2009 STEERING

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

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Automatic Transmission Control Bolt	10 N.m	89 lb in
Lower Steering Column Shroud Bolt	3 N.m	27 lb in
Shift Lever Bolt	20 N.m	15 lb ft
Steering Column Bracket Screw	6 N.m	53 lb in
Steering Column Bolt	27 N.m	20 lb ft
Steering Column Nut	27 N.m	20 lb ft
Steering Column Seal Nut	3 N.m	27 lb in
Steering Shaft Coupling Bolt (at the Upper Intermediate Shaft)	50 N.m	37 lb ft
Steering Shaft Coupling Bolt (at the Steering Gear)	47 N.m	35 lb ft
Steering Shaft Coupling Nut (at the Steering Column)	62 N.m	46 lb ft
Steering Wheel Heat Module Screw	2 N.m	18 lb in
Steering Wheel Lower Cover Bolt	1 N.m	9 lb in
Steering Wheel Nut	41 N.m	30 lb ft
Tilt Motor Bracket Bolt	2 N.m	18 lb in
Turn Signal Multifunction Switch Bolt	3 N.m	27 lb in
Upper Steering Column Shroud Bolt	2 N.m	18 lb in

SCHEMATIC AND ROUTING DIAGRAMS

STEERING WHEEL SCHEMATICS (STEERING WHEEL SCHEMATICS)

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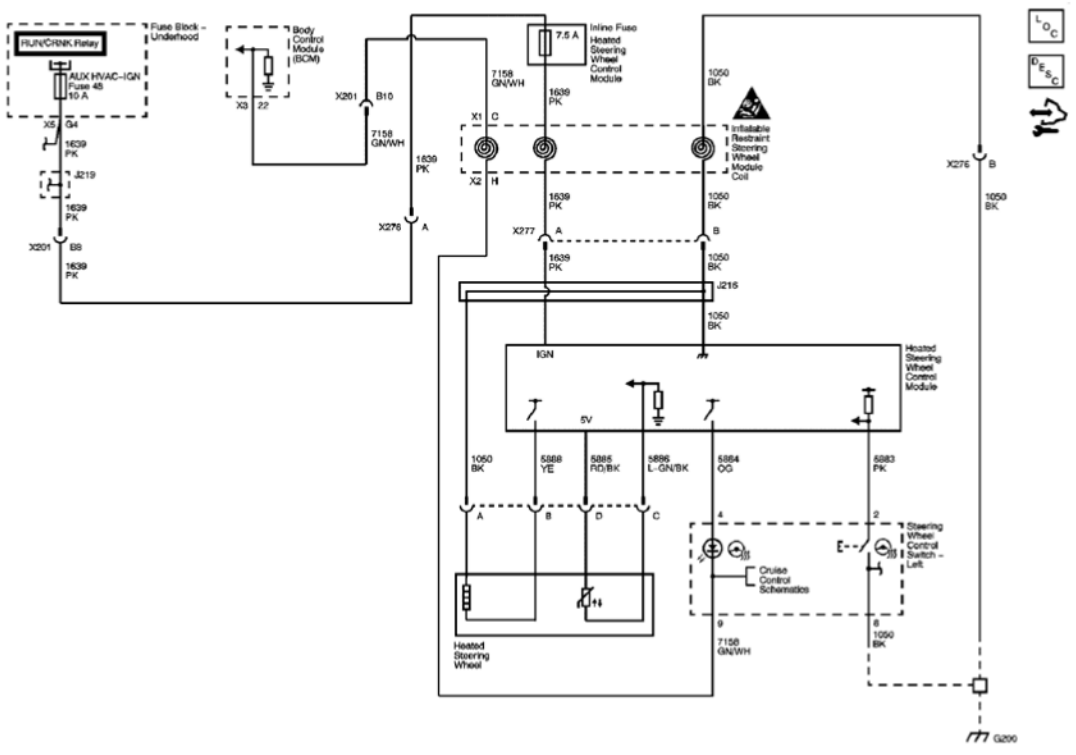


Fig. 1: Heated Steering Wheel (KA9)
Courtesy of GENERAL MOTORS CORP.

STEERING WHEEL SCHEMATICS (TILT/TELESCOPING STEERING COLUMN)

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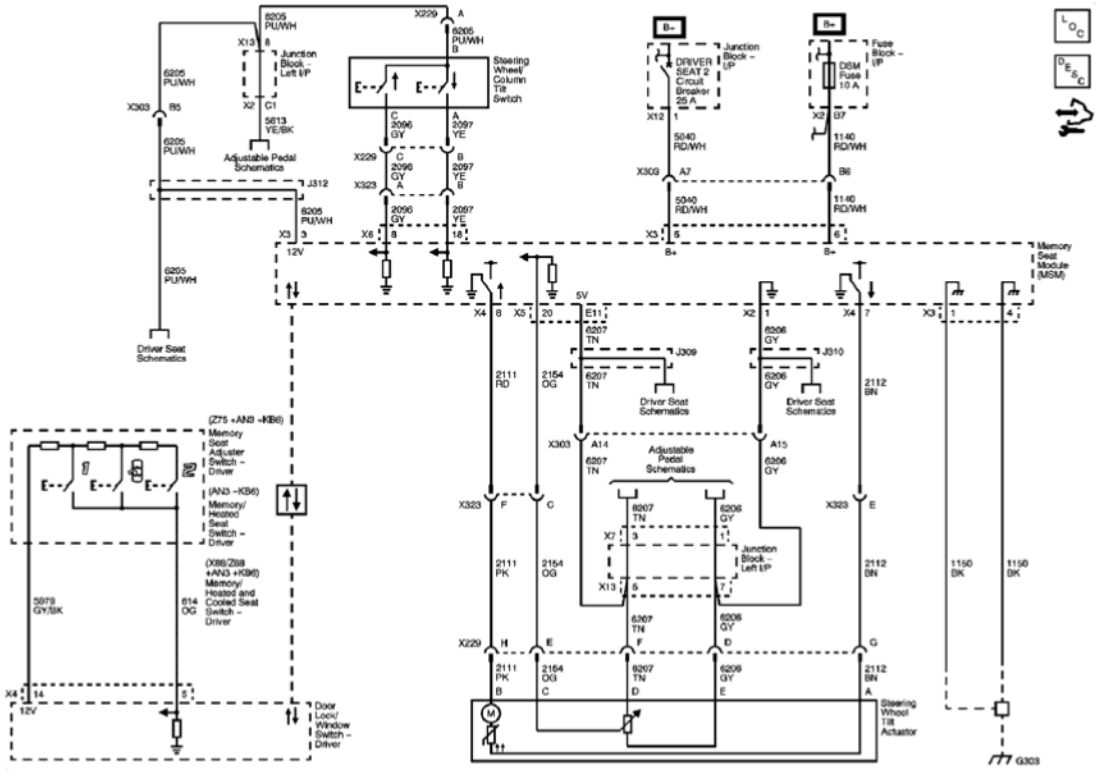


Fig. 2: Heated/Cooled Seat - Passenger - X88 or Z88 with KB6
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

STEERING COLUMN DISASSEMBLED VIEW (MANUAL TILT)

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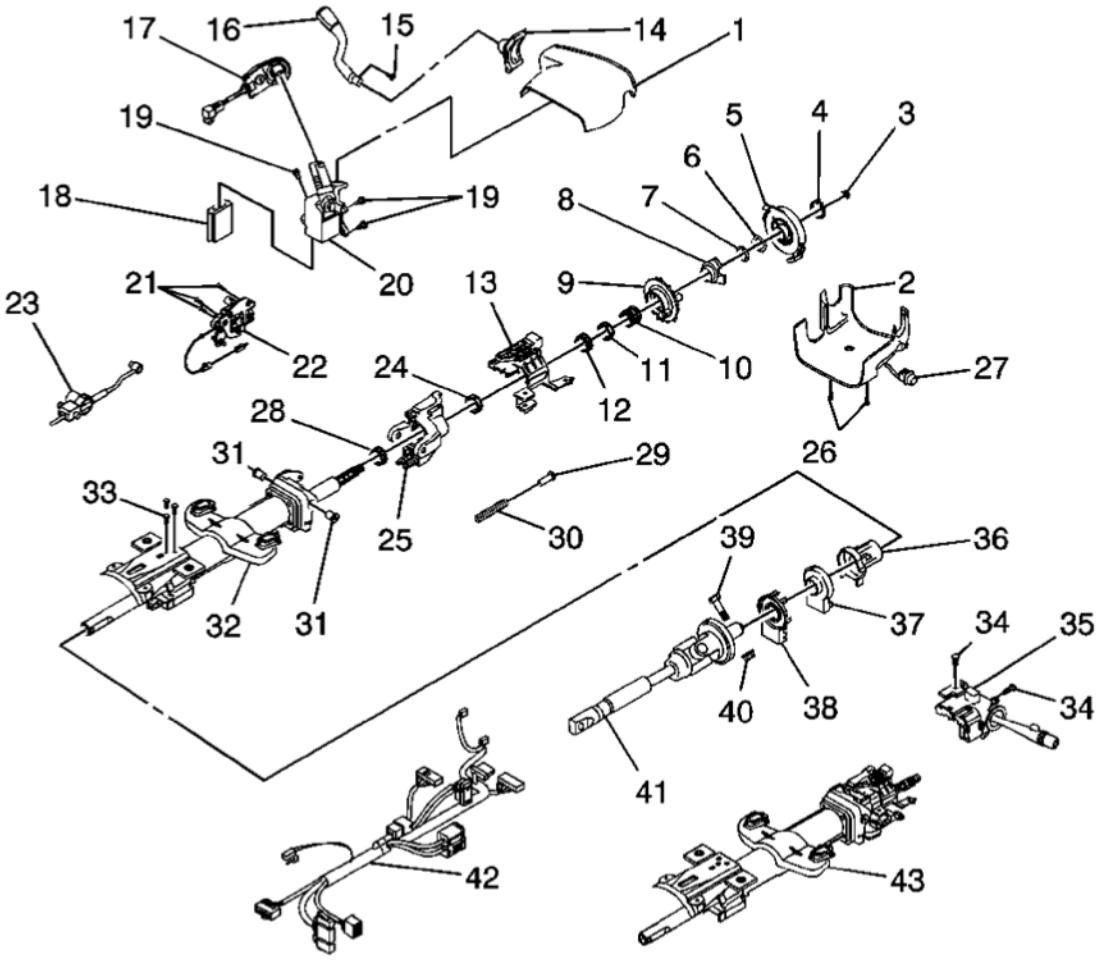


Fig. 3: Disassembled View
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Upper Steering Column Shroud
2	Lower Steering Column Shroud
3	Steering Wheel Nut
4	Inflatable Restraint Steering Wheel Module Coil Retaining Ring
5	Inflatable Restraint Steering Wheel Module Coil
6	Inflatable Restraint Steering Wheel Module Coil Wave Washer
7	Steering Shaft Lock Plate Retaining Ring
8	Turn Signal Switch Cancel Cam Position Plate
9	Turn Signal Switch Cancel Cam
10	Steering Shaft Upper Bearing Spring
11	Steering Shaft Upper Bearing Inner Race Seat
12	Steering Shaft Upper Bearing Inner Race

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13	Turn Signal Multifunction Switch Bracket
14	Shift Lever Seal
15	Shift Lever Bolt
16	Shift Lever
17	Theft Deterrent Module
18	Ignition and Start Switch
19	Ignition Lock Cylinder Case Bolt
20	Ignition Lock Cylinder Case
21	Transmission Control Bolt
22	Transmission Control
23	Automatic Transmission Shift Lock Control Actuator
24	Steering Shaft Upper Bearing
25	Steering Column Tilt Head Assembly
26	Lower Steering Column Shroud Bolt
27	Tilt Lever
28	Steering Shaft Upper Bearing
29	Steering Column Tilt Spring Guide
30	Steering Column Tilt Spring
31	Pivot Pin
32	Steering Column Support and Upper Jacket Assembly
33	Steering Column Bracket Screw
34	Turn Signal Multifunction Switch Bolt
35	Turn Signal Multifunction Switch
36	Steering Shaft Lower Bearing
37	Steering Wheel Position Sensor
38	Steering Wheel Position Sensor Retaining Clip
39	Steering Shaft Coupling Bolt
40	Steering Shaft Coupling Nut
41	Upper Intermediate Steering Shaft
42	Steering Column Electrical Harness
43	Service Steering Column

STEERING COLUMN DISASSEMBLED VIEW (AUTOMATIC TILT)

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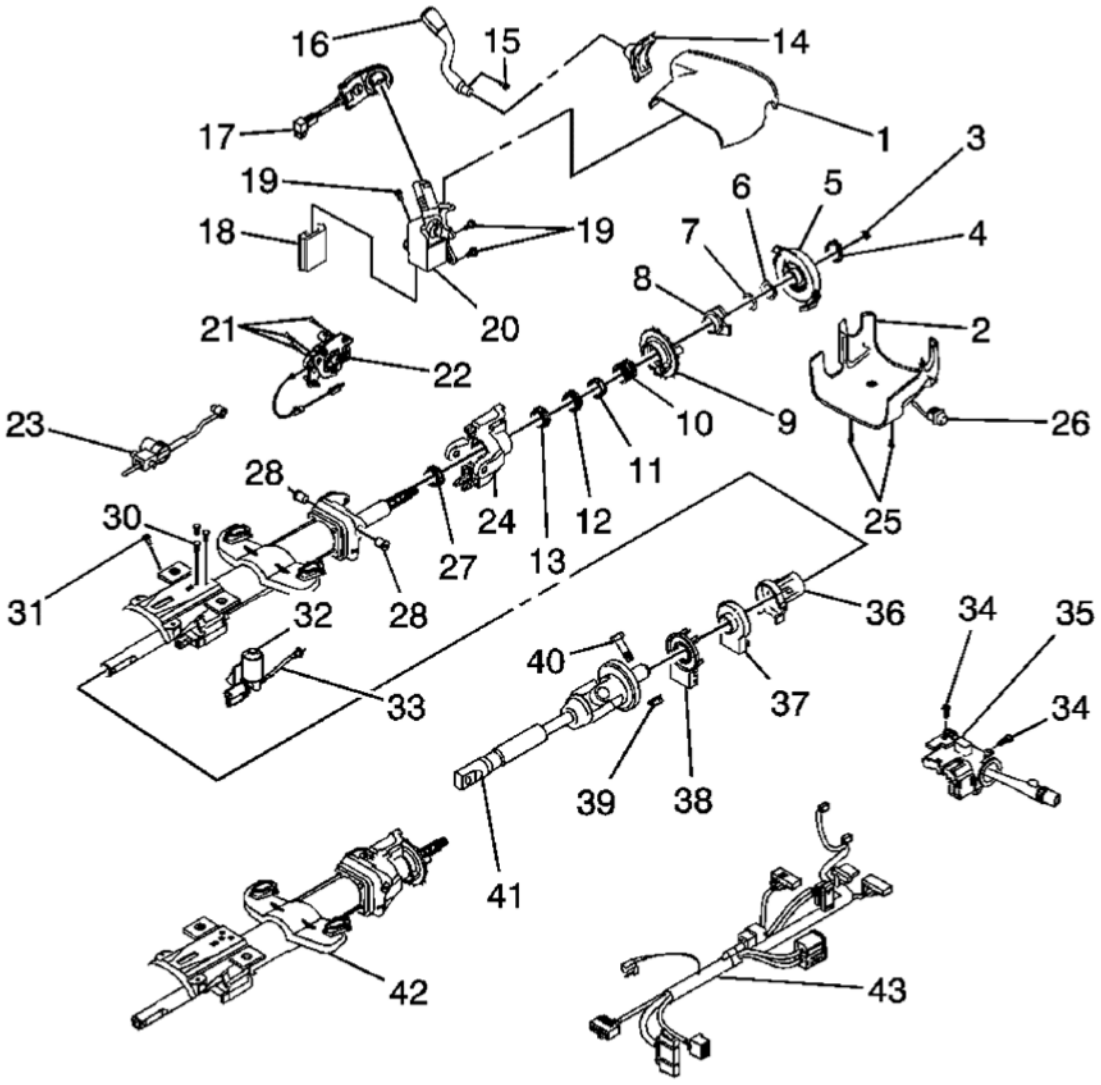


Fig. 4: Disassembled View
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Upper Steering Column Shroud
2	Lower Steering Column Shroud
3	Steering Wheel Nut
4	Inflatable Restraint Steering Wheel Module Coil Retaining Ring
5	Inflatable Restraint Steering Wheel Module Coil
6	Inflatable Restraint Steering Wheel Module Coil Wave Washer
7	Steering Shaft Lock Plate Retaining Ring
8	Turn Signal Switch Cancel Cam Position Plate
9	Turn Signal Switch Cancel Cam

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10	Steering Shaft Upper Bearing Spring
11	Steering Shaft Upper Bearing Inner Race Seat
12	Steering Shaft Upper Bearing Inner Race
13	Steering Shaft Upper Bearing
14	Shift Lever Seal
15	Shift Lever Bolt
16	Shift Lever
17	Theft Deterrent Module
18	Ignition and Start Switch
19	Ignition Lock Cylinder Case Bolt
20	Ignition Lock Cylinder Case
21	Transmission Control Bolt
22	Transmission Control
23	Automatic Transmission Shift Lock Control Actuator
24	Steering Column Tilt Head Assembly
25	Lower Steering Column Shroud Bolt
26	Steering Column Tilt Wheel Switch
27	Steering Shaft Upper Bearing
28	Pivot Pin
29	Steering Column Support and Upper Jacket Assembly
30	Steering Column Bracket Screw
31	Tilt Motor Bracket Bolt
32	Tilt Motor
33	Tilt Motor Cable
34	Turn Signal Multifunction Switch Bolt
35	Turn Signal Multifunction Switch
36	Steering Shaft Lower Bearing
37	Steering Wheel Position Sensor
38	Steering Wheel Position Sensor Retaining Clip
39	Steering Shaft Coupling Nut
40	Steering Shaft Coupling Bolt
41	Upper Intermediate Steering Shaft
42	Service Steering Column
43	Steering Column Electrical Harness

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description

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DTC B2850, B2855, B2870, or B2875	B2870 01: Tilt Up Switch Circuit Short to Battery B2875 01: Tilt Down Switch Circuit Short to Battery
DTC B2860 or B2880	B2880 01: Tilt Position Sensor Circuit Short to Battery B2880 06: Tilt Position Sensor Circuit Short to Ground or Open B2880 5A: Tilt Position Sensor Circuit Plausibility Failure B2880 61: Tilt Position Sensor Actuator Stuck
DTC B2890	B2890 4B: Tilt and Telescope Motor Circuit Calibration Not Learned

DIAGNOSTIC STARTING POINT - STEERING COLUMN

Begin the system diagnosis by reviewing the system Description and Operation. Refer to **Steering Wheel and Column Description and Operation**. Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the Description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Steering Wheel and Column** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

DTC B2850, B2855, B2870, OR B2875

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category

DTC Descriptor

DTC B2870 01

Tilt Up Switch Circuit Short to Battery

DTC B2875 01

Tilt Down Switch Circuit Short to Battery

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	1	1	-	-
Signal Terminal C	1	1	B2870 01	-
Signal Terminal A	1	1	B2875 01	-
1. Tilt Malfunction				

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Circuit Description

The memory seat module (MSM) receives voltage inputs from the tilt switch based on the position of the switch. The MSM then supplies battery voltage and a ground to the tilt motor control circuits depending on which direction of movement is requested.

Conditions for Running the DTC

The ignition ON.

Conditions for Setting the DTC

The MSM detects a tilt switch input for more than 30 consecutive seconds after the tilt motor movement has stopped.

Action Taken When the DTC Sets

- The tilt motor will be deactivated.
- Memory recall functions will be disabled.

Conditions for Clearing the DTC

- A current DTC will clear when the failed switch input is no longer active.
- A history DTC will clear after 100 ignition cycles.

Diagnostic Aids

An intermittently stuck tilt switch may cause a DTC to set.

Reference Information

Schematic Reference

Steering Wheel Schematics (Steering Wheel Schematics) or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

- **Circuit Testing**

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

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

Ignition ON,observe the scan tool Tilt Up Switch parameter and Tilt Down Switch parameter while cycling the switch between states.The reading should be Inactive and change to Active when pushing the appropriate switch.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the tilt switch.
2. Ignition ON, verify a test lamp illuminates between the B+ circuit terminal B and ground.
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
3. Verify the scan tool tilt switch parameter is Inactive.
    - If not the specified value, test the control circuit listed below for a short to voltage. If the circuit tests normal, replace the MSM.
        - Tilt Up Switch terminal C
        - Tilt Down Switch terminal A
4. Install a 3A fused jumper wire between the control circuits listed below and the B+ circuit terminal. Verify the scan tool tilt switch parameter is Active.
    - Tilt Up Switch terminal C
    - Tilt Down Switch terminal A
    - If not the specified value, test the appropriate control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the MSM.
5. If all circuit test normal, test or replace the tilt switch.

Component Testing

Tilt Switch

1. Ignition OFF, disconnect the harness connector at the tilt switch.
2. Test for infinite resistance between the control terminals A and C with the switch in the neutral position.
    - If less than the specified range, replace the tilt switch.
3. Test for less than 1 ohm between the control terminals listed below and the B+ terminal B with the switch in each appropriate position.
    - Tilt Up Switch terminal C

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- Tilt Down Switch terminal A

- If greater than the specified value, replace the tilt switch.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Column Tilt Wheel Switch Replacement**
- **Control Module References** for MSM replacement, setup, and programming

DTC B2860 OR B2880

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B2880 01

Tilt Position Sensor Circuit Short to Battery

DTC B2880 06

Tilt Position Sensor Circuit Short to Ground or Open

DTC B2880 5A

Tilt Position Sensor Circuit Plausibility Failure

DTC B2880 61

Tilt Position Sensor Actuator Stuck

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
	B1395 02, B1825 06, B1850 06, B2355 06,	B1395 05, B1825 01, B1850 01, B2355 01,		

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5-Volt Reference	B2365 06, B2375 06, B2880 06, B3606 06	B2365 01, B2375 01, B2880 01, B3606 01	B2880 01	-
Signal	B2880 06	B2880 06	B2880 01	B2880 5A
Tilt Motor Control - Up	B2880 61, B3921 02	B2880 61	B2880 61, B3921 01	-
Tilt Motor Control - Down	B2880 61, B3921 02	B2880 61	B2880 61, B3921 01	-
Low Reference	-	B2880 61	B2880 01	-

Circuit Description

The memory seat module (MSM) determines the position of the steering column based on inputs received from the tilt position sensors built into the tilt actuators. The MSM supplies a 5-volt reference and a low reference to the sensors and monitors the column position via the steering column tilt sensor signal circuit.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

B2880 01

The steering column tilt sensor signal voltage is greater than 4.8 volts for more than 2 seconds.

B2880 06

The steering column tilt sensor signal voltage is less than 0.2 volt for more than 2 seconds.

B2880 5A

An incorrect steering column tilt sensor signal voltage is seen.

B2880 61

The steering column tilt sensor signal voltage does not change when the tilt actuator is commanded.

Action Taken When the DTC Sets

Steering column tilt operations are suspended.

Conditions for Clearing the DTC

- A current DTC will clear when the malfunction is no longer present
- A history DTC will clear after 50 malfunction-free ignition cycles.

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Reference Information

Schematic Reference

Steering Wheel Schematics (Steering Wheel Schematics) or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

Ignition ON, command the tilt motor UP and DOWN with a scan tool. The reading should be between 0.2 and 4.8 volts.

Circuit/System Testing

Tilt Sensor Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the tilt actuator.
2. Ignition OFF, test for less than 10.0 ohms between the low reference circuit terminal E and ground.
    - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the MSM.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal D and ground.
    - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the MSM.
    - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the MSM.
4. Verify the scan tool Tilt Sensor parameter is less than 0.2 volt.

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- If greater than the specified range, test the signal circuit terminal C for a short to voltage. If the circuit tests normal, replace the MSM.

5. Install a 3A fused jumper wire between the signal circuit terminal C and the 5-volt reference circuit terminal D. Verify the scan tool Tilt Sensor parameter is greater than 4.8 volts.
    - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the MSM.
6. Install a test lamp between the control circuit terminal A and the control circuit terminal B.
7. Command the column to tilt up and down using the tilt switch. The test lamp should illuminate with each command.
    - If the test lamp does not illuminate, test both control circuits for a short to ground or an open/high resistance. If the circuits test normal, replace the MSM.
8. If all circuits test normal, test or replace the tilt actuator.

Component Testing

Tilt Actuator

1. Ignition OFF, disconnect the harness connector at the tilt actuator.
2. Test for less than 2.0 ohms between the control terminal A and the control terminal B.
    - If greater than the specified range, replace the tilt actuator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Tilt Motor Replacement**
- **Control Module References** for MSM replacement, setup, and programming

DTC B2890

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B2890 4B

Tilt and Telescope Motor Circuit Calibration Not Learned

Circuit Description

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The memory seat module (MSM) learns tilt soft stops approximately 1.3 cm (0.5 in) from the mechanical ends of travel. The system uses soft stops to prevent wear on the system by ensuring that the steering column movement stops before it reaches its mechanical end of travel in any direction. The soft stops are initially programmed at the factory. The stop positions may be reprogrammed, which is necessary any time the MSM is replaced.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The soft stops have not been learned.

Action Taken When the DTC Sets

- The tilt motor will be deactivated.
- Memory recall functions will be disabled.

Conditions for Clearing the DTC

- A current DTC will clear when the soft stops have been learned.
- A history DTC will clear after 100 ignition cycles.

Reference Information

Schematic Reference

Steering Wheel Schematics (Steering Wheel Schematics) or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

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Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

1. Ignition ON, perform the scan tool Learn Column Soft Stops procedure. Refer to **Power Tilt Steering Column Calibration**.
2. Operate the vehicle within the Conditions for Running and Setting. Verify DTC B2890 does not reset.
    - If the DTC resets, replace the MSM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for MSM 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**
- **Ignition Key Cannot Be Removed from the Ignition Lock Cylinder**
- **Ignition Key Cannot Turn or Sticks in Any Position**
- **Noise in Steering Column**
- **High Shift Effort**
- **Looseness in Steering Column**
- **Heated Steering Wheel Indicator Malfunction**
- **Heated Steering Wheel Malfunction**

HEATED STEERING WHEEL INDICATOR MALFUNCTION

Diagnostic Instructions

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- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

When the ignition is ON and the heated steering wheel switch is pressed, the switch circuit is pulled to ground. The heat module monitors the switch circuit, and turns the steering wheel heat system ON or OFF when the circuit is grounded. The heat module supplies voltage to the indicator lamp when the system is on.

Reference Information

Schematic Reference

- **Steering Wheel Schematics (Steering Wheel Schematics)** or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**
- **Cruise Control Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

Ignition ON, press and release the heated steering wheel switch. The heated steering wheel indicator should illuminate and the both sides of the steering wheel should become warm.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the heated steering wheel control module.
2. Test for less than 10.0 ohms between the ground circuit terminal B X277 and ground.
    - If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, verify a test lamp illuminates between the ignition voltage circuit terminal A X277 and ground.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high

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resistance.

4. Install a 3A fused jumper wire between the indicator control circuit terminal 4 and B+. Verify the heated steering wheel indicator is illuminated.
    - If the indicator does not illuminate, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, test or replace the left steering wheel control switch.
5. Verify that a test lamp does not illuminate between the indicator control circuit terminal 4 and ground.
    - If the test lamp is always ON, test the indicator control circuit for a short to voltage. If the circuit tests normal, replace the heated steering wheel control module.
6. If all circuits test normal, replace the steering wheel heat control module.

Component Testing

Heated Steering Wheel Control Switch

1. Place the heated steering wheel control switch in the OFF position.
2. Test for infinite resistance between terminal 2 and terminal 8.
    - If less than the specified value, replace the switch.
3. Place the heated steering wheel control switch in the ON position.
4. Test for less than 2 ohms between terminal 2 and terminal 8.
    - If greater than the specified value, replace the switch.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Control Switch Assembly Replacement**
- **Steering Wheel Heat Control Module Replacement**
- **Control Module References** for heated steering wheel control module replacement, programming, and setup

HEATED STEERING WHEEL MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The heated steering wheel control module controls the heated strewing wheel and the heated steering wheel on indicator based on an input from the heated steering wheel switch. When the heated steering wheel switch is pressed, the switch signal circuit is pulled to ground. This indicates to the heating steering wheel control module

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

Reference Information

Schematic Reference

Steering Wheel Schematics (Steering Wheel Schematics) or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Circuit/System Verification

Ignition ON, press and release the heated steering wheel switch. The heated steering wheel indicator should illuminate and both sides of the steering wheel should become warm.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the heated steering wheel control module.
2. Test for less than 10.0 ohms between the ground terminal B X277 and ground.
    - If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, verify a test lamp illuminates between the B+ terminal A X277 and ground.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance.
4. Ignition OFF, connect a test lamp between the signal circuit terminal 2 and B+. Place the heated steering wheel switch in the OFF position.
    - If the test lamp illuminates, test the signal circuit for a short to ground, If all circuits test normal, test or replace the heated steering wheel control switch.
5. Connect a test lamp between the signal circuit terminal 2 and B+. Place the heated steering wheel switch in the ON position.

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- If the test lamp does not illuminate, test the signal circuit for a short to voltage or open/high resistance and test the ground circuit for an open/high resistance. If all circuits test normal, test or replace the heated steering wheel control switch.

6. Verify that a test lamp does not illuminate between the control circuit terminal B and ground.
   - If the test lamp illuminates, test for a short to voltage on the heated steering wheel element control circuit.
7. Test for 1.5-3.0 ohms between the control circuit terminal B and the ground terminal A.
   - If not within the specified range, test the heating element control circuit for a short to ground or open/high resistance and the ground circuit for an open/high resistance. If all circuits test normal, replace the heated steering wheel.
8. Verify that a test lamp does not illuminate between the signal circuit terminal C and ground.
   - If the test lamp illuminates, test for a short to voltage on the heated steering wheel element signal circuit.
9. Test for 6000-35000 ohms between the signal circuit terminal C and the 5 volt reference terminal D.
   - If not within the specified range, replace the heated steering wheel.
10. If all circuits test normal, replace the heated steering wheel control module.

Component Testing

Heated Steering Wheel Control Switch

1. Place the heated steering wheel control switch in the OFF position.
2. Test for infinite resistance between terminal 2 and terminal 8.
   - If less than the specified value, replace the switch.
3. Place the heated steering wheel control switch in the ON position.
4. Test for less than 2 ohms between terminal 2 and terminal 8.
   - If greater than the specified value, replace the switch.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Control Switch Assembly Replacement**
- **Steering Wheel Heat Control Module Replacement**
- **Control Module References** for heated steering wheel control module replacement, setup, and programming

STEERING COLUMN TILT MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.

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- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit Description

The memory seat module (MSM) receives voltage inputs from the tilt switch based on the position of the switch. The MSM then supplies battery voltage and a ground to the tilt motor control circuits depending on which direction of movement is requested.

Reference Information

Schematic Reference

Steering Wheel Schematics (Steering Wheel Schematics) or **Steering Wheel Schematics (Tilt/Telescoping Steering Column)**

Connector End View Reference

Component Connector End Views

Description and Operation

Steering Wheel and Column Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, observe the scan tool Tilt Up Switch and the Tilt Down Switch parameters while cycling the tilt switch between the TILT UP and TILT DOWN positions. The reading should be Inactive and change to Active when pushing the appropriate switch.
    - If any of the parameters do not cycle between the specified values, refer to Tilt Switch Circuit Malfunction below.
2. Command the column to tilt up and down using the tilt switch. The column should move in the commanded direction.
    - If the column does not operate as specified, refer to Tilt Actuator Circuit Malfunction below.

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Circuit/System Testing

Tilt Switch Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the tilt switch.
2. Ignition ON, verify a test lamp illuminates between the B+ circuit terminal B and ground.
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
3. Verify both scan tool tilt switch parameters are Inactive.
    - Tilt Up Switch - control circuit terminal C
    - Tilt Down Switch - control circuit terminal A
    - If any of the parameters are not the specified value, test the appropriate control circuit terminal for a short to voltage. If the circuit tests normal, replace the MSM.
4. Install a 3A fused jumper wire between the B+ circuit terminal B and the control circuit terminals listed below. Verify both scan tool tilt switch parameters are Active.
    - Tilt Up Switch - terminal C
    - Tilt Down Switch - terminal A
    - If not the specified value, test the appropriate control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the MSM.
5. If all circuit test normal, test or replace the tilt switch.

Tilt Actuator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the tilt actuator.
2. Install a test lamp between the control circuit terminal A and the control circuit terminal B.
3. Command the column to tilt up and down using the tilt switch. The test lamp should illuminate with each command.
    - If the test lamp does not illuminate, test both control circuits for a short to ground or an open/high resistance. If the circuits test normal, replace the MSM.
4. If all circuits test normal, test or replace the tilt actuator.

Component Testing

Tilt Switch

1. Ignition OFF, disconnect the harness connector at the tilt switch.
2. Test for infinite resistance between the B+ terminal B and the control terminals listed below with the switch in the neutral position:
    - Terminal A
    - Terminal C
    - If less than the specified range, replace the tilt switch.
3. Test for less than 1 ohm between the B+ terminal B and the control terminal C with the switch in the

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TILT UP position.

- If greater than the specified range, replace the tilt switch.

4. Test for less than 1 ohm between the B+ terminal B and the control terminal A with the switch in the TILT DOWN position.
   - If greater than the specified range, replace the tilt switch.

Tilt Actuator

1. Ignition OFF, disconnect the harness connector at the tilt actuator.
2. Test for less than 2.0 ohms between the control terminal A and the control terminal B.
   - If greater than the specified range, replace the tilt actuator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Column Tilt Wheel Switch Replacement**
- **Tilt Motor Replacement**
- **Control Module References** for MSM replacement, setup, and programming

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**
2	Verify that the steering column tilt function is inoperative. Does the steering column tilt function operate normally?	System OK	Go to **Step 3**
3	Verify that the following components are not seized or corroded: • Tilt pivot pins • Tilt head lock shoes Are the components seized or corroded?	Go to **Step 7**	Go to **Step 4**
4	Inspect the tilt pivot pins for binding. Are the tilt pivot pins binding?	Go to **Step 8**	Go to **Step 5**
5	Inspect for a weak or broken steering column tilt spring. Is the steering column tilt spring weak or broken?	Go to **Step 9**	Go to **Step 6**

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6	Inspect the steering column wiring harness routing for tightness. Was the steering column wiring harness routed correctly?	Go to **Step 11**	Go to **Step 10**
7	Replace the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**. Did you complete the repair?	Go to **Step 11**	-
8	If serviceable, replace the pivot pins. If not serviceable replace the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**. Did you complete the repair?	Go to **Step 11**	-
9	Replace the tilt spring. Did you complete the repair?	Go to **Step 11**	-
10	Route the steering column wiring harness to the correct location. Did you correctly rout the wiring harness?	Go to **Step 11**	-
11	Operate the steering column tilt function in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

NOISE IN STEERING COLUMN

Step	Action	Yes	No
1	Did you review the Steering Wheel and Column Description 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. Is noise present in the steering column during operation?	Go to **Step 3**	System OK
3	Inspect the steering column mounting features for the following conditions: • Steering column mounting fasteners for looseness • Steering column mounting features are sheared		

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	Are the steering column mounting features loose?	Go to **Step 9**	Go to **Step 4**
4	Inspect the SIR/SRS coil for noise. Is the SIR/SRS coil noisy?	Go to **Step 10**	Go to **Step 5**
5	Inspect the lock plate retaining ring for correct installation. Is the lock plate retaining ring installed incorrectly?	Go to **Step 11**	Go to **Step 6**
6	Inspect the steering column upper and lower bearings for the following conditions: • Damage • Lubrication • Wear • Proper seating Are the bearings in need of repair or replacement?	Go to **Step 12**	Go to **Step 7**
7	Does the tilt joint need to be lubricated?	Go to **Step 13**	Go to **Step 8**
8	**IMPORTANT:** **This is best evaluated while driving the vehicle, turning the steering and applying the brake pedal.** Inspect the steering column intermediate shaft for noise.Is the steering column intermediate shaft noisy?	Go to **Step 14**	Go to **Step 15**
9	**IMPORTANT:** **If the steering column mounting feature is damaged or sheared, the steering column will need to be replaced. Refer to Steering Column Replacement (HP2) or Steering Column Replacement (Without HP2) or Steering Column Replacement (Without HP2 With Electric Tilt Column).** Tighten the steering column mounting fastener to specifications. Refer to **Fastener Tightening Specifications**.Did you complete the repair?	Go to **Step 15**	-
10	Replace the SIR/SRS coil. Refer to **Steering Wheel Inflatable Restraint Module Coil Replacement** . Did you complete the repair?	Go to **Step 15**	-
11	Install the lock plate retaining ring correctly. Did you complete the repair?	Go to **Step 15**	-
12	**IMPORTANT:** **If the steering column upper and/or lower bearings are not serviceable, the steering column will need to be replaced. Refer to Steering Column Replacement (HP2) or Steering Column Replacement (Without HP2) or Steering Column Replacement (Without HP2**		-

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	With Electric Tilt Column). Replace the upper and/or lower bearings, if serviceable.Did you complete the replacement?	Go to **Step 15**	
13	Lubricate the tilt joint. Did you complete the repair?	Go to **Step 15**	-
14	Replace the appropriate steering intermediate shaft component. Did you complete the repair?	Go to **Step 15**	-
15	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

HIGH SHIFT EFFORT

Step	Action	Yes	No
DEFINITION: Abnormally high shift effort is required to shift the transmission out of the Park (P) position.			
1	Did you review the Steering Wheel and Column Description and Operation?	Go to **Step 2**	Go to **Steering Wheel and Column Description and Operation**
2	Verify that a high column shift effort is required in order to shift out of the PARK position. Does the column shifter operate normally?	System OK	Go to **Step 3**
3	Inspect for worn or worn or damaged automatic transmission range selector shift cable. Is the transmission range selector shift cable worn or damaged?	Go to **Step 6**	Go to **Step 4**
4	Inspect the automatic transmission range selector shift cable for binding or mis-adjustment. Is the automatic transmission range selector shift cable binding or mis-adjusted?	Go to **Step 7**	Go to **Step 5**
5	Inspect the column linear shift assembly for damage. Is the column linear shift assembly damaged?	Go to **Step 8**	Go to **Step 9**
6	Replace the automatic transmission range selector shift cable. Did you complete the repair?	Go to **Step 9**	-
7	Adjust the automatic transmission range selector shift cable. Did you complete the repair?	Go to **Step 9**	-
	IMPORTANT: **If the column linear shift assembly is not serviceable, then the steering column will need to be replaced. Refer to Steering Column Replacement (HP2) or Steering Column Replacement (Without**		

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8	**HP2) or Steering Column Replacement (Without HP2 With Electric Tilt Column).** Replace the column linear shift assembly, if serviceable.Did you complete the replacement?	Go to **Step 9**	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

LOOSENESS IN STEERING COLUMN

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. Is the steering column loose?	Go to **Step 3**	System OK
3	Inspect the steering column mounting features for the following conditions. • Steering column mounting fasteners for looseness • Steering column mounting features are sheared Are the steering column mounting features loose?	Go to **Step 5**	Go to **Step 4**
4	Inspect the upper and/or lower bearings for looseness. Are any of the bearings worn or loose?	Go to **Step 6**	Go to **Step 7**
5	**IMPORTANT:** **If the steering column mounting feature is damaged or sheared, the steering column will need to be replaced. Refer to Steering Column Replacement (HP2) or Steering Column Replacement (Without HP2) or Steering Column Replacement (Without HP2 With Electric Tilt Column).** Tighten the steering column mounting fastener to specifications. Refer to **Fastener Tightening Specifications**.Did you complete the repair?	Go to **Step 7**	-
6	**IMPORTANT:** **If the steering column upper and/or lower bearings are not serviceable, the steering column will need to be replaced. Refer to Steering Column Replacement (HP2) or Steering Column Replacement (Without HP2) or Steering Column Replacement (Without HP2 With Electric Tilt Column).**		

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	Replace the upper and/or lower bearings, if serviceable.Did you complete the repair?	Go to **Step 7**	-
7	Operate the steering column in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

REPAIR INSTRUCTIONS

STEERING SHAFT COUPLING REPLACEMENT

Special Tools

J 42640: Steering Column Anti-Rotation Pin

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

WARNING: Refer to SIR Warning .

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

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

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

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

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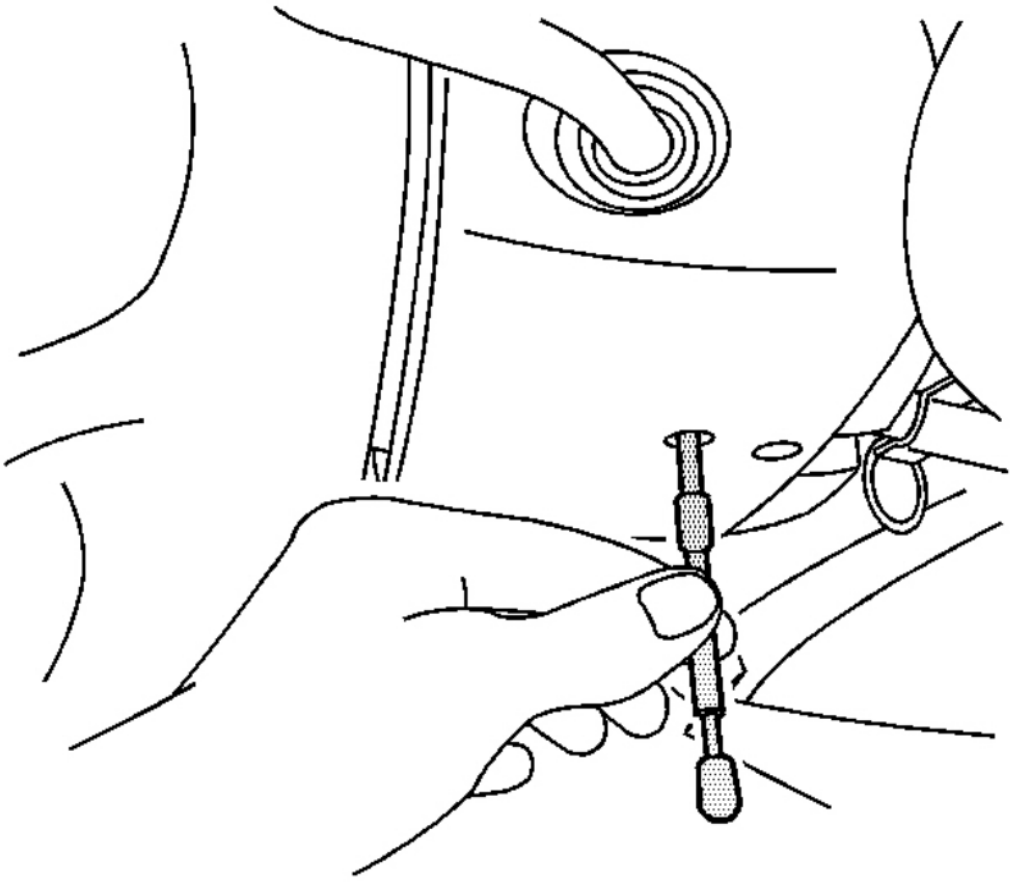


Fig. 5: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 42640:** anti-rotation pin in the steering column lower access hole.
3. Remove the engine shield. Refer to **Engine Shield Replacement** .
4. Mark the relationships of the steering shaft coupling, the upper intermediate steering shaft, and the power steering gear.
    1. Mark the relationship of the upper intermediate steering shaft to the steering shaft coupling.
    2. Mark the relationship of the steering shaft coupling to the steering gear.

NOTE: DO NOT pull on the steering shaft coupling to separate it from the steering gear.

5. Remove the steering shaft coupling bolt at the steering gear.

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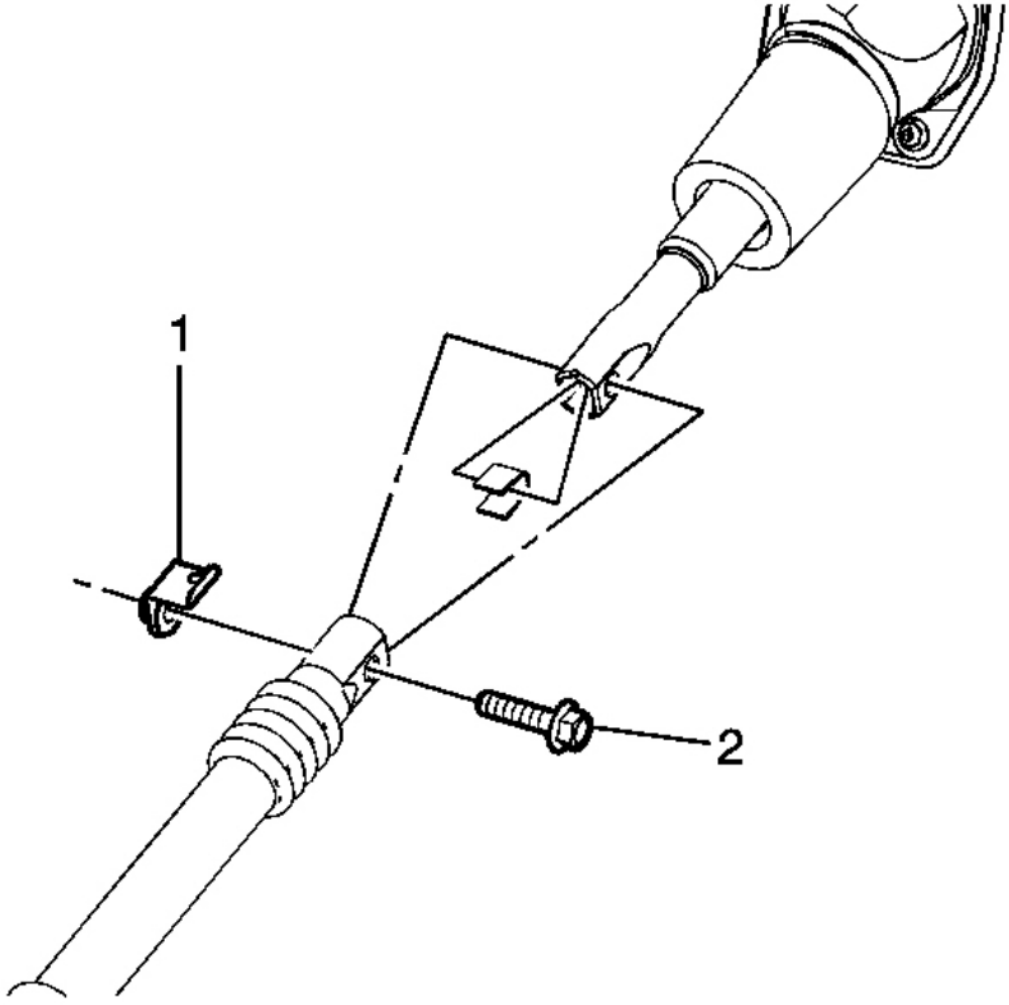


Fig. 6: View Of Upper & Lower Intermediate Shafts & Components
Courtesy of GENERAL MOTORS CORP.

6. Remove the steering shaft coupling nut (1) and bolt (2) at the upper intermediate steering shaft.
7. Remove the steering shaft coupling from the vehicle.

Installation Procedure

NOTE: If a new steering shaft coupling is being installed then transfer the position of the alignment marks from the old component to the same locations on the new component. Failure to transfer the alignment marks

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may result in an off-center steering wheel after installation.

1. Install the steering shaft coupling to the vehicle.

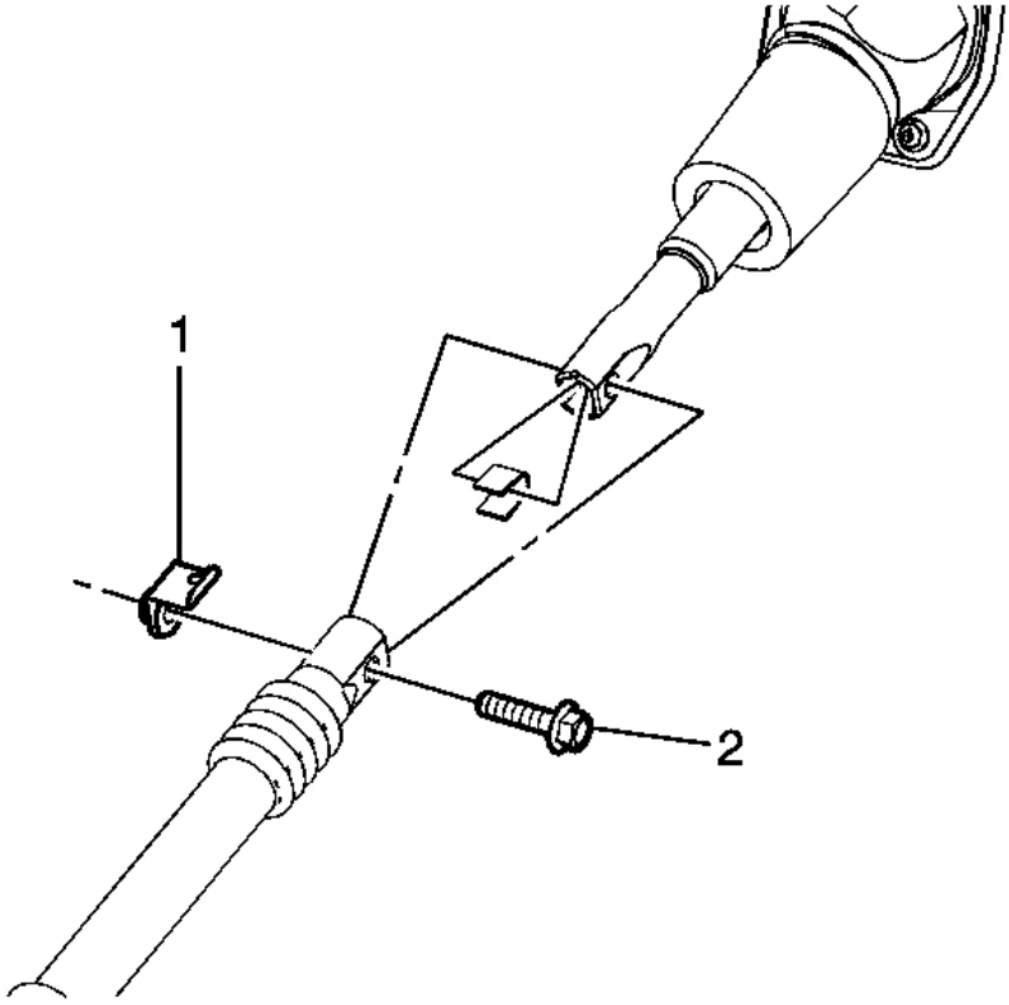


Fig. 7: View Of Upper & Lower Intermediate Shafts & Components
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the steering shaft coupling nut (1) and bolt (2) at the upper intermediate steering shaft and tighten

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to 50 N.m (37 lb ft).

3. Install the steering shaft coupling bolt at the steering gear and tighten to 47 N.m (35 lb ft).
4. Install the engine shield. Refer to **Engine Shield Replacement** .

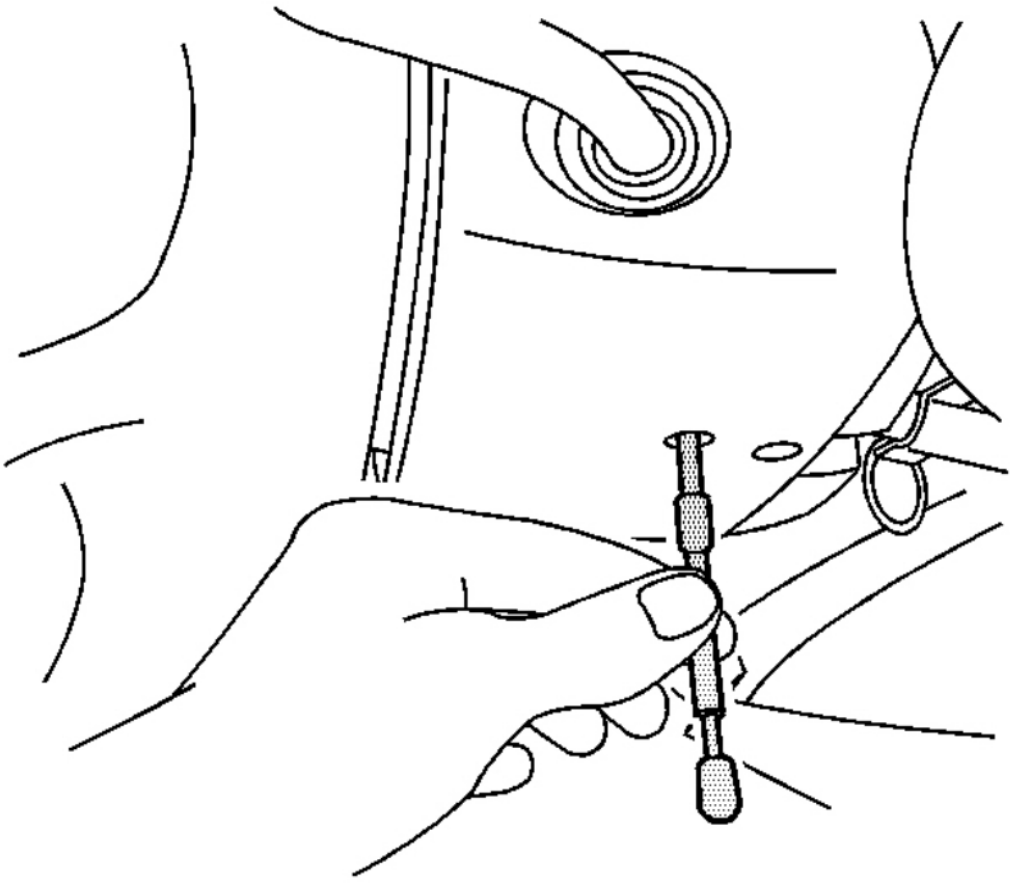


Fig. 8: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

5. Remove the **J 42640:** anti-rotation pin from the steering column lower access hole.

UPPER INTERMEDIATE STEERING SHAFT REPLACEMENT

Special Tools

J 42640 Steering Column Anti-Rotation Pin

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Removal Procedure

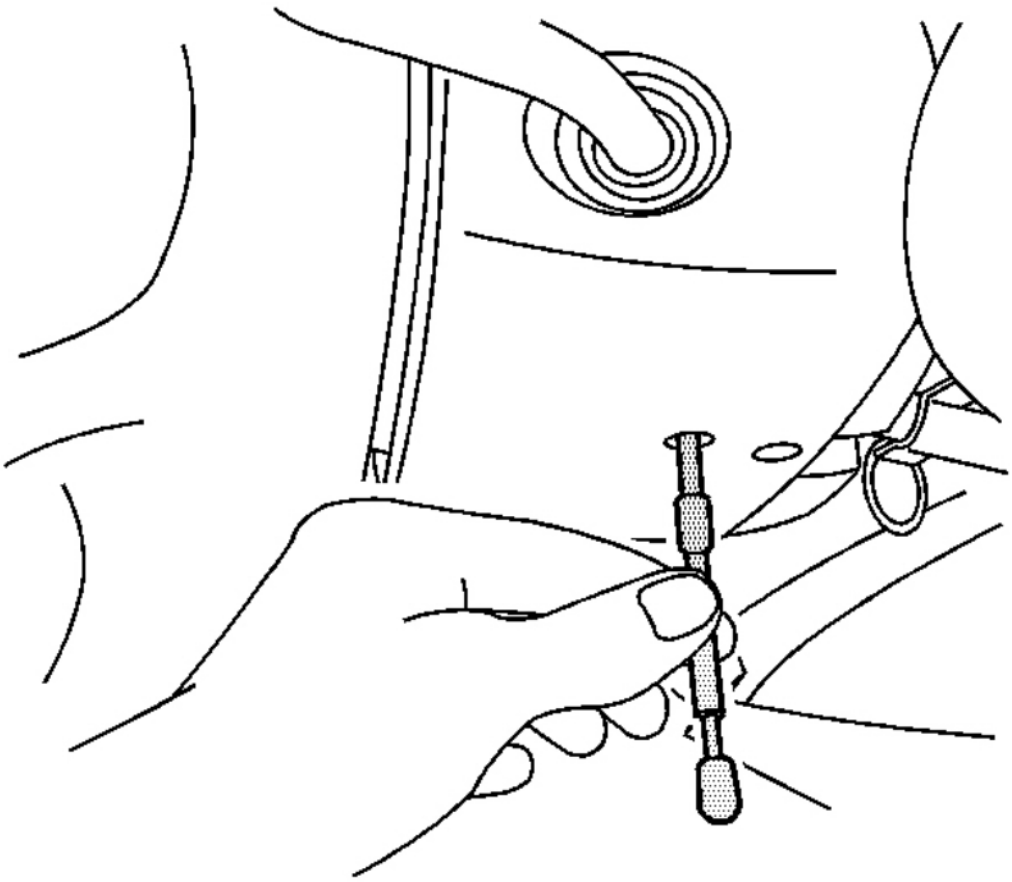


Fig. 9: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

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

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

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After disconnecting these components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to the SIR coil. If you think the SIR coil has became un-centered, refer to your applicable INFLATABLE RESTRAINT STEERING WHEEL MODULE COIL CENTERING procedure to re-center SIR Coil .

1. Install anti-rotation pin **J 42640** in the steering column lower access hole.
2. Mark the relationships of the following components:
    1. Mark the relationship of the upper intermediate steering shaft to the steering column.
    2. Mark the relationship of the upper intermediate steering shaft to the steering shaft coupling

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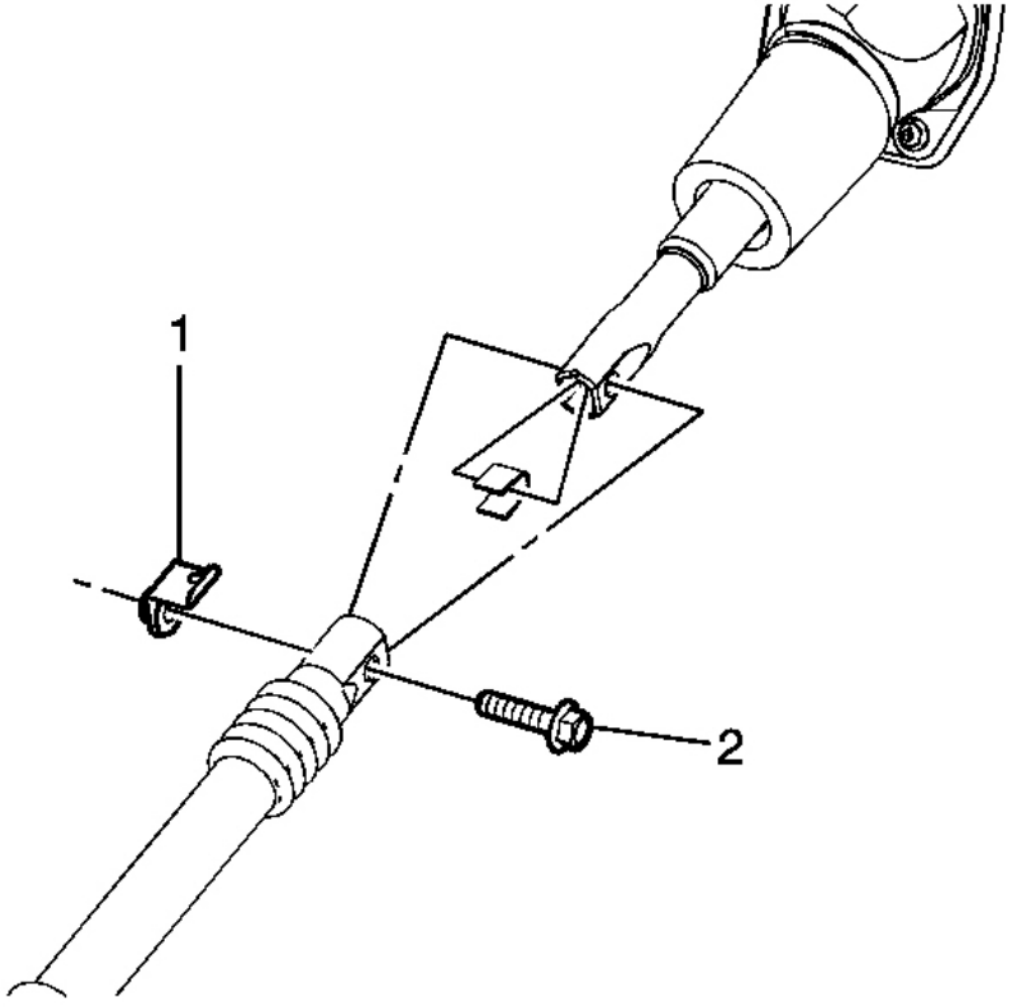


Fig. 10: View Of Upper & Lower Intermediate Shafts & Components
Courtesy of GENERAL MOTORS CORP.

3. Remove the steering shaft coupling nut (1) and bolt (2) at the upper intermediate steering shaft.
4. Remove the steering column seal. Refer to **Steering Column Seal Replacement**.

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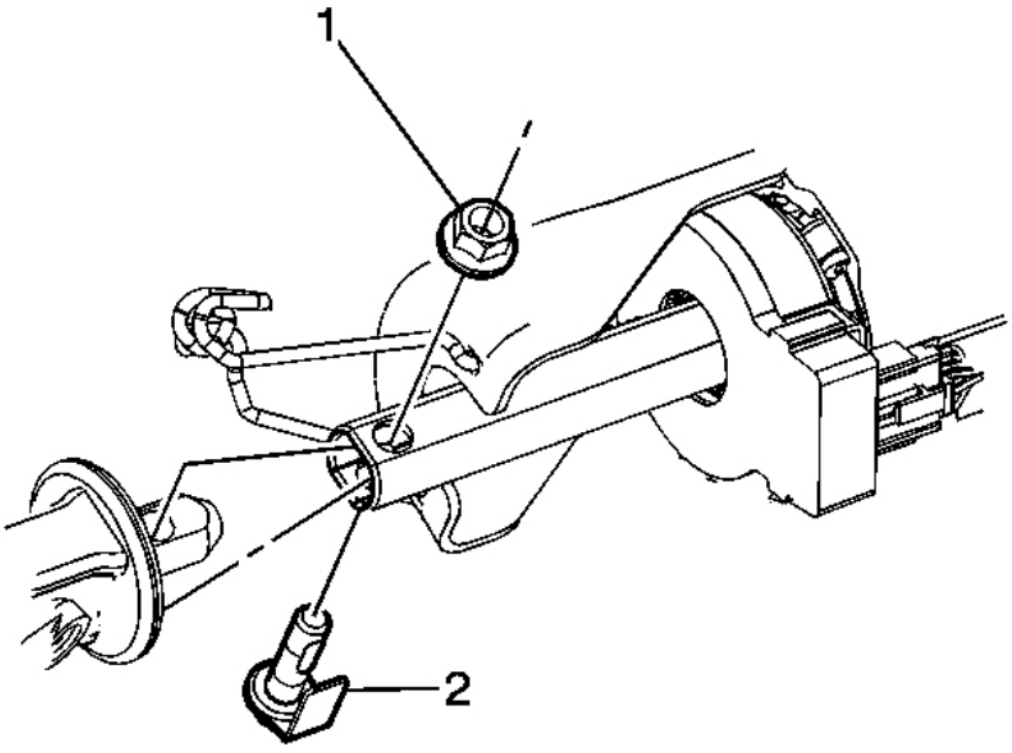


Fig. 11: View Of Upper Intermediate Shaft Pinch Bolt, Nut & Steering Column
Courtesy of GENERAL MOTORS CORP.

5. Remove the steering shaft coupling nut (1) and bolt (2) at the steering column.
6. Remove the upper intermediate steering shaft from inside the engine compartment.

Installation Procedure

NOTE: If a new steering shaft coupling is being installed then transfer the position of the alignment marks from the old component to the same locations on the new component. Failure to transfer the alignment marks may result in an off-center steering wheel after installation.

1. Install the upper intermediate steering shaft from inside the engine compartment.

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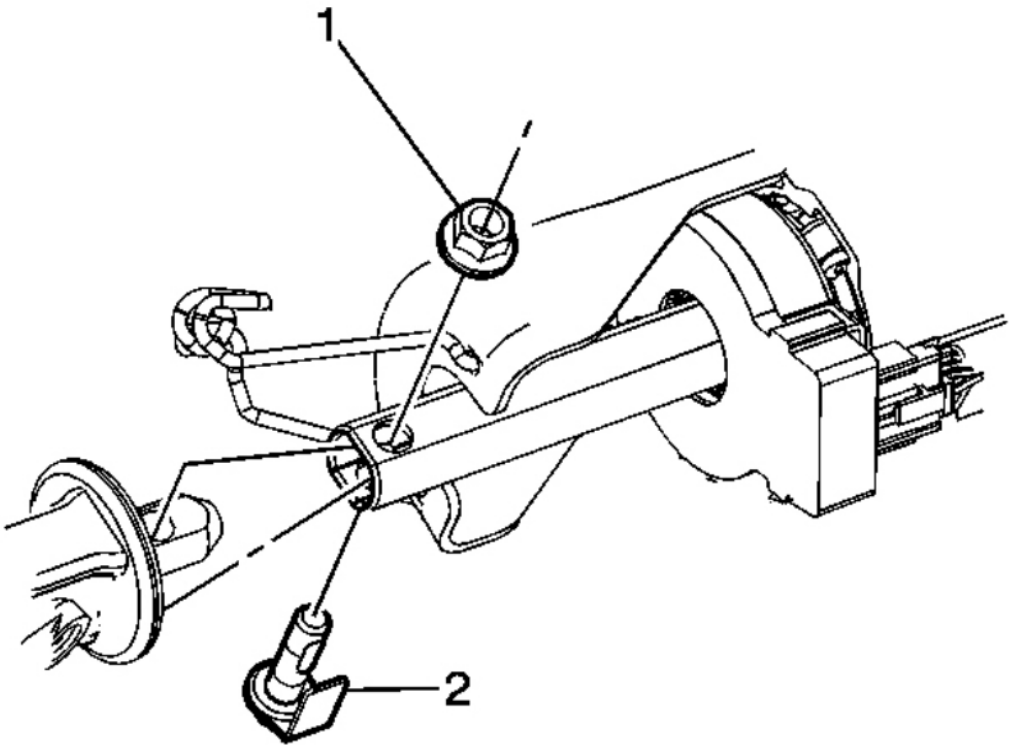


Fig. 12: View Of Upper Intermediate Shaft Pinch Bolt, Nut & Steering Column
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the steering shaft coupling nut (1) and bolt (2) at the steering column and tighten to 62 N.m (46 lb ft).
3. Install the steering column seal. Refer to **Steering Column Seal Replacement**.

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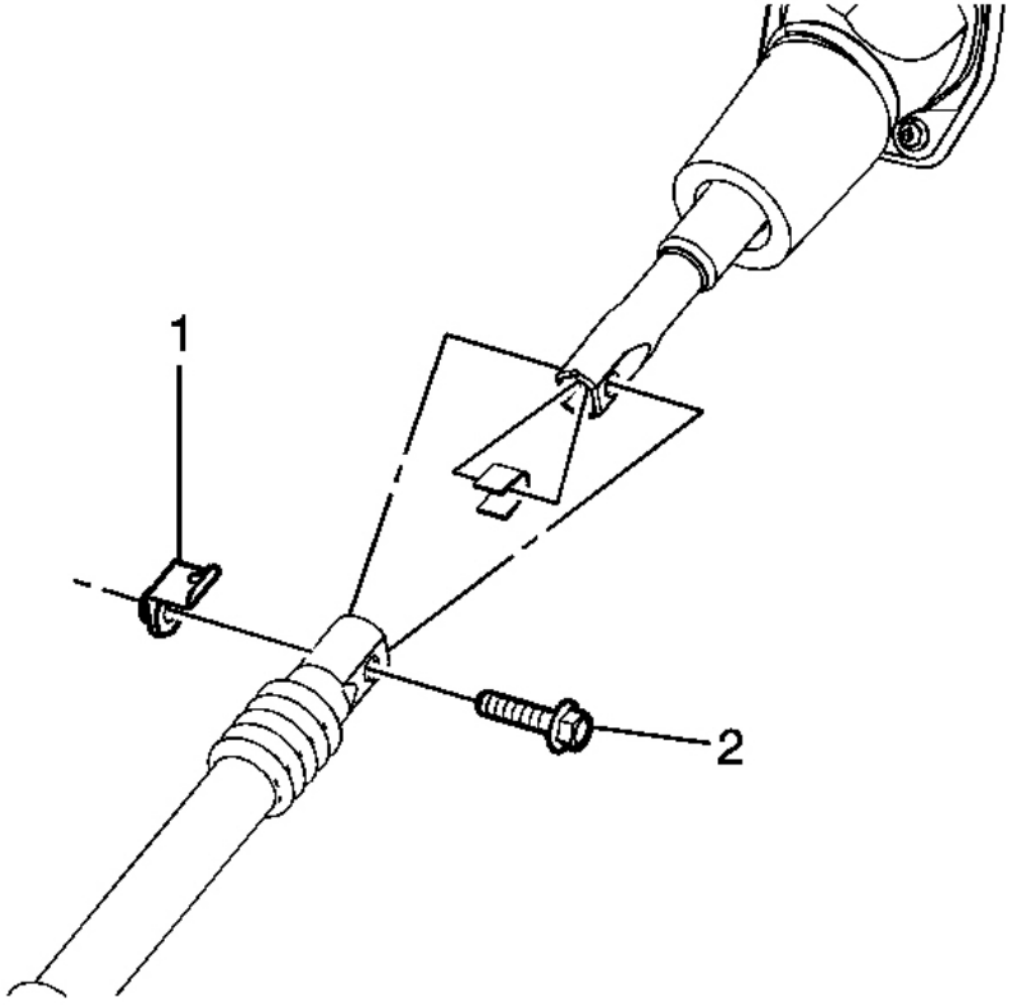


Fig. 13: View Of Upper & Lower Intermediate Shafts & Components
Courtesy of GENERAL MOTORS CORP.

4. Install the steering shaft coupling nut (1) and bolt (2) at the steering shaft coupling and tighten to 50 N.m (37 lb ft).

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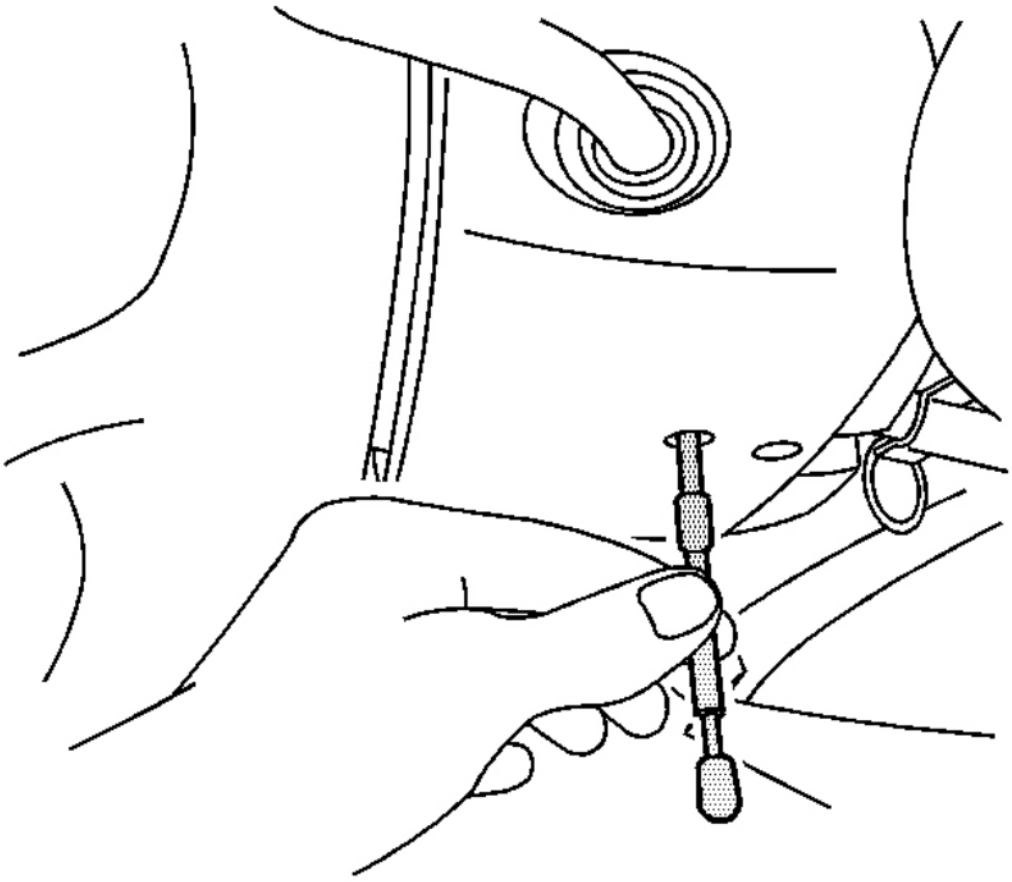


Fig. 14: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

5. Remove anti-rotation pin **J 42640** from the steering column lower access hole.

STEERING COLUMN ACCIDENT DAMAGE INSPECTION

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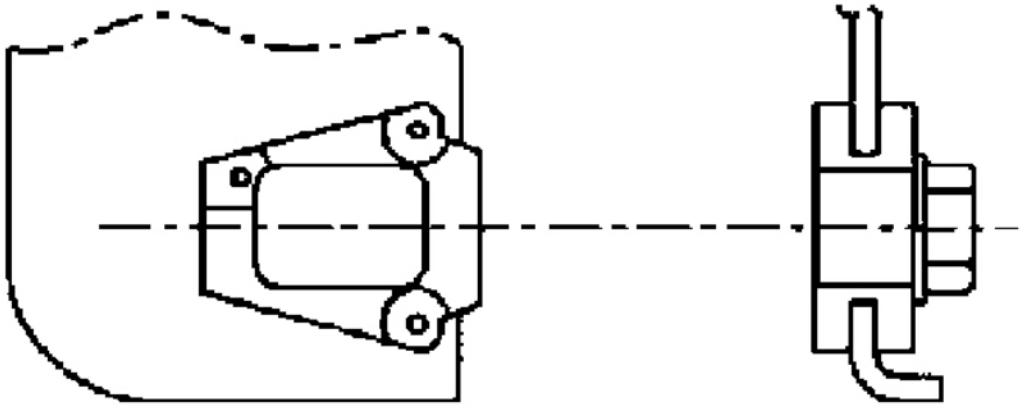


Fig. 15: Inspecting Capsules On Steering Column Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

- 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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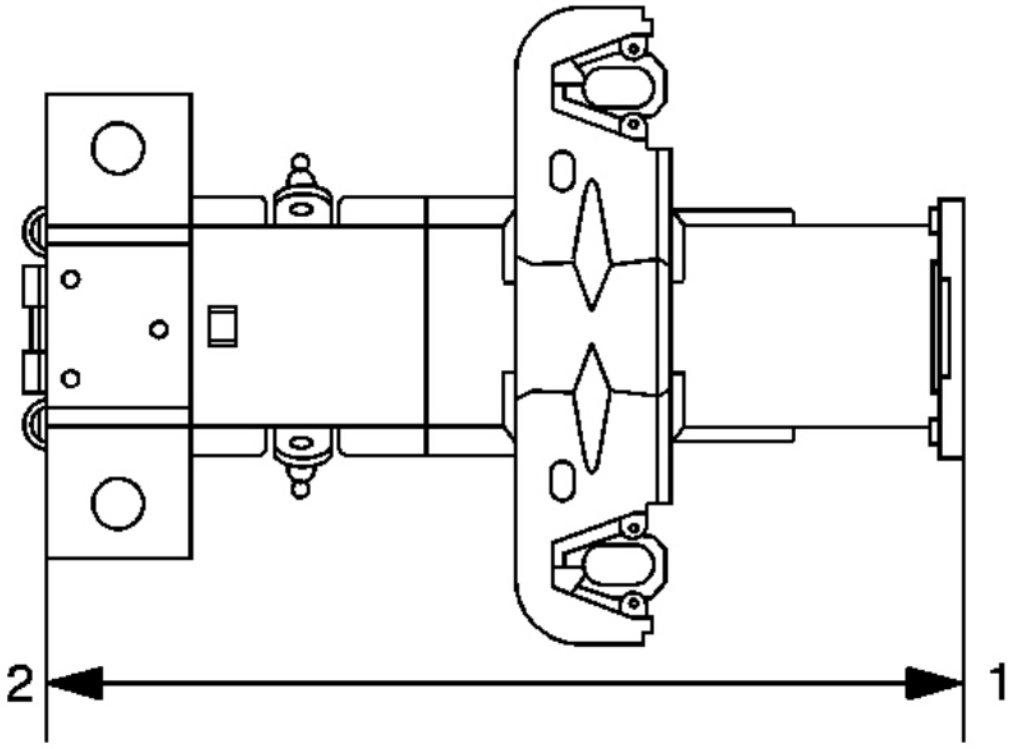


Fig. 16: Jacket Assembly Measurement
Courtesy of GENERAL MOTORS CORP.

- Inspect for jacket assembly collapse by measuring the distance from the steering column support bracket mounting plate (1) to the lower edge of the jacket lower bracket (2). Replace the jacket assembly if the measured dimensions are less than 286 mm.

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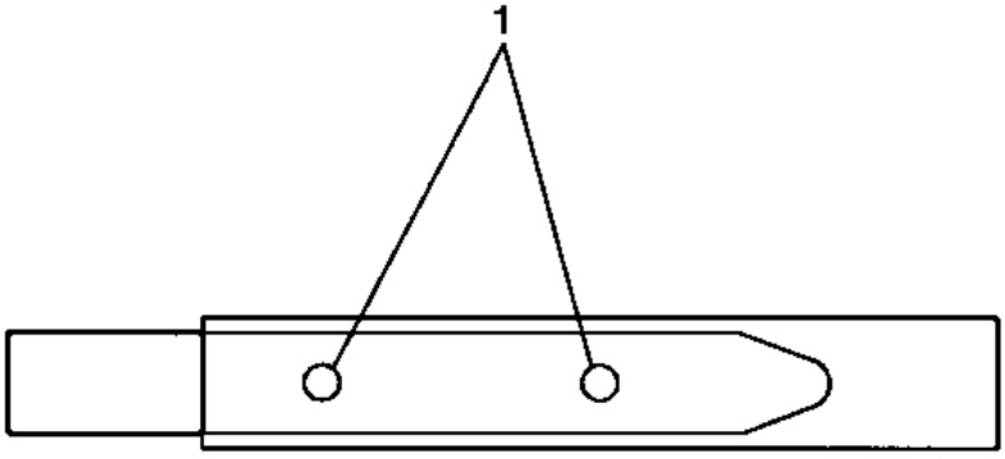


Fig. 17: Inspecting Steering Shaft For Sheared Injected Plastic
Courtesy of GENERAL MOTORS CORP.

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

STEERING COLUMN SHROUD REPLACEMENT (WITHOUT ELECTRONIC TILT STEERING)

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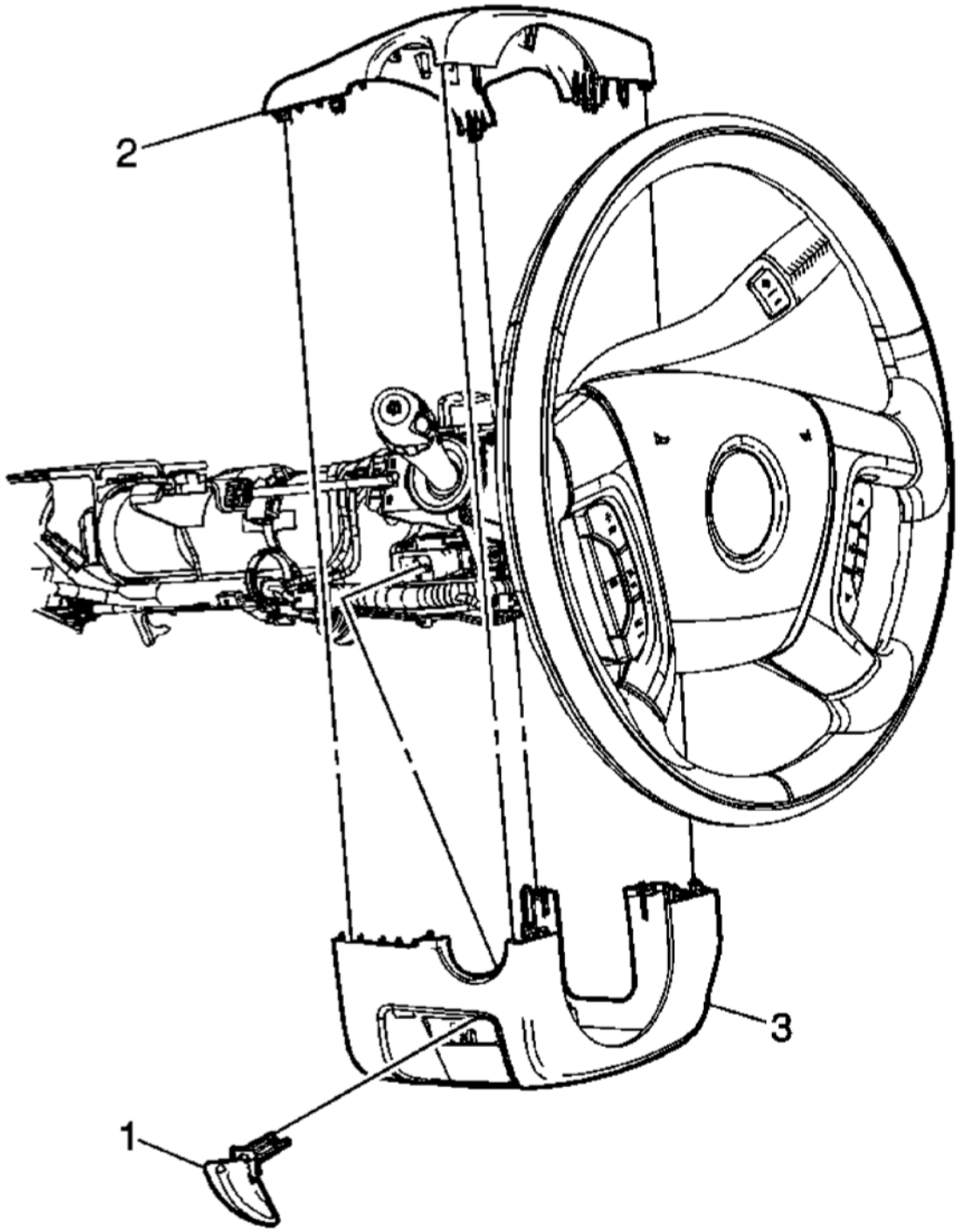


Fig. 18: View Of Upper & Lower Steering Column Trim Cover & Tilt Lever
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
	Tilt Lever

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1	**Procedure:** Remove by pulling straight outwards.
2	Upper Steering Column Shroud
3	Lower Steering Column Shroud **CAUTION:** **Refer to Fastener Caution .** **Procedure** 1. If equipped, remove the 2 lower steering column shroud bolts. 2. Install 2 lower steering column shroud bolts if damage exists to the steering column shroud locking features. **Tighten:** 3 N.m (27 lb in)

STEERING COLUMN SHROUD REPLACEMENT (WITH ELECTRONIC TILT STEERING)

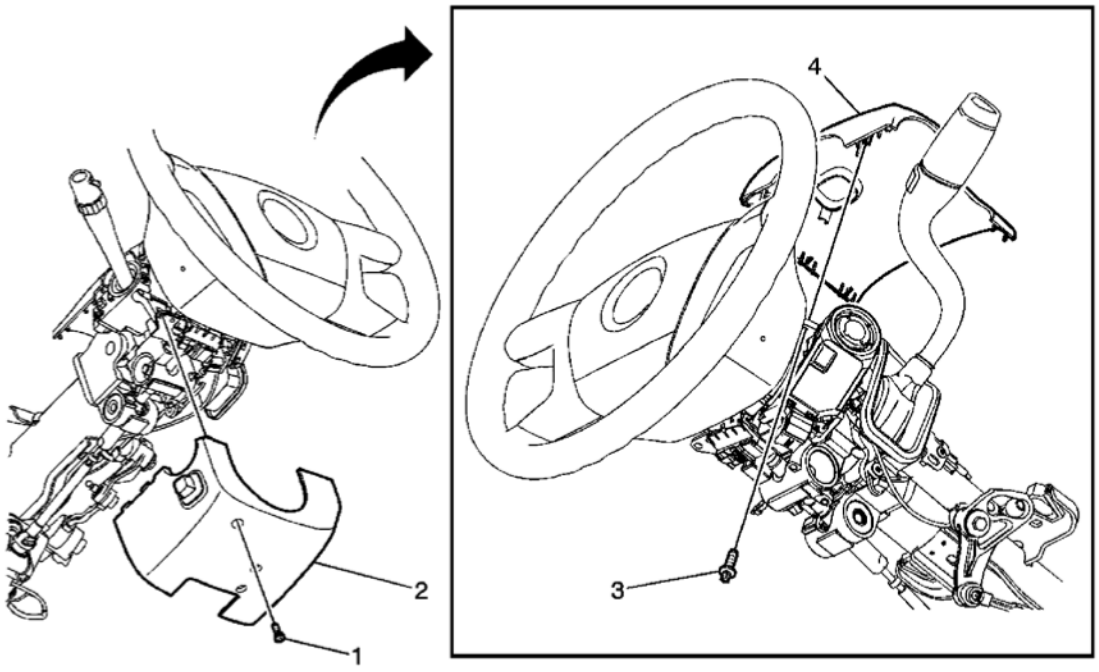


Fig. 19: Steering Column Shroud Replacement (With Electronic Tilt Steering)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
	Lower Steering Column Shroud Bolt

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1	**CAUTION:** **Refer to Fastener Caution .** **Tighten:** 3 N.m (27 lb in)
2	Lower Steering Column Shroud **Procedure** 1. Disconnect any electrical connectors as needed. 2. Disconnect the shift lever seal from the steering column lower trim cover.
3	Upper Steering Column Shroud Bolt **Tighten:** 2 N.m (18 lb in)
4	Upper Steering Column Shroud **Procedure:** Disconnect the shift lever seal from the steering column upper trim cover.

POWER TILT STEERING COLUMN CALIBRATION

Tilt Soft Stops

After replacement of the memory seat module (MSM), tilt motor, or steering column, it is necessary to program the tilt soft stops. Each soft stop is a programmable end of travel that is set approximately 1.3 cm (0.5 in) from the mechanical end of travel. The steering column has a soft stop set at each end of the tilt up/down movement. The system uses soft stops to prevent wear on the system by ensuring that the steering column movement stops before it reaches its mechanical end of travel in any direction. The soft stops are initially programmed at the factory.

Tilt Soft Stop Programming Procedure

1. Ignition ON, Engine OFF.
2. Connect a scan tool to the vehicle.
3. Select Memory Seat Module.
4. Select Special Functions.
5. Select Driver Seat.
6. Select Learn Column Soft Stops.
7. Follow the scan tool on-screen instructions.

TURN SIGNAL MULTIFUNCTION SWITCH REPLACEMENT

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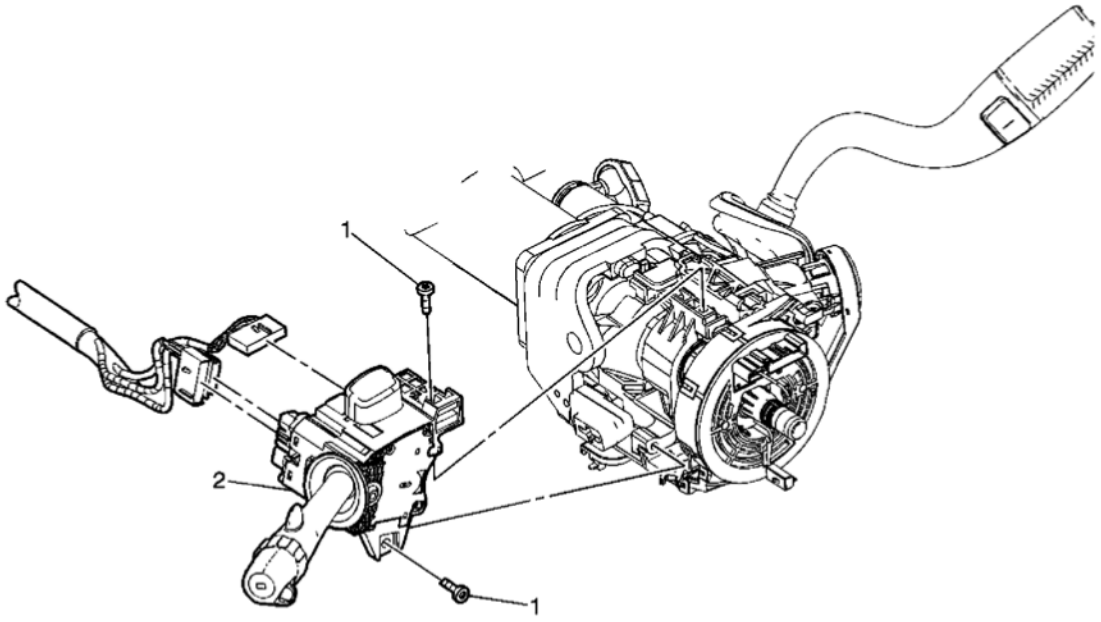


Fig. 20: View Of Multifunction Turn Signal Switch & Screws
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
WARNING: **Refer to SIR Warning .** **Preliminary Procedure** 1. Remove the steering wheel. Refer to **Steering Wheel Replacement**. 2. Remove the steering column shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.	
1	Turn Signal Multifunction Switch Bolt (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 3 N.m (27 lb in)
2	Turn Signal Multifunction Switch **Procedure:** Disconnect any electrical connectors as needed.

SHIFT LEVER REPLACEMENT

Removal Procedure

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1. Remove the steering column shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.
2. Roll back the shift lever seal on the shift lever until the shift lever bolt is exposed.
3. Disconnect any electrical connectors as needed.

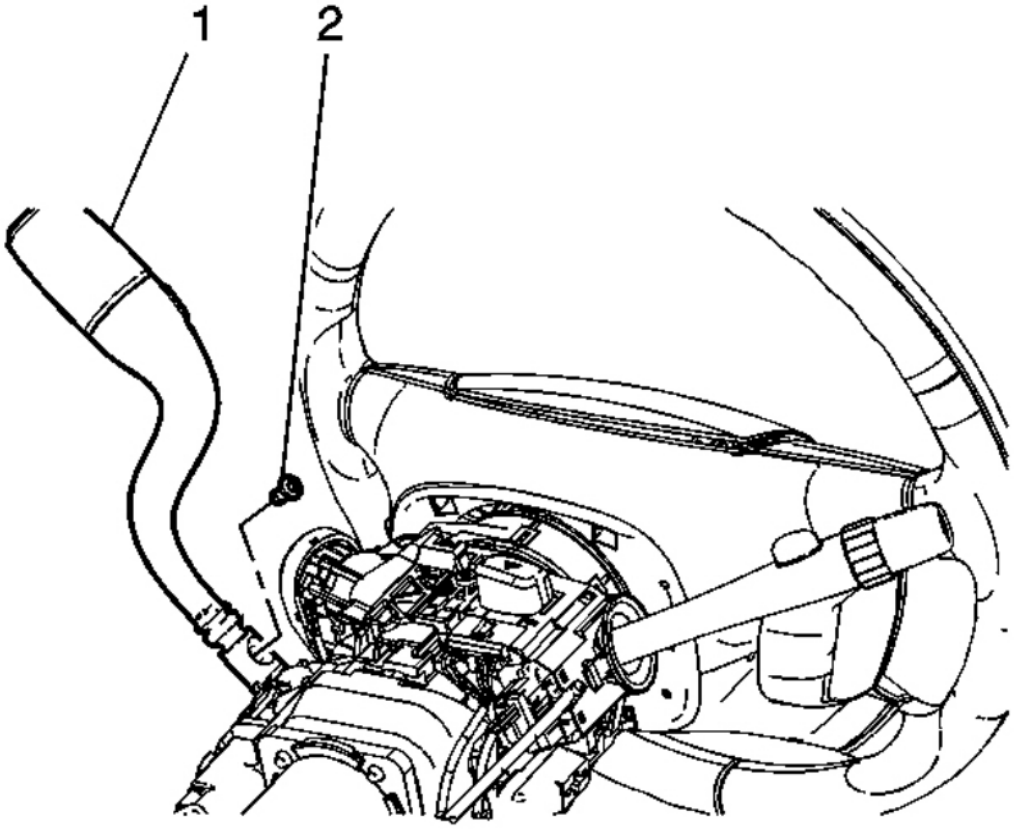


Fig. 21: Locating Shift Lever & Screw
Courtesy of GENERAL MOTORS CORP.

4. Remove the shift lever bolt (2).
5. Remove the shift lever (1).

Installation Procedure

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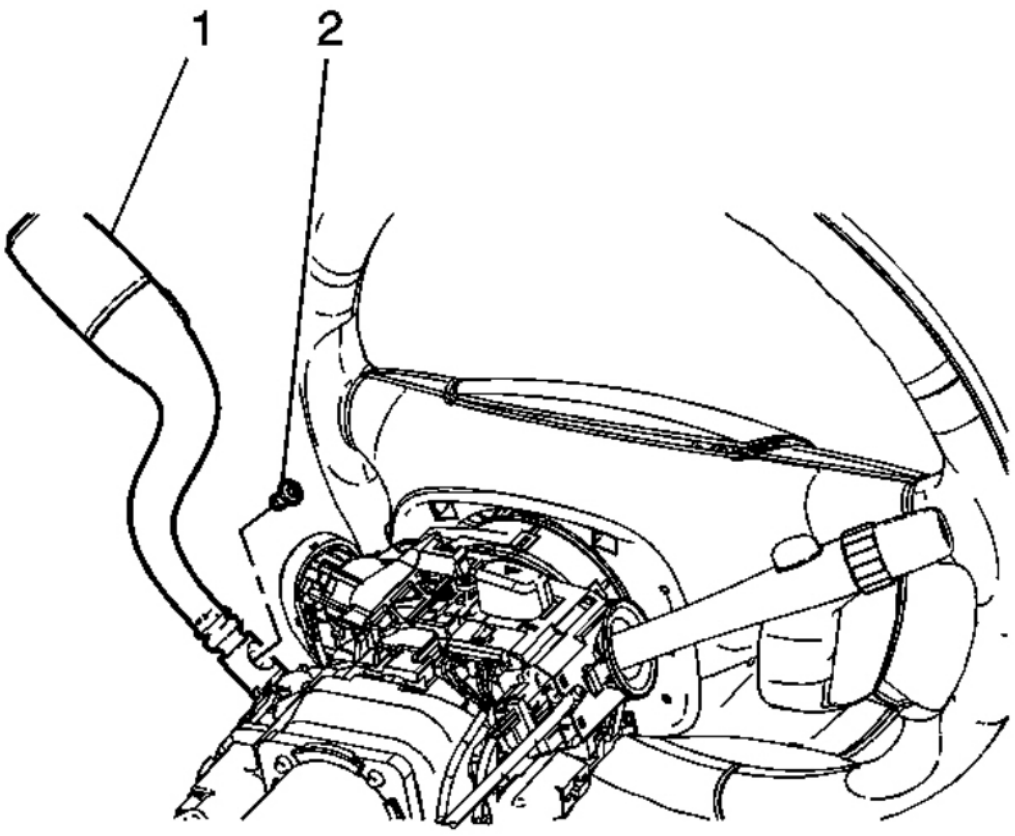


Fig. 22: Locating Shift Lever & Screw
Courtesy of GENERAL MOTORS CORP.

1. Install the shift lever (1).

CAUTION: Refer to Fastener Caution .

2. Install the shift lever bolt (2) and tighten to 20 N.m (15 lb ft).
3. Connect all electrical connectors.
4. Position the shift lever seal.
5. Install the steering column shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.

TRANSMISSION CONTROL REPLACEMENT

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Removal Procedure

WARNING: Refer to SIR Warning .

1. Remove the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**.
2. Remove the shift lever. Refer to **Shift Lever Replacement**.

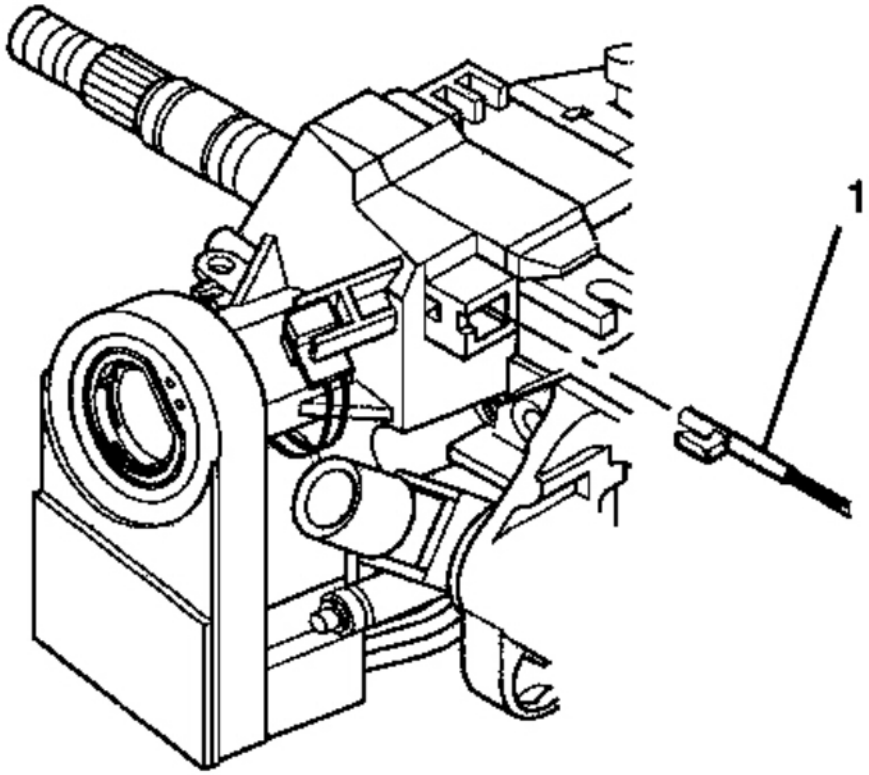


Fig. 23: Identifying Park Lock Cable At Ignition Lock Cylinder
Courtesy of GENERAL MOTORS CORP.

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

3. Disconnect the automatic transmission park lock cable (1).

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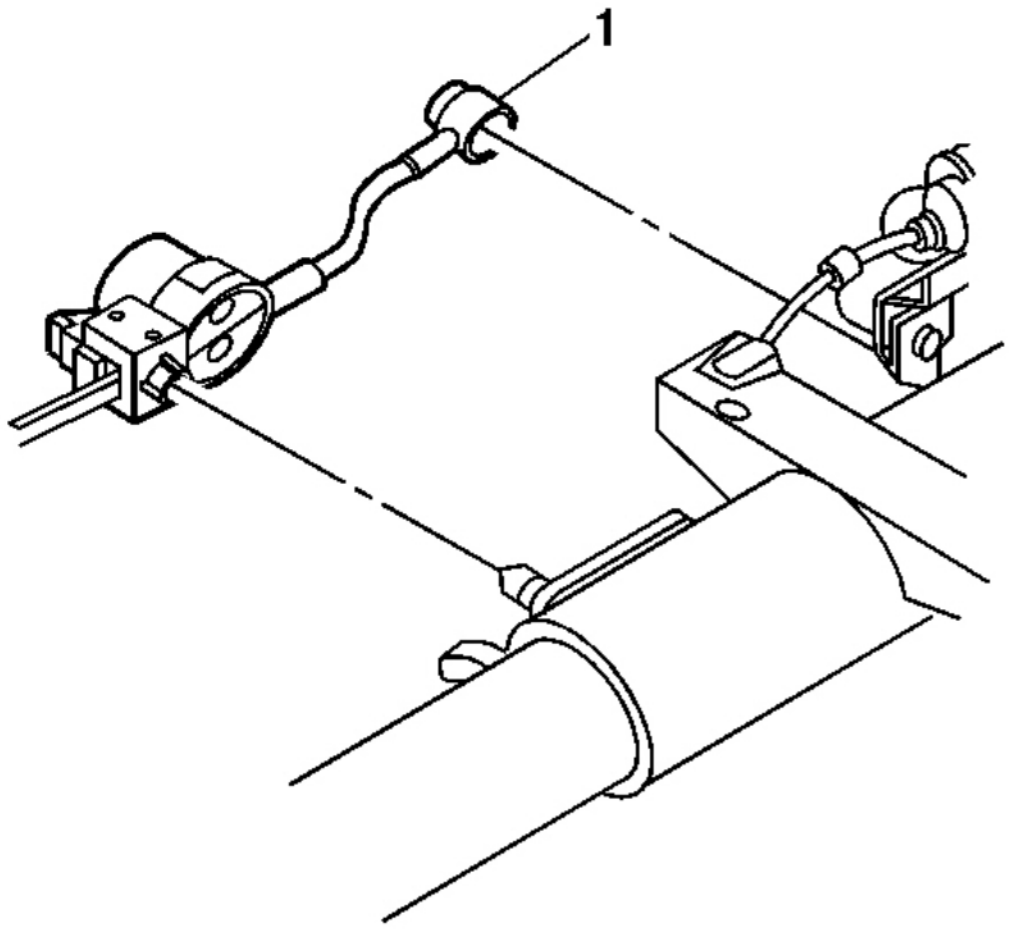


Fig. 24: View Of AT Shift Lock Control Actuator
Courtesy of GENERAL MOTORS CORP.

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

4. Disconnect the automatic transmission shift lock control actuator (1) from the automatic transmission control.

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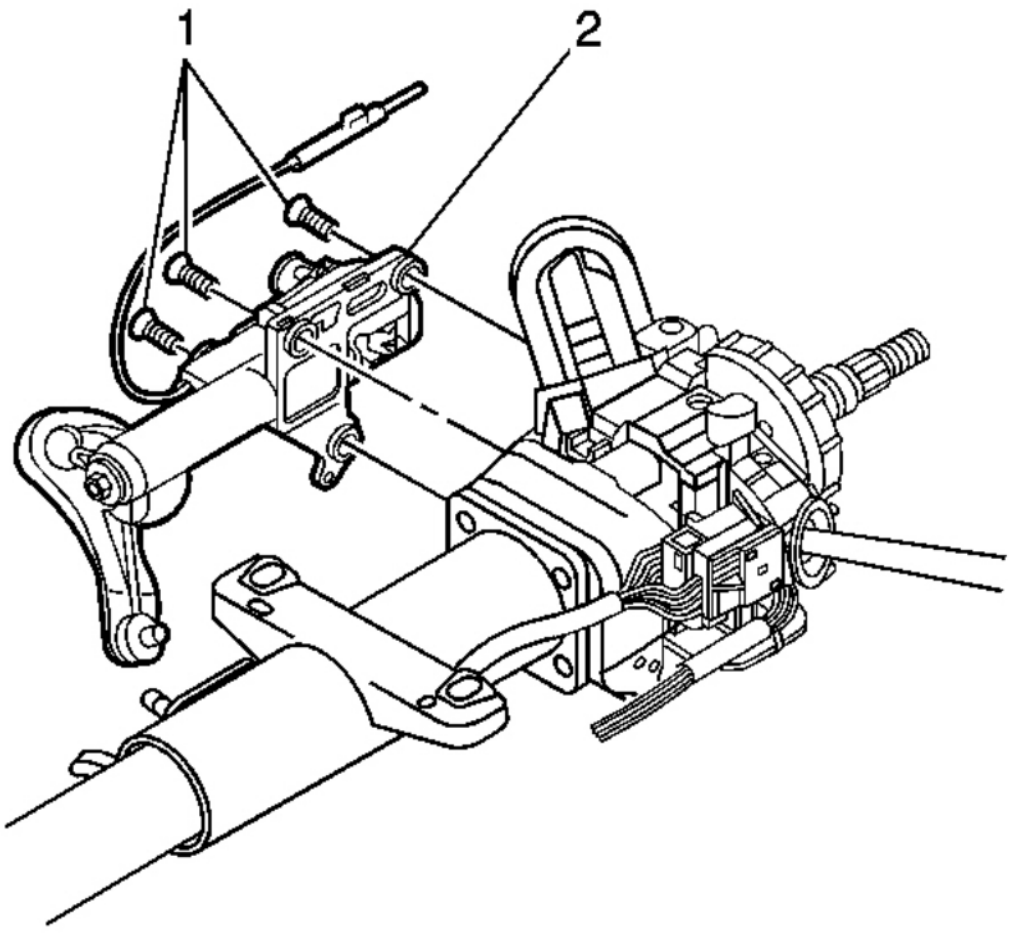


Fig. 25: View Of AT Control & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the automatic transmission control bolts (1).
6. Remove the automatic transmission control (2).

Installation Procedure

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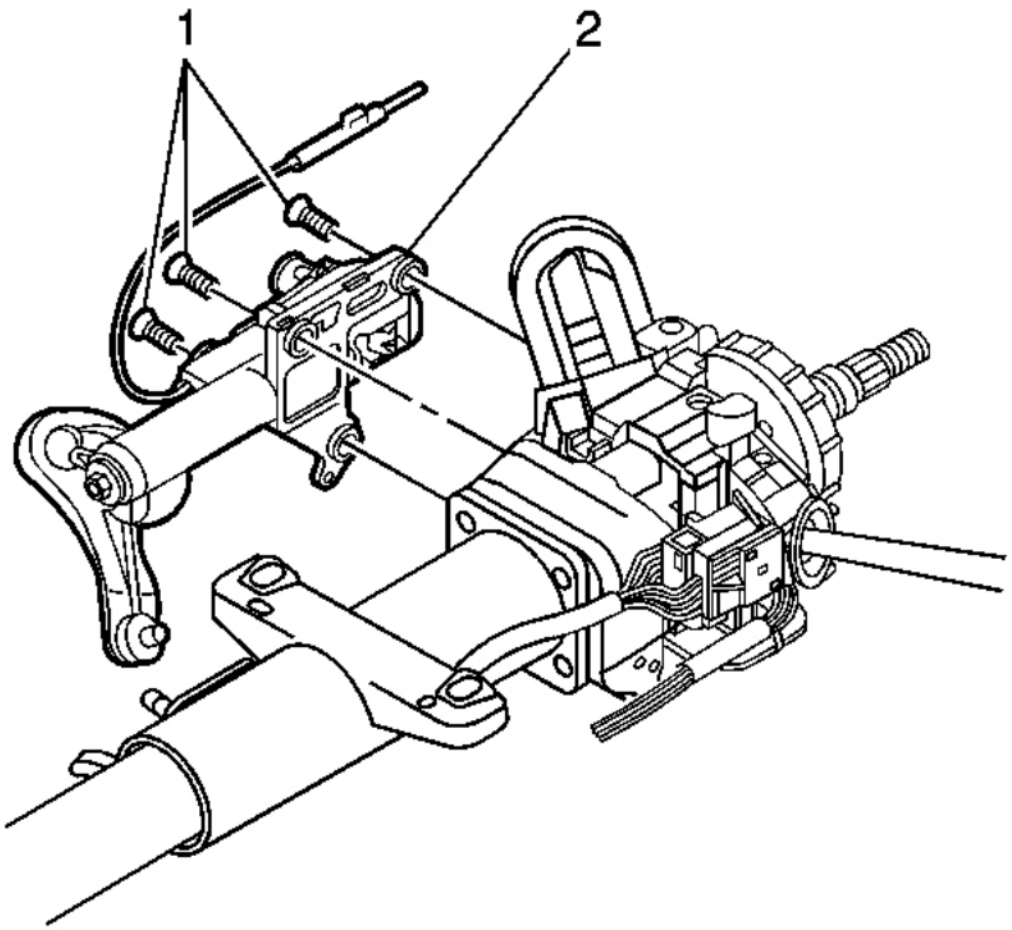


Fig. 26: View Of AT Control & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the automatic transmission control (2).

CAUTION: Refer to Fastener Caution .

NOTE: Move the automatic transmission control as needed to install all the automatic transmission control bolts.

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

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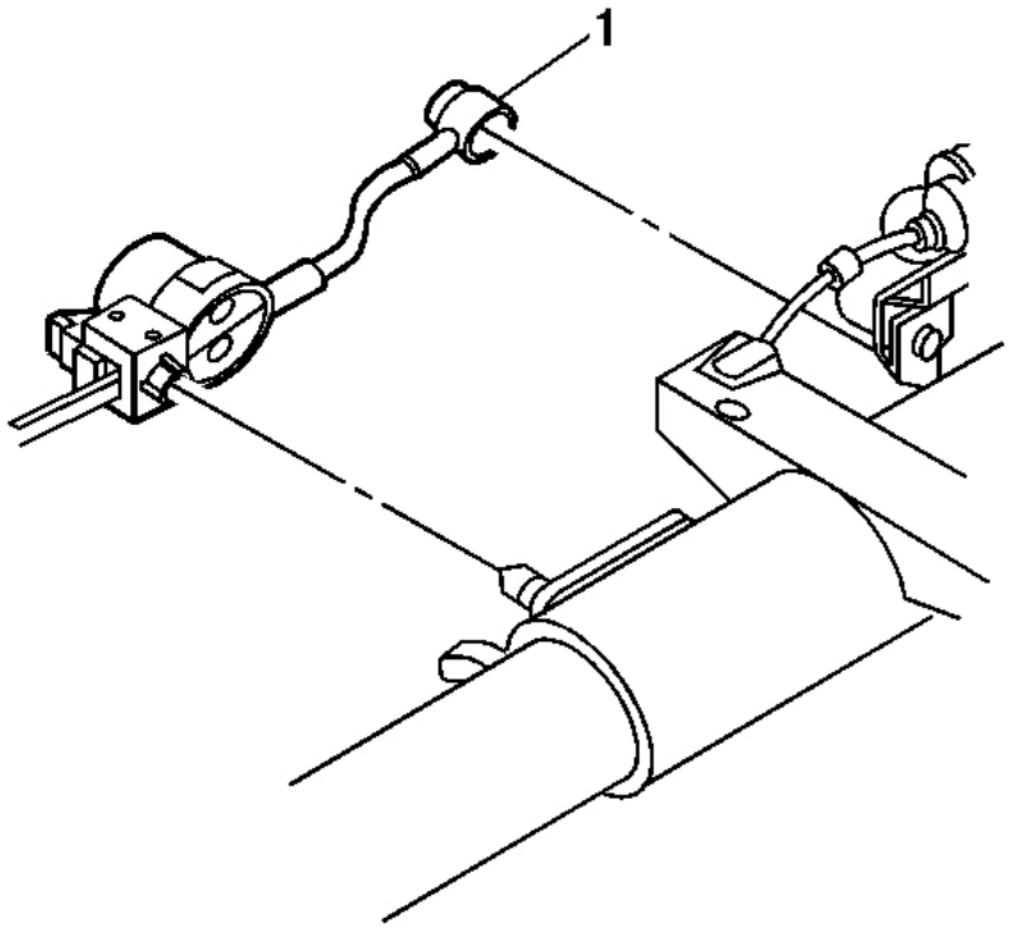


Fig. 27: View Of AT Shift Lock Control Actuator
Courtesy of GENERAL MOTORS CORP.

3. Connect the automatic transmission shift lock control actuator (1) to the automatic transmission control.

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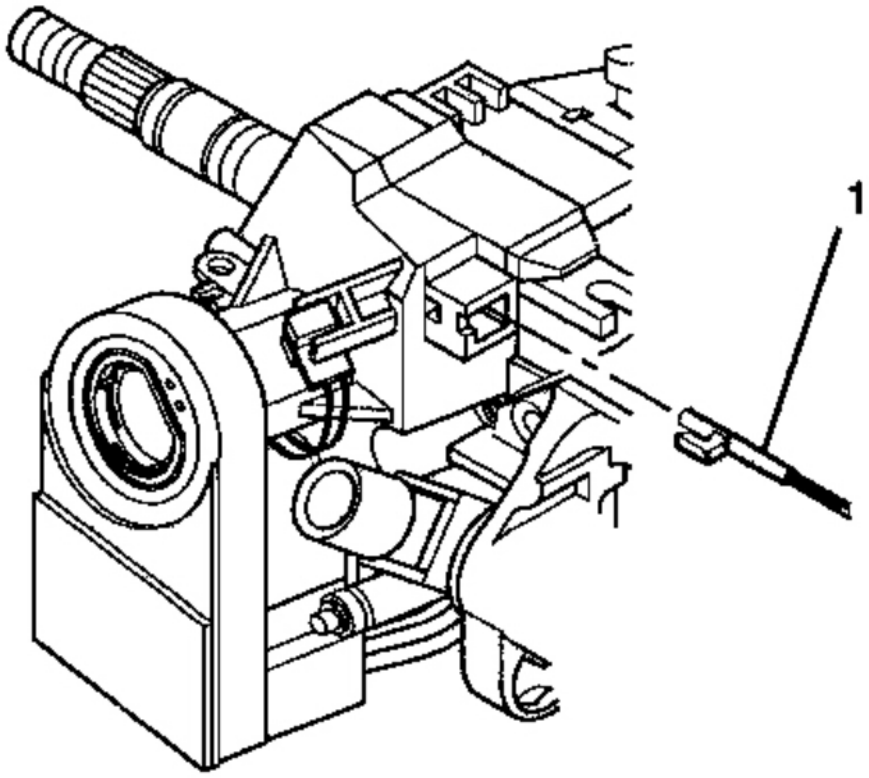


Fig. 28: Identifying Park Lock Cable At Ignition Lock Cylinder
Courtesy of GENERAL MOTORS CORP.

4. Connect the automatic transmission park lock cable (1).
    1. Place the ignition lock cylinder into the OFF position.
    2. Place the automatic transmission control into the PARK position.
    3. Press the locking tab on the end of the automatic transmission park lock cable into the slot in the ignition lock cylinder case.
5. Install the shift lever. Refer to **Shift Lever Replacement**.
6. Install the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**.

STEERING COLUMN TILT WHEEL SWITCH REPLACEMENT

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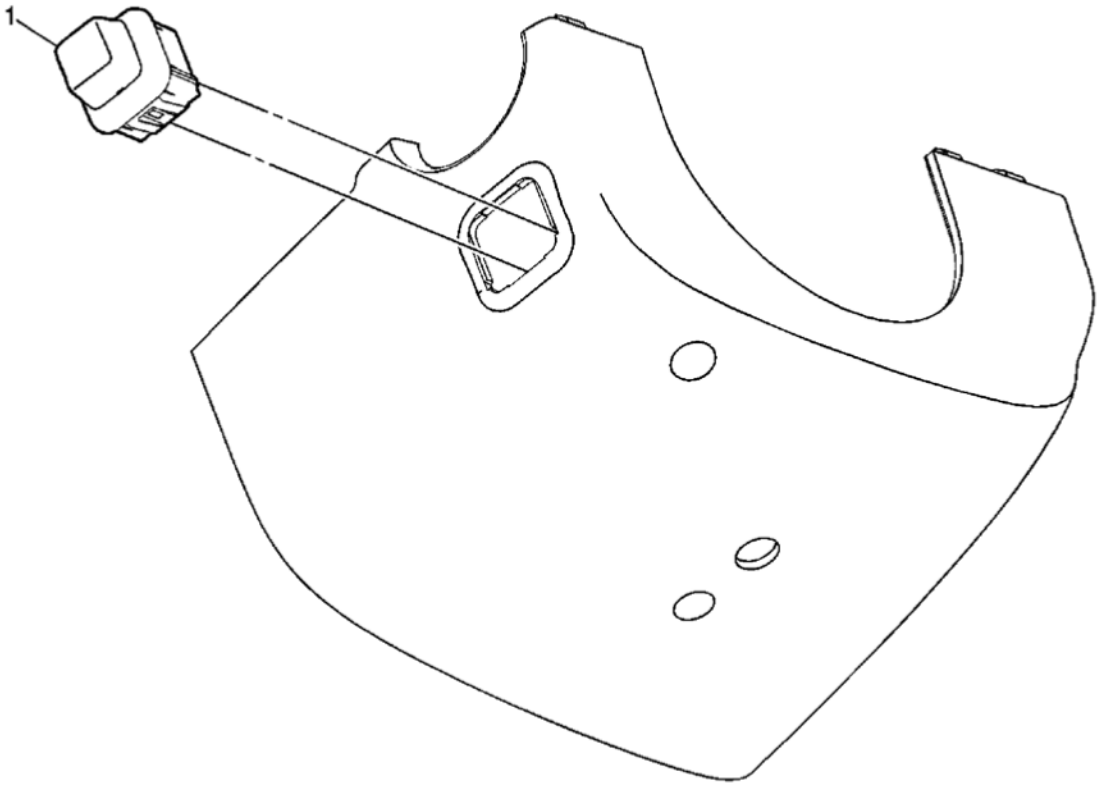


Fig. 29: Steering Column Tilt Wheel Switch Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the steering column lower shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.	
1	Steering Column Tilt Wheel Switch **Procedure** 1. Disconnect any electrical connectors as needed. 2. Release the plastic retaining tabs to release the switch from the steering column lower shroud.

TILT LEVER REPLACEMENT

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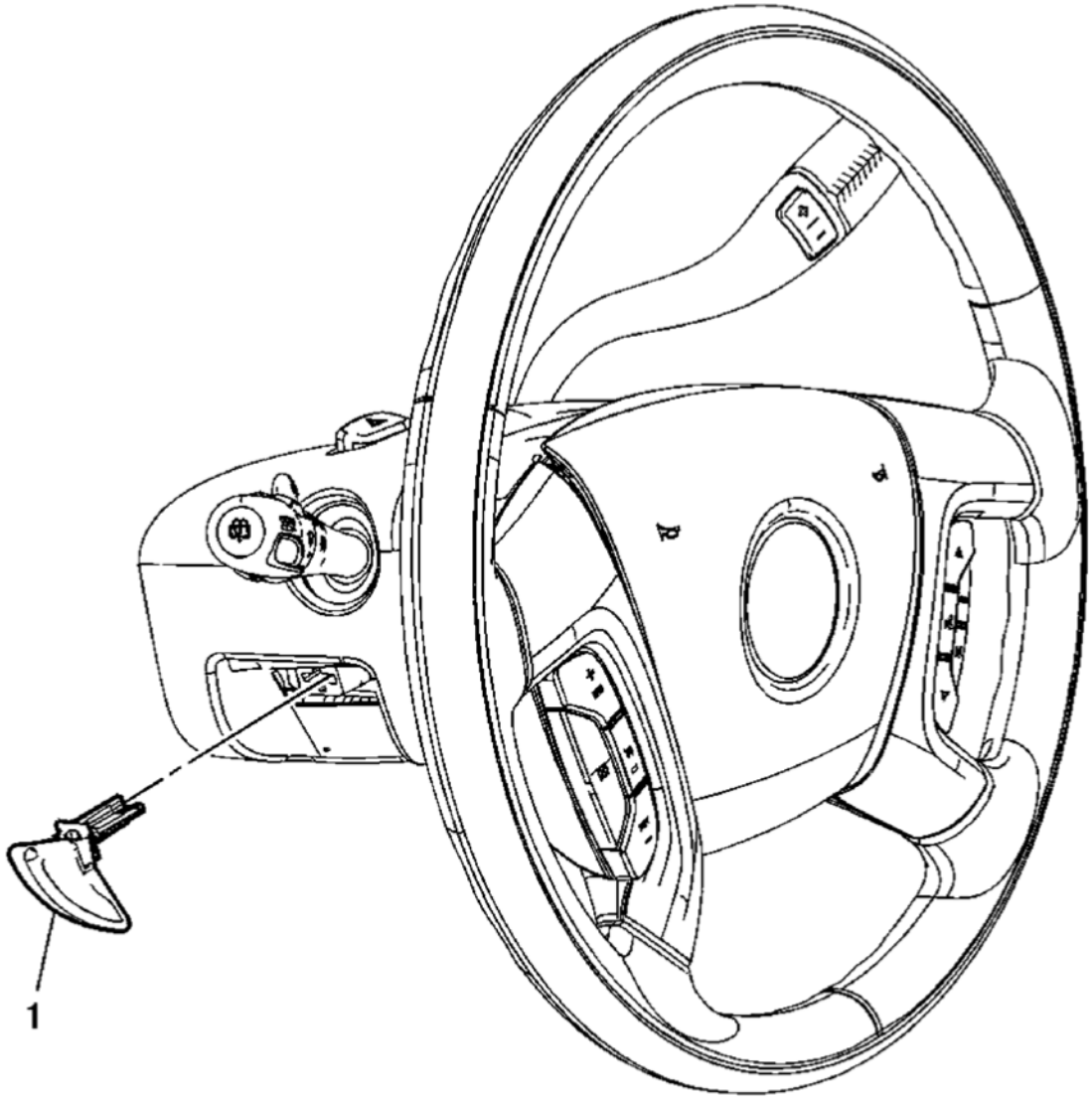


Fig. 30: View Of Tilt Lever
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Tilt Lever **Procedure:** Remove by pulling straight outwards.

STEERING WHEEL HEAT CONTROL MODULE REPLACEMENT

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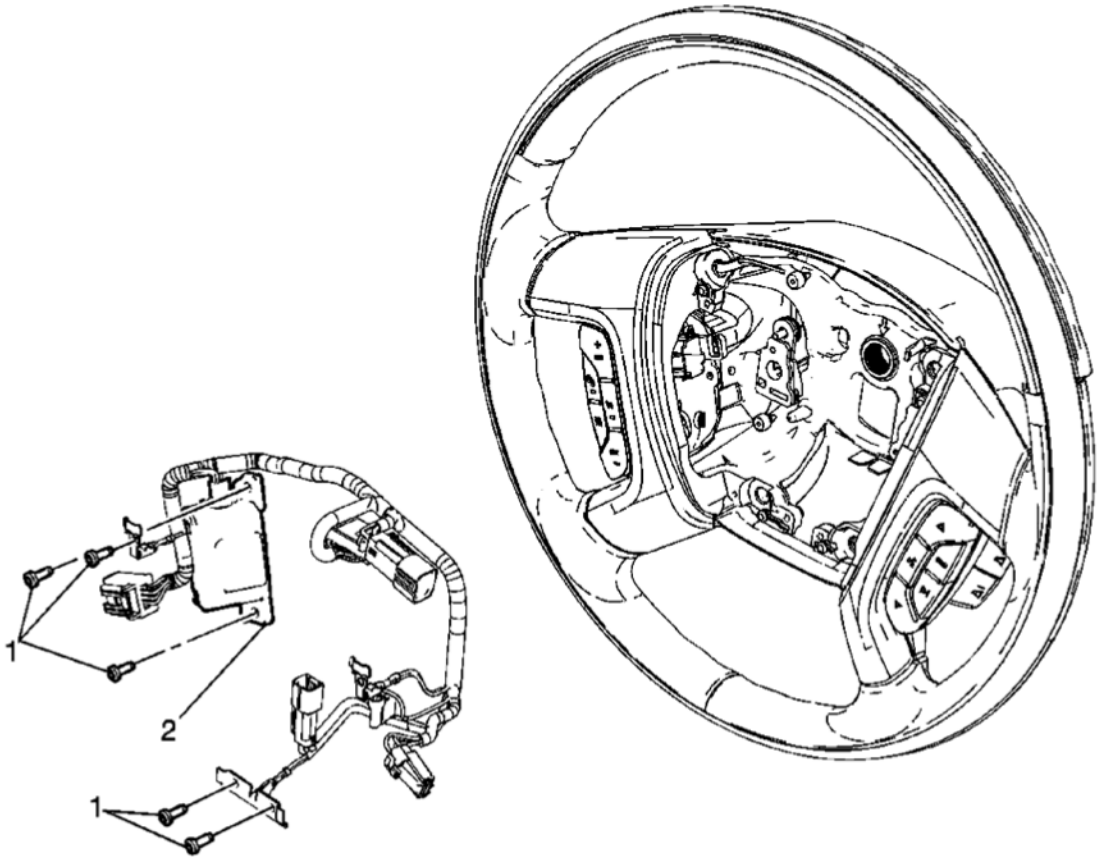


Fig. 31: View Of Steering Wheel Heat Module & Screws
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the horn switch. Refer to **Steering Wheel Horn Switch Replacement** .	
1	Steering Wheel Heat Module Screw (Qty: 5) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 2 N.m (18 lb in)
2	Steering Wheel Heat Module **Procedure:** Disconnect any electrical connectors as needed.

STEERING WHEEL REPLACEMENT

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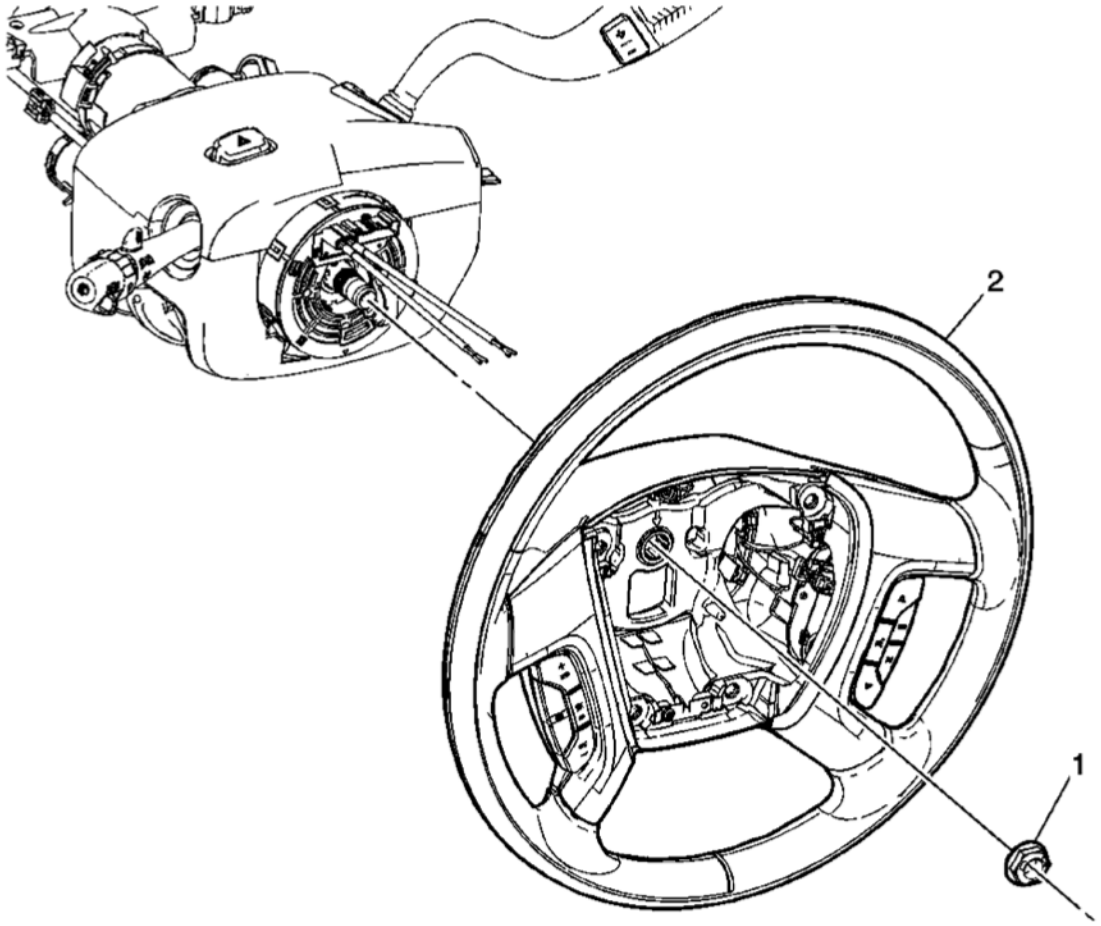


Fig. 32: View Of Steering Wheel & Nut
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
WARNING: **Refer to SIR Warning .** **Preliminary Procedure:** Remove the inflatable restraint steering wheel module. Refer to **Steering Wheel Inflatable Restraint Module Replacement** .	
1	Steering Wheel Nut **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 41 N.m (30 lb ft)
	Steering Wheel **Procedure**

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2	1. Disconnect any electrical connectors as needed. 2. Loosen the steering wheel nut until two to three threads are left engaged. 3. Wiggle the steering wheel until it disengages completely. 4. Remove the steering wheel nut and steering wheel.

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 using the appropriate information in the body repair section.
7. Install the steering wheel. Refer to **Steering Wheel Replacement**.

STEERING WHEEL LOWER COVER REPLACEMENT

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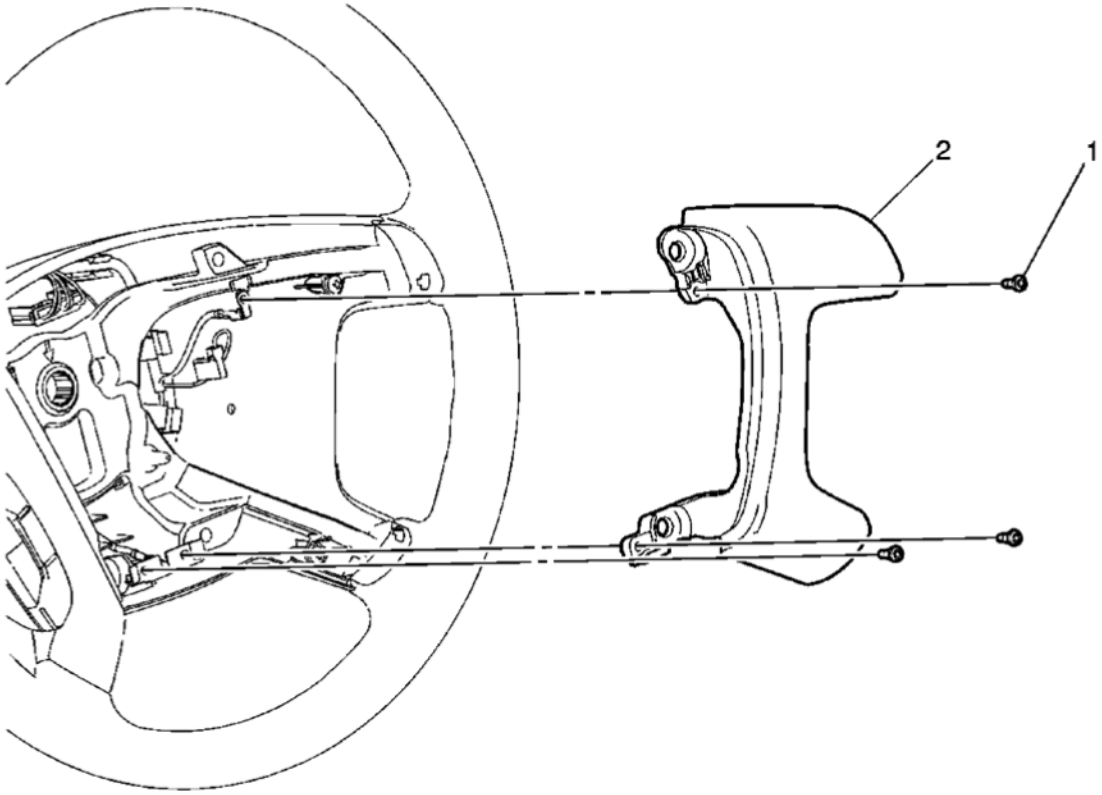


Fig. 33: Steering Wheel Lower Cover Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the steering wheel horn switch. Refer to **Steering Wheel Horn Switch Replacement** .	
1	Steering Wheel Lower Cover Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 1 N.m (9 lb in)
2	Steering Wheel Lower Cover **Procedure:** Transfer any steering wheel control switch assemblies as needed. Refer to **Steering Wheel Control Switch Assembly Replacement** .

STEERING COLUMN TILT SPRING REPLACEMENT

Removal Procedure

1. Remove the knee bolster. Refer to **Knee Bolster Replacement (Except Cadillac)** or **Knee Bolster**

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Replacement (Cadillac) .

2. Remove the steering column shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.
3. Put the steering column in the uppermost tilted position.

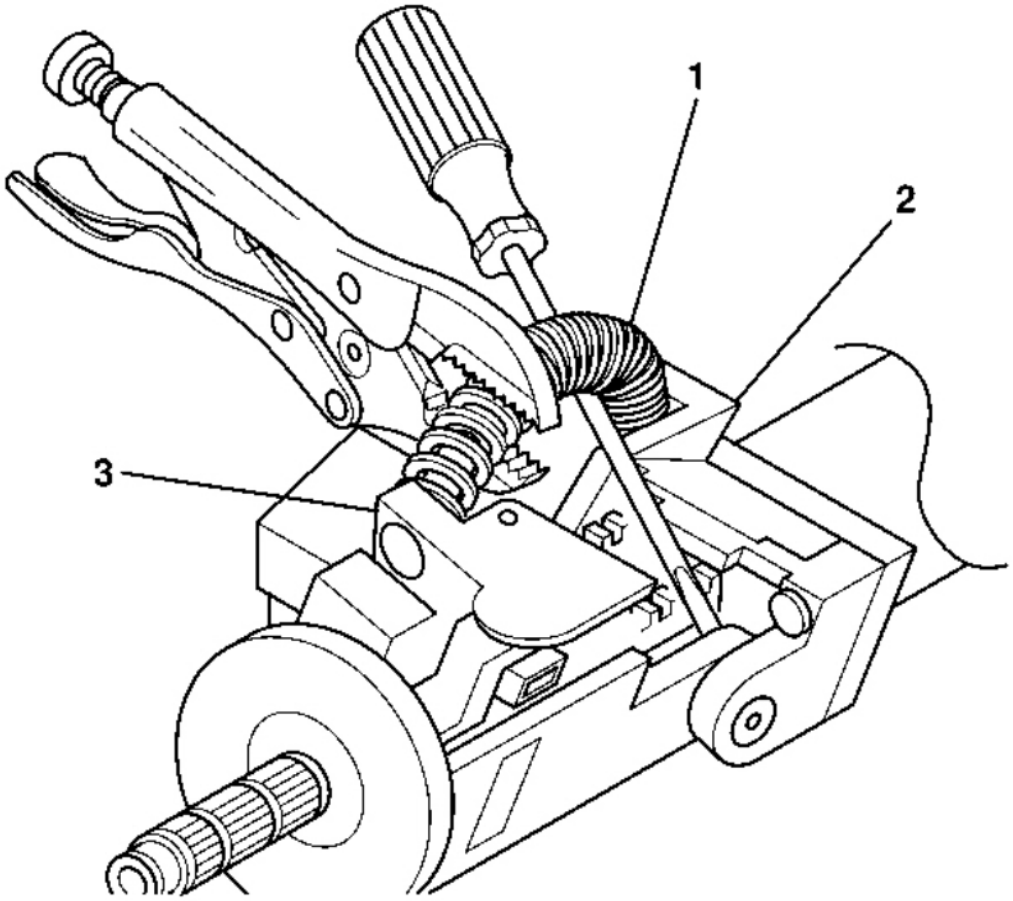


Fig. 34: Removing Tilt Spring From Steering Column Support Assembly
Courtesy of GENERAL MOTORS CORP.

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

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and the spring guide.

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

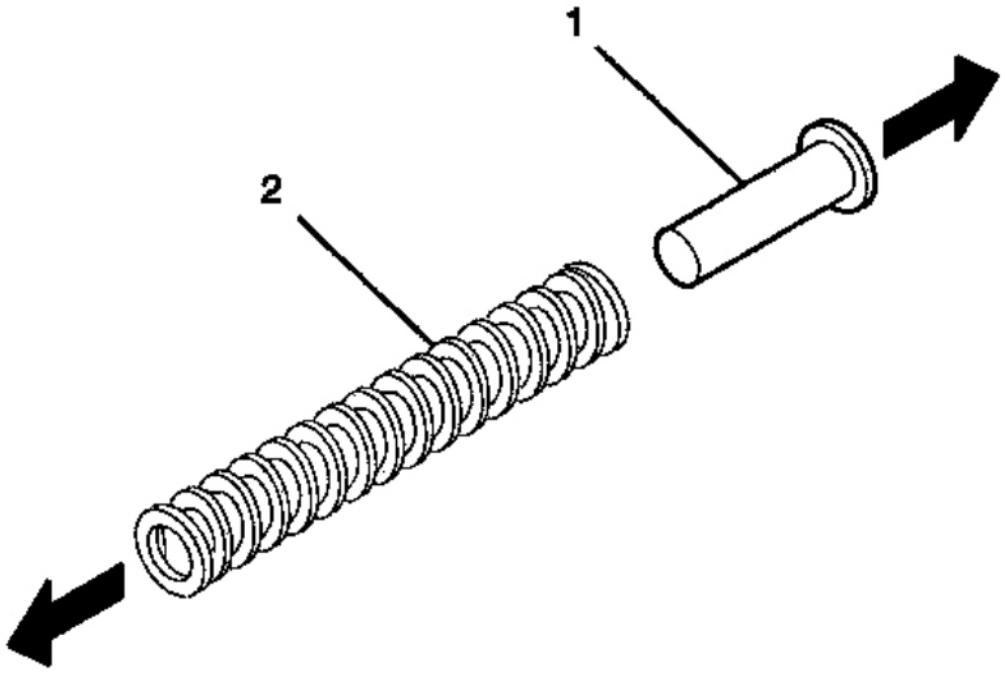


Fig. 35: Identifying Spring Guide Components
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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

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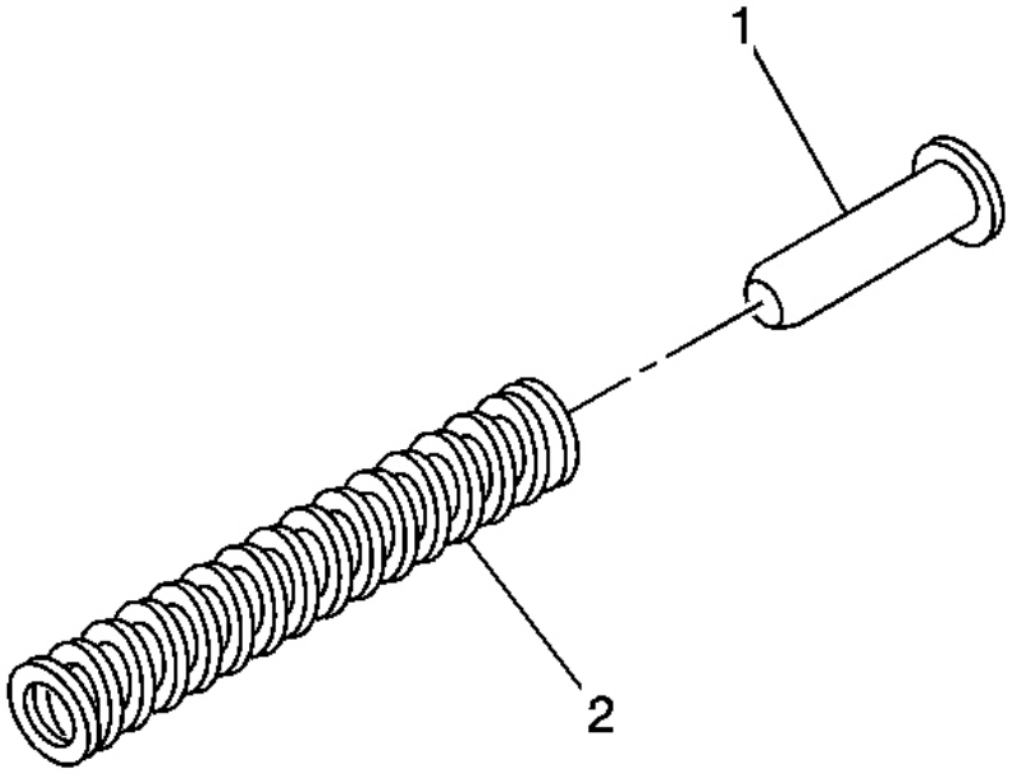


Fig. 36: View Of Tilt Spring & Guide
Courtesy of GENERAL MOTORS CORP.

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

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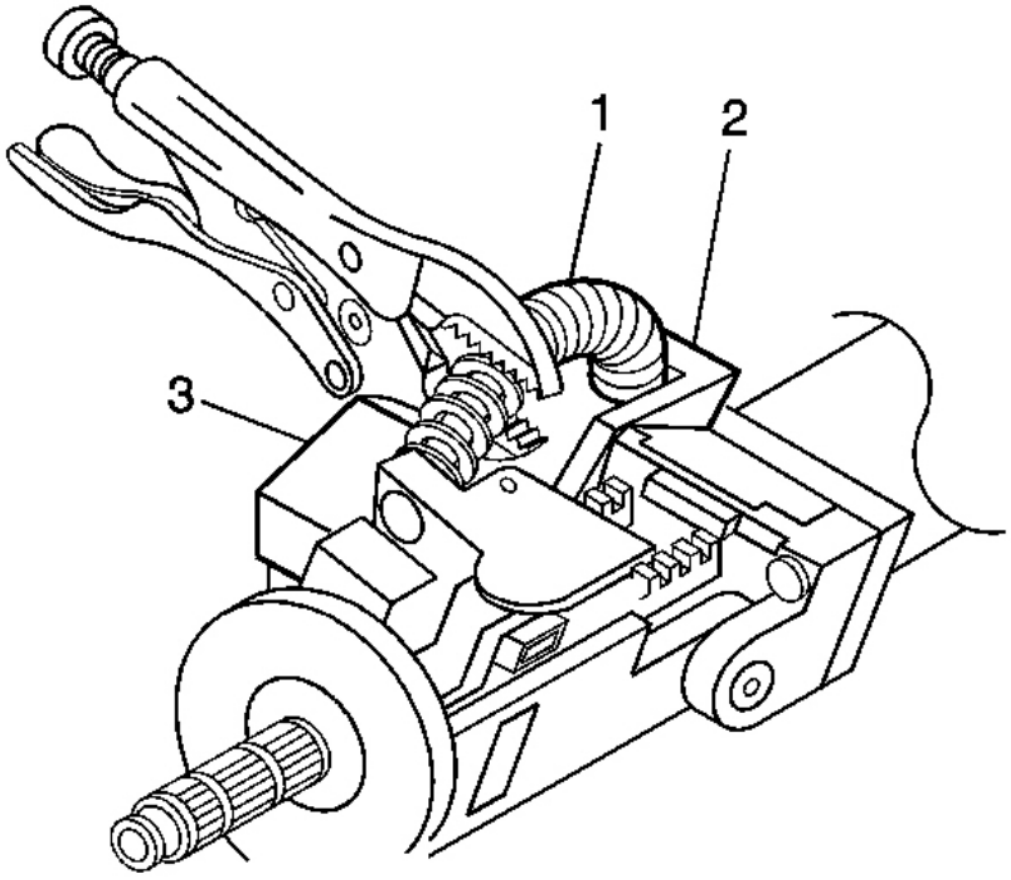


Fig. 37: View Of Steering Column, Tilt Head & Spring
Courtesy of GENERAL MOTORS CORP.

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

3. Install the tilt spring (1) onto the steering column (2) using the following procedure:
    1. Install the tilt spring (1) onto the post on the steering column tilt head (3).
    2. Install the tilt spring (1) onto the post on the steering column (2).

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3. Remove the locking pliers.

4. Install the steering column shroud. Refer to **Steering Column Shroud Replacement (Without Electronic Tilt Steering)** or **Steering Column Shroud Replacement (With Electronic Tilt Steering)**.
5. Install the knee bolster. Refer to **Knee Bolster Replacement (Except Cadillac)** or **Knee Bolster Replacement (Cadillac)** .

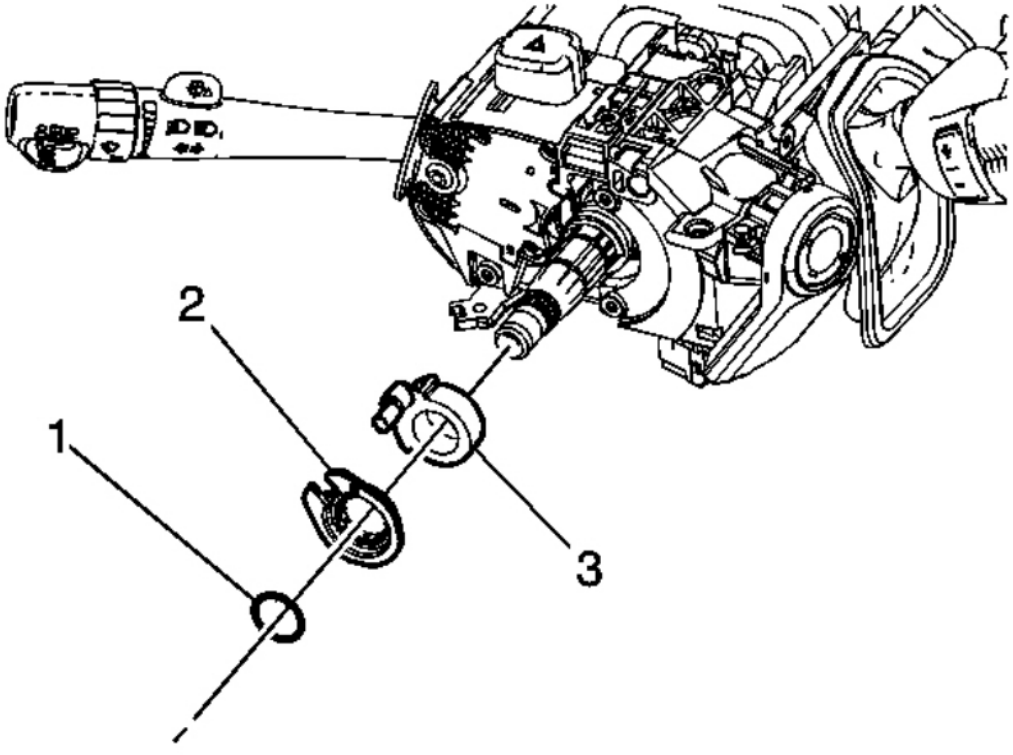
TURN SIGNAL SWITCH CANCEL CAM POSITION PLATE REPLACEMENT

Tools Required

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

Removal Procedure

1. Remove the inflatable restraint steering wheel module coil and the inflatable restraint steering wheel module coil wave washer. Refer to **Steering Wheel Inflatable Restraint Module Coil Replacement** .



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Fig. 38: View Of Steering Column Shaft Assembly Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DISCARD the old steering shaft lock plate ring.

2. Remove the following parts from the steering shaft:
   1. Steering shaft lock plate retaining ring (1) using compressor **J 23653-SIR** and adapter **J 42137** . See **Special Tools**.
   2. Turn signal switch cancel cam position plate (2)
   3. Turn signal switch cancel cam (3)

Installation Procedure

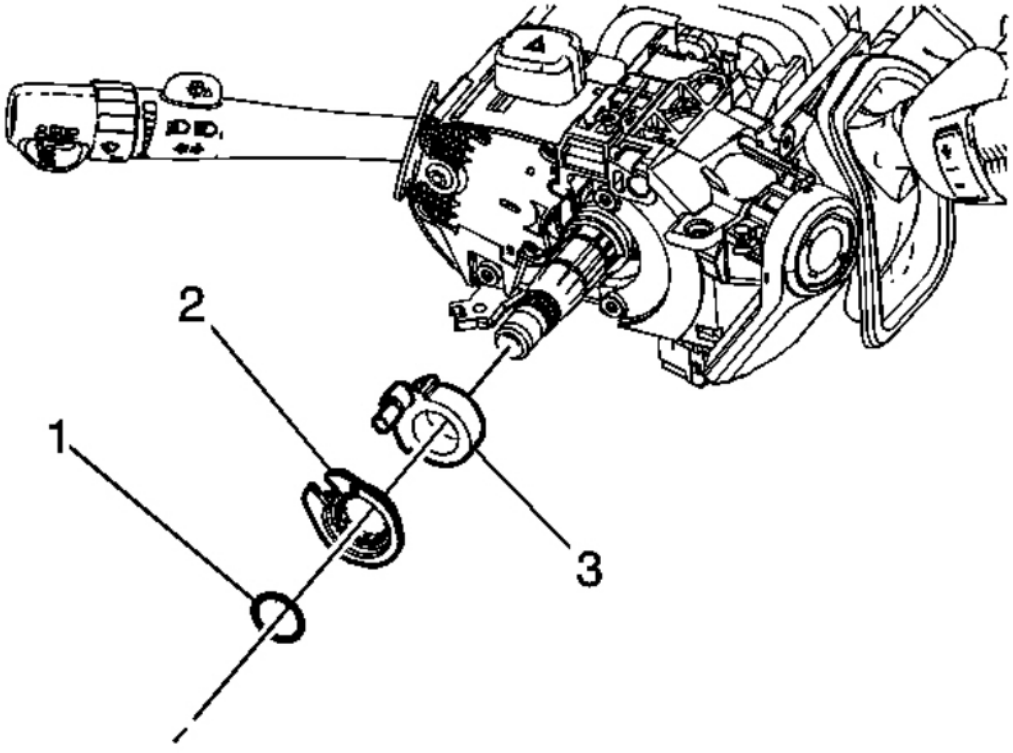


Fig. 39: View Of Steering Column Shaft Assembly Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use a NEW steering shaft lock plate retaining ring.

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1. Install the following parts onto the steering shaft:
    1. Lubricate the turn signal switch cancel cam (3) with GM P/N 12377900 (Canadian P/N 10953529).
    2. Turn signal switch cancel cam position plate (2)
    3. Steering shaft lock plate retaining ring (1) using compressor **J 23653-SIR** and adapter **J 42137** . See **Special Tools**.
2. Install the inflatable restraint steering wheel module coil and the inflatable restraint steering wheel module coil wave washer. Refer to **Steering Wheel Inflatable Restraint Module Coil Replacement** .

STEERING SHAFT UPPER BEARING REPLACEMENT

Special Tools

- **J 21854-01** Pivot Pin Remover. See **Special Tools**.
- **J 23653-SIR** Steering Column Lock Plate Compressor. See **Special Tools**.
- **J 42137** Cam Orientation Plate Adapter. See **Special Tools**.
- **J 42640** Steering Column Anti-Rotation Pin

Removal Procedure

WARNING: Refer to SIR Warning .

1. Remove the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**.
2. Remove the inflatable restraint steering wheel module coil. Refer to **Steering Wheel Inflatable Restraint Module Coil Replacement** .
3. Remove the turn signal multifunction switch. Refer to **Turn Signal Multifunction Switch Replacement**.
4. Remove the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement** .
5. Remove the tilt spring. Refer to **Steering Column Tilt Spring Replacement**.
6. Remove the automatic transmission control. Refer to **Transmission Control Replacement**.

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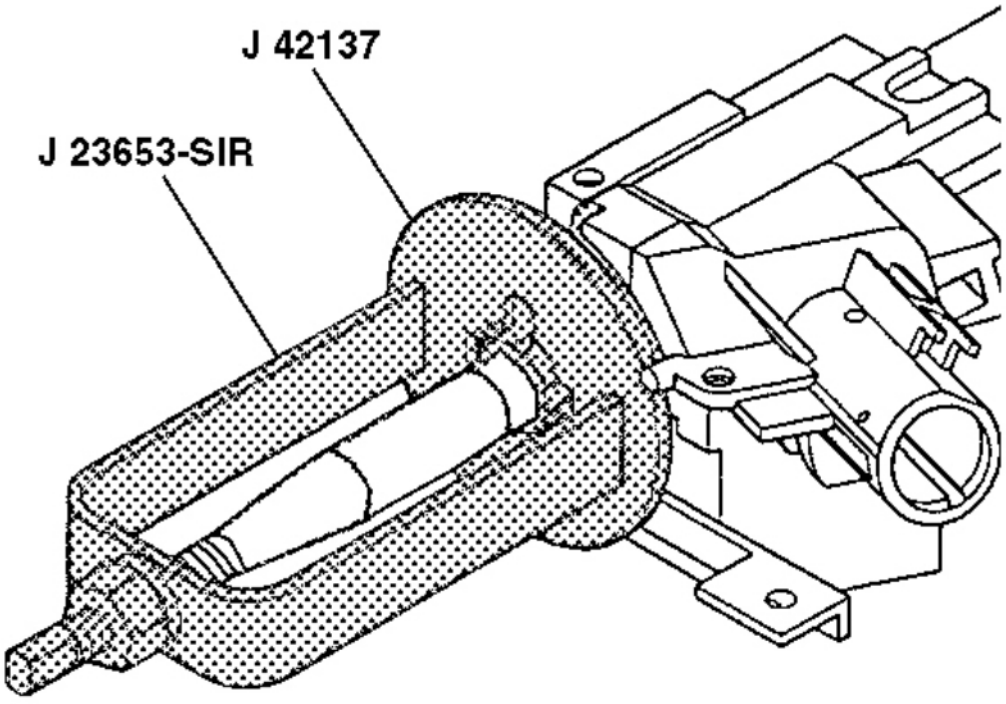


Fig. 40: Compressing Cam Orientation Plate Using J 23653-SIR & J 42137
Courtesy of GENERAL MOTORS CORP.

7. Using compressor **J 23653-SIR** and adapter **J 42137** , remove and discard the steering shaft lock plate retaining ring. See **Special Tools**.

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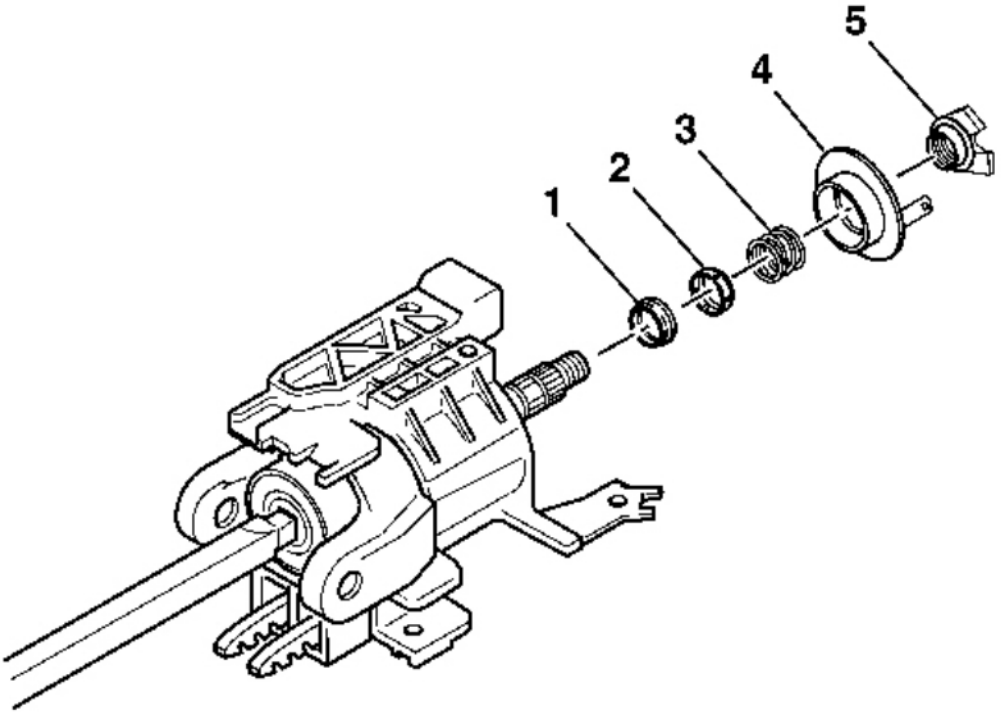


Fig. 41: Identifying Steering Column Shaft Assembly Components
Courtesy of GENERAL MOTORS CORP.

8. Remove the following parts from the steering column shaft assembly:
    1. The turn signal switch cancel cam position plate (5)
    2. The turn signal switch cancel cam (4)
    3. The steering shaft upper bearing spring (3)
    4. The steering shaft upper bearing inner race seat (2)
    5. The steering shaft upper bearing inner race (1)

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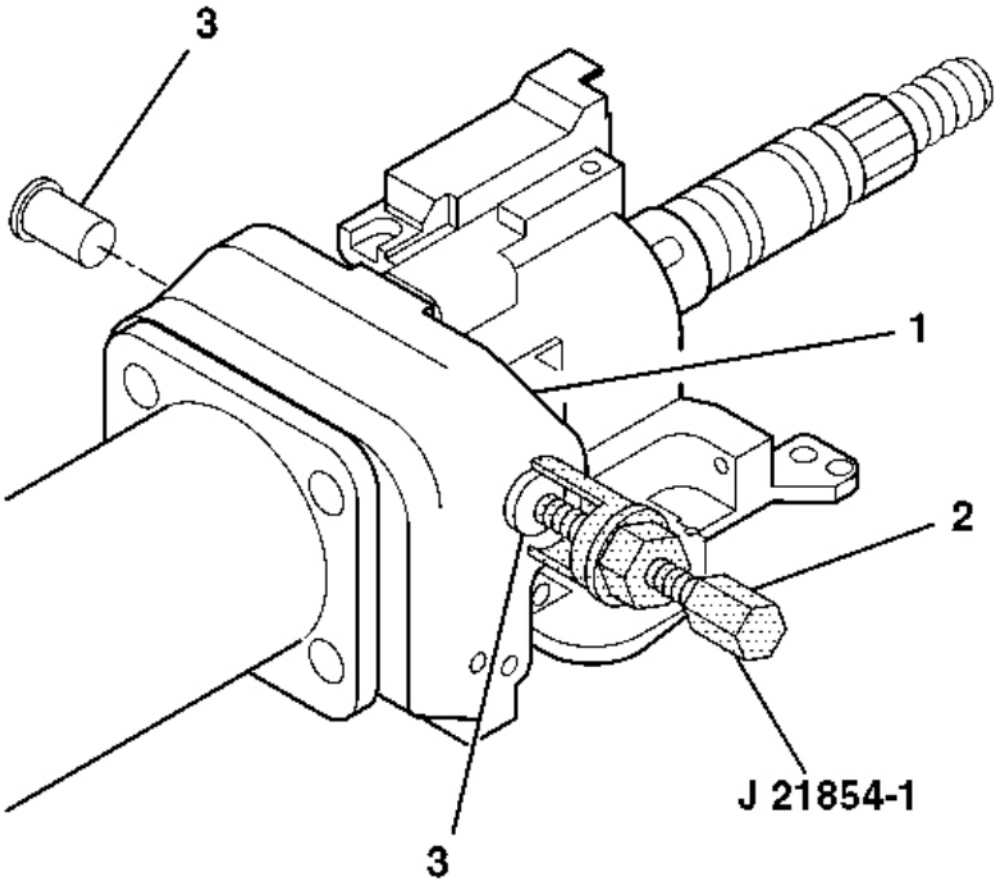


Fig. 42: View Of Pivot Pins To Steering Column Tilt Head Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the 2 pivot pins (3) from the steering column tilt head assembly (1) by using remover **J 21854-01** (2). See **Special Tools**.

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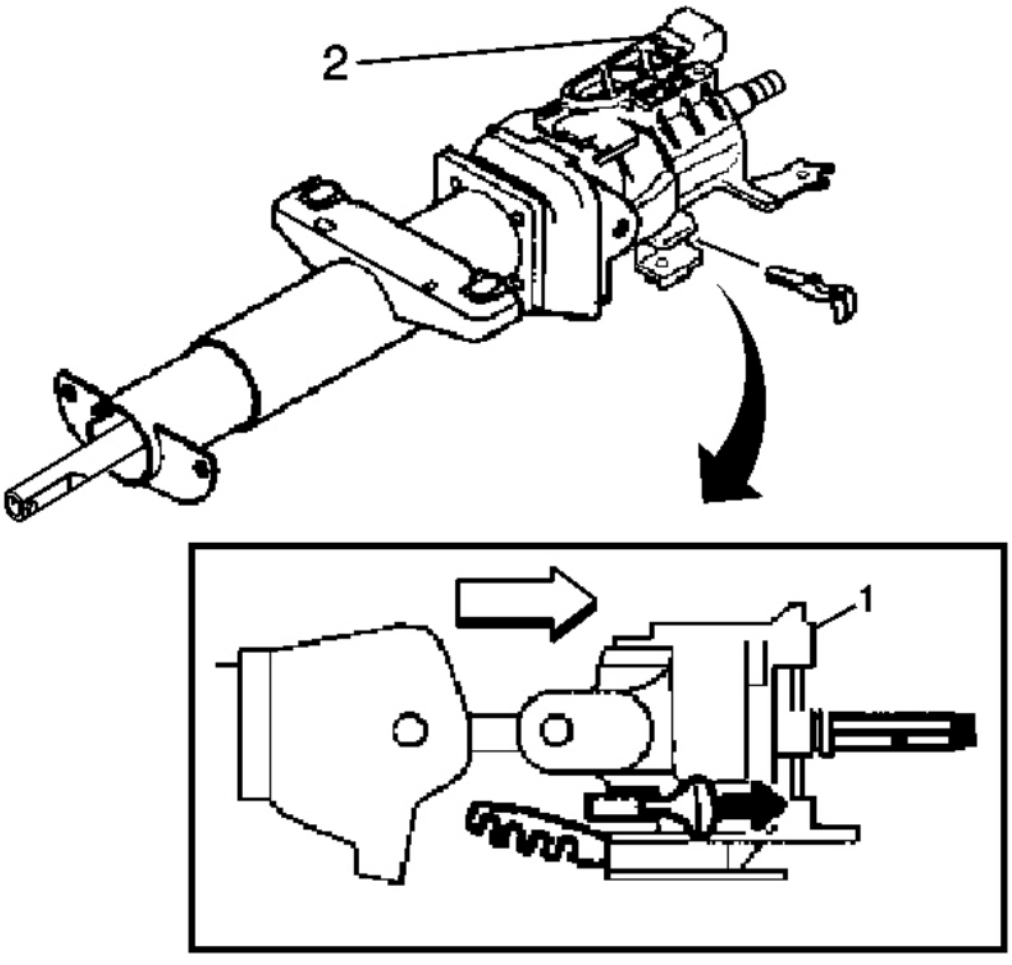


Fig. 43: View Of Steering Column Tilt Head Assembly & Steering Column
Courtesy of GENERAL MOTORS CORP.

10. Install the tilt lever into the steering column tilt head assembly (1).
11. 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.
12. Remove the steering column tilt head assembly.
13. Remove anti-rotation pin **J 42640** .
14. Remove the tilt lever.

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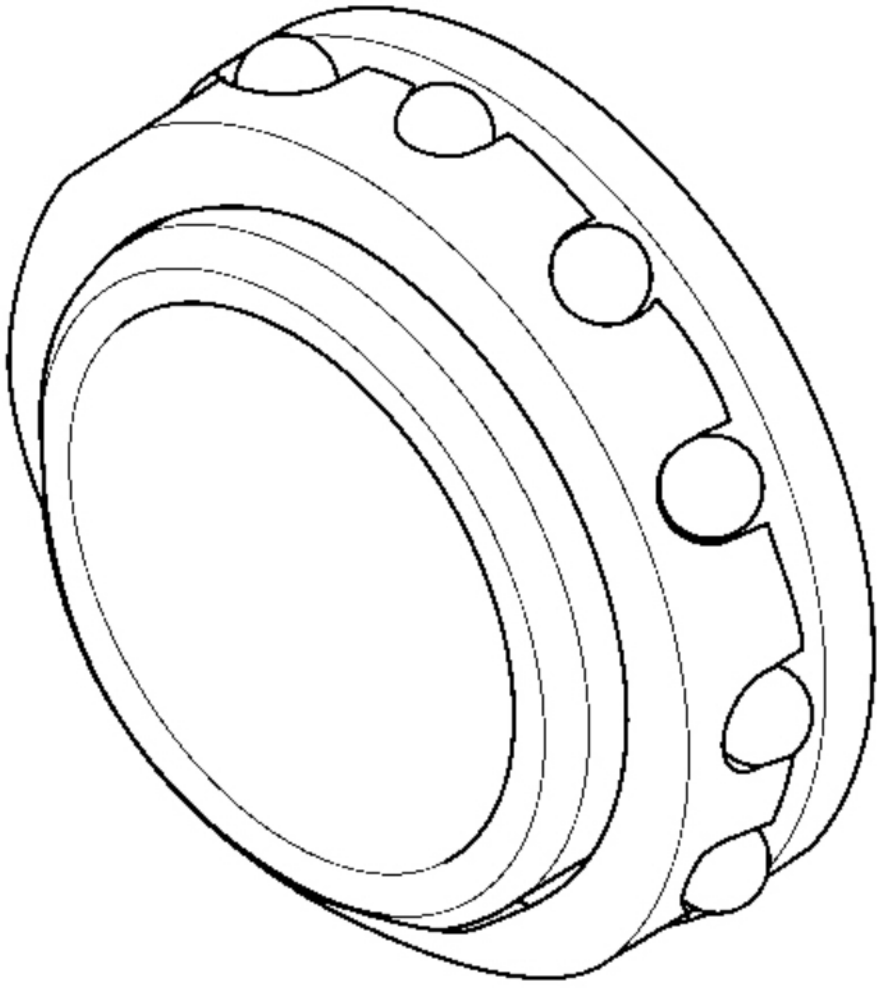


Fig. 44: View Of Upper Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

15. Remove the steering shaft upper bearing from the steering column tilt head assembly.

Installation Procedure

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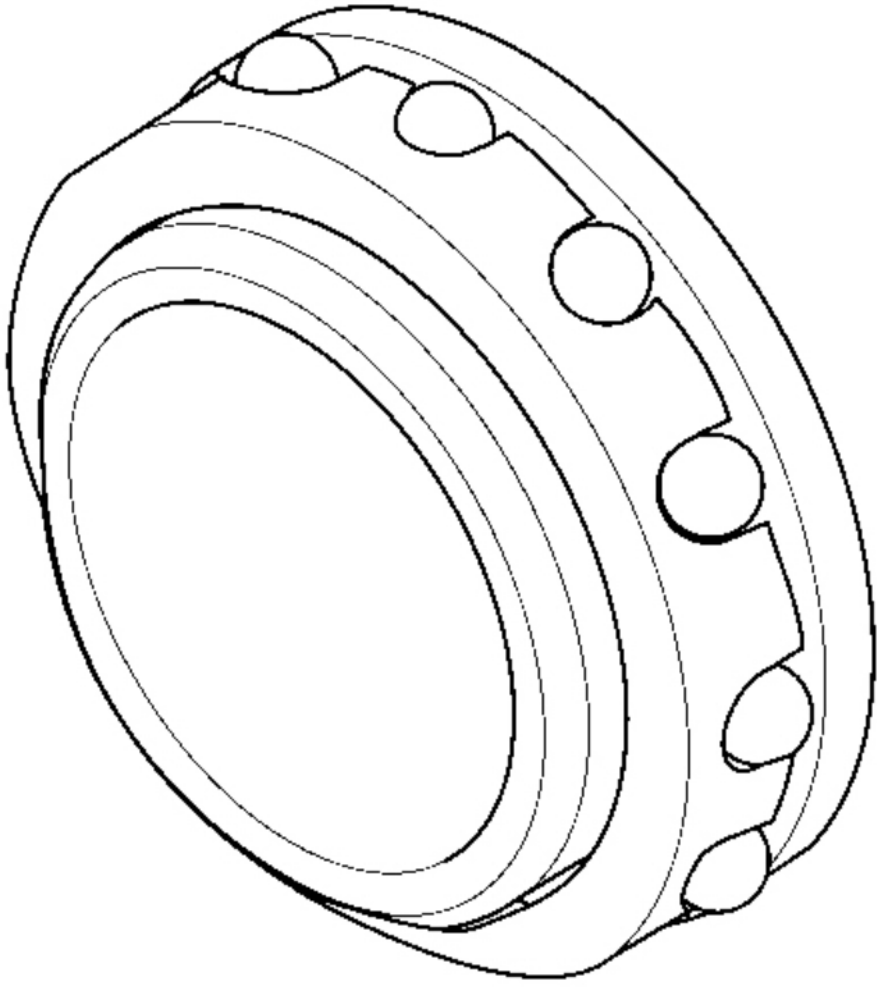


Fig. 45: View Of Upper Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the steering shaft upper bearing to the steering column tilt head assembly.

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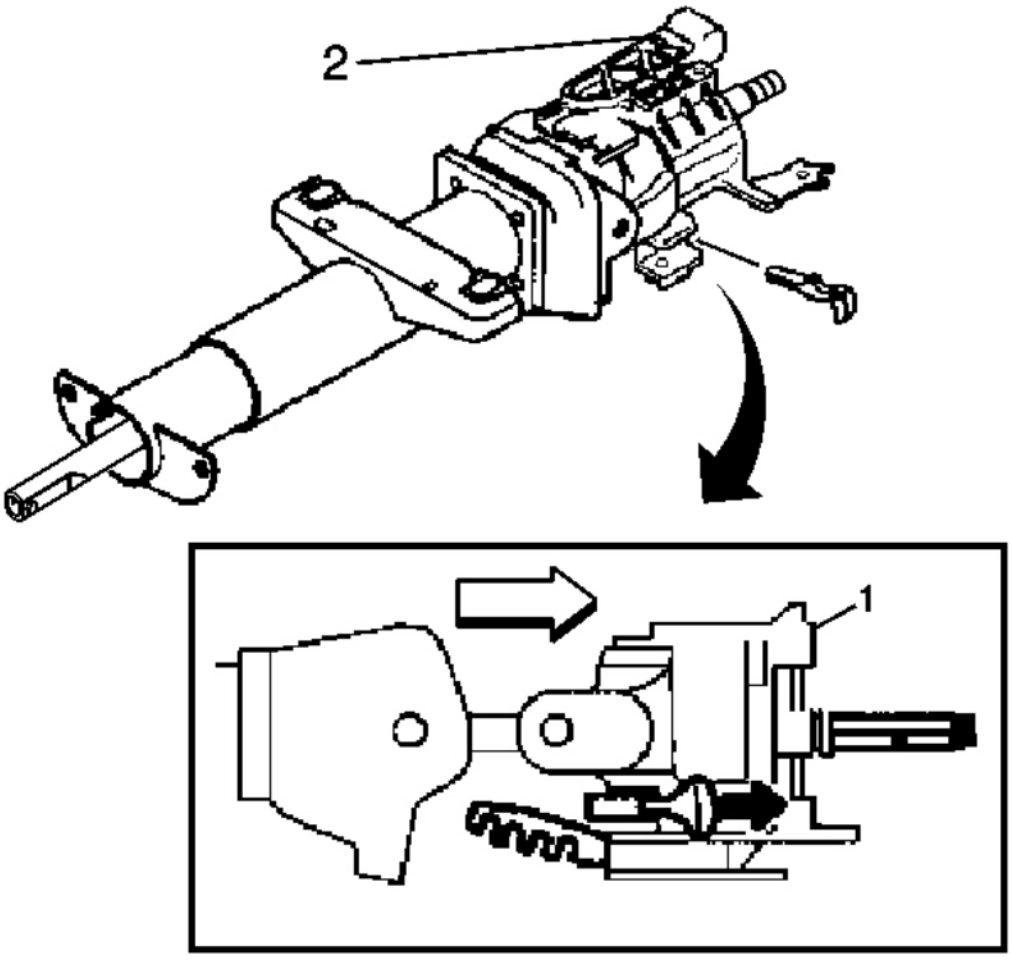


Fig. 46: View Of Steering Column Tilt Head Assembly & Steering Column
Courtesy of GENERAL MOTORS CORP.

2. Install the steering column shaft assembly.
3. Maneuver and push the steering column tilt head assembly (1) towards the steering column in order to lock the steering wheel lock shoes in place.

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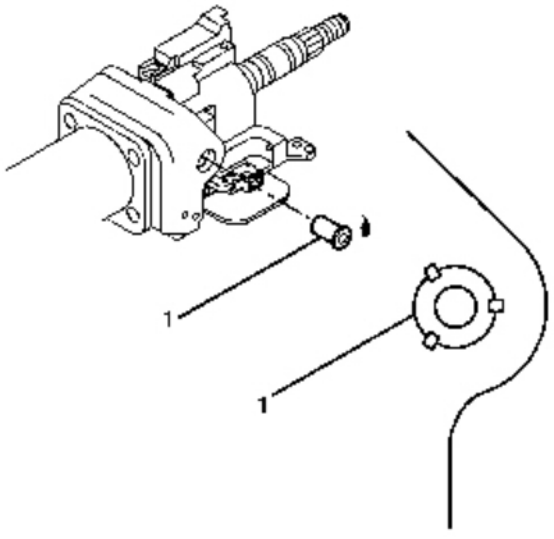


Fig. 47: View Of Pivot Pins At Steering Column Assembly
Courtesy of GENERAL MOTORS CORP.

4. Lubricate the pivot pins (1) with GM P/N 12346293 (Canadian P/N 992723).
5. Firmly seat each pivot pin (1) into the steering column tilt head assembly.
6. Stake the steering column in 3 locations around each pivot pin.
7. Install anti-rotation pin **J 42640** .

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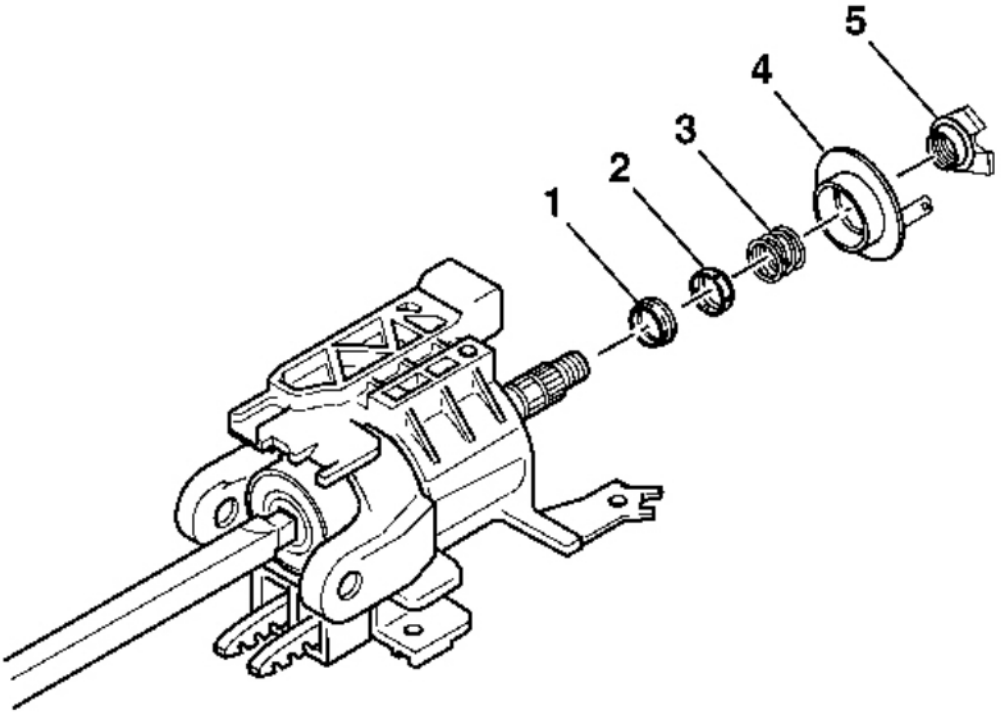


Fig. 48: Identifying Steering Column Shaft Assembly Components
Courtesy of GENERAL MOTORS CORP.

8. Install the following parts onto the steering column shaft assembly:
    1. Lubricate the steering shaft upper bearing inner race (1) with GM P/N 12345718 (Canadian P/N 10953516).
    2. The steering shaft upper bearing inner race (1)
    3. The steering shaft upper bearing inner race seat (2)
    4. The steering shaft upper bearing spring (3)
    5. Lubricate the turn signal switch cancel cam (4) with GM P/N 12377900 (Canadian P/N 10953529).
    6. The turn signal switch cancel cam (4)
    7. The turn signal switch cancel cam position plate (5)

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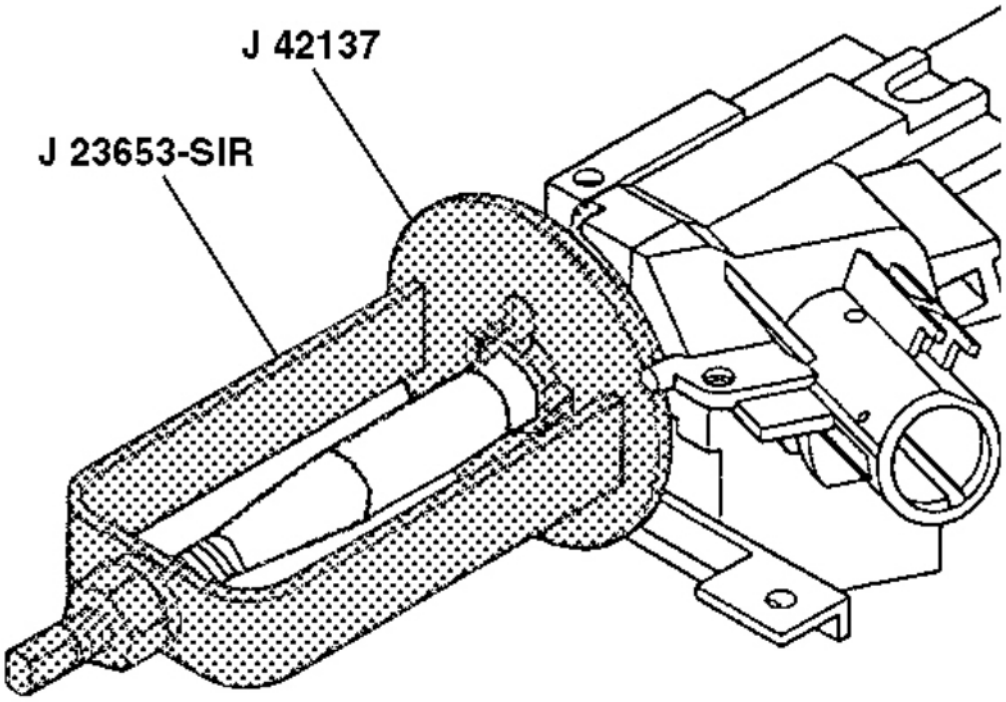


Fig. 49: Compressing Cam Orientation Plate Using J 23653-SIR & J 42137
Courtesy of GENERAL MOTORS CORP.

9. Install the new steering shaft lock plate retaining ring onto the steering shaft using compressor **J 23653-SIR** and adapter **J 42137** . See **Special Tools**.
10. Install the automatic transmission control assembly. Refer to **Transmission Control Replacement**.
11. Install the tilt spring. Refer to **Steering Column Tilt Spring Replacement**.
12. Install the ignition lock cylinder case. Refer to **Ignition Lock Cylinder Case Replacement** .
13. Install the turn signal multifunction switch. Refer to **Turn Signal Multifunction Switch Replacement**.
14. Install the inflatable restraint steering wheel module coil. Refer to **Steering Wheel Inflatable Restraint Module Coil Replacement** .
15. Install the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**.

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STEERING COLUMN REPLACEMENT (HP2)

Special Tools

J 42640 Steering Column Anti-Rotation Pin

Removal Procedure

WARNING: Refer to SIR Warning .

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

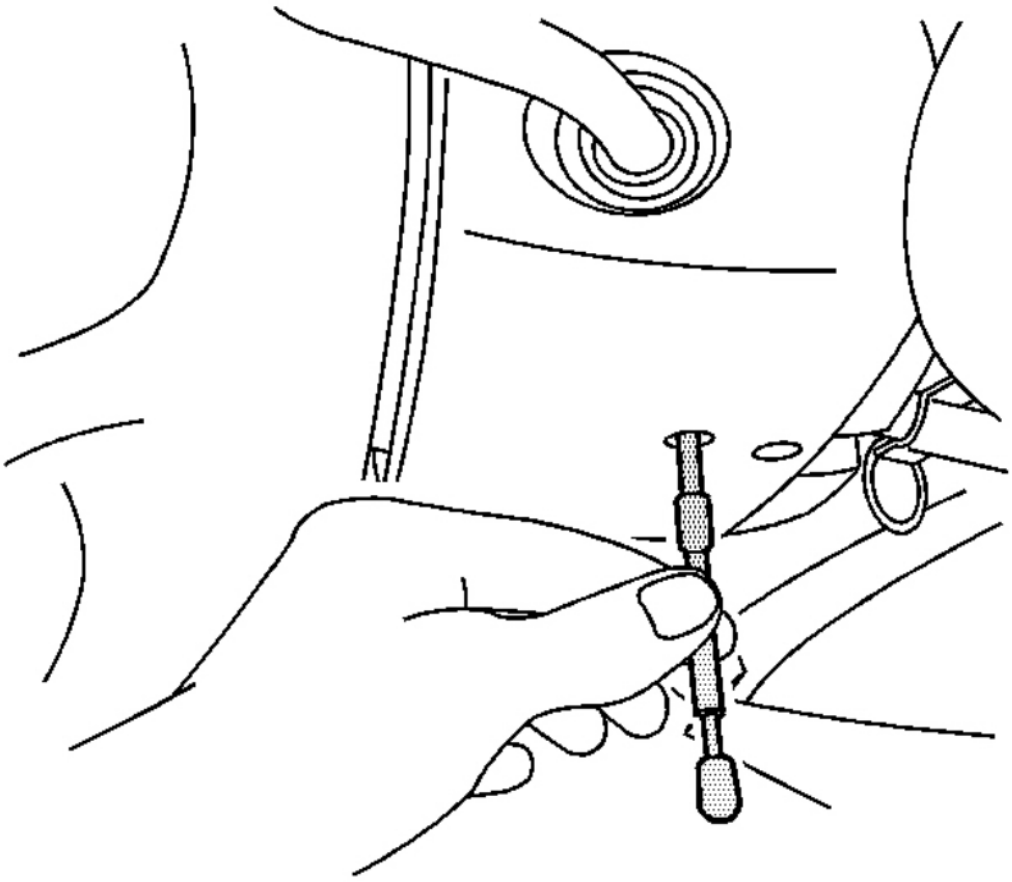


Fig. 50: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

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

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

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

2. Lock the steering column through the access hole in the steering column shroud using anti-rotation pin **J 42640** .
3. Remove the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
4. Disconnect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
5. Disconnect the upper intermediate steering shaft from the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Disconnect the steering column electrical connectors as needed.

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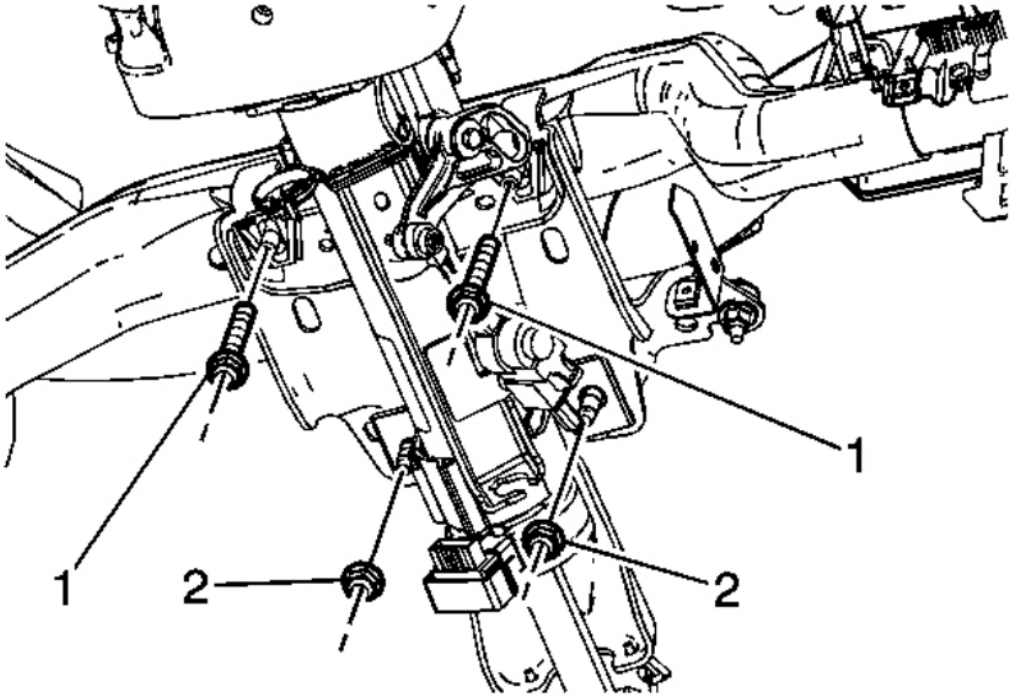


Fig. 51: Identifying Steering Column Bolts, Steering Column Nuts & Steering Column Brackets
Courtesy of GENERAL MOTORS CORP.

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

7. Remove the 2 steering column bolts (1) and 2 steering column nuts (2) from the steering column brackets.

NOTE: Mark the location of the 2 washers at the lower steering column bracket. These washers must be reinstalled in the same location.

8. Remove the steering column and the 2 washers from the vehicle.

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9. If replacing the steering column transfer all components as needed.

Installation Procedure

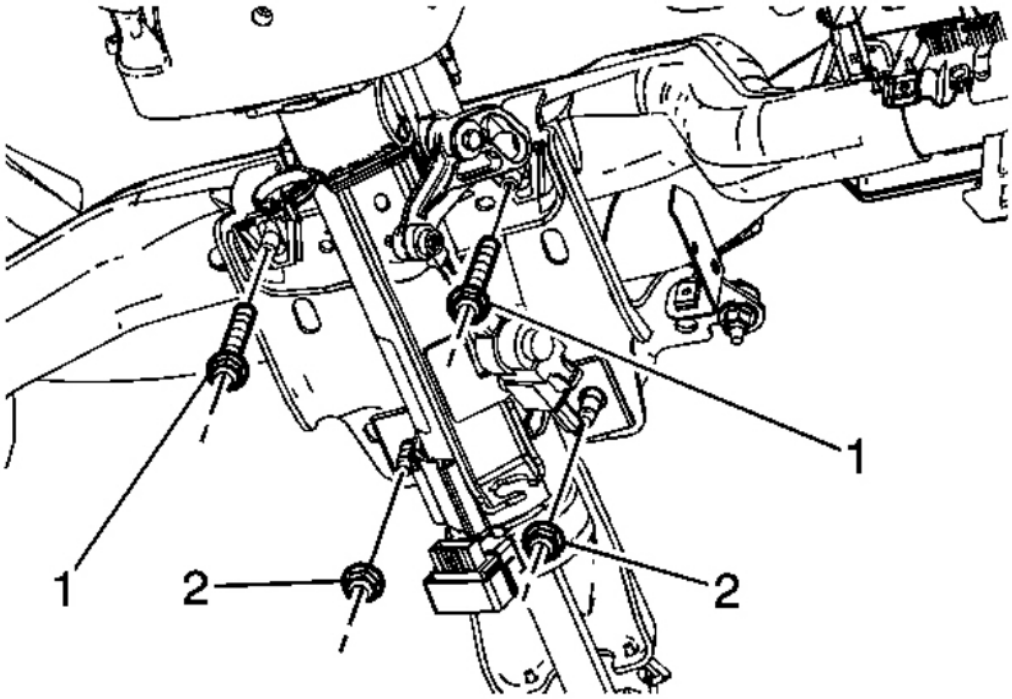


Fig. 52: Identifying Steering Column Bolts, Steering Column Nuts & Steering Column Brackets
Courtesy of GENERAL MOTORS CORP.

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

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

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driver, perform the following:

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

NOTE: Install the two washers in the same location at the lower steering column bracket as marked in the previous step.

1. Install the steering column and 2 washers to the vehicle.

CAUTION: Refer to Fastener Caution .

2. Install the 2 steering column bolts (1) and 2 steering column nuts (1) using the procedure shown above and tighten to 27 N.m (20 lb ft).
3. Connect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
4. Install the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
5. Connect the upper intermediate steering shaft to the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Connect the steering column electrical connectors.
7. Enable the SIR system. Refer to **SIR Disabling and Enabling** .

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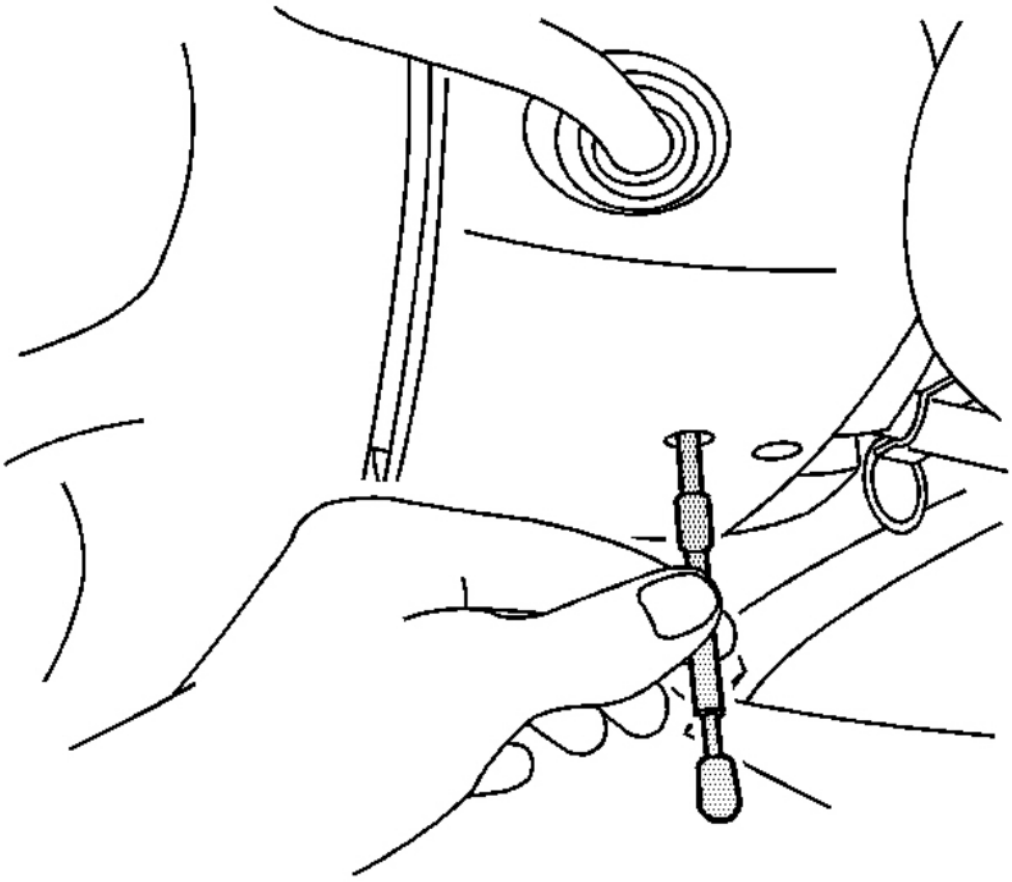


Fig. 53: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

8. Remove anti-rotation pin **J 42640** from the steering column.
9. If replacing the steering column, the power tilt steering column calibration must be performed. Refer to **Power Tilt Steering Column Calibration**.

STEERING COLUMN REPLACEMENT (WITHOUT HP2)

Special Tools

J 42640 Steering Column Anti-Rotation Pin

Removal Procedure

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WARNING: **Refer to SIR Warning .**

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

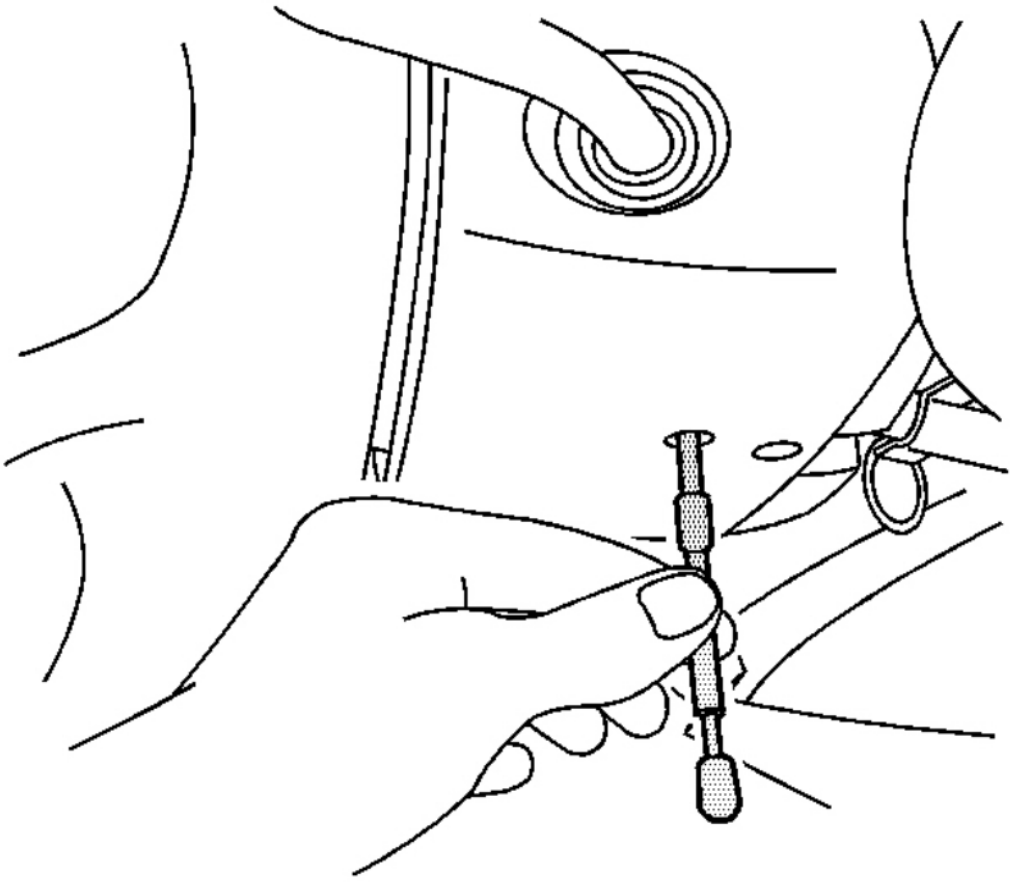


Fig. 54: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

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

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

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

2. Lock the steering column through the access hole in the steering column shroud using anti-rotation pin **J 42640** .
3. Remove the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
4. Disconnect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
5. Disconnect the upper intermediate steering shaft from the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Disconnect the steering column electrical connectors as needed.

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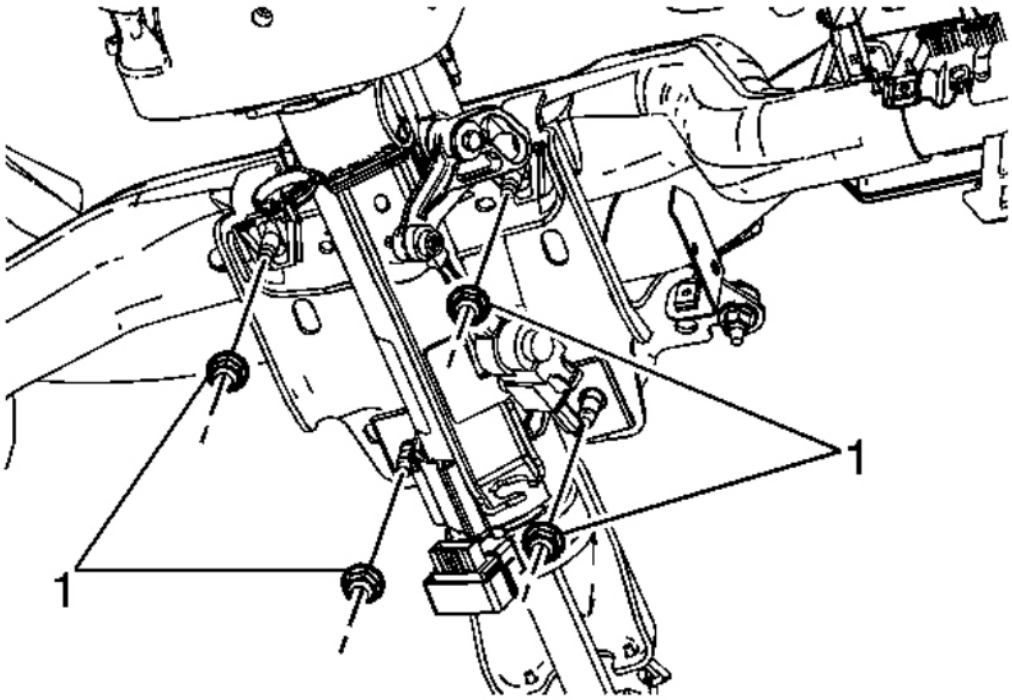


Fig. 55: View Of Steering Column Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

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

7. Remove the 4 steering column nuts (1) from the steering column brackets.

NOTE: Mark the location of the 2 washers at the lower steering column bracket. These washers must be reinstalled in the same location.

8. Remove the steering column and the 2 washers from the vehicle.

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9. If replacing the steering column transfer all components as needed.

Installation Procedure

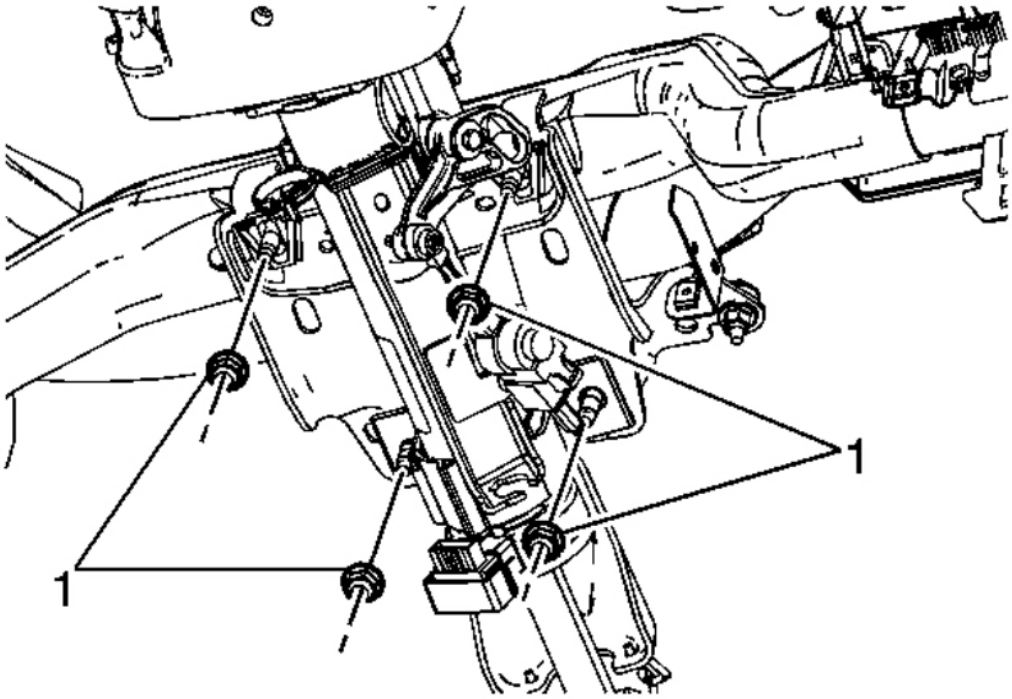


Fig. 56: View Of Steering Column Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

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

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

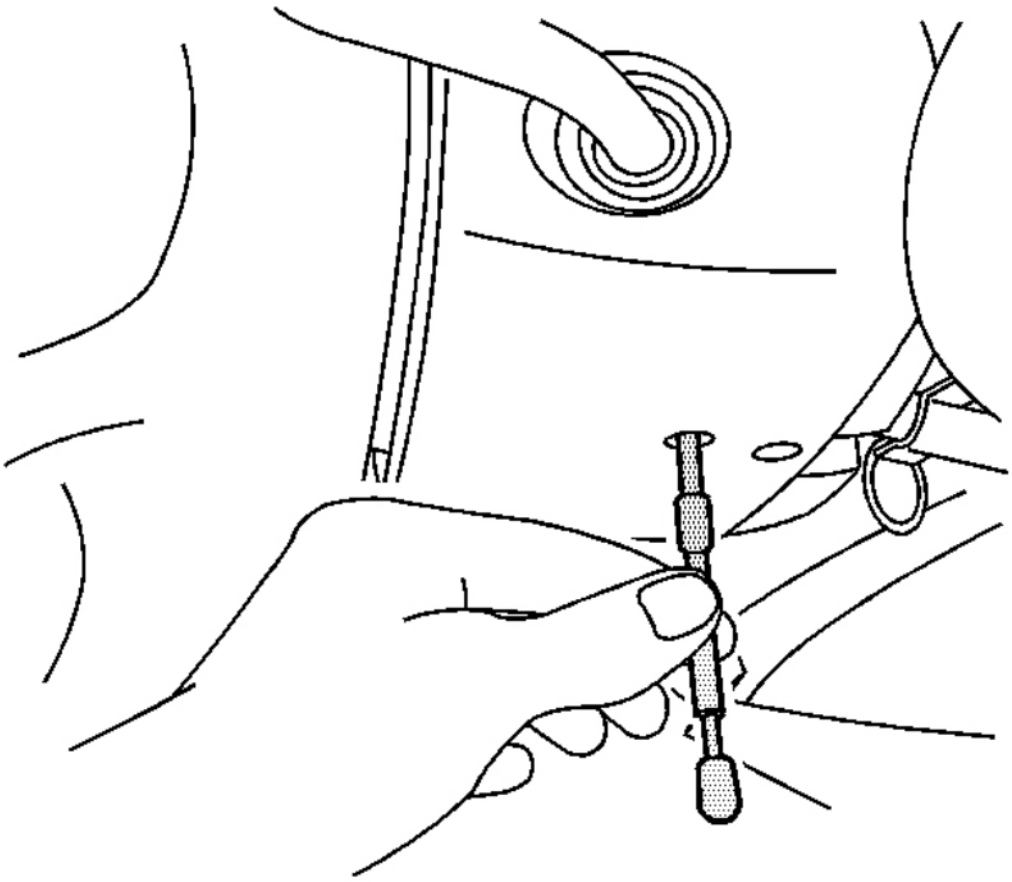
NOTE: Install the two washers in the same location at the lower steering column bracket as marked in the previous step.

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1. Install the steering column and 2 washers to the vehicle.

CAUTION: Refer to Fastener Caution .

2. Install the 4 steering column nuts (1) using the procedure shown above and tighten to 27 N.m (20 lb ft).
3. Connect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
4. Install the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
5. Connect the upper intermediate steering shaft to the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Connect the steering column electrical connectors.



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Fig. 57: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

7. Remove anti-rotation pin **J 42640** from the steering column.
8. Enable the SIR system. Refer to **SIR Disabling and Enabling** .

STEERING COLUMN REPLACEMENT (WITHOUT HP2 WITH ELECTRIC TILT COLUMN)

Special Tools

J 42640 Steering Column Anti-Rotation Pin

Removal Procedure

WARNING: Refer to SIR Warning .

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

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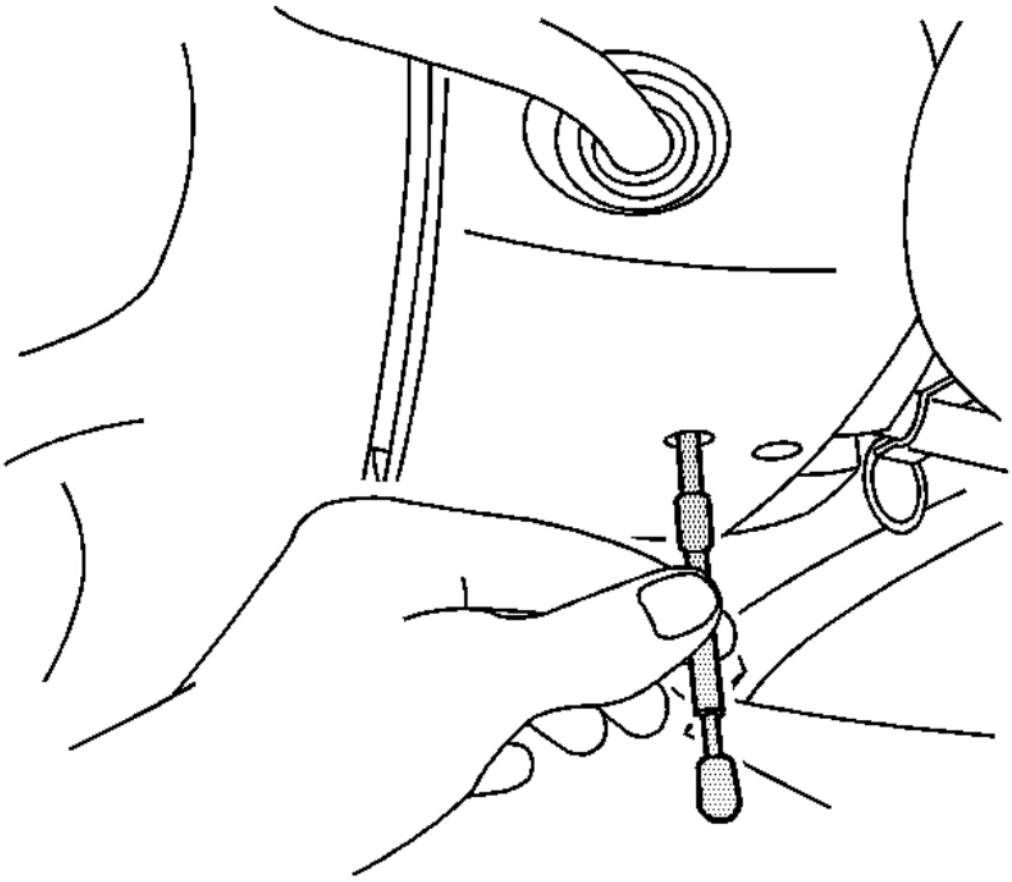


Fig. 58: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

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

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

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

2. Lock the steering column through the access hole in the steering column shroud using anti-rotation pin **J 42640** .
3. Remove the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
4. Disconnect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
5. Disconnect the upper intermediate steering shaft from the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Disconnect the steering column electrical connectors as needed.

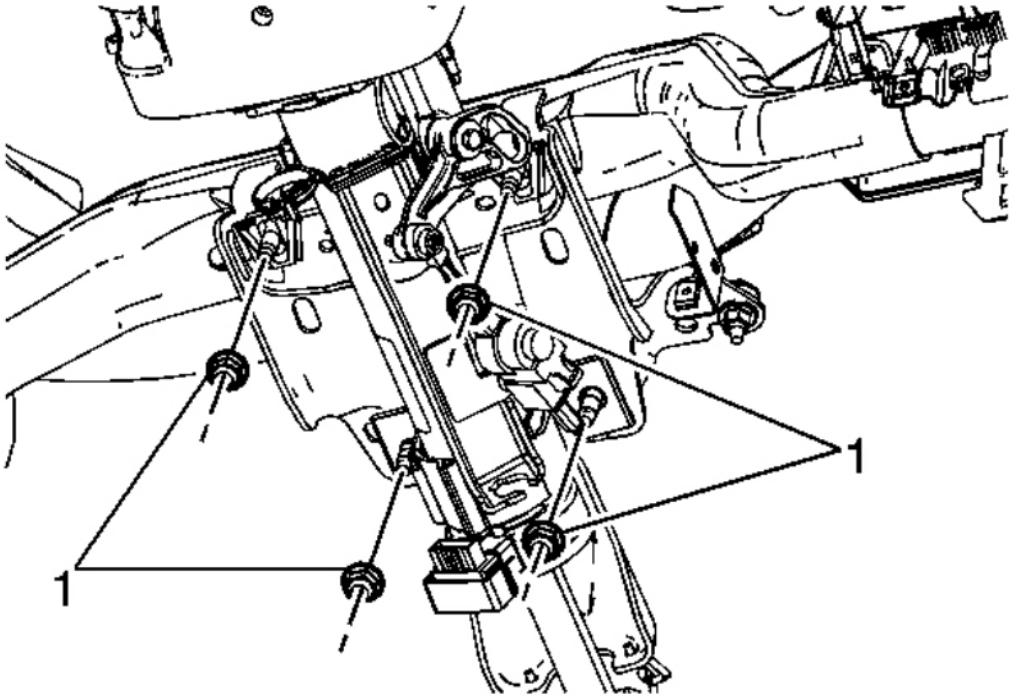


Fig. 59: View Of Steering Column Bracket Nuts

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Courtesy of GENERAL MOTORS CORP.

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

7. Remove the 4 steering column nuts (1) from the steering column brackets.

NOTE: Mark the location of the 2 washers at the lower steering column bracket. These washers must be reinstalled in the same location.

8. Remove the steering column and the 2 washers from the vehicle.
9. If replacing the steering column transfer all components as needed.

Installation Procedure

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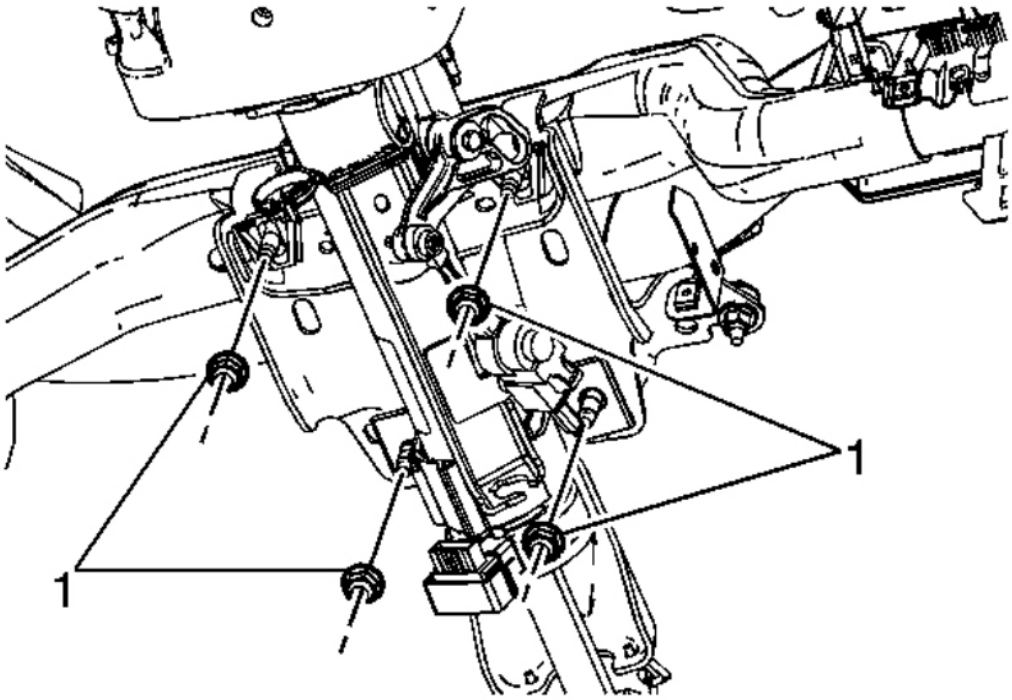


Fig. 60: View Of Steering Column Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

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

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

NOTE: Install the two washers in the same location at the lower steering column bracket as marked in the previous step.

1. Install the steering column and 2 washers to the vehicle.

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CAUTION: Refer to Fastener Caution .

2. Install the 4 steering column nuts (1) using the procedure shown above and tighten to 27 N.m (20 lb ft).
3. Connect the automatic transmission shift lock actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .
4. Install the instrument panel driver knee bolster deflector. Refer to **Instrument Panel Driver Knee Bolster Deflector Replacement** .
5. Connect the upper intermediate steering shaft to the steering column. Refer to **Upper Intermediate Steering Shaft Replacement**.
6. Connect the steering column electrical connectors.
7. Enable the SIR system. Refer to **SIR Disabling and Enabling** .

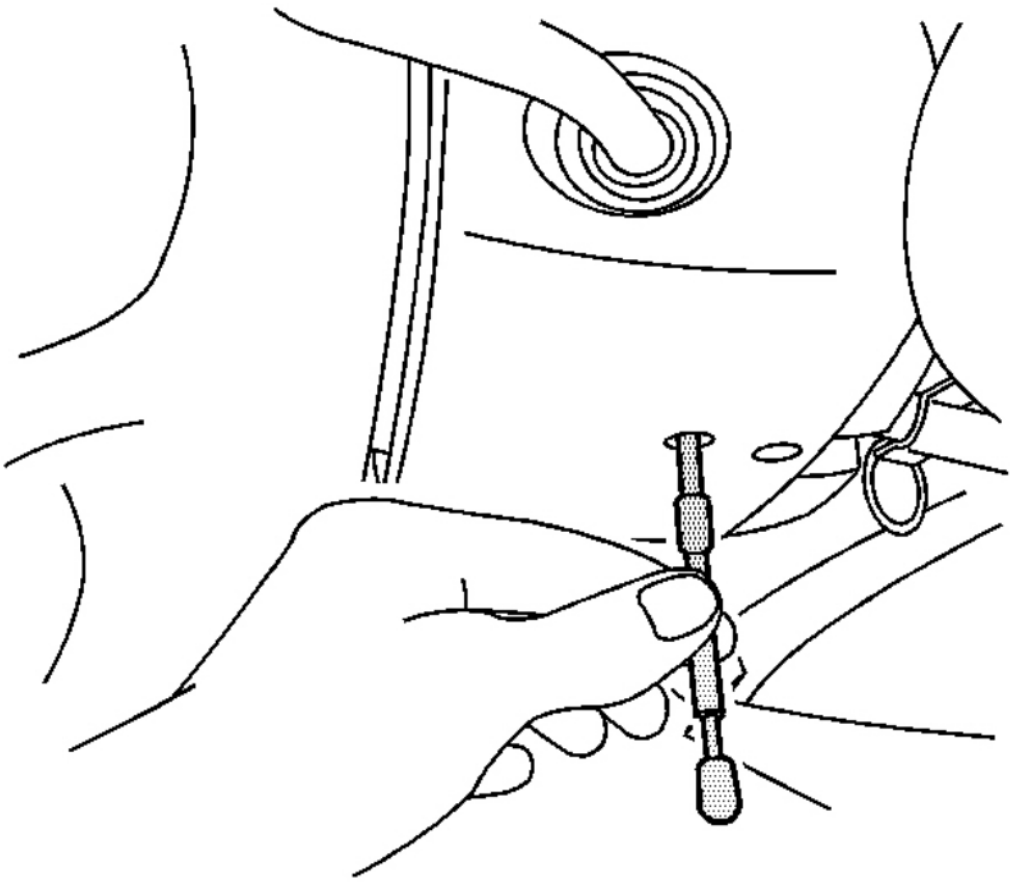


Fig. 61: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

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8. Remove anti-rotation pin **J 42640** from the steering column.
9. Calibrate the power tilt steering column. Refer to **Power Tilt Steering Column Calibration**.

STEERING COLUMN SEAL REPLACEMENT

Removal Procedure

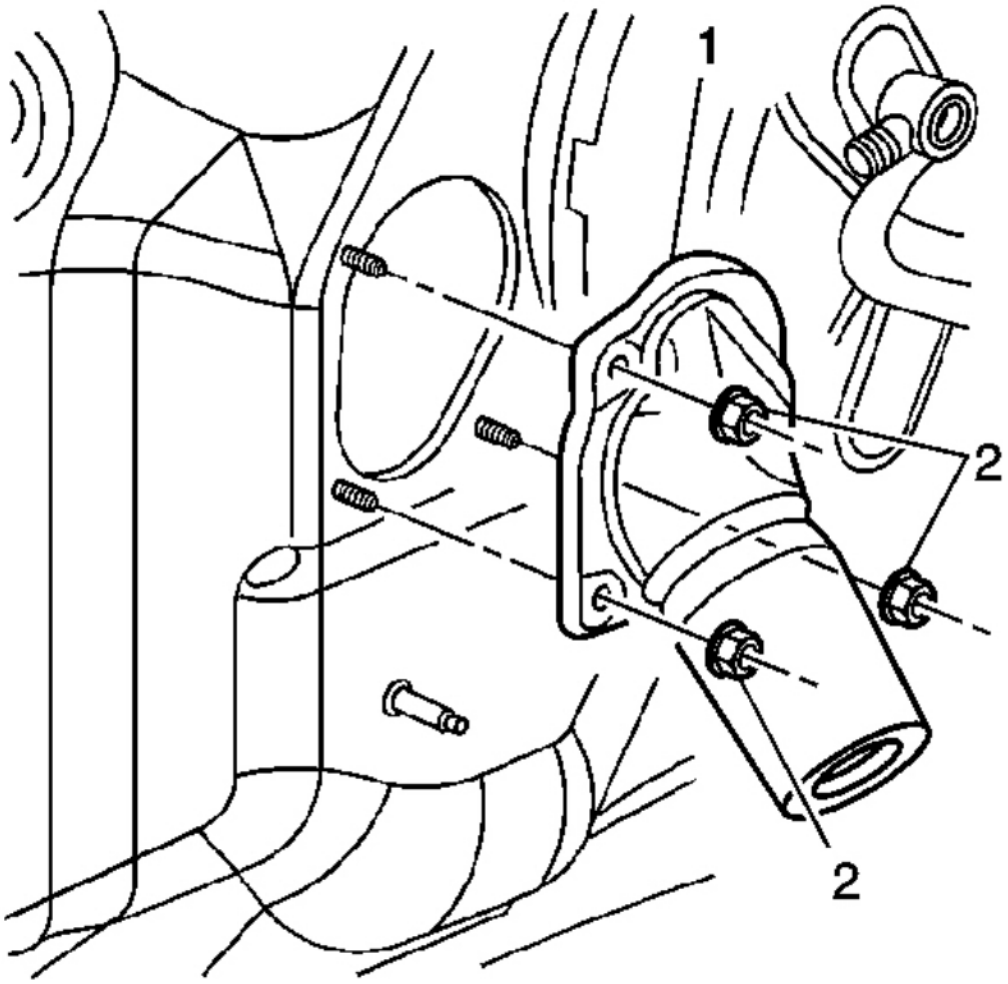


Fig. 62: View Of Steering Column Seal & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the steering shaft coupling from the upper intermediate steering shaft. Refer to **Steering Shaft Coupling Replacement**.

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2. Remove the 3 steering column seal nuts (2).
3. Remove the steering column seal (1) from the vehicle.

Installation Procedure

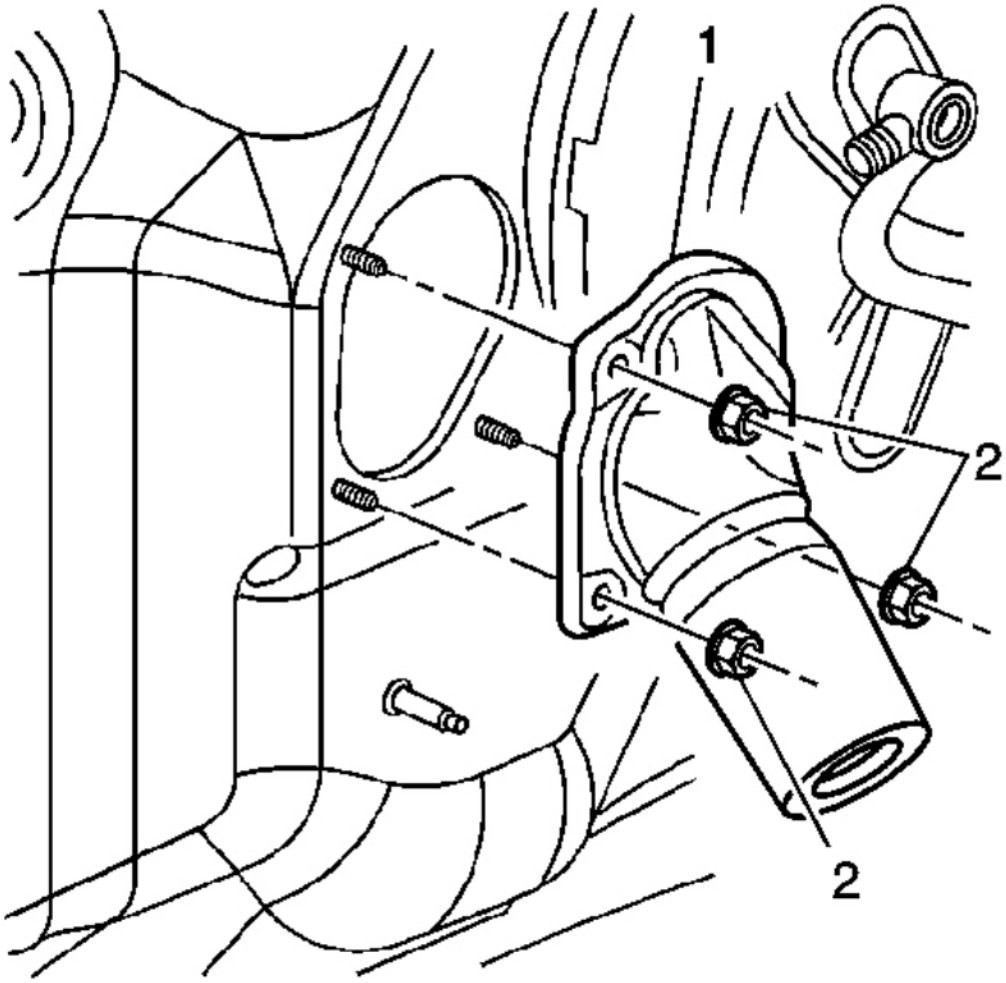


Fig. 63: View Of Steering Column Seal & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the steering column seal (1) to the vehicle.

CAUTION: Refer to Fastener Caution .

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2. Install the 3 steering column seal nuts (2) and tighten to 3 N.m (27 lb in).
3. Connect the steering shaft coupling to the upper intermediate steering shaft. Refer to **Steering Shaft Coupling Replacement**.

STEERING SHAFT LOWER BEARING REPLACEMENT

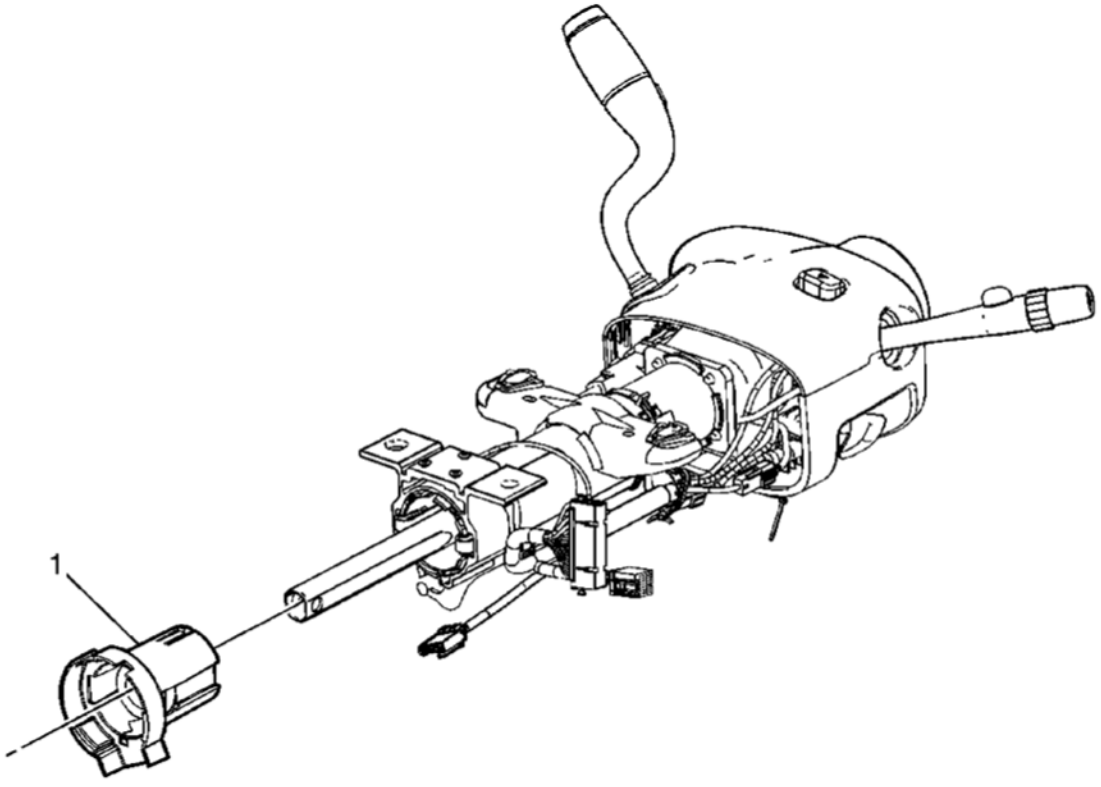


Fig. 64: View Of Steering Column Bracket, Bolt, Electrical Connector & Bearing Adaptor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the steering wheel position sensor. Refer to **Steering Wheel Position Sensor Replacement**.	
1	Steering Shaft Lower Bearing **Procedure:** Release the plastic retaining tabs and slide the steering shaft lower bearing out of the steering column.

STEERING WHEEL POSITION SENSOR REPLACEMENT

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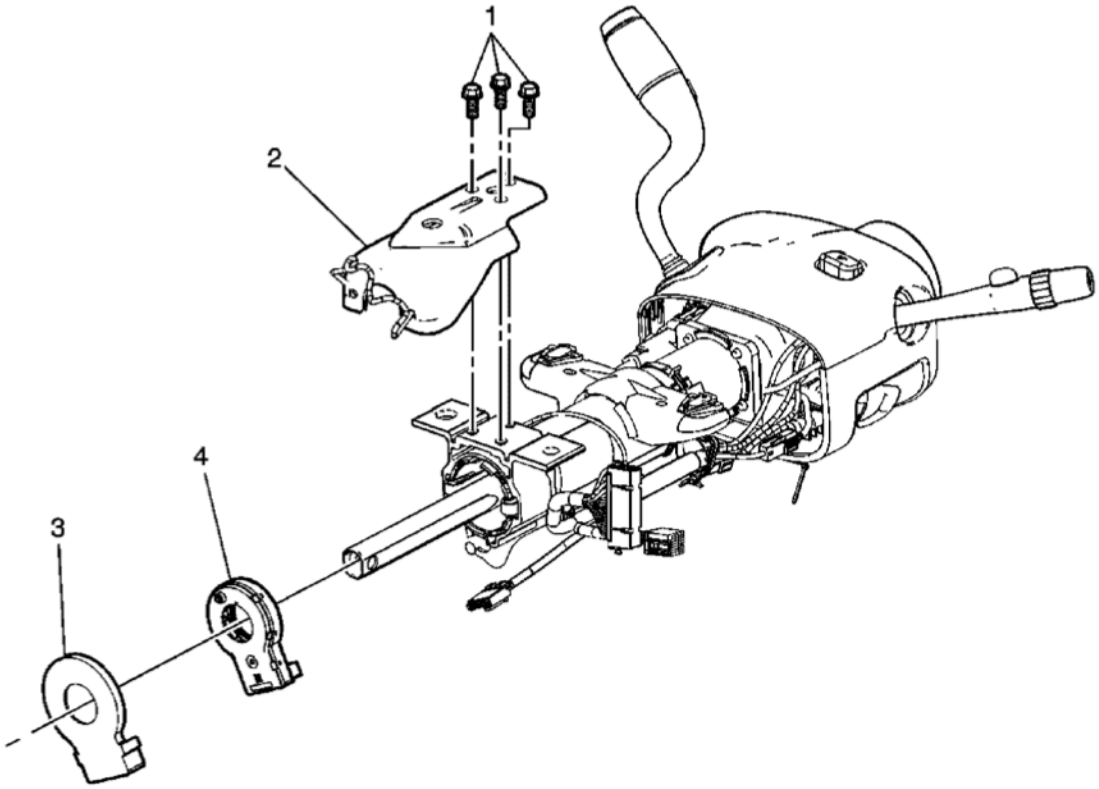


Fig. 65: View Of Steering Column Bracket, Bolts, Electrical Connector, Position Sensor & Position Sensor Clip
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the steering column. Refer to **Steering Column Replacement (HP2)** or **Steering Column Replacement (Without HP2)** or **Steering Column Replacement (Without HP2 With Electric Tilt Column)**.	
1	Steering Column Bracket Screw (Qty: 3) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 6 N.m (53 lb in)
2	Steering Column Bracket
3	Steering Wheel Position Sensor Retaining Clip
	Steering Wheel Position Sensor **Procedure:** Disconnect any electrical connectors as needed. **Tip:**

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4	• When reusing a steering wheel position sensor, you must install a pin into the sensor before removal or the sensor will lose its centered position and must be discarded. The pin diameter must be in the range of 1-2 mm. • A new steering wheel position sensor will come with a pin installed in the sensor. The steering wheel position sensor will already come centered, DO NOT remove the pin until the steering wheel position sensor is properly seated. • During installation the steering wheel position sensor must be set with approximately 3 mm gap between it and the bearing adapter.

STEERING WHEEL POSITION SENSOR CENTERING

Removal Procedure

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

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

After disconnecting these components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to the SIR coil. If you think the SIR coil has became un-centered, refer to your applicable INFLATABLE RESTRAINT STEERING WHEEL MODULE COIL CENTERING procedure to re-center SIR Coil.

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

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

2. Verify the type of steering wheel position sensor.

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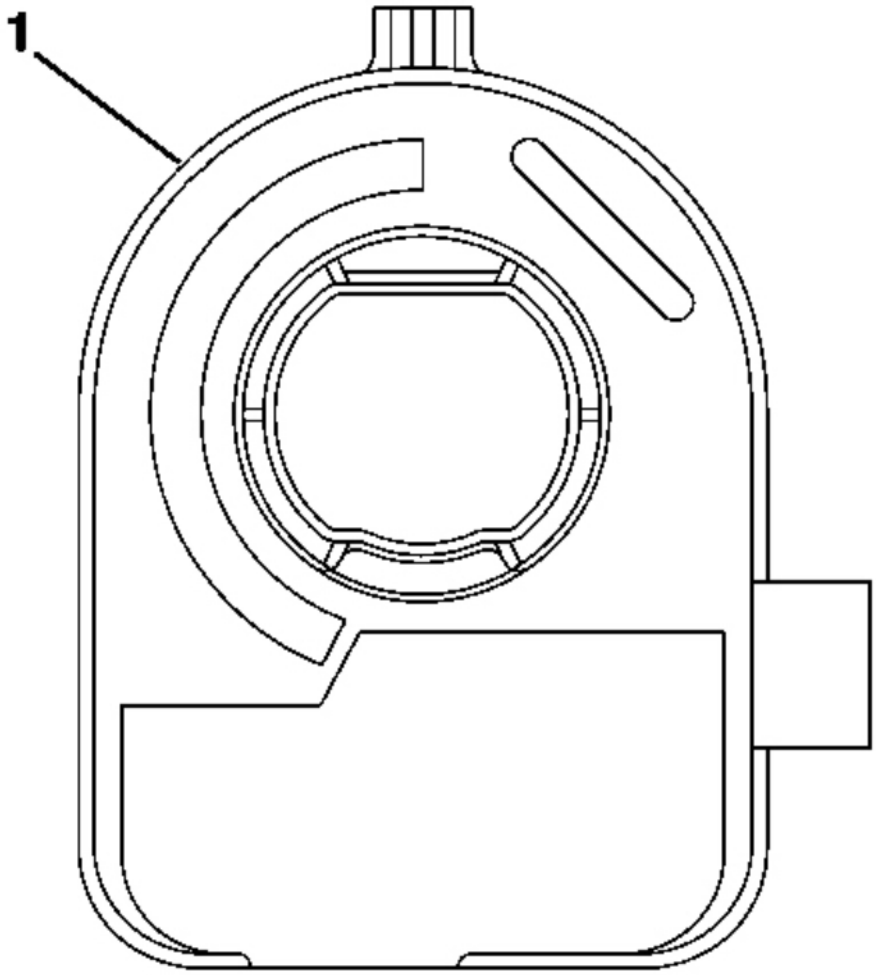


Fig. 66: FRONT Of The Sensor Connector Will Be On The Right
Courtesy of GENERAL MOTORS CORP.

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

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

4. Remove the connector from the sensor.
5. Remove the sensor from the adapter and bearing assembly.

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6. To install the sensor, proceed to step 1 in the installation procedure.

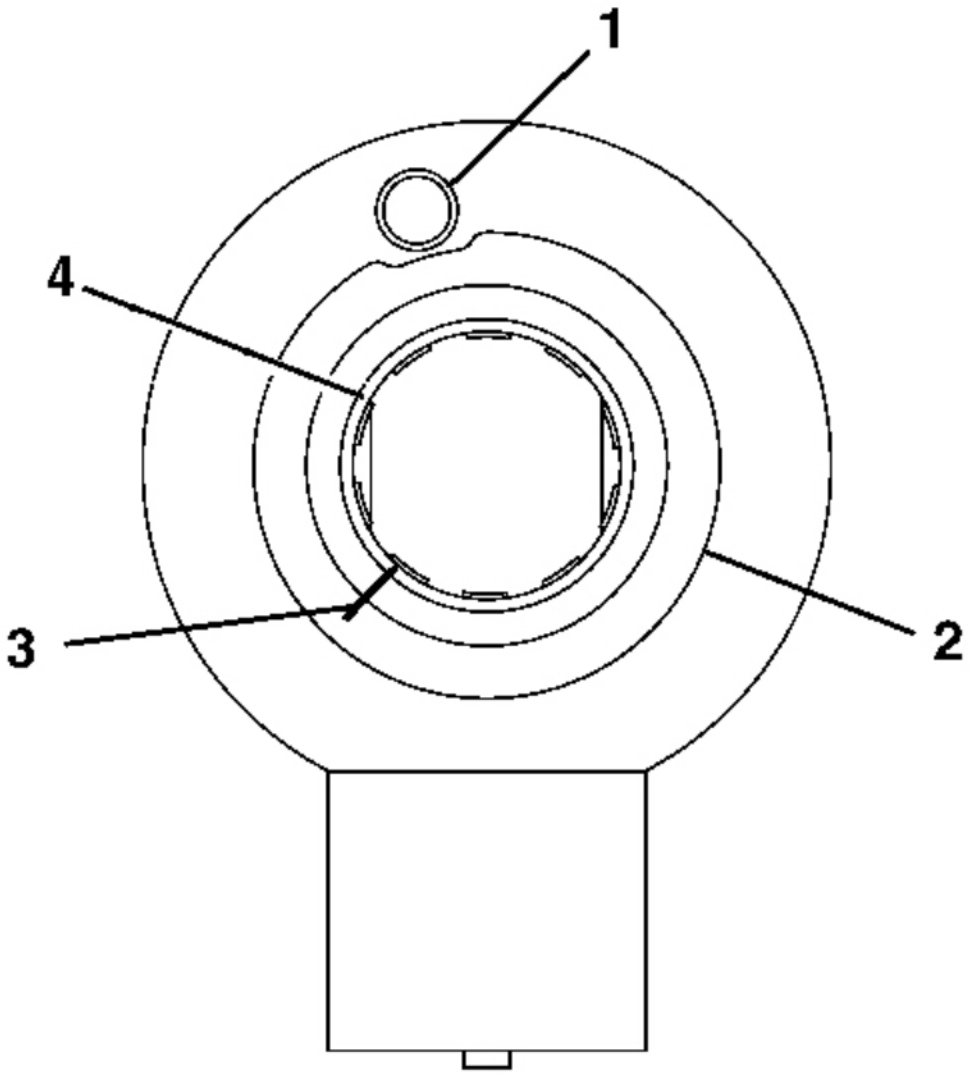


Fig. 67: Steering Wheel Position Sensor Foam Ring, Pin Hole And Rotor Flange Cuff
Courtesy of GENERAL MOTORS CORP.

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

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- A flush rotor flange cuff (4)

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

8. Make an alignment mark on the flush rotor flange cuff.
9. Remove the connector from the sensor.
10. Remove the sensor from the adapter and bearing assembly.
11. To install the sensor, proceed to step 4 in the installation procedure.

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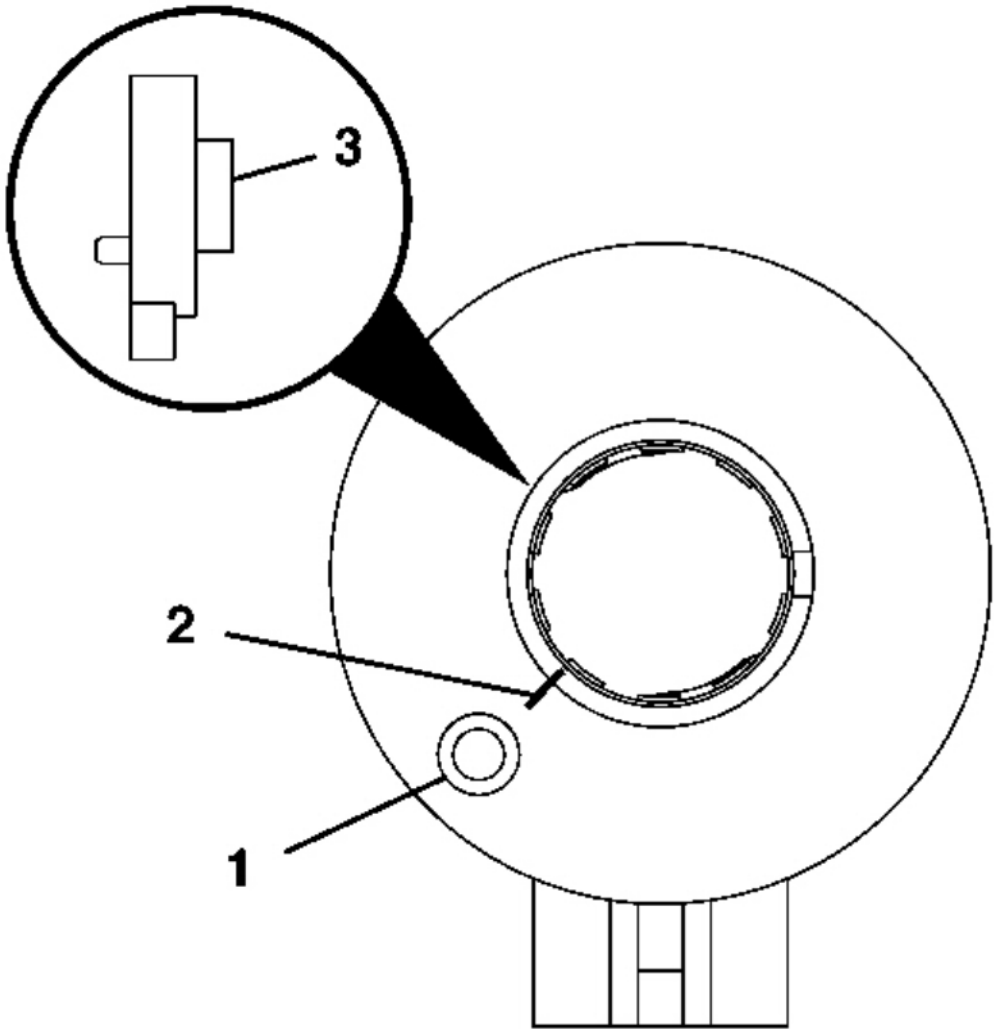


Fig. 68: Steering Wheel Position Sensor Alignment Mark
Courtesy of GENERAL MOTORS CORP.

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

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15. To install the sensor, proceed to step 8 in the installation procedure.

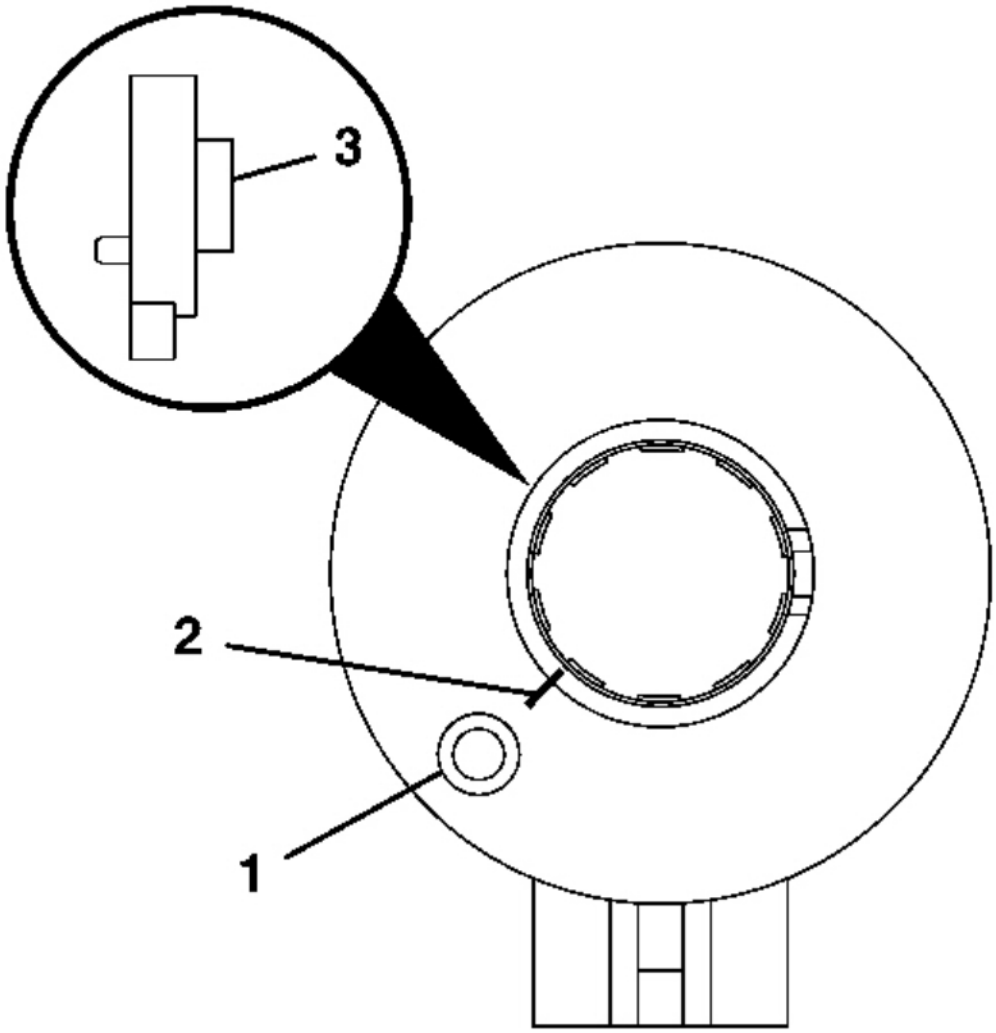


Fig. 69: Steering Wheel Position Sensor Alignment Mark
Courtesy of GENERAL MOTORS CORP.

16. From the technicians point of view, the FRONT of the sensor will have:
    - A raised rotor flange cuff (3)
    - An alignment mark (2) on the rotor flange cuff for installation
    - A pin hole (1) for the centering pin-Note location of the pin hole.

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- A sensor clip in FRONT of the sensor

17. Remove the connector from the sensor.
18. Remove the sensor clip from the sensor.
19. Remove the sensor from the adapter and bearing assembly.
20. To install the sensor, proceed to step 12 in the installation procedure.

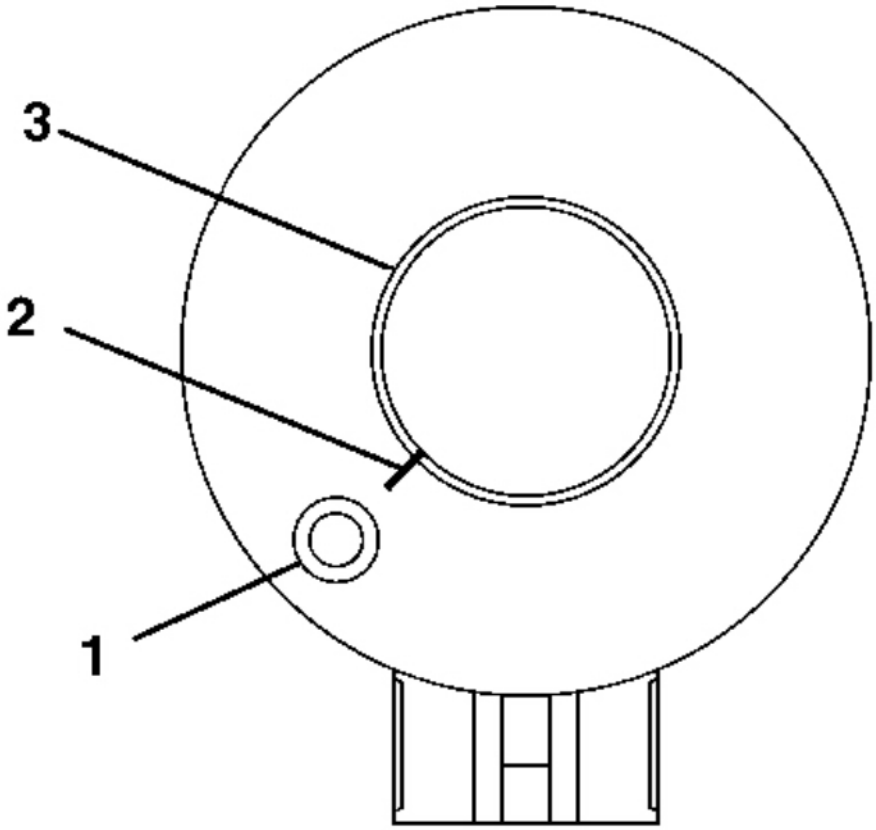


Fig. 70: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole And Alignment Mark
Courtesy of GENERAL MOTORS CORP.

21. From the technicians point of view, the FRONT of the sensor will have:
    - A flush rotor flange cuff (3)
    - A pin hole (1) for the centering pin-Note the location of the pin hole.
    - An alignment mark (2) on the flush rotor flange cuff for installation

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22. Remove the connector from the sensor.
23. Remove the sensor from the adapter and bearing assembly.
24. To install the sensor, proceed to step 16 in the installation procedure.

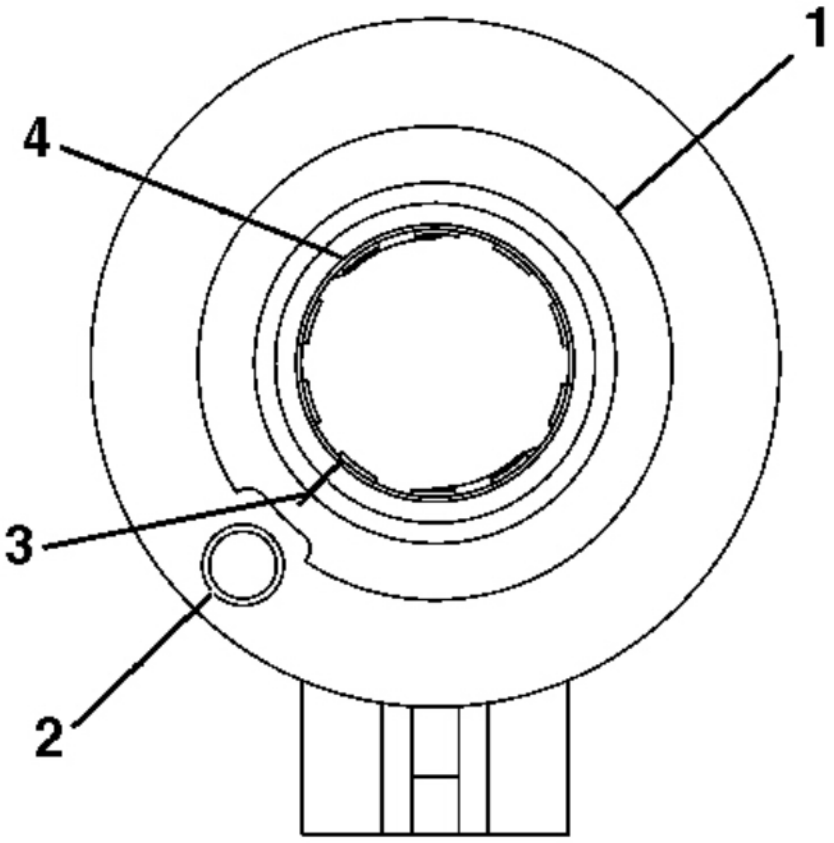


Fig. 71: Steering Wheel Position Sensor Rotor Flange Cuff, Centering Pin Hole, Alignment Mark And Foam Ring
Courtesy of GENERAL MOTORS CORP.

25. From the technicians point of view, the FRONT of the sensor will have:
    - A flush rotor flange cuff (4)
    - A pin hole (2) for the centering pin-Note the location of the pin hole.
    - An alignment mark (3) on the flush rotor flange cuff for installation
    - A foam ring (1)

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26. Remove the connector from the sensor.
27. Remove the sensor from the adapter and bearing assembly.
28. To install the sensor, proceed to step 20 in the installation procedure.

Installation Procedure

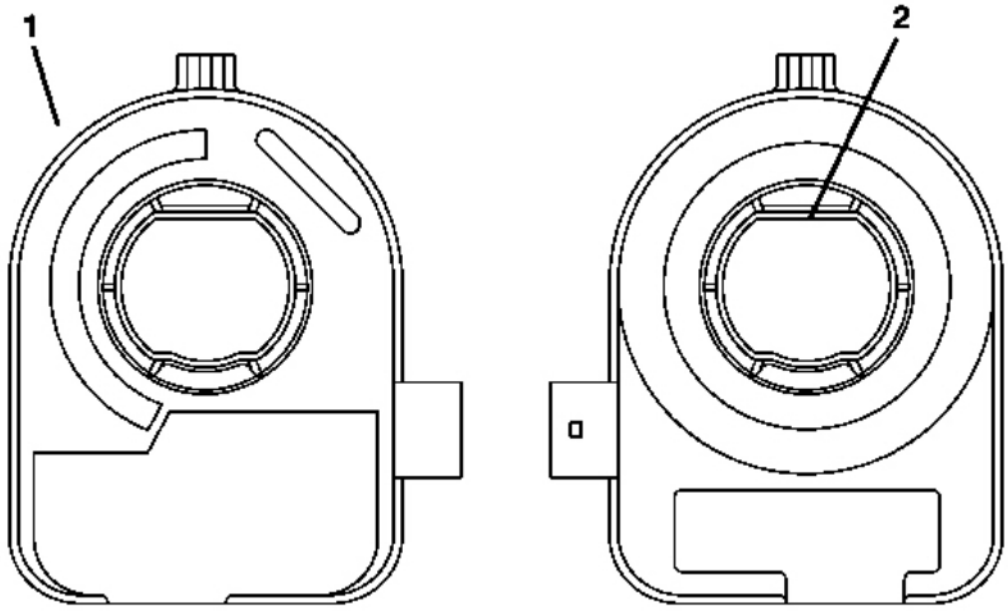


Fig. 72: Front And Back Views Of Steering Wheel Position Sensor
Courtesy of GENERAL MOTORS CORP.

NOTE: **If you are reusing the existing sensor, centering of the old sensor is not necessary.**
If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated.

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

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

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

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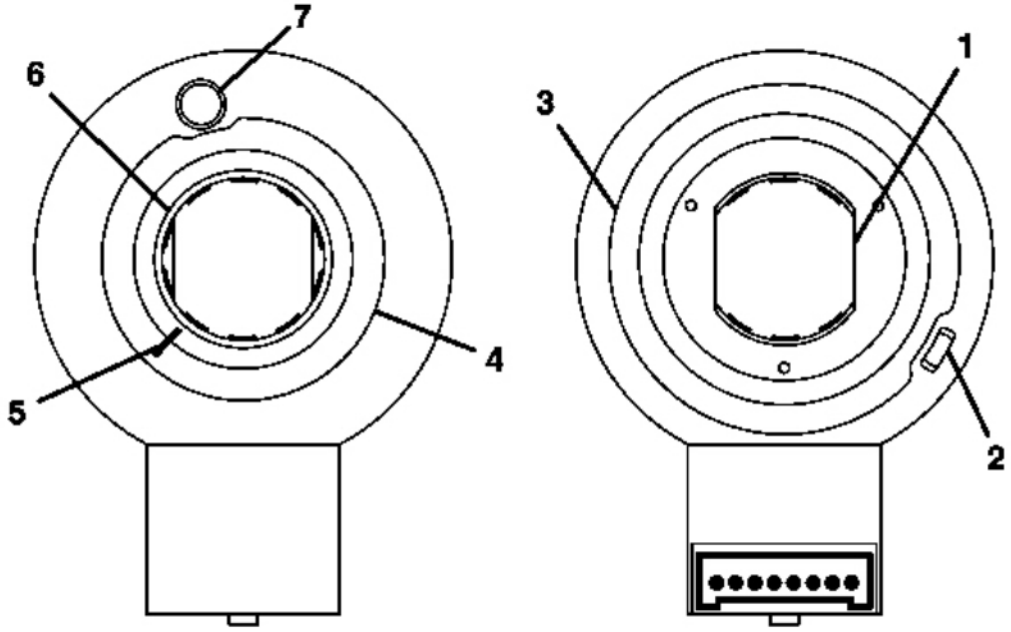


Fig. 73: Steering Wheel Position Sensor Identification Points
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **If you are reusing the existing sensor, align the marks on the flush rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**
If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in

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the sensor, order a new sensor.

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

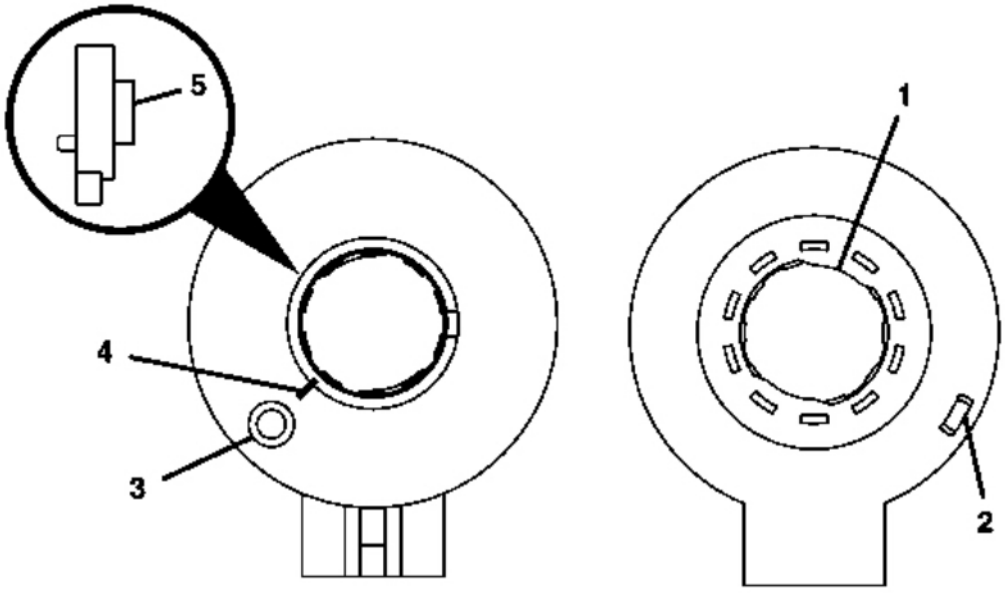


Fig. 74: Steering Wheel Position Sensor Front View
Courtesy of GENERAL MOTORS CORP.

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

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

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not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

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

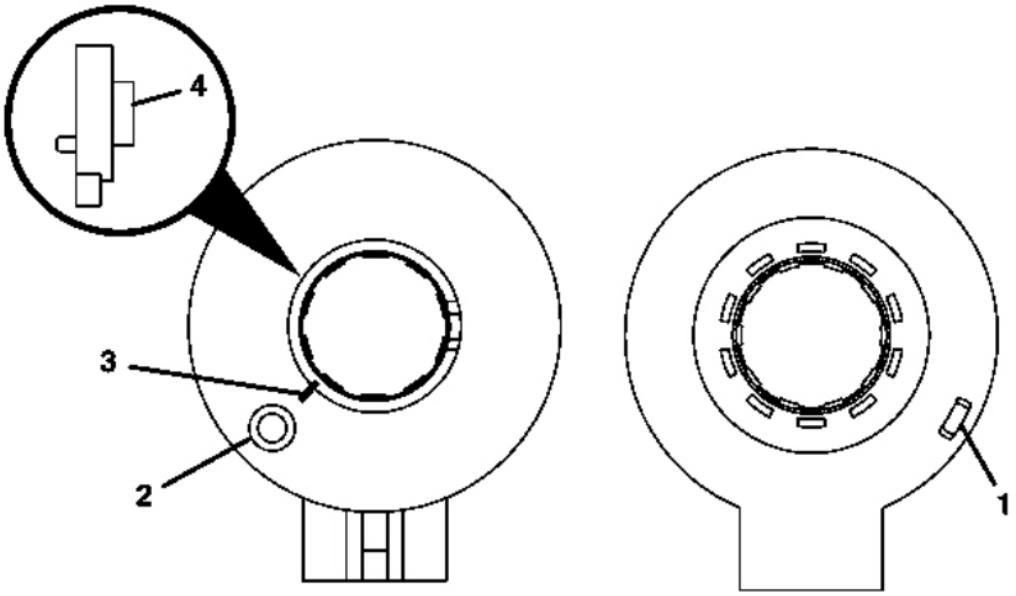


Fig. 75: Steering Wheel Position Sensor Centering Pin Hole, Rotor Flange Cuff And Alignment Mark
Courtesy of GENERAL MOTORS CORP.

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

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

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

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

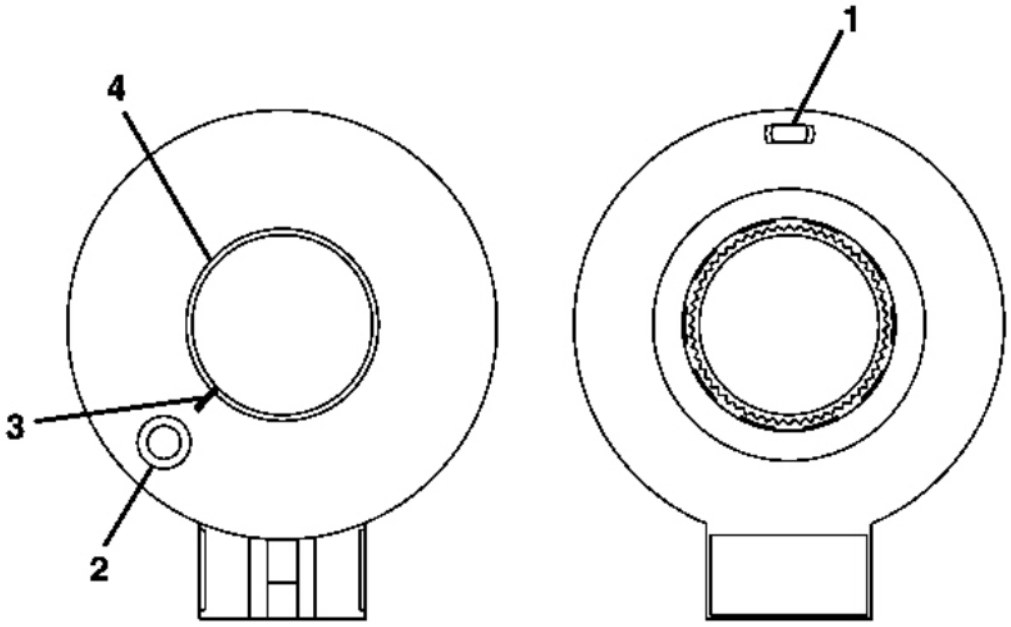


Fig. 76: Steering Wheel Position Sensor Center Pin, Rotor Flange Cuff And Installation Alignment Mark
Courtesy of GENERAL MOTORS CORP.

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

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

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flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.
If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

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

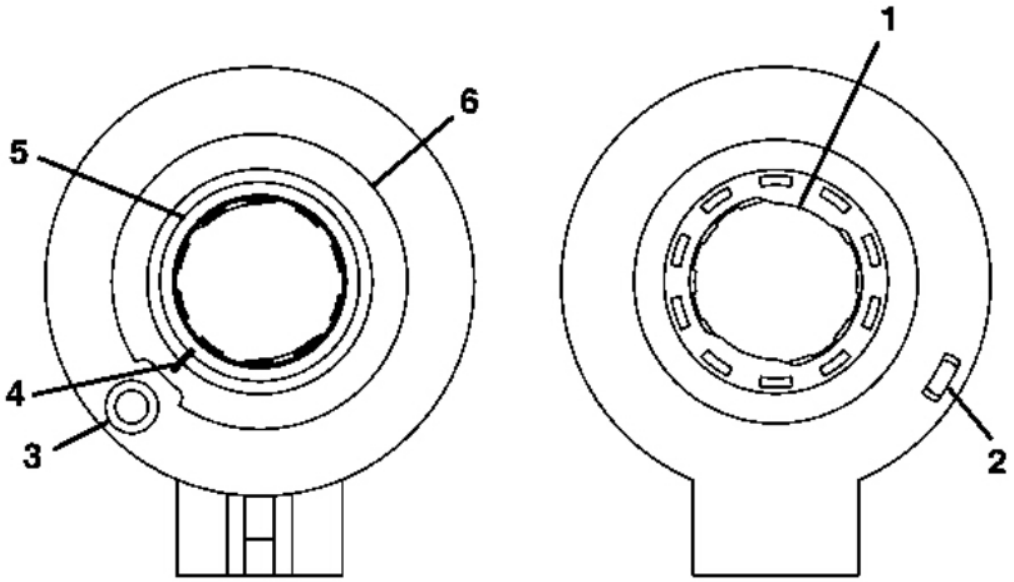


Fig. 77: Steering Wheel Position Sensor Double D Flats
Courtesy of GENERAL MOTORS CORP.

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

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NOTE: **If you are reusing the existing sensor, align the marks on the flush rotor flange cuff before installation. The alignment mark must stay aligned until the sensor is seated into the adapter and bearing assembly.**
If you are installing a new sensor, the new sensor will come with a pin. Do not remove the pin until the sensor is seated. If the pin is not installed in the sensor, order a new sensor.

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

TILT MOTOR REPLACEMENT

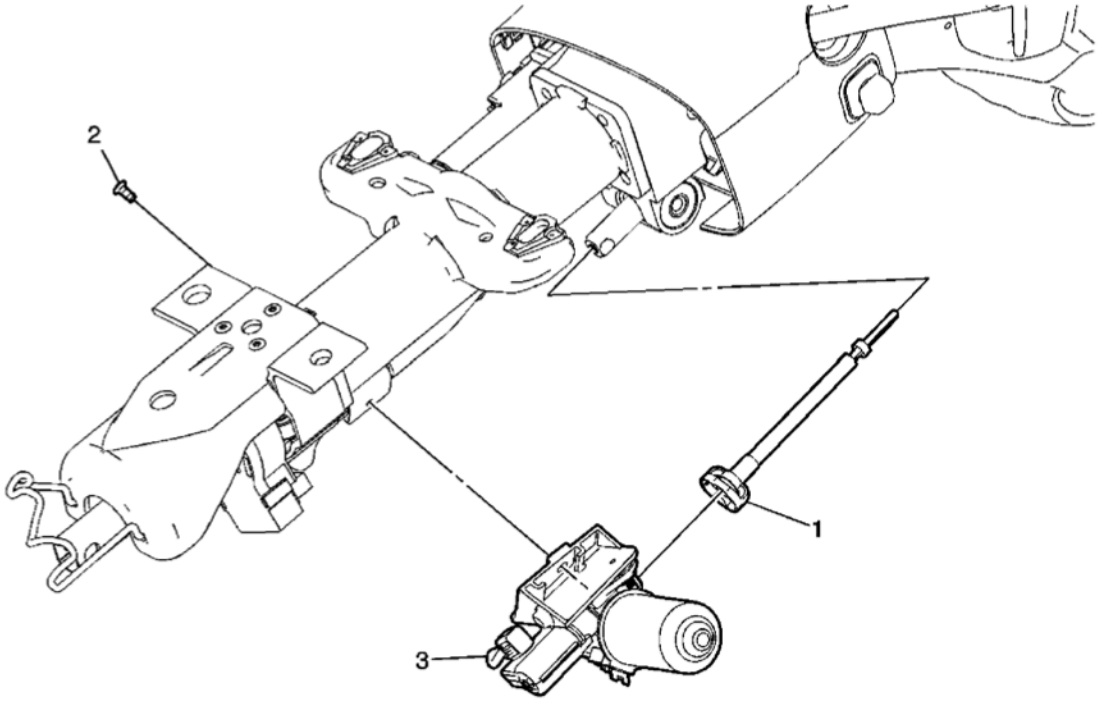


Fig. 78:
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the automatic transmission shift lock control actuator. Refer to **Automatic Transmission Shift Lock Control Actuator Replacement** .	
1	Tilt Motor Cable **Procedure:** Squeeze the sides of the connector at each end to release the tilt motor cable assembly.
	Tilt Motor Bracket Bolt (Qty: 2)

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2	**CAUTION:** **Refer to Fastener Caution .** **Tighten:** 2 N.m (18 lb in)
3	Tilt Motor **Procedure** 1. Disconnect any electrical connectors as needed. 2. The steering column tilt head must be tilted straight to the steering column assembly before removing or installing the tilt motor or misalignment may occur. 3. After repairs, calibrate the power tilt steering column. Refer to **Power Tilt Steering Column Calibration**.

DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN DESCRIPTION AND OPERATION

Tilt Switch Operation

The tilt steering column has a two-position switch which may be used to adjust the position of the steering wheel up or down which is tilt. The position of the column may be changed as follows:

- Press the switch up to tilt the column up.
- Press the switch down to tilt the column down.

The memory seat module (MSM) receives inputs from the tilt switch to manually move the column to a desired position. Pressing the control switch sends an input to the MSM. The MSM receives an input and actuates the corresponding column motor.

Pressing the switch momentarily in either the UP or DOWN and releasing within 0.5 seconds, causes the column to advance slightly in the corresponding direction then stop. This feature allows fine control of the steering column position in each direction. If the switch is pressed and held for longer than 0.5 seconds, the column advances slightly in that direction, pauses, then resumes movement as long as the switch is held.

Motor

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

Position Sensor

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The tilt position sensor is used by the MSM to store column positions in memory and to return the column to the stored memory positions. The MSM provides a 5-volt reference voltage and a ground to the tilt position sensor. The sensor feedback circuit voltage varies from 0.25-4.75 volts. Each sensor is mounted to its corresponding motor cable assembly. When the motor rotates its cable, the resistance of the sensor varies. The MSM monitors the feedback voltage to determine the column position via the tilt position sensor input circuits. When an entry or exit position is saved, the MSM stores the column positions by recording each position sensor's feedback voltage. When an entry or exit position is commanded, the module moves the motor until all the position sensor feedback voltages equal the feedback voltages stored in memory.

Tilt Memory

Memory settings and the personalization of steering wheel positions are available with the tilt steering column. The data stored consists of entry positions and exit positions. The entry position is the position that the steering column moves in when the ignition is turned ON. The exit position is the direction that the steering column moves up when the ignition is turned OFF and the driver's door is opened.

An initial memory setting is set in the MSM at the assembly plant. This setting may be changed to suit the customer at the time of purchase or at anytime in the future.

Entry/Exit Personalization

The MSM stores personalization information. The driver information center (DIC) is used to enable and disable the personalization feature in the MSM. A Class 2 message is sent to the MSM, by the DIC, which specifies that the MSM enable the personalization feature until disabled again using the DIC.

The steering column control module can store 6 possible positions: 3 entry positions and 3 exit positions.

- Driver 1 exit position, set using the memory switches
- Driver 2 exit position, set using the memory switches
- Default exit position which is all forward, all up, with no memory position set
- Driver 1 entry position, set using the memory switches
- Driver 2 entry position, set using the memory switches
- Last known driver entry position which is when the ignition is turned ON by an unknown driver

Memory Setting

When the driver door switch assembly (DDSA) receives inputs from the memory function switch, the steering column personalization positions may be recorded for one or two different drivers. Once a steering column driving entry or exit position is adjusted by the driver it must be set in memory. To record a position, the driver must press the SET MEMORY button, which is followed by a chime to acknowledge that input. Within 5 seconds, either the MEMORY 1 or MEMORY 2 button must be pressed. When the DDM receives these inputs, it sends a class 2 message to the MSM. The MSM records the feedback voltages from the column position sensors for that driver. A single chime is sounded to acknowledge that the position was recorded.

To record a second position, the second driver must press the SET MEMORY 2 button, after they have made the appropriate adjustments, and the process continued.

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Memory Personalization Recall

When the driver presses the MEMORY 1 or MEMORY 2 button, the DDSA receives the input and a single chime is sounded. The DDSA sends a class 2 message to the MSM indicating which driver memory setting has been selected. The MSM applies both battery positive voltage and ground to the column motors until all the column position sensor feedback voltages equal the feedback voltages stored in memory for the appropriate driver.

When a keyless entry transmitter is used to unlock the vehicle doors, the remote function actuator (RFA) module communicates which driver key fob performed that command. The MSM receives the unlock command via a class 2 message from the RFA module.

Tilt Description

The energy absorbing and locking steering column includes three important features in addition to the steering function.

1. The steering column is energy absorbing and is designed to compress in a front-end collision which will lessen the chance of injury to the driver.
2. The steering column has a tilt control system that consists of an electronic control module capable of class 2 serial data communication, a steering column power assembly with a positioning motor and sensor, and a steering column control switch.
3. The multi-function lever provides for the control of the headlamp high beams, and the windshield washer and wiper.

Column Shift Assembly

If the vehicle is equipped with a column mounted gear shift, it has a linear shift assembly on the steering column. The linear shift assembly has a cable that runs from the linear shift assembly to the ignition lock cylinder case. The purpose of this cable is to prevent the ignition key from being turned to the OFF position when the transmission is in gear and the vehicle may still be moving. The linear shift assembly cable contains a pin that is spring loaded to mechanically prevent the ignition key cylinder from being turned to the lock position when the vehicle transmission is not in the PARK position. If vehicle power is lost, and/or the transmission is not in the PARK position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column.

Heated Steering Wheel

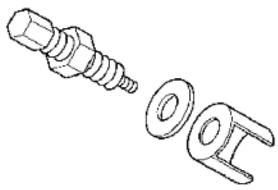
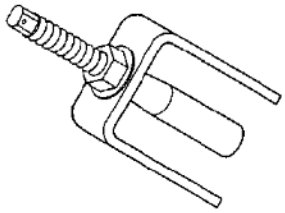
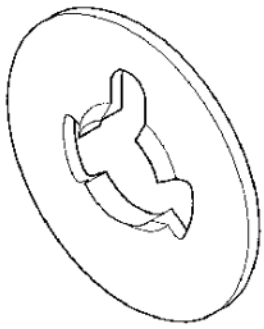
The heated steering wheel system consists of a heated steering wheel, a heated steering wheel switch, and a steering wheel heat module. The heated steering wheel includes non-serviceable heating elements and a temperature sensor. The heating elements and sensor are located in the left and right sides of the rim of the steering wheel. The heated steering wheel switch is located in the left steering wheel control switch assembly. The steering wheel heat module is located at the top of the steering wheel center hub. When the switch is pressed, the switch signal circuit is grounded and the heat module turns the heated steering wheel on. The system then remains on until the customer turns it off. The wheels normal operating temperature is 32°C (89.6° F). The wheel takes approximately 3 to 4 minutes to reach the normal operating temperature. The wheel will take longer to heat up if the vehicle temperature is below -21°C (-5.8°F). The built-in temperature sensor

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provides input to the controller to limit the temperature to the normal operating temperature. The wheel will not operate if the vehicle temperature is at or above 32°C (89.6°F).

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 21854-01 Pivot Pin Remover
	J 23653-SIR Steering Column Lock Plate Compressor
	J 42137 Cam Orientation Plate Adapter
	J 42640

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	Steering Column Anti-Rotation Pin

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