

2006 STEERING

Power Steering System - Equinox & Torrent

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Intermediate Steering Shaft Pinch Bolt	34 N.m	25 lb ft
Outer Tie Rod Retention Nut	60 N.m	44 lb ft
Steering Gear to Cradle Mounting Bolt	110 N.m	81 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

POWER STEERING SYSTEM SCHEMATICS

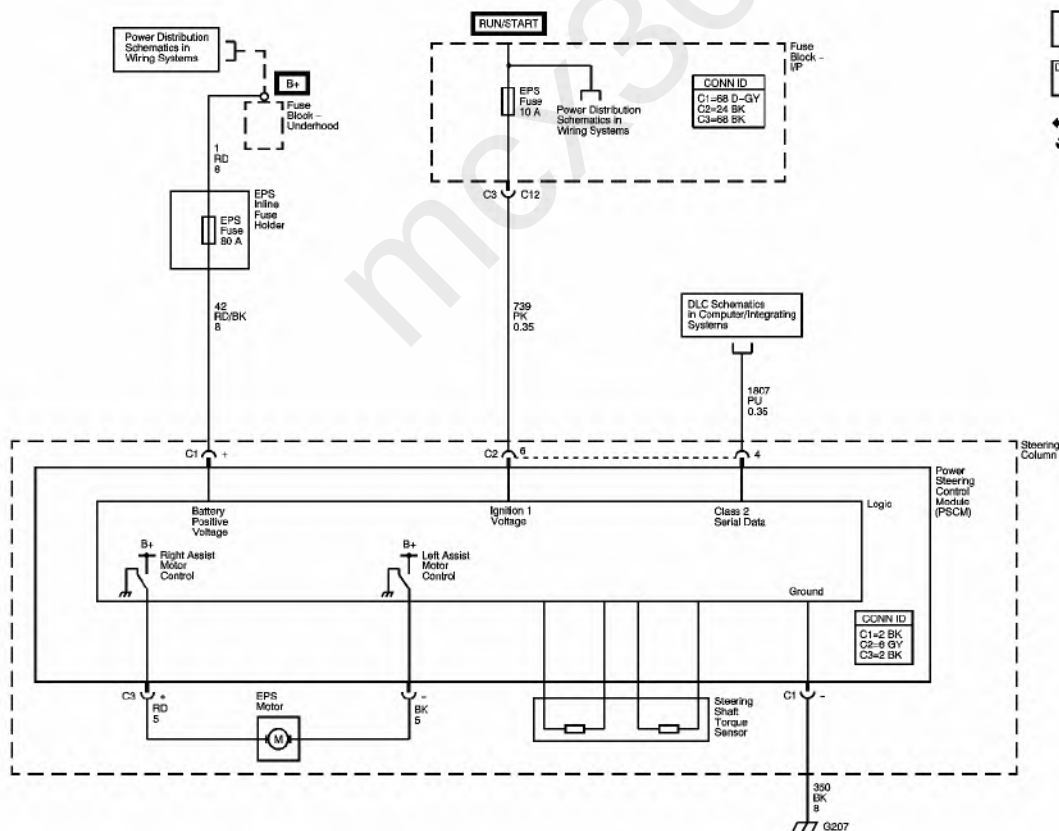


Fig. 1: Power Steering System Schematics
 Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

POWER STEERING SYSTEM COMPONENT VIEWS

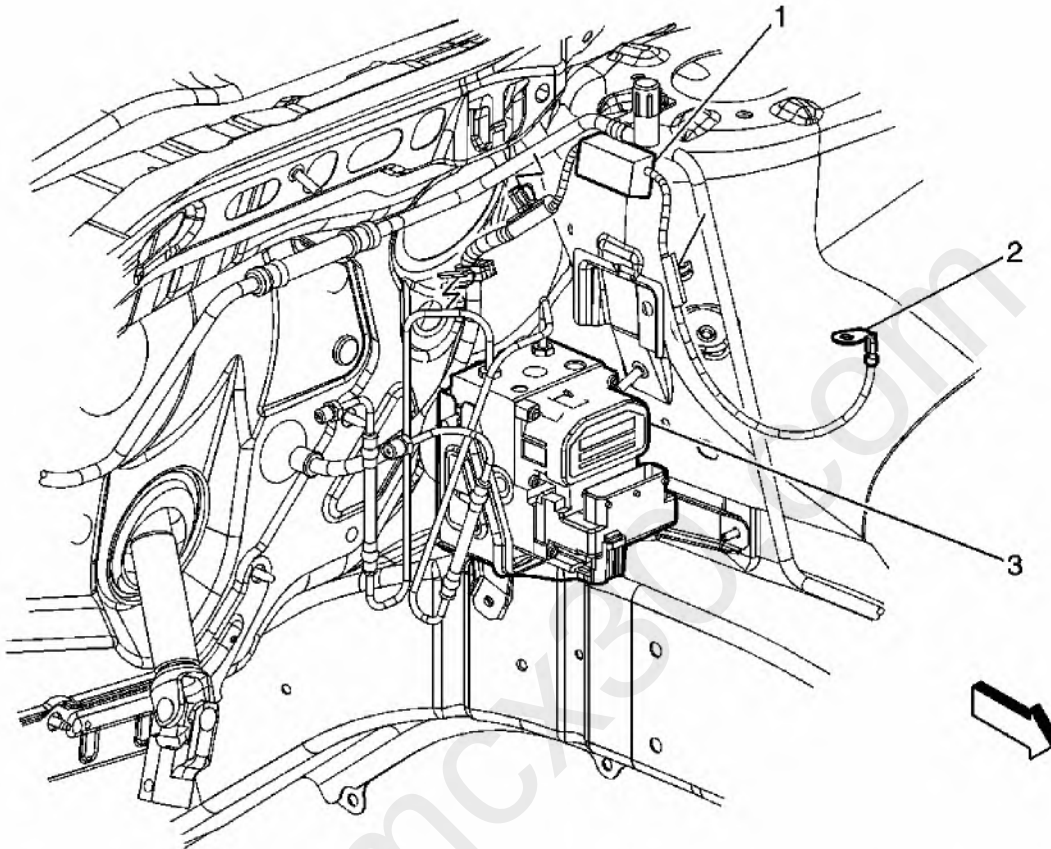


Fig. 2: View of Electronic Power Steering Harness, Underhood Side Harness Routing
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	EPS Inline Fuse Holder
2	PSCM Harness Connection to the Underhood Fuse Block
3	Electronic Brake Control Module (EBCM)

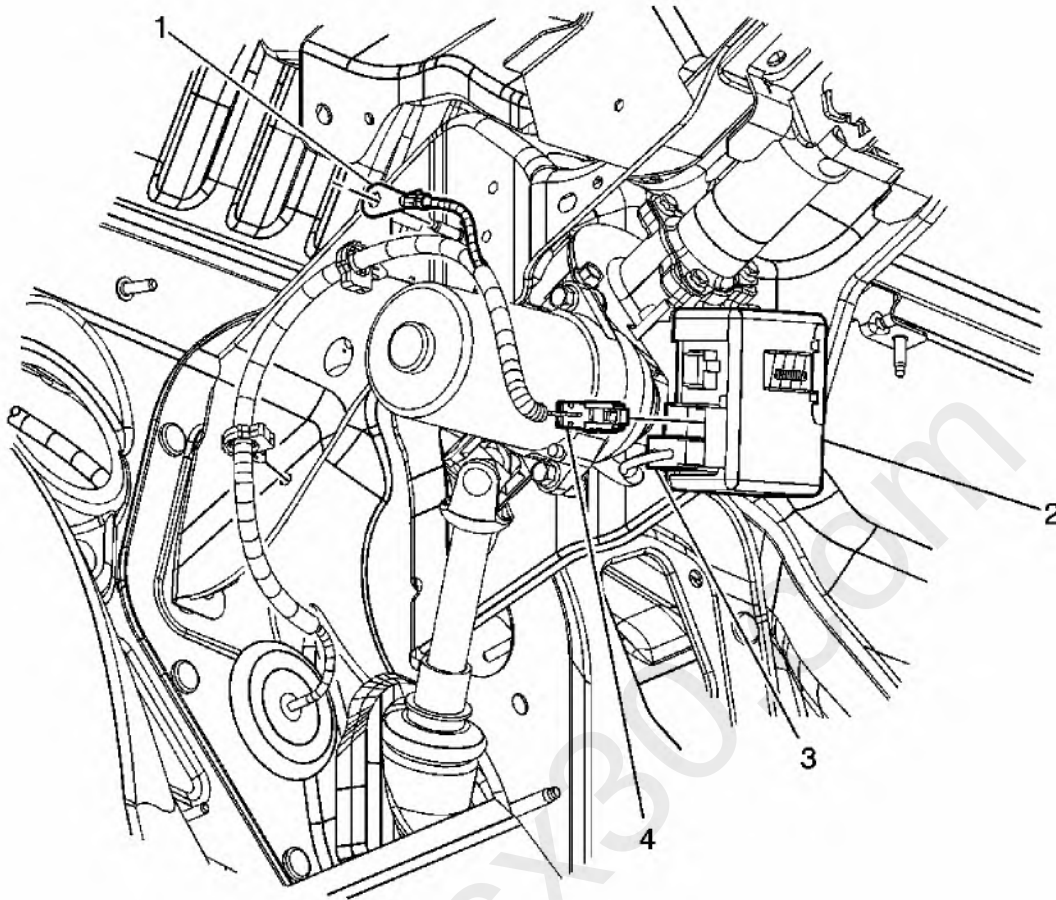


Fig. 3: View of Electronic Power Steering Harness, I/P Side Harness Routing
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	G207
2	Power Steering Control Module (PSCM)
3	Power Steering Control Module (PSCM) C3 - EPS Motor Pigtail
4	Power Steering Control Module (PSCM) C1

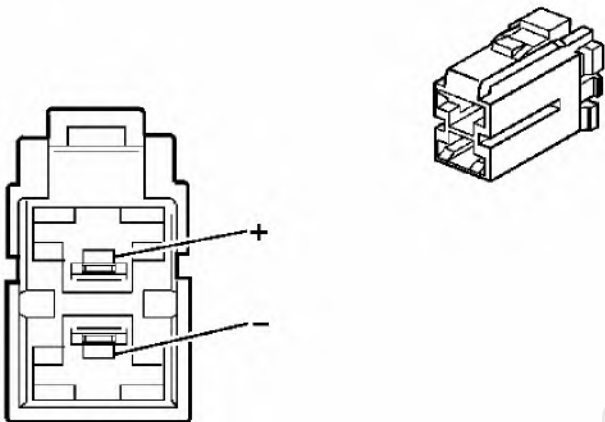
POWER STEERING SYSTEM CONNECTOR END VIEWS

Power Steering Control Module (PSCM) C1



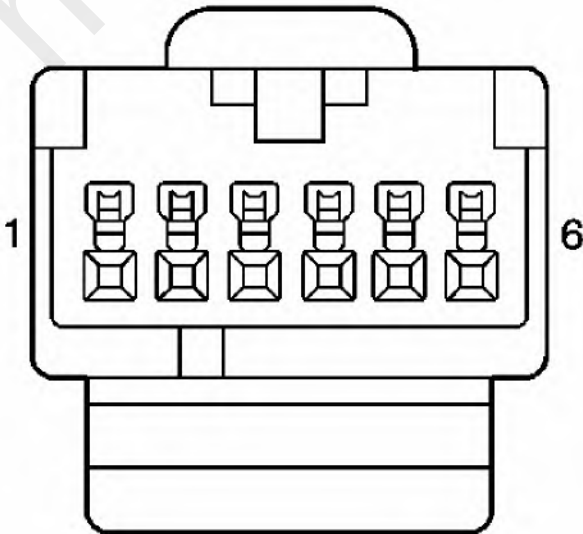
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Connector Part Information		• OEM: 7123-4123-30 • Service: 88953301 • 2-Way F (BK)	
Pin	Wire Color	Circuit No.	Function
+	RD/BK	42	Battery Positive Voltage
-	BK	350	Ground

Power Steering Control Module (PSCM) C2



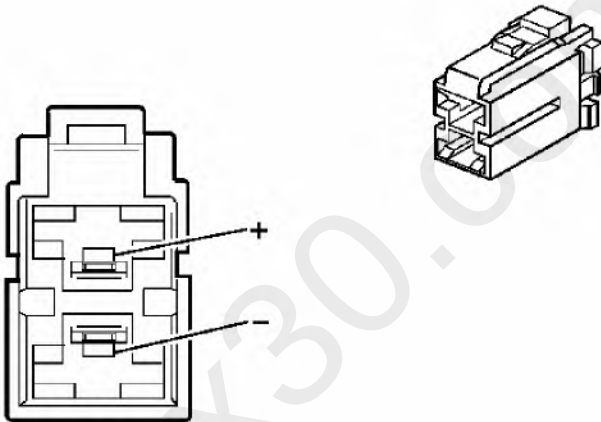
		• OEM: 776195-6	
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Connector Part Information		• Service: See Catalog • 6-Way F (GY)	
Pin	Wire Color	Circuit No.	Function
1-3	-	-	Not Used
4	PU	1807	Class 2 Serial Data
5	-	-	Not Used
6	PK	739	Ignition 1 Voltage

Power Steering Control Module (PSCM) C3

			
Connector Part Information		• OEM: 7123-4123-30 • Service: 88953301 • 2-Way F (BU)	
Pin	Wire Color	Circuit No.	Function
+	RD	-	Left Assist Motor Control
-	BK	-	Right Assist Motor Control

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC C0000	- Vehicle Speed Information Circuit
DTC C0475	- Electric Steering Motor Circuit
DTC C0476	- Electric Steering Motor Range/Performance
DTC C0545	- Steering Wheel Torque Input Sensor

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DTC C0551	Option Configuration Error
DTC C0847	- Device 1 Ignition Circuit Low
DTC C0848	- Device 1 Ignition Circuit High
DTC C0896	Device Voltage Range/Performance
DTC C0899	Device 1 Voltage Low
DTC C0900	Device 1 Voltage High

DIAGNOSTIC STARTING POINT - POWER STEERING SYSTEM

System Familiarization

Review the electric power steering (EPS) system operation in order to familiarize yourself with the correct system functions and operations. Refer to **Power Steering System Description and Operation**.

Visual/Physical Inspection

- Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect for aftermarket components such as tires, or wheels which could affect the operation and/or performance of the power steering system.
- Inspect the steering column for accident damage. Refer to **Steering Column Accident Damage Inspection** in Steering Wheel and Column.

System Diagnosis

After incorrect system operation has been verified and that aftermarket devices, or intermittent conditions are not the cause, begin the system diagnosis with the Vehicle Diagnostic System Check. The Vehicle Diagnostic System Check will provide the following information:

1. The identification of the control modules that control the Power Steering System.
2. The ability of those control modules to communicate via the serial data circuit.
3. The presence of any stored diagnostic trouble codes (DTCs) in those control modules and there status.

The use of the Vehicle Diagnostic System Check will identify the correct procedure for diagnosing the malfunction and where the procedure is located. Refer to **Diagnostic System Check - Vehicle** in Vehicle DTC Information.

SCAN TOOL DATA LIST

IMPORTANT: Not all listed data parameters are available on all vehicles.

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Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions: Ignition ON/Engine ON/Steering wheel centered/No force applied to steering wheel			
Actual Motor Current	Data Display and EPS Data List 2	Amps	0.0
Battery Voltage	Data Display and EPS Data List 1	Volts	14.3
Desired Motor Current	Data Display and EPS Data List 2	Amps	0.0
Ignition Cycles Since Last Code Set	EPS Data List 2	Numeric	0
Ignition Voltage	Data Display and EPS Data List 1	Volts	14.3
Limiting Motor Current	Data Display	Amps	58 amps
Lowest Limiting Current	EPS Data List 2	Amps	58 amps
Motor Voltage +	Data Display and EPS Data List 1	Volts	0.0
Motor Voltage -	Data Display and EPS Data List 1	Volts	0.0
Overload Protection Incidents	EPS Data List 2	Numeric	0
Steering Calibration	EPS Data List 1	Numeric 1-8	Varies
Steering Shaft Torque	EPS Data List 2	N.m or lb ft	0.00
Torque Sensor Amplified	Data Display	N.m or lb ft	0.00
Torque Sensor Main	Data Display	N.m or lb ft	0.00
Torque Sensor Sub	Data Display	N.m or lb ft	0.00
Tuning Profile	Data Display	Numeric 1-8	Varies
Vehicle Speed	Data Display and EPS Data List 1	km/h or mph	0
9-11 Volt Battery Occurrences	EPS Data List 2	Numeric	0

SCAN TOOL DATA DEFINITIONS**IMPORTANT: Not all listed data parameters are available on all vehicles.****Actual Motor Current**

The scan tool displays 0-58 amps. The actual amount of current the power steering control module (PSCM) is commanding to the electric power steering (EPS) motor.

Battery Voltage

The scan tool displays 8-17 volts. The level of battery voltage available at the PSCM.

Desired Motor Current

The scan tool displays 0-58 amps. The amount of current the PSCM is attempting to command to the EPS motor.

Ignition Cycles Since Last Code Set

The scan tool displays the number of times the ignition has been cycled since the last EPS DTC was set.

Ignition Voltage

The scan tool displays 0-17 volts. The level of ignition voltage available at the PSCM.

Limiting Motor Current

The scan tool displays up to 65 amps. The amount of current last commanded to the EPS motor before the system went into overload protection mode. 65 amps indicates that an overload protection incident has not occurred.

Lowest Limiting Current

The scan tool displays up to 65 amps. The amount of current last commanded to the EPS motor before the system went into overload protection mode. 65 amps indicates that an overload protection incident has not occurred.

Motor Voltage +

The scan tool displays 7-14 volts. The amount of voltage being supplied to the EPS motor while turning right.

Motor Voltage -

The scan tool displays 7-14 volts. The amount of voltage being supplied to the EPS motor while turning left.

Overload Protection Incidents

The scan tool displays the number of times the EPS system has entered into overload protection mode.

Steering Calibration

The scan tool displays 1-8. The number of the steering calibration the PSCM has chosen based on the VIN. All 8 of the steering calibrations for EPS are stored in the body control module (BCM).

Steering Shaft Torque

The scan tool displays -20.70 N.m to +20.70 N.m (15.2 lb ft). The amount of torque being applied to the steering column shaft when turning the steering wheel. This signal voltage is from the detection coil of the torque sensor which is then converted to N.m by the PSCM. A - value indicates a left turn, a positive value indicates a right turn.

Torque Sensor Amplified

The PSCM takes the detection coil voltage and multiplies it. This amplified signal voltage is used by the PSCM to compensate for lag in mechanical steering components.

Torque Sensor Main

The scan tool displays -17.2 N.m to +17.2 N.m (12.6 lb ft). The amount of torque being applied to the steering column shaft when turning the steering wheel. This signal voltage is from the detection coil of the torque sensor which is then converted to N.m by the PSCM. A - value indicates a left turn, a positive value indicates a right turn.

Torque Sensor Sub

The scan tool displays -17.2 N.m to +17.2 N.m (12.6 lb ft). This signal voltage is from the compensation coil of the torque sensor which is then converted to N.m by the PSCM. The Torque Sensor Main and Torque Sensor Sub data parameters should behave the same as each other.

Tuning Profile

The scan tool displays 1-8. The number of the steering calibration the PSCM has been programmed to. After replacement, the PSCM must be programmed with the proper calibration using the Saturn Service Stall.

Vehicle Speed

The scan tool displays 0-255 km/h (0-156 mph). The actual speed of the vehicle.

9-11 Volt Battery Occurrences

The scan tool displays the number of times the EPS system battery voltage has gone from 9-11 volts.

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DTC C0000

Circuit Description

The power steering control module (PSCM) receives a vehicle speed message from the engine control module (ECM) via the class 2 serial data circuit. The PSCM uses this vehicle speed message, and other inputs, to determine the desired amount of steering assist.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0000 - Vehicle Speed Information Circuit

Conditions for Running the DTC

- The ignition is ON.
- DTC U1300, U1301, or U2100 are not set.
- Vehicle speed is greater than 8.1 km/h (5 mph).

Conditions for Setting the DTC

The PSCM receives an invalid, or no vehicle speed message from the ECM.

Action Taken When the DTC Sets

- DTC C0000 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- Steering assist level defaults to 120 km/h (74.5 mph) vehicle speed level of assist.

Conditions for Clearing the DTC

- A current DTC will clear on the next malfunction free ignition cycle.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles.

Test Description

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

2: Tests for the presence of vehicle speed related DTCs in the control modules where the vehicle speed message originates.

DTC C0000

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics			

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1	Did you perform the Diagnostic System Check-Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	1. Turn ON the ignition, with the engine OFF. 2. Select the Engine and Transmission Diagnostic Trouble Codes (DTC) function in Powertrain with a scan tool. Does the scan tool display any engine or transmission DTCs?	Go to Diagnostic Trouble Code (DTC) List - Vehicle in Vehicle DTC Information	Go to Step 3
3	1. Clear the electric power steering (EPS) DTCs with the scan tool. 2. Operate the vehicle within the conditions for running the DTC. Does DTC C0000 reset?	Go to Step 2	System OK

DTC C0475**Circuit Description**

The power steering control module (PSCM) continuously monitors the voltage and current levels being commanded to the electric power steering (EPS) motor. The PSCM compares the desired and actual current levels to detect malfunctions in the EPS motor, or the circuits to the motor.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0475 - Electric Steering Motor Circuit

Conditions for Running the DTC

- The ignition is ON.
- No voltage DTCs are present.

Conditions for Setting the DTC

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The actual motor current does not equal the desired motor current.

Action Taken When the DTC Sets

- DTC C0475 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- No steering assist is provided.

Conditions for Clearing the DTC

- A current DTC will clear on the next malfunction free ignition cycle.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles.

DTC C0475

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics			
Connector End View Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check-Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	Inspect for poor connections at the electric power steering (EPS) motor harness 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 6	Go to Step 3
3	Test the EPS motor control circuits 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 6	Go to Step 4
4	Test the EPS motor control circuits for a short to voltage. Refer to Testing for a Short to Voltage and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 5
5	Replace and setup the EPS assembly. Refer to Control Module References in Programming and Setup.		

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	Did you complete the repair?	Go to Step 6	-
6	1. Clear the DTCs with a scan tool. 2. Operate the vehicle within the Conditions for Running the DTC.		
	Does DTC C0475 reset?	Go to Step 2	System OK

DTC C0476

Circuit Description

The power steering control module (PSCM) monitors the temperature of the electric power steering (EPS) system. The PSCM uses voltage and current levels to calculate an estimated system temperature. If the PSCM detects a high system temperature, the amount of assist is reduced to lower the EPS system temperature to prevent thermal damage to the system.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0476 - Electric Steering Motor Range/Performance

Condition for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The PSCM detects a high system temperature.

Action Taken When the DTC Sets

- A DTC C0476 is stored in memory.
- Steering assist is reduced.

Conditions for Clearing the DTC

- A current DTC will clear when the EPS system temperature returns to normal.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles.

Diagnostic Aids

- DTC C0476 does not indicate that a malfunction has occurred. DTC C0476 indicates that the PSCM had to limit current to the EPS motor to avoid system thermal damage.
- Inspect the area around the EPS assembly. Ensure that no other components have come in contact with the EPS assembly such as insulation or other electrical components.

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- Ensure that no steering components, such as ball joints, tie rod ends, universal joints, or the steering rack and pinion are mechanically binding.
- Inspect for aftermarket items that may increase the amount of steering assist required.

Test Description

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

2: Tests if the high system temperature is system, or driving condition related. Most occurrences of the DTC are caused by frequent static steering, such as parking maneuvers and high ambient temperatures,

DTC C0476

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics			
Connector End View Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check-Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	Review the electric power steering (EPS) system with the customer to determine the conditions under which the DTC set. Did steering conditions or high ambient temperatures cause DTC C0476 to set?	Go to Step 3	Go to Diagnostic Aids
3	1. Clear the DTCs with a scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0476 reset?	Go to Step 2	System OK

DTC C0545

Circuit Description

The electric power steering (EPS) system uses a torque sensor to detect the amount of torque being applied to the steering column shaft when the steering wheel is turned. The power steering control module (PSCM) uses this sensor as it's main input in determining the amount of steering assist needed.

DTC Descriptor

This diagnostic procedure supports the following DTC:

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DTC C0545 - Steering Wheel Torque Input Sensor

Condition for Running the DTC

The ignition, and the engine are ON.

Condition for Setting the DTC

- The PSCM's torque sensor input is greater than 20.70 N.m (15.2 lb ft) during a right turn.
- The PSCM's torque sensor input is less than -20.70 N.m (15.2 lb ft) during a left turn.
- The difference between the 2 torque sensor coils is greater than 2.4 N.m (1.7 lb ft).

Action Taken When the DTC Sets

- A DTC C0545 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- No steering assist is provided.

Conditions for Clearing the DTC

- A current DTC will clear on the next malfunction free ignition cycle.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles.

Diagnostic Aids

The torque sensor is hard wired to the PSCM. No connector, or circuit testing can be performed. if an intermittent malfunction is suspected with the torque sensor, or the circuits to the torque sensor, replace the EPS assembly. Refer to **Steering Column Replacement** in Steering Wheel and Column. The scan tool can be used to view the torque sensor value.

Test Description

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

2: Tests the torque sensor in its active state.

DTC C0545

Step	Action	Values	Yes	No	Go to Diagnostic
Schematic Reference: <u>Power Steering System Schematics</u> Connector End View Reference: <u>Power Steering System</u> Connector End Views					
	Did you perform the Diagnostic System Check-				

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1	Vehicle?	Go to Step 2			System Check - Vehicle in Vehicle DTC Information
2	1. Start the engine. 2. Observe the Steering Shaft Torque data parameter in the electric power steering (EPS) Data List 2, using a scan tool. 3. Turn the steering wheel 90 degrees to the right and hold the steering wheel position. Does the scan tool indicate that the Steering Shaft Torque data parameter changes state while turning the steering wheel and is less than the specified value?	20.70 N.m (15.2 lb ft)	Go to Diagnostic Aids	Go to Step 3	
3	Replace and setup the EPS assembly. Refer to Control Module References in Programming and Setup. Did you complete the repair?	Go to Step 4			-
4	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0545 reset?	Go to Step 2			System OK

DTC C0551

Circuit Description

After replacement of the electric power steering (EPS) assembly, the power steering control module (PSCM) must be configured with the proper tuning profile using the service

programming system.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0551 Option Configuration Error

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The PSCM has not been configured with the proper tuning profile.

Action Taken When the DTC Sets

- DTC C0551 is stored in memory.
- The instrument panel cluster (IPC) displays the SERVICE VEHICLE SOON warning indicator.
- Steering assist is set to a default level.

Conditions for Clearing the DTC

- A current DTC will clear after the PSCM has been configured with the proper tuning profile.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles after the PSCM has been configured.

Diagnostic Aids

A newly replaced EPS assembly will set DTC C0551 on it's initial ignition ON cycle.

Test Description

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

2: Tests if the condition is current.

DTC C0551

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?		Go to Diagnostic System Check - Vehicle in

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		Go to Step 2	Vehicle DTC Information
2	1. Turn ON the ignition, with the engine OFF. 2. Observe the Tuning Profile parameter in the electric power steering (EPS) data list, with a scan tool. Does the scan tool display Tuning Profile 0?	Go to Step 3	Go to Step 4
3	Configure the power steering control module (PSCM). Refer to Control Module References in Computer/Integrating Systems. Did you complete the repair?	Go to Step 4	-
4	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0551 reset?	Go to Step 2	System OK

DTC C0847**Circuit Description**

The body control module (BCM) contains the 2 amp EPS fuse. This fuse and the ignition 1 voltage circuit supply ignition voltage to the power steering control module (PSCM). This ignition voltage is used to wake up the PSCM.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0847 - Device 1 Ignition Circuit Low

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The ignition 1 voltage circuit is shorted to ground or open.
- DTCs U1300 and U1301 are not set.

Action Taken When the DTC Sets

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- DTC C0847 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- The EPS system is disabled.

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.

Diagnostic Aids

The Ignition 1 voltage circuit supplies several other control modules with ignition voltage. Before preceding with the diagnostic table below, ensure no other control modules that use the ignition 1 circuit for their ignition voltage supply have any ignition voltage malfunctions present, such as the sensing and diagnostic module (SDM), or the cruise control module (CCM). Refer to **Power Distribution Schematics** in Wiring Systems. If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems for further diagnosis.

Test Description

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

2: Tests if the malfunction is intermittent.

5: Tests if a short to ground exists in the ignition 1 voltage circuit, or in the PSCM.

DTC C0847

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics			
Connector End View Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check-Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the power steering control module (PSCM), using a scan tool.		

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	Does the scan tool communicate with the PSCM?	Go to Diagnostic Aids	Go to Step 3
3	1. Turn OFF the ignition. 2. Inspect the 2 A EPS fuse for an open. Is the fuse open?	Go to Step 4	Go to Step 6
4	1. Replace the 2 A EPS fuse. 2. Turn ON the ignition, with the engine OFF. Does the fuse open?	Go to Step 5	Go to Diagnostic Aids
5	Test the ignition 1 voltage circuit of the PSCM for 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 10	Go to Step 9
6	Test the ignition 1 voltage circuit of the PSCM for an open. Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 7
7	Inspect for poor connections at the harness connector of the body control module (BCM). 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 10	Go to Step 8
8	Inspect for poor connections at the harness connector of the PSCM. 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 10	Go to Step 9
9	Replace and setup the electric power steering (EPS) assembly. Refer to Control Module References in Programming and Setup. Did you complete the replacement?	Go to Step 10	-
10	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC.		

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Does DTC C0847 reset?

Go to **Step 2**

System OK

DTC C0848

Circuit Description

The power steering control module (PSCM) receives a class 2 power mode message from the body control module (BCM) to determine the position of the ignition switch. After a power mode OFF message is received, the PSCM monitors the ignition 1 voltage circuit to detect if a short to voltage exists.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0848 - Device 1 Ignition Circuit High

Conditions for Running the DTC

- The ignition is OFF.
- The class 2 power mode message indicates OFF.

Conditions for Setting the DTC

- The PSCM ignition 1 voltage circuit is shorted to voltage.
- DTCs U1300 and U1301 are not set.

Action Taken When the DTC Sets

- DTC C0848 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.

Conditions for Clearing the MIL/DTC

- A current DTC will clear on the next consecutive malfunction free ignition cycle.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles.

DTC C0848

Step	Action	Yes	No
Connector End Views Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check-Vehicle?		Go to Diagnostic System Check - Vehicle in Vehicle DTC

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		Go to Step 2	Information
2	Test the ignition 1 voltage circuit for a short to voltage. Refer to Testing for a Short to Voltage and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
3	1. Clear the DTCs with a scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0848 reset?	Go to Step 2	System OK

DTC C0896**Circuit Description**

The power steering control module (PSCM) has a discrete battery positive voltage supply circuit. The PSCM monitors the voltage level on this circuit to ensure the electric power steering (EPS) system has adequate voltage levels to perform the system functions.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0896 Device Voltage Range/Performance

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

EPS system battery voltage is 9-11 volts.

Action Taken When the DTC Sets

- DTC C0896 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- Steering assist is reduced.

Conditions for Clearing the DTC

- A current DTC will clear when EPS system voltage is greater than 11 volts.

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- A history DTC will clear after 100 consecutive ignition cycles with EPS system voltage greater than 11 volts.

Diagnostic Aids

The scan tool can be used to view the number of times a low battery voltage incident has occurred. If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems for further diagnosis.

Test Description

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

2: Tests if the malfunction exists in the vehicles charging system.

3: Tests if the malfunction is intermittent.

DTC C0896

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics Connector End View Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	1. Turn ON the ignition, with the engine OFF. 2. Observe the Battery 1 parameter in the body control module (BCM) Accessory data list, using a scan tool. Does the scan tool display greater than 11 volts?	Go to Step 3	Go to Symptoms - Engine Electrical in Engine Electrical
3	Observe the Battery Voltage parameter in the EPS Data List 1. Does the scan tool display greater than 11 volts?	Go to Diagnostic Aids	Go to Step 4
4	Test the battery positive voltage circuit of the power steering control module (PSCM) for a high resistance. 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 10	Go to Step 5
5	Test the ground circuit of the PSCM for a high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 6
6	Inspect for poor connections at the harness connector of the underhood fuse block stud terminal. 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 10	Go to Step 7
7	Inspect for poor connections at the harness connector of the PSCM. 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 10	Go to Step 8
8	Inspect for poor connections at the ground terminal. 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 10	Go to Step 9
9	Replace and setup the electric power steering (EPS) assembly. Refer to Control Module References in Programming and Setup. Did you complete the replacement?	Go to Step 10	-
10	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0896 reset?	Go to Step 2	System OK

DTC C0899

Circuit Description

The power steering control module (PSCM) has a discrete battery positive voltage supply circuit. The PSCM monitors the voltage level on this circuit to ensure the electric power steering (EPS) system has adequate voltage levels to perform the system functions. If the voltage level is low, DTC C0899 sets.

DTC Descriptor

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This diagnostic procedure supports the following DTC:

DTC C0899 Device 1 Voltage Low

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

EPS system voltage is less than 8 volts

Action Taken When the DTC Sets

- DTC C0899 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- No steering assist is provided.

Conditions for Clearing the DTC

- A current DTC will clear when EPS system voltage is greater than 8.65 volts.
- A history DTC will clear after 100 consecutive ignition cycles with the EPS system voltage greater than 8.65 volts.

Diagnostic Aids

The scan tool can be used to view the number of times a low battery incident has occurred. If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems for further diagnosis.

Test Description

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

2: Tests if the malfunction exists in the vehicles charging system.

3: Tests if the malfunction is in the EPS system.

DTC C0899

Step	Action	Yes	No
Schematic Reference: Power Steering System Schematics			
Connector End View Reference: Power Steering System Connector End Views			
1	Did you perform the Diagnostic System Check - Vehicle?		Go to Diagnostic System Check - Vehicle in

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		Go to Step 2	Vehicle DTC Information
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Turn ON the scan tool. Does the scan tool power up and communicate with the engine control module (ECM)?	Go to Step 3	Go to Symptoms - Engine Electrical in Engine Electrical
3	Observe the Battery Voltage parameter in the electric power steering (EPS) Data List, using the scan tool. Does the scan tool display less than 8 volts?	Go to Step 3	Go to Diagnostic Aids
4	Test the battery positive voltage circuit of the power steering control module (PSCM) for a high resistance. Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 5
5	Test the ground circuit of the PSCM for a high resistance. Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 6
6	Inspect for poor connections at the harness connector of the PSCM. 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 10	Go to Step 7
7	Inspect for poor connections at the harness connector of the underhood fuse block stud terminal. 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 10	Go to Step 8
8	Inspect for poor connections at the ground connector. 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 10	Go to Step 9

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9	Replace and setup the EPS assembly. Refer to Control Module References in Programming and Setup. Did you complete the replacement?	Go to Step 10	-
10	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC. Does DTC C0899 reset?	Go to Step 2	System OK

DTC C0900**Circuit Description**

The power steering control module (PSCM) has a discrete battery voltage supply circuit. The PSCM monitors the voltage level on this circuit to protect itself against high voltage damage.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0900 Device 1 Voltage High

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

EPS system voltage is greater than 17 volts.

Action Taken When the DTC Sets

- DTC C0900 is stored in memory.
- The instrument panel cluster (IPC) message center displays the PWR STR warning message.
- The PSCM is disabled to protect itself.

Conditions for Clearing the MIL/DTC

- A current DTC will clear when the EPS system voltage returns to less than 15.5 volts.
- A history DTC will clear after 100 consecutive ignition cycles with the EPS system voltage less than 15.5 volts.
- Using a scan tool

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Diagnostic Aids

Jump starting the vehicle can cause DTC C0900 to set. If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems for further diagnosis.

DTC C0900

Step	Action	Values	Yes	No
Connector End Views Reference: Power Steering System				
Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Battery Voltage parameter in the engine control module (ECM) data list. Does the scan tool display greater than the specified value?	17 V	Go to Symptoms - Engine Electrical in Engine Electrical	Go to Step 3
3	Test the ground circuit of the power steering control module (PSCM) for a high resistance. Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 4		Go to Diagnostic Aids
	1. Use the scan tool in order to clear the DTC.			

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4	2. Operate the vehicle within the conditions for running the DTC. Does DTC C0900 reset?	Go to Step 2	System OK
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SYMPTOMS - POWER STEERING SYSTEM

IMPORTANT: Review the system description and operation in order to familiarize yourself with the system functions. Refer to Power Steering System Description and Operation.

Visual/Physical Inspection

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

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

- **Rattle, Clunk, or Shudder Noise from the Power Steering System**
- **Increase in Effort While Turning Steering Wheel**
- **Poor Return of Steering Wheel**
- **Steering Wheel Surges/Jerks While Turning**

RATTLE, CLUNK, OR SHUDDER NOISE FROM THE POWER STEERING SYSTEM

Rattle, Clunk, or Shudder Noise from the Power Steering System

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Steering Wheel and Column
2	Verify that a rattle, clunk or shudder noise is present. Is a rattle, clunk or shudder noise present?	Go to Step 3	System OK
3	Inspect the power steering gear for the proper installation. Refer to Power Steering Gear Replacement . Is the power steering gear installation incorrect?	Go to Step 6	Go to Step 4

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4	Inspect the intermediate shaft. Is the intermediate shaft worn?	Go to Step 8	Go to Step 5
5	Inspect the suspension. Is the suspension worn?	Go to Step 7	Go to Noise Diagnosis - Front Suspension In Suspension General Diagnosis
6	Install the power steering gear correctly. Refer to Power Steering Gear Replacement . Did you complete the repair?	Go to Step 9	-
7	Replace the worn suspension components. Did you complete the repair?	Go to Step 9	-
8	Replace the intermediate shaft. Refer to Intermediate Steering Shaft Replacement in Steering Wheel and Column. Did you complete the repair?	Go to Step 9	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

INCREASE IN EFFORT WHILE TURNING STEERING WHEEL

Increase in Effort While Turning Steering Wheel

Step	Action	Yes	No
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Power Steering System Description and Operation
2	Verify that there is an increase in effort while turning is present. Does the system operate normally?	System OK	Go to Step 3
3	Check for the following tire related conditions: • Incorrect tire inflation-Refer to Label - Vehicle Certification, Tire Place Card, Anti-Theft and Service Parts ID in General Information. • Improper tire size		

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	Did you find and correct the condition?	Go to Step 10	Go to Step 4
4	1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> in General Information. 2. Check for a binding or worn tie rod end. Is the tie rod binding or worn?	Go to Step 7	Go to Step 5
5	Check for a worn or binding intermediate shaft. Is the intermediate shaft worn or binding?	Go to Step 8	Go to Step 6
6	Check for a worn or binding steering gear. Is the steering worn or binding?	Go to Step 9	System OK
7	Replace the outer tie rod end. Refer to <u>Rack and Pinion Outer Tie Rod End Replacement</u> . Did you complete the repair?	Go to Step 10	-
8	Replace the intermediate shaft. Refer to <u>Intermediate Steering Shaft Replacement</u> in Steering Wheel and Column. Did you complete the repair?	Go to Step 10	-
9	Replace the steering gear. Refer to <u>Power Steering Gear Replacement</u> . Did you complete the repair?	Go to Step 10	-
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

POOR RETURN OF STEERING WHEEL

Poor Return of Steering Wheel

Step	Action	Yes	No
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to <u>Power Steering System Description and Operation</u>
2	Verify a poor return of the steering wheel is present. Does the system operate normally?	System OK	Go to Step 3
	Check for incorrect tire inflation. Refer to <u>Label - Vehicle Certification, Tire Place</u>		

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3	Card, Anti-Theft and Service Parts ID in General Information. Did you find and correct the condition?	Go to Step 11	Go to Step 4
4	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information. 2. Check for a binding or worn tie rod end. Is the tie rod binding or worn?	Go to Step 8	Go to Step 5
5	Check for a worn or binding intermediate shaft. Is the intermediate shaft worn or binding?	Go to Step 9	Go to Step 6
6	Check for worn a or binding ball joint. Are the ball joints worn or binding?	Go to Step 10	Go to Step 7
7	Check for proper alignment of the front suspension. Refer to Measuring Wheel Alignment in Wheel Alignment. Did you complete the wheel alignment?	Go to Step 11	-
8	Replace the outer tie rod end. Refer to Rack and Pinion Outer Tie Rod End Replacement . Did you complete the repair?	Go to Step 11	-
9	Replace the intermediate Shaft. Refer to Intermediate Steering Shaft Replacement in Steering Wheel and Column. Did you complete the repair?	Go to Step 11	-
10	Replace the ball joint. Refer to Lower Ball Joint Replacement in Front Suspension. Did you complete the repair?	Go to Step 11	-
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

STEERING WHEEL SURGES/JERKS WHILE TURNING

Steering Wheel Surges/Jerks While Turning

Step	Action	Yes	No
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Power Steering System Description and Operation

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2	Verify that the steering wheel surges/jerks while turning. Does the system operate normally?	System OK	Go to Step 3
3	Check for worn or binding front suspension components. Did you find and correct the condition?	Go to Step 15	Go to Step 4
4	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information. 2. Check for a binding or worn tie rod end. Is the tie rod binding or worn?	Go to Step 11	Go to Step 5
5	Check for a worn or binding intermediate shaft. Is the intermediate shaft worn or binding?	Go to Step 12	Go to Step 6
6	Check for worn a binding steering gear. Is the steering gear worn or binding?	Go to Step 13	Go to Step 7
7	Check for a worn or binding steering column. Is the steering column worn or binding?	Go to Step 14	Go to Step 8
8	Check for excessive heat in the EPS motor. Does the EPS appear to be overheated?	Go to Step 09	Go to Step 10
9	IMPORTANT: - Do not perform excessive parking lot maneuvers during testing. - Excessive parking lot maneuvers can cause the EPS motor to heat up. Allow the EPS motor to cool and retest the system. Did you find and correct the condition?	Go to Step 15	Go to Step 10
10	Check for low battery voltage. Refer to Diagnostic Starting Point - Engine Electrical in Engine Electrical. Did you find and correct the condition?	Go to Step 15	System OK
11	Replace the outer tie rod end. Refer to Rack and Pinion Outer Tie Rod End Replacement . Did you complete the repair?	Go to Step 15	-
12	Replace the intermediate shaft. Refer to Intermediate Steering Shaft Replacement		

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	in Steering Wheel and Column. Did you complete the repair?	Go to Step 15	-
13	Replace the steering gear. Refer to Power Steering Gear Replacement . Did you complete the repair?	Go to Step 15	-
14	Replace the steering column. Refer to Steering Column Replacement in Steering Wheel and Column. Did you complete the repair?	Go to Step 15	-
15	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

RACK AND PINION OUTER TIE ROD END REPLACEMENT

Tools Required

J 24319-B Steering Linkage and Tie Rod Puller

Removal Procedure

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

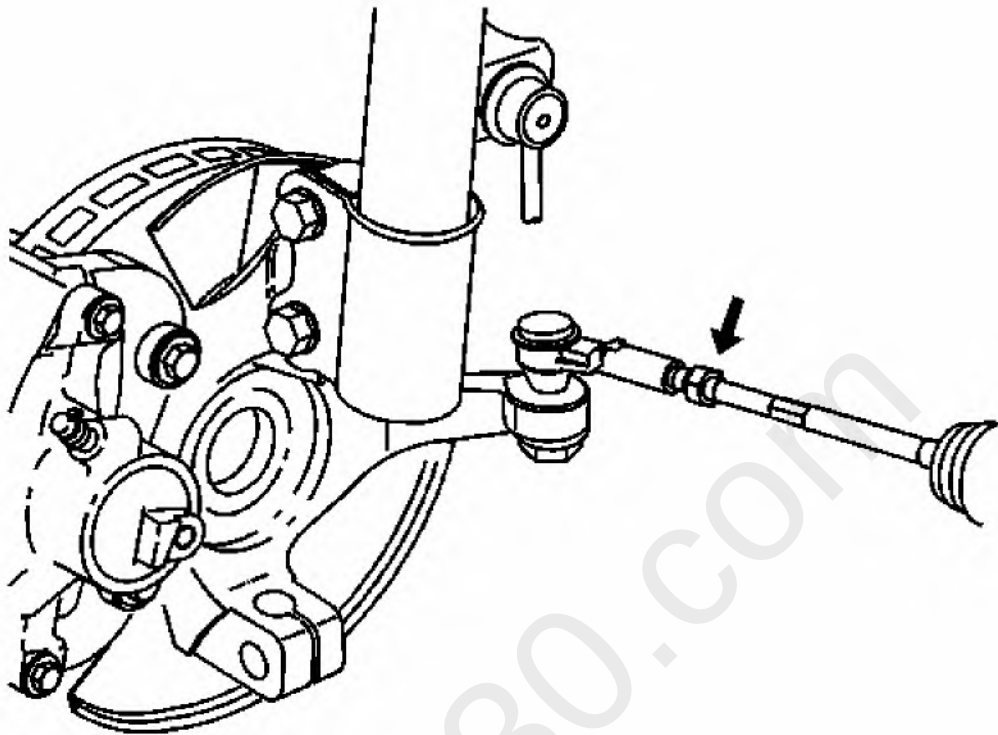


Fig. 4: Identifying Tie Rod Inner Jam Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Mark the location of the jam nut for installation.

3. Loosen the tie rod inner jam nut.

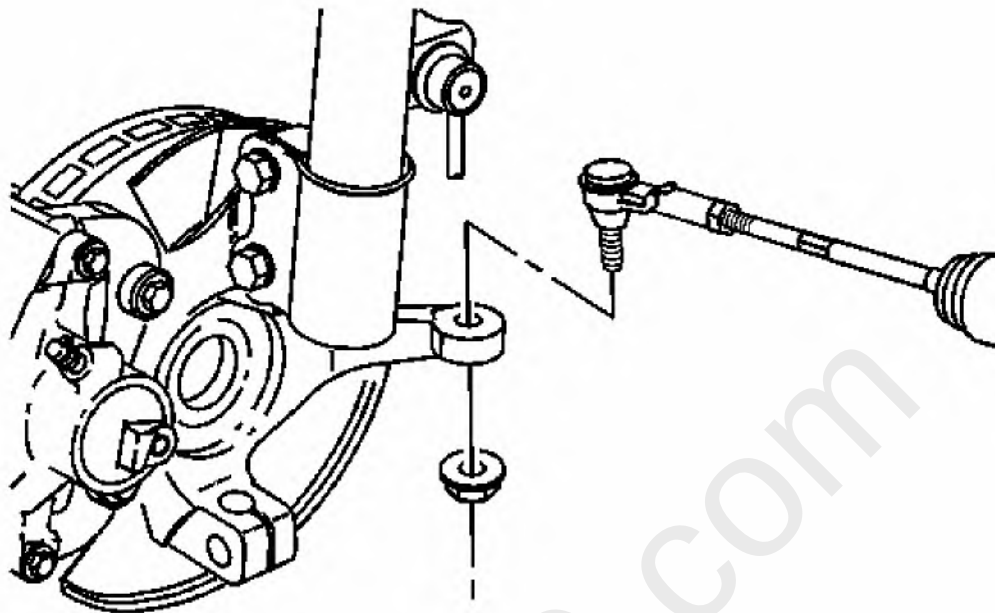


Fig. 5: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the ball stud to prevent turning during removal of the nut.

4. Remove the tie rod to knuckle nut. Discard the nut.

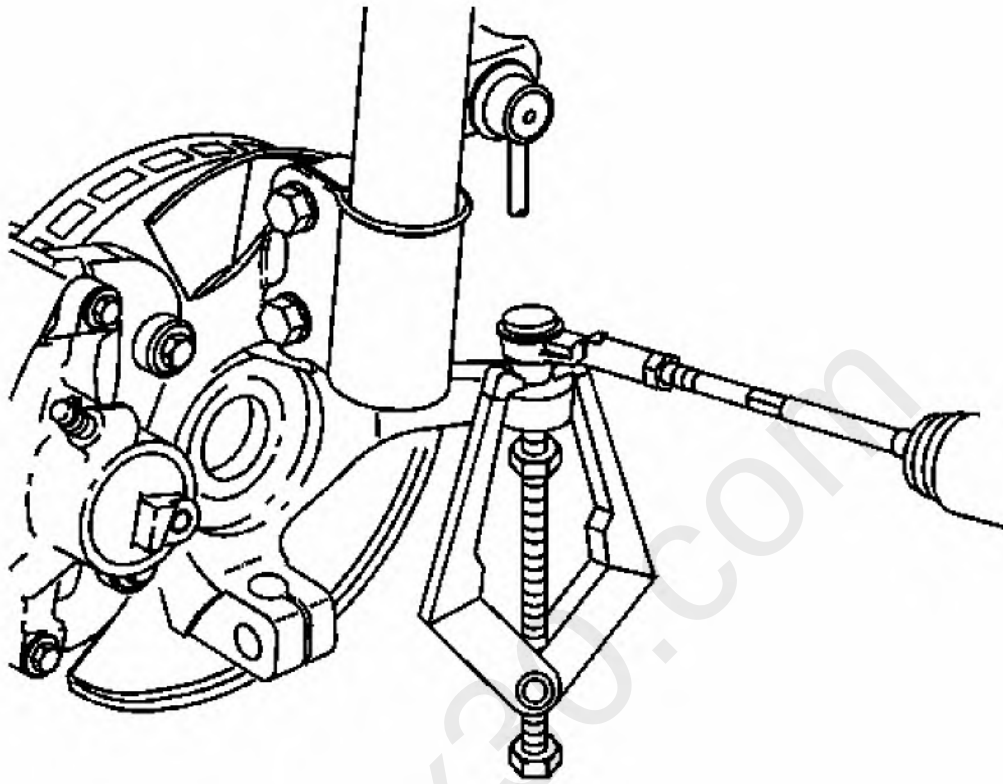


Fig. 6: Separating Outer Tie Rod End From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not free the ball stud by using a pickle fork or a wedge-type tool. Damage to the seal or bushing may result.

5. Use the **J 24319-B** to separate the tie rod from the steering knuckle.

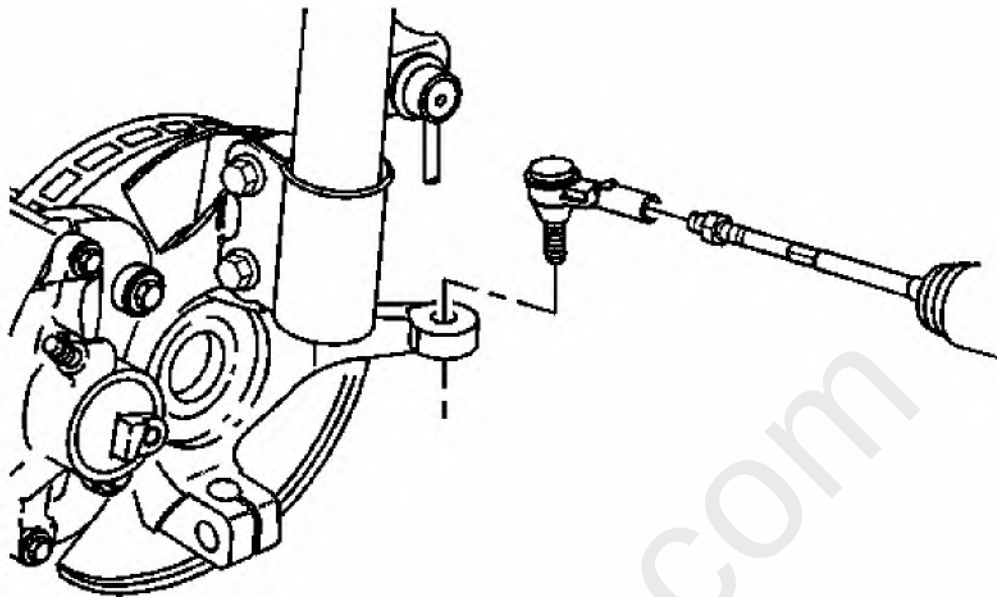


Fig. 7: View Of Outer & Inner Tie Rods
Courtesy of GENERAL MOTORS CORP.

6. Remove the outer tie rod from the inner tie rod.

Installation Procedure

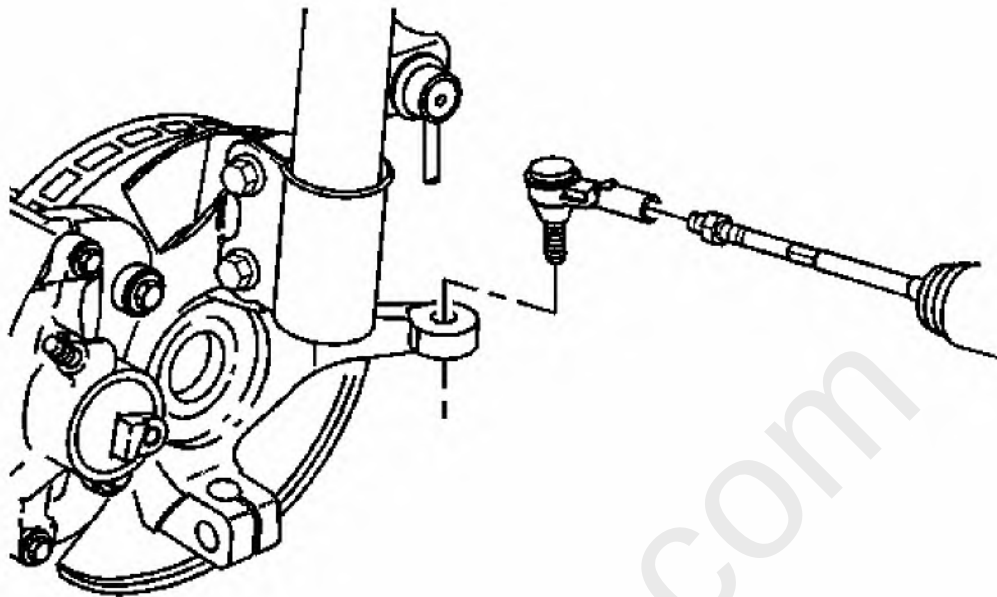


Fig. 8: View Of Outer & Inner Tie Rods
Courtesy of GENERAL MOTORS CORP.

1. Install the outer tie rod to the inner tie rod.
2. Connect the tie rod to the knuckle.

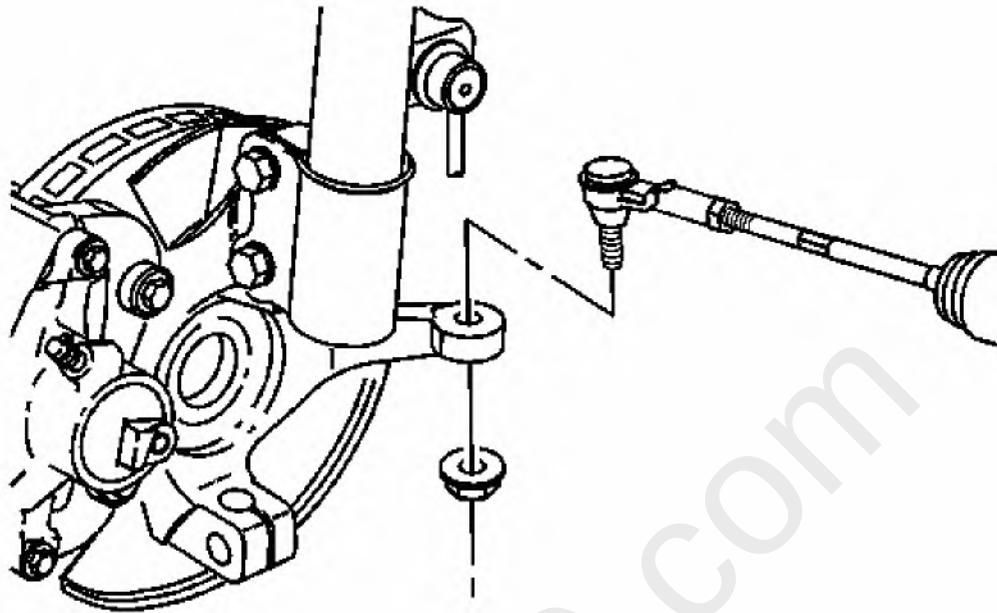


Fig. 9: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install a new tie rod retention nut.

Tighten: Tighten the nut to 60 N.m (44 lb ft).

4. Install the front tire assembly. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
5. Check the wheel alignment. Refer to Measuring Wheel Alignment in Wheel Alignment.

RACK AND PINION BOOT REPLACEMENT - ON VEHICLE

Tools Required

J 22610 Keystone Clamp Pliers. See Special Tools.

Removal Procedure

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

2. Remove the tire assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

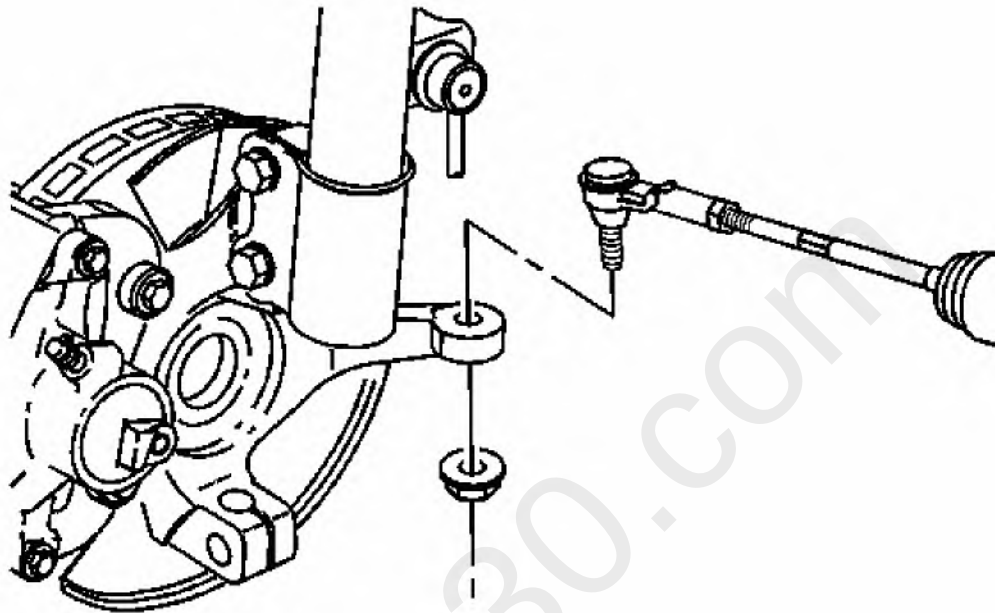


Fig. 10: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

3. Remove the outer tie rod. Refer to **Rack and Pinion Outer Tie Rod End Replacement**.
4. Remove the jam nut.

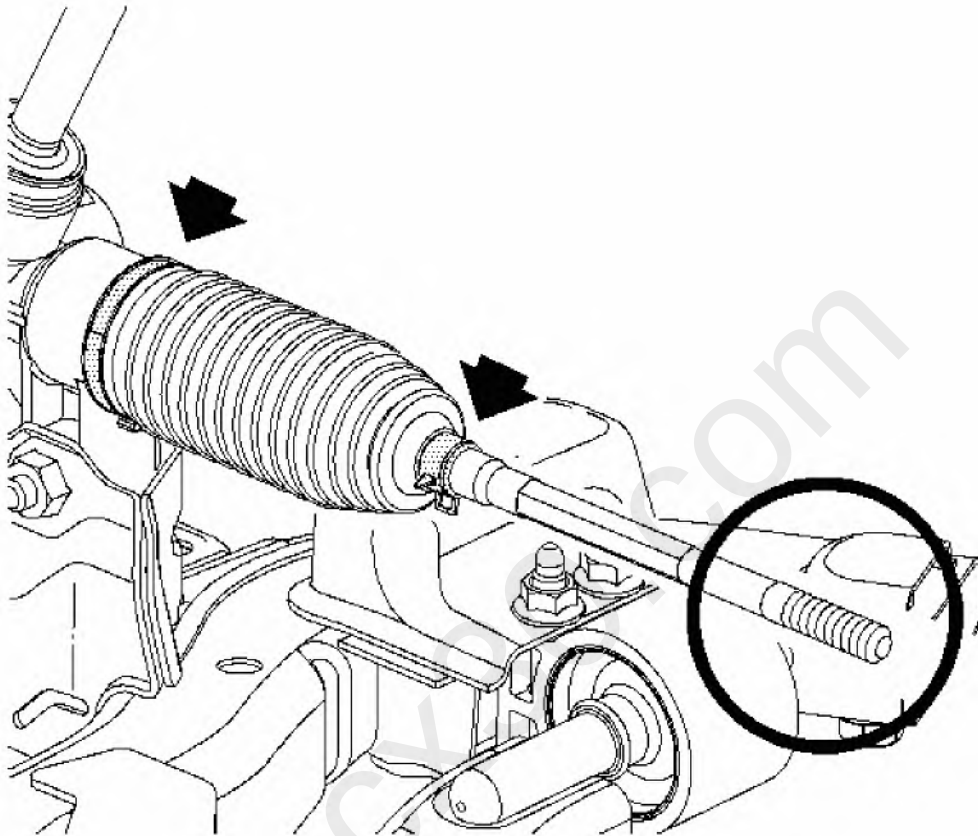


Fig. 11: Spring, Boot, Outer End & Steering Gear
Courtesy of GENERAL MOTORS CORP.

5. Remove the spring from the boot, outer end.
6. Cut and remove the crimp clamp, inner end. Discard the clamp.
7. Unseat the boot from the steering gear and remove.

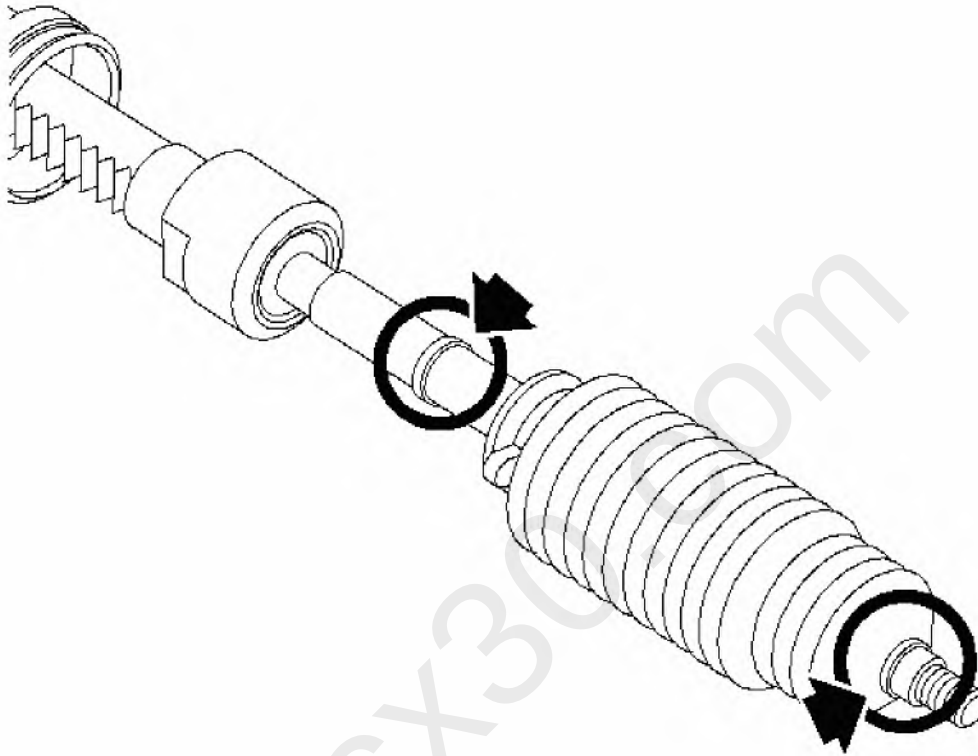


Fig. 12: Inner Tie Rod & Boot
Courtesy of GENERAL MOTORS CORP.

8. Clean the inner tie rod and boot contact area of grease and debris.

Installation Procedure

IMPORTANT: The inner tie rod must be free of debris and moisture. The boot sealing areas must be clean and dry.

1. Apply approximately 3/4 of the supplied grease packet into the small end of the boot cavity. Apply the remainder of the grease on the shaft where the small end of the boot meets the shaft.

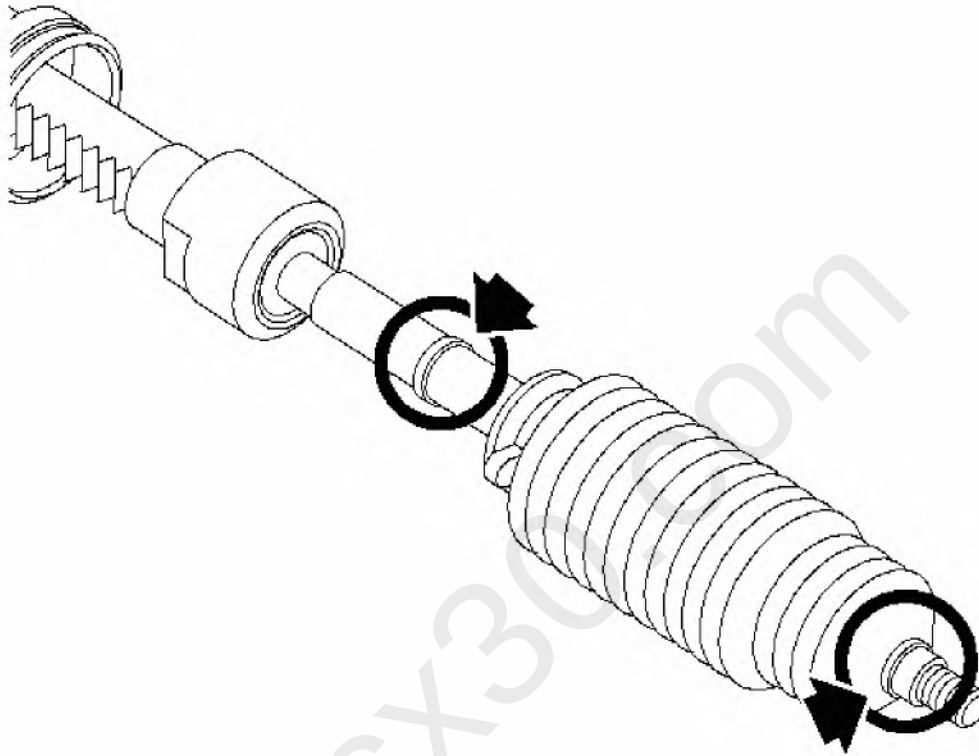


Fig. 13: Inner Tie Rod & Boot
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the large end of the boot is firmly seated in the gear housing groove.

2. Install the boot with the large clamp loosely attached, not crimped.

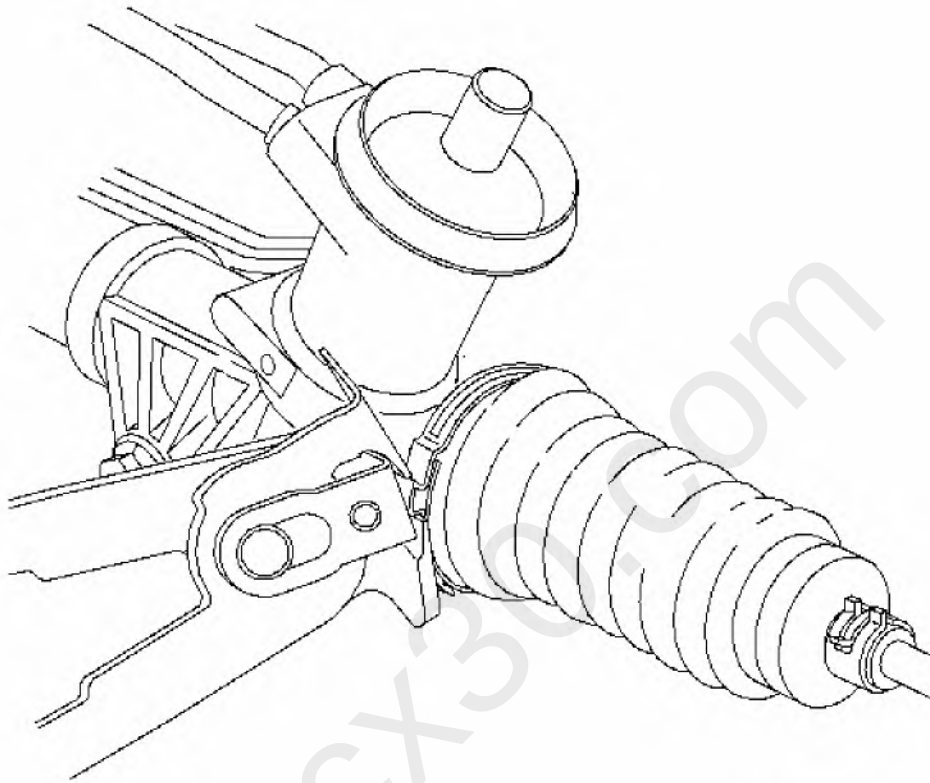


Fig. 14: Attaching Steering Gear Boot Clamp On Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 22610** , crimp the large clamp. See **Special Tools**.

IMPORTANT: Ensure the small end of the boot is firmly seated in the inner tie rod end groove.

4. Install the spring clamp to the small end of the boot.

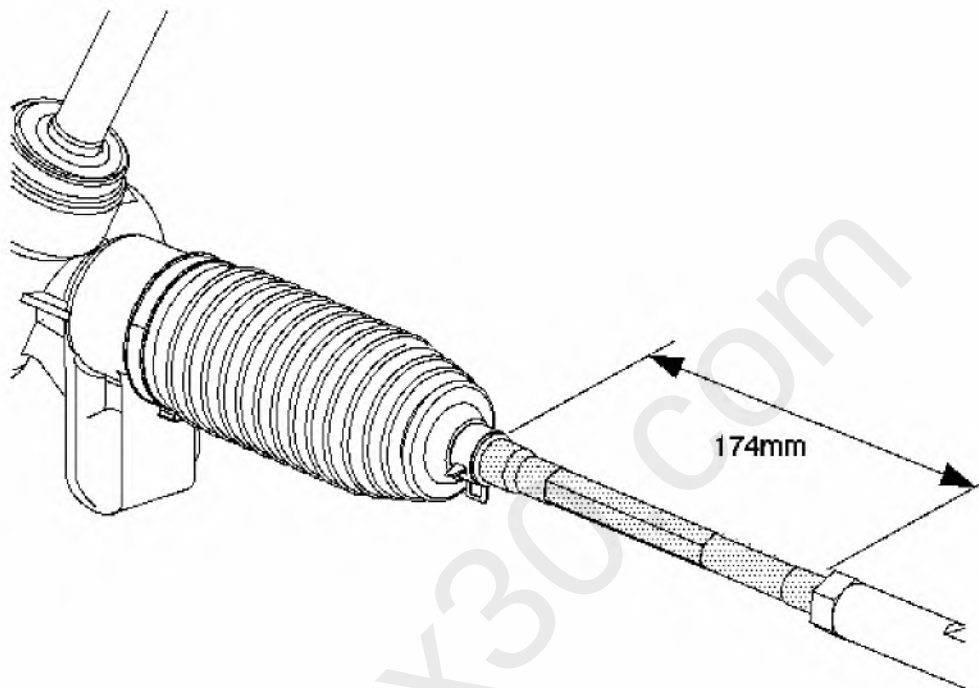


Fig. 15: Jam Nut & Boot Clamp
Courtesy of GENERAL MOTORS CORP.

5. Install the jam nut approximately 174 mm (6.85 in) from the boot clamp.

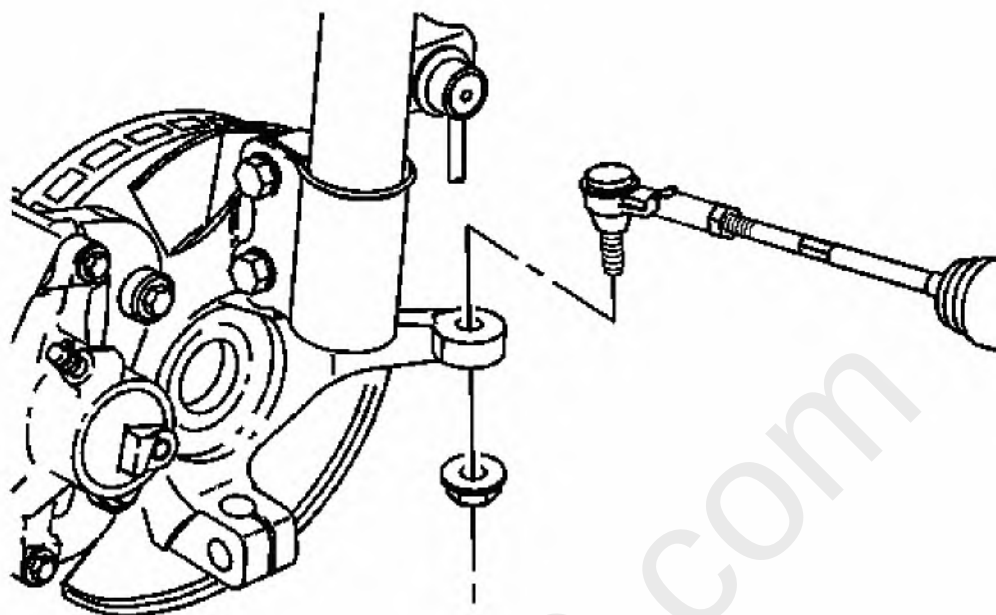


Fig. 16: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

6. Install the outer tie rod. Refer to **Rack and Pinion Outer Tie Rod End Replacement**.
7. Install the tire assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Check the front wheel alignment and align as necessary. Refer to **Measuring Wheel Alignment** in Wheel Alignment.

POWER STEERING GEAR REPLACEMENT

Tools Required

J 24319-B Steering Linkage and Tie Rod Puller

Removal Procedure

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

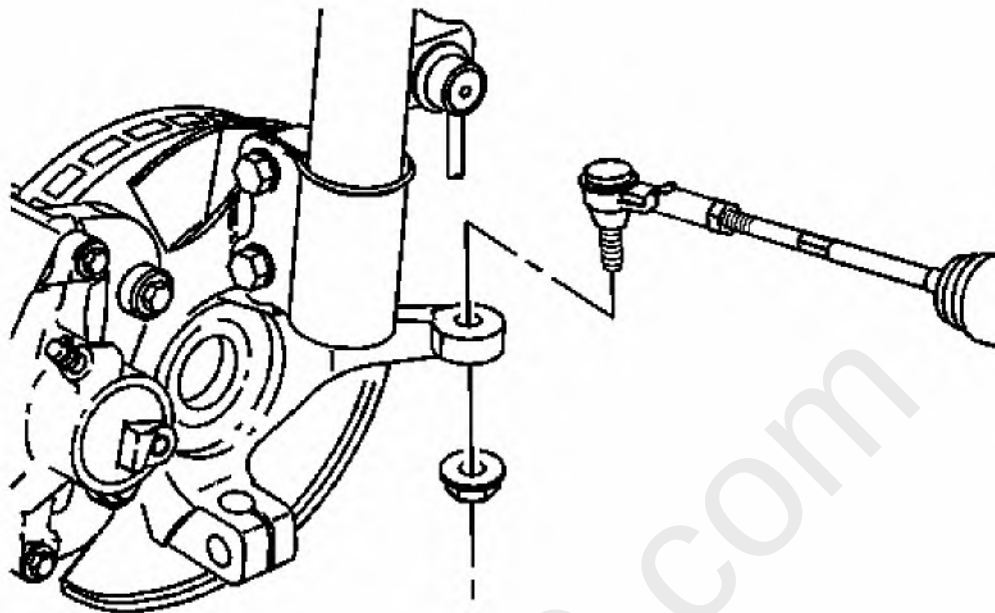


Fig. 17: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

3. Remove both outer tie rod to steering knuckle nuts. Discard the nuts.

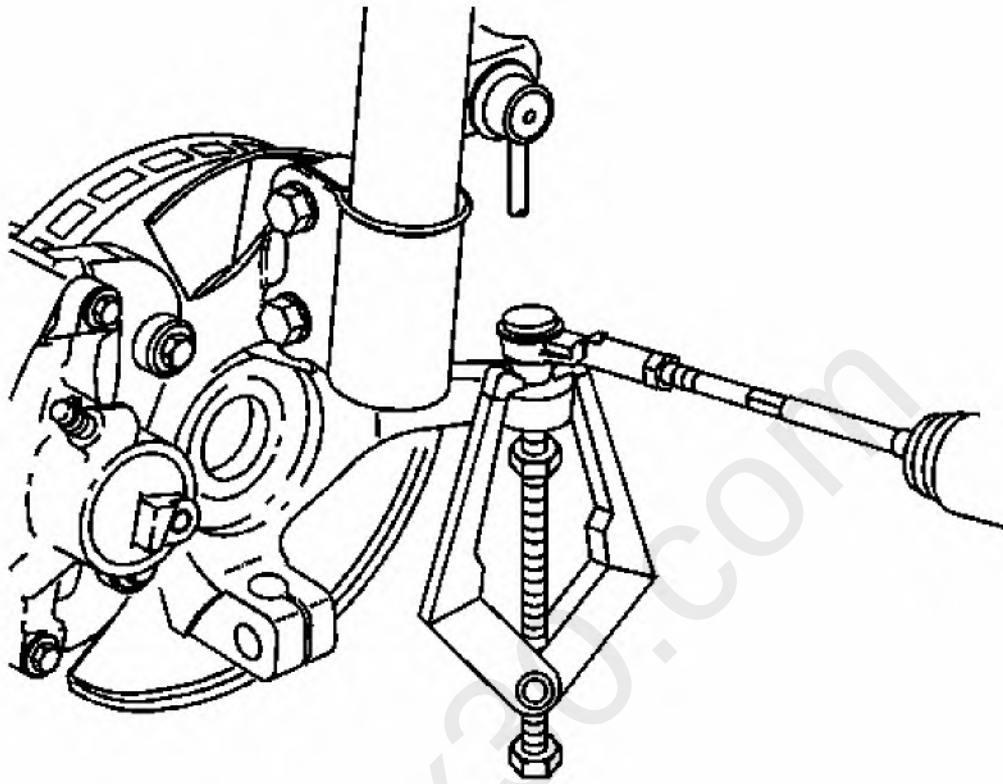


Fig. 18: Separating Outer Tie Rod End From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not free the ball stud by using a pickle fork or a wedge-type tool. Damage to the seal or bushing may result.

IMPORTANT: Hold the ball stud to prevent turning during removal of the nut.

4. Using the **J 24319-B** , separate the tie rods from the steering knuckles.

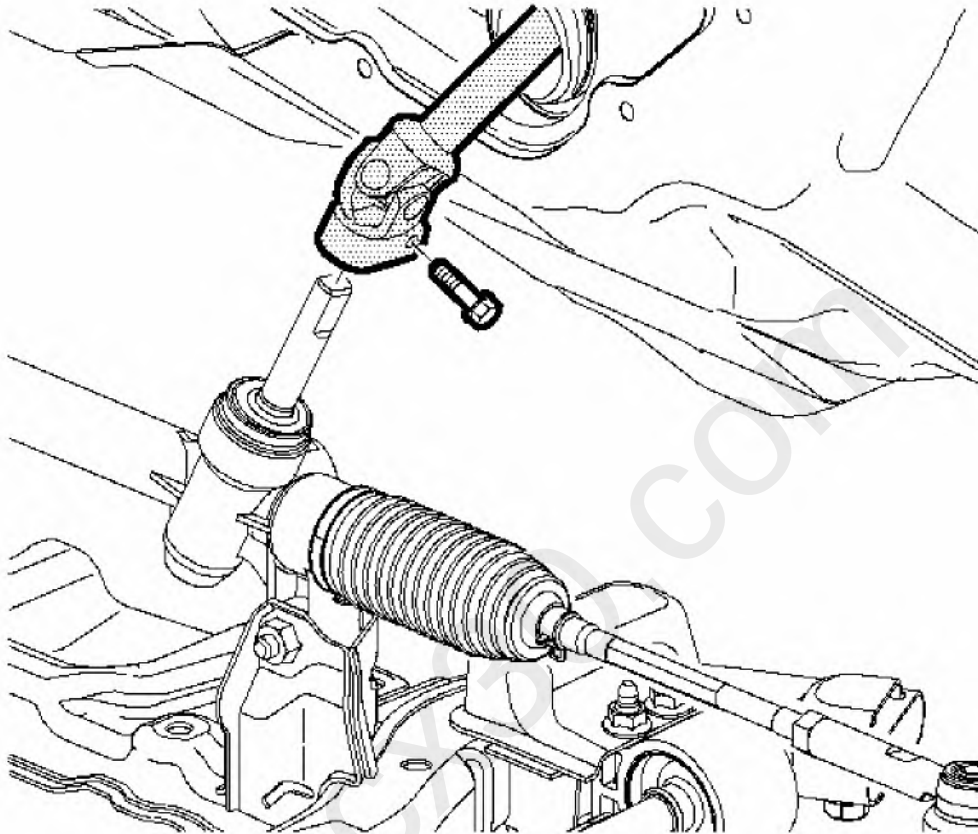


Fig. 19: Removing/Installing Steering Shaft To Intermediate Shaft
Courtesy of GENERAL MOTORS CORP.

5. Rotate the intermediate steering shaft in order to gain access to the intermediate shaft pinch bolt.
6. Remove the intermediate to steering gear pinch bolt. Discard the bolt.
7. Disconnect the intermediate shaft from the steering gear.

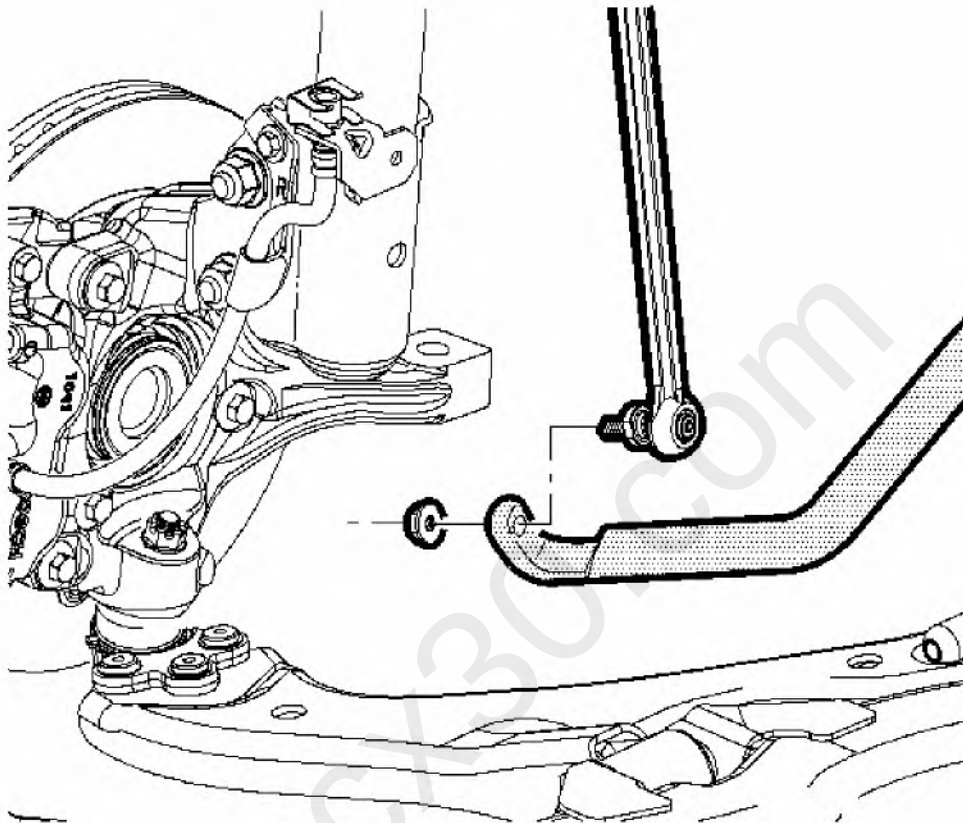


Fig. 20: View Of Stabilizer Shaft & Link
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the stabilizer links from the stabilizer bar. Refer to **Stabilizer Shaft Link Replacement** in Front Suspension.

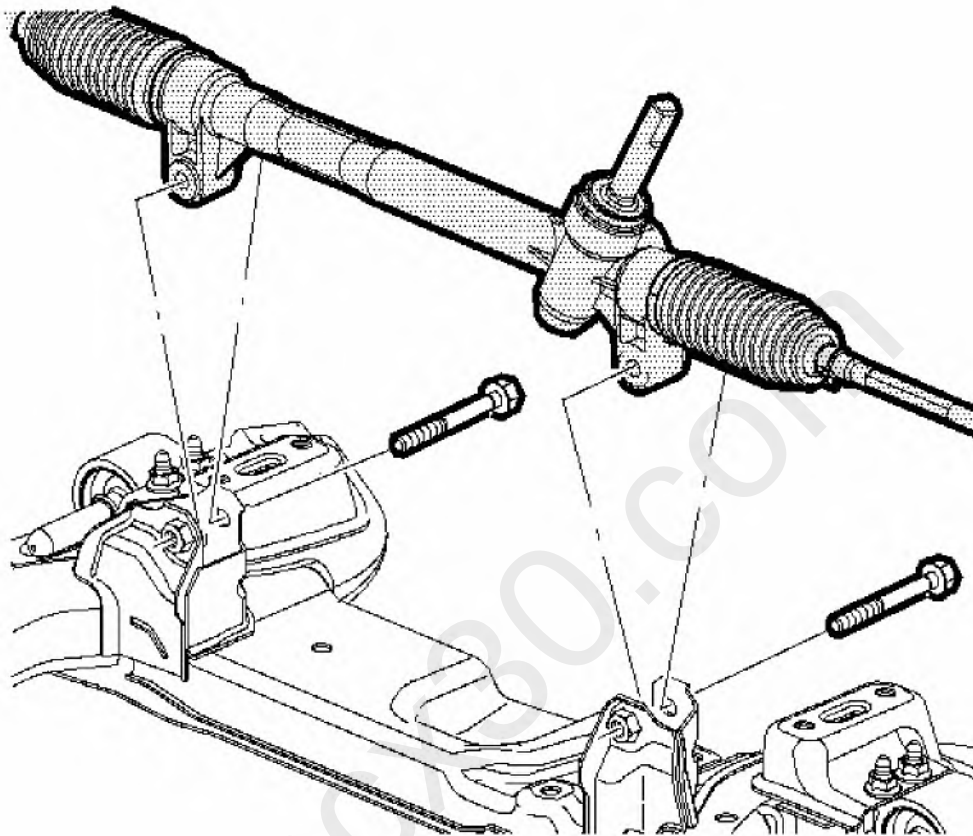


Fig. 21: View Of Steering Gear & Steering Gear-To-Frame Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the steering gear to cradle mounting bolts.
10. Remove the steering gear through the right side of the vehicle.
11. With heat shield equipped steering gears, remove the heat shield. Save for installation.

Installation Procedure

1. If applicable, install the heat shield.

IMPORTANT: Ensure the stabilizer is swung in the upmost position for gear clearance.

2. Install the steering gear from the right side of the vehicle.

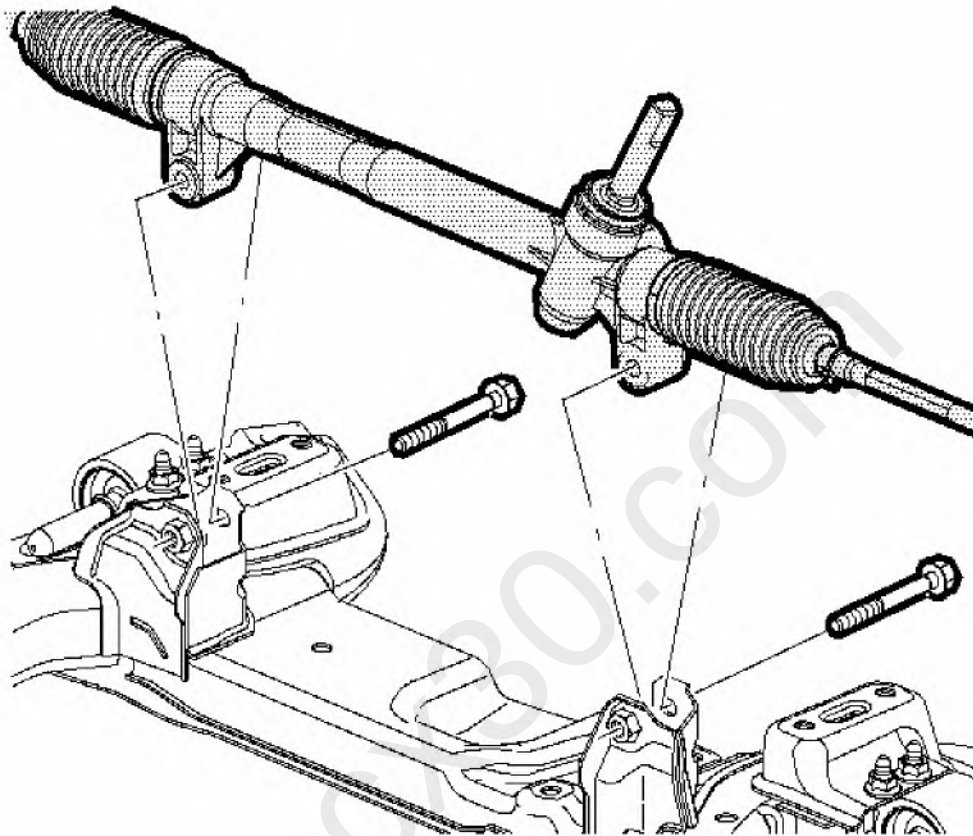


Fig. 22: View Of Steering Gear & Steering Gear-To-Frame Bolts
Courtesy of GENERAL MOTORS CORP.

3. Center the gear mounting bushings into the cradle supports.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Hand start both steering gear to cradle mounting bolts.

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

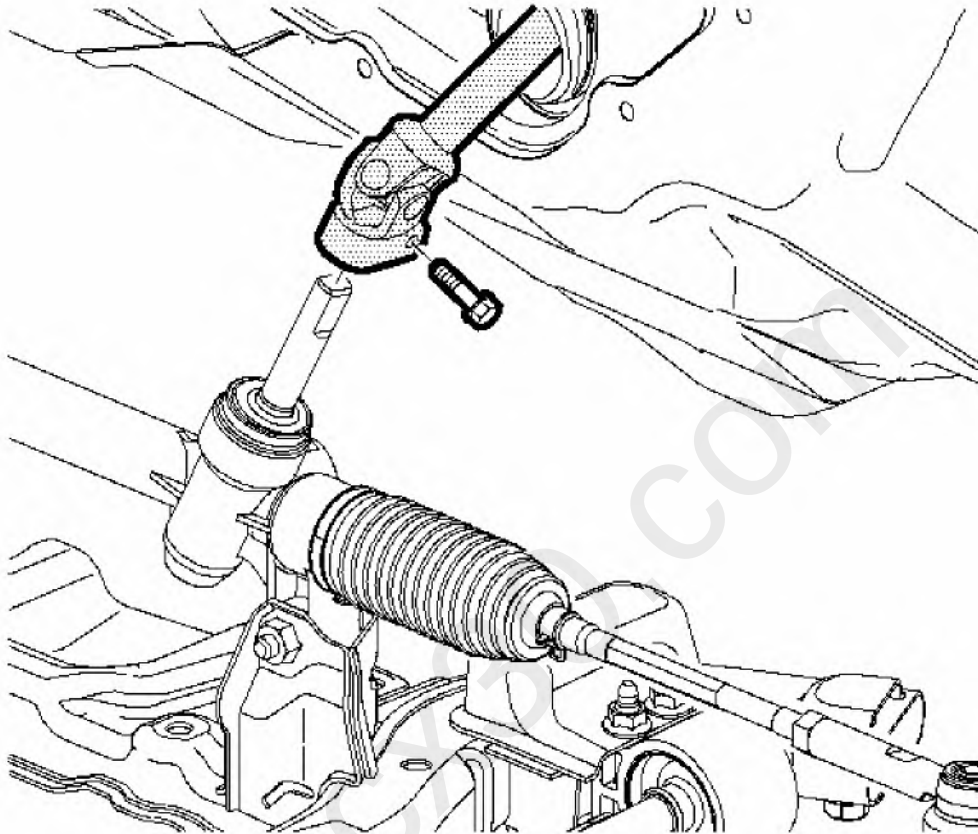


Fig. 23: Removing/Installing Steering Shaft To Intermediate Shaft
Courtesy of GENERAL MOTORS CORP.

5. Connect the intermediate shaft to the steering gear and install a new pinch bolt.

Tighten: Tighten the intermediate pinch bolt to 34 N.m (25 lb ft).

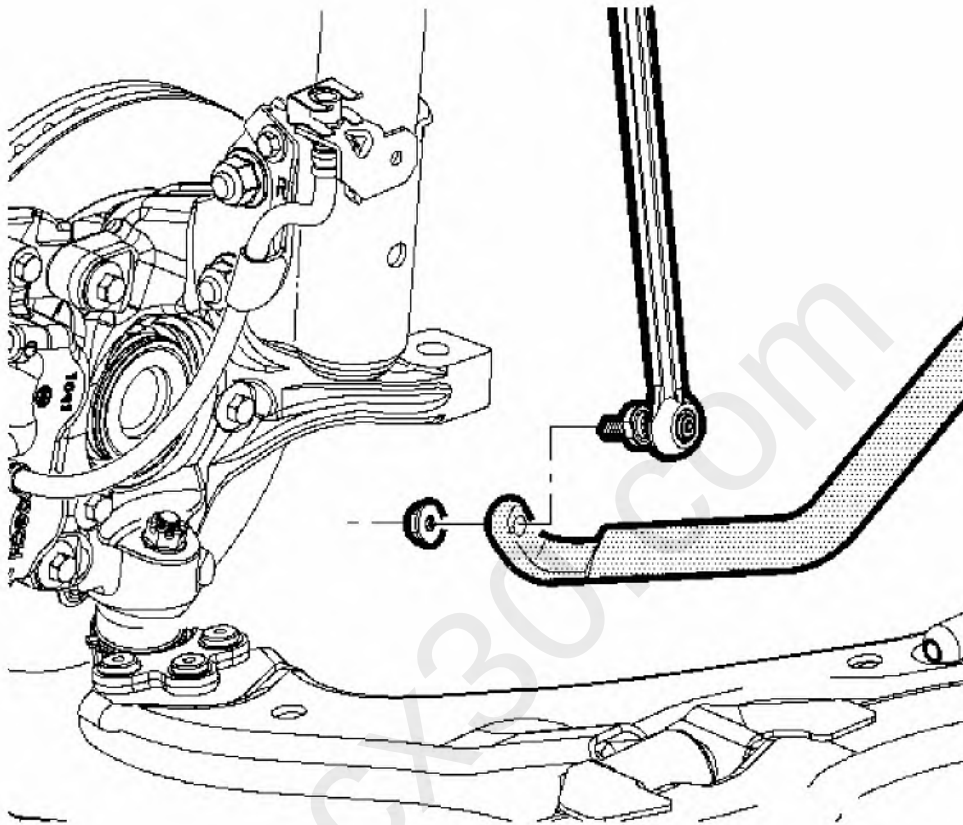


Fig. 24: View Of Stabilizer Shaft & Link
Courtesy of GENERAL MOTORS CORP.

6. Connect the stabilizer links to the stabilizer bar. Refer to **Stabilizer Shaft Link Replacement** in Front Suspension.

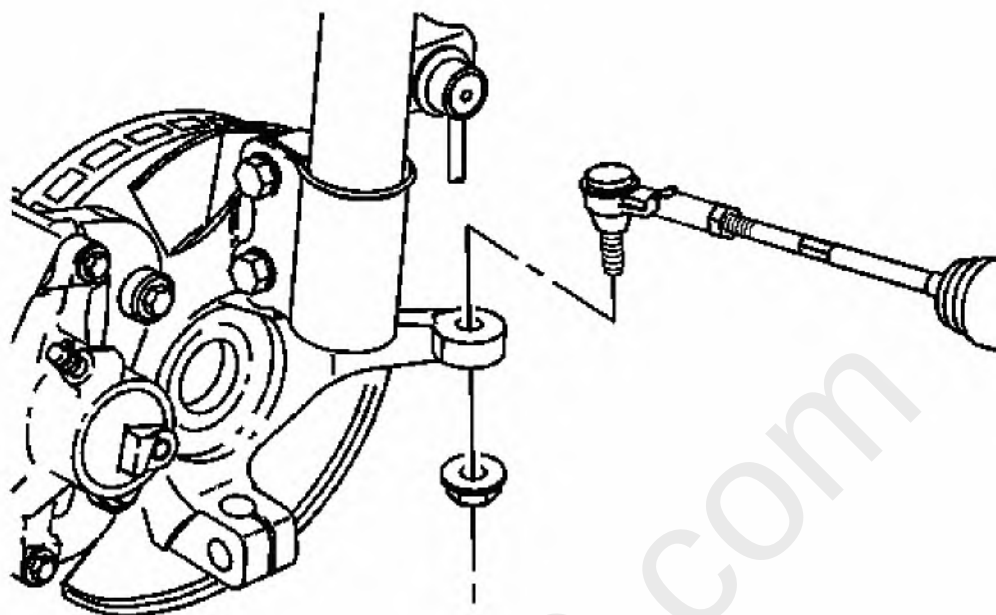


Fig. 25: View Of Tie Rod End To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the ball stud to prevent turning during installation of the nut.

7. Connect the tie rod to the knuckle and install a new nut.

Tighten: Tighten the nut to 60 N.m (44 lb ft).

8. Install the front tires and wheels. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
9. Check the front wheel alignment and align as necessary. Refer to **Measuring Wheel Alignment** in Wheel Alignment.
10. Lower the vehicle.

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM DESCRIPTION AND OPERATION

The electric power steering (EPS) system reduces the amount of effort needed to steer the vehicle. The system uses the body control module (BCM), power steering control module (PSCM), torque sensor, discrete battery voltage supply circuit, EPS motor, serial data bus,

and the instrument panel cluster (IPC) message center to perform the system functions. The PSCM, torque sensor, nor the EPS motor are serviced separately from each other or from the steering column. Ant EPS components diagnosed to be malfunctioning requires replacement of the steering column assembly, also known as the EPS assembly.

Torque Sensor

The PSCM uses a torque sensor as it's main input for determining the amount of steering assists. The steering column has an input shaft, from the steering wheel to the torque sensor, and an output shaft, from the torque sensor to the steering shaft coupler. The input and output shafts are separated by a torsion bar, where the torque sensor is located. The sensor consists of a compensation coil, detecting coil, and 3 detecting rings. These detecting rings have toothed edges that face each other. Detecting ring 1 is fixed to the output shaft, detecting rings 2 and 3 are fixed to the input shaft. The detecting coil is positioned around the toothed edges of detecting rings 1 and 2. As torque is applied to the steering column shaft the alignment of the teeth between detecting rings 1 and 2 changes, which causes the detecting coil signal voltage to change. The PSCM recognizes this change in signal voltage as steering column shaft torque. The compensation coil is used to compensate for changes in electrical circuit impedance due to circuit temperature changes from electrical current and voltage levels as well as ambient temperatures for accurate torque detection.

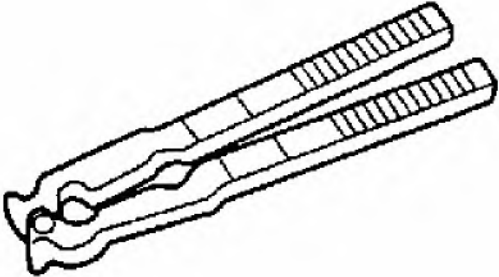
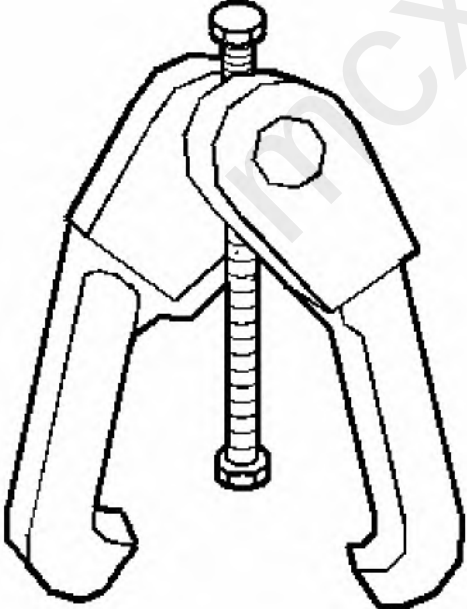
EPS Motor

The EPS motor is a 12 volt brushed DC reversible motor with a 65 amp rating. The motor assists steering through a worm shaft and reduction gear located in the steering column housing.

Power Steering Control Module (PSCM)

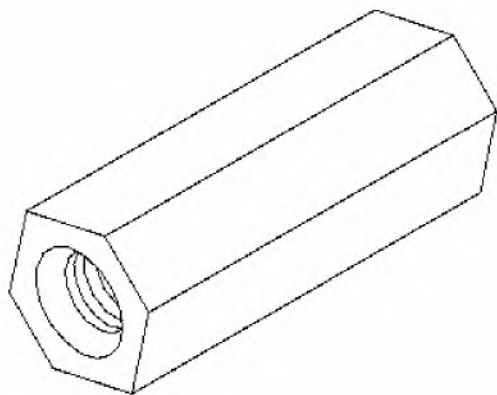
The PSCM uses a combination of torque sensor inputs, vehicle speed, calculated system temperature and the steering calibration to determine the amount of steering assist. When the steering wheel is turned, the PSCM uses signal voltage from the torque sensor to detect the amount of torque being applied to the steering column shaft and the amount of current to command to the EPS motor. The PSCM receives serial data from the engine control module (ECM) to determine vehicle speed. At low speeds more assist is provided for easy turning during parking maneuvers. At high speeds, less assist is provided for improved road feel and directional stability. The PSCM nor the EPS motor are designed to handle 65 amps continuously. The PSCM will go into overload protection mode to avoid system thermal damage. In this mode the PSCM will limit the amount of current commanded to the EPS motor which reduces steering assist levels. The PSCM also chooses which steering calibration to use when the ignition is turned ON, based on the VIN. The PSCM contains all 8 of the steering calibrations which are different in relation to the vehicles RPO's. The PSCM has the ability to detect malfunctions within the EPS system. Any malfunction detected will cause the IPC message center to display the PWR STR (or Power Steering) warning message.

SPECIAL TOOLS AND EQUIPMENT**SPECIAL TOOLS****Special Tools**

Illustration	Tool Number/ Description
	J 22610 Keystone Clamp Pliers
	J 24319-B Steering Linkage and Tie Rod Puller

2006 Chevrolet Equinox LT

2006 STEERING Power Steering System - Equinox & Torrent



J 44015
Steering Linkage Installer

mcx30.com