2004 STEERING

Rear Wheel Steering - C/K SUV

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Axle Bracket Retaining Bolts/Nuts	25 N.m	18 lb ft
Brake Hose Bracket Retaining Bolt	12 N.m	106 lb in
Control Module to Bracket	25 N.m	18 lb ft
Inner Tie Rod End Support Clamp	25 N.m	18 lb ft
Inner Tie Rod End to Steering Gear	100 N.m	74 lb ft
Inner Tie Rod Jam Nut	65 N.m	48 lb ft
Lower Ball Joint Pinch Bolt	230 N.m	169 lb ft
Lower Ball Joint Retaining Bolts	110 N.m	81 lb ft
Outer Tie Rod End Retaining Bracket Bolts	65 N.m	48 lb ft
Outer Tie Rod End Retaining Nut to Steering Knuckle	55 N.m	40 lb ft
Park Brake Cable Bracket Retaining Bolt	65 N.m	48 lb ft
Rear Wheel Position Sensor	4 N.m	35 lb in
Rear Wheel Steering Control Module Bracket to Frame Nuts	25 N.m	18 lb ft
Steering Gear Actuator and Cover Retaining Bolts	61 N.m	45 lb ft
Steering Gear Motor to the Steering Gear, 4 mm bolts	4 N.m	35 lb in
Steering Gear Motor to the Steering Gear, 6 mm bolts	10 N.m	89 lb in
Steering Gear Protection Shield Retaining Bolts	180 N.m	132 lb ft
Upper Ball Joint Retaining Bolts	110 N.m	81 lb ft
Upper Ball Joint Retaining Nut	200 N.m	147 lb ft
Wheel Hub and Bearing Retaining Bolts	140 N.m	103 lb ft
Wheel Drive Shaft Retaining Nut	250 N.m	184 lb ft
Yaw Rate Sensor/Lateral Accelerometer Sensor Nuts	10 N.m	89 lb in

SCHEMATIC AND ROUTING DIAGRAMS

REAR WHEEL STEERING SCHEMATICS

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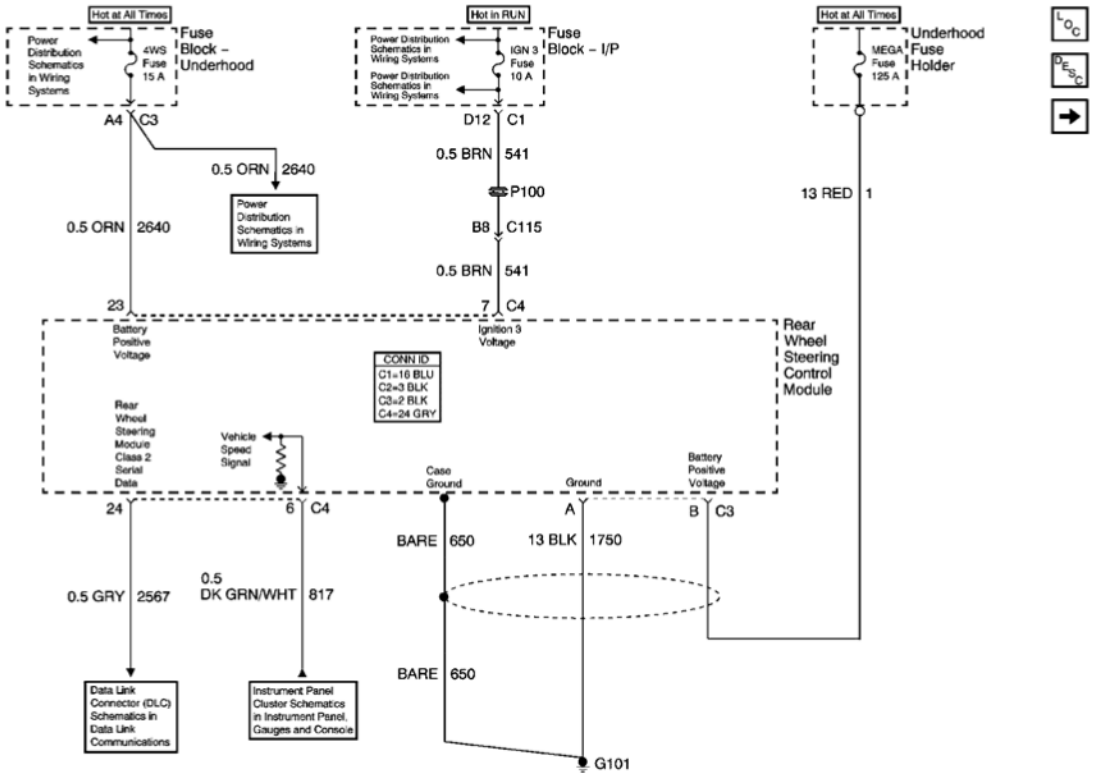


Fig. 1: Power, Ground, Serial Data & Vehicle Speed Schematic
Courtesy of GENERAL MOTORS CORP.

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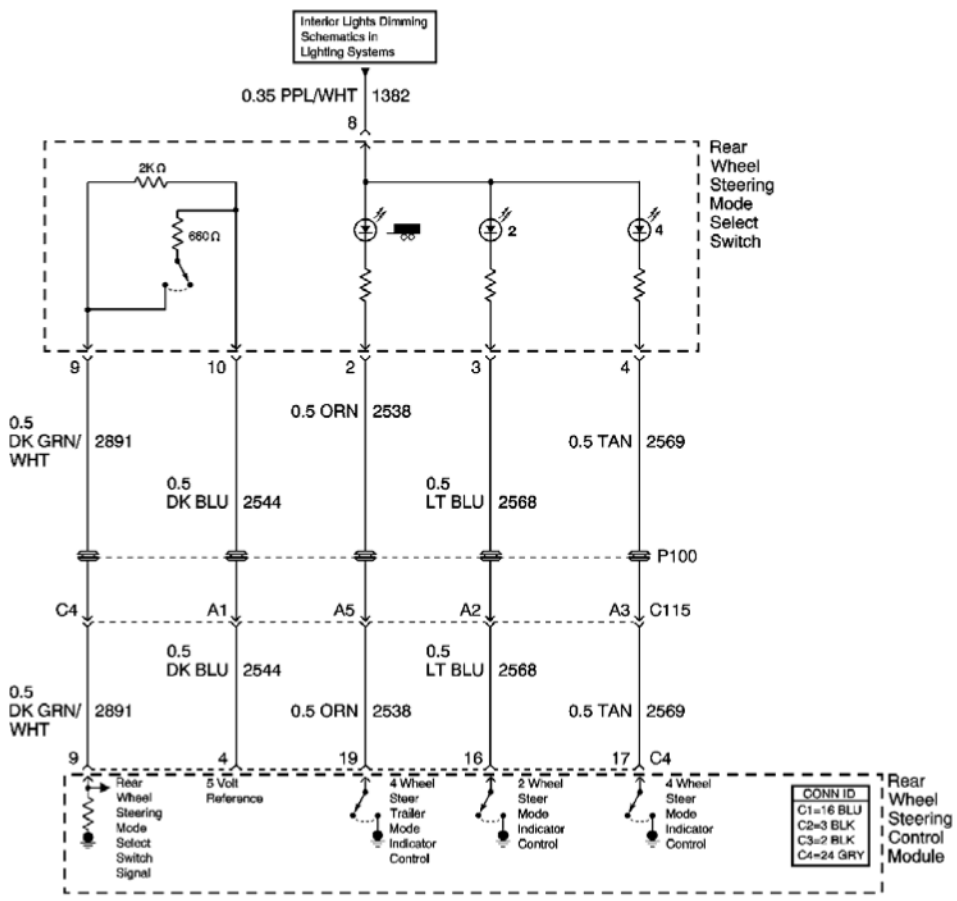


Fig. 2: Mode Selection Schematic
Courtesy of GENERAL MOTORS CORP.

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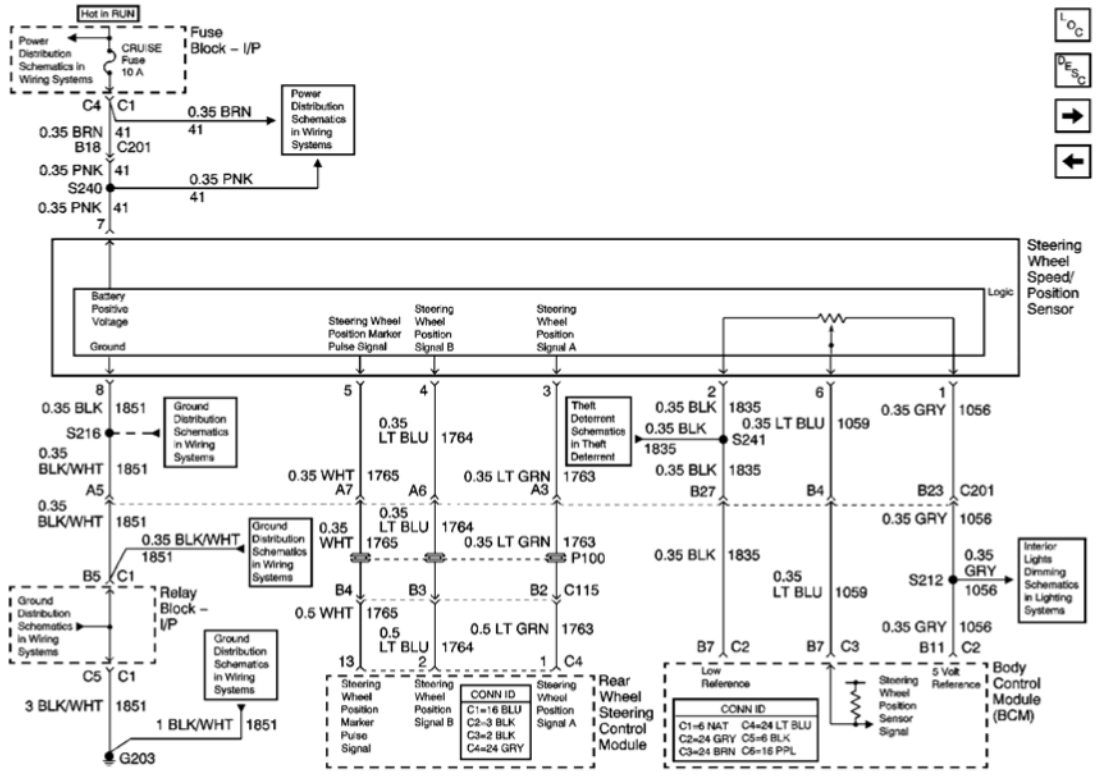


Fig. 3: Steering Wheel Speed/Position Schematic
Courtesy of GENERAL MOTORS CORP.

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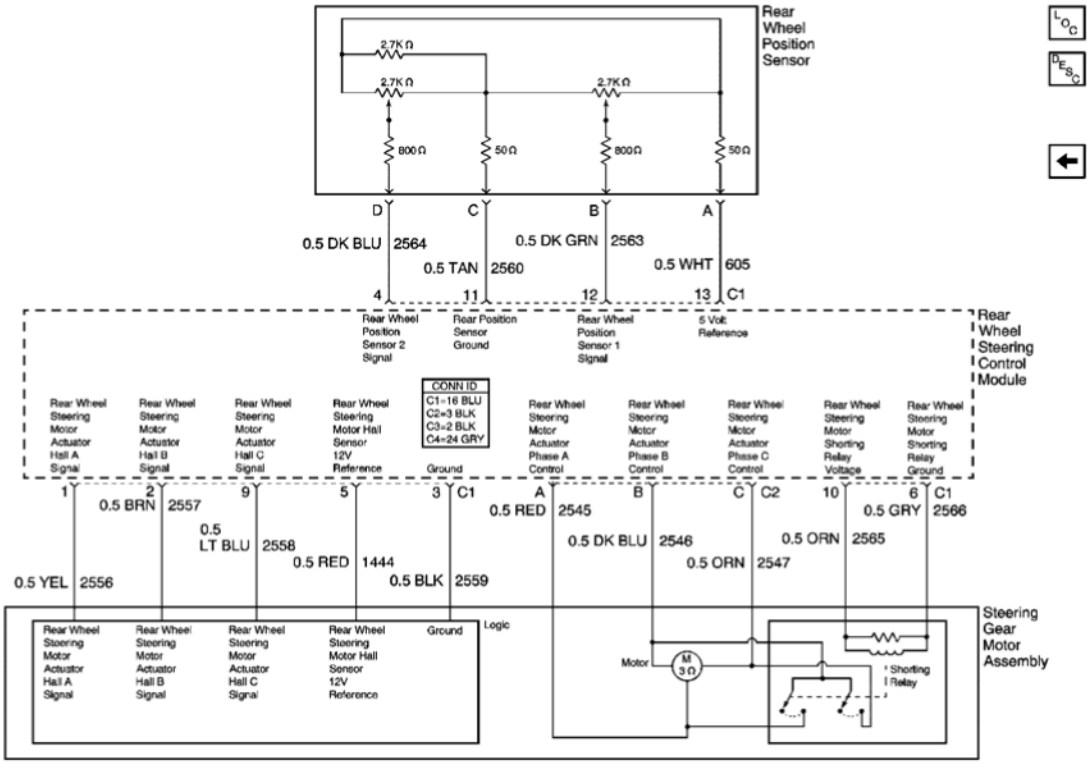


Fig. 4: Rear Wheel Position Controls Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

REAR WHEEL STEERING COMPONENT VIEWS

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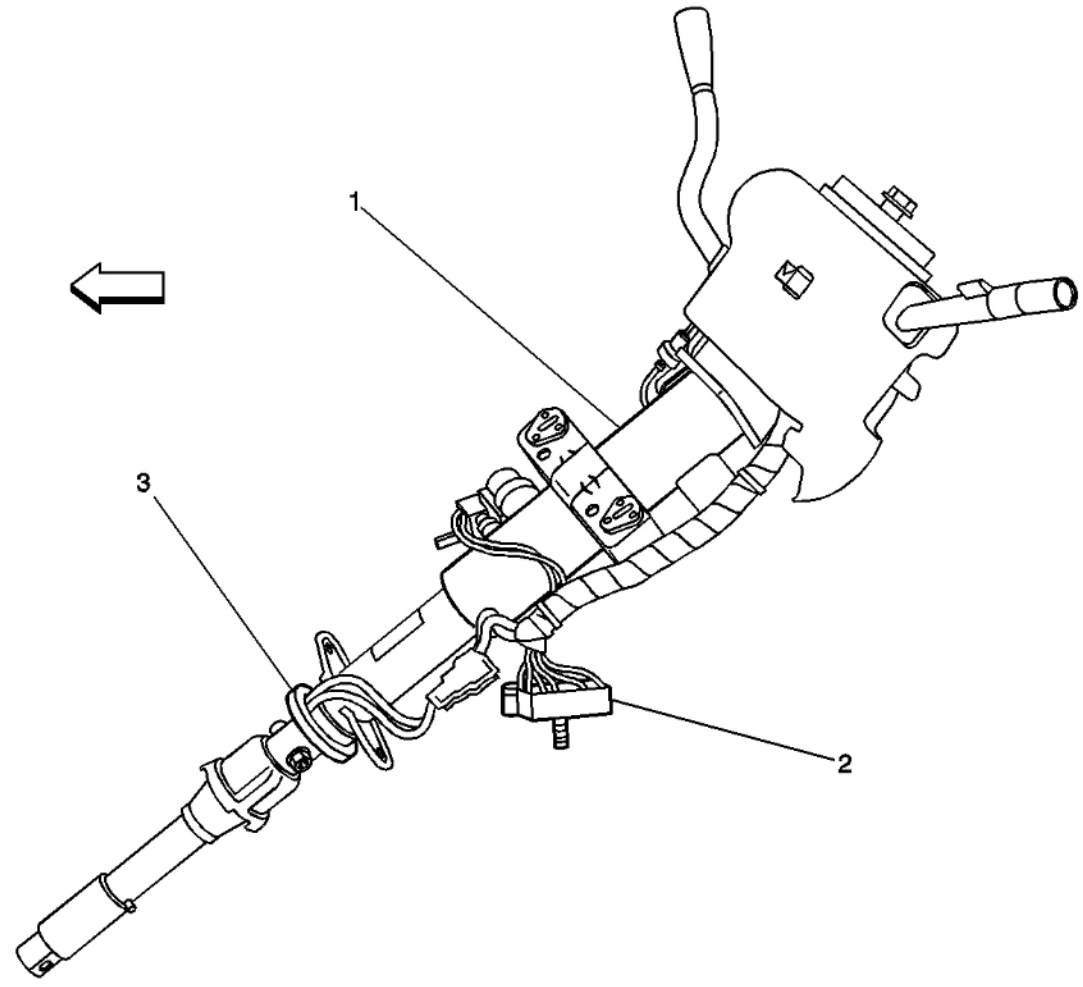


Fig. 5: Steering Wheel Speed/Position Sensor Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Steering Column
2	C201
3	Steering Wheel Speed/Position Sensor

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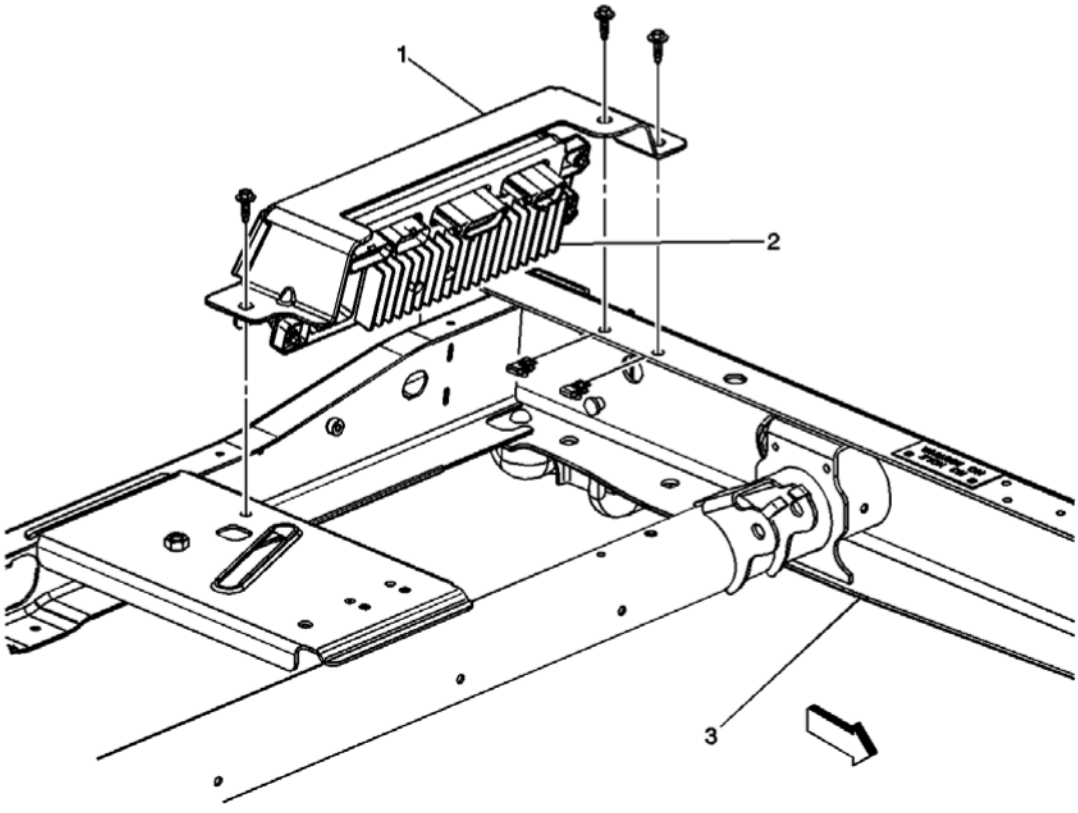


Fig. 6: Rear Wheel Steering Control Module Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Mounting Bracket
2	Rear Wheel Steering Control Module
3	Frame

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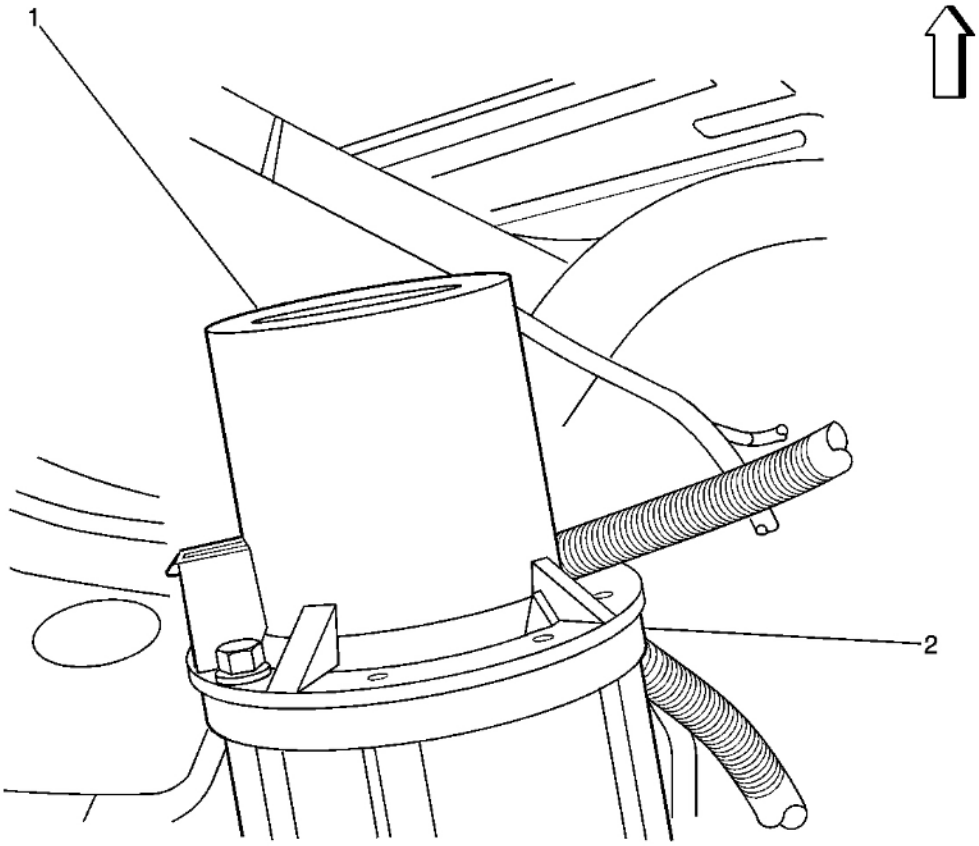


Fig. 7: Rear Steering Gear Motor Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	Rear Steering Gear Motor
2	Steering Gear Assembly

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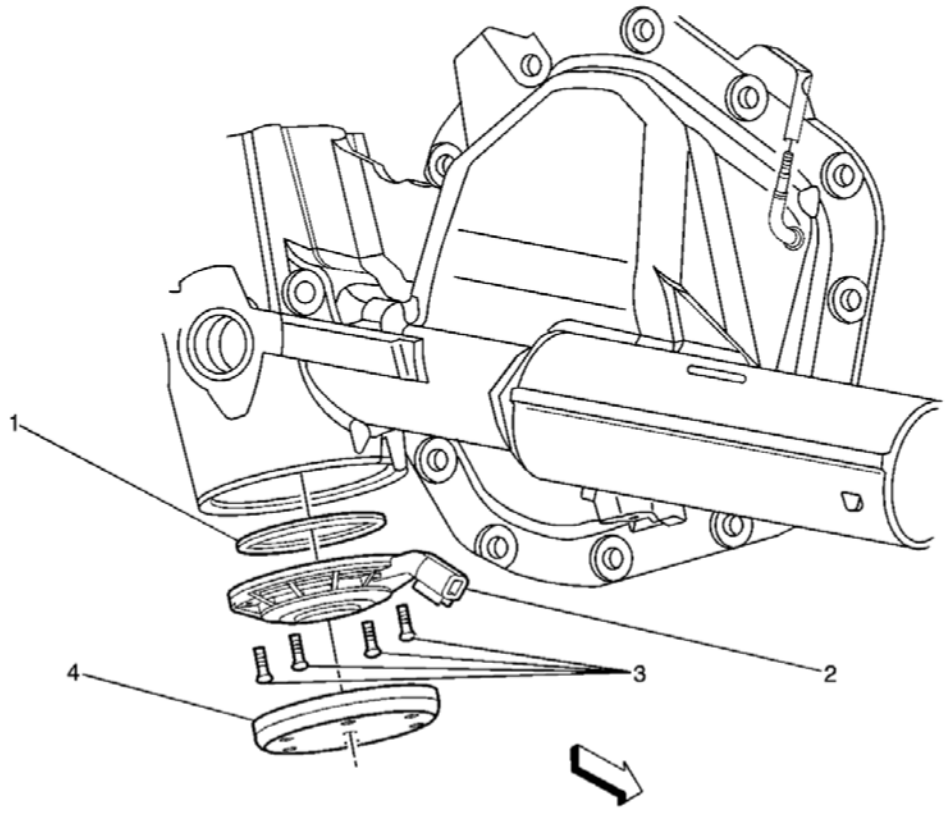


Fig. 8: Rear Wheel Position Sensor Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
1	O-Ring
2	Rear Wheel Position Sensor
3	Retaining Bolts
4	Sensor Cover

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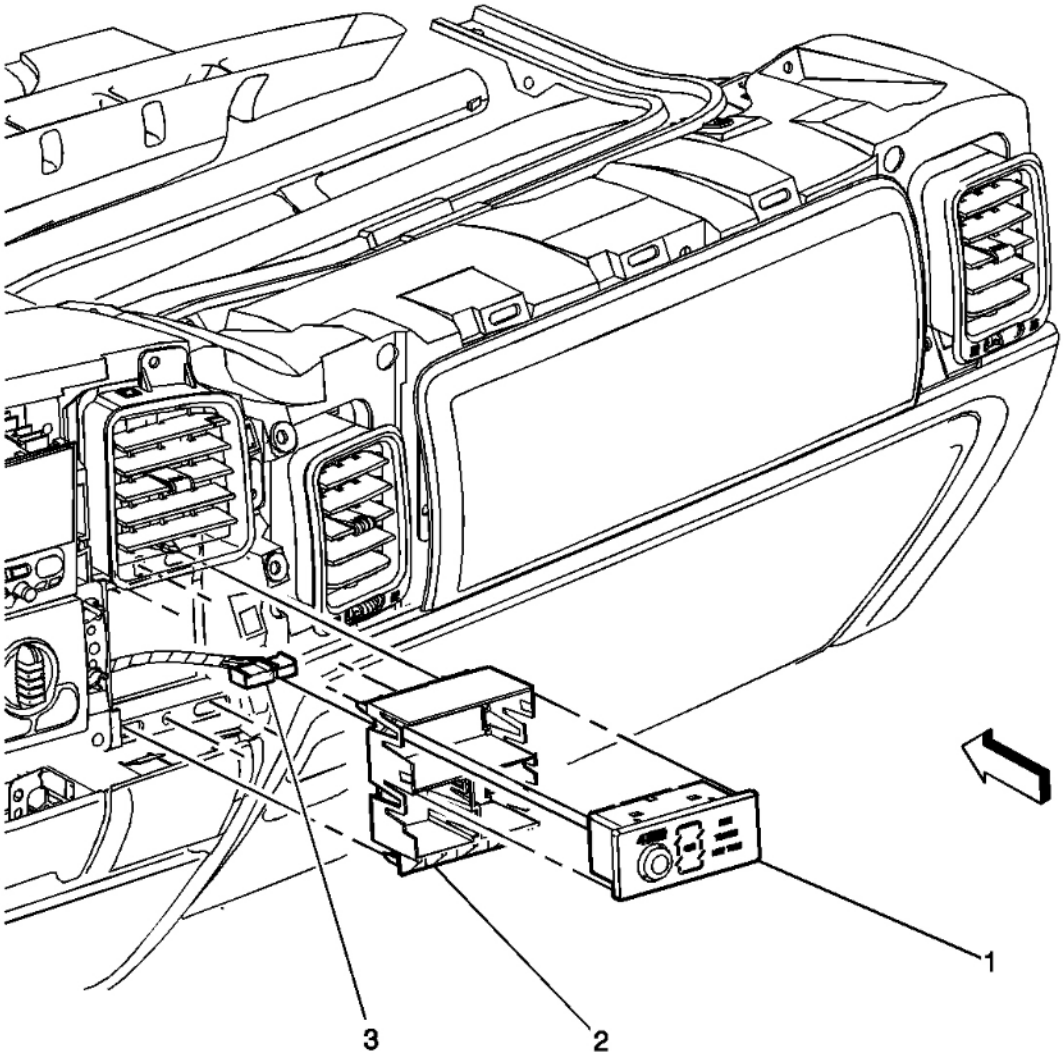


Fig. 9: Rear Wheel Steering Mode Select Switch Component View
Courtesy of GENERAL MOTORS CORP.

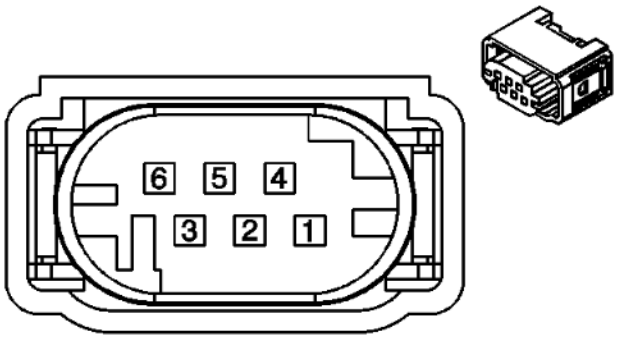
Callouts For Fig. 9

Callout	Component Name
1	Rear Wheel Steering Mode Select Switch
2	Switch Housing
3	Switch Electrical Connector

REAR WHEEL STEERING CONNECTOR END VIEWS

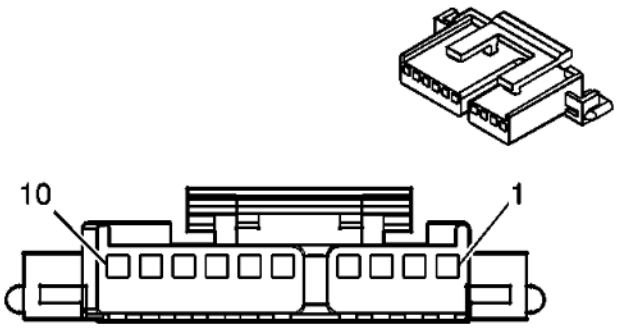
Combination Yaw Rate Sensor/Lateral Accelerometer Sensor Connector End View

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Connector Part Information		• 15421324 • 6-Way F MQS Sealed (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	DK GRN	2087	Steering Wheel Position Sensor 5V Reference
2	LT BLU	715	Lateral Accelerometer Signal
3	DK BLU	716	Yaw Rate Sensor Signal
4-5	-	-	Not Used
6	LT BLU	2088	Steering Wheel Position Sensor Low Reference

Rear Wheel Steering Mode Select Switch Connector End View



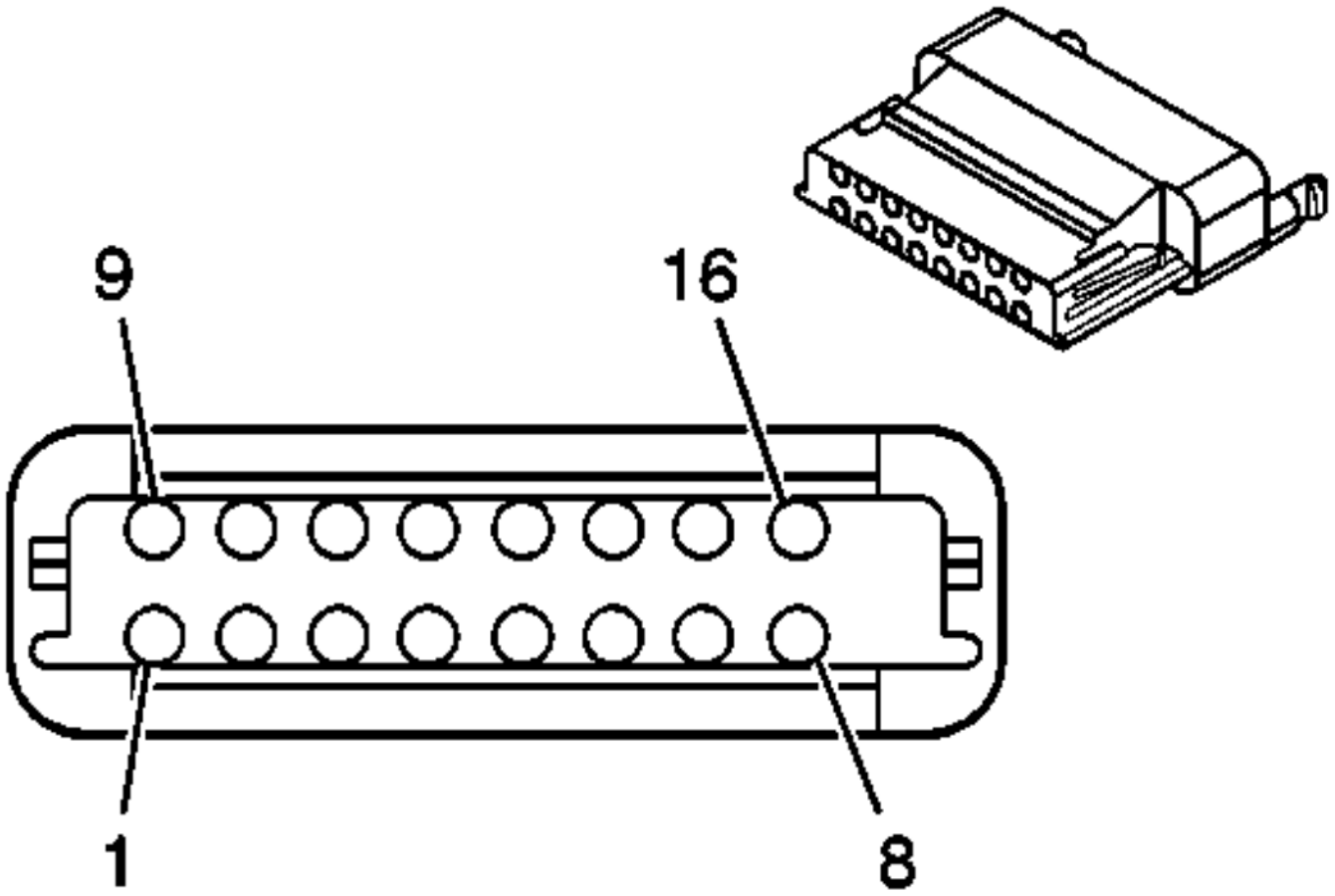
Connector Part Information		• 12047531 • 10-Way F Micro-Pack 100 Series (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	-	-	Not Used
2	ORN	2538	4 Wheel Steer Trailer Mode Indicator Supply

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			Voltage
3	LT BLU	2568	2 Wheel Steer Mode Indicator Supply Voltage
4	TAN	2569	4 Wheel Steer Mode Indicator Supply Voltage
5	BRN/WHT	230	Instrument Panel Lamps Dimming Control
6	BLK	1050	Ground
7	-	-	Not Used
8	PPL/WHT	1382	LED Dimming Supply
9	DK GRN/WHT	2891	Rear Wheel Steering Mode Select Switch Signal
10	DK BLU	2544	Rear Wheel Steering Mode Select Switch 5V Reference

Rear Wheel Steering Control Module - C1 Connector End View

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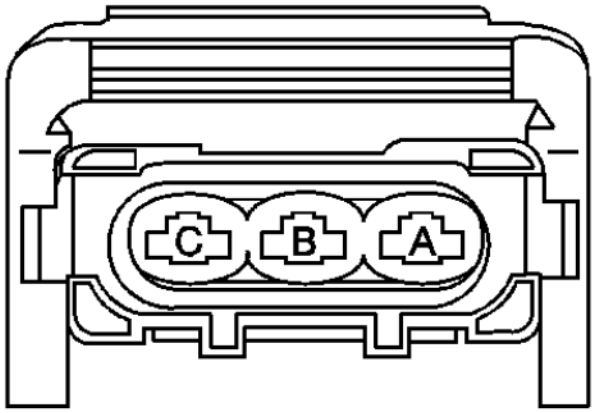


Connector Part Information		• 12191065 • 16-Way F Micro-Pack 100 Series (BLU)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	YEL	2556	Rear Wheel Steering Motor Actuator Hall A Signal
2	BRN	2557	Rear Wheel Steering Motor Actuator Hall B S
3	BLK	2559	Rear Wheel Steering Motor Hall Sensor Grou
4	DK BLU	2564	Rear Wheel Position sensor Position 2 signal
5	RED	1444	Rear Wheel Steering Motor Hall Sensor 12V Reference

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6	GRY	2566	Rear Wheel Steering Motor Shorting Relay Ground
7-8	-	-	Not Used
9	LT BLU	2558	Rear Wheel Steering Motor Actuator Hall C S
10	ORN	2565	Rear Wheel Steering Motor Shorting Relay Voltage
11	TAN	2560	Rear position Sensor Ground
12	DK GRN	2563	Rear Wheel Position Sensor Position 1 Signa
13	WHT	605	5 Volt Reference
14-16	-	-	Not Used

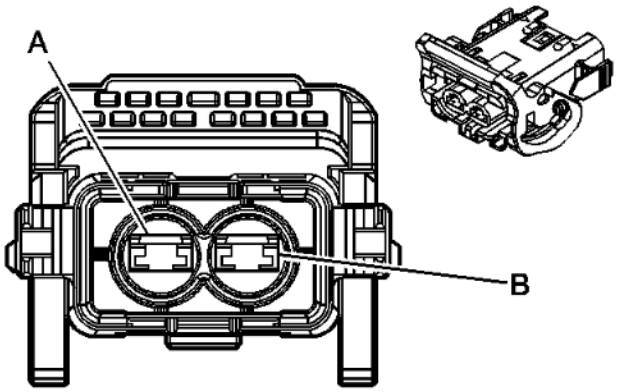
Rear Wheel Steering Control Module - C2 Connector End View



Connector Part Information		• 15355393 • 3-Way F Mini-Fit Jr (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	2545	Rear Wheel Steering Motor Actuator Phase A Control
B	DK BLU	2546	Rear Wheel Steering Motor Actuator Phase B Control
C	ORN	2547	Rear Wheel Steering Motor Actuator Phase C Control

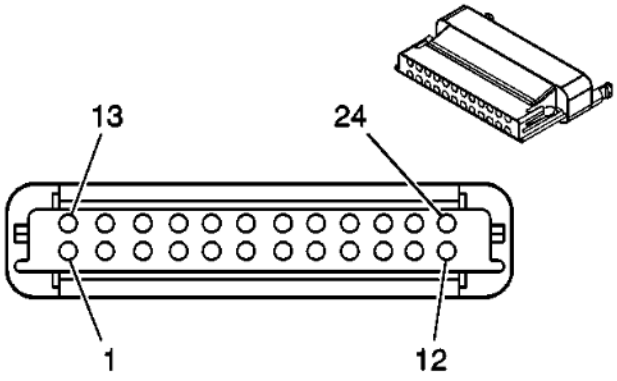
Rear Wheel Steering Control Module - C3 Connector End View

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Connector Part Information		• 15355404 • 2-Way F Maxi 800 Sealed (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK	1750	Ground
B	RED	1042	Battery Positive Voltage

Rear Wheel Steering Module - C4 Connector End View

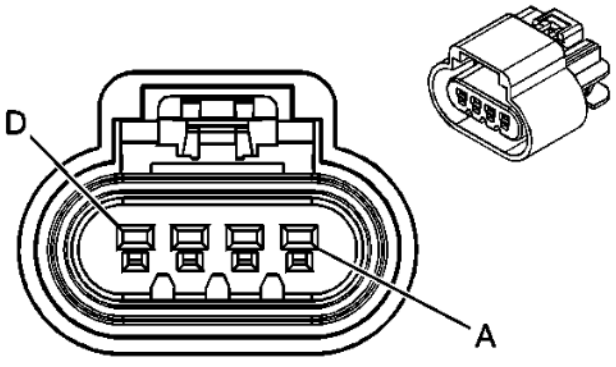


Connector Part Information		• 12129225 • 24-Way F Micro-Pack 100 Series, Sealed (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	LT GRN	1763	Steering Wheel Position Sensor Phase A Signal
2	LT BLU	1764	Steering Wheel Position Sensor Phase B Signal
			Steering Wheel Position Sensor Low

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3	LT BLU	2088	Reference
4	DK BLU	2544	Rear Wheel Steering Mode Select Switch 5V Reference
5	-	-	Not Used
6	DK GRN/WHT	817	Vehicle Speed Signal
7	BRN	541	Ignition 3 Voltage
8	DK BLU	716	Yaw Rate Sensor Signal
9	DK GRN/WHT	2891	Rear Wheel Steering Mode Select Switch Signal
10-12	-	-	Not Used
13	WHT	1765	Steering Wheel Position Marker Pulse Signal
14	-	-	Not Used
15	DK GRN	2087	Steering Wheel Position Sensor 5V Reference
16	LT BLU	2568	2 Wheel Steer Mode Indicator Supply Voltage
17	TAN	2569	4 Wheel Steer Mode Indicator Supply Voltage
18	-	-	Not Used
19	ORN	2538	4 Wheel Steer Trailer Mode Indicator Supply Voltage
20	LT BLU	715	Lateral Accelerometer Signal
21-22	-	-	Not Used
23	ORN	2640	Battery Positive Voltage
24	GRY	2567	Rear Wheel Steering Module Class 2 Serial Data

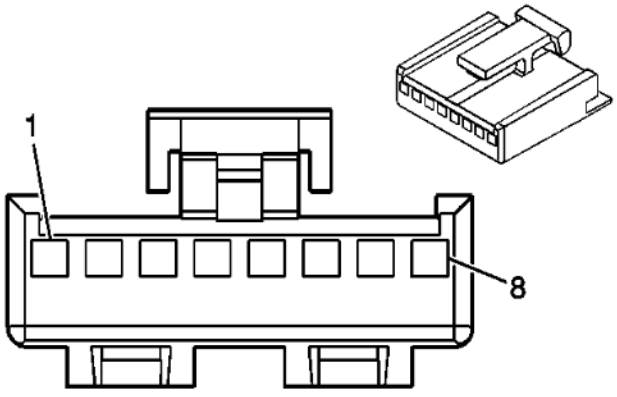
Rear Wheel Position Sensor Connector End View



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Connector Part Information		• 15326815 • 4-Way F GT 15 Sealed 4.0 (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	WHT	605	5 Volt Reference
B	DK GRN	2563	Rear Wheel Position Sensor Position 1 Signal
C	TAN	2560	Rear Position Sensor Ground
D	LT BLU	2564	Rear Wheel Position Sensor Position 2 Signal

Steering Wheel Speed/Position Sensor Connector End View



Connector Part Information		• 12052444 • 8-Way F Micro-Pack 100 Series (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	GRY	1056	Steering Wheel Position Sensor 5V Reference Voltage
2	BLK	1835	Security System Sensor Low Reference
3	LT GRN	1763	Steering Wheel Position Sensor Phase A Signal
4	LT BLU	1764	Steering Wheel Position Sensor Phase B Signal
5	WHT	1765	Steering Wheel Position Marker Pulse Signal
6	LT BLU	1059	Steering Wheel Position Sensor Signal
7	PNK	41	Ignition 3 Voltage
8	BLK	1851	Ground

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - REAR WHEEL STEERING

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Begin the system diagnosis with the Diagnostic System Check. Refer to **Diagnostic System Check - Rear Wheel Steering**. The Diagnostic System Check will provide the following information:

- The identification of the control module that commands the system.
- The ability of the control module to communicate through the serial data circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

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

DIAGNOSTIC SYSTEM CHECK - REAR WHEEL STEERING

Circuit Description

The Rear Wheel Steering Diagnostic System Check is an organized approach to identifying problems associated with the Rear Wheel Steering System. This must be the starting point for any Rear Wheel Steering System related concern and will direct you to the next logical step in diagnosing a malfunction. Most system malfunctions are linked to faulty wiring, connections and occasionally, to components. Understanding the Rear Wheel Steering System and using the diagnostic tables correctly will reduce diagnostic time and prevent unnecessary parts replacement.

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: Lack of communication may be due to partial or total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.

4: The symptom list in Symptoms will determine the correct diagnostic procedure to use.

Diagnostic System Check - Rear Wheel Steering

Step	Action	Yes	No
1	Install a scan tool. Does the scan tool power up?	Go to **Step 2**	Go to **Scan Tool Does Not Power Up** in Data Link Communications
2	• Turn ON the ignition with the engine OFF. • Use the scan tool in order to establish communication with the following modules: • Automatic Transfer Case (ATC) • Truck Body Control Module (TBC) • Electronic Brake Control Module (EBCM) • Instrument Panel Cluster (IPC) • Powertrain Control Module (PCM) • Rear Wheel Steering Control Module		Go to **Scan Tool Does Not**

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	• Sensing and Diagnostic Module (SDM) Does the scan tool communicate with all of the control modules listed above?	Go to **Step 3**	**Communicate with Class 2 Device** in Data Link Communications
3	**IMPORTANT:** **The engine may start during the following step. Turn OFF the engine as soon as you have observed the Crank power mode.** 1. Access the class 2 Power Mode in the Diagnostic Circuit Check on the scan tool. 2. Rotate the ignition switch through all positions while observing the Ignition Switch Power Mode parameter. Does the Ignition Switch parameter reading match the ignition switch position for all switch positions?	Go to **Step 4**	Go to **Power Mode Mismatch** in Body Control System
4	Select the display DTCs function on the scan tool for the following control modules: • Automatic Transfer Case (ATC) • Truck Body Control Module (TBC) • Electronic Brake Control Module (EBCM) • Instrument Panel Cluster (IPC) • Powertrain Control Module (PCM) • Rear Wheel Steering Control Module • Sensing and Diagnostic Module (SDM) Does the scan tool display any DTCs for the control modules listed above?	Go to **Step 5**	Go to **Symptoms - Rear Wheel Steering System**
5	Does the scan tool display any DTCs that begin with a "U"?	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications	Go to **Step 6**
6	Does the scan tool display DTC B1000?	Go to **Diagnostic Trouble Code (DTC) List** in Body Control System	Go to **Step 7**
7	Does the scan tool display DTC B1367, P0562, P0563, P0621, P0615, P0622, P1637, P1638?	Go to **Diagnostic Trouble Code**	Go to **Diagnostic**

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		(DTC) List in Engine Electrical	Trouble Code (DTC) List

SCAN TOOL OUTPUT CONTROLS

Rear Wheel Steering Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
2-Wheel Steer Mode Lamp	-	The scan tool commands the 2-Wheel Steer Mode Lamp ON when selected. The 2-Wheel Steer LED on the Rear Wheel Steering Mode Select switch should illuminate until commanded OFF.
4-Wheel Steer Mode Lamp	-	The scan tool commands the 4-Wheel Steer Mode Lamp ON when selected. The 4-Wheel Steer LED on the Rear Wheel Steering Mode Select switch should illuminate until commanded OFF.
4-Wheel Steer-Tow Mode Lamp	-	The scan tool commands the 4-Wheel Steer Tow Mode Lamp ON when selected. The TOW LED on the Rear Wheel Steering Mode Select switch should illuminate until commanded OFF.
Command 2-Wheel Steer	-	The scan tool commands the 2-Wheel Steering mode when ON is selected.
Command 4-Wheel Steer	-	The scan tool commands the 4-Wheel Steering mode when ON is selected.
Command 4 Wheel Steer-Tow	-	The scan tool commands the 4-Wheel Steering Trailering mode when ON is selected.
Command Rear Steer Left	-	The scan tool commands the Rear Steering Motor and turns the rear wheels left when commanded ON. The system returns to normal operation when the parameter is commanded OFF.
Command Rear Steer Right	-	The scan tool commands the Rear Steering Motor and turns the rear wheels right when commanded ON. The system returns to normal operation when the parameter is commanded OFF.
Learn Alignment	-	The scan tool performs the Learn Alignment Procedure.
Steer Mode Lamps (All)	-	The scan tool commands all of the Rear Wheel Steering Mode Lamps ON when selected.

SCAN TOOL DATA LIST

Rear Wheel Steering Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions : Ignition ON/Engine ON			
2-Wheel Steer Mode Lamp	Output	On/Off	Varies

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4-Wheel Steer Mode Lamp	Output	On/Off	Varies
4WS-Tow Mode Lamp	Output	On/Off	Varies
8-Digit GM Part Number	ID Information	Numeric	Varies
Actual Rear Steering Angle	Data Display	Degrees	0° to 12°
Base Model Part Number	ID Information	Numeric	Varies
Battery Voltage	Data Display	Voltage	9.0-16.0 volts
Calibration Part Number	ID Information	Numeric	Varies
Calibration S/W Suffix	ID Information	Numeric	Varies
Digital SWPS Phase A	Data Display	High/Low	Varies
Digital SWPS Phase B	Data Display	High/Low	Varies
Hall Sensor Reference	Data Display	Voltage	12 volts
Ignition 3	Data Display	Voltage	9.0-16 volts
Ignition Cycles Since Last Fault	Data Display	Counts	Counts
Marker Pulse	Data Display	High/Low	1
Motor Current	Data Display	Amps	20-50 A Typical 0 to 85A Max
Motor Relay Commanded State	Data Display	ON/OFF	Varies
Motor Relay Feedback State	Data Display	ON/OFF	Varies
Rear Steer Mode Actual	Data Display	2WS, 4WS, 4WS Tow	Varies
Rear Steer Mode Requested	Data Display	2WS, 4WS, 4WS Tow	Varies
Rear Steer Position 1	Data Display	Voltage	0.25-4.75 volts
Rear Steer Position 2	Data Display	Voltage	0.25-4.75 volts
Rear Steer Select Switch	Data Display	On/Off	Off
Rear Wheel Centering 1	Data Display	Voltage	2.5 volts
Rear Wheel Centering 2	Data Display	Voltage	2.5 volts
Requested Rear Steering Angle	Data Display	Degrees	0° to 12°
Sensor Supply Voltage	Data Display	Voltage	4.97 volts
Steering Wheel Angle	Data Display	Degrees	-609° to +609°
Steering Wheel Angle (TBC)	Data Display	Degrees	-225 to +225
Steering Wheel Sensor Signal	BCM Data Display	Voltage	0.25 volts to 4.75 volts
Vehicle Speed	Data Display	km/h (mph)	Varies

SCAN TOOL DATA DEFINITIONS

2-Wheel Steer Mode Lamp

Scan tool displays ON/OFF. The state of the mode indicator as commanded by the rear wheel steering control module.

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4-Wheel Steer Mode Lamp

Scan tool displays ON/OFF. The state of the mode indicator as commanded by the rear wheel steering control module.

4-Wheel Steer-Tow Mode Lamp

Scan tool displays ON/OFF. The state of the mode indicators commanded by the rear wheel steering control module.

8-Digit GM Part Number

The scan tool displays the GM part number of the rear wheel steering control module.

Actual Rear Steering Angle

The scan tool displays the actual angle of the rear wheels. With a range of 0° to 12°.

Battery Voltage

The scan tool displays 0-16.0 volt. The scan tool displays the battery system voltage as monitored by the rear wheel steering control module.

Command 2-Wheel Steer

The scan tool displays ON/OFF. The scan tool displays ON when commanded by the scan tool while causing the 2-Wheel Steer LED to be illuminated. The scan tool displays OFF when commanded by the scan tool while causing the 2-Wheel Steer LED to be turned OFF.

Command 4-Wheel Steer

The scan tool displays ON/OFF. The scan tool displays ON when commanded by the scan tool while causing the 4-Wheel Steer LED to be illuminated. The scan tool displays OFF when commanded by the scan tool while causing the 4-Wheel Steer LED to be turned OFF.

Command 4-Wheel Steer-Tow

The scan tool displays ON/OFF. The scan tool displays ON when commanded by the scan tool while causing the 4-Wheel Steer and trailing LED to be illuminated. The scan tool displays OFF when commanded by the scan tool while causing the 4-Wheel Steer and trailering LED to be turned OFF.

Commanded Rear Steer Left

The scan tool displays ON/OFF. The scan tool causes the rear wheels to turn to the left during an ON command and return to normal operation during the OFF command.

Commanded Rear Steer Right

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The scan tool displays ON/OFF. The scan tool causes the rear wheels to turn to the right during an ON command and return to normal operation during the OFF command.

Digital SWPS Phase A-Steering Wheel Position Sensor

The scan tool displays High/Low. Phase A signal of the Steering Wheel Position Sensor should change states as the steering wheel is rotated left or right. Each transition from high to low represents one degree.

Digital SWPS Phase B-Steering Wheel Position Sensor

The scan tool displays High/Low. Phase B signal of the Steering Wheel Position Sensor should change states as the steering wheel is rotated left or right. Each transition from high to low represents one degree.

Hall Sensor Reference

The scan tool displays 12 V. The hall sensor reference is the supply voltage of the hall sensor.

Ignition 3

The scan tool displays 0-16 volts. Ignition 3 is hot in run mode only.

Ignition Cycles Since Last Fault

The scan tool displays 0-100. The number of ignition cycles since the last fault occurred.

Motor Current

The scan tool displays 0-85-amp Max, A typical range of 20-50 Amps. Motor current is the range of the current in the rear steering motor during normal operation.

Motor Relay Commanded State

The scan tool displays ON/OFF. When system is in RUN then the relay will be ON, if system is shut down for any reason the relay will be OFF.

Motor Relay Feedback State

The scan tool displays ON/OFF. The actual state of relay.

Rear Steer Mode Actual

The scan tool displays: 2WS, 4WS, 4WS Tow. The actual state of the rear wheel steering system.

Rear Steer Mode Request

The scan tool displays: 2WS, 4WS, 4WS Tow. The requested state of the rear wheel steering system.

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Rear Steer Select Switch

The scan tool displays ON/OFF. The rear wheel steering selection switch allows the driver to change steering modes. Display shows ON with the switch depressed.

Rear Wheel Centering 1

The scan tool displays 2.5 volts. The parameter, represented as a voltage, that monitors the rear wheel position 1 signal. When the rear wheel sensor is centered, the scan tool displays 2.5 volts.

Rear Wheel Centering 2

The scan tool displays 2.5 volts. The parameter, represented as a voltage, that monitors the rear wheel position 2 signal. When the rear wheel sensor is centered, the scan tool displays 2.5 volts.

Rear Wheel Position 1

The scan tool displays 0.25-4.75 volts. This parameter monitors the first of two rear wheel sensor signals for out of specified operation range.

Rear Wheel Position 2

The scan tool displays 0.25-4.75 volts. This parameter monitors the second of two rear wheel sensor signals for out of specified operation range.

Requested Rear Steering Angle

The scan tool displays 0-12 degrees. This is the command coming from the rear wheel steering module.

Sensor Supply Voltage

The scan tool displays approx 5.00 volts. The sensor supply voltage is the supply voltage of the rear wheel position sensor.

Steering Wheel Angle

The scan tool displays -609 to +609 degrees. The steering wheel angle parameter indicates the direction of rotation of the steering wheel.

Steering Wheel Angle (TBC)

This parameter is displayed in degrees from -225 to +225. This angle represents the analog signal communicated to the rear wheel steering control module from the BCM via class 2 communication.

Steering Wheel Sensor Signal

This parameter is displayed in BCM Data. The scan tool displays from 0.25 to 4.75 volts. The signal is a

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linear signal that measures its minimum voltage when the steering wheel is turned approximately 1 full turn to the right from center. The scan tool displays approximately 2.5 volts with the steering wheel centered.

SWPS Marker Pulse

The scan tool displays HIGH/LOW. The marker pulse is used to center the rear wheels during the learn alignment procedure.

Vehicle Speed

The scan tool displays 0 to 159 mph. The rear wheel steering control module receives vehicle speed information, 0-255 km/h (0-159 mph) from the PCM vehicle speed signal circuit. The PCM calculates the vehicle speed from VSS signal.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Module(s)
B3593	Malfunctioning Rear Wheel Steering Mode Select Switch	Rear Wheel Steering Control Module
C0000	Vehicle Speed Information Circuit Malfunction	Rear Wheel Steering Control Module
C0253	EBCM Control Valve Circuit	Rear Wheel Steering Control Module
C0455	Steering Position Sensor Circuit Malfunction (VES)	Rear Wheel Steering Control Module
C0472	Steering Handwheel Speed Sensor Signal V Low	Rear Wheel Steering Control Module
C0473	Steering Handwheel Speed Sensor Signal V High	Rear Wheel Steering Control Module
C0522	Position Signal Circuit On The Rear Position Sensor	Rear Wheel Steering Control Module
C0527	Invalid Switch Combination Is Detected	Rear Wheel Steering Control Module
C0532	Rear Wheel Position Sensor Signals Have Invalid Values	Rear Wheel Steering Control Module
C0533	Shorting Relay Is Stuck Open/Closed, Commanded Vs. Actual	Rear Wheel Steering Control Module
C0538	Rear Wheel Steering Control Module Does Not See Rear Wheel Steering Gear Motor Respond To Current Inputs Properly	Rear Wheel Steering Control Module
C0538	Rear Wheel Steering Control Module Does Not See Rear Wheel Steering Gear Motor Respond To Current Inputs Properly	Rear Wheel Steering Control Module

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C0543	Rear Actuator Does Not Achieve Desired Position	Rear Wheel Steering Control Module
C0550	ECU Malfunction - Internal Write/Checksum Malfunction	Rear Wheel Steering Control Module

DTC B3593: MALFUNCTIONING REAR WHEEL STEERING MODE SELECT SWITCH

Circuit Description

The rear wheel steering control module monitors the rear wheel steering mode select switch 5-volt reference circuit for out of range voltage conditions. When the mode select switch button is depressed the switch is in the active state. When the mode select switch is released the switch is in the inactive state. The following conditions will help determine if there is a malfunctioning rear wheel steering mode select switch:

- The resistance of the load in the active state is 500 ohms with an additional 1,000 ohms pull-up resistor.
- The resistance of the load in the inactive state is 2,000 ohms with an additional 1,000 ohms pull-up resistor.
- The pull-up voltage is 12 volts.

Conditions for Running the DTC

Turn ON the ignition, with engine ON.

Conditions for Setting the DTC

- The mode select switch 5-volt reference circuit is open, shorted to ground or voltage.
- The mode select switch signal circuit is open or shorted to voltage.

Action Taken When the DTC Sets

- The Service 4-Wheel Steer indicator on IPC will be displayed.
- The code is displayed on the scan tool as DTC B3593.
- The output to the motor is ramped down slowly at a rate of 1 degree/second back to center and held.
- The rear wheels will be returned to the centered position.

Conditions for Clearing the DTC

- The conditions for DTC are not currently present.
- The module receives a clear code command from the scan tool.
- The DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

- Inspect for poor connections at the harness connector of the rear wheel steering control module and Rear Wheel Steering Select Switch. Refer to **Testing for Intermittent Conditions and Poor Connections** ,

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and to **Connector Repairs** in Wiring Systems.

- Observe the rear wheel steering mode select switch. If all of the mode indicator LEDs are illuminated the rear wheel steering control module has lost its alignment memory settings and the scan tool must be used to re-calibrate the rear wheel steering alignment data in the rear wheel steering control module.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: The normal state of the switch is the state of the switch input before activation. The terminology used by the scan tool is OFF.

3: Tests for the proper operation of the switch in the normally open position.

4: Tests for the proper operation of the switch in the closed position.

8: Tests the 5-volt reference circuit for an open or a short to ground.

DTC B3593

Step	Action	Value	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	-	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine OFF. 3. Activate the rear wheel steer mode select switch. 4. With a scan tool, observe the Rear Wheel Steer Mode Select Switch Data parameter. Does the parameter change?	ON/OFF	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the rear wheel steer mode select switch. 3. Measure the resistance between the 5-volt reference circuit and the mode select switch signal circuit on the rear wheel steer mode select switch. Does the resistance measure within the specified	1.8 kohms to 2.2 kohms		

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	parameter?		Go to **Step 4**	Go to **Step 14**
4	1. Depress the rear wheel steer mode select switch. 2. Measure the resistance between the 5-volt reference circuit and the mode select switch signal circuit on this switch. Does the resistance measure within the specified parameter?	450 ohms-550 ohms	Go to **Step 5**	Go to **Step 14**
5	1. Turn the ignition to the ON position, with the engine OFF. 2. Measure the voltage between the 5-volt reference circuit of the rear wheel steer mode select switch harness connector and a good ground. Is the voltage at the 5-volt reference circuit within the specified parameter?	4.750 to 5.00 V	Go to **Step 7**	Go to **Step 6**
6	Is the voltage at the 5-volt reference circuit less than the specified parameter?	4.75 to 5.00 V	Go to **Step 8**	Go to **Step 9**
7	1. Turn the ignition switch to the OFF position. 2. Measure the resistance between the mode select switch signal circuit of the rear wheel steer mode select switch connector and a good ground. Is the resistance at the mode select switch signal circuit less than the specified parameter?	1500 ohms	Go to **Step 12**	Go to **Step 10**
8	Test the 5-volt reference circuit of the rear wheel steer mode select switch for an open, or a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
9	Test the 5-volt reference circuit of the rear wheel steer mode select switch for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
10	Test the mode select switch signal circuit of the rear wheel steer mode select switch for an open, high resistance or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

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	Did you find and correct the condition?		Go to **Step 15**	Go to **Step 11**
11	Inspect for poor connections at the harness connector of the rear wheel steering control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
12	Inspect for poor connections at the harness connector of the rear wheel steer mode select switch. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
13	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering)** Replace the rear wheel steering control module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the rear wheel steer mode select switch. Refer to **Rear Wheel Steering Mode Switch Replacement**. Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC C0000: VEHICLE SPEED INFORMATION CIRCUIT MALFUNCTION

Circuit Description

The rear wheel steering control module receives a vehicle speed signal input from the powertrain control module (PCM) via the vehicle speed signal circuit and also receives vehicle speed data over the serial data class 2 circuit. Once vehicle speed has been detected, the rear wheel steering control module compares the two inputs for accuracy. The module calculates the vehicle speed from the PCM with a resolution of 0.80 km/h (0.5 mph) from 0-209 km/h (0-130 mph). The discrete VSS signal must be present for rear wheel steer operation. The class 2 information is only used for comparison calculations.

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Conditions for Running the DTC

- The engine must be running.
- The vehicle speed must be greater than 15 km/h (9 mph).

Conditions for Setting the DTC

- The vehicle speed discrete line and the vehicle speed class 2 line information vary by more than 15 km/h (9.0 mph).
- The Class 2 vehicle speed is greater than 33 km/h (20 mph) and the calculated speed input is less than 5 km/h (3 mph) continuous for 10 seconds.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0000.
- The output to the motor is ramped down slowly and held.
- The rear wheels will return to the centered position.

Conditions for Clearing the MIL/DTC

- The rear wheel steering control module detects a vehicle speed signal from the PCM of greater than 32 km/h (20 mph).
- A history DTC will clear after not seeing the malfunction for 100 consecutive ignition cycles.
- The module receives a clear code command from the scan tool.
- Malfunction conditions are not currently present.

Diagnostic Aids

- Most of the occurrences of this DTC are caused by a short or an open vehicle speed sensor signal circuit to the rear wheel steering control module. Review rear wheel steering system operation or, with the customer, verify the condition under which the DTC set.
- Inspect for poor connections at the harness connector of the rear wheel steering control module. Refer to **Testing for Intermittent Conditions and Poor Connections** , and to **Connector Repairs** in Wiring Systems.
- Observe the rear wheel steering mode select switch. If all of the mode indicator LEDs are illuminated the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering alignment data in the rear wheel steering control module. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

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3: Tests whether the condition is module, system, or condition related.

4: Tests whether the condition has been corrected or identified as specified in the supporting text.

5: Test for an open or short in the vehicle speed signal circuit of the rear wheel steering control module.

DTC C0000

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics Connector End View Reference: Rear Wheel Steering Connector End Views			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, monitor the DTC Information for DTC C0000 in the rear wheel steering control module. Does the scan tool indicate that DTC C0000 is current?	Go to **Step 3**	Go to **Step 4**
3	With a scan tool, monitor the DTC Information for DTC P0608 in the IPC. Does the scan tool indicate that DTC P0608 is current?	You must repair this DTC first. Go to **DTC P0608**	Go to Diagnostic Aids
4	1. Use the scan tool in order to clear the DTCs. **IMPORTANT:** **Do not cycle the ignition.** 2. Operate the vehicle within normal operating conditions. Does the DTC reset?	Go to **Step 5**	System OK
5	Test the vehicle speed signal circuit of the rear wheel steering control module for a short to ground, short to voltage or an open between PCM and the rear wheel steering control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the rear wheel steering control module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** Did you find and correct the condition?	Go to **Step 8**	Go to **Step 7**
	IMPORTANT:		

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7	**Perform the Learn Alignment procedure.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**.Did you complete the replacement?	Go to **Step 8**	-
8	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within normal operating conditions. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0253: EBCM CONTROL VALVE CIRCUIT

Circuit Description

The steering position sensor provides 3 digital signal inputs and 1 analog signal inputs to the rear wheel steering control module. The 3 digital signals are:

- Phase A
- Phase B
- Index pulse

The analog signal is the steering wheel position signal. This is a class 2 signal from the TBC.

The rear wheel position sensor provides 2 discreet analog signal inputs to the rear wheel steering control module. These inputs are :

- Rear wheel position 1 signal
- Rear wheel position 2 signal

The rear wheel steering control module compares the differences between the steering wheel position sensor and the rear wheel position sensor. If the difference exceeds the internal values in the rear wheel steering control module than C0253 will set.

Conditions for Running the DTC

- The ignition is ON.
- Performing the alignment procedure.

Conditions for Setting the DTC

- A valid alignment was not performed.
- The steering wheel sensor analog voltage is out of valid alignment range, which is within 2.0-3.0 volts.
- The steering wheel sensor marker pulse is out of valid alignment range, and the steering wheel sensor

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index switch points are not between + or - 10° of center.

- The rear sensor analog voltage out of valid alignment range:
  - The scan tool data parameter rear wheel centering 1 is not within 2.0-3.0 volts.
  - The scan tool data parameter rear wheel centering 2 is not within 2.0-3.0 volts.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator on IPC will be displayed.
- The code is displayed on the scan tool as DTC C0253.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands to open the power relay, and to close the motor shorting relay.
- The rear wheels will be returned to the centered position.

Conditions for Clearing the DTC

- The condition for the DTC is not currently present.
- The module receives a clear code command from the scan tool.
- The history DTC clears after 100 malfunction free ignition cycles.
- A valid alignment is performed.

Diagnostic Aids

- Inspect for poor connections at the harness connector of the rear wheel steering control module, rear wheel position sensor and the steering wheel position sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** , and to **Connector Repairs** in Wiring Systems.
- Observe the rear wheel steering mode select switch. If all of the mode indicator LEDs are illuminated the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering alignment data in the rear wheel steering control module. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** .

Steering Wheel Position Sensor - Digital Signal

- 3 outputs used (Phase A, Phase B, Index Pulse)
- Phase A & Phase B

  Offset PWM wave forms created when turning the wheel

- Index pulse

  Signal is present only when steering wheel is within 10 degrees either side of center

Steering Wheel Position Sensor- Analog Signal

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- This is a class 2 message from the TBC
- Voltage is at or near 2.5 volts with wheels at center
- Voltage increases/decreases for less than one full turn (+/- 225 Degrees), then plateaus for the remainder of the travel

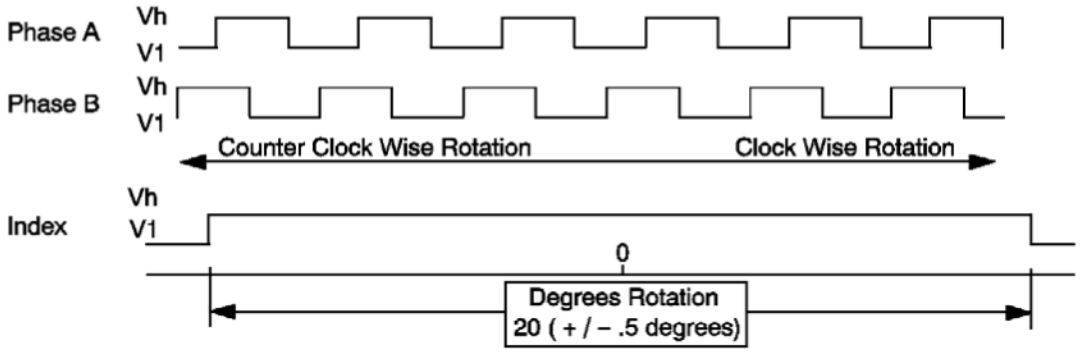


Fig. 10: Steering Wheel Position Sensor - Digital Signal
Courtesy of GENERAL MOTORS CORP.

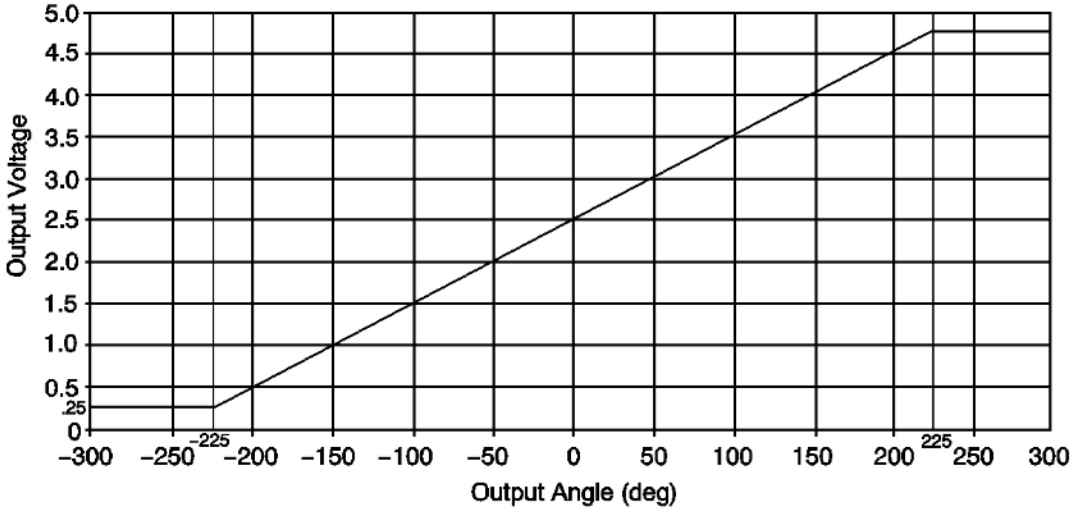


Fig. 11: Steering Wheel Position Sensor - Analog Signal
Courtesy of GENERAL MOTORS CORP.

Test Description

The number below refers to the step number on the diagnostic table.

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2: This step verifies there was an improper rear wheel steering alignment performed.

DTC C0253

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine OFF. 3. With a scan tool, monitor the DTC Information for DTC C0253 in the rear wheel steering control module. Does the scan tool indicate that DTC C0253 is current?	Go to **Step 3**	Go to Diagnostic Aids
3	With a scan tool, monitor the DTC Information for DTC C0455 in the rear wheel steering control module. Does the scan tool indicate that DTC C0455 is current?	Go to **DTC C0455**	Go to **Step 4**
4	With a scan tool, monitor the DTC Information for DTC C0522 in the rear wheel steering control module. Does the scan tool indicate that DTC C0522 is current?	Go to **DTC C0522**	Go to **Step 5**
5	With the scan tool, monitor the sensor data. Is the steering wheel sensor analog voltage within valid alignment range (which is within 2.0-3.0 volts) and also is the sensor feed voltage 5.00 volts?	Go to **Step 6**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
6	With the scan tool, monitor the sensor data. Is the steering wheel sensor marker pulse within valid alignment range, and the steering wheel sensor index switch points are between + or - 10° of center, is the steering wheel centered?	Go to **Step 7**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
7	Is the scan tool data parameter rear wheel centering 1 within 2.0-3.0 volts and rear wheel centering 2 within 2.0-3.0 volts?	Go to **Step 8**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
8	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.**		

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	Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**.Did you complete the replacement?	Go to **Step 9**	-
9	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0455: STEERING POSITION SENSOR CIRCUIT MALFUNCTION (VES)

Circuit Description

The steering wheel position sensor (SWPS) provides one analog signal and 3 digital signals. The digital signals, Phase A, Phase B and marker pulse, are direct inputs to the rear wheel steering control module. The analog signal is input to the BCM and is sent via a class 2 message to the rear wheel steering control module. Battery voltage is supplied to the sensor from the cruise fuse to operate the digital portion of the sensor.

A 12-volt reference is provided by the rear wheel steering control module to the Phase A, Phase B, and marker pulse circuits of the SWPS. The module monitors each circuit as it is either remains high or is pulled low by the SWPS.

The scan tool displays the Phase A and Phase B data parameters as either HIGH or LOW when the steering wheel is being rotated. Each change from HIGH to LOW, or LOW to HIGH, represents one degree of steering wheel rotation. When observing the Phase A and Phase B data with the scan tool, the parameters will not always display the same value at the same time.

The marker pulse is a digital pulse signal that is displayed as HIGH by the scan tool with the steering wheel angle between +10 degrees and -10 degrees. At greater than 10 degrees steering wheel angle in either direction, the marker pulse data will be displayed as LOW.

The BCM provides the 5-volt reference and low reference for the analog portion of the SWPS. The BCM reads the SWPS analog signal in voltage, which is typically 2.5-volt with the steering wheel on center. The voltage ranges from 0.25-volt at approximately 1 full turn left to 4.75-volt at approximately 1 full turn right. The voltage will then remain at that level for the remainder of steering wheel travel. This voltage can be monitored in BCM data display.

The rear wheel steering control module receives the analog signal via a class 2 message from the BCM. When monitoring the rear wheel steering data, this information is displayed in the Steering Wheel Angle (TBC) Data parameter, and is shown in degrees. The range of the display is +/- 225 degrees, with negative numbers representing steering input to the left, and positive numbers representing input to the right.

Conditions for running the DTC

Turn ON the ignition, with engine ON.

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Conditions for Setting the DTC

- A condition that sets a BCM DTC C0472 or C0473 is present.
- The marker pulse signal was low at less than +/-10 degrees of steering wheel angle and the steering wheel angle has changed more than 30 degrees.
- The marker pulse signal was high at greater than +/-10 degrees of steering wheel angle and the steering wheel angle has changed more than 30 degrees.
- No change in Phase A or Phase B signals and the steering wheel angle has changed more than 30 degrees.
- The SWPS Phase A, Phase B, or marker pulse circuits have an open, short to ground, or short to battery voltage.

Action Taken When the DTC Sets

- The Service 4-Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0455.
- The output to the motor is ramped down slowly, at a rate of 2 degrees per second to 0 degrees and held.
- The rear wheels will be returned to the centered position.
- The internal power relay of the rear wheel steering control module is turned off, which in turn shuts down the 12-volt reference to the SWPS. This results in all digital signals being displayed as low by the scan tool. Battery voltage and hall sensor reference voltage will also display low voltage. This occurs only when the DTC is current.

Conditions for Clearing the DTC

- Conditions for DTC are not currently present.
- The module receives a clear code command from the scan tool.
- The DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

IMPORTANT: When the DTC is current, the internal power relay of the rear wheel steering control module is turned OFF, which in turn shuts down the 12-volt reference to the SWPS. This results in all digital signals being displayed as low by the scan tool. Battery voltage and hall sensor reference voltage will also display low voltage. Cycling the ignition will cause the DTC to become a history code. When the DTC is a history code, the power relay is ON with ignition ON, and the 12-volt reference is supplied to the SWPS. During diagnosis, any steps that require monitoring data must be performed when the code is not current. Monitoring data while the DTC is current will result in inaccurate data being displayed, and misdiagnosis will result.

The following conditions are possible causes:

- A class 2 communication problem with the TBC.

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- The steering wheel was rotated with the steering gear disconnected.
- A malfunctioning steering wheel position sensor is present.
- A steering wheel position sensor circuit is open.
- A steering wheel position sensor circuit was shorted.

Perform an inspection of the wiring and of the connectors. Failure to carefully inspect the wiring and the connectors may result in misdiagnosis. Misdiagnosis causes part replacement with reappearance of the malfunction.

Steering Wheel Position Sensor - Digital Signal

- 3 outputs used (Phase A, Phase B, Index Pulse)
- Phase A & Phase B

  Offset PWM wave forms created when turning the wheel

- Index pulse

  Signal is present only when steering wheel is within 10 degrees either side of center

Output is used to determine Direction of Rotation and Rate of Rotation

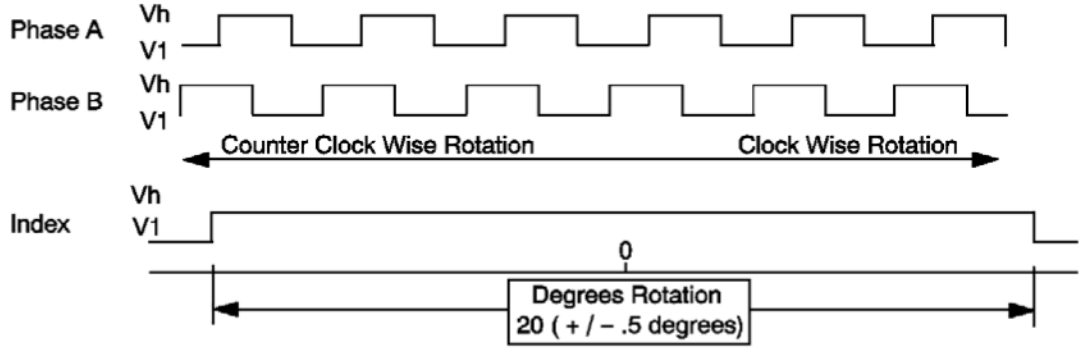


Fig. 12: Steering Wheel Position Sensor - Digital Signal
Courtesy of GENERAL MOTORS CORP.

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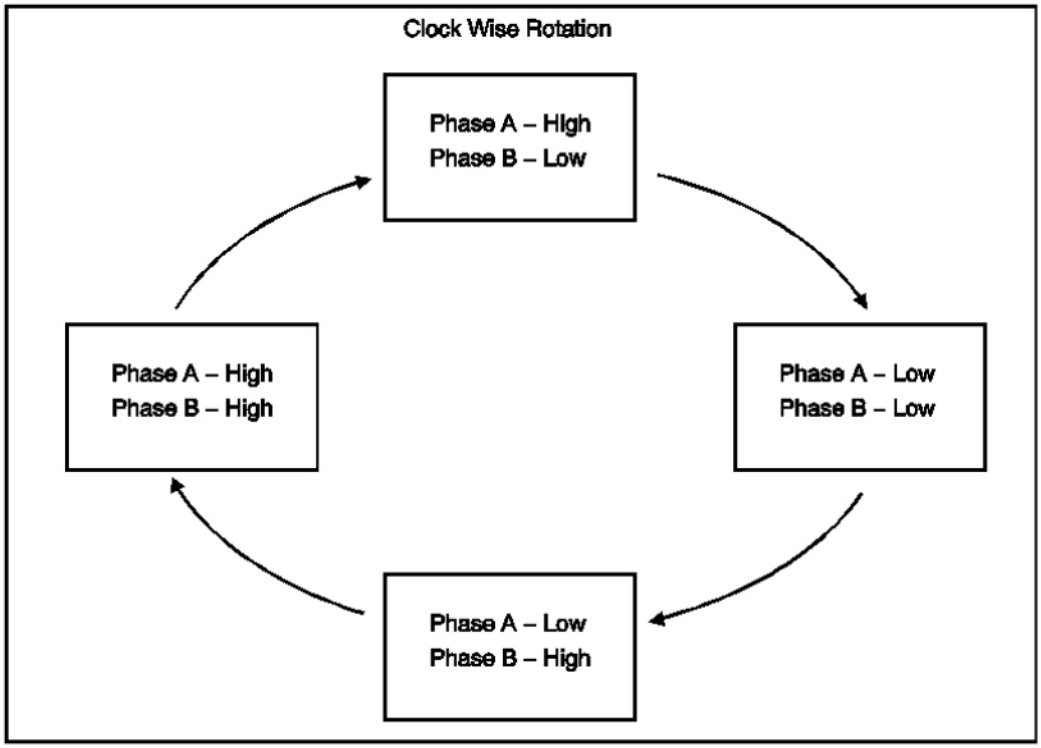
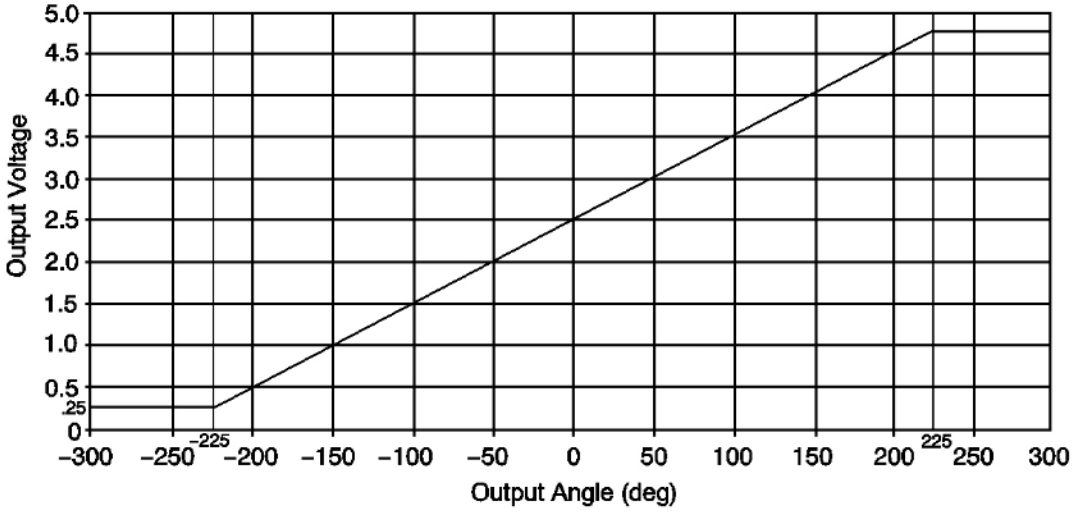


Fig. 13: Steering Wheel Position Sensor - A & B Phase
Courtesy of GENERAL MOTORS CORP.



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Fig. 14: Steering Wheel Position Sensor - Analog Signal
Courtesy of GENERAL MOTORS CORP.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step will help determine if the fault is in the analog or the digital portion of the SWPS.

4: This step determines if the condition is currently present.

6: This step will help determine if a short to voltage exists in any of the digital circuits. A short to voltage in any of these circuits will cause all parameters to remain high.

14: This step checks for proper voltage to the phase A and Phase B circuits at the sensor and for proper operation of the sensor.

15: This step checks for proper voltage to the marker pulse circuit of the sensor and for proper operation of the sensor.

17: This step checks for proper operation of the sensor circuits by testing the sensors ability to switch a voltage signal between high and low.

DTC C0455

Step	Action	Values	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Diagnostic System Check - Rear Wheel Steering?	-	Go to **Step 2**	Go to **Diagnostic Starting Point - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition ON, with the engine OFF. 3. With the scan tool, monitor the DTC information in the Rear Wheel Steering Control module. Does the information indicate the DTC C0455 is current?	-	Go to **Step 3**	Go to **Step 4**
3	With the scan tool, monitor the DTC information in the BCM. Does the information indicate a DTC C0472 or C0473 is present?	-	Go to **DTC C0472 or C0473**	Go to **Step 4**
	1. Center the steering wheel. 2. Turn OFF the ignition. 3. Wait 10 seconds.			

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4	4. Turn ON the ignition, with the engine OFF. 5. Rotate the steering wheel 90 degrees left and right. 6. Monitor the DTC information in the rear wheel steering control module. Does the DTC C0455 become current?	-	Go to **Step 5**	Go to Diagnostic Aids
5	**IMPORTANT:** **Rotating the steering wheel in excess of 30 degrees from center in either direction will result in DTC C0455 becoming current. This will result in inaccurate data being displayed and will cause misdiagnosis. If this occurs, you must repeat steps 1 through 4 of the following procedure before monitoring the data parameters.** 1. Center the steering wheel. 2. Turn OFF the ignition. 3. Wait 10 seconds. 4. Turn ON the ignition, with the engine OFF. 5. Observe the steering wheel angle in the rear wheel steering data list. 6. Move the steering wheel slowly back and forth over center. Does the steering wheel angle value change?	-	Go to **Step 13**	Go to **Step 6**
6	**IMPORTANT:** **If DTC C0455 becomes current during this step, you must repeat steps 1 through 4 of Step 5 before monitoring the data parameters.** Using the scan tool, monitor the Phase A, Phase B, and Marker Pulse Data parameters.Do all parameters remain HIGH at all times with steering input?	-	Go to **Step 8**	Go to **Step 7**
7	**IMPORTANT:** **If DTC C0455 becomes current during this step, you must repeat steps 1 through 4 of Step 5 before monitoring the data parameters.** Using the scan tool, monitor the Phase A and Phase B Data parameters.Does the Phase A or	-		

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	Phase B parameter remain HIGH at all times with steering input?		Go to **Step 11**	Go to **Step 12**
8	Test the battery positive voltage circuit of the steering wheel position sensor (SWPS) for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 9**
9	Test the ground circuit of the SWPS for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 10**
10	Test the Phase A, Phase B, and marker pulse circuits for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 14**
11	Test the Phase A or Phase B circuit for an open circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 22**	Go to **Step 14**
12	Test the Phase A or Phase B circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 14**
13	Test the marker pulse circuit for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 15**
14	**IMPORTANT:** **If DTC C0455 becomes current during this step, you must repeat steps 1 through 4 of Step 5 before performing the following test.** With the ignition ON, use a DVOM to measure the voltage of the Phase A and Phase B circuits by back probing the circuits at the SWPS while slowly rotating the steering wheel back an forth over center.Does the voltage switch in the range specified?	0.080-0.180 V to 10.5-12.0 V	Go to **Step 19**	Go to **Step 16**
15	**IMPORTANT:** **If DTC C0455 becomes current during this step, you must repeat steps 1 through 4 of Step 5 before performing the following test.** With the ignition ON, use a DVOM to measure the voltage of the marker pulse circuit by back probing the circuit at the SWPS while rotating	10.5-12.0 V to 0.080-0.180 V		

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	the steering wheel from center to more than 10 degrees but less than 30 degrees.Does the voltage change from high on center to low at greater than 10 degrees rotation?		Go to **Step 19**	Go to **Step 16**
16	Does the voltage of a circuit tested in a previous step remain high at all times?	-	Go to **Step 18**	Go to **Step 17**
17	1. Connect a DVOM positive lead to battery voltage. 2. Connect the DVOM negative lead to the circuit that remained low in the preceding step by back probing the circuit at the SWPS. 3. Move the steering wheel slowly back and forth over center. Does the voltage switch between high and low?	-	Go to **Step 19**	Go to **Step 18**
18	Inspect for poor connections at the SWPS. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 20**
19	Inspect for poor connections at the rear wheel steering control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 21**
20	**IMPORTANT:** **Perform the learn alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the SWPS. Refer to **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement** in Steering Wheel and Column.Did you complete the replacement?	-	Go to **Step 22**	-
21	**IMPORTANT:** **Perform the learn alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) .** Replace the rear wheel steering control module. Refer to **Rear Wheel Steering Control Module Replacement**.Did you complete the	-		

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	replacement?		Go to **Step 22**	-
22	1. Use the scan tool to clear DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC C0472: STEERING HANDWHEEL SPEED SENSOR SIGNAL V LOW; C0473: STEERING HANDWHEEL SPEED SENSOR SIGNAL V HIGH

Circuit Description

The steering wheel position sensor (SWPS) provides one analog signal and 3 digital signals. The digital signals, Phase A, Phase B and marker pulse, are direct inputs to the rear wheel steering control module. The analog signal is input to the BCM and is sent via a class 2 message to the rear wheel steering control module. Battery voltage is supplied to the sensor from the cruise fuse to operate the digital portion of the sensor.

A 12-volt reference is provided by the rear wheel steering control module to the Phase A, Phase B, and marker pulse circuits of the SWPS. The module monitors each circuit as it is either remains high or is pulled low by the SWPS

The scan tool displays the Phase A and Phase B Data parameters as either HIGH or LOW when the steering wheel is being rotated. Each change from HIGH to LOW, or LOW to HIGH, represents one degree of steering wheel rotation. When observing the Phase A and Phase B data with the scan tool, the parameters will not always display the same value at the same time.

The marker pulse is a digital pulse signal that is displayed as HIGH by the scan tool with the steering wheel angle between +10 degrees and -10 degrees. At greater than 10 degrees steering wheel angle in either direction, the marker pulse data will be displayed as LOW.

The BCM provides the 5-volt reference and low reference for the analog portion of the SWPS. The BCM reads the SWPS analog signal in voltage, which is typically 2.5-volt with the steering wheel on center. The voltage ranges from 0.25-volt at approximately one full turn left to 4.75-volt at approximately one full turn right. The voltage will then remain at that level for the remainder of steering wheel travel. This voltage can be monitored in BCM data display.

The rear wheel steering control module receives the analog signal via a class 2 message from the BCM. When monitoring the rear wheel steering data, this information is displayed in the Steering Wheel Angle (TBC) Data parameter, and is shown in degrees. The range of the display is +/- 225 degrees, with negative numbers representing steering input to the left, and positive numbers representing input to the right.

Conditions for Running the DTC

The ignition is ON.

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Conditions for Setting the DTC

The BCM detects that the analog steering signal circuit is an open, shorted to ground or shorted to voltage.

Action Taken When the DTC Sets

The BCM sends a serial data message reporting the failed steering signal.

Conditions for Clearing the DTC

- A current DTC will clear when the malfunction is no longer present.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles or when the scan tool Clear DTCs function is used.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Electrical Intermittents** , **Testing for Intermittent Conditions and Poor Connections** , **Wiring Repairs** and **Connector Repairs** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step checks the 5-volt reference and signal circuits. It also checks the ability of the BCM to read the signal circuit.

5: This step checks the integrity of the low reference circuit.

10: This step tests for excessive voltage on the 5-volt reference circuit.

DTC C0472 or C0473

Step	Action	Values	Yes	No
Schematic Reference: Body Control System Schematics in Body Control System **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Rear Wheel Steering Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Use the scan tool to clear the DTC. 2. Start the engine. 3. With the engine running, turn the steering wheel back and forth from lock to lock. Does the DTC reset?	-	Go to **Step 3**	Go to Diagnostic Aids
	1. Turn the ignition OFF.			

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3	2. Disconnect the steering wheel position sensor harness connector. 3. Turn the ignition ON. 4. Select the Body Control Module Data List on the scan tool. 5. Observe the Analog SWPS Signal parameter on the scan tool. Does the scan tool indicate that the Steering Wheel Position Sensor Data parameter is less than specified value?	0.15 V	Go to **Step 4**	Go to **Step 9**
4	1. Connect a 3-amp fused jumper wire between the steering wheel position 5-volt reference circuit and the analog steering signal circuit. 2. Observe the Analog SWPS Signal parameter on the scan tool. Does the scan tool indicate that the Steering Wheel Position Sensor Data parameter is greater than specified value?	4.75 V	Go to **Step 5**	Go to **Step 6**
5	Use a DMM to measure the voltage between the steering wheel position 5-volt reference circuit and the steering wheel position low reference circuit. Does the voltage measure greater than the specified value?	4.75 V	Go to **Step 10**	Go to **Step 8**
6	Test the 5-volt reference circuit of the steering wheel position sensor for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 7**
7	Test the signal circuit of the steering wheel position sensor for an open or a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
8	Test the low reference circuit of the steering wheel position sensor for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
9	Test the signal circuit of the steering wheel position sensor for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring	-		

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	Systems. Did you find and correct the condition?		Go to **Step 15**	Go to **Step 14**
10	Test the 5-volt reference circuit of the steering wheel position sensor for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
11	Inspect for poor connections at the harness connector of the steering wheel position sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for poor connections at the harness connector of the BCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	**IMPORTANT:** **Perform the learn alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering)** Replace the steering wheel position sensor. Refer to **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement** in Steering Wheel and Column.Did you complete the replacement?	-	Go to **Step 15**	-
14	**IMPORTANT:** **Perform the setup procedure for the BCM.** Replace the BCM. Refer to **Body Control Module Replacement** in Body Control Systems.Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC C0522: POSITION SIGNAL CIRCUIT ON THE REAR POSITION SENSOR

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Circuit Description

This circuit monitors the rear position sensor signals for an out-of-specified operating range in IGNITION and RUN. The rear wheel position sensor has 2 signal circuits: position 1 and position 2. Position 1 is a linear measurement of voltage per degree. The voltage range for position 1 is from 0.25 to 4.75 volts, and the angular measurement range is from - 600° to + 600°. At 0.25 volts the steering wheel has been rotated - 600° past center. At 4.75 volts the steering wheel has been rotated + 600° past center.

Position 2 circuit is a linear measurement of voltage per degree. The voltage for position 2 increases or decreases from 0.25 to 4.75 volts every 180°, which is a half steering wheel rotation. When the steering wheel is 0° or at center, position 1 and position 2 output signals measure 2.5 volts respectively.

Conditions for Running the DTC

The ignition must be ON with the engine ON.

Conditions for Setting the DTC

- Position A signal or position B signal circuit on the rear position sensor must be less than 0.075 volts.
- Position A signal or position B signal circuit on the rear position sensor must be greater than 4.925 volts.
- The 5 volt reference circuit is open or shorted to ground.
- The position sensor ground circuit is open.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed
- The code is displayed on the scan tool as DTC C0522.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands to open the power relay, and to close the motor shorting relay.
- The rear wheels will be returned to the centered position.

Conditions for Clearing the MIL/DTC

- Conditions for DTC are not currently present.
- The module receives a clear code command from the scan tool.
- A history DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

- Use a DMM to check supply voltage.
- Use a DMM to measure the resistance. If the resistance at any of the items listed below are not in the specified range, replace the rear position sensor.
    - The resistance between the position 1 and the sensor ground circuit is 1720 ohms.
    - The resistance between the position 1 and the 5 volt reference circuit is 1700 ohms.

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  - The resistance between the position 2 and the sensor ground circuit is 1780 ohms.
  - The resistance between the position 2 and the 5 volt reference circuit is 1000 ohms.
  - The resistance between the 5 volt reference circuit and the sensor ground circuit is 1780 ohms.
- When the supply voltage is open or shorted to ground, position 1 and position 2 data parameter show 0 volts on the scan tool.
- When the ground circuit is open, position 1 and position 2 data parameter show 5 volts on the scan tool.
- Using the data display menu verify that the rear wheel position 1 has an output voltage range between 0.25-4.75 volts.
- Using the data display menu verify that the rear wheel position 2 has an output voltage range between 0.25-4.75 volts.
- Use a DMM to check resistance at the rear wheel position sensor. When the steering wheel is centered, the resistance between the rear wheel position sensor position 1 or position 2 signal and rear wheel position sensor ground is approximately 1,500 ohms.
- Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs**
- Inspect the rear wheel position sensor for damage. If none is found then remove and inspect the sensor and coupler for damage or water intrusion. Refer to **Rear Position Sensor Replacement**. If water damage is found, refer to **Rack and Pinion Boot Replacement**.
- Rear Wheel Position Sensor Voltage-Rear Wheel Position Sensor Voltage 2 is at 2.5 volt when centered.
- Rear Wheel Position Sensor
- Rear Position Sensor Voltages

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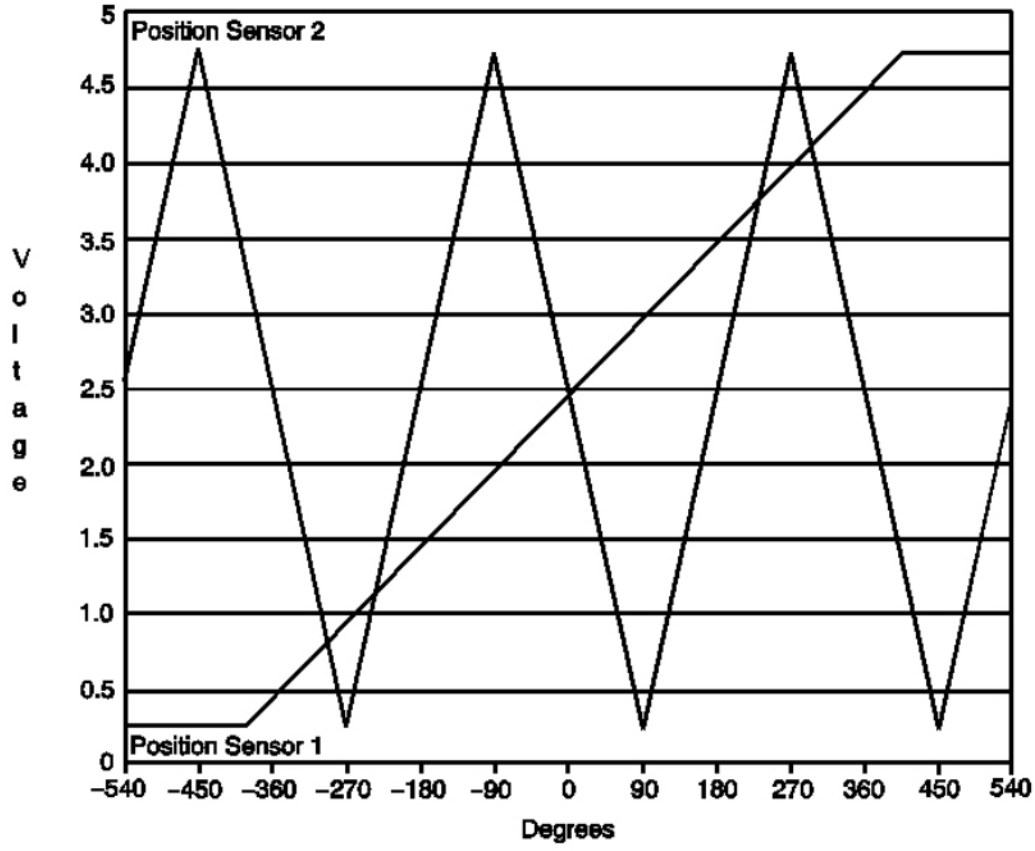


Fig. 15: Rear Wheel Position Sensor Voltage
Courtesy of GENERAL MOTORS CORP.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

1: This step requires the technician to perform the diagnostic procedure for the control module.

2: The minimum high limit is the value of voltage above which the code will set. The maximum low limit is the value of voltage below which the code will set.

3: Test for the proper operation of the position 1 or position 2 circuit in the high voltage range. Use a connector test adaptor kit in order to jumper the connections between the rear position sensor and the harness connector.

4: Test for the proper operation of the position 1 or position 2 circuit in the high voltage range.

5: Test for short to ground in the 5 volt reference circuit.

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DTC C0522

Step	Action	Values	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	-	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine OFF. 3. With a scan tool, observe the rear position sensor position 1 and the rear position sensor position 2 data parameters. Does the scan tool indicate that the position 1 and position 2 data parameter are within the specified range?	0.25-4.75 V	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the rear position sensor. 3. Jumper all of the circuits of the rear wheel position sensor to the harness connector of the rear position sensor using a connector test adaptor kit. 4. Disconnect the position 1 and position 2 circuit. 5. Turn the ignition switch to the ON position, with the engine OFF. 6. With a scan tool, observe the position 1 and the position 2 data parameters. Does the scan tool indicate that the position 1 or position 2 data parameter is greater than the specified value?	4.75 V	Go to **Step 4**	Go to **Step 8**
	1. Turn the ignition switch to the ON position with the engine OFF. 2. Connect the position 1 and the position 2 circuits. 3. Connect a 3 amp fused jumper wire between the sensor ground circuit of the rear position sensor and position 1 and			

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4	position 2 of the rear position sensor. 4. Turn the ignition switch to the ON position. 5. With a scan tool, observe the position 1 and the position 2 data parameter. Does the scan tool indicate that the position 1 and/or the position 2 data parameter is less than the specified value?	0.25 V	Go to **Step 5**	Go to **Step 9**
5	1. Turn the ignition switch to the OFF position. 2. Disconnect the fused jumper wire. 3. Connect a 3 amp fused jumper wire between the 5 volt reference circuit of the rear position sensor and position 1 and position 2 of the rear position sensor. 4. Turn the ignition switch to the ON position with the engine OFF. 5. With a scan tool, observe the position 1 and the position 2 data parameter. Does the scan tool indicate that the position 1 and/or position 2 data parameter is greater than the specified value?	4.75 V	Go to **Step 7**	Go to **Step 6**
6	Test the 5 Volt reference circuit of the rear position sensor for a short to ground or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
7	Test the 5 volt reference circuit of the rear wheel position sensor for a short to voltage, a high resistance, or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
8	Test the position 1 and position 2 signal circuit of the rear wheel position sensor for a short to ground. Refer to **Circuit Testing** , and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
9	Test the position 1 and position 2 signal circuit of the rear wheel position sensor for a short to voltage, a high resistance or a open. Refer to **Circuit Testing** , and to **Wiring Repairs** in Wiring Systems.	-		

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	Did you find and correct the condition?		Go to **Step 15**	Go to **Step 10**
10	Test the ground circuit of the rear wheel position sensor for a high resistance or an open. Refer to **Circuit Testing** , and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
11	Inspect for poor connections at the harness connector of the rear wheel position sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for poor connections at the harness connector of the rear wheel control module. Refer to **Testing for Intermittent Conditions and Poor Connections** , and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel position sensor. Refer to **Rear Position Sensor Replacement**.Did you complete the replacement?	-	Go to **Step 15**	-
14	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

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DTC C0527: INVALID SWITCH COMBINATION IS DETECTED

Circuit Description

The rear steering gear motor is a 3 phase DC motor. It has 3 hall effect switches inside the motor assembly. The rear wheel steering control module monitors the hall switches for proper switch position, and will shut down the system if a invalid switch combination is detected. A DTC C0527 will set at that time.

Conditions for Running the DTC

The ignition must be ON with the engine ON.

Conditions for Setting the DTC

- When hall 1, hall 2, and hall 3 circuits have 12 volts as their output, simultaneously, the rear steering motor is not in a recognized, valid position by the rear wheel steering module.
- When hall 1, hall 2, and hall 3 circuits have 0 volts as their output, simultaneously, the rear steering motor is not in a recognized, valid position by the rear wheel steering module.
- The hall sensor supply circuit is open.
- The hall sensor ground circuit is open.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0527.
- The output command to the motor is zeroed and the motor drive circuits are disabled using commands from the rear wheel steering control module to open the motor shorting relay.
- The rear wheels will be returned to the centered position.

Conditions for Clearing the DTC

- Conditions for the DTC are not present.
- The module receives a clear code command from the scan tool.
- The history DTC clears after 100 malfunction-free ignition cycles.

Diagnostic Aids

If the wiring harness to the steering gear motor is damaged in any way, it MUST be replaced. You can only service the connectors and terminals.

Use a scan tool to monitor the outputs of the hall-affect sensor 12 volt reference circuit. If the voltage of this circuit does not measure between 11.75-12.00 volts, inspect the harness connector of the rear wheel steering control module. Inspect the harness connector for intermittent or poor connections. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems.

Test Description

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The numbers below refer to the step numbers on the diagnostic table.

2: This step helps the technician determine if the fault is current.

3: This step determines if the DTC is the result of an intermittent connection at the control module.

DTC C0527

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine ON. 3. With a scan tool, monitor the DTC Information for DTC C0527 in the rear wheel steering control module. Does the scan tool indicate that DTC C0527 is current?	Go to **Step 3**	Go to Diagnostic Aids
3	Inspect for poor connections at the harness connector of the rear wheel steering control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 7**	Go to **Step 4**
4	**IMPORTANT:** **If the wiring harness to the steering gear motor is damaged in any way, it MUST be replaced. You can only service the connectors and terminals.** Inspect for poor connections at the harness connector of the rear wheel steering control module and the steering gear motor connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems.Did you find and correct the condition?	Go to **Step 7**	Go to **Step 5**
5	1. Replace the steering gear motor assembly. Refer to **Steering Gear Motor Assembly Replacement** in Rear Wheel Steering. 2. Use the scan tool in order to clear the DTCs. 3. Operate the vehicle within normal operating conditions.		

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	Does the DTC reset?	Go to **Step 6**	Go to **Step 7**
6	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	Go to **Step 7**	-
7	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within normal operating conditions. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0532: REAR WHEEL POSITION SENSOR SIGNALS HAVE INVALID VALUES

Circuit Description

The rear wheel steering module monitors the input signal of the rear wheel position sensor and the hall sensor circuits. The rear wheel steering module tracks the signals sent by the rear wheel position sensor and the hall sensor circuits, phase A, phase B, and phase C. If any one of the hall sensor circuits are open, shorted to voltage or shorted to ground while the rear steering motor is tracking the rear wheel position sensor, an invalid motor position will occur, thus setting the DTC.

If the rear wheel position sensor signals have invalid values the rear wheel steering control module will not be able to track the position of the rear wheel position sensor, causing an invalid motor position, thus setting the DTC.

Conditions for Running the DTC

The fault is detected when the ignition is ON and the engine is ON.

Conditions for Setting the DTC

Comparison of the rear position sensor and the rear wheel position differ by more than 1.4 °.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0532.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands to open the power relay, and to close the motor shorting relay.
- The rear wheels are returned to the centered position.

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Conditions for Clearing the DTC

- The conditions for setting the DTC are not currently present.
- The rear wheel steering control module receives a clear code command from the scan tool.
- The DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

- Inspect for poor connections at the harness connector of the rear wheel steering control module, rear wheel position sensor and the rear wheel steering motor connectors. Refer to **Testing for Intermittent Conditions and Poor Connections** , and to **Connector Repairs** in Wiring Systems.
- Inspect the rear wheel position sensor for damage. If none is found then remove and inspect the sensor and coupler for damage or water intrusion. Refer to **Rear Position Sensor Replacement**. If water damage is found, refer to **Rack and Pinion Boot Replacement**.
- Observe the rear wheel steering mode select switch. If all of the mode indicator LEDs are illuminated the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering alignment data in the rear wheel steering control module. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)**

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step tests for the proper operation of the rear steering position sensor.
3: This step tests for the proper operation of the rear steering motor position sensor.
4: This step performs the diagnostic procedure for the rear steering position sensor.
5: This step performs the diagnostic procedure for the rear steering motor position sensor.

DTC C0532

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics Connector End View Reference: Rear Wheel Steering Connector End Views			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine ON. 3. With a scan tool, select the Display DTC function on the scan tool. Does the scan tool display DTC C0522 along with		

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	DTC C0532?	Go to **Step 4**	Go to **Step 3**
3	Does the scan tool display DTC C0527 along with DTC C0532?	Go to **Step 5**	Go to **Step 6**
4	Perform the diagnostic procedure for DTC C0522. Refer to **DTC C0522**. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
5	Perform the diagnostic procedure for DTC C0527. Refer to **DTC C0527**. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the rear wheel steering control module and the rear wheel position sensor and rear wheel steering motor connectors. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition ?	Go to **Step 8**	Go to **Step 7**
7	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	Go to **Step 8**	-
8	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0533: SHORTING RELAY IS STUCK OPEN/CLOSED, COMMANDED VS. ACTUAL

Circuit Description

The rear wheel steering control module controls a normally closed relay that shorts the motor phase leads. The relay is part of the rear wheel steering actuator motor assembly and cannot be serviced separately from the motor assembly. The motor assembly can be serviced separately from the rear wheel steering actuator.

Conditions for Running the DTC

- The ignition is ON.
- The rear wheel steering control module is in START-UP/INITIALIZATION.

Conditions for Setting the DTC

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- The DTC is set when the shorting relay is stuck open, commanded vs. actual.
- The DTC is set when the shorting relay is stuck closed, commanded vs. actual.

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0533.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands to open the power relay, and to close the motor shorting relay.
- The rear wheels will be returned to the default centered position.

Conditions for Clearing the DTC

- The conditions for setting the DTC are not currently present.
- The rear wheel steering control module receives a clear code command from the scan tool.
- The DTC clears after 100 malfunction free ignition cycles.

DTC C0533

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics Connector End View Reference: Rear Wheel Steering Connector End Views			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	Inspect for poor connections at the rear wheel steering control module and the rear wheel steering motor connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 5**	Go to **Step 3**
3	Replace the rear wheel steering motor. Refer to **Steering Gear Motor Assembly Replacement**. Did you find and correct the condition?	Go to **Step 5**	Go to **Step 4**
4	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	Go to **Step 5**	-
	1. Use the scan tool in order to clear the DTCs.		

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5	2. Operate the vehicle within normal operating conditions. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0538: REAR WHEEL STEERING CONTROL MODULE DOES NOT SEE REAR WHEEL STEERING GEAR MOTOR RESPOND TO CURRENT INPUTS PROPERLY

Circuit Description

The rear wheel steering module provides the current that activates the rear wheel steering motor actuator control circuits. Phase A, Phase B, and Phase C are the input circuits to the steering gear motor assembly. In its active state, the output current is pulse width modulated with up to 85-amps at 12 volts, with a normal range of 20 to 50-amps. When the rear wheel steering control module does not see the rear wheel steering gear motor respond to the current inputs properly the rear wheel steering control module will set a DTC C0538.

Conditions for Running the DTC

The fault is detected when the engine is ON.

Conditions for Setting the DTC

- Rear steering motor circuits short to positive battery voltage
- Rear steering motor circuits short to ground
- Rear steering motor circuits open

Action Taken When the DTC Sets

- The Service 4 Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0538.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands to open the power relay and to close the motor shorting relay.
- Rear wheels returned to the centered position.

Conditions for Clearing the DTC

- The conditions for the DTC are not currently present.
- The rear wheel steering control module receives a clear code command from the scan tool.
- The history DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

- Inspect for poor connections at the harness connector of the rear wheel steering control module and inspect the wiring harness. Refer to **Testing for Intermittent Conditions and Poor Connections** , and to **Connector Repairs** in Wiring Systems.

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- Observe the rear wheel steering mode select switch. If all of the mode indicator LEDs are illuminated the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering alignment data in the rear wheel steering control module. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step will help the technician determine if there is an intermittent connection at the harness connector of the rear wheel steering motor.

DTC C0538

Step	Action	Values	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	-	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	With a scan tool, monitor the DTC Information DTC C0538 in the rear wheel steering module. Does the scan tool indicate that DTC C0538 is current?	-	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn the ignition switch to the OFF position. 2. Inspect for poor connections at the harness connector of the rear wheel steering control module for the rear wheel steering gear motor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 6**	Go to **Step 4**
4	1. Replace the rear wheel steering motor. Refer to **Steering Gear Motor Assembly Replacement**. 2. Turn the ignition switch to the ON position, with the engine OFF. 3. Use the scan tool in order to clear the DTCs.	-		

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	4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?		Go to **Step 5**	Go to **Step 6**
5	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering module. Refer to **Rear Wheel Steering Control Module Replacement**Did you complete the replacement?	-	Go to **Step 6**	-
6	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC C0543: REAR ACTUATOR DOES NOT ACHIEVE DESIRED POSITION

Circuit Description

When the engine is ON, the rear wheel steering control module monitors the position of the front and rear wheels. When the system is commanding a rear wheel angle and, due to mechanical binding, the rear actuator does not achieve the desired position a servo error fault is generated, thus setting a DTC C0543.

Conditions for Running the DTC

- The engine is ON.
- The vehicle speed must be greater than 5 km/h (3 mph).

Conditions for Setting the DTC

Comparison of commanded rear position to actual is greater than 3 degrees.

Action Taken When the DTC Sets

- The Service 4-Wheel Steer indicator in IPC will be displayed.
- The code is displayed on the scan tool as DTC C0543.
- The output command to the motor is zeroed and the motor drive circuits are disabled using commands to open the power relay and close the motor shorting relay.

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- The rear wheels are returned to the default centered position.

Conditions for Clearing the DTC

- The conditions for setting the DTC are not currently present.
- The rear Wheel steering control module receives clear code command from the scan tool.
- The history DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

Inspect for objects or damage that may restrict movement of the rear wheels, or damage to the rear wheel steering gear.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step begins the procedure that will allow the technician to determine the components responsible for setting DTC C0543.

3: This step will help determine if there are objects caught in the rear wheels.

DTC C0543

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**			
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition switch to the ON position, with the engine ON. 3. With a scan tool, select the Display DTC function. Does the scan tool display DTC C0543?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn the ignition switch to the OFF position. 2. Inspect the rear wheels for objects that may cause obstruction and remove. Did you find and correct the condition?	Go to **Step 4**	Go to Diagnostic Aids
	1. Turn the ignition switch to the ON position, with the engine ON.		

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4	2. Use a scan tool in order to clear the DTC. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to **Step 3**	System OK

DTC C0550: ECU MALFUNCTION - INTERNAL WRITE/CHECKSUM MALFUNCTION

Circuit Description

When the ignition switch is turned ON, the rear wheel steering control module monitors communications between its internal microprocessors and performs self-diagnostic tests. If an internal malfunction is detected, the rear wheel steering control module will store a DTC C0550 in its memory.

Conditions for Running the DTC

Turn the ignition switch to the ON position, with engine ON.

Conditions for Setting the DTC

- The rear wheel steering control module detected an internal malfunction.
- The malfunction must be detected when the ignition switch is first turned ON.

Action Taken When the DTC Sets

- The Service 4-Wheel Steer indicator in IPC will be displayed.
- The code is displayed on scan the tool as DTC C0550.
- The output command to the motor is zeroed. The motor drive circuits are disabled using commands from the rear wheel steering control module to open the power relay.
- The rear wheels will be returned to the default centered position.

Conditions for Clearing the DTC

- Conditions for the DTC are not currently present.
- The module receives a clear code command from the scan tool.
- The DTC clears after 100 malfunction free ignition cycles.

Diagnostic Aids

- Any additional codes displayed with DTC C0550 should be diagnosed and repaired first.
- The rear wheel steering control module tests for multiple internal malfunctions and will store a DTC C0550 if one or more internal malfunctions are detected. Therefore, depending on which malfunction was detected, and what internal circuitry was affected, this DTC may cause various symptoms.
- Any condition resulting in the sensor supply voltage being pulled high or low could result in an erroneous

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DTC C0550.

- A fault in the battery positive voltage circuit from the 125A MEGA fuse can result in an erroneous DTC C0550.

DTC C0550

Step	Action	Values	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views**				
1	Did you perform the Diagnostic System Check-Rear Wheel Steering?	-	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	1. Install a scan tool. 2. Turn the ignition ON, with the engine OFF. 3. With the scan tool, monitor the DTC information of the Rear Wheel Steering Control module. Are there any additional codes displayed along with the DTC C0550?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	With the scan tool, monitor the DTC information of the Rear Wheel Steering Control module. Does the information indicate that the DTC C0550 is current?	-	Go to **Step 4**	Go to Diagnostic Aids
4	With the scan tool, observe the sensor supply voltage in the rear wheel steering data. Is the voltage above the specified value?	5.0 V	Go to **Step 7**	Go to **Step 5**
5	With the scan tool, observe the sensor supply voltage in the rear wheel steering data. Is the voltage below the specified value?	0.25 V	Go to **Step 8**	Go to **Step 6**
6	Test for an open or short to ground in the battery voltage supply circuit of the 125 A MEGA fuse. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 9**
7	Test the 5-volt reference circuit for a short to battery voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 9**
8	Test the 5-volt reference circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 9**

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9	Inspect for poor connections at the rear wheel steering control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 10**
10	**IMPORTANT:** **Perform the learn alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.** Replace the rear wheel steering control module. Refer to **Rear Wheel Steering Control Module Replacement** in Rear Wheel Steering.Did you complete the replacement?	-	Go to **Step 11**	-
11	1. Use the scan tool to clear DTCs. 2. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

SYMPTOMS - REAR WHEEL STEERING SYSTEM

IMPORTANT: The following steps must be completed before using the symptom tables:

1. **Perform the Rear Wheel Steering Diagnostic System Check before using the symptom tables in order to verify that the following conditions are true:**
   - **DTCs are not set.**
   - **The control modules can communicate via the serial data link.**
2. **Review the system description and operation in order to familiarize yourself with the system functions. Refer to Rear Wheel Steering Description and Operation.**

Visual/Physical Inspection

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

Intermittent

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

Symptom List

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

- **One or Multiple Rear Wheel Steering Mode Switch Indicators Always On**
- **One or Multiple Rear Wheel Steering Mode Switch Indicators Inoperative**

ONE OR MULTIPLE REAR WHEEL STEERING MODE SWITCH INDICATORS ALWAYS ON

Circuit Description

The rear wheel steering control module controls the ground circuit of each mode indicator lamp individually. The lamps all share a single common input from the interior lights dimming circuit.

Diagnostic Aids

Inspect all connections at the rear wheel steering control module and the rear wheel steering mode select switch for loose or damaged terminals or damaged wiring. Use of the Rear Wheel Steering Diagnostic System Check will help ensure there are not other conditions or DTCs.

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: This step verifies that there are no other lighting concerns.

3: This step will verify the operation of the mode lamps and the Rear Wheel Steering systems ability to change mode of operation.

One Or Multiple Rear Wheel Steering Mode Switch Indicators Always On

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views** in Rear Wheel Steering			
1	Did you perform the Rear Wheel Steering Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	Are all other lighting systems operating properly?	Go to **Step 3**	Go to **Diagnostic System Check - Lighting Systems**
	1. Turn the ignition switch to the ON position. 2. Operate the rear wheel steering mode select switch while observing the mode indicator	Go to **Testing for Intermittent**	

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3	lamps. Do the indicators turn on/off as expected?	**Conditions and Poor Connections** in Wiring Systems	Go to **Step 4**
4	1. Disconnect the rear wheel steering mode select switch. 2. Test for a ground signal at the affected indicator control circuit at the rear wheel steering mode select switch connector. Is a ground signal present?	Go to **Step 5**	Go to **Step 6**
5	Test the affected indicator control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 10**	Go to **Step 7**
6	Inspect for poor connections at the harness connector of the Rear Wheel Steering Mode Select switch. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 10**	Go to **Step 8**
7	Inspect for poor connections at the harness connector of the rear wheel steering control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 10**	Go to **Step 9**
8	Replace the rear wheel steering mode select switch. Refer to **Rear Wheel Steering Mode Switch Replacement**. Did you complete the replacement?	Go to **Step 10**	-
9	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering)** Replace the rear wheel steering control module. Refer to **Rear Wheel Steering Control Module Replacement** in Rear Wheel Steering.Did you complete the replacement?	Go to **Step 10**	-
10	1. Use the scan tool to clear any DTCs. 2. Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

ONE OR MULTIPLE REAR WHEEL STEERING MODE SWITCH INDICATORS INOPERATIVE

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Circuit Description

The rear wheel steering control module controls the ground circuit of each mode indicator individually. The lamps all share a single common input from the interior lights dimming circuit.

Diagnostic Aids

Inspect all connections at the rear wheel steering control module and the rear wheel steering mode select switch for loose or damaged terminals or damaged wiring. Use of the Rear Wheel Steering Diagnostic System Check will help ensure there are not other conditions or DTCs.

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: This step verifies that there are no other lighting concerns

3: This step will verify the operation of the mode lamps and the Rear Wheel Steering systems ability to change mode of operation.

One Or Multiple Rear Wheel Steering Mode Switch Indicators Inoperative

Step	Action	Yes	No
Schematic Reference: Rear Wheel Steering Schematics **Connector End View Reference: Rear Wheel Steering Connector End Views** in Rear Wheel Steering.			
1	Did you perform the Rear Wheel Steering Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Rear Wheel Steering**
2	Are all other lighting systems operating properly?	Go to **Step 3**	Go to **Diagnostic System Check - Lighting Systems**
3	1. Turn the ignition switch to the ON position. 2. Operate the rear wheel steering mode select switch while observing the mode indicator lamps. Do the mode indicator lamps turn on/off as expected?	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems	Go to **Step 4**
4	1. Disconnect the rear wheel steering mode select switch. 2. Turn the ignition switch to the ON position. 3. Using the scan tool, actuate the affected indicator control circuit. 4. Test for a ground signal at the affected indicator control circuit at the rear wheel steering mode select switch connector.		

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	Is a ground signal present?	Go to **Step 6**	Go to **Step 5**
5	Test the affected indicator control circuit for an open, high resistance or short to voltage. Refer to **Circuit Testing** and **Circuit Testing** in Wiring Systems. Did you find and correct a condition?	Go to **Step 11**	Go to **Step 8**
6	Test the four wheel steering mode indicator LED dimming signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	Go to **Step 11**	Go to **Step 7**
7	Inspect for poor connections at the harness connector of the four wheel steering mode select switch. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
8	Inspect for poor connections at the harness connector of the rear wheel steering control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
9	Replace the rear wheel steering mode select switch. Refer to **Rear Wheel Steering Mode Switch Replacement**. Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Perform the Learn Alignment procedure. Refer to Measuring Wheel Alignment (w/Rear Wheel Steering) or Measuring Wheel Alignment (w/o Rear Wheel Steering)** Replace the rear wheel steering control module. Refer to **Rear Wheel Steering Control Module Replacement** in Rear Wheel Steering.Did you complete the replacement?	Go to **Step 11**	-
11	1. Use the scan tool to clear any DTCs. 2. Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

REPAIR INSTRUCTIONS

REAR WHEEL STEERING MODE SWITCH REPLACEMENT

Removal Procedure

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1. Remove the dash trim bezel. Refer to **Bezel Replacement - Instrument Panel (I/P) Cluster** in Instrument Panel, Gages and Console.

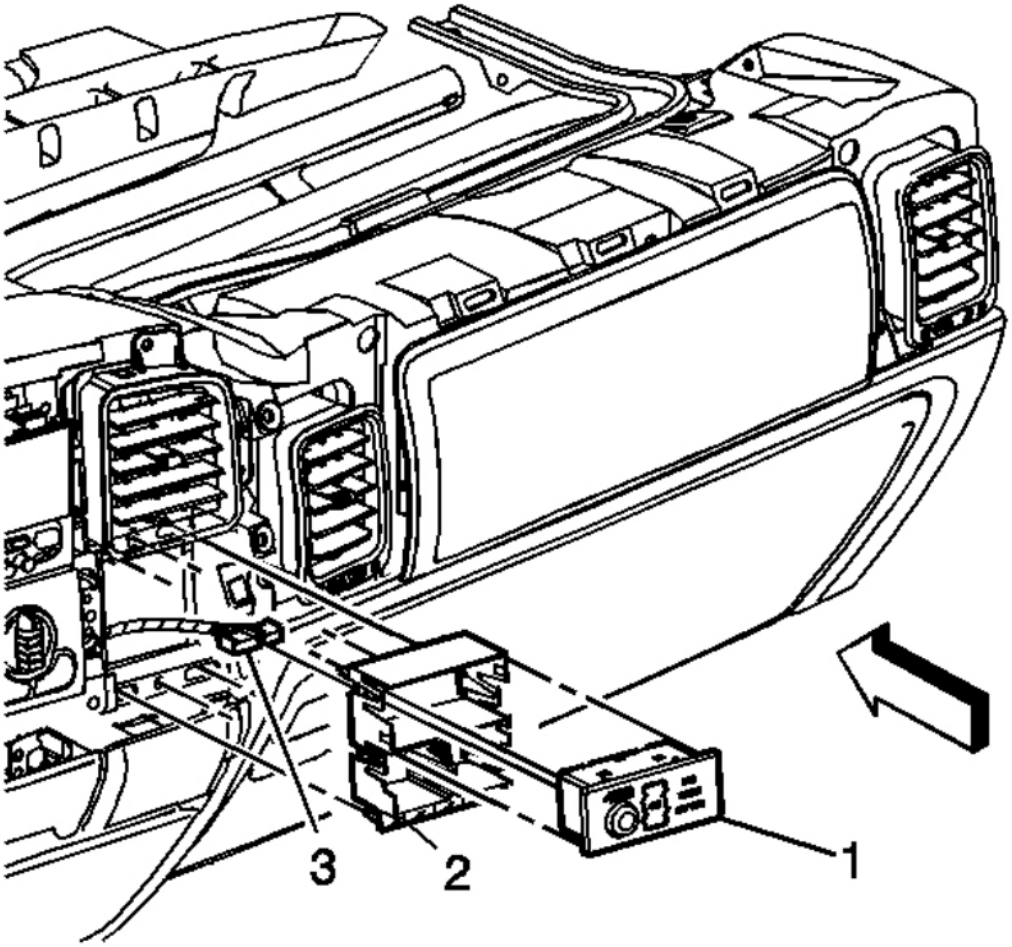


Fig. 16: View Of Rear Wheel Steering Mode Switch Assembly, Housing & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Grasp the rear wheel steering mode switch housing (2) and pull outward to remove the switch assembly.
3. Disconnect the electrical connector (3) from the rear wheel steering mode switch.
4. Remove the rear wheel steering mode switch assembly (1) from the vehicle.

Installation Procedure

1. Reconnect the rear wheel steering mode switch (3) electrical connectors.

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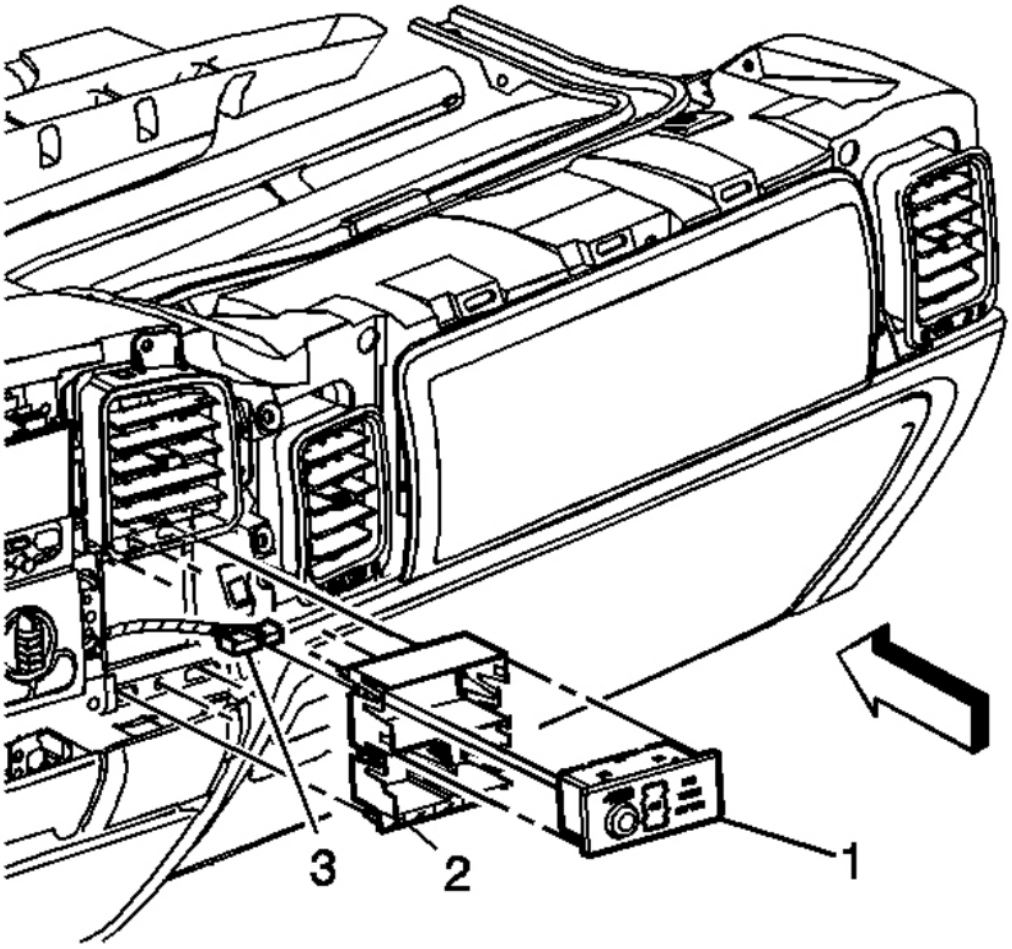


Fig. 17: View Of Rear Wheel Steering Mode Switch Assembly, Housing & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Install the rear wheel steering mode switch (1) into the dash.
3. Reinstall the dash trim bezel. Refer to **Bezel Replacement - Instrument Panel (I/P) Cluster** in Instrument Panel, Gages and Console.

REAR WHEEL STEERING TIE ROD END REPLACEMENT - OUTER

Tools Required

J 24319-B Universal Steering Linkage Puller

Removal Procedure

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NOTE: **Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

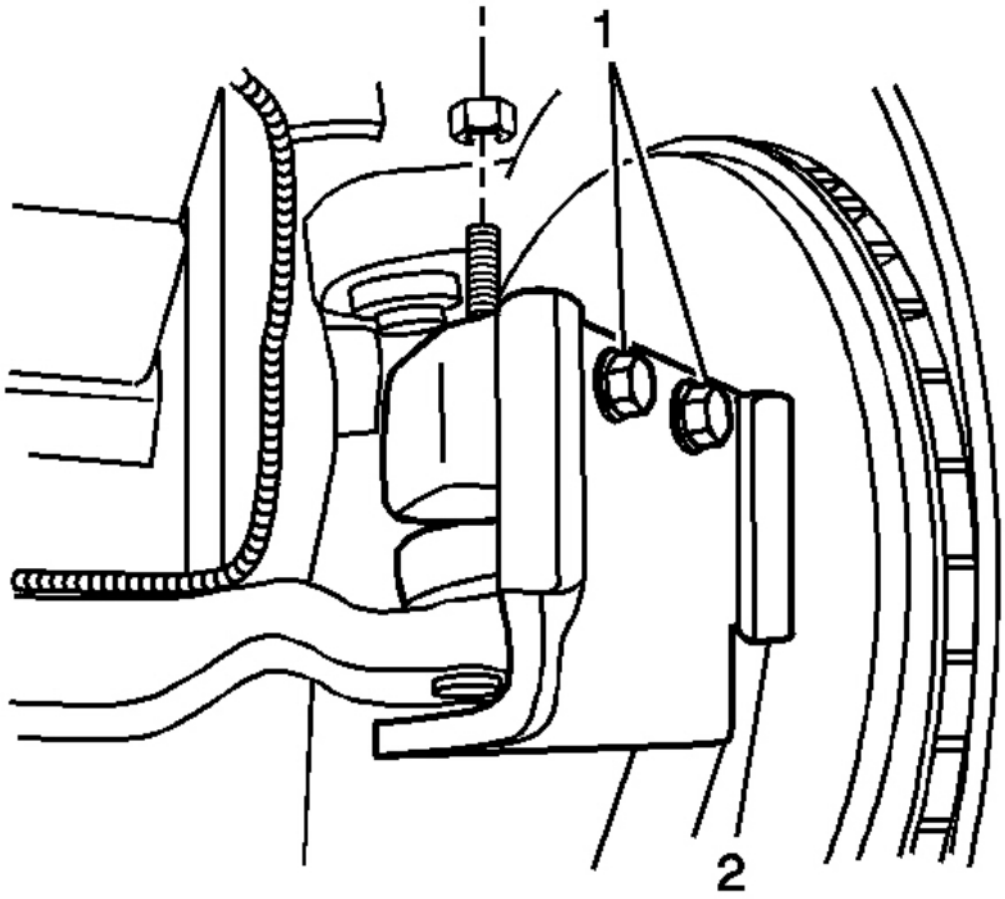


Fig. 18: View Of Outer Tie Rod Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the tie rod bracket (2) retaining bolts (1) from the steering knuckle.

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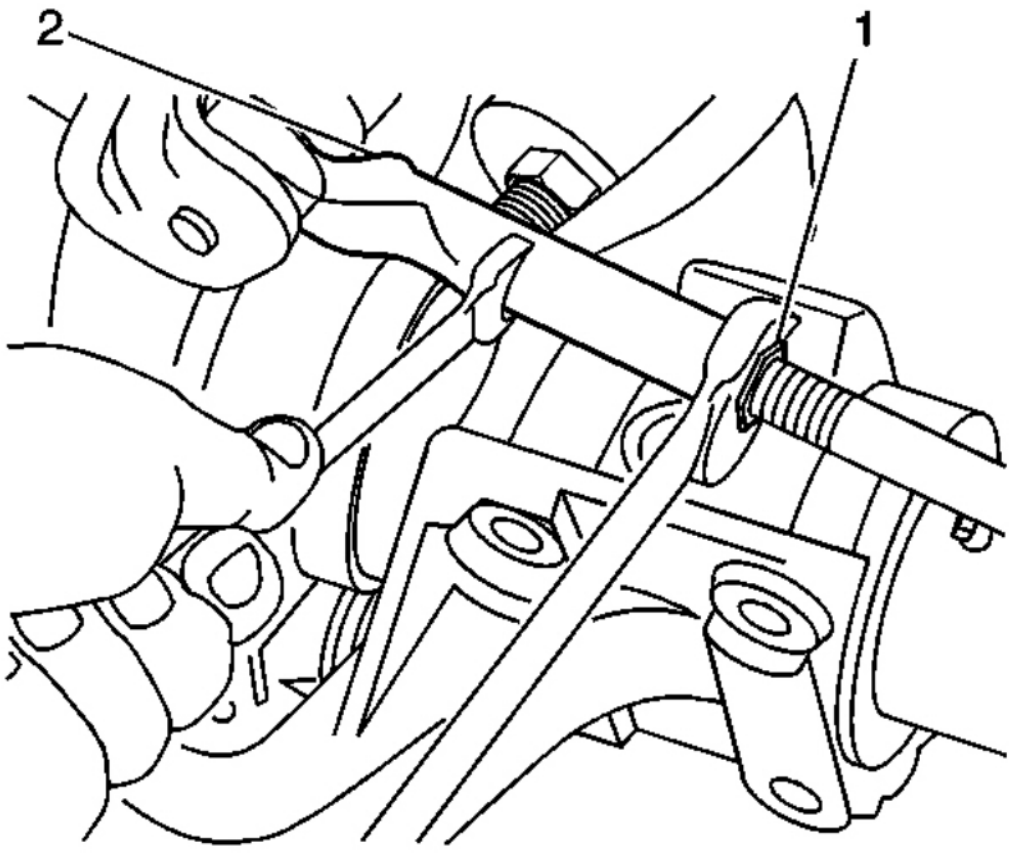


Fig. 19: Loosening Tie Rod Jam Nut
Courtesy of GENERAL MOTORS CORP.

4. Loosen the tie rod jam nut (1).
5. Remove the nut retaining the outer tie rod end to the steering knuckle.

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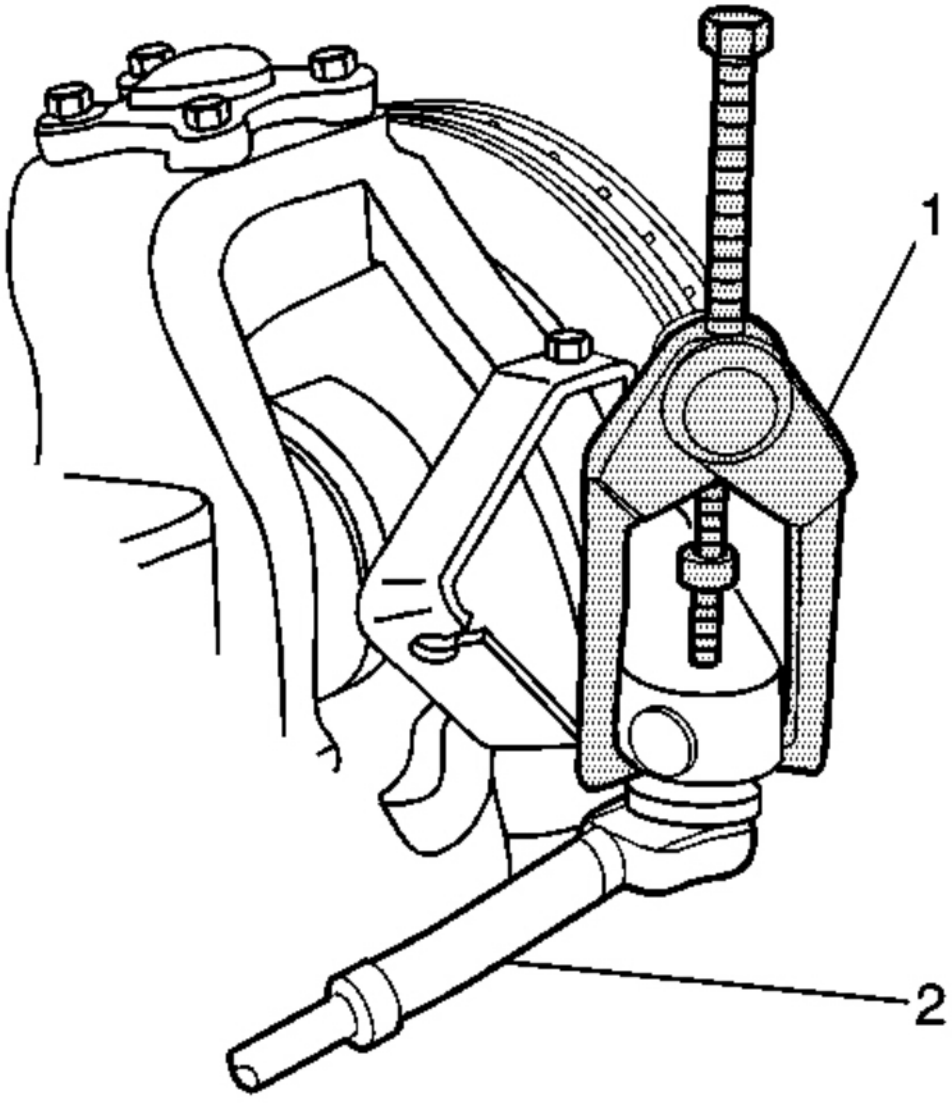


Fig. 20: Removing Outer Tie Rod End Using J 24319-B
Courtesy of GENERAL MOTORS CORP.

6. Using the **J 24319-B** (1), remove the outer tie rod end from the steering knuckle.
7. Remove the outer tie rod end from the inner tie rod.

Installation Procedure

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1. Install the outer tie rod end to the inner tie rod.
2. Install the outer tie rod end to the steering knuckle.

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

3. Install the outer tie rod end retaining nut to the steering knuckle.

Tighten: Tighten the nut to 55 N.m (40 lb ft).

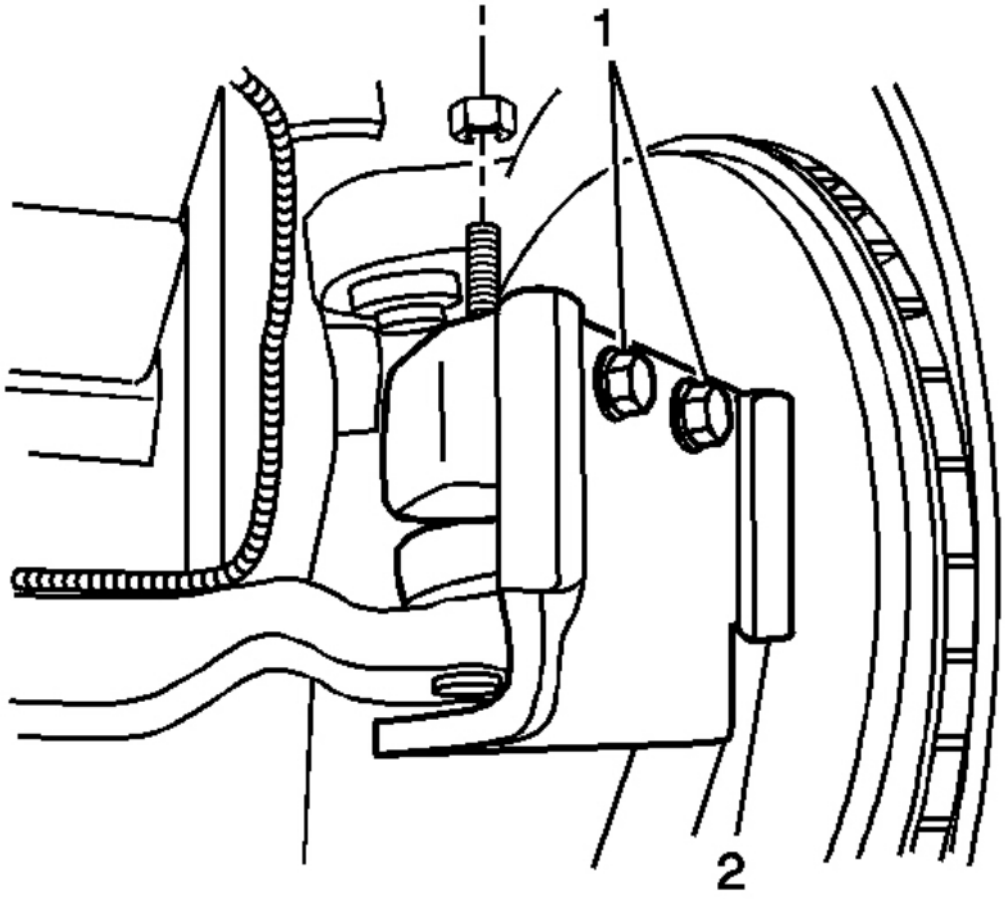


Fig. 21: View Of Outer Tie Rod Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the outer tie rod end retaining bracket (2).

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Tighten: Tighten the retaining bolts to 65 N.m (48 lb ft).

5. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
6. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

REAR WHEEL STEERING TIE ROD END REPLACEMENT - INNER

Tools Required

- **J 44665-2** Inner Tie Rod Wrench. See **Special Tools and Equipment**.
- **J 44665-1** Inner Tie Rod Wrench. See **Special Tools and Equipment**.

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the rack and pinion boot from the steering gear. Refer to **Rack and Pinion Boot Replacement**.

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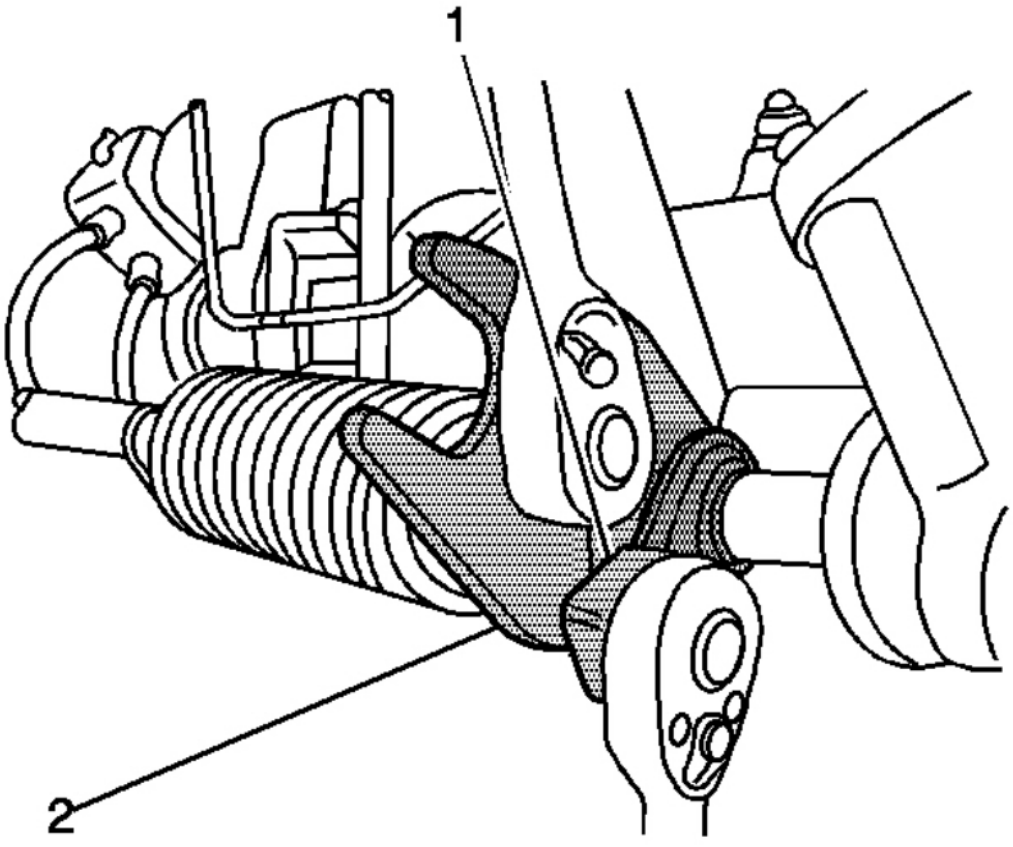


Fig. 22: View Of Inner Tie Rod Support Clamp & J 44665-1 & J 44665-2
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The inner tie rod support clamp has right hand threads. The inner tie rod support nut has left hand threads. To remove the support clamp turn the clamp counterclockwise.

4. Using the **J 44665-1** (1) and **J 44665-2** (2) remove the inner tie rod support clamp. See **Special Tools and Equipment**.

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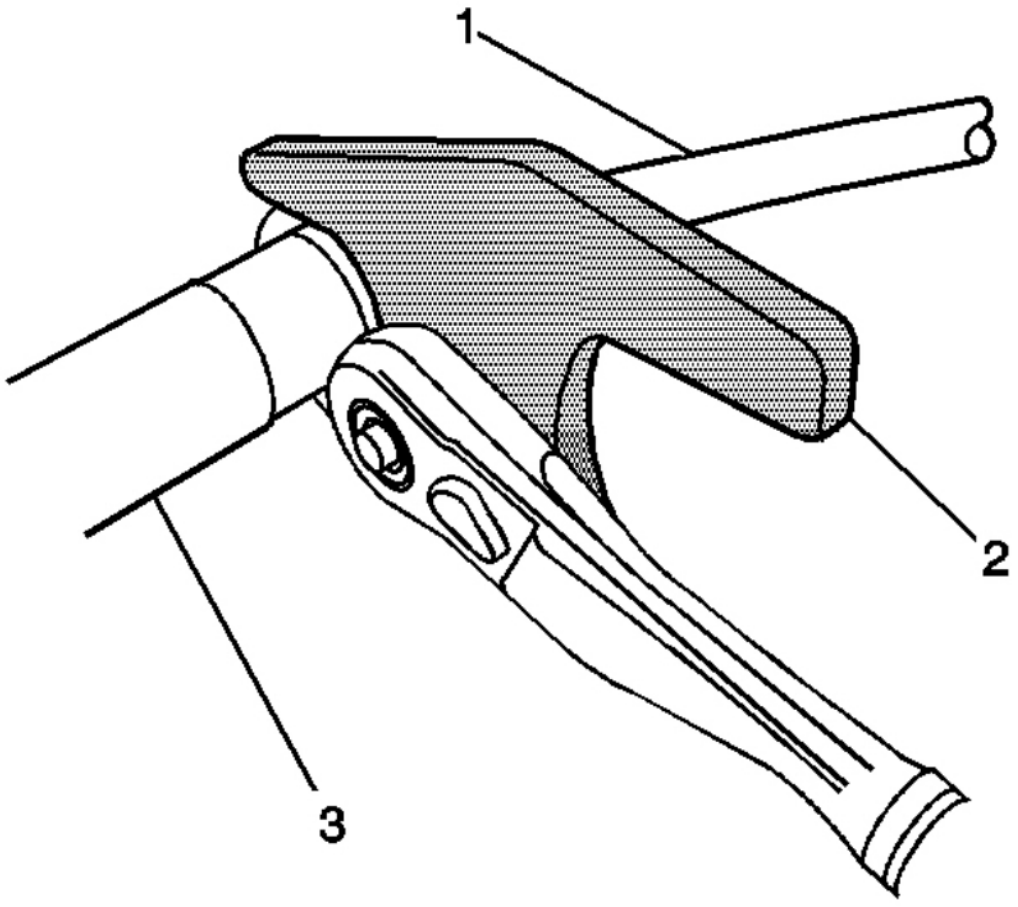


Fig. 23: View Of Inner Tie Rod & J 44665-2
Courtesy of GENERAL MOTORS CORP.

5. Remove the inner tie rod (1) from the steering gear using the **J 44665-2** (2). See **Special Tools and Equipment**.

Installation Procedure

1. Install the inner tie rod to the steering gear.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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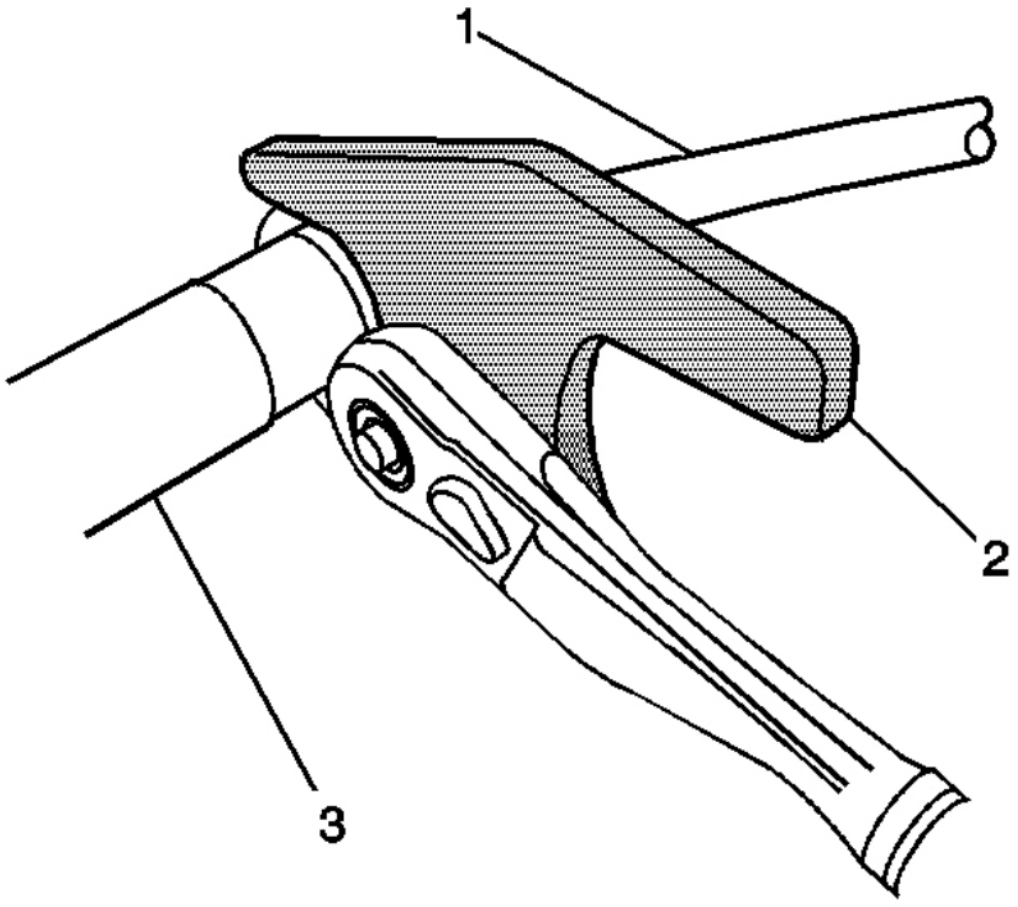


Fig. 24: View Of Inner Tie Rod & J 44665-2
Courtesy of GENERAL MOTORS CORP.

2. Using the **J 44665-2** (2) tighten the inner tie rod (1). See **Special Tools and Equipment**.

   Tighten: Tighten the inner tie rod to 100 N.m (74 lb ft).

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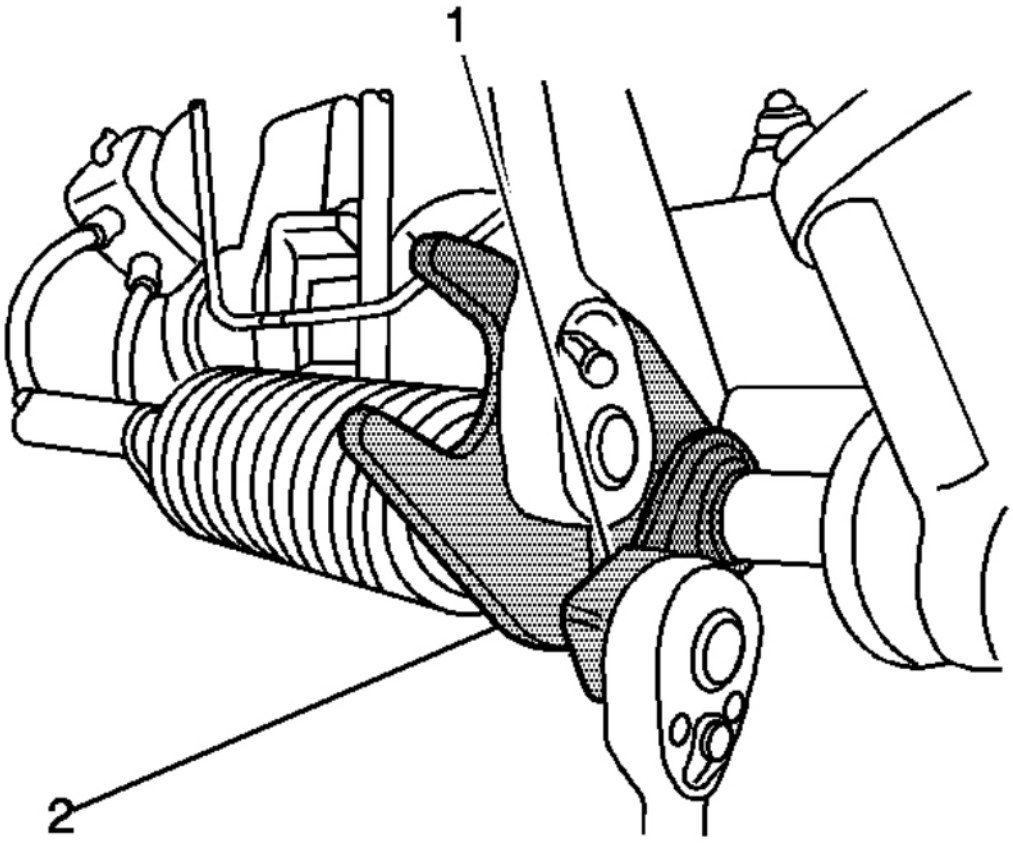


Fig. 25: View Of Inner Tie Rod Support Clamp & J 44665-1 & J 44665-2
Courtesy of GENERAL MOTORS CORP.

3. Install the inner tie rod support clamp to the steering gear. Use the **J 44665-1** (1) and the **J 44665-2** (2) in order to tighten the inner tie rod support clamp. See **Special Tools and Equipment**.

   Tighten: Tighten the inner tie rod support clamp to 25 N.m (18 lb ft).

4. Install the rack and pinion boot to the steering gear. Refer to **Rack and Pinion Boot Replacement**.
5. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
6. Lower the vehicle.
7. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

RACK AND PINION BOOT REPLACEMENT

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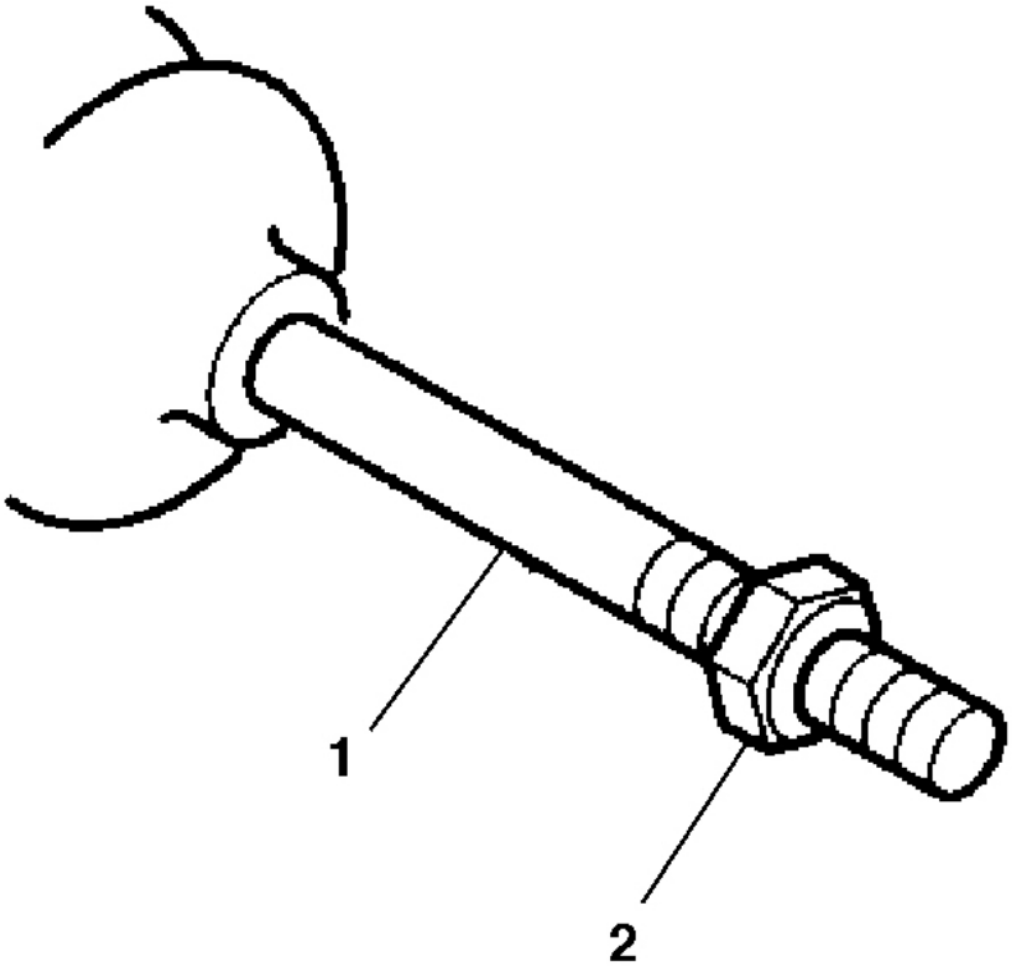
Tools Required

J 22610 Keystone Clamp Pliers. See **Special Tools and Equipment**.

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the outer tie rod from the vehicle. Refer to **Rear Wheel Steering Tie Rod End Replacement - Outer**.



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Fig. 26: Identifying Inner Tie Rod Assembly Jam Nut
Courtesy of GENERAL MOTORS CORP.

3. Remove the tie rod jam nut (2) from the inner tie rod.

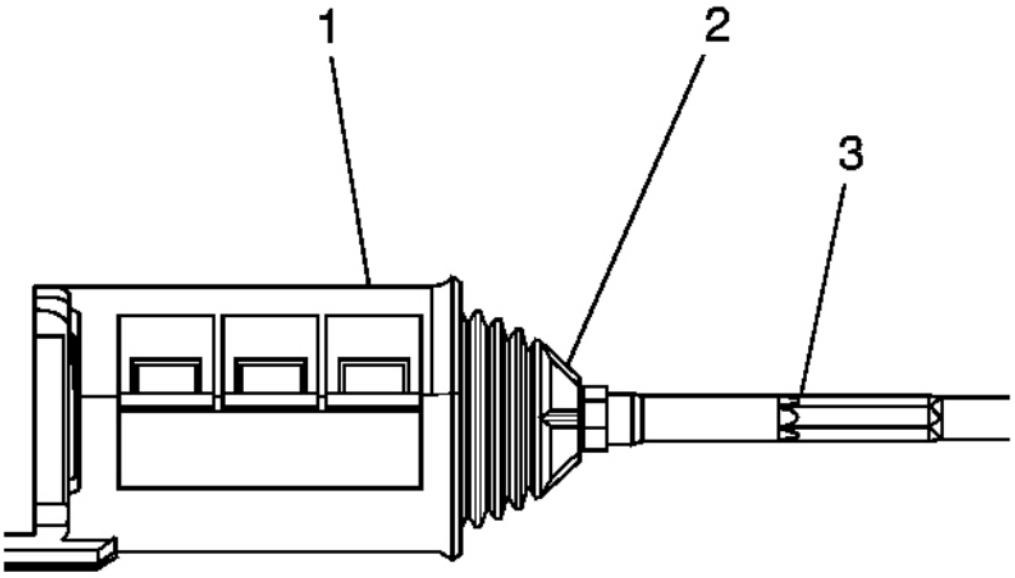


Fig. 27: View Of Rack & Pinion Boot & Protector
Courtesy of GENERAL MOTORS CORP.

4. Remove the rack and pinion boot protector (1) from the rack and pinion boot (2), if equipped.

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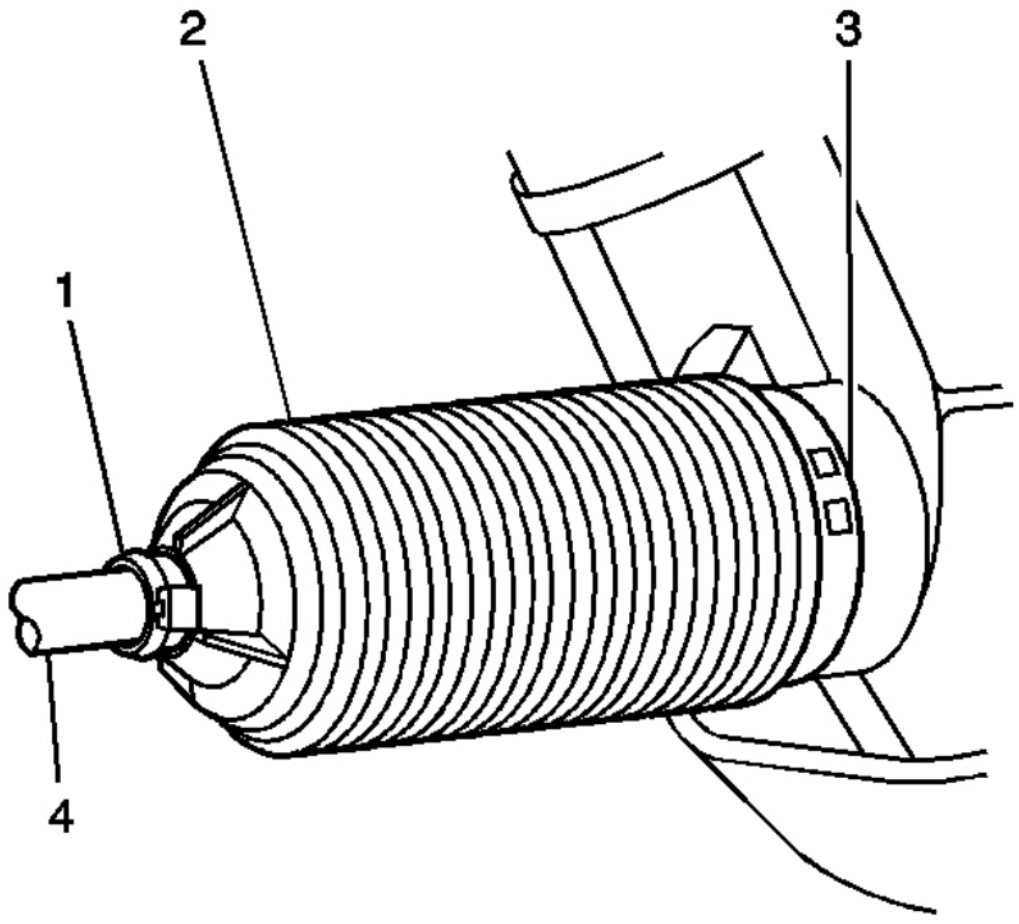


Fig. 28: View Of Outer Clamp Retaining Boot
Courtesy of GENERAL MOTORS CORP.

5. Remove the outer clamp (1) retaining the boot (2) to the steering gear.

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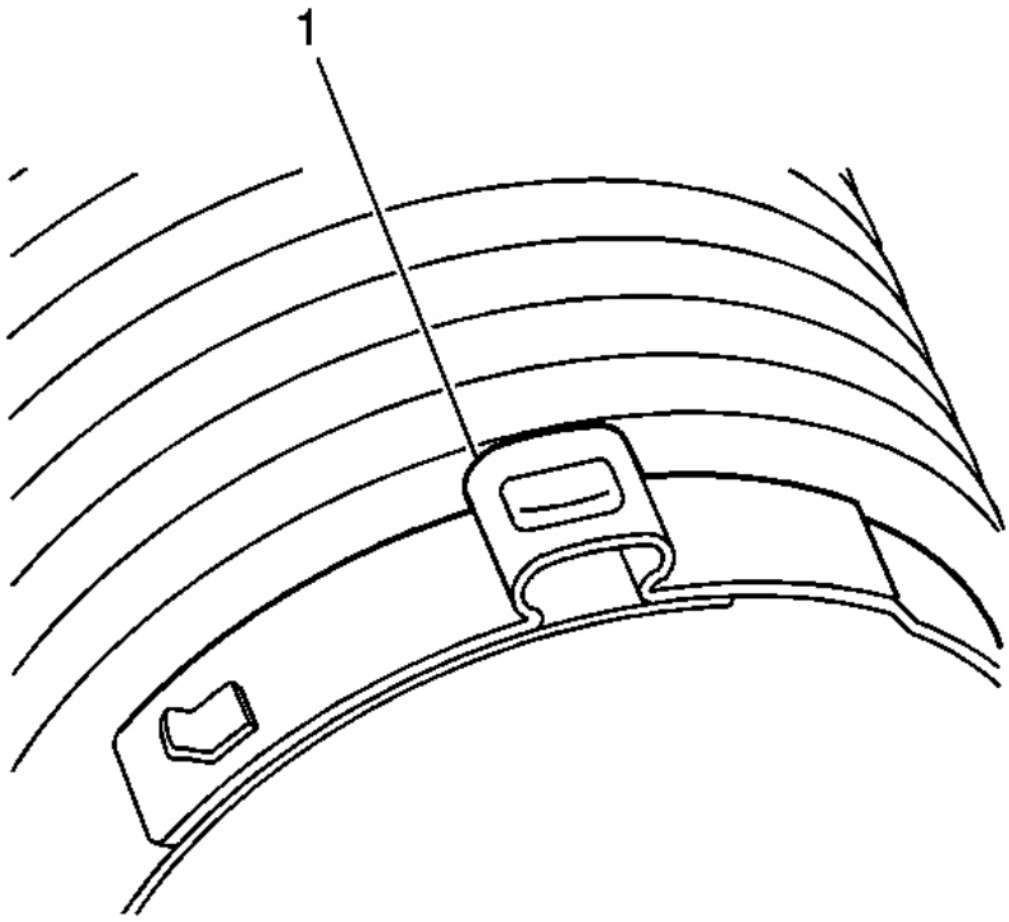


Fig. 29: View Of Inner Clamp Retaining Boot
Courtesy of GENERAL MOTORS CORP.

6. Remove the inner clamp (1) retaining the boot to the steering gear.

IMPORTANT: Check the boot for damage by using a light and flexing the boot to inspect for wear. If the boot is damaged replace the steering gear actuator. Refer to Steering Gear Actuator and Cover Replacement.

7. Remove the boot from the steering gear.

Installation Procedure

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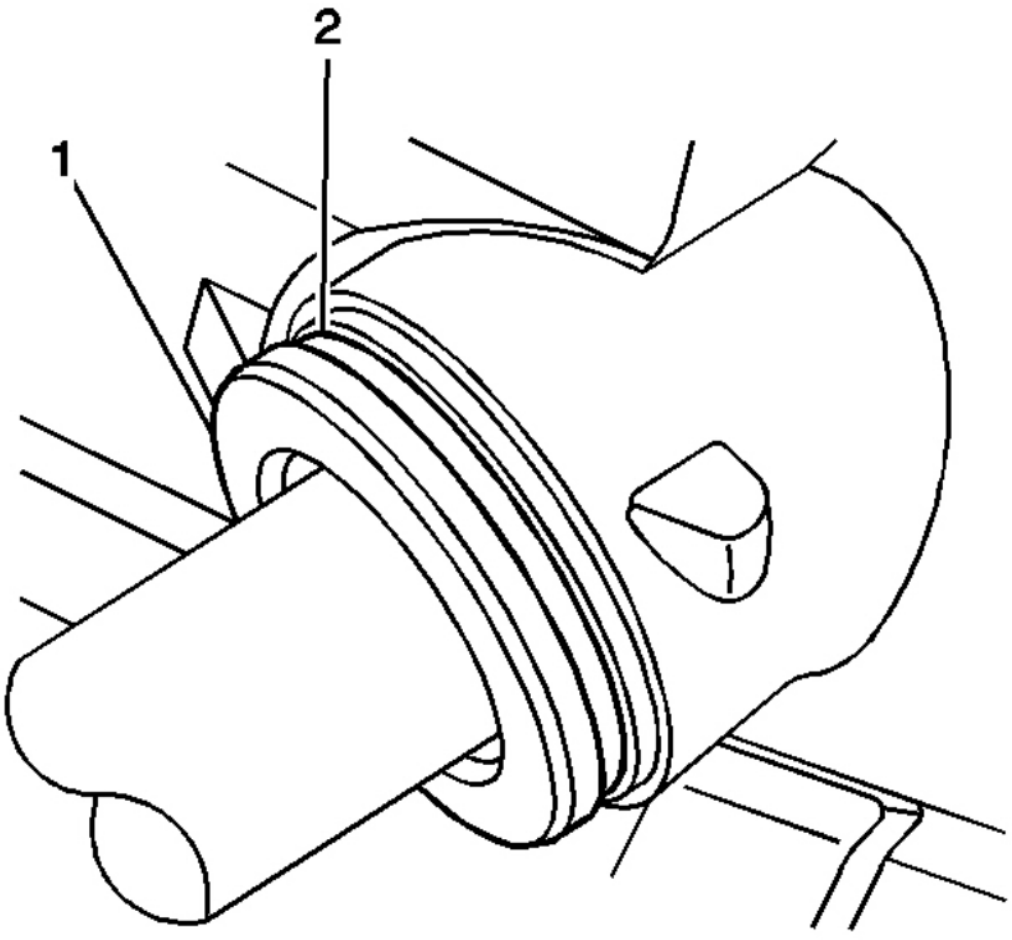


Fig. 30: Ensuring Rack & Pinion Boot Is Seated In Groove
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make sure the rack and pinion boot is seated in the groove (2) on the steering gear actuator.

1. Install the boot to the steering gear.

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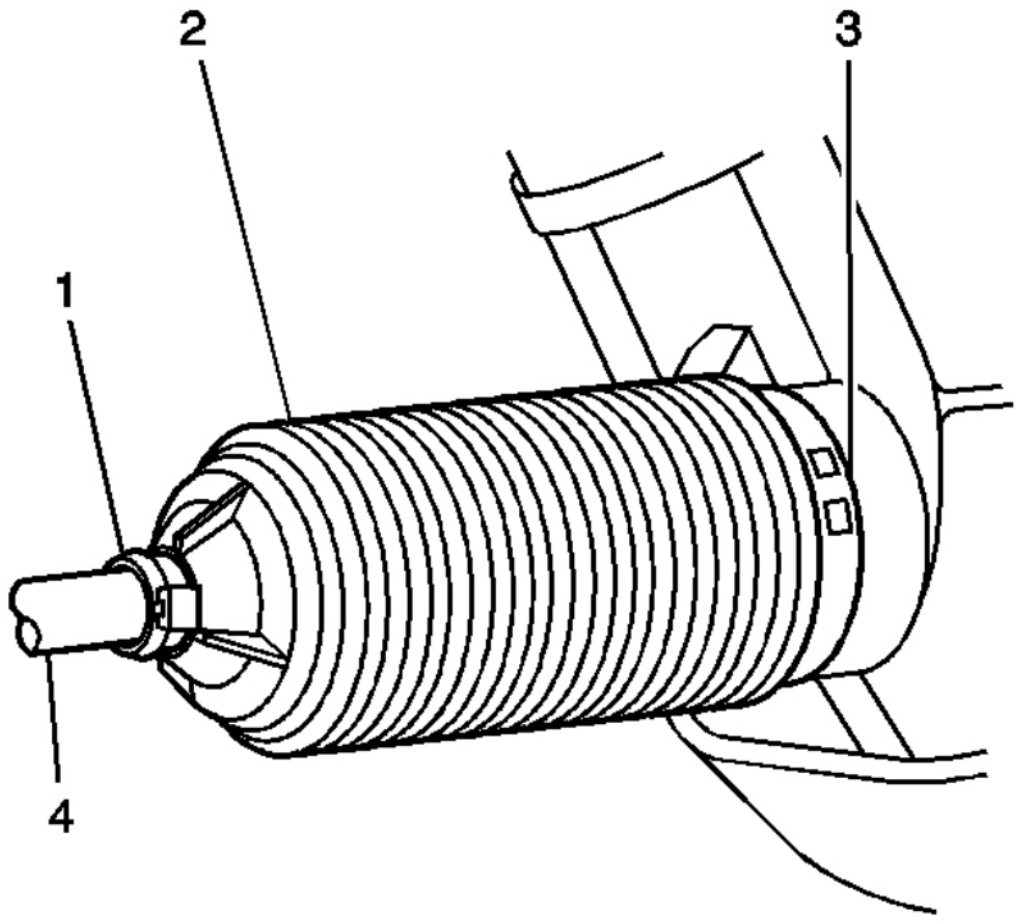


Fig. 31: View Of Outer Clamp Retaining Boot
Courtesy of GENERAL MOTORS CORP.

2. Install the outer clamp (1) retaining the boot (2) to the steering gear.
3. Install the inner clamp (3) retaining the boot (2) to the steering gear.

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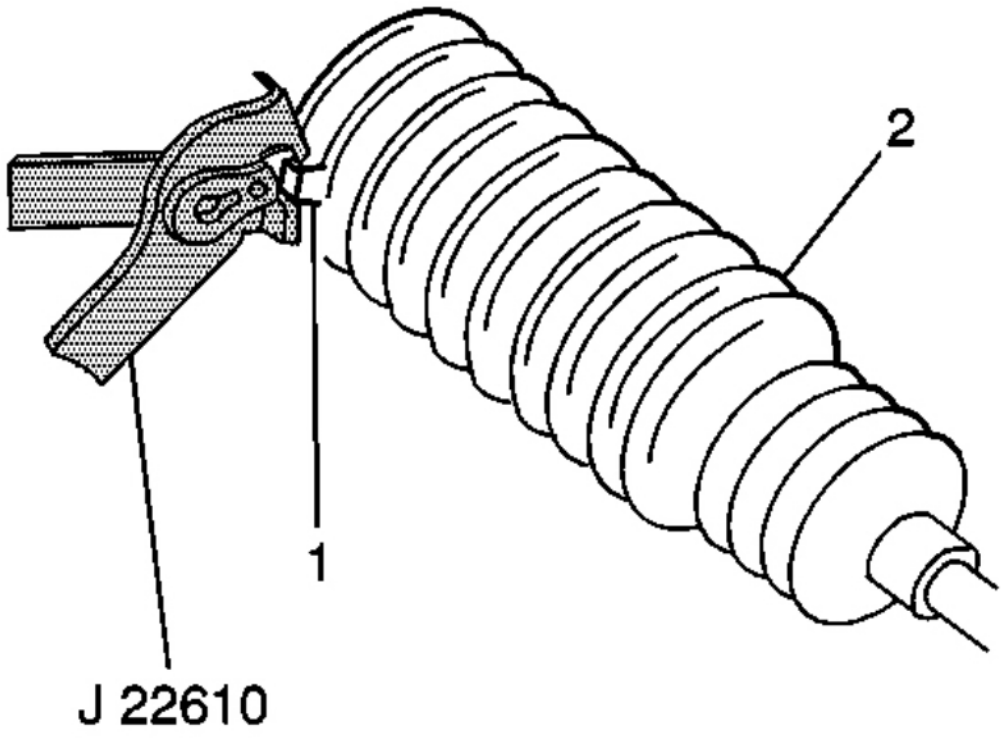


Fig. 32: Crimping Retaining Clamp Using J 22610
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 22610** , crimp the retaining clamp (1) to the steering gear. See **Special Tools and Equipment**.

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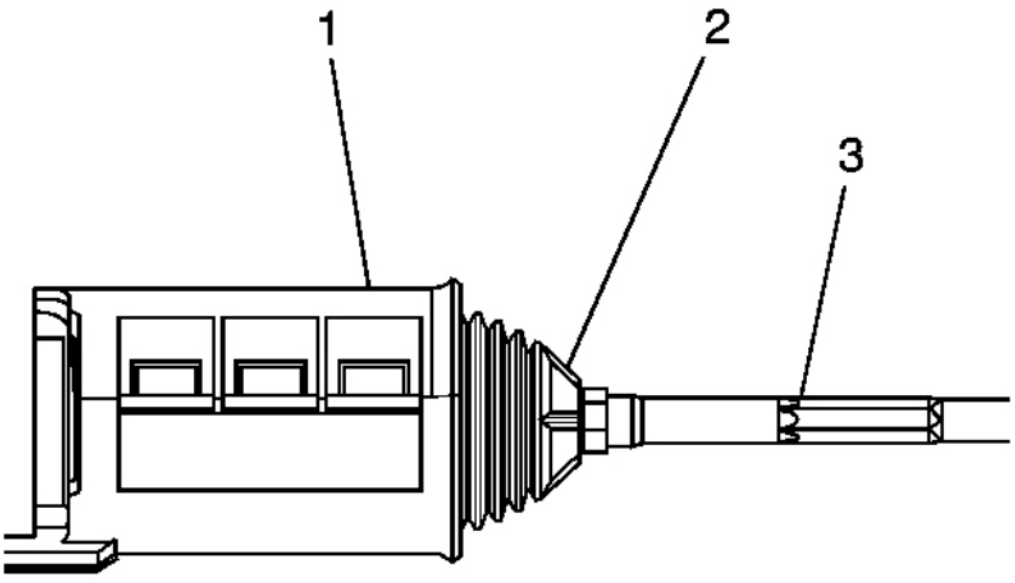


Fig. 33: View Of Rack & Pinion Boot & Protector
Courtesy of GENERAL MOTORS CORP.

5. Install the rack and pinion boot protector (1) to the rack and pinion boot (2), if equipped.

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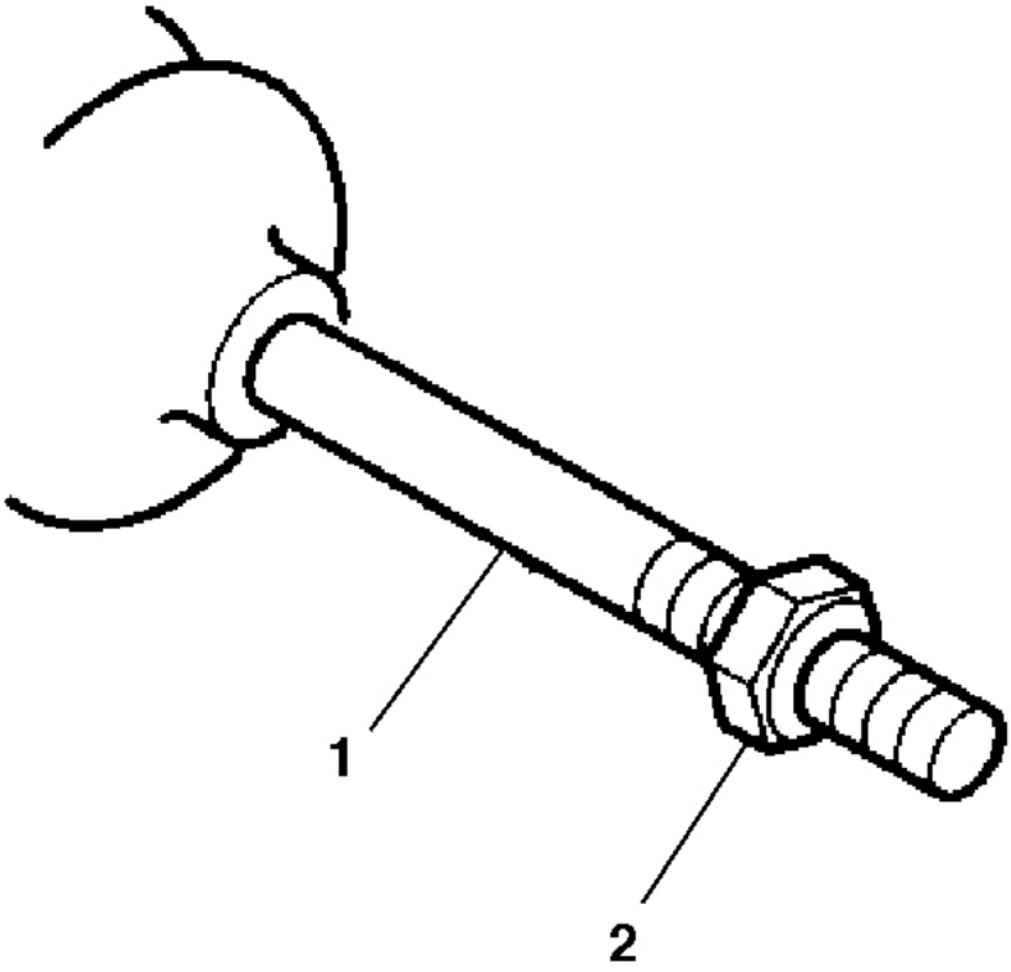


Fig. 34: Identifying Inner Tie Rod Assembly Jam Nut
Courtesy of GENERAL MOTORS CORP.

6. Install the tie rod jam nut (2) to the inner tie rod.
7. Install the outer tie rod. Refer to **Rear Wheel Steering Tie Rod End Replacement - Outer**.
8. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** .

STEERING GEAR ACTUATOR BOOT SHIELD REPLACEMENT

Removal Procedure

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NOTE: **When lifting the vehicle do not allow the jack to touch the rear steering gear. If the jack touches the rear steering gear you may damage the gear or the rack and pinion boots. If the boots are damaged replace the rack and pinion boot.**

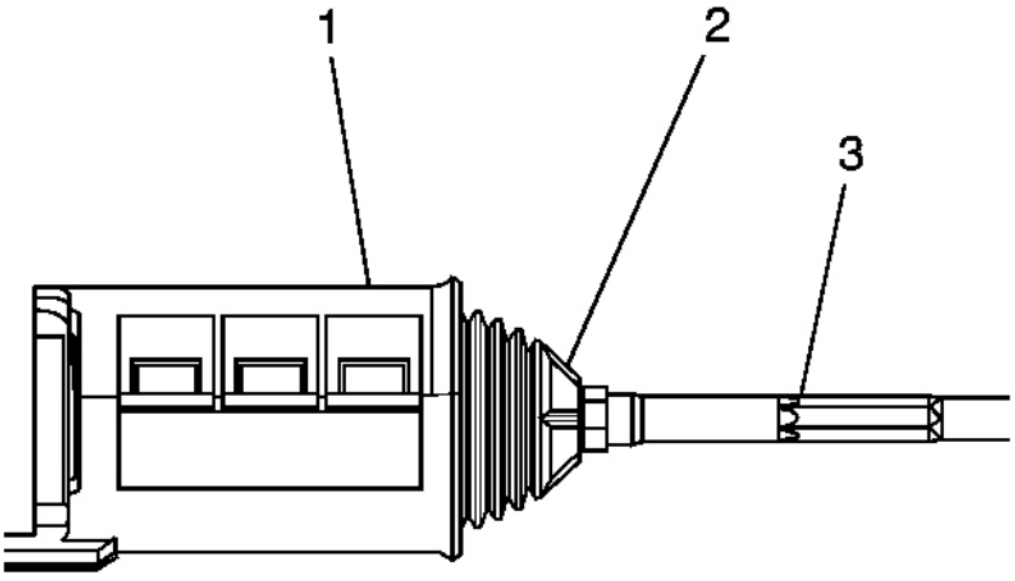


Fig. 35: View Of Rack & Pinion Boot & Protector
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Unsnap the locking tabs on the rack and pinion boot protector (1).
3. Remove the rack and pinion boot protector (1) from the rack and pinion boot (2).

Installation Procedure

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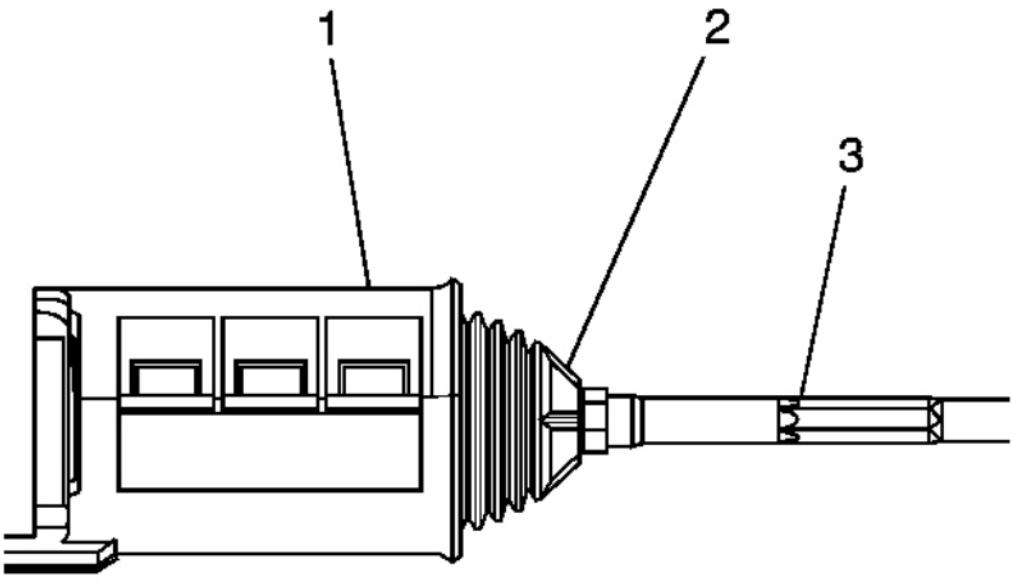


Fig. 36: View Of Rack & Pinion Boot & Protector
Courtesy of GENERAL MOTORS CORP.

1. Install the rack and pinion boot protector (1) to the rack and pinion boot (2).
2. Snap the locking tabs together on the rack and pinion boot protector.
3. Lower the vehicle.

STEERING GEAR MOTOR ASSEMBLY REPLACEMENT

Removal Procedure

NOTE: **Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

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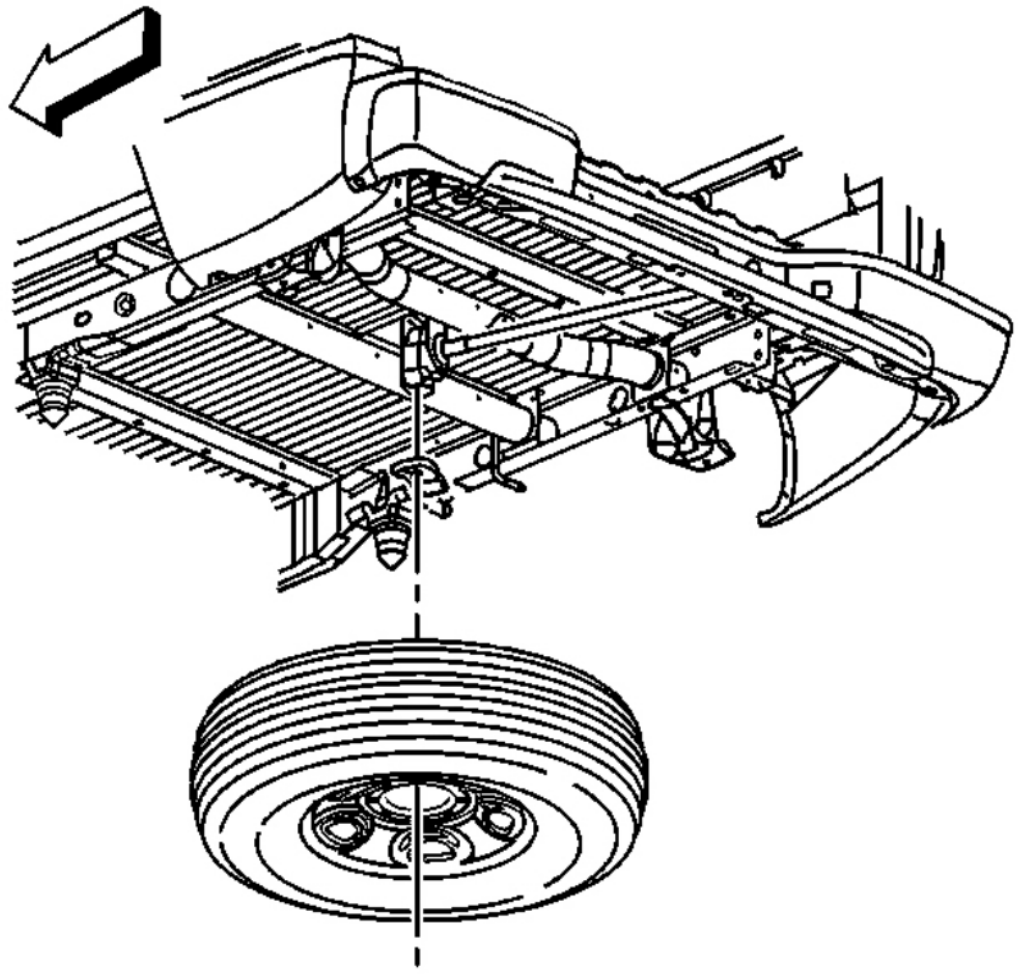


Fig. 37: View Of Spare Tire
Courtesy of GENERAL MOTORS CORP.

2. Remove the spare tire from the vehicle.

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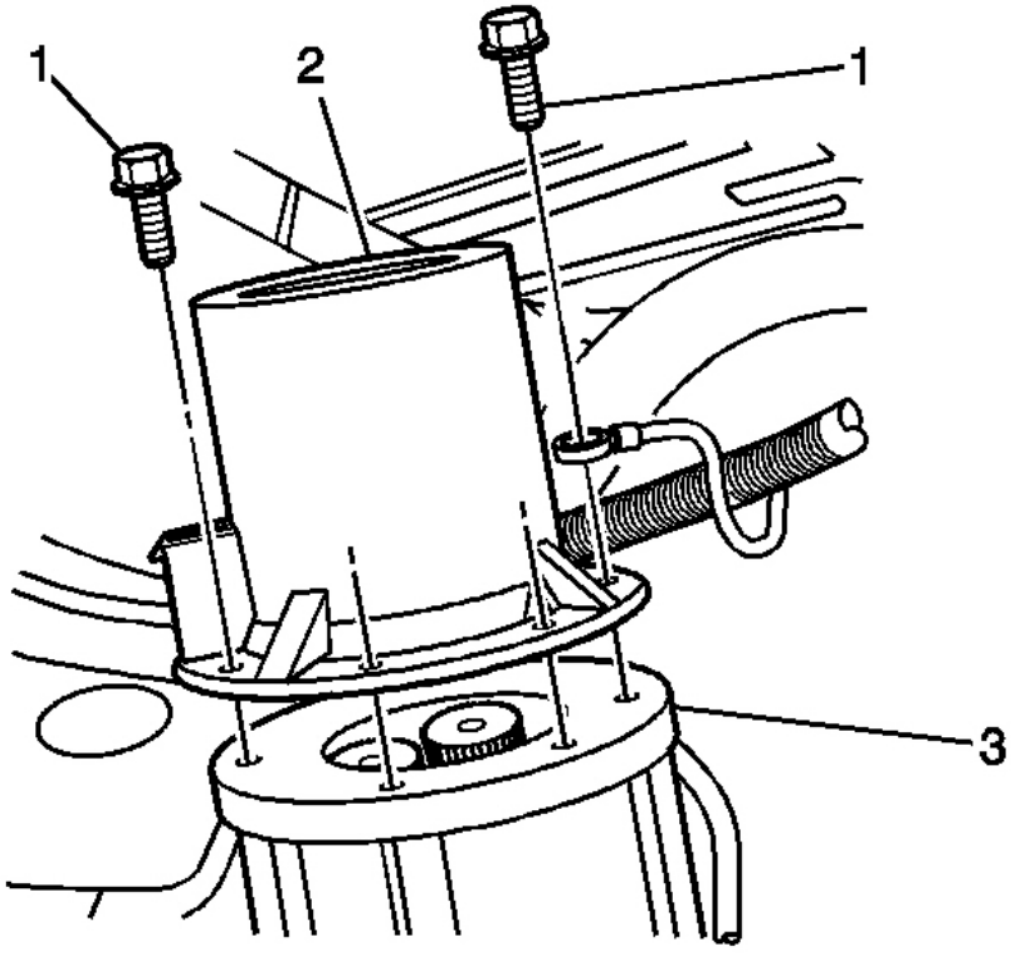


Fig. 38: View Of Steering Gear Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolts (1) retaining the steering gear motor (2) to the steering gear.
4. Remove the steering gear motor from the steering gear.
5. Cover the steering gear motor opening to keep contamination out of the oil in the planetary gear assembly.
6. Remove the wiring harness from the retaining clips.

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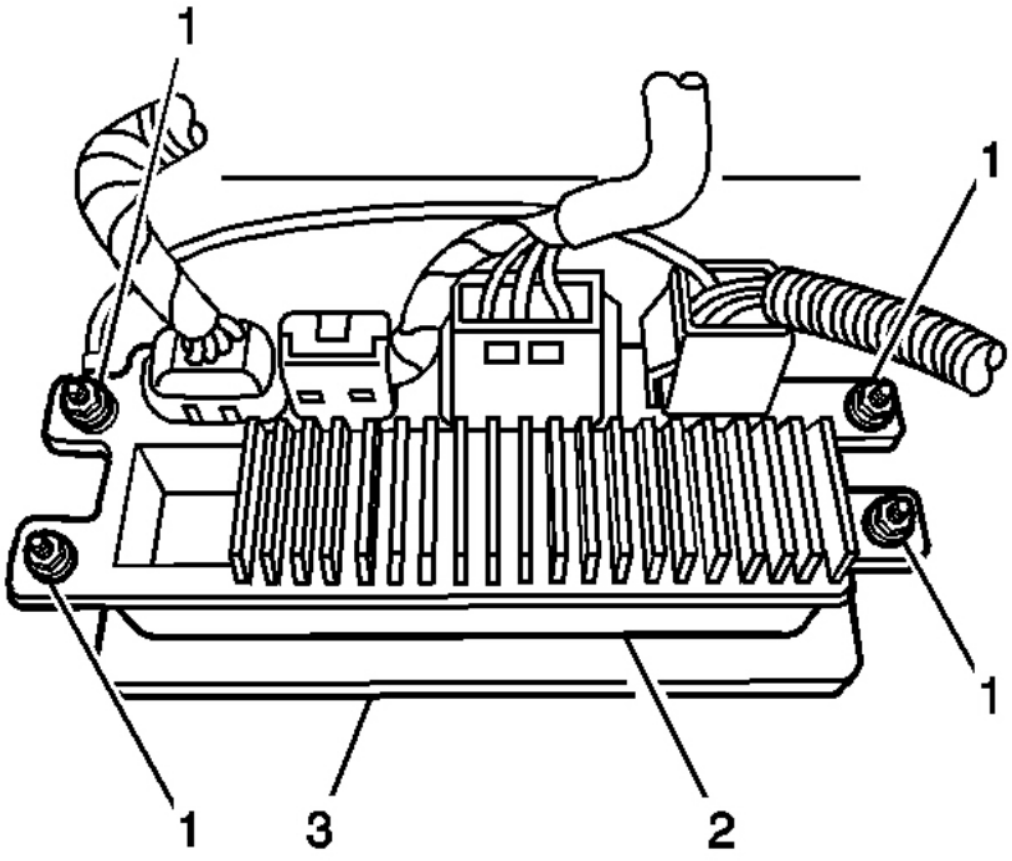


Fig. 39: View Of Control Module & Connector
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the wiring harness from the control module (2).

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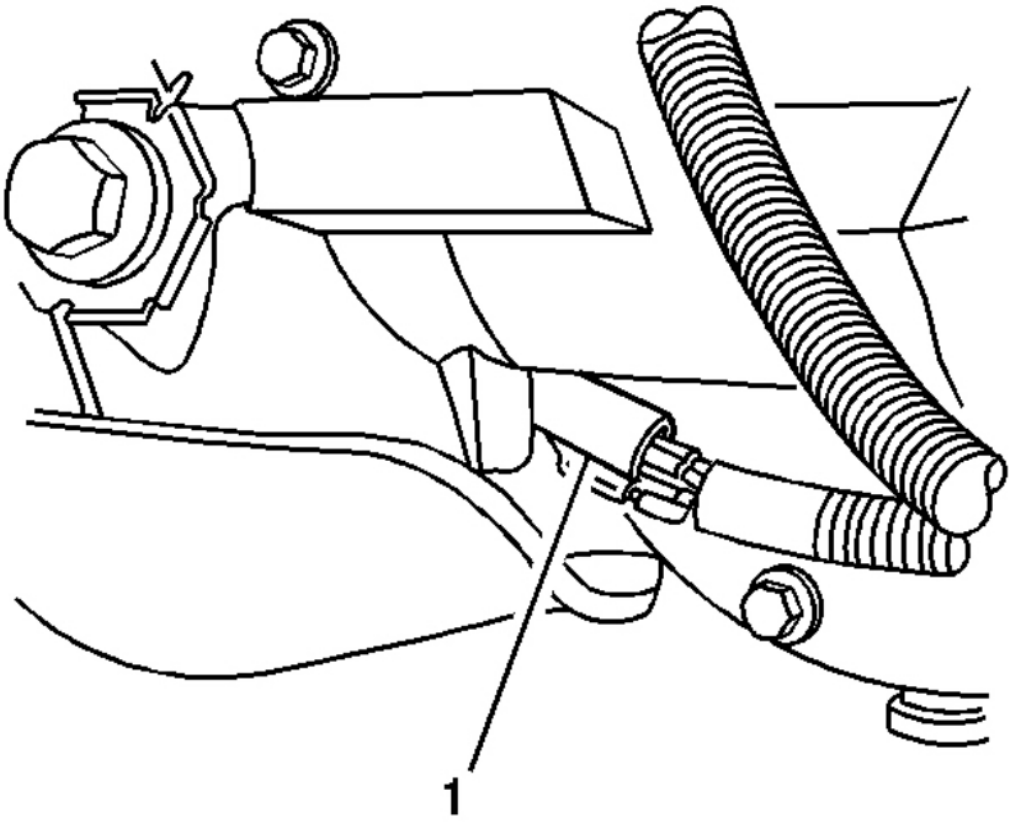


Fig. 40: View Of Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the electrical connector (1) from the rear position sensor.
9. Remove the steering gear motor and wiring harness from the vehicle.

Installation Procedure

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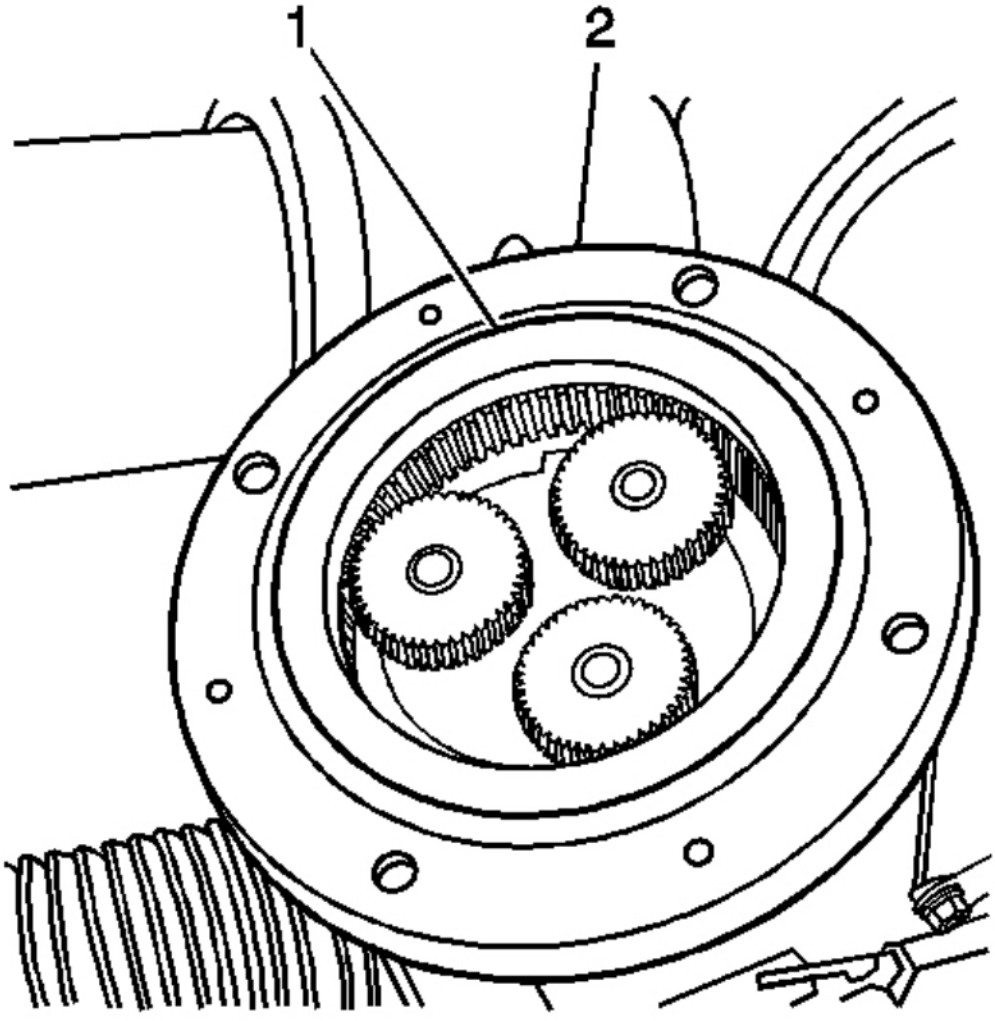


Fig. 41: View Of Steering Gear Motor & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make sure the O-ring is seated in the O-ring groove.

1. Install the O-ring seal (1) to the steering gear.
2. Install the steering gear motor (2) to the vehicle.

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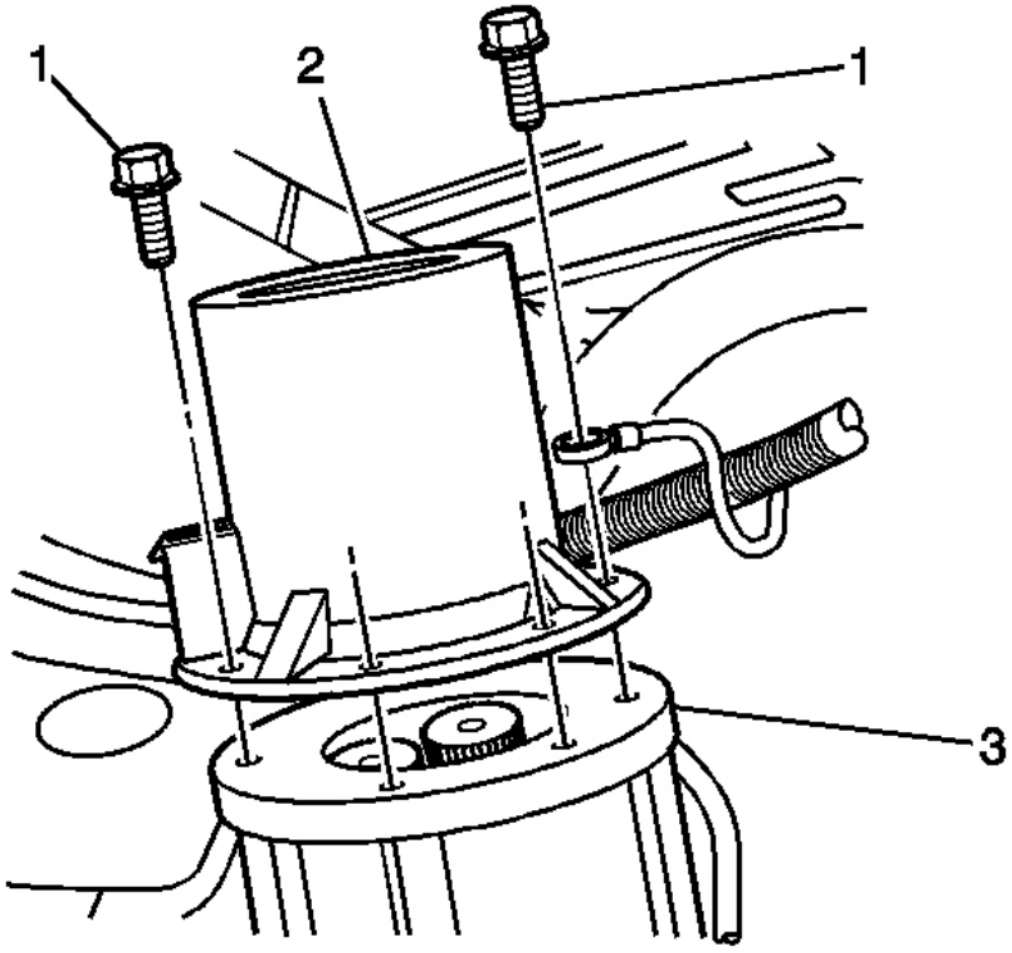


Fig. 42: View Of Steering Gear Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the bolts (1) retaining the steering gear motor (2) to the steering gear.

   Tighten: Tighten the 6 mm (0.24 in) steering gear motor retaining bolts to 10 N.m (89 lb in).

   Tighten: Tighten the 4 mm (0.16 in) steering gear motor retaining bolts to 4 N.m (35 lb in).

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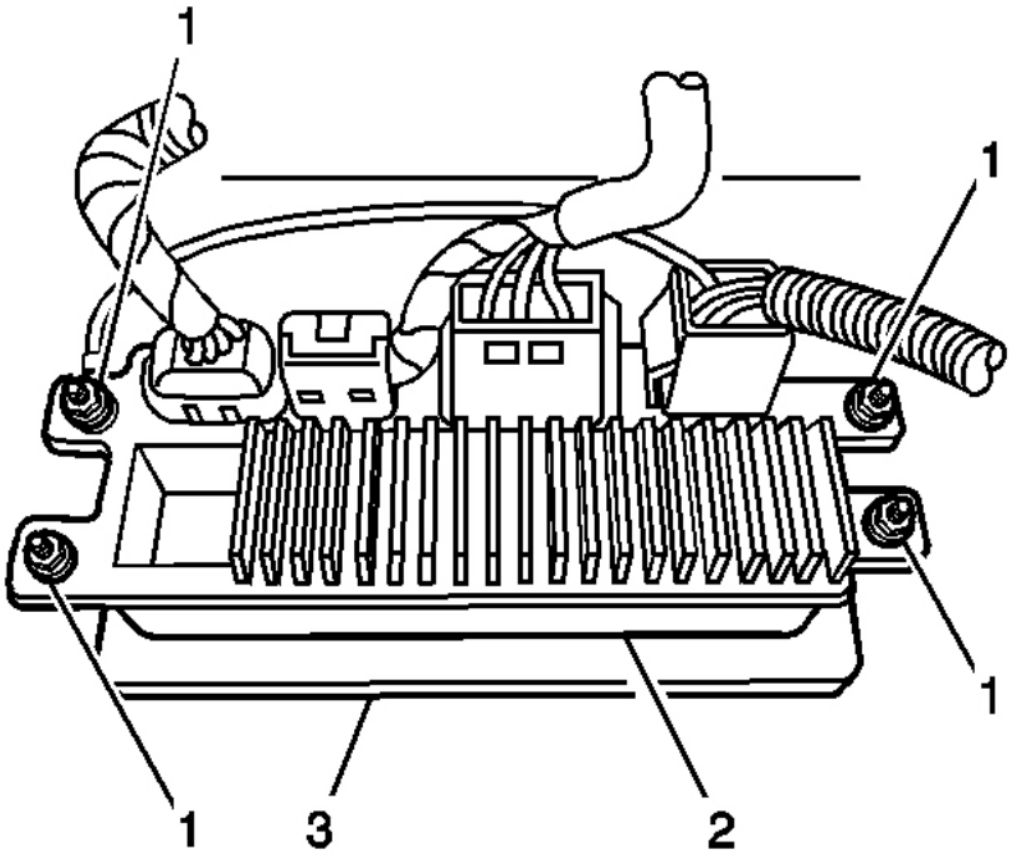


Fig. 43: View Of Control Module & Connector
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Route the wiring harness in the same location as the wiring was removed.

4. Connect the electrical connectors to the control module (2).

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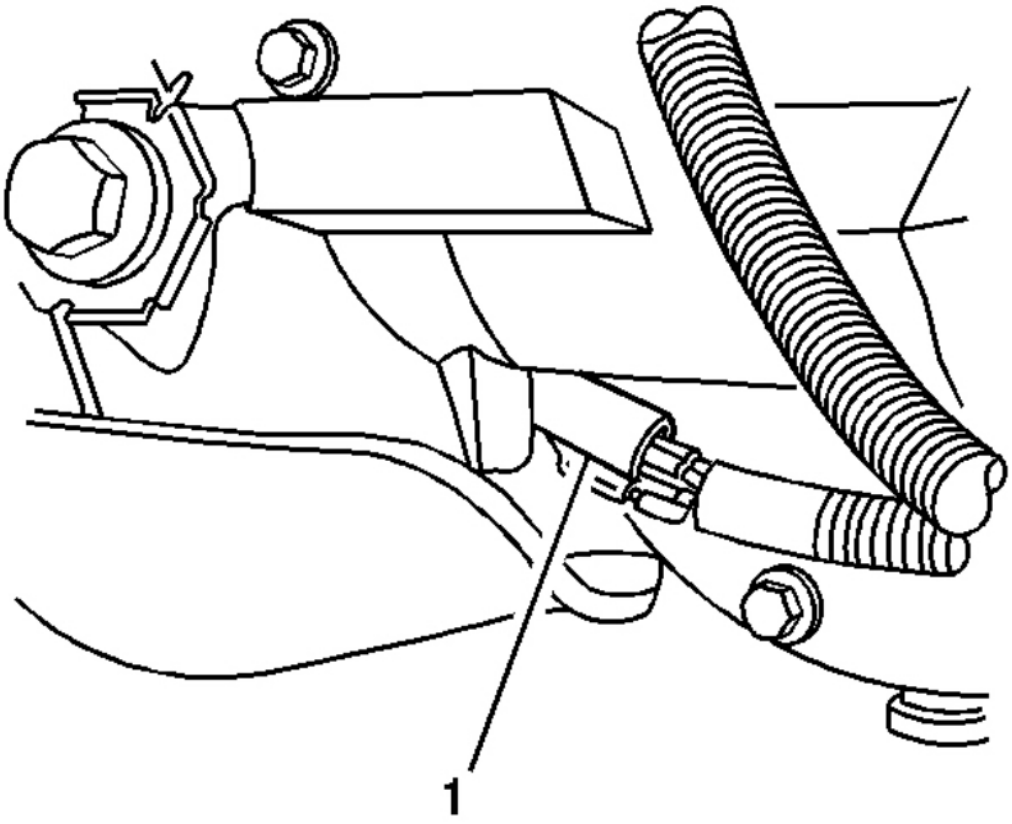


Fig. 44: View Of Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connector (1) to the rear position sensor.
6. Connect the wire harness retaining clips.

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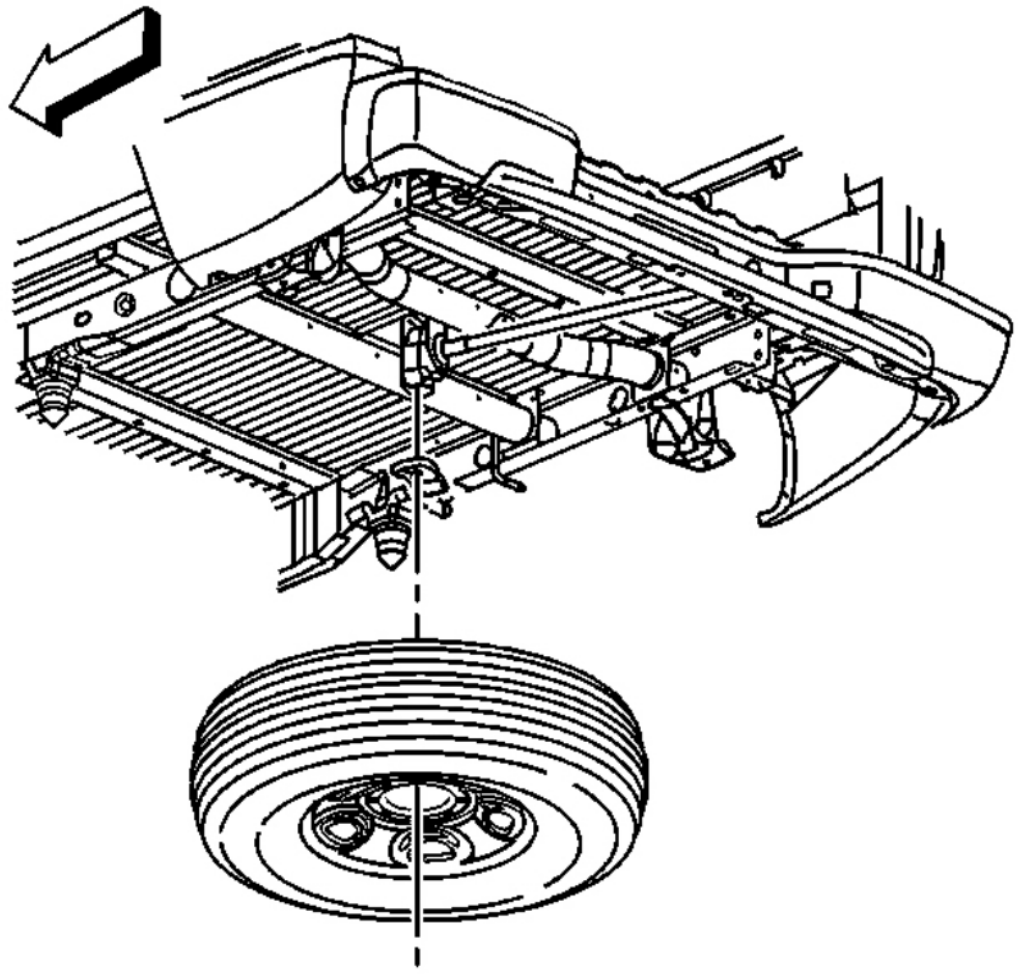


Fig. 45: View Of Spare Tire
Courtesy of GENERAL MOTORS CORP.

7. Install the spare tire to the vehicle.
8. Lower the vehicle.

REAR POSITION SENSOR REPLACEMENT

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

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1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

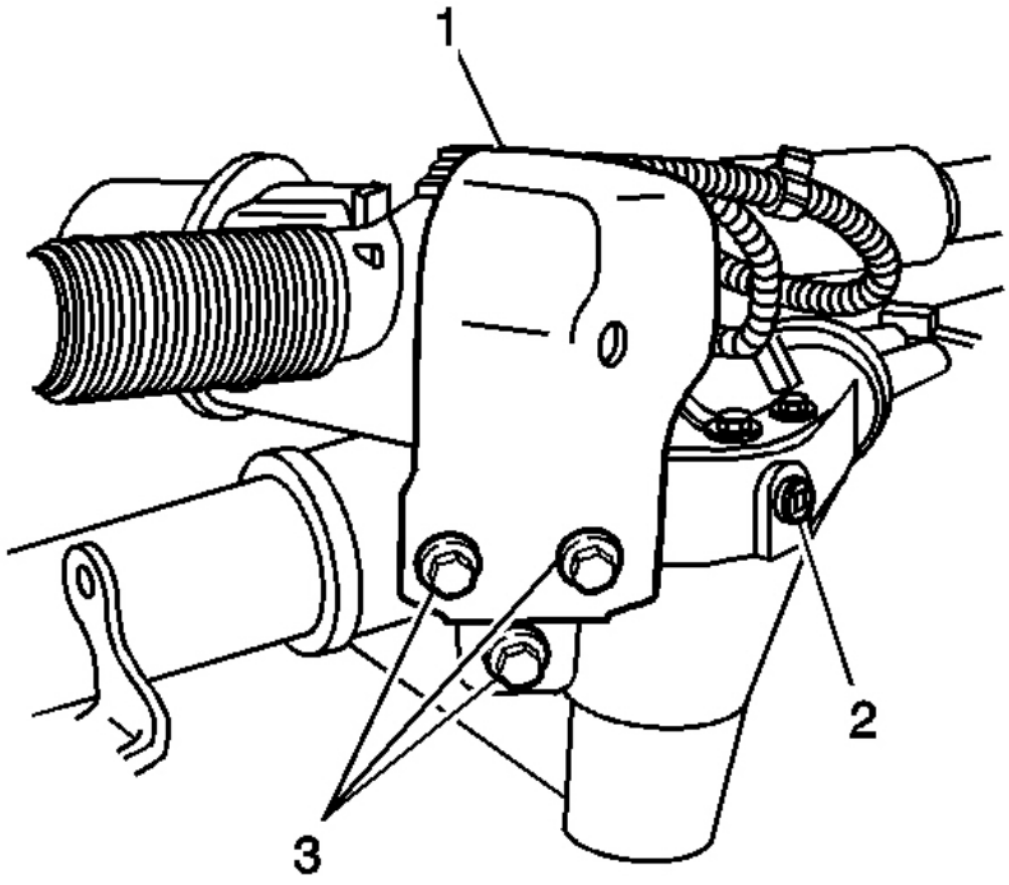


Fig. 46: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

2. Remove the steering gear protection shield (1) retaining bolts (3).

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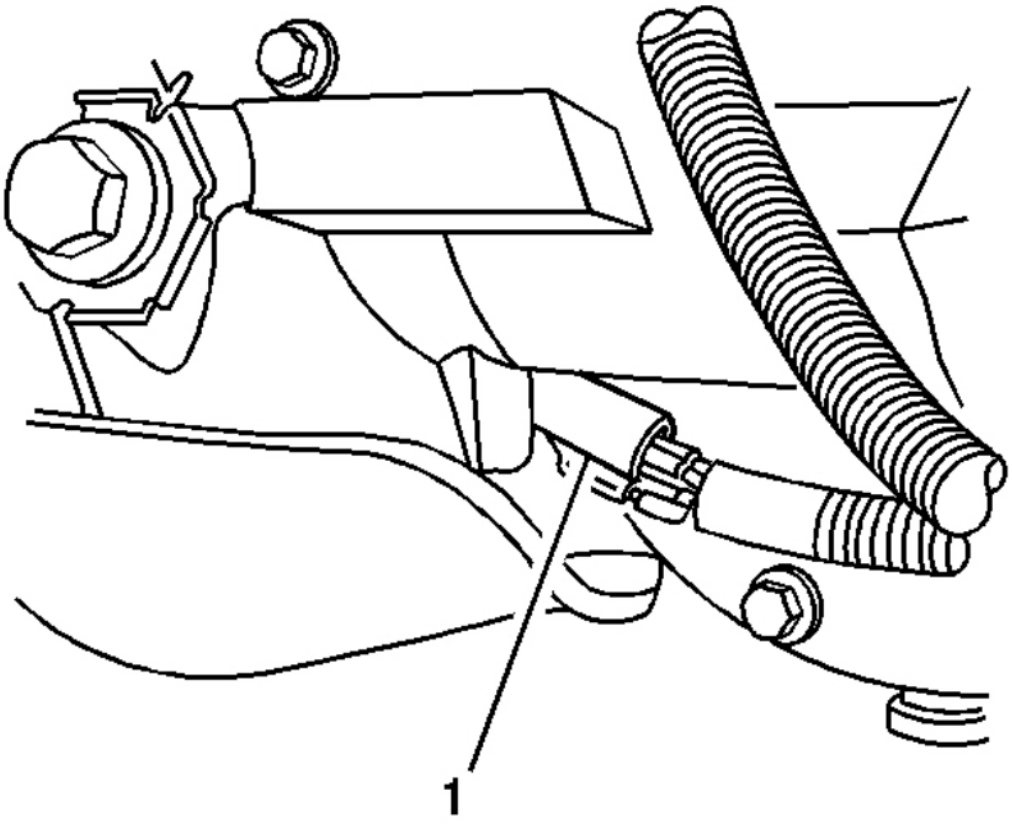


Fig. 47: View Of Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the electrical connector (1).

NOTE: **When removing the rear position cover from the steering gear be careful not to damage to the rear position sensor.**

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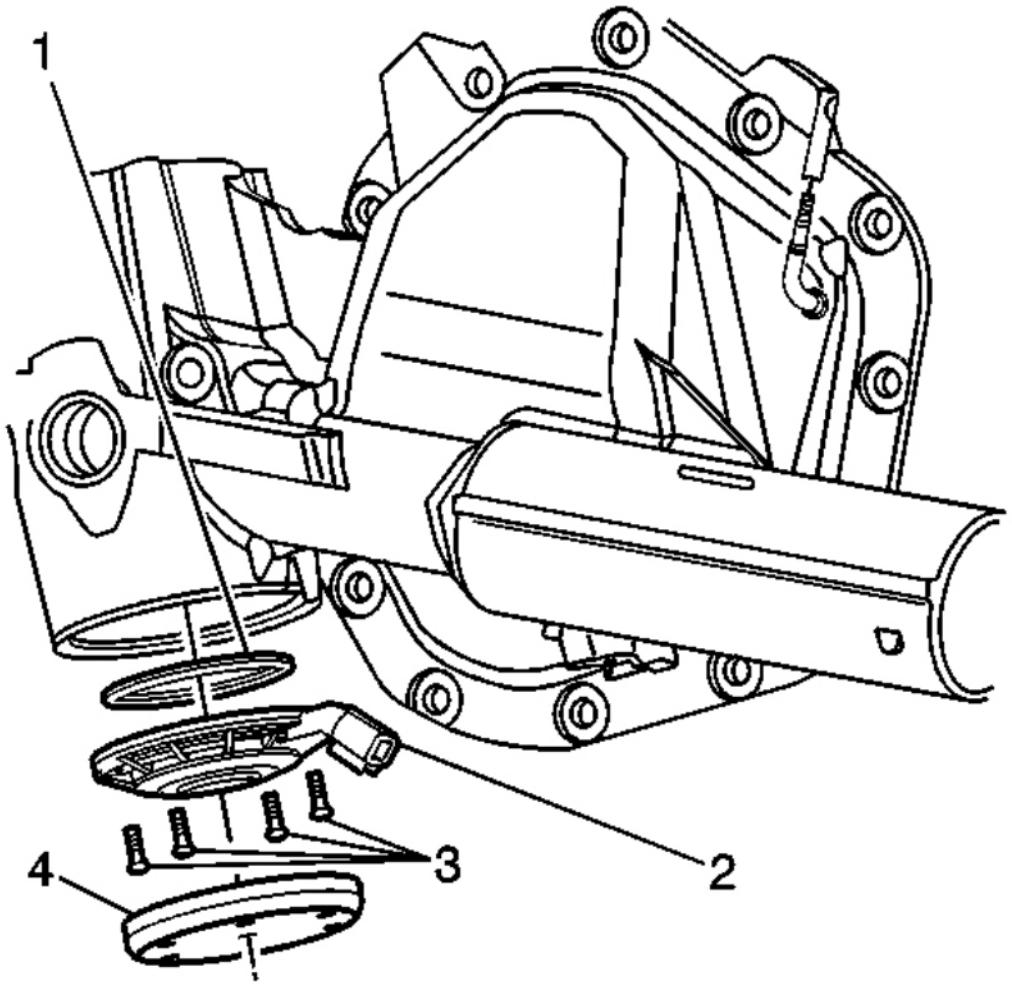


Fig. 48: View Of Rear Wheel Position Sensor, Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the rear wheel position sensor cover (4) from the steering gear by prying on the cover using the slot.
5. Remove the rear wheel position sensor retaining bolts (3).

IMPORTANT: Check the inner tie rod boot for wear or damage.

6. If the boots are damaged replace the steering gear actuator. Refer to **Steering Gear Actuator and Cover Replacement**.

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IMPORTANT: Maintain the sensor position. Do not turn the sensor.

7. Remove the rear wheel position sensor (2) from the steering gear.

Installation Procedure

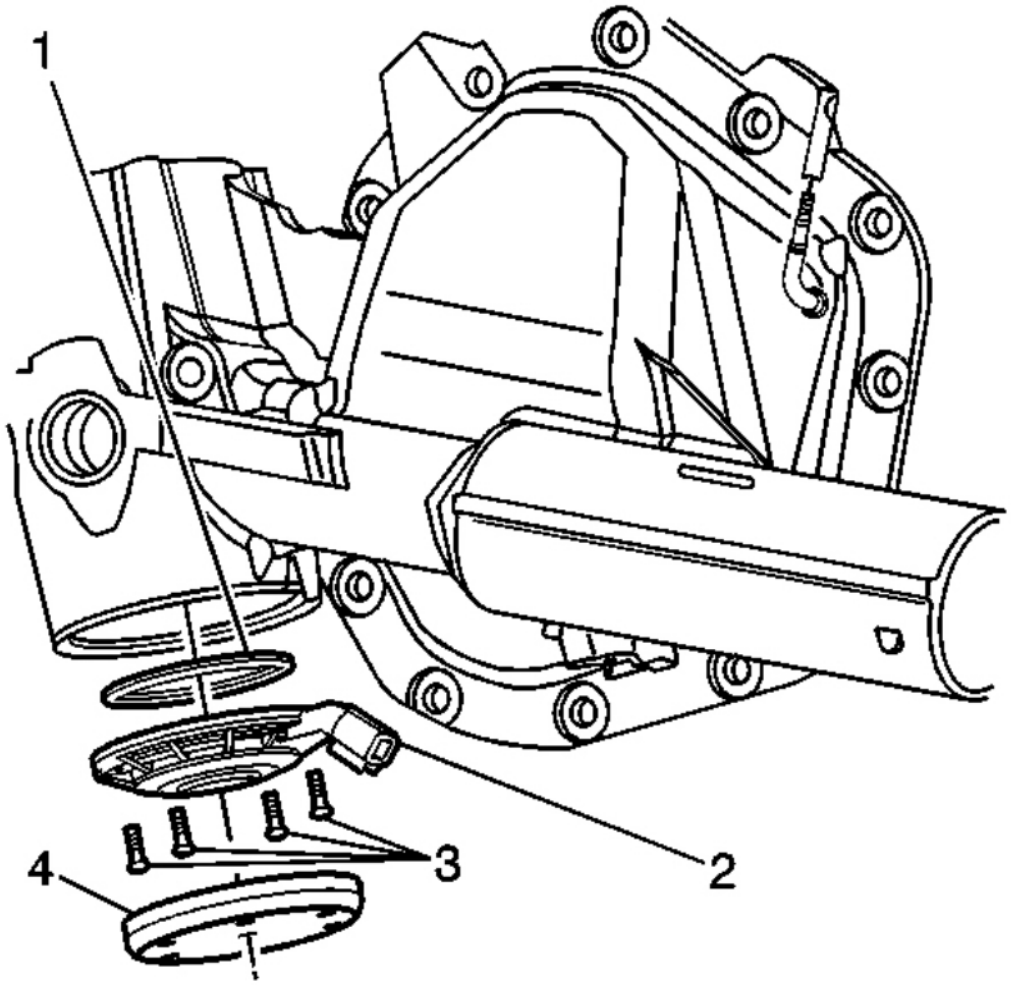


Fig. 49: View Of Rear Wheel Position Sensor, Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make sure the O-ring (1) is installed.

1. Install the rear wheel position sensor (2) to the steering gear.

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IMPORTANT: Be careful to maintain the position of the replacement sensor.

2. Remove the pin retaining the position of the new sensor and immediately install the sensor to the steering gear.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the rear wheel position sensor retaining bolts. Apply LOCTITE 242 blue.

   Tighten: Tighten the bolts to 4 N.m (35 lb in).

4. Install the rear wheel position sensor cover (4).

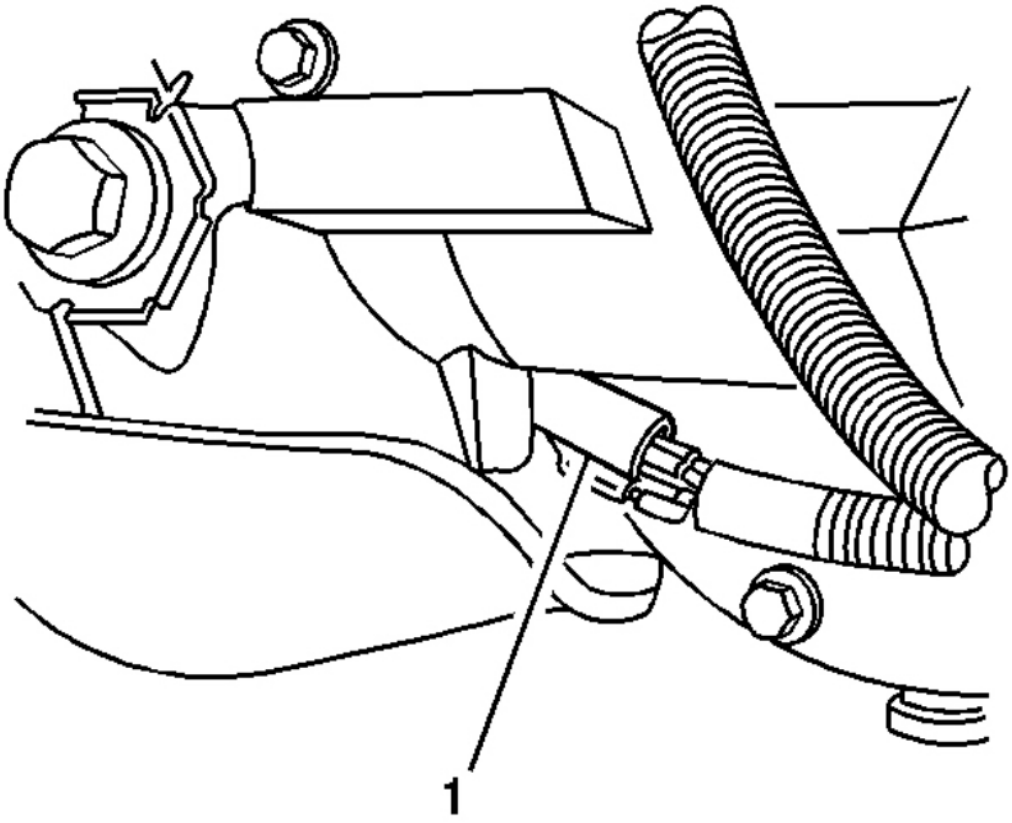


Fig. 50: View Of Electrical Connector
Courtesy of GENERAL MOTORS CORP.

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5. Connect the electrical connector (1).

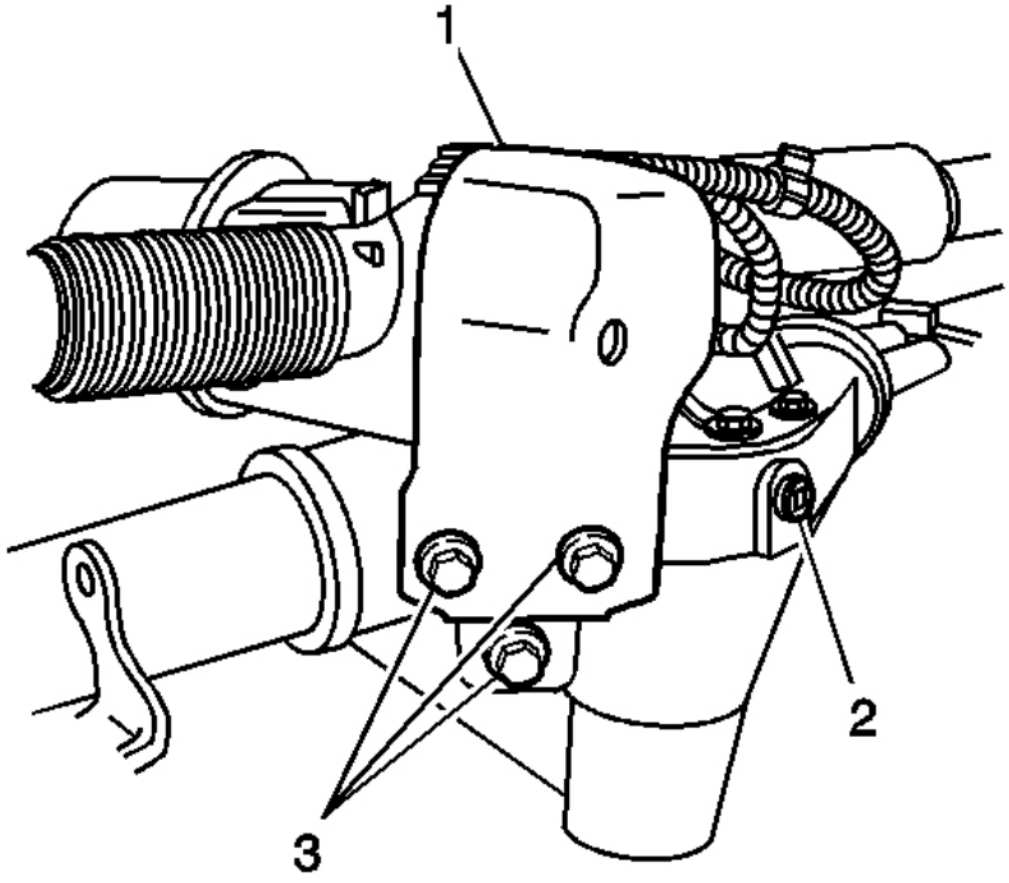


Fig. 51: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

6. Install the steering gear protection shield (1) and retaining bolts (3).

   Tighten: Tighten the steering gear protection shield retaining bolts to 180 N.m (132 lb ft).

7. Lower the vehicle.
8. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

STEERING GEAR ACTUATOR AND COVER REPLACEMENT

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Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

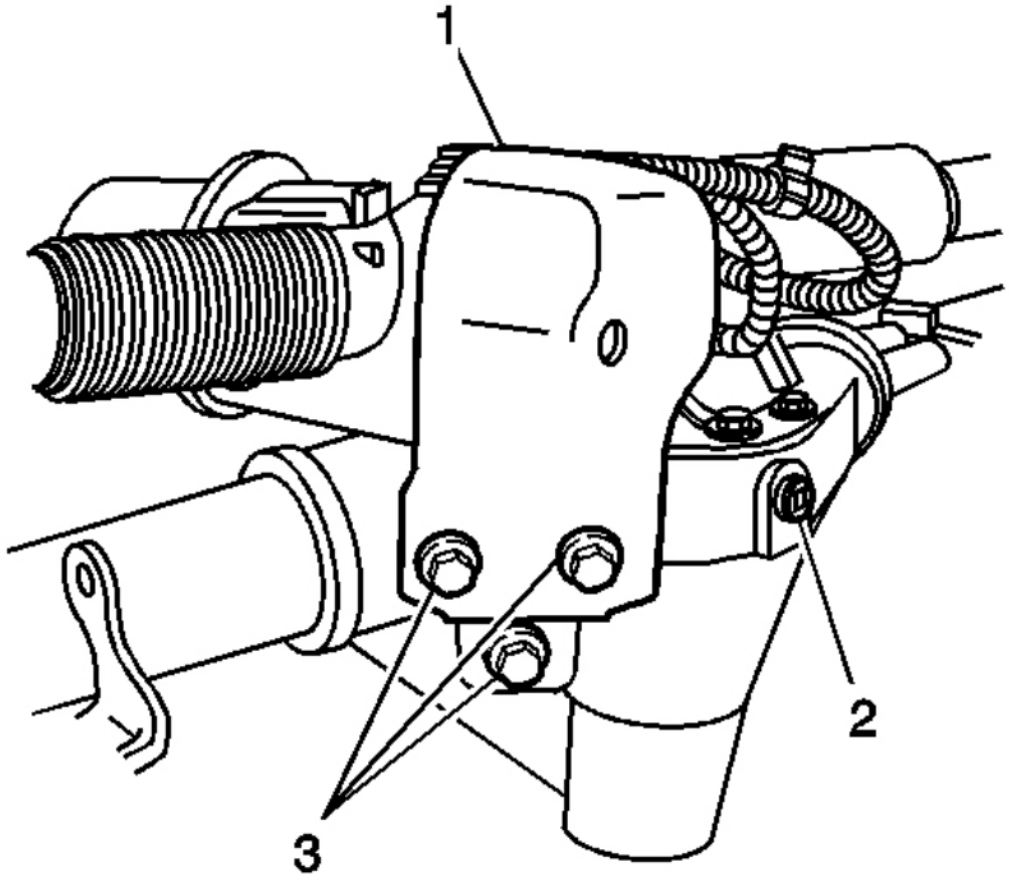


Fig. 52: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

3. Remove the drain plug (2) and drain the fluid from the differential housing.
4. Remove the bolts (3) retaining the steering gear protection shield.

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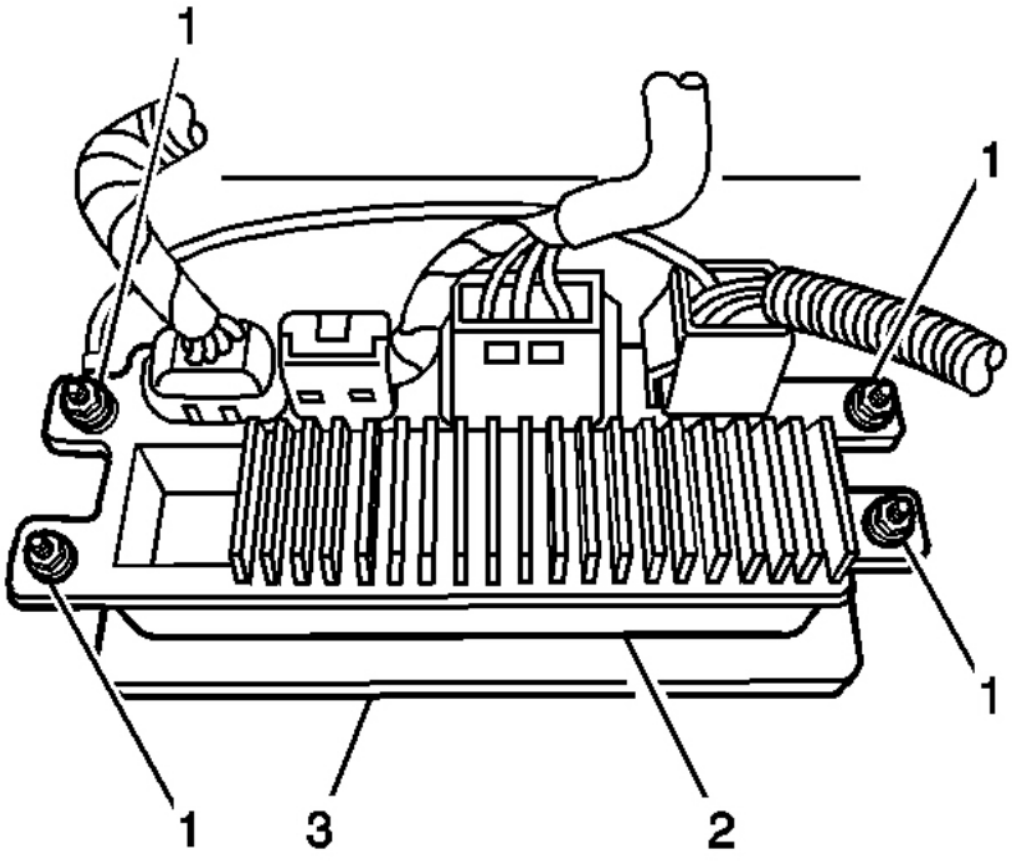


Fig. 53: View Of Control Module & Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the electrical connectors from the control module (2).

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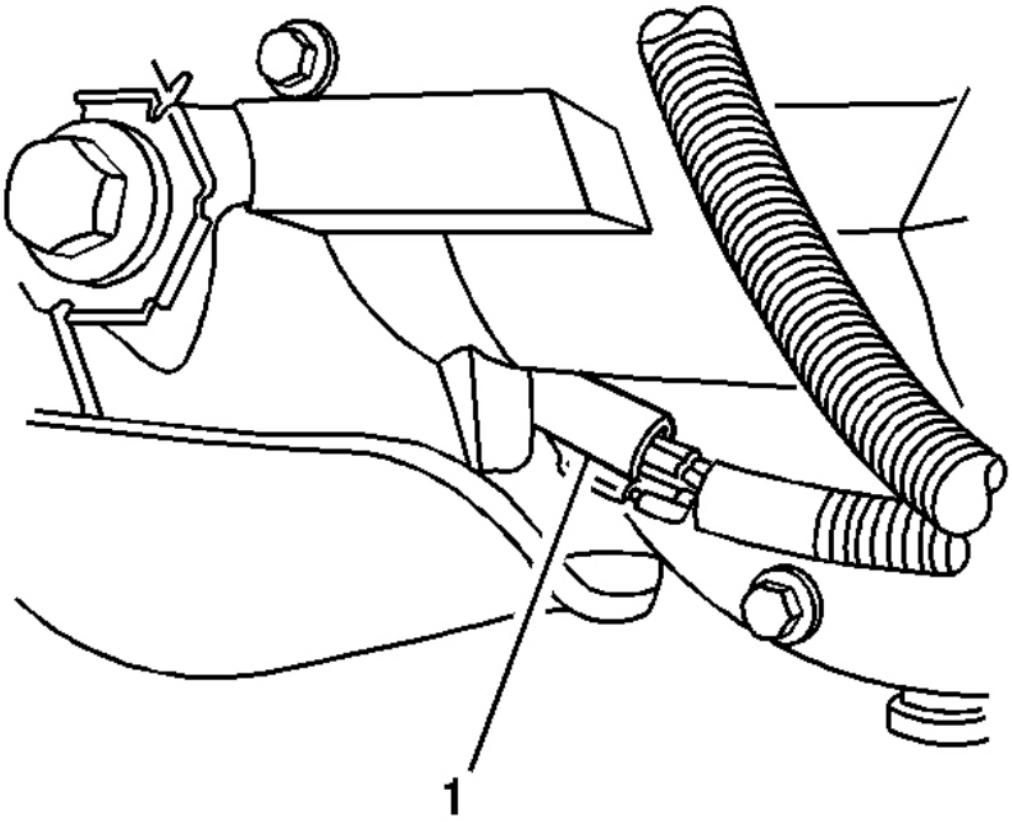


Fig. 54: View Of Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the electrical connector (1) from the rear position sensor.
7. Remove the outer tie rod ends from the steering knuckle. Refer to **Rear Wheel Steering Tie Rod End Replacement - Outer**.

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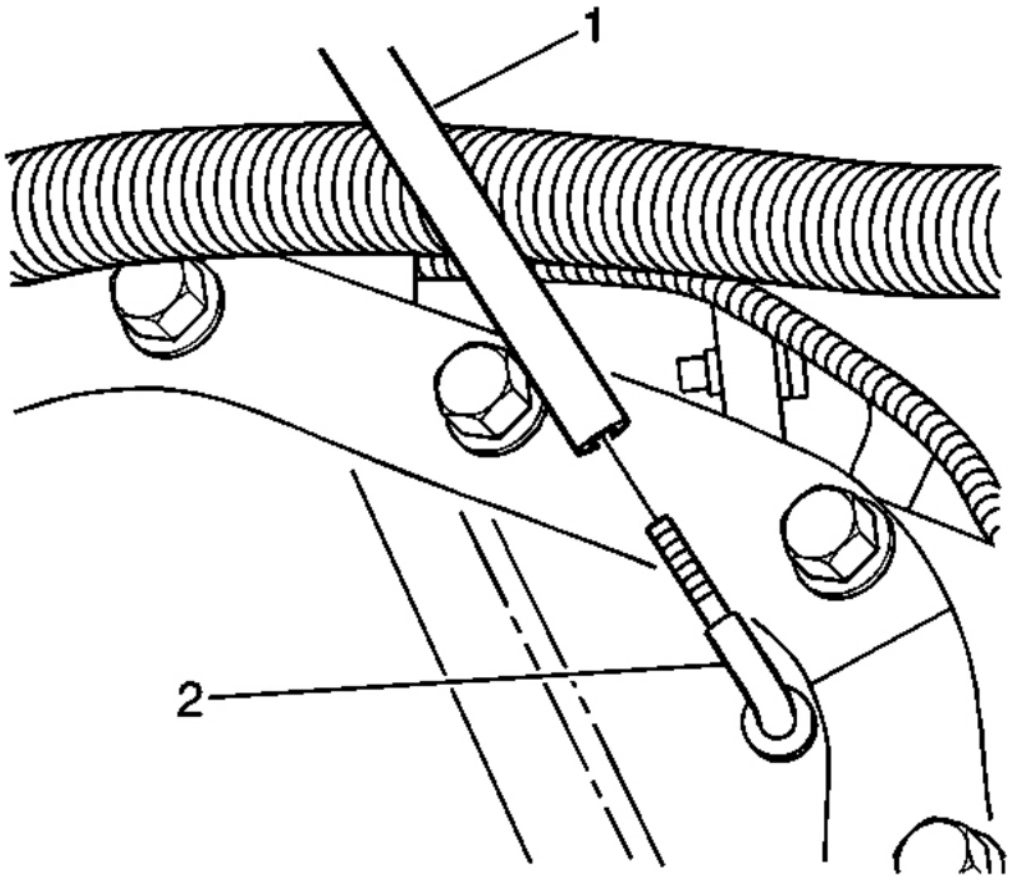


Fig. 55: View Of Differential Vent Hose At Vent Tube
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the differential vent hose (1) from the vent tube (2).

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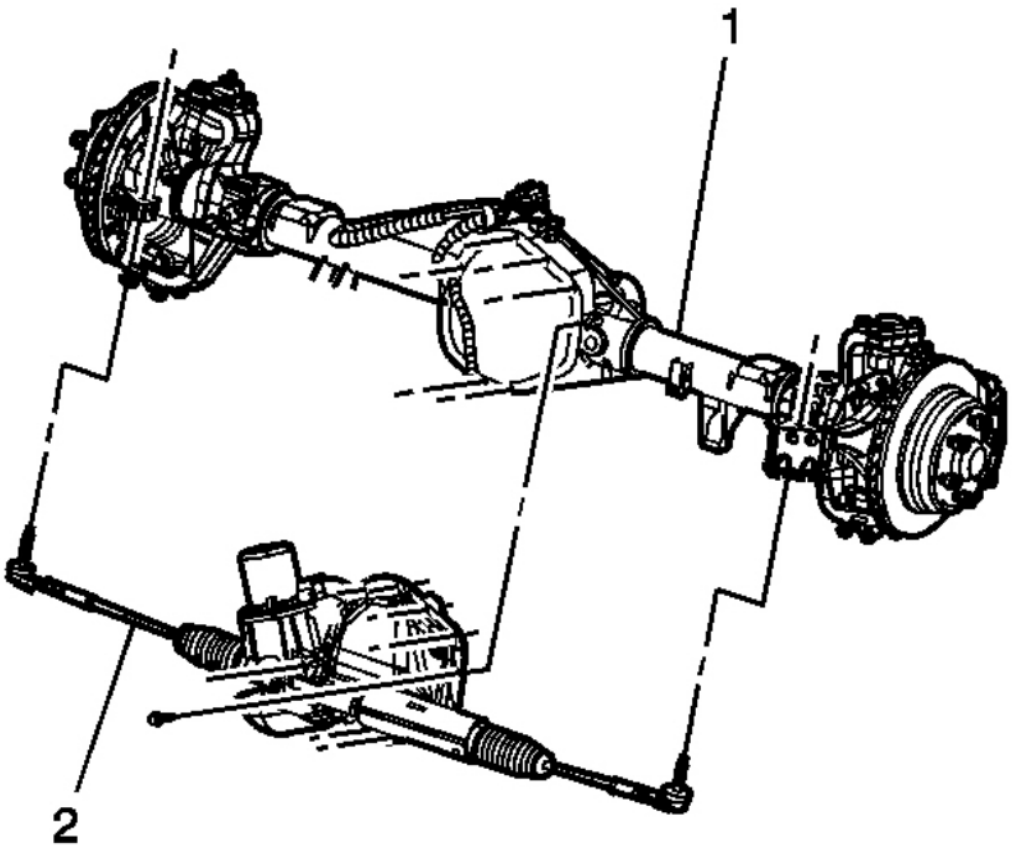


Fig. 56: View Of Steering Gear Actuator & Cover At Differential
Courtesy of GENERAL MOTORS CORP.

9. Remove the bolts retaining the steering gear actuator and cover (2) to the differential (1).
10. Remove the steering gear actuator and cover from the vehicle.

Installation Procedure

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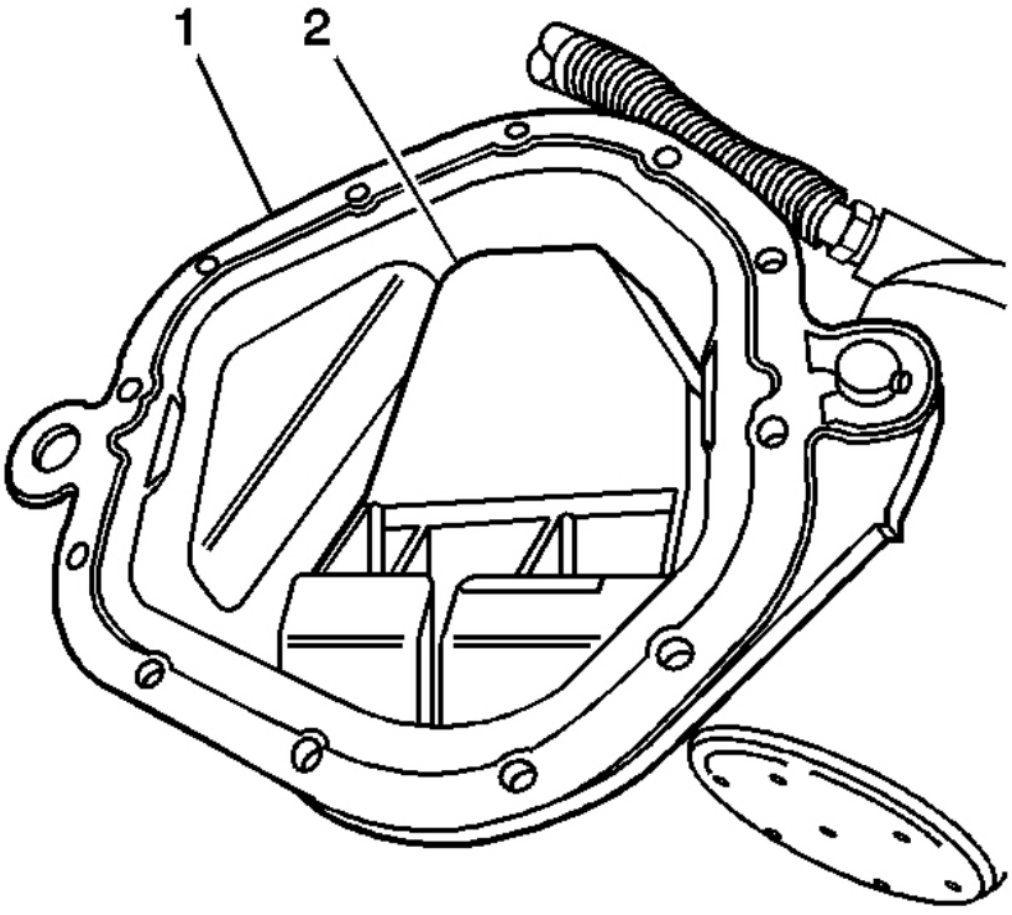


Fig. 57: View Of Steering Gear Actuator & Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Clean all of the sealing surfaces prior to installing the gasket. Do not reinstall the old gasket, replace the gasket whenever the actuator is removed from the axle.

1. Install the steering gear actuator (2) and gasket (1) to the differential.

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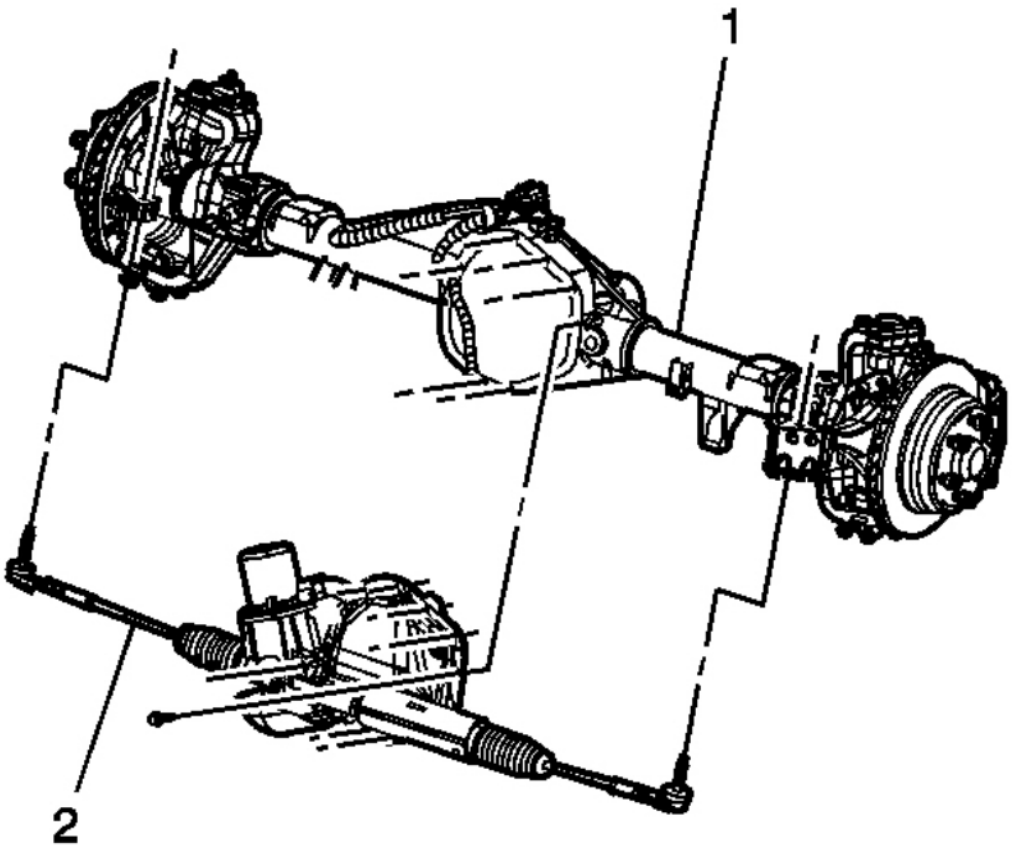


Fig. 58: View Of Steering Gear Actuator & Cover At Differential
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the steering gear actuator and cover (2) retaining bolts.

   Tighten: Tighten the bolts to 61 N.m (45 lb ft).

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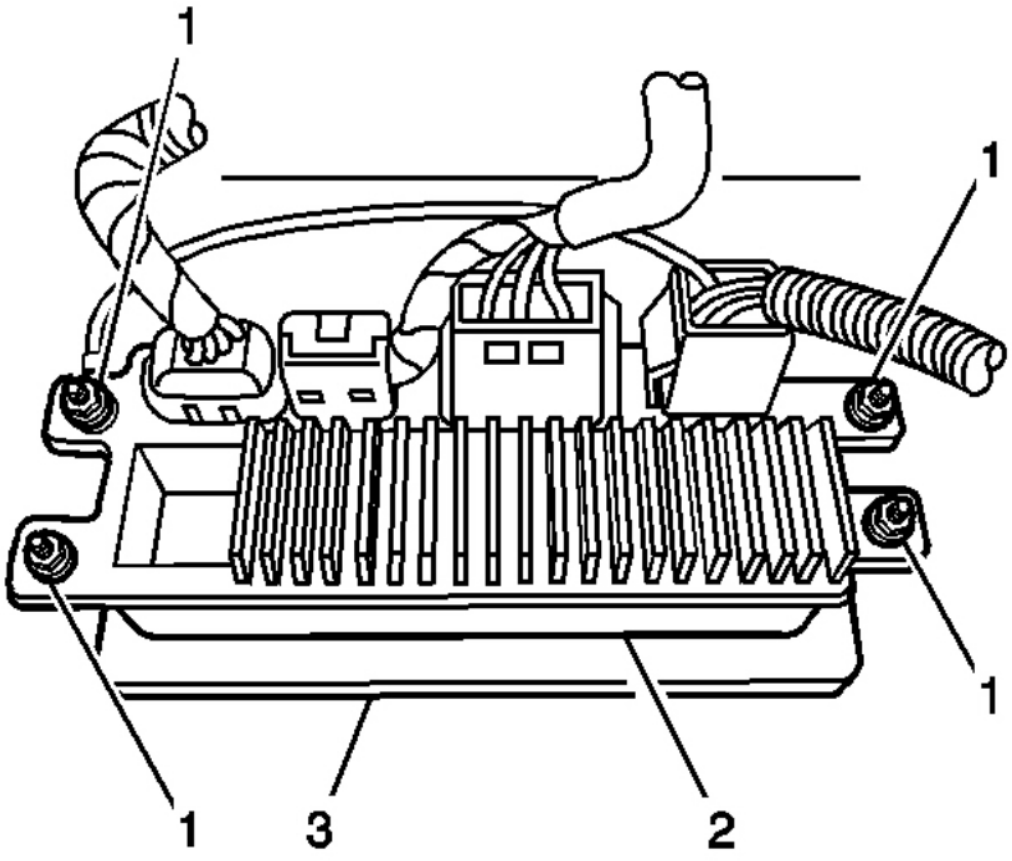


Fig. 59: View Of Control Module & Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the electrical connectors to the control module (2).

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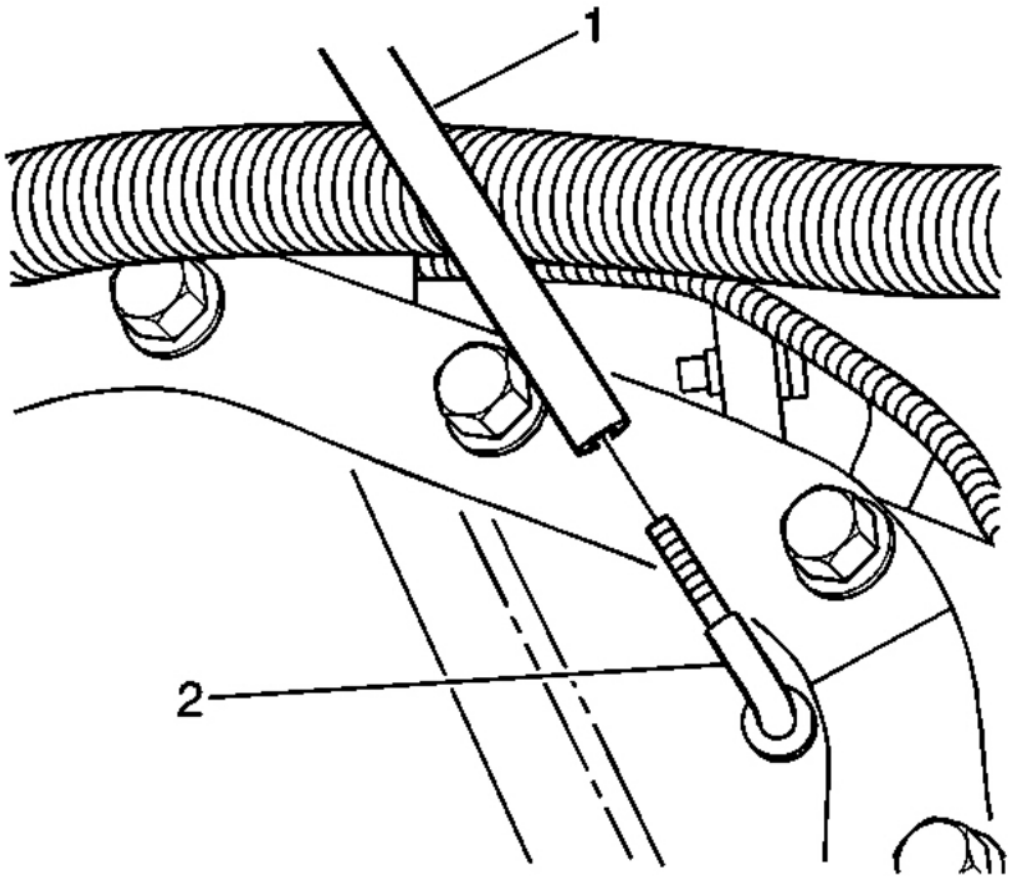


Fig. 60: View Of Differential Vent Hose At Vent Tube
Courtesy of GENERAL MOTORS CORP.

4. Install the differential vent hose (1) to the vent tube (2).
5. Install the outer tie rod ends to the steering knuckle. Refer to **Rear Wheel Steering Tie Rod End Replacement - Outer**.

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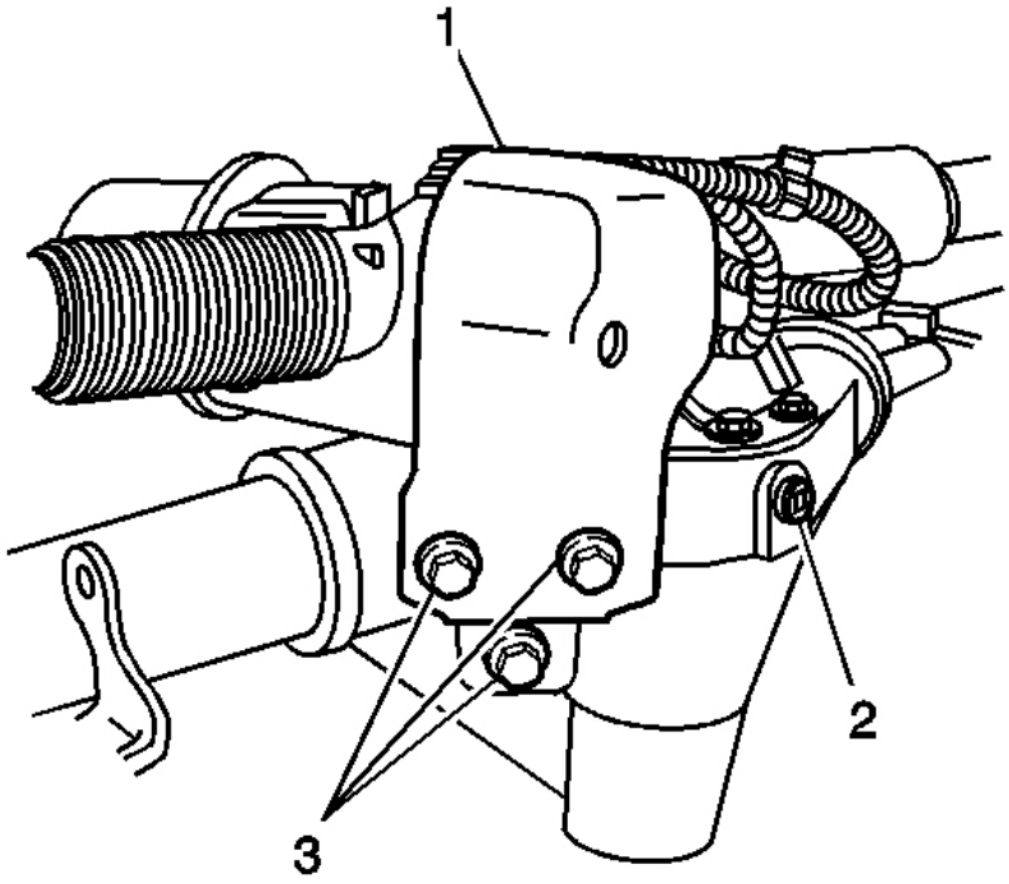


Fig. 61: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

6. Install the drain plug (2) and fill the differential with fluid. Refer to **Lubricant Replacement - Rear Drive Axle (8.6 Inch Axle)** or **Lubricant Replacement - Rear Drive Axle (9.5, 10.5 Inch Axle)** or **Lubricant Replacement - Rear Drive Axle (9.75 Inch Axle)** in Rear Drive Axle.
7. Install the bolts (3) retaining the steering gear protection shield.

   Tighten: Tighten the bolts to 180 N.m (132 lb ft).

8. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
9. Lower the vehicle.
10. Check the wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

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UPPER BALL JOINT REPLACEMENT

Tools Required

- **J 44664** Upper Ball Joint Nut Remover. See **Special Tools and Equipment**.
- **J 44663** Upper Ball Joint Remover. See **Special Tools and Equipment**.

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

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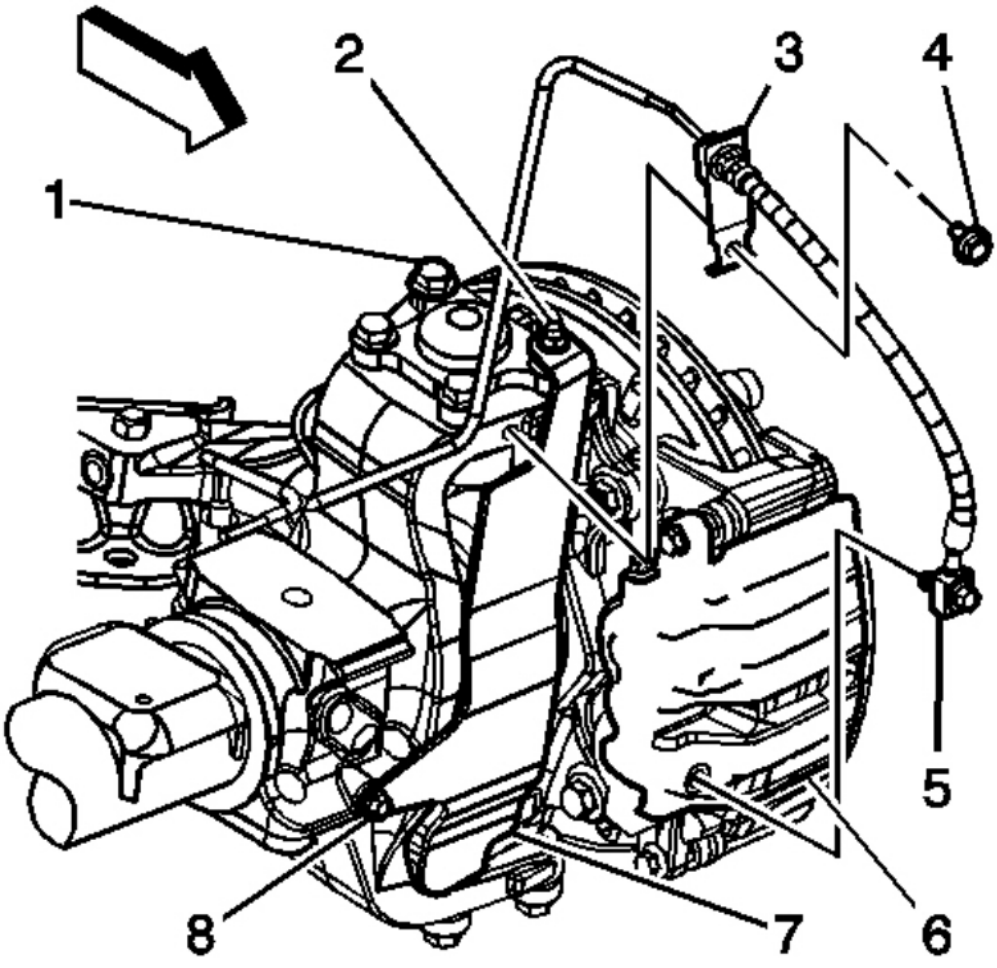


Fig. 62: View Of Axle Bracket, Brake Hose Bracket & Fasteners
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolt (8) and nut (2) retaining the bracket to the axle.
4. Remove the bracket (7) from the vehicle.
5. Remove the bolt (4) retaining the brake hose bracket (3) to the axle.

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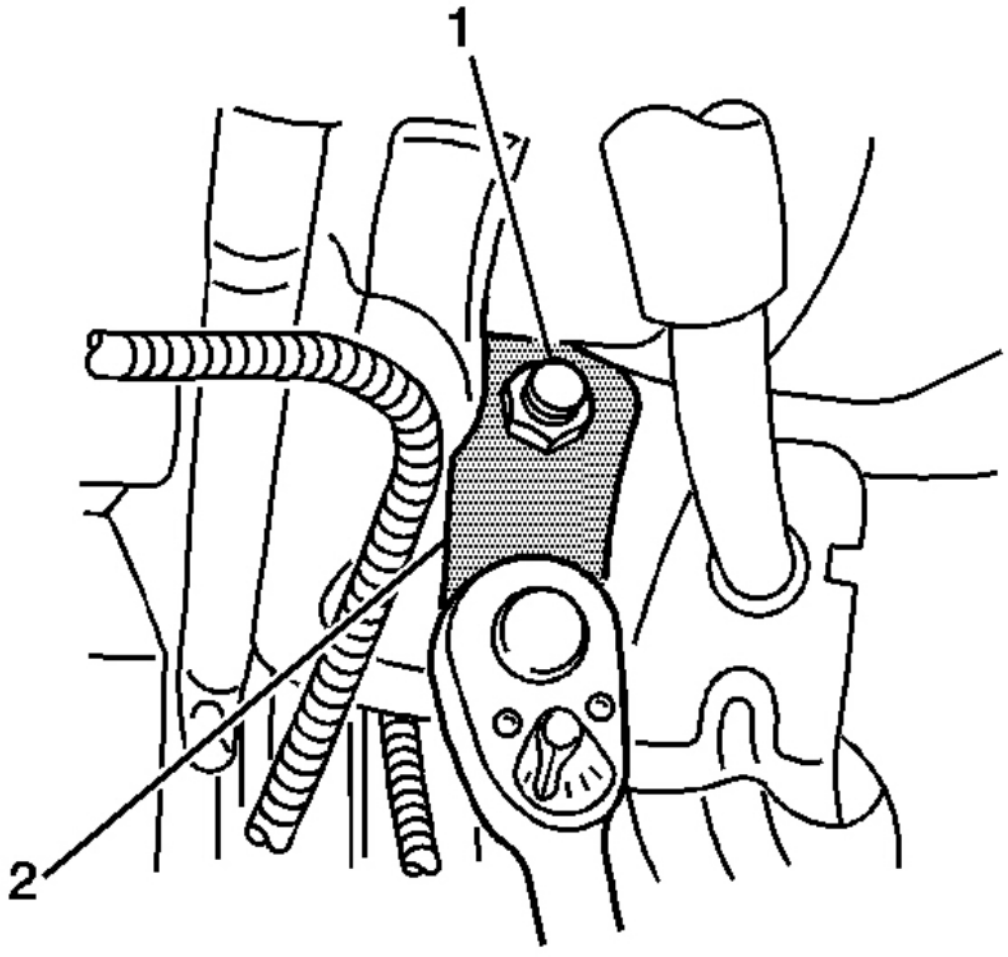


Fig. 63: View Of Upper Ball Joint To Steering Knuckle Nut & J 44664
Courtesy of GENERAL MOTORS CORP.

6. Using the **J 44664** (2), remove the nut (1) retaining the upper ball joint to the steering knuckle. See **Special Tools and Equipment**.

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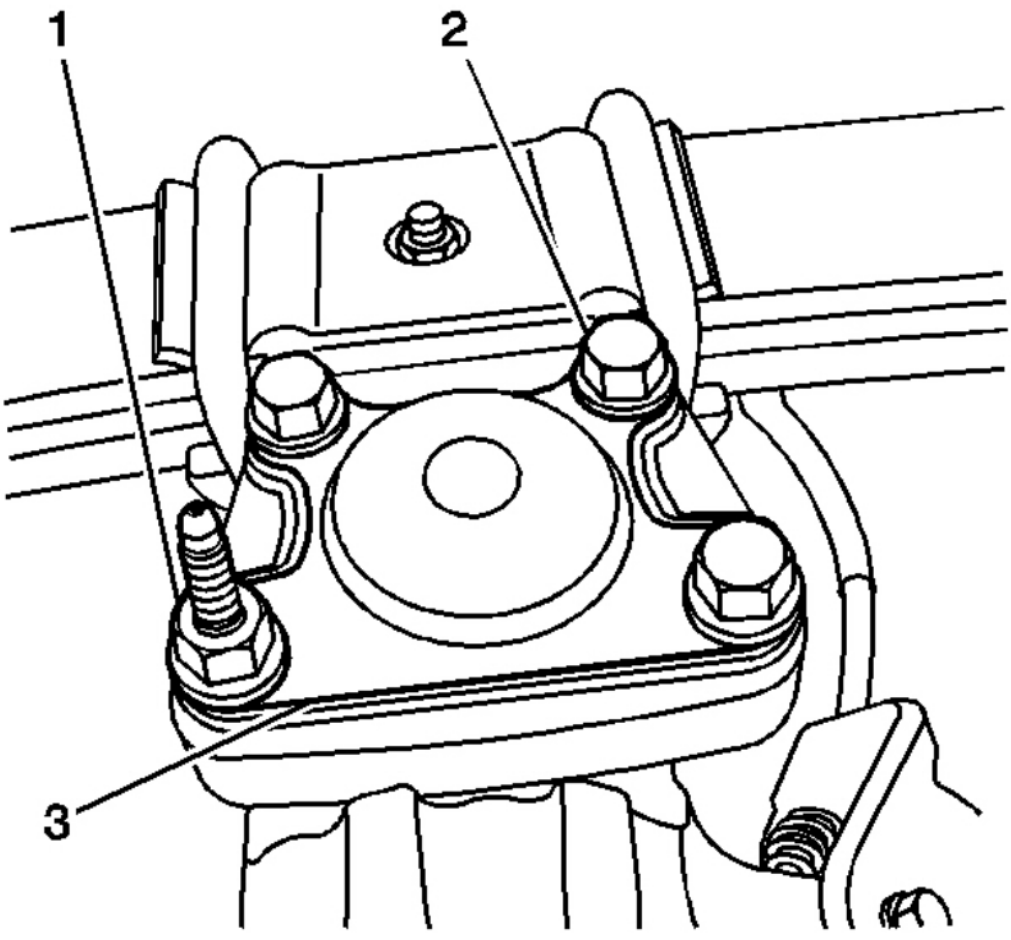


Fig. 64: View Of Upper Ball Joint, Retaining Bolts & Stud
Courtesy of GENERAL MOTORS CORP.

7. Remove the upper ball joint (3) retaining bolts (2) and stud (1).

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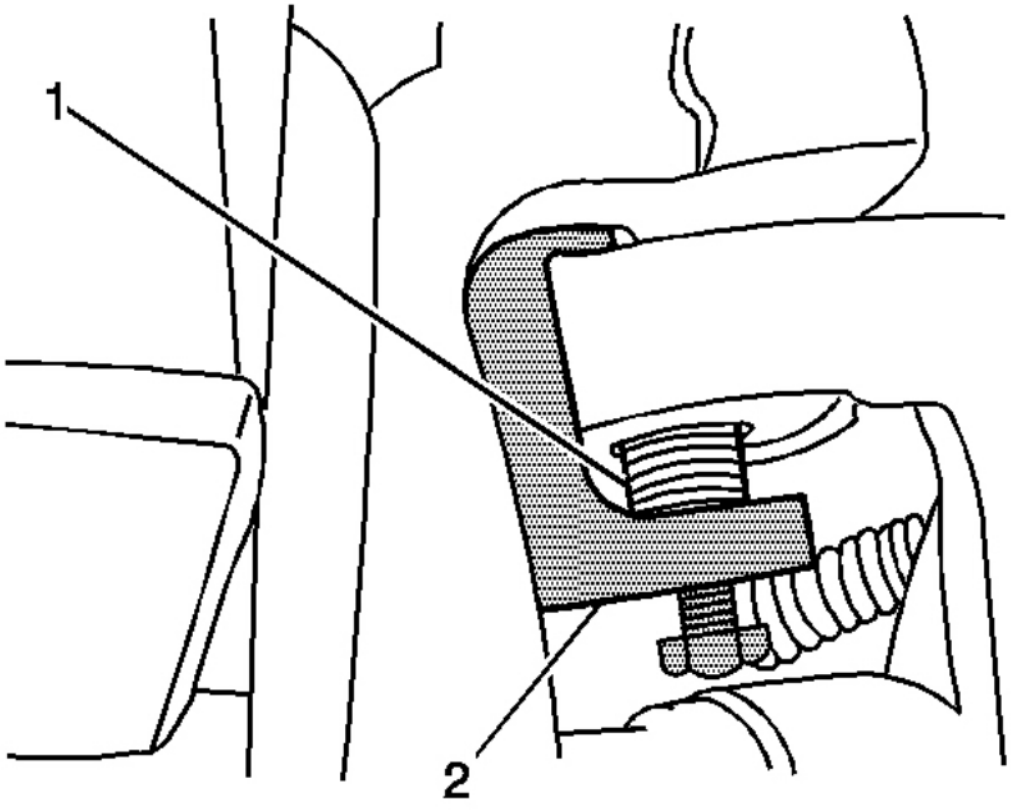


Fig. 65: Removing Upper Ball Joint Using J 44663
Courtesy of GENERAL MOTORS CORP.

8. Using the **J 44663** (2), remove the upper ball joint stud from the steering knuckle. See **Special Tools and Equipment**.

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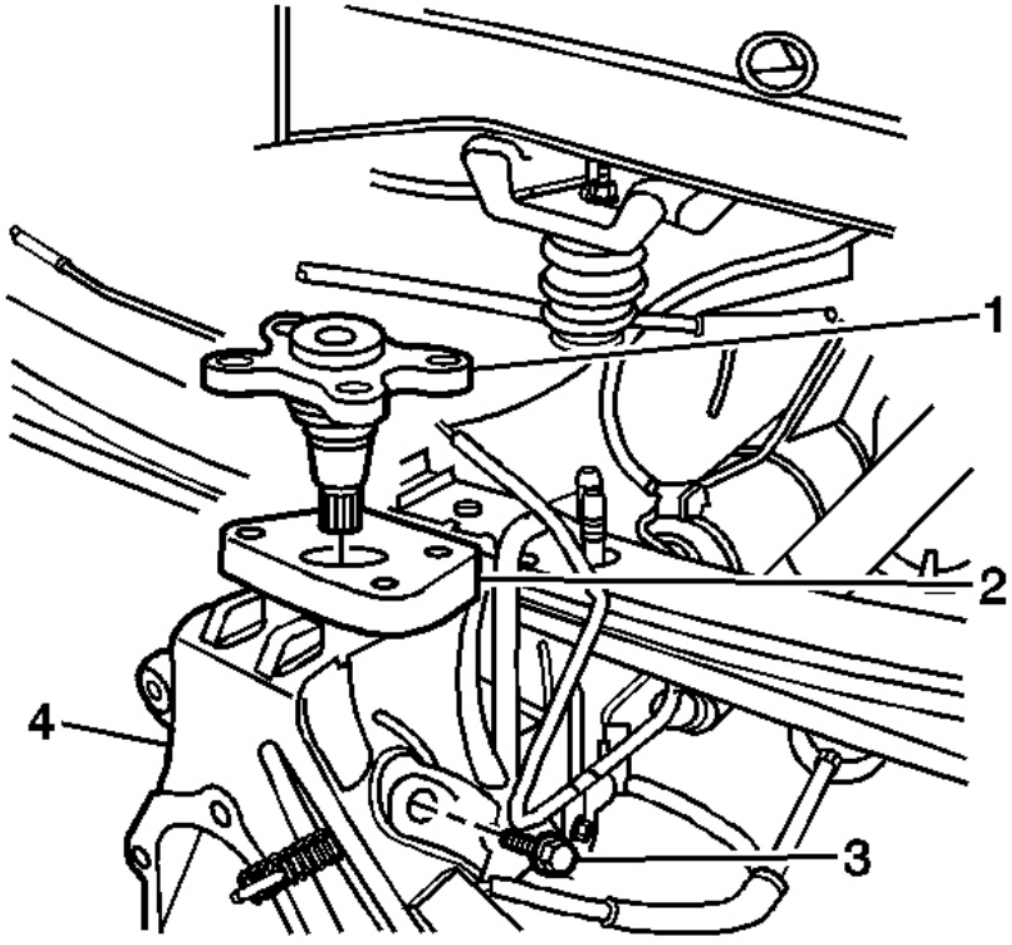


Fig. 66: View Of Upper Ball Joint & Park Brake Cable Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the upper ball joint (1) from the vehicle.

Installation Procedure

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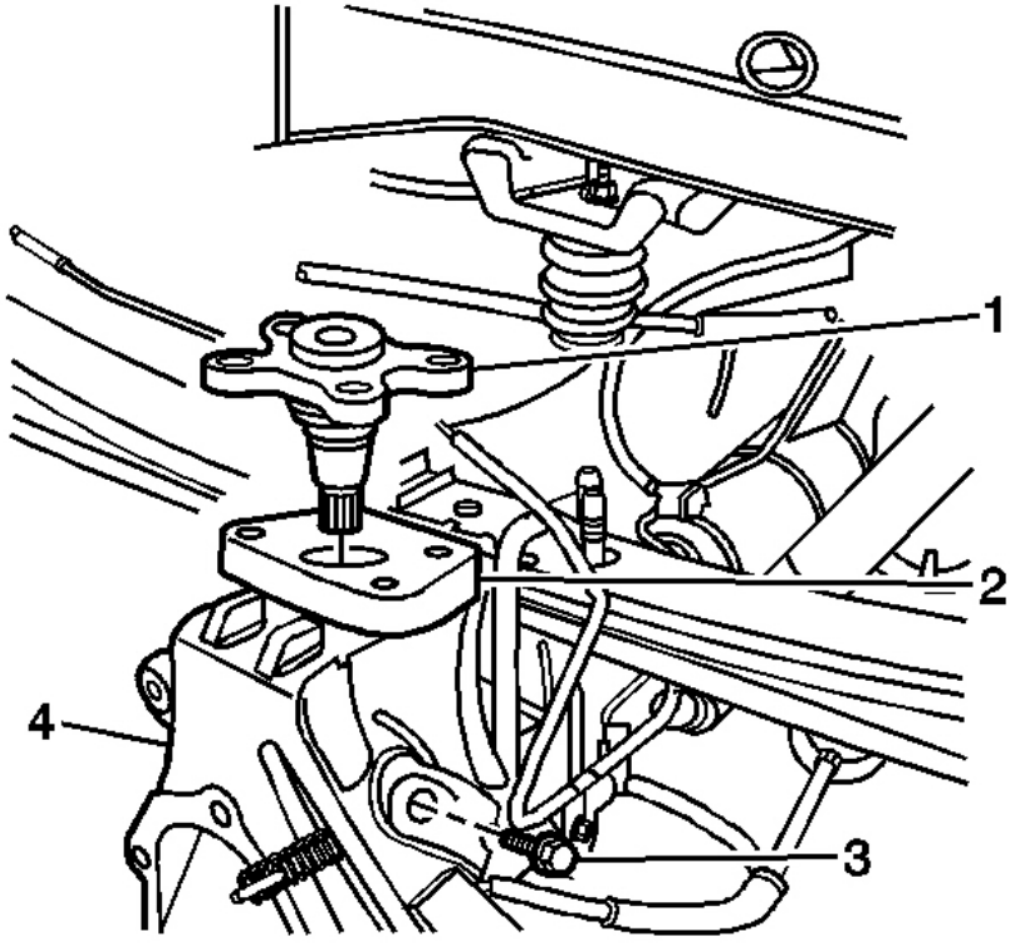


Fig. 67: View Of Upper Ball Joint & Park Brake Cable Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the upper ball joint (1) to the steering knuckle.

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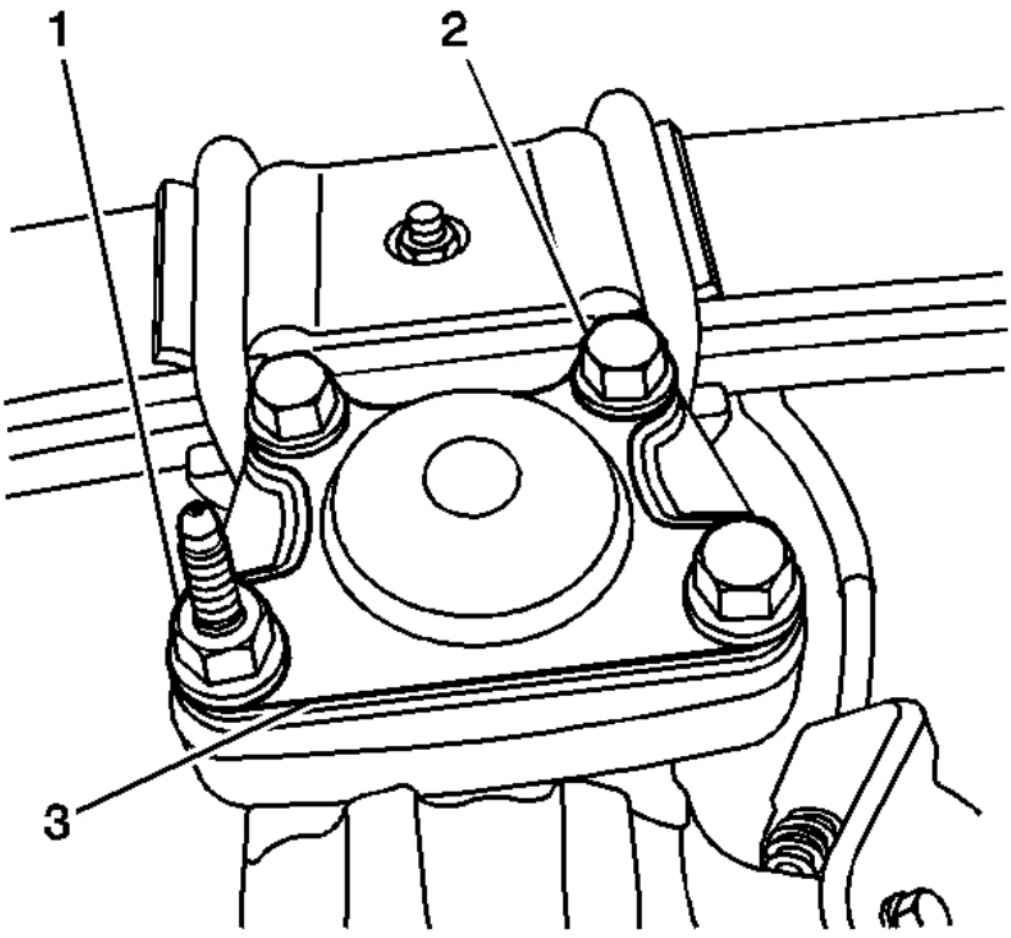


Fig. 68: View Of Upper Ball Joint, Retaining Bolts & Stud
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the upper ball joint retaining bolts (2) and stud (1).

Tighten: Tighten the bolts to 110 N.m (81 lb ft).

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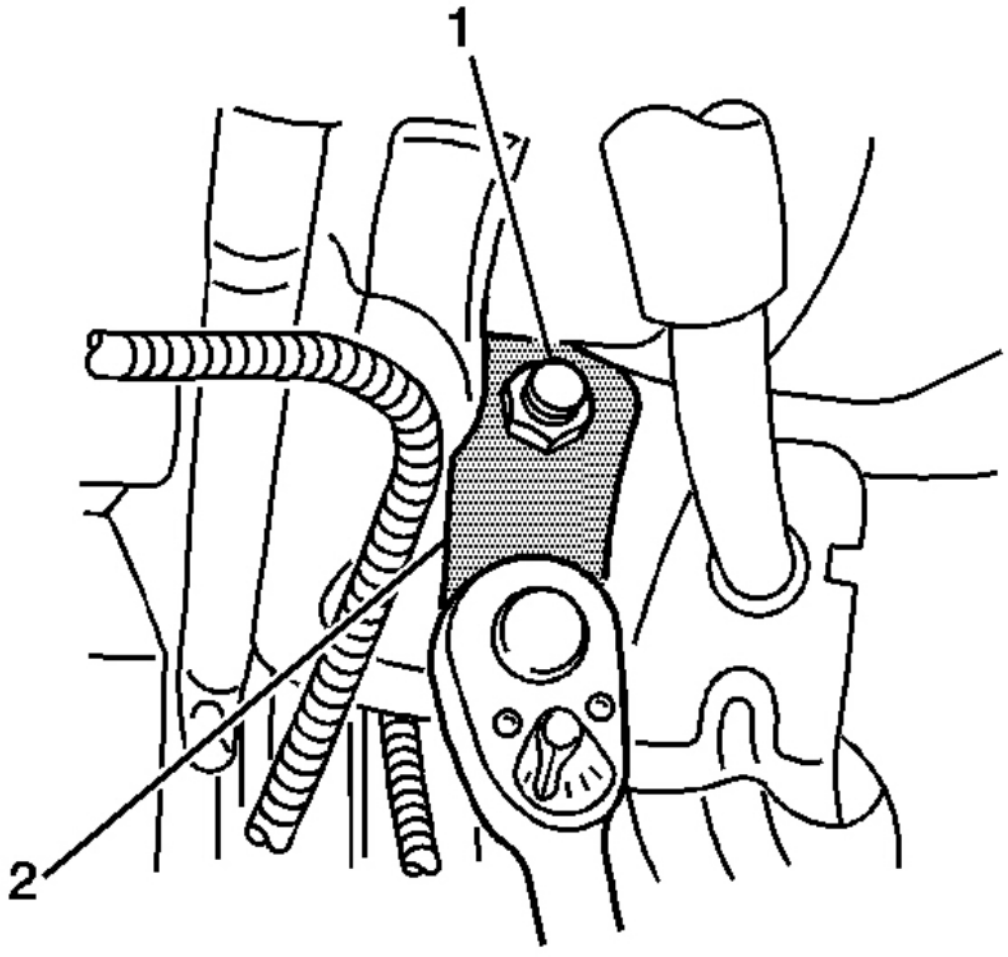


Fig. 69: View Of Upper Ball Joint To Steering Knuckle Nut & J 44664
Courtesy of GENERAL MOTORS CORP.

3. Install the nut (1) retaining the upper ball joint to the steering knuckle. Use the **J 44664** (2) in order to tighten the joint. See **Special Tools and Equipment**.

   Tighten: Tighten the upper ball joint to the steering knuckle nut to 200 N.m (147 lb ft).

4. Install the bracket (7) to the axle.

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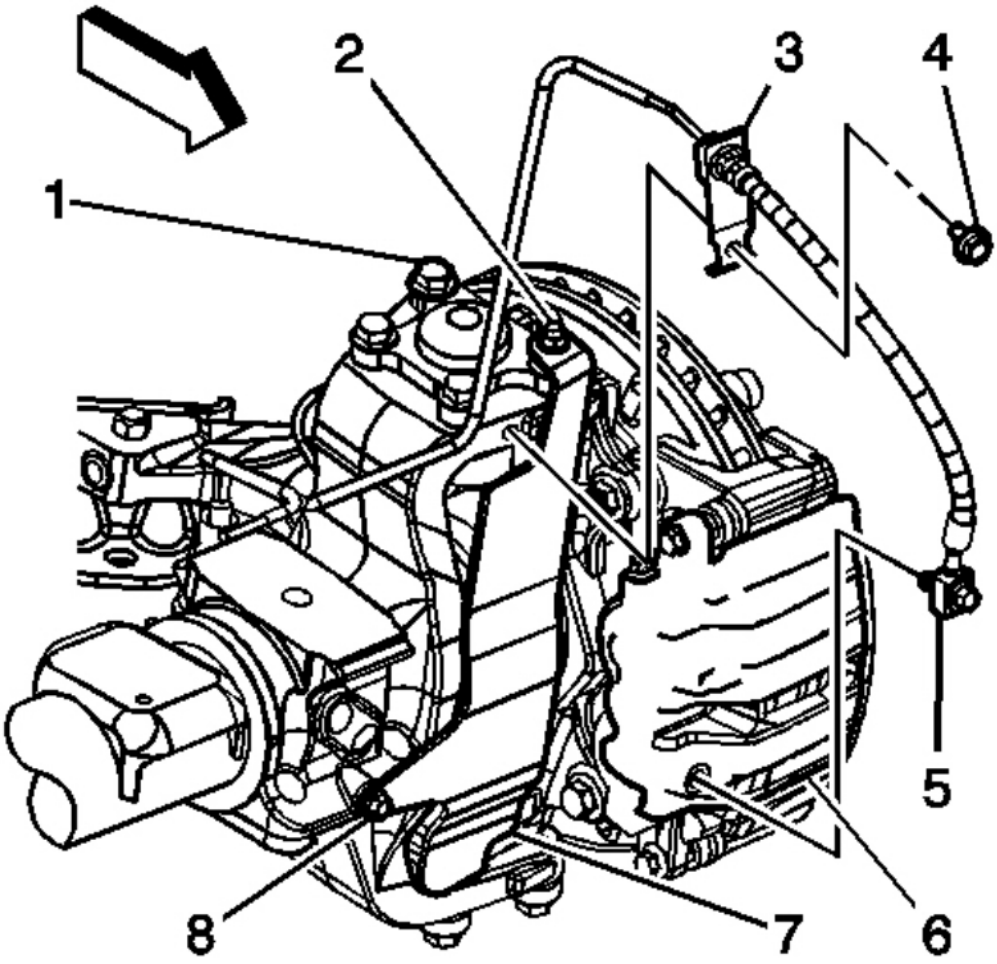


Fig. 70: View Of Axle Bracket, Brake Hose Bracket & Fasteners
Courtesy of GENERAL MOTORS CORP.

5. Install the bolt (8) and nut (2) retaining the bracket to the axle.

   Tighten: Tighten the bolt and nut to 25 N.m (18 lb ft).

6. Install the bolt (4) retaining the brake hose bracket (3) to the axle.

   Tighten: Tighten the brake hose bracket retaining bolt to 12 N.m (106 lb in).

7. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

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8. Lower the vehicle.
9. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

LOWER BALL JOINT REPLACEMENT

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

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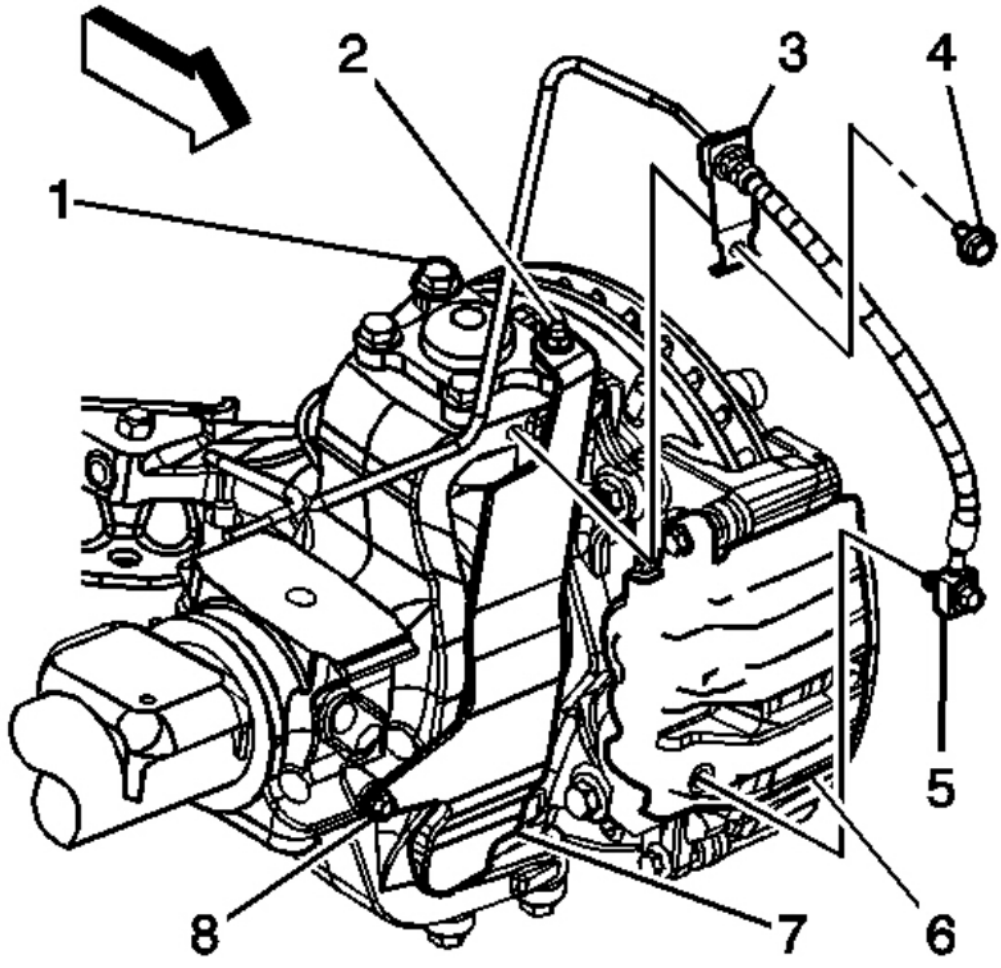


Fig. 71: View Of Axle Bracket, Brake Hose Bracket & Fasteners
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolt (8) and nut (2) retaining the bracket to gain access to the pinch bolt.

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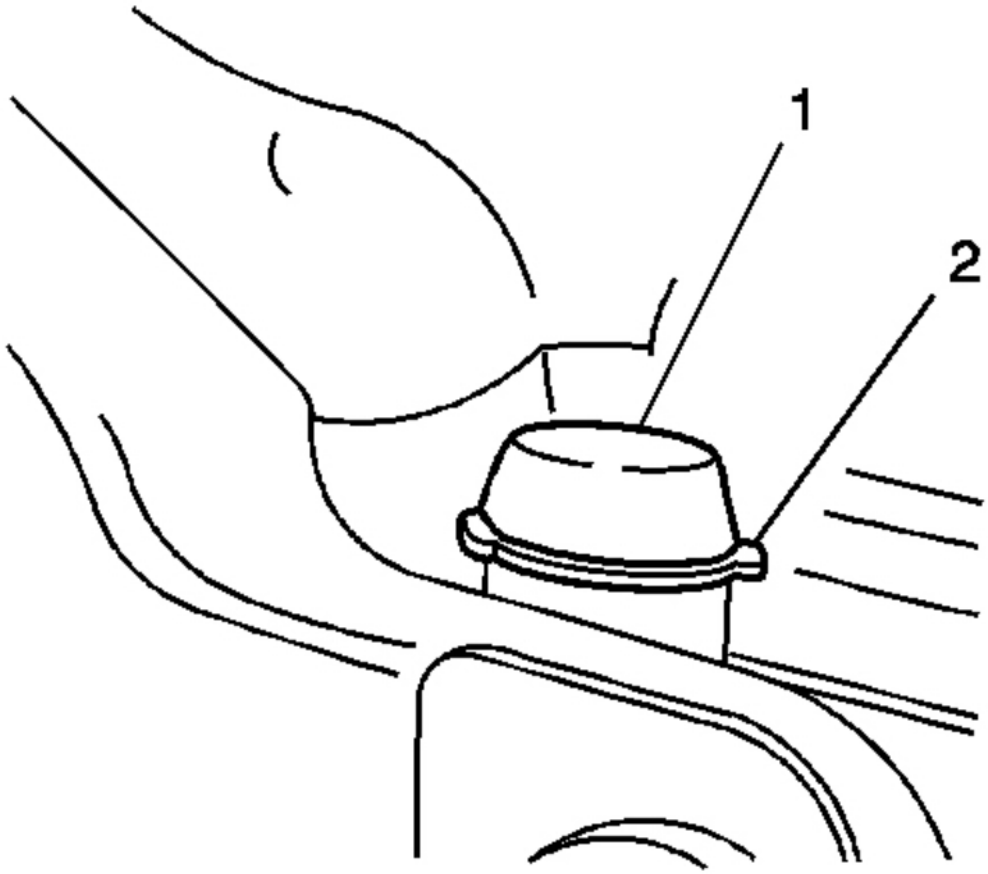


Fig. 72: View Of Lower Ball Joint Stud & Snap Ring
Courtesy of GENERAL MOTORS CORP.

4. Remove the snap ring (2) from the ball joint stud (1).

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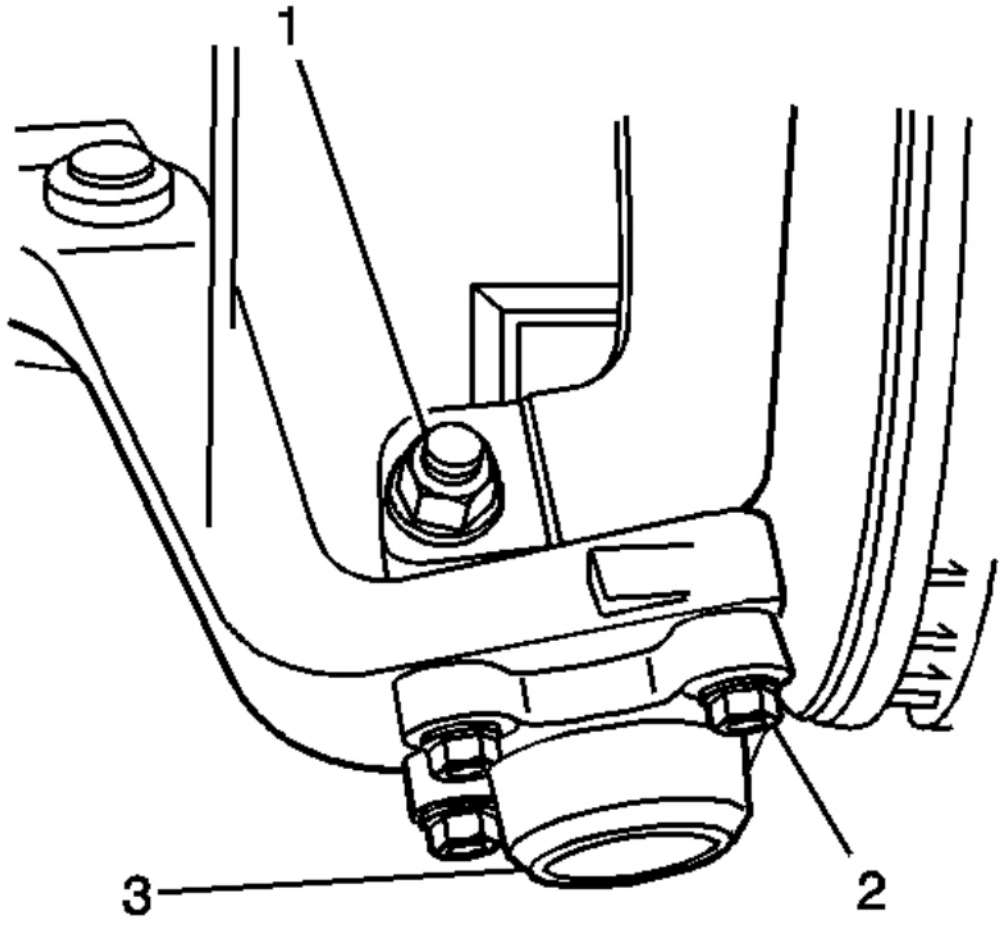


Fig. 73: View Of Lower Ball Joint, Bolts & Pinch Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the bolts (2) retaining the lower ball joint (3) to the steering knuckle.
6. Remove the pinch bolt (1) retaining the lower ball.

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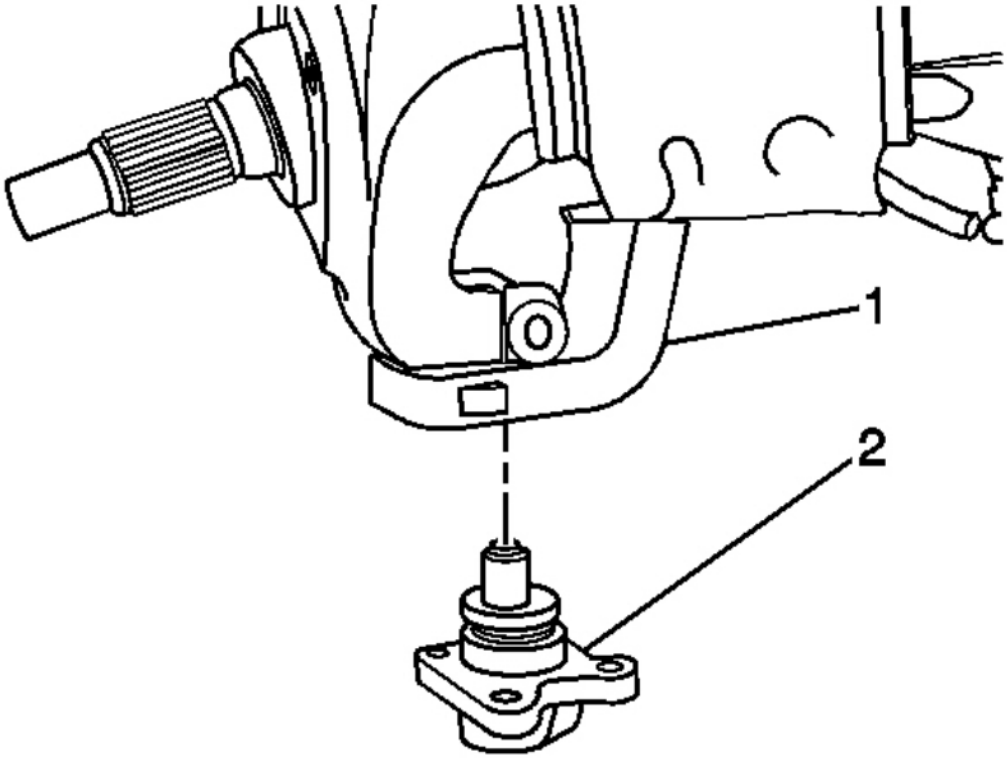


Fig. 74: View Of Lower Ball Joint
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower ball joint (2) from the vehicle.

Installation Procedure

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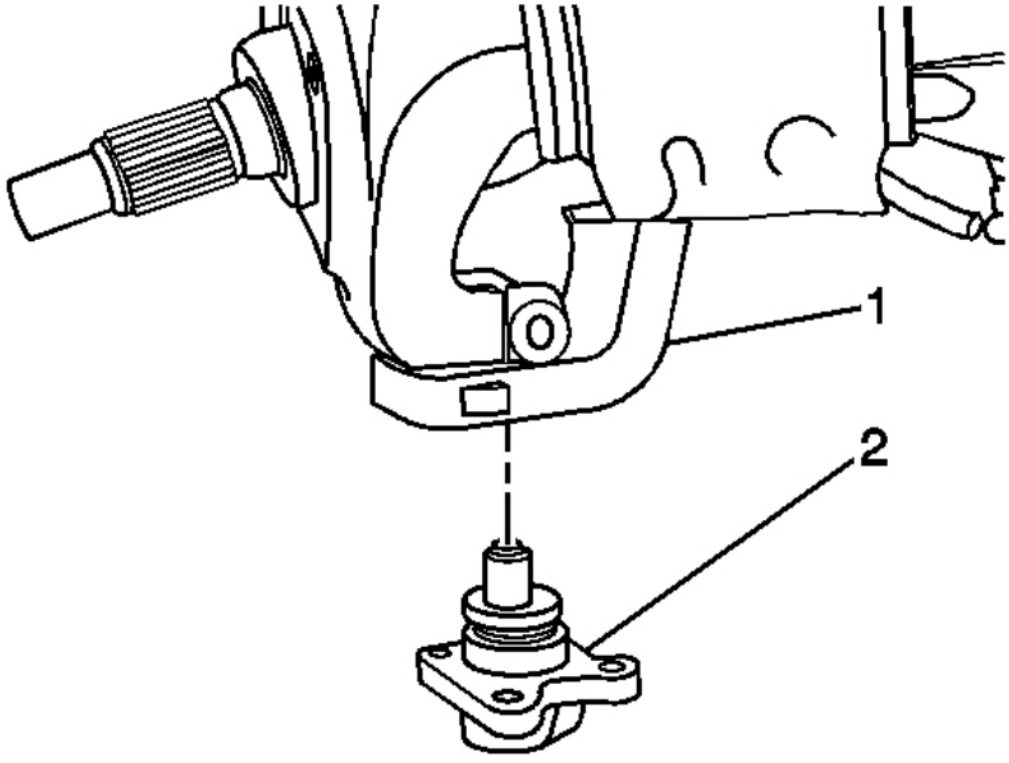


Fig. 75: View Of Lower Ball Joint
Courtesy of GENERAL MOTORS CORP.

1. Install the lower ball joint (2) to the vehicle.

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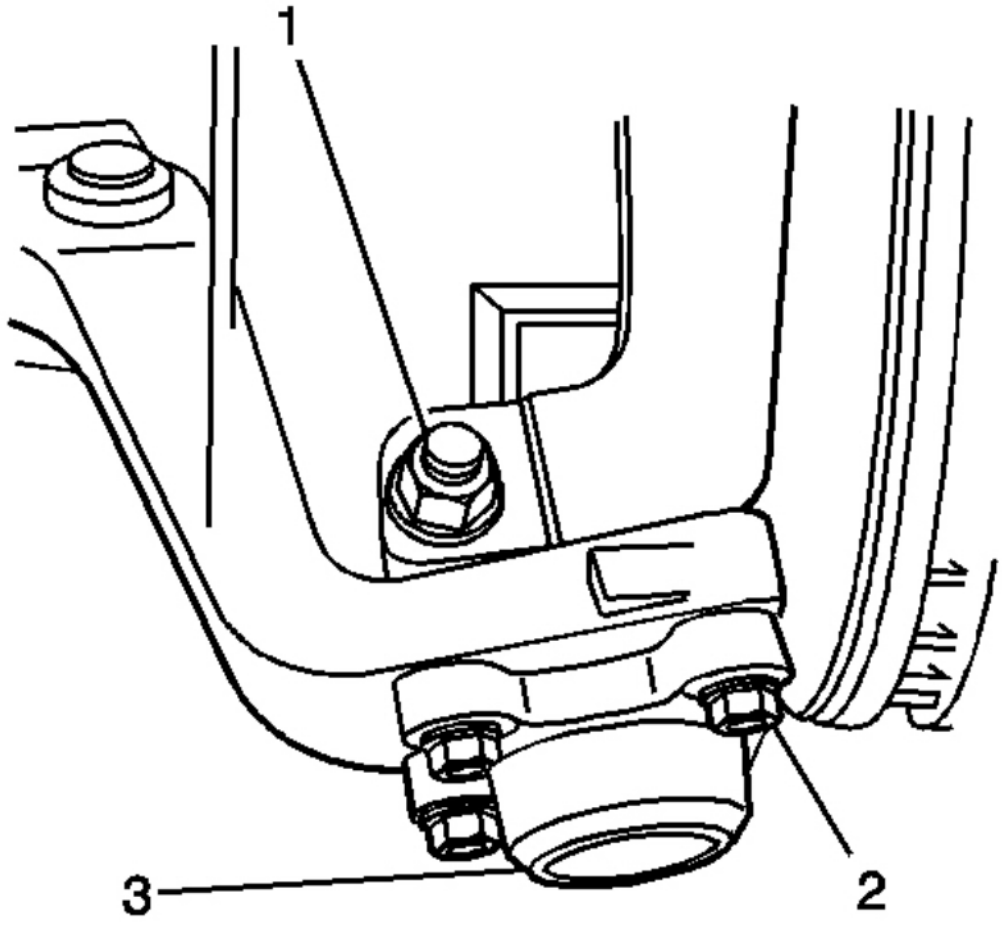


Fig. 76: View Of Lower Ball Joint, Bolts & Pinch Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the bolts (2) retaining the lower ball joint (3) to the steering knuckle.

   Tighten: Tighten the bolts to 110 N.m (81 lb ft).

3. Install the lower ball joint pinch bolt (1).

   Tighten: Tighten the bolt to 230 N.m (169 lb ft).

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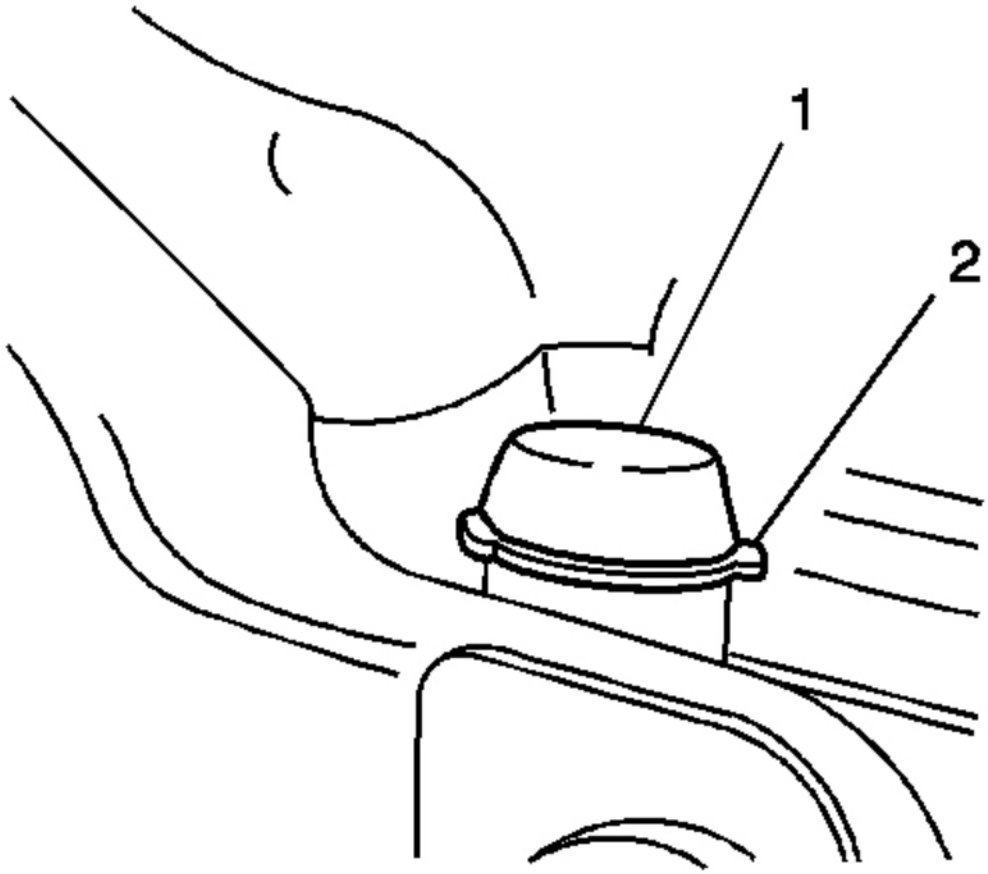


Fig. 77: View Of Lower Ball Joint Stud & Snap Ring
Courtesy of GENERAL MOTORS CORP.

4. Install the snap ring (2) to the lower ball joint.

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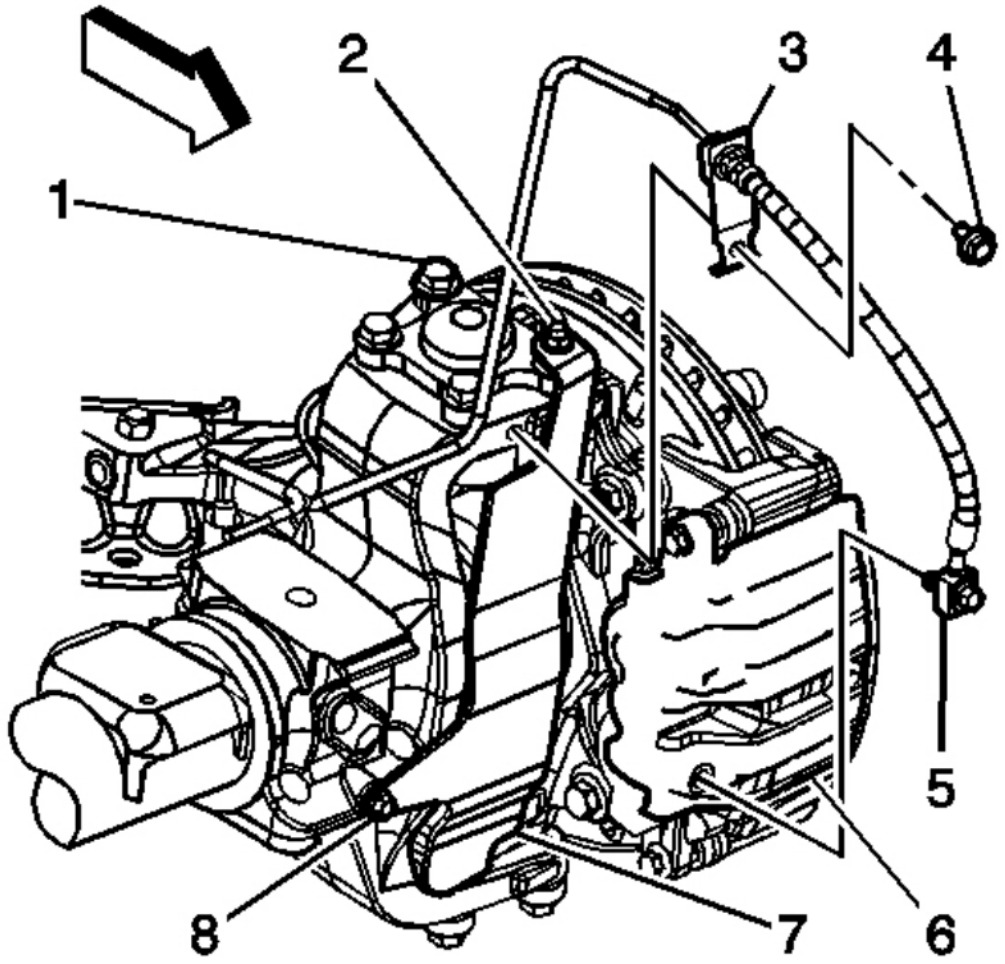


Fig. 78: View Of Axle Bracket, Brake Hose Bracket & Fasteners
Courtesy of GENERAL MOTORS CORP.

5. Install the bolt (8) and nut (2) retaining the bracket to the axle.

   Tighten: Tighten the retaining bolt and nut to 25 N.m (18 lb ft).

6. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
7. Lower the vehicle.
8. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

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STEERING KNUCKLE REPLACEMENT

Tools required

J 24319-B Universal Steering Linkage Puller

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel hub and bearing. Refer to **Wheel Hub and Bearing Replacement**.
4. Remove the upper ball joint. Refer to **Upper Ball Joint Replacement**.
5. Remove the lower ball joint. Refer to **Lower Ball Joint Replacement**.

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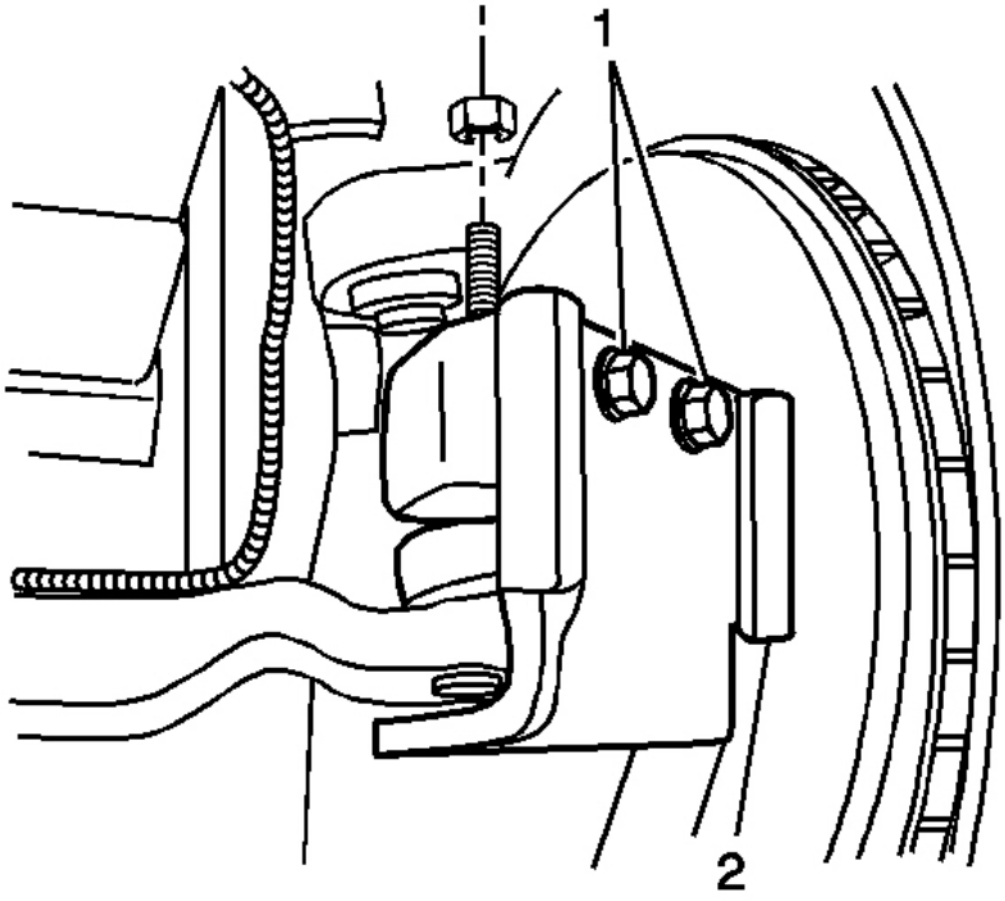


Fig. 79: View Of Outer Tie Rod Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the outer tie rod retaining nut and bracket (2).

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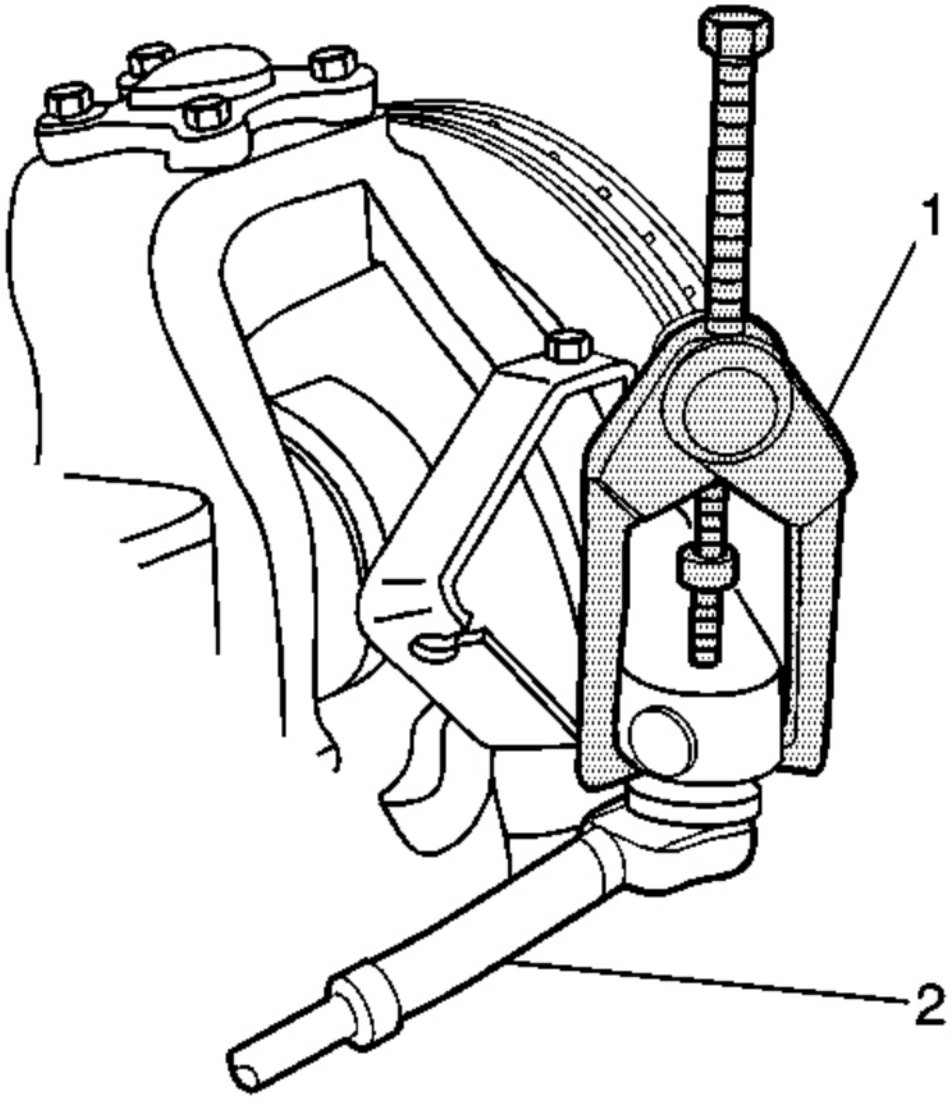


Fig. 80: Removing Outer Tie Rod End Using J 24319-B
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the outer tie rod from the steering knuckle using the **J 24319-B** (1).

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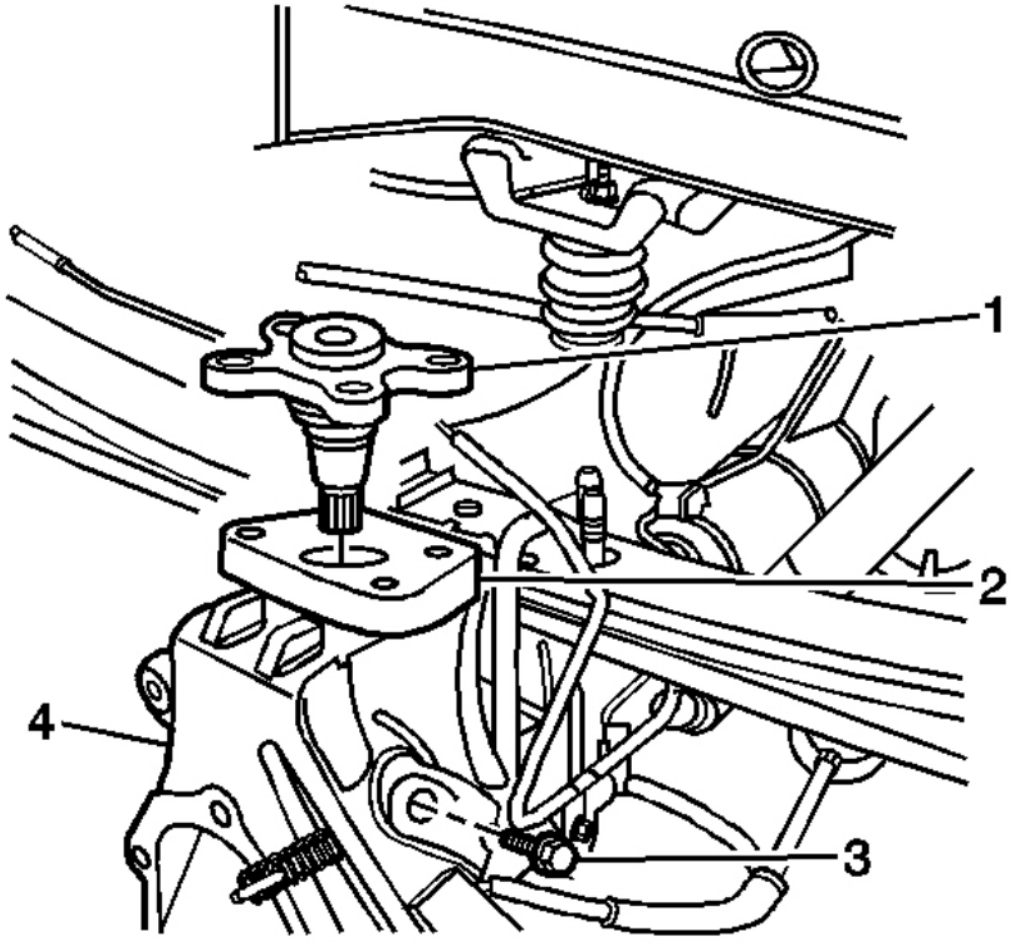


Fig. 81: View Of Upper Ball Joint & Park Brake Cable Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the park brake cable retaining bolt (3) from the steering knuckle.

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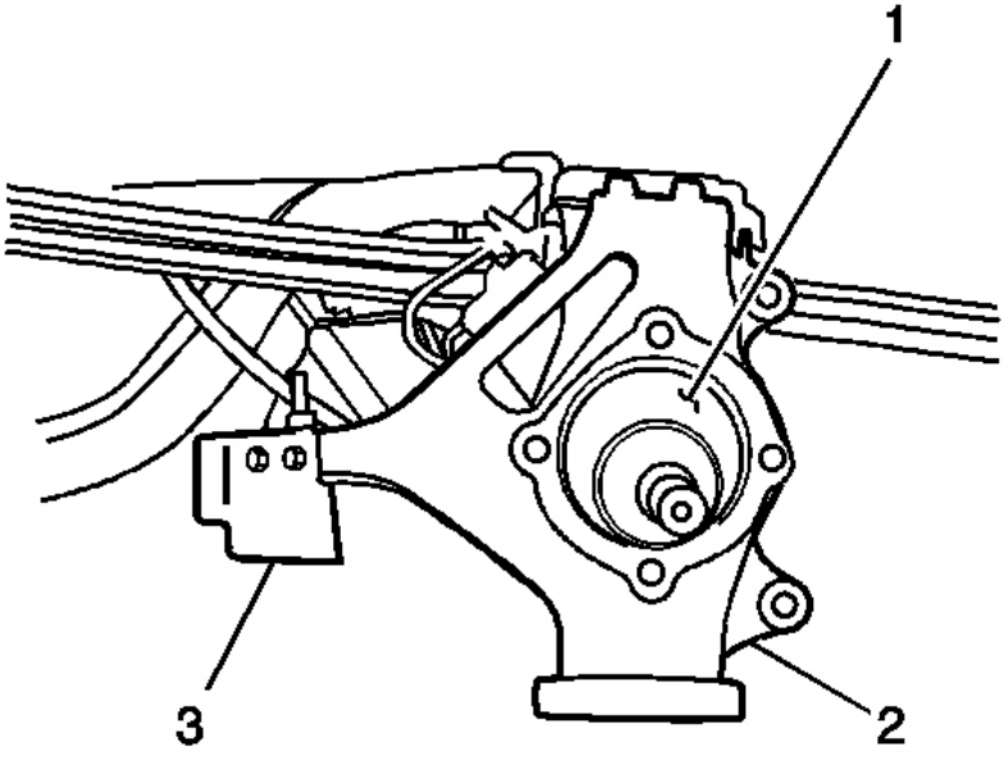


Fig. 82: View Of Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

9. Remove the steering knuckle (2) from the vehicle.

Installation Procedure

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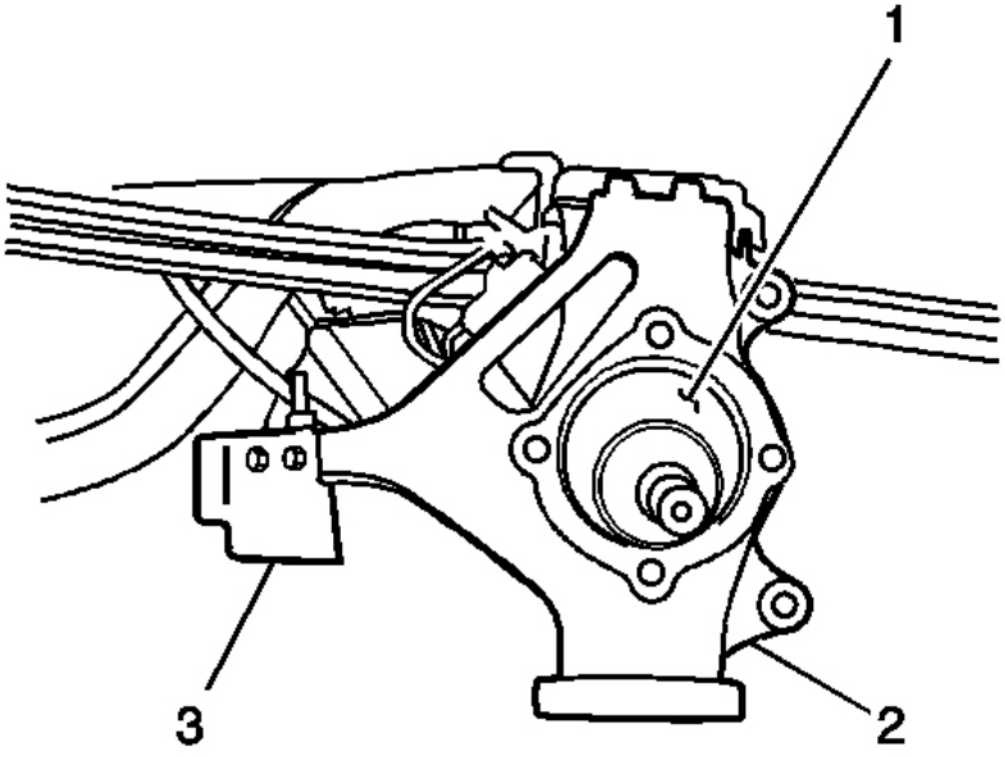


Fig. 83: View Of Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

1. Install the steering knuckle (2) to the vehicle.
2. Install the upper ball joint. Refer to **Upper Ball Joint Replacement**.
3. Install the lower ball joint. Refer to **Lower Ball Joint Replacement**.

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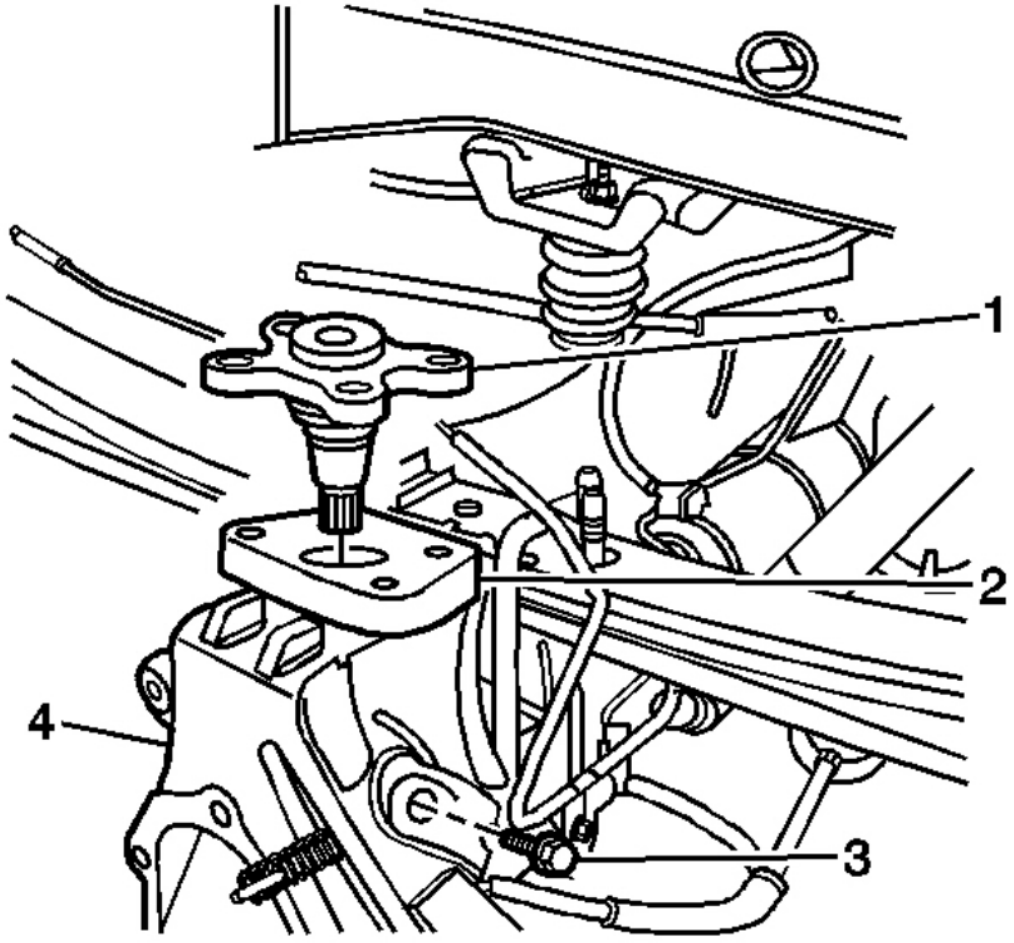


Fig. 84: View Of Upper Ball Joint & Park Brake Cable Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the park brake cable retaining bolt (3) to the steering knuckle.

   Tighten: Tighten the bolt to 65 N.m (48 lb ft).

5. Install the wheel hub and bearing. Refer to **Wheel Hub and Bearing Replacement**.

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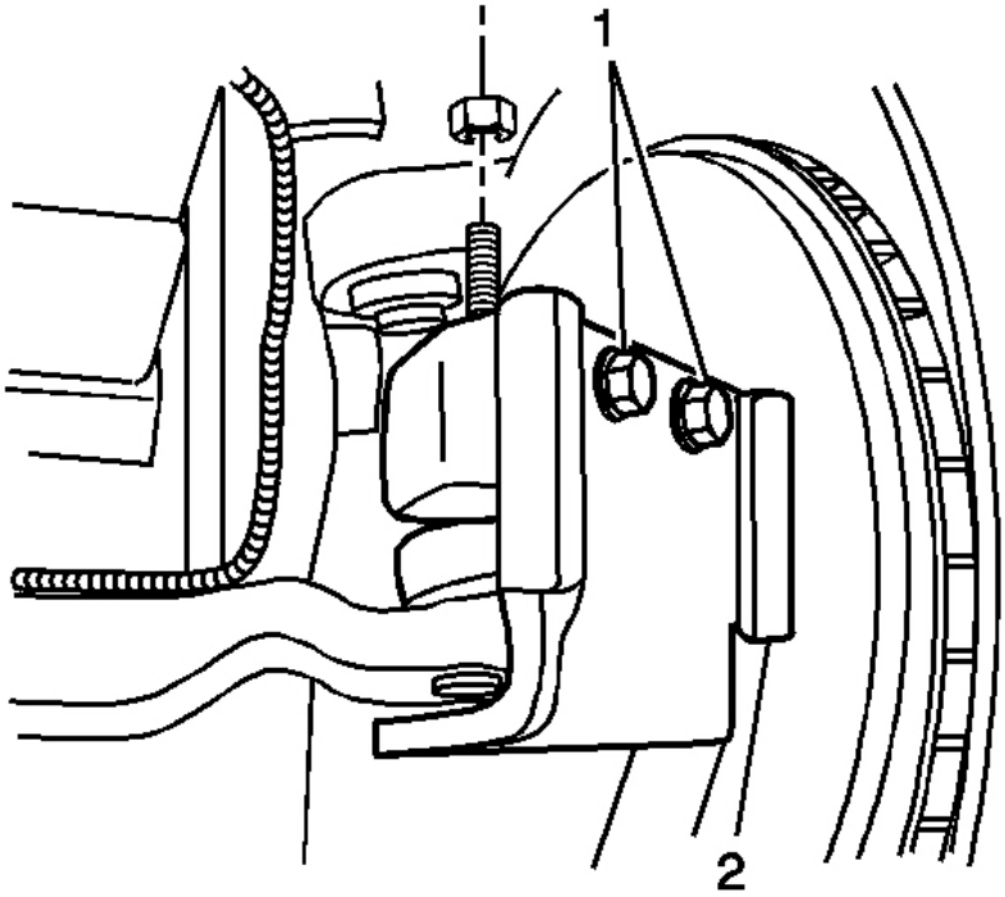


Fig. 85: View Of Outer Tie Rod Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the outer tie rod retaining nut to the steering knuckle.

   Tighten: Tighten the nut to 55 N.m (40 lb ft).

7. Install the outer tie rod retaining bracket (2).

   Tighten: Tighten the bracket to 65 N.m (48 lb ft).

8. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
9. Lower the vehicle.
10. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or

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Measuring Wheel Alignment (w/o Rear Wheel Steering) in Wheel Alignment.

WHEEL HUB AND BEARING REPLACEMENT

Tools Required

J 45859 Axle Remover

Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the outer tie rod from the steering knuckle. Refer to **Rear Wheel Steering Tie Rod End Replacement - Outer**.
4. Remove the brake rotor. Refer to **Brake Rotor Replacement - Rear (W/NYS)** or **Brake Rotor Replacement - Rear (W/O NYS)** in Disc Brakes.

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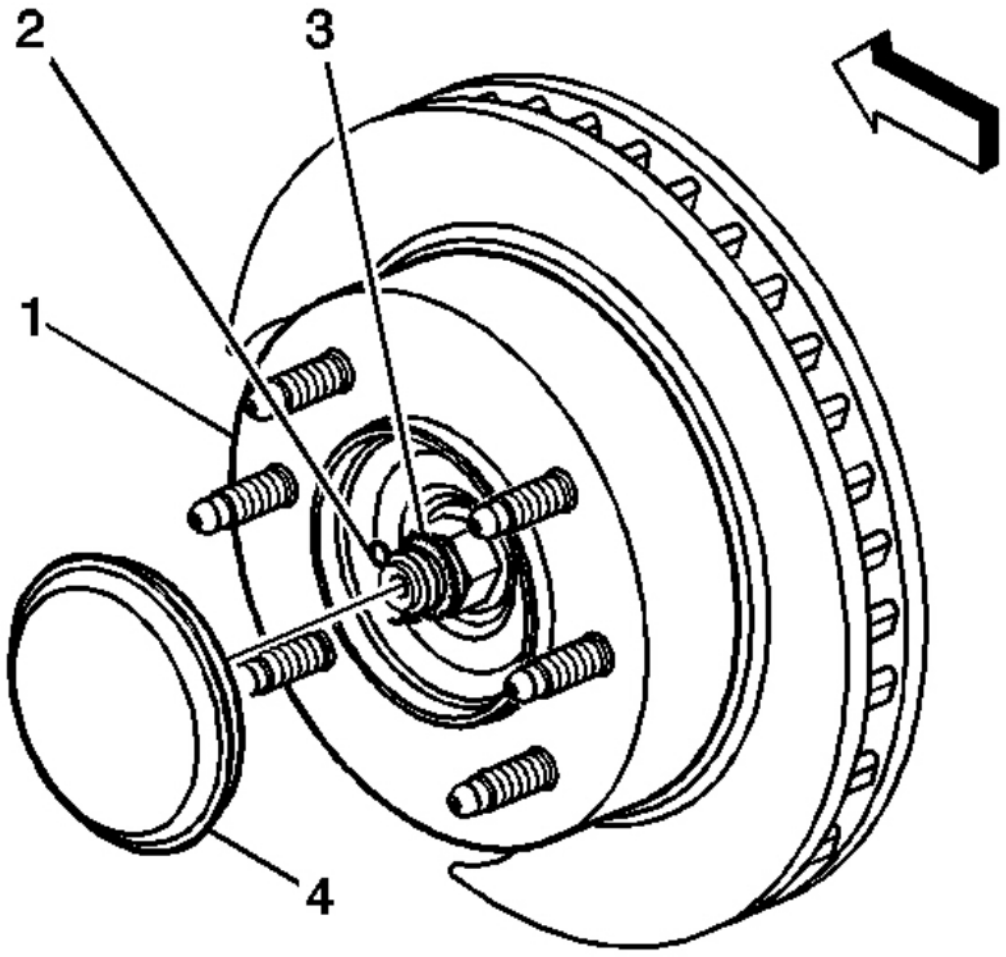


Fig. 86: View Of Axle Nut Dust Cover, Cotter Pin & Retainer
Courtesy of GENERAL MOTORS CORP.

5. Remove the axle nut dust cover (4).
6. Remove the cotter pin (2) and retainer (3) from the wheel drive shaft nut.
7. Remove the wheel drive shaft retaining nut.

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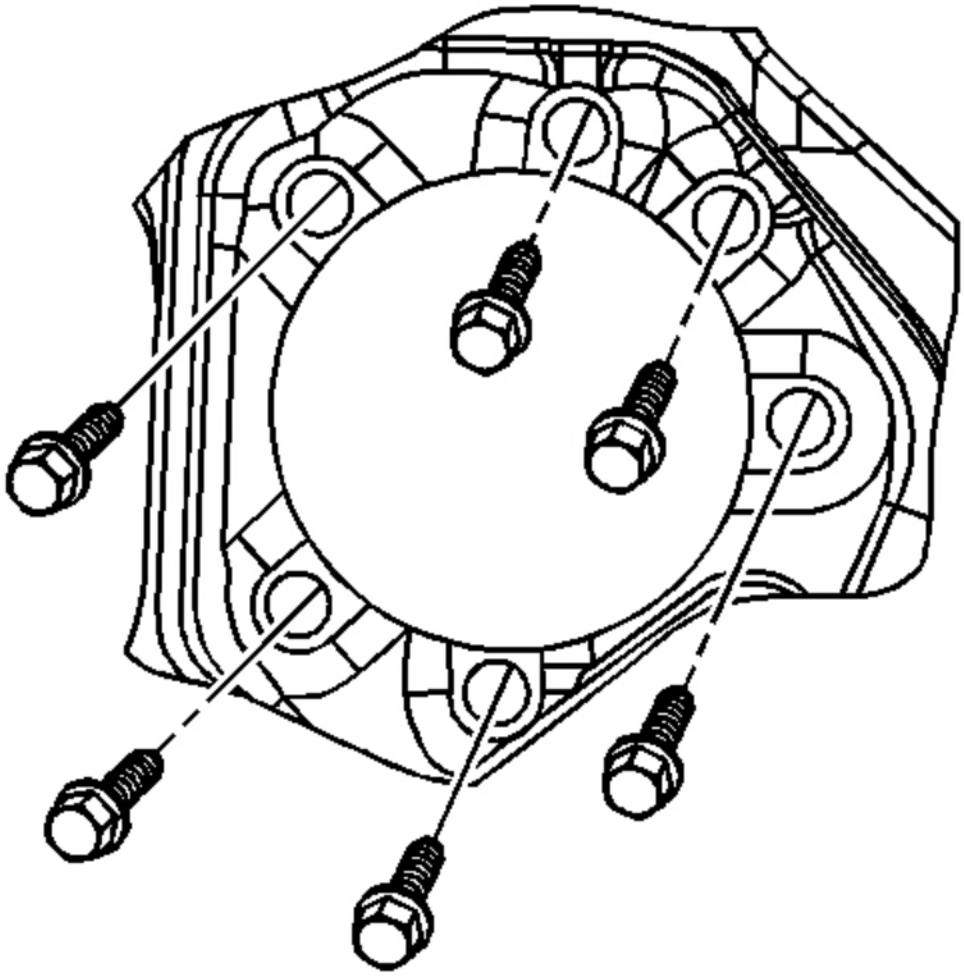


Fig. 87: View Of Wheel Hub & Bearing Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the wheel hub and bearing retaining bolts.

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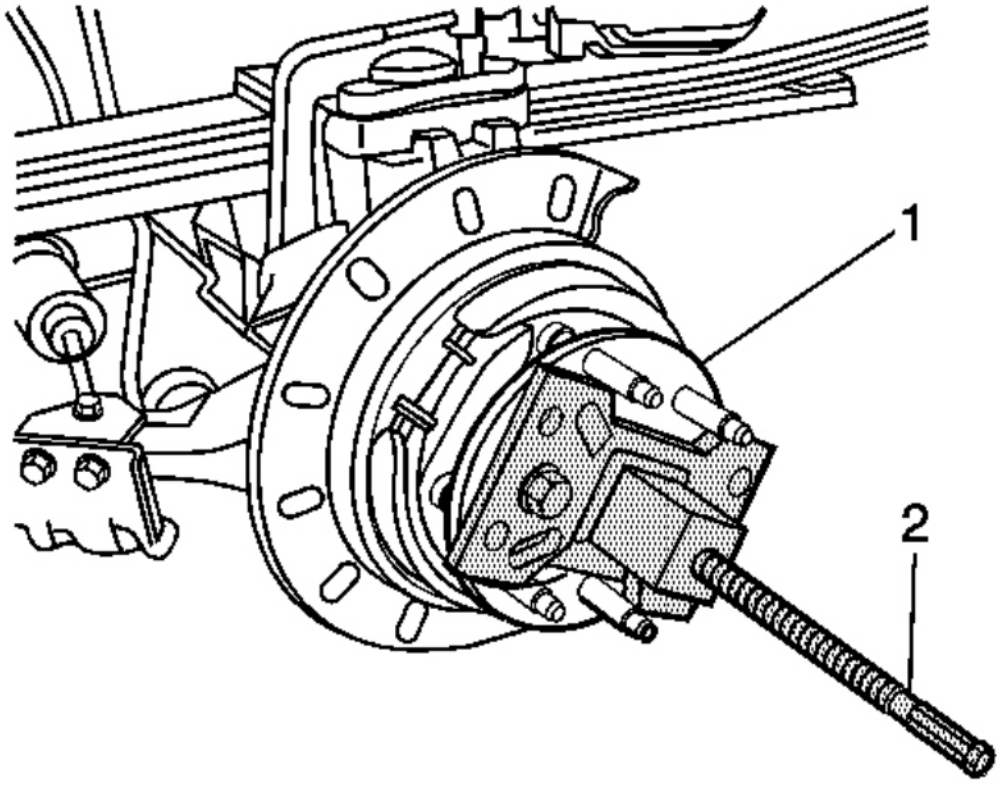


Fig. 88: Separating Wheel Drive Shaft From Wheel Hub & Bearing Using J 45859
Courtesy of GENERAL MOTORS CORP.

9. Separate the wheel drive shaft from the wheel hub and bearing using a **J 45859** (2) or equivalent.

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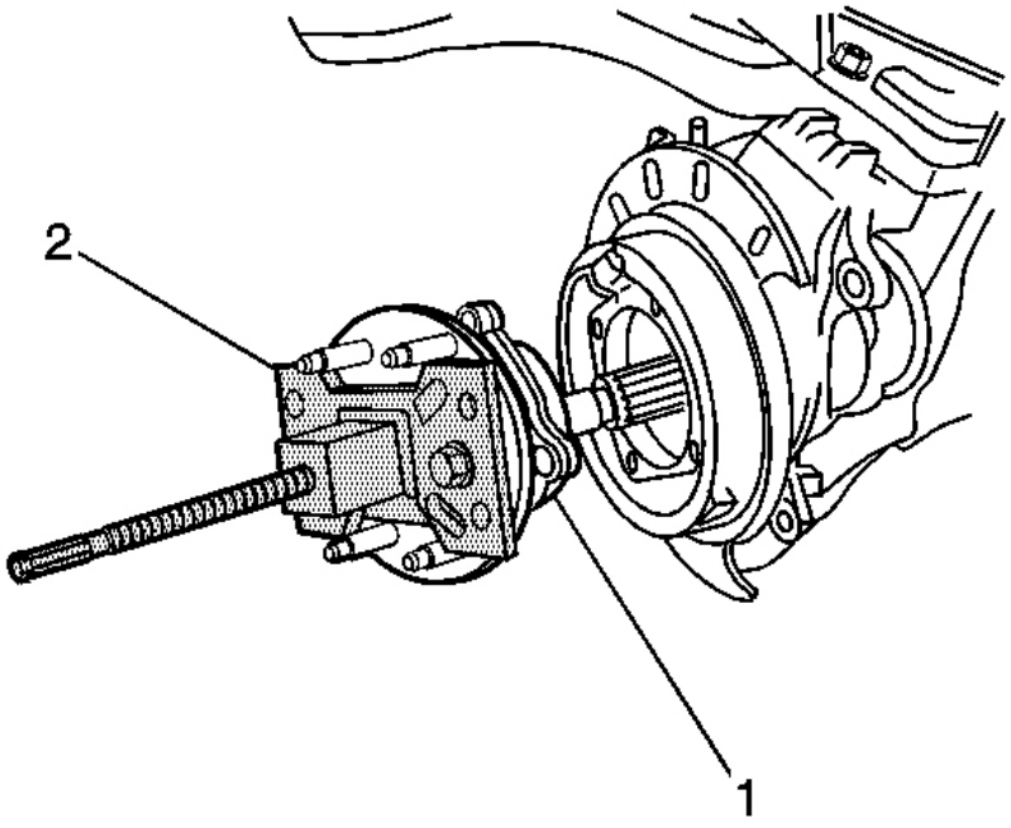


Fig. 89: Removing Wheel Hub & Bearing From Vehicle
Courtesy of GENERAL MOTORS CORP.

10. Remove the wheel hub and bearing (1) from the vehicle.

Installation Procedure

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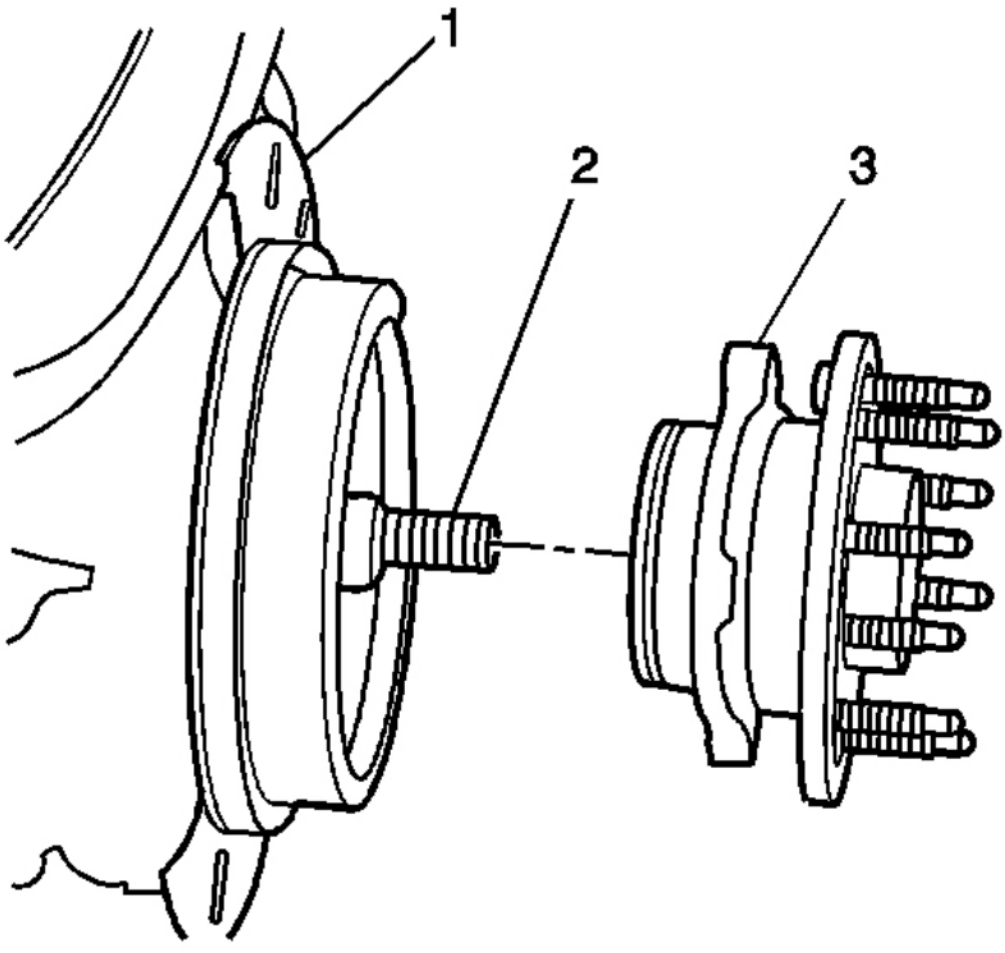


Fig. 90: Installing Wheel Hub & Bearing To Vehicle
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel hub and bearing (3) to the vehicle.

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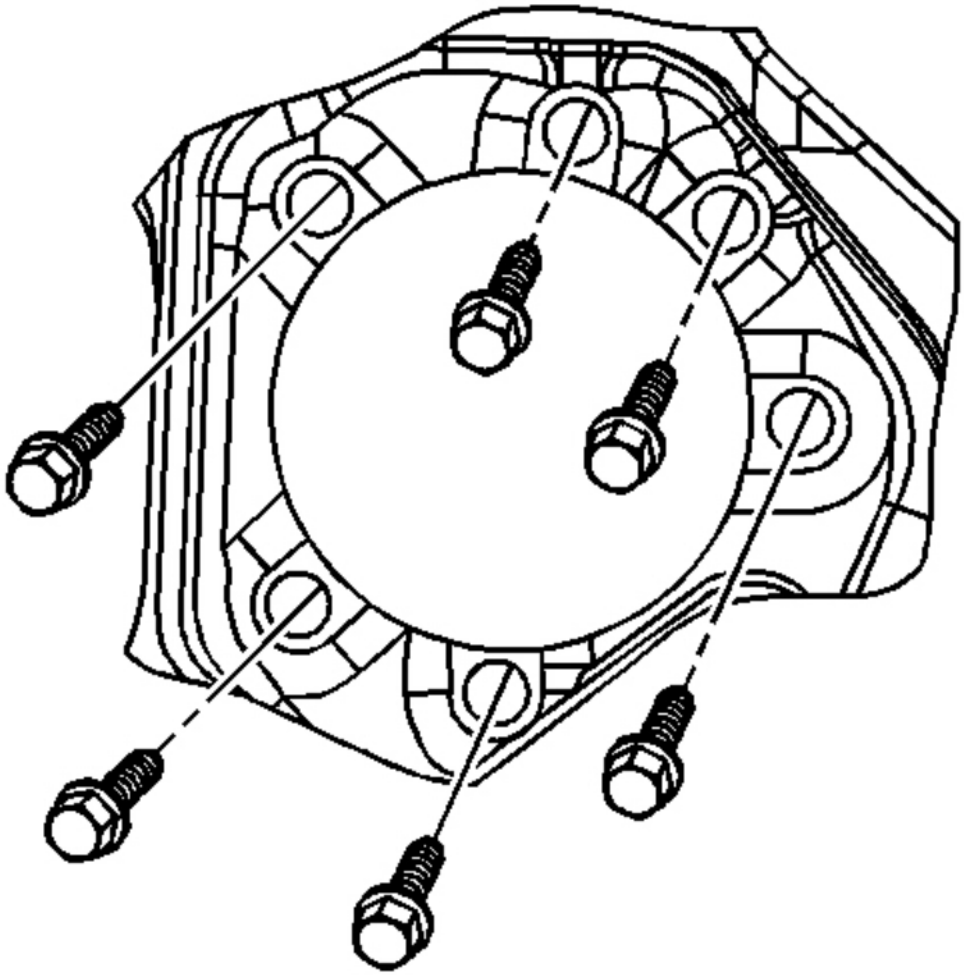


Fig. 91: View Of Wheel Hub & Bearing Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the wheel hub and bearing retaining bolts.

   Tighten: Tighten the bolts to 140 N.m (103 lb ft).

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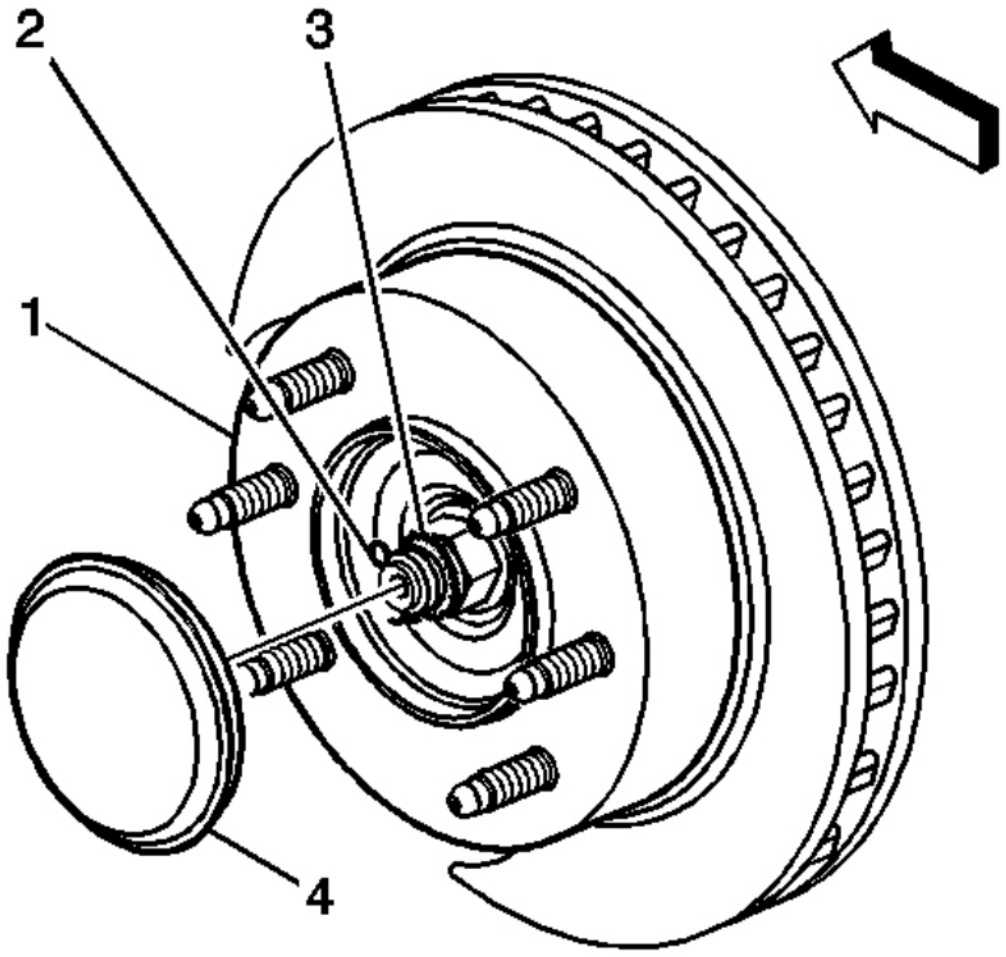


Fig. 92: View Of Axle Nut Dust Cover, Cotter Pin & Retainer
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the wheel drive shaft retaining nut.

   Tighten: Tighten the nut to 250 N.m (184 lb ft).

4. Install the retainer (3) and cotter pin (2) to the wheel drive shaft nut.
5. Install the dust cap (4).
6. Install the outer tie rod to the steering knuckle. Refer to **Rear Wheel Steering Tie Rod End**

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Replacement - Outer.

7. Install the brake rotor. Refer to **Brake Rotor Replacement - Rear (W/NYS)** or **Brake Rotor Replacement - Rear (W/O NYS)** in Disc Brakes.
8. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
9. Lower the vehicle.

REAR WHEEL STUD REPLACEMENT

Special Tools

J 43631 Ball Joint Remover. See **Special Tools and Equipment**.

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel from the vehicle. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel hub and bearing from the vehicle. Refer to **Wheel Hub and Bearing Replacement**.

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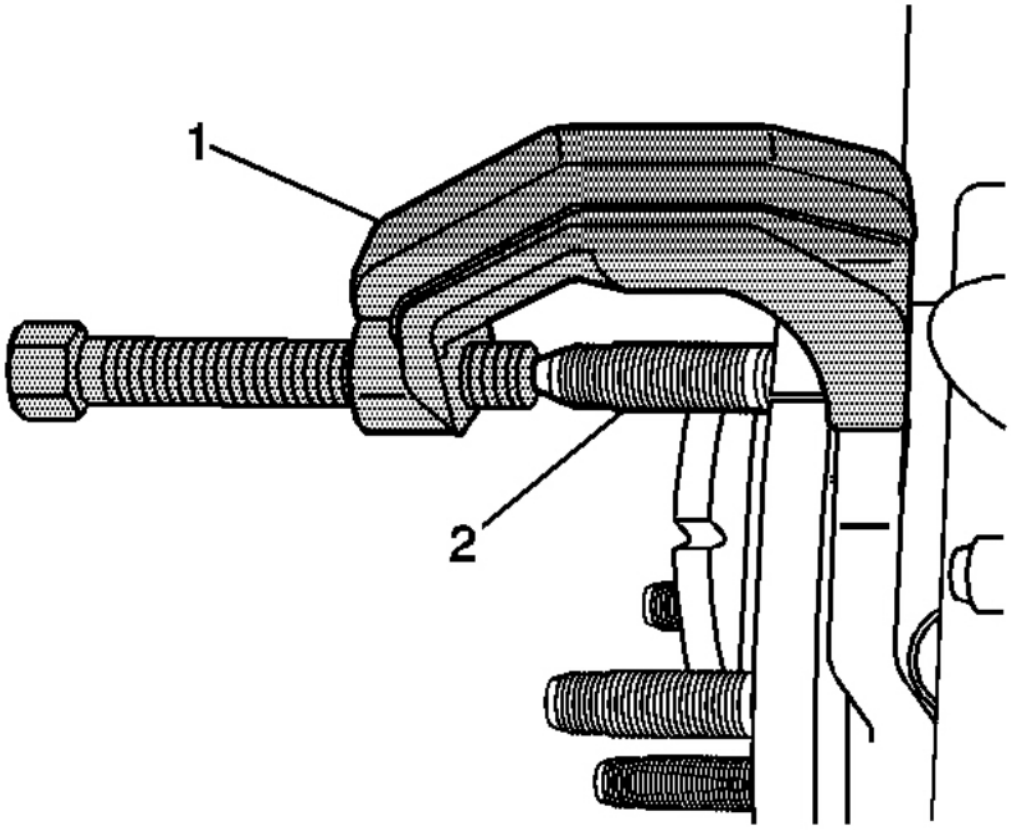


Fig. 93: Removing Wheel Stud Using J 43631
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 43631** (1), remove the wheel stud (2) from the wheel hub. See **Special Tools and Equipment**.

Installation Procedure

1. Install a new wheel stud to the wheel hub.

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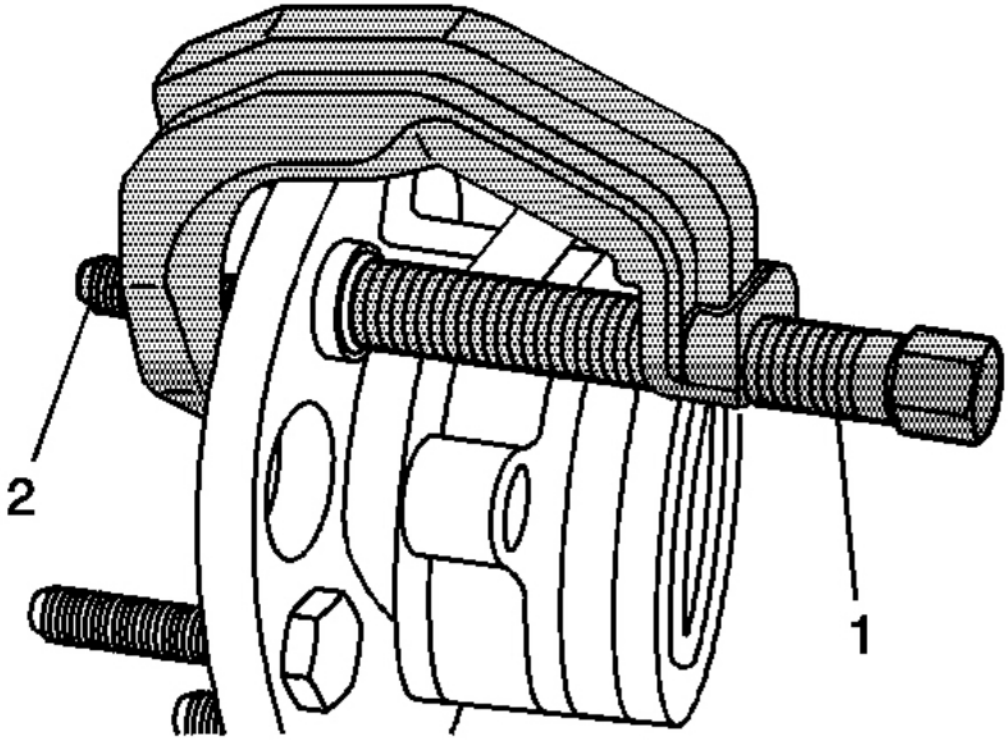


Fig. 94: Installing Wheel Stud Using J 43631
Courtesy of GENERAL MOTORS CORP.

2. Using the **J 43631** (1), install the wheel stud (2) to the wheel hub. See **Special Tools and Equipment**.
3. Install the wheel hub and bearing to the vehicle. Refer to **Wheel Hub and Bearing Replacement**.
4. Install the tire and wheel to the vehicle. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
5. Lower the vehicle.

REAR WHEEL STEERING CONTROL MODULE BRACKET REPLACEMENT

Removal Procedure

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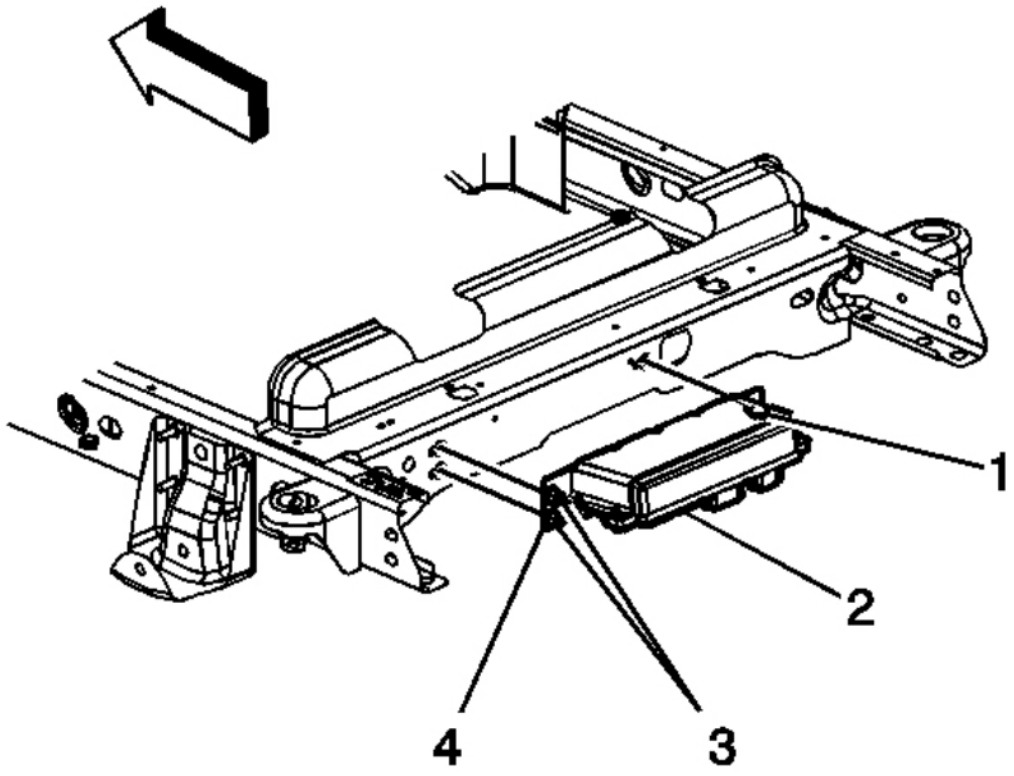


Fig. 95: View Of Rear Wheel Steering Control Module & Bracket
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear wheel steering control module (2) from the bracket. Refer to **Rear Wheel Steering Control Module Replacement**.
2. Remove the nuts retaining the bracket to the frame.
3. Remove the bracket from the vehicle.

Installation Procedure

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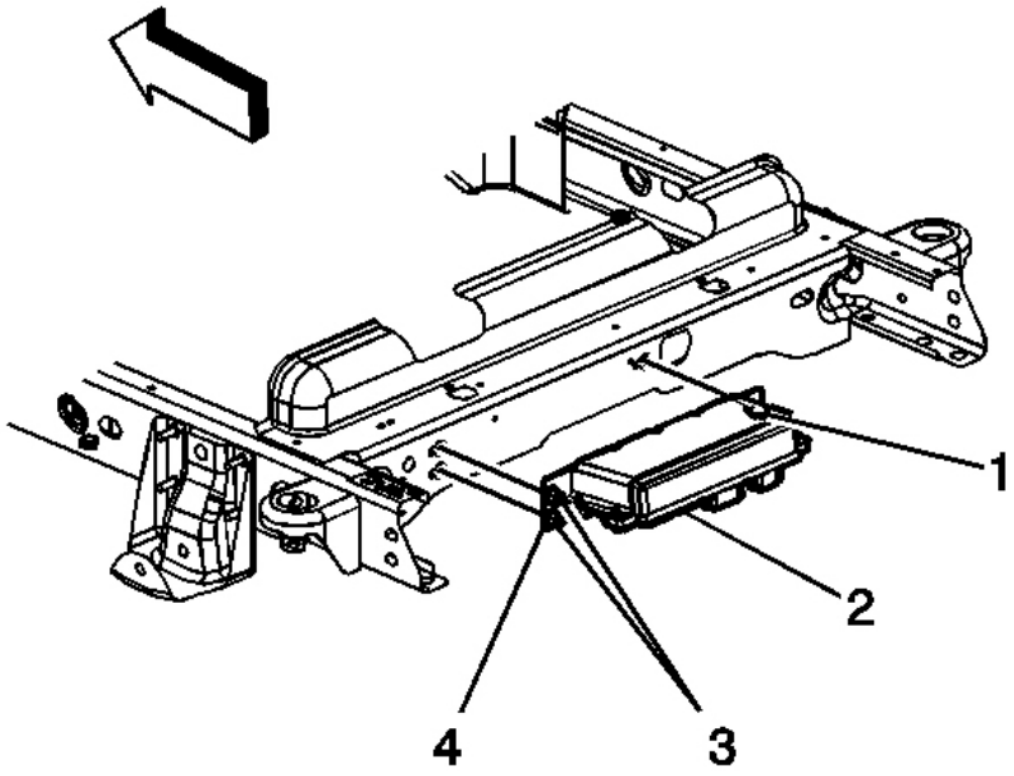


Fig. 96: View Of Rear Wheel Steering Control Module & Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the bracket to the vehicle.

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

2. Install the bracket retaining nuts.

   Tighten: Tighten the retaining nuts to 25 N.m (18 lb ft).

3. Install the rear wheel steering control module (2) o the bracket. Refer to **Rear Wheel Steering Control Module Replacement**.
4. Perform a learn alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

REAR WHEEL STEERING CONTROL MODULE REPLACEMENT

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Removal Procedure

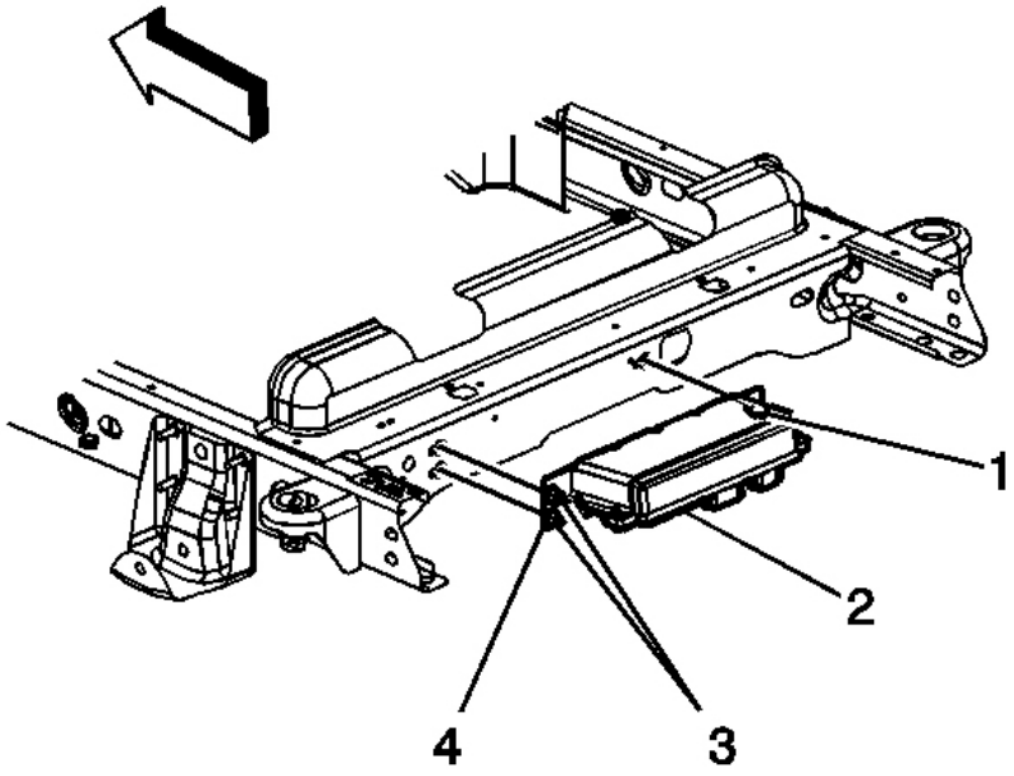


Fig. 97: View Of Rear Wheel Steering Control Module & Bracket
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the electrical connector from the control module.
3. Remove the nuts retaining the control module (2) to the bracket.
4. Remove the control module from the bracket (4).

Installation Procedure

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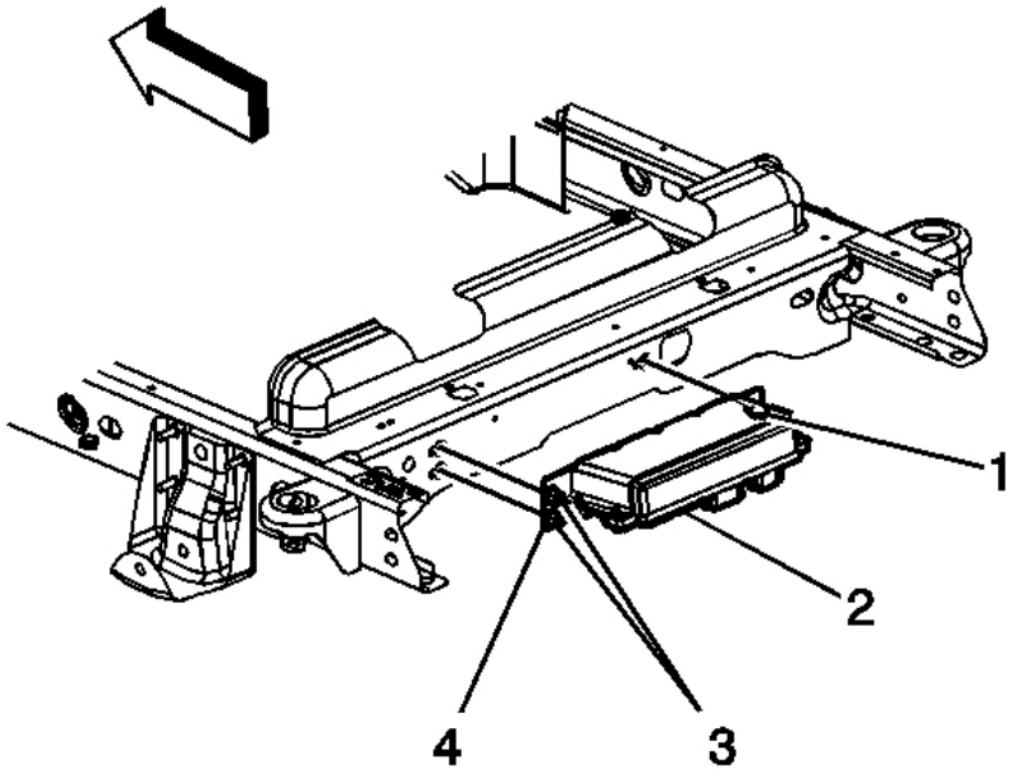


Fig. 98: View Of Rear Wheel Steering Control Module & Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the control module (2) to the bracket.

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

2. Install the nuts retaining the control module to the vehicle.

   Tighten: Tighten the control module retaining nuts to 25 N.m (18 lb ft).

3. Connect the electrical connectors to the control module.
4. Program the control module. Refer to **Service Programming System (SPS)** in Programming.
5. Perform a learn alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

STEERING GEAR PROTECTION SHIELD REPLACEMENT

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Removal Procedure

NOTE: Refer to Rear Wheel Steering Lifting and Jacking Notice in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

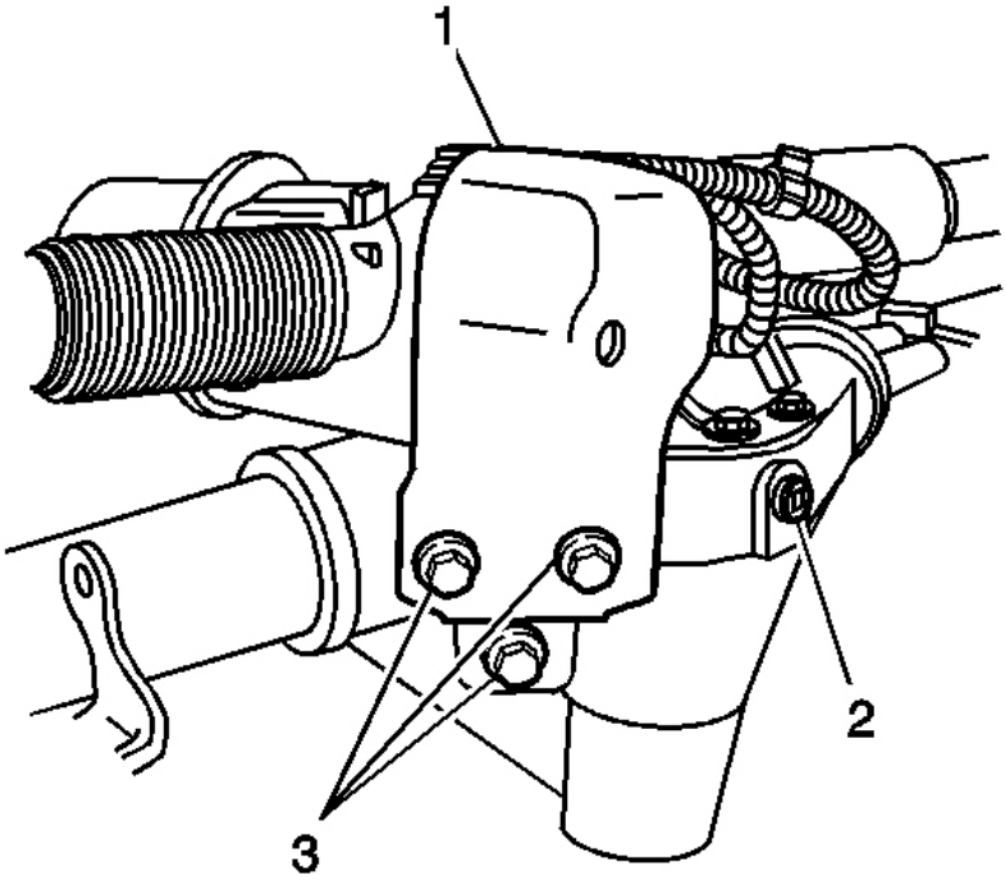


Fig. 99: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolts (3) retaining the steering gear protection shield to the steering gear.
3. Remove the steering gear protection shield from the vehicle.

Installation Procedure

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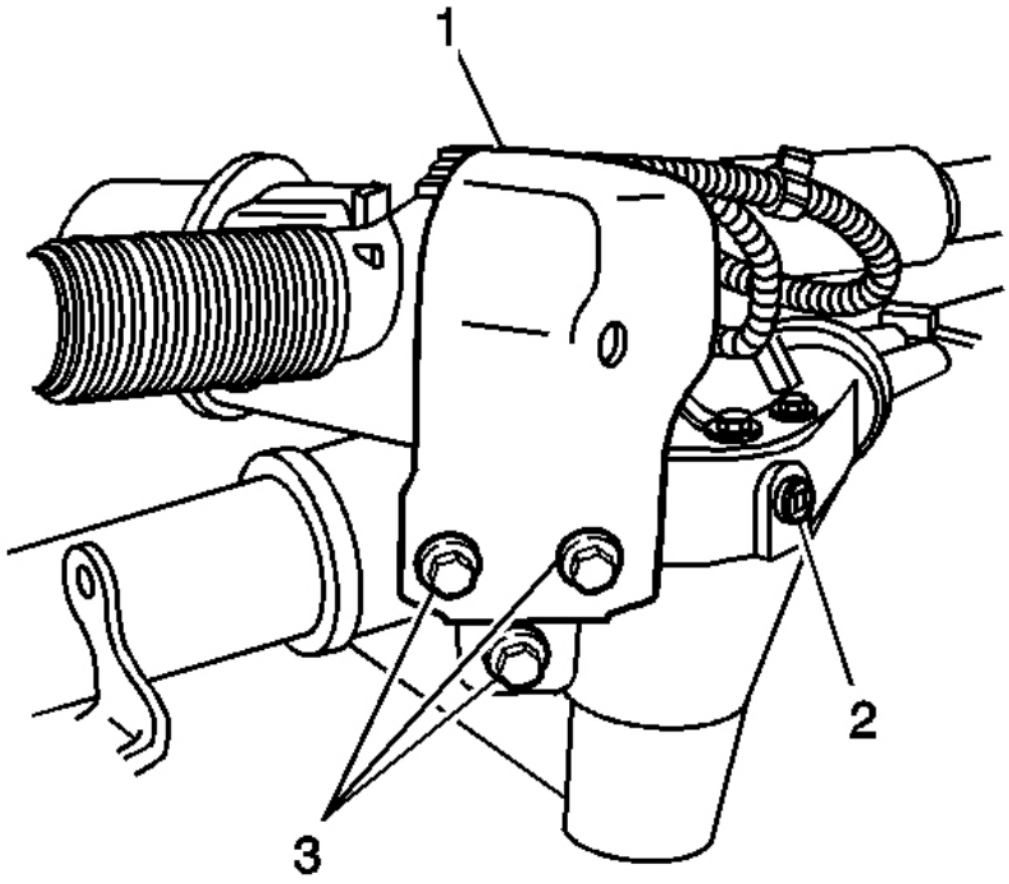


Fig. 100: Steering Gear Protection Shield
Courtesy of GENERAL MOTORS CORP.

1. Install the steering gear protection shield to the steering gear.

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

2. Install the steering gear protection shield retaining bolts (3) to the steering gear.

   Tighten: Tighten the bolts to 180 N.m (132 lb ft).

3. Lower the vehicle.
4. Perform a four wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

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DESCRIPTION AND OPERATION

REAR WHEEL STEERING DESCRIPTION AND OPERATION

Quadrasteer™ is a 4-wheel steering system that dramatically enhances low speed maneuverability, high speed stability, and towing capability. The system is an electrically powered rear wheel steering system comprised of the following components:

- A steerable, solid rear axle
- A heavy duty wiring harness and fuse
- A programmable control module
- A power relay in the control module
- A rack and pinion style steering actuator mounted on the rear differential cover
- An electric motor assembly on top of the rear steering actuator
- Three hall effect switches in the motor assembly
- A shorting relay in the motor assembly
- A rear wheel position sensor located under a cover on the bottom of the actuator, below the motor assembly
- A steering wheel position sensor located at the base of the steering column
- A mode select switch on the dash

The rear wheel steering control module has these inputs:

- Battery voltage
- Switched battery voltage
- Class 2 serial data
- Steering wheel position sensor analog signal, via class 2 message from the body control module (BCM)
- Steering wheel position sensor phase A
- Steering wheel position sensor phase B
- Steering wheel position sensor marker pulse
- Rear wheel position sensor position 1
- Rear wheel position sensor position 2
- Rear wheel steering motor hall sensor hall A
- Rear wheel steering motor hall sensor hall B
- Rear wheel steering motor hall sensor hall C
- Vehicle speed signal from the instrument panel cluster (IPC)
- Rear wheel steering mode switch signal

The rear wheel steering control module has these outputs:

- Rear wheel steering module class 2 serial data

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- Rear wheel steering motor phase A control
- Rear wheel steering motor phase B control
- Rear wheel steering motor phase C control
- Rear wheel steering motor shorting relay voltage
- Rear wheel steering mode select switch supply voltage
- 2-wheel steer mode indicator control
- 4-wheel steer mode indicator control
- 4-wheel steer tow mode indicator control
- Rear wheel position sensor 5-volt reference
- Rear wheel steering motor hall sensor 12-volt reference
- Steering wheel position sensor phase A, phase B, and marker pulse 12-volt reference

Separate connectors to the rear wheel steering control module are provided for the following 4 capacities:

- Vehicle battery power
- The vehicle class 2, steering wheel position, mode select switch, speed sensor signals
- The motor phase power leads
- The motor hall sensors, shorting relay, and rear wheel position sensor signals

IMPORTANT:

- **Beginning with the 2003 model year, the rear wheel steering control module supports flash programming.**
- **Beginning with the 2004 model year, the combination yaw rate/lateral accelerometer sensor has been removed.**

The system operates in 3 principal modes, as follows:

2-Wheel Steer Mode:

Normal steering operation-The rear wheels held in a centered position and rear wheel steering is disabled while in this mode.

4-Wheel Steer Mode:

The 4-wheel steering mode provides 3 principal phases of steering: negative phase, neutral phase, and positive phase. Negative phase occurs at low speeds and the rear wheels turn opposite of the front wheels. In the neutral phase, the rear wheels are centered and do not turn. Positive phase occurs at higher speeds and the rear wheels turn in the same direction as the front wheels. NOTE : There is a cross-over speed. This is the speed at which the control module transitions from negative phase steering to positive phase steering. In 4-wheel steer mode, this transition occurs when the vehicle obtains a speed of 65 km/h (40 mph).

4-Wheel Steer Tow Mode

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The 4-wheel steer tow mode provides more positive phase steering than the normal 4-wheel steering at high speed. During low speed driving, the 4-wheel steer tow mode provides similar negative phase steering as it does in the normal 4-wheel steering mode. The cross over speed in the 4-wheel steer tow mode occurs at 40 km/h (25 mph).

Rear-Wheel-Steering-Control-Module

The rear wheel steering control module controls all functions of the rear wheel steering system. The module has a dedicated power feed line from an under hood fuse holder, via a 125-amp mega fuse. The module is located in the rear of the vehicle on the underbody. The module uses the inputs listed above to determine when and how far to turn the rear wheels. The module uses the hall switches in the motor assembly, a shorting relay, and a motor control relay to monitor and control the direction and speed of the motor. The module also controls the duty cycle of the phase leads to the motor. The motor control relay is part of the rear wheel steering control module and is not serviceable. The module uses both a class 2 and a discrete vehicle speed signal. The 2 vehicle speed signals are used for comparison purposes. The system will not function without a discrete vehicle speed sensor signal. The module uses digital inputs from the steering wheel position sensor to determine steering wheel position and rate of change. The body control module (BCM) sends a class 2 message for the analog portion of the signal from the steering wheel position sensor. The rear wheel position sensor signals provide the module with rear wheel position data. The module will send out a class 2 message to the instrument panel cluster (IPC) to turn ON and OFF the Service 4 Wheel Steering message. The rear wheel steering control module also controls the ground circuits for the mode indicator lamps in the mode select switch.

The control module allows the vehicle rear wheels to turn a maximum of 12 degrees left or right. When the vehicle is operated in reverse, the maximum rear wheel steering angle is 5 degrees left or right. When the vehicle is sitting still in the test mode the system will move a maximum of 5 degrees left or right.

IMPORTANT: The rear wheel steering control module may shut down if the system is operated under very extreme conditions and becomes overheated. The Service 4 Wheel Steering message will not be displayed. Once the temperature decreases back to operating range, the rear wheel steering system will resume normal operation upon the next ignition cycle.

Rear Wheel Steering Mode Switch

The mode switch located in the instrument panel allows the driver the option of selecting 2-wheel steering, 4-wheel steering, or 4-wheel steering tow modes of operation. The mode switch has indicators that show which mode the rear wheel steering system is in. When all indicators are lit the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering control module. During a mode change, the indicator for the selected mode will flash until the mode change is complete. The rear wheel steering control module will wait for the steering wheel to pass the center position before entering the selected mode. The indicators on the mode switch are LEDs, the switch is also back lit.

Rear Wheel Steering Motor Assembly

The rear wheel steering motor assembly is a 3 phase, 6 pole, brushless DC motor. The motor assembly is

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located on the top of the rear steering actuator, and transmits its power through a planetary gear set inside the actuator. There are 3 hall switches inside the assembly: hall A, hall B, and hall C. The rear wheel steering control modules uses the hall switch inputs to monitor the position, speed and direction of the motor. There is a motor phase shorting relay located inside the motor assembly. The hall switches and shorting relay are part of the motor assembly and cannot be serviced separately. The motor leads are not to be repaired or spliced in any fashion. If there is damage to the motor wiring, the motor assembly must be replaced, as any damage to the wiring could permit water intrusion into the actuator. The motor assembly can be serviced separately from the actuator.

Steering Wheel Position Sensor

The steering wheel position sensor (SWPS) provides one analog signal and 3 digital signals. The digital signals, Phase A, Phase B and marker pulse, are direct inputs to the rear wheel steering control module. The analog signal is input to the body control module (BCM) and is sent via a class 2 message to the rear wheel steering control module. Battery voltage is supplied to the sensor from the cruise fuse to operate the digital portion of the sensor. A 12-volt reference is provided by the rear wheel steering control module to the Phase A, Phase B, and marker pulse circuits of the SWPS. The module monitors each circuit as it is either remains high or is pulled low by the SWPS. The scan tool displays the Phase A and Phase B data parameters as either HIGH or LOW when the steering wheel is being rotated. Each change from HIGH to LOW, or LOW to HIGH, represents one degree of steering wheel rotation. When observing the Phase A and Phase B data with the scan tool, the parameters will not always display the same value at the same time. The marker pulse is a digital pulse signal that is displayed as HIGH by the scan tool with the steering wheel angle between +10 degrees and -10 degrees. At greater than 10 degrees steering wheel angle in either direction, the marker pulse data will be displayed as LOW. The BCM provides the 5-volt reference and low reference for the analog portion of the SWPS. The BCM reads the SWPS analog signal in voltage, which is typically 2.5 volts with the steering wheel on center. The voltage ranges from 0.25 volts at approximately one full turn left to 4.75 volts at approximately one full turn right. The voltage will then remain at that level for the remainder of steering wheel travel. This voltage can be monitored in BCM data display. The rear wheel steering control module receives the analog signal via a class 2 message from the BCM. When monitoring the rear wheel steering data, this information is displayed in the Steering Wheel Angle (TBC) data parameter, and is shown in degrees. The range of the display is +/- 225 degrees, with negative numbers representing steering input to the left, and positive numbers representing input to the right. The sensor may also be utilized by other optional systems.

Rear Wheel Position Sensor

The rear wheel position sensor has 2 signal circuits: position 1 and position 2. Position 1 is a linear measurement of voltage per degree. The voltage range for position 1 is from 0.25-4.75 volts, and the angular measurement range is from -620 degrees to +620 degrees. At 0.25 volts the steering wheel has been rotated -600 degrees past center. At 4.75 volts the steering wheel has been rotated +600 degrees past center. Position 2 circuit is a linear measurement of voltage per degree. The voltage for position 2 increases or decreases from 0.25-4.75 volts every 180 degrees. When the steering wheel is 0 degrees enter, position 1 and position 2 output signals measure 2.5 volts respectively.

Steerable Rear Axle

The steerable rear axle has a rack and pinon style actuator mounted to the differential cover, specially

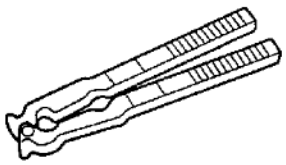
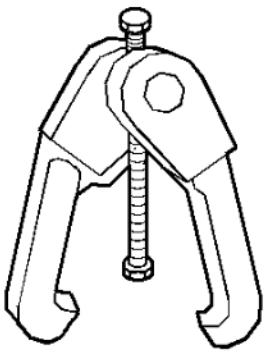
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designed axle shafts, and movable hub and bearing assemblies mounted by upper and lower ball joints. The actuator housing is part of the differential cover. In the event of a system malfunction, the actuator returns the rear wheels to the center position through internal springs. The actuator has specially designed inner and outer tie rods ends. There are inner tie rod boots to prevent contaminants from entering the actuator. Long term exposure to moisture due to a damaged boot or components can result in an internal malfunction or damage. The actuator has the rear wheel steering motor assembly attached to the upper housing. There are shields and a skid plate on the rear axle to protect the actuator. There are no internal adjustments to the actuator. It is mandatory to perform a four wheel alignment if any hard parts, such as tie rods, ball joints or wheel bearings are serviced. The axle shafts are a heavy duty design with a specially designed CV joint and boot at the wheel end of the axle to provide up to 15 degrees of movement. The axle assembly is a heavier duty version of the standard rear axle used on a non rear wheel steer truck. You must consult the owners manual and the trailer towing guide for specific towing capacities.

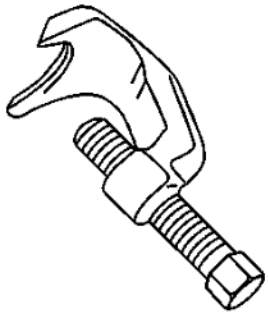
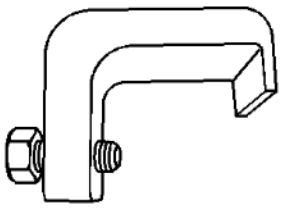
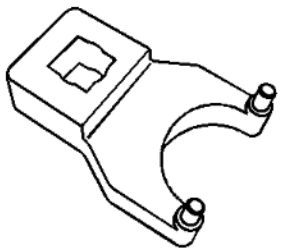
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

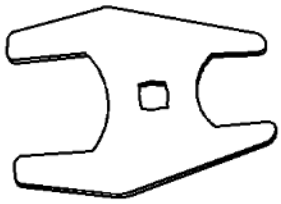
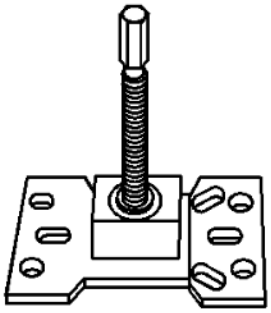
Special Tools

Illustration	Tool Number/ Description
	J 22610 Service Boot Clamp Installer
	J 24319-B Universal Steering Linkage Puller

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	J 43631 Ball Joint Remover
	J 44663 Ball Joint Remover
	J 44664 Ball Joint Nut Remover
	J 44665-1 Inner Tie Rod Wrench
	J 44665-2 Inner Tie Rod Wrench

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	J 45859 Axle Remover

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