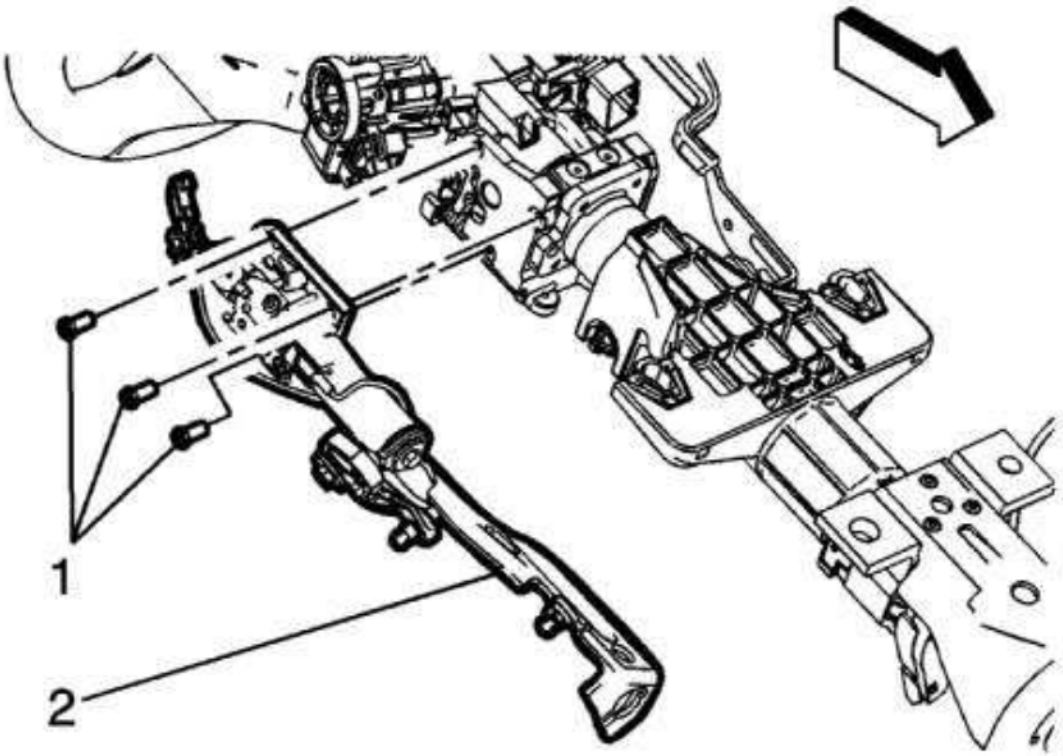


Fig. 40: Automatic Transmission Control Bolts
Courtesy of GENERAL MOTORS COMPANY

1. Position the automatic transmission control (2) on the steering column.

CAUTION: **Refer to Fastener Caution .**

2. Install the automatic transmission control bolts (1) and tighten to 10 N.m (89 lb in).

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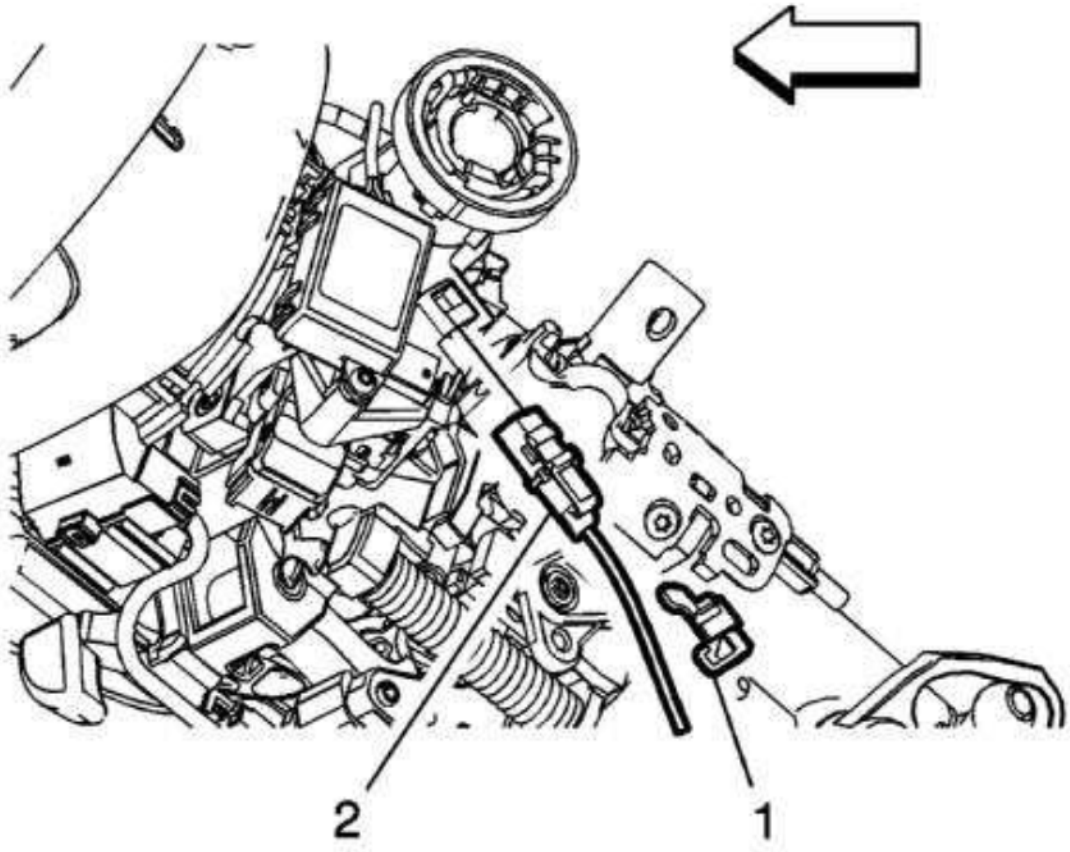


Fig. 41: Automatic Transmission Park Lock Cable Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Connect the automatic transmission park lock cable (2) to the ignition lock cylinder case.
    1. Place the ignition lock cylinder in the OFF-LOCK position.
    2. Place the automatic transmission control in the PARK position.
    3. Push the automatic transmission park lock cable into the ignition lock cylinder case until the lock tab engages.
4. Install the automatic transmission park lock cable lock clip (1).
5. Connect the range selector lever cable. **Range Selector Lever Cable Replacement**

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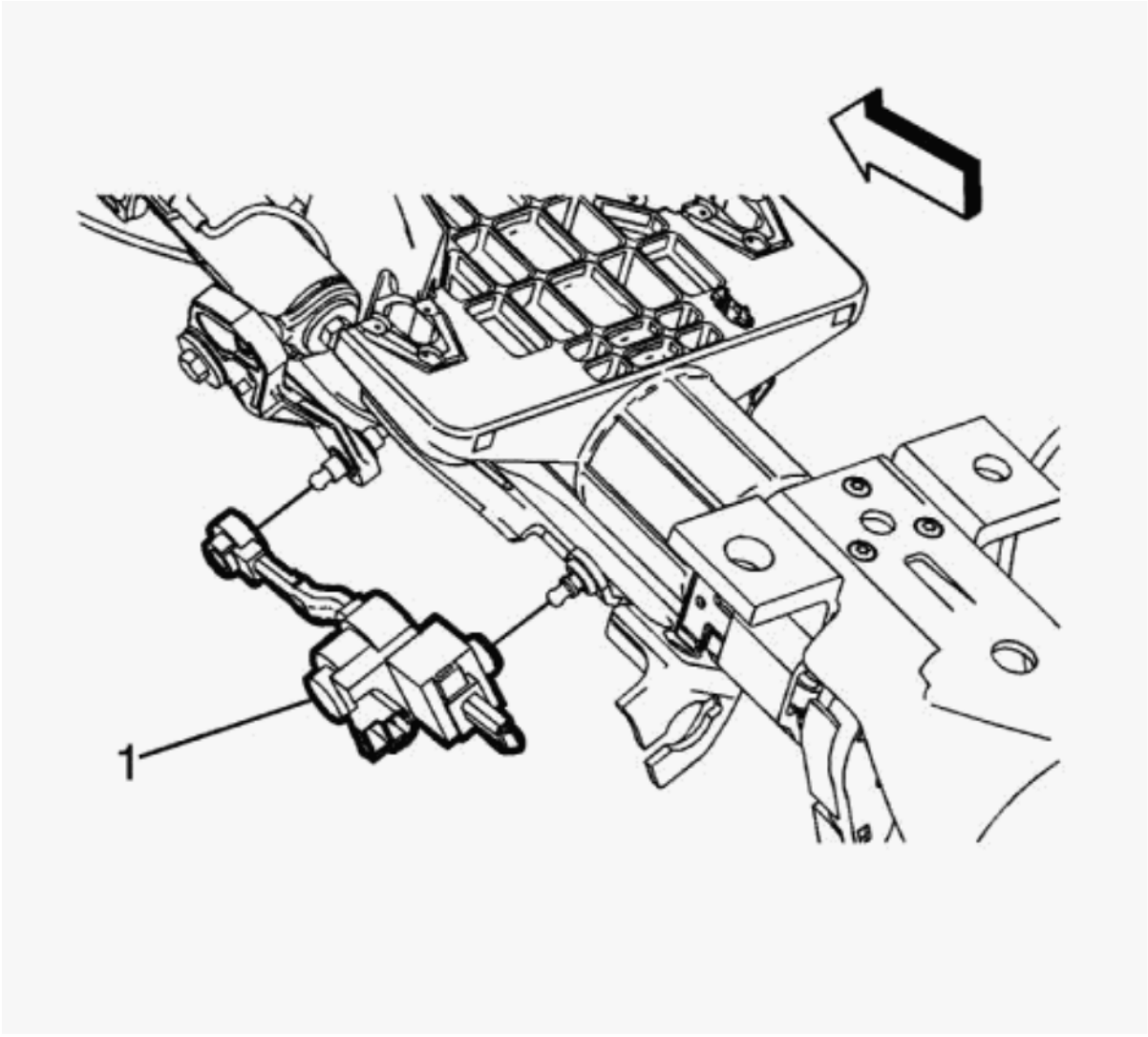


Fig. 42: Automatic Transmission Shift Lock Control Solenoid
Courtesy of GENERAL MOTORS COMPANY

6. Connect the automatic transmission shift lock control solenoid (1) to the automatic transmission control bracket. **Automatic Transmission Shift Lock Control Actuator Replacement**

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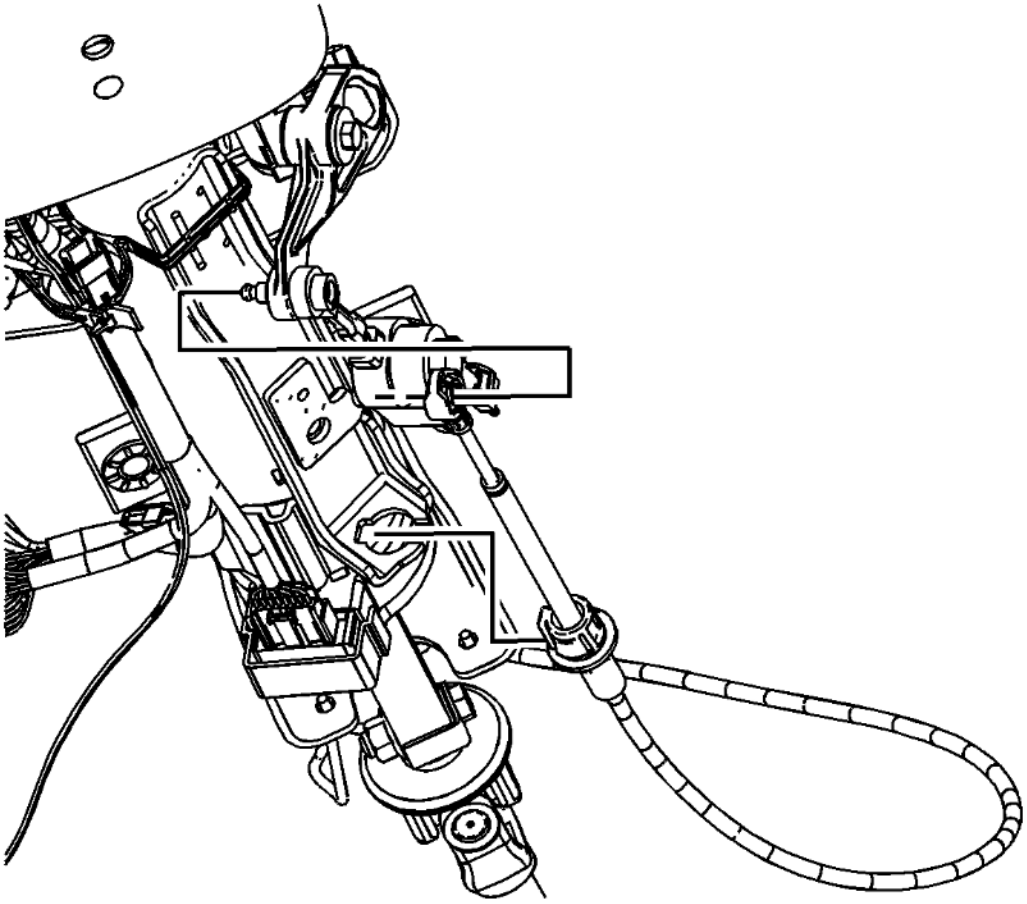


Fig. 43: View Of Cable, Steering Column Ball Stud & Steering Column Bracket
Courtesy of GENERAL MOTORS COMPANY

7. Install the automatic transmission range selector lever cable lever. **Range Selector Lever Cable Lever Replacement**
8. Steering Column - Install - **Steering Column Replacement**

STEERING COLUMN TILT WHEEL RELEASE LEVER REPLACEMENT

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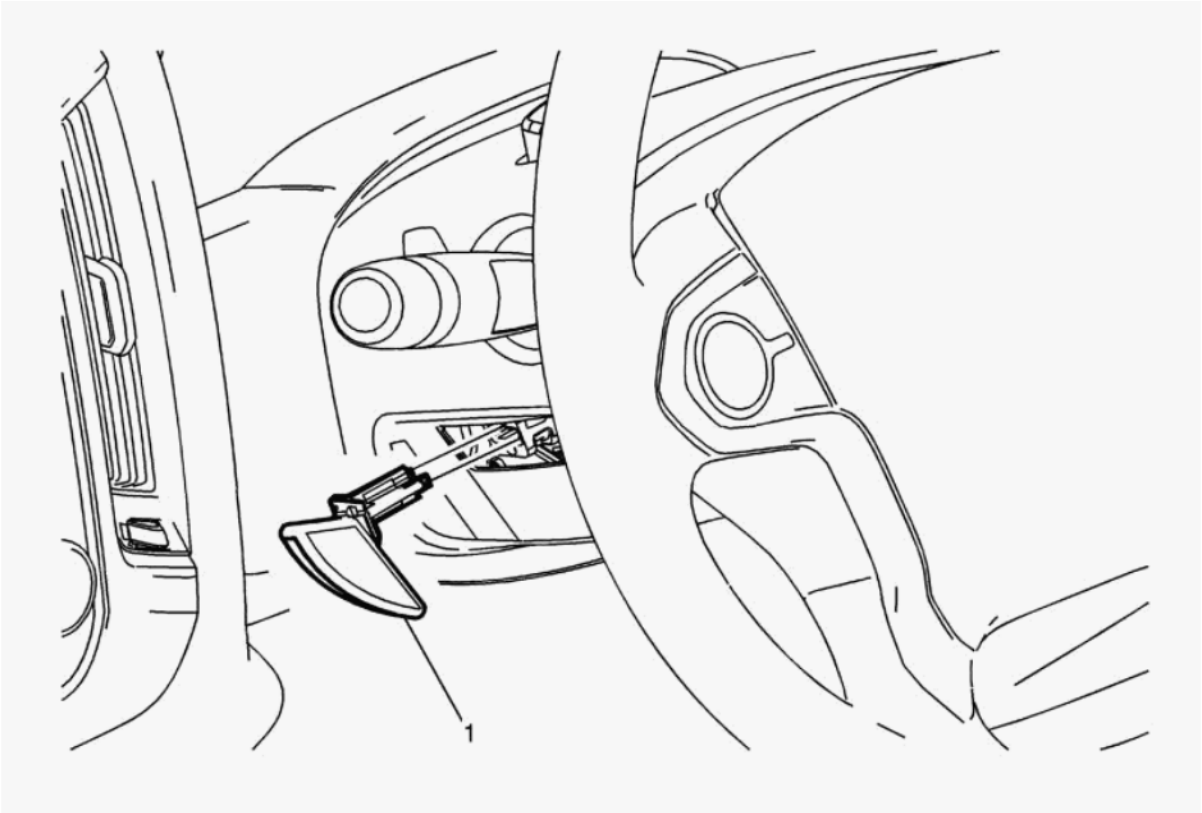


Fig. 44: Steering Column Tilt Wheel Release Lever
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Steering Column Tilt Wheel Release Lever **Procedure** Remove the steering column tilt wheel release lever by pulling outward.

STEERING WHEEL REPLACEMENT

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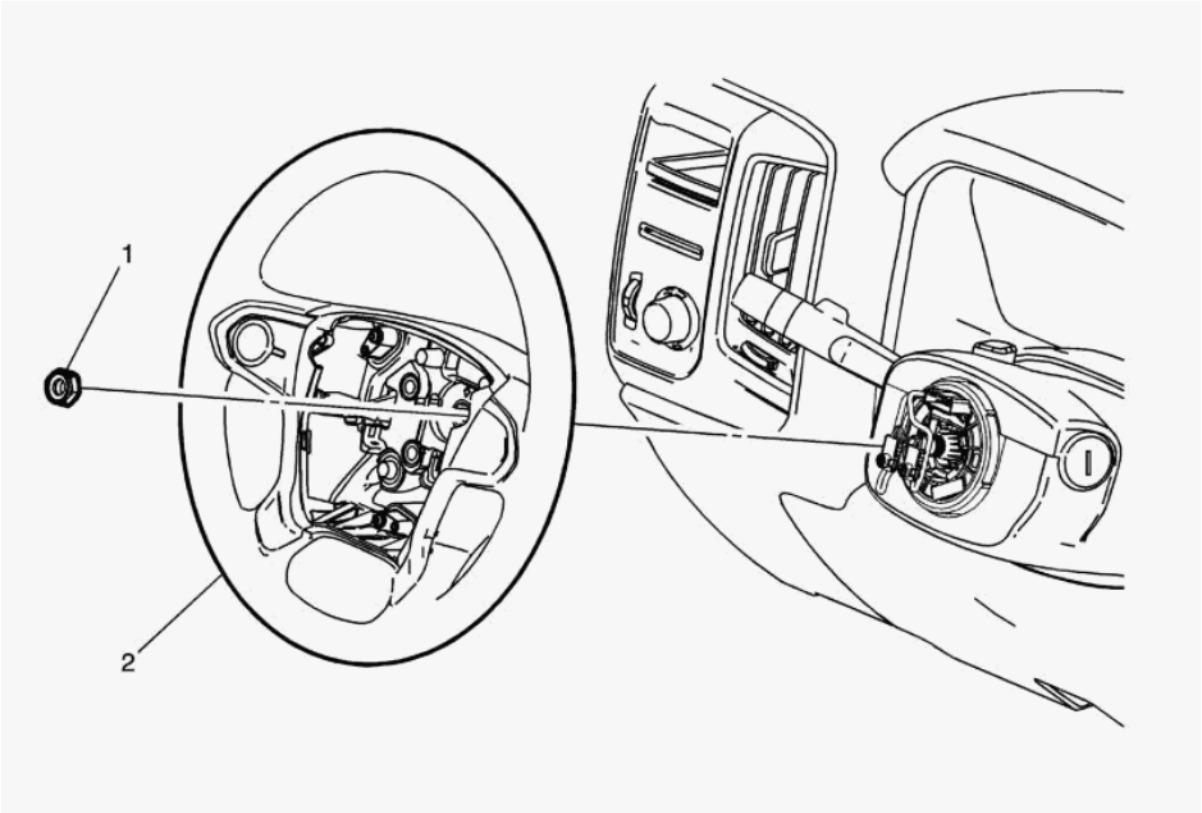


Fig. 45: Steering Wheel
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Refer to SIR Warning . **WARNING:** Refer to SIR Inflator Module Handling and Storage Warning . **Preliminary Procedure** Steering Wheel Airbag Replacement	
1	Steering Wheel Nut **CAUTION:** Refer to Fastener Caution . **Tighten** 37 N.m (27 lb ft)

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Callout	Component Name
2	Steering Wheel **CAUTION:** **Do not hammer on the end of the steering column shaft. Hammering could loosen the plastic injections which maintain the steering column rigidity.** **Procedure** 1. Disconnect the electrical connectors. 2. Install the steering wheel nut until 2 to 3 threads are engaged. 3. Wiggle the steering wheel until the wheel disengages completely. 4. Steering Wheel Nut - Remove 5. Steering Wheel - Remove 6. Transfer components as necessary.

STEERING WHEEL SPOKE COVER REPLACEMENT (LH WITH CRUISE CONTROL SWITCH)

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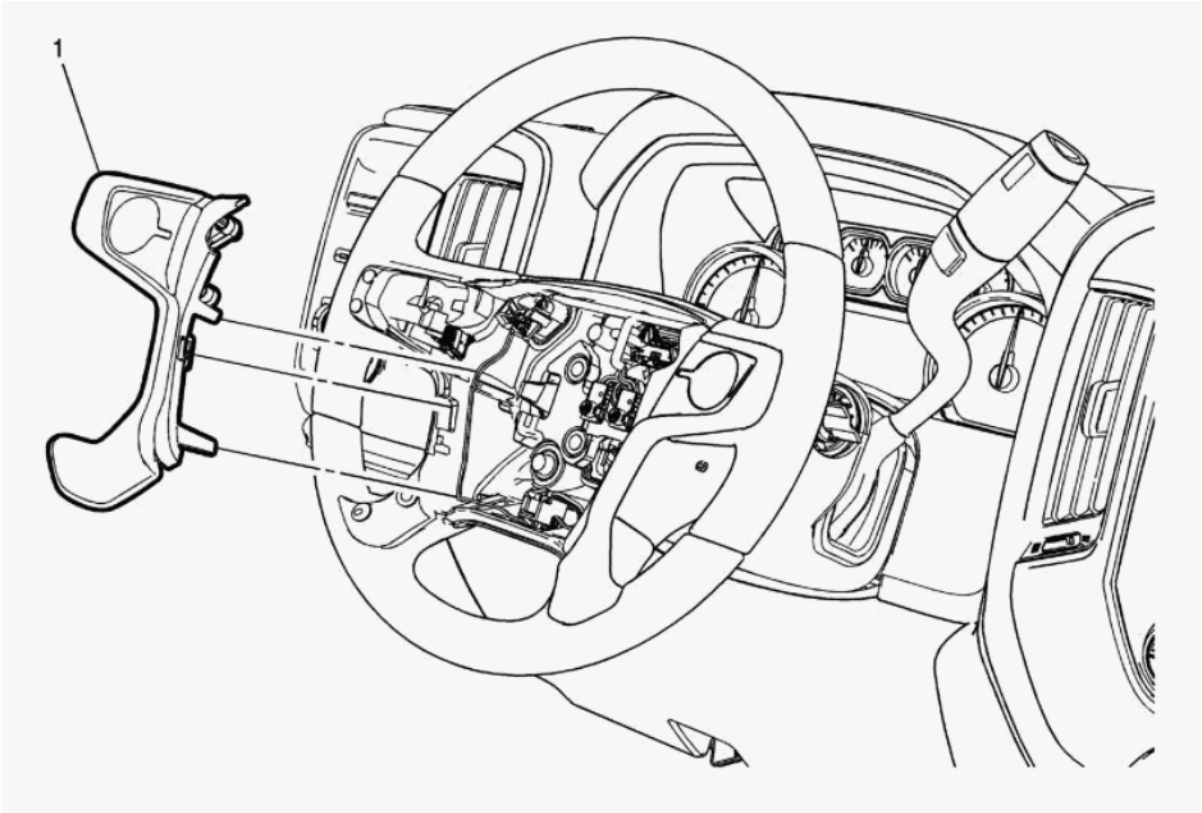


Fig. 46: Steering Wheel Spoke Cover (LH with Cruise Control Switch)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. **Steering Wheel Airbag Replacement** 2. **Radio Control Switch Replacement - Rear**	
1	Steering Wheel Spoke Cover Fastener **CAUTION:** **Refer to Fastener Caution .**
2	Steering Wheel Spoke Cover **Procedure** 1. Use the appropriate tool to gently release the retaining tabs on the cover. 2. Disconnect the electrical connector. 3. Transfer components as necessary. **NOTE:** **Gently release the tabs one by**

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Callout	Component Name
	one, using care to avoid snapping any tabs off.

STEERING WHEEL SPOKE COVER REPLACEMENT (RH WITH RADIO CONTROL SWITCH)

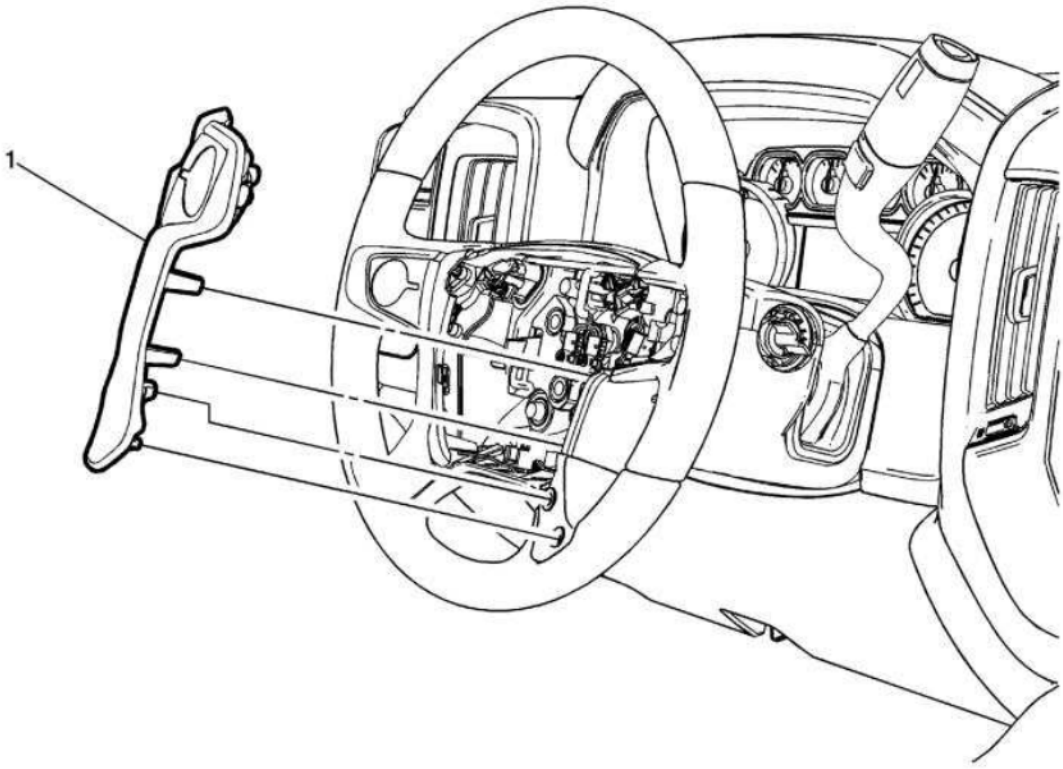


Fig. 47: Steering Wheel Spoke Cover (RH with Radio Control Switch)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Steering Wheel Airbag Replacement 2. Radio Control Switch Replacement - Rear	
1	Steering Wheel Spoke Cover Fastener **CAUTION:** Refer to Fastener Caution .
2	Steering Wheel Spoke Cover **Procedure**

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Callout	Component Name
	1. Use the appropriate tool to gently release the retaining tabs on the cover. 2. Disconnect the electrical connector. 3. Transfer components as necessary. **NOTE:** **Gently release the tabs one by one, using care to avoid snapping any tabs off.**

STEERING COLUMN TILT SPRING REPLACEMENT

Removal Procedure

1. Instrument Panel Knee Bolster - Remove - **Instrument Panel Knee Bolster Replacement**
2. Steering Column Shroud - Remove - **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**
3. Position the steering column in the uppermost tilted position.

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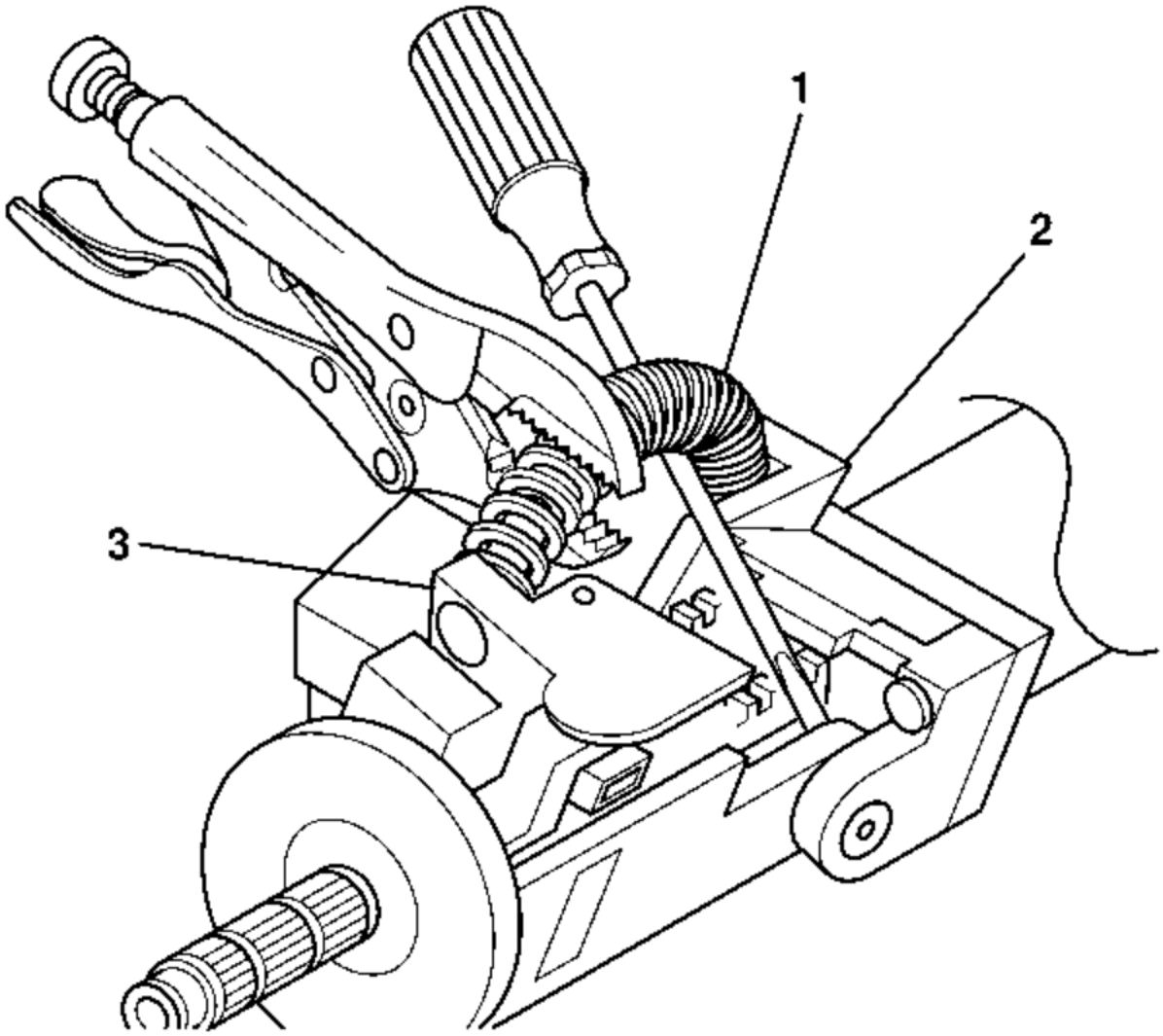


Fig. 48: View Of Tilt Spring And Steering Column Support Assembly
Courtesy of GENERAL MOTORS COMPANY

WARNING: The tilt spring and the spring guide are under pressure. The tilt spring and the spring guide may become a projectile. Secure the spring with locking pliers during removal. Secure the spring with locking pliers during installation. Bodily injury may result during removal and installation of the tilt spring and the spring guide. Always use caution during removal and installation of the tilt spring and the spring guide.

4. Remove the tilt spring (1) from the steering column using the following procedure:
    1. Pry the tilt spring (1) until a bulge occurs and most of the tension is removed.
    2. Secure the tilt spring (1) with locking pliers.
    3. Continue prying until the tilt spring (1) disengages from the posts on the steering column (2) and the steering column tilt head (3).

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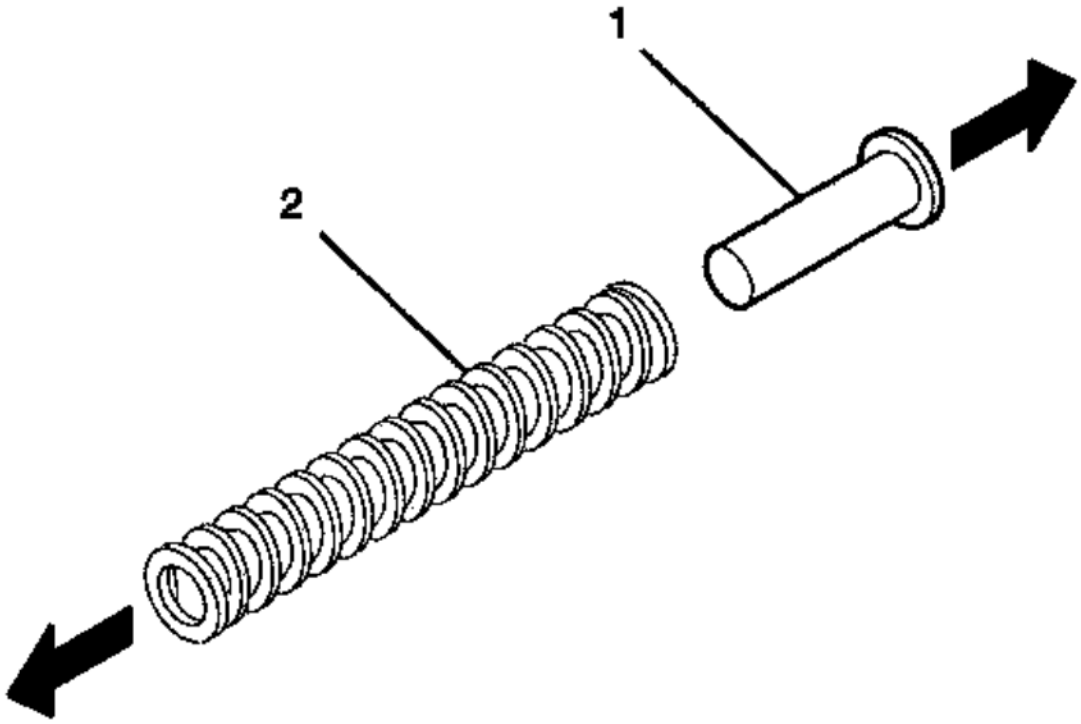


Fig. 49: Identifying Spring Guide Components
Courtesy of GENERAL MOTORS COMPANY

5. Remove the spring guide (1) from the tilt spring (2).

Installation Procedure

1. Position the steering column in the uppermost tilted position.

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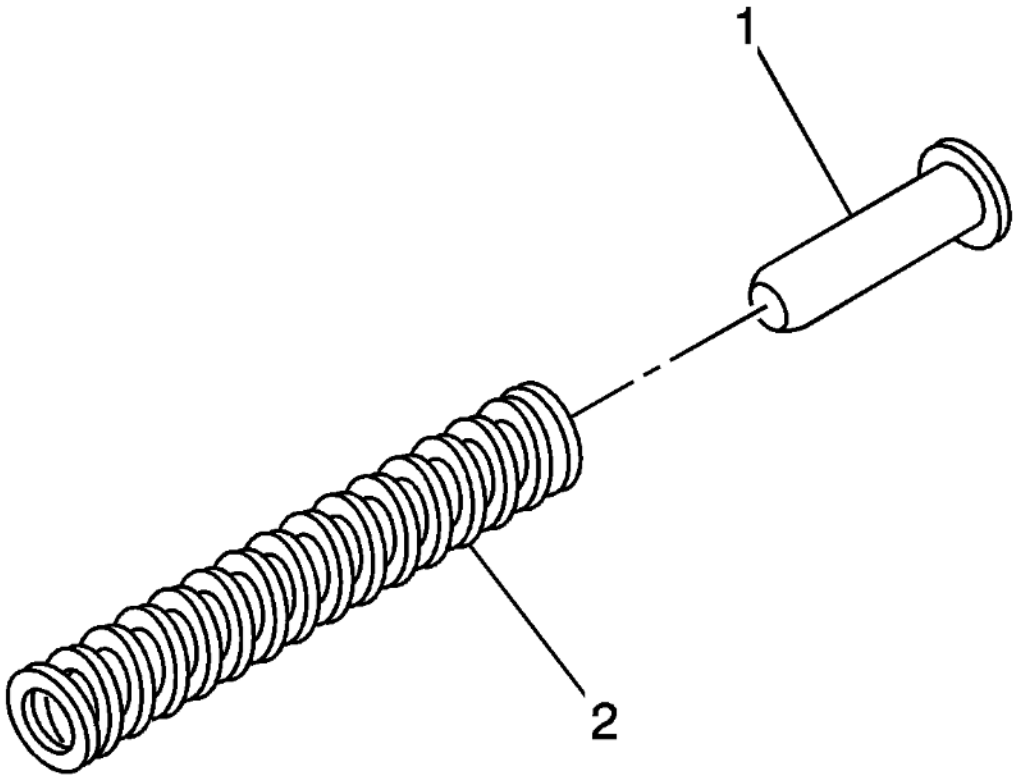


Fig. 50: View Of Tilt Spring & Guide
Courtesy of GENERAL MOTORS COMPANY

2. Install the spring guide (1) into the tilt spring (2).

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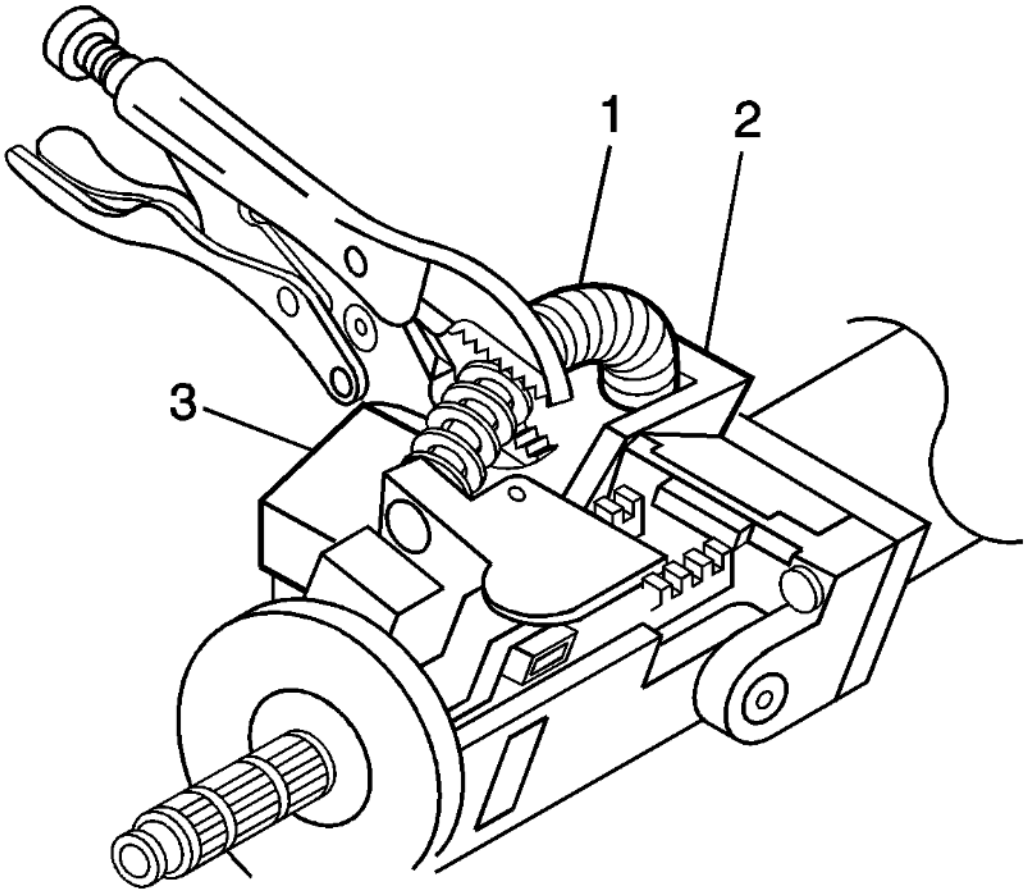


Fig. 51: View Of Steering Column, Tilt Head & Spring
Courtesy of GENERAL MOTORS COMPANY

WARNING: **The tilt spring and the spring guide are under pressure. The tilt spring and the spring guide may become a projectile. Secure the spring with locking pliers during removal. Secure the spring with locking pliers during installation. Bodily injury may result during removal and installation of the tilt spring and the spring guide. Always use caution during removal and installation of the tilt spring and the spring guide.**

3. Install the tilt spring (1) on the steering column using the following procedure:
    1. Install the tilt spring (1) onto the post on the steering column tilt head (3).
    2. Install the tilt spring (1) onto the post on the steering column (2).
    3. Remove the locking pliers.
4. Steering Column Shroud - Install - **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**
5. Instrument Panel Knee Bolster - Install - **Instrument Panel Knee Bolster Replacement**

TURN SIGNAL SWITCH CANCEL CAM REPLACEMENT

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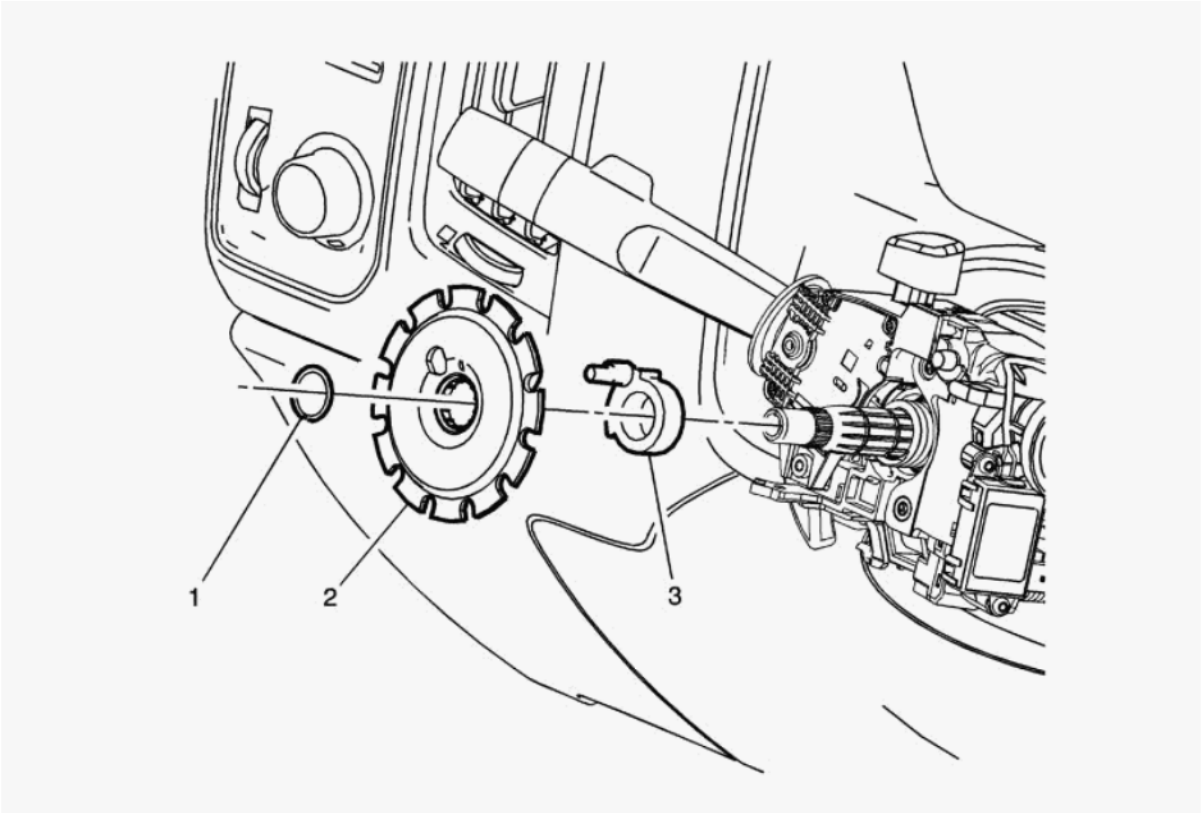


Fig. 52: Turn Signal Switch Cancel Cam
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure **Steering Wheel Airbag Coil Replacement**	
1	Steering Shaft Lock Plate Retaining Ring **CAUTION:** **Refer to** **Fastener** **Caution** . **Procedure** 1. Use the **CH-23653-SIR** compressor to remove the steering shaft lock plate retaining ring. DISCARD the retaining ring. 2. Install a NEW steering shaft lock plate retaining ring. **Special Tools** **CH-23653-SIR** Steering Column Lock Plate Compressor Equivalent regional tools:**Special Tools**

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Callout	Component Name
2	Turn Signal Switch Cancel Cam Position Plate **Procedure** Use the alignment tooth on the turn signal switch cancel cam position plate to ensure proper alignment with the steering column shaft.
3	Turn Signal Switch Cancel Cam

STEERING SHAFT UPPER BEARING REPLACEMENT

Special Tools

- **CH-21854-01** Pivot Pin Remover
- **CH-42640** Steering Column Anti-Rotation Pin

Equivalent regional tools:**Special Tools**

Removal Procedure

1. Steering Column - Remove - **Steering Column Replacement**
2. Steering Column Tilt Spring - Remove - **Steering Column Tilt Spring Replacement**
3. Transmission Control - Remove - **Transmission Control Replacement**
4. Steering Wheel Airbag Coil - Remove - **Steering Wheel Airbag Coil Replacement**
5. Turn Signal Switch Cancel Cam - Remove - **Turn Signal Switch Cancel Cam Replacement**

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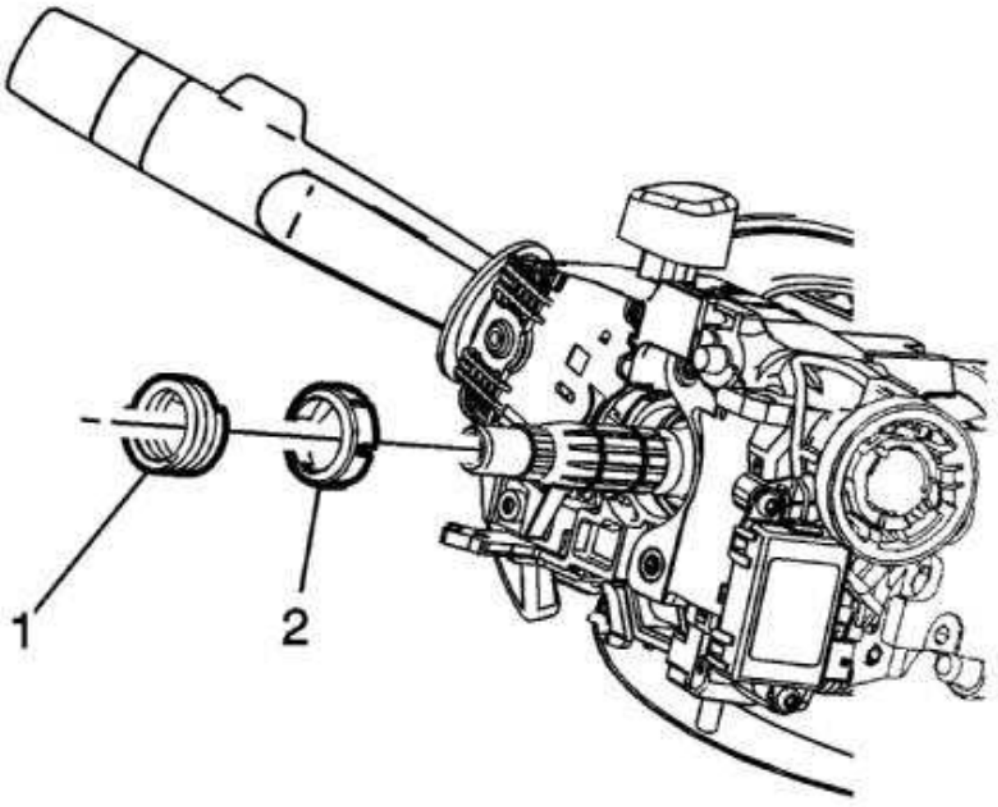


Fig. 53: Steering Shaft Upper Bearing Spring
Courtesy of GENERAL MOTORS COMPANY

6. Remove the steering shaft upper bearing spring (1) and steering shaft upper bearing race seat (2).
7. Theft Deterrent Module - Remove - **Theft Deterrent Module Replacement**
8. Turn Signal Switch - Remove - **Turn Signal Switch Replacement**
9. Ignition Lock Cylinder Case - Remove - **Ignition Lock Cylinder Case Replacement**

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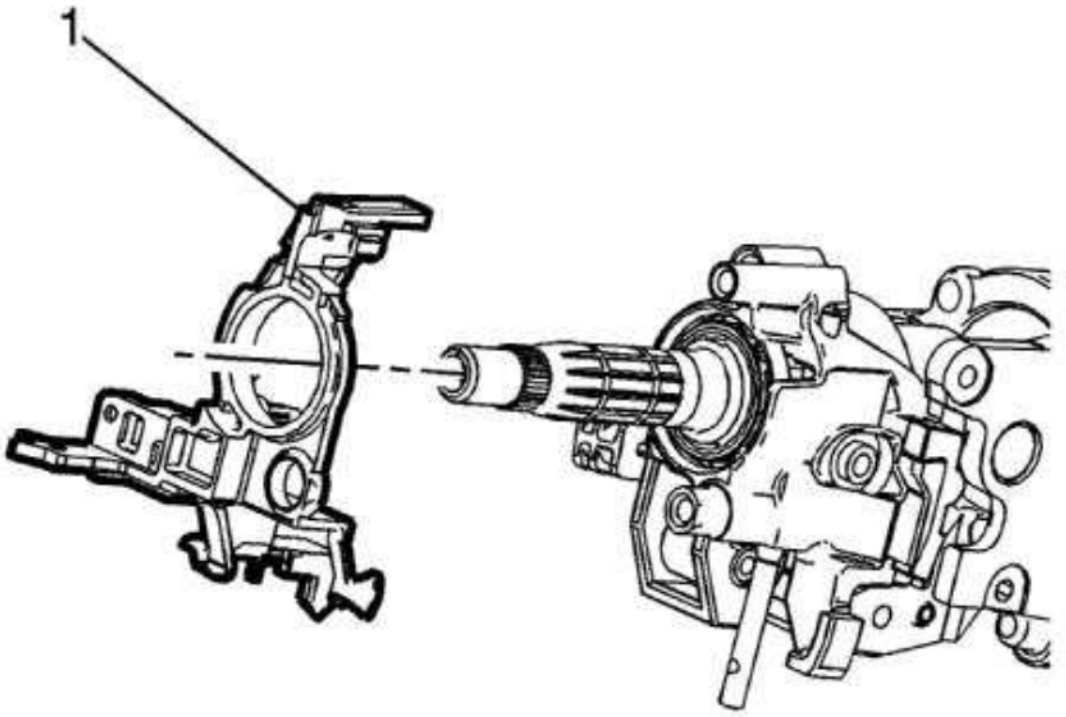


Fig. 54: Turn Signal Switch Bracket
Courtesy of GENERAL MOTORS COMPANY

10. Remove the turn signal switch bracket (1).
11. Install the steering column tilt wheel release lever in the steering column tilt head assembly.

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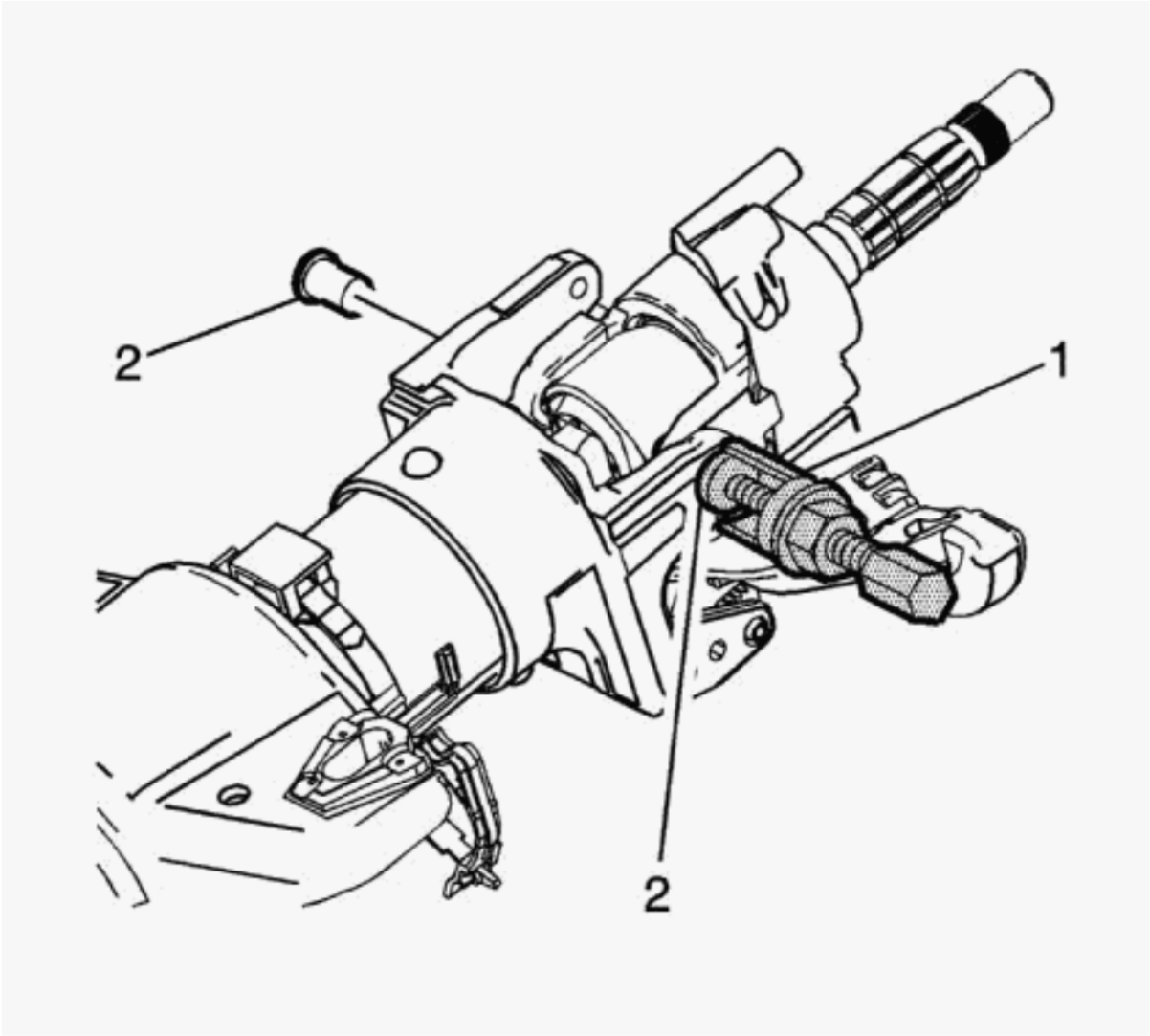


Fig. 55: Pivot Pin Remover
Courtesy of GENERAL MOTORS COMPANY

12. Use the **CH-21854-01** pivot pin remover (1) to remove the steering column tilt head pivot pins (2) from the steering column tilt head assembly.
13. Remove the **CH-42640** anti-rotation pin from the steering column.

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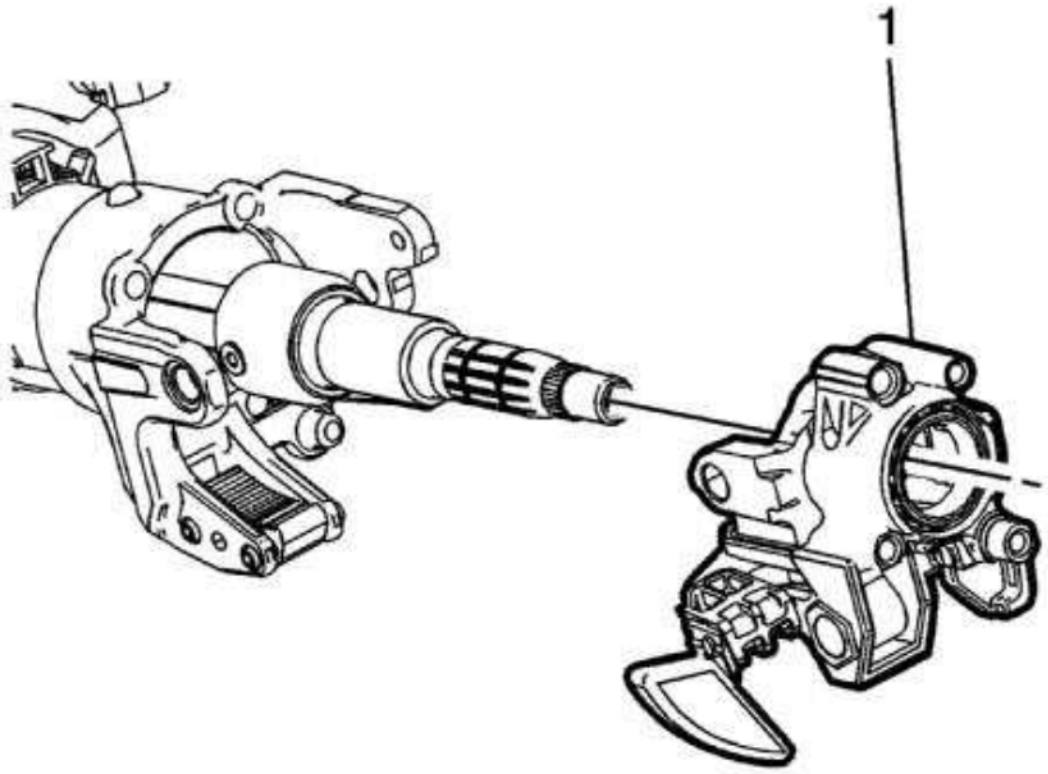


Fig. 56: Steering Column Tilt Head Assembly
Courtesy of GENERAL MOTORS COMPANY

14. Pull back on the steering column tilt wheel release lever and pull the steering column tilt head assembly (1) down and away to disengage the tilt mechanism.
15. Remove the steering column tilt head assembly (1) from the steering column.
16. Remove the steering column tilt wheel release lever (2) from the steering column tilt head assembly.

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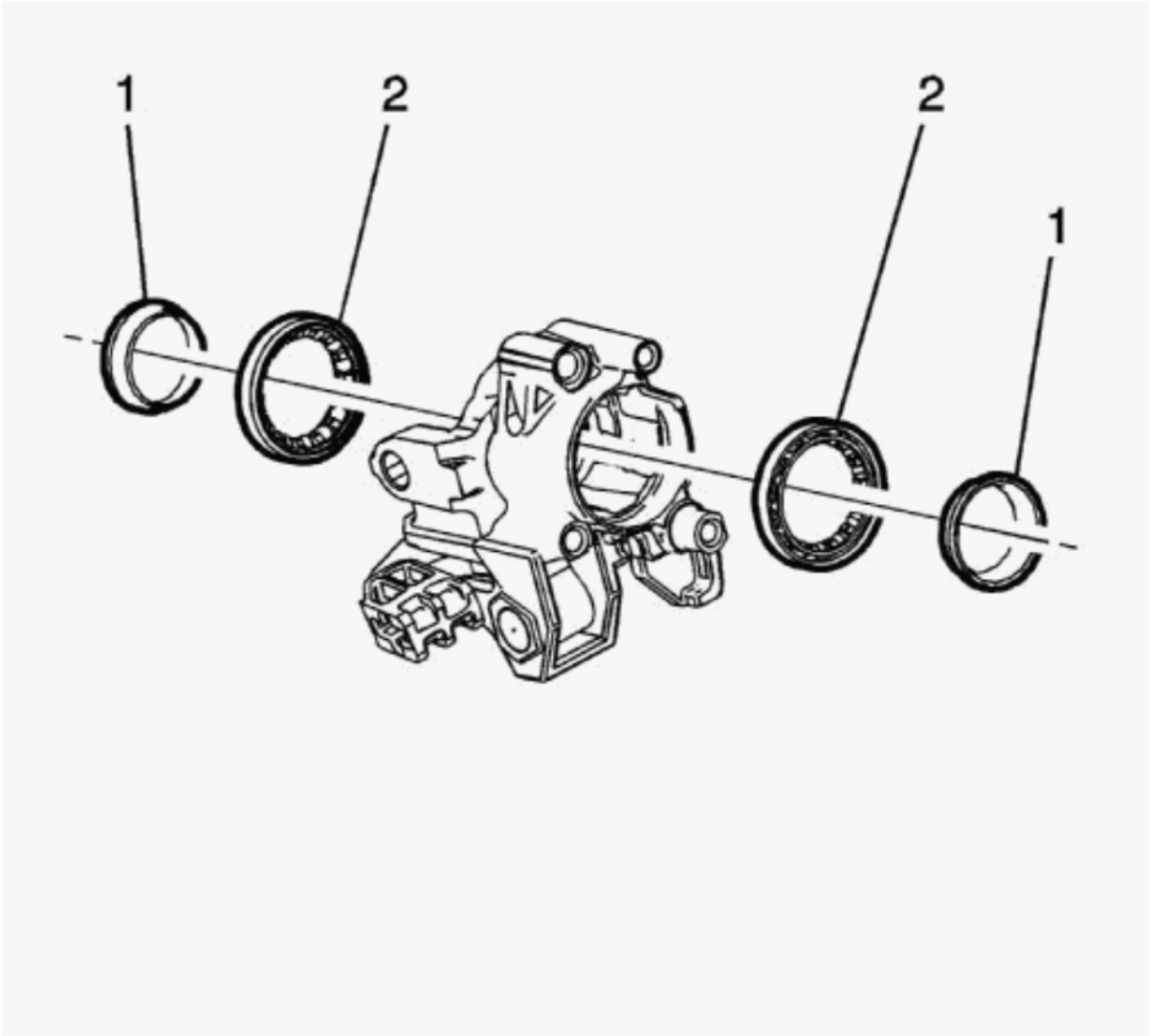


Fig. 57: Steering Shaft Upper Bearing Race
Courtesy of GENERAL MOTORS COMPANY

17. Remove the steering shaft upper bearing race(s) (1) and steering shaft upper bearing(s) (2) from the steering column tilt head assembly.

Installation Procedure

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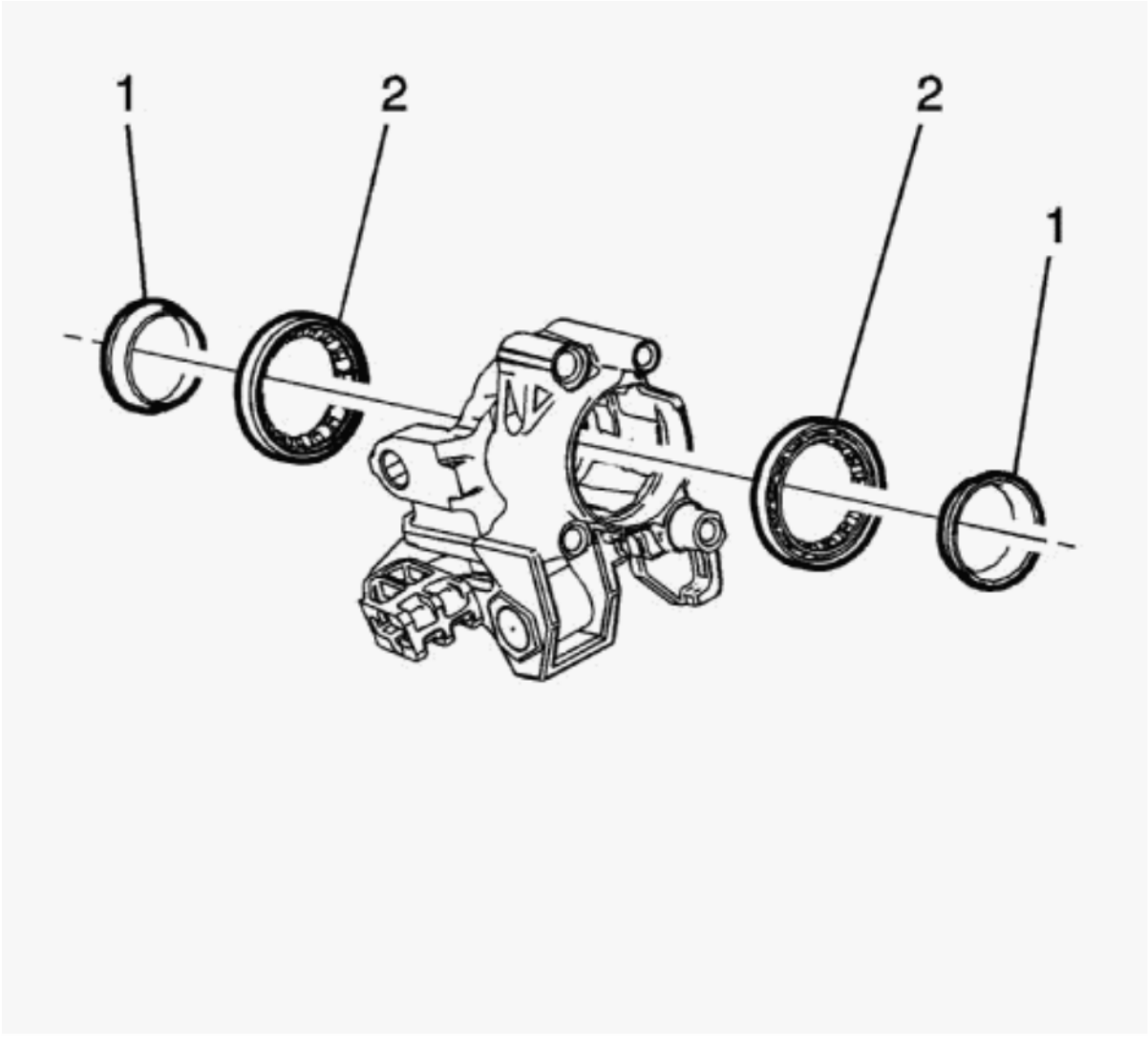


Fig. 58: Steering Shaft Upper Bearing Race
Courtesy of GENERAL MOTORS COMPANY

1. Install the steering shaft upper bearing(s) (2) and steering shaft upper bearing race(s) (1) in the steering column tilt head assembly.

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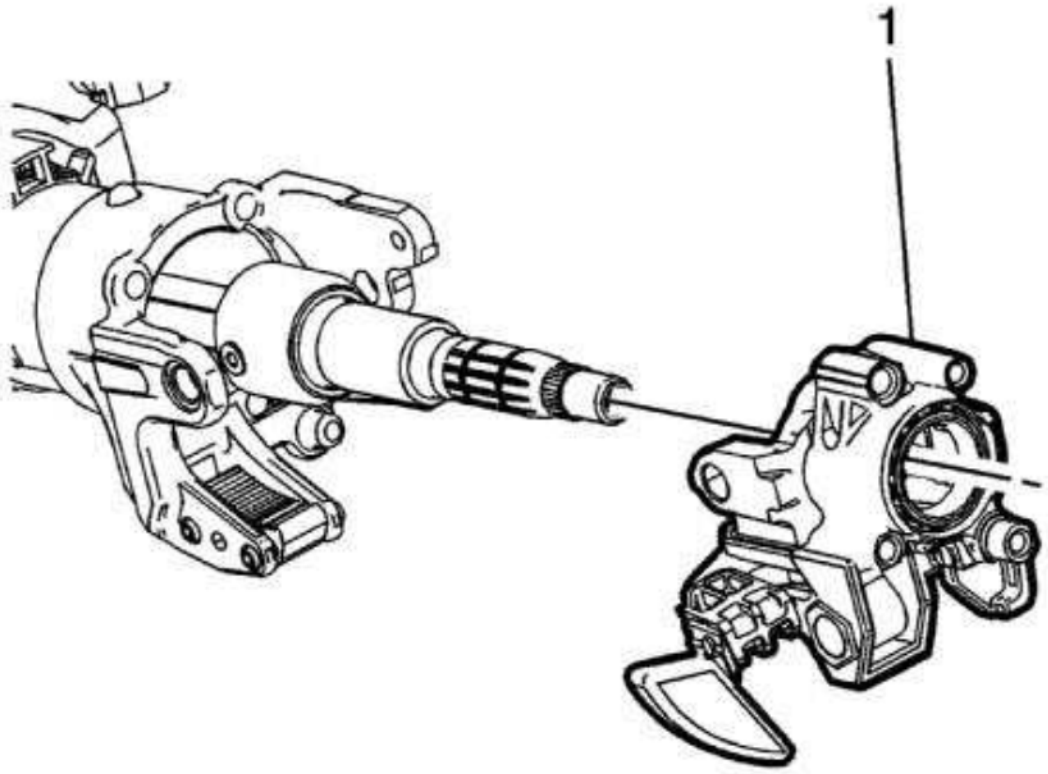


Fig. 59: Steering Column Tilt Head Assembly
Courtesy of GENERAL MOTORS COMPANY

2. Install the steering column tilt wheel release lever (2) in the steering column tilt head assembly.
3. Pull back on the steering column tilt wheel release lever and engage the steering column tilt head assembly (1) in the tilt mechanism.
4. Install the **CH-42640** anti-rotation pin in the steering column.
5. Lubricate the steering column tilt head pivot pins. **Adhesives, Fluids, Lubricants, and Sealers**

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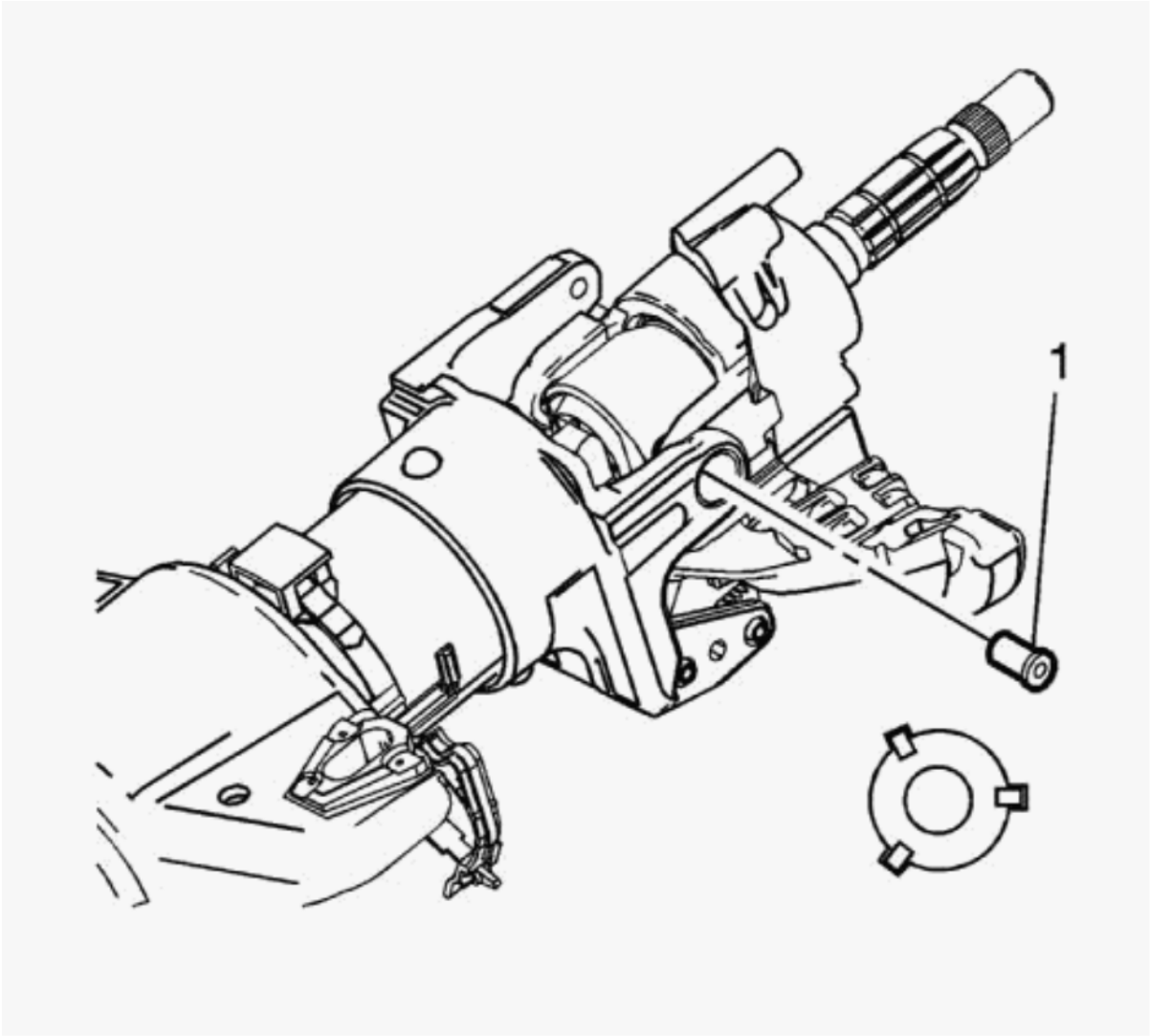


Fig. 60: Steering Column Tilt Head Pivot Pins
Courtesy of GENERAL MOTORS COMPANY

6. Install the steering column tilt head pivot pins (1) into the steering column tilt head assembly.
7. Stake the steering column in three locations around each steering column tilt head pivot pin.

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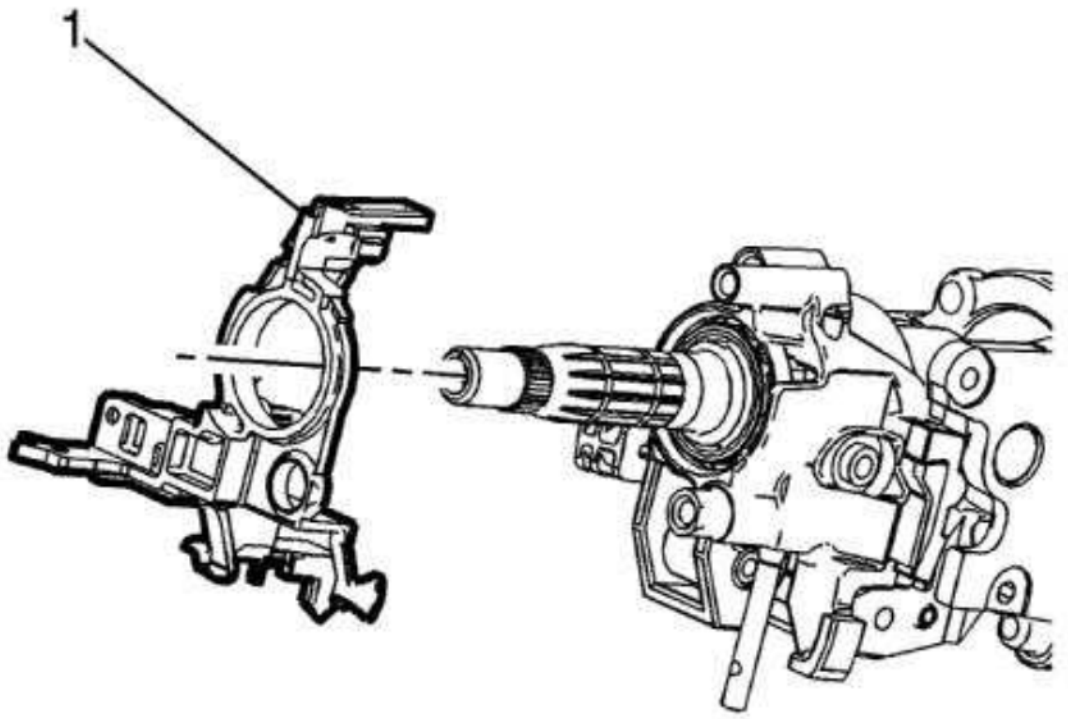


Fig. 61: Turn Signal Switch Bracket
Courtesy of GENERAL MOTORS COMPANY

8. Install the turn signal switch bracket (1).
9. Ignition Lock Cylinder Case - Install - **Ignition Lock Cylinder Case Replacement**
10. Turn Signal Switch - Install - **Turn Signal Switch Replacement**
11. Theft Deterrent Module - Install - **Theft Deterrent Module Replacement**

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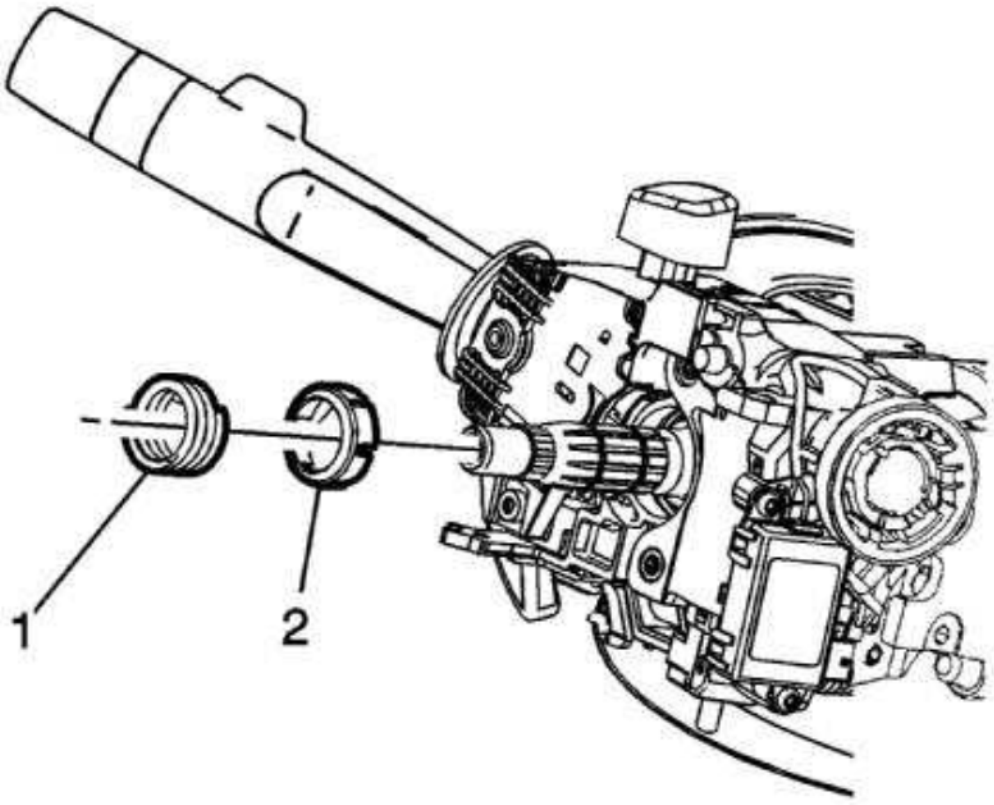


Fig. 62: Steering Shaft Upper Bearing Spring
Courtesy of GENERAL MOTORS COMPANY

12. Install the steering shaft upper bearing race seat (2) and steering shaft upper bearing spring (1).
13. Turn Signal Switch Cancel Cam - Install - **Turn Signal Switch Cancel Cam Replacement**
14. Steering Wheel Airbag Coil - Install - **Steering Wheel Airbag Coil Replacement**
15. Transmission Control - Install - **Transmission Control Replacement**
16. Steering Column Tilt Spring - Install - **Steering Column Tilt Spring Replacement**
17. Steering Column - Install - **Steering Column Replacement**

STEERING COLUMN REPLACEMENT

Special Tools

CH-42640 Steering Column Anti-Rotation Pin

Equivalent regional tools:**Special Tools**

Removal Procedure

1. Unlearn the steering angle sensor using the scan tool to perform the reset function listed under the

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steering wheel angle sensor module. **Steering Wheel Angle Sensor Centering**

WARNING: **Refer to SIR Warning .**

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

2. Disable the SIR system. **SIR Disabling and Enabling**

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

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

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

3. With the wheels of the vehicle in the straight ahead position, use the **CH-42640** anti-rotation pin to lock the steering column.
4. Steering Column Shroud - Remove - **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**
5. Instrument Panel Knee Bolster - Remove - **Instrument Panel Knee Bolster Replacement**
6. Floor Front Air Outlet Duct - Left Side - Remove - **Floor Front Air Outlet Duct Replacement - Left Side**

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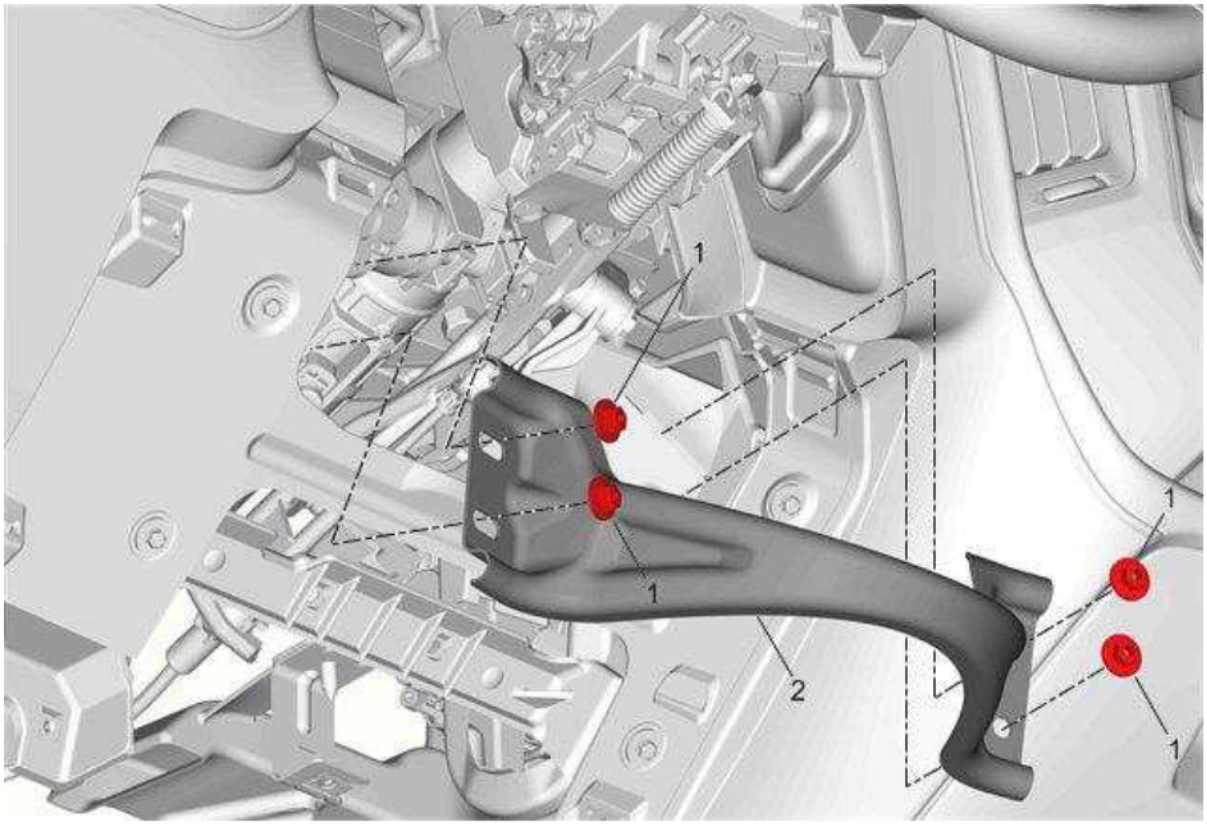


Fig. 63: Deflector And Nuts
Courtesy of GENERAL MOTORS COMPANY

7. Remove the instrument panel knee bolster deflector nuts (1) and deflector (2).
8. Separate the upper intermediate steering shaft from the steering column. **Upper Intermediate Steering Shaft Replacement**
9. If equipped, disconnect the automatic transmission shift lock control actuator. **Automatic Transmission Shift Lock Control Actuator Replacement**
10. Disconnect the range selector lever cable from the steering column and set aside. **Range Selector Lever Cable Replacement**

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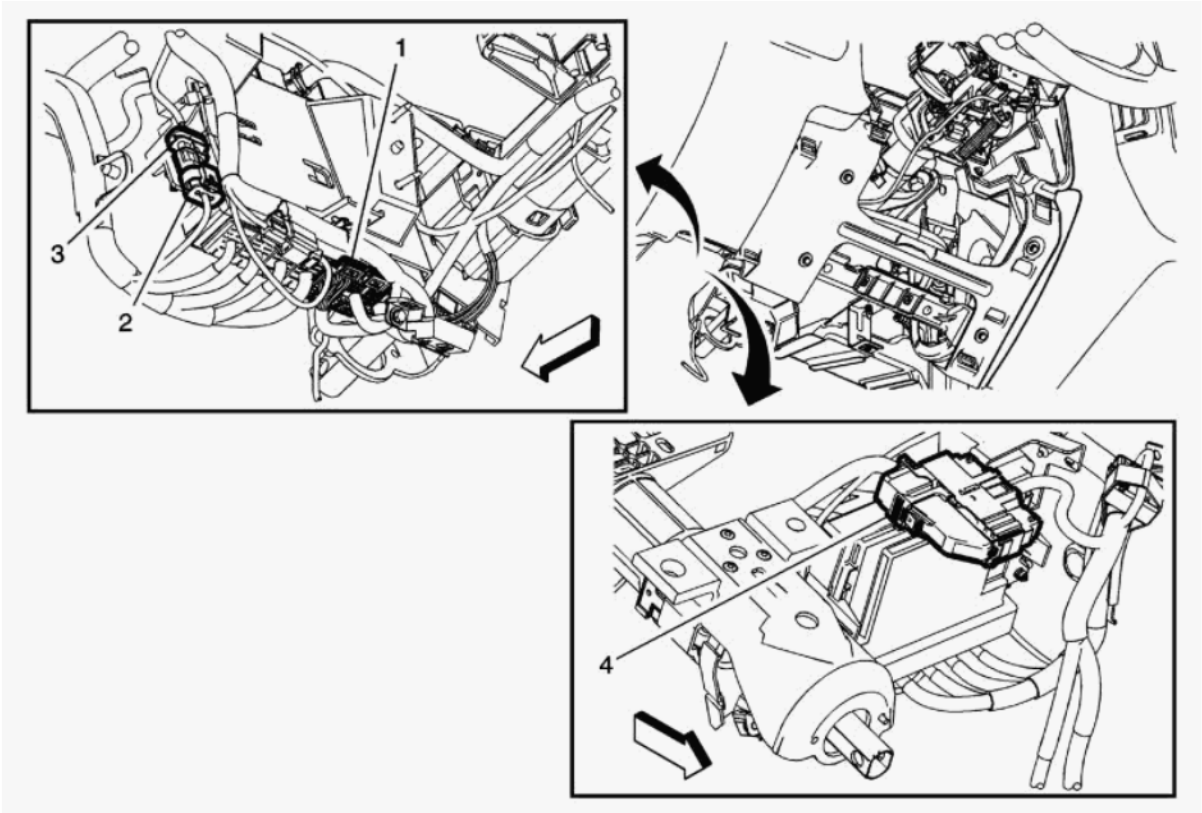


Fig. 64: Steering Column Wiring Harness Connector
Courtesy of GENERAL MOTORS COMPANY

11. Disconnect the steering column wiring harness connector (1) from the body control module.
12. Disconnect the vehicle body wiring harness connector (2) from the steering wheel airbag wiring harness connector (3).

    Remove the airbag wiring harness connector from the plastic retainer on the body control module bracket.

13. Release the cam lock on the steering column wiring harness connector (4) on top of the body control module bracket and disconnect the connector from the vehicle body wiring harness.

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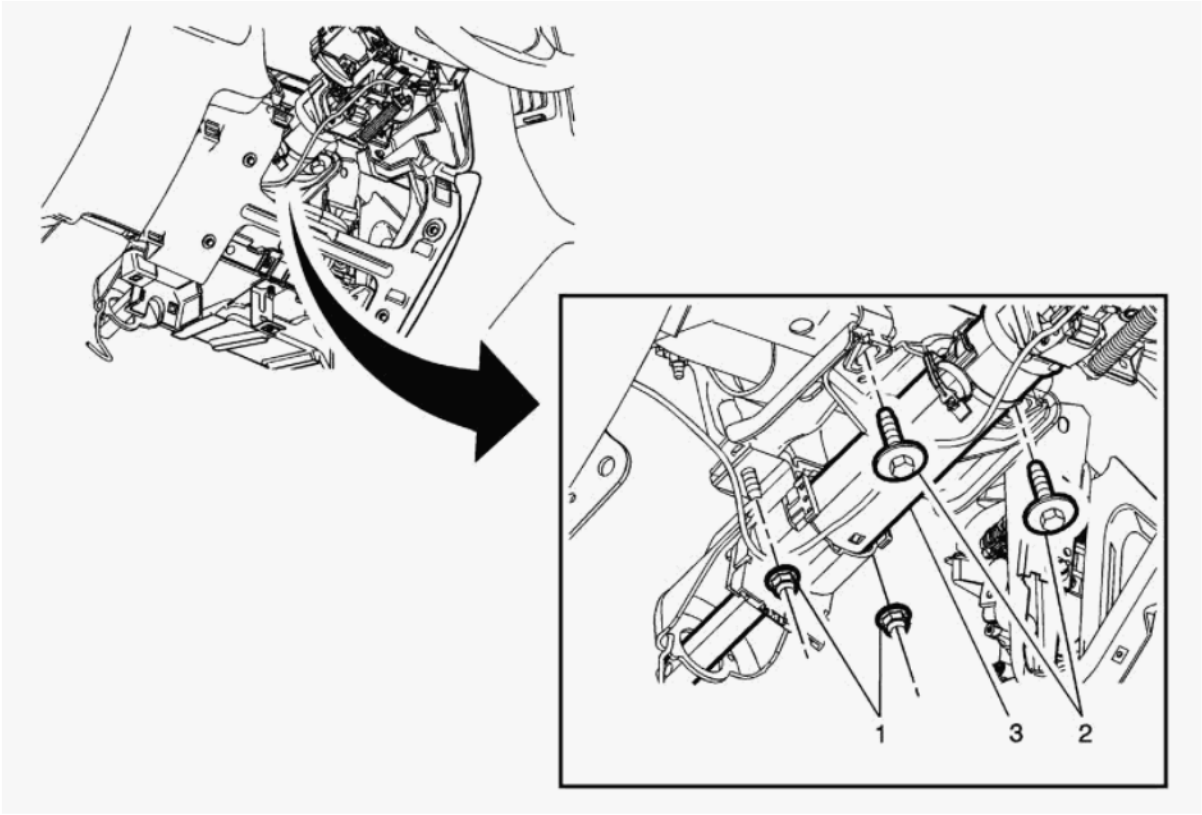


Fig. 65: Steering Column
Courtesy of GENERAL MOTORS COMPANY

14. Remove the steering column nuts (1).
15. Remove the steering column bolts (2).
16. Remove the steering column (3) from the vehicle.
17. Transfer components as necessary.

Installation Procedure

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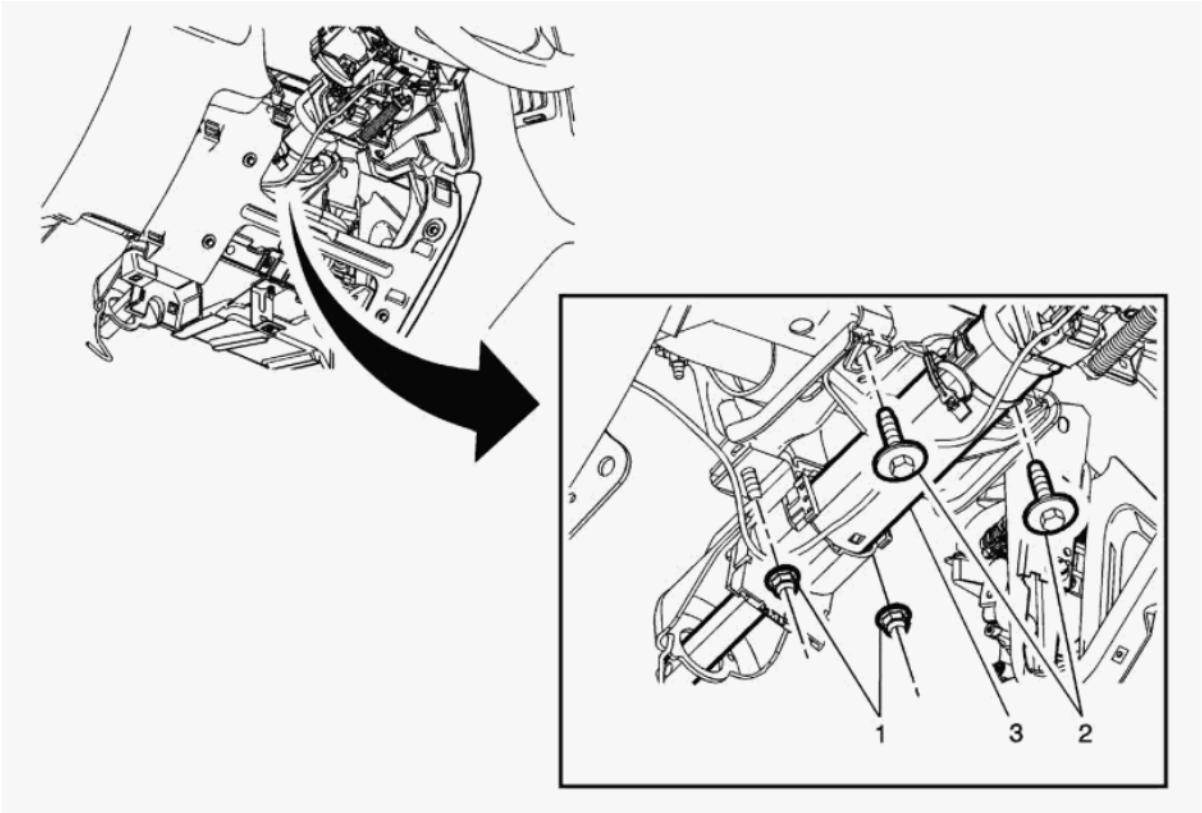


Fig. 66: Steering Column
Courtesy of GENERAL MOTORS COMPANY

1. Position the steering column (3) in the vehicle.

WARNING: In order to ensure the intended function of the steering column in a vehicle during a crash and in order to avoid personal injury to the driver, perform the following:

- **Tighten the steering column lower fasteners before you tighten the steering column upper fasteners. Failure to do this can damage the steering column.**
- **Tighten the steering column fasteners to the specified torque. Overtightening the upper steering column fasteners could affect the steering column collapse.**

2. Start the steering column nuts (1) but do NOT tighten.
3. Start the steering column bolts (2) but do NOT tighten.

CAUTION: Refer to Fastener Caution .

4. Tighten the steering column nuts (1) to 27 N.m (20 lb ft).
5. Tighten the steering column bolts (2) to 27 N.m (20 lb ft).

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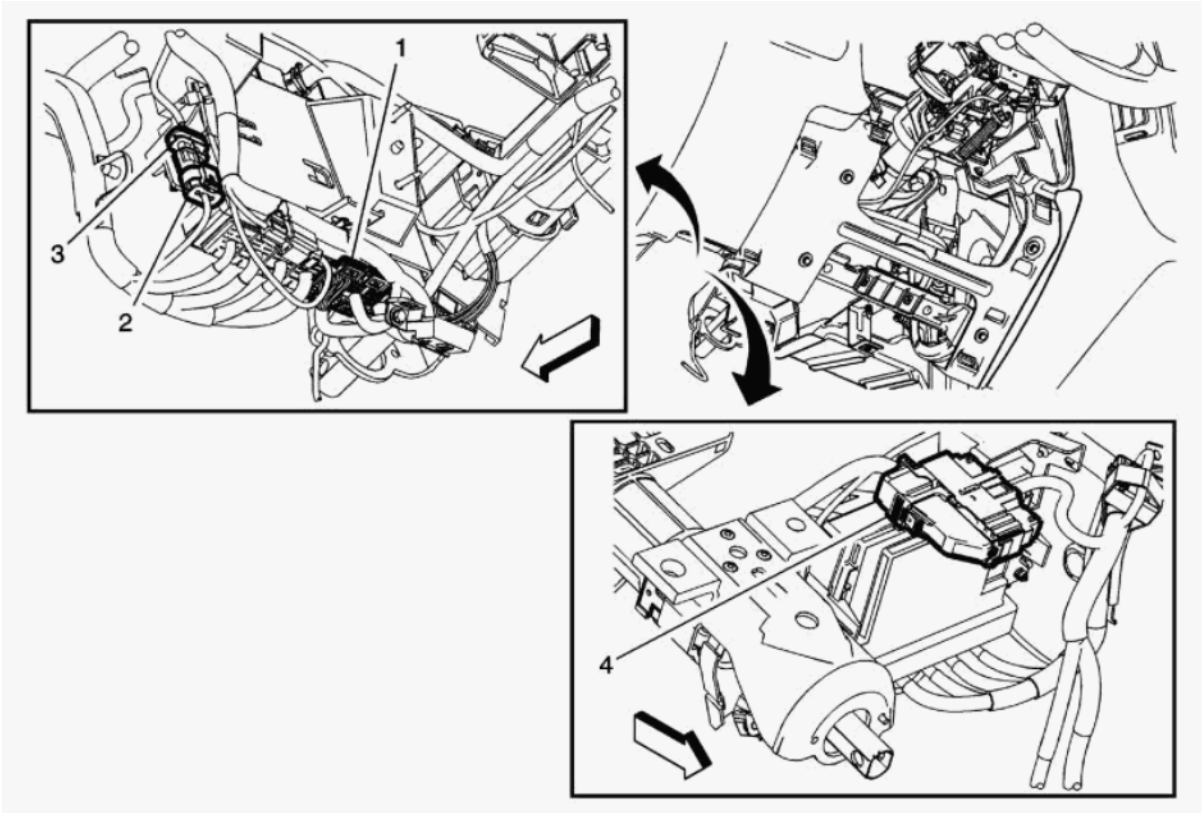


Fig. 67: Steering Column Wiring Harness Connector
Courtesy of GENERAL MOTORS COMPANY

6. Connect the steering column wiring harness connector (4) to the vehicle body wiring harness on top of the body control module bracket.

   Ensure the cam lock on the connector is secured completely.

7. Secure the steering wheel airbag wiring harness connector (3) on the plastic retainer on the body control module bracket and connect the vehicle body wiring harness connector (2).
8. Connect the steering column wiring harness connector (1) to the body control module.
9. Connect the range selector lever cable to the steering column. **Range Selector Lever Cable Replacement**
10. If equipped, connect the automatic transmission shift lock control actuator. **Automatic Transmission Shift Lock Control Actuator Replacement**
11. Connect the upper intermediate steering shaft to the steering column. **Upper Intermediate Steering Shaft Replacement**

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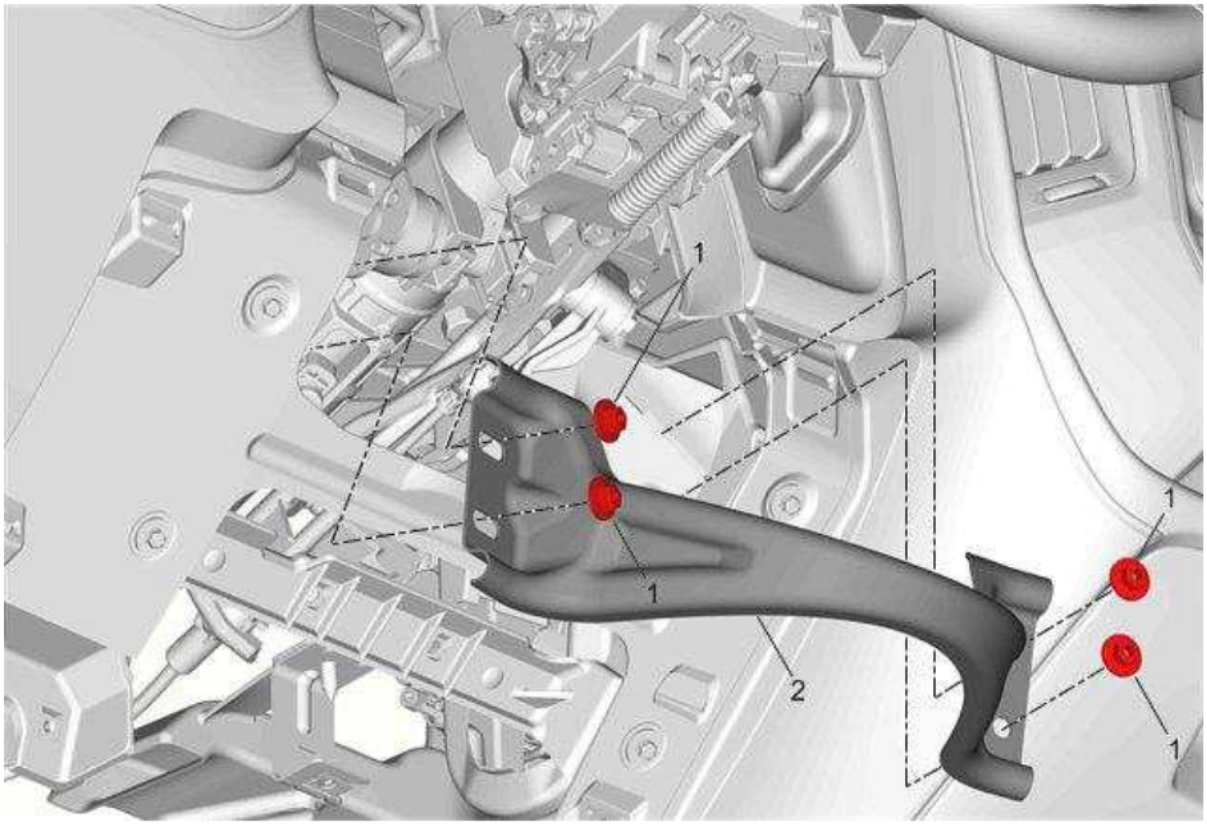


Fig. 68: Deflector And Nuts
Courtesy of GENERAL MOTORS COMPANY

12. Install the instrument panel knee bolster deflector (2) and nuts (1) and tighten the nuts to 9 N.m (80 lb in).
13. Floor Front Air Outlet Duct - Left Side - Install - **Floor Front Air Outlet Duct Replacement - Left Side**
14. Instrument Panel Knee Bolster - Install - **Instrument Panel Knee Bolster Replacement**
15. Steering Column Shroud - Install - **Steering Column Shroud Replacement (Manual Tilt)Steering Column Shroud Replacement (Manual Tilt and Telescope)**
16. Enable the SIR System. **SIR Disabling and Enabling**
17. Relearn the steering angle sensor. **Steering Wheel Angle Sensor Centering**

STEERING COLUMN SEAL REPLACEMENT

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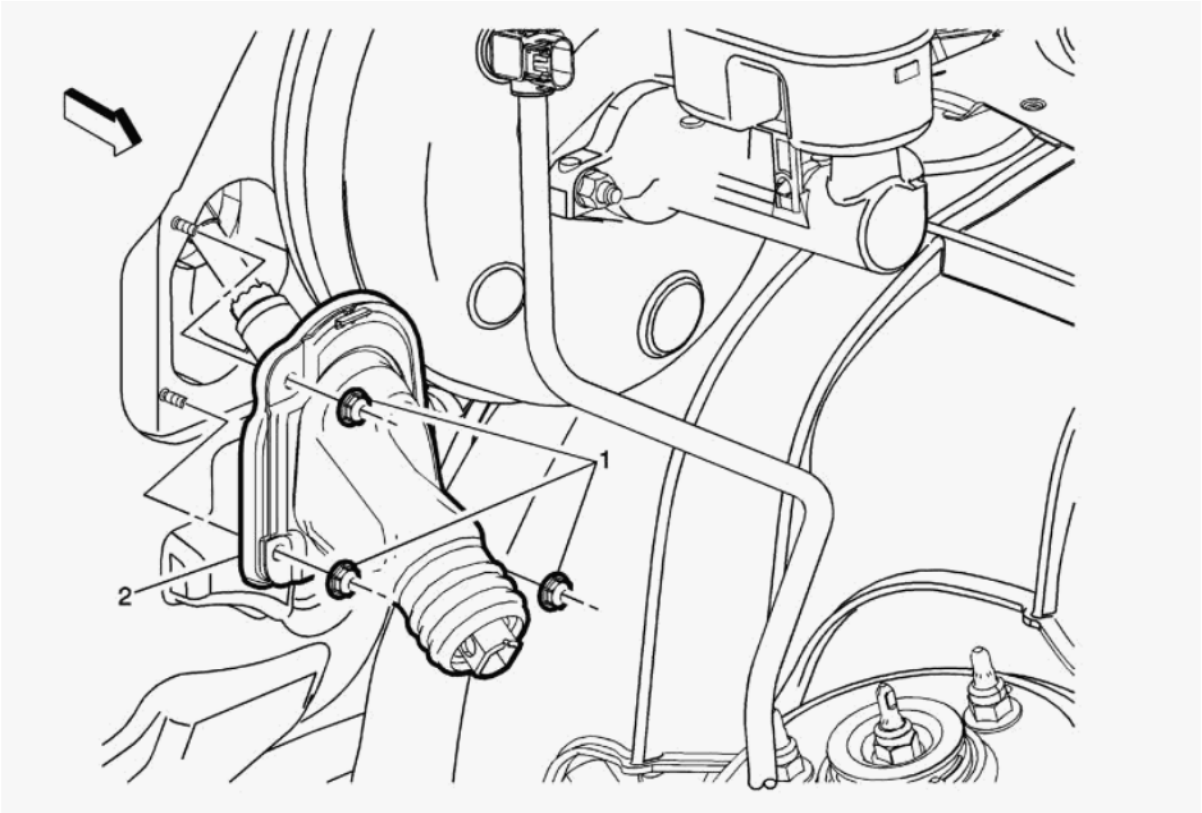


Fig. 69: Steering Column Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Intermediate Steering Shaft@Upper Intermediate Steering Shaft - Separate - **Intermediate Steering Shaft Replacement (Light Duty)Intermediate Steering Shaft Replacement (Heavy Duty)**	
1	Steering Column Seal Nut **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 3 N.m (27 lb in)
2	Steering Column Seal

STEERING SHAFT LOWER BEARING ADAPTER REPLACEMENT

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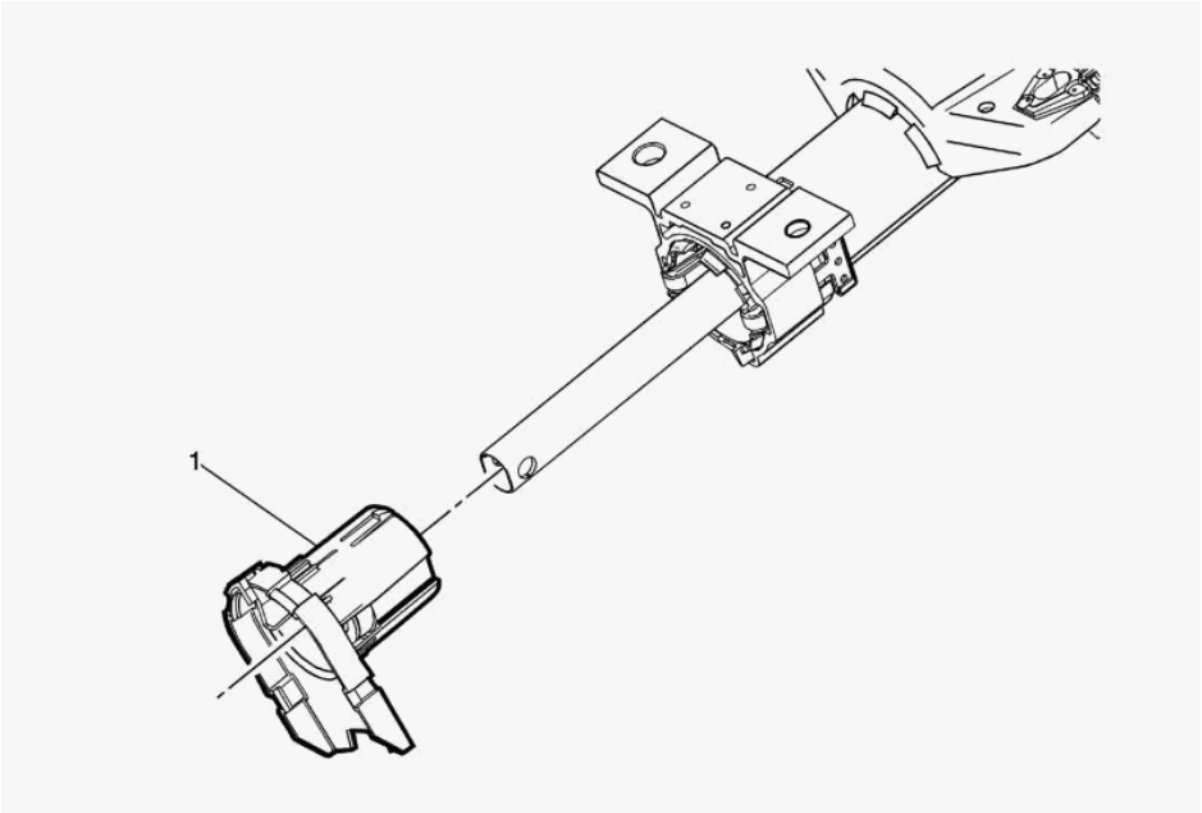


Fig. 70: Steering Shaft Lower Bearing Adapter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure **Steering Angle Sensor Replacement**	
1	Steering Shaft Lower Bearing Adapter Retainer
2	Steering Shaft Lower Bearing Adapter **Procedure** 1. Release the plastic retaining tabs and slide the steering shaft lower bearing adapter off the steering column. 2. Use the following procedure to install the steering shaft lower bearing adapter correctly: 1. Measure 154 mm (6 in) from the end of the steering column shaft and draw a line around the shaft. 2. After installing the steering shaft lower bearing adapter, slide the steering shaft lower bearing adapter retainer to the drawn mark. 3. Ensure there is approximately 3-5 mm (0.12-.020 in) clearance between the bearing adapter and retainer.

STEERING WHEEL POSITION SENSOR REPLACEMENT

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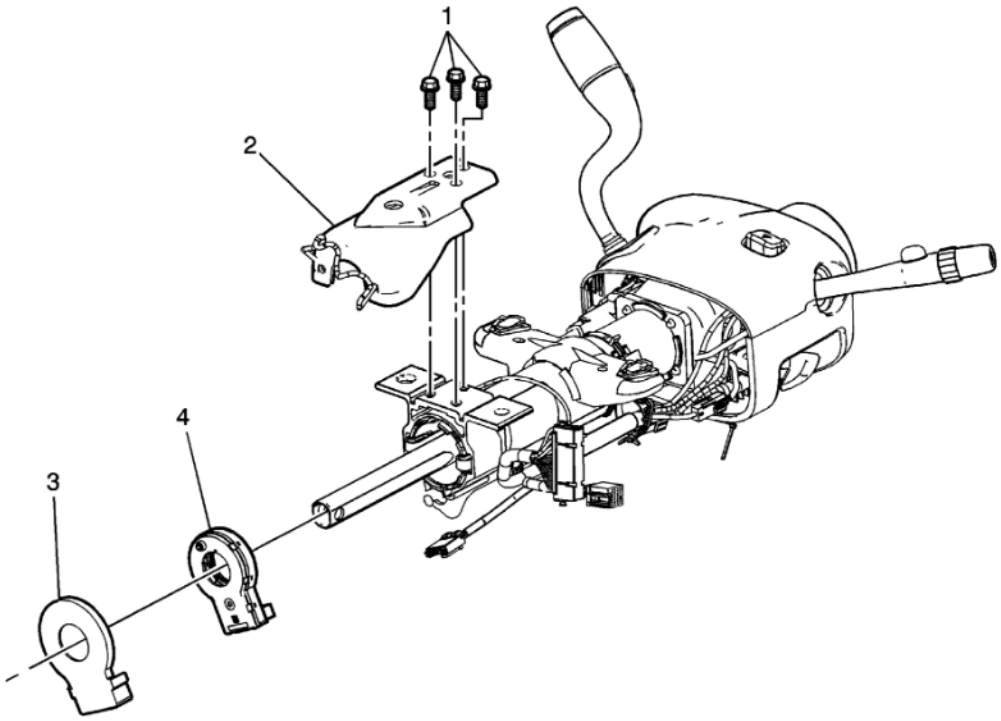


Fig. 71: Steering Wheel Position Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the steering column. Refer to **Steering Column Replacement**.	
1	Steering Column Bracket Screw (Qty: 3) **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 6 N.m (53 lb in)
2	Steering Column Bracket
3	Steering Wheel Position Sensor Retaining Clip
4	Steering Wheel Position Sensor **Procedure** Disconnect any electrical connectors as needed. • When reusing a steering wheel position sensor, you must install a pin into the sensor before removal or the sensor will lose its centered position and must be discarded. The pin diameter must be in the range of 1-2 mm. • A new steering wheel position sensor will come with a pin installed in the sensor. The steering wheel position sensor will already come centered, DO NOT remove the pin until the steering wheel position sensor is properly seated.

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Callout	Component Name
	• During installation the steering wheel position sensor must be set with approximately 3 mm gap between it and the bearing adapter.

STEERING WHEEL POSITION SENSOR CENTERING

Removal Procedure

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

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

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

1. With the wheels of the vehicle in the straight ahead position, secure the steering wheel or the steering column with a steering column anti-rotation pin, a steering column lock, or a strap, as applicable, in order to prevent rotation.

NOTE: **Identify the type of steering wheel position sensor from the illustrations shown BEFORE removing the sensor from the steering column. Once you have identified the steering wheel position sensor, follow the instructions listed in the removal procedure.**

2. Verify the type of steering wheel position sensor.

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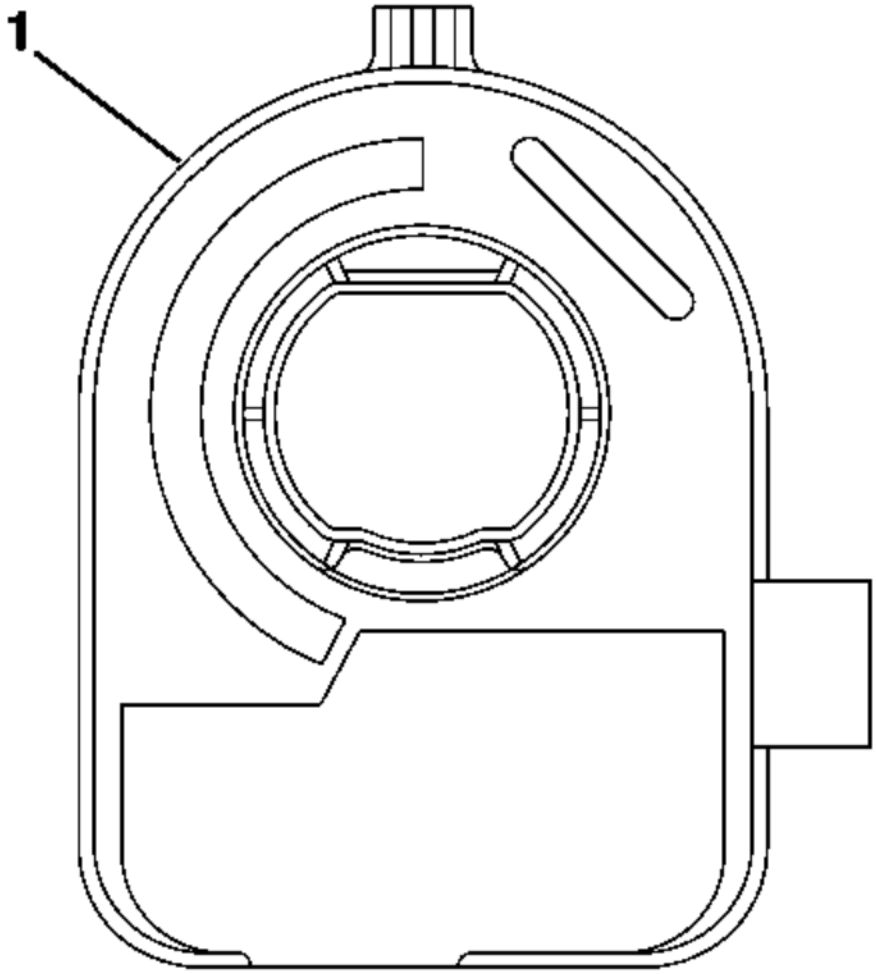


Fig. 72: FRONT Of The Sensor Connector Will Be On The Right
Courtesy of GENERAL MOTORS COMPANY

3. From the technicians point of view of the FRONT of the sensor (1), the connector will be on the right.

NOTE: **If you are reusing the existing sensor, you do not have to align the sensor before removal. Centering is not necessary in order to install the old sensor.**

4. Remove the connector from the sensor.
5. Remove the sensor from the adapter and bearing assembly.
6. To install the sensor, proceed to step 1 in the installation procedure.

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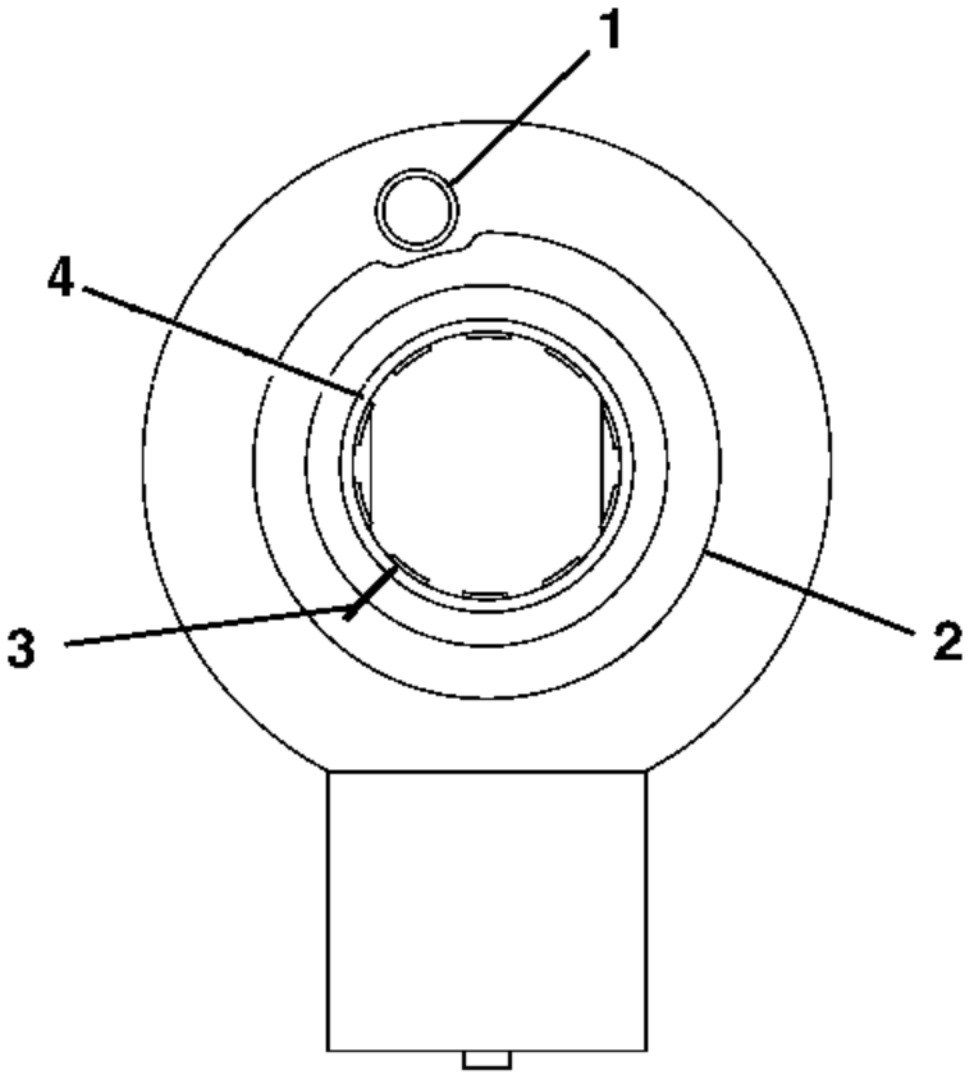


Fig. 73: Steering Wheel Position Sensor Foam Ring, Pin Hole And Rotor Flange Cuff
Courtesy of GENERAL MOTORS COMPANY

7. From the technicians point of view, the FRONT of the sensor will have:
   - A foam ring (2)
   - A pin hole (1) for the centering the pin-Note the location of the pin hole.
   - A flush rotor flange cuff (4)

NOTE: **If you are reusing the existing sensor, make an alignment mark (3) on the rotor flange cuff before removing the sensor. Failure to do so will cause misalignment of the old sensor. Replace a misaligned sensor with a new sensor.**

8. Make an alignment mark on the flush rotor flange cuff.
9. Remove the connector from the sensor.
10. Remove the sensor from the adapter and bearing assembly.

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11. To install the sensor, proceed to step 4 in the installation procedure.

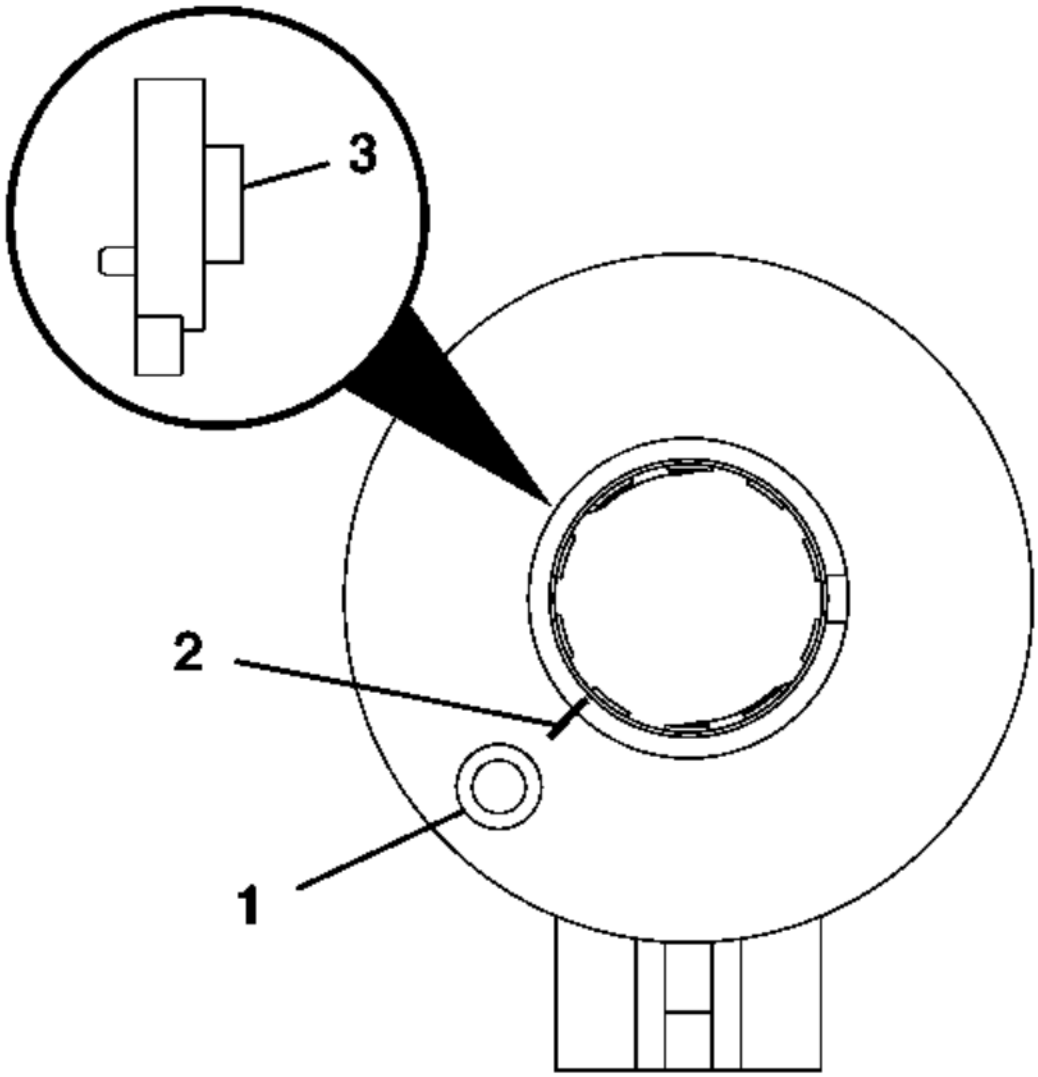


Fig. 74: Steering Wheel Position Sensor Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

12. From the technicians point of view, the FRONT of the sensor will have:
    - A raised rotor flange cuff (3)
    - An alignment mark (2) on the rotor flange cuff for installation
    - A pin hole (1) for the centering pin-Note the location of the pin hole.
13. Remove the connector from the sensor.
14. Remove the sensor from the adapter and bearing assembly.
15. To install the sensor, proceed to step 8 in the installation procedure.

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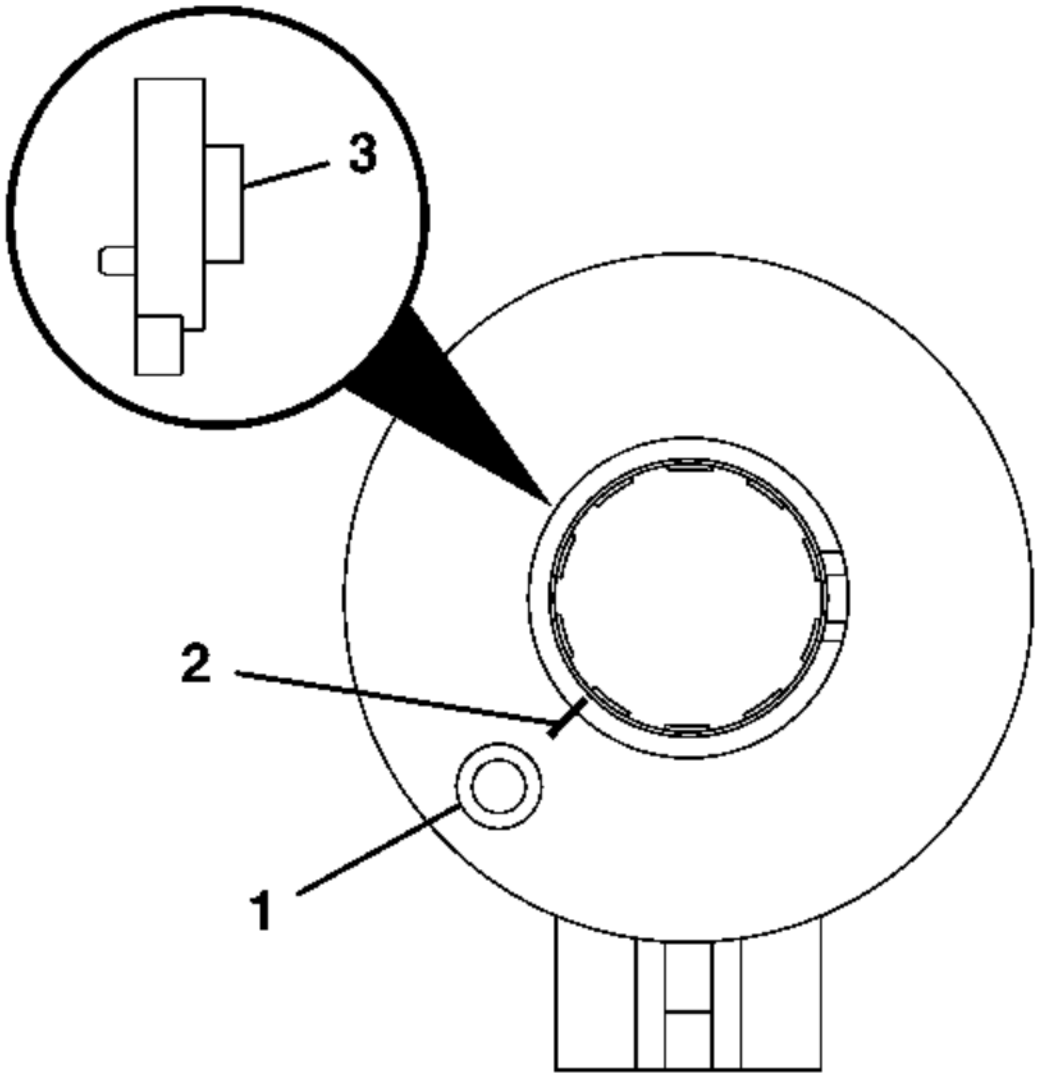


Fig. 75: Steering Wheel Position Sensor Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

16. From the technicians point of view, the FRONT of the sensor will have:
    - A raised rotor flange cuff (3)
    - An alignment mark (2) on the rotor flange cuff for installation
    - A pin hole (1) for the centering pin-Note location of the pin hole.
    - A sensor clip in FRONT of the sensor
17. Remove the connector from the sensor.
18. Remove the sensor clip from the sensor.
19. Remove the sensor from the adapter and bearing assembly.
20. To install the sensor, proceed to step 12 in the installation procedure.

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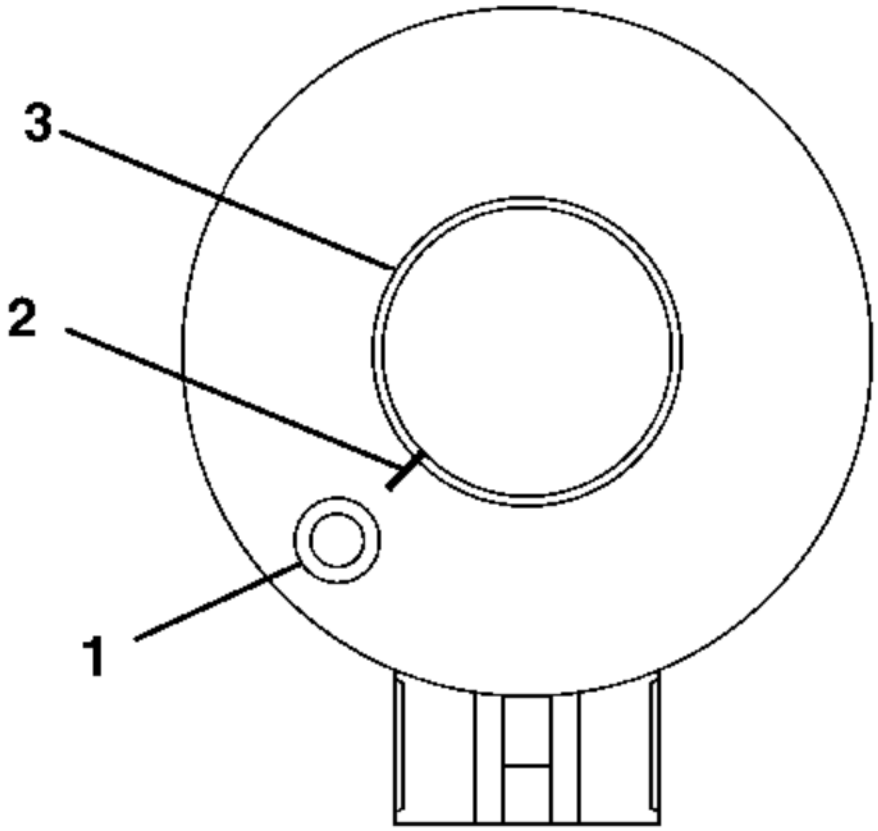


Fig. 76: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole And Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

21. From the technicians point of view, the FRONT of the sensor will have:
    - A flush rotor flange cuff (3)
    - A pin hole (1) for the centering pin-Note the location of the pin hole.
    - An alignment mark (2) on the flush rotor flange cuff for installation
22. Remove the connector from the sensor.
23. Remove the sensor from the adapter and bearing assembly.
24. To install the sensor, proceed to step 16 in the installation procedure.

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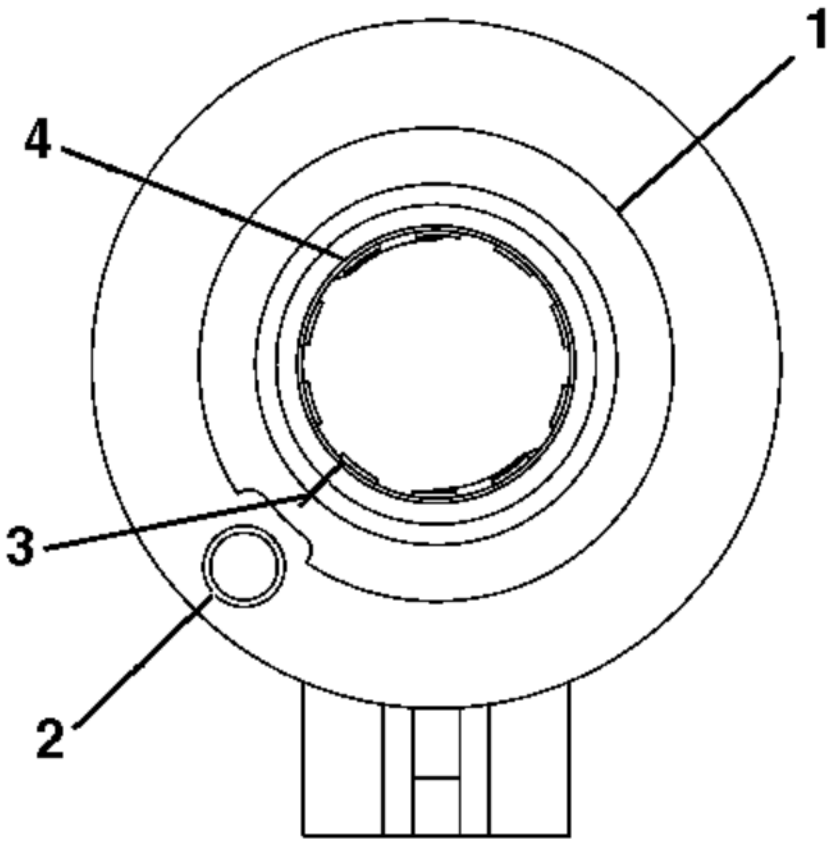


Fig. 77: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole, Alignment Mark And Foam Ring
Courtesy of GENERAL MOTORS COMPANY

25. From the technicians point of view, the FRONT of the sensor will have:
    - A flush rotor flange cuff (4)
    - A pin hole (2) for the centering pin-Note the location of the pin hole.
    - An alignment mark (3) on the flush rotor flange cuff for installation
    - A foam ring (1)
26. Remove the connector from the sensor.
27. Remove the sensor from the adapter and bearing assembly.
28. To install the sensor, proceed to step 20 in the installation procedure.

Installation Procedure

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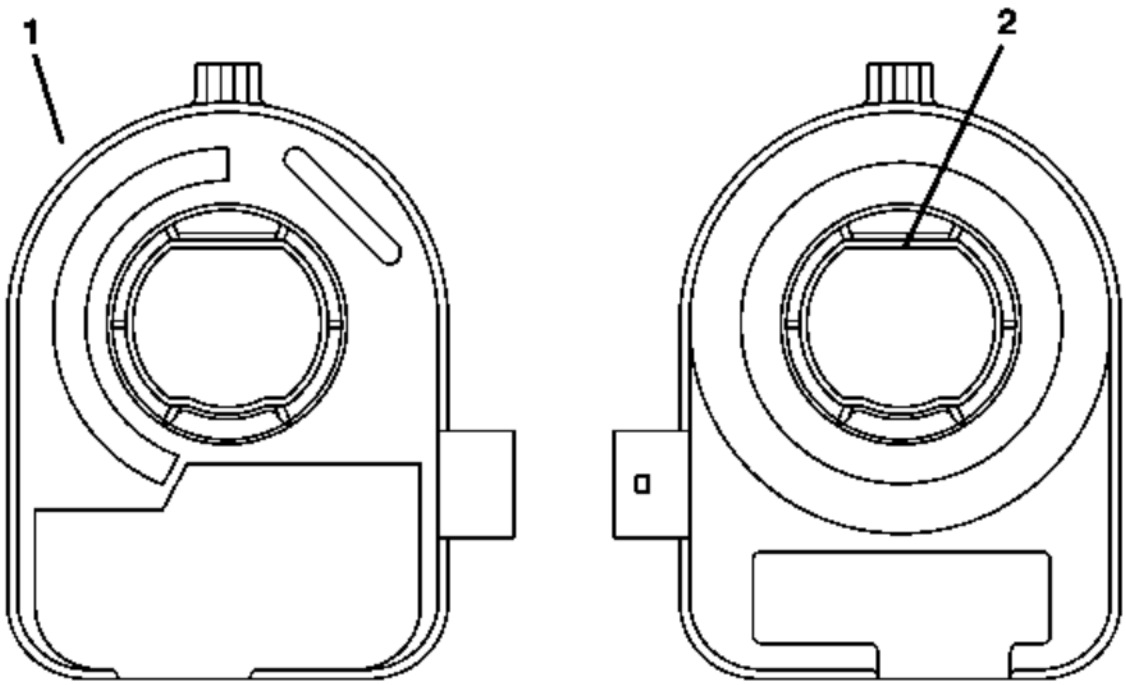


Fig. 78: Front And Back Views Of Steering Wheel Position Sensor
Courtesy of GENERAL MOTORS COMPANY

NOTE: **If you are reusing the existing sensor, centering of the old sensor is not necessary.**

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated.

1. From the technicians point of view of the FRONT of the sensor (1), the connector will be on your right.

   From the technicians point of view of the BACK of the sensor (2), the connector will be on your left.

2. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
3. Install the connector to the sensor.

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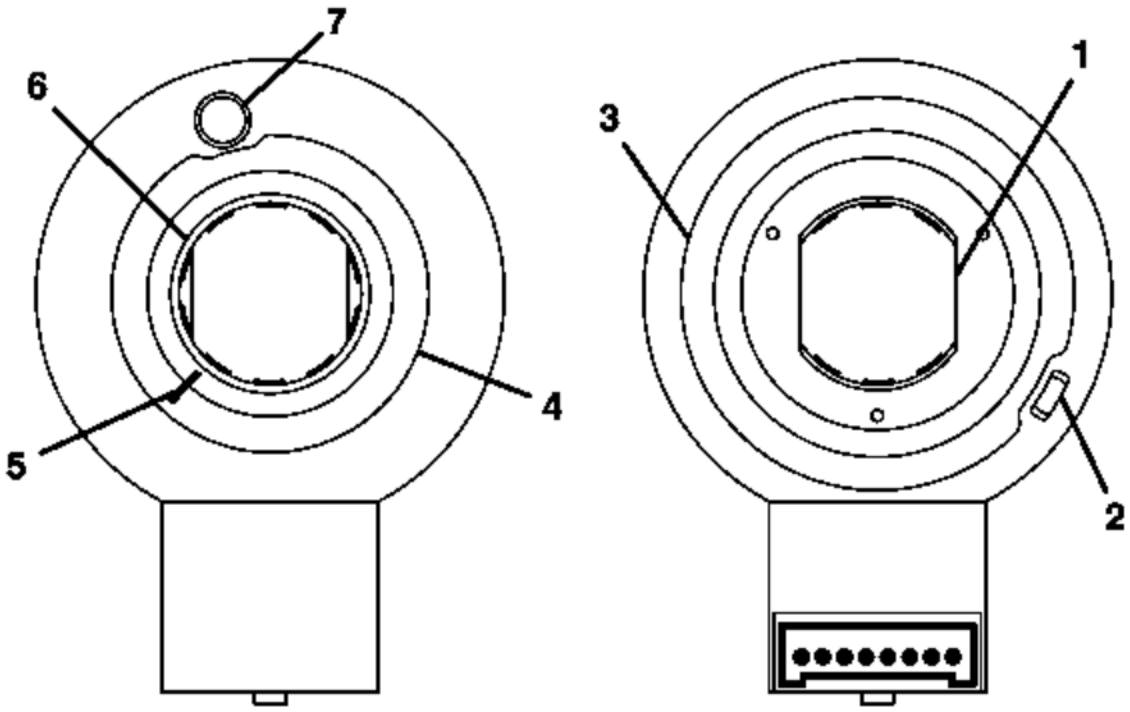


Fig. 79: Steering Wheel Position Sensor Identification Points
Courtesy of GENERAL MOTORS COMPANY

4. From the technicians point of view, the FRONT of the sensor will have:
    - A foam ring (4)
    - A pin hole (7) for the centering pin-Note the location of the pin hole.
    - A flush rotor flange cuff (6)
    - An alignment mark (5) for installation
5. From the technicians point of view, the BACK of the sensor will have:
    - Double D flats (1)
    - A foam ring (3)
    - An alignment tab (2) for installing the sensor to the adapter and bearing assembly
    - A view of the inside of the connector

NOTE: **If you are reusing the existing sensor, align the marks on the flush rotor**

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flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

6. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
7. Install the connector to the sensor.

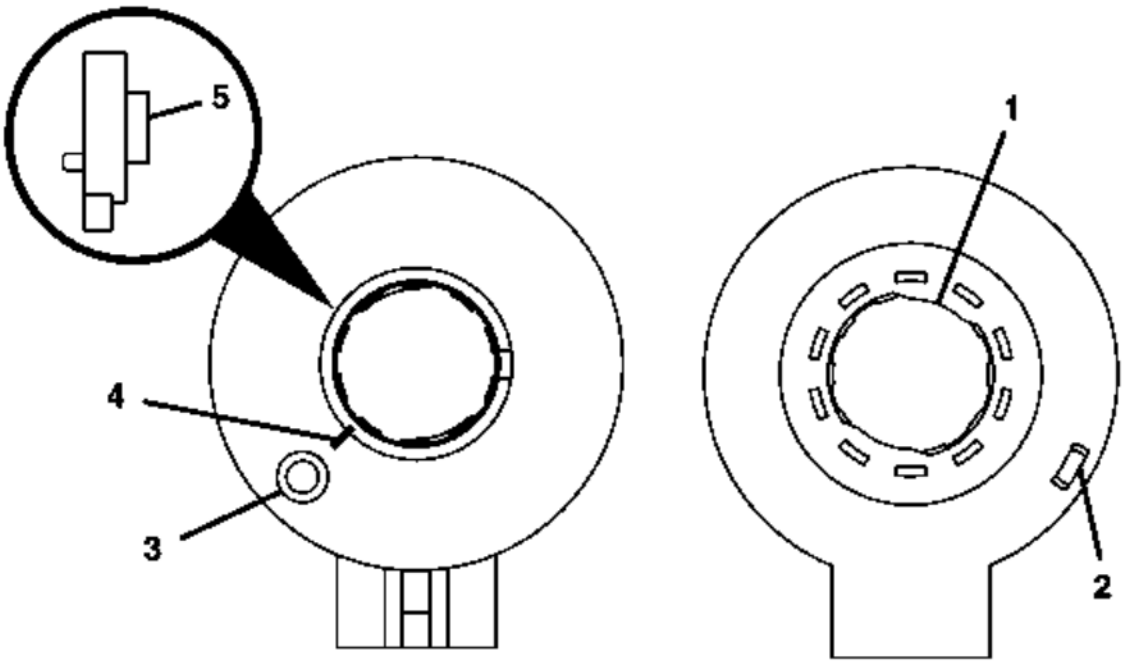


Fig. 80: Steering Wheel Position Sensor Front View
Courtesy of GENERAL MOTORS COMPANY

8. From the technicians point of view, the FRONT of the sensor will have:
    - A pin hole (3) for the centering pin-Note location of the pin hole.
    - A raised rotor flange cuff (5)

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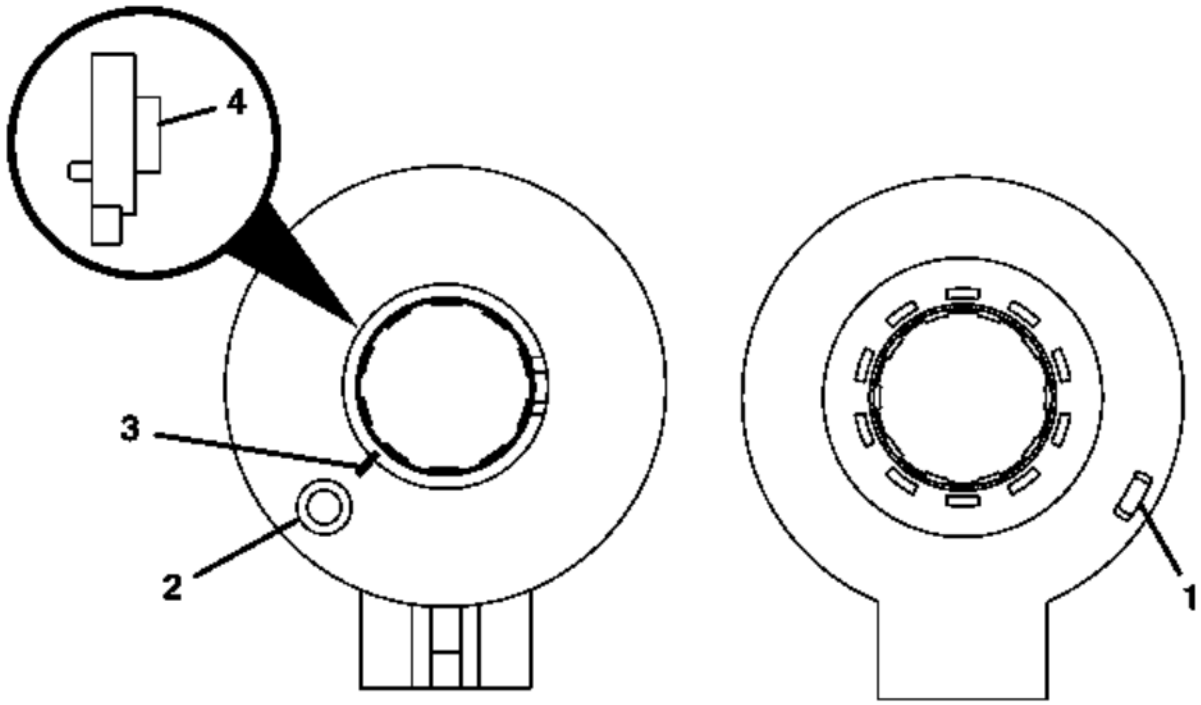
- An alignment mark (4) for installation

9. From the technicians point of view, the BACK of the sensor will have:
    - Double D flats (1)
    - An alignment tab (2) for installing the sensor to the adapter and bearing assembly

NOTE: **If you are reusing the existing sensor, align the marks on the raised rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

10. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
11. Install the connector to the sensor.



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Fig. 81: Steering Wheel Position Sensor Centering Pin Hole, Rotor Flange Cuff And Alignment Mark

Courtesy of GENERAL MOTORS COMPANY

12. From the technicians point of view, the FRONT of the sensor will have:
    - A pin hole (2) for the centering pin-Note the location of the pin hole.
    - A raised rotor flange cuff (4)
    - An alignment mark (3) for installation
13. From the technicians point of view, the BACK of the sensor will have an alignment tab (1) for installation. This sensor does not have double D flats.

NOTE: **If you are reusing the existing sensor, align the marks on the raised rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

14. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
15. Install the connector to the sensor.

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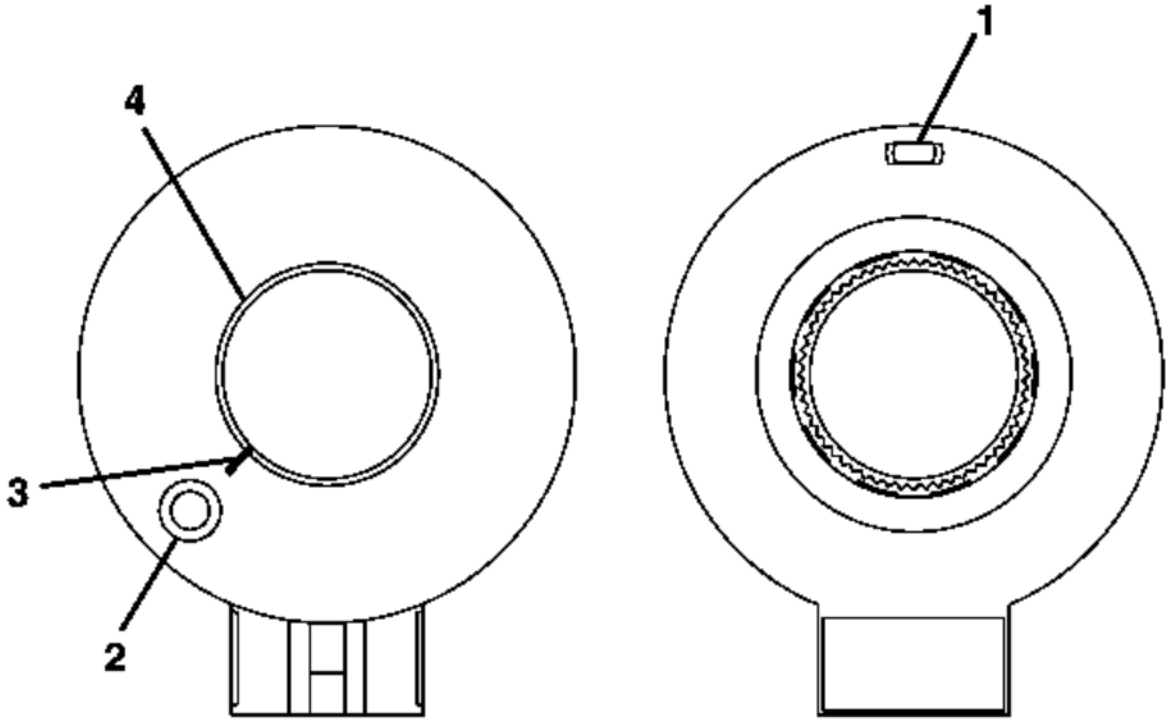


Fig. 82: Steering Wheel Position Sensor Center Pin, Rotor Flange Cuff And Installation Alignment Mark
Courtesy of GENERAL MOTORS COMPANY

16. From the technicians point of view, the FRONT of the sensor will have:
    - A pin hole (2) for the centering pin-Note the location of the pin hole.
    - A flush rotor flange cuff (4)
    - An alignment mark (3) for installation
17. From the technicians point of view, the BACK of the sensor will have an alignment tab (1) for installation. This sensor does not have double D flats.

NOTE: **If you are reusing the existing sensor, align the marks on the flush rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in

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the sensor, order a new sensor.

18. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
19. Install the connector to the sensor.

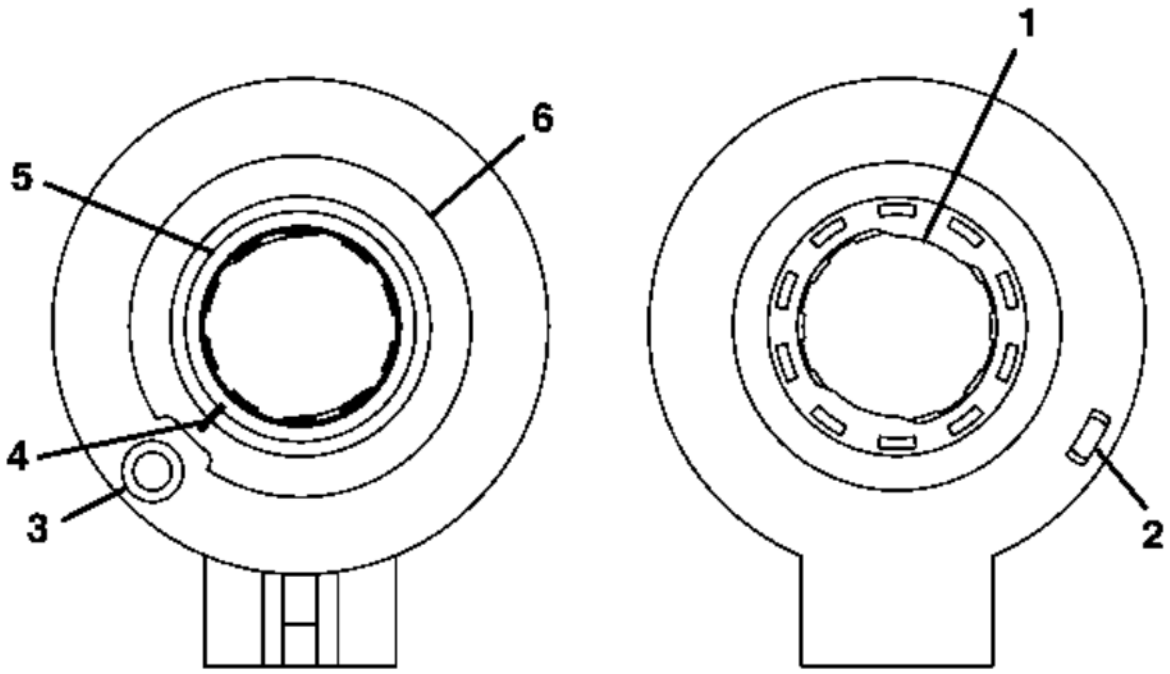


Fig. 83: Steering Wheel Position Sensor Double D Flats
Courtesy of GENERAL MOTORS COMPANY

20. From the technicians point of view, the FRONT of the sensor will have:
    - A pin hole (3) for the centering pin-Note location of the pin hole.
    - A flush rotor flange cuff (5)
    - An alignment mark (4) for installation
    - A foam ring (6)
21. From the technicians point of view, the BACK of the sensor will have:
    - Double D flats (1)

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- An alignment tab (2) for installing the sensor to the adapter and bearing assembly

NOTE: **If you are reusing the existing sensor, align the marks on the flush rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**

If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

22. Looking at the FRONT of the sensor, align the sensor with the steering shaft and install the sensor to the adapter and bearing assembly.
23. Install the connector to the sensor.

DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION

The steering wheel and column has 4 primary functions:

- Heated Steering Wheel
- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Heated Steering Wheel

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 ground to the indicator lamp and supplies voltage to the heating elements, which are internal to the steering wheel. The heated steering wheel temperature is monitored through an internal temperature sensor. When the steering wheel reaches operating temperature the module will cycle the voltage on and off to maintain the operating temperature.

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.

Vehicle Security, Found on Some Vehicle Models

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-location varies
- The steering column lock-content varies
- The ignition cylinder-location varies

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- The theft deterrent module-location varies

Driver Convenience

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

- The turn signal switch
- The hazard switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad/cruise control switch
- The redundant radio/entertainment system controls
- The manual/power tilt or tilt/telescoping functions
- The power pedal adjustment control switch
- The navigation/OnStarÂ® features
- The HVAC controls

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. In addition to these features, the following driver safety features may be on the steering column. To inspect the steering column for damage, refer to **Steering Column Accident Damage Inspection (Manual Tilt)Steering Column Accident Damage Inspection (Manual Tilt and Telescope)**.

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.

Linear Shift Assembly

If the vehicle is equipped with a column mounted gear shift, it has a linear shift assembly on the steering column. The linear shift assembly has a cable that runs from the linear shift assembly to the ignition lock cylinder case. The purpose of this cable is to prevent the ignition key from being turned to the OFF

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position when the transmission is in gear and the vehicle may still be moving. The linear shift assembly cable 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.

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** .

Automatic Transmission Shift Lock Actuator

The automatic transmission shift lock control system is a safety device that prevents an inadvertent shift out of PARK when the engine is running. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consists of the following components: the automatic transmission shift lock control solenoid, the automatic transmission shift lock control switch, the body control module (BCM), the powertrain control module (PCM)/engine control module (ECM). With the ignition in the ON position, voltage is supplied to automatic transmission shift lock control switch. Voltage flows through the normally closed contacts of the automatic transmission shift lock control switch to the automatic transmission shift lock control solenoid. When the BCM receives a class 2 message from the PCM/ECM indicating the transmission is in the park position the BCM then grounds the automatic transmission shift lock solenoid control circuit . This energizes the automatic transmission shift lock control solenoid causing the transmission shift lever to be physically locked in the PARK position. When the brake pedal is pressed the contacts in the automatic transmission shift lock control switch open, de-energizing the automatic transmission shift lock control solenoid. This allows the shift lever to be move out of the PARK position.

Steering Wheel Angle Sensor or Steering Wheel Position Sensor

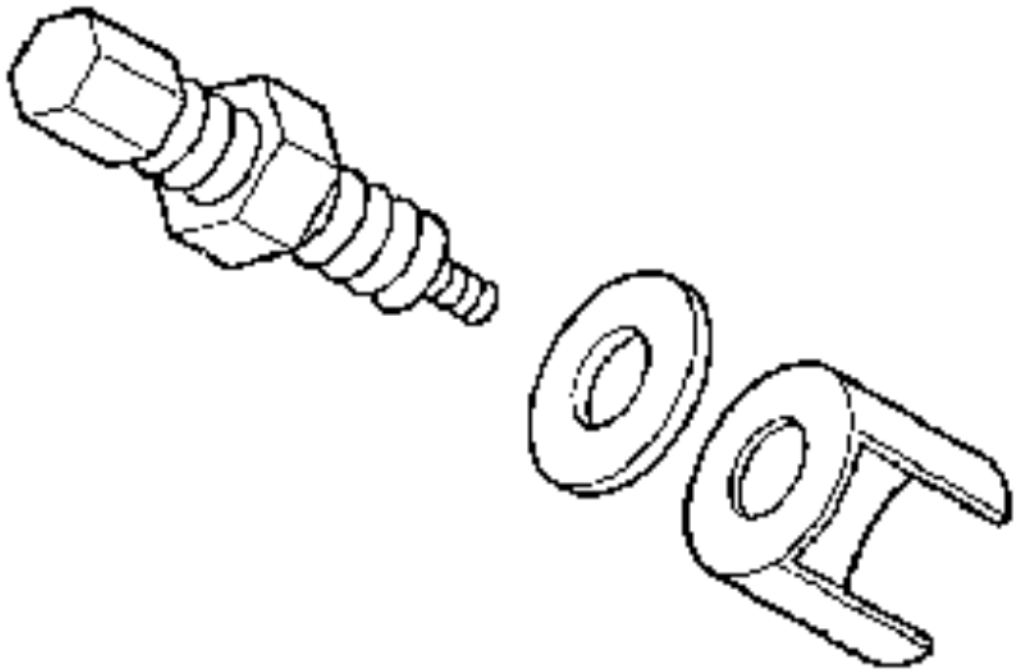
The steering wheel position sensor is located somewhere along the steering shaft assembly. The sensor measures the position of the steering wheel and the speed at which it is rotated. A signal representing this measurement is provided to the vehicle stability enhancement system (VSES) module. The VSES module uses this signal, along with several others representing different vehicle conditions, to monitor the driving behavior of the vehicle and ensure that it stays in control. If the VSES module determines that the vehicle is out of control it provides signals to the powertrain control module (PCM) and the ABS module. These output signals are used to modulate the transmission torque and brake pressure of each of the vehicles wheels in order to regain control of the vehicle.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description

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Illustration	Tool Number/ Description
	CH-21854-01 J-21854-01 Pivot Pin Remover

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Illustration	Tool Number/ Description
	CH-23653-SIR J-23653-SIR Steering Column Lock Plate Compressor

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Illustration	Tool Number/ Description
	CH-42640 J-42640 Steering Column Anti-Rotation Pin

Article GUID: A00854511

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