

STEERING

Power Steering - Corvette

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Steering Gear Bolt	125 N.m	92 lb ft
Steering Linkage Inner Tie Rod	100 N.m	74 lb ft
Steering Linkage Inner Tie Rod Nut	75 N.m	55 lb ft
Steering Linkage Outer Tie Rod		
• First Pass	30 N.m	26 lb ft
• Final Pass	120 Degrees	

SCHEMATIC WIRING DIAGRAMS

POWER STEERING SYSTEM WIRING SCHEMATICS

Electric Power Steering Wiring Schematics

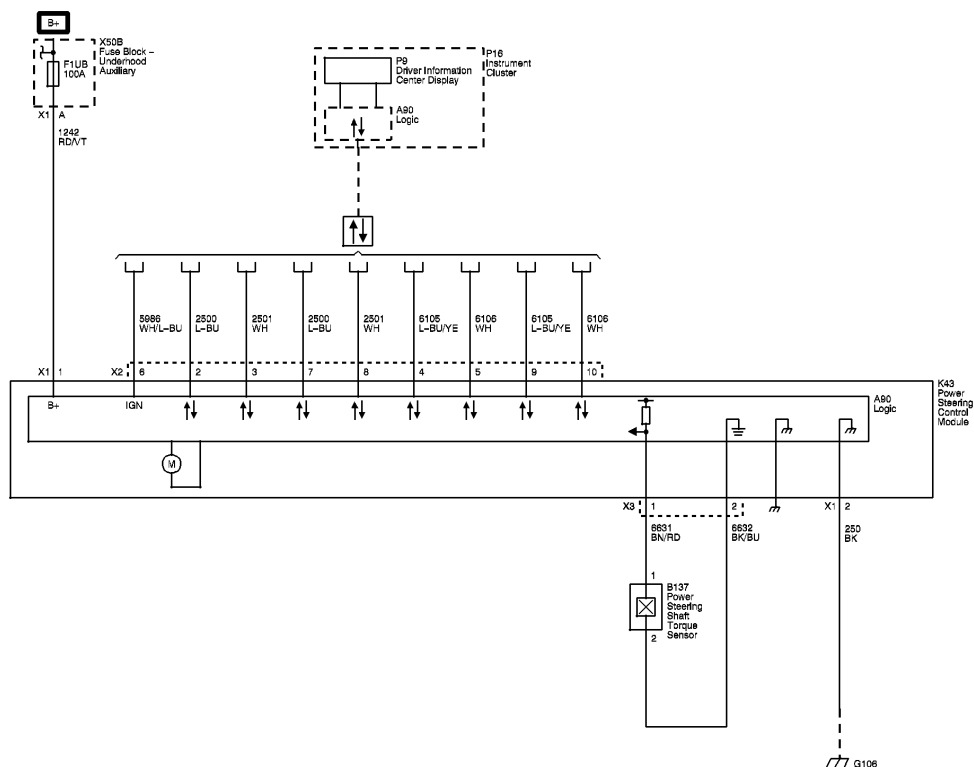


Fig. 1: Electric Power Steering Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC C0176</u>	DTC C0176 11 Control Module Temperature Sensor High Input DTC C0176 54 Control Module Temperature Sensor High Temperature
<u>DTC C0475</u>	DTC C0475 00 Electric Steering Motor Circuit Malfunction
<u>DTC C047A</u>	DTC C047A 00 Electric Steering Motor Position Sensor Circuit Malfunction. DTC C047A 5A Electric Steering Motor Position Sensor Circuit Not Plausible
<u>DTC C0544</u>	DTC C0544 5A Steering Wheel Angle Sensor Signal Not Plausible

<u>DTC C0545</u>	Malfunction. DTC C0545 3A Steering Wheel Torque Sensor Incorrect Component Installed DTC C0545 4B Steering Wheel Torque Sensor Calibration Not Learned.
<u>DTC C0546</u>	DTC C0546 39 Steering System Temperature Sensor Circuit Internal Malfunction
<u>DTC C055C</u>	DTC C055C 00 Steering Gear Performance Malfunction
<u>DTC C0565</u>	DTC C0565 5A Vehicle Identification Number Not Plausible
<u>DTC C056D</u>	DTC C056D 34 Electronic Control Unit Hardware RAM Malfunction DTC C056D 35 Electronic Control Unit Hardware ROM Malfunction DTC C056D 36 Electronic Control Unit Hardware EEPROM Performance/Malfunction DTC C056D 37 Electronic Control Unit Hardware Software Malfunction DTC C056D 39 Electronic Control Unit Hardware Internal Malfunction DTC C056D 3B Electronic Control Unit Hardware Internal Self - Test Malfunction
<u>DTC C056E</u>	DTC C056E 36 Electronic Control Unit Software EEPROM Performance/Malfunction DTC C056E 42 Electronic Control Unit Software Configuration Not Programmed DTC C056E 46 Electronic Control Unit Software Calibration Not Learned

DTC C0176: CONTROL MODULE TEMPERATURE SENSOR

Diagnostic Instructions

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

DTC Descriptor

DTC C0176 11

Control Module Temperature Sensor High Input

DTC C0176 54

Control Module Temperature Sensor High Temperature

Circuit/System Description

The power steering control module monitors the temperature of the power steering system. The power steering control module uses voltage, current levels and input from an internal temperature sensor to calculate an estimated system temperature. If the power steering control module detects a high system temperature event is occurring, the amount of assist is decreased to reduce system temperature, in effort to prevent thermal damage to the power steering components.

Conditions for Running the DTC

- Ignition ON, engine running.
- Power steering system voltage is 9-16 V.
- Repetitive steering input applied.

Conditions for Setting the DTC

The power steering control module detects a high system temperature.

Action Taken When the DTC Sets

- DTC C0176 54 is stored in memory.
- Steering assist is reduced.

Conditions for Clearing the DTC

A current DTC will clear on the next malfunction-free ignition cycle.

Diagnostic Aids

- DTC C0176 54 does not indicate that a malfunction has occurred. Rather that the power steering control module had to limit current to the power steering motor to avoid thermal damage to the power steering system components. Discuss with the customer about driving conditions when the steering assist was reduced.
- Ensure that no steering components down stream of the power steering column assembly, such as ball joints, tie rod ends, universal joints or the steering gear assembly, are mechanically binding.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Verify that the DTC sets outside of the conditions for running and setting. Since most occurrences of this DTC are caused by excessive driver inputs, review with the customer the conditions under which the DTC set. Operate the vehicle within the conditions that the customer experienced, avoiding excessive inputs and verify the DTC does not reset.
 - **If the DTC did not set outside of the conditions for running and setting**
 1. Ignition ON.
 2. Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to **Steering Effort Hard or Too Easy in One or Both Directions**
 - If steering components are mechanically binding, replace the mechanically binding steering components.
 - If no steering components are mechanically binding
 3. Replace the Steering Gear.
 - **If the DTC set outside of the conditions for running and setting**
2. All OK. The power steering is operating as designed.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C0475: ELECTRIC STEERING MOTOR

Diagnostic Instructions

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

DTC Descriptors

DTC C0475 00

Electric Steering Motor Circuit Malfunction

Circuit/System Description

The power steering control module continuously monitors the voltage and current levels being commanded to the 3-phase steering assist motor. The power steering control module compares the desired and actual current levels to detect malfunctions in the internal power steering assist motor circuits.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The power steering control module detects a short to ground, short to voltage or an open/high resistance on any of the internal power steering assist motor circuits.

Action Taken When the DTC Sets

- The DTC is stored in memory.
- No steering assist.

Conditions for Clearing the DTC

A history DTC will clear after 40 consecutive malfunction free ignition cycles.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. Verify that DTC C0475 is not set.

- **If the DTC is set**

Replace the K43 Power Steering Control Module.

- **If the DTC is not set**

2. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR

Diagnostic Instructions

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

DTC Descriptor

DTC C047A 00

Electric Steering Motor Position Sensor Circuit Malfunction.

DTC C047A 5A

Electric Steering Motor Position Sensor Circuit Not Plausible

Circuit/System Description

The power steering control module continuously monitors the motor position sensor voltage signals. The voltage signals of the motor position sensor and the digital torque sensor index current signal are both processed by the power steering control module to detect and calculate the steering wheel angle.

Conditions for Running the DTC

- Ignition ON.
- The steering wheel has been rotated greater than 15°.

Conditions for Setting the DTC

C047A 00

The power steering control module detects a short to ground, short to voltage or an open/high resistance on any of the internal motor position sensor circuits.

C047A 5A

The calculated difference between the internal steering angle and the external steering angle is out of the specified range.

Action Taken When the DTC Sets

- No steering assist.
- A Service Power Steering Drive with Care message may be displayed on the driver information center.

Conditions for Clearing the DTC

A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Diagnostic Aids

Verify the torque sensor harness is properly routed and connected.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC U0125, U0126 or C0710 is not set.
 - **If any of the DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If none of the DTCs are set**
3. Verify that DTC C047A is not set.
 - **If the DTC is set**

Replace the Steering Gear.

- **If the DTC is not set**
4. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and

DTC C0544: STEERING WHEEL ANGLE SENSOR

Diagnostic Instructions

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

DTC Descriptor

DTC C0544 5A

Steering Wheel Angle Sensor Signal Not Plausible

Circuit/System Description

The power steering control module continuously monitors the steering wheel angle sensor. The steering wheel angle sensor indicates the direction in which the driver intends to go.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The power steering control module detects a not plausible signal from the steering wheel angle sensor.

Action Taken When the DTC Sets

- DTC C0544 is stored in memory.
- No steering assist.

Conditions for Clearing the DTC

A history DTC will clear after 40 consecutive malfunction free ignition cycles.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify that no other DTCs are set except for C0544.
 - **If any other DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**

- **If no other DTCs are set**
3. Verify that DTC C0544 is not set.
 - **If the DTC is set**
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the B99 Steering Wheel Angle Sensor.
 - If the DTC does not set
 - 3. All OK.
 - **If the DTC is not set**
 4. All OK.

Repair Instructions

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

- **Steering Angle Sensor Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C0545: STEERING WHEEL TORQUE SENSOR

Diagnostic Instructions

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

DTC Descriptor

DTC C0545 00

Steering Wheel Torque Sensor Malfunction.

DTC C0545 3A

Steering Wheel Torque Sensor Incorrect Component Installed

DTC C0545 4B

Steering Wheel Torque Sensor Calibration Not Learned.

Circuit/System Description

The power steering control module continuously monitors the digital torque sensor's torque. As the steering wheel is turned and torsional twist is applied to the steering shaft, the steering input and output shafts are monitored via the torque signal circuit and then processed by the power steering control module to calculate the steering torque.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The power steering control module detects a short to ground, short to voltage or an open/high resistance on any of the torque sensor circuits.

Action Taken When the DTC Sets

- DTC C0545 is stored in memory.
- No steering assist.

Conditions for Clearing the DTC

A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

DTC C0545 00 and C0545 3A

1. Verify that the X3 harness connector is installed properly at the K43 Power Steering Control Module.
 - **If the X3 harness connector at the K43 Power Steering Control Module is not installed properly**
 1. Connect the X3 harness connector properly at the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the Steering Gear.
 - If the DTC does not set
 3. All OK.
 - **If the X3 harness connector at the K43 Power Steering Control Module is installed properly**
2. Ignition ON.
3. Verify the scan tool Torque Sensor parameter changes when turning the steering wheel.
 - **If the parameter does not change**

Replace the Steering Gear.

- If the parameter changes

4. All OK.

DTC C0545 4B

1. Ignition ON.
2. Verify the scan tool Torque Sensor parameter changes when turning the steering wheel.
 - If the parameter does not change
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the Steering Gear.
 - If the DTC does not set
 3. All OK.
 - If the parameter changes
3. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR

Diagnostic Instructions

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

DTC Descriptor

DTC C0546 39

Steering System Temperature Sensor Circuit Internal Malfunction

Circuit/System Description

The power steering control module monitors the temperature of the power steering system. The power steering control module uses voltage, current levels and input from an internal temperature sensor to calculate an estimated system temperature. If the power steering control module detects a high system temperature event is occurring the amount of assist is decreased to reduce system

temperature, in effort to prevent thermal damage to the power steering components.

Conditions for Running the DTC

- Ignition ON, engine running.
- Power steering system voltage is 9-16 V.
- Repetitive steering input applied.

Conditions for Setting the DTC

The power steering control module detects a high system temperature.

Action Taken When the DTC Sets

- DTC C0546 39 is stored in memory.
- Steering assist is reduced.

Conditions for Clearing the DTC

A current DTC will clear on the next malfunction-free ignition cycle.

Diagnostic Aids

Ensure that no steering components down stream of the power steering column assembly, such as ball joints, tie rod ends, universal joints or the steering gear assembly, are mechanically binding.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify DTC C0546 is not set.
 - **If DTC C0546 is set**
 1. Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to **Steering Effort Hard or Too Easy in One or Both Directions**
 - If steering components are mechanically binding, replace the mechanically binding steering components.
 - If no steering components are mechanically binding
 2. Replace the Steering Gear.
 - **If DTC C0546 is not set**
3. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION

Diagnostic Instructions

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

DTC Descriptor

DTC C055C 00

Steering Gear Performance Malfunction

Circuit/System Description

The power steering control module continuously verifies the mechanical friction of the steering gear. If

valid.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The DTC is set when the mechanical friction of the steering gear is too high.

Action Taken When the DTC Sets

- DTC C055C is stored in memory.
- No steering assist.

Conditions for Clearing the DTC

A history DTC will clear after 40 consecutive malfunction free ignition cycles.

Diagnostic Aids

Ensure that no steering components down stream of the power steering column assembly, such as ball joints, tie rod ends, universal joints or the steering gear assembly, are mechanically binding.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C055C is not set.
 - **If the DTC is set**
 - 1. Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to **Steering Effort Hard or Too Easy in One or Both Directions**
 - If steering components are mechanically binding, replace the mechanically binding steering components.
 - If no steering components are mechanically binding, replace the Steering Gear.
 - **If the DTC is not set**
3. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE

Diagnostic Instructions

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

DTC Descriptor

DTC C0565 5A

Vehicle Identification Number Not Plausible

Circuit/System Description

The vehicle identification number (VIN) is programmed into the power steering control module during initial programming of the module.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The power steering control module is properly not programmed.

Action Taken When the DTC Sets

- DTC C0565 is stored in memory.
- No steering assist.

Conditions for Clearing the DTC

A history DTC will clear after 40 consecutive malfunction free ignition cycles.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C0565 is not set.
 - **If the DTC C0565 is set**

2. Verify the DTC does not set.
 - If the DTC sets, replace the Steering Gear.
 - If the DTC does not set
3. All OK.
 - **If the DTC C0565 is not set**
3. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C056D: ELECTRONIC CONTROL UNIT HARDWARE MALFUNCTION

Diagnostic Instructions

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

DTC Descriptors

DTC C056D 34

Electronic Control Unit Hardware RAM Malfunction

DTC C056D 35

Electronic Control Unit Hardware ROM Malfunction

DTC C056D 36

Electronic Control Unit Hardware EEPROM Performance/Malfunction

DTC C056D 37

Electronic Control Unit Hardware Software Malfunction

DTC C056D 39

Electronic Control Unit Hardware Internal Malfunction

DTC C056D 3B

Electronic Control Unit Hardware Internal Self - Test Malfunction

Circuit/System Description

The power steering control module continuously monitors the voltage and current levels being commanded to the 3-phase steering assist motor. The power steering control module compares the desired and actual current levels to detect malfunctions in the internal power steering assist motor circuits.

Conditions for Running the DTC

Ignition OFF, ACCESSORY or RUN mode.

Conditions for Setting the DTC

The power steering control module has detected missing calibration data, calibration procedure not run or completed, missing VIN or internal software malfunction.

Actions Taken When DTC Sets

- DTC is stored in memory.
- Steering assist is set to a default level.

Conditions for Clearing the DTC

A current or history DTC will clear after the power steering control module has been programmed and calibrated.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

- **Circuit Testing**

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C056D is not set.
 - **If the DTC C056D is set**
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the Steering Gear.
 - If the DTC does not set
 3. All OK.
 - **If the DTC C056D is not set**
3. All OK.

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE MALFUNCTION

Diagnostic Instructions

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

DTC Descriptors

DTC C056E 36

Electronic Control Unit Software EEPROM Performance/Malfunction

Electronic Control Unit Software Configuration Not Programmed

DTC C056E 46

Electronic Control Unit Software Calibration Not Learned

Circuit/System Description

After replacement of the power steering control module, the power steering control module must be configured with the proper tuning profile using the service programming system (SPS).

After replacement of the power steering control module, power steering motor or steering gear, the steering position/torque sensor calibration procedure must be performed.

Conditions for Running the DTC

Ignition OFF, ACCESSORY or RUN mode.

Conditions for Setting the DTC

The power steering control module has detected missing calibration data, calibration procedure not run or completed, missing VIN or internal software malfunction.

Actions Taken When DTC Sets

- DTC is stored in memory.
- Steering assist is set to a default level.

Conditions for Clearing the DTC

A current or history DTC will clear after the power steering control module has been programmed and calibrated.

Reference Information

Schematic Reference

Power Steering Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Steering System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C056E is not set.
 - **If the DTC C056E is set**
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the Steering Gear.
 - If the DTC does not set
 - 3. All OK.
3. All OK.
 - **If the DTC C056E is not set**

Repair Instructions

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

- **Electric Belt Drive Rack and Pinion Steering Gear Replacement**
- **Control Module References** for power steering control module replacement, programming and setup.

SYMPTOMS - POWER STEERING SYSTEM

NOTE: 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.

Symptoms List

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**
- **Whine or Growl Noise from the Power Steering System**
- **Poor Return of Steering Wheel**
- **Steering Wheel Surges/Jerks While Turning**
- **Steering Effort Hard or Too Easy in One or Both Directions**

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 Description and Operation and perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Steering Wheel and Column</u>
2	Verify a rattle noise is present by driving the vehicle on a rough road. Verify a clunk noise is present by turning the steering wheel to the left and to the right several times with the key in the ON position. Is a rattle or a clunk noise present?	Go to Step 3	System OK
3	Inspect the steering gear for the proper installation. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> . Is the steering gear installation incorrect?	Go to Step 6	Go to Step 4
4	Inspect the intermediate steering shaft. Is the intermediate steering shaft worn?	Go to Step 8	Go to Step 5
5	Inspect the front suspension. Refer to <u>Noise Diagnosis - Front Suspension</u> . Is the front suspension worn?	Go to Step 7	Go to Step 3
6	Install the steering gear correctly. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> . Did you complete the repair?	Go to Step 9	-
7	Replace the worn front suspension component that is causing the noise. Did you complete the repair?	Go to Step 9	-
8	Replace the intermediate steering shaft. Refer to <u>Intermediate Steering Shaft Replacement</u> . 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

WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM

Whine or Growl Noise from the Power Steering System

Step	Action	Yes	No
Special Tools CH-39570 Chassis Ear For equivalent regional tools, refer to Special Tools .			
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Power Steering System
2	Verify that a whine or growl noise is present. Is a whine or growl noise is present?	Go to Step 3	System OK
3	Perform the Diagnostic System Check - Vehicle. Refer to Diagnostic System Check - Vehicle . Are any codes present?	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 4
4	Inspect the power steering gear fasteners for looseness. Is the steering gear loose?	Go to Step 11	Go to Step 5
5	Verify that steering column front of dash seal is in position. Is the steering column front of dash seal damaged or out of position?	Go to Step 12	Go to Step 6
6	Inspect the power steering gear motor for a whine or growl noise using the CH-39570 chassis ear. Is the noise present at the power steering motor?	Go to Step 15	Go to Step 7
7	Inspect the power steering gear for a whine or growl noise using the CH-39570 chassis ear. Is the noise present at the power steering gear?	Go to Step 15	Go to Step 8
8	Disconnect the outer tie rods, refer to Steering Linkage Outer Tie Rod Replacement and individually turn each steering knuckle assembly right to left. Is a whine or growl noise present?	Go to Step 9	Go to Step 10
9	Disconnect the lower control arms from the steering knuckles, refer to Lower Control Arm Replacement and individually turn each steering knuckle assembly right to left. Is a whine or growl noise present?	Go to Step 13	Go to Step 14
	NOTE: Position the vehicle front wheels straight ahead. Do NOT rotate the steering wheel more than one		

	procedure. Disconnect the intermediate shaft from the steering column, refer to <u>Intermediate Steering Shaft Replacement</u> .		
10	1. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. 2. Rotate the steering wheel back to the original position. Is a whine or growl noise present?	Go to <u>Symptoms - Steering Wheel and Column</u>	Go to Step 15
11	Tighten the power steering gear fasteners. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u>. Did you complete the repair?	Go to Step 16	-
12	Reposition or replace the steering column front of dash seal. Did you complete the repair?	Go to Step 16	-
13	Replace the upper control arm. Refer to <u>Upper Control Arm Replacement</u> . Did you complete the repair?	Go to Step 16	-
14	Replace the lower control arm. Refer to <u>Lower Control Arm Replacement</u> . Did you complete the repair?	Go to Step 16	-
15	Replace the power steering gear. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u>. Did you complete the repair?	Go to Step 16	-
16	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

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 <u>Symptoms - Power Steering System</u>
2	Verify that there is an increase in effort while turning is present. Does the system operate normally?	System OK	Go to Step 3
	Check for the following tire related conditions:		

3	• Incorrect tire inflation-Refer to <u>Vehicle Certification, Tire Placard, Anti-Theft and Service Parts ID Label</u> . • Improper tire size		
	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> . 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 gear worn or binding?	Go to Step 9	System OK
7	Replace the outer tie rod. Refer to <u>Steering Linkage Outer Tie Rod Replacement</u> . Did you complete the repair?	Go to Step 10	-
8	Replace the intermediate shaft. Refer to <u>Intermediate Steering Shaft Replacement</u> . Did you complete the repair?	Go to Step 10	-
9	Replace the steering gear. Refer to <u>Electric Belt Drive Rack and Pinion 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	-

POOR RETURN OF STEERING WHEEL

Poor Return of Steering Wheel

Step	Action	Yes	No
DEFINITION: After completing a turn, extra steering input is required for the steering wheel to return to center.			
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Power Steering System</u>
2	Verify that poor return of the steering wheel is present. Does the system operate normally?	System OK	Go to Step 3
	1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .		

3	2. Lubricate the tie rod ends and ball joints, if applicable. 3. Inspect the suspension system for worn or damaged components. 4. Repair as necessary. Did you find and correct the condition?	Go to Step 12	Go to Step 4
4	1. Rotate the steering wheel ONE revolution in both directions. 2. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction?	Go to Step 5	Go to Step 10
5	NOTE: Position the wheels straight ahead. Do NOT rotate the steering wheel more than one complete revolution from center. 1. Disconnect the intermediate shaft from the steering column. 2. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. 3. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction?	Go to Step 11	Go to Step 6
6	Inspect the intermediate shaft for stiff or loose joints. Repair or replace as necessary. Did you find and complete the repair?	Go to Step 12	Go to Step 7
7	1. Remove the front tire and wheel assemblies. Refer to <u>Tire and Wheel Removal and Installation</u>. 2. Disconnect both outer tie rod ends from the steering knuckles. 3. Use your hands in order to move the tie rod end studs. 4. If abnormally difficult to move, replace the tie rod end. If equipped with recirculating ball steering, ensure that idler and pitman arm joints are not too stiff. Repair as		

	Did you find and complete the repair?	Go to Step 12	Go to Step 8
8	1. Use your hands to rotate the steering knuckle inboard and outboard in order to inspect for a binding strut bearings, ball joints or axle. 2. Repair or replace any abnormally stiff or loose components. Did you find and complete the repair?	Go to Step 12	Go to Step 9
9	Inspect for binding in the steering gear. If a binding is present, repair or replace the steering gear. Did you find and complete the repair?	Go to Step 12	Go to Step 10
10	Inspect the wheel alignment and adjust as necessary. Refer to <u>Wheel Alignment Measurement</u> . Did you find and complete the repair?	Go to Step 12	-
11	Inspect the steering column for a binding. If a binding is present, repair or replace the steering column as necessary. Did you find and complete the repair?	Go to Step 12	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	-

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 <u>Symptoms - Power Steering System</u>
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 14	Go to Step 4
4	1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Check for a binding or worn tie rod end. Is the tie rod end binding or worn?	Go to Step 10	Go to Step 5
	Check for a worn or binding intermediate		

5	steering shaft(s). Is the intermediate steering shaft(s) worn or binding?	Go to Step 11	Go to Step 6
6	Check for worn a binding power steering gear. Is the power steering gear worn or binding?	Go to Step 12	Go to Step 7
7	Check for a worn or binding steering column. Is the steering column worn or binding?	Go to Step 13	Go to Step 8
8	Check for excessive heat in the power steering assist motor. Does the power steering assist motor appear to be overheated?	Go to Step 09	Go to Step 12
9	NOTE: - Do not perform excessive parking lot maneuvers during testing. - Excessive parking lot maneuvers can cause the power steering assist motor to heat up. Allow the power steering assist motor to cool and retest the system. Did you correct the condition?	Go to Step 14	Go to Step 12
10	Replace the outer tie rod end. Refer to <u>Steering Linkage Outer Tie Rod Replacement</u> . Did you complete the repair?	Go to Step 14	-
11	Replace the intermediate steering shaft(s). Refer to <u>Intermediate Steering Shaft Replacement</u> . Did you complete the repair?	Go to Step 14	-
12	Replace the power steering gear. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> . Did you complete the repair?	Go to Step 14	-
13	Replace the steering column. Refer to <u>Steering Column Replacement (Without Electronic Steering Column Lock)</u> , <u>Steering Column Replacement (With Electronic Steering Column Lock)</u> . Did you complete the repair?	Go to Step 14	-
14	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

STEERING WHEEL KICKBACK

Steering Wheel Kickback

Condition	Action
The steering column mounting bolts are	Tighten the pivot bolt and the mounting bolts to

loose.	specification.
The steering gear is loosely mounted.	Tighten the steering gear mounting bolts to specification.
The tie rod ends are loose or damaged.	If necessary, inspect for damage and replace the tie rod ends. Refer to <u>Steering Linkage Outer Tie Rod Replacement</u> .

STEERING EFFORT HARD OR TOO EASY IN ONE OR BOTH DIRECTIONS

Steering Effort Hard or Too Easy in One or Both Directions

Condition	Action
The battery power is low.	Ensure proper battery voltage.
The intermediate shaft dash seal is binding.	Adjust the dash seal or replace the intermediate shaft if necessary. Refer to <u>Intermediate Steering Shaft Replacement</u> .
The intermediate shaft joints are loose or worn.	Inspect the joints and the pinch bolts for damage and replace the intermediate shaft if necessary. Refer to <u>Intermediate Steering Shaft Replacement</u> .
The steering gear is binding.	If necessary, inspect and replace the steering gear. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> .
The upper steering shaft is bent.	If necessary, replace the steering column. Refer to <u>Steering Column Replacement (Without Electronic Steering Column Lock)</u> , <u>Steering Column Replacement (With Electronic Steering Column Lock)</u> .
The connectors to the assist motor are damaged or disconnected.	Verify the connectors are properly connected. Verify the connectors are not damaged. If the connectors are damaged, replace the connectors.
The sensor wire is damaged.	Replace the steering gear. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> .
The controller is malfunctioning.	Confirm the DTC. If necessary, replace the motor/module assembly. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> .
The motor shaft is binding.	Confirm the DTC. If necessary, replace the motor/module assembly. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement</u> .

REPAIR INSTRUCTIONS

STEERING LINKAGE INNER TIE ROD INSPECTION

Special Tools

J-8001 Dial Indicator Set

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

NOTE: **This inspection procedure does not supersede local government required inspections that have more stringent requirements.**

1. Turn the ignition key to the ON position with the engine OFF.
2. With the aid of an assistant, turn the steering wheel to the full stop position and hold the steering wheel in that position until the test is complete. The tie rod being tested should be inside the steering gear housing seated against the steering stop.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. If there is not a good location for the **J-8001** Dial Indicator pointer at the steering gear housing, install a large worm gear hose clamp to the steering gear housing over the larger steering gear boot clamp and align the clamp so that the screw can be a location for the **J-8001** Dial Indicator pointer.

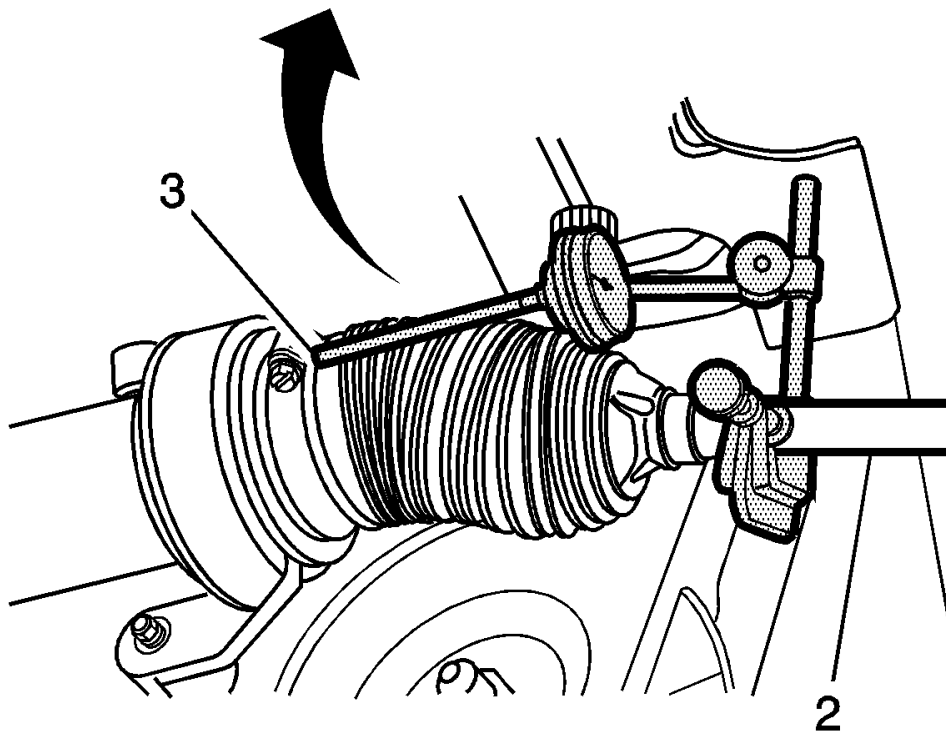
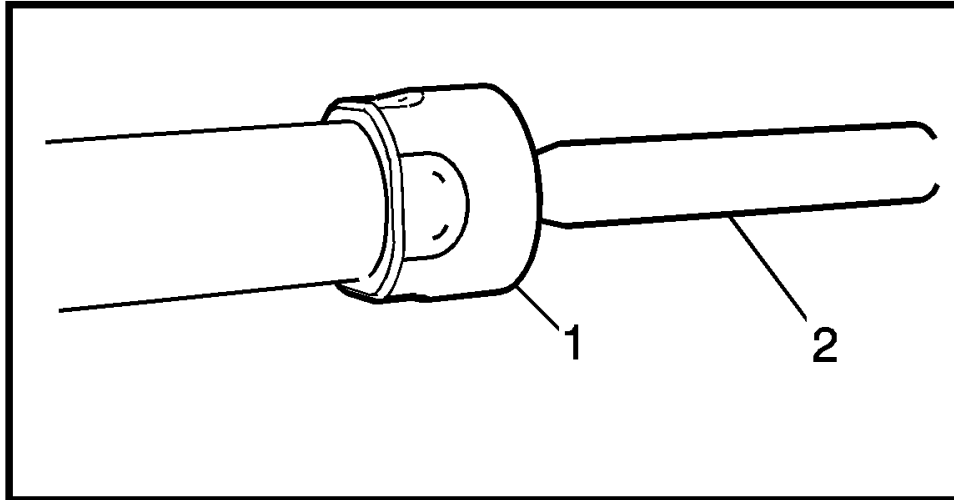


Fig. 2: Measuring Lash Between Inner Tie Rod & Steering Gear Housing
Courtesy of GENERAL MOTORS COMPANY

5. Install the J-8001 Dial Indicator between the inner tie rod (2) and the steering gear housing or

the worm gear clamp in such a way as to measure the lash between the inner tie rod and the steering gear housing.

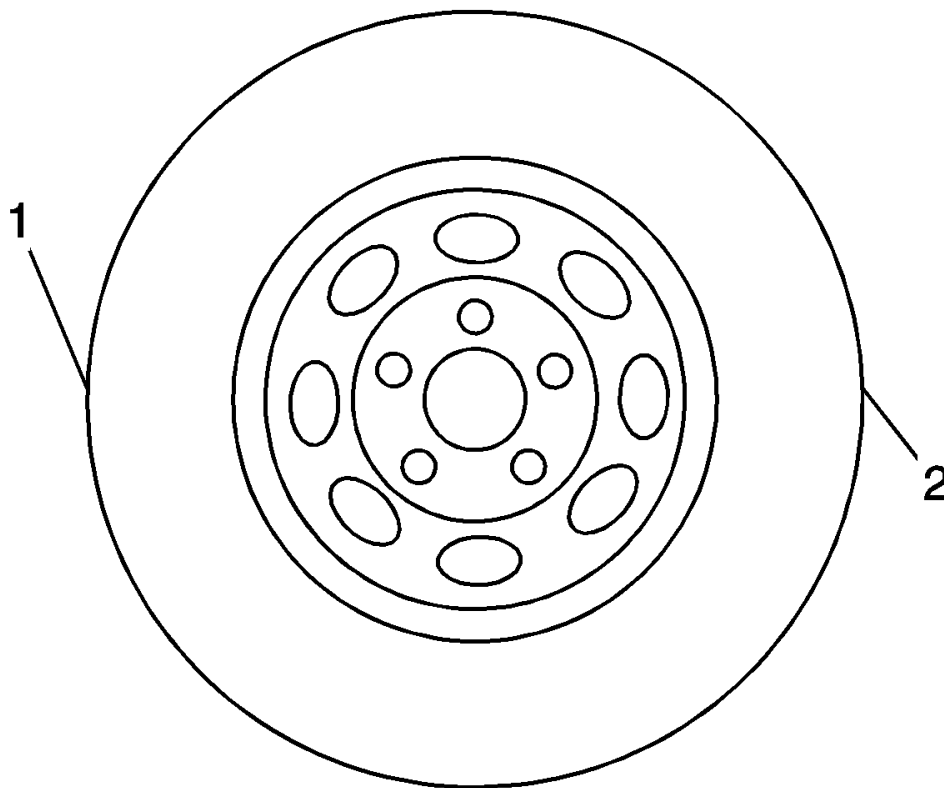


Fig. 3: Identifying Tire Grasping Positions
Courtesy of GENERAL MOTORS COMPANY

NOTE: Only move the tire enough to feel any lash between the inner tie rod and the inner tie rod housing without moving the steering gear rack.

6. Grasping the tire at the 3 o'clock (2) and 9 o'clock (1) positions, gently push in on one side of the tire in order to remove any lash.
7. Zero the **J-8001** Dial Indicator.
8. On the same side of the tire previously pushed in, gently pull out and measure the lash.
9. Record the measurement seen on the **J-8001** Dial Indicator.
10. If the measured value exceeds 0.5 mm (0.02 in), replace the inner tie rod. Refer to **Steering Linkage Inner Tie Rod Replacement (Left Side)**, **Steering Linkage Inner Tie Rod Replacement (Right Side)**.

11. Repeat the procedure for the other side.

STEERING LINKAGE OUTER TIE ROD INSPECTION

Special Tools

J-8001 Dial Indicator Set

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

NOTE: **This inspection procedure does not supersede local government required inspections that have more stringent requirements.**

1. Inspect the outer tie rod end seal. If the outer tie rod end seal is torn, replace the outer tie rod end. Refer to **Steering Linkage Outer Tie Rod Replacement**.
2. Raise the side of the vehicle being inspected with a floor jack while maintaining contact between the opposite wheel and the shop floor. Support the lower control arm with a floor jack stand as far outboard as possible and remove the floor jack. Refer to **Lifting and Jacking the Vehicle** .

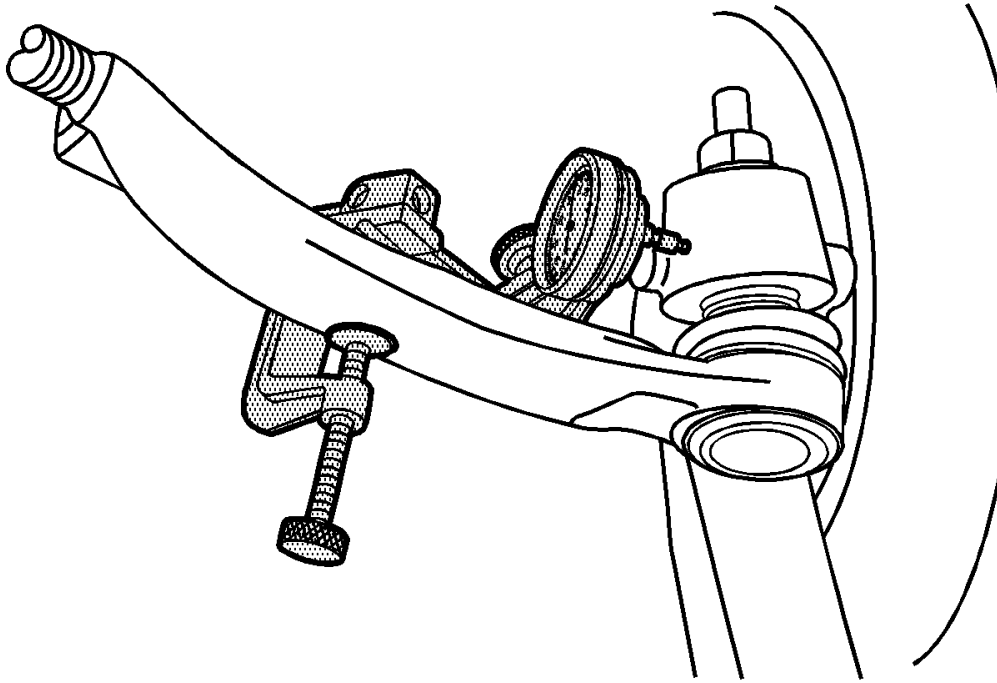


Fig. 4: Measuring Outer Tie Rod Lash
Courtesy of GENERAL MOTORS COMPANY

3. Install the **J-8001** Dial Indicator between the outer tie rod end and the steering knuckle as shown in the graphic. Note that the tire and wheel assembly is shown removed only for clarification of the **J-8001** Dial Indicator position.

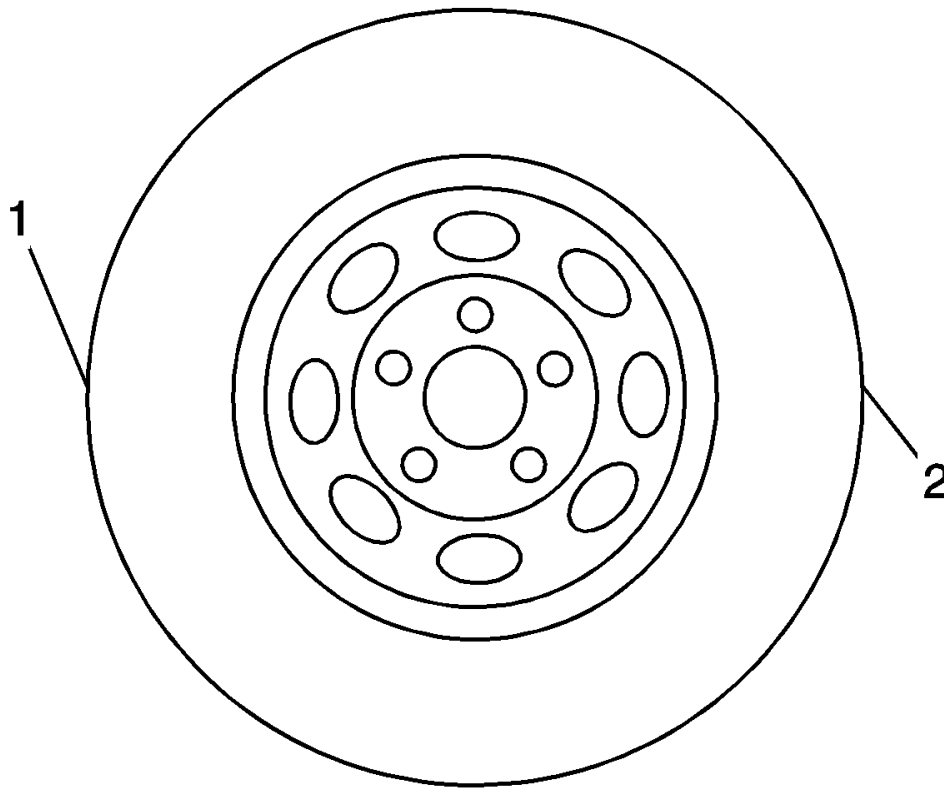


Fig. 5: Identifying Tire Grasping Positions
Courtesy of GENERAL MOTORS COMPANY

4. Grasping the tire at the 3 o'clock (2) and 9 o'clock (1) positions, gently push in on one side of the tire to remove any lash.
5. Zero the **J-8001** Dial Indicator.
6. On the same side of the tire previously pushed inwards, gently pull outwards and measure the lash.
7. Record the measurement seen on the **J-8001** Dial Indicator.
8. If the measured value exceeds 0.5 mm (0.02 in) then replace the outer tie rod. Refer to **Steering Linkage Outer Tie Rod Replacement**.
9. Repeat the procedure for the other side.

STEERING LINKAGE OUTER TIE ROD REPLACEMENT

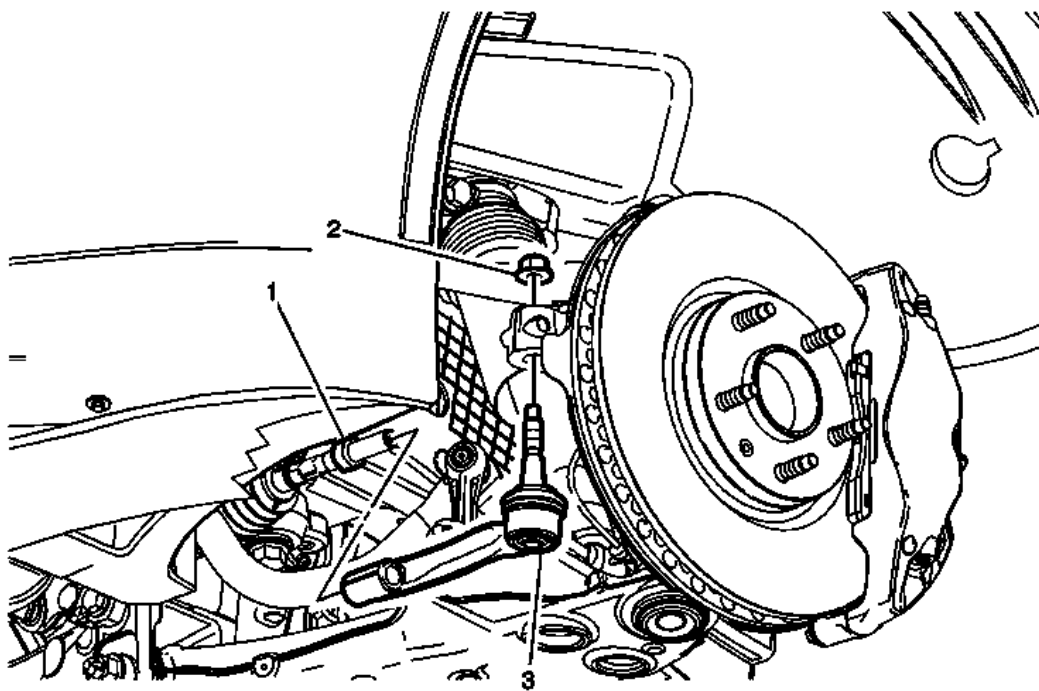


Fig. 6: Steering Linkage Outer Tie Rod
 Courtesy of GENERAL MOTORS COMPANY

Steering Linkage Outer Tie Rod Replacement

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the front tire and wheel assembly. Refer to <u>Tire and Wheel Removal and Installation</u> .	
1	Steering Linkage Inner Tie Rod Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Place match marks on the inner tie rod nut and the inner tie rod. 2. During installation, align the match marks. 3. Do not tighten the inner tie rod nut during installation. Tighten the nut after adjusting the front toe.

	75 N.m (55 lb ft)
2	Steering Linkage Outer Tie Rod Nut Tighten 30 N.m (26 lb ft) + 120 degrees
3	Steering Linkage Outer Tie Rod CAUTION: Do not free the ball stud by using a pickle fork or a wedge-type tool. Damage to the seal or bushing may result. Procedure 1. Use the J-42188 separator to disconnect the outer tie rod from the steering knuckle. 2. Clean the tapered surface of the steering knuckle. 3. Inspect the inner tie rod for bent or damaged threads and replace the inner tie rod if necessary. Refer to <u>Steering Linkage Inner Tie Rod Replacement (Left Side)</u> , <u>Steering Linkage Inner Tie Rod Replacement (Right Side)</u> . 4. Measure and adjust the front toe. Refer to <u>Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment</u> . Special Tools J-42188 Ball Joint Separator For equivalent regional tools, refer to <u>Special Tools</u> .

STEERING GEAR BOOT REPLACEMENT

Special Tools

J-22610 Keystone Clamp Pliers

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

Removal Procedure

1. If servicing the left side steering gear boot, remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
2. If servicing the right side steering gear boot, remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the steering linkage outer tie rod. Refer to **Steering Linkage Outer Tie Rod Replacement**.

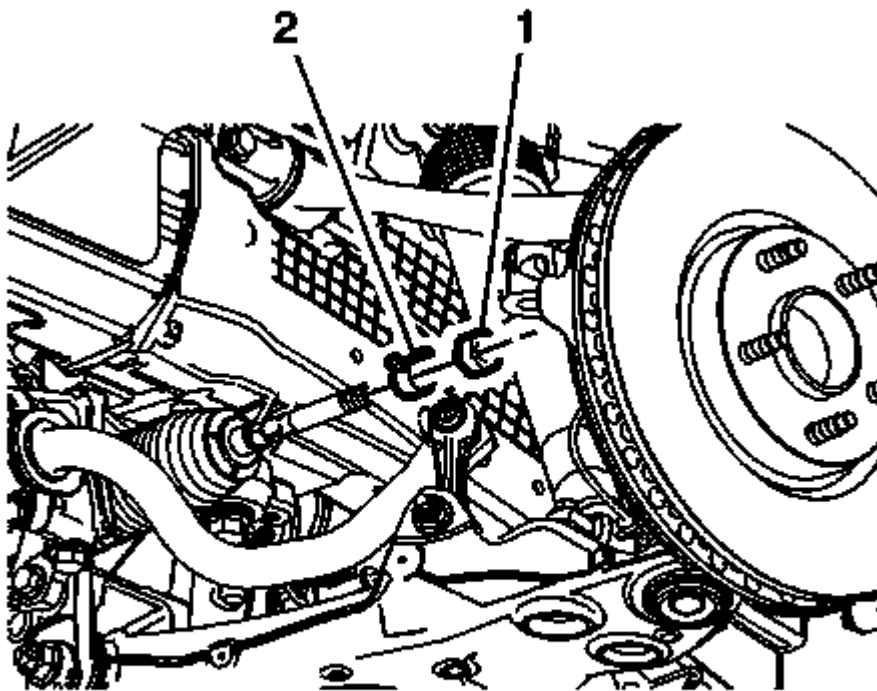


Fig. 7: Steering Linkage Inner Tie Rod Nut
Courtesy of GENERAL MOTORS COMPANY

5. Remove the steering linkage inner tie rod nut (1).
6. Remove the steering gear boot outer clamp (2).
7. Lower the vehicle.

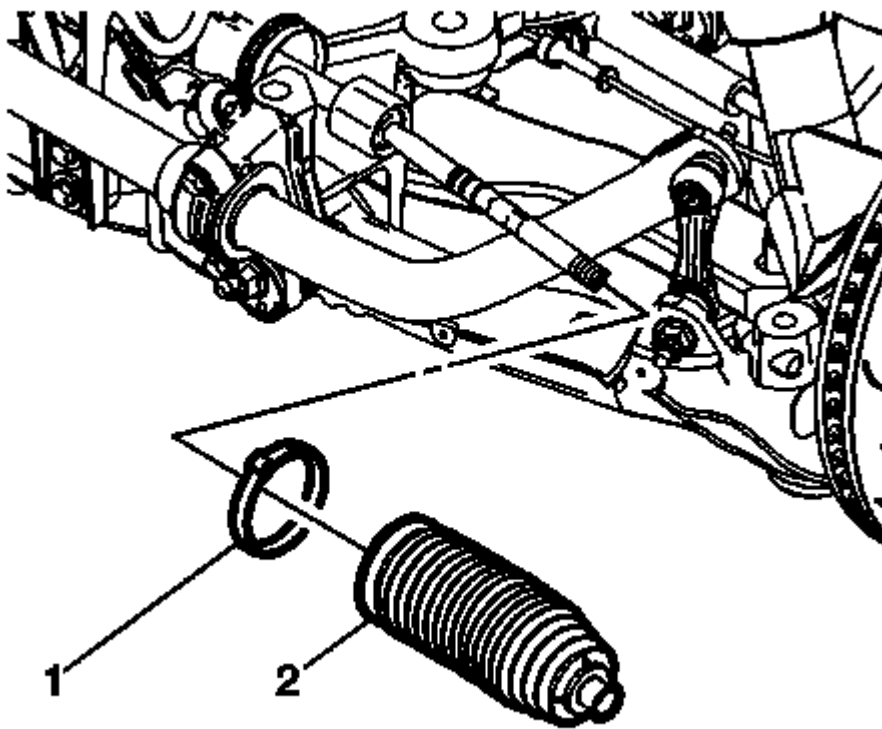


Fig. 8: NEW Steering Gear Boot Inner Clamp
Courtesy of GENERAL MOTORS COMPANY

8. From the engine compartment, access and cut the steering gear boot inner clamp (1). Discard the clamp.
9. Raise the vehicle.
10. Remove the steering gear boot (2) from the steering gear.
11. After removing the steering gear boot, inspect the steering linkage inner tie rod for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement**.

Installation Procedure

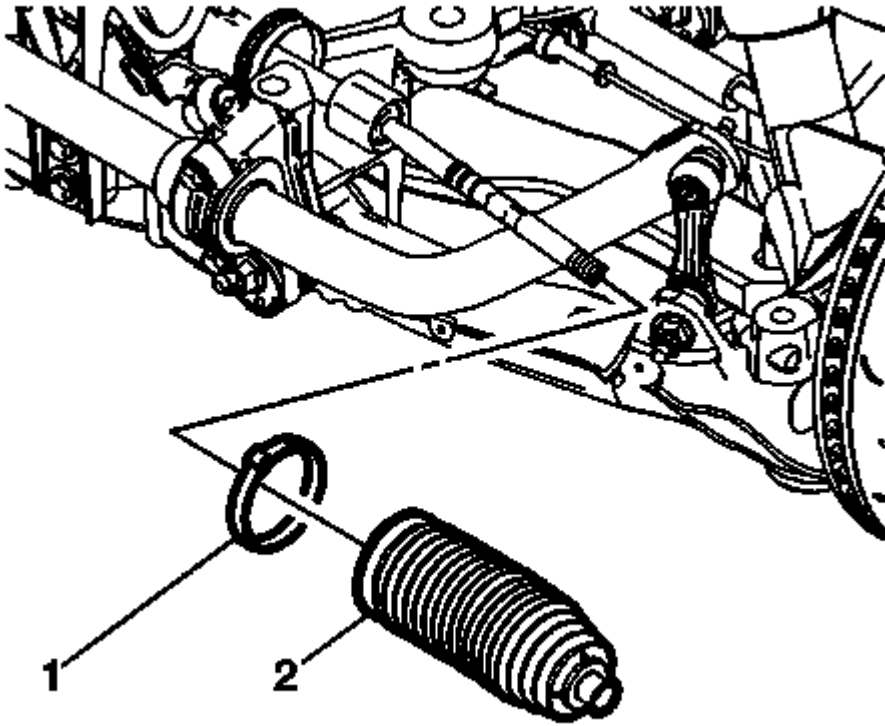


Fig. 9: NEW Steering Gear Boot Inner Clamp
Courtesy of GENERAL MOTORS COMPANY

1. Install a NEW steering gear boot inner clamp (1) loosely on the steering gear boot (2).
2. Install the steering gear boot (2) on the steering gear.
3. Lower the vehicle.
4. From the engine compartment, use the **J-22610** pliers to secure the NEW steering gear boot inner clamp (1).
5. Raise the vehicle.

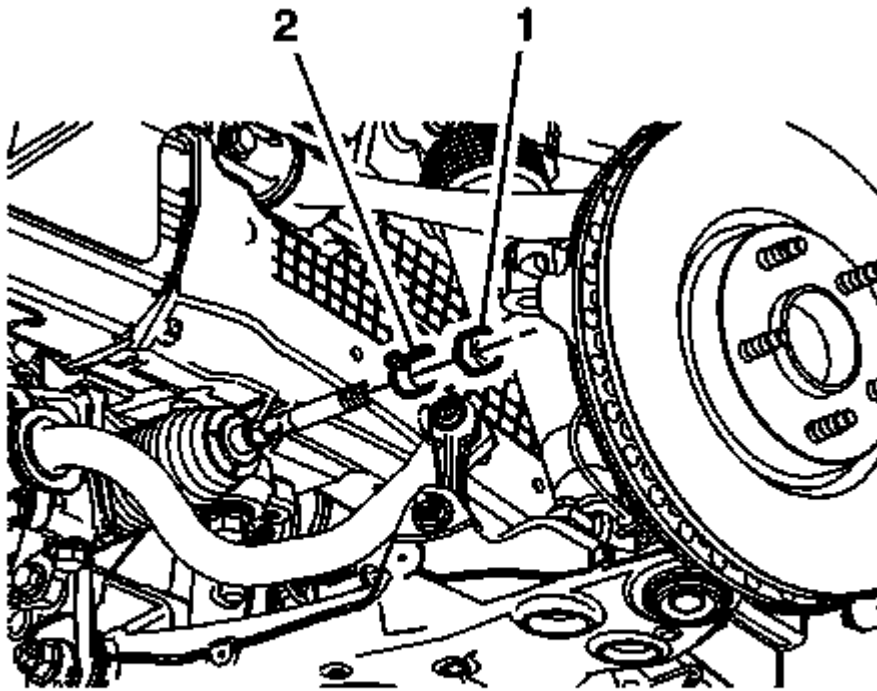


Fig. 10: Steering Linkage Inner Tie Rod Nut
Courtesy of GENERAL MOTORS COMPANY

6. Install the steering gear boot outer clamp (2).
7. Install the steering linkage inner tie rod nut (1).
8. Install the steering linkage outer tie rod. Refer to **Steering Linkage Outer Tie Rod Replacement**.
9. If servicing the right side steering gear boot, install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement**.
10. If servicing the left side steering gear boot, install the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement**.

ELECTRIC BELT DRIVE RACK AND PINION STEERING GEAR REPLACEMENT

Special Tools

J-42640 Steering Column Anti-rotation Pin

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

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

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

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

1. Use the **J-42640** anti-rotation pin to lock the steering column.
2. Disconnect the intermediate steering shaft from the steering gear. Refer to **Intermediate Steering Shaft Replacement** .
3. Install the engine support fixture. Refer to **Engine Support Fixture** .
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
6. Remove the front cradle. Refer to **Front Cradle Replacement** .

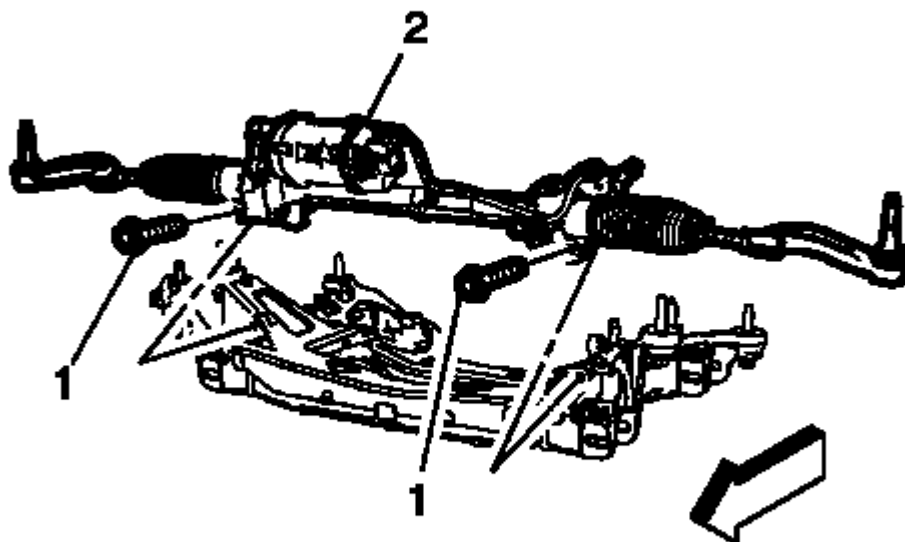


Fig. 11: Power Steering Gear Mounting Fasteners
Courtesy of GENERAL MOTORS COMPANY

7. Remove the steering gear bolts (1) and the electric belt drive rack and pinion steering gear (2) from the front cradle.

Installation Procedure

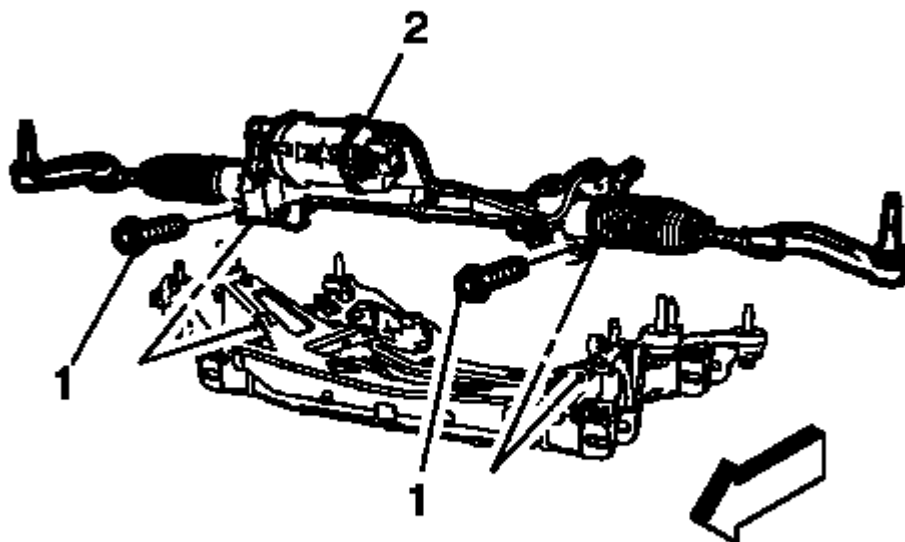


Fig. 12: Power Steering Gear Mounting Fasteners
 Courtesy of GENERAL MOTORS COMPANY

1. Position the electric belt drive rack and pinion steering gear (2) on the front cradle and start the steering gear bolts (1).

CAUTION: Refer to Fastener Caution .

2. Tighten the steering gear bolts (1) to 125 N.m (92 lb ft).
3. Install the front cradle. Refer to Front Cradle Replacement .
4. Install the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation .
5. Remove the engine support fixture. Refer to Engine Support Fixture .
6. Connect the intermediate steering shaft to the steering gear. Refer to Intermediate Steering Shaft Replacement .
7. Remove the J-42640 anti-rotation pin from the steering column.
8. Measure and adjust the front toe. Refer to Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment .

STEERING LINKAGE INNER TIE ROD REPLACEMENT (LEFT SIDE)

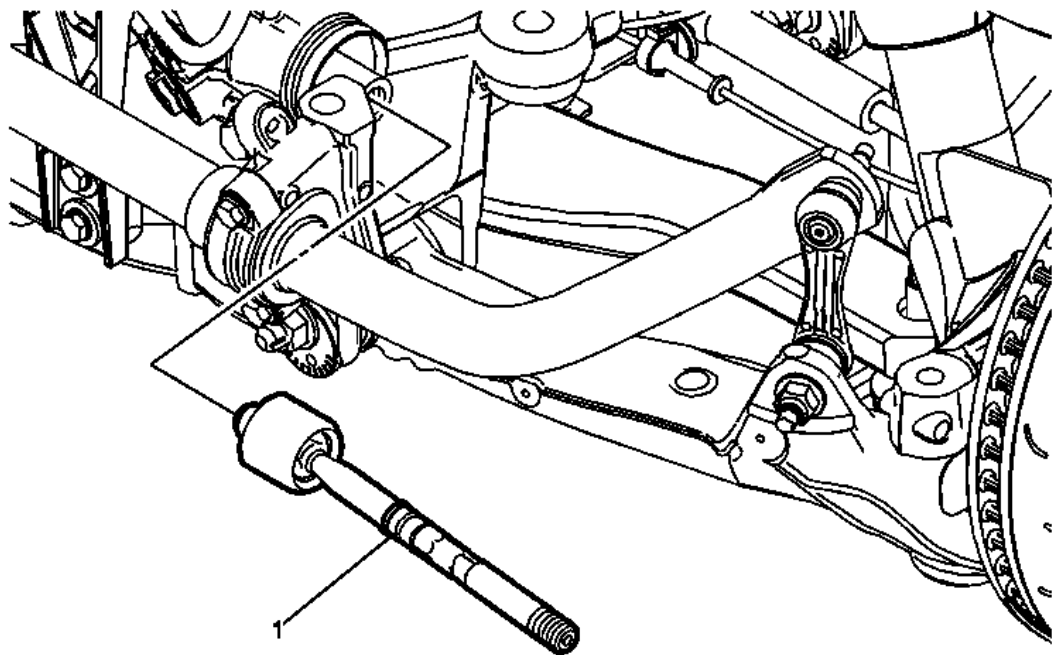


Fig. 13: Steering Linkage Inner Tie Rod (Left Side)
Courtesy of GENERAL MOTORS COMPANY

Steering Linkage Inner Tie Rod Replacement (Left Side)

Callout	Component Name
Preliminary Procedures	
1. Remove the left side steering gear boot. Refer to Steering Gear Boot Replacement. 2. After removing the steering gear boot, inspect the steering linkage inner tie rod for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement.	
	Steering Linkage Inner Tie Rod - Left Side CAUTION: Refer to Fastener Caution . Procedure 1. Turn the steering wheel to expose the first two inches of steering gear rack on the left side of the gear. Hold the rack with a wrench across the two recesses

1

2. Use the **J-34028** inner tie rod wrench to remove and install the left side inner tie rod.
3. After installing the left side inner tie rod, measure and adjust the front toe. Refer to **Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment** .

Tighten

100 (74 lb ft)

Special Tools

J-34028 Inner Tie Rod Wrench

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

STEERING LINKAGE INNER TIE ROD REPLACEMENT (RIGHT SIDE)

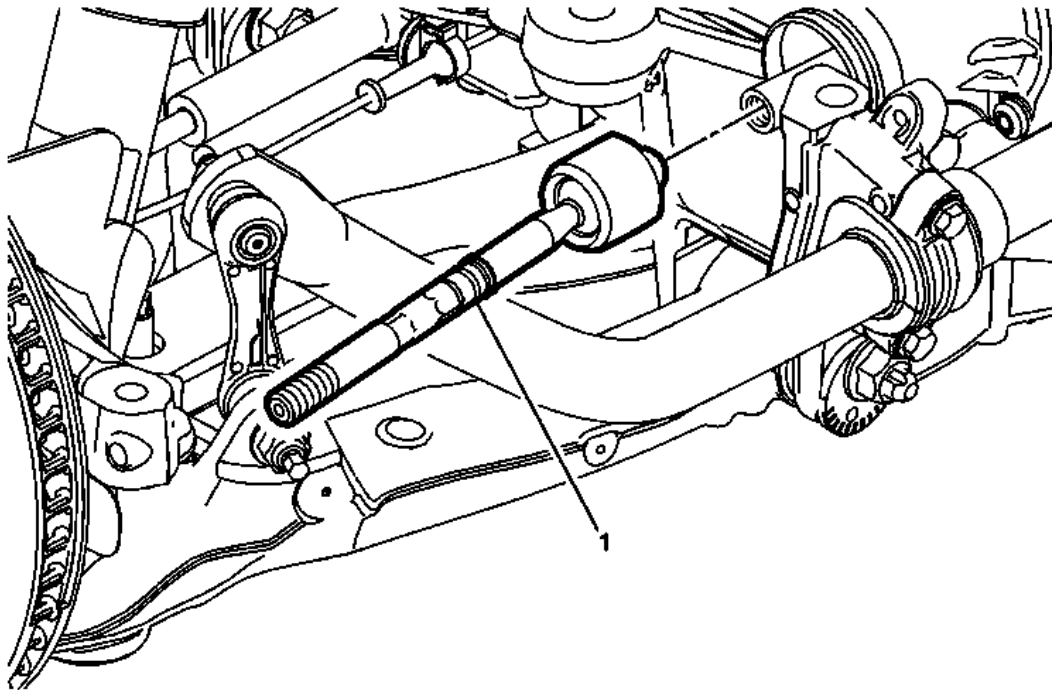


Fig. 14: Steering Linkage Inner Tie Rod (Right Side)

Courtesy of GENERAL MOTORS COMPANY

Steering Linkage Inner Tie Rod Replacement (Right Side)

Callout	Component Name
Preliminary Procedures	
1.	

Replacement.

3. After removing the steering gear boots, inspect the steering linkage inner tie rods for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the steering gear. Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement.**

Steering Linkage Inner Tie Rod - Right Side

CAUTION:

Refer to **Fastener Caution** .

Procedure

1

1. Turn the steering wheel to expose the first two inches of steering gear rack on the left side of the gear. Use an assistant to hold the rack with a wrench across the two recesses in the rack sides.
2. Use the **J-34028** inner tie rod wrench to remove and install the right side inner tie rod.
3. After installing the right side inner tie rod, measure and adjust the front toe. Refer to **Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment** .

Tighten

100 (74 lb ft)

Special Tools

J-34028 Inner Tie Rod Wrench

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

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM DESCRIPTION AND OPERATION

The belt driven electronic power steering system consists of the following components:

- A belt drive and a ball nut mechanism
- A power pack; containing the power steering control module, its sensors, the power steering motor
- A torque sensor
- The steering gear (rack and pinion)

The belt driven electric power steering system reduces the amount of effort needed to steer the vehicle by utilizing the power steering control module to control the power steering motor to maneuver the steering rack. The power steering control module uses input from the torque sensor, motor rotational sensor, battery voltage circuit and GMLAN serial data circuit to determine the level of motor

amount of steering assist needed to steer the vehicle. At low speeds more assist is provided for easy turning during parking maneuvers. At higher speeds less assist is provided for improved road feel and directional stability

The torque sensor is attached to the steering gear housing near the input shaft and is critical to proper operation of the electronic power steering system. As the steering wheel is turned and torque is applied to the steering shaft, the torque sensor monitors the amount of input torque.

The power steering control module responds to the torque sensor and motor rotational sensor by commanding current to the power steering motor.

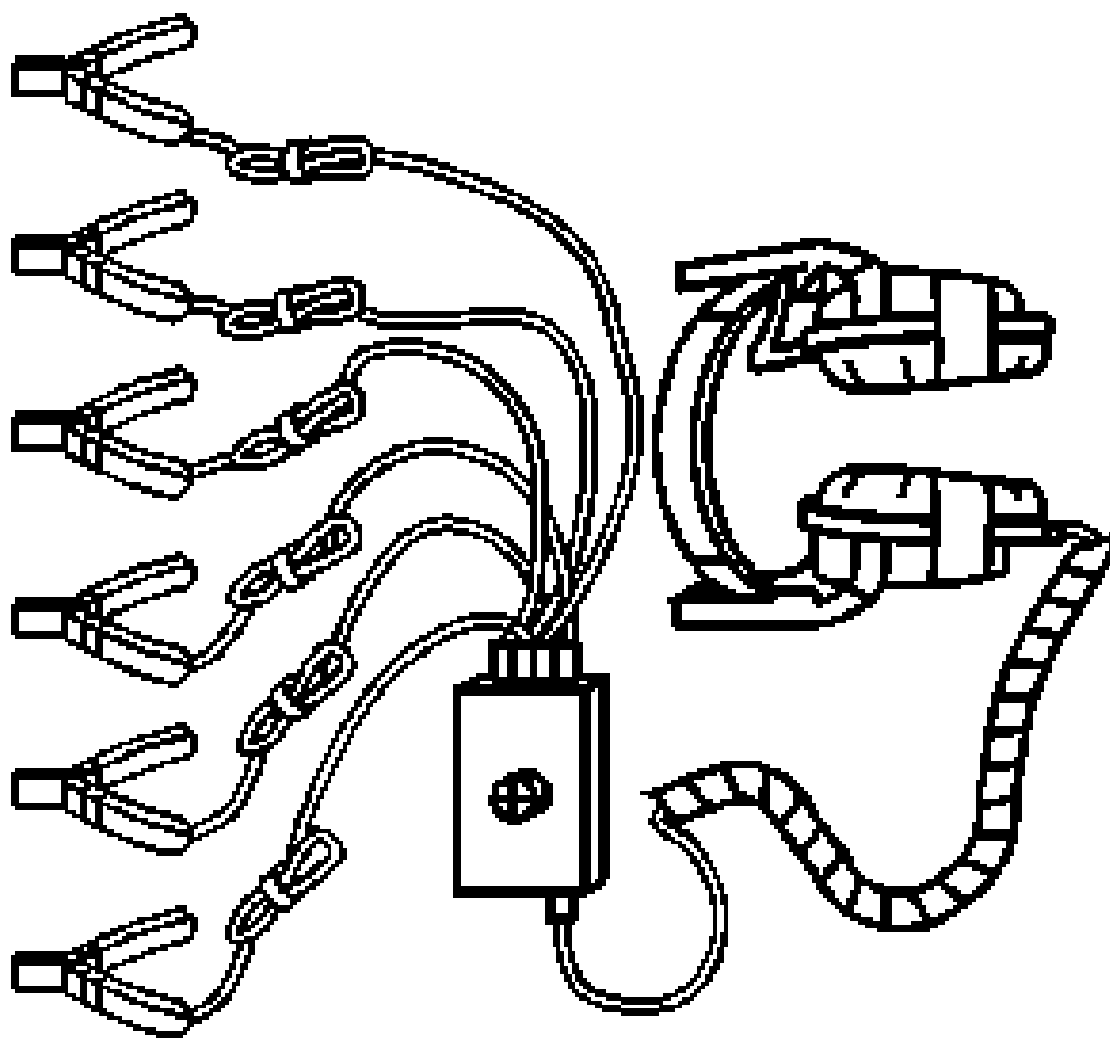
The power steering control module and motor are attached to the base of the steering gear housing and applies power assist through the belt drive and ball nut mechanism to the steering rack. The ball nut mechanism translates the rotational movement of the belt drive system to lateral movement of the steering rack. The power steering control module has the ability to detect malfunctions within the electric power steering system. Any malfunction detected that disables steering assist will cause the SERVICE POWER STEERING message to be displayed on the driver information center. Additionally, the power steering control module calculates an internal system temperature which is used to protect the power steering system from damage caused by high temperature. When the calculated temperature exceeds a pre-determined level the amount of current commanded to the power steering motor is reduced. This will result in a temporary reduced level of assist. Full assist will return once the calculated temperature drops below the pre-determined level.

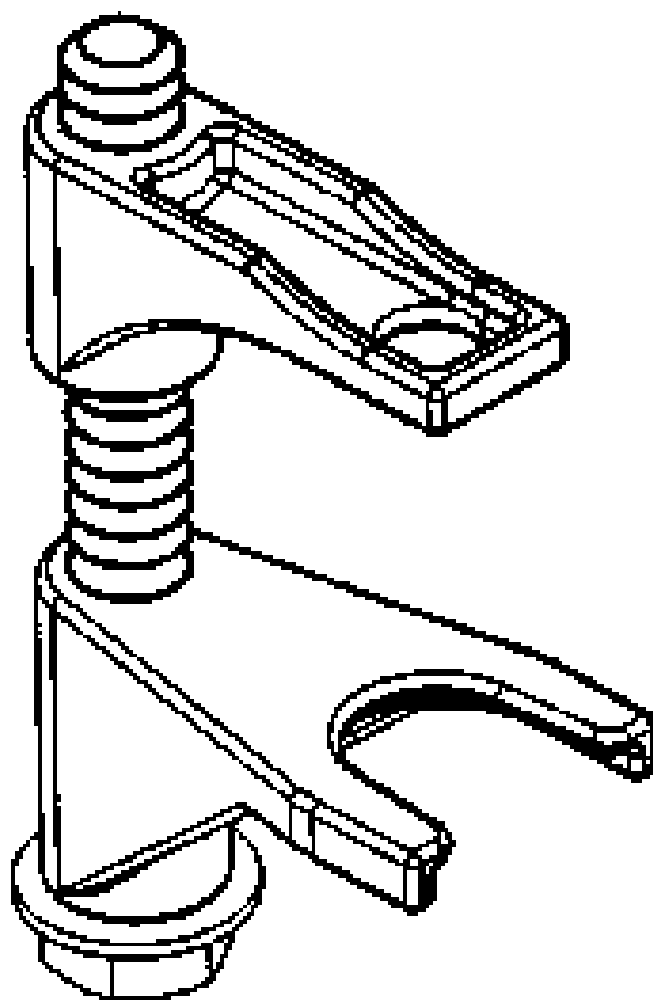
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

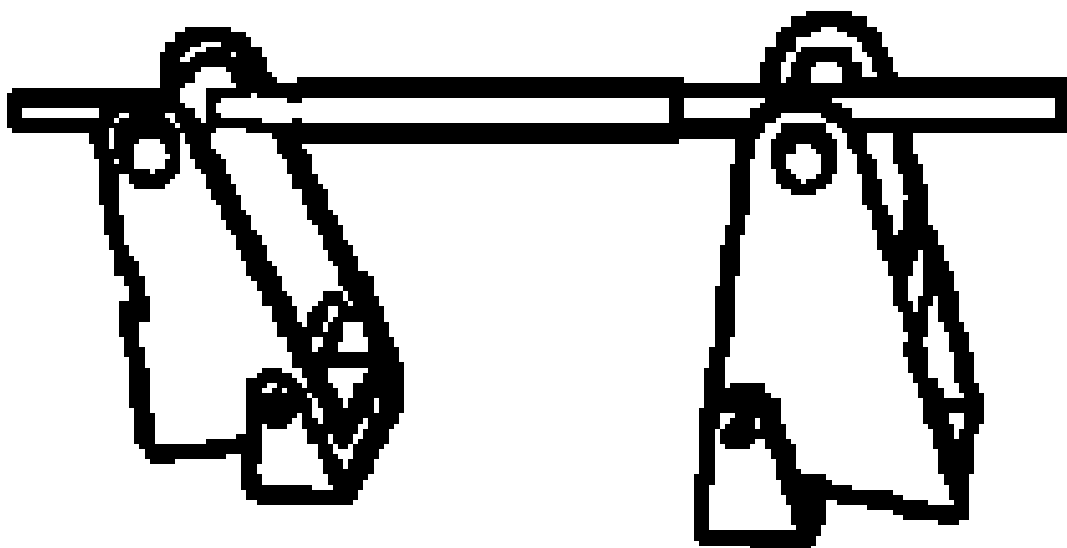
Illustration	Tool Number/ Description
	CH-39570

SA9217NE
Chassis Ear

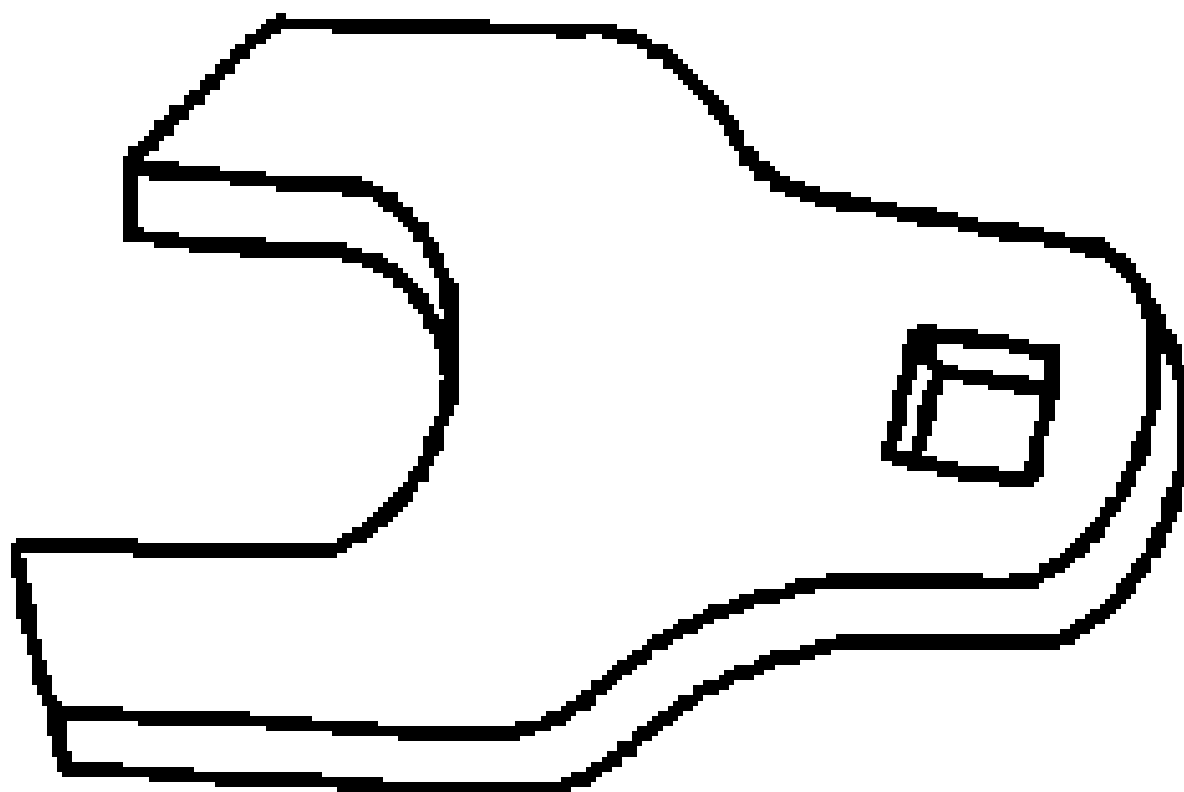




CH-42188
J-42188
Ball Joint
Separator



J-33432-A
Leaf Spring
Compressor



J-34028
Inner Tie
Rod
Wrench