# 2006 STEERING

## Steering Wheel and Column - Avalanche, Escalade, Suburban, Tahoe & Yukon

## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

**Fastener Tightening Specifications**

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Column Support Bracket Nuts | 30 N.m | 22 lb ft |
| Horn Contact Plate Screws | 5.5 N.m | 49 lb in |
| Ignition Lock Cylinder Case Screws | 7 N.m | 62 lb in |
| Intermediate Shaft to the Steering Column Pinch Bolt | 62 N.m | 46 lb ft |
| Intermediate Shaft to the Steering Gear Pinch Bolt | 47 N.m | 35 lb ft |
| Knee Bolster Deflector | 9 N.m | 80 lb in |
| Linear Shift Assembly to Steering Column Mounting Screws | 10 N.m | 89 lb in |
| Shift Lever Screw | 20 N.m | 15 lb ft |
| Steering Column Bulkhead Connector Screw | 6 N.m | 53 lb in |
| Steering Column Seal Nuts | 3 N.m | 27 lb in |
| Steering Column Support Screws | 17 N.m | 13 lb ft |
| Steering Column Trim Cover Screw Lower | 3 N.m | 27 lb in |
| Steering Column Trim Cover Screw Upper | 1 N.m | 9 lb in |
| Steering Wheel Nut | 40 N.m | 29 lb ft |
| Steering Wheel Shroud Screws | 2 N.m | 18 lb in |
| Turn Signal Multifunction Switch Screws Side | 7 N.m | 62 lb in |
| Turn Signal Multifunction Switch Screws Top (Domestic Column Shift) | 3 N.m | 27 lb in |
| Turn Signal Multifunction Switch Screws Top (Domestic Floor Shift and Export Column Shift) | 7 N.m | 62 lb in |
| Upper Intermediate Shaft to Lower Intermediate Shaft Pinch Bolt | 50 N.m | 37 lb ft |

## SCHEMATIC AND ROUTING DIAGRAMS

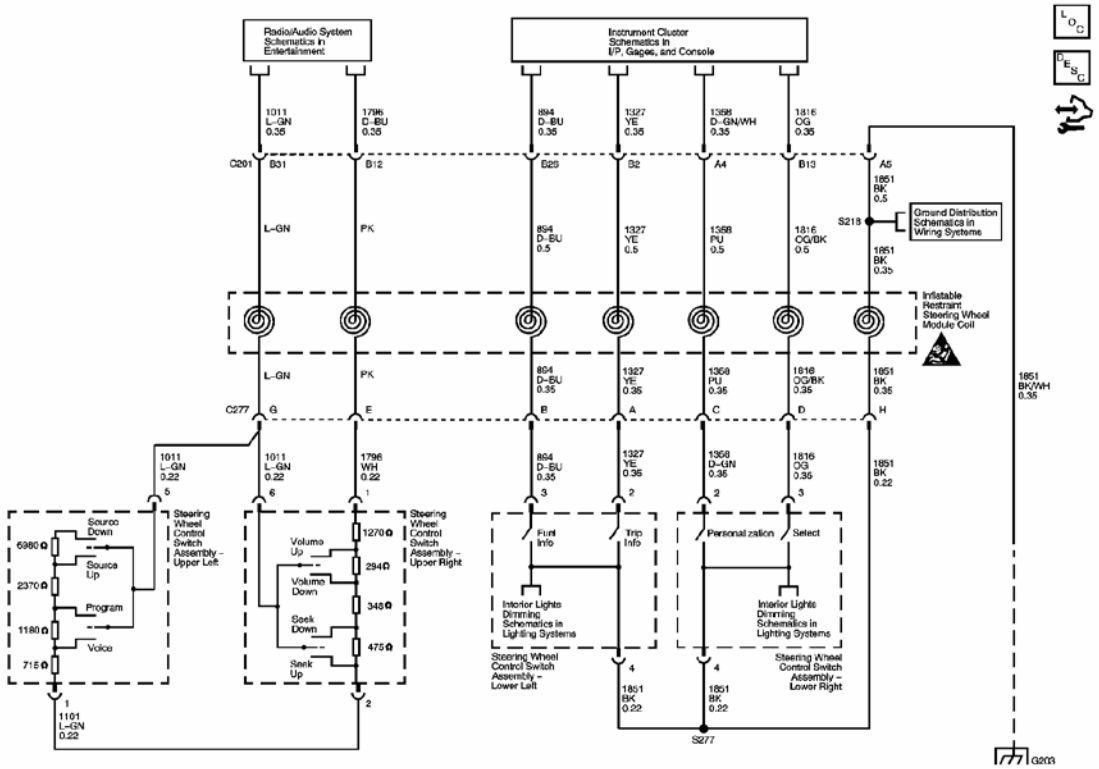
### STEERING WHEEL AND COLUMN SCHEMATIC ICONS

**Steering Wheel and Column Schematic Icons**

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| Icon | Icon Definition |
|---|---|
|  | **CAUTION:**<br>**When performing service on or near the SIR components or the SIR wiring, the SIR system must be disabled. Refer to SIR DISABLING AND ENABLING ZONES . Failure to observe the correct procedure could cause deployment of the SIR components, personal injury, or unnecessary SIR system repairs.** |

## STEERING WHEEL SCHEMATICS




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**Fig. 1: Steering Wheel Schematic**
**Courtesy of GENERAL MOTORS CORP.**

## COMPONENT LOCATOR

### STEERING COLUMN DISASSEMBLED VIEW (COLUMN SHIFT LEAN SHAFT)

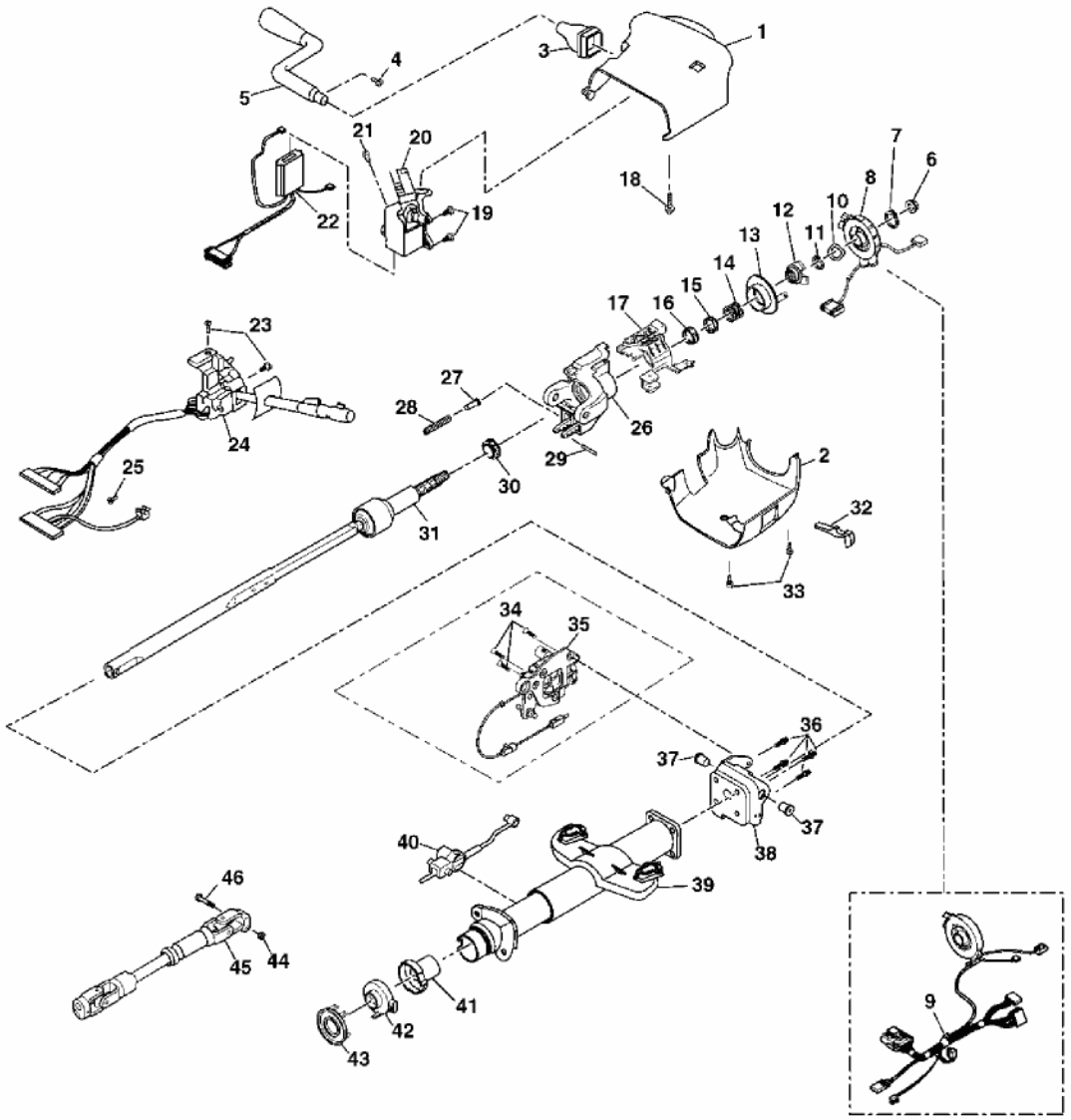



**Fig. 2: Tilt Steering Column Disassembled View (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

**Callouts For Fig. 2**

| Callout | Component Name |
|---|---|
| 1 | Upper Trim Cover |
| 2 | Lower Trim Cover |

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| | |
|---|---|
| 3 | Shift Lever Seal |
| 4 | Shift Lever Screw |
| 5 | Shift Lever |
| 6 | Flanged Prevailing Torque Nut |
| 7 | Retaining Ring |
| 8 | SIR Coil |
| 9 | SIR Coil and Harness Assembly |
| 10 | Wave Washer |
| 11 | Bearing Retainer |
| 12 | Cam Orientation Plate |
| 13 | Turn Signal Cancel Cam Assembly |
| 14 | Upper Bearing Spring |
| 15 | Upper Bearing Inner Race Seat |
| 16 | Inner Race |
| 17 | Turn Signal Switch Housing |
| 18 | TORX® Head Screw |
| 19 | Pan Head Tapping Screws |
| 20 | Ignition Lock Cylinder Case Assembly |
| 21 | Pan Head Tapping Screw |
| 22 | Ignition Switch Assembly |
| 23 | Pan Head Tapping Screws |
| 24 | Turn Signal and Multifunction Switch Assembly |
| 25 | Axial Position Assurance Connector |
| 26 | Steering Column Tilt Head Assembly |
| 27 | Spring Guide |
| 28 | Tilt Spring |
| 29 | Release Lever Pin |
| 30 | Bearing Assembly |
| 31 | Steering Column Shaft Assembly |
| 32 | Tilt Knob |
| 33 | Pan Head Tapping Screws |
| 34 | Oval Head Soc Tap Screws |
| 35 | Linear Shift Assembly |
| 36 | TORX® Head Screws |
| 37 | Pivot Pins |
| 38 | Steering Column Support Assembly |
| 39 | Steering Column Jacket Assembly |
| 40 | Automatic Transmission Shift Lock Control |

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| | |
|---|---|
| | Adapter and Bearing Assembly |
| 42 | Steering Wheel Position Sensor Assembly |
| 43 | Sensor Retainer |
| 44 | Hexagon Head Nut |
| 45 | Intermediate Shaft |
| 46 | Bolt and Retainer Assembly |

**STEERING COLUMN DISASSEMBLED VIEW (FLOOR SHIFT LEAN SHAFT)**

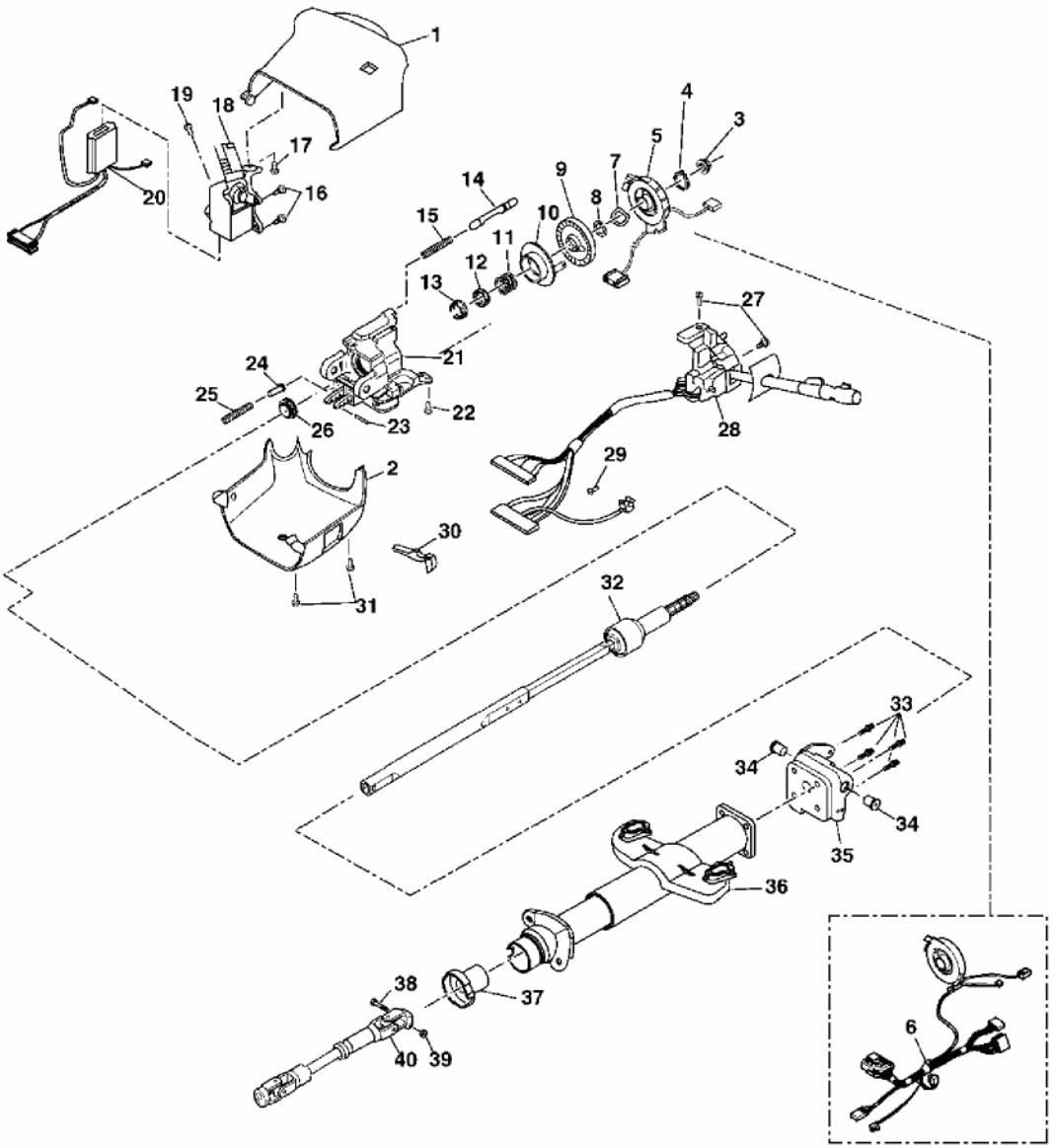



**Fig. 3: Tilt Steering Column Disassembled View (Floor Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

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**Callouts For Fig. 3**

| Callout | Component Name |
|---|---|
| 1 | Upper Trim Cover |
| 2 | Lower Trim Cover |
| 3 | Flanged Prevailing Torque Nut |
| 4 | Retaining Ring |
| 5 | SIR Coil |
| 6 | SIR Coil and Harness Assembly |
| 7 | Wave Washer |
| 8 | Bearing Retainer |
| 9 | Shaft Lock Shield Assembly |
| 10 | Turn Signal Cancel Cam Assembly |
| 11 | Upper Bearing Spring |
| 12 | Upper Bearing Inner Race Seat |
| 13 | Inner Race |
| 14 | Lock Bolt |
| 15 | Lock Bolt Spring |
| 16 | Pan Head Tapping Screws |
| 17 | TORX® Head Screw |
| 18 | Ignition Lock Cylinder Case Assembly |
| 19 | Pan Head Tapping Screw |
| 20 | Ignition Switch Assembly |
| 21 | Steering Column Tilt Head Assembly |
| 22 | TORX® Head Screw |
| 23 | Release Lever Pin |
| 24 | Spring Guide |
| 25 | Tilt Spring |
| 26 | Bearing Assembly |
| 27 | Pan Head Tapping Screws |
| 28 | Turn Signal and Multifunction Switch Assembly |
| 29 | Axial Position Assurance Connector |
| 30 | Tilt Knob |
| 31 | Pan Head Tapping Screws |
| 32 | Steering Column Shaft Assembly |
| 33 | TORX® Head Screws |
| 34 | Pivot Pins |
| 35 | Steering Column Support Assembly |
| 36 | Steering Column Jacket Assembly |
| | |

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| | |
|---|---|
| 37 | Adapter and Bearing Assembly |
| 38 | Bolt and Retainer Assembly |
| 39 | Hexagon Head Nut |
| 40 | Intermediate Shaft Assembly |

**STEERING WHEEL AND COLUMN COMPONENT VIEWS**

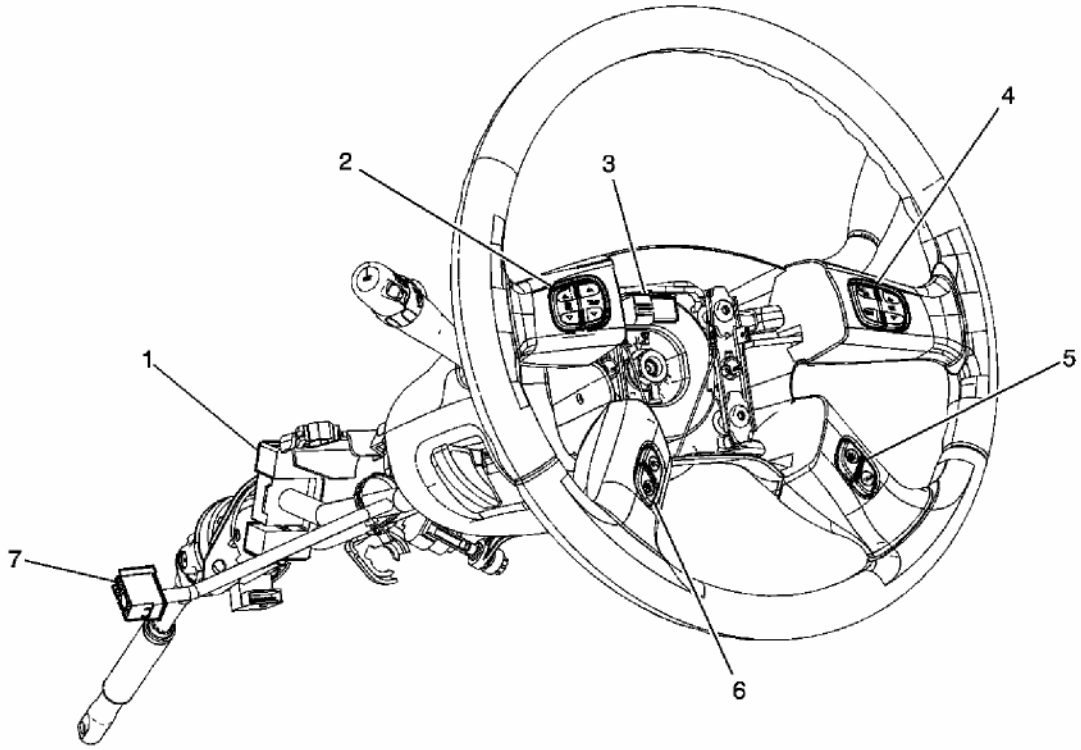



**Fig. 4: Steering Wheel and Column Components**
**Courtesy of GENERAL MOTORS CORP.**

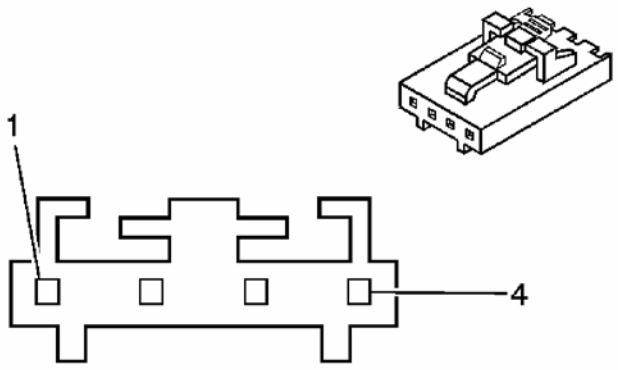
**Callouts For Fig. 4**

| Callout | Component Name |
|---|---|
| 1 | C201 |
| 2 | Upper Left - Radio |
| 3 | C277 |
| 4 | Upper Right - Radio |
| 5 | Lower Right - DIC |
| 6 | Lower Left - DIC |
| 7 | I/P Fuse Block C2 |

**STEERING WHEEL AND COLUMN CONNECTOR END VIEWS**

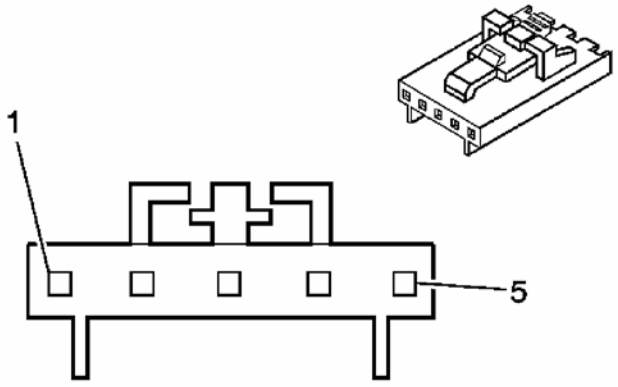
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## Steering Wheel Control Switch Assembly - Lower Left




| Connector Part Information | | • 50-57-9404<br>• 4-Way F (BK) | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | BN | 230 | Instrument Panel Lamps Dimming Control |
| 2 | YE | 1327 | Fuel Signal |
| 3 | D-BU | 894 | Trip Signal |
| 4 | BK | 2250 | Ground |

## Steering Wheel Control Switch Assembly - Lower Right

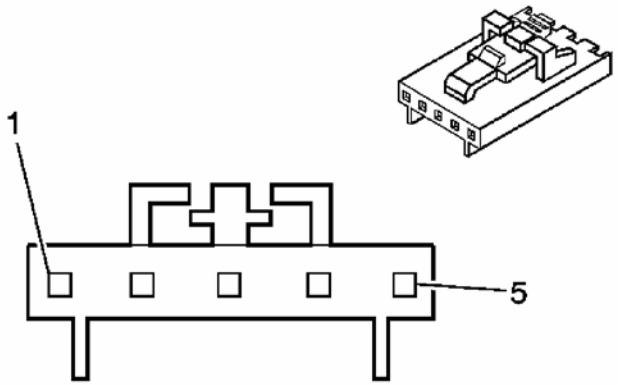



| Connector Part Information | | • 50-57-9405<br>• 5-Way F (BK) | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | BN | 230 | Instrument Panel Lamps Dimming Control |

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| | | | |
|---|---|---|---|
| 2 | D-GN | 1358 | Personalization Signal |
| 3 | OG | 1816 | Select Signal |
| 4 | BK | 2250 | Ground |
| 5 | - | - | Not Used |

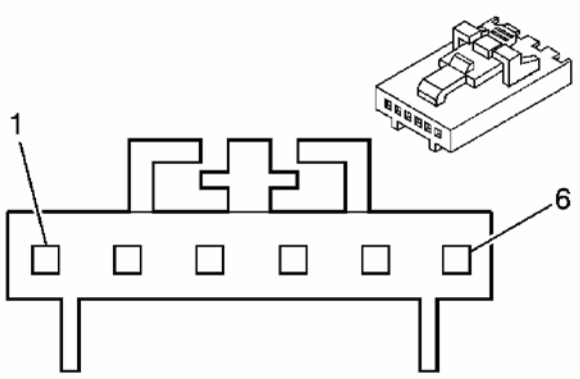
**Steering Wheel Control Switch Assembly - Upper Left**




| **Connector Part Information** | | • **50-57-9405**<br>• **5-Way F (BK)** | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | L-GN | 2283 | Remote Radio Control Signal |
| 2 | BN | 230 | Instrument Panel Lamps Dimming Control |
| 3 | BK | 2250 | Ground |
| 4 | - | - | Not Used |
| 5 | L-GN | 1011 | Remote Radio Control Signal |

**Steering Wheel Control Switch Assembly - Upper Right**

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| Connector Part Information | | • 50-57-9406<br>• 6-Way F (BK) | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | WH | 2283 | 12-Volt Reference |
| 2 | L-GN | 1011 | Remote Radio Control Signal |
| 3 | BN | 230 | Instrument Panel Lamps Dimming Control |
| 4 | - | - | Not Used |
| 5 | BK | 2250 | Ground |
| 6 | L-GN | 1101 | Remote Radio Control Signal |

## DIAGNOSTIC INFORMATION AND PROCEDURES

### DIAGNOSTIC STARTING POINT - STEERING WHEEL CONTROLS

Begin the system diagnosis with **Diagnostic System Check - Vehicle** . The Diagnostic System Check - Vehicle will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check - Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

**DTC B2815**

**DTC Descriptor**

## DTC B2815

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## Steering Wheel Controls Illegal Resistance Value

**Diagnostic Fault Information**

Always perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

**Circuit/System Description**

The body control module (BCM) supplies 12 volts to the audio steering wheel control multiple momentary contact switches and monitors the return signal. Each switch is associated to a set resistance value, when pressed a specific voltage drop occurs through a series of resistors unique to that switch. The BCM identifies the selection, then sends a serial data message that is received by the component controlled, activating the feature.

**Conditions for Running the DTC**

The ignition is ON.

**Conditions for Setting the DTC**

The BCM detects a switch voltage that is higher than normal.

**Action Taken When the DTC Sets**

The BCM will ignore the switch command.

**Conditions for Clearing the DTC**

- The DTC will become history if the BCM no longer detects a circuit malfunction.
- The history DTC will clear after 100 fault-free ignition cycles.
- The DTC can be cleared with a scan tool.

**Diagnostic Aids**

- This diagnostic is for the audio steering wheel controls.
- Before diagnosis of the steering wheel controls, ensure the primary controls of the associated component are functioning properly.
- Review schematic when testing switch resistance values.

**Reference Information**

**Schematic Reference**

**Steering Wheel Schematics**

**Connector End View Reference**

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- **Steering Wheel and Column Connector End Views**
- **Computer/Integrating Systems Connector End Views**

## Electrical Information Reference

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

#### Circuit/System Verification

Ignition ON, observe the scan tool steering wheel controls (SWC) Switch Voltage parameter in the body control module (BCM) data list. Pressing the switch should read voltage present, and drop to 0 volts when released.

#### Circuit/System Testing

It is recommended that Component Testing is performed before Circuit Testing when diagnosing steering wheel controls.

**CAUTION: Refer to SIR Caution .**

1. Ignition OFF, disconnect the right steering wheel control connector.
2. Ignition ON, with a scan tool, verify the SWC Switch Voltage parameter is at 0 volts.
   - If over 0 volts, test the remote radio control signal circuit for a short to voltage. If the circuits test normal, replace the BCM.
3. If all circuits test normal, refer to **Component Testing**.

#### Component Testing

**CAUTION: Refer to SIR Caution .**

1. Ignition OFF, disconnect the harness connector at the audio steering wheel control switches.
2. Test the switch for infinite resistance between the voltage supply terminal and the signal terminal with the switch in the open position.
   - If less than infinite resistance, replace the switch.
3. Test resistance values between the voltage supply terminal and the signal terminal with the switch closed in each position and verify readings are approximate to what the

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schematic reads.

- If values do not, replace the switch.

#### Repair Instructions

Always perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Control Switch Assembly Replacement**
- **Control Module References** for BCM replacement, setup, and programming

### STEERING WHEEL CONTROLS INOPERATIVE

#### Diagnostic Fault Information

Always perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

#### Circuit/System Description

The body control module (BCM) supplies 12 volts to the audio steering wheel control multiple momentary contact switches and monitors the return signal. Each switch is associated to a set resistance value, when pressed a specific voltage drop occurs through a series of resistors unique to that switch. The BCM identifies the selection, then sends a serial data message that is received by the component controlled, activating the feature.

#### Diagnostic Aids

- This diagnostic is for the audio steering wheel controls.
- Before diagnosis of the steering wheel controls, ensure the primary controls of the associated component are functioning properly.
- Review with the schematic when testing switch resistance values.
- If a single switch function is inoperative, test the suspect switch. Refer to **Component Testing**.
- A poor connection at the right switch could cause the left switch to malfunction or be inoperative.

#### Reference Information

#### Schematic Reference

**Steering Wheel Schematics**

**Connector End View Reference**

- **Steering Wheel and Column Connector End Views**

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- **Computer/Integrating Systems Connector End Views**

## Electrical Information Reference

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

#### Circuit/System Verification

Ignition ON, observe the scan tool steering wheel controls (SWC) Switch Voltage parameter in the BCM data list. Pressing the switch should read voltage present, and drop to 0 volts when released.

#### Circuit/System Testing

It is recommended that Component Testing is performed before Circuit Testing when diagnosing steering wheel controls.

**CAUTION: Refer to SIR Caution .**

1. Ignition OFF, disconnect the harness connector at the audio steering wheel control switches.
2. Ignition ON, test for 12 volts between the voltage supply circuit and ground at the right switch harness connector.
   - If less than 10 volts, test the voltage supply circuit for a short to ground or an open/high resistance. If circuit tests normal, replace the BCM.
3. Install a 3-amp fused jumper wire at the right switch supply voltage circuit. Toggle the jumper wire to the signal circuits at the left and the right harness connectors. Verify DTC B2815 sets.
   - If DTC B2815 does not set, test the signal circuits for a short to ground or an open/high resistance. If circuits test normal, replace the BCM.
4. Remove the 3-amp fused jumper wire.
5. Ignition OFF, test the jumper wire for less than 1.0 ohm of resistance between the left and right switch connectors.
   - If greater than 1.0 ohm, test the jumper wire circuit for an open/high resistance.
6. If circuit tests normal, test or replace the switch.

#### Component Testing

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**CAUTION: Refer to SIR Caution .**

1. Ignition OFF, disconnect the harness connector at the suspect audio steering wheel control switch.
2. Test the switch for infinite resistance between the supply voltage terminal and the signal terminal with the switch in the open position.
   - If less than infinite resistance, replace the switch.
3. Test resistance values between the supply voltage terminal and the signal terminal with the switch closed in each position and verify readings are approximate to what the schematic reads.
   - If values do not, replace the switch.

**Repair Instructions**

Always perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Control Switch Assembly Replacement**
- **Control Module References** for BCM replacement, setup, and programming

**SYMPTOMS - STEERING WHEEL AND COLUMN**

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

**Visual/Physical Inspection**

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

**Symptoms List**

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

- **Steering Column Tilt Function Inoperative**
- **Lock System Does Not Unlock**
- **Lock System Does Not Lock**
- **Lock System Sticks in Start**
- **Ignition Key Cannot Be Removed from the Ignition Lock Cylinder**

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- **Ignition Key Cannot Turn or Sticks in Any Position**
- **Noise in Steering Column**
- **High Shift Effort**
- **Looseness in Steering Column**

**SYMPTOMS - STEERING WHEEL CONTROLS**

**IMPORTANT:**

1. **Perform the Diagnostic System Check - Vehicle , before using the Symptom Tables in order to verify that all of the following conditions are true:**
   - **There are no DTCs set.**
   - **The control modules can communicate via the serial data link.**
2. **Review the system operation in order to familiarize yourself with the system functions. Refer to Steering Wheel Controls Description and Operation.**

**Visual/Physical Inspection**

- Inspect for aftermarket devices which may affect the operation of the Steering Wheel Controls System. Refer to **Checking Aftermarket Accessories** .
- Inspect for easily accessible or visible system components for obvious damage or conditions which may cause the symptom.

**Intermittent**

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

**Symptom List**

Refer to **Steering Wheel Controls Inoperative** in order to diagnose the symptom.

**LOCK SYSTEM DOES NOT UNLOCK**

**Lock System Does Not Unlock**

| Step | Action | Yes | No |
|---|---|---|---|
| DEFINITION: The lock system does not allow the key to rotate out of the OFF position. | | | |
| 1 | Did you review the Steering Wheel and Column Description and Operation? | | Go to **Steering Wheel and Column Description and** |

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| | | | |
|---|---|---|---|
| | | Go to **Step 2** | **Operation** |
| 2 | Verify that the lock system does not unlock.<br>Does the lock system operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect for an incorrect, worn, or damaged key.<br>Is the key incorrect, worn, or damaged? | Go to **Step 7** | Go to **Step 4** |
| 4 | Inspect for a faulty lock cylinder.<br>Is the lock cylinder damaged? | Go to **Step 8** | Go to **Step 5** |
| 5 | Inspect the ignition lock cylinder case assembly for damage.<br>Is the ignition lock cylinder case assembly damaged? | Go to **Step 9** | Go to **Step 6** |
| 6 | Inspect the ignition switch assembly for damage.<br>Is the ignition switch assembly damaged? | Go to **Step 10** | Go to **Step 3** |
| 7 | Replace the key. Refer to **Key and Lock Cylinder Coding** in General Information.<br>Did you complete the repair? | Go to **Step 11** | - |
| 8 | Replace the lock cylinder. Refer to **Ignition Lock Cylinder Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 9 | Replace the ignition lock cylinder case assembly. Refer to **Ignition Lock Cylinder Case Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 10 | Replace the ignition switch. Refer to **Ignition Switch Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 11 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**STEERING COLUMN TILT FUNCTION INOPERATIVE**

**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 **Steering Wheel and Column Description and Operation** |
| | Verify that the steering column tilt function | | |

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| | | | |
|---|---|---|---|
| 2 | is inoperative.<br>Does the steering column tilt function operate normally? | System OK | Go to **Step 3** |
| 3 | Verify that the shoe is not seized on the pivot pin.<br>Is the shoe seized on the pivot pin? | Go to **Step 9** | Go to **Step 4** |
| 4 | Inspect the shoe grooves for dirt, burrs, or rust.<br>Are the shoe grooves free of dirt, burrs, and rust? | Go to **Step 9** | Go to **Step 5** |
| 5 | Inspect weak or broken shoe lock spring.<br>Is the shoe lock spring weak or broken? | Go to **Step 9** | Go to **Step 6** |
| 6 | Inspect the pivot pins for binding.<br>Are the pivot pins binding? | Go to **Step 10** | Go to **Step 7** |
| 7 | Inspect for a weak or broken wheel tilt spring.<br>Is the wheel tilt spring weak or broken? | Go to **Step 11** | Go to **Step 8** |
| 8 | Inspect the steering column wiring harness for tightness.<br>Is the steering column wiring harness too tight? | Go to **Step 12** | Go to **Step 3** |
| 9 | Replace the tilt head. Refer to **Steering Column Tilt Head Housing Replacement (Tilt)**.<br>Is the repair complete? | Go to **Step 13** | - |
| 10 | Replace the pivot pins. Refer to **Lower Bearing and Steering Column Jacket Replacement (Column Shift Lean Shaft)** or **Lower Bearing and Steering Column Jacket Replacement (Floor Shift Lean Shaft)**.<br>Is the repair complete? | Go to **Step 13** | - |
| 11 | Replace the tilt spring. Refer to **Tilt Spring Replacement**.<br>Is the repair complete? | Go to **Step 13** | - |
| 12 | Reroute the steering column wiring harness to the correct location.<br>Is the steering column wiring harness routed properly? | Go to **Step 13** | - |
| 13 | Operate the steering column tilt function in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

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## LOCK SYSTEM DOES NOT LOCK

### Lock System Does Not Lock

| Step | Action | Yes | No |
|---|---|---|---|
| DEFINITION: The lock system will not allow the key to be turned to the OFF lock 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 the lock system does not lock. Does the lock system operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect for a faulty lock cylinder or release button. Is the lock cylinder or release button damaged? | Go to **Step 7** | Go to **Step 4** |
| 4 | Inspect the shift cable adjustment. Is the shift cable adjusted incorrectly? | Go to **Step 8** | Go to **Step 5** |
| 5 | Inspect the ignition switch for damage. Is the ignition switch damaged? | Go to **Step 9** | Go to **Step 6** |
| 6 | Inspect the linear shift for damage. Is the linear shift control damaged? | Go to **Step 10** | Go to **Step 7** |
| 7 | Replace the lock cylinder. Refer to **Ignition Lock Cylinder Replacement**. Did you complete the repair? | Go to **Step 11** | - |
| 8 | Adjust the shift cable. Refer to **Automatic Transmission Range Selector Cable Adjustment** in Automatic Transmission - 4L60-E/4L65-E or to **Automatic Transmission Range Selector Cable Adjustment** in Automatic Transmission - 4L80-E/4L85-E. Did you complete the repair? | Go to **Step 11** | - |
| 9 | Replace the ignition switch. Refer to **Ignition Switch Replacement**. Did you complete the repair? | Go to **Step 11** | - |
| 10 | Replace the linear shift assembly. Refer to **Linear Shift Assembly Replacement**. Did you complete the repair? | Go to **Step 11** | - |
| 11 | Operate the system in order to verify the repair. | | |

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| | | | |
|---|---|---|---|
| | Did you correct the condition? | System OK | Go to **Step 3** |

**LOCK SYSTEM STICKS IN START**

**Lock System Sticks in Start**

| Step | Action | Yes | No |
|---|---|---|---|
| 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 the lock system sticks in the START position.<br>Does the lock system operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect the ignition lock cylinder case assembly for damage.<br>Is the ignition lock cylinder case assembly damaged? | Go to **Step 6** | Go to **Step 4** |
| 4 | Inspect the lock cylinder for damage.<br>Is the lock cylinder damaged? | Go to **Step 7** | Go to **Step 5** |
| 5 | Inspect the ignition switch for damage.<br>Is the ignition switch damaged? | Go to **Step 8** | Go to **Step 3** |
| 6 | Replace the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement**.<br>Did you complete the repair? | Go to **Step 9** | - |
| 7 | Replace the lock cylinder. Refer to **Ignition Lock Cylinder Replacement**.<br>Did you complete the repair? | Go to **Step 9** | - |
| 8 | Replace the ignition switch. Refer to **Ignition Switch Replacement**.<br>Did you complete the repair? | Go to **Step 9** | - |
| 9 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**IGNITION KEY CANNOT BE REMOVED FROM THE IGNITION LOCK CYLINDER**

**Ignition Key Cannot Be Removed from the Ignition Lock Cylinder**

| Step | Action | Yes | No |
|---|---|---|---|
| | Did you review the Steering Wheel and Column Description and Operation? | | Go to **Steering Wheel and** |

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| | | | |
|---|---|---|---|
| 1 | | Go to **Step 2** | **Column Description and Operation** |
| 2 | Verify that the key cannot be removed from the lock cylinder in the OFF position.<br>Does the lock system operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect for incorrect, worn, or damaged key.<br>Is the key incorrect, worn, or damaged? | Go to **Step 5** | Go to **Step 4** |
| 4 | Inspect for a faulty lock cylinder or release button.<br>Is the lock cylinder or release button damaged? | Go to **Step 6** | Go to **Step 3** |
| 5 | Replace the key. Refer to **Key and Lock Cylinder Coding** in General Information.<br>Did you complete the repair? | Go to **Step 7** | - |
| 6 | Replace the lock cylinder. Refer to **Ignition Lock Cylinder Replacement**.<br>Did you complete the repair? | Go to **Step 7** | - |
| 7 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**IGNITION KEY CANNOT TURN OR STICKS IN ANY POSITION**

**Ignition Key Cannot Turn or Sticks in Any Position**

| Step | Action | Yes | No |
|---|---|---|---|
| 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 the lock system has a high lock effort.<br>Does the lock system operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect for an incorrect, worn, or damaged key.<br>Is the key incorrect, worn, or damaged? | Go to **Step 7** | Go to **Step 4** |
| 4 | Inspect for a faulty lock cylinder.<br>Is the lock cylinder damaged? | Go to **Step 8** | Go to **Step 5** |
| 5 | Inspect the ignition lock cylinder case assembly for damage.<br>Is the ignition lock cylinder case assembly | | |

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| | | | |
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| | damaged? | Go to **Step 9** | Go to **Step 6** |
| 6 | Inspect the ignition switch assembly for damage.<br>Is the ignition switch assembly damaged? | Go to **Step 10** | Go to **Step 7** |
| 7 | Replace the key. Refer to **Key and Lock Cylinder Coding** in General Information.<br>Did you complete the repair? | Go to **Step 11** | - |
| 8 | Replace the lock cylinder. Refer to **Ignition Lock Cylinder Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 9 | Replace the ignition lock cylinder case assembly. Refer to **Ignition Lock Cylinder Case Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 10 | Replace the ignition switch. Refer to **Ignition Switch Replacement**.<br>Did you complete the repair? | Go to **Step 11** | - |
| 11 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**NOISE IN STEERING COLUMN**

## Noise in Steering Column

| Step | Action | Yes | No |
|---|---|---|---|
| 1 | Did you review the Steering wheel and Column Description and Operation and perform the necessary inspections? | Go to **Step 2** | Go to **Steering Wheel and Column Description and Operation** |
| 2 | Verify that noise is present in the steering column during operation.<br>Is noise present in the steering column during operation? | Go to **Step 3** | System OK |
| 3 | Inspect the steering column components for looseness.<br>Is the steering column components loose? | Go to **Step 10** | Go to **Step 4** |
| 4 | Inspect the SIR/SRS coil for noise.<br>Is the SIR/SRS coil noisy? | Go to **Step 11** | Go to **Step 5** |
| 5 | Inspect the horn contact ring for lubrication.<br>Is the horn contact ring lubricated? | Go to **Step 12** | Go to **Step 6** |
| | Inspect the lock plate retaining ring for the | | |

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| | | | |
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| 6 | correct installation.<br>Is the lock plate retaining ring installed properly? | Go to **Step 13** | Go to **Step 7** |
| 7 | Inspect the shaft bearing for the following conditions:<br>• Damage<br>• Lubrication<br>• Wear<br>• Proper seating<br>Are the bearings in need of repair or replacement? | Go to **Step 14** | Go to **Step 8** |
| 8 | Inspect the spherical joint for lubrication.<br>Is the spherical joint lubricated? | Go to **Step 15** | Go to **Step 9** |
| 9 | Inspect the steering column coupling for looseness.<br>Is the steering column coupling loose? | Go to **Step 16** | Go to **Step 3** |
| 10 | Tighten the steering column components to specifications. Refer to **Fastener Tightening Specifications**.<br>Did you complete the repair? | Go to **Step 17** | - |
| 11 | Replace the SIR coil. Refer to **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil)** or **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil and Harness Assembly)** in SIR.<br>Did you complete the repair? | Go to **Step 17** | - |
| 12 | Lubricate the horn contact ring.<br>Did you complete the repair? | Go to **Step 17** | - |
| 13 | Install the lock plate retaining ring properly.<br>Did you complete the repair? | Go to **Step 17** | - |
| 14 | Repair the shaft bearings as necessary. Refer to **Lower Bearing and Steering Column Jacket Replacement (Column Shift Lean Shaft)** or **Lower Bearing and Steering Column Jacket Replacement (Floor Shift Lean Shaft)**.<br>Did you complete the repair? | Go to **Step 17** | - |
| | Lubricate the spherical joints. | | |

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| | | | |
|---|---|---|---|
| 15 | Did you complete the repair? | Go to **Step 17** | - |
| 16 | Tighten the steering column coupling to specifications. Refer to **Fastener Tightening Specifications**.<br>Did you complete the repair? | Go to **Step 17** | - |
| 17 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**HIGH SHIFT EFFORT**

**High Shift Effort**

| Step | Action | Yes | No |
|---|---|---|---|
| 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 shift effort is required in order to shift out of the PARK position.<br>Does the shifter operate normally? | System OK | Go to **Step 3** |
| 3 | Inspect for worn or damaged shift linkage components.<br>Are the shift linkage components worn or damaged? | Go to **Step 6** | Go to **Step 4** |
| 4 | Inspect for a damaged linear shift assembly.<br>Is the linear shift assembly damaged? | Go to **Step 7** | Go to **Step 5** |
| 5 | Inspect the shift cable for binding or misadjustment.<br>Is the shift cable binding or misadjusted? | Go to **Step 8** | Go to **Step 3** |
| 6 | Replace the shift cable. Refer to **Automatic Transmission Range Selector Cable Replacement** in Automatic Transmission - 4L60-E/4L65-E or to **Automatic Transmission Range Selector Cable Replacement** in Automatic Transmission - 4L80-E/4L85-E.<br>Did you complete the repair? | Go to **Step 9** | - |
| 7 | Replace the linear shift assembly. Refer to **Linear Shift Assembly Replacement**.<br>Did you complete the repair? | Go to **Step 9** | - |
| | Adjust the shift cable. Refer to **Automatic** | | |

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| | | | |
|---|---|---|---|
| 8 | **Transmission Range Selector Cable Adjustment** in Automatic Transmission - 4L60-E/4L65-E or to **Automatic Transmission Range Selector Cable Adjustment** in Automatic Transmission - 4L80-E/4L85-E.<br>Did you complete the repair? | Go to **Step 9** | - |
| 9 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

**LOOSENESS IN STEERING COLUMN**

**Looseness in Steering Column**

| Step | Action | Yes | No |
|---|---|---|---|
| 1 | Did you review the Steering Wheel and Column Description and Operation and perform the necessary inspections? | Go to **Step 2** | Go to **Steering Wheel and Column Description and Operation** |
| 2 | Verify that the steering column is loose.<br>Is the steering column loose? | Go to **Step 3** | System OK |
| 3 | Inspect the steering column mounting brackets for looseness.<br>Are the steering column mounting brackets loose? | Go to **Step 8** | Go to **Step 4** |
| 4 | Verify that the steering column bracket capsule is not sheared.<br>Is the steering column bracket capsule sheared? | Go to **Step 9** | Go to **Step 5** |
| 5 | Inspect the support screws for looseness.<br>Are the support screws loose? | Go to **Step 10** | Go to **Step 6** |
| 6 | Inspect the intermediate shaft for worn joints or looseness.<br>Is the intermediate joint worn or loose? | Go to **Step 11** | Go to **Step 7** |
| 7 | Inspect the tilt head, support and pivot pins for looseness.<br>Are there any loose components? | Go to **Step 12** | Go to **Step 2** |
| 8 | Tighten the brackets to specifications. Refer to **Fastener Tightening Specifications**.<br>Did you complete the repair? | Go to **Step 13** | - |
| | Replace the jacket assembly. Refer to | | |

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| | | | |
|---|---|---|---|
| 9 | **Lower Bearing and Steering Column Jacket Replacement (Column Shift Lean Shaft)** or **Lower Bearing and Steering Column Jacket Replacement (Floor Shift Lean Shaft)**.<br>Did you complete the replacement? | Go to **Step 13** | - |
| 10 | Tighten the support screws to specifications. Refer to **Fastener Tightening Specifications**.<br>Did you complete the repair? | Go to **Step 13** | - |
| 11 | Tighten or replace the intermediate shaft as needed. Refer to the following procedures:<br>• **Intermediate Steering Shaft Replacement - Upper**<br>• **Intermediate Steering Shaft Replacement - Lower**<br>Did you complete the repair? | Go to **Step 13** | - |
| 12 | Repair or replace the tilt head, support and pivot pins as necessary. Refer to **Steering Column Tilt Head Housing Replacement (Tilt)**.<br>Did you complete the replacement? | Go to **Step 13** | - |
| 13 | Operate the system in order to verify the repair.<br>Did you correct the condition? | System OK | Go to **Step 3** |

## REPAIR INSTRUCTIONS

### INTERMEDIATE STEERING SHAFT REPLACEMENT - UPPER

**Tools Required**

**J 42640** Steering Column Anti-Rotation Pin

**Removal Procedure**

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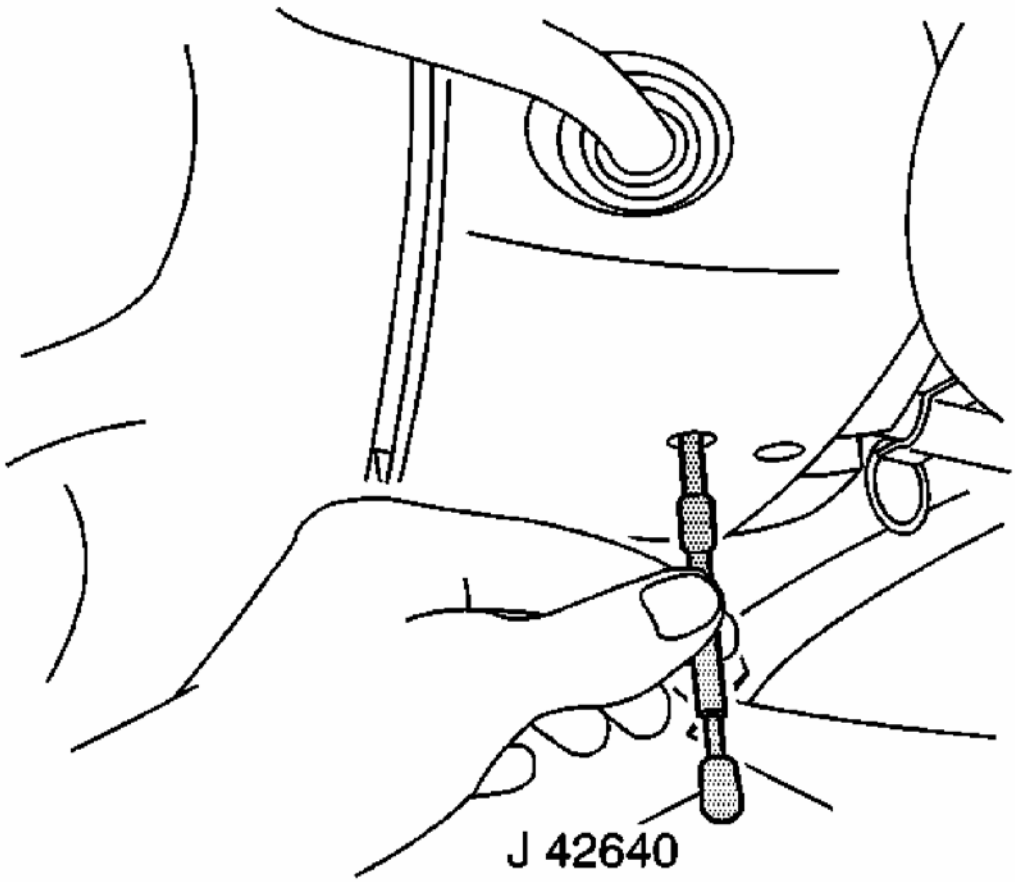



**Fig. 5: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: The wheels of the vehicle must be straight ahead and the steering column in the LOCK position before disconnecting the steering column or intermediate shaft from the steering gear. Failure to do so will cause the SIR coil assembly to become uncentered, which may cause damage to the coil assembly.**

1. Install the **J 42640** in the steering column lower access hole.

**IMPORTANT: Mark the relationship of the intermediate shaft components in order to assure proper installation.**

2. Mark the relationships of the following components:

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- Mark the relationship of the bolt and clamp at both ends of the upper intermediate shaft.
- Mark the relationship of the upper intermediate shaft to the lower intermediate shaft.

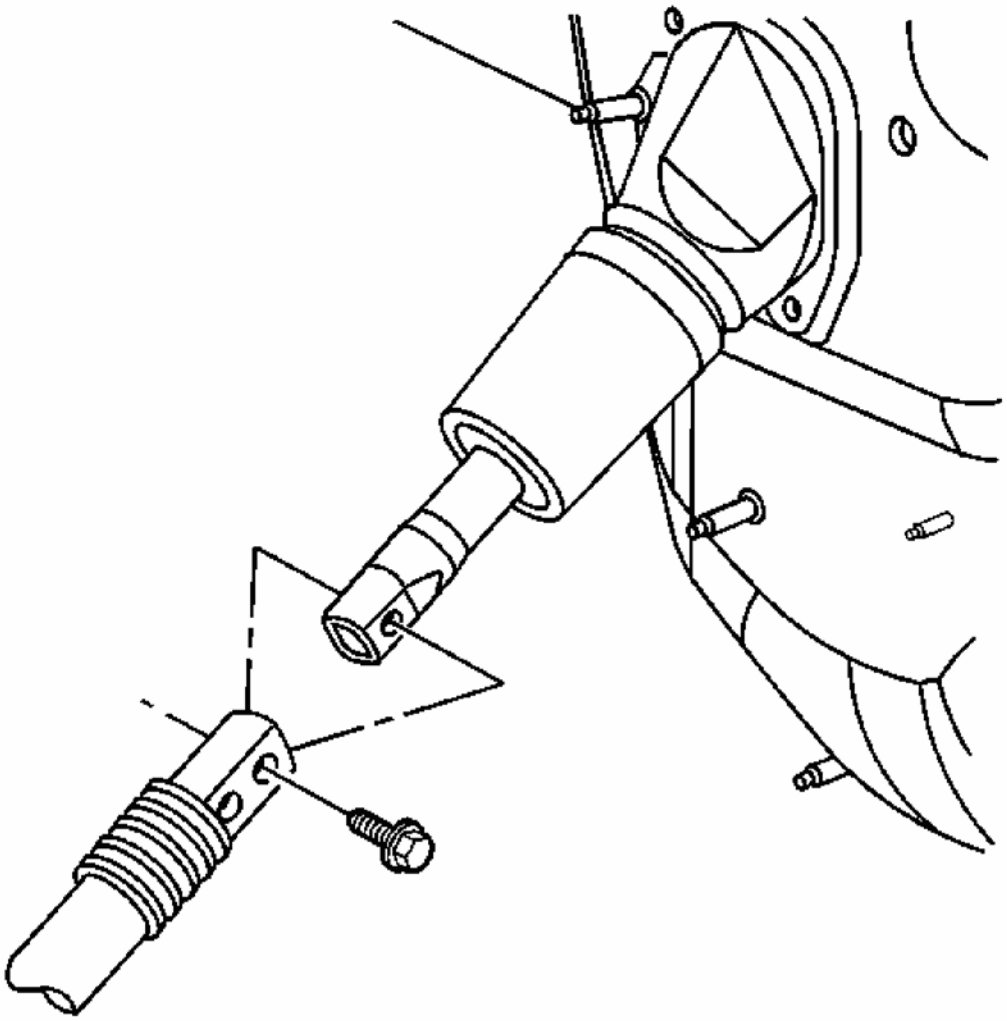


**Fig. 6: Remove The Nut And Bolt From The Lower Shaft To Upper Shaft**
**Courtesy of GENERAL MOTORS CORP.**

3. Remove the nut and bolt from the lower shaft to upper shaft connection.

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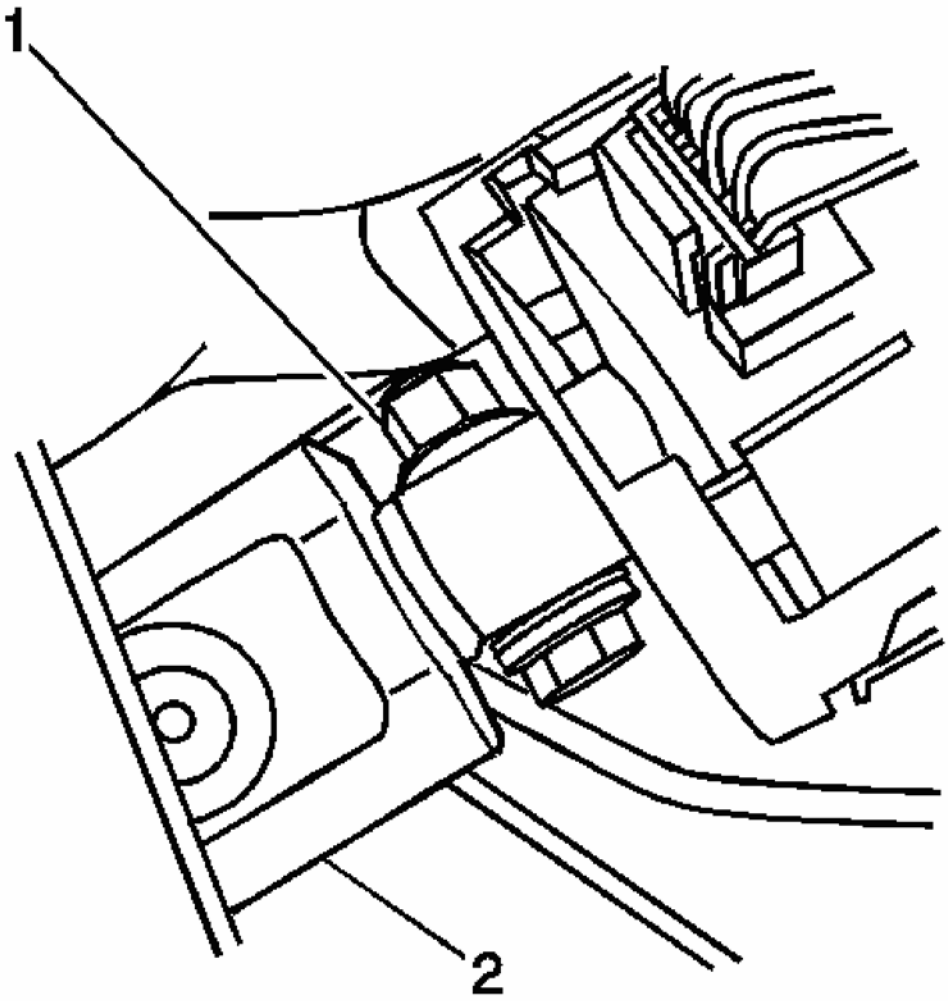



**Fig. 7: View Of Upper Shaft To Steering Column Nut Bolt**
**Courtesy of GENERAL MOTORS CORP.**

4. Remove the nut and bolt (1) from the upper shaft (2) to steering column connection.
5. Slide the intermediate shaft down, out of the steering column connection.
6. Remove the accelerator pedal position sensor. Refer to **Accelerator Pedal with Position Sensor Replacement** or **Accelerator Pedal with Position Sensor Replacement** in Engine Controls.
7. Slide the upper intermediate shaft towards the instrument panel, out of the lower intermediate shaft, and remove the shaft from the vehicle.

**Installation Procedure**

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**IMPORTANT: If you are installing the same shaft, align the marks and the relationship of the bolt and clamp made during the removal procedure.**

1. Install the lower end of the upper intermediate shaft through the bulkhead, into the lower shaft.

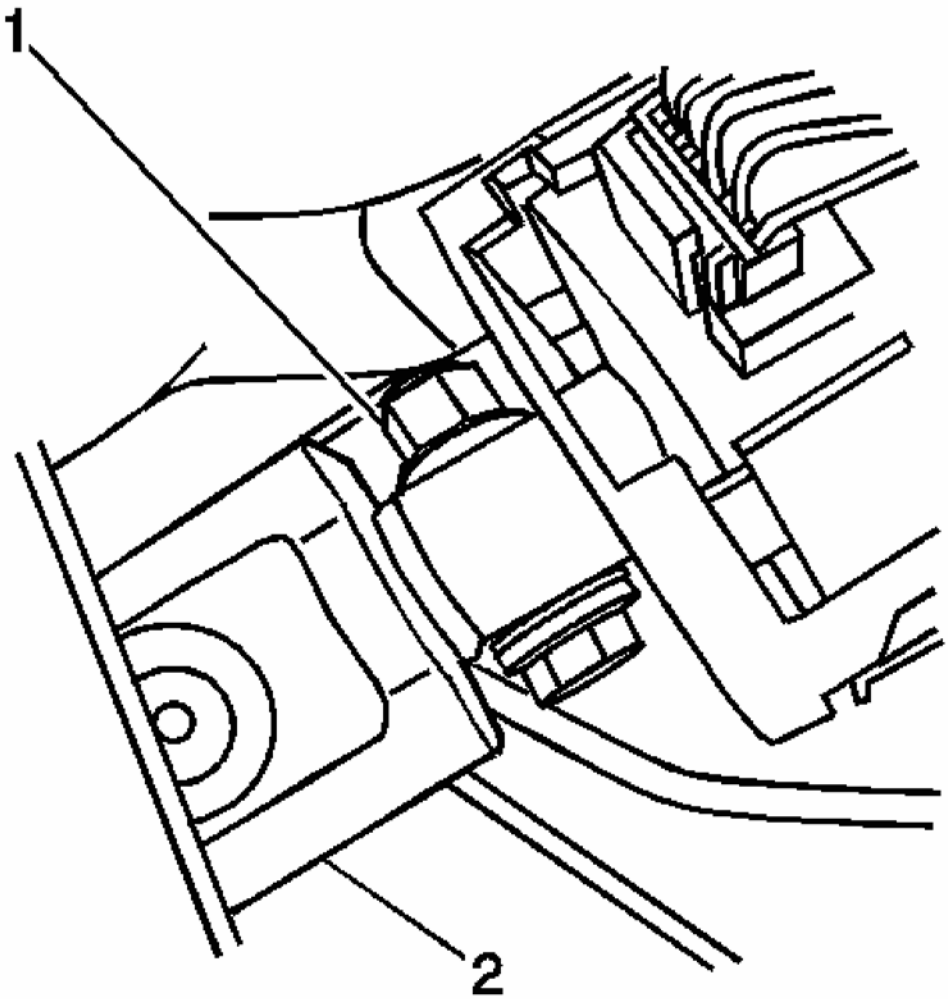



**Fig. 8: View Of Upper Shaft To Steering Column Nut Bolt**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the upper end of the upper intermediate shaft (2) to the steering column.

**NOTE: Refer to Fastener Notice in Cautions and**

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**Notices.**

3. Install the bolt and nut (1) at the connection of the upper intermediate shaft to the steering column.

   **Tighten:** Tighten the nut to 62 N.m (46 lb ft).

4. Install the accelerator pedal position sensor. Refer to **Accelerator Pedal with Position Sensor Replacement** or **Accelerator Pedal with Position Sensor Replacement** in Engine Controls.

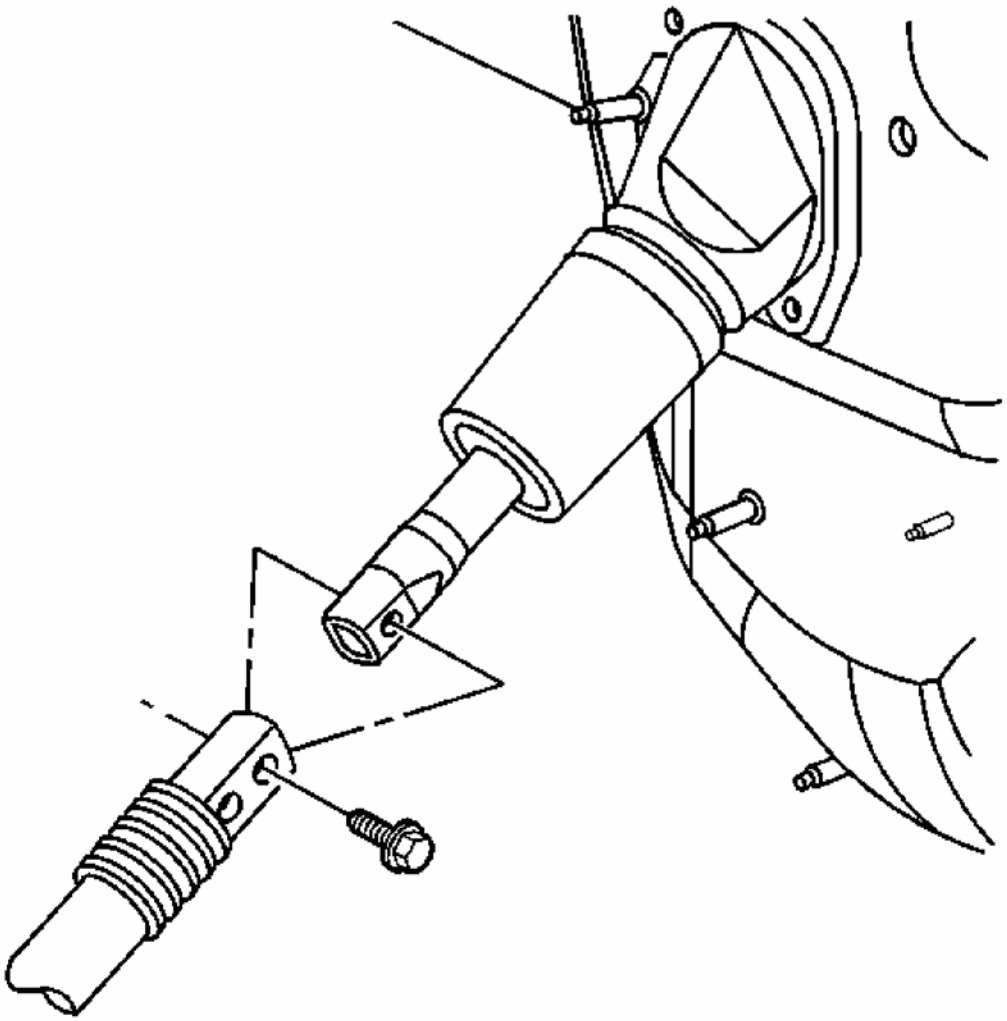


**Fig. 9: Remove The Nut And Bolt From The Lower Shaft To Upper Shaft**
**Courtesy of GENERAL MOTORS CORP.**

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5. Install the bolt and nut at the connection of the upper intermediate shaft to the lower intermediate shaft.

   **Tighten:** Tighten the nut to 50 N.m (37 lb ft).

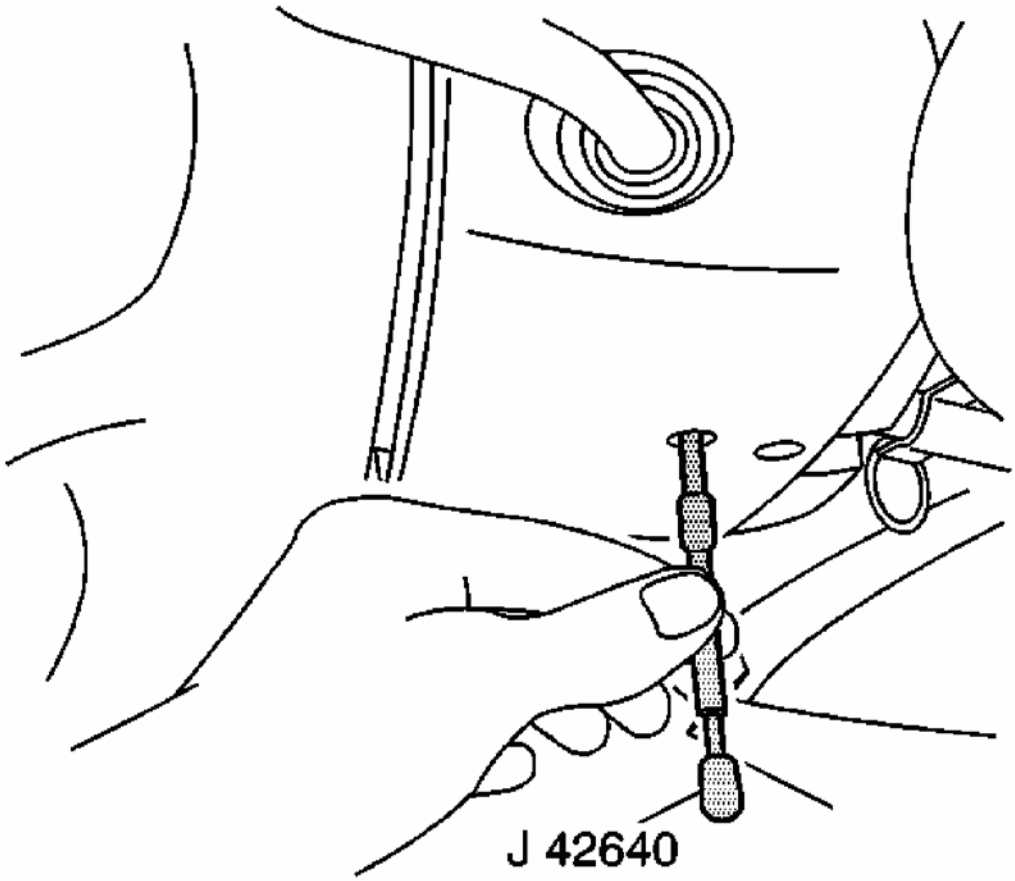



**Fig. 10: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

6. Remove the **J 42640** from the steering column lower access hole.

**INTERMEDIATE STEERING SHAFT REPLACEMENT - LOWER**

**Tools Required**

**J 42640** Steering Column Anti-Rotation Pin

**Removal Procedure**

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**CAUTION: Refer to SIR Caution in Cautions and Notices.**

**NOTE: The wheels of the vehicle must be straight ahead and the steering column in the LOCK position before disconnecting the steering column or intermediate shaft from the steering gear. Failure to do so will cause the SIR coil assembly to become uncentered, which may cause damage to the coil assembly.**

1. Set the front wheels in the straight-ahead position.

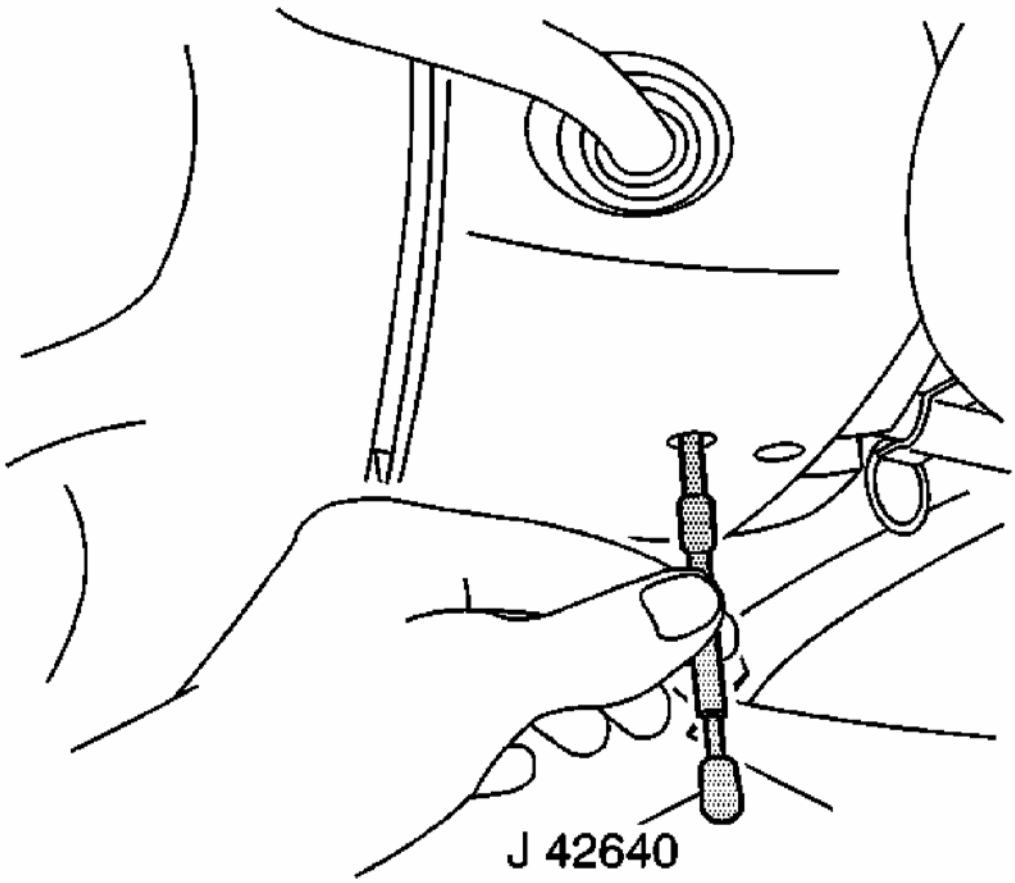



**Fig. 11: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the **J 42640** in the steering column lower access hole.
3. Mark the relationship of the intermediate shaft components in order to assure proper

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installation.

1. Mark the relationship of the upper intermediate shaft to the lower intermediate shaft.
2. Mark the relationship of the lower shaft coupler to the steering gear input shaft.

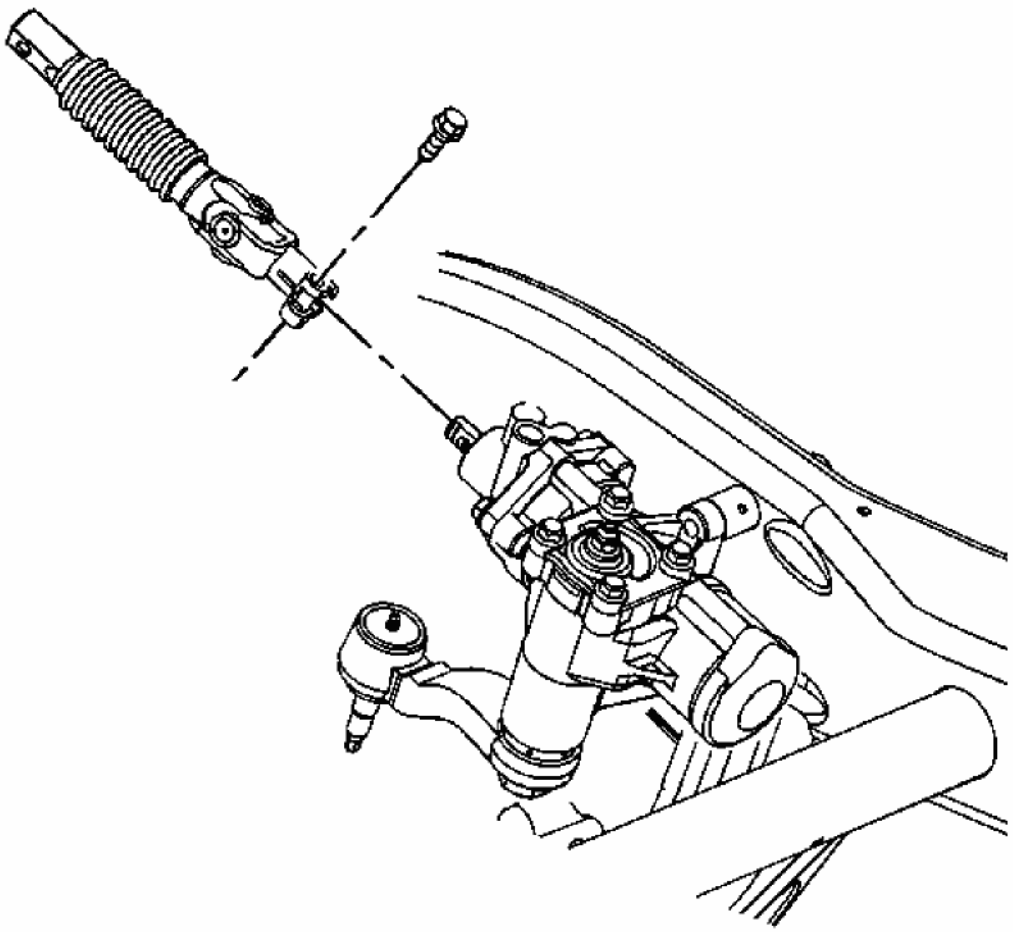


**Fig. 12: Removing The Bolt From The Upper To Lower Shaft Connection**
**Courtesy of GENERAL MOTORS CORP.**

4. Remove the bolt from the upper to lower shaft connection.
5. Remove the bolt from the lower shaft coupler.
6. Remove the intermediate shaft assembly.

Slide the shaft towards the dash in order to get the lower shaft coupler clear of the steering gear input shaft.

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7. Slide the intermediate shaft down out of the upper shaft.

**Installation Procedure**

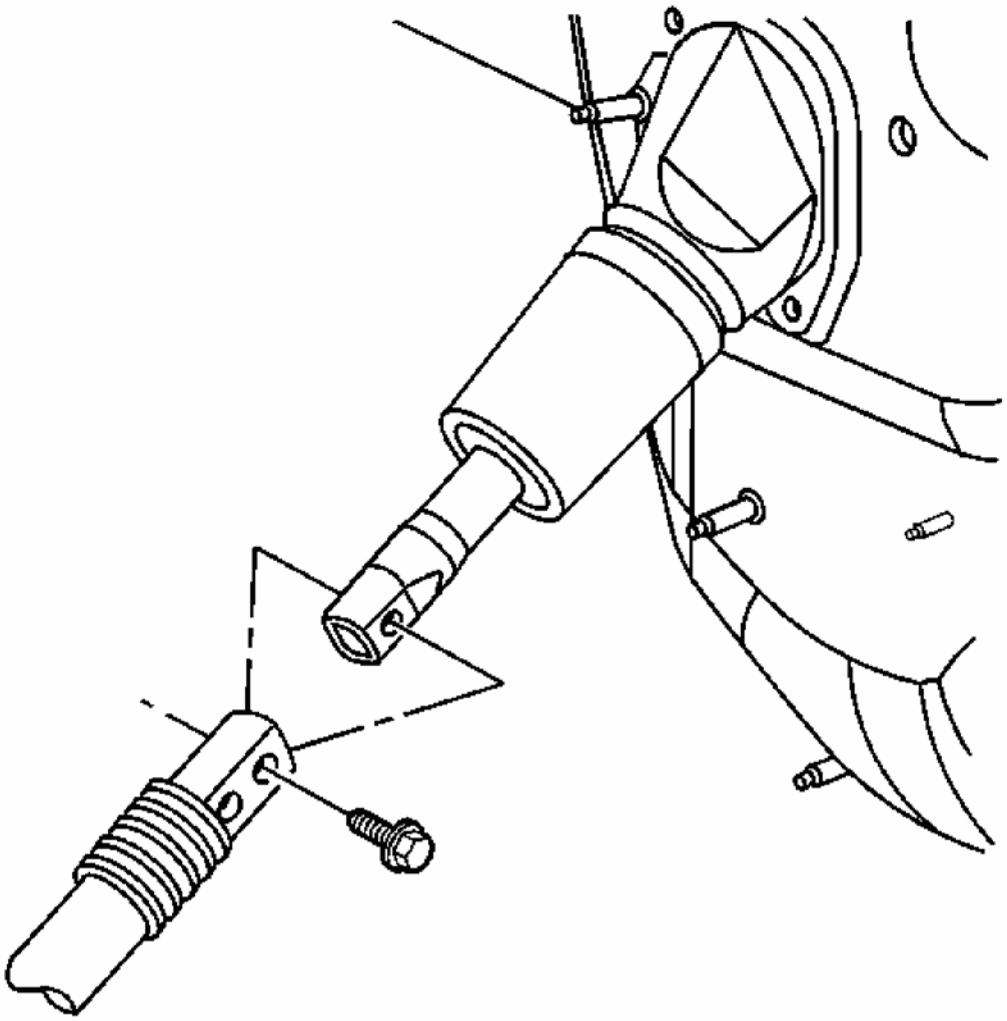


**Fig. 13: Remove The Nut And Bolt From The Lower Shaft To Upper Shaft**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the upper end of the intermediate shaft into the upper shaft.
2. Install the lower end of the intermediate shaft coupler.
    1. If you are reinstalling the same shaft, align the marks made during the removal procedure.
    2. Install the lower end of the intermediate shaft coupler onto the steering gear worm shaft.

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3. Install the bolt to the lower shaft coupler.

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

4. Install the bolt to the upper end of the shaft.

**Tighten:**

- Tighten the upper bolt to 47 N.m (35 lb ft).
- Tighten the coupler pinch bolt to 50 N.m (37 lb ft).

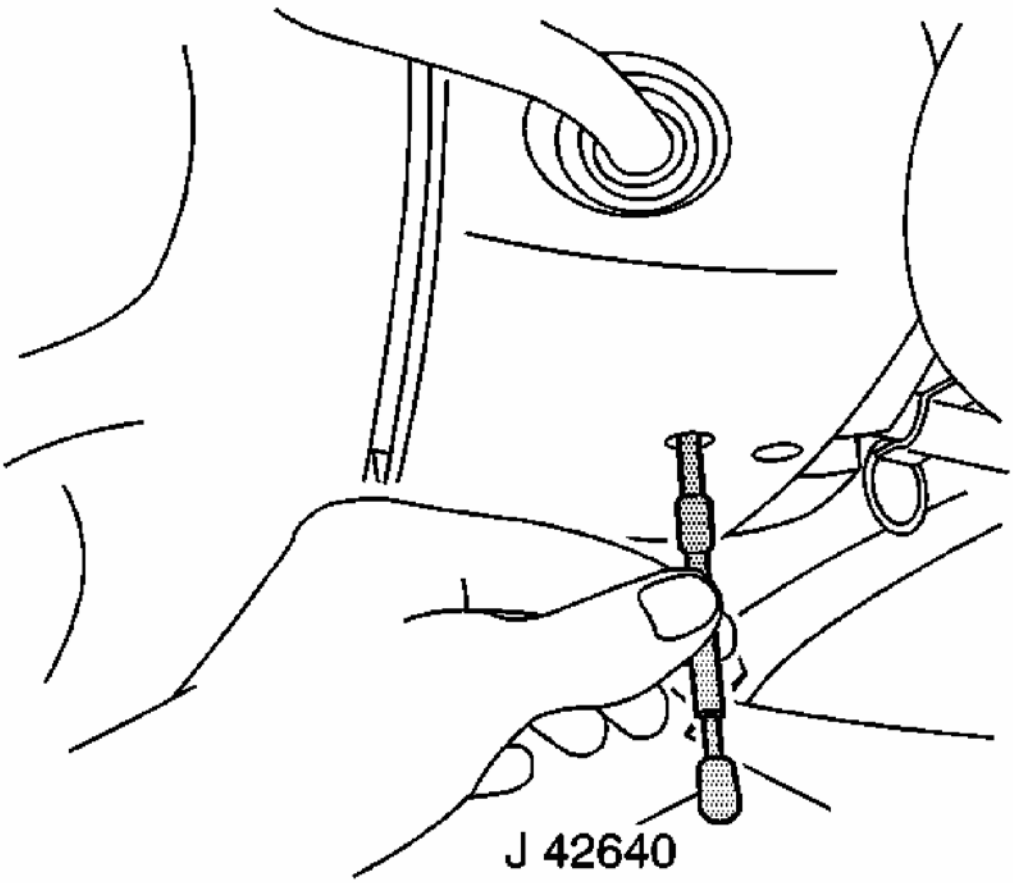



**Fig. 14: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

5. Remove the **J 42640** from the steering column lower access hole.

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**STEERING COLUMN ACCIDENT DAMAGE INSPECTION**

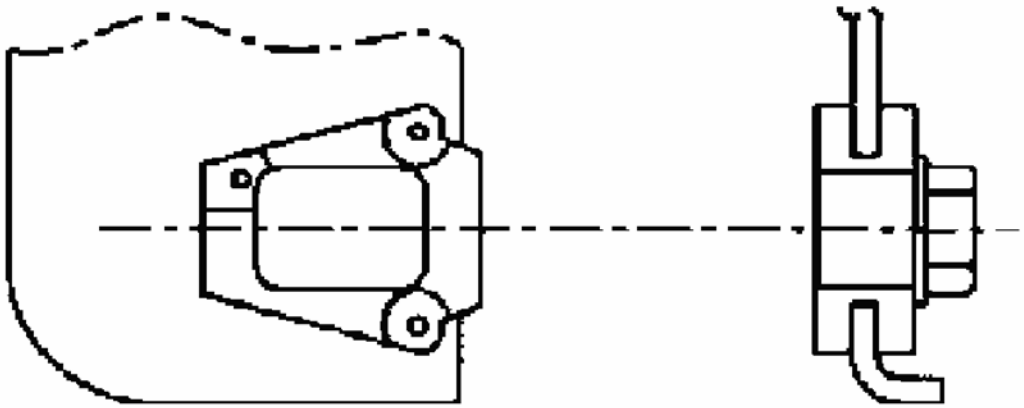


**Fig. 15: Inspecting Capsules On Steering Column Bracket Assembly**
**Courtesy of GENERAL MOTORS CORP.**

- 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 replace the jacket assembly.

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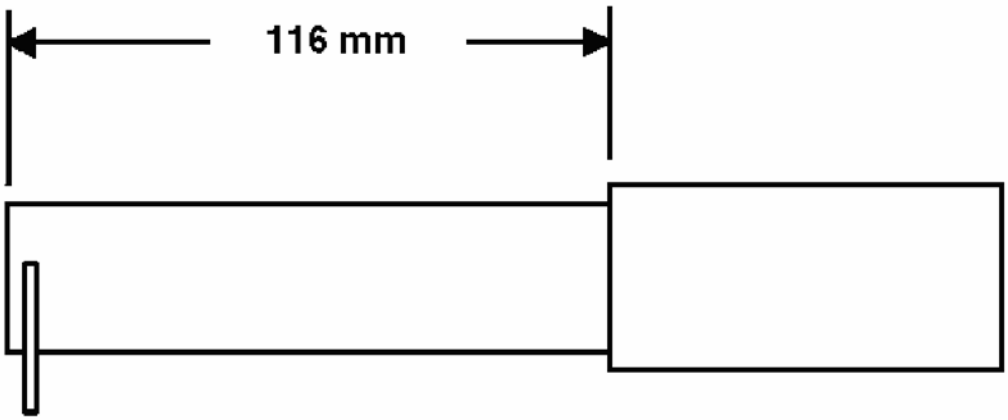



**Fig. 16: Measuring The Distance From The Lower Edge Of The Upper Jacket To A Defined Point On The Lower Jacket**
**Courtesy of GENERAL MOTORS CORP.**

- Inspect for jacket assembly collapse by measuring the distance from the lower edge of the upper jacket to a defined point on the lower jacket. Replace the jacket assembly if the measured dimensions are not within specifications.

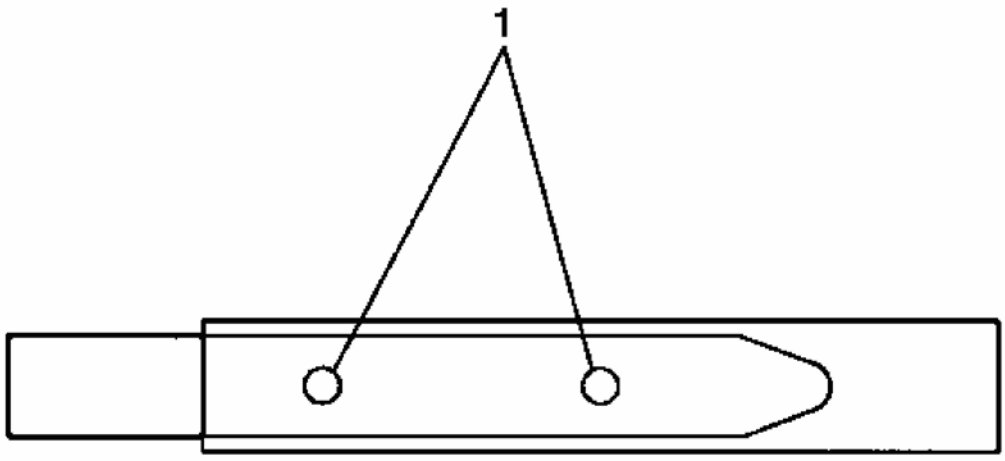



**Fig. 17: Inspecting Steering Shaft For Sheared Injected Plastic**
**Courtesy of GENERAL MOTORS CORP.**

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- Remove the SIR coil from the steering column and allow the coil to hang freely before the shaft is rotated. Refer to **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil)** or **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil and Harness Assembly)** in SIR.
- 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 TRIM COVERS REPLACEMENT

### Removal Procedure

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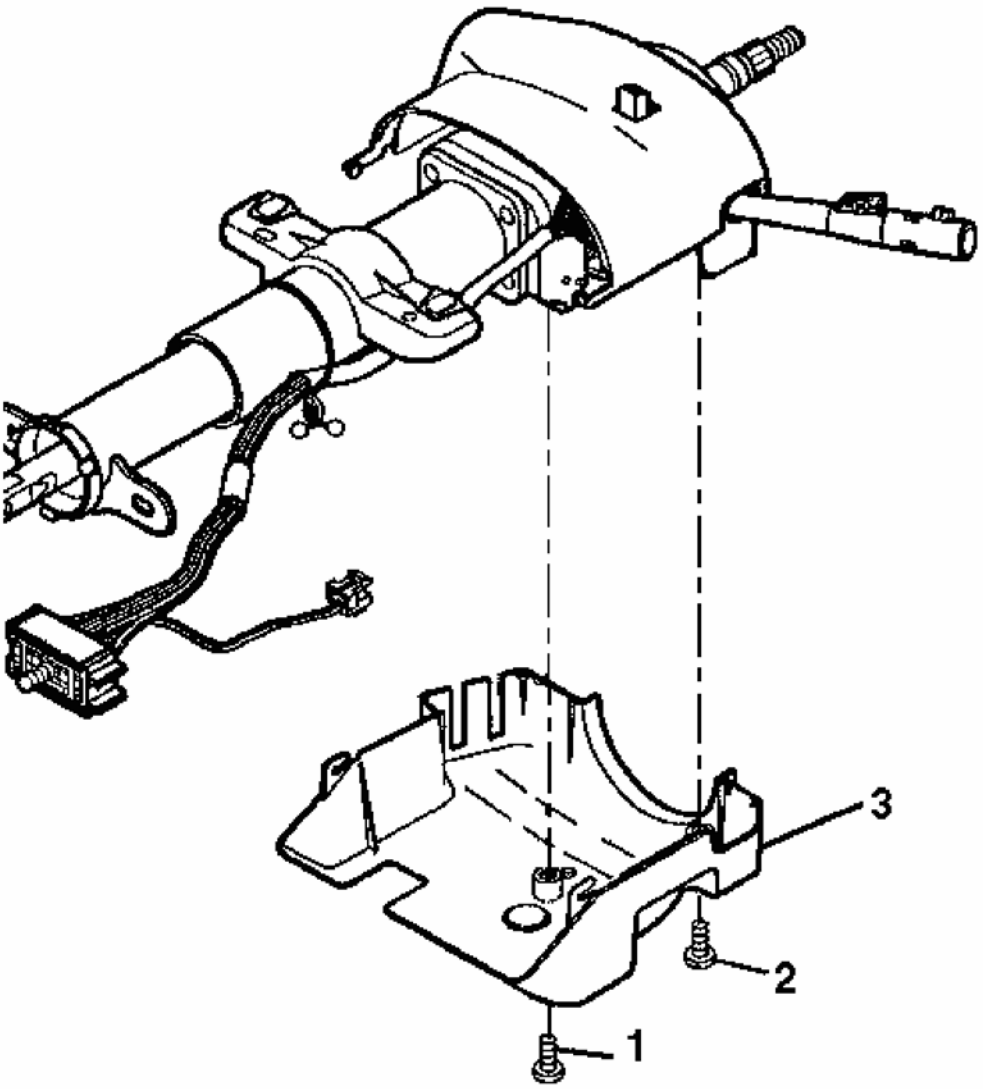



**Fig. 18: View Of Lower Trim Cover Assembly**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the steering wheel from the column. Refer to **Steering Wheel Replacement**.
3. Remove the tilt lever from the lower trim cover. Refer to **Tilt Lever Replacement**.
4. If necessary, remove the 2 pan head tapping screws (1, 2) from the lower trim cover

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(3). Remove the lower trim cover (3).

If screws are not present in the lower trim cover, proceed to the next step.

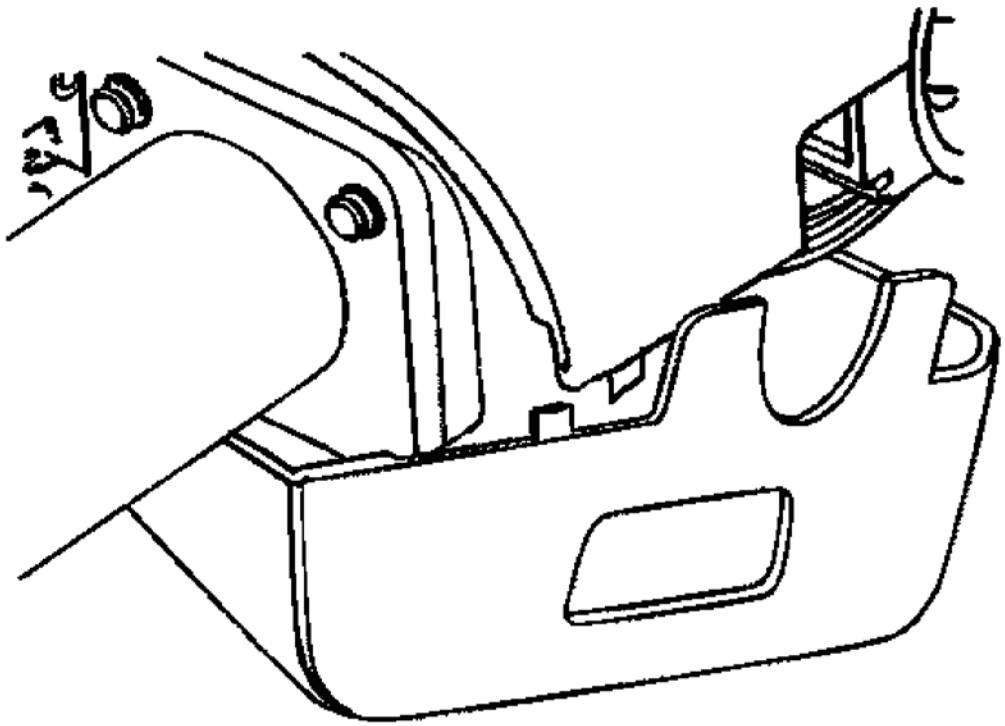


**Fig. 19: View Of Lower Trim Cover At Upper Trim Cover**
**Courtesy of GENERAL MOTORS CORP.**

5. Gently unsnap the lower trim cover from the upper trim cover.

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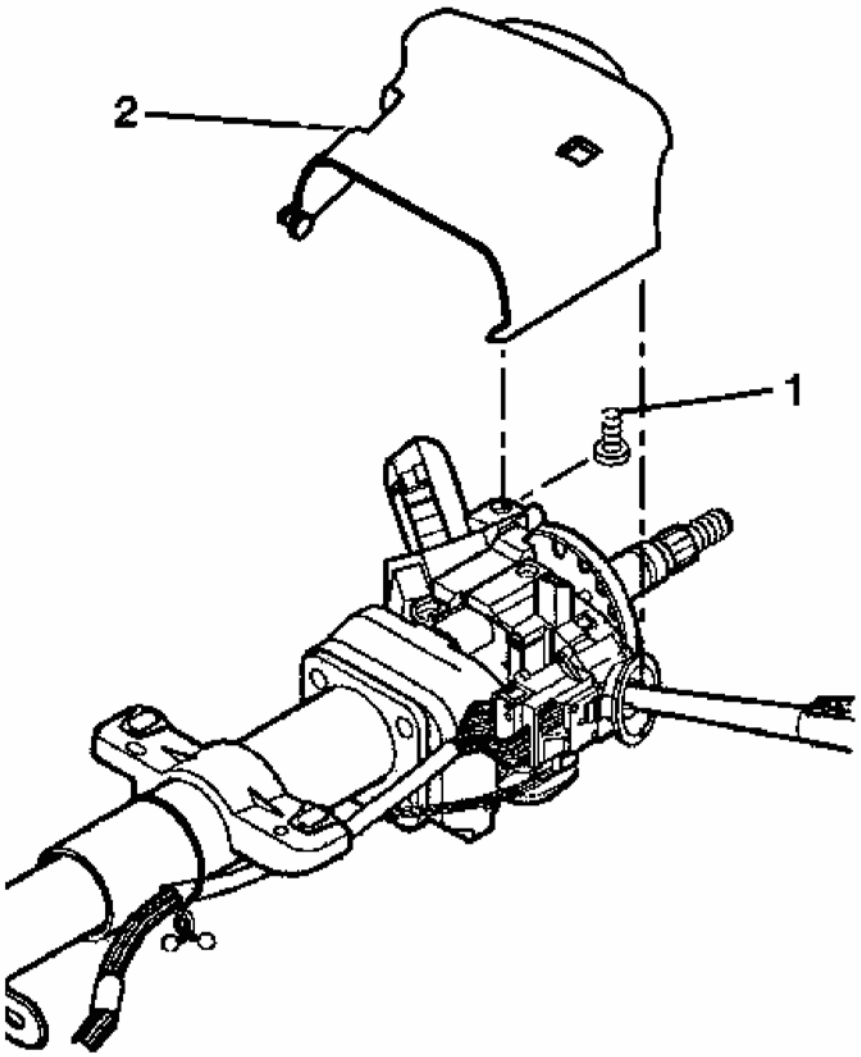



**Fig. 20: View Of TORX(R) Head Screw & Upper Trim Cover**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: You must check for 1 pan head tapping screw (1) in the upper trim cover (2) before removal.**

6. If necessary, remove 1 TORX® head screw (1) from the upper trim cover (2).

   If a screw is not present, remove the upper trim cover (2).

**Installation Procedure**

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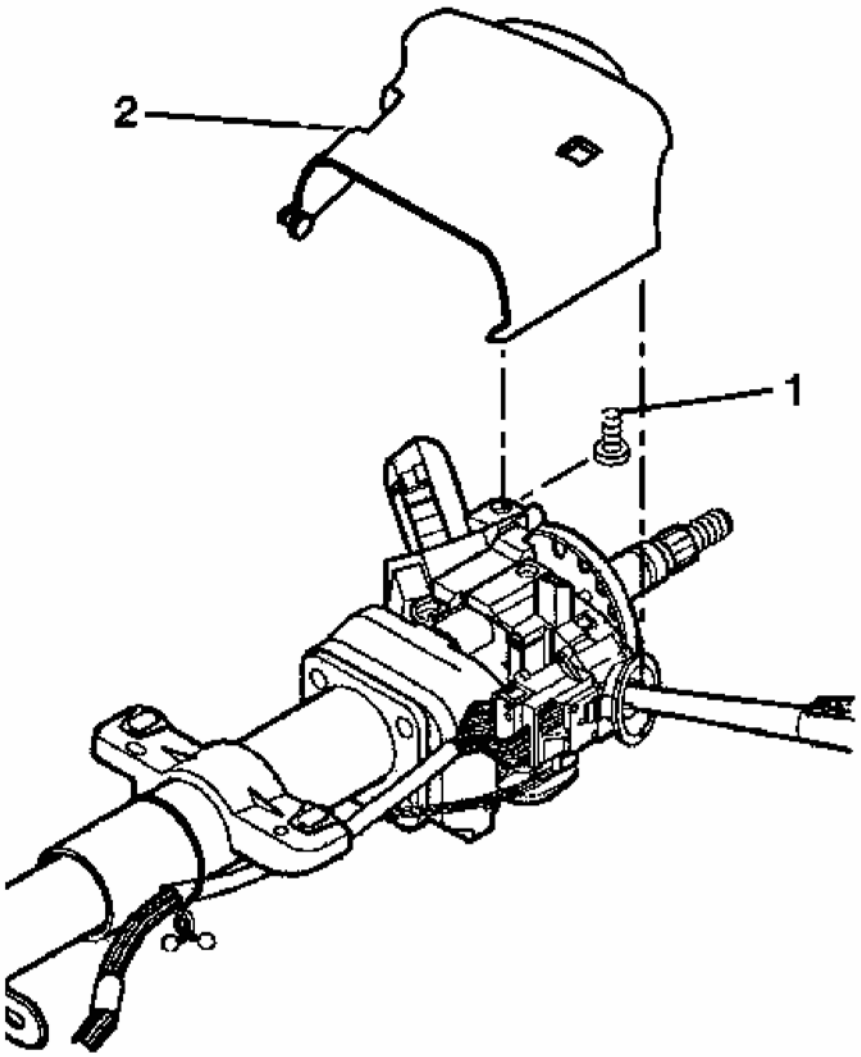



**Fig. 21: View Of TORX(R) Head Screw & Upper Trim Cover**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE:** **Refer to Fastener Notice in Cautions and Notices.**

**IMPORTANT: If the snap on/off feature on the trim covers was damaged during the removal procedure, you must use screws for the installation procedure. If screws were present in the trim covers before the removal procedure, you must use the screws during the installation procedure.**

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**If there was not any damage done to the trim covers during the removal procedure and no screws were present, proceed to step 3.**

1. Install the upper trim cover (2) onto the steering column. Install 1 TORX® head screw (1) into the upper trim cover (2).

   **Tighten:** Tighten the screw to 1.5 N.m (13 lb in).

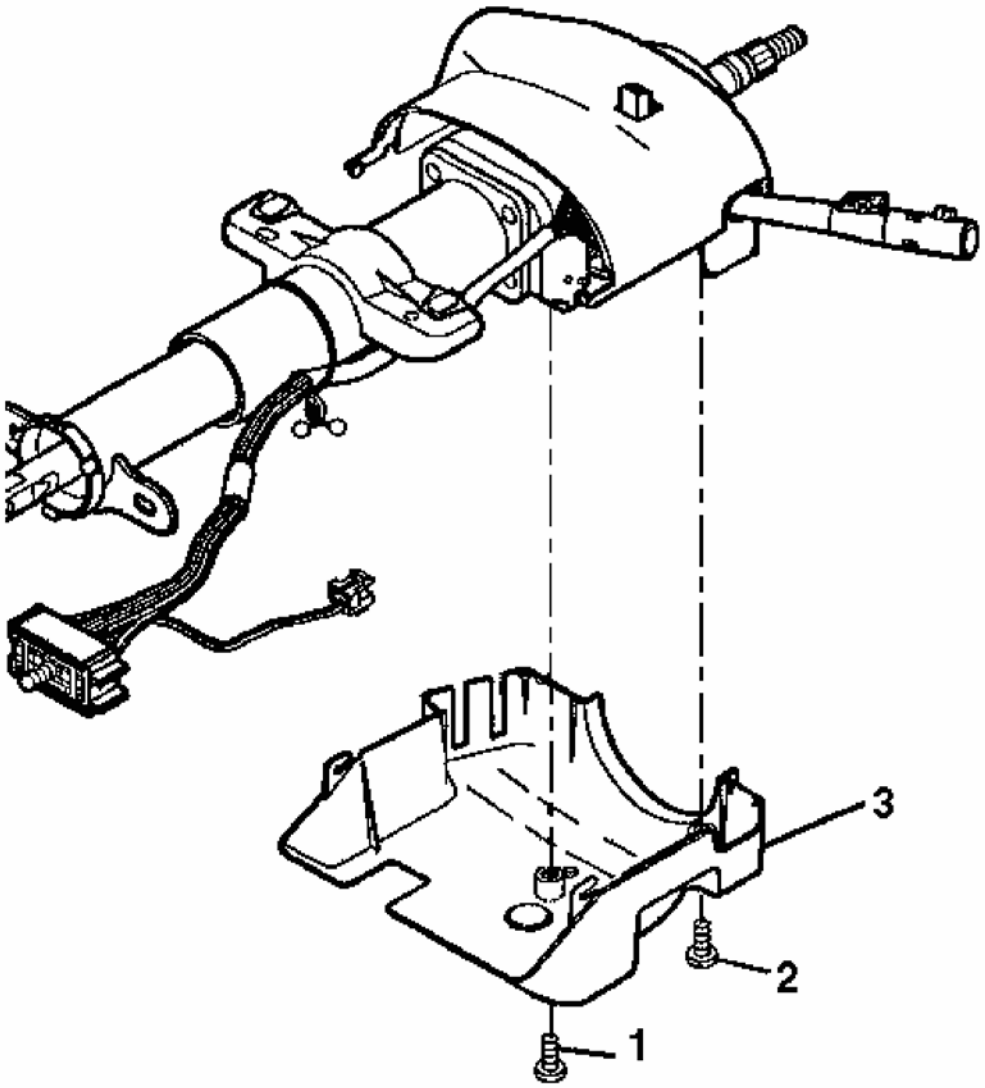



**Fig. 22: View Of Lower Trim Cover Assembly**
**Courtesy of GENERAL MOTORS CORP.**

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2. Install the lower trim cover (3) onto the steering column. Install 2 pan head tapping screws (1, 2) into the lower trim cover (3).

   **Tighten**

   - Tighten 1 pan head tapping screw (1) to 3.5 N.m (31 lb in).
   - Tighten 1 pan head tapping screw (2) to 2 N.m (18 lb in).

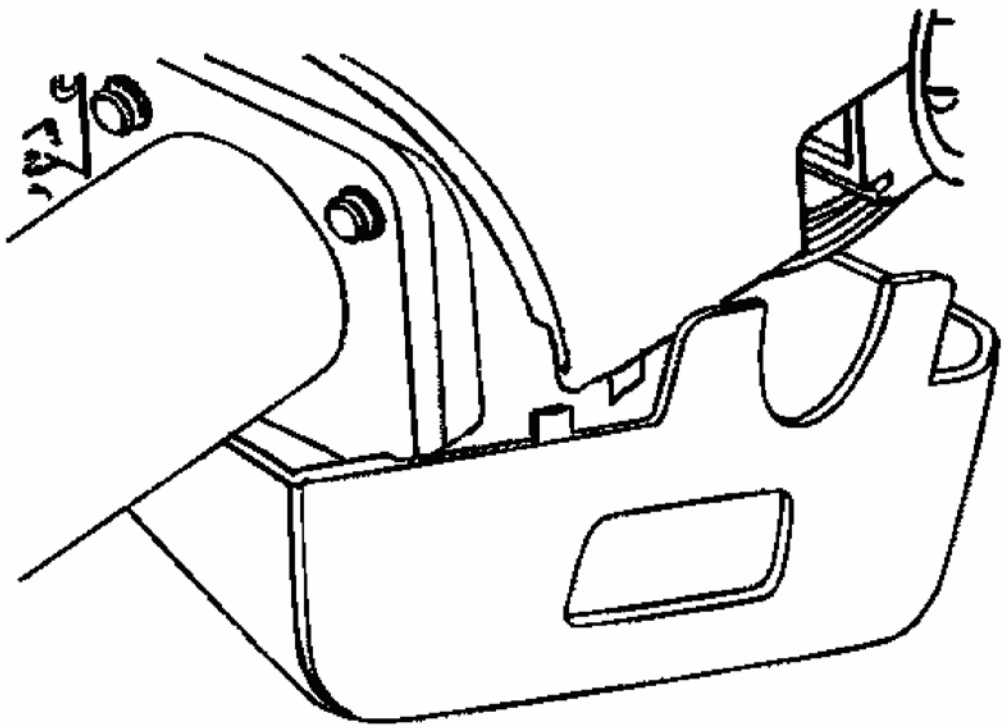


**Fig. 23: View Of Lower Trim Cover At Upper Trim Cover**
**Courtesy of GENERAL MOTORS CORP.**

3. Install the upper and lower trim covers onto the steering column.

   **IMPORTANT: If column shift, the shift lever seal must be seated in the trim covers.**

4. Slide the shift lever seal down the shift lever.
5. Gently snap the upper and lower trim covers together.
6. Install the tilt lever into the lower trim cover. Refer to **Tilt Lever Replacement**.

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7. Install the steering wheel onto the steering column. Refer to **Steering Wheel Replacement**.
8. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

## IGNITION SWITCH REPLACEMENT

### Tools Required

**J 42759** Ignition Switch Connector Release Tool. See **Special Tools**.

### Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

2. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
3. Remove the hush and knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages, and Console.
4. Remove the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**.
5. With the key installed, turn the key to the RUN position.

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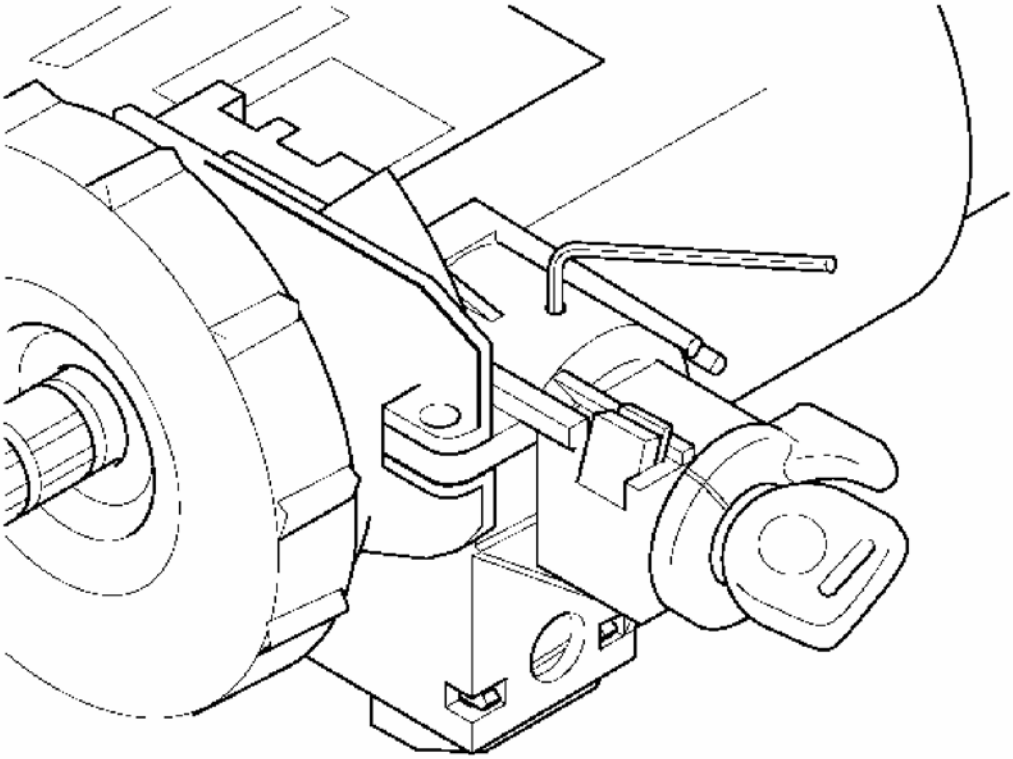


**Fig. 24: Releasing/Installing Lock Cylinder Using Allen Wrench**
**Courtesy of GENERAL MOTORS CORP.**

6. Install an Allen wrench into the hole on top of the lock cylinder housing.

   Push down on the Allen wrench to release the tab on the lock cylinder inside the lock cylinder housing.

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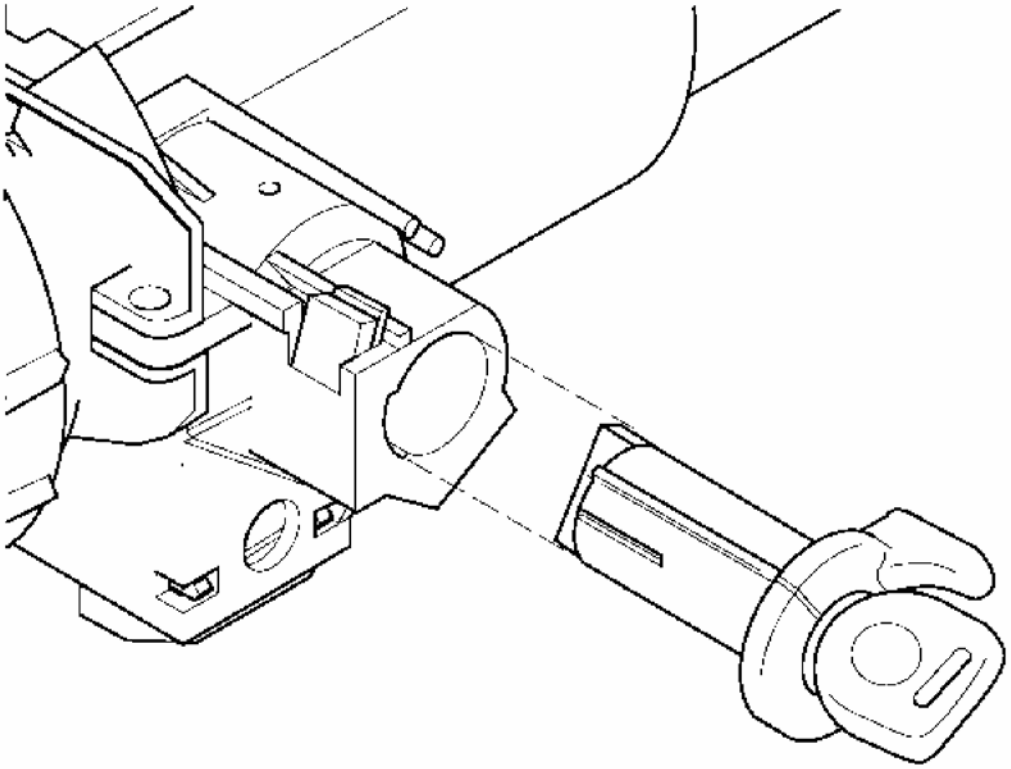


**Fig. 25: View Of Lock Cylinder At Lock Cylinder Housing**
**Courtesy of GENERAL MOTORS CORP.**

7. Slide the lock cylinder out of the lock cylinder housing.
8. Disconnect the passlock and key buzzer from the lock cylinder housing.

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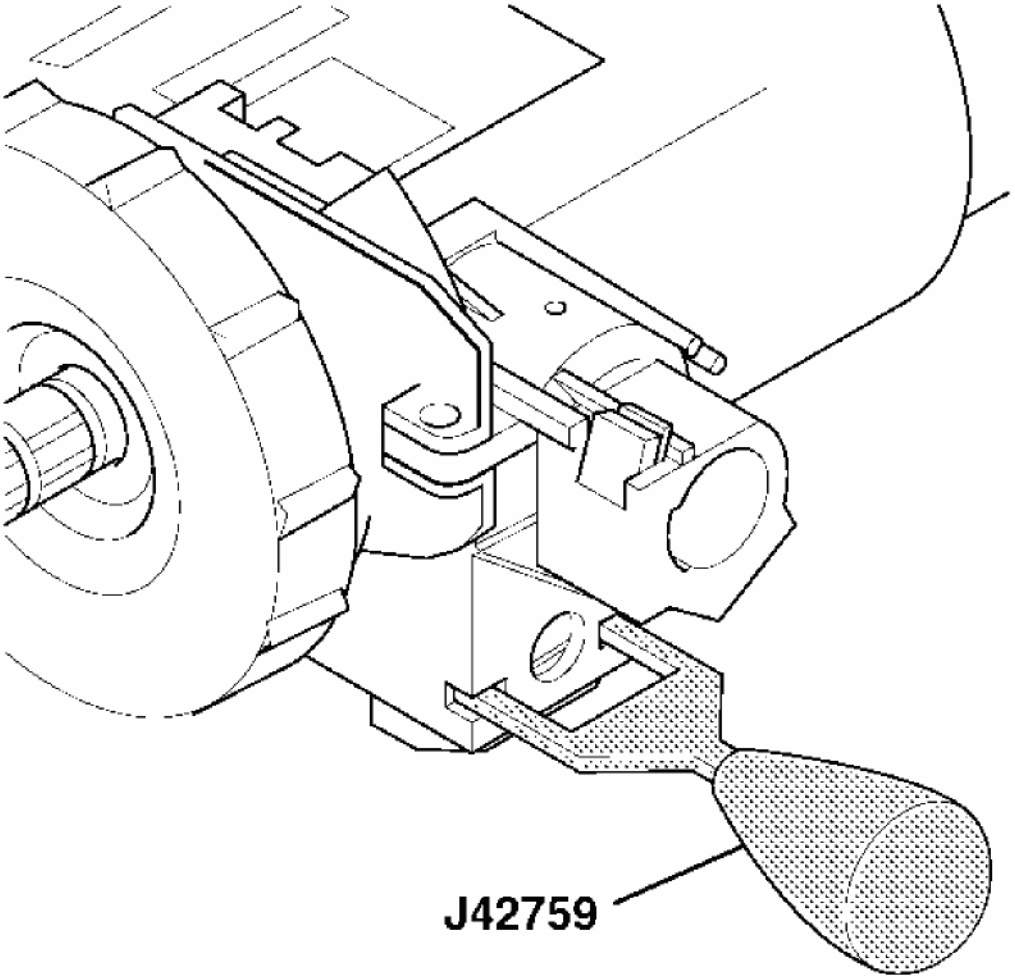



**Fig. 26: Inserting J 42759 Into The Lock Cylinder Housing To Release The Tabs On The Ignition Switch**
**Courtesy of GENERAL MOTORS CORP.**

9. Insert **J 42759** into the lock cylinder housing to release the tabs on the ignition switch. See **Special Tools**.
10. Pull the ignition switch out of the lock cylinder housing.
11. Disconnect the connector from the ignition switch.

**Installation Procedure**

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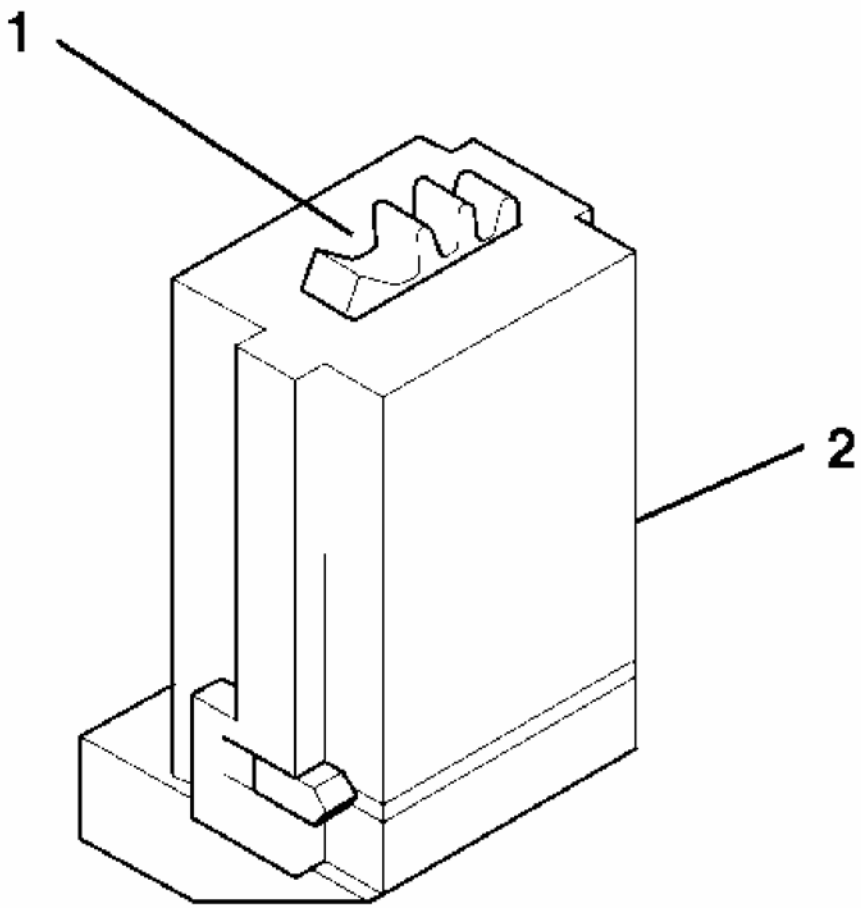



**Fig. 27: Aligning Gear In The Ignition Switch**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: The gears between the ignition switch and the lock cylinder housing must be in the correct position. Failure to do so will cause a misalignment of the gears in the ignition switch and the lock cylinder housing, which may result in a NO START or BATTERY DRAIN.**

1. Verify the alignment of the gear (1) in the ignition switch (2). If gear (1) is not in position shown, turn gear in ignition switch (2) until you reach the correct position.

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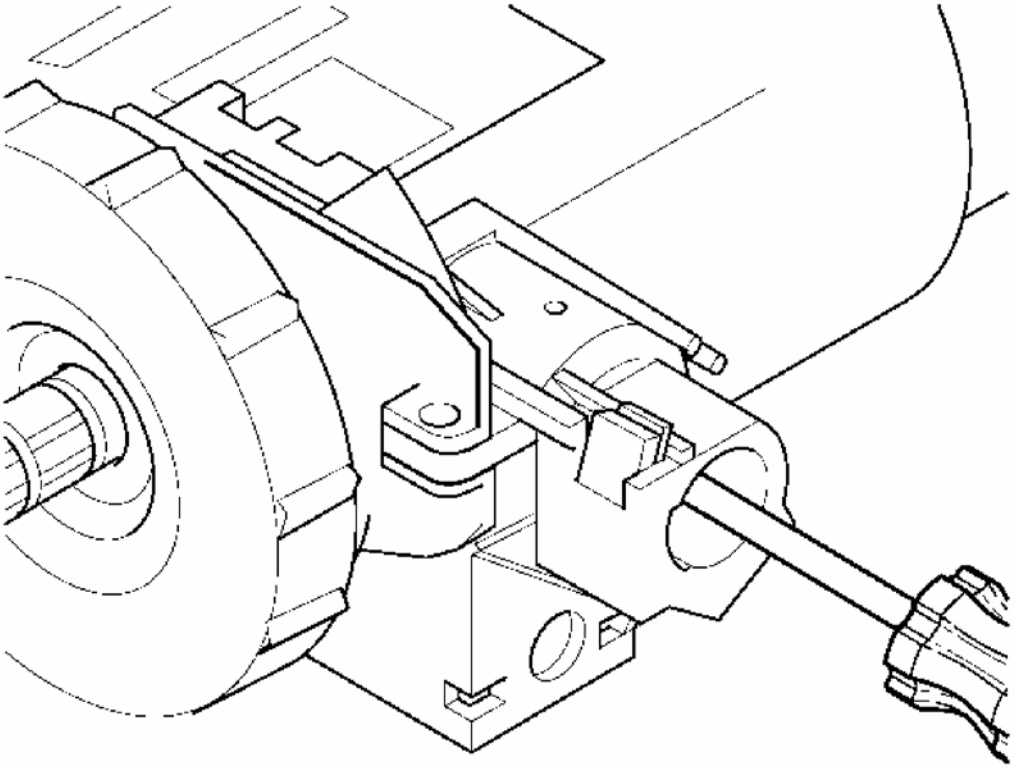


**Fig. 28: Using Screwdriver To Rotate The Lock Cylinder Housing Gear**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: In order to reach a stop while rotating the lock cylinder housing gear you MUST push and hold in the solenoid on the electric park lock.**

2. Use a screwdriver to rotate the lock cylinder housing gear counterclockwise until it hits a stop.
3. Connect the connector to the ignition switch.

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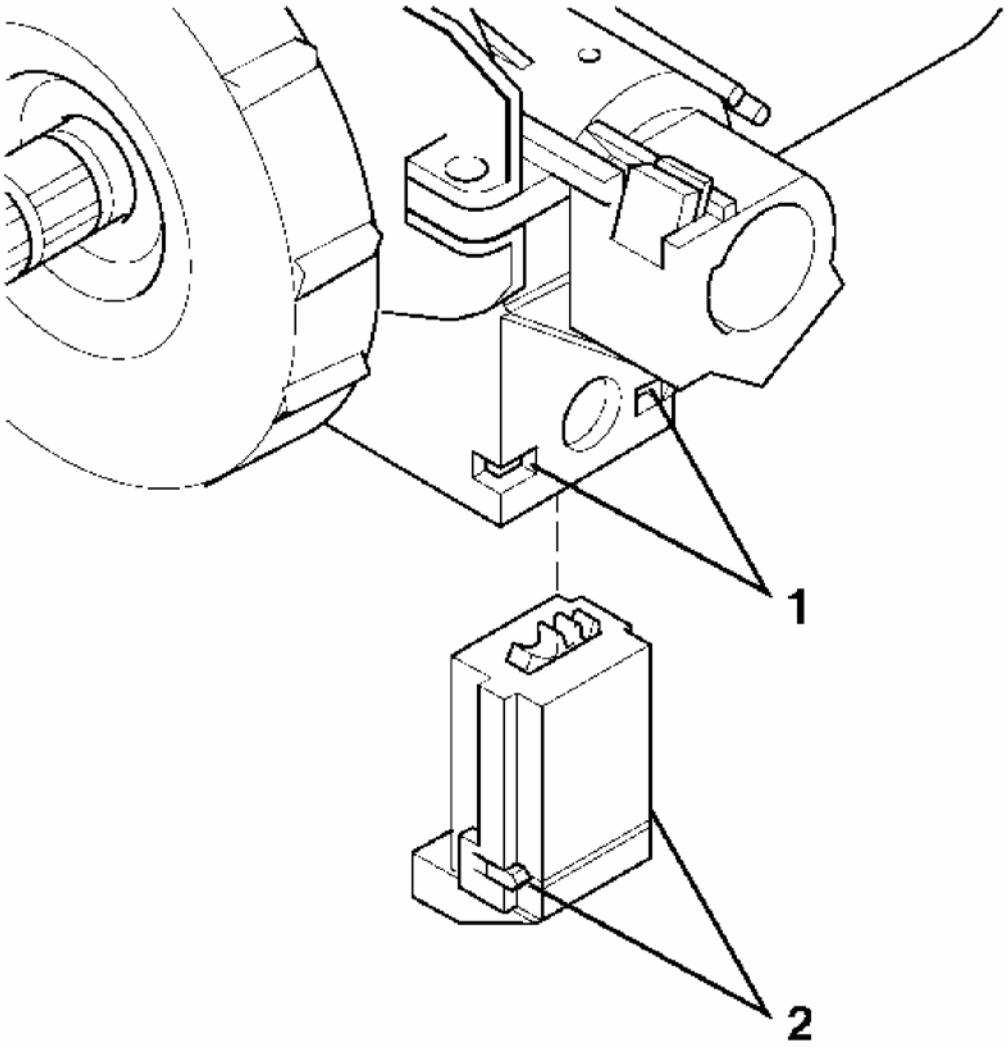



**Fig. 29: Inserting Ignition Switch Into The Lock Cylinder Housing**
**Courtesy of GENERAL MOTORS CORP.**

4. Insert the ignition switch into the lock cylinder housing. The tabs (2) on the ignition switch MUST be seated inside the lock cylinder housing (1) for proper installation.

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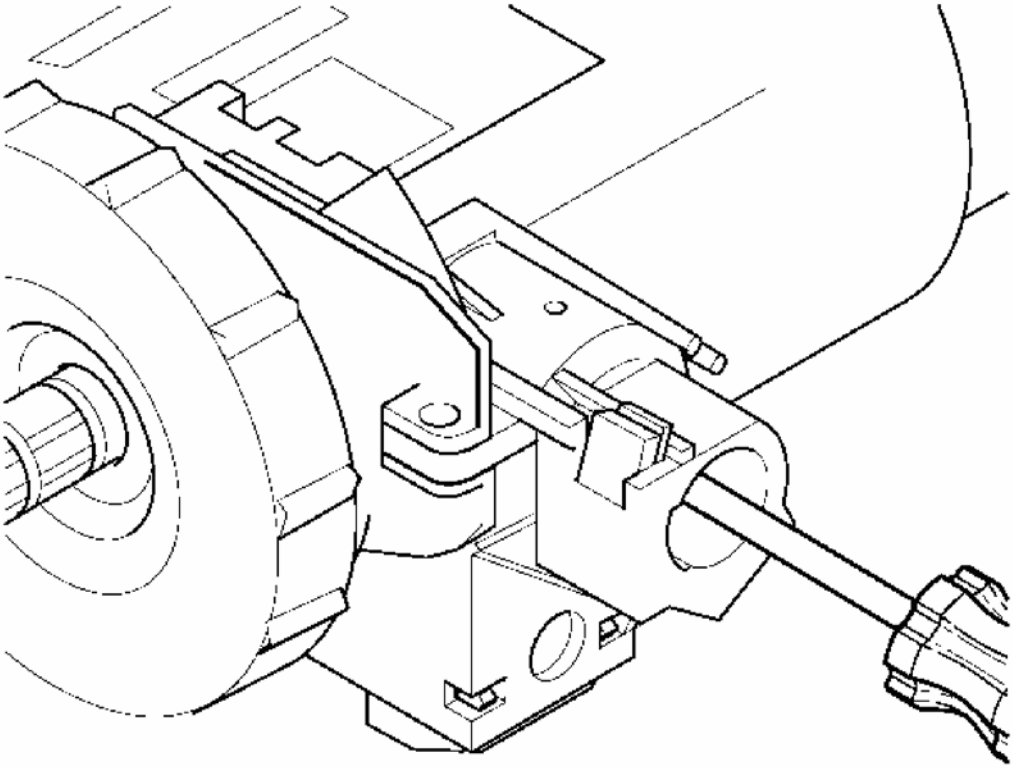


**Fig. 30: Using Screwdriver To Rotate Lock Cylinder Housing Gear**
**Courtesy of GENERAL MOTORS CORP.**

5. Use a screwdriver to rotate the lock cylinder housing gear clockwise to the START position - allowing it to spring return into the RUN position.

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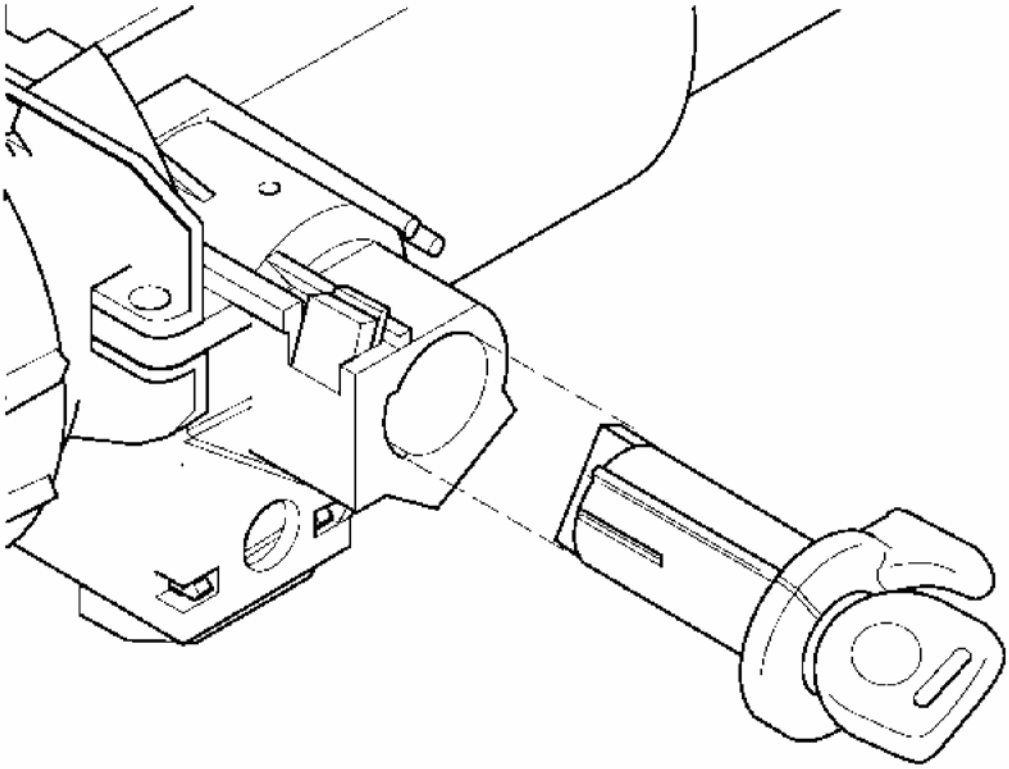


**Fig. 31: View Of Lock Cylinder At Lock Cylinder Housing**
**Courtesy of GENERAL MOTORS CORP.**

6. Align the lock cylinder and install the lock cylinder into the lock cylinder housing.
7. Connect the passlock and key buzzer into the lock housing.
8. Install the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**.
9. Install the hush and knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages, and Console.
10. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
11. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

**IGNITION LOCK CYLINDER REPLACEMENT**

**Removal Procedure**

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

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**CAUTION: Refer to SIR Caution in Cautions and Notices.**

2. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
3. Lower the hush and knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gauges, and Console.
4. Remove the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**.
5. With the key installed, turn the key to the RUN position.

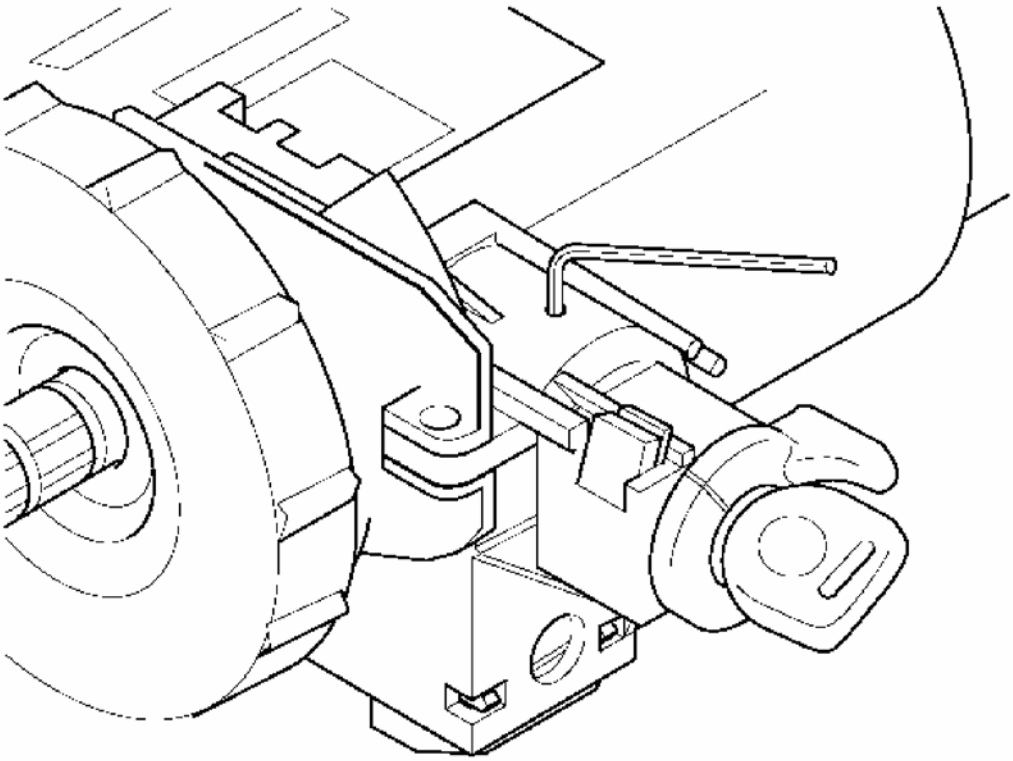


**Fig. 32: Releasing/Installing Lock Cylinder Using Allen Wrench**
**Courtesy of GENERAL MOTORS CORP.**

6. Install an Allen wrench into the hole on top of the lock cylinder housing.

   Push down on the Allen wrench to release the tab on the lock cylinder inside the lock cylinder housing.

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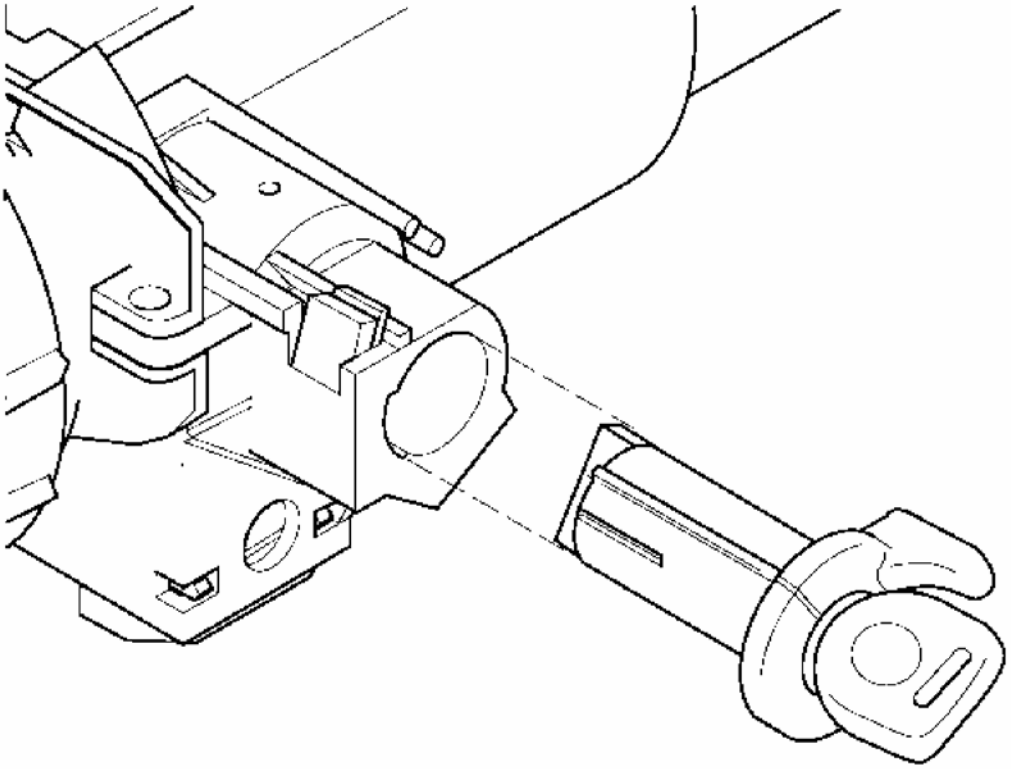


**Fig. 33: View Of Lock Cylinder At Lock Cylinder Housing**
**Courtesy of GENERAL MOTORS CORP.**

7. Slide the lock cylinder out of the lock cylinder housing.

**Installation Procedure**

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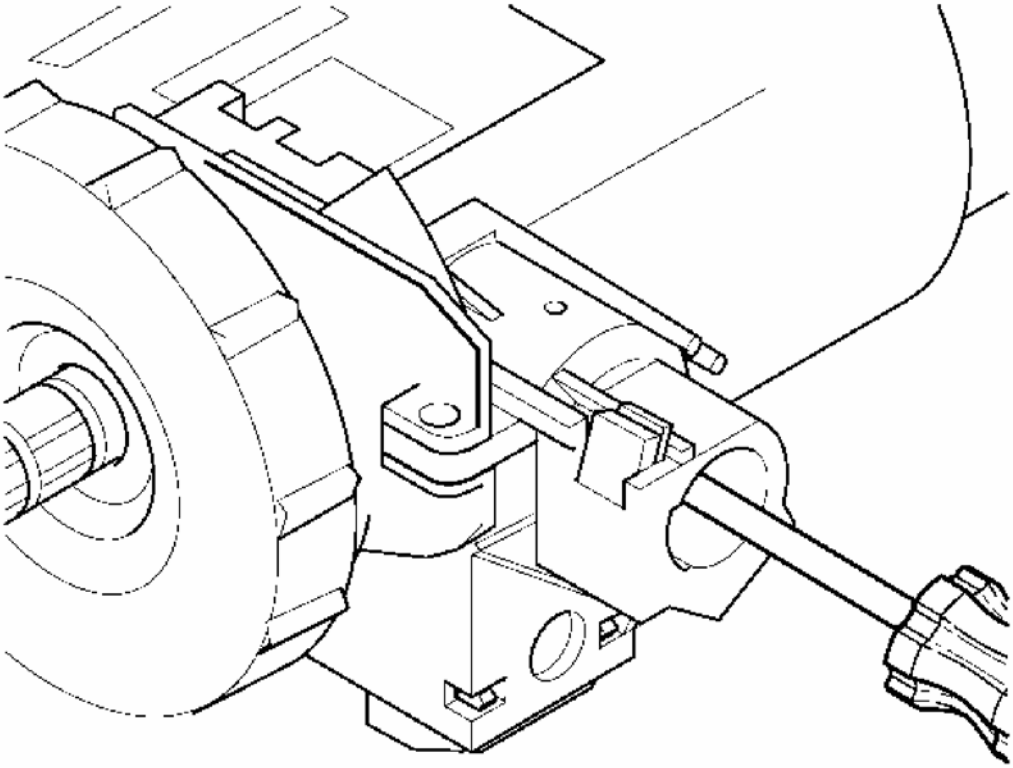


**Fig. 34: Using Screwdriver To Rotate Lock Cylinder Housing Gear**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the key into the lock cylinder.

**IMPORTANT: The gears between the ignition switch and the lock cylinder housing must be in the correct position. Failure to do so will cause a misalignment of the gears in the ignition switch and the lock cylinder housing, which may result in a NO START or BATTERY DRAIN.**

2. Use a screwdriver to rotate the lock cylinder housing gear clockwise to the start position - allowing it to spring return into the RUN position.

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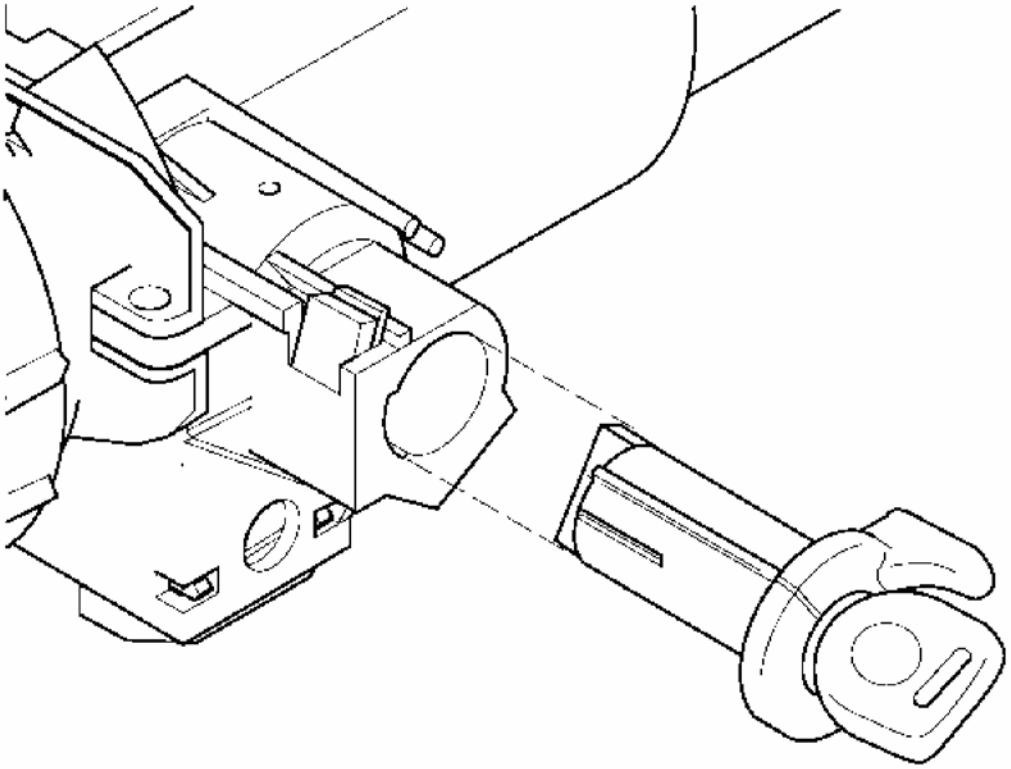


**Fig. 35: View Of Lock Cylinder At Lock Cylinder Housing**
**Courtesy of GENERAL MOTORS CORP.**

3. Align the lock cylinder and install into the lock cylinder housing.
4. Install the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**.
5. Install the hush and knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gauges, and Console.
6. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

**IGNITION LOCK CYLINDER CASE REPLACEMENT**

**Removal Procedure**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

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1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the ignition switch. Refer to **Ignition Switch Replacement**.
3. Remove the turn signal cancel cam. Refer to **Steering Column Tilt Head Housing Replacement (Tilt)**.
4. Remove the park lock cable from the lock cylinder housing.

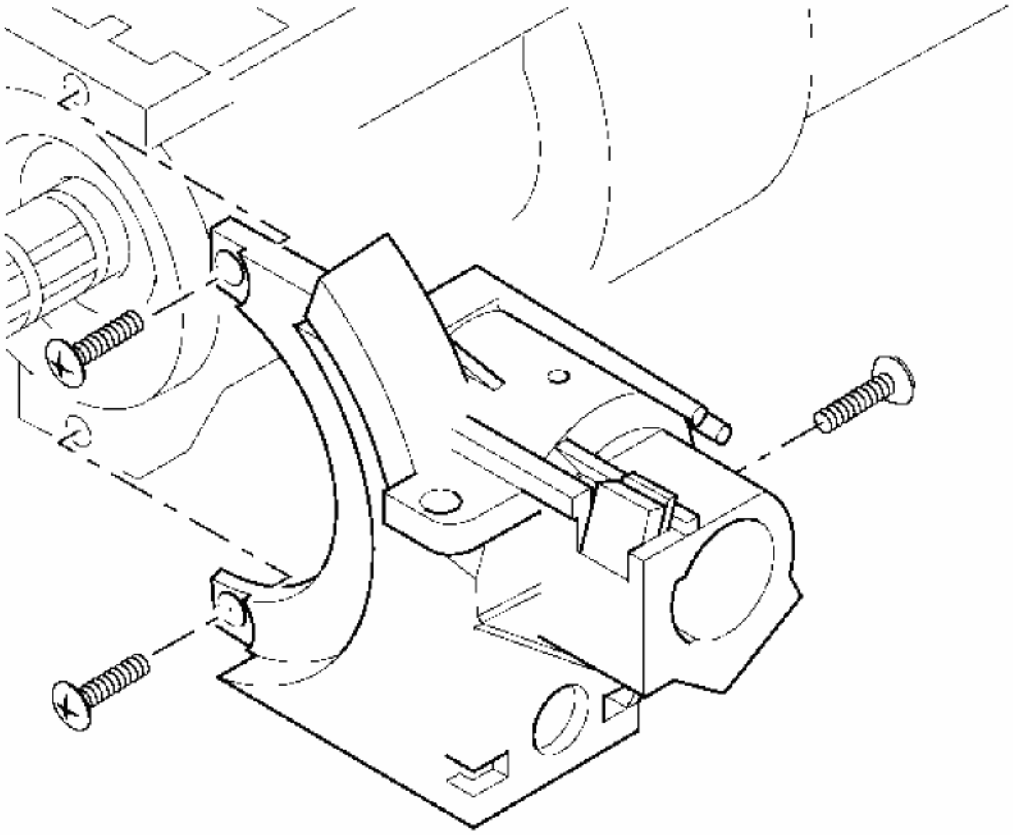


**Fig. 36: View Of Lock Cylinder Housing TORX Screws**
**Courtesy of GENERAL MOTORS CORP.**

5. Remove 3 TORX® screws.
6. Remove the lock cylinder housing from the steering column.

**Installation Procedure**

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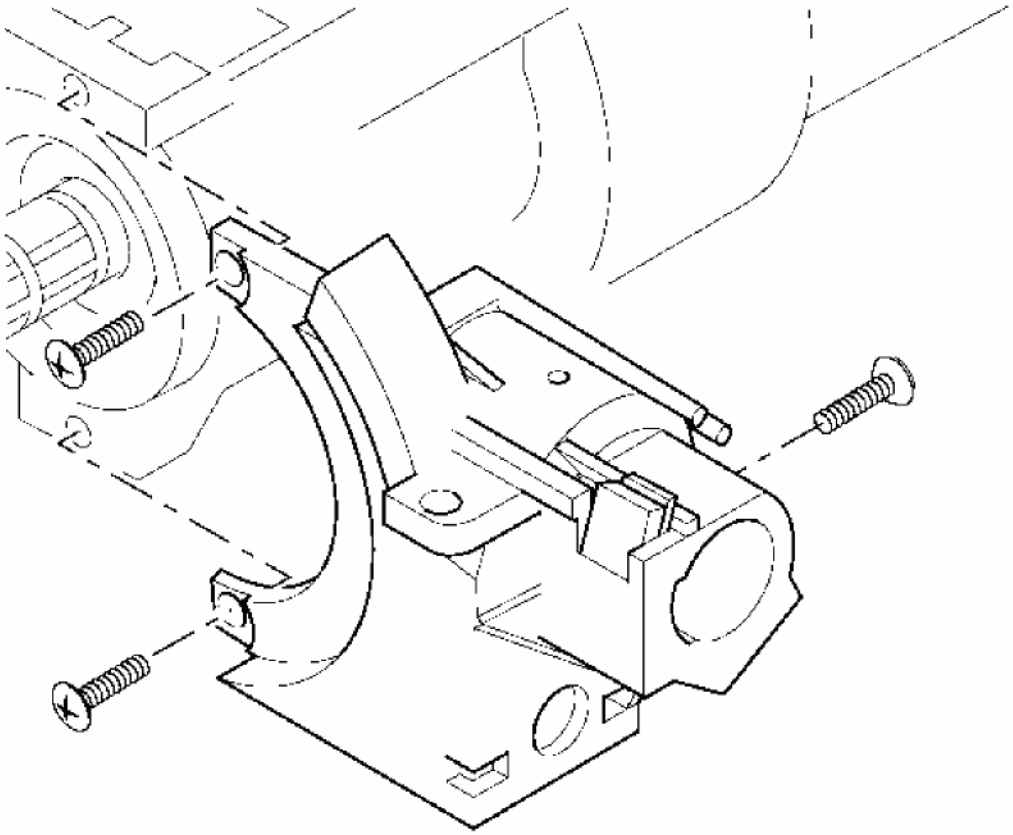


**Fig. 37: View Of Lock Cylinder Housing TORX Screws**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

1. Install 3 TORX® screws into the lock cylinder housing.

   **Tighten:** Tighten the TORX® screws to 7 N.m (62 lb in).

2. Install the turn signal cancel cam. Refer to **Steering Column Tilt Head Housing Replacement (Tilt)**.
3. Install the park lock cable into the lock cylinder housing.
4. Install the ignition switch. Refer to **Ignition Switch Replacement**.
5. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**MULTIFUNCTION, TURN SIGNAL SWITCH REPLACEMENT**

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**Removal Procedure**

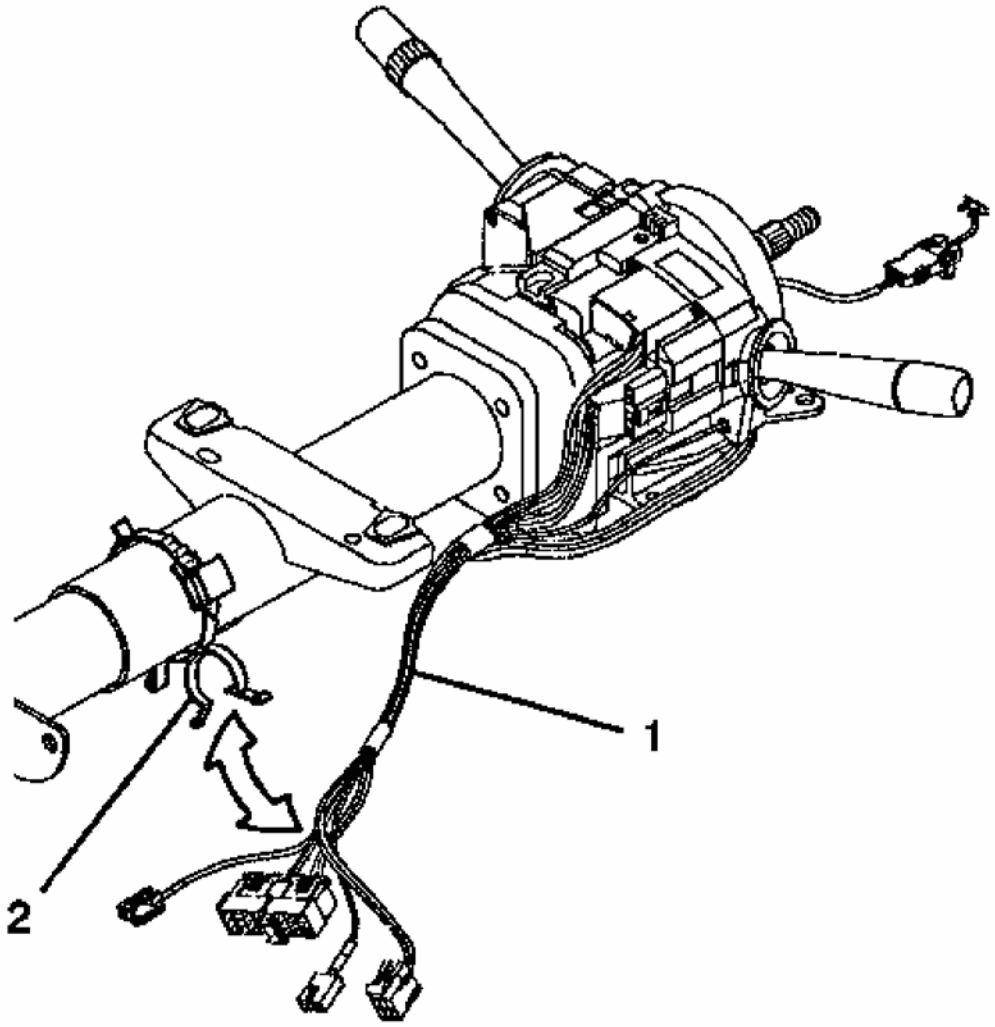



**Fig. 38: View Of Steering Column Wire Harness Assembly & Wire Harness Strap**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.

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**IMPORTANT: The abrasion sleeve located on the steering column wire harness assembly must be reinstalled. Make note of what connector is coming out of the abrasion sleeve for installation purposes.**

3. Remove the wire harness assembly (1) from the wire harness strap (2).
4. Disconnect the turn signal and multifunction switch assembly connector from the SIR system coil connector.

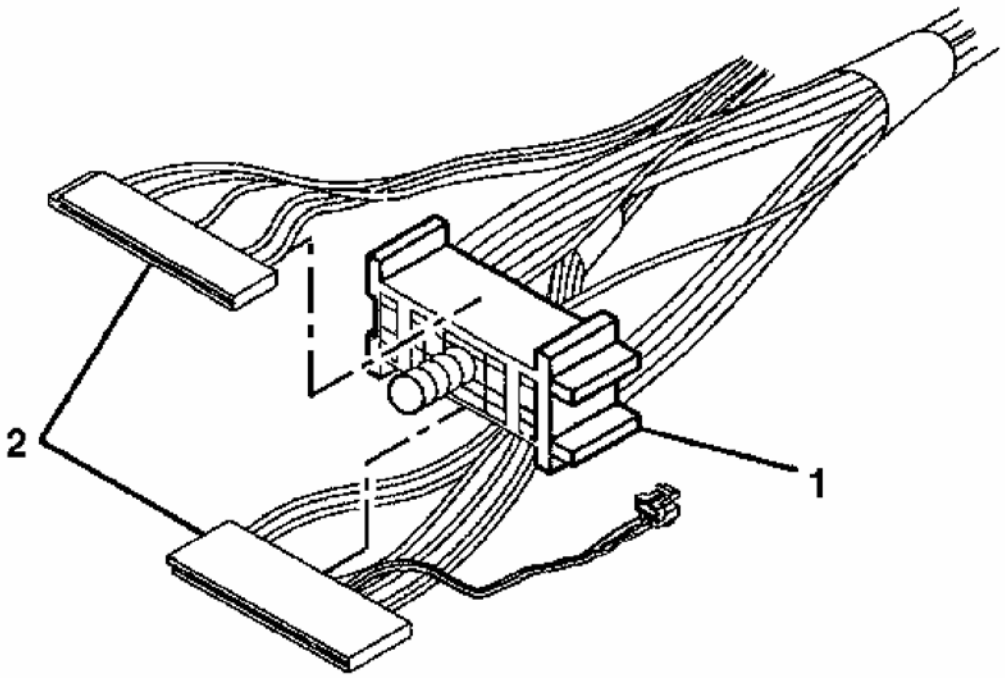



**Fig. 39: Turn Signal & Multifunction Switch Assembly Connectors**
**Courtesy of GENERAL MOTORS CORP.**

5. Slide the 2 connectors (2) of the turn signal and multifunction switch assembly out of the bulkhead connector (1).

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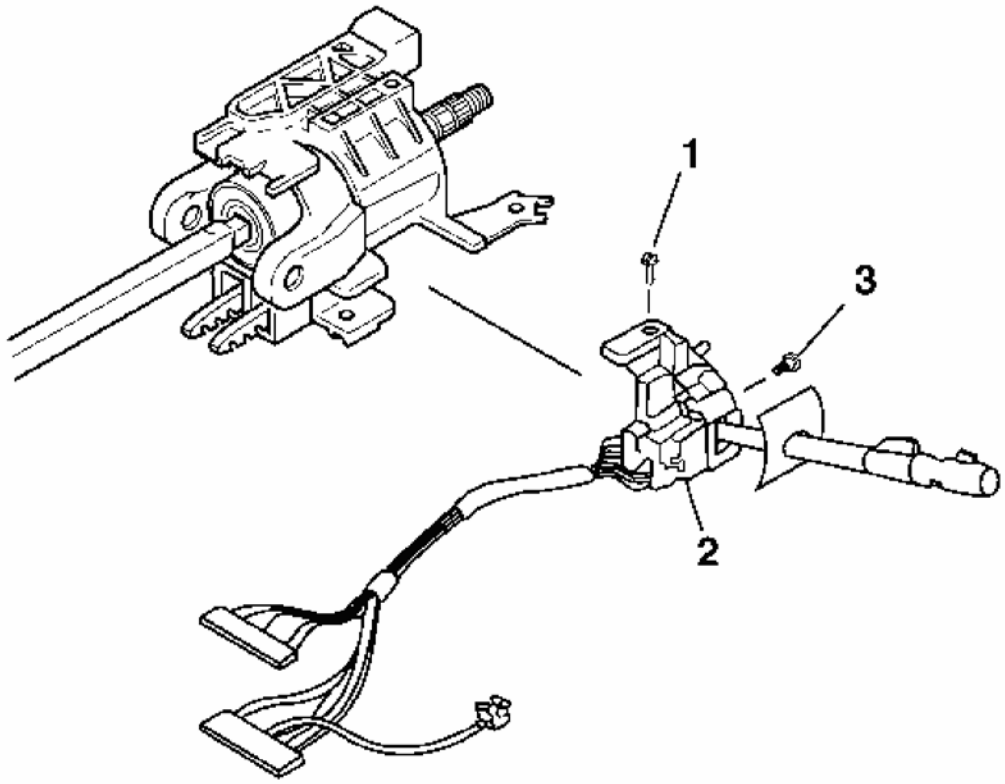



**Fig. 40: View Of Turn Signal & Multifunction Switch Assembly**
**Courtesy of GENERAL MOTORS CORP.**

6. Remove the 2 pan head tapping screws (1) and (3) from the turn signal and multifunction switch assembly (2).
7. Remove the turn signal and multifunction switch assembly (2) from the steering column tilt head assembly.

**Installation Procedure**

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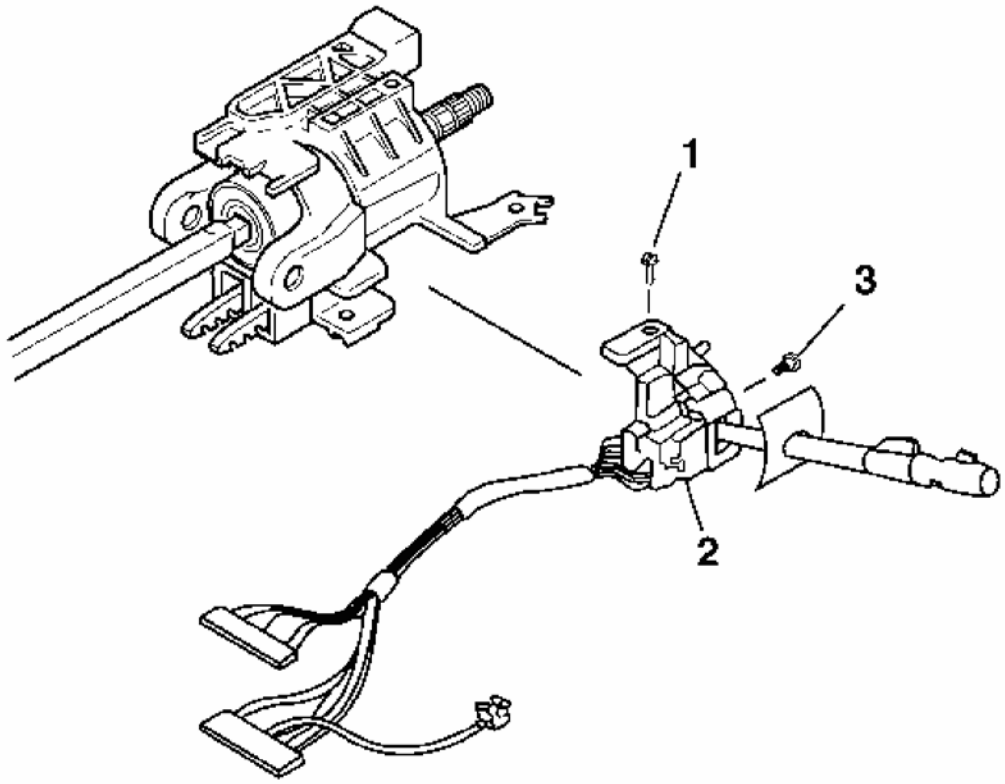



**Fig. 41: View Of Turn Signal & Multifunction Switch Assembly**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the turn signal and multifunction switch assembly (2) onto the steering column tilt head assembly.

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

**IMPORTANT: Be sure that the electrical contact of the turn signal and multifunction switch assembly (2) rests on the turn signal cancel cam assembly.**

2. Screw the 2 pan head tapping screws (1) and (3) into the turn signal and multifunction assembly (2).

**Tighten**

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- Tighten the top pan head tapping screw (1) to 3 N.m (27 lb in) for Domestic Column Shift.
- Tighten the top pan head tapping screw (1) to 7 N.m (62 lb in) for Domestic Floor Shift and Export Column Shift.
- Tighten the side pan head tapping screw (3) to 7 N.m (62 lb in) for all.

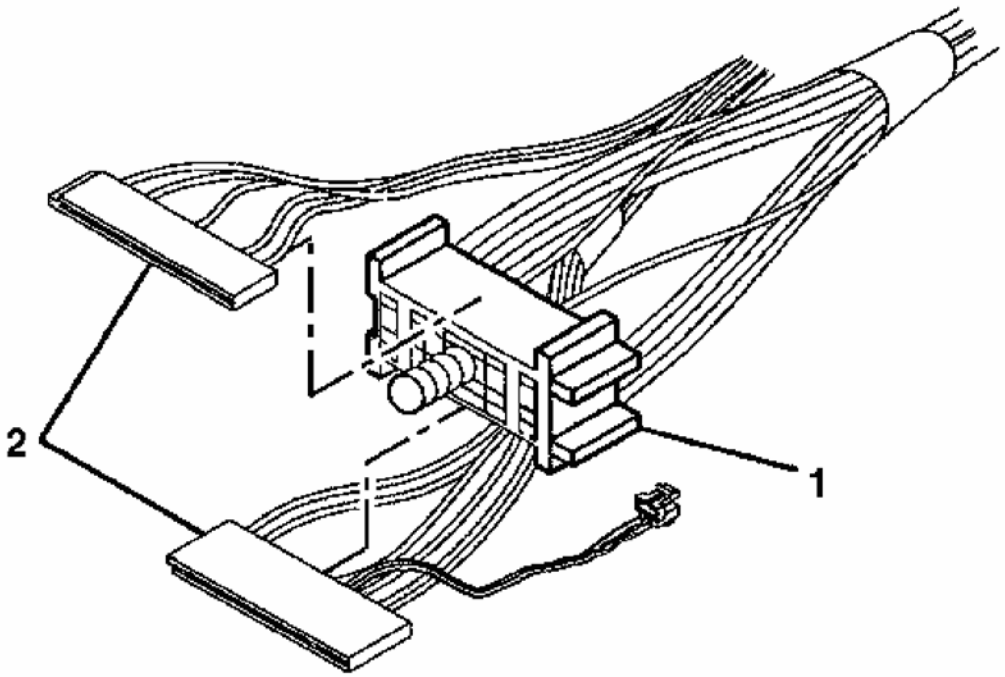



**Fig. 42: Turn Signal & Multifunction Switch Assembly Connectors**
**Courtesy of GENERAL MOTORS CORP.**

3. Slide the 2 connectors (2) of the turn signal and multifunction switch assembly into the bulkhead connector (1).

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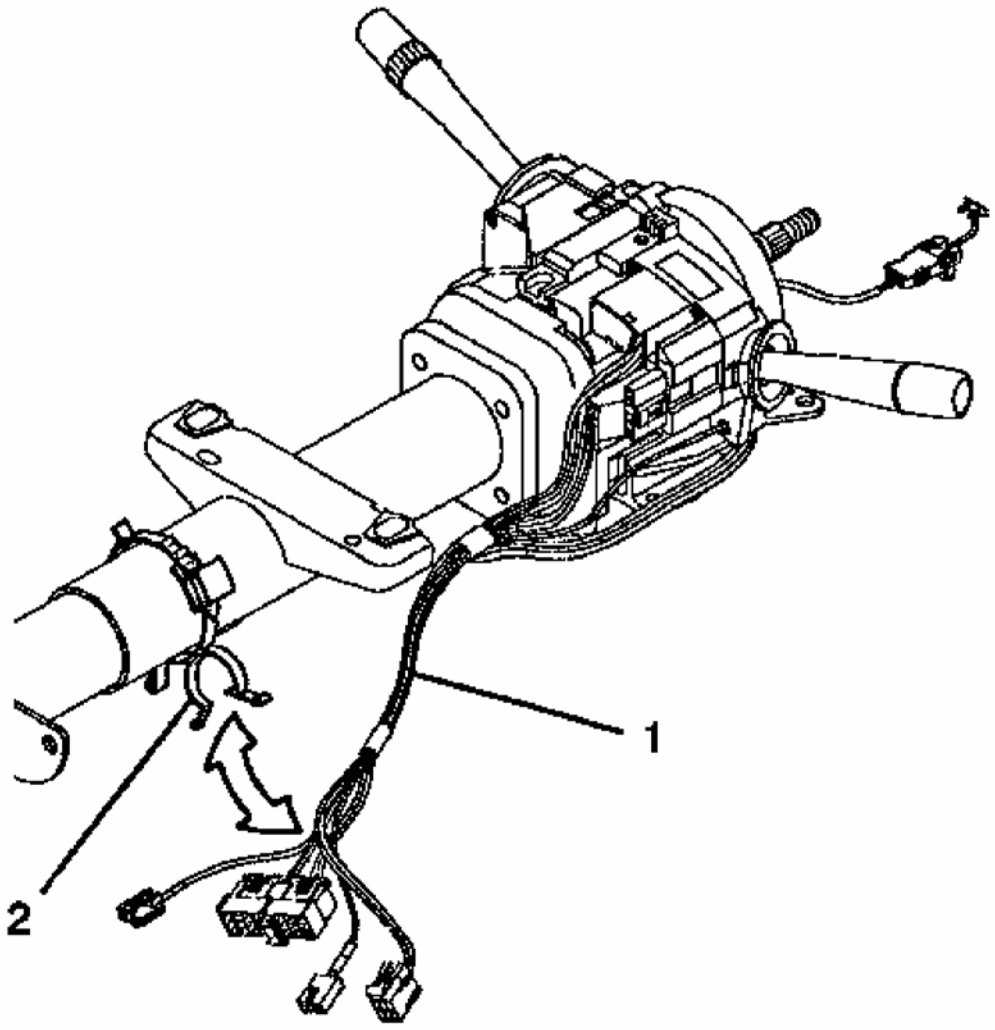



**Fig. 43: View Of Steering Column Wire Harness Assembly & Wire Harness Strap**
**Courtesy of GENERAL MOTORS CORP.**

4. Connect the turn signal and multifunction switch assembly connector to the SIR coil connector.

**IMPORTANT: The abrasion sleeve must be installed back onto the steering column wire harness assembly. The ignition lock cylinder case wires and connector must be hanging out of the middle of the abrasion sleeve.**

5. Install the wire harness assembly (1) into the wire harness strap (2).

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6. Install the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.
7. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**SHIFT LEVER REPLACEMENT (WITHOUT TOW/HAUL SWITCH)**

**Removal Procedure**

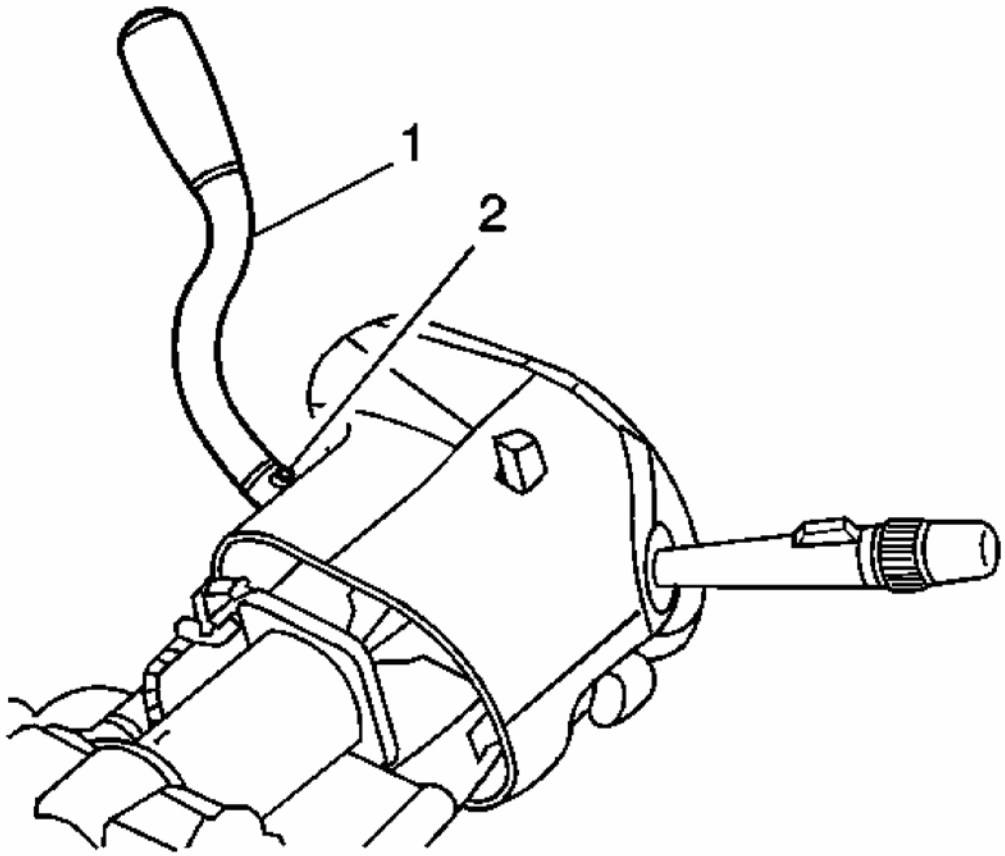



**Fig. 44: Locating Seal On The Shift Lever And TORX® Head Shift Lever Screw (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

1. Roll back the seal until the TORX® head shift lever screw (2) is exposed.
2. Remove the TORX® head shift lever screw (2).
3. Remove the shift lever.

**Installation Procedure**

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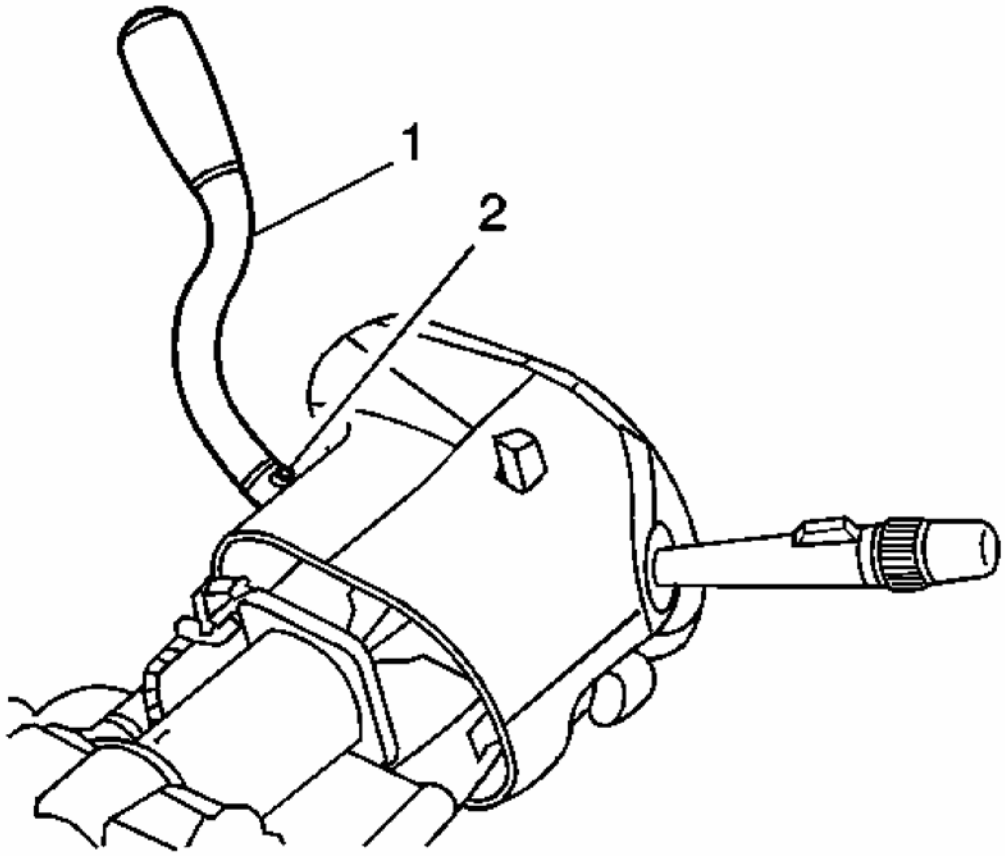



**Fig. 45: Locating Seal On The Shift Lever And TORX® Head Shift Lever Screw (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the shift lever (1).

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

2. Install the TORX® head shift lever screw (2).

   **Tighten:** Tighten the screw to 20 N.m.

3. Roll the seal over the TORX® head shift lever screw (2).

**SHIFT LEVER REPLACEMENT (WITH TOW/HAUL SWITCH)**

**Removal Procedure**

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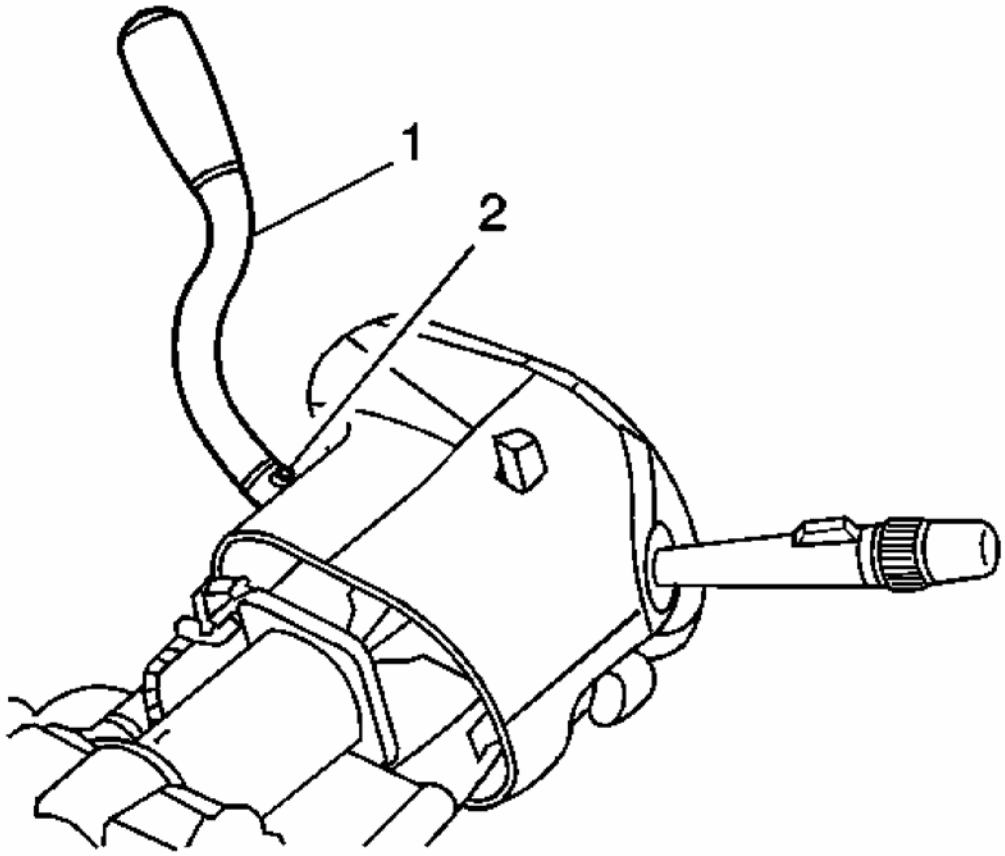



**Fig. 46: Locating Seal On The Shift Lever And TORX® Head Shift Lever Screw (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

1. Remove the trim covers. Refer to **Steering Column Trim Covers Replacement**.
2. Roll back the seal on the shift lever (1) until the TORX® head shift lever screw (2) is exposed.
3. Remove the TORX® head shift lever screw (2).
4. Remove the knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages and Console.

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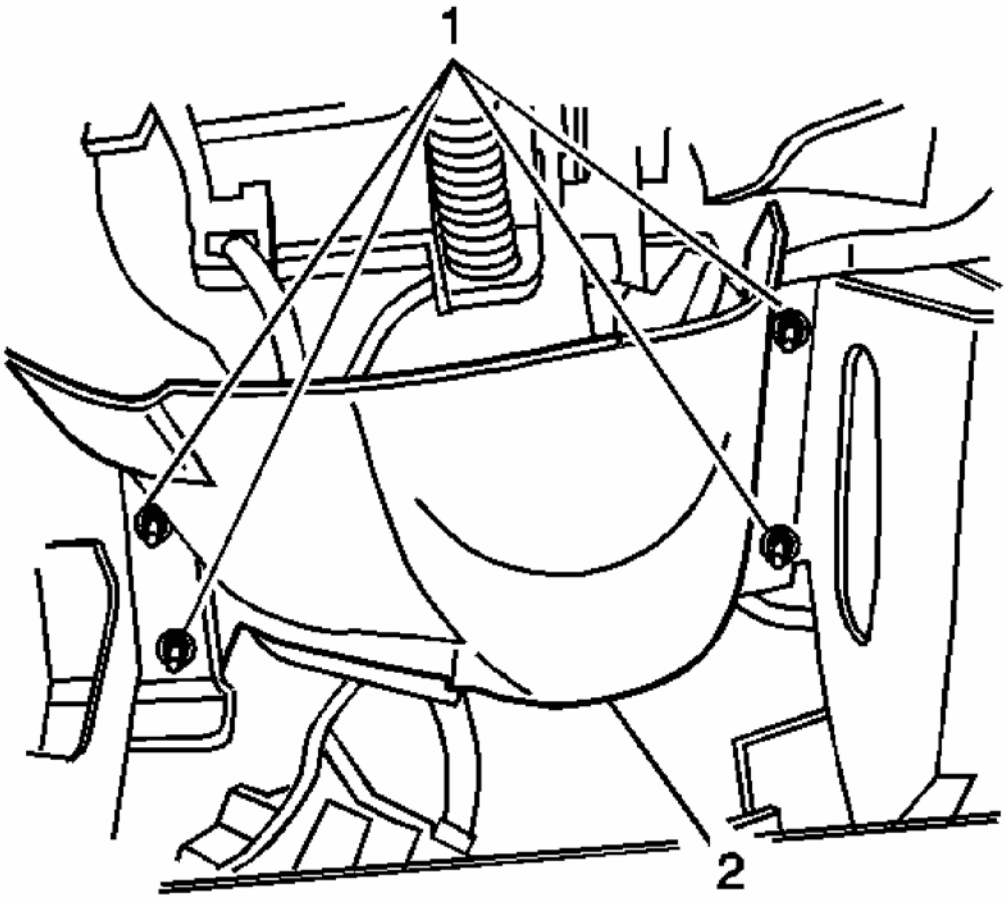



**Fig. 47: Removing Nuts From The Knee Bolster Deflector Bracket (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

5. Remove the nuts (1) from the knee bolster deflector bracket.

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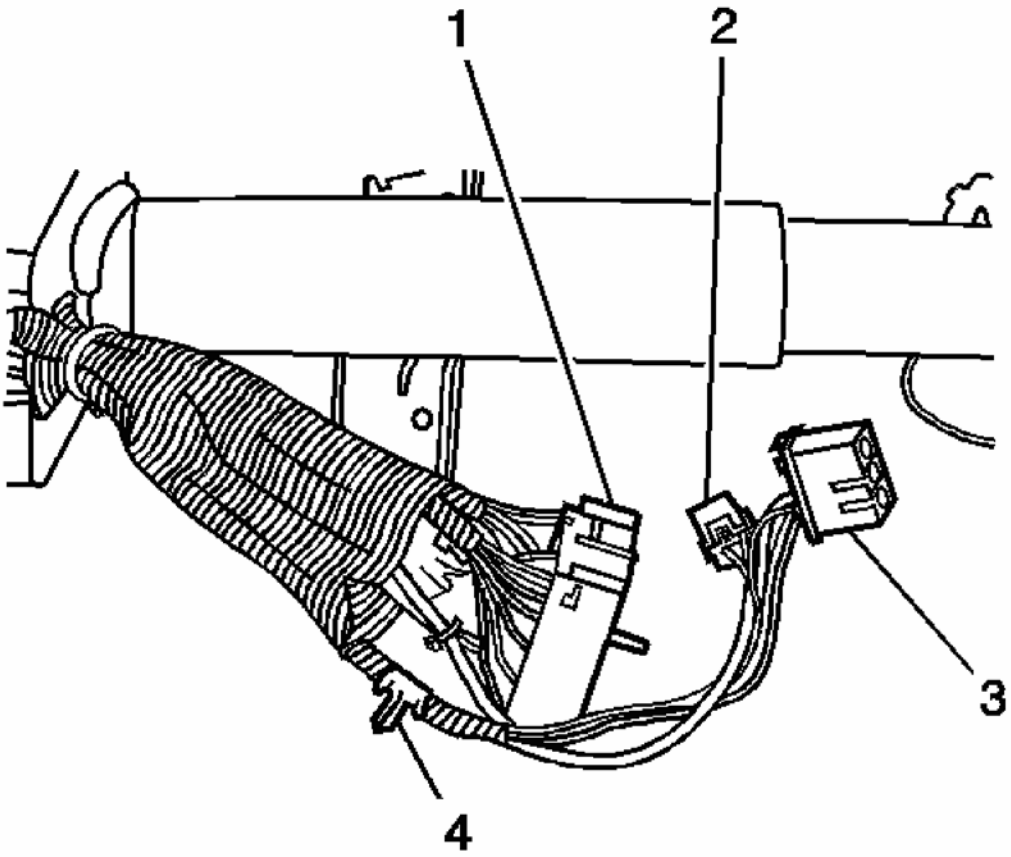



**Fig. 48: Removing Wiring Harness Retaining Pin From The Instrument Panel (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: During removal of the steering column the wire harness retaining clip must be removed and reinstalled after installing the steering column or damage may occur to the wire harness.**

6. Remove the wiring harness retaining pin (4) from the instrument panel.
7. Remove the wire straps and open the harness insulation to gain access to the electrical wiring.
8. Remove the wiring from the electrical connector.
9. Remove the shift lever.

**Installation Procedure**

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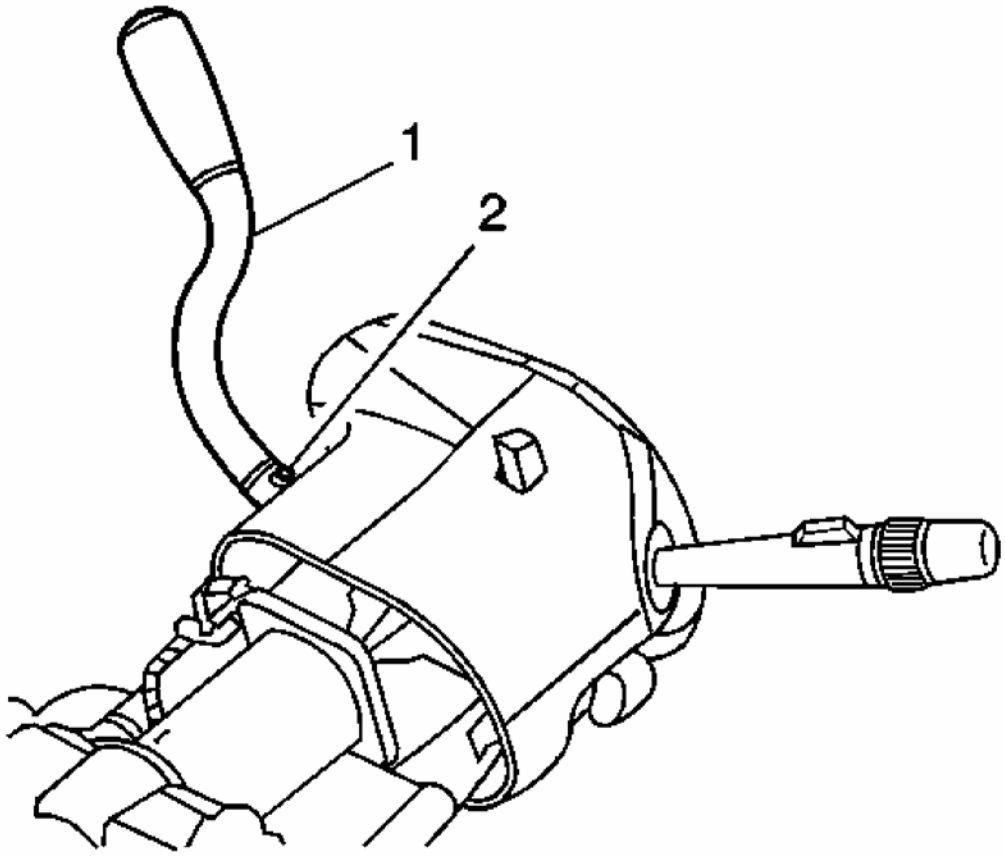



**Fig. 49: Locating Seal On The Shift Lever And TORX® Head Shift Lever Screw (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the shift lever (1).
2. Connect the shifter electrical connector.
3. Install the wire straps to the harness.

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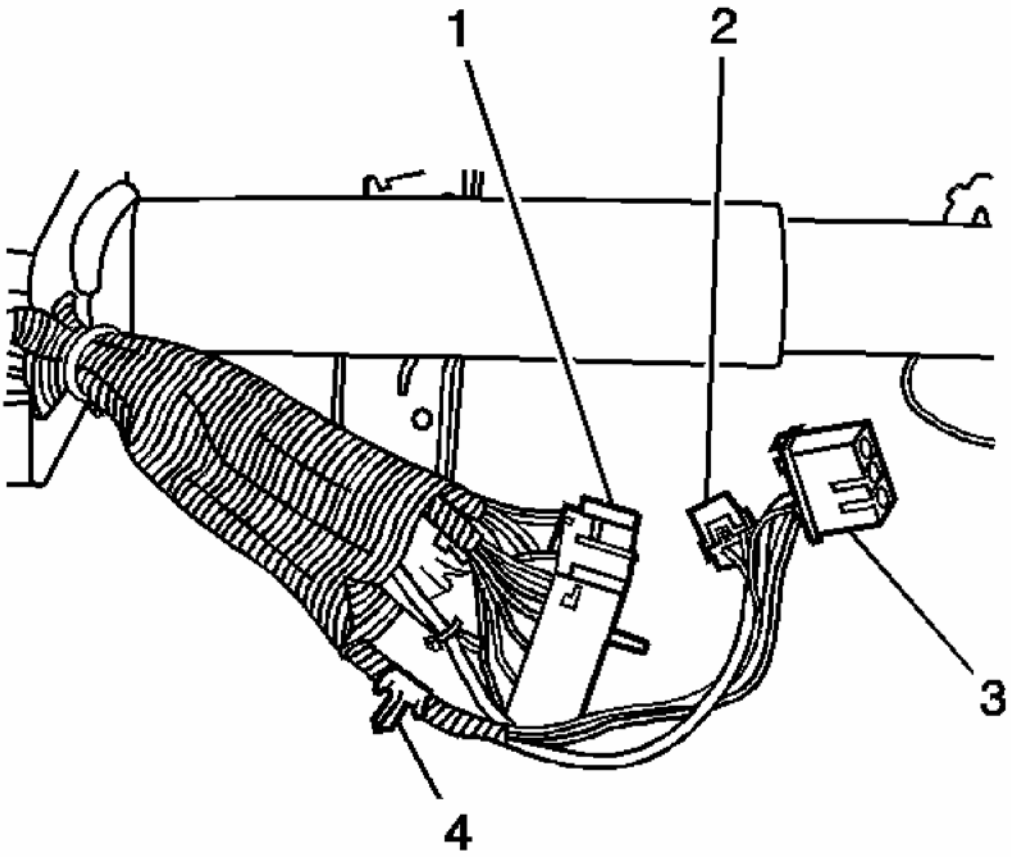



**Fig. 50: Removing Wiring Harness Retaining Pin From The Instrument Panel (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

4. Install the harness retaining pin (4) to the instrument panel.

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

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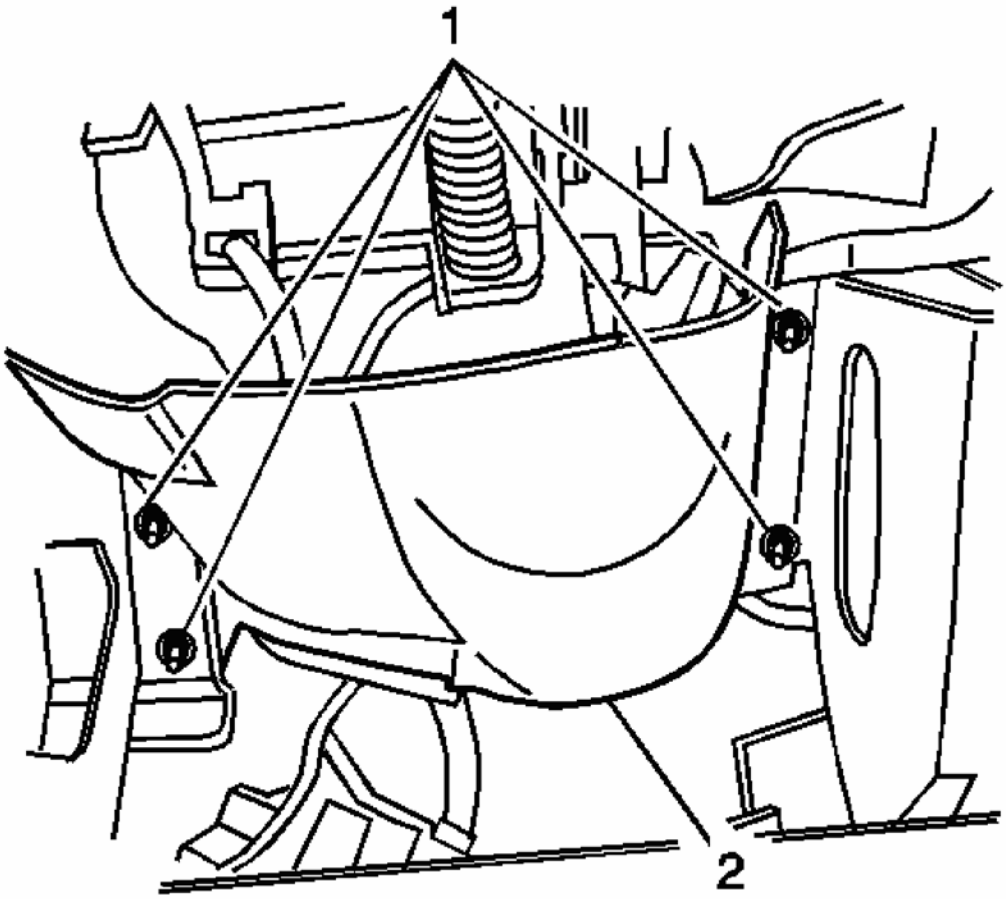



**Fig. 51: Removing Nuts From The Knee Bolster Deflector Bracket (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

5. Install the knee bolster deflector bracket and nuts (1).

   **Tighten:** Tighten the nuts to 9 N.m (80 lb in).

6. Install the knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages and Console.
7. Install the TORX® head shift lever screw.

   **Tighten:** Tighten the screw to 20 N.m (15 lb ft).

8. Roll the seal over the TORX® head shift lever screw.
9. Install the 2 TORX® head screws to the lower column trim cover.

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10. Install the trim covers. Refer to **Steering Column Trim Covers Replacement**.

## LINEAR SHIFT ASSEMBLY REPLACEMENT

### Removal Procedure

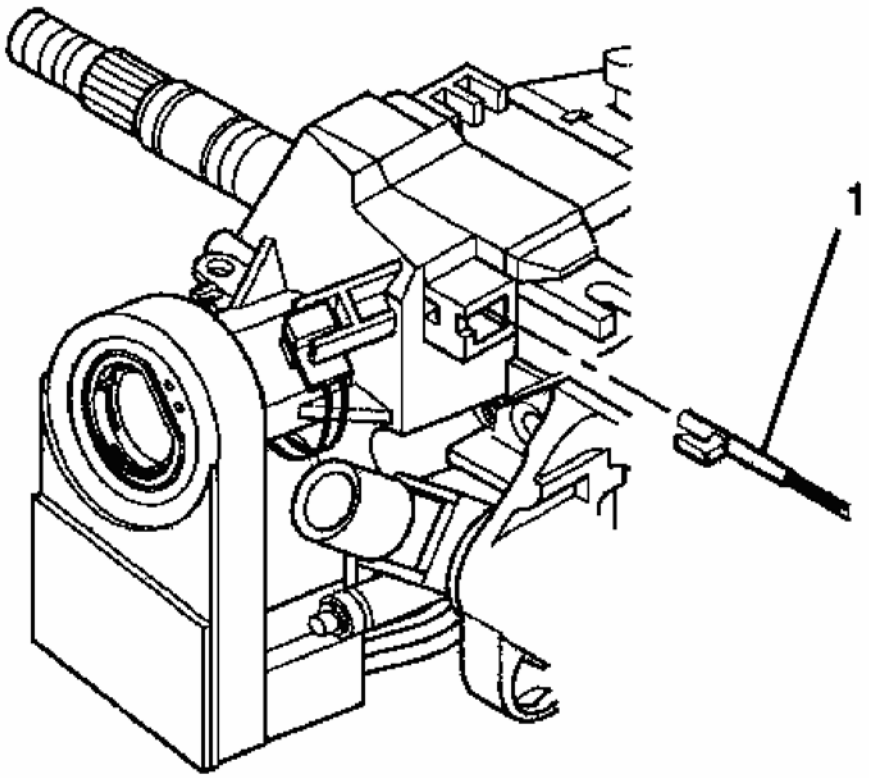



**Fig. 52: Identifying Park Lock Cable At Ignition Lock Cylinder**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the shift lever. Refer to **Shift Lever Replacement (Without Tow/Haul Switch)** or **Shift Lever Replacement (With Tow/Haul Switch)**.
3. Remove the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.
4. Disconnect the park lock cable assembly (1).

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5. The steering column lock cylinder set should be in the OFF-LOCK position.
6. Insert a small screwdriver into the slot on the ignition lock cylinder case and push against the locking tab to remove.

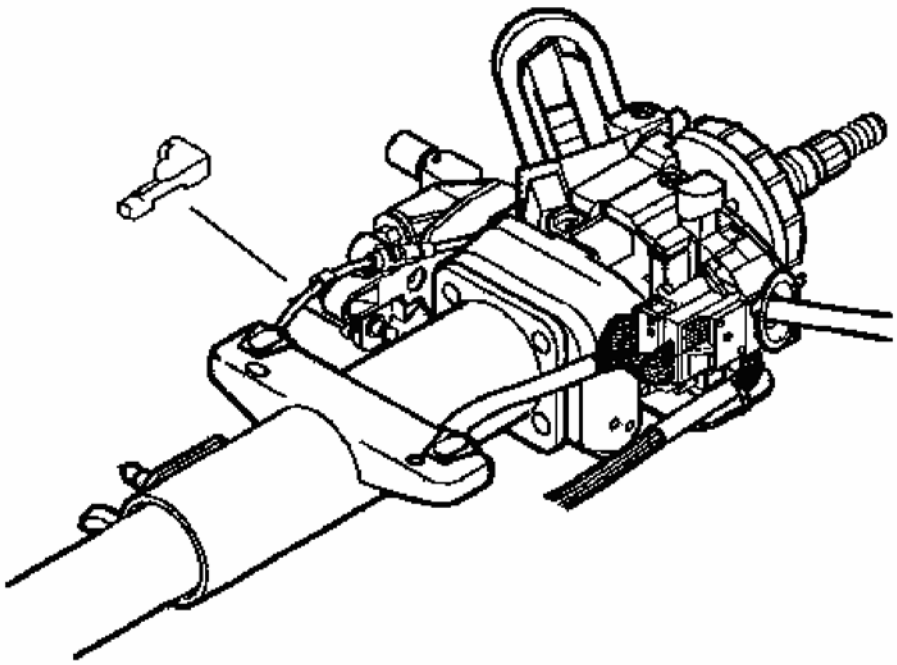


**Fig. 53: View Of Park Position Switch Assembly**
**Courtesy of GENERAL MOTORS CORP.**

7. Disconnect the automatic transmission shift lock control connector from the park position switch assembly.
8. Slide the park position switch assembly off of the linear shift assembly.

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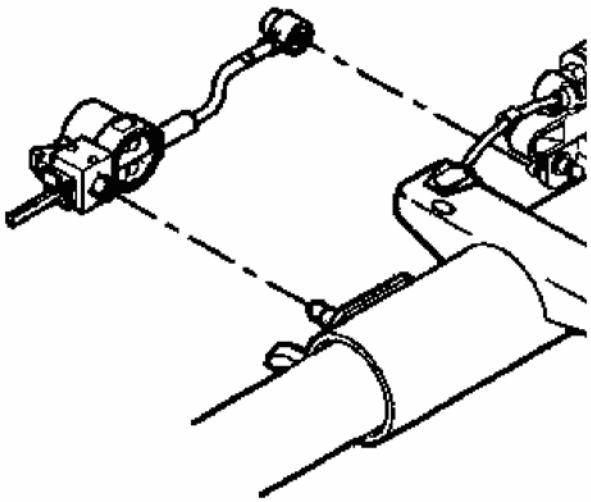


**Fig. 54: View Of Automatic Transmission Shift Lock Control Actuator**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: 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.**

9. Remove the automatic transmission shift lock control from the steering column.
10. Use a small screwdriver to pry the automatic transmission shift lock control from the steering column jacket assembly.

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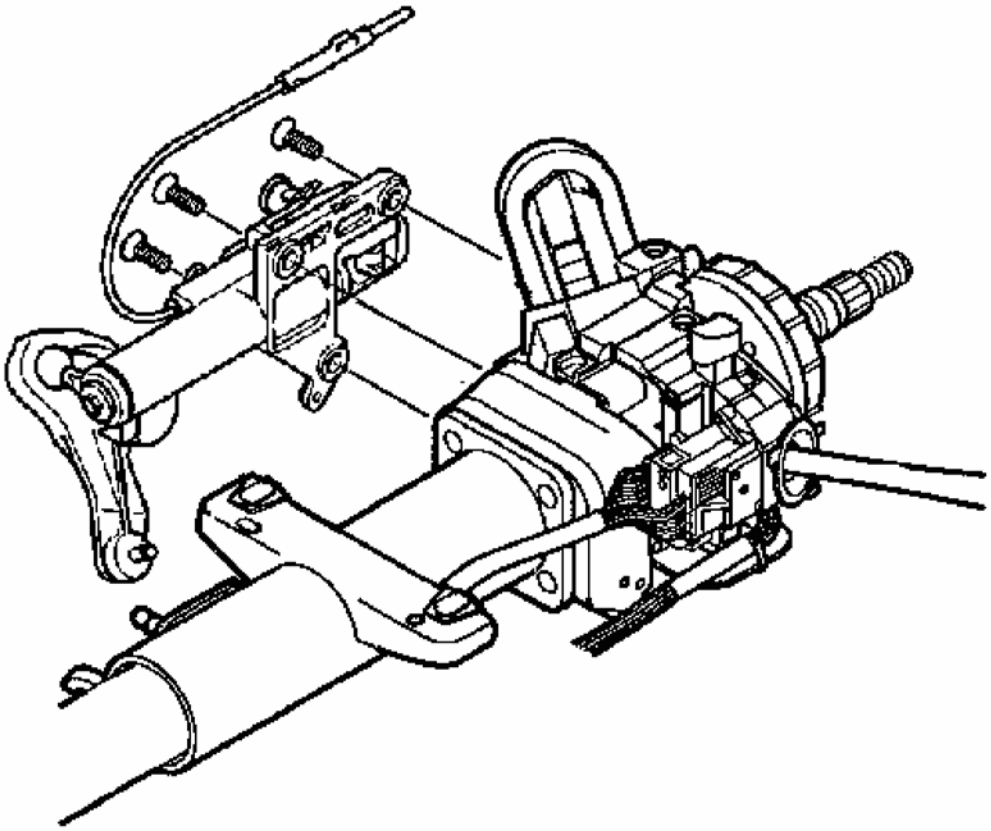


**Fig. 55: View Of Linear Shift Assembly And Retaining Screws**
**Courtesy of GENERAL MOTORS CORP.**

11. Remove the 3 TORX® screws from the linear shift assembly.
12. Remove the linear shift assembly from the steering column support assembly.

**Installation Procedure**

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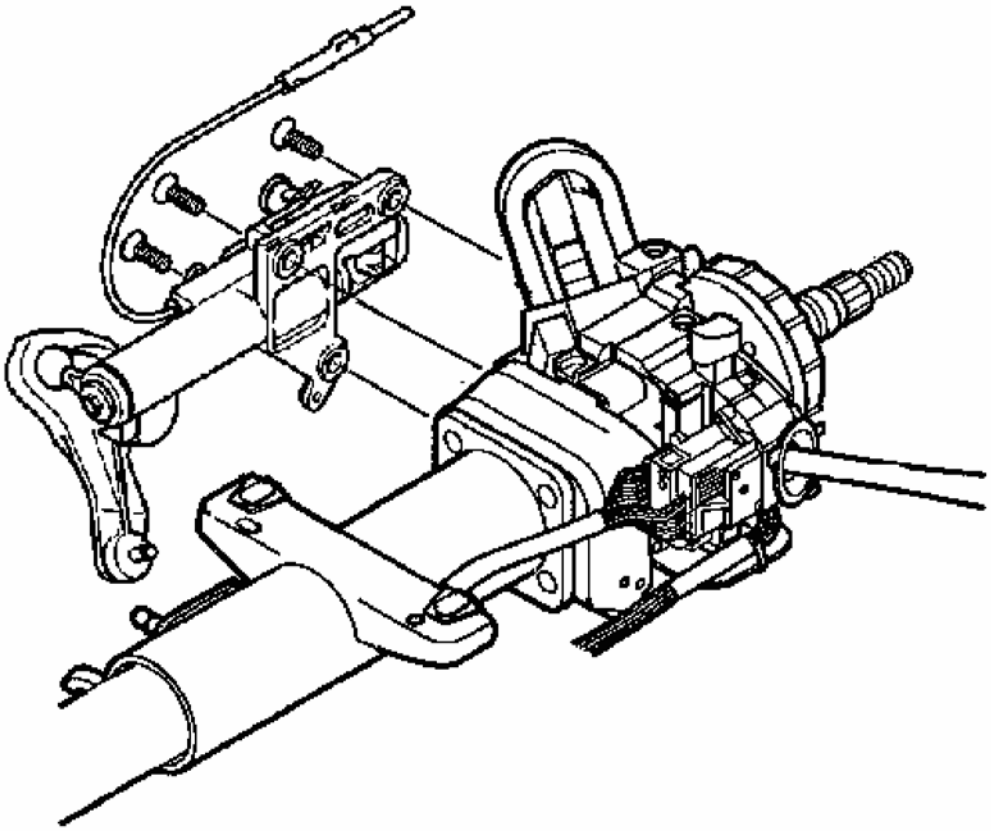


**Fig. 56: View Of Linear Shift Assembly And Retaining Screws**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the linear shift assembly onto the steering column support assembly.

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

2. Secure the linear shift assembly to the steering column assembly with the 3 flat head tapping screws.

   Move the linear shift assembly out of the PARK position to install the lower socket tapping screw.

   **Tighten:** Tighten the 3 TORX® screws to 10 N.m (89 lb in).

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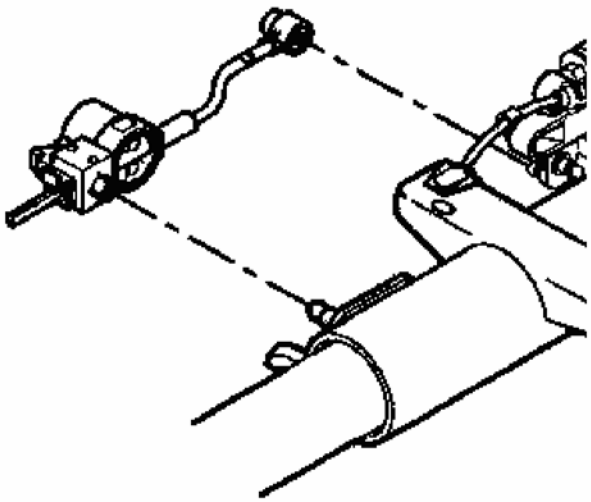


**Fig. 57: View Of Automatic Transmission Shift Lock Control Actuator**
**Courtesy of GENERAL MOTORS CORP.**

3. Install the automatic transmission shift lock control.
4. Install the shift lever clevis and put the column in the neutral position.
5. The neutral position is 2 positions from the park position.

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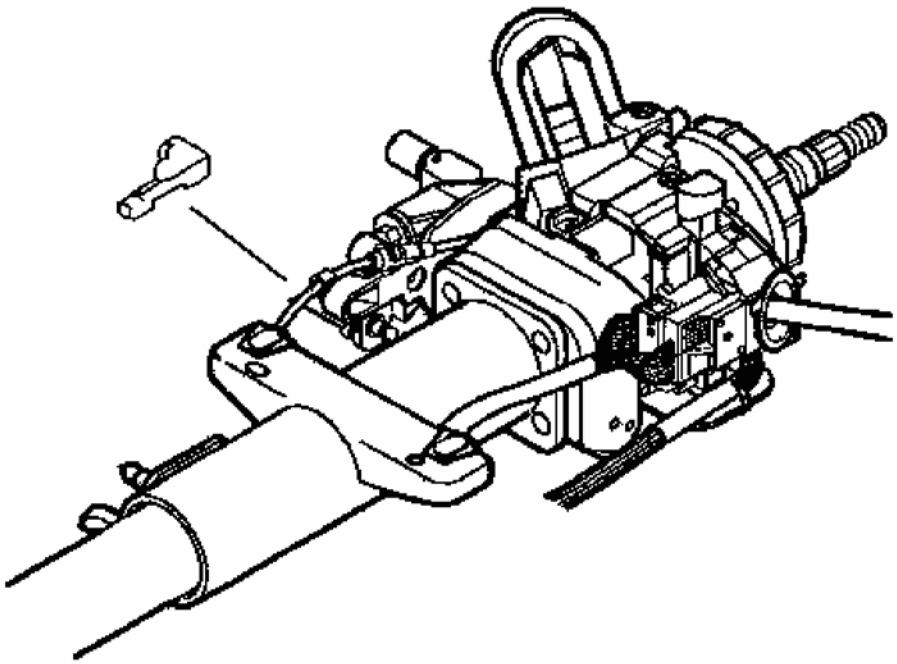


**Fig. 58: View Of Park Position Switch Assembly**
**Courtesy of GENERAL MOTORS CORP.**

6. Slide the park position switch assembly onto the linear shift assembly.
7. Connect the automatic transmission shift lock control connector onto the park position switch assembly.

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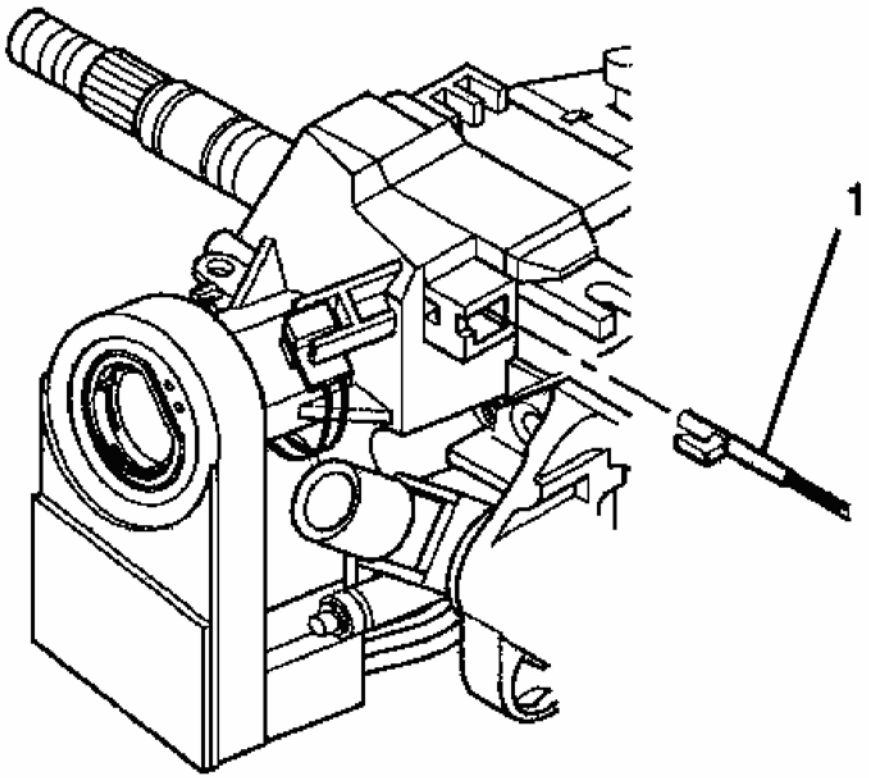



**Fig. 59: Identifying Park Lock Cable At Ignition Lock Cylinder**
**Courtesy of GENERAL MOTORS CORP.**

8. Connect the park lock cable assembly (1) to the ignition lock cylinder case in the following way:
    1. Place the steering column lock cylinder set into the off position.
    2. Place the shift lever clevis into the park position.
    3. Press the locking tab on the end of the park lock cable assembly (1) into the slot in the ignition lock cylinder case.
9. Install the shift lever. Refer to **Shift Lever Replacement (Without Tow/Haul Switch)** or **Shift Lever Replacement (With Tow/Haul Switch)**.
10. Install the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.
11. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**TILT LEVER REPLACEMENT**

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**Removal Procedure**

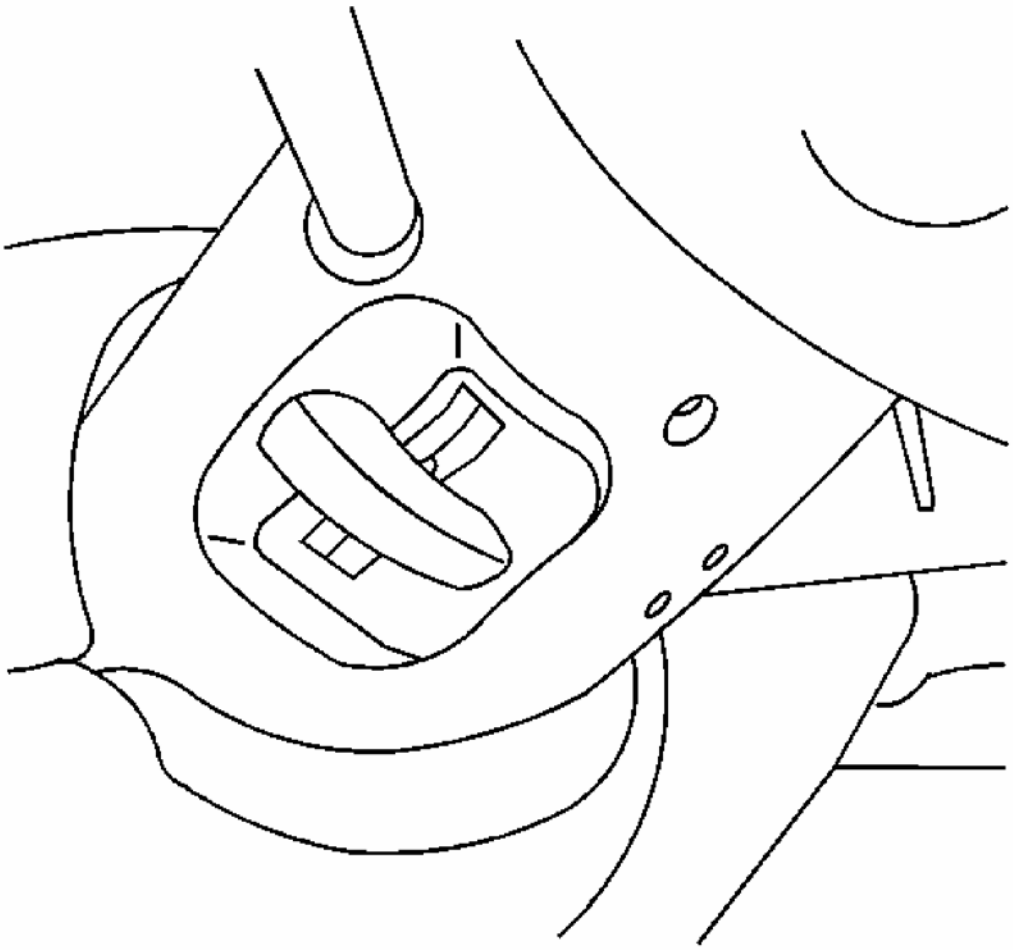


**Fig. 60: Pulling The Tilt Lever Out Of The Steering Column**
**Courtesy of GENERAL MOTORS CORP.**

1. Remove the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**.
2. Remove the tilt lever.

**Installation Procedure**

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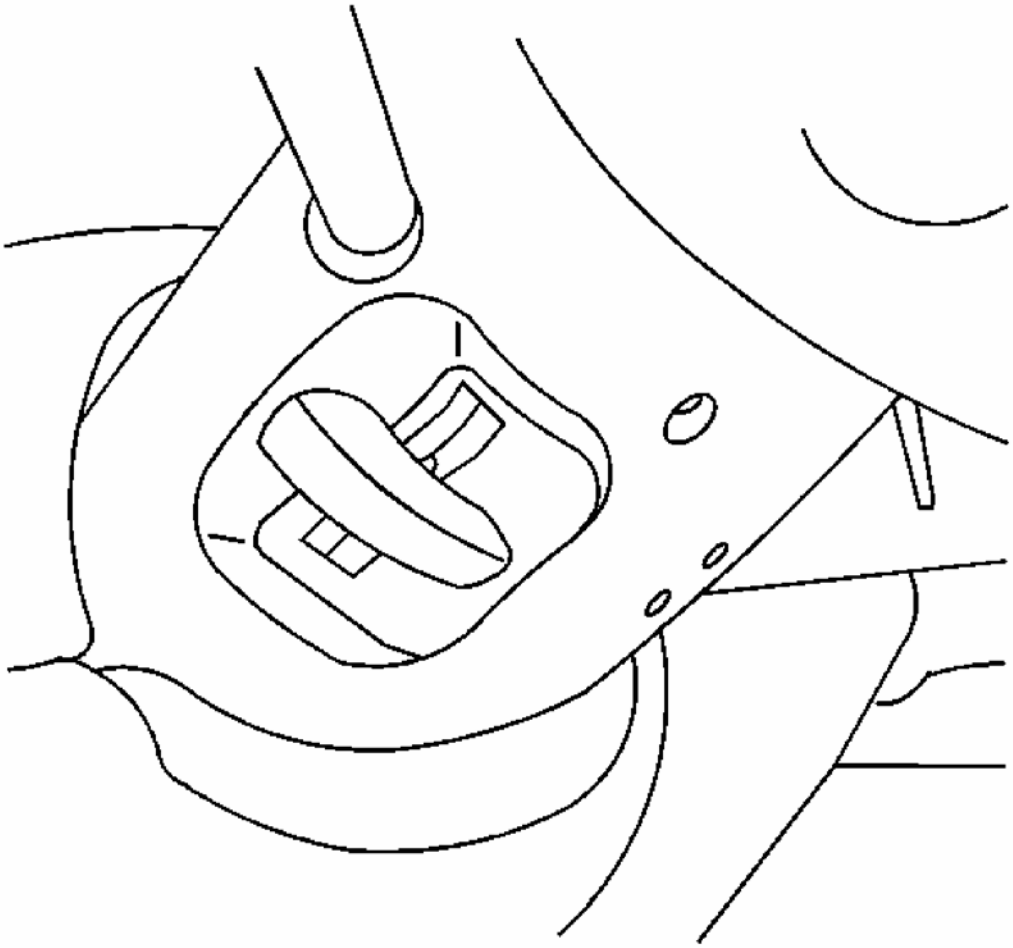


**Fig. 61: Pulling The Tilt Lever Out Of The Steering Column**
**Courtesy of GENERAL MOTORS CORP.**

1. Align the lever in the steering column.
2. Push the lever into the steering column.
3. Install the steering column trim covers. Refer to **Steering Column Trim Covers Replacement**

**HORN SWITCH REPLACEMENT**

**Removal Procedure**

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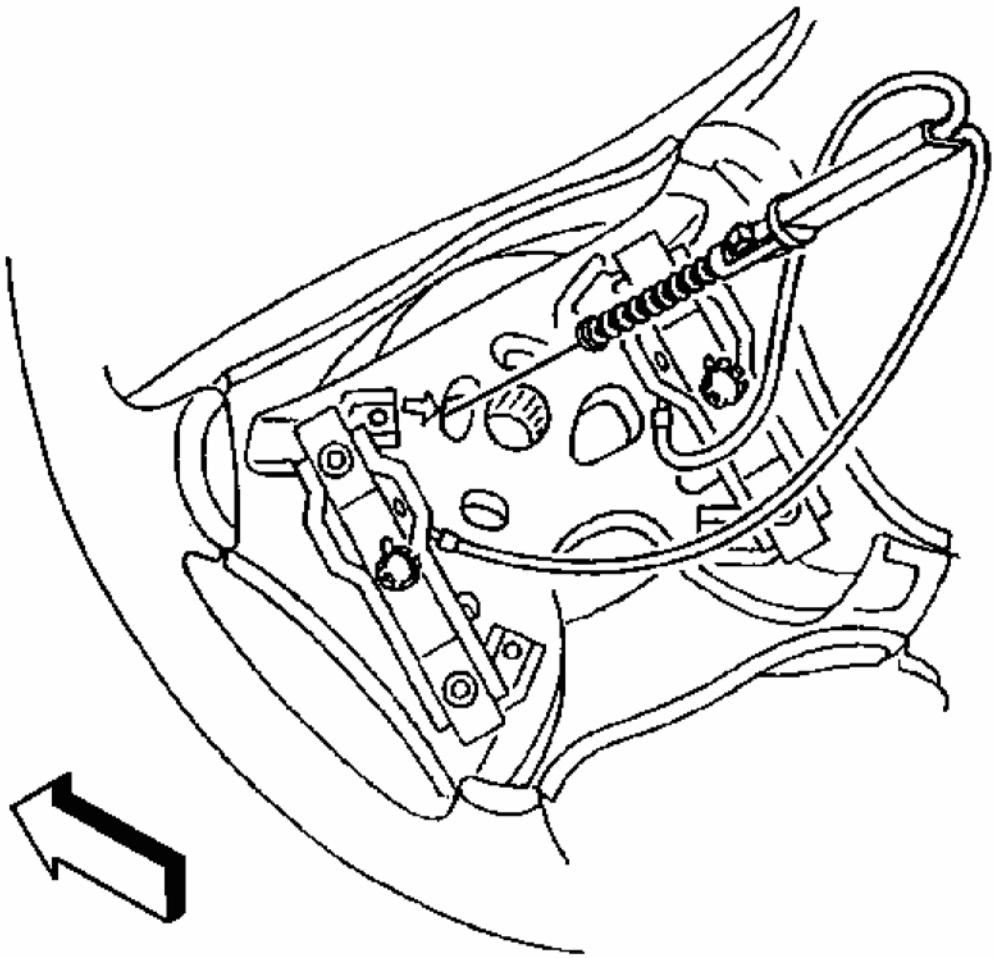


**Fig. 62: View Of Horn Plunger At Steering Column**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SERVICING THE SIR SYSTEM CAUTION in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the inflatable restraint steering wheel module. Refer to **Inflatable Restraint Steering Wheel Module Replacement** in SIR.
3. Remove the horn plunger from the steering column by pressing inward to the stop and rotating the horn plunger 90 degrees.

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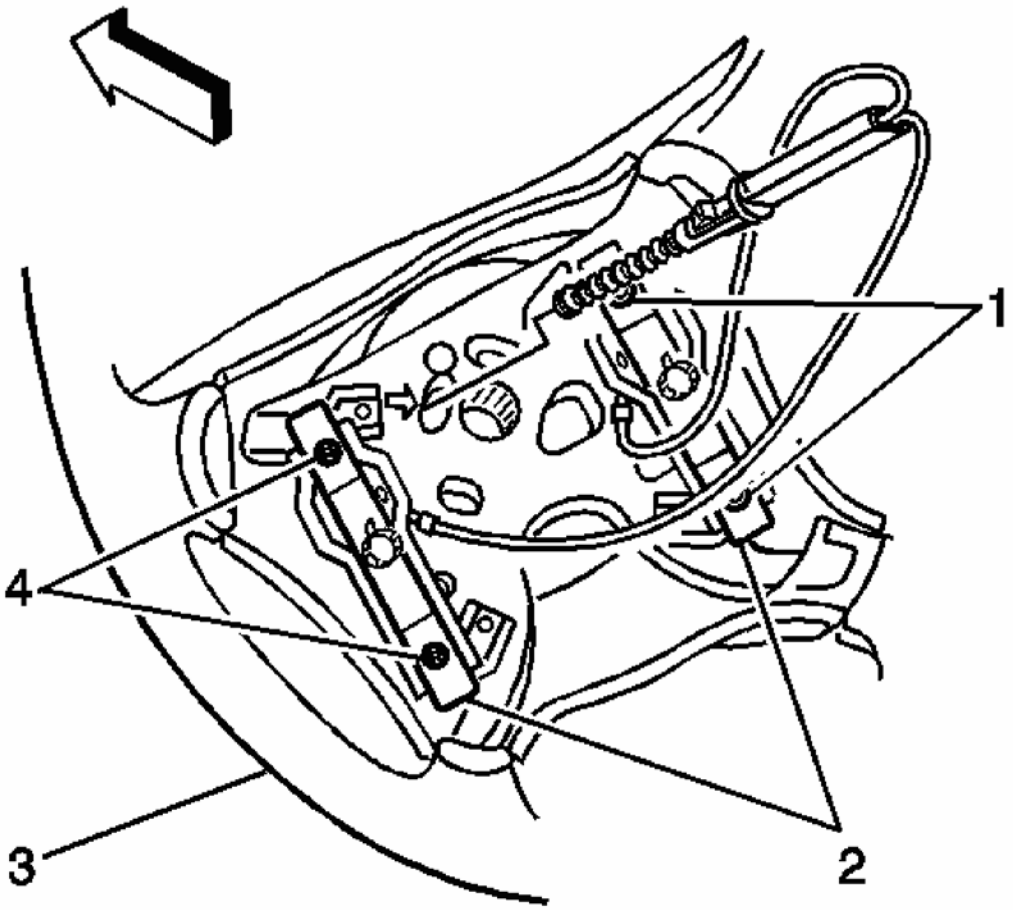



**Fig. 63: View of Horn Contact Plate, Steering Wheel & Screws**
**Courtesy of GENERAL MOTORS CORP.**

4. Disconnect the captured screws (1,4) to the horn contact plate (2) from the steering wheel (3).
5. Remove the horn switch (2) from the steering wheel (3).

**Installation Procedure**

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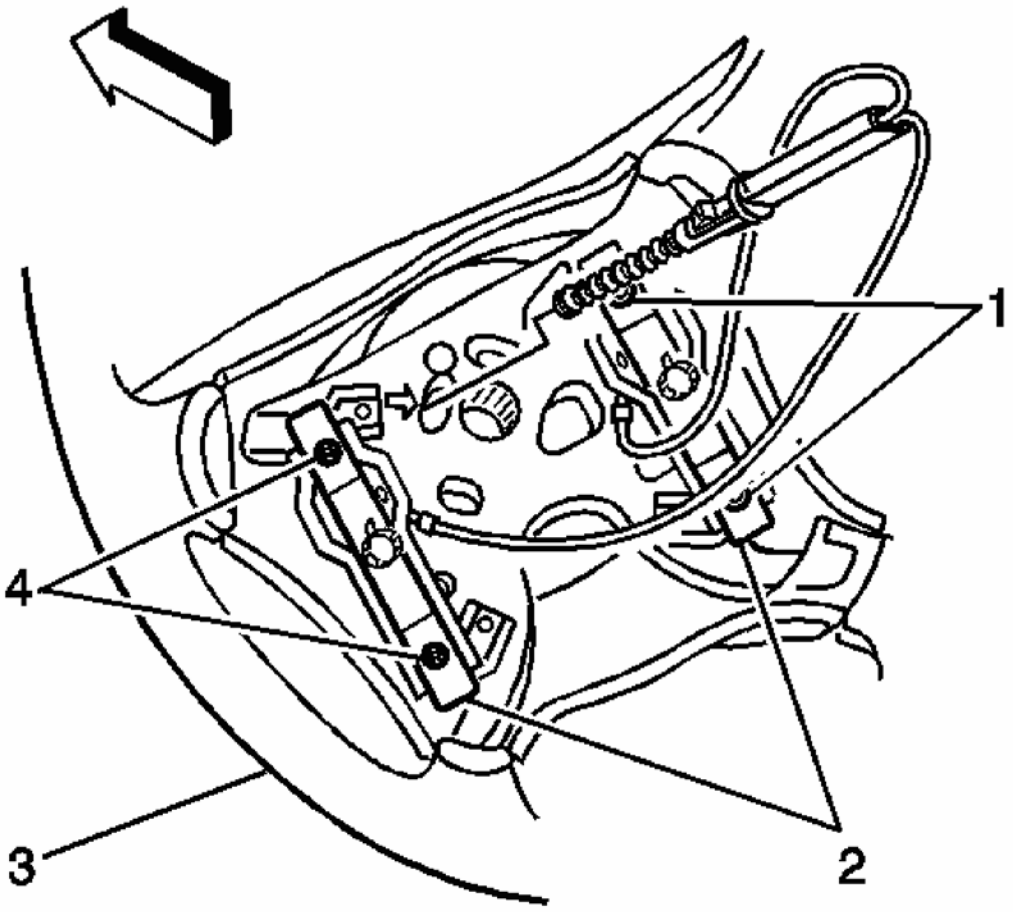



**Fig. 64: View of Horn Contact Plate, Steering Wheel & Screws**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the horn switch (2) to the steering wheel (3).

**NOTE: Refer to FASTENER NOTICE in Cautions and Notices.**

2. Connect the captured screws (1,4) from the horn contact plate (2) to the steering wheel (3).

**Tighten:** Tighten the screws to 5.5 N.m (50 lb in).

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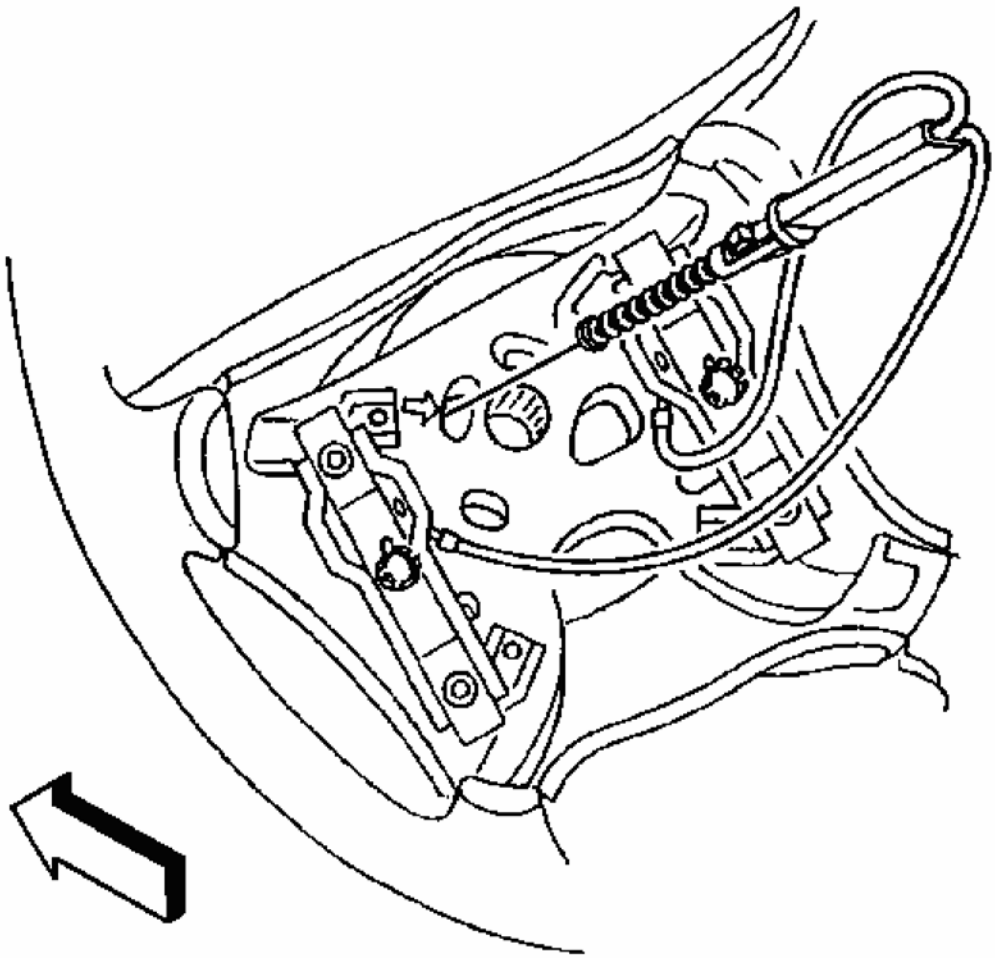


**Fig. 65: View Of Horn Plunger At Steering Column**
**Courtesy of GENERAL MOTORS CORP.**

3. Install the horn plunger to the steering column.
4. Install the inflator module. Refer to **Inflatable Restraint Steering Wheel Module Replacement** in SIR.
5. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

## STEERING WHEEL CONTROL SWITCH ASSEMBLY REPLACEMENT

### Removal Procedure

1. Remove the steering wheel. Refer to **Steering Wheel Replacement**.

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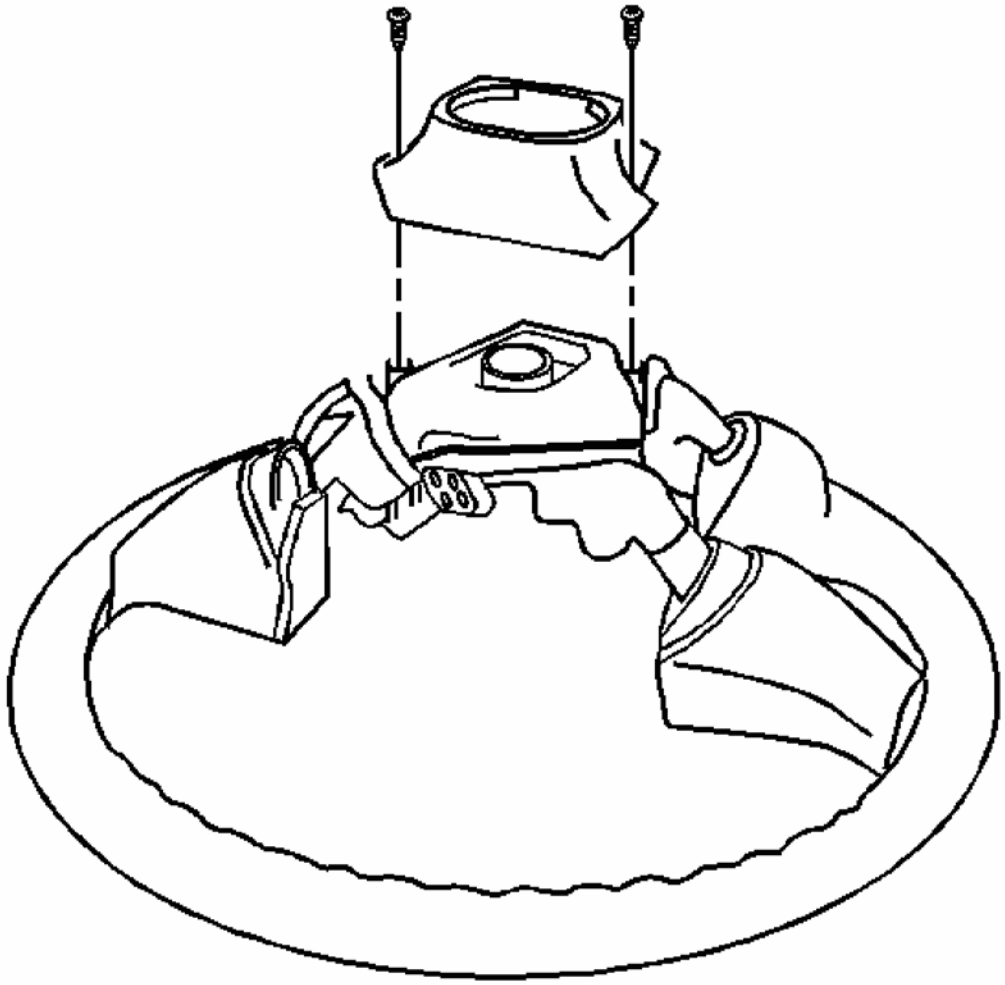


**Fig. 66: View Of Shroud & Screws**
**Courtesy of GENERAL MOTORS CORP.**

2. Remove the shroud retaining screws from the back of the steering wheel.
3. Remove the shroud from the steering wheel.

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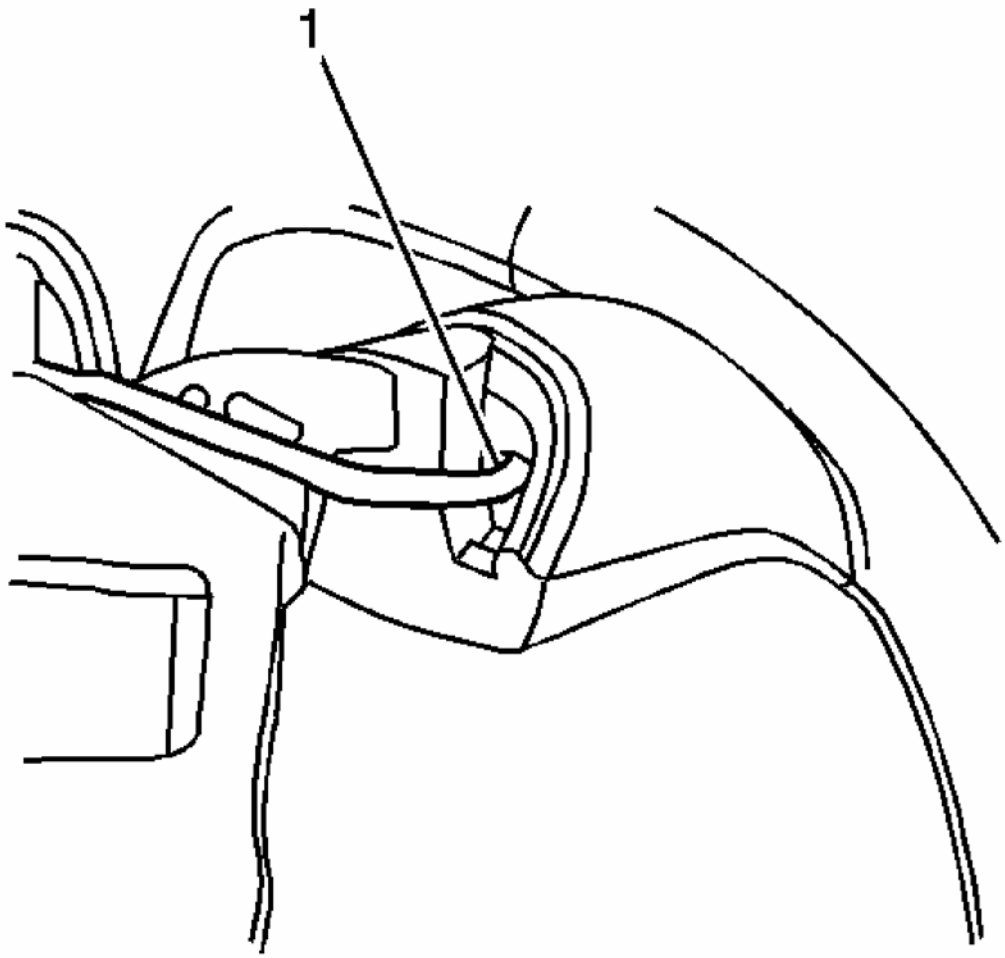



**Fig. 67: Positioning A Blunt Ended Tool Into The Wire Harness Cavity**
**Courtesy of GENERAL MOTORS CORP.**

4. Position a blunt ended tool into the wire harness cavity (1) and apply moderate pressure in order to partially remove the steering wheel control switch from the steering wheel.

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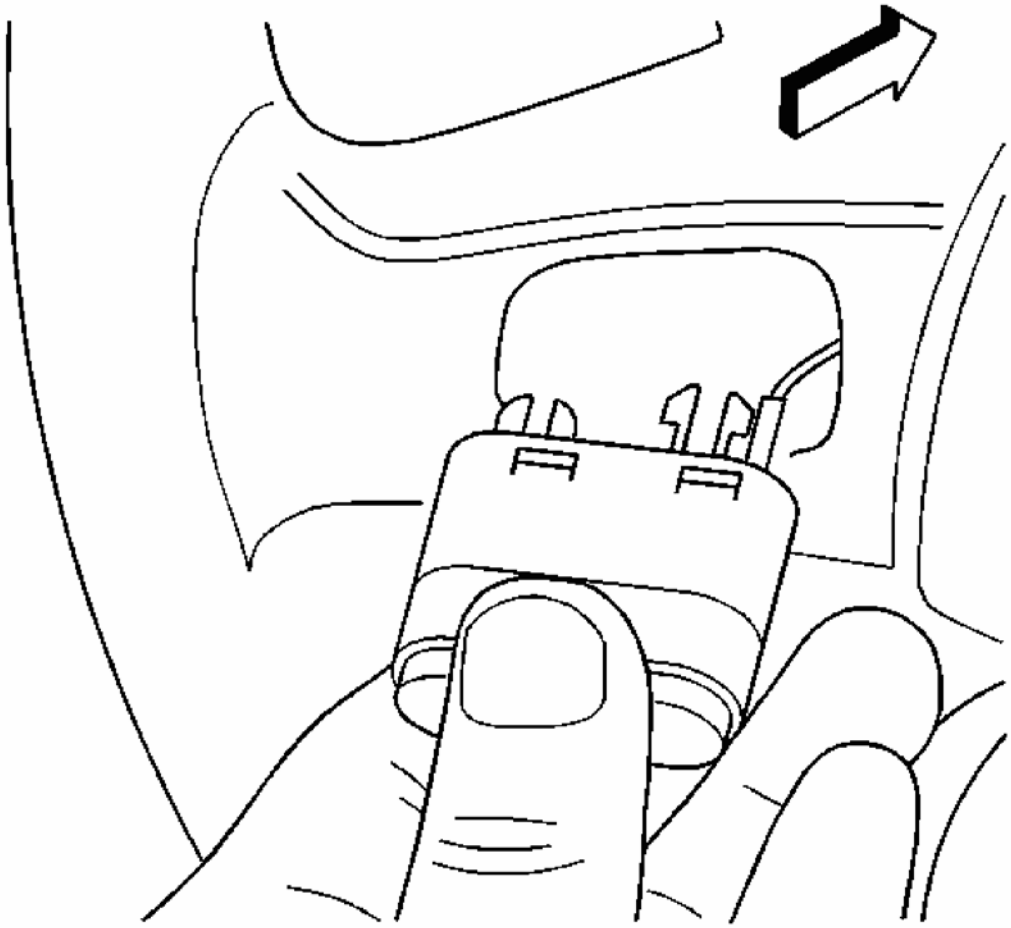


**Fig. 68: View Of Steering Wheel Control Switch Electrical Connector**
**Courtesy of GENERAL MOTORS CORP.**

5. Disconnect the steering wheel control switch electrical connector.

**IMPORTANT: The bulbs in the steering wheel control switches are not serviceable. The switches should be replaced only as an assembly.**

6. Remove the steering wheel control switch from the steering wheel.

**Installation Procedure**

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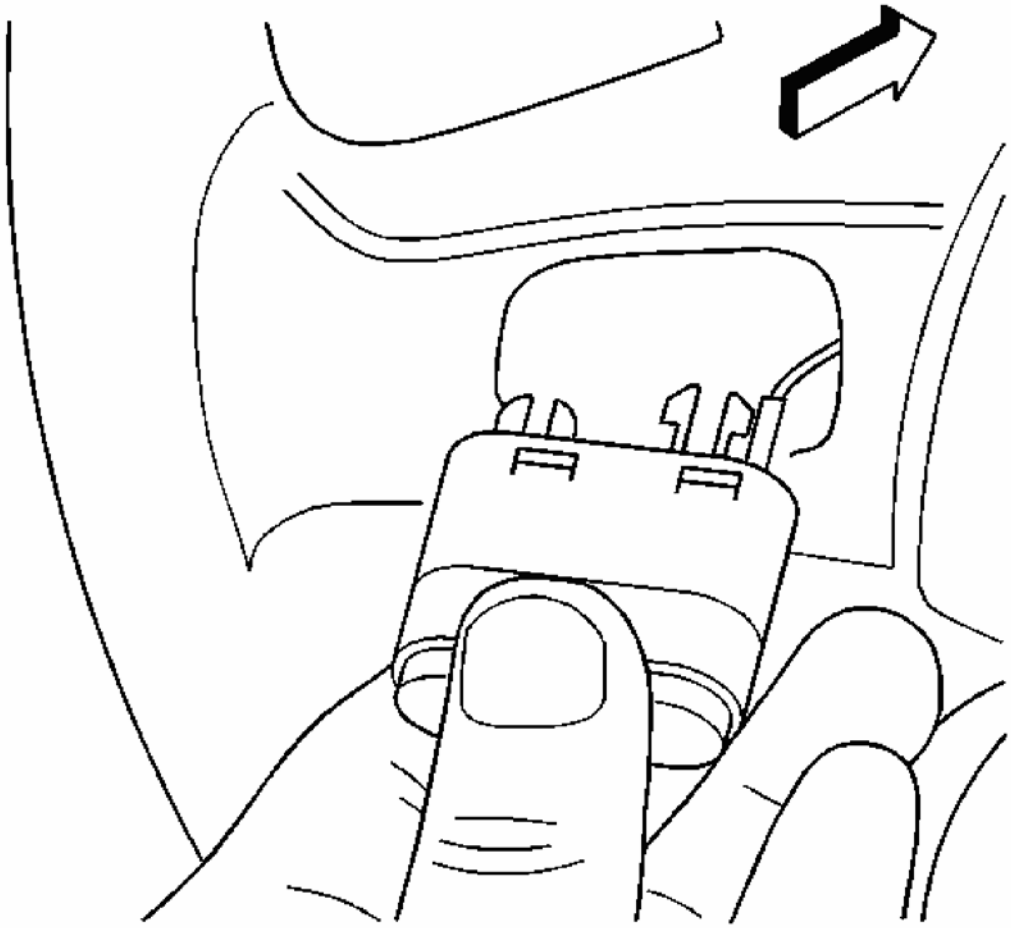


**Fig. 69: View Of Steering Wheel Control Switch Electrical Connector**
**Courtesy of GENERAL MOTORS CORP.**

1. Position the steering wheel control switch to the steering wheel.
2. Connect the electrical connector to the steering wheel control switch.
3. Install the steering wheel control switch into the steering wheel, ensuring the retaining tabs are fully seated.

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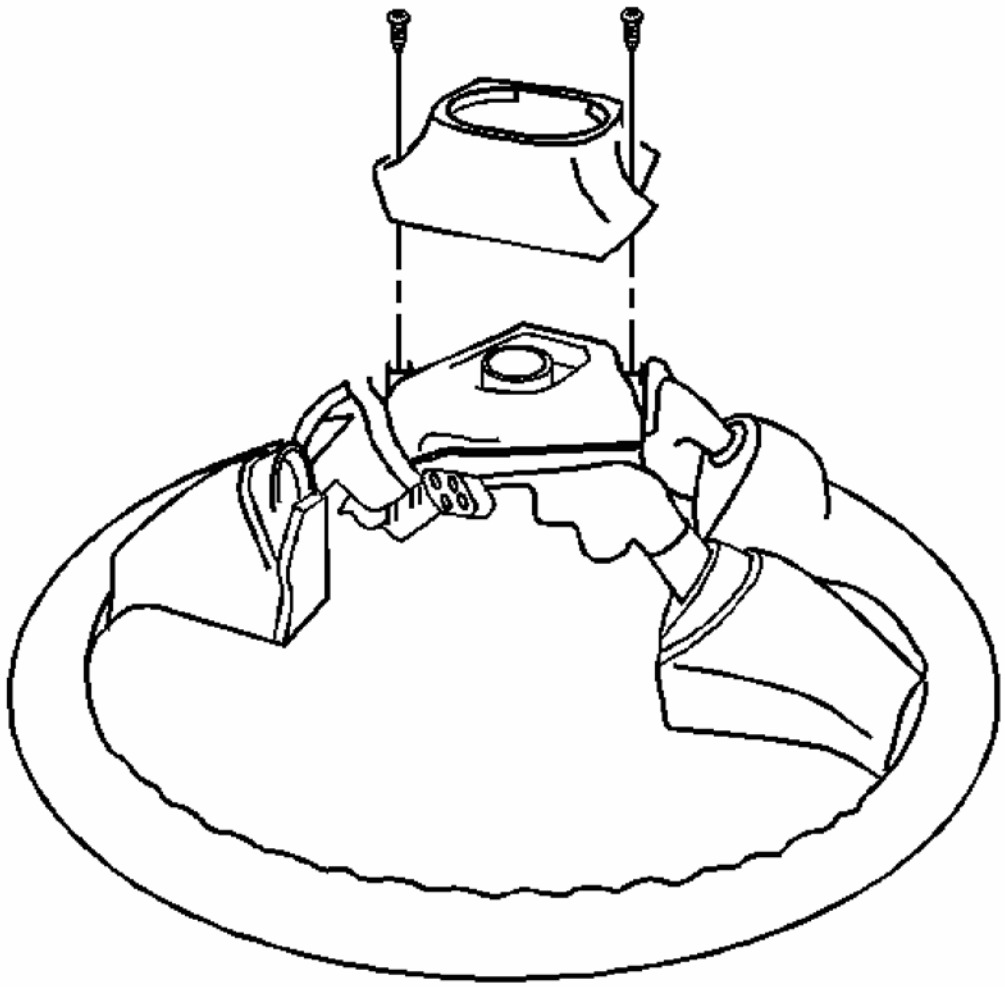


**Fig. 70: View Of Shroud & Screws**
**Courtesy of GENERAL MOTORS CORP.**

4. Install the shroud to the steering wheel.

   **NOTE: Refer to Fastener Notice in Cautions and Notices.**

5. Install the shroud retaining screws to the steering wheel.

   **Tighten:** Tighten the screws to 2 N.m (18 lb in).

6. Install the steering wheel. Refer to **Steering Wheel Replacement**.

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## STEERING WHEEL REPLACEMENT

### Tools Required

**J 1859-A** Steering Wheel Puller. See **Special Tools**.

**J-36541-A** Steering Wheel Puller Adapter

**J 42578** Steering Wheel Puller Legs. See **Special Tools**.

### Removal Procedure

1. Disable the supplemental inflatable restraint (SIR) system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the inflator module. Refer to **Horn Switch Replacement** in SIR.
3. Remove the horn switch. Refer to **Horn Switch Replacement**.
4. Make an alignment mark in order to note the relationship of the steering wheel to the steering shaft.
5. Remove the steering wheel nut.

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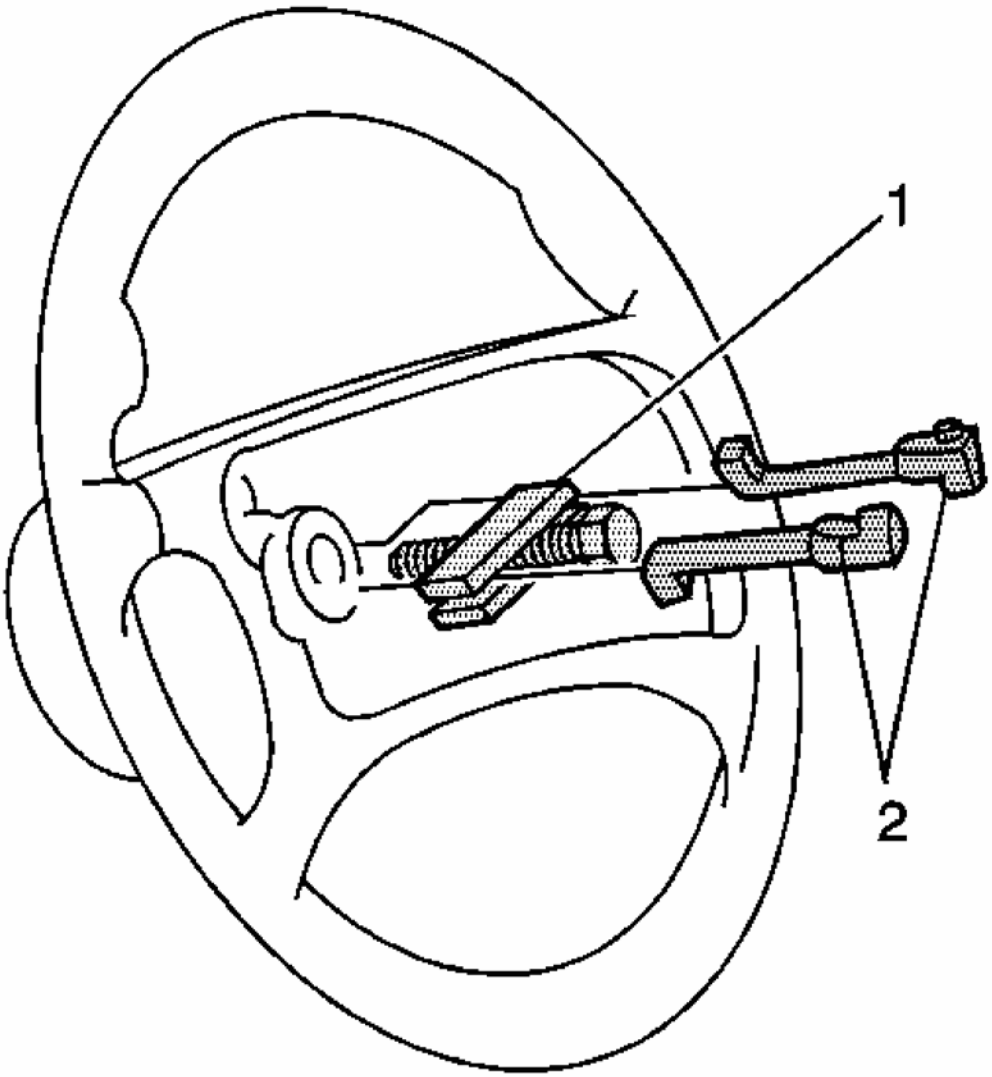



**Fig. 71: Removing The Steering Wheel**
**Courtesy of GENERAL MOTORS CORP.**

6. Remove the steering wheel using:
   - **J 1859-A** (1) with. See **Special Tools**.
   - **J-36541-A** (2) or **J 42578** (2). See **Special Tools**.

**Installation Procedure**

1. Align the marks made during the removal of the steering shaft and the steering wheel.

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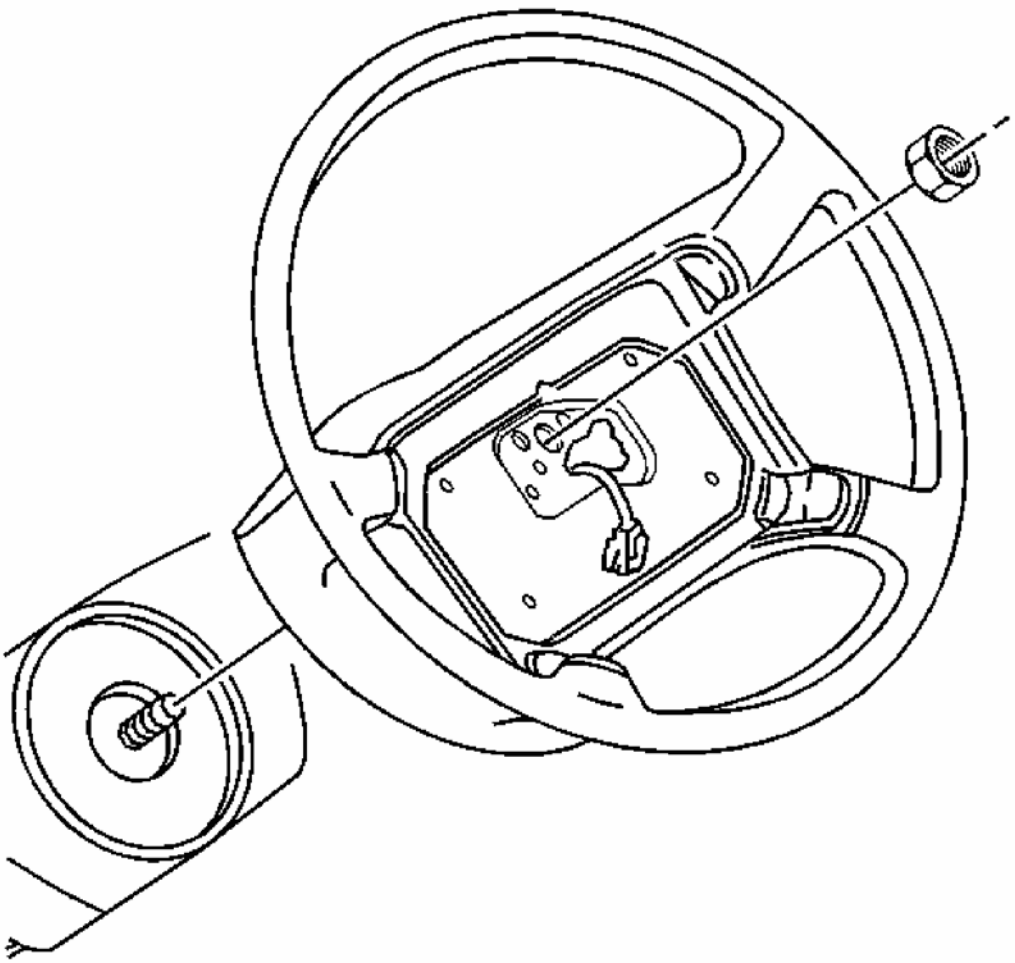


**Fig. 72: Installing The Steering Wheel Onto The Steering Shaft**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the steering wheel onto the steering shaft.

**NOTE:** **Refer to Fastener Notice in Cautions and Notices.**

3. Install the steering wheel nut to the steering shaft.

   **Tighten:** Tighten the nut to 40 N.m (29 lb ft).

4. Install the horn switch. Refer to **Horn Switch Replacement**.
5. Install the inflator module. Refer to **Inflatable Restraint Steering Wheel Module Replacement** in SIR.

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6. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

## REPAIRING SCRATCHED WOOD STEERING WHEELS

### Repair Procedure

1. Remove the steering wheel. Refer to **Steering Wheel Replacement**.
2. Wash the wood section of the wheel with wax and grease remover.
3. Mask off the non-wood area of the steering wheel.

**IMPORTANT: Do NOT sand through the clear.**

4. Sand with 400 grit sand paper first. Finish sanding with 600 grit.
5. Wash the wood section of the wheel again with wax and grease remover.
6. Clear coat the steering wheel. Refer to the 2003 GM Approved Refinish Materials Booklet, GM 4901 M-D-2003 (English) or M-D-F2003 (French).
7. Install the steering wheel. Refer to **Steering Wheel Replacement**.

## TILT SPRING REPLACEMENT

### Removal Procedure

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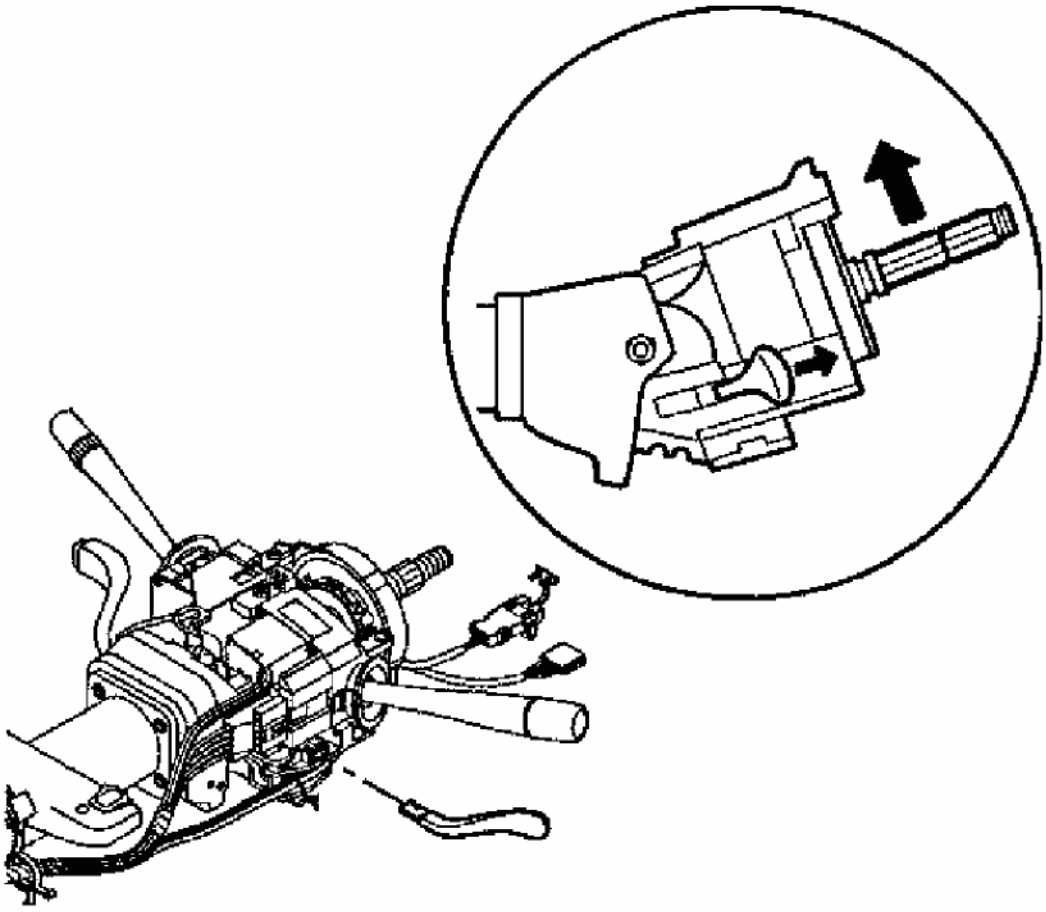


**Fig. 73: Tilting Column To Up Position**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.
3. Install the tilt lever onto the steering column tilt head assembly.
4. Use the tilt lever to tilt the column to the UP position.

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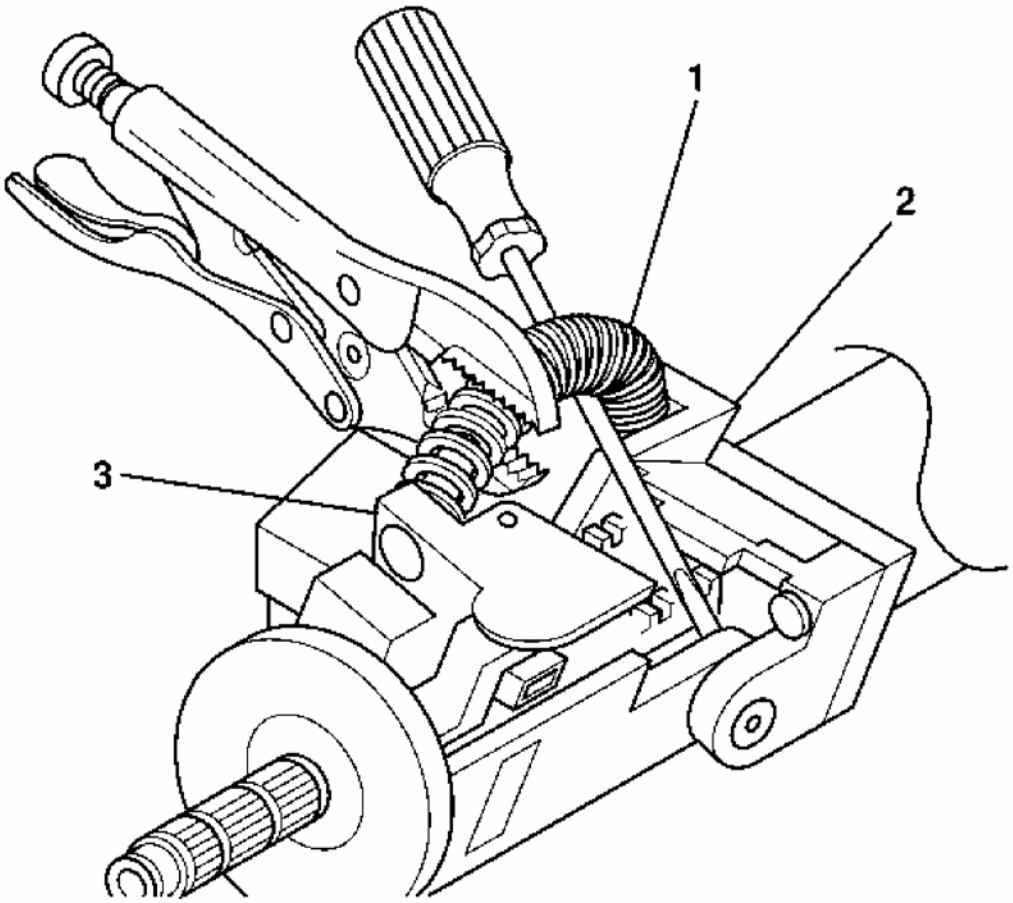



**Fig. 74: Removing Tilt Spring From Steering Column Support Assembly**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: 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.**

5. Remove the tilt spring (1) from the steering column support assembly (2) and from the steering column tilt head assembly (3) by using the following procedure:
    1. Pry up the tilt spring (1) until a bulge occurs and most of the tilt spring tension is removed.

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2. Secure the tilt spring (1) with locking pliers.
3. Continue prying up the tilt spring (1) until the tilt spring disengages from the post on the steering column support assembly (2) and from the steering column tilt head assembly (3).

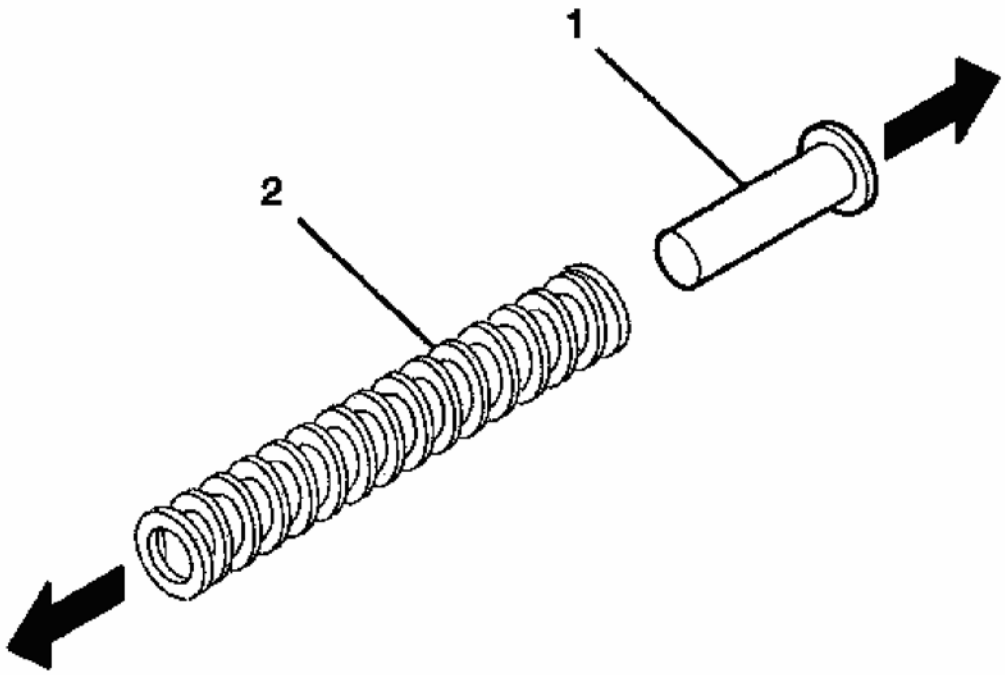



**Fig. 75: Identifying Spring Guide Components**
**Courtesy of GENERAL MOTORS CORP.**

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

**Installation Procedure**

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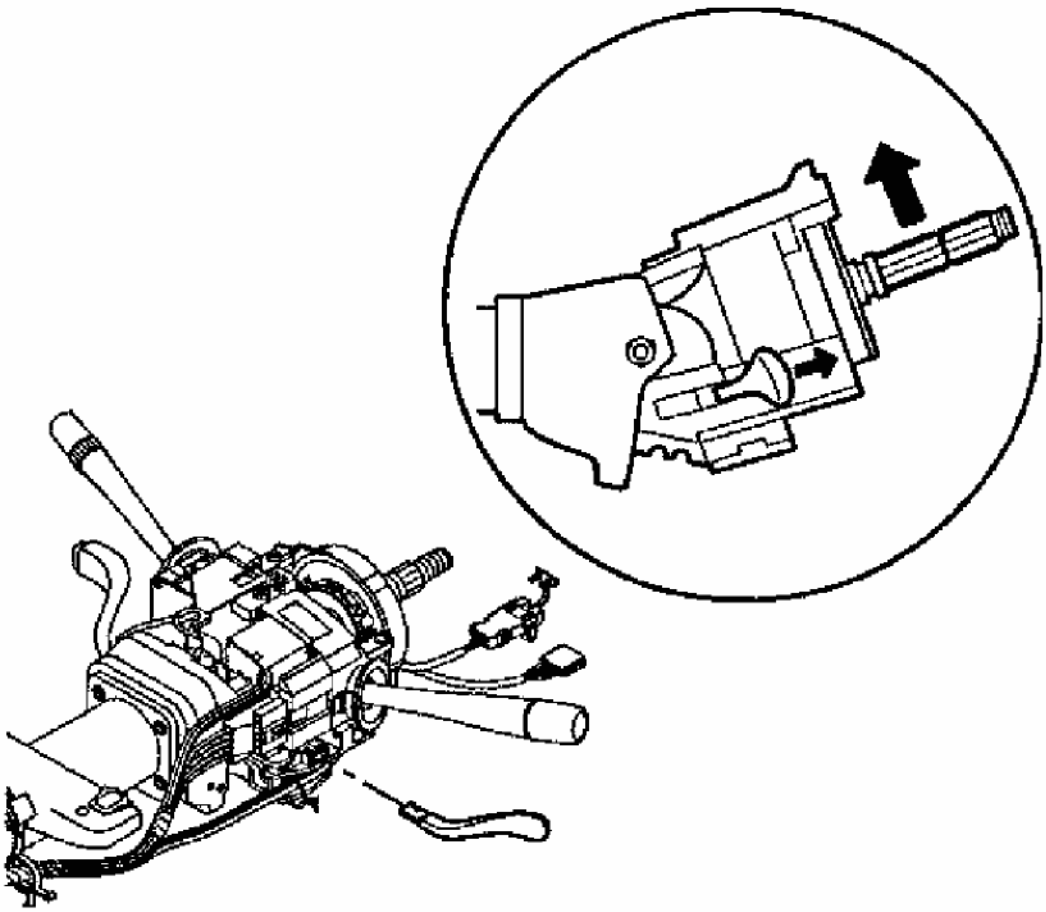


**Fig. 76: Tilting Column To Up Position**
**Courtesy of GENERAL MOTORS CORP.**

1. Use the tilt lever to tilt the column to the UP position.

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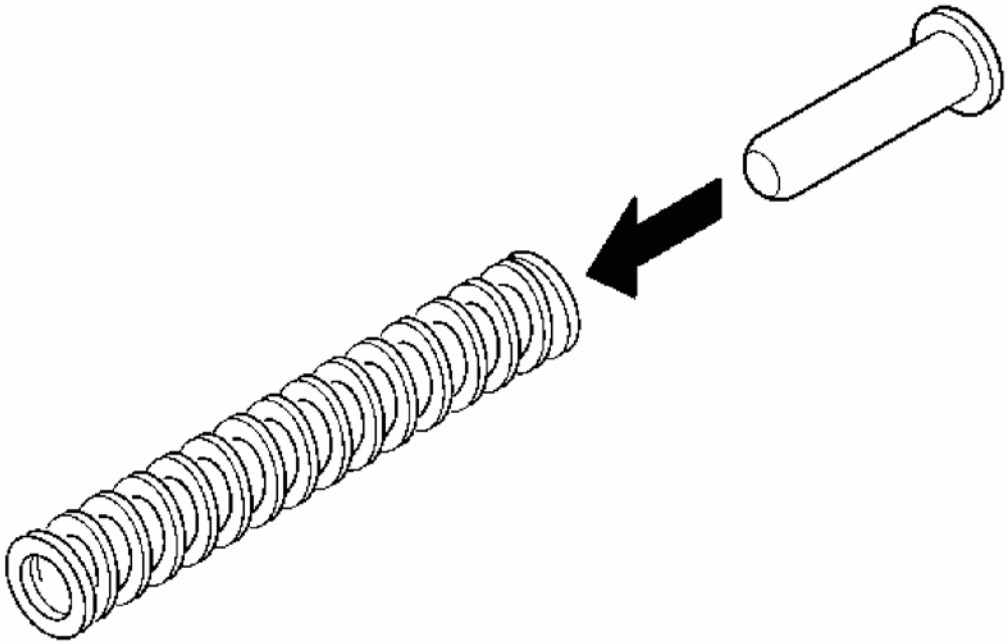


**Fig. 77: Spring Guide & Tilt Spring**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the spring guide into the tilt spring.

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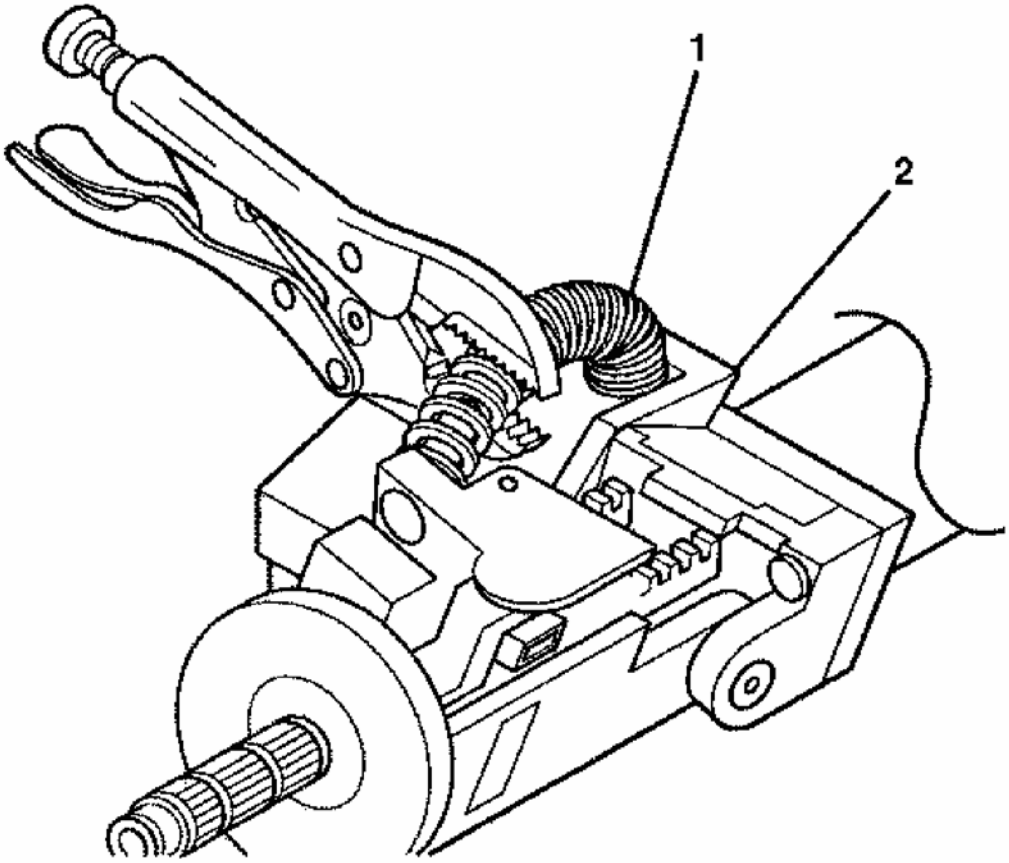



**Fig. 78: Installing Tilt Spring Onto The Steering Column Support Assembly**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: 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) onto the steering column support assembly (2) and onto the steering column tilt head assembly by using the following procedure:
    1. Install the tilt spring (1) onto the steering column tilt head assembly.
    2. Install the tilt spring (1) onto the post on the steering column support assembly

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(2).

4. Install the upper and lower trim covers. Refer to **Steering Column Trim Covers Replacement**.
5. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**STEERING COLUMN TILT HEAD HOUSING REPLACEMENT (TILT)**

**Removal Procedure**

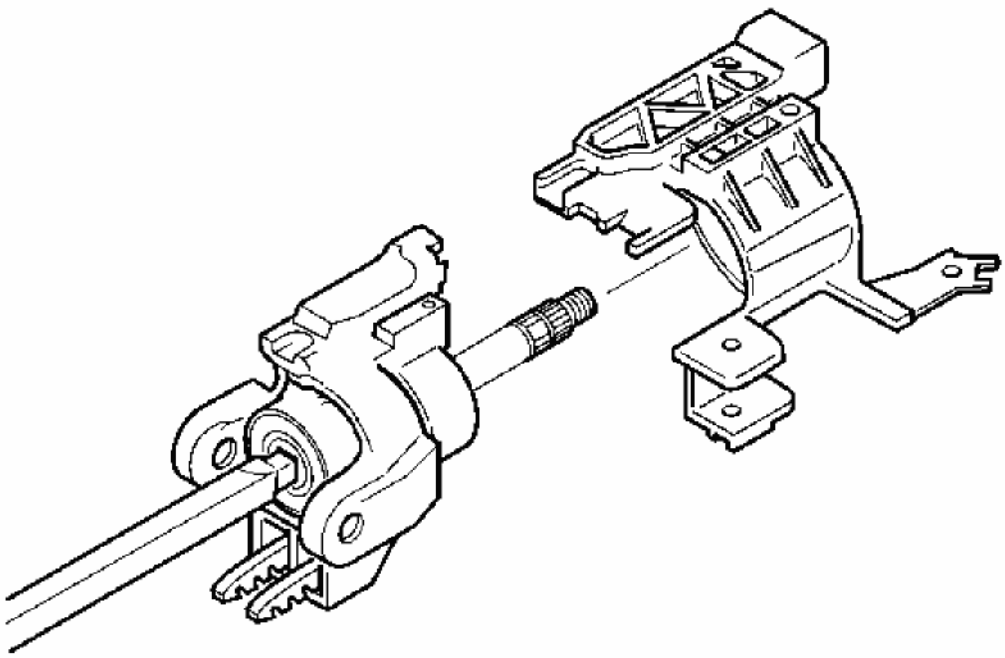


**Fig. 79: View Of Turn Signal Switch Housing & Steering Column Shaft Assembly**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the turn signal cancel cam assembly. Refer to **Turn Signal Cancel Cam and Upper Bearing Thrust Washer**.
3. Remove the turn signal and multifunction switch assembly only. Refer to **Multifunction, Turn Signal Switch Replacement**.
4. Slide the turn signal switch housing off of the steering column shaft assembly.

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5. Remove the tilt head housing and steering shaft as an assembly. Refer to **Lower Bearing and Steering Column Jacket Replacement (Column Shift Lean Shaft)** or **Lower Bearing and Steering Column Jacket Replacement (Floor Shift Lean Shaft)**.
6. Remove the tilt head from the steering shaft.

**Installation Procedure**

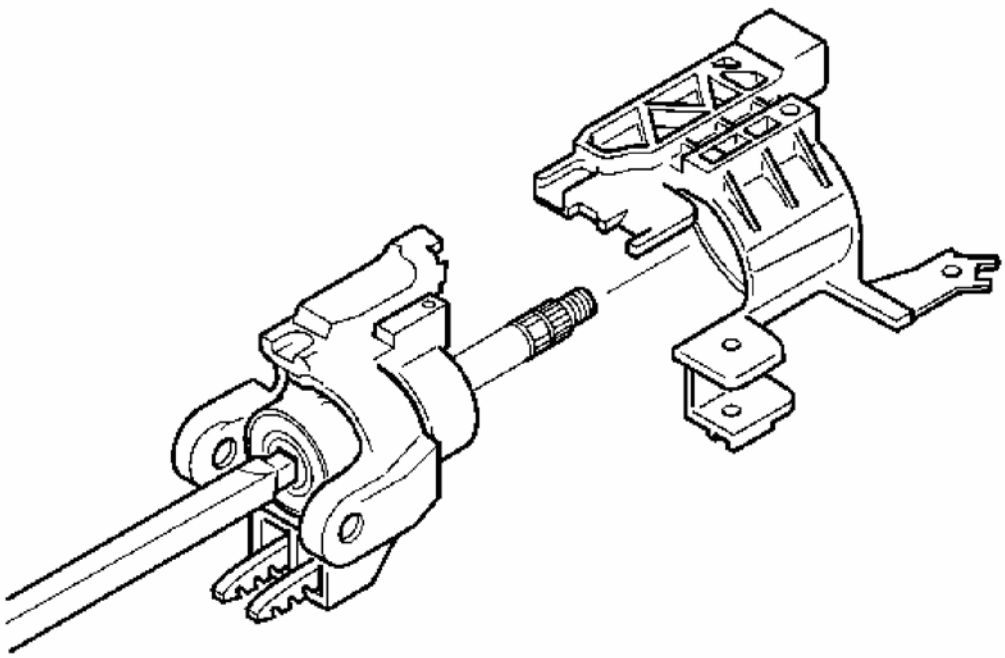


**Fig. 80: View Of Turn Signal Switch Housing & Steering Column Shaft Assembly**
**Courtesy of GENERAL MOTORS CORP.**

1. Install the tilt head onto the steering shaft.
2. Install the tilt head housing and steering shaft as an assembly. Refer to **Lower Bearing and Steering Column Jacket Replacement (Column Shift Lean Shaft)** or **Lower Bearing and Steering Column Jacket Replacement (Floor Shift Lean Shaft)**.

**IMPORTANT: The switch mounting bracket must be pressed firmly against the steering column tilt head.**

3. Slide the turn signal switch housing onto the steering column shaft assembly.
4. Install the turn signal and multifunction switch assembly only. Refer to **Multifunction,**

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**Turn Signal Switch Replacement**.

5. Install the turn signal cancel cam assembly. Refer to **Turn Signal Cancel Cam and Upper Bearing Thrust Washer**.
6. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

### TURN SIGNAL CANCEL CAM AND UPPER BEARING THRUST WASHER

## Tools Required

- **J 23653-SIR** Steering Column Lock Plate Compressor
- **J 42137** Cam Orientation Plate Adapter. See **Special Tools**.

**Removal Procedure**

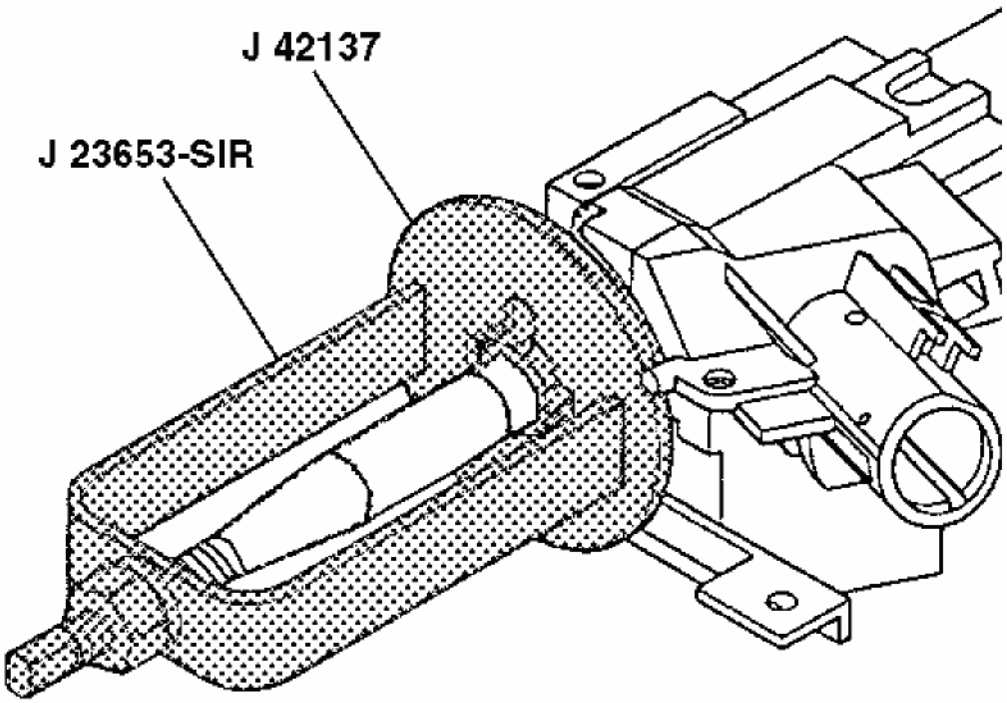



**Fig. 81: Compressing Cam Orientation Plate Using J 23653-SIR & J 42137**
**Courtesy of GENERAL MOTORS CORP.**

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**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**IMPORTANT: Let the SIR coil hang freely after removal.**

2. Remove the SIR coil. Refer to **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil)** or **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil and Harness Assembly)** in SIR.
3. Remove and discard the bearing retainer using **J 23653-SIR** and **J 42137** . See **Special Tools**.

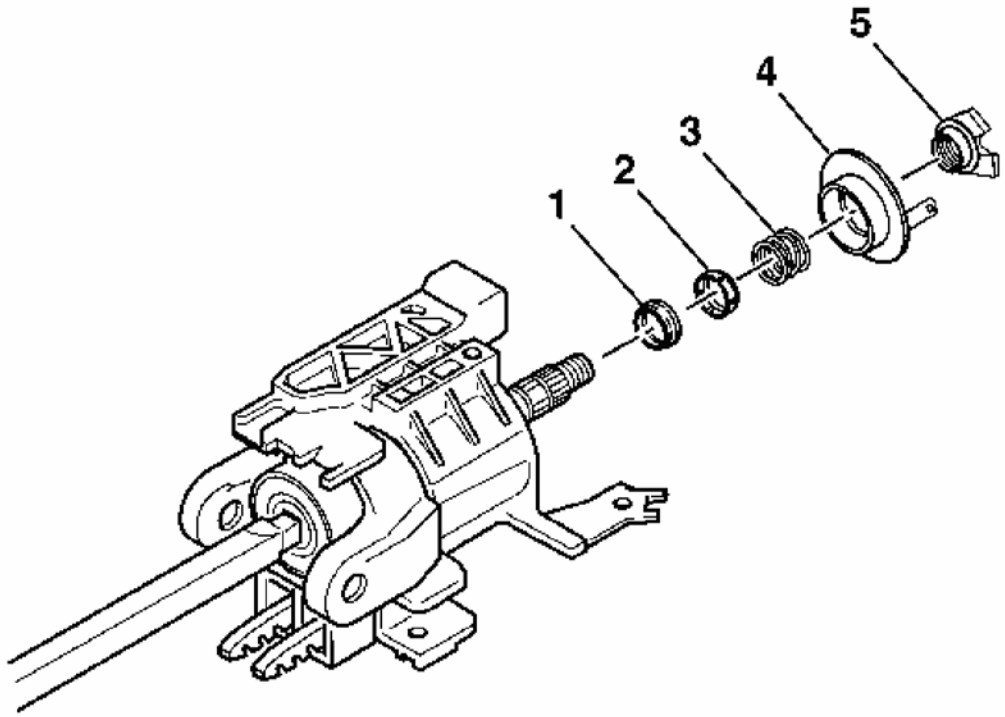



**Fig. 82: Removing The Tilt Head From The Steering Shaft (Standard)**
**Courtesy of GENERAL MOTORS CORP.**

4. If tilt column, remove the following parts from the steering column shaft assembly:
   1. The cam orientation plate (5)

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2. The turn signal cancel cam assembly (4)
3. The upper bearing spring (3)
4. The upper bearing inner race seat (2)
5. The inner race (1)

**Installation Procedure**

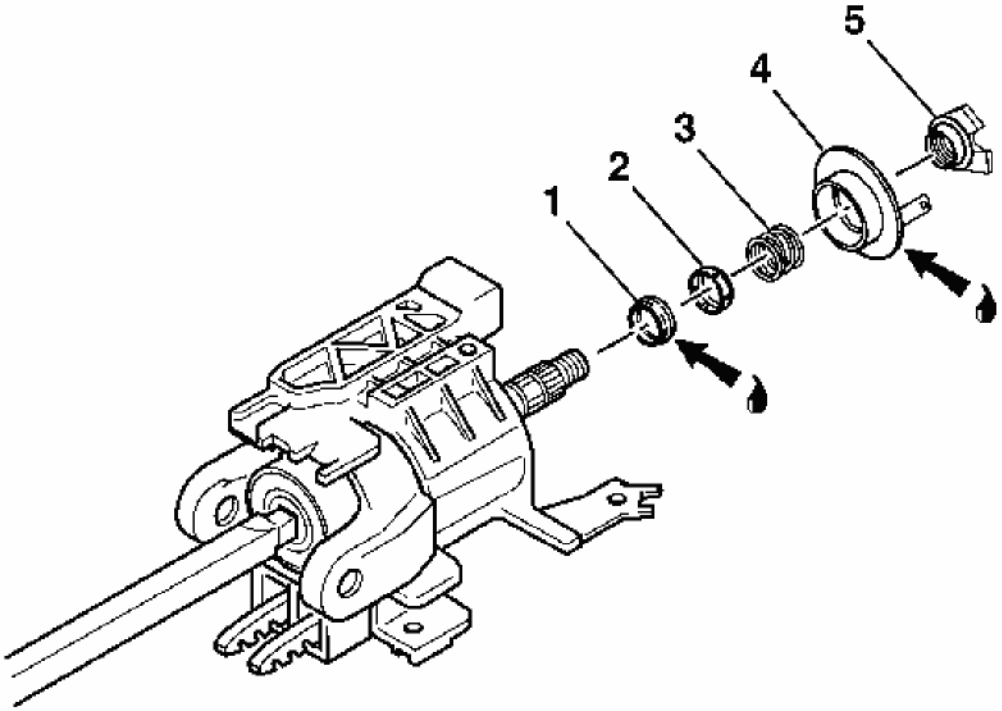



**Fig. 83: Installing Following Parts Onto The Steering Column Shaft Assembly (Standard)**
**Courtesy of GENERAL MOTORS CORP.**

1. If tilt column, install the following parts onto the steering column shaft assembly:
   1. Lubricate the inner race (1) with GM P/N 12345718 (Canadian P/N 10953516).
   2. The inner race (1)
   3. The upper bearing inner race seat (2)
   4. The upper bearing spring (3)
   5. Lubricate the turn signal cancel cam assembly (4) with GM P/N 12377900 (Canadian P/N 10953529).

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6. The turn signal cancel cam assembly (4) onto the steering shaft assembly
7. The cam orientation plate (5)

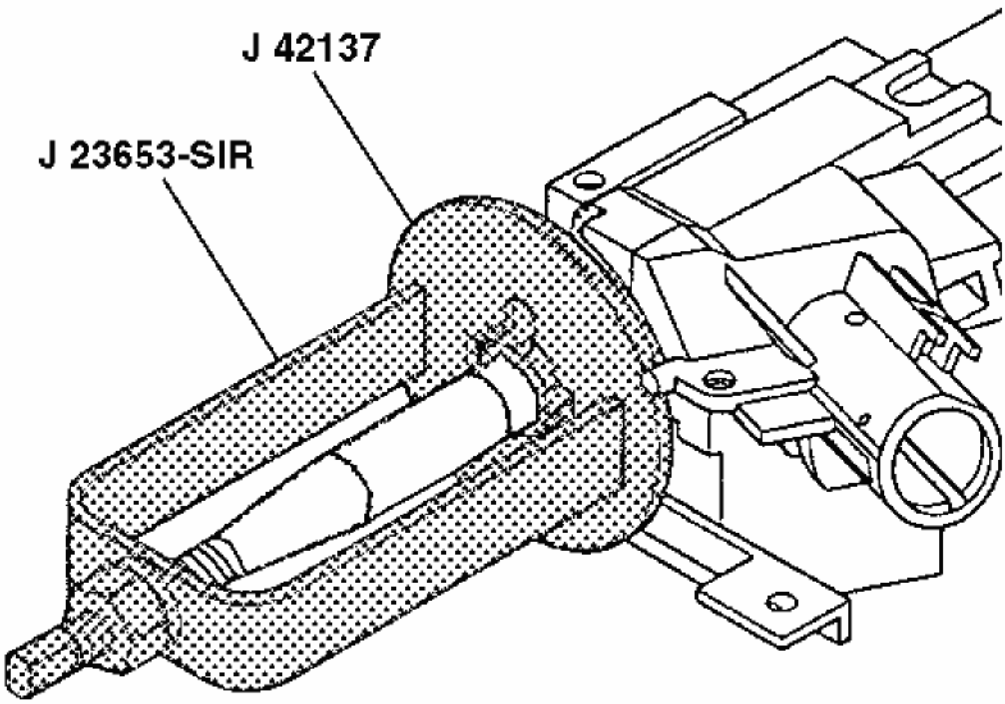



**Fig. 84: Compressing Cam Orientation Plate Using J 23653-SIR & J 42137**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the new bearing retainer onto the steering shaft assembly.
3. Compress the cam orientation plate using **J 23653-SIR** and **J 42137** . See **Special Tools**.
4. Firmly seat the bearing retainer into the groove on the steering shaft assembly.
5. Remove **J 23653-SIR** .
6. Install the SIR coil. Refer to **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil)** or **Inflatable Restraint Steering Wheel Module Coil Replacement (Coil and Harness Assembly)** in SIR.
7. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

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**STEERING COLUMN REPLACEMENT**

**Tools Required**

**J 42640** Steering Column Anti-Rotation Pin

**Removal Procedure**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the supplemental inflatable restraint (SIR) system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages and Console.

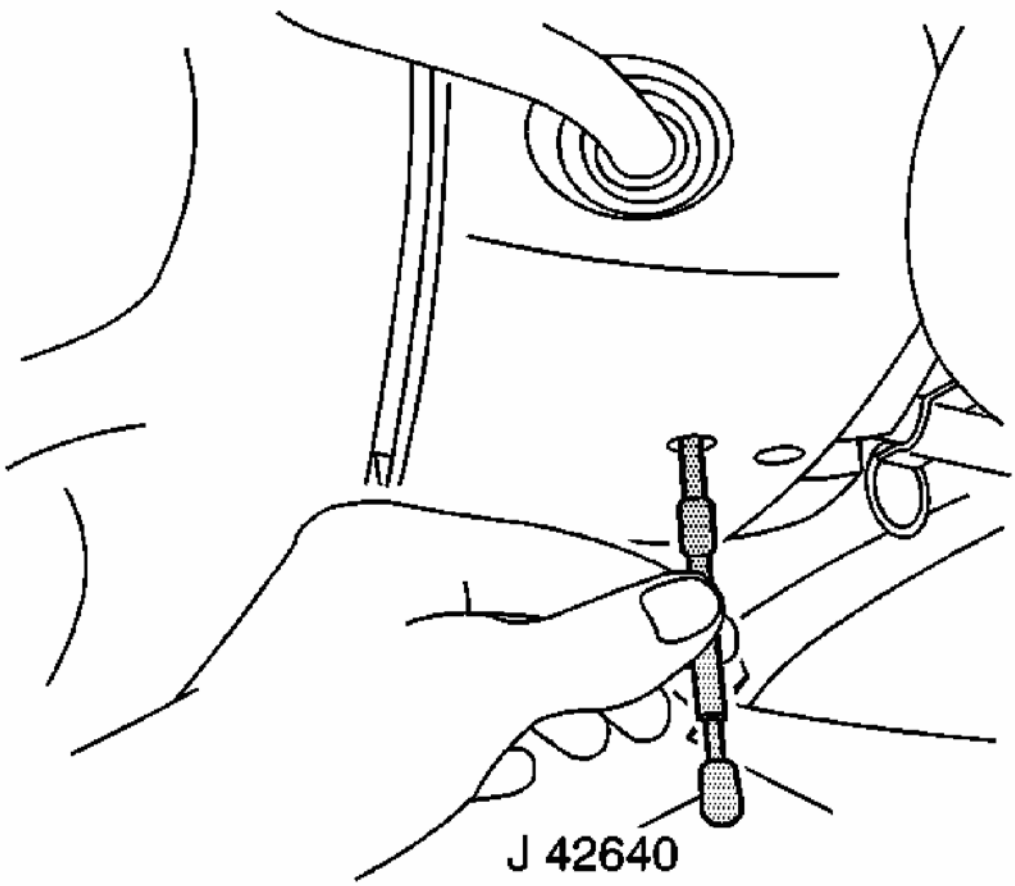



**Fig. 85: Identifying J 42640**

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**Courtesy of GENERAL MOTORS CORP.**

**NOTE: The front wheels of the vehicle must be maintained in the straight ahead position and the steering column must be in the LOCK position before disconnecting the steering column or intermediate shaft. Failure to follow these procedures will cause improper alignment of some components during installation and result in damage to the SIR coil assembly.**

3. Lock the steering column through the access hole in the lower trim cover using **J 42640** .
4. Remove the body control module bracket. Do not disconnect the harness from the body control module. Refer to **Body Control Module Replacement** in Computer/Integrating Systems.

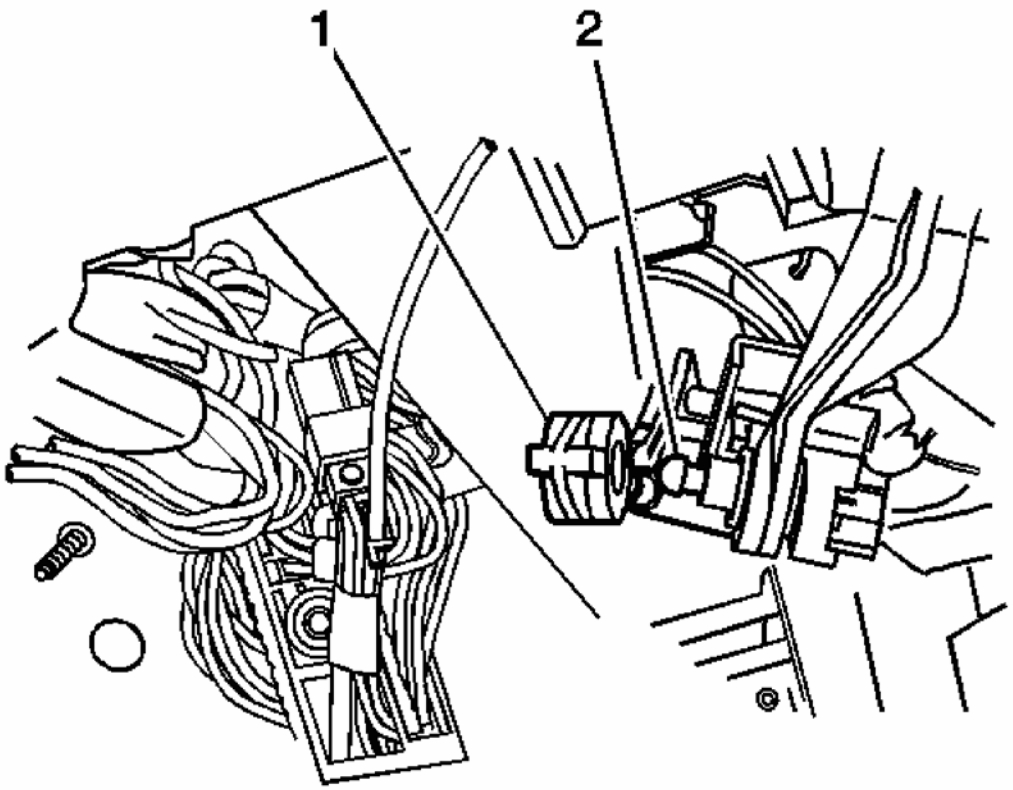



**Fig. 86: Disconnecting Transmission Shift Cable From The Column**
**Courtesy of GENERAL MOTORS CORP.**

5. Disconnect the transmission shift cable (1) from the column.

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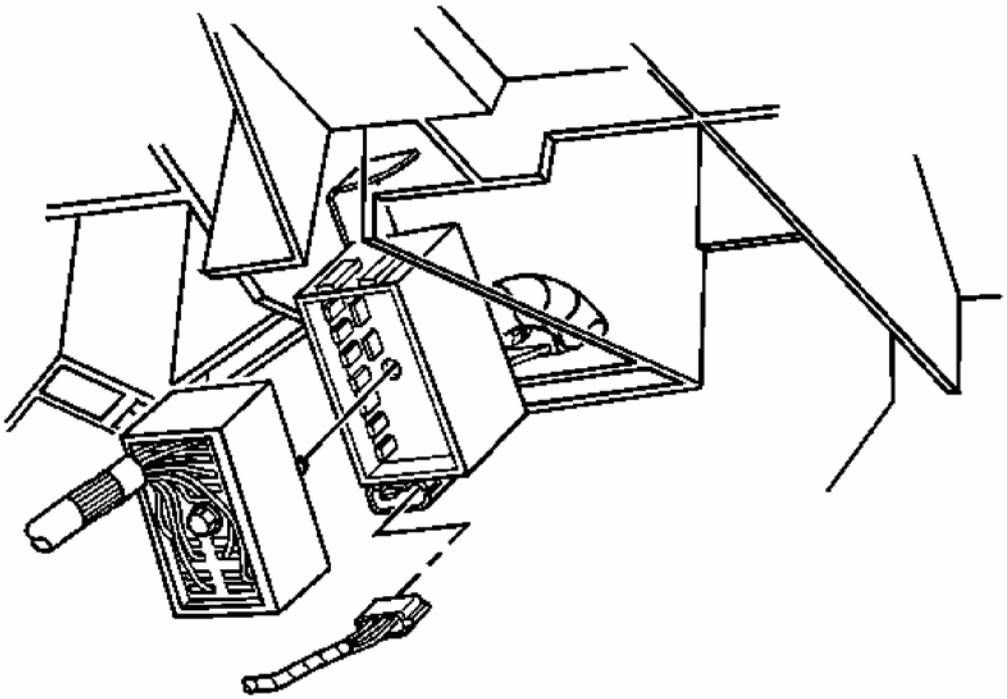


**Fig. 87: View Of Steering Column Electrical Connectors**
**Courtesy of GENERAL MOTORS CORP.**

6. Disconnect the steering column electrical connectors.

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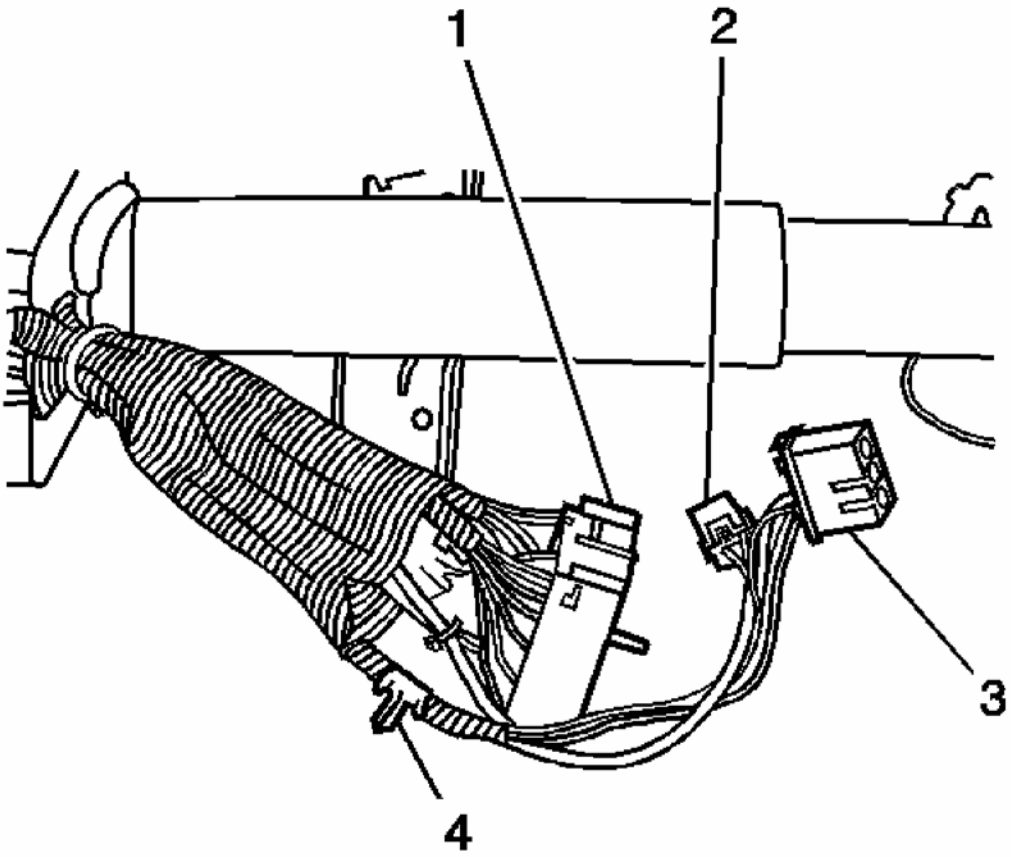



**Fig. 88: Removing Wiring Harness Retaining Pin From The Instrument Panel (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: During removal of the steering column the wire harness retaining clip must be removed and reinstalled after installing the steering column or damage may occur to the wire harness.**

7. Remove the wiring harness retaining pin (4) from the instrument panel.

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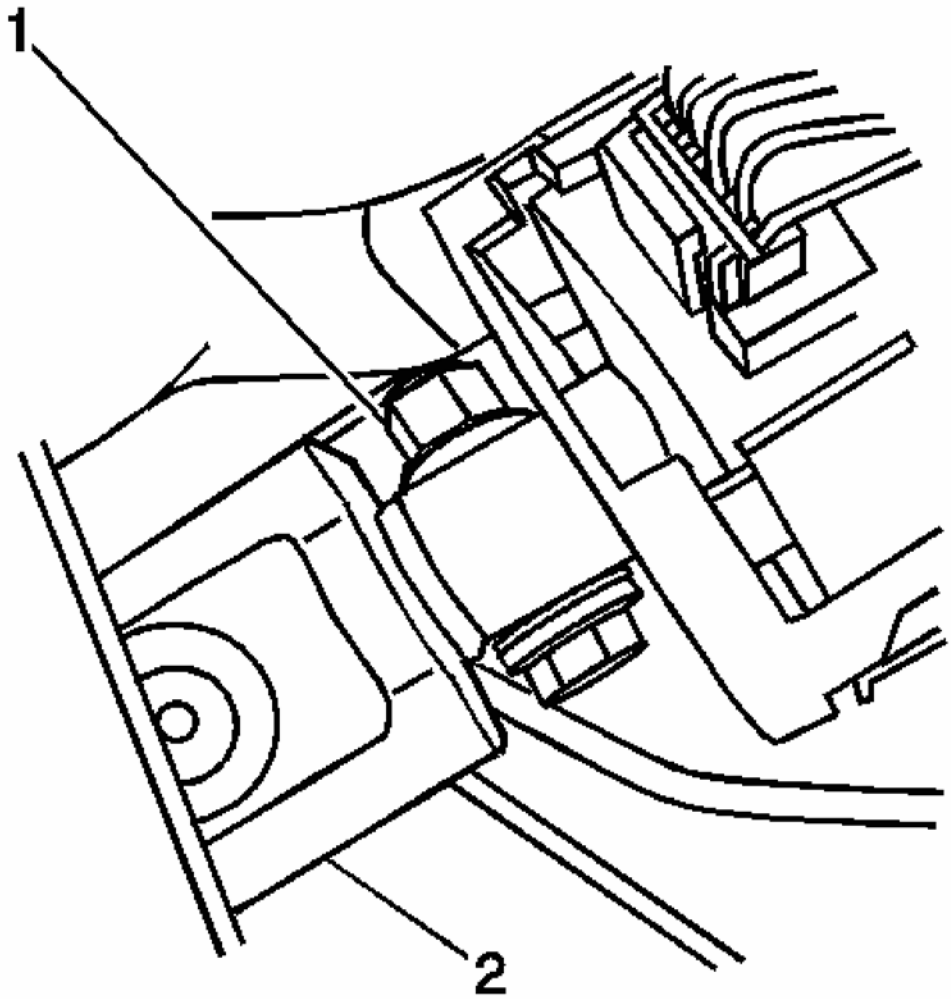



**Fig. 89: View Of Upper Shaft To Steering Column Nut Bolt**
**Courtesy of GENERAL MOTORS CORP.**

8. Remove the upper intermediate shaft pinch bolt (1) from the steering column, and remove the shaft from the steering column.

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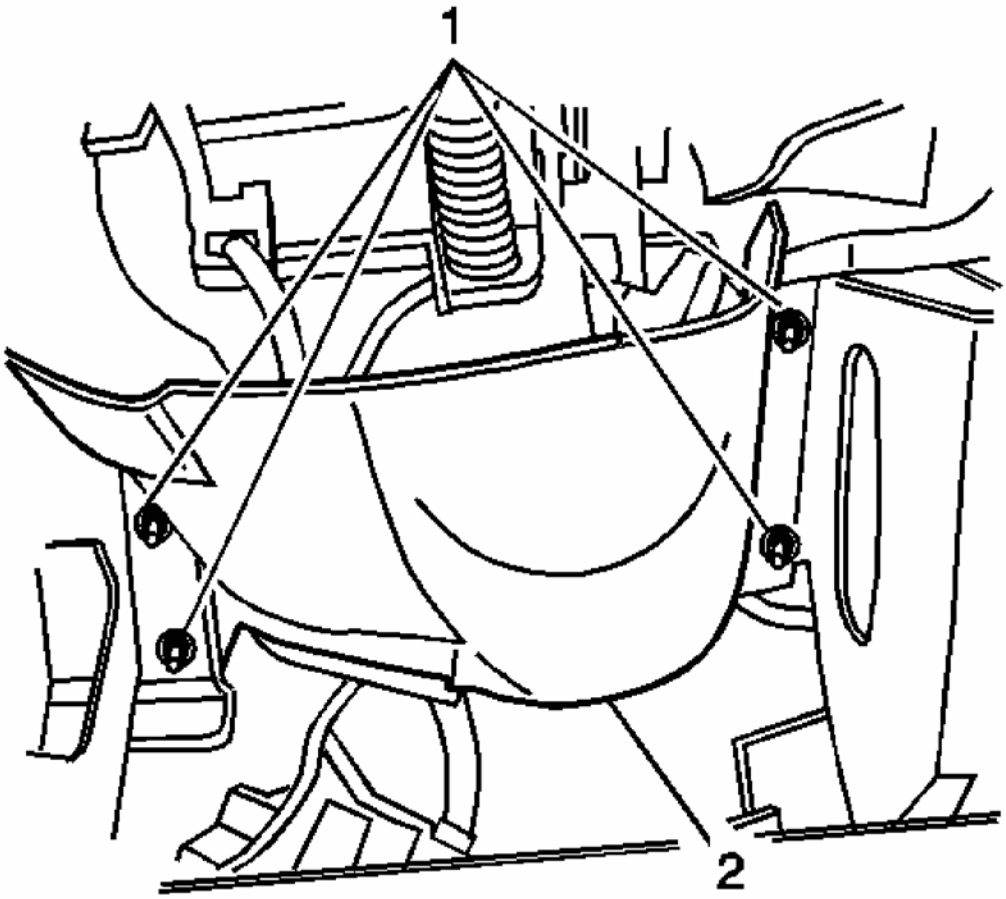



**Fig. 90: Removing Nuts From The Knee Bolster Deflector Bracket (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

9. Remove the nuts (1) from the knee bolster deflector.

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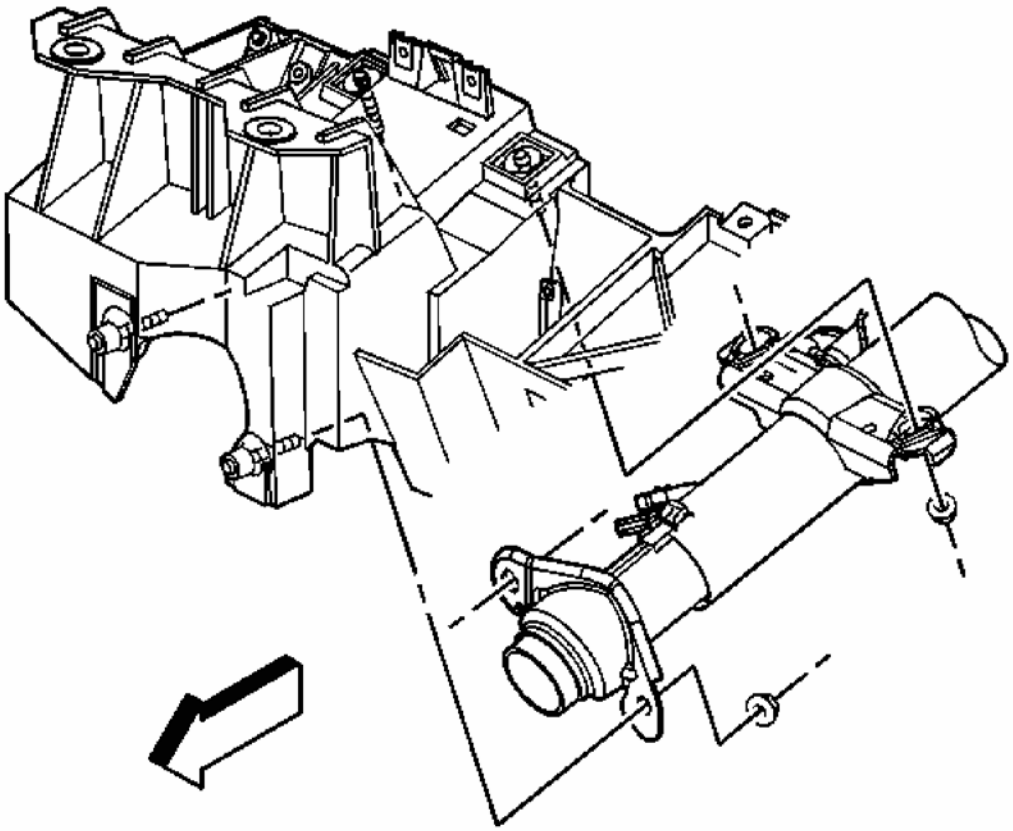


**Fig. 91: Removing Nuts From The Support Brackets**
**Courtesy of GENERAL MOTORS CORP.**

10. Remove the nuts from the upper support brackets.
11. Remove the nuts from the lower support brackets.

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

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12. Remove the steering column from the vehicle.

**Installation Procedure**

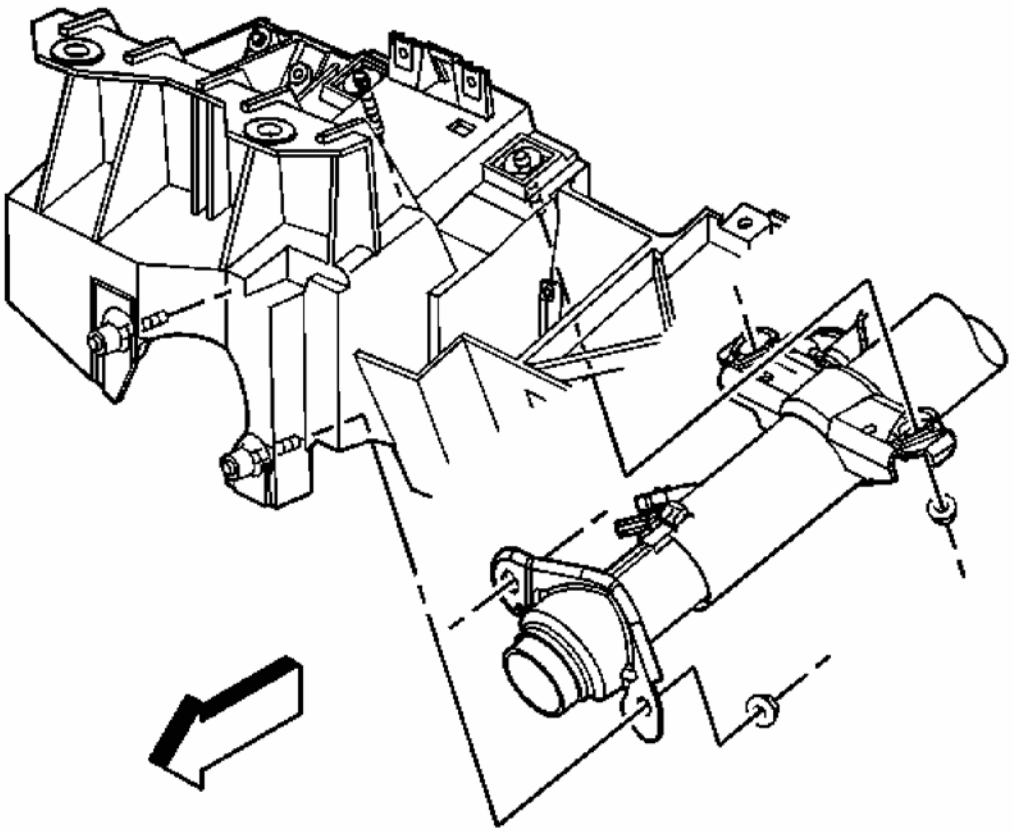


**Fig. 92: Removing Nuts From The Support Brackets**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: 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**

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**steering column fasteners could affect the steering column collapse.**

1. Install the steering column to the vehicle.

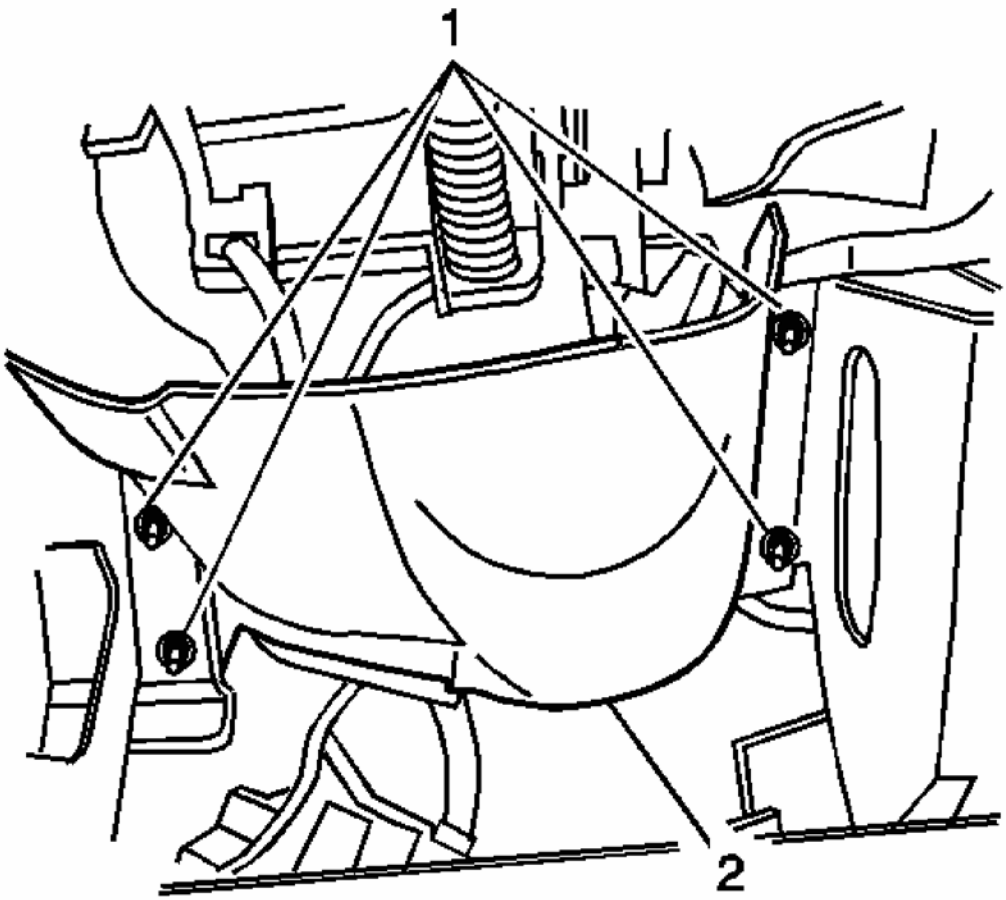
   **NOTE: Refer to Fastener Notice in Cautions and Notices.**

2. Install the lower column nuts.

   **Tighten:** Tighten the nuts to 30 N.m (22 lb ft).

3. Install the nuts to upper support brackets.

   **Tighten:** Tighten the nuts to 30 N.m (22 lb ft).




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**Fig. 93: Removing Nuts From The Knee Bolster Deflector Bracket (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

4. Install the nuts (1) which retain the knee bolster deflector to the instrument panel.

   **Tighten:** Tighten the retaining nuts to 9 N.m (80 lb in).

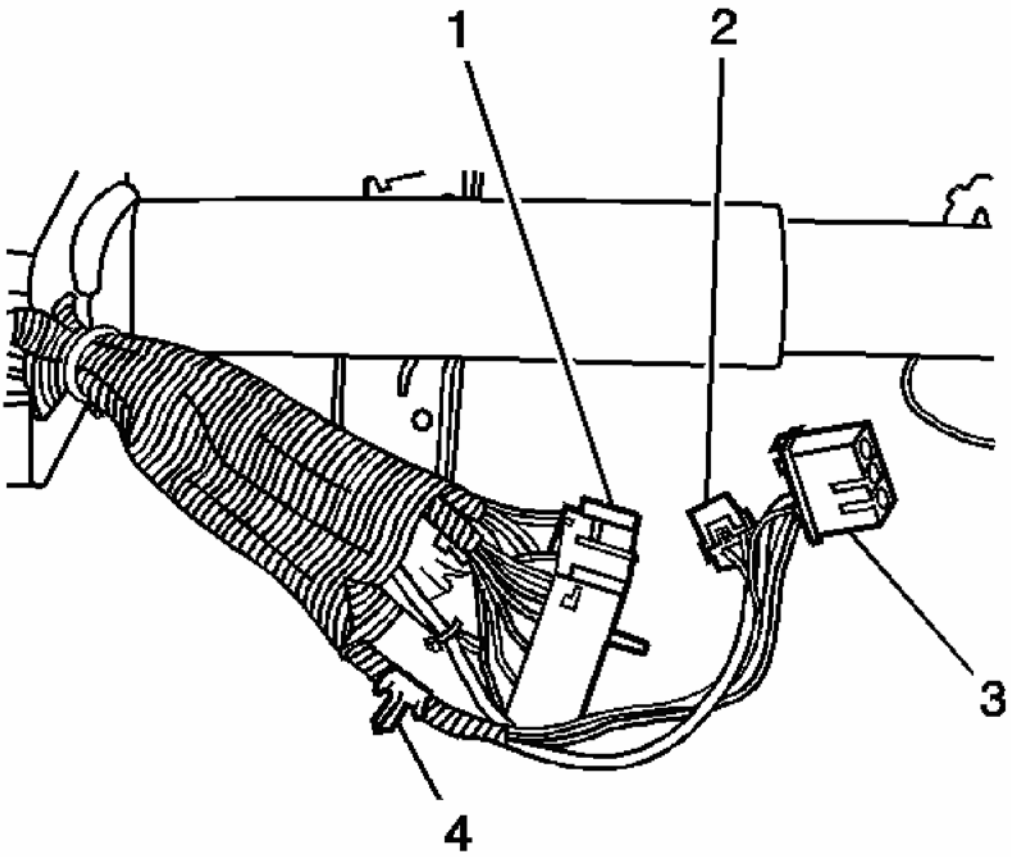



**Fig. 94: Removing Wiring Harness Retaining Pin From The Instrument Panel (With Tow/Haul Switch)**
**Courtesy of GENERAL MOTORS CORP.**

5. Install the wiring harness retaining (4) pin to the instrument panel.

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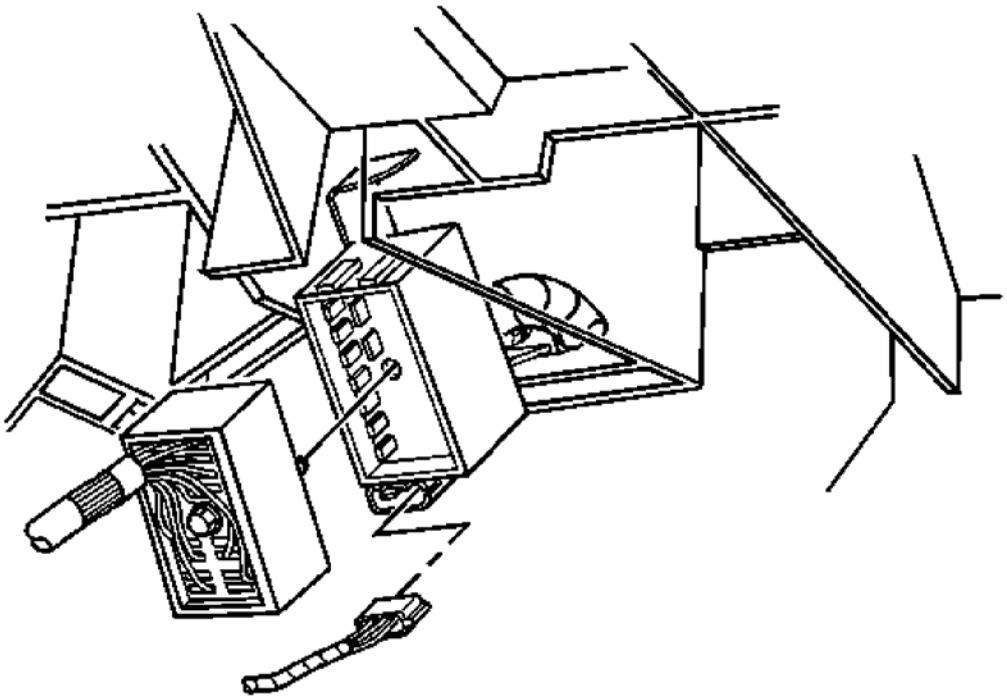


**Fig. 95: View Of Steering Column Electrical Connectors**
**Courtesy of GENERAL MOTORS CORP.**

6. Connect the steering column electrical connectors to the vehicle wiring harness.

   **Tighten:** Tighten the connector to 6 N.m (53 lb in).

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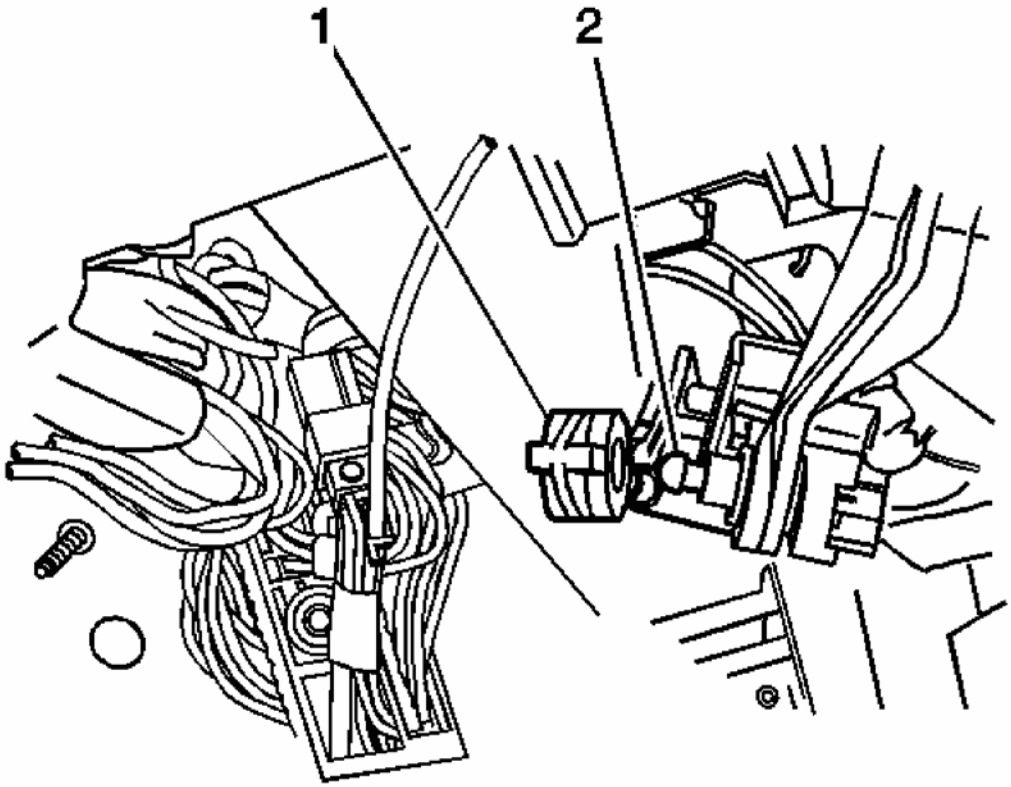



**Fig. 96: Disconnecting Transmission Shift Cable From The Column**
**Courtesy of GENERAL MOTORS CORP.**

7. Connect the transmission shift cable (1) to the steering column.
8. Install the body control module bracket. Refer to **Body Control Module Replacement** in Computer/Integrating Systems.
9. Install the knee bolster. Refer to **Knee Bolster Replacement** in Instrument Panel, Gages, and Console.
10. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

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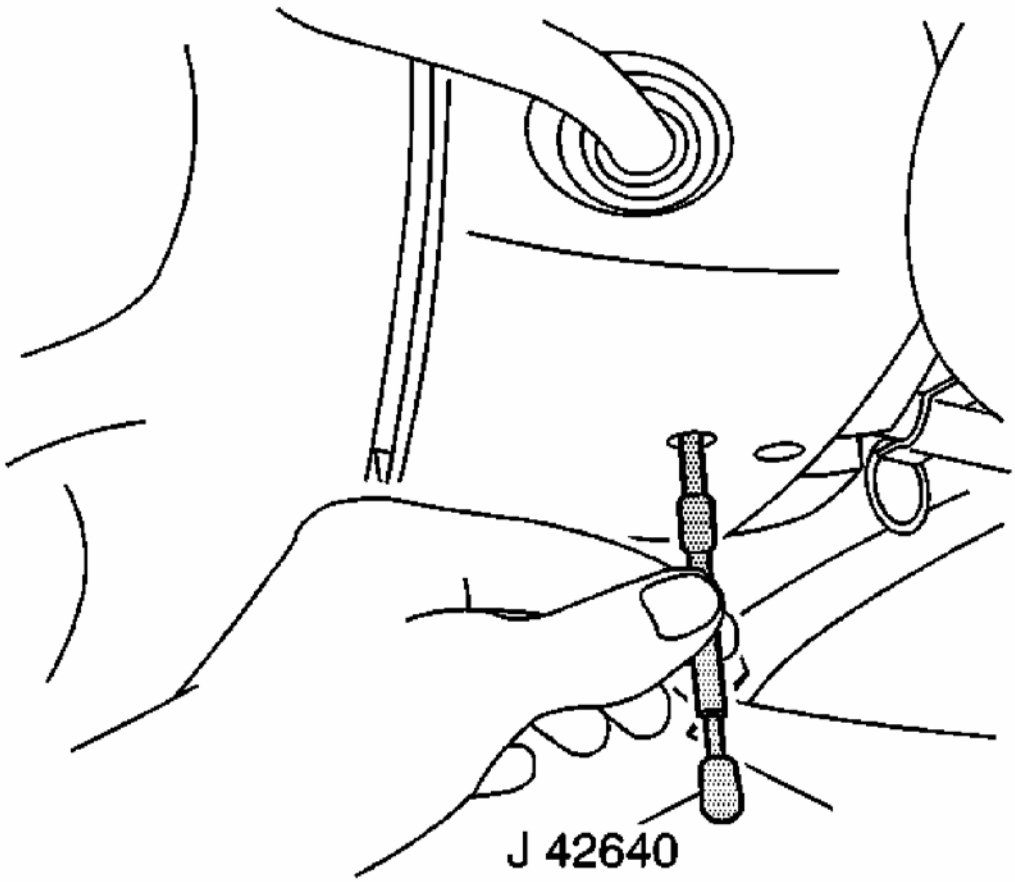



**Fig. 97: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

11. Remove **J 42640** from the steering column.

**STEERING COLUMN SEAL REPLACEMENT**

**Removal Procedure**

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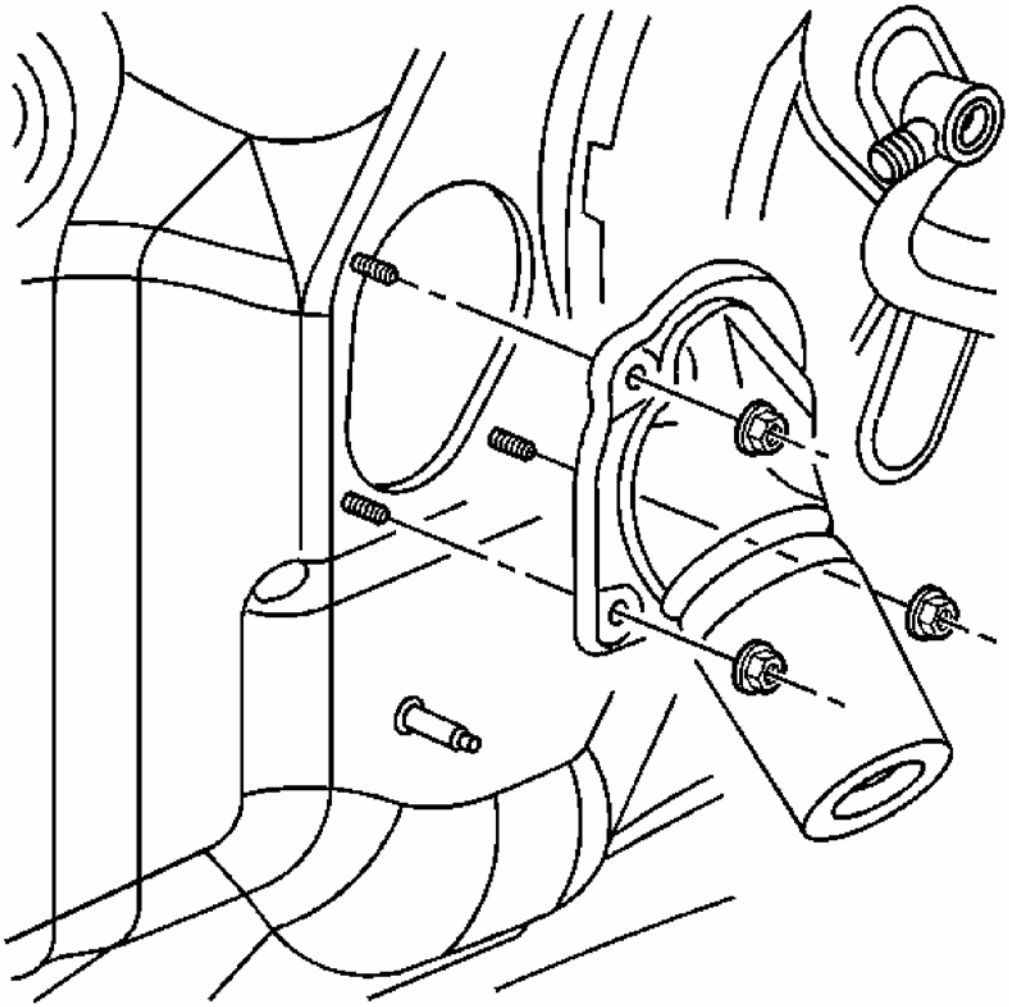


**Fig. 98: Steering Column Seal**
**Courtesy of GENERAL MOTORS CORP.**

1. Set the front wheels in the straight-ahead position.
2. Set the steering wheel in the LOCK position.
3. Remove the intermediate shaft. Refer to **Intermediate Steering Shaft Replacement - Lower**.
4. Remove the nuts from the studs.
5. Remove the seal from the vehicle.

**Installation Procedure**

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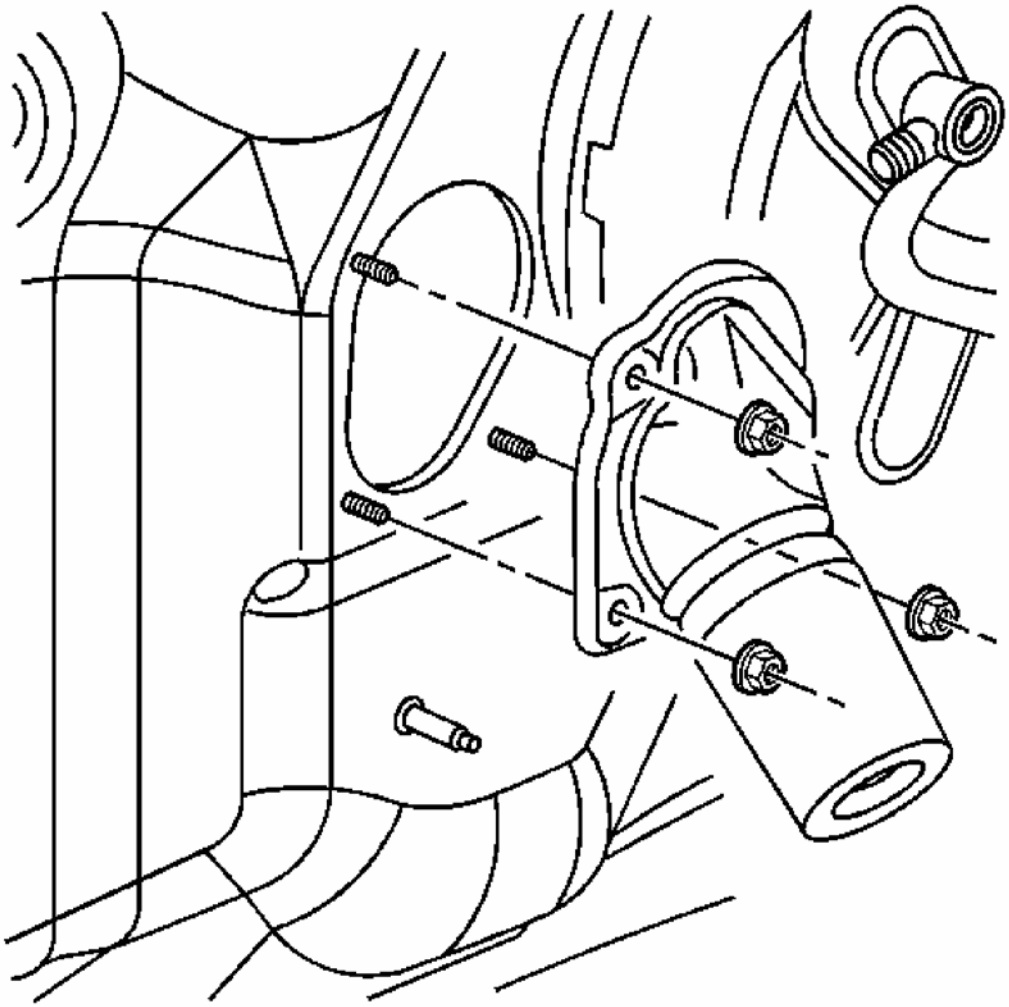


**Fig. 99: Steering Column Seal**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

1. Install the seal to the vehicle.
2. Install the nuts to the studs.

   **Tighten:** Tighten the nuts to 3 N.m (27 lb in).

3. Install the intermediate shaft. Refer to **Intermediate Steering Shaft Replacement - Lower**.

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## LOWER BEARING AND STEERING COLUMN JACKET REPLACEMENT (COLUMN SHIFT LEAN SHAFT)

**Tools Required**

**J 21854-01** Pivot Pin Remover

**Removal Procedure**

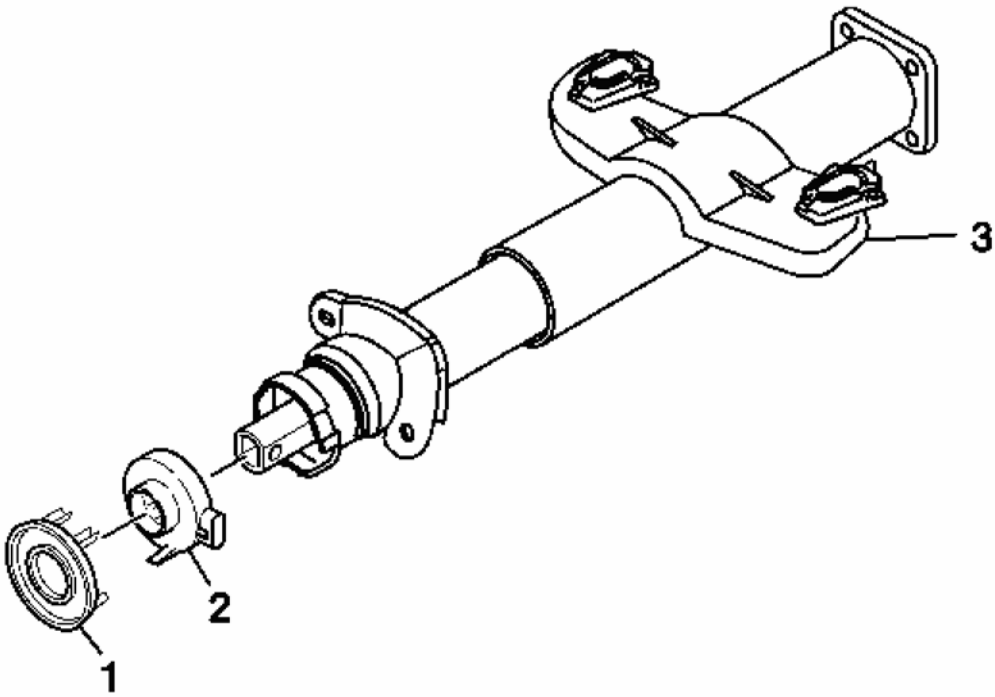



**Fig. 100: Removing Steering Shaft Position Sensor From The Steering Column Jacket Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the steering column from the vehicle. Refer to **Steering Column Replacement**.
3. Remove the turn signal multifunction switch. Refer to **Multifunction, Turn Signal Switch Replacement**.

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4. Remove the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement**.
5. Remove the tilt spring assembly only. Refer to **Tilt Spring Replacement**.
6. Remove the linear shift and the automatic shift lock control. Refer to **Linear Shift Assembly Replacement**.
7. Inspect the steering column for accident damage. Refer to **Steering Column Accident Damage Inspection**.
8. Remove the sensor retainer (1) from the steering column jacket assembly (3).
9. Remove the steering shaft position sensor (2) from the steering column jacket assembly (3).

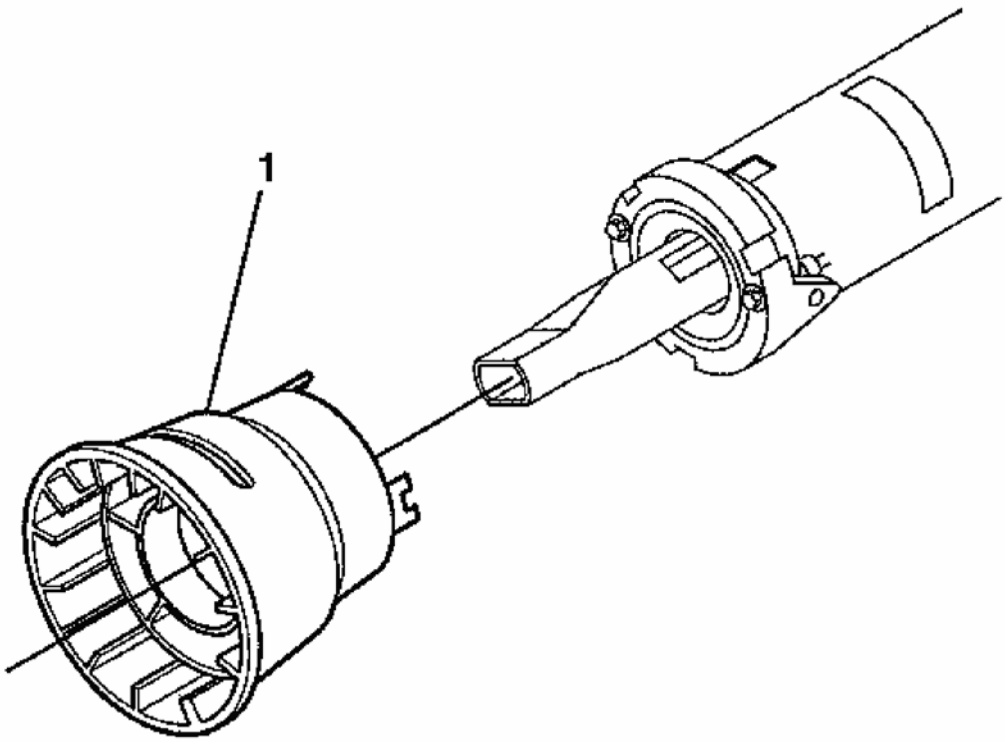



**Fig. 101: View Of Adapter & Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

10. Gently pull the adapter and bearing assembly (1) from the steering shaft assembly.

    If the cage and balls separate from the adapter and bearing assembly, you may install them back together in the installation procedure.

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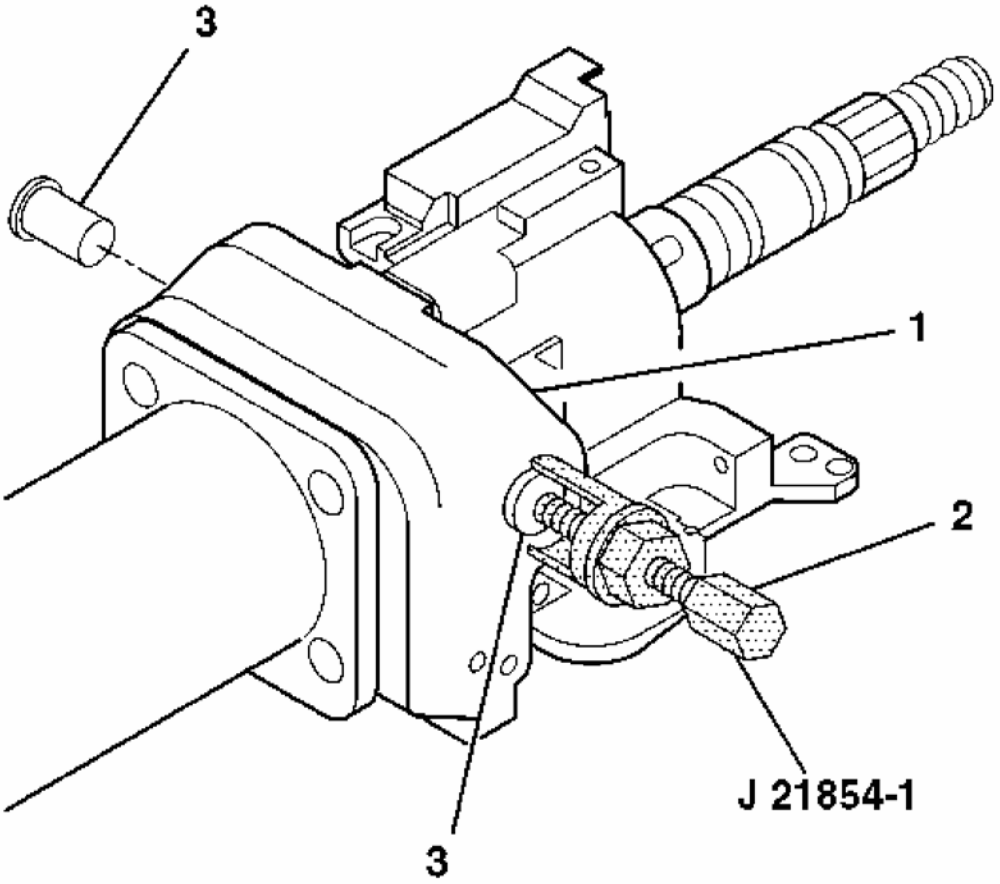



**Fig. 102: View Of Pivot Pins To Steering Column Tilt Head Assembly**
**Courtesy of GENERAL MOTORS CORP.**

11. Remove the 2 pivot pins (3) from the steering column tilt head assembly (1) by using **J 21854-01** .

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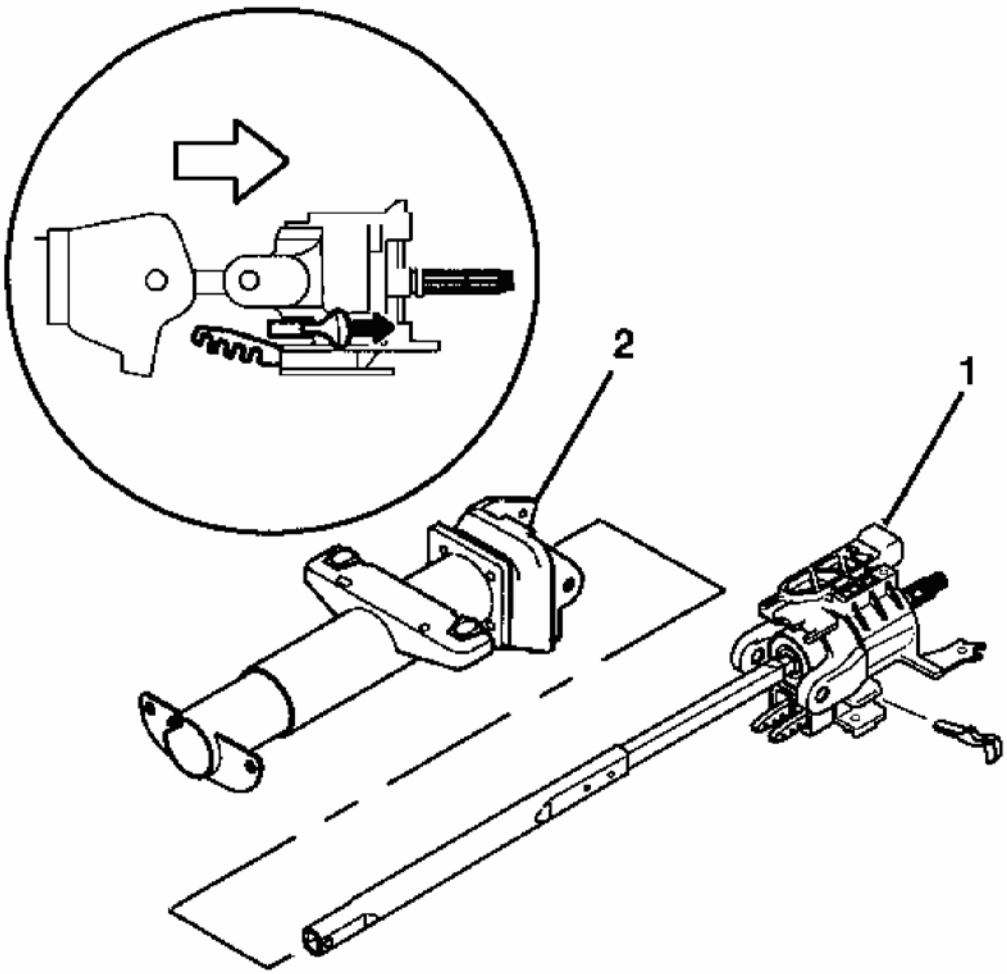



**Fig. 103: Installing The Tilt Lever Into The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

12. Install the tilt lever into the steering column tilt head assembly (1).
13. Pull back on the tilt lever and at the same time pull the steering column tilt head assembly (1) down and away from the steering column.
14. Remove the steering column tilt head assembly (1) with the steering column shaft assembly from the steering column jacket assembly (2).
15. Remove the tilt lever.

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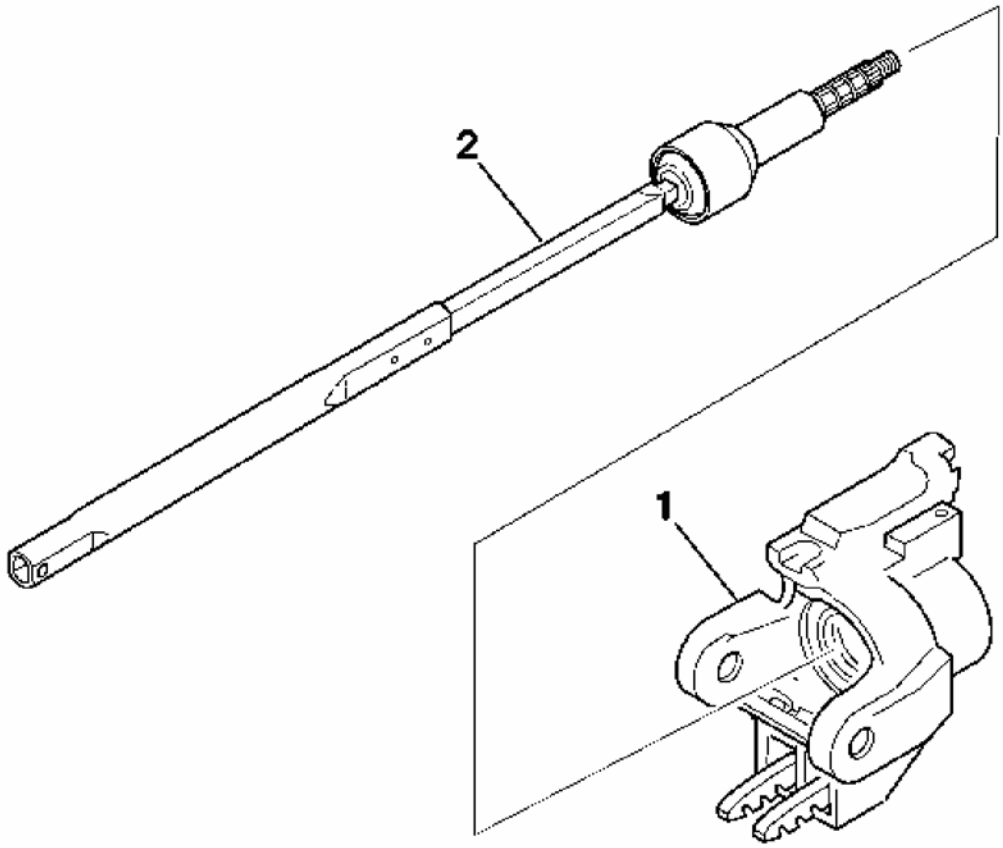



**Fig. 104: Removing Steering Column Shaft Assembly From The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

16. Remove the steering column shaft assembly (2) from the steering column tilt head assembly (1).

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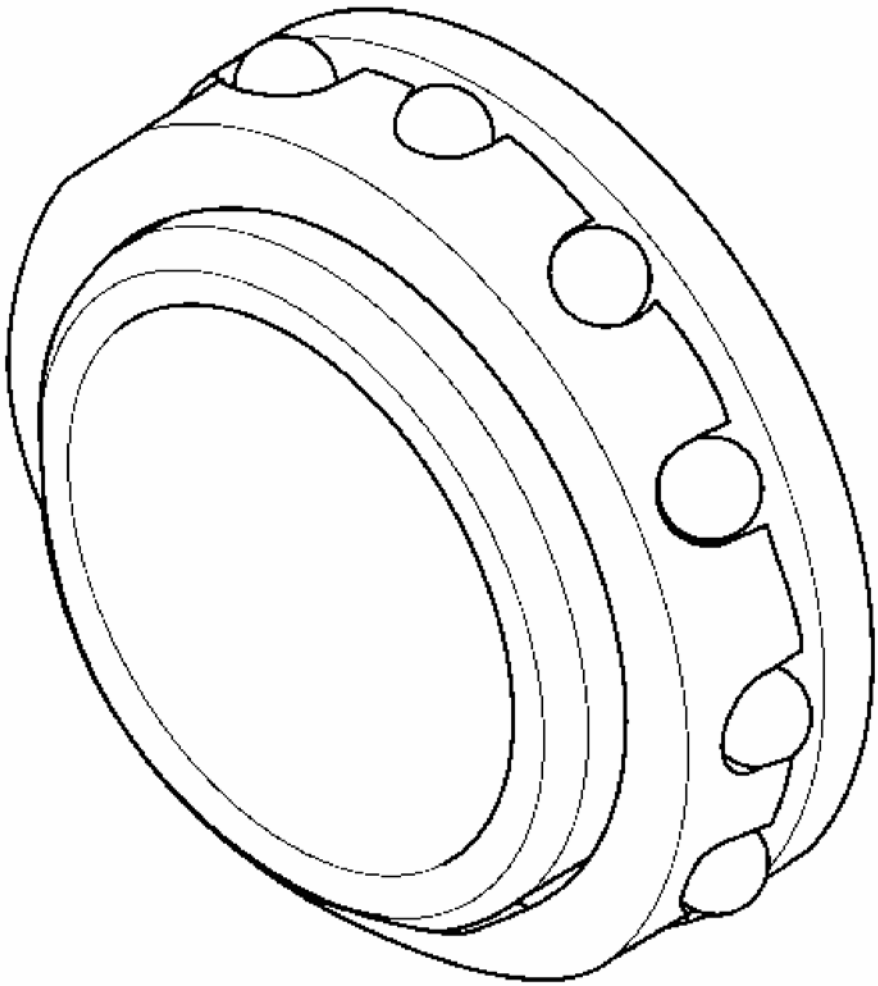


**Fig. 105: View Of Upper Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

17. Remove the upper bearing assembly.

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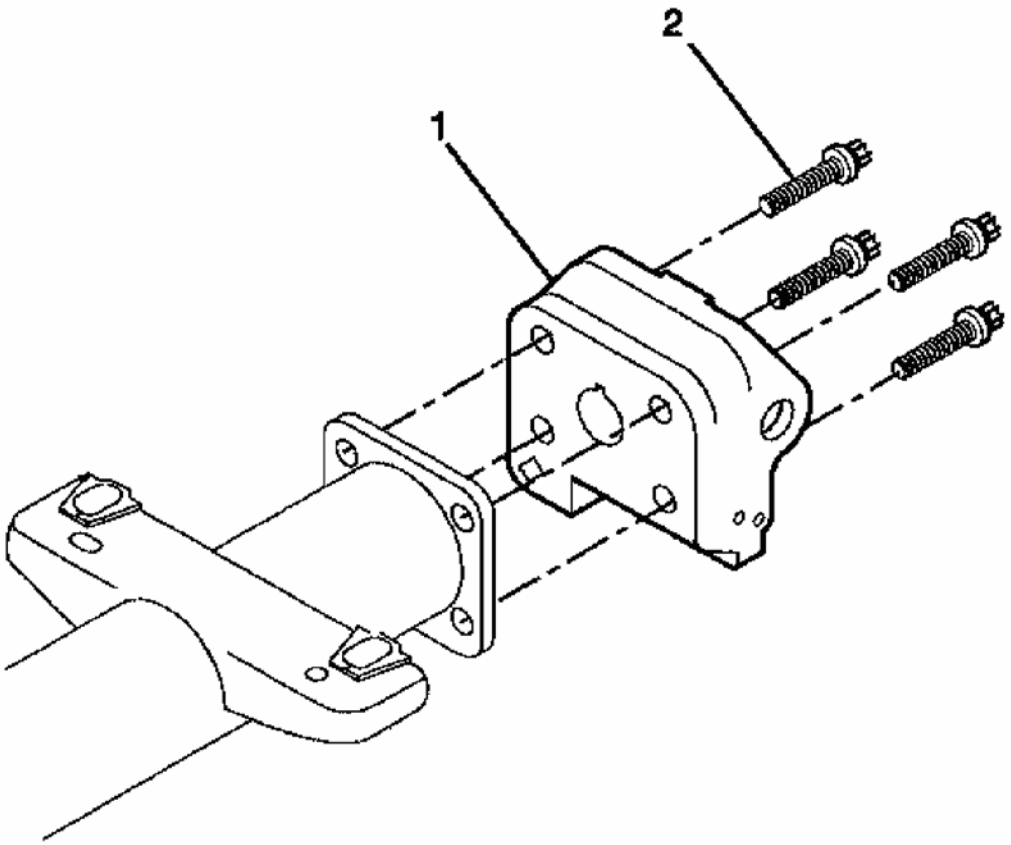



**Fig. 106: View Of Steering Column Support Assembly & TORX(R) Head Screws**
**Courtesy of GENERAL MOTORS CORP.**

18. Remove the 4 TORX® head screws (2) from the steering column support assembly (1).
19. Discard the 4 TORX® head screws.
20. Remove the steering column support assembly (1) from the steering column jacket assembly.

**Installation Procedure**

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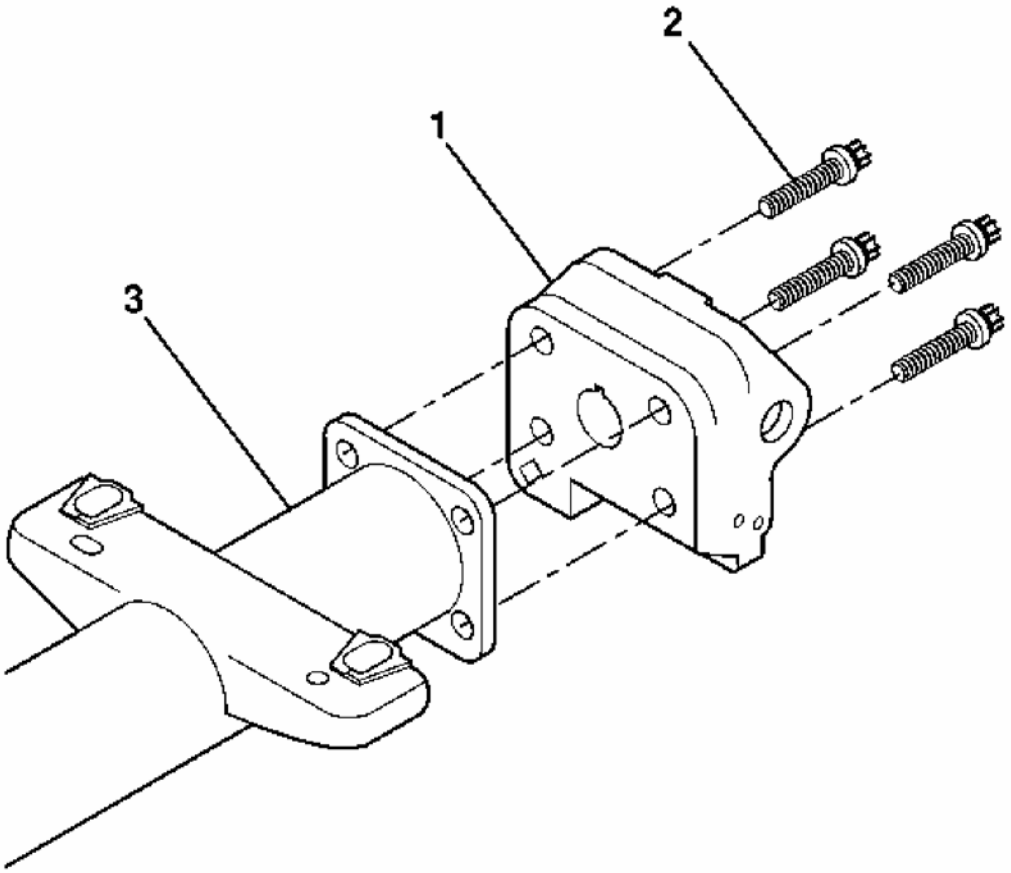



**Fig. 107: View Of Steering Column Support Assembly, Steering Column Jacket Assembly & Screws**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

**IMPORTANT: Replace the steering column support assembly (1) if the steering column support assembly (1) has been staked 3 times.**

1. Attach the steering column support assembly (1) to the steering column jacket assembly (3) with 4 TORX® head screws (2).

   **Tighten:** Tighten the screws to 17 N.m (13 lb ft).

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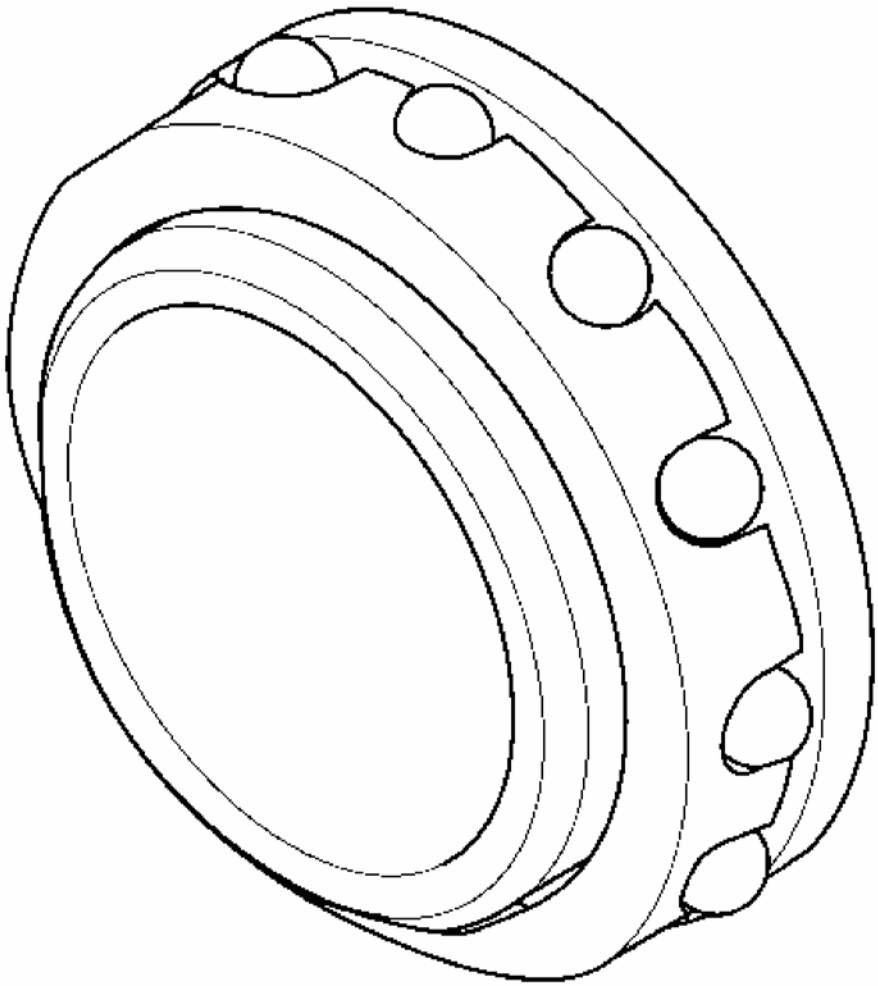


**Fig. 108: View Of Upper Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the upper bearing assembly.

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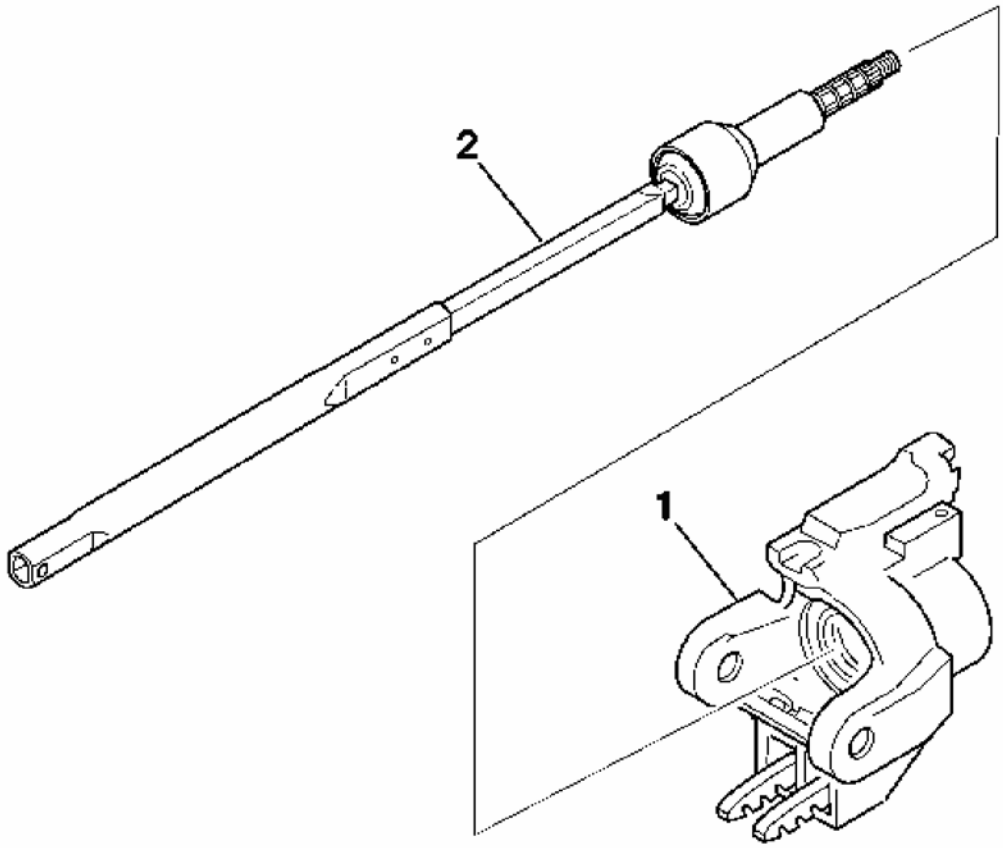



**Fig. 109: Removing Steering Column Shaft Assembly From The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

3. Install the steering column shaft assembly (2) into the steering column tilt head assembly (1).

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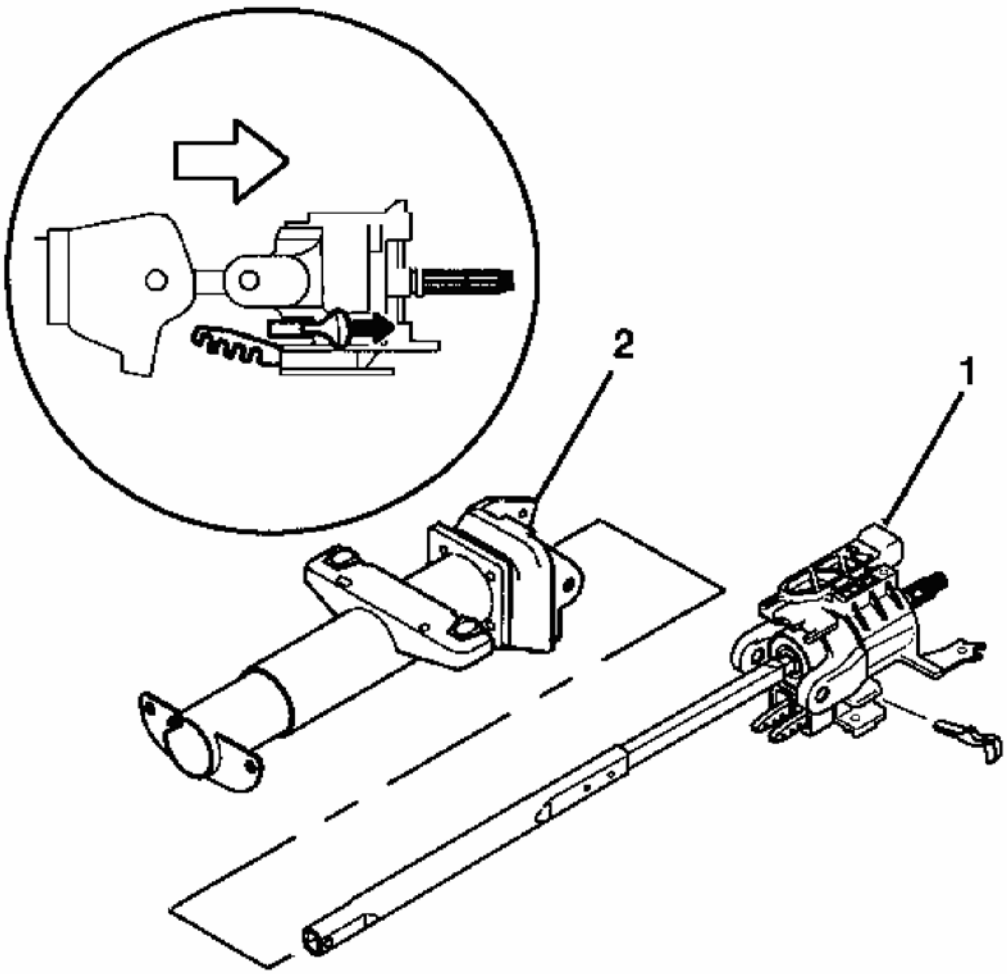



**Fig. 110: Installing The Tilt Lever Into The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

4. Install the steering column shaft assembly with the steering column tilt head assembly (1) into the steering column jacket assembly (2).
5. Maneuver the tilt knob and push the steering column tilt head assembly (1) up towards the steering column in order to lock the steering wheel lock shoes in place.

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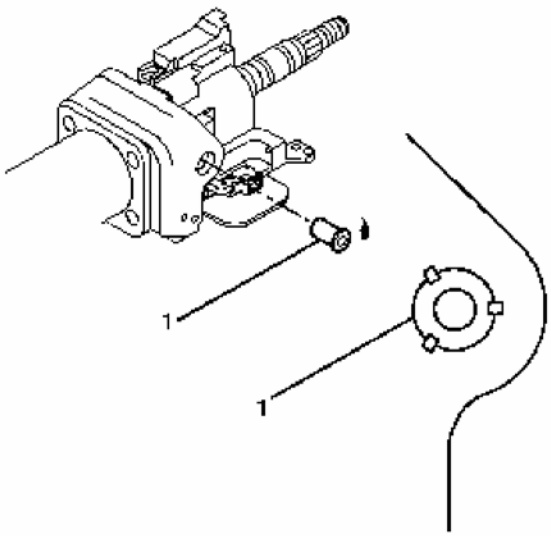



**Fig. 111: View Of Pivot Pins At Steering Column Assembly**
**Courtesy of GENERAL MOTORS CORP.**

6. Lubricate the pivot pins (1) with GM P/N 12346293 (Canadian P/N 992723).
7. Firmly seat each pivot pin (1) into the steering column tilt head assembly.
8. Stake the steering column support assembly in 3 locations around each pivot pin.

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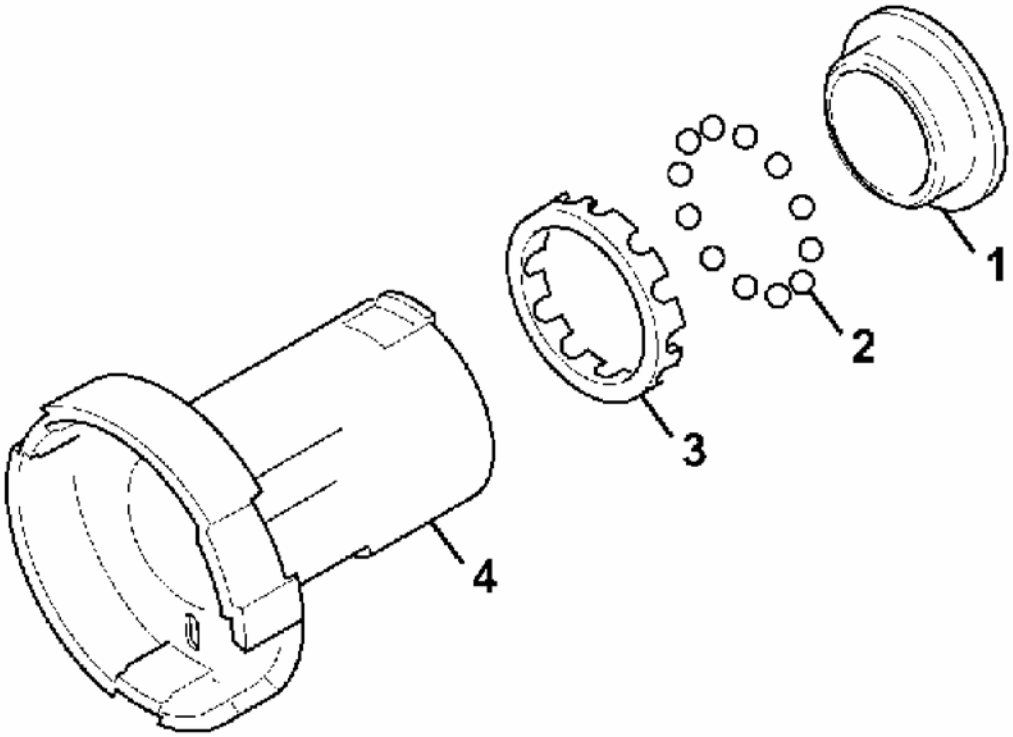



**Fig. 112: Installing Balls Into The Cage (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: Verify that all 12 balls are present and that NO foreign debris is present in the inner race, cage, balls or outer race. The orientation of the cage MUST be as shown to install properly.**

9. If necessary, install the balls (2) into the cage (3).

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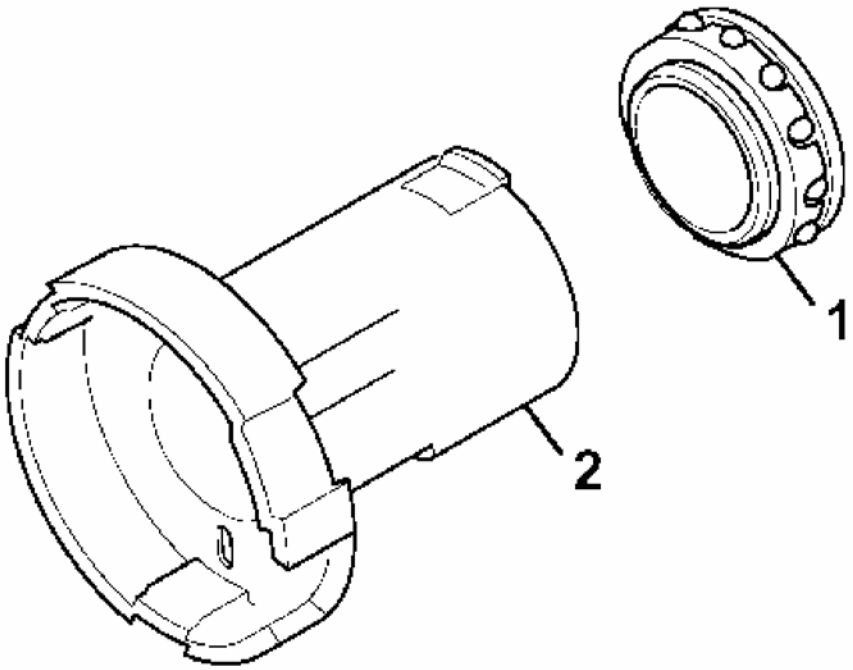



**Fig. 113: Installing Race Into The Ball And Cage Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

10. Install the race (1) into the ball and cage assembly.
11. Install the race, cage and balls into the adapter and bearing assembly (2).

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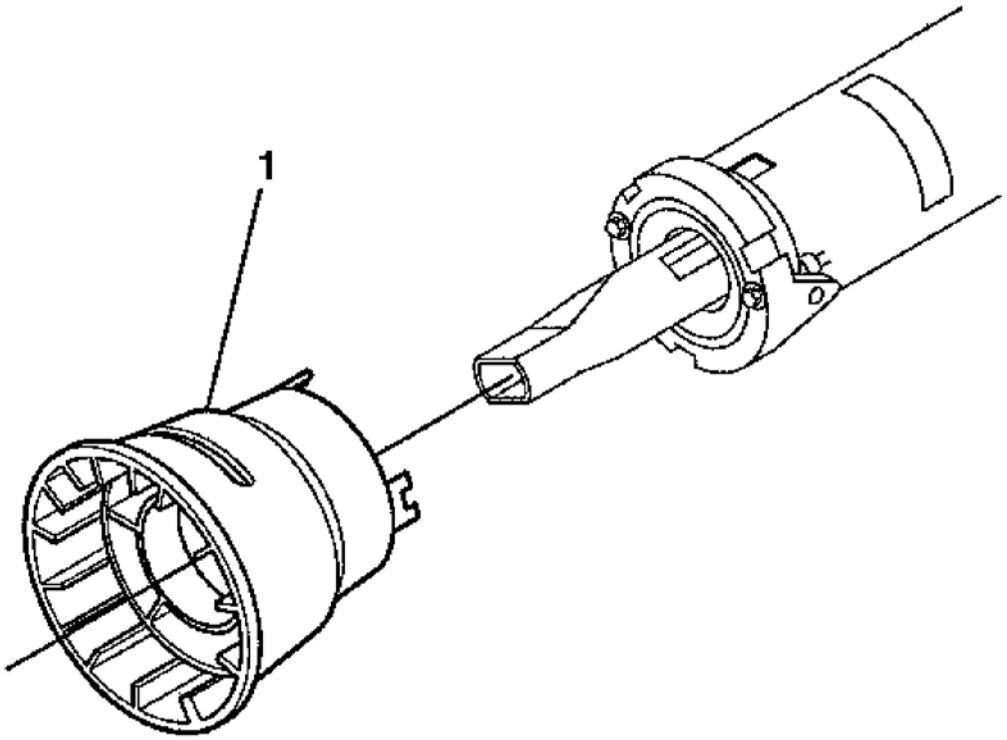



**Fig. 114: View Of Adapter & Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

12. Install the adapter and bearing assembly (1) onto the steering column jacket assembly by performing the following steps:
    1. Align the tab on the adapter and bearing assembly (1) with the slot in the steering column jacket assembly.
    2. Push the adapter and bearing assembly (1) onto the steering column shaft assembly until the tab snaps into the slot.

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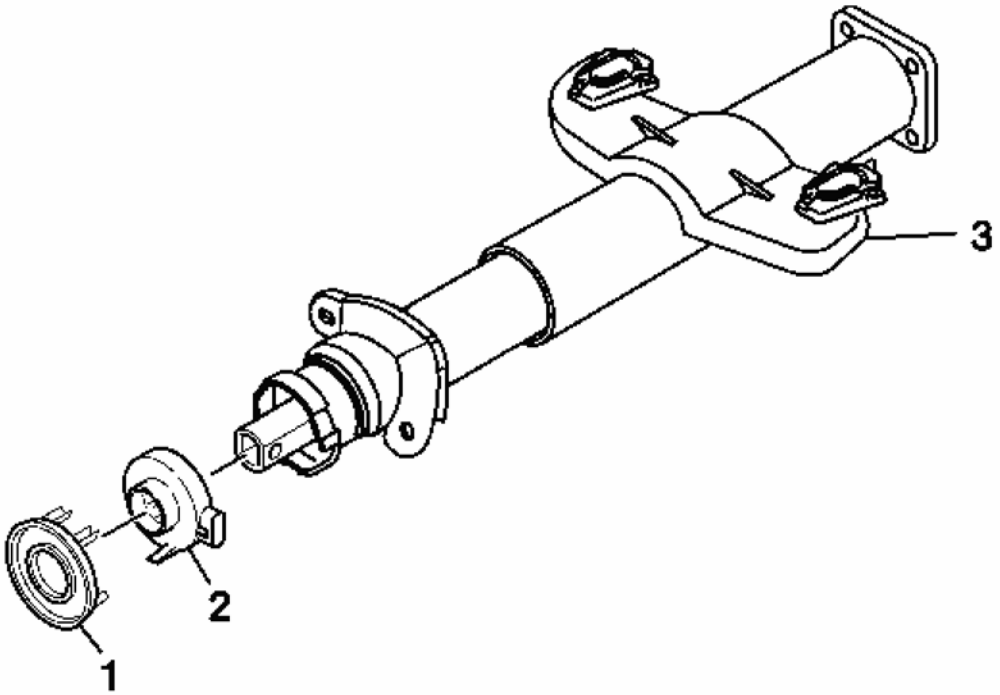



**Fig. 115: Removing Steering Shaft Position Sensor From The Steering Column Jacket Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

13. Install the steering shaft position sensor (2) onto the steering column jacket assembly (3).
14. Install the sensor retainer (1) onto the steering column jacket assembly (3).
15. Install the linear shift and the automatic transmission shift lock control only. Refer to **Linear Shift Assembly Replacement**.
16. Install the tilt spring only. Refer to **Tilt Spring Replacement**.
17. Install the turn signal multifunction switch. Refer to **Multifunction, Turn Signal Switch Replacement**.
18. Install the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement**.
19. Install the steering column into the vehicle. Refer to **Steering Column Replacement**.
20. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**LOWER BEARING AND STEERING COLUMN JACKET REPLACEMENT (FLOOR SHIFT LEAN SHAFT)**

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**Tools Required**

**J 21854-01** Pivot Pin Remover

**Removal Procedure**

**CAUTION: Refer to SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.
2. Remove the steering column from the vehicle. Refer to **Steering Column Replacement**.
3. Remove the turn signal multifunction switch. Refer to **Multifunction, Turn Signal Switch Replacement**.
4. Remove the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement**.
5. Remove the tilt spring only. Refer to **Tilt Spring Replacement**.

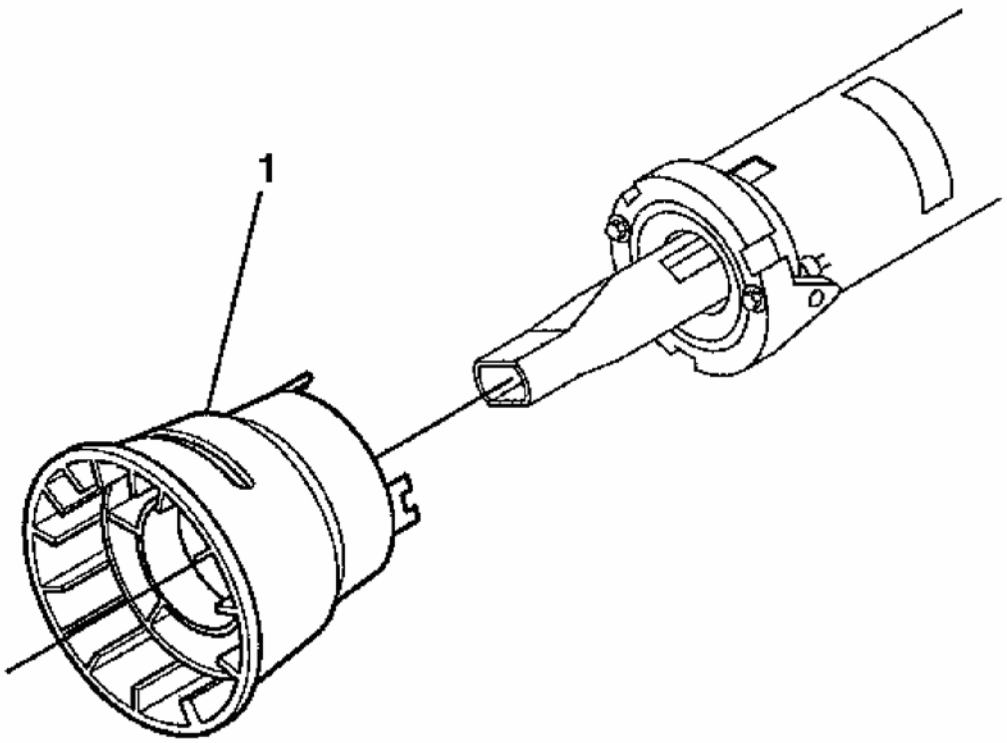



**Fig. 116: View Of Adapter & Bearing Assembly**

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**Courtesy of GENERAL MOTORS CORP.**

6. Inspect the steering column for accident damage. Refer to **Steering Column Accident Damage Inspection**.
7. Gently pull the adapter and bearing assembly (1) from the steering shaft assembly.

   If the cage and balls separate from the adapter and bearing assembly, you may install them back together in the installation procedure.

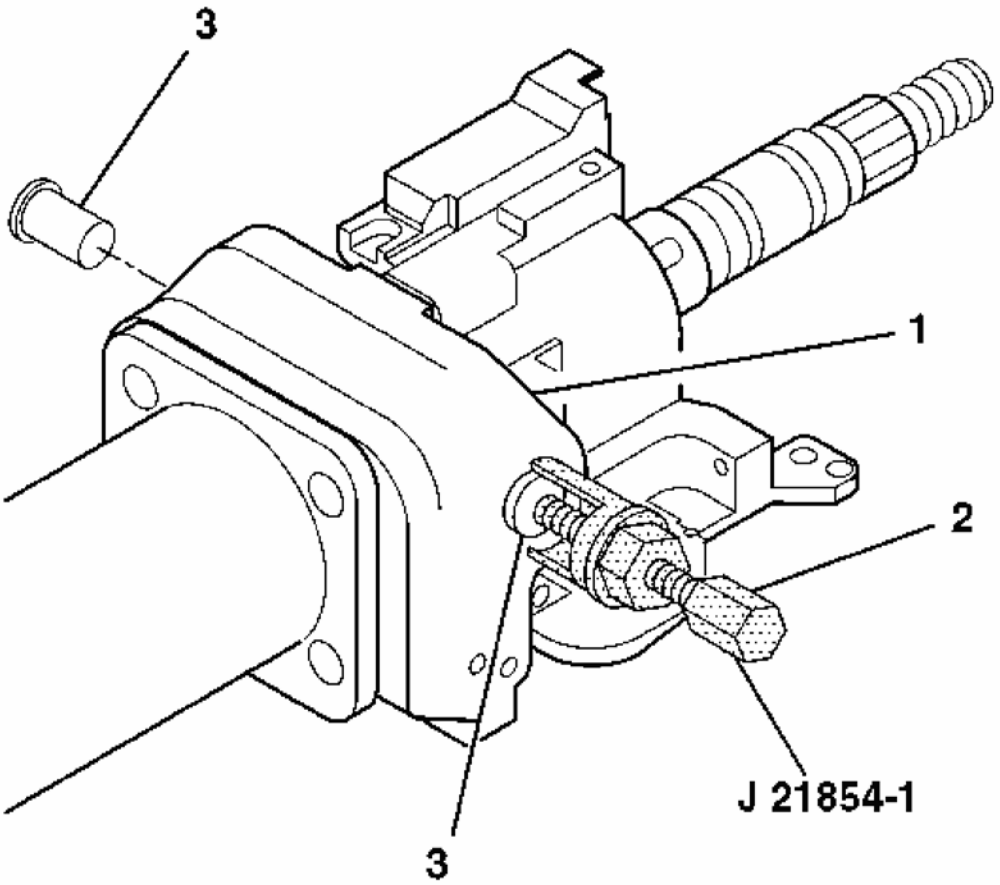



**Fig. 117: View Of Pivot Pins To Steering Column Tilt Head Assembly**
**Courtesy of GENERAL MOTORS CORP.**

8. Remove the 2 pivot pins (3) from the steering column tilt head assembly (1) by using **J 21854-01** .

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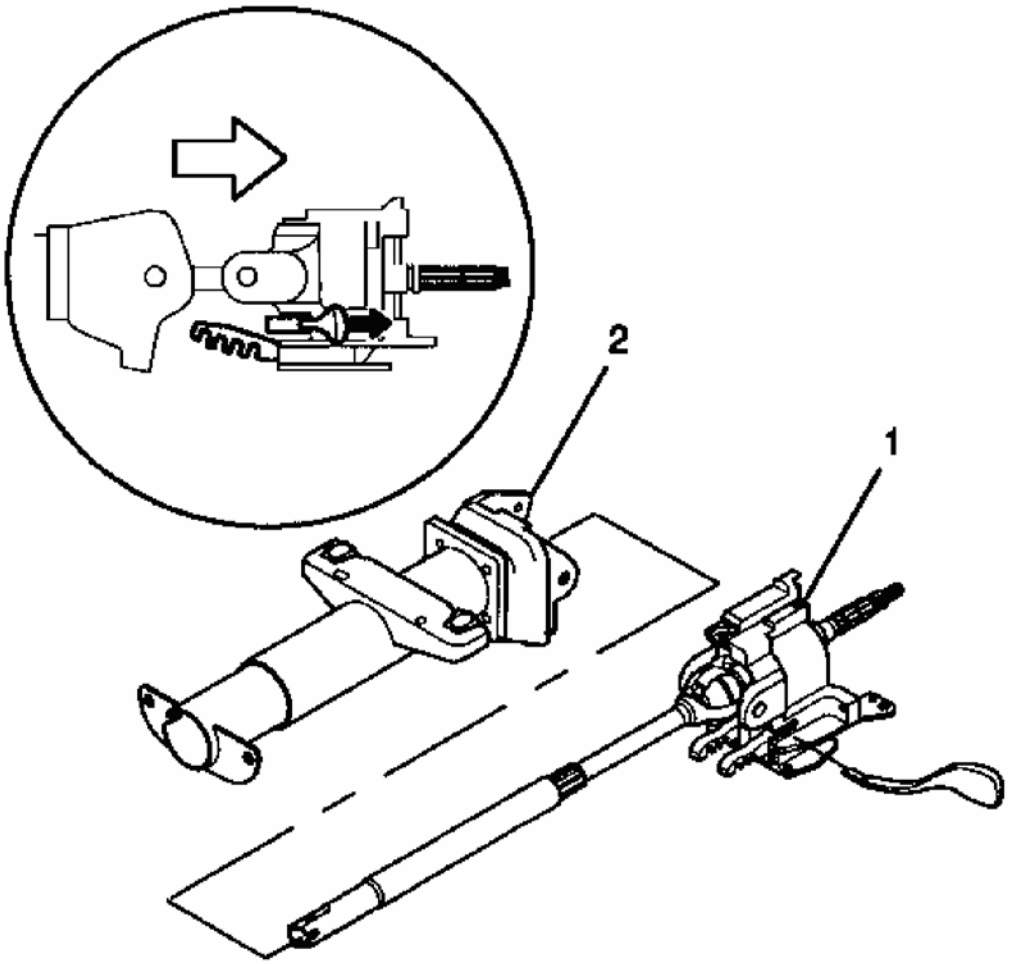



**Fig. 118: Removing Steering Column Tilt Head Assembly From The Steering Column Support Assembly (Floor Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

9. Install the tilt knob into the steering column tilt head assembly (1).
10. Pull back on the tilt knob and at the same time pull the steering column tilt head assembly (1) down and away from the steering column.
11. Remove the steering column tilt head assembly (1) with the steering shaft assembly from the steering column support assembly (2).
12. Remove the tilt knob.

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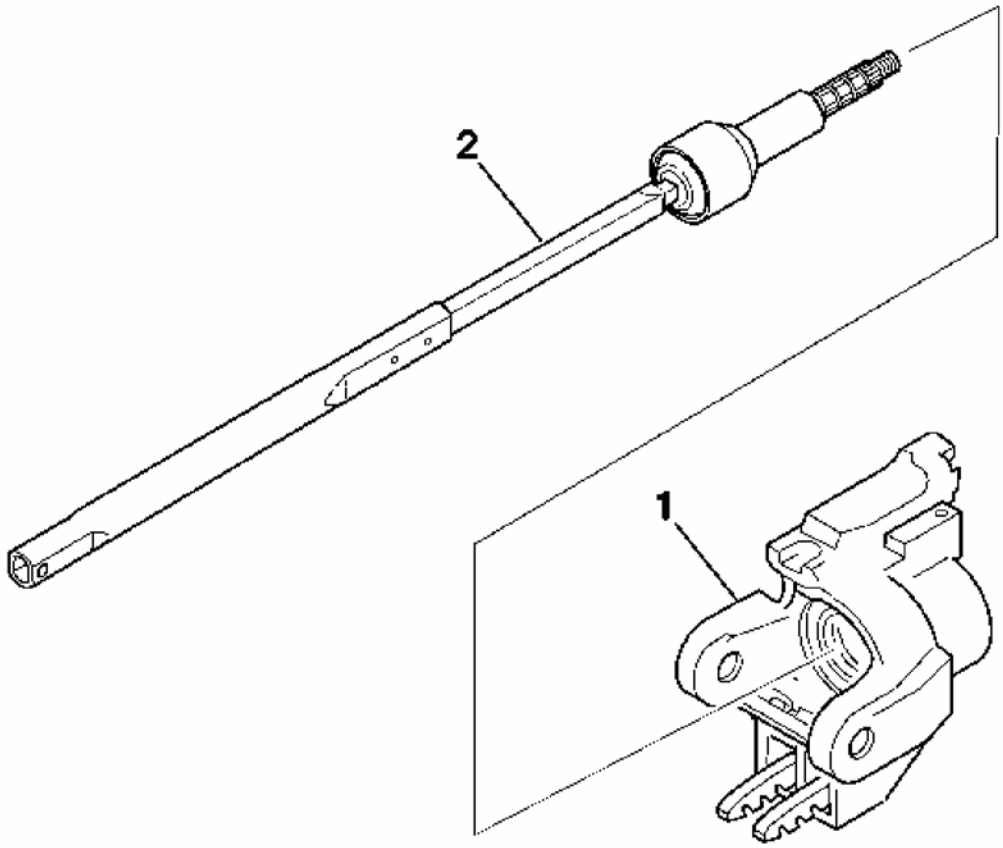



**Fig. 119: Removing Steering Column Shaft Assembly From The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

13. Remove the steering shaft assembly (2) from the steering column tilt head assembly (1).

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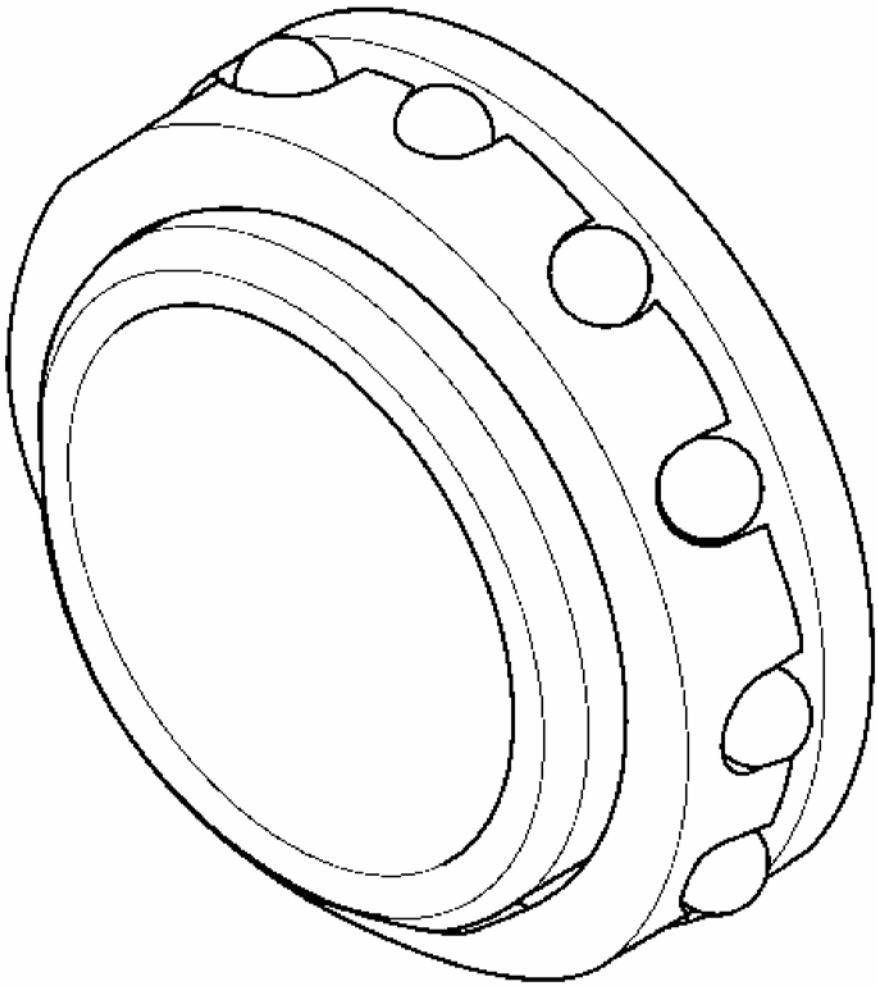


**Fig. 120: View Of Upper Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

14. Remove the upper bearing assembly.

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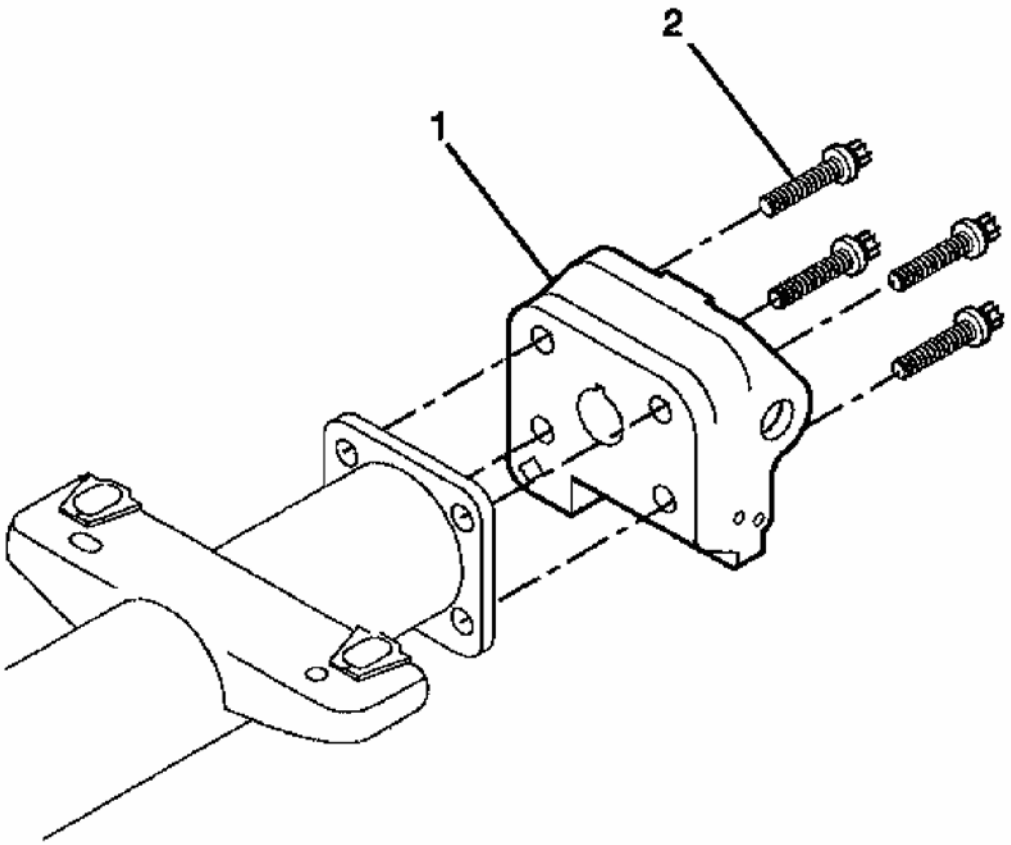



**Fig. 121: View Of Steering Column Support Assembly & TORX(R) Head Screws**
**Courtesy of GENERAL MOTORS CORP.**

15. Remove the 4 TORX® head screws (2) from the steering column support assembly (1).
16. Discard the 4 TORX® head screws.
17. Remove the steering column support assembly (1) from the steering column jacket assembly.

**Installation Procedure**

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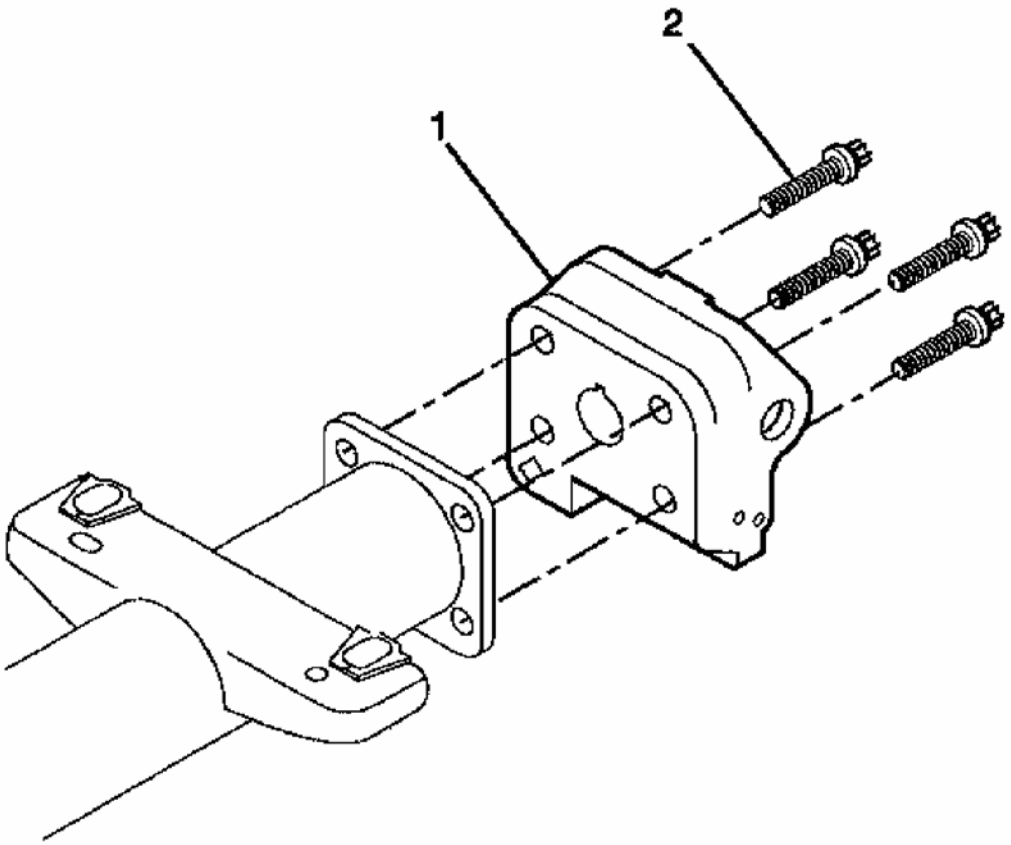



**Fig. 122: View Of Steering Column Support Assembly & TORX(R) Head Screws**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: Refer to Fastener Notice in Cautions and Notices.**

**IMPORTANT: Replace the steering column support assembly if the steering column support assembly has been staked 3 times.**

1. Attach the steering column support assembly (1) to the steering column jacket assembly with 4 new TORX® head screws (2).

   **Tighten:** Tighten the screws to 17 N.m (13 lb ft).

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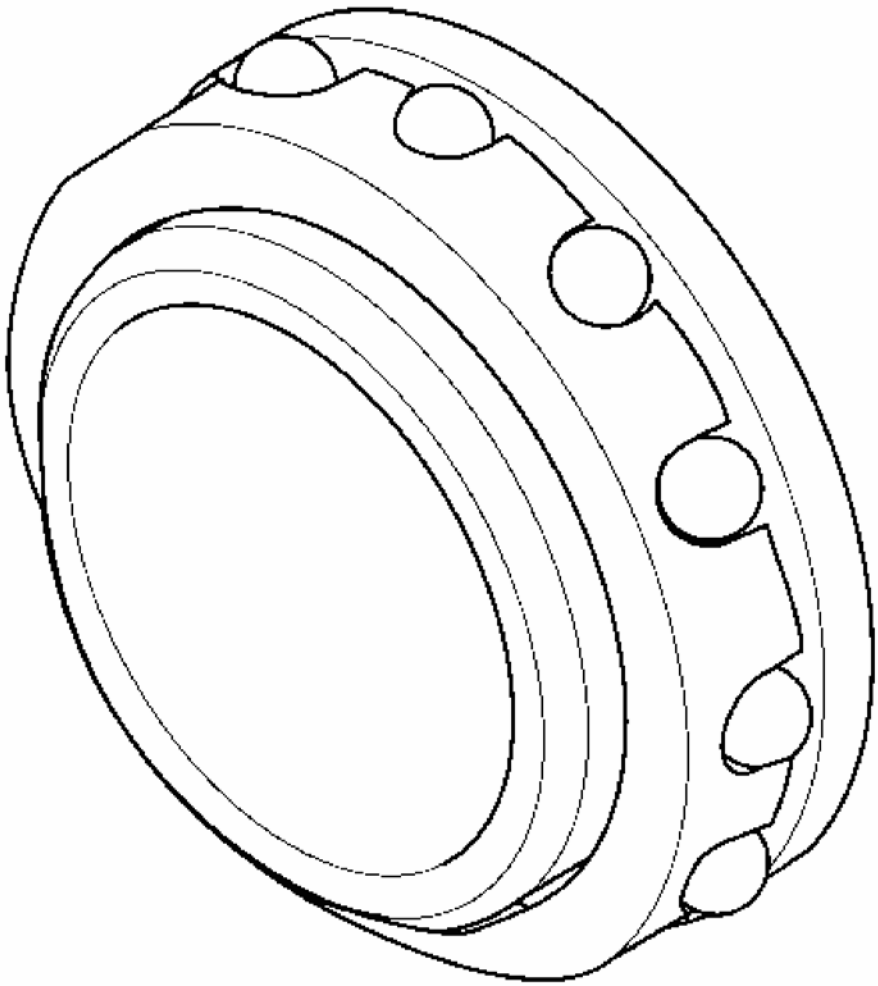


**Fig. 123: View Of Upper Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

2. Install the upper bearing assembly.

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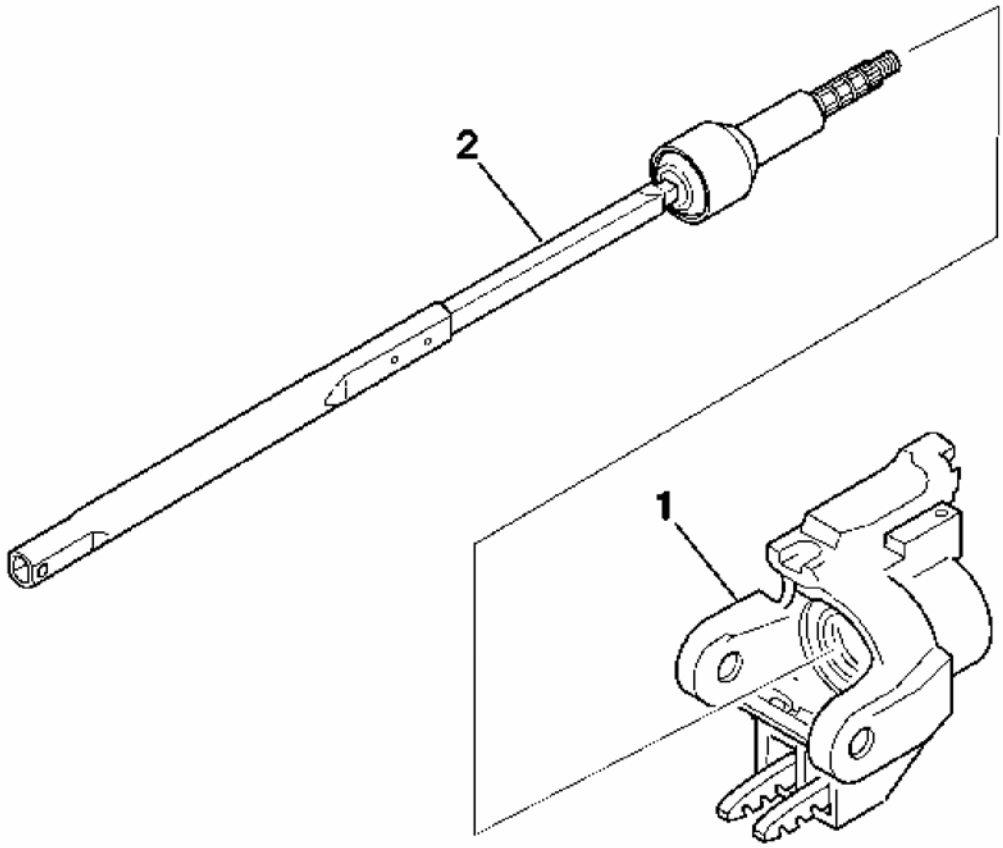



**Fig. 124: Removing Steering Column Shaft Assembly From The Steering Column Tilt Head Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

3. Install the steering column shaft assembly (2) into the steering column tilt head assembly (1).

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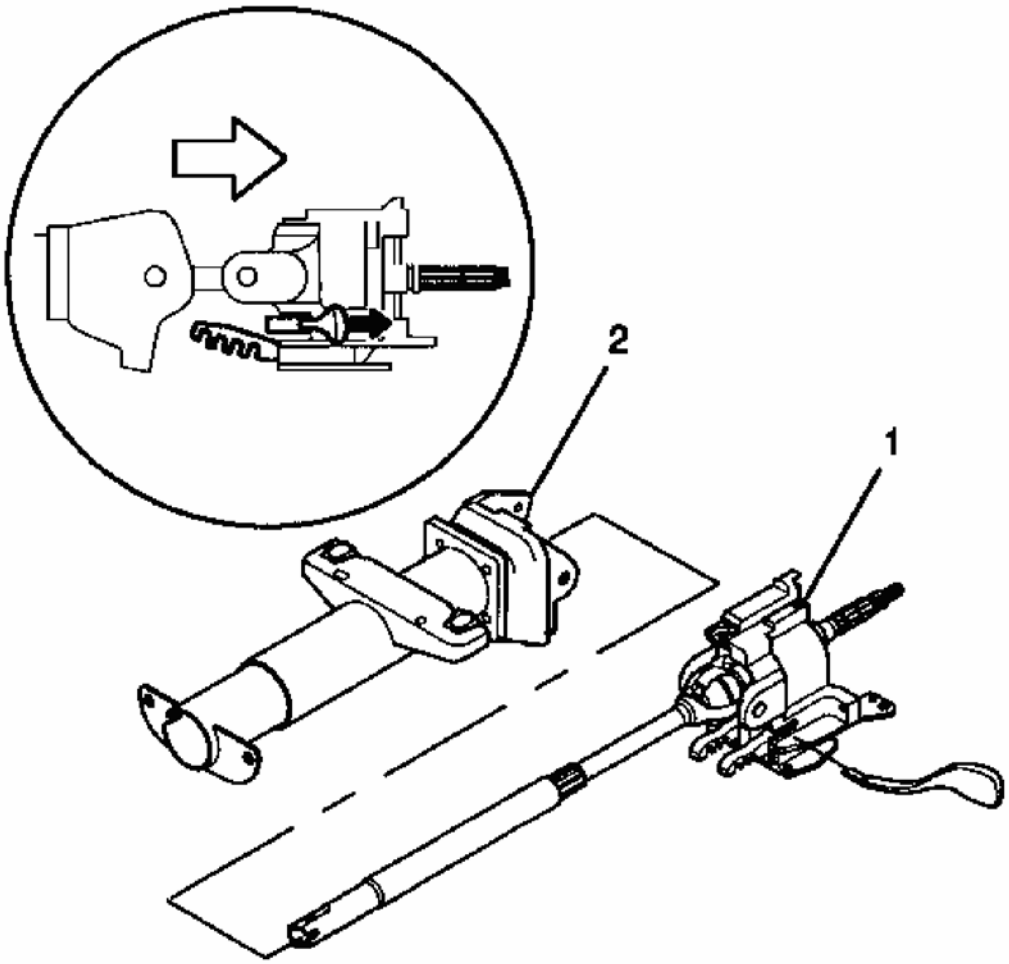



**Fig. 125: Removing Steering Column Tilt Head Assembly From The Steering Column Support Assembly (Floor Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

4. Install the steering column shaft assembly with the steering column tilt head assembly (1) into the steering column support assembly (2).
5. Move the tilt knob and push the steering column tilt head assembly up towards the steering column in order to lock the steering wheel lock shoes in place.

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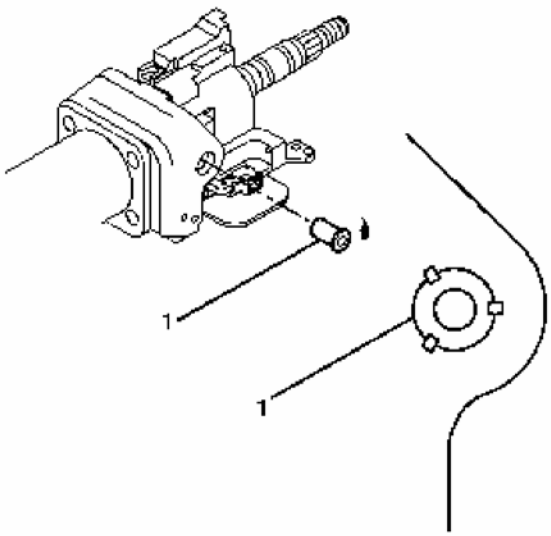



**Fig. 126: View Of Pivot Pins At Steering Column Assembly**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: Replace the steering column support assembly if the steering column support assembly has been staked 3 times.**

6. Lubricate the pivot pins (1) with GM P/N 12346293 (Canadian P/N 992723).
7. Firmly seat each pivot pin (1) into the steering column tilt head assembly.
8. Stake the steering column support assembly in 3 locations around each pivot pin (1).

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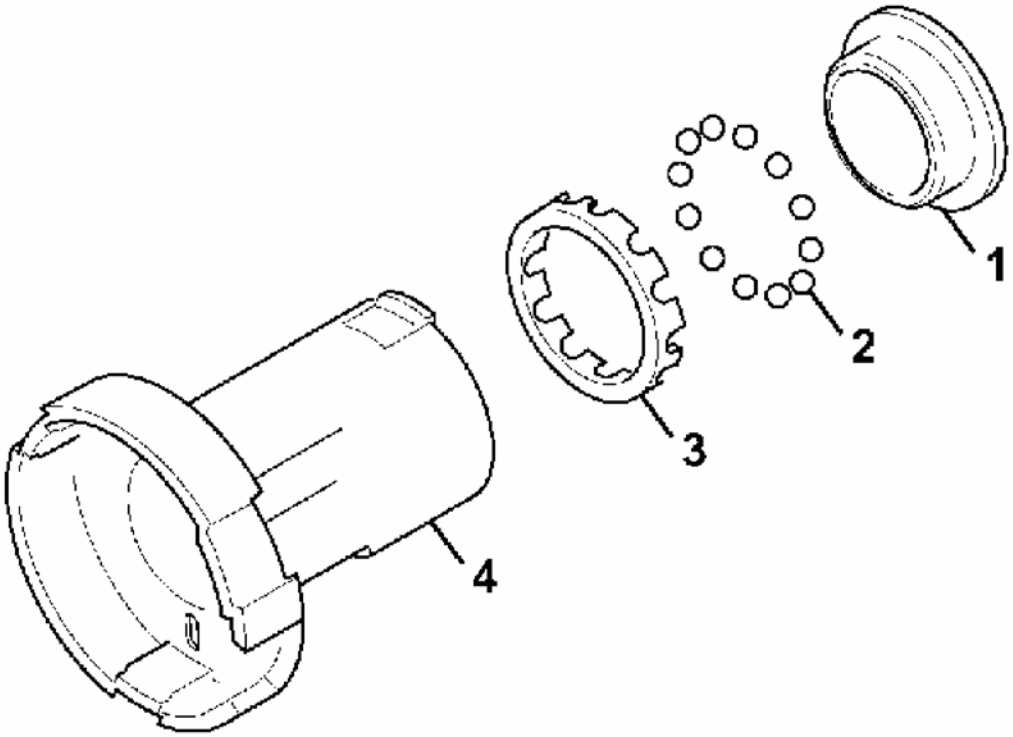



**Fig. 127: Installing Balls Into The Cage (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: Verify that all 12 balls are present and that NO foreign debris is present in the inner race, cage, balls or outer race. The orientation of the cage MUST be as shown to install properly.**

9. If necessary, install the balls (2) into the cage (3).

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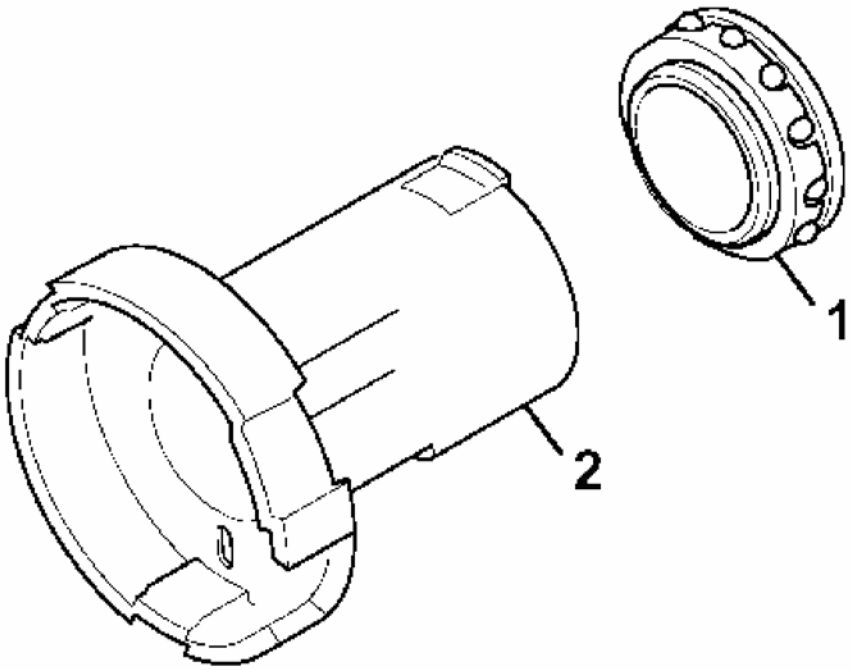



**Fig. 128: Installing Race Into The Ball And Cage Assembly (Column Shift Lean Shaft)**
**Courtesy of GENERAL MOTORS CORP.**

10. Install the race (1) into the ball and cage assembly.
11. Install the race, cage and balls into the adapter and bearing assembly (2).

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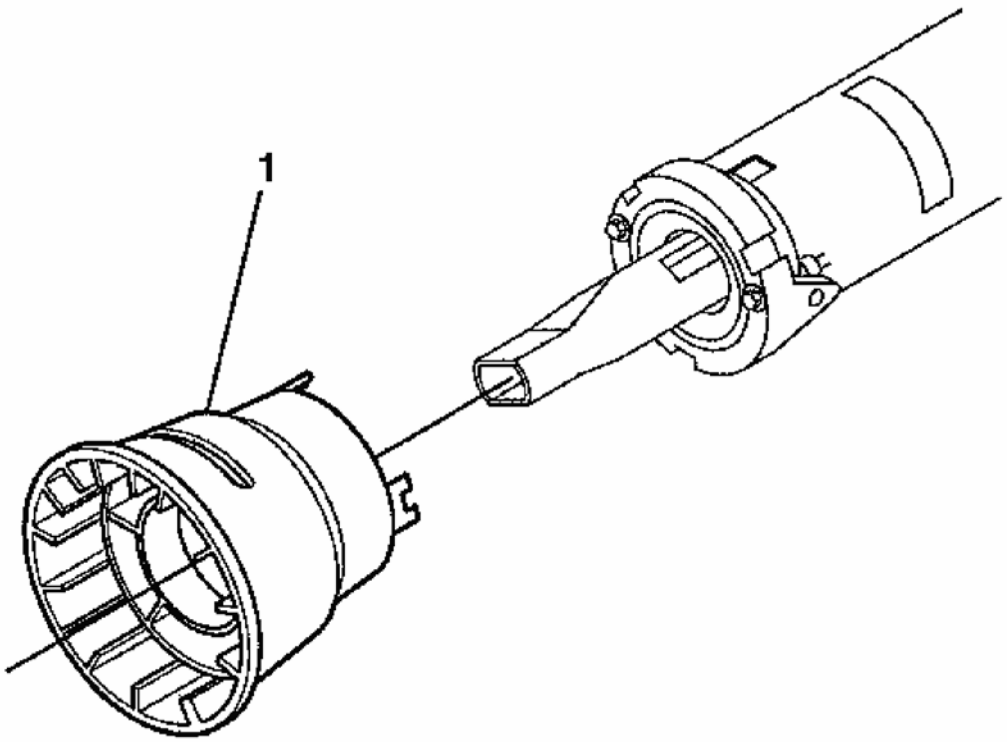



**Fig. 129: View Of Adapter & Bearing Assembly**
**Courtesy of GENERAL MOTORS CORP.**

12. Install the adapter and bearing assembly (1) onto the steering column jacket assembly by performing the following steps:
    1. Align the tab on the adapter and bearing assembly (1) with the slot in the steering column jacket assembly.
    2. Push the adapter and bearing assembly (1) onto the steering column shaft assembly until the tab snaps into the slot.
13. Install the tilt spring only. Refer to **Tilt Spring Replacement**.
14. Install the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement**.
15. Install the turn signal multifunction switch. Refer to **Multifunction, Turn Signal Switch Replacement**.
16. Install the steering column into the vehicle. Refer to **Steering Column Replacement**.
17. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**STEERING WHEEL POSITION SENSOR OR STEERING SHAFT LOWER BEARING**

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**REPLACEMENT**

**Tools Required**

**J 42640** Steering Column Anti-Rotation Pin

**Removal Procedure**

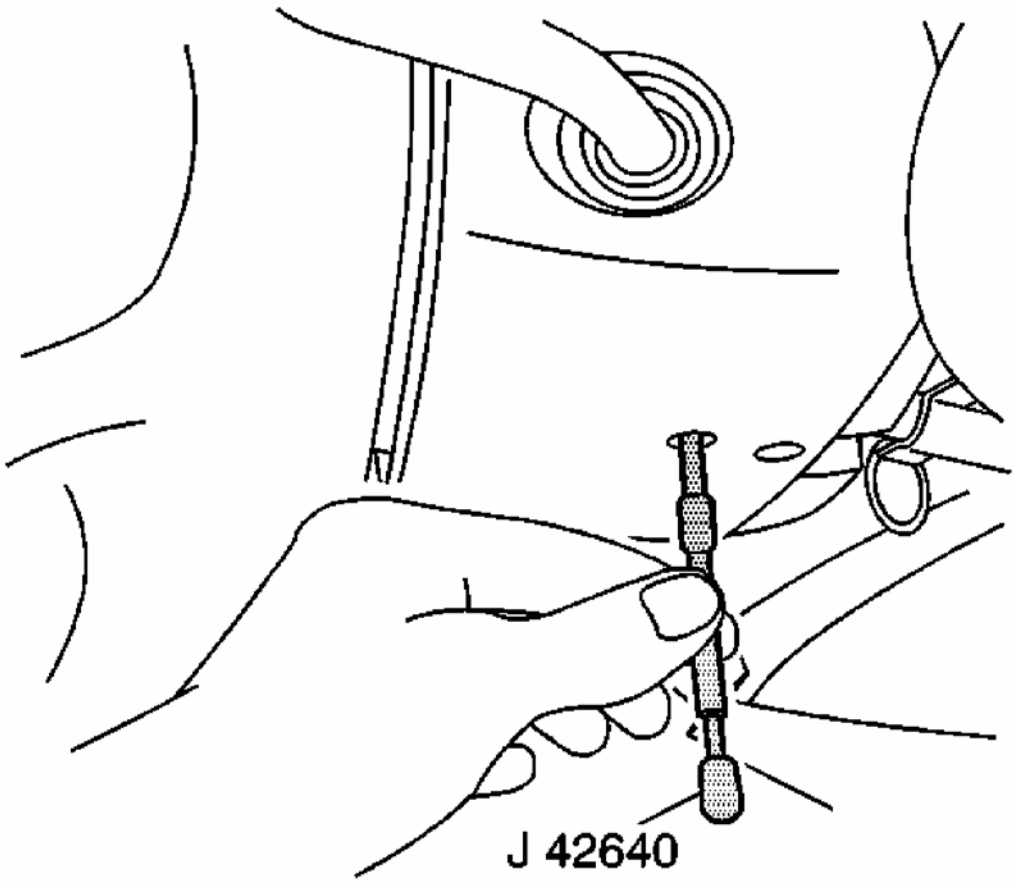



**Fig. 130: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

**CAUTION: Refer to SIR Caution SIR Caution in Cautions and Notices.**

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** in SIR.

**NOTE: The front wheels of the vehicle must be maintained in the**

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**straight ahead position and the steering column must be in the LOCK position before disconnecting the steering column or intermediate shaft. Failure to follow these procedures will cause improper alignment of some components during installation and result in damage to the SIR coil assembly.**

2. Lock the steering column through the access hole in the lower trim cover using **J 42640** .

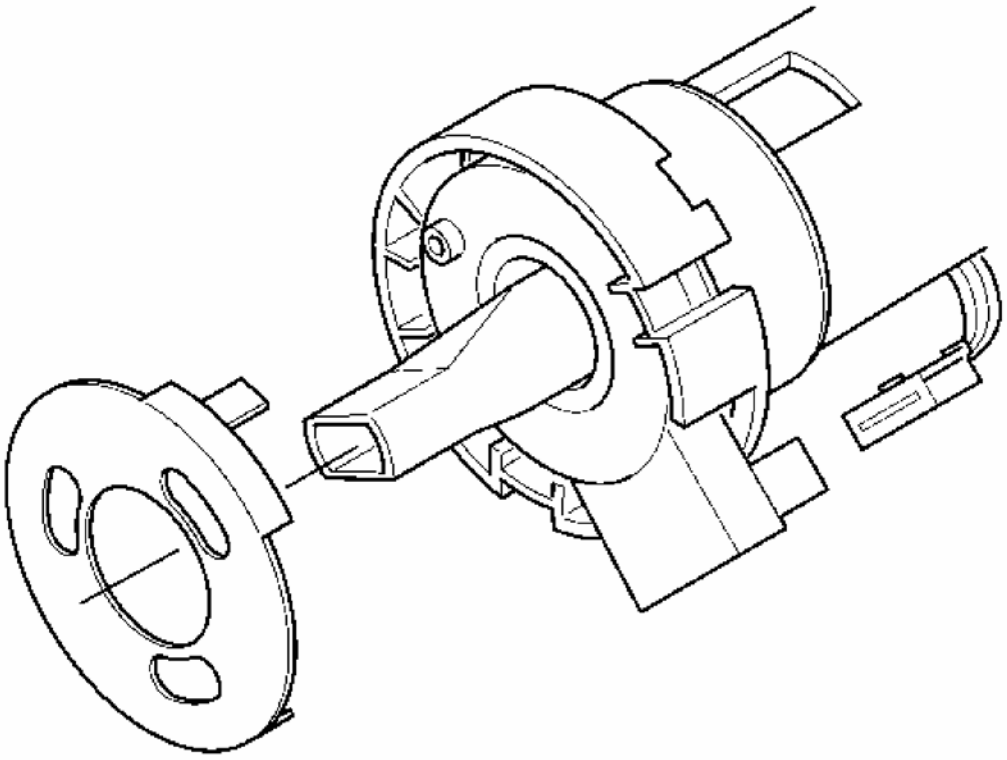


**Fig. 131: Removing Sensor Retainer From The Steering Shaft**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: A new sensor must come with a pin installed. If pin is not installed, return and reorder sensor. Do not apply force to the sensor and the bearing assembly in a sideways direction.**

3. Remove the steering column from the vehicle. Refer to **Steering Column Replacement**.

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4. Remove the sensor connector by using a suitable tool in order to pull the connector down around the right side of the steering column for accessibility.
5. Remove the sensor retainer from the steering shaft.

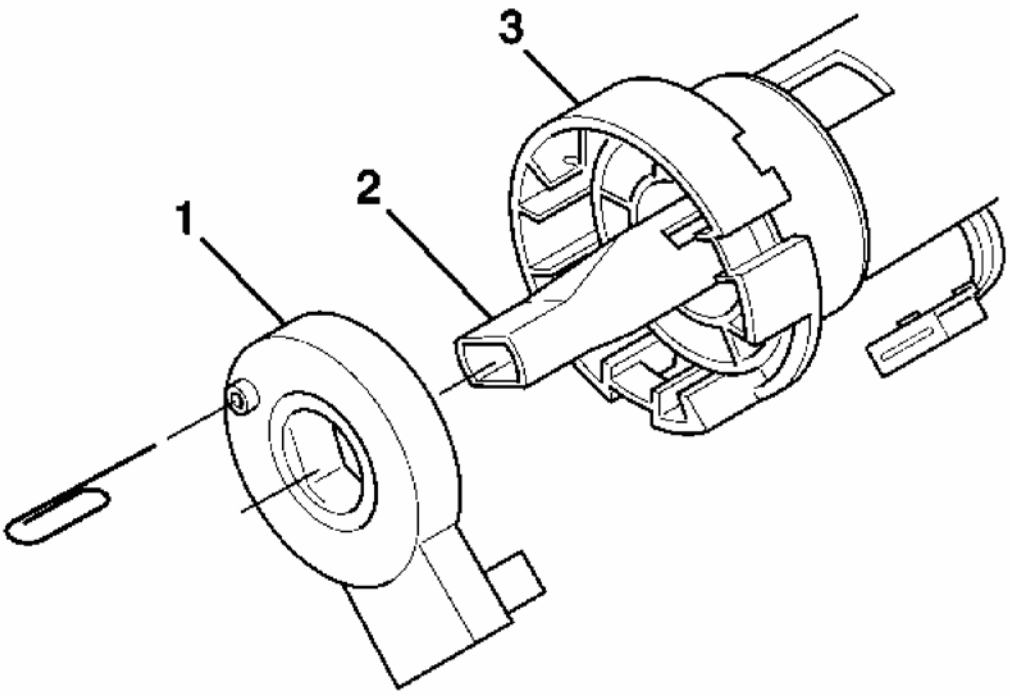



**Fig. 132: Removing Position Sensor By Pulling The Sensor Straight Out From The Bearing Adapter**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: When reusing the sensor (1) you must install a pin into the sensor before it is removed from the steering shaft. By not installing a pin into the sensor it will cause the sensor to lose its centering position and must be discarded.**
**Pin diameter must be in the range of 1-2 mm.**
**Do not remove the bearing adapter (3).**

6. If reusing the sensor (1), remove the position sensor by pulling the sensor straight out from the bearing adapter (3) until the sensor is almost off the steering shaft (2). Install a pin into the sensor before removing from the steering shaft (2). Do not remove the pin until the sensor is re-installed.
7. If replacing the sensor (1), remove the sensor by pulling the sensor straight out from the

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bearing adapter (3) and off the steering shaft.

**Installation Procedure**

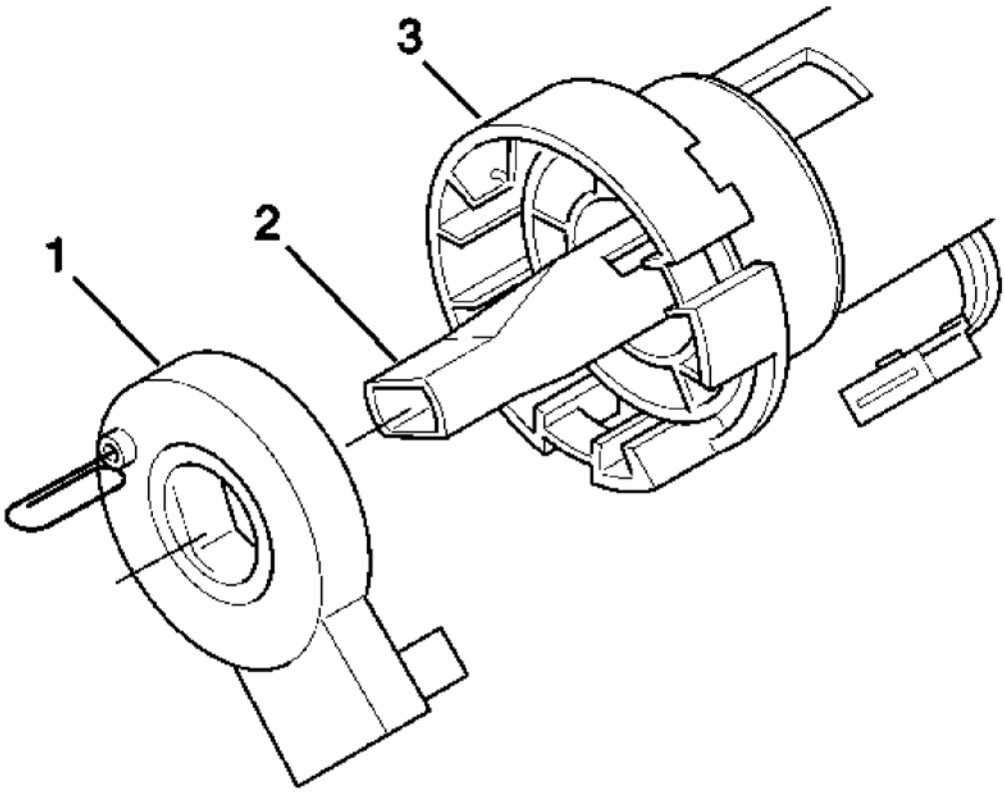



**Fig. 133: Aligning Sensor Onto The Steering Shaft And Into The Bearing Adapter**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: Do not apply force to the sensor (1) or the bearing adapter (3) in a sideways direction.**

1. If reusing the sensor, with the pin still installed, align the sensor onto the steering shaft (2) and into the bearing adapter (3).

**IMPORTANT: If installing a new sensor the sensor will come pre-centered. Do not remove the pin until installation is complete.**

2. Install the sensor onto the steering shaft (2) and into the bearing adapter (3).

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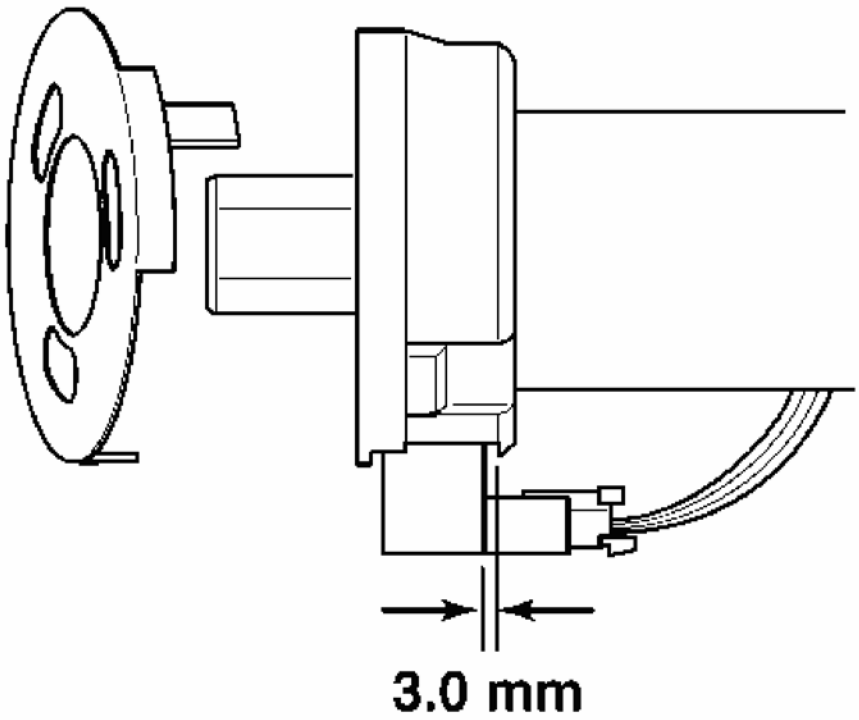



**Fig. 134: Setting Sensor Gap**
**Courtesy of GENERAL MOTORS CORP.**

3. The sensor must be set to approximately 3 mm gap between the sensor and the bearing adapter.
4. Install the sensor connector.
5. Remove the pin from the sensor.
6. Install the sensor retainer onto the steering shaft.

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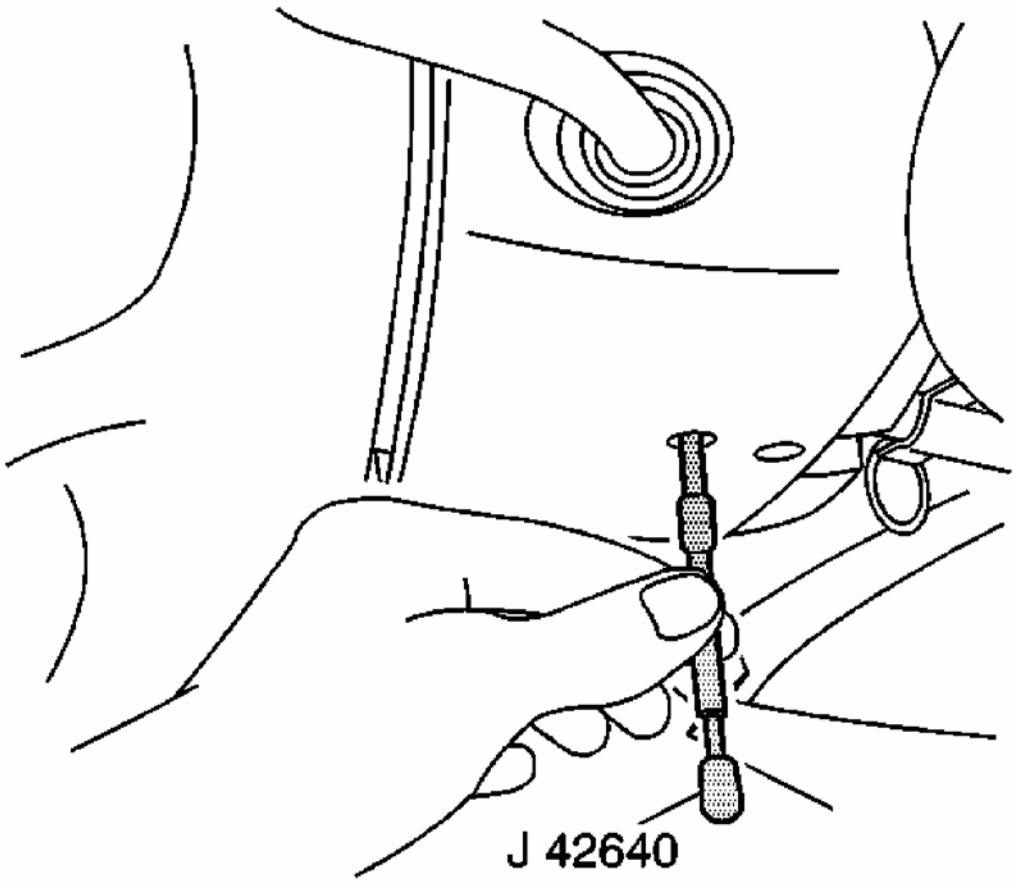



**Fig. 135: Identifying J 42640**
**Courtesy of GENERAL MOTORS CORP.**

7. Install the steering column to the vehicle. Refer to **Steering Column Replacement**.
8. Remove **J 42640** from the steering column.
9. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 3** .

**STEERING WHEEL POSITION SENSOR CENTERING**

**Removal Procedure**

**IMPORTANT: 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.**

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1. Verify the type of steering wheel position sensor.

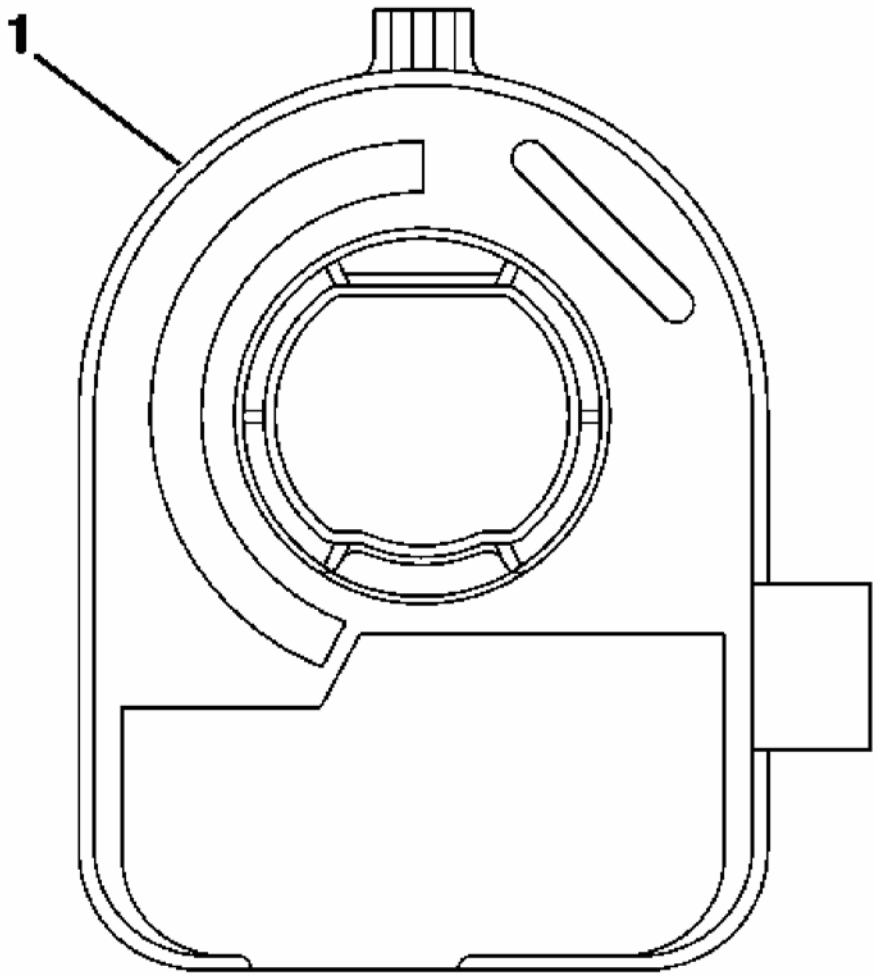



**Fig. 136: FRONT Of The Sensor Connector Will Be On The Right**
**Courtesy of GENERAL MOTORS CORP.**

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

**IMPORTANT: If reusing the existing sensor, you do not have to align the sensor before removal. Centering is not required when it is time to reinstall.**

3. Remove the connector from the sensor.

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4. Remove the sensor (1) from the adapter and bearing assembly.
5. To install the sensor, proceed to step 1 in the installation section.

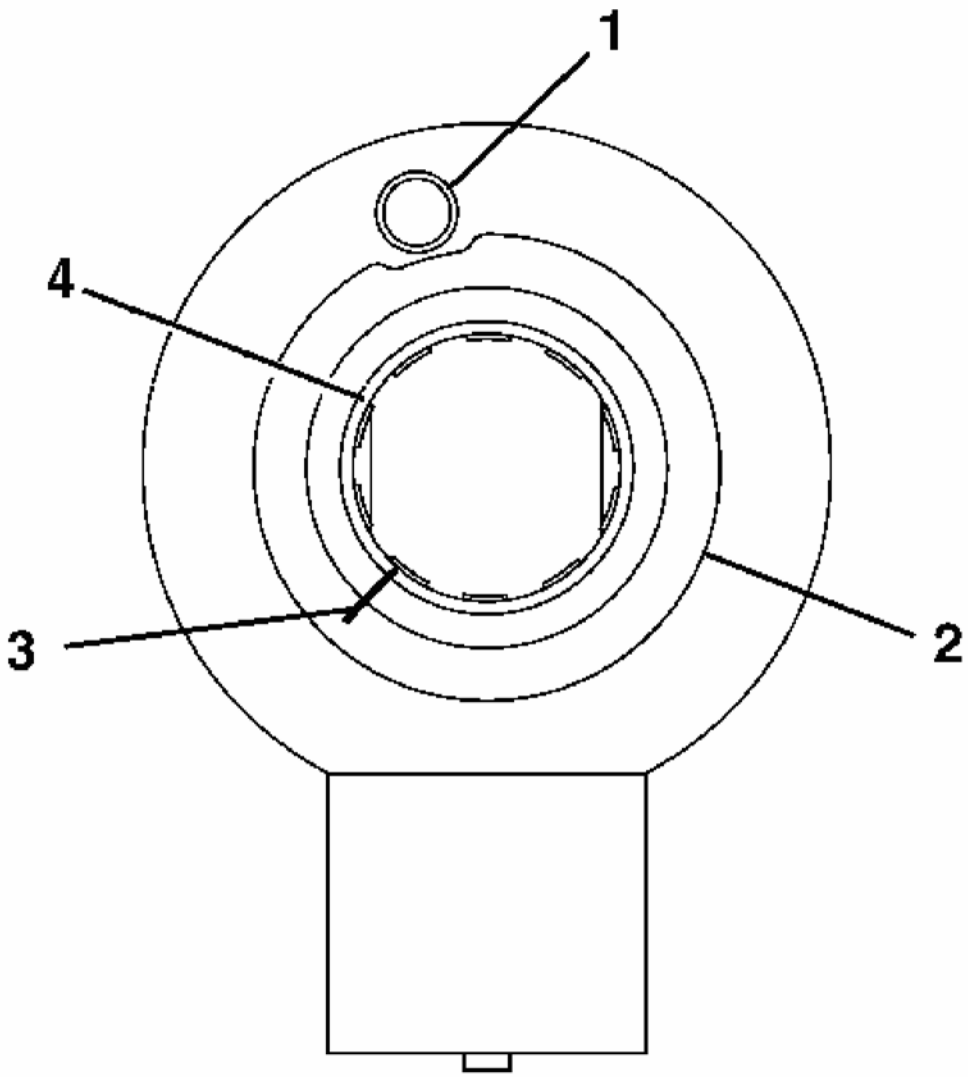



**Fig. 137: Steering Wheel Position Sensor Foam Ring, Pin Hole And Rotor Flange Cuff**
**Courtesy of GENERAL MOTORS CORP.**

6. From the technicians point of view, the FRONT of the sensor will have:
   - A foam ring (2)
   - A pin hole (1) for centering the pin. Note the location of the pin hole.

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- A flush rotor flange cuff (4)

**IMPORTANT: If reusing the existing sensor, you must make an alignment mark on the rotor flange cuff (3) before removing the sensor. Failure to do so will cause misalignment when installing the sensor. A new sensor will be required if misaligned.**

7. Make an alignment mark on the flush rotor flange cuff (3).
8. Remove the connector from the sensor.
9. Remove the sensor from the adapter and bearing assembly.
10. To install the sensor, proceed to step 5 in the installation procedure.

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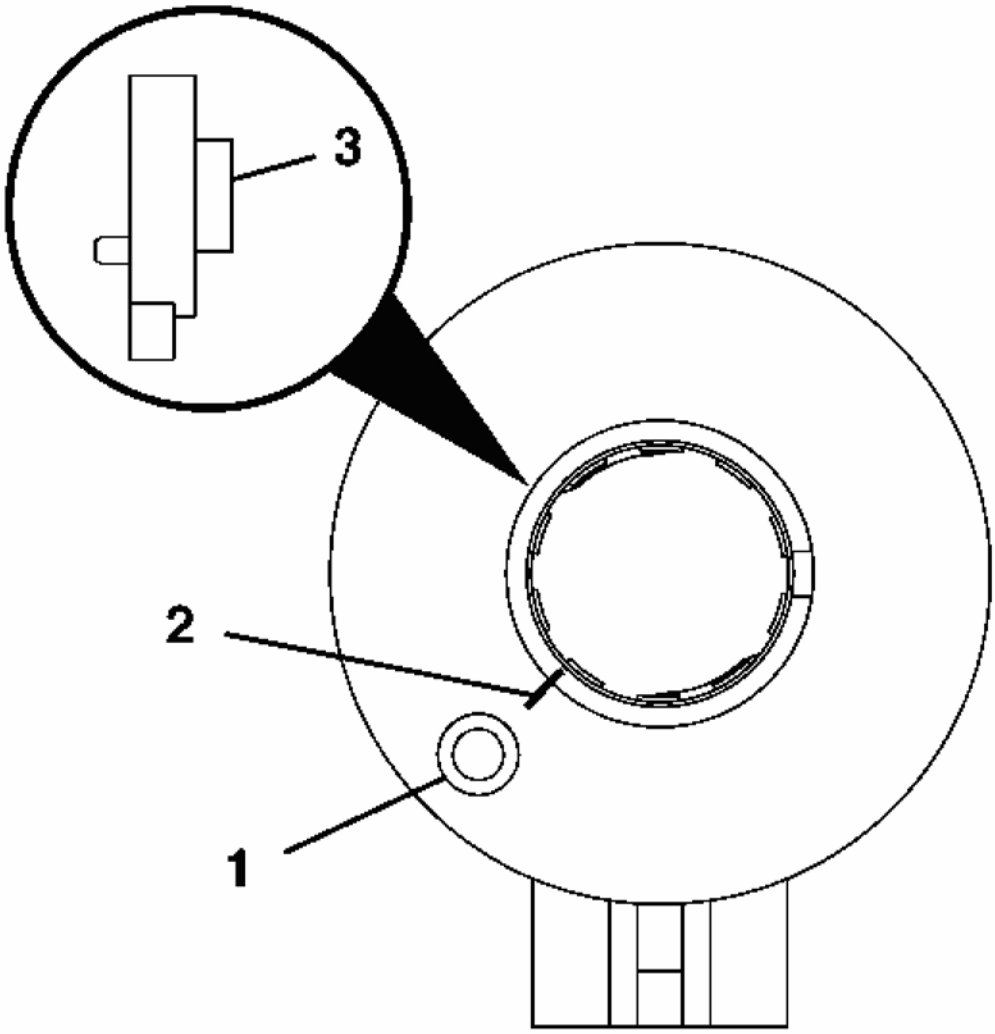



**Fig. 138: Steering Wheel Position Sensor Alignment Mark**
**Courtesy of GENERAL MOTORS CORP.**

11. 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 (3) for installation
    - A pin hole (1) for the centering pin. Note the location of the pin hole.
12. Remove the connector from the sensor.
13. Remove the sensor from the adapter and bearing assembly.
14. To install the sensor, proceed to step 9 in the installation procedure.

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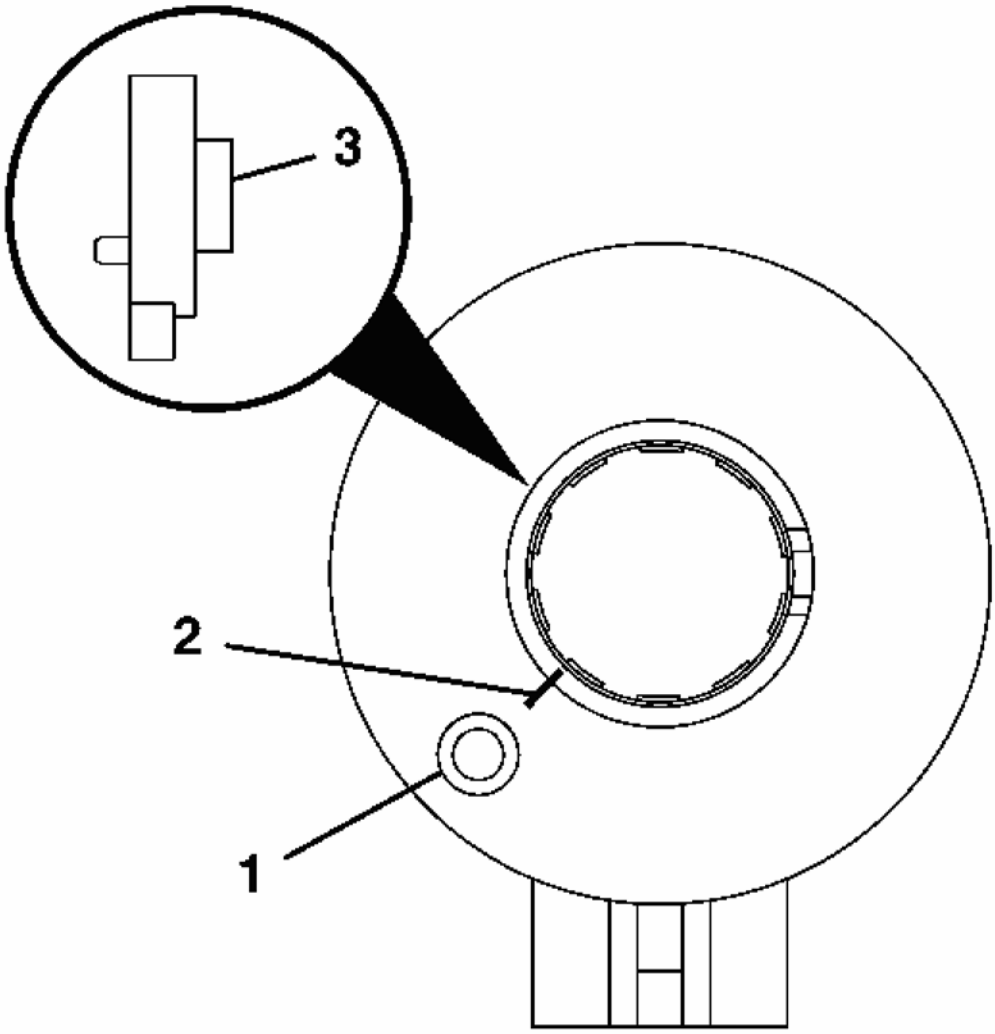



**Fig. 139: Steering Wheel Position Sensor Alignment Mark**
**Courtesy of GENERAL MOTORS CORP.**

15. 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 (3) for installation
    - A pin hole (1) for the centering pin. Note location of the pin hole.
    - A sensor clip in FRONT of the sensor
16. Remove the connector from the sensor.
17. Remove the sensor clip from the sensor.
18. Remove the sensor from the adapter and bearing assembly.

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19. To install the sensor, proceed to step 13 in the installation procedure.

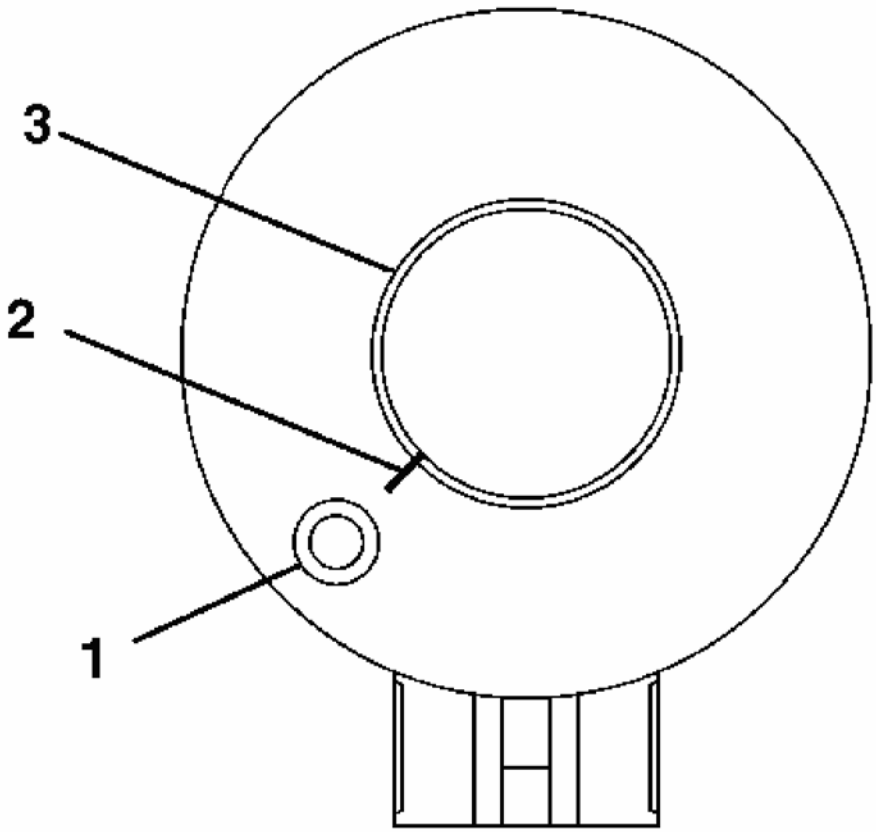



**Fig. 140: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole And Alignment Mark**
**Courtesy of GENERAL MOTORS CORP.**

20. 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 (3) for installation
21. Remove the connector from the sensor.
22. Remove the sensor from the adapter and bearing assembly.
23. To install the sensor, proceed to step 17 in the installation procedure.

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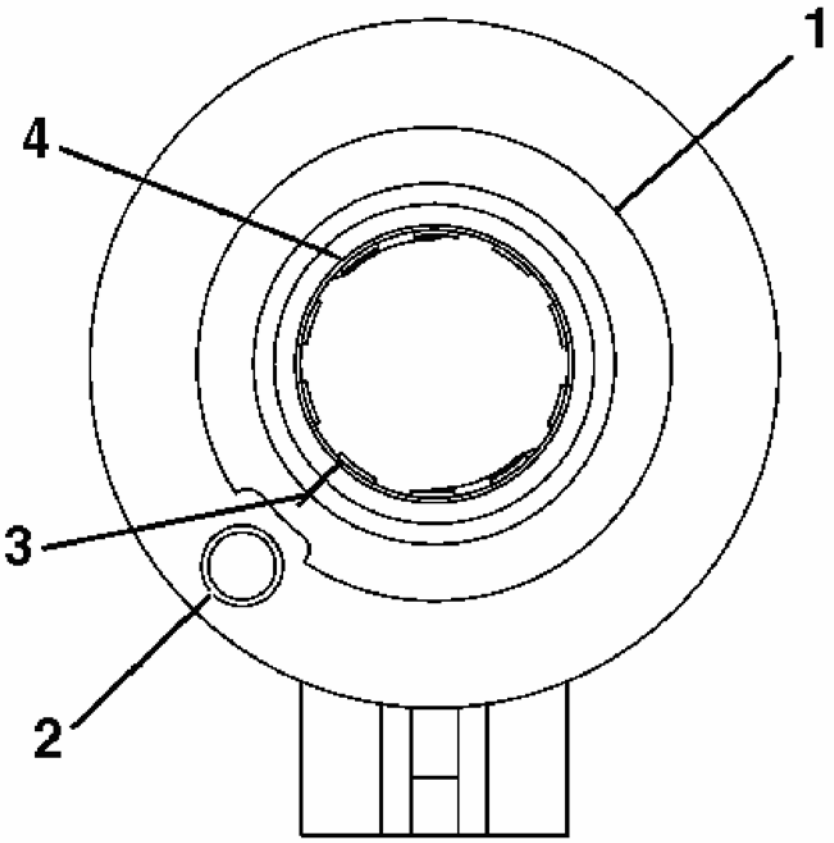



**Fig. 141: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole, Alignment Mark And Foam Ring**
**Courtesy of GENERAL MOTORS CORP.**

24. 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 (4) for installation
    - A foam ring (1)
25. Remove the connector from the sensor.
26. Remove the sensor from the adapter and bearing assembly.
27. To install the sensor, proceed to step 21 in the installation procedure.

**Installation Procedure**

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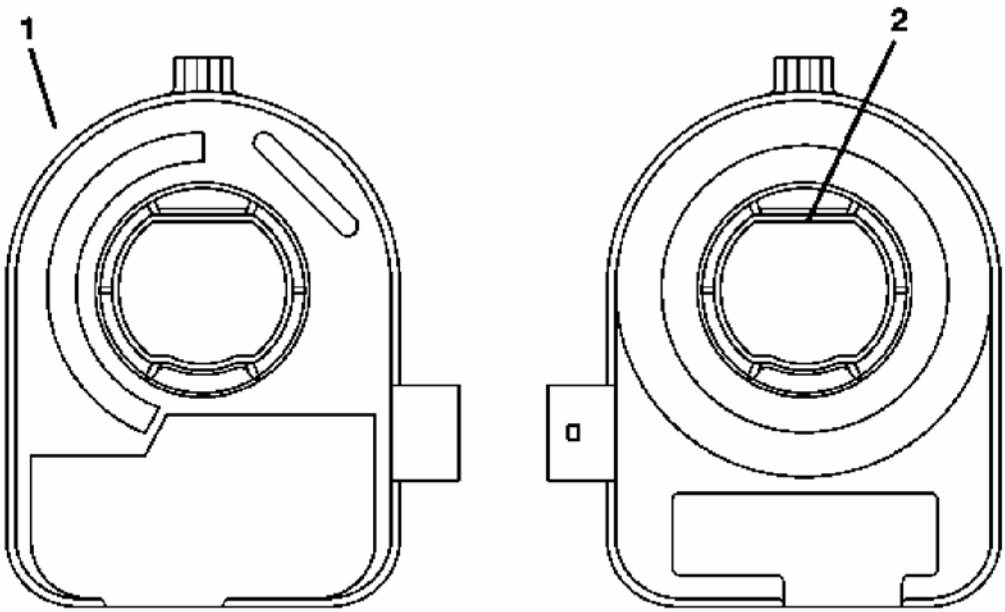



**Fig. 142: Front And Back Views Of Steering Wheel Position Sensor**
**Courtesy of GENERAL MOTORS CORP.**

**IMPORTANT: If reusing the existing sensor, no centering of the sensor is required.**

1. If installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is seated.
2. From the technicians point of view, the FRONT of the sensor (1) connector will be on your right.

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

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

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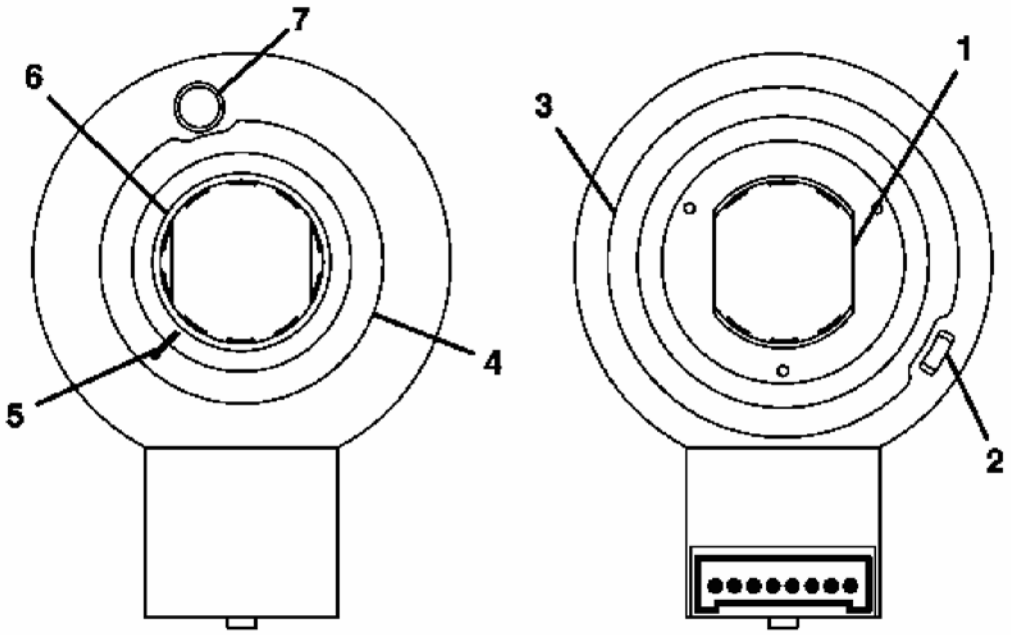



**Fig. 143: Steering Wheel Position Sensor Identification Points**
**Courtesy of GENERAL MOTORS CORP.**

5. 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 flushed rotor flange cuff (6)
   - An alignment mark (5) for installation
6. 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 into the adapter and bearing assembly
   - A view of the inside of the connector

**IMPORTANT: If reusing the existing sensor, you must 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 installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is**

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**seated. If the new sensor did not come with a pin installed, you must reorder a new sensor.**

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

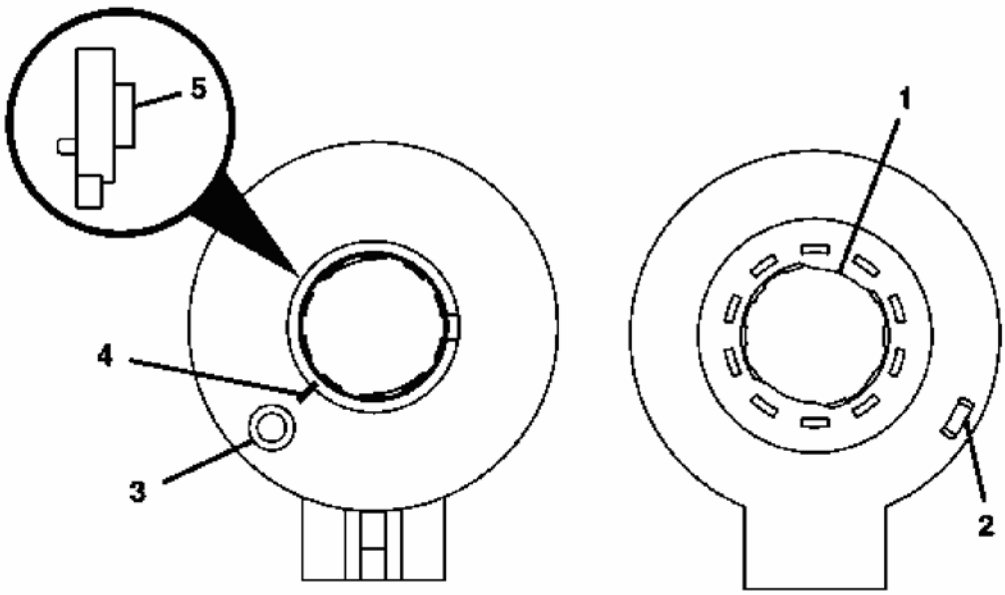



**Fig. 144: Steering Wheel Position Sensor Front View**
**Courtesy of GENERAL MOTORS CORP.**

9. 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)
   - An alignment mark (4) for installation
10. From the technicians point of view, the BACK of the sensor will have:
   - Double D flats (1)
   - An alignment tab (2) for installing into the adapter and bearing assembly

**IMPORTANT: If reusing the existing sensor, you must align the marks on the raised rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is**

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**seated into the adapter and bearing assembly.**
**If installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is seated. If the new sensor did not come with a pin installed, you must reorder a new sensor.**

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

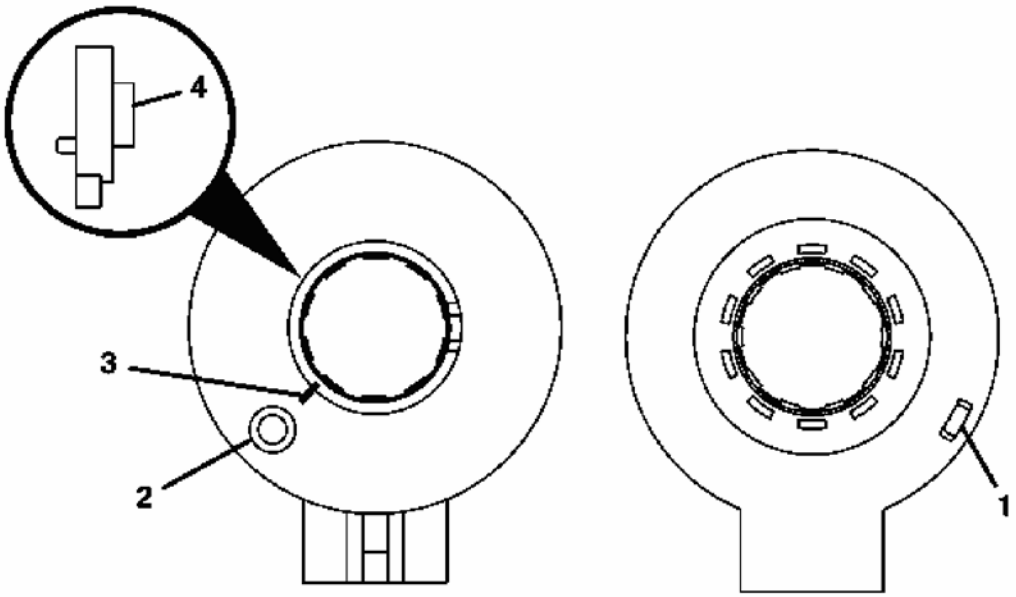



**Fig. 145: Steering Wheel Position Sensor Centering Pin Hole, Rotor Flange Cuff And Alignment Mark**
**Courtesy of GENERAL MOTORS CORP.**

13. 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
14. 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.

**IMPORTANT: If reusing the existing sensor, you must align the marks on**

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**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 installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is seated. If the new sensor did not come with a pin installed, you must reorder a new sensor.**

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

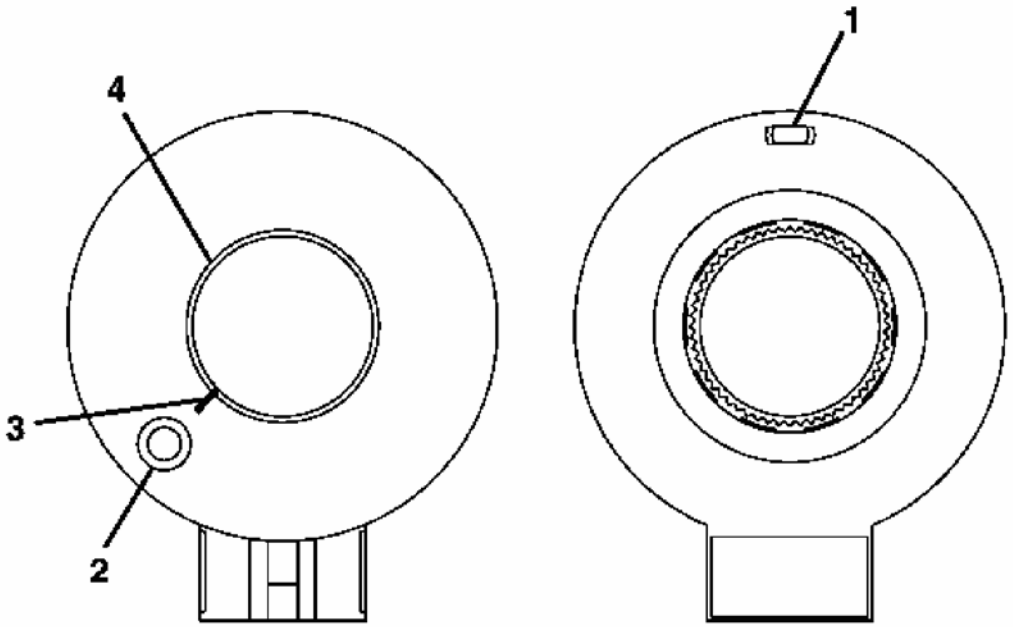



**Fig. 146: Steering Wheel Position Sensor Center Pin, Rotor Flange Cuff And Installation Alignment Mark**
**Courtesy of GENERAL MOTORS CORP.**

17. 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
18. From the technicians point of view, the BACK of the sensor will have an alignment tab

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(1) for installation. This sensor does not have double D flats.

**IMPORTANT: If reusing the existing sensor, you must 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 installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is seated. If the new sensor did not come with a pin installed, you must reorder a new sensor.**

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

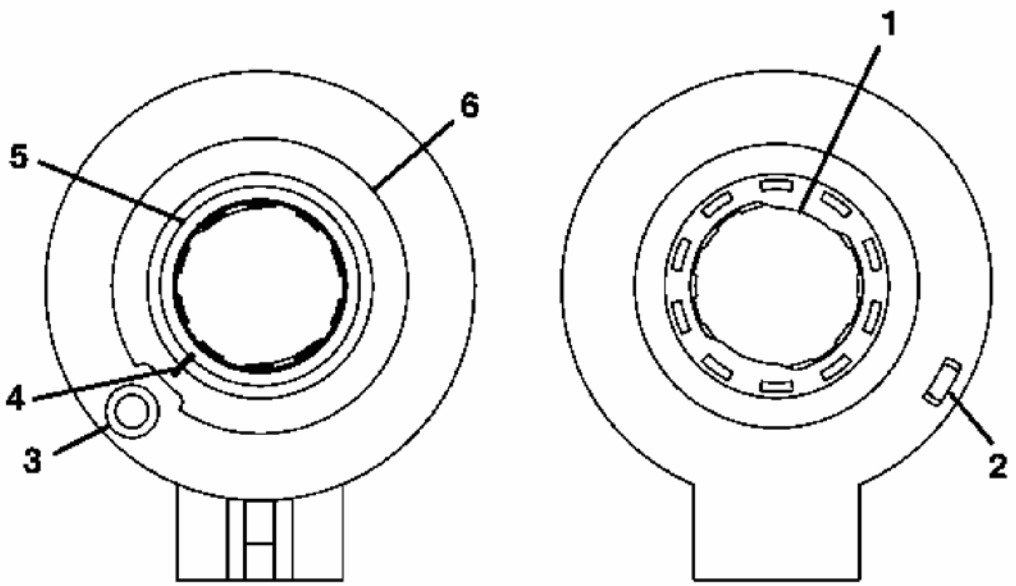



**Fig. 147: Steering Wheel Position Sensor Double D Flats**
**Courtesy of GENERAL MOTORS CORP.**

21. 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)

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

**IMPORTANT: If reusing the existing sensor, you must 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 installing a new sensor, it will come with a pin installed in the sensor. Do not remove the pin until the sensor is seated. If the new sensor did not come with a pin installed, you must reorder a new sensor.**

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

**INFLATABLE RESTRAINT STEERING WHEEL MODULE COIL CENTERING**

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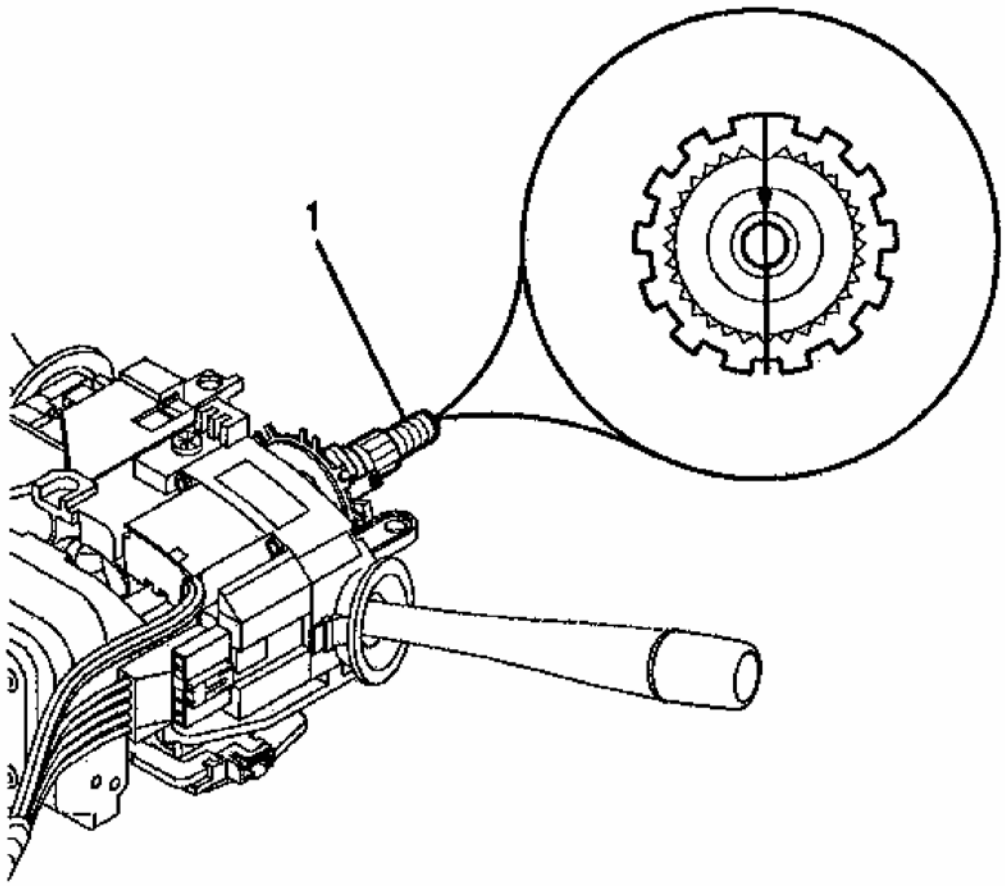



**Fig. 148: View Of Block Tooth Of Steering Shaft Assembly In 12 O'clock Position**
**Courtesy of GENERAL MOTORS CORP.**

**NOTE: The new SIR coil assembly will be centered. Improper alignment of the SIR coil assembly may damage the unit, causing an inflatable restraint malfunction.**

**IMPORTANT: If double wire harness strap is installed onto the wire harness assembly and column, you must reuse the holder for the wire straps during installation.**
**Remove the wire harness strap(s) where necessary.**

1. Verify the following conditions before centering the SIR coil:
   - The wheels on the vehicle are straight ahead.
   - The block tooth (1) of the steering shaft assembly is in the 12 o'clock position.

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- The ignition switch is in the LOCK position.

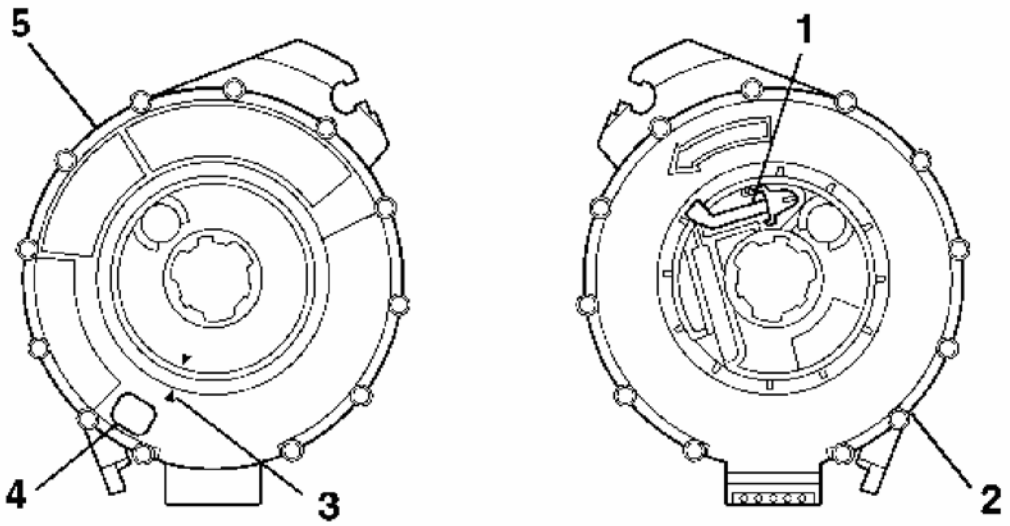



**Fig. 149: Centering SIR Coil (With Centering Window & Spring Service Lock)**
**Courtesy of GENERAL MOTORS CORP.**

2. If the front (5) of the SIR coil has a centering window (4), and the back side (2) includes a spring service lock (1), perform the following steps:
    1. Hold the SIR coil with the face up.
    2. While depressing the spring service lock, rotate the coil hub clockwise until the coil ribbon stops.
    3. Rotate the coil hub slowly, counterclockwise, until the centering window appears yellow and both arrows (3) line up.
    4. Release spring service lock between the locking tab. The SIR coil is now centered.
    5. Align the centered SIR coil with the horn tower and slide onto the steering shaft assembly.

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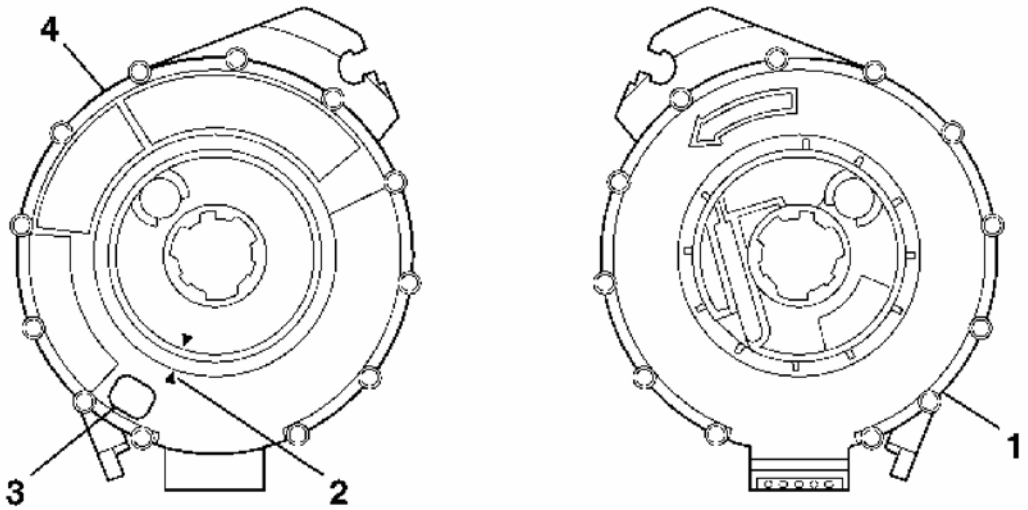



**Fig. 150: Centering SIR Coil (With Centering Window, Without Spring Service Lock)**
**Courtesy of GENERAL MOTORS CORP.**

3. If the front (4) of the SIR coil has a centering window (3), and the back side (1) includes NO spring service lock, perform the following steps:
    1. Hold the SIR coil with the face up.
    2. Rotate the coil hub clockwise until the coil ribbon stops.
    3. Rotate the coil hub slowly, counterclockwise until the centering window appears yellow and both arrows (2) line up. This is the CENTER position.
    4. While holding the coil hub in the CENTER position, align the SIR coil with the horn tower and slide onto the steering shaft assembly.

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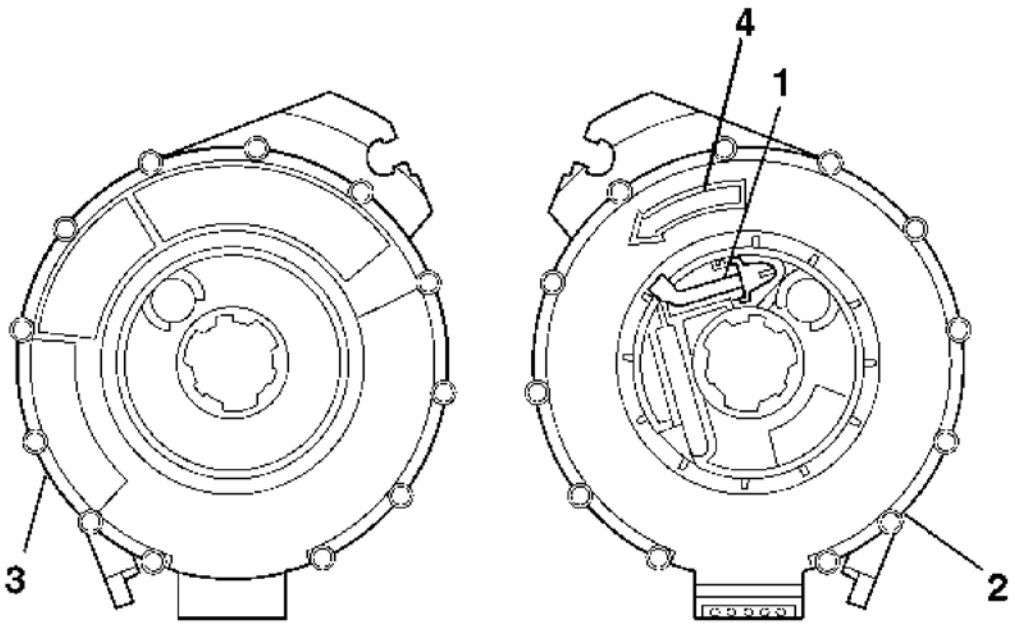



**Fig. 151: Centering SIR Coil (No Centering Window, But Back Side Includes A Spring Service Lock)**
**Courtesy of GENERAL MOTORS CORP.**

4. If the front side (3) of the SIR coil has NO centering window, but the back side (2) includes a spring service lock (1), perform the following steps:
    1. Hold the SIR coil with the back side up.
    2. While depressing the spring service lock, rotate the coil hub in the direction of the arrow (4) until the coil ribbon stops.
    3. Still pressing the spring service lock, rotate the coil hub in the opposite direction 21/2 revolutions.
    4. Release the spring service lock between locking tabs. The SIR coil is now centered.
    5. Align the centered SIR coil with the horn tower and slide onto the steering shaft assembly.

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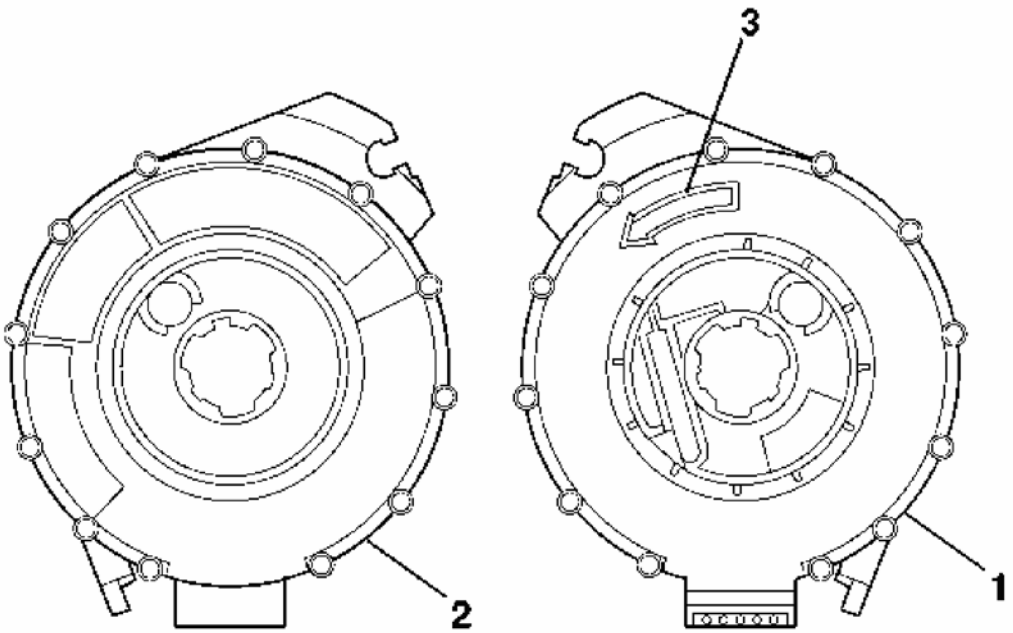



**Fig. 152: Centering SIR Coil (Without Centering Window, Without Spring Service Lock)**
**Courtesy of GENERAL MOTORS CORP.**

5. If the front side (2) of the SIR coil has NO centering window, and the back side (1) includes NO spring service lock, perform the following steps:
    1. Hold the SIR coil with the face up.
    2. Rotate the coil hub in the direction of the arrow until the coil ribbon stops.
    3. Rotate the coil hub, slowly, counterclockwise, for 21/2 revolutions. This is the CENTER position.
    4. While maintaining the coil hub in the CENTER position, align the centered SIR coil with the horn tower and slide onto the steering shaft assembly.
6. If double wire harness strap is installed onto the wire harness assembly and column, you must route the wires up against the steering column. One wire harness strap will surround one lead from the coil to the steering column. The other wire harness strap will surround all leads to the steering column.

## DESCRIPTION AND OPERATION

### STEERING WHEEL CONTROLS DESCRIPTION AND OPERATION

The steering wheel control switches duplicate the function of the primary controls of the

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associated component, through a network of multiple momentary contact switches and a series of resistors. The body control module (BCM) supplies voltage to the switches and monitors the return signal for when a switch is pressed, a specific voltage drop occurs. The BCM identifies the one selected, then sends a serial data message that is received by the component controlled, activating the feature.

This section is intended to diagnosis the circuits between the BCM and the steering wheel control switches. If the primary control for the device is inoperative, refer to the appropriate section for the component the steering wheel control switch is functioning.

**STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION**

The steering wheel and column has 4 primary functions:

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

**Vehicle Steering**

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

**Vehicle Security 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
- The manual transmission steering column lock
- The ignition cylinder

**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

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- The redundant radio/entertainment system controls
- The tilt or tilt/telescoping functions
- The navigation/OnStar® features
- The HVAC controls

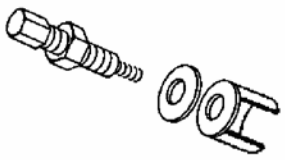
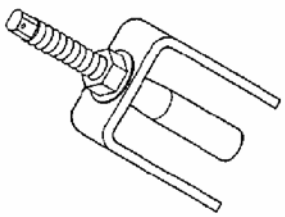
**Driver Safety**

The energy-absorbing steering column compresses in the event of a front-end collision, which reduces the chance of injury to the driver. The mounting capsules break away from the mounting bracket in the event of an accident.

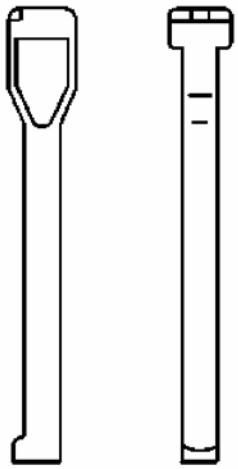
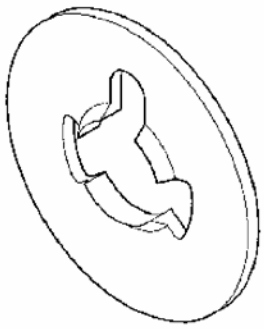
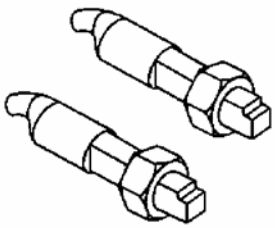
## SPECIAL TOOLS AND EQUIPMENT

**SPECIAL TOOLS**

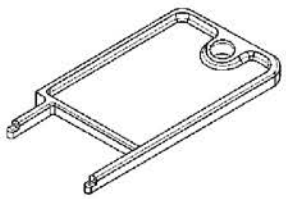
### Special Tools

| Illustration | Tool Number/Description |
|---|---|
|  | J 1859-A<br>Steering Wheel Puller |
|  | J 21854-01<br>Pivot Pin Remover |
|  | J 23653-SIR<br>Steering Column Lock Plate Compressor |
| | |

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| | |
|---|---|
|  | J 36541-A<br>Steering Wheel Puller Legs |
|  | J 42137<br>Cam Orientation Plate Adapter |
|  | J 42578<br>Steering Wheel Puller Legs |
| | J 42640<br>Steering Column Anti-Rotation Pin |

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| | |
|---|---|
|  | |
|  | J 42759<br>Ignition Switch Connector Release Tool |

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