

2021 STEERING

Power Steering System - Canyon, Colorado

SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
Application
Power Steering Assist Motor Seal
Steering Gear Belt
Steering Gear Boot Inner Clamp

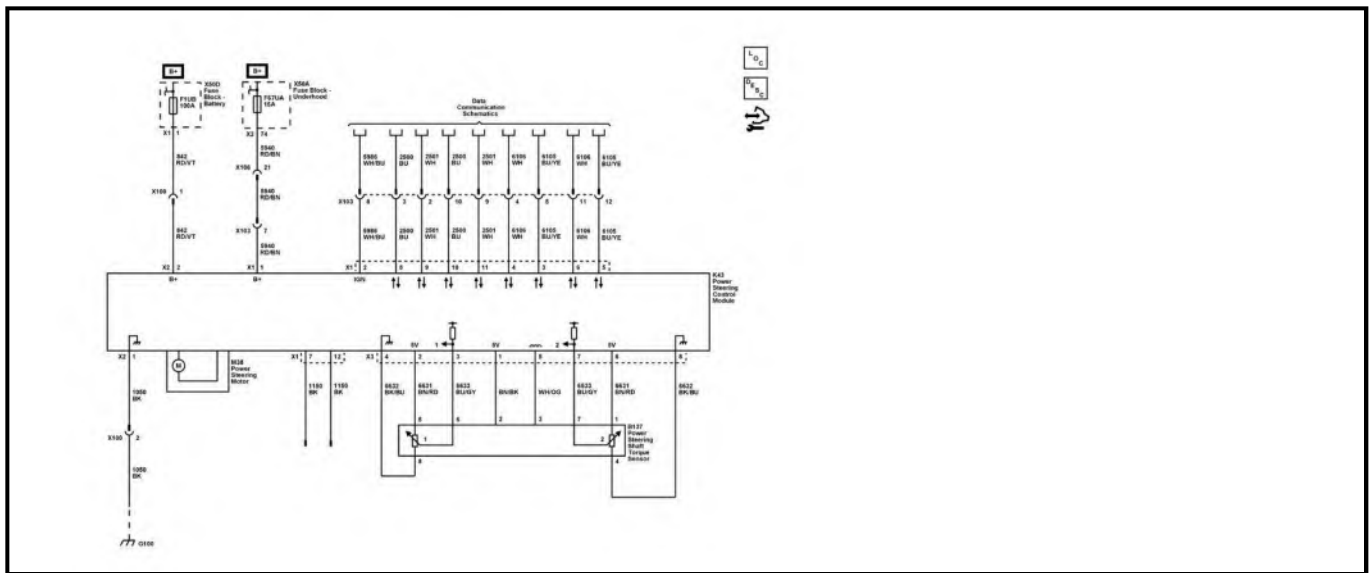
Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Power Steering Assist Motor Pivot Bolt	12 N.m (106 lb in)
Steering Gear Bolt- Lower	
• First Pass:	150 N.m (111 lb ft)
• Final Pass:	30 - 45 degrees
Steering Gear Bolt- Upper	100 N.m (74 lb ft)
Steering Gear Housing Cover Bolt	12 N.m (106 lb in)
Steering Linkage Inner Tie Rod	90 N.m (66 lb ft)
Steering Linkage Outer Tie Rod Nut	
• First Pass:	35 N.m (26 lb ft)
• Final Pass:	85 - 95 degrees

SCHEMATIC WIRING DIAGRAMS

POWER STEERING WIRING SCHEMATICS

Electric Power Steering



DIAGNOSTIC INFORMATION AND PROCEDURES

DTC C0176

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 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 Wiring Schematics

Connector End View Reference

Master Electrical Component List , or Inline Harness Connector End Views - Index or 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.
 - **If the DTC did not set outside of the conditions for running and setting**
 1. Ignition ON.
 2. Operate the vehicle within the conditions that the customer experienced, avoiding excessive inputs, and verify the DTC does not reset.
 - If the DTC is set
 - Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to Steering Effort Hard 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 power steering motor control module.
 - Go to next step: If the DTC is not set
 3. All OK.
 - **Go to next step: 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.

- [Power Steering Assist Motor Replacement \(2WD\)](#), or [Power Steering Assist Motor Replacement \(4WD\)](#).
- [Control Module References](#) for power steering control module replacement, programming and setup.

DTC C0460

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 C0460 4B

Steering Wheel Angle Sensor Calibration Not Learned

DTC C0460 58

Steering Wheel Angle Sensor Signal Performance

DTC C0460 5A

Steering Wheel Angle Sensor Not Plausible

Circuit/System Description

The power steering control module continuously monitors the parameters of the steering gear. The power steering control module performs a self-test diagnostic during power-up to determine if the steering wheel angle sensor is configured and the signal is plausible.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

C0460 4B

Steering Angle Sensor has not been properly calibrated.

C0460 58

Steering Angle sensor has a hardware failure.

C0460 5A

Steering wheel angle sensor signal is not plausible

Action Taken When the DTC Sets

- DTC C0460 is stored in memory.
- Steering assist is reduced.

Conditions for Clearing the DTC

C0460 4B

Steering Angle Sensor has been properly calibrated.

C0460 58

Steering Angle Sensor has no hardware failure.

C0460 5A

Steering Angle Sensor signal is plausible.

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

Reference Information

Schematic Reference

Power Steering Wiring Schematics

Connector End View Reference

Master Electrical Component List , or Inline Harness Connector End Views - Index or 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 C0460 4B

1. Ignition ON.
2. Verify that DTC C0460 4b is not set.
 - **If the DTC C0460 4B is set**

Perform Steering Wheel Angle Sensor Centering with scan tool.

1. Verify that DTC C0460 4B is not set.
 - **If the DTC C0460 4B is set**

Replace the electronic power steering motor control module.

- **Go to next step: If the DTC C0460 4B did not set**

Go to next step: All OK.

- **Go to next step: If the DTC C0460 4B is not set**

3. All OK.

DTC C0460 58

1. Ignition ON.
2. Verify that DTC C0460 58 is not set.

- **If the DTC C0460 58 is set**

Replace the Electric Belt Drive Rack and Pinion Steering Gear.

- **Go to next step: If the DTC C0460 58 is not set**

3. All OK.

DTC C0460 5A

1. Ignition ON.
2. Verify that DTC C0460 5A is not set.

- **If the DTC C0460 5A is set**

Perform Steering Wheel Angle Sensor Centering with scan tool.

1. Verify that DTC C0460 5A is not set.

- **If the DTC C0460 5A is set**

Replace the electronic power steering motor control module.

- **Go to next step: If the DTC C0460 5A did not set**

Go to next step: All OK.

2. Verify that DTC C0460 58 did not reset.

- **If the DTC C0460 58 is set**

Replace the Electric Belt Drive Rack and Pinion Steering Gear.

- **Go to next step: If the DTC C0460 58 did not set**

Go to next step: All OK.

- **Go to next step: If the DTC C0460 5A is not set**

3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Power Steering Assist Motor Replacement (2WD), or Power Steering Assist Motor Replacement (4WD).
- Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD), or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD).
- Control Module References for power steering control module replacement, programming and setup.

DTC C0475

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.
- Steering assist is reduced.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

[Power Steering Wiring Schematics](#)

Connector End View Reference

[Master Electrical Component List](#) , or [Inline Harness Connector End Views - Index](#) or [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 DTC C0475 is not set.
 - **If the DTC is set**

Replace the K43 Power Steering Control Module.
 - **Go to next step: If the DTC is not set**
2. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Control Module References](#) for power steering control module programming and setup.

DTC C047A

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.

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.

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 motor position sensor circuits.

Action Taken When the DTC Sets

- No steering assist.
- The driver information center displays the SERVICE POWER STEERING warning message.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

[Power Steering Wiring Schematics](#)

Connector End View Reference

[Master Electrical Component List](#) , or [Inline Harness Connector End Views - Index](#) or [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 C047A is not set.
 - **If the DTC is set**
Replace the K43 Power Steering Control Module.
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Power Steering Assist Motor Replacement \(2WD\)](#), or [Power Steering Assist Motor Replacement \(4WD\)](#).
- [Control Module References](#) for power steering control module replacement, programming and setup.

DTC C0545

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 C0545 00

Steering Wheel Torque Sensor

Circuit/System Description

The power steering control module continuously monitors the digital torque sensors torque and index current signals. 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. The steering wheel torque sensor needs to be calibrated to be fully functional.

Conditions for Running the DTC

The ignition is 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.
- The driver information center displays the SERVICE POWER STEERING warning message.
- No Steering assist.

Conditions for Clearing the DTC

- A current DTC will clear on the next malfunction free ignition cycle.
- A history DTC will clear after 40 consecutive malfunction free ignition cycles.

Reference Information

Schematic Reference

Power Steering Wiring Schematics

Connector End View Reference

Master Electrical Component List , or Inline Harness Connector End Views - Index or 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 DTC C0545 is not set.
 - If the DTC is set

NOTE:

Check the torque sensor terminal connections for signs of corrosion or damage. Before reconnecting the torque sensor, verify if the harness has dielectric grease (Nyogel) applied. If so, do not add additional grease.

Replace the steering gear.

- **Go to next step: 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 \(2WD\)](#), or [Electric Belt Drive Rack and Pinion Steering Gear Replacement \(4WD\)](#).
- [Control Module References](#) for control module replacement, programming and setup.

DTC C056D (POWER STEERING CONTROL MODULE)

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 C056D

Electronic Control Unit Hardware

For symptom byte information, refer to [Symptom Byte List](#).

Circuit/System Description

The internal fault detection is handled inside the power steering control module. The symptom byte information is for engineering reference only. No external circuit diagnosis is involved.

Conditions for Running the DTC

The power steering control module runs the program to detect an internal fault when power up is commanded. The only requirements are voltage and ground. This program runs even if the voltage is out of the valid operating range.

Conditions for Setting the DTC

The power steering control module has detected an internal malfunction.

Action Taken When the DTC Sets

The power steering control module refuses all additional inputs.

Conditions for Clearing the DTC

- A current DTC clears when the malfunction is no longer present.
- A history DTC clears when the power steering control module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Diagnostic Aids

- This DTC may be stored as a history DTC without affecting the operation of the power steering control module.
- If stored only as a history DTC and not retrieved as a current DTC, do not replace the power steering control module.

- If this DTC is retrieved as both a current and history DTC, replace the power steering control module.

Reference Information

Schematic Reference

- [Data Communication Wiring Schematics](#)
- [Control Module References](#)

Connector End View Reference

[Master Electrical Component List](#) , or [Inline Harness Connector End Views - Index](#) or [Component Connector End Views - Index](#)

Description and Operation

[Data Link Communications 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 C056D is not set.
 - If DTC C056D is set

NOTE: Check for faulty connections or corrosion at the K43 Power Steering Control Module harness and engine wiring harness before replacing the K43 Power Steering Control Module.

Replace the K43 Power Steering Control Module.

- **Go to next step: If DTC C056D is not set**

3. All OK

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for control module replacement, programming and setup

DTC C056E

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 41

Electronic Control Unit Hardware Not Programmed

DTC C056E 4B

Electronic Control Unit Hardware 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 ON.

Conditions for Setting the DTC

DTC C056E 41

This DTC will set if the operational software or calibration code (tuning parameter value) does not save in Flash.

DTC C056E 4B

This DTC will set if the power steering control module, motor or torque sensor has not been calibrated using the steering position / torque sensor calibration procedure.

Actions Taken When DTC Sets

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

Conditions for Clearing the DTC

DTC C056E 41

A current or history DTC will clear after the power steering control module has been configured with the proper tuning profile.

DTC C056E 4B

A current or history DTC will clear after the steering position/torque sensor calibration procedure has been performed.

Reference Information

Schematic Reference

Power Steering Wiring Schematics

Connector End View Reference

[Master Electrical Component List](#) , or [Inline Harness Connector End Views - Index](#) or [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 C056E 41

1. Ignition ON.
2. Verify that DTC C056E 41 is not set.
 - **If the DTC C056E 41 is set**
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the K43 Power Steering Control Module.
 - Go to next step: If the DTC does not set
 3. All OK.
 - **Go to next step: If the DTC C056E 41 is not set**
3. All OK.

DTC C056E 4B

1. Ignition ON.
2. Verify that DTC C056E 4B is not set.
 - **If the DTC C056E 4B is set**
 1. Refer to K43 Power Steering Control Module: Programming and Setup and follow the steps to perform "Replace and Program Control Module."
 2. Verify the DTC does not set.
 - If the DTC sets, replace the K43 Power Steering Control Module.
 - Go to next step: If the DTC does not set
 3. All OK.
 - **Go to next step: If the DTC C056E 4B is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- 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, Pop 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 in One or Both Directions**

RATTLE, CLUNK, POP 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 - Power Steering System</u>
2	Road test the vehicle in order to verify the complaint. It may be necessary to compare to a like vehicle. Is a rattle, clunk or shudder noise present?	Go to Step 3	System OK
3	Inspect the power steering gear bushings for wear or damage. Are the power steering gear bushings worn or damaged?	Go to Step 8	Go to Step 4
4	Inspect the power steering gear fasteners for looseness. Are the power steering gear fasteners loose?	Go to Step 9	Go to Step 5
5	Inspect the steering linkage inner and outer tie rods for looseness. Refer to <u>Steering Linkage Inner Tie Rod Inspection</u> , and <u>Steering Linkage Outer Tie Rod Inspection</u> . Did you find and correct the condition?	Go to Step 12	Go to Step 6
6	Inspect the front suspension components for damage or wear. Are the front suspension components damaged or worn?	Go to Step 10	Go to Step 7
7	Inspect the intermediate steering shaft and lower steering shaft assembly for proper installation and loose or missing fasteners. Are the intermediate steering shaft and lower steering shaft assembly installed incorrectly or do they have loose or missing fasteners?	Go to Step 11	Go to Step 2
8	Replace the power steering gear. Refer to <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD)</u> , or <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD)</u> . Did you complete the repair?	Go to Step 12	-

Step	Action	Yes	No
9	Install the power steering gear fasteners correctly. Refer to Fastener Specifications .	Go to Step 12	-
10	Replace the damaged or worn front suspension components. Did you complete the repair?	Go to Step 12	-
11	Install the intermediate steering shaft, lower steering shaft assembly and/or fasteners correctly. Refer to Intermediate Steering Shaft Replacement , or Lower Steering Shaft Assembly Replacement . Did you complete the repair?	Go to Step 12	-
12	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

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Power Steering System
2	Road test the vehicle in order to verify the complaint. Is a whine or growl noise present?	Go to Step 3	System OK
3	Inspect the power steering assist motor for a whine or growl noise using the J-39570 chassis ear. Is the noise present at the power steering assist motor?	Go to Step 5	Go to Step 4
4	Inspect the power steering gear for a whine or growl noise using the J-39570 chassis ear. Is the noise present at the power steering gear?	Go to Step 6	Go to Step 3
5	Replace the power steering assist motor. Refer to Power Steering Assist Motor Replacement (2WD) , or Power Steering Assist Motor Replacement (4WD) . Did you complete the repair?	Go to Step 7	-
6	Replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD) , or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD) . Did you complete the repair?	Go to Step 7	-
7	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

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 Symptoms - Power Steering System
2	Road test the vehicle in order to verify the complaint. It may be necessary to compare to a like vehicle. Does the system operate normally?	System OK	Go to Step 3

Step	Action	Yes	No
3	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Lubricate the tie rod ends and ball joints, if applicable. 3. Inspect the steering and suspension systems for worn or damaged components. 4. Repair as necessary. Did you find and correct the condition?	Go to Step 14	Go to Step 4
4	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Inspect the steering system for unequal effort. The vehicle must be suspended on a hoist, the engine running, and the transmission in park or neutral. Grasp the tire and wheel assembly and manually simulate a turn from the left of center and the right of center observing whether more force is needed to turn to the left or to the right. Was the tire and wheel assembly abnormally difficult to turn or was there a binding condition while turning in either direction?	Go to Step 5	Go to Step 11
5	NOTE: Position the wheels straight ahead. Do NOT rotate the steering wheel more than one complete revolution from center. 1. Lower the vehicle, but do not allow the tires to contact the ground. 2. Disconnect the intermediate steering shaft from the upper intermediate steering shaft. Refer to Intermediate Steering Shaft Replacement . 3. Note the position of the steering wheel and rotate the steering wheel ONE revolution in	Go to Step 12	Go to Step 6

Step	Action	Yes	No
	both directions. 4. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult turn or was there a binding condition while turning in either direction?		
6	1. Disconnect intermediate steering shaft from the steering gear. Refer to Intermediate Steering Shaft Replacement . 2. Inspect the intermediate steering shaft for stiff or binding joints. Replace as necessary. Did you find and complete the repair?	Go to Step 14	Go to Step 7
7	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Grasp the tire and wheel assembly and manually simulate a turn from the left of center and the right of center observing whether more force is needed or a binding condition exists while turning to the left or to the right. Was the tire and wheel assembly abnormally difficult to turn or was there a binding condition while turning in either direction?	Go to Step 8	Go to Step 2
8	1. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation . 2. Disconnect both steering linkage outer tie rod ends from the steering knuckles. Refer to Steering Linkage Outer Tie Rod Replacement (Without ZR2), or Steering Linkage Outer Tie Rod Replacement (With ZR2). 3. Use your hands in order to move the tie rod end studs. 4. If abnormally difficult to move, replace the tie rod end. Did you find and complete the repair?	Go to Step 14	Go to Step 9
9	Using hand's, manually simulate a turn from the left of center and the right of center observing whether	Go to Step 14	Go to Step 10

Step	Action	Yes	No
	more force is needed or a binding condition exists to inspect the strut, strut bearings, ball joints, or axle drive shafts for binding. Replace as necessary. Did you find and complete the repair?		
10	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Using a wrench, turn the steering gear input shaft from the left of center and the right of center observing whether more force is needed or a binding condition exists. Was the steering gear abnormally difficult to turn or binding?	Go to Step 13	Go to Step 2
11	Inspect the wheel alignment and adjust as necessary. Refer to Wheel Alignment Measurement . Did you find and complete the repair?	Go to Step 14	-
12	Inspect the steering column and front of dash seal for a binding. If a binding is present, repair or replace the steering column or front of dash seal as necessary. Did you find and complete the repair?	Go to Step 14	-
13	Replace the steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD) , or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD) . 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 SURGES/JERKS WHILE TURNING

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 Symptoms - Power Steering System
2	Road test the vehicle in order to verify the complaint. Does the system operate normally?	System OK	Go to Step 3
3	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Lubricate the tie rod ends and ball joints, if applicable.	Go to Step 12	Go to Step 4

Step	Action	Yes	No
	3. Inspect the steering and suspension systems for worn or damaged components. 4. Repair as necessary. Did you find and correct the condition?		
4	NOTE: Position the wheels straight ahead. Do NOT rotate the steering wheel more than one complete revolution from center. 1. Lower the vehicle, but do not allow the tires to contact the ground. 2. Disconnect the intermediate steering shaft from the upper intermediate steering shaft. Refer to Intermediate Steering Shaft Replacement . 3. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. 4. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to turn or was there a binding condition while turning in either direction?	Go to Step 10	Go to Step 5
5	1. Disconnect intermediate steering shaft from the steering gear. Refer to Intermediate Steering Shaft Replacement . 2. Inspect the intermediate steering shaft for stiff or binding joints. Replace as necessary. Did you find and complete the repair?	Go to Step 12	Go to Step 6
6	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly.	Go to Step 7	Go to Step 2

Step	Action	Yes	No
	Grasp the tire and wheel assembly and manually simulate a turn from the left of center and the right of center observing whether more force is needed or a binding condition exists while turning to the left or to the right. Was the tire and wheel assembly abnormally difficult to turn or was there a binding condition while turning in either direction?		
7	1. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation . 2. Disconnect both steering linkage outer tie rod ends from the steering knuckles. Refer to Steering Linkage Outer Tie Rod Replacement (Without ZR2), or Steering Linkage Outer Tie Rod Replacement (With ZR2). 3. Use your hands in order to move the tie rod end studs. 4. If abnormally difficult to move, replace the tie rod end. Did you find and complete the repair?	Go to Step 12	Go to Step 8
8	Using hand's, manually simulate a turn from the left of center and the right of center observing whether more force is needed or a binding condition exists to inspect the strut, strut bearings, ball joints, or axle drive shafts for binding. Replace as necessary. Did you find and complete the repair?	Go to Step 12	Go to Step 9
9	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Using a wrench, turn the steering gear input shaft from the left of center and the right of center observing whether more force is needed or a binding condition exists. Was the steering gear abnormally difficult to turn or binding?	Go to Step 11	Go to Step 2
10	Inspect the steering column and front of dash seal for a binding. If a binding is present, repair or replace the steering column or front of dash seal as necessary. Did you find and complete the repair?	Go to Step 12	-

Step	Action	Yes	No
11	Replace the steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD) , or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD) . Did you complete the repair?	Go to Step 12	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS

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 Symptoms - Power Steering System
2	Road test the vehicle in order to verify the complaint. It may be necessary to compare to a like vehicle. Is the steering effort hard in one or both directions?	Go to Step 3	System OK
3	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Lubricate the tie rod ends and ball joints, if applicable. 3. Inspect the steering and suspension systems 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	NOTE: Position the wheels straight ahead. Do NOT rotate the steering wheel more than one complete revolution from center. 1. Lower the vehicle, but do not allow the tires to contact the ground. 2. Disconnect the intermediate steering shaft from the upper intermediate steering shaft. Refer to Intermediate Steering Shaft Replacement. 3. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. 4. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to turn or was there a binding condition while turning in either direction?	Go to Step 10	Go to Step 5

Step	Action	Yes	No
5	1. Disconnect lower intermediate steering shaft from the steering gear. 2. Inspect the lower intermediate steering shaft for stiff or binding joints. Replace as necessary. Did you find and complete the repair?	Go to Step 12	Go to Step 6
6	NOTE: The effort required to turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Grasp the tire and wheel assembly and manually simulate a turn from the left of center and the right of center observing whether more force is needed or a binding condition exists while turning to the left or to the right. Was the tire and wheel assembly abnormally difficult turn or was there a binding condition while turning in either direction?	Go to Step 7	Go to Step 2
7	1. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation . 2. Disconnect both steering linkage outer tie rod ends from the steering knuckles. Refer to Steering Linkage Outer Tie Rod Replacement (Without ZR2), or Steering Linkage Outer Tie Rod Replacement (With ZR2). 3. Use your hands in order to move the tie rod end studs. 4. If abnormally difficult to move, replace the tie rod end. Did you find and complete the repair?	Go to Step 12	Go to Step 8
8	Using hand's, manually simulate a turn from the left of center and the right of center observing whether more force is needed or a binding condition exists to inspect the strut, strut bearings, ball joints, or axle driveshafts for binding. Replace as necessary. Did you find and complete the repair?	Go to Step 12	Go to Step 9
9	NOTE: The effort required to	Go to Step 11	Go to Step 2

Step	Action	Yes	No
	turn the belt driven electric steering gear will be harder than a hydraulic system, but the gear should rotate smoothly. Using a wrench, turn the steering gear input shaft from the left of center and the right of center observing whether more force is needed or a binding condition exists. Was the steering gear abnormally difficult to turn or binding?		
10	Inspect the steering column and front of dash seal for a binding. If a binding is present, repair or replace the steering column or front of dash seal as necessary.	Go to Step 12	-
11	Replace the steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD), or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD). Did you complete the repair?	Go to Step 12	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

STEERING LINKAGE INNER TIE ROD INSPECTION

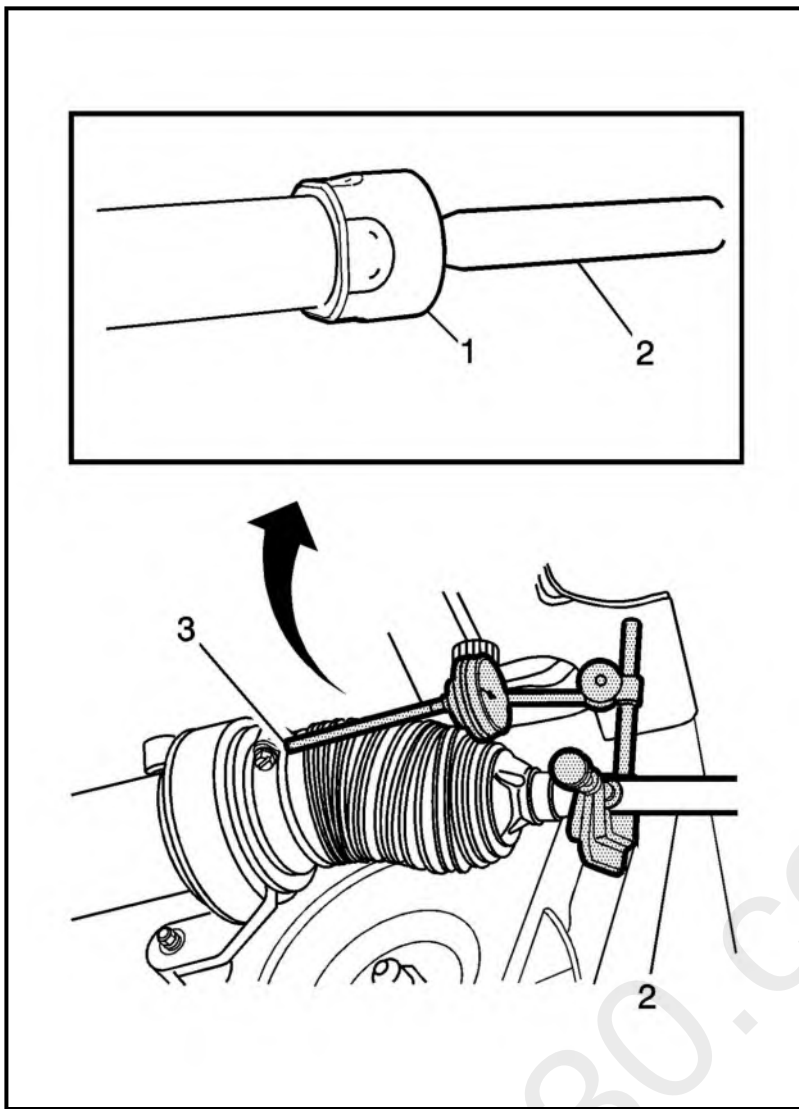
Special Tools

GE-8001 Dial Indicator Set

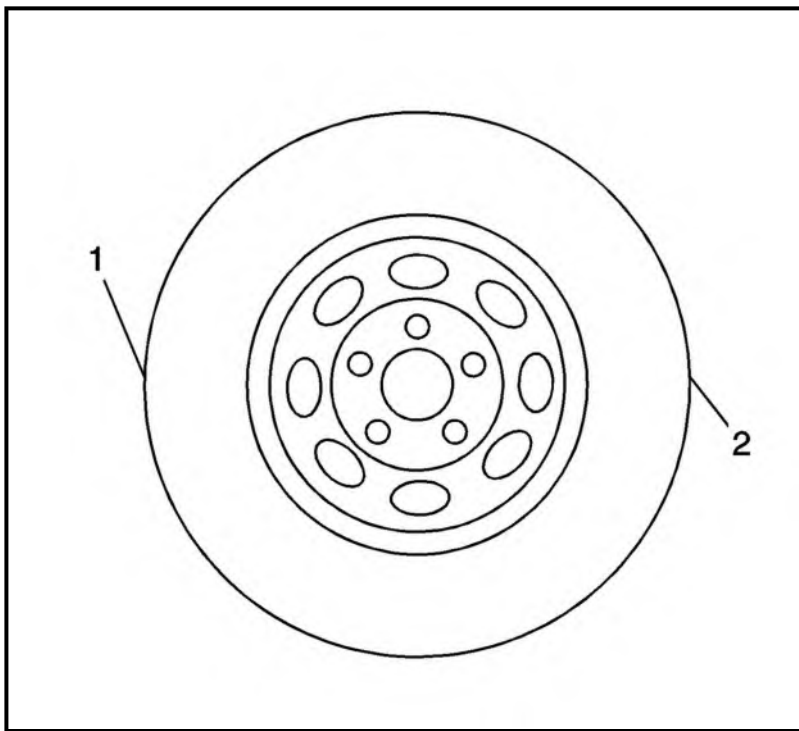
For equivalent regional tools, refer to [Special Tools](#).

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. Part of the steering linkage inner tie rod (2) being tested should be inside the steering gear housing. The inner tie rod housing (1) being tested should be inside the steering gear housing and 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 **GE-8001** dial indicator pointer at the steering gear housing, install a large worm gear hose clamp (3) 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 **GE-8001** dial indicator pointer.
5. Install the **GE-8001** dial indicator between the inner tie rod 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. The lash between the inner tie rod and the steering gear housing is equal to the lash between the inner tie rod and the inner tie rod housing because the inner tie rod housing is inside the steering gear housing during this procedure.
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.



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.

7. Zero the **GE-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 shown on the **GE-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 \(Without ZR2\)](#), or [Steering Linkage Inner Tie Rod Replacement \(With ZR2\)](#).
11. Repeat the procedure for the other side.

STEERING LINKAGE OUTER TIE ROD INSPECTION

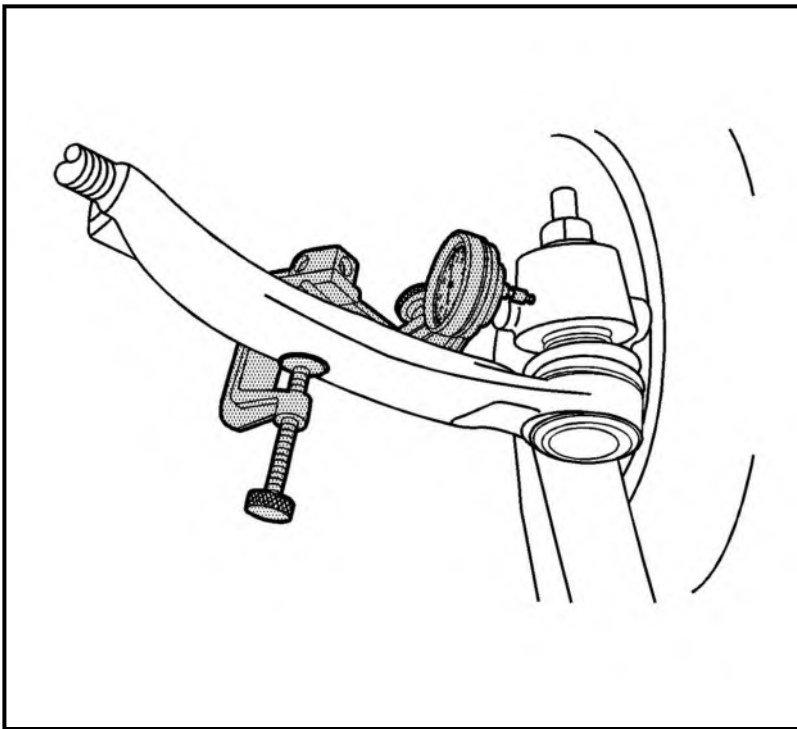
Special Tools

GE-8001 Dial Indicator Set

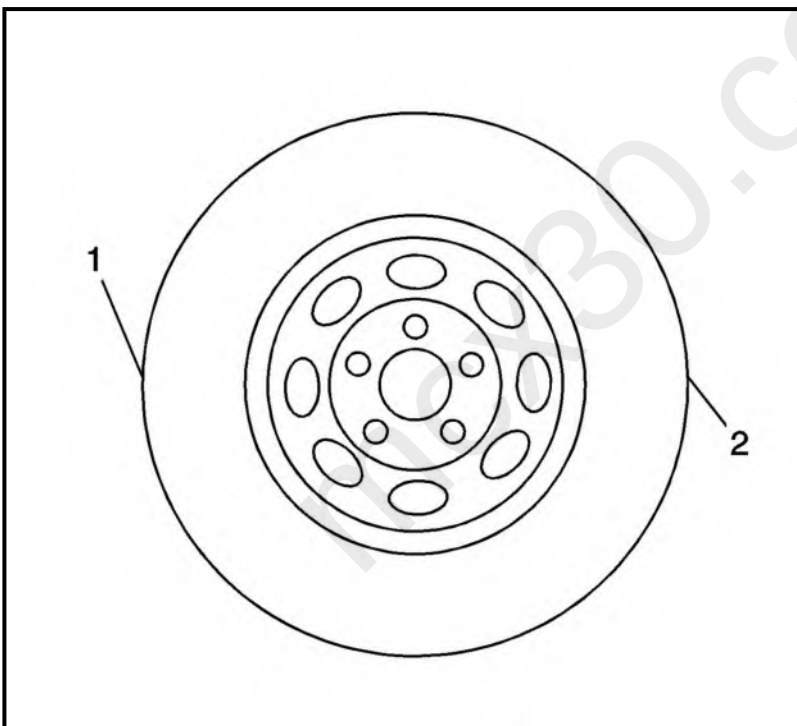
For equivalent regional tools, refer to [Special Tools](#).

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

1. Inspect the outer tie rod seal. If the outer tie rod seal is torn, replace the outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).
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](#).
3. Install the **GE-8001** dial indicator between the outer tie rod and the steering knuckle as shown in the graphic. Note that the tire and wheel assembly is shown removed only for clarification of the **GE-8001** dial indicator position.

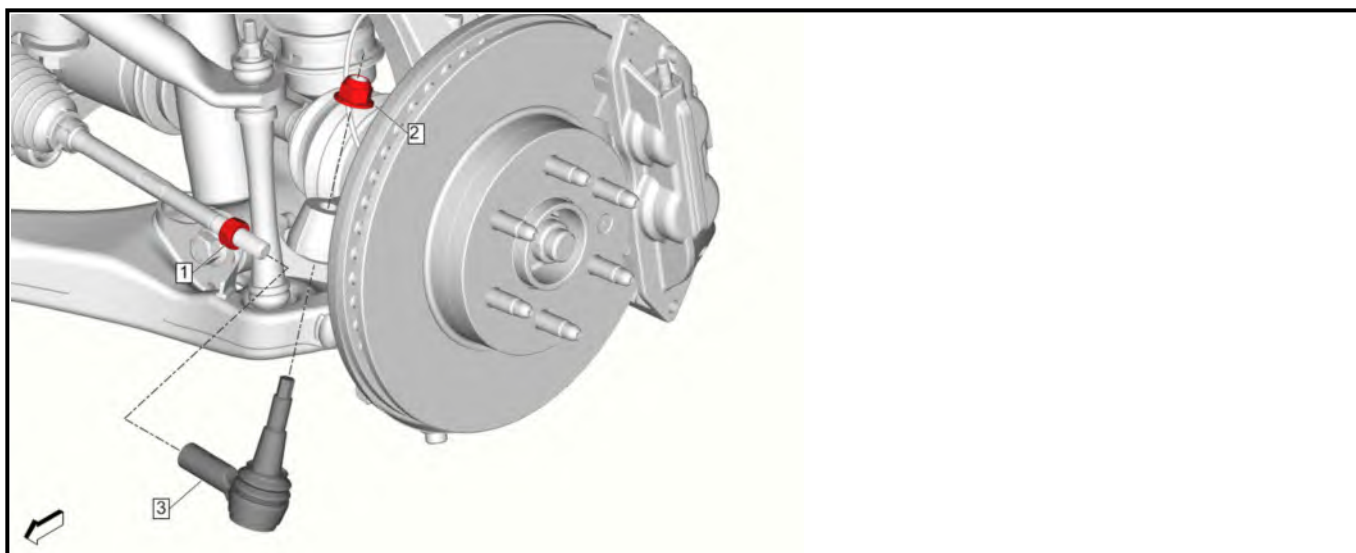


4. Grasping the tire at the 3 o'clock (2) and 9 o'clock (1) positions, gently push in on one side of the tire to remove any lash.



5. Zero the **GE-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 shown on the **GE-8001** dial indicator.
8. If the measured value exceeds 0.5 mm (0.02 in), replace the outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).
9. Repeat the procedure for the other side.

STEERING LINKAGE OUTER TIE ROD REPLACEMENT (WITHOUT ZR2)

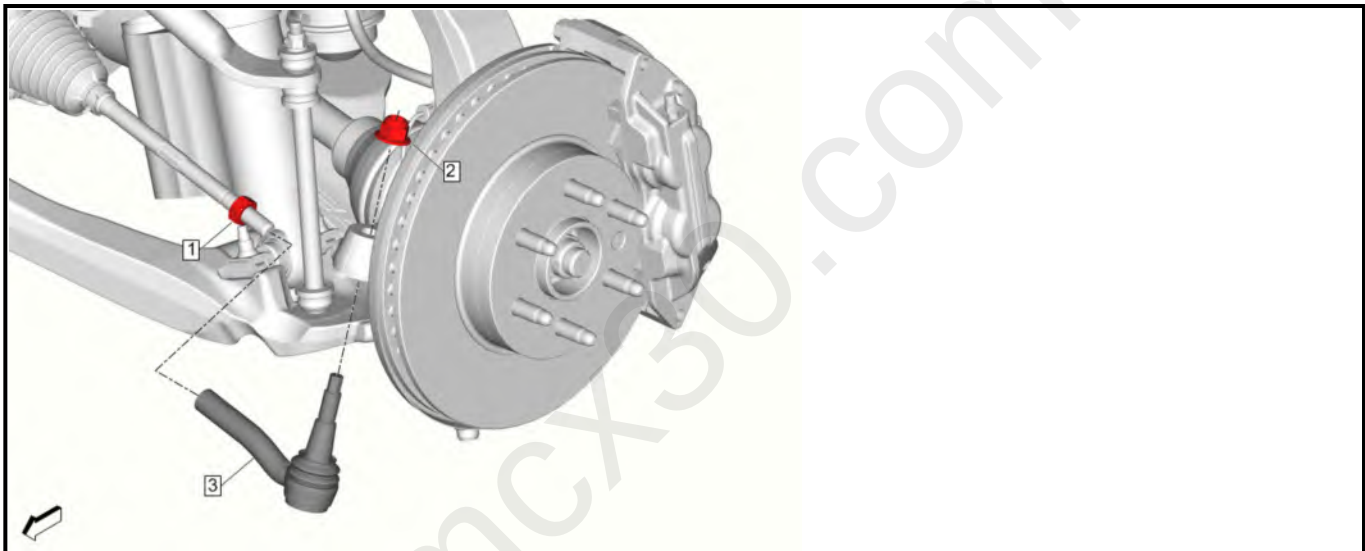


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the front tire and wheel assembly. Tire and Wheel Removal and Installation	
1	Steering Linkage Inner Tie Rod Nut Procedure Place match marks on the steering linkage inner tie rod nut and the steering linkage inner tie rod. NOTE: Do NOT tighten the steering linkage inner tie rod nut during installation. Tighten the nut after adjusting the front toe.
2	Steering Linkage Outer Tie Rod Nut CAUTION: Refer to Fastener Caution . Procedure Use the EN-45059 meter to tighten the steering linkage outer tie rod nut. Tighten First Pass: 35 N.m (26 lb ft) Final Pass: (85 - 95 degrees) Special Tools EN-45059 Torque Angle Meter Equivalent regional tools: Special Tools
3	Steering Linkage Outer Tie Rod

Callout	Component Name
	Procedure 1. Use the CH-24319 - B puller to separate the steering linkage outer tie rod from the steering knuckle. 2. Clean the tapered surface of the steering knuckle. 3. Inspect the steering linkage inner tie rod for bent or damaged threads. If necessary, replace the steering linkage inner tie rod. Steering Linkage Inner Tie Rod Replacement (Without ZR2) 4. Lubricate the steering linkage inner tie rod threads with chassis lubricant. 5. Measure and adjust the front toe. Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment Special Tools CH-24319 - B Universal Steering Linkage and Tie Rod Puller Equivalent regional tools: Special Tools

STEERING LINKAGE OUTER TIE ROD REPLACEMENT (WITH ZR2)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the front tire and wheel assembly. Tire and Wheel Removal and Installation	
1	Steering Linkage Inner Tie Rod Nut Procedure Place match marks on the steering linkage inner tie rod nut and the steering linkage inner tie rod. NOTE: Do NOT tighten the steering linkage inner tie rod nut during installation. Tighten the

Callout	Component Name
	nut after adjusting the front toe.
2	Steering Linkage Outer Tie Rod Nut CAUTION: Refer to Fastener Caution . Procedure Use the EN-45059 meter to tighten the steering linkage outer tie rod nut. Tighten First Pass: 35 N.m (26 lb ft) Final Pass: (85 - 95 degrees) Special Tools EN-45059 Torque Angle Meter Equivalent regional tools: Special Tools
3	Steering Linkage Outer Tie Rod Procedure 1. Use the CH-24319 - B puller to separate the steering linkage outer tie rod from the steering knuckle. 2. Clean the tapered surface of the steering knuckle. 3. Inspect the steering linkage inner tie rod for bent or damaged threads. If necessary, replace the steering linkage inner tie rod Steering Linkage Inner Tie Rod Replacement (With ZR2). 4. Lubricate the steering linkage inner tie rod threads with chassis lubricant. 5. Measure and adjust the front toe. Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment Special Tools CH-24319 - B Universal Steering Linkage and Tie Rod Puller Equivalent regional tools: Special Tools

STEERING GEAR BOOT REPLACEMENT (WITHOUT ZR2)

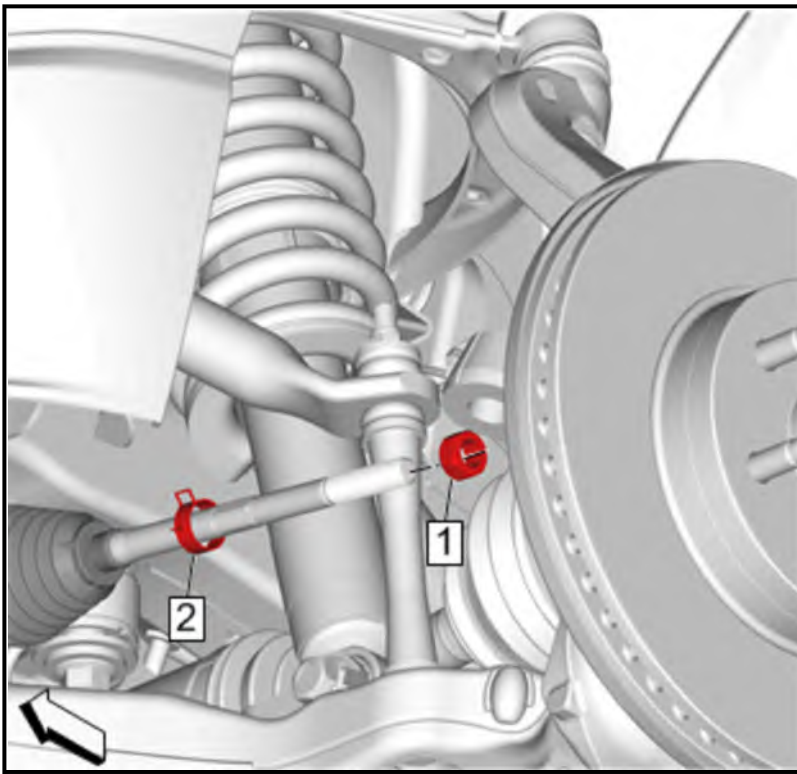
Special Tools

CH-22610 Keystone Clamp Pliers

Equivalent regional tools: [Special Tools](#)

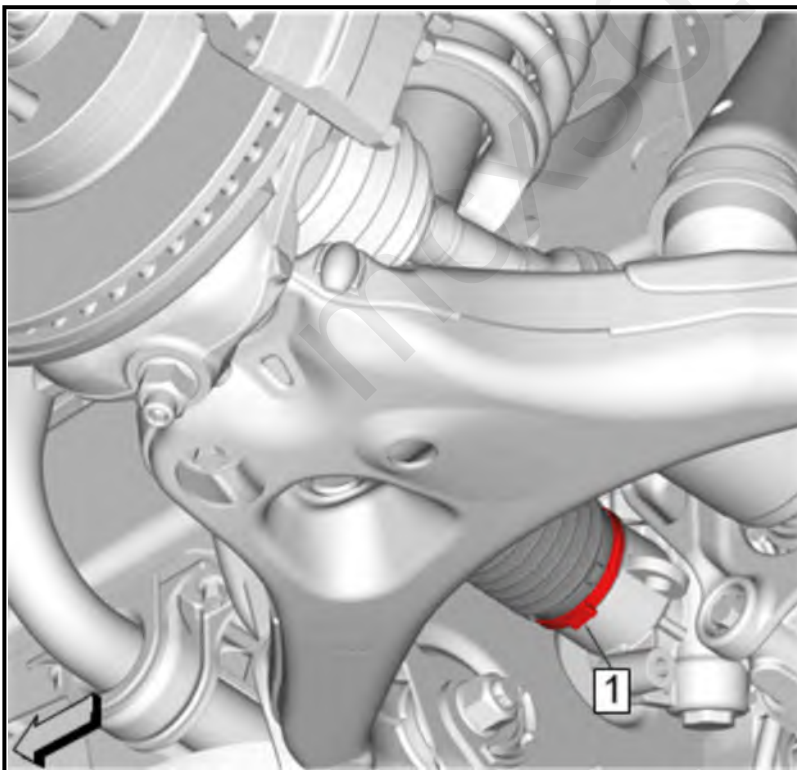
Removal Procedure

1. Steering Linkage Outer Tie Rod - Remove - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#).
2. Steering Linkage Inner Tie Rod Nut (1) - Remove



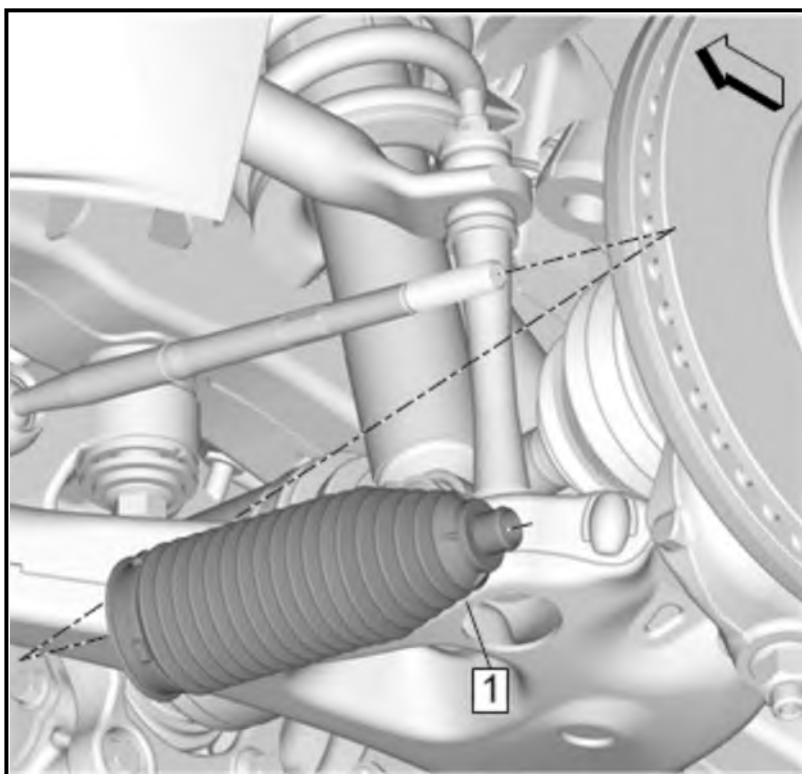
NOTE: Place match marks on the steering linkage inner tie rod nut and the steering linkage inner tie rod.

3. Steering Gear Boot Outer Clamp (2) - Remove
4. Steering Gear Boot Inner Clamp (1) - Remove



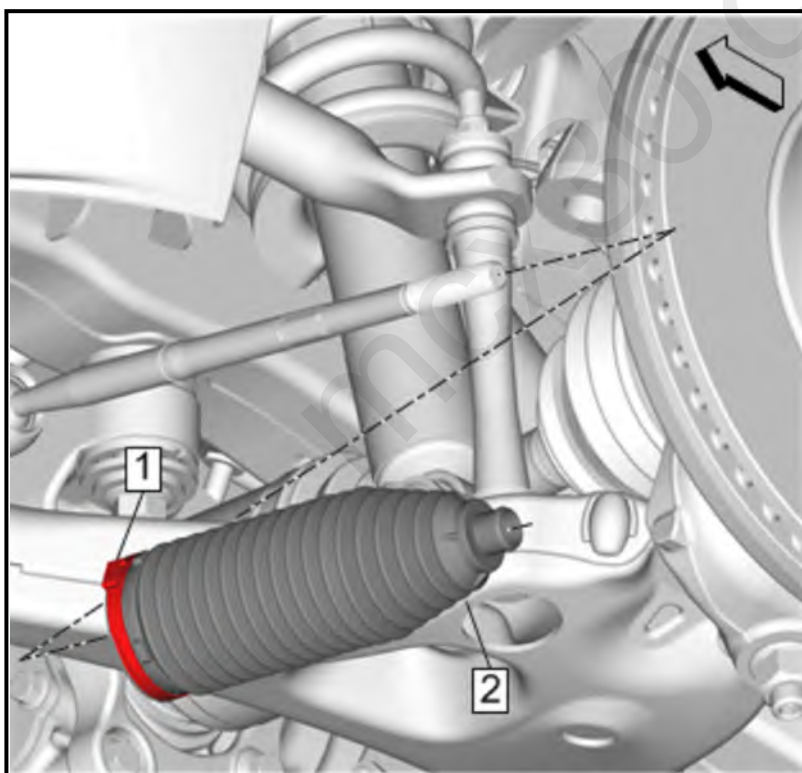
DISCARD the clamp.

5. Remove the steering gear boot (1) from the steering gear.

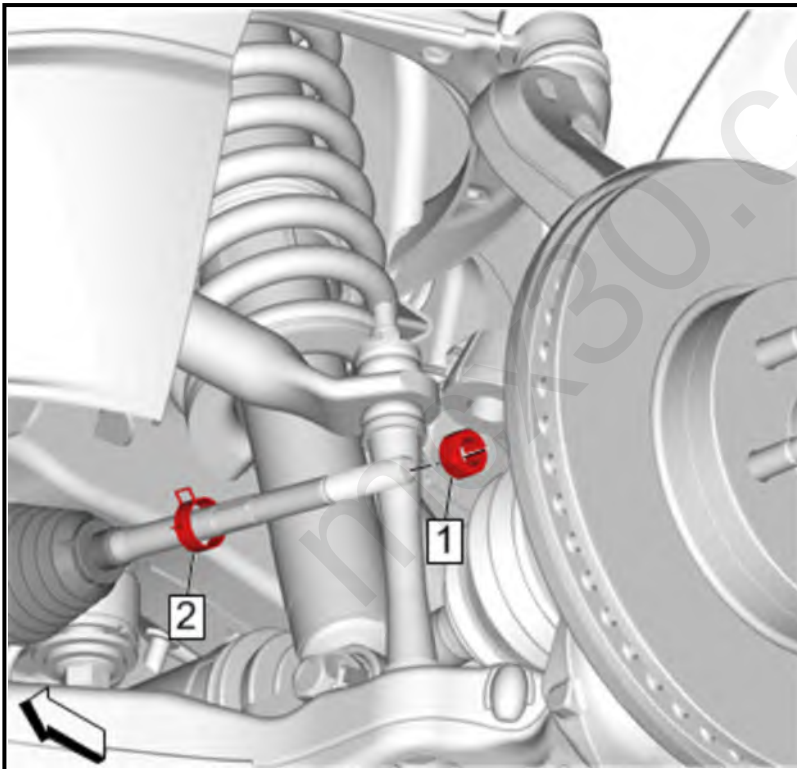
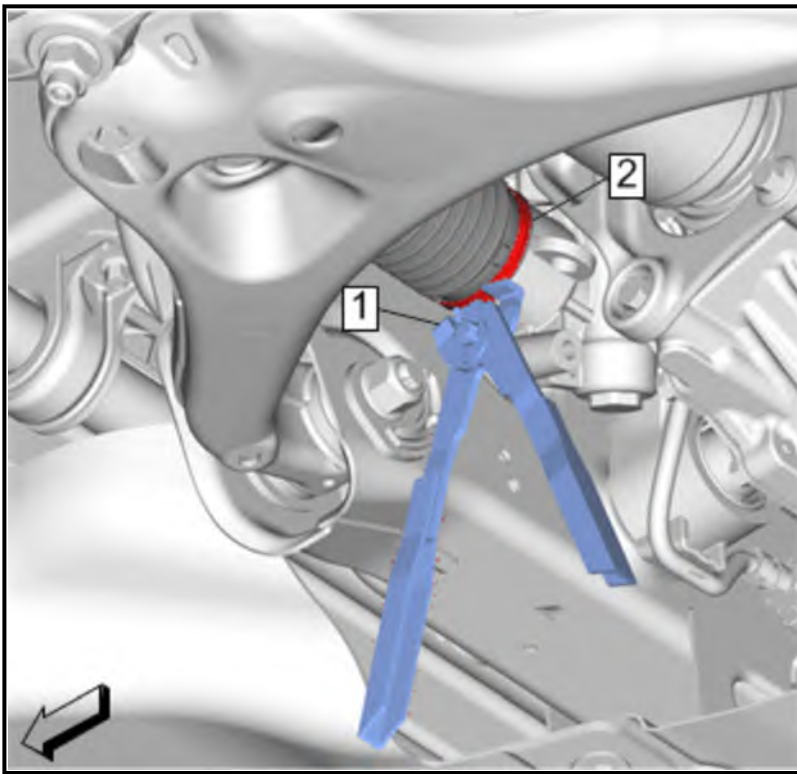


Installation Procedure

1. Position a NEW steering gear boot inner clamp (1) on the steering gear boot (2).



2. Position the steering gear boot (2) on the steering gear.
3. Use the **CH-22610** pliers (1) to tighten the steering gear boot inner clamp (2).



4. Steering Linkage Inner Tie Rod Nut (1) - Install
5. Steering Linkage Outer Tie Rod - Install - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#)
6. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)

STEERING GEAR BOOT REPLACEMENT (WITH ZR2)

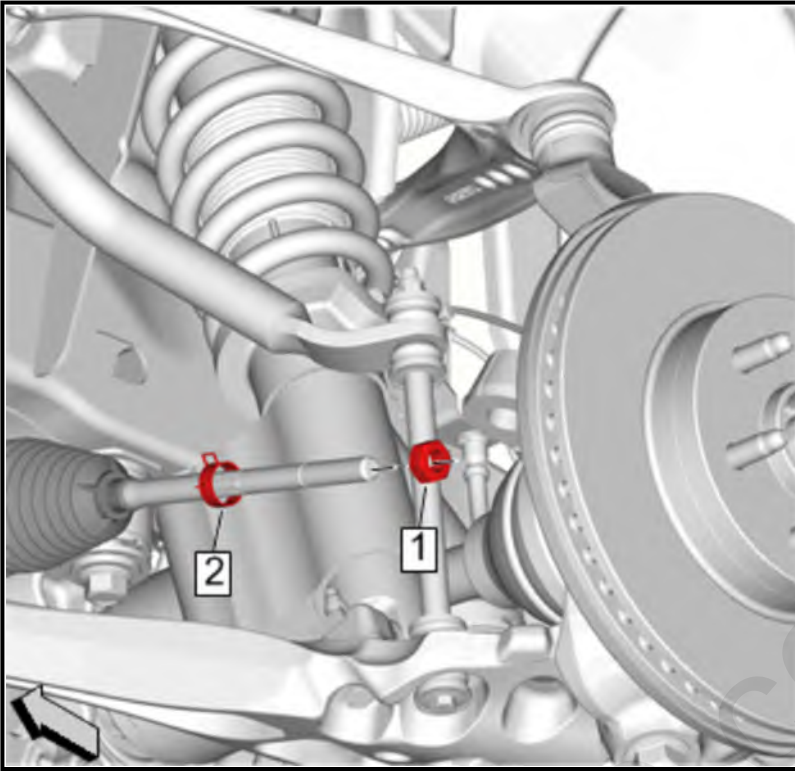
Special Tools

CH-22610 Keystone Clamp Pliers

Equivalent regional tools: [Special Tools](#)

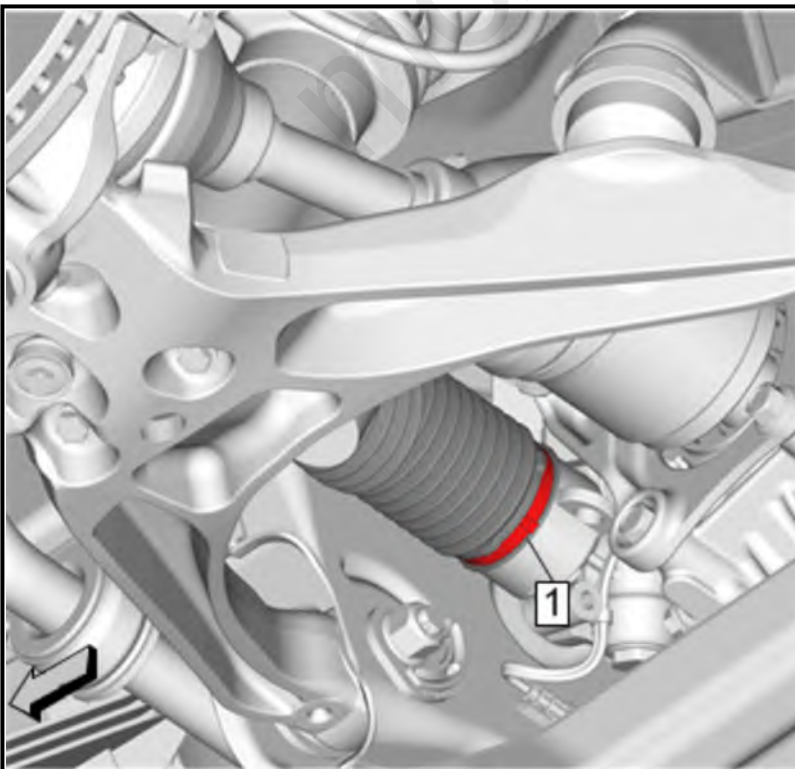
Removal Procedure

1. Steering Linkage Outer Tie Rod - Remove - [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).
2. Steering Linkage Inner Tie Rod Nut (1) - Remove



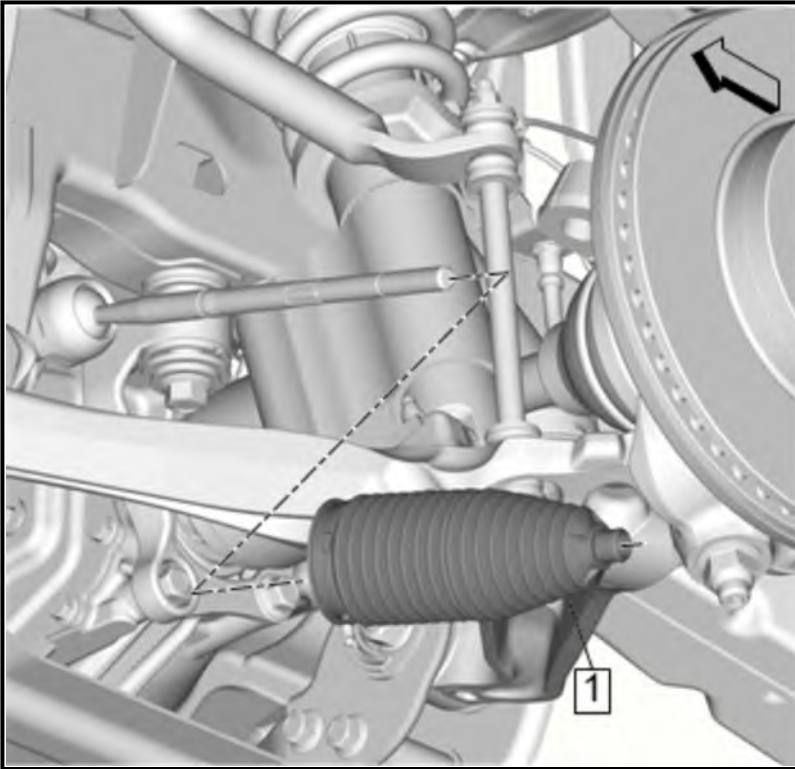
NOTE: Place match marks on the steering linkage inner tie rod nut and the steering linkage inner tie rod.

3. Steering Gear Boot Outer Clamp (2) - Remove
4. Steering Gear Boot Inner Clamp (1) - Remove



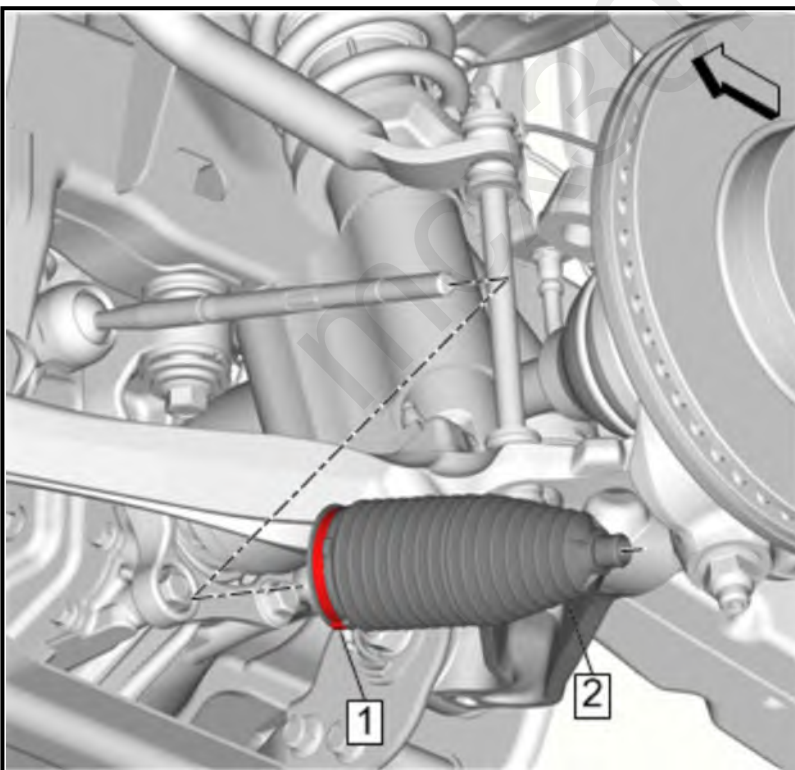
DISCARD the clamp.

5. Remove the steering gear boot (1) from the steering gear.



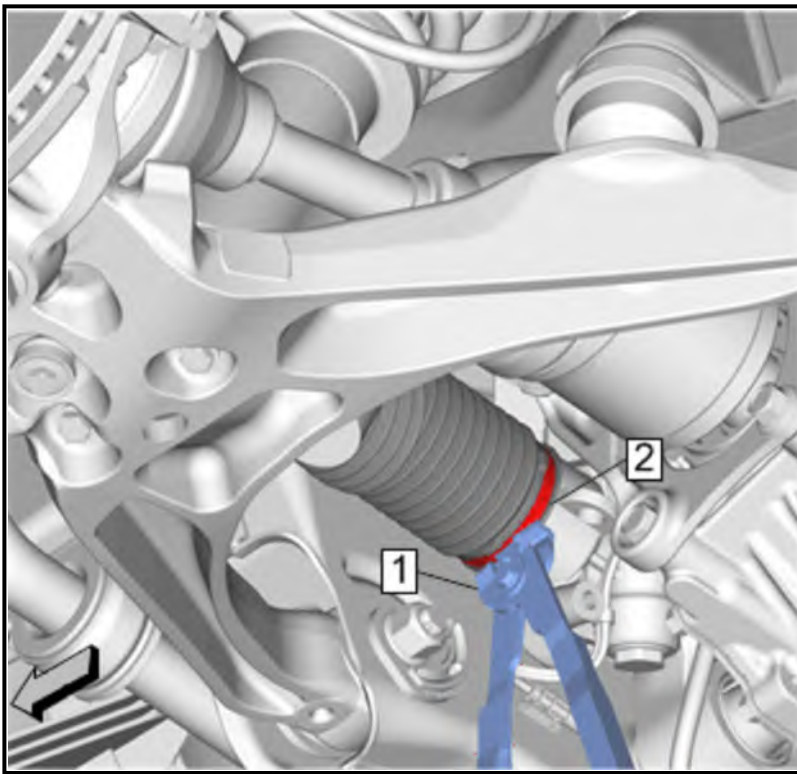
Installation Procedure

1. Position a NEW steering gear boot inner clamp (1) on the steering gear boot (2).

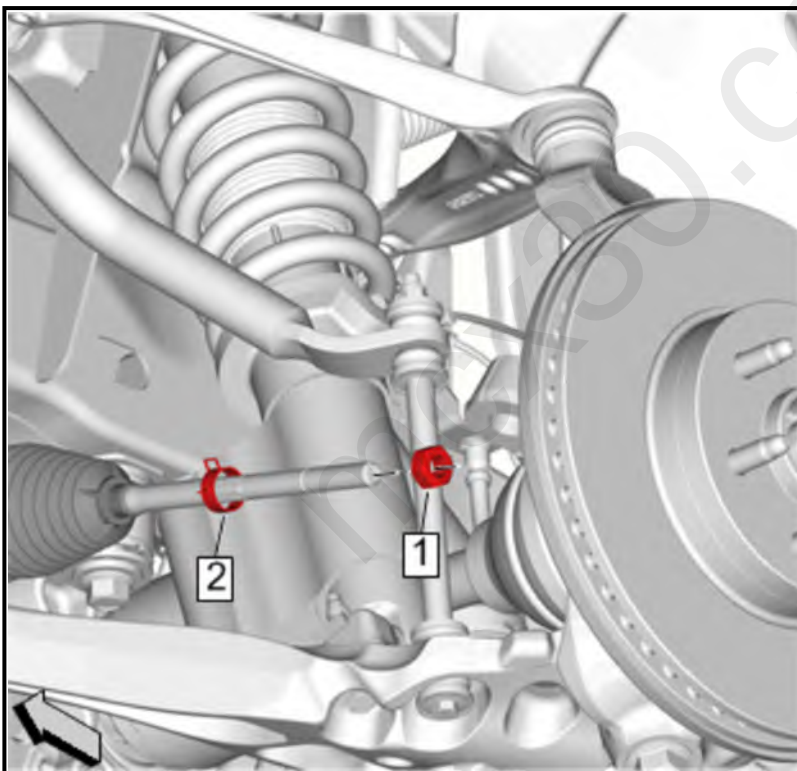


2. Position the steering gear boot (2) on the steering gear.

3. Use the **CH-22610** pliers (1) to tighten the steering gear boot inner clamp (2).



4. Steering Gear Boot Outer Clamp (2) - Install



5. Steering Linkage Inner Tie Rod Nut (1) - Install

6. Steering Linkage Outer Tie Rod - Install - [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#)

7. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)

ELECTRIC BELT DRIVE RACK AND PINION STEERING GEAR REPLACEMENT (2WD)

Special Tools

EN-45059 Torque Angle Meter

Equivalent regional tools: [Special Tools](#)

CAUTION: Electrostatic discharge (ESD) can damage many solid-state electrical components. ESD susceptible components may or may not be labeled with the ESD symbol. Handle all electrical components carefully. Use the following precautions in order to avoid ESD damage:

- Touch a metal ground point in order to remove your body's static charge before servicing any electronic component; especially after sliding across the vehicle seat.
- Do not touch exposed terminals. Terminals may connect to circuits susceptible the ESD damage.
- Do not allow tools to contact exposed terminals when servicing connectors.
- Do not remove components from their protective packaging until required to do so.
- Avoid the following actions unless required by the diagnostic procedure:
 - Jumpering or grounding of the components or connectors.
 - Connecting test equipment probes to components or connectors. Connect the ground lead first when using test probes.
- Ground the protective packaging of any component before opening. Do not rest solid-state components on metal workbenches, or on top of TVs, radios, or other electrical devices.

CAUTION: During removal and installation, all EPS components including mechanical and/or electrical is extremely susceptible to damage. Dropping or prying on any EPS component may cause internal damage. If damage occurs or a part is dropped, the EPS component must be replaced.

CAUTION: Care must be taken during removal and installation of the Electronic Power Steering (EPS) components to not hit or break the EPS motor/controller module or module harness connectors. If the EPS motor/ controller module or module connectors are damaged, the complete component must be replaced.

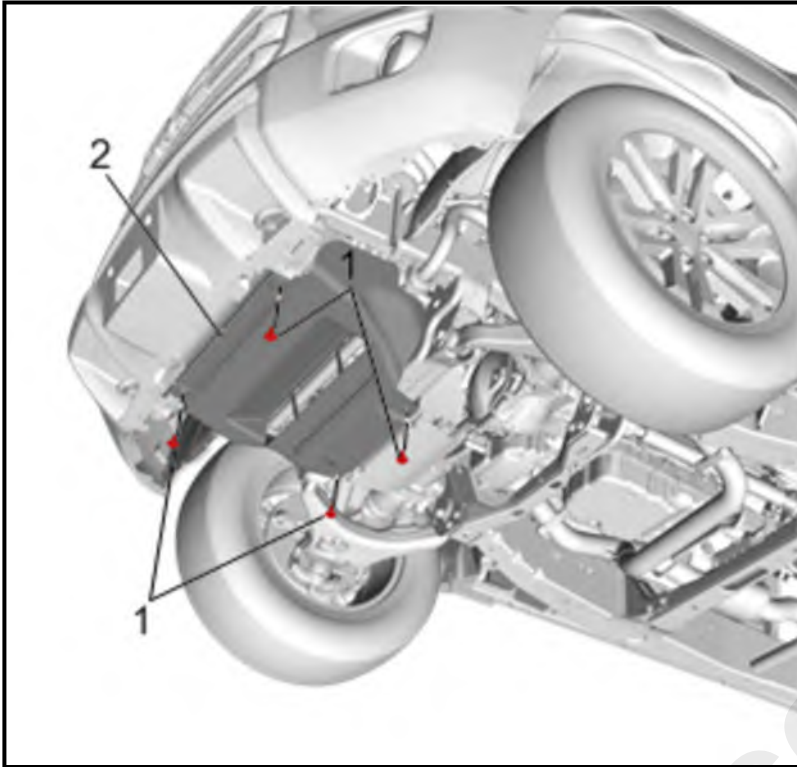
CAUTION: With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must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

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

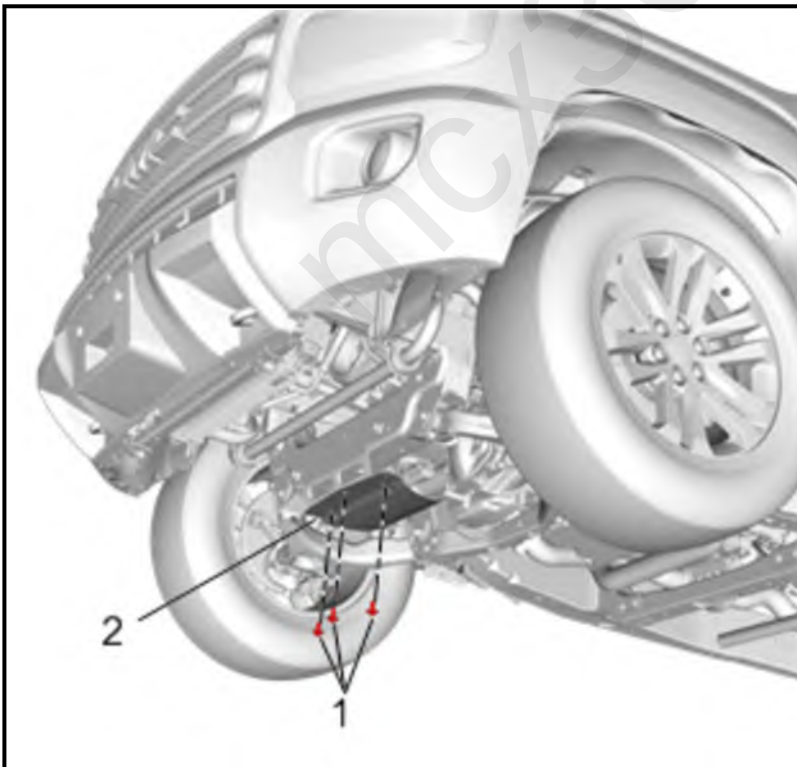
After disconnecting these components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to the SIR coil. If you think the SIR coil has become un-centered, refer to your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

1. With the steering wheel in the straight ahead position, LOCK the steering column.
2. Remove the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)

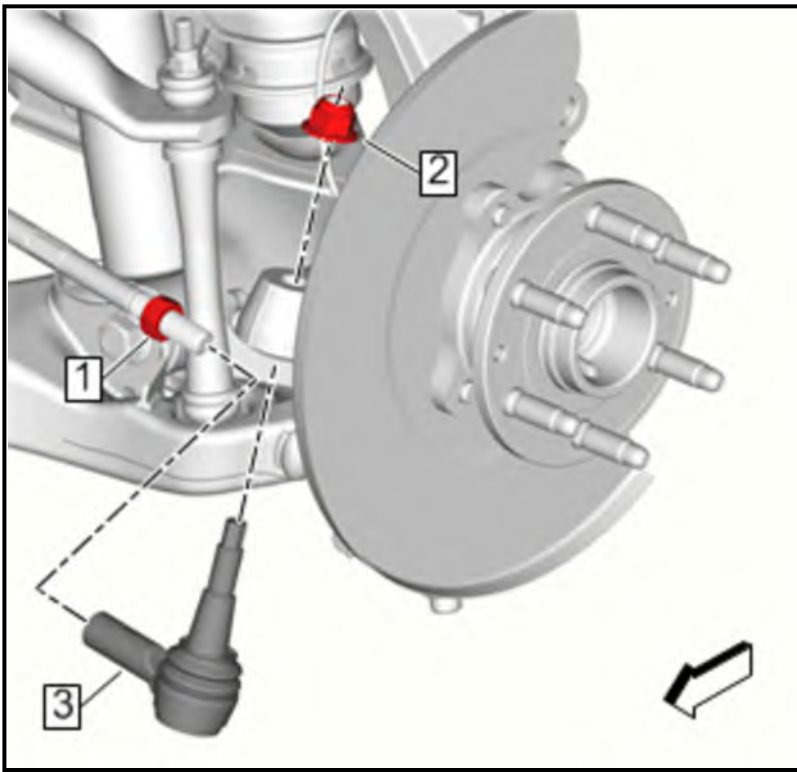
3. Underbody Splash Shield (2) - Remove - [Underbody Splash Shield Replacement \(without ZR2\)](#) , or [Underbody Splash Shield Replacement \(with ZR2\)](#) , or [Underbody Splash Shield Replacement \(Bison\)](#)



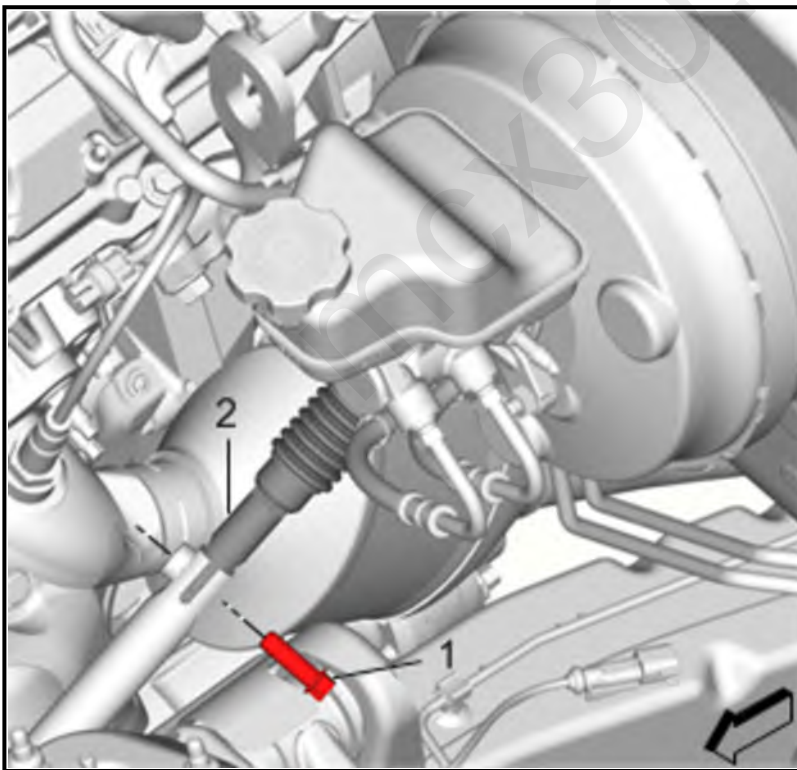
4. Steering Gear Skid Shield (2) - Remove - [Steering Gear Skid Shield Replacement \(without ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(with ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(Bison\)](#)



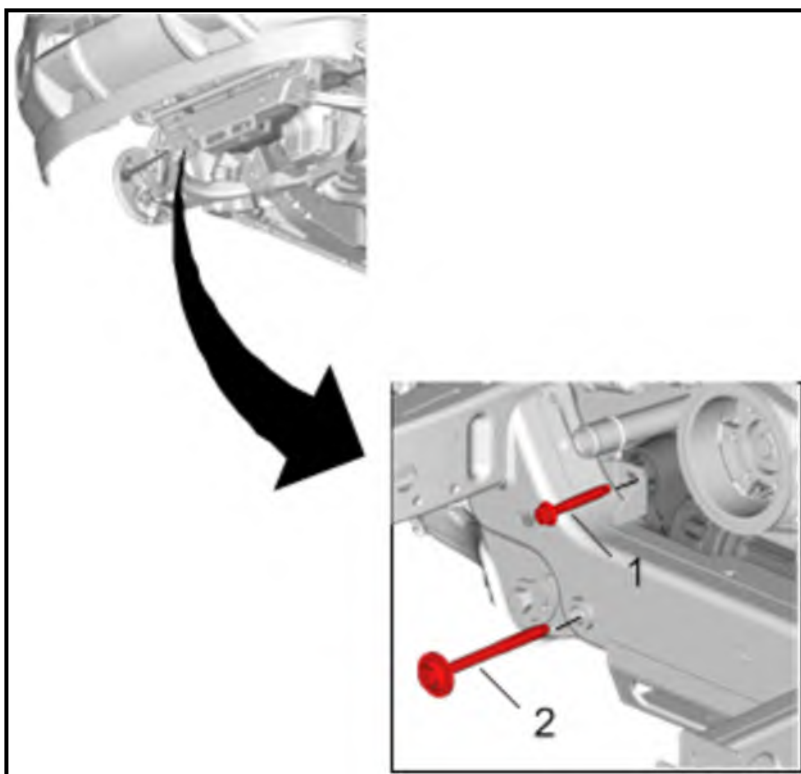
5. Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Separate [2x] - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#)



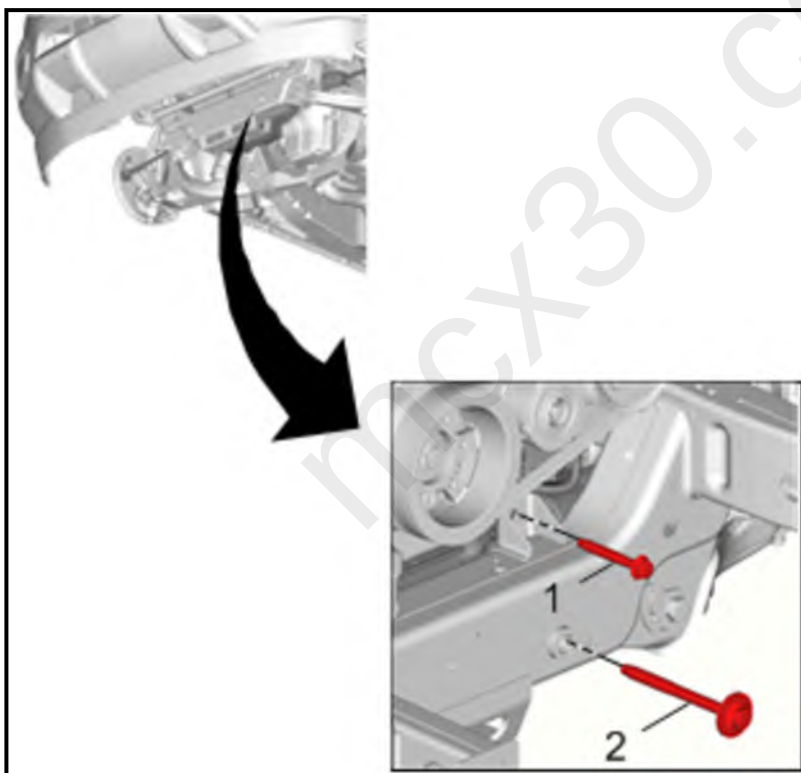
6. Disconnect the vehicle wiring harnesses from the steering gear and set aside.
7. Place match marks on the intermediate steering shaft and the lower steering shaft assembly to aid in installation.
8. Intermediate Steering Shaft (2) @ Lower Steering Shaft Assembly - Separate - [Lower Steering Shaft Assembly Replacement](#)



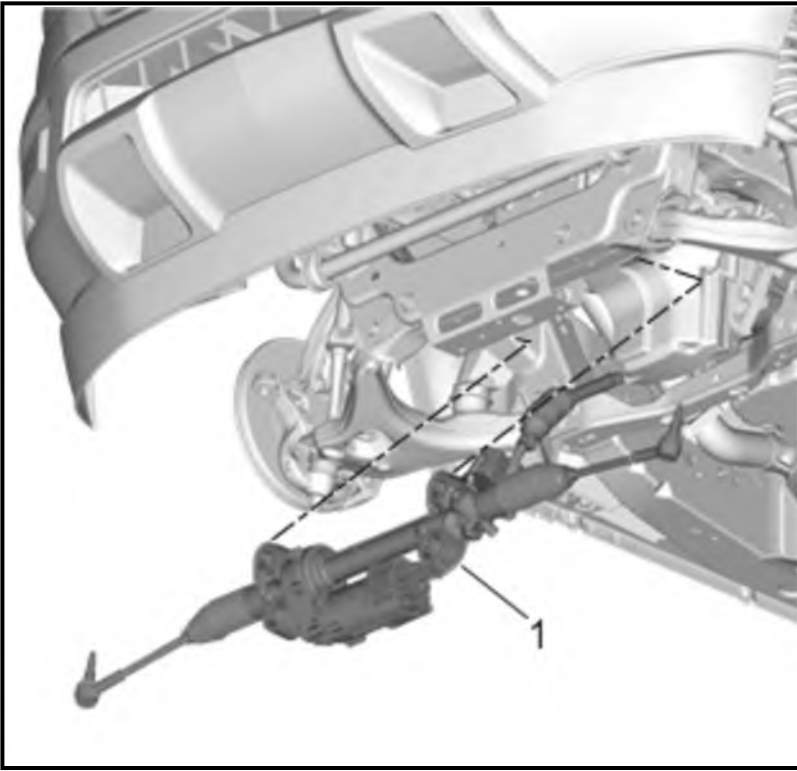
9. Support the steering gear assembly with a suitable support.
10. On the right side of the vehicle, remove the upper steering gear bolt (1) and the lower steering gear bolt (2).



11. On the left side of the vehicle, remove the upper steering gear bolt (1) and the lower steering gear bolt (2).



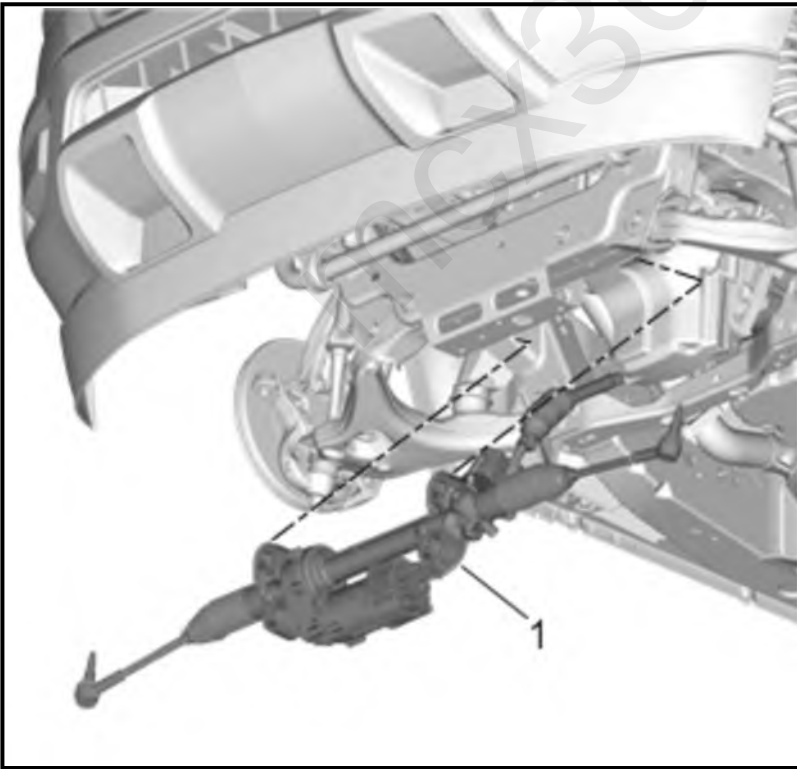
12. With the assistance of a helper, remove the support and rotate the steering gear (1) toward the front of the vehicle until the steering gear shaft and lower steering shaft assembly are vertical.



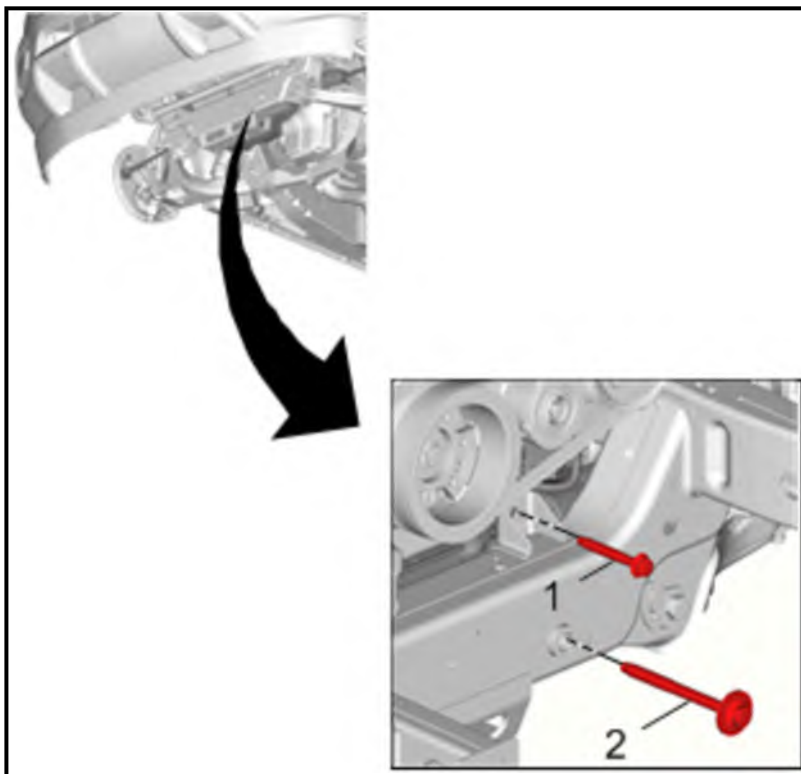
13. Carefully remove the steering gear (1) from the vehicle.
14. Transfer components as necessary.

Installation Procedure

1. With the assistance of a helper, hold the steering gear (1) with the steering gear shaft and lower steering shaft assembly vertical.



2. Carefully position the steering gear (1) on the vehicle and support the assembly with a suitable support.
3. On the left side of the vehicle, loosely install the lower steering gear bolt (2) and the upper steering gear bolt (1).

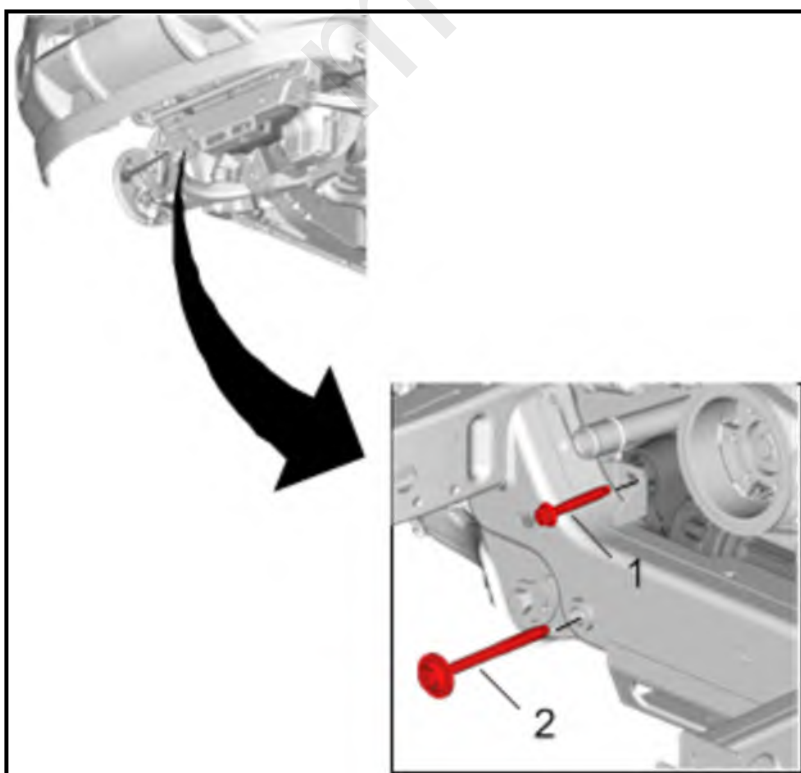


CAUTION: Refer to [Fastener Caution](#) .

4. After all steering gear bolts are installed, tighten the upper steering gear bolt (1) to 100 N.m (74 lb ft).
5. After all steering gear bolts are installed, use the **EN-45059** meter to tighten the lower steering gear bolt (2).

Tighten

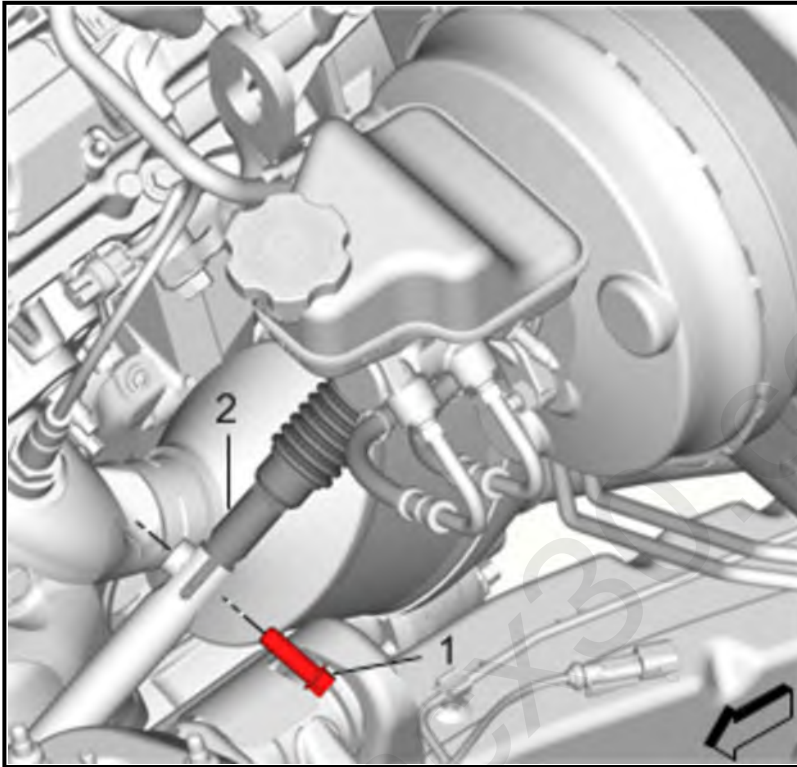
1. First Pass: 150 N.m (111 lb ft)
 2. Final Pass: (30 - 45 degrees)
6. On the right side of the vehicle, loosely install the lower steering gear bolt (2) and the upper steering gear bolt (1).



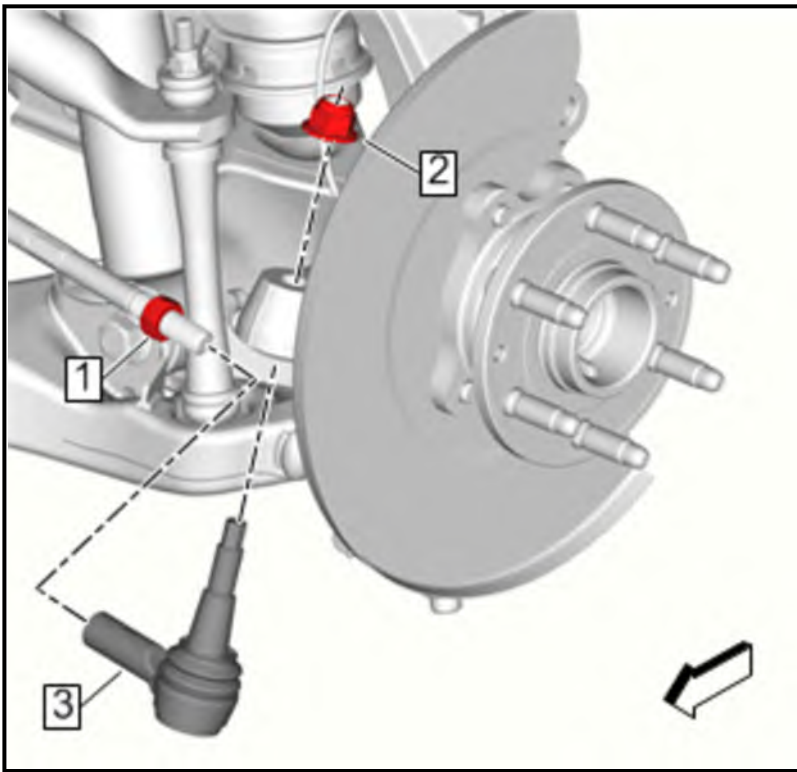
7. After all steering gear bolts are installed, tighten the upper steering gear bolt (1) to 100 N.m (74 lb ft).
8. After all steering gear bolts are installed, use the **EN-45059** meter to tighten the lower steering gear bolt (2).

Tighten

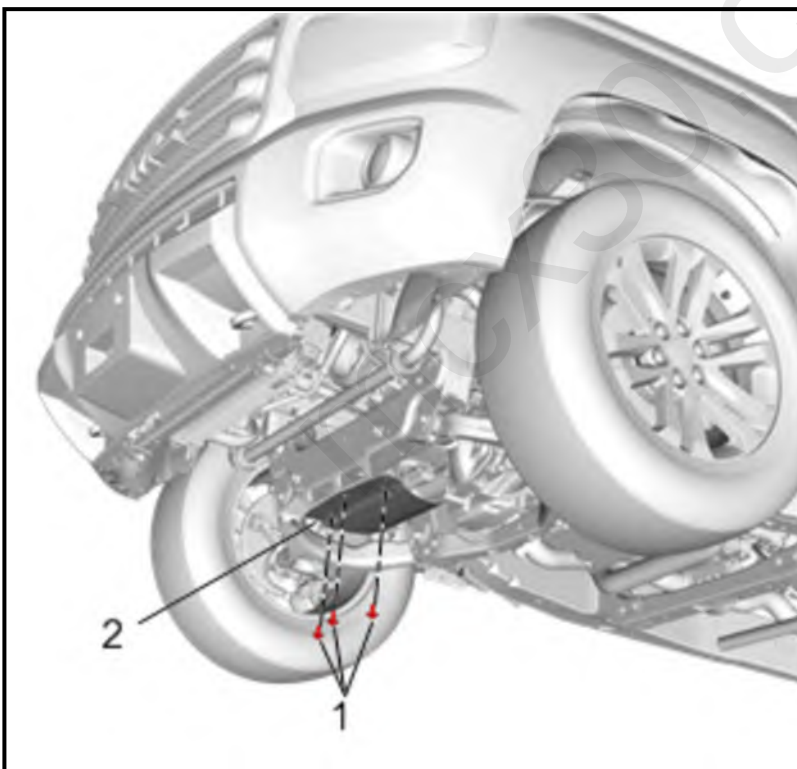
1. First Pass: 150 N.m (111 lb ft)
2. Final Pass: (30 - 45 degrees)
9. Remove the support from underneath the vehicle.
10. Connect the vehicle wiring harnesses to the steering gear.
11. Intermediate Steering Shaft (2) @ Lower Steering Shaft Assembly - Install - [Lower Steering Shaft Assembly Replacement](#)



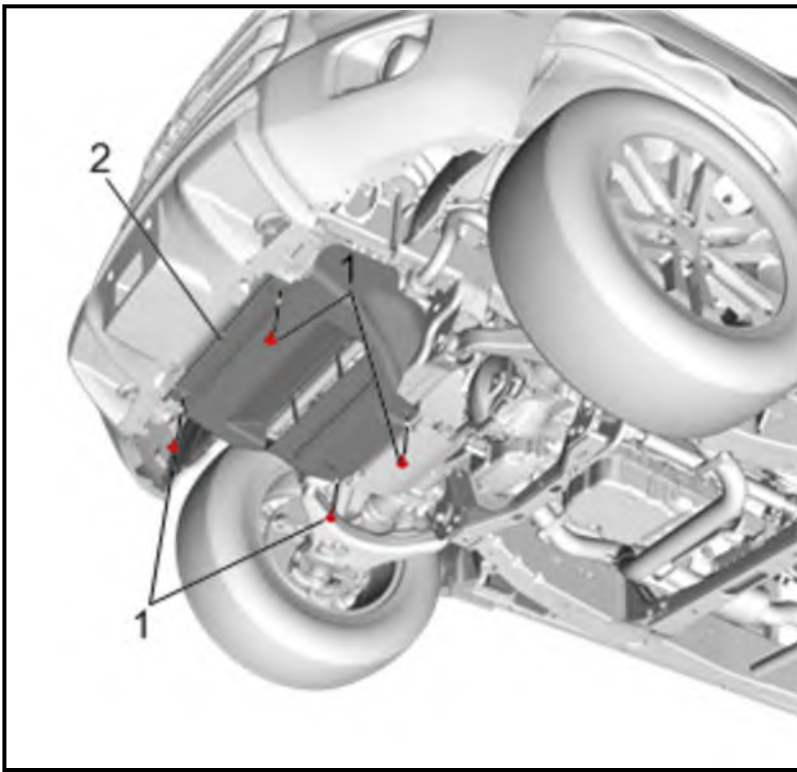
12. Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Install [2x] - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#)



13. Steering Gear Skid Shield (2) - Install - [Steering Gear Skid Shield Replacement \(without ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(with ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(Bison\)](#)



14. Underbody Splash Shield (2) - Install - [Underbody Splash Shield Replacement \(without ZR2\)](#) , or [Underbody Splash Shield Replacement \(with ZR2\)](#) , or [Underbody Splash Shield Replacement \(Bison\)](#)



15. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)
16. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)
17. Program the power steering control module. [K43 Power Steering Control Module: Programming and Setup](#)

ELECTRIC BELT DRIVE RACK AND PINION STEERING GEAR REPLACEMENT (4WD)

Special Tools

EN-45059 Torque Angle Meter

Equivalent regional tools: [Special Tools](#)

Removal Procedure

CAUTION:

Electrostatic discharge (ESD) can damage many solid-state electrical components. ESD susceptible components may or may not be labeled with the ESD symbol. Handle all electrical components carefully. Use the following precautions in order to avoid ESD damage:

- Touch a metal ground point in order to remove your body's static charge before servicing any electronic component; especially after sliding across the vehicle seat.
- Do not touch exposed terminals. Terminals may connect to circuits susceptible the ESD damage.
- Do not allow tools to contact exposed terminals when servicing connectors.
- Do not remove components from their protective packaging until required to do so.
- Avoid the following actions unless required by the diagnostic procedure:
 - Jumpering or grounding of the components or connectors.
 - Connecting test equipment probes to components or connectors. Connect the ground lead first when using test probes.

- Ground the protective packaging of any component before opening. Do not rest solid-state components on metal workbenches, or on top of TVs, radios, or other electrical devices.

CAUTION: During removal and installation, all EPS components including mechanical and/or electrical is extremely susceptible to damage. Dropping or prying on any EPS component may cause internal damage. If damage occurs or a part is dropped, the EPS component must be replaced.

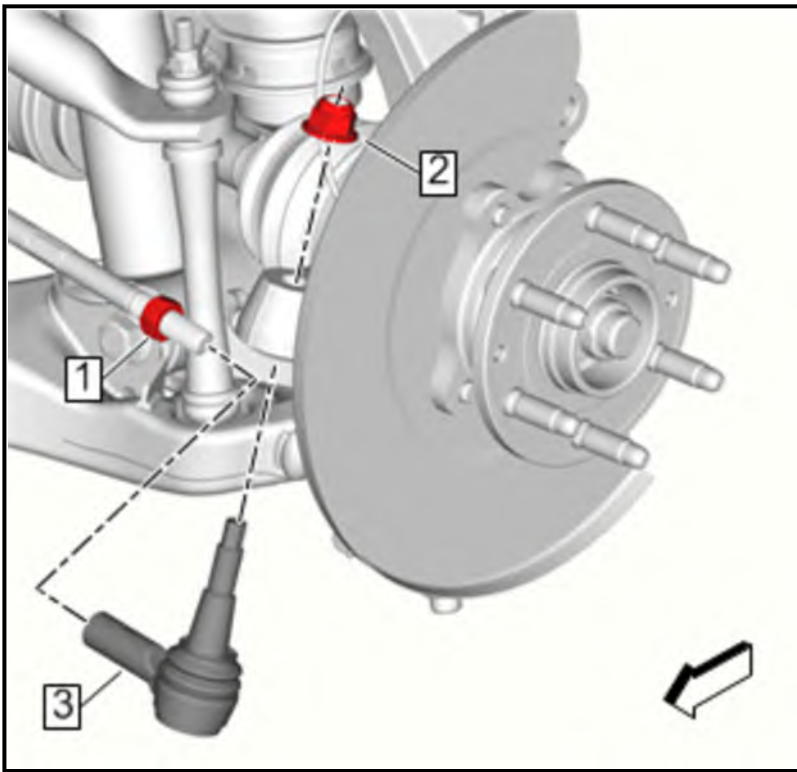
CAUTION: Care must be taken during removal and installation of the Electronic Power Steering (EPS) components to not hit or break the EPS motor/controller module or module harness connectors. If the EPS motor/ controller module or module connectors are damaged, the complete component must be replaced.

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:

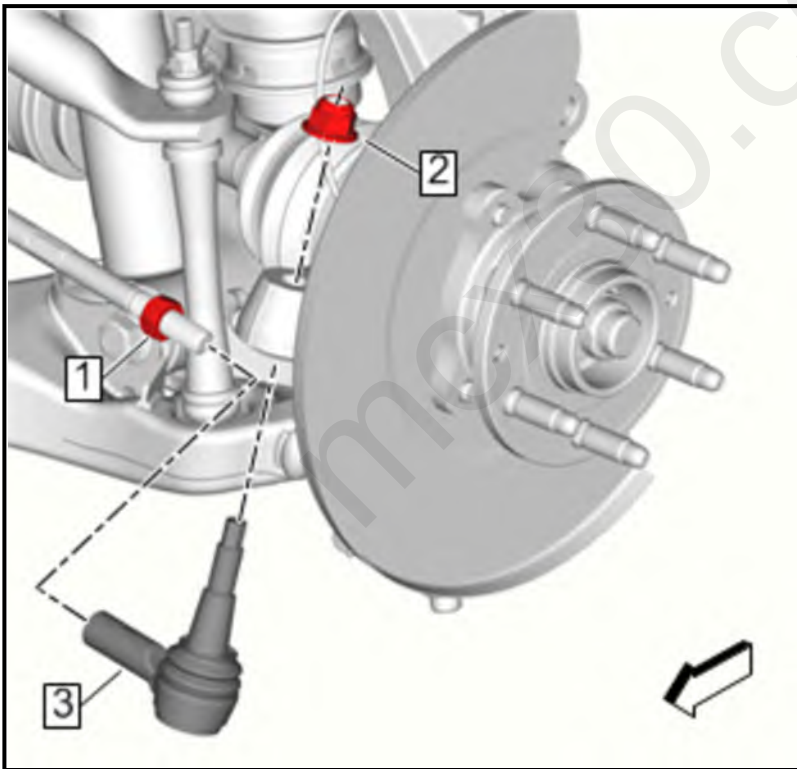
- The steering column
- The intermediate shaft(s)
- The steering gear

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.

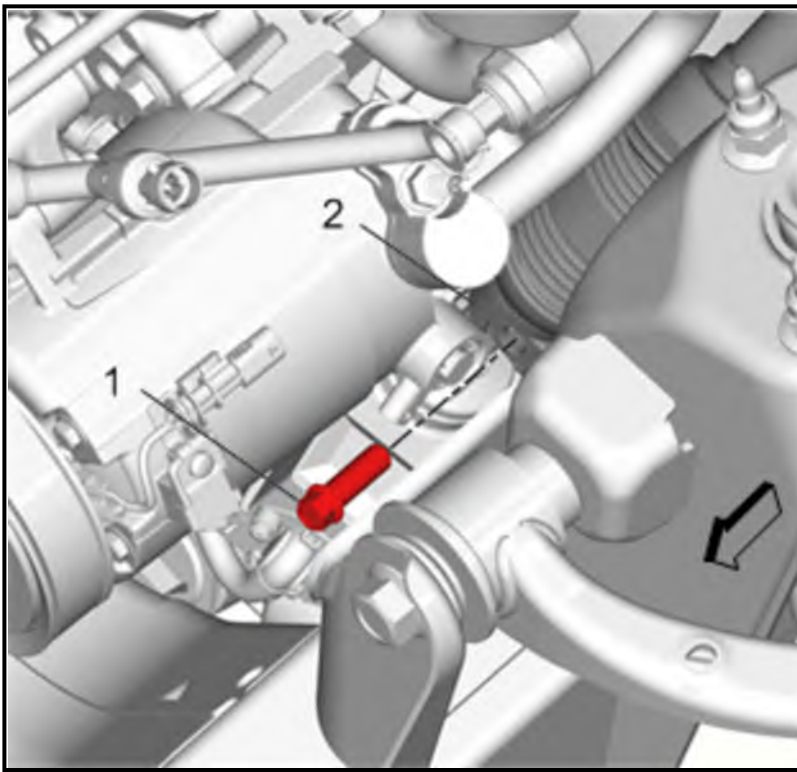
1. With the steering wheel in the straight ahead position, LOCK the steering column.
2. Remove the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)
3. Underbody Splash Shield - Remove - [Underbody Splash Shield Replacement \(without ZR2\)](#) , or [Underbody Splash Shield Replacement \(with ZR2\)](#) , or [Underbody Splash Shield Replacement \(Bison\)](#)
4. Steering Gear Skid Shield - Remove - [Steering Gear Skid Shield Replacement \(without ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(with ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(Bison\)](#)
5. Steering Linkage Outer Tie Rod-Right Side (3) @ Steering Knuckle - Separate - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#)



6. Steering Linkage Outer Tie Rod-Left Side (3) @ Steering Knuckle - Remove - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).



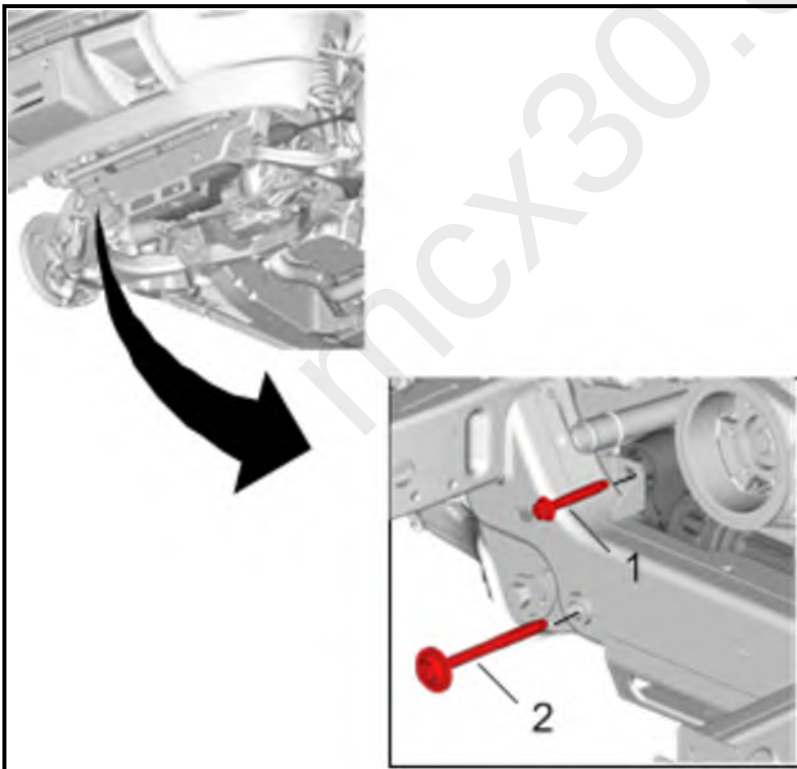
7. Disconnect the vehicle wiring harnesses from the steering gear and the front drive axle and retainers and set aside.
8. Place match marks on the lower steering shaft bolt to gear to aid in installation.
9. Lower Steering Shaft Assembly Lower Bolt (1) - Remove



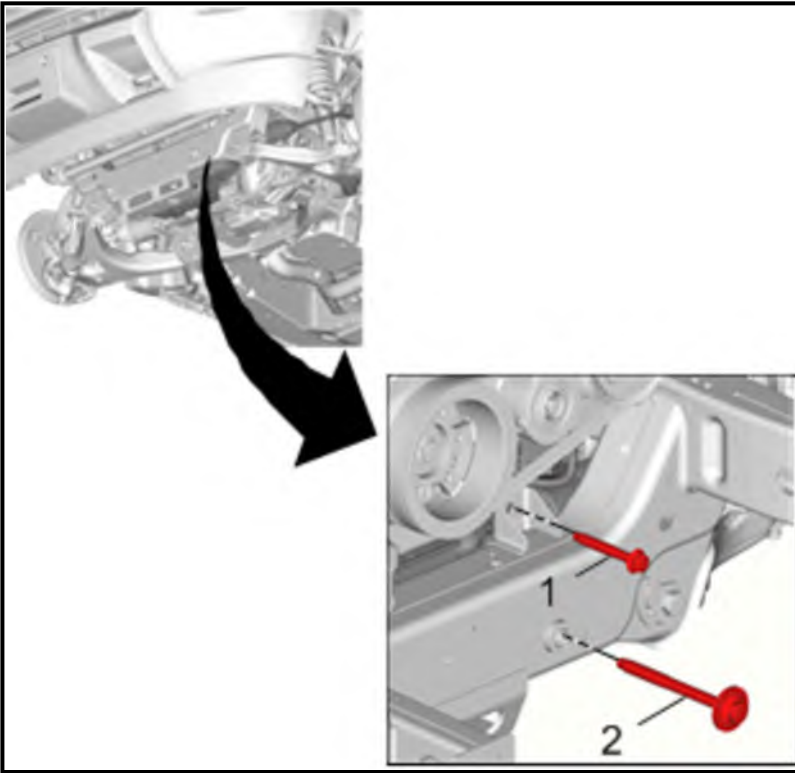
10. Lower Steering Shaft Assembly (2) - Separate

11. Support the steering gear assembly with a suitable support.

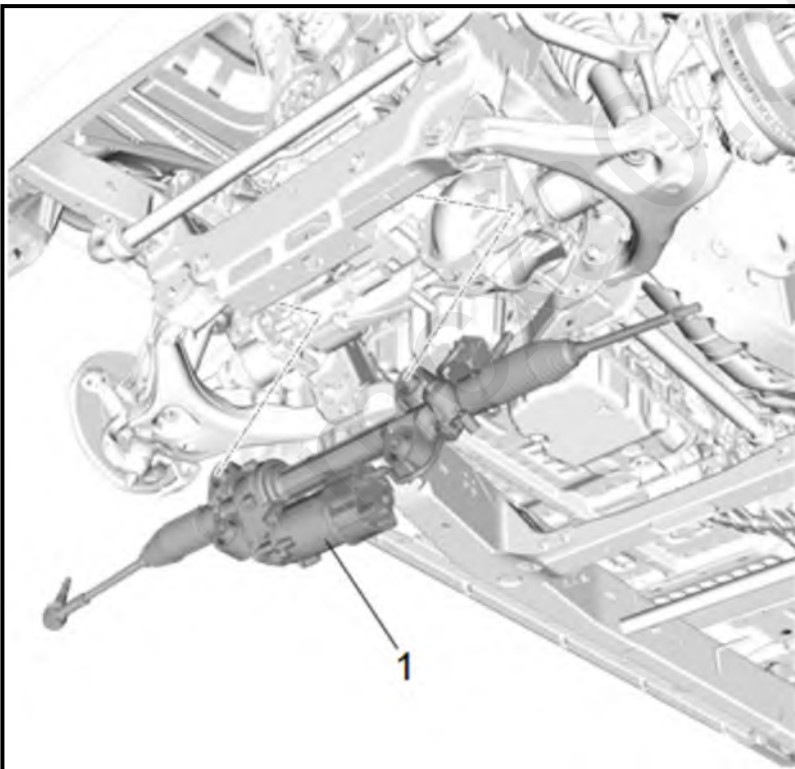
12. On the right side of the vehicle, remove the upper steering gear bolt (1) and the lower steering gear bolt (2).



13. On the left side of the vehicle, remove the upper steering gear bolt (1) and the lower steering gear bolt (2).



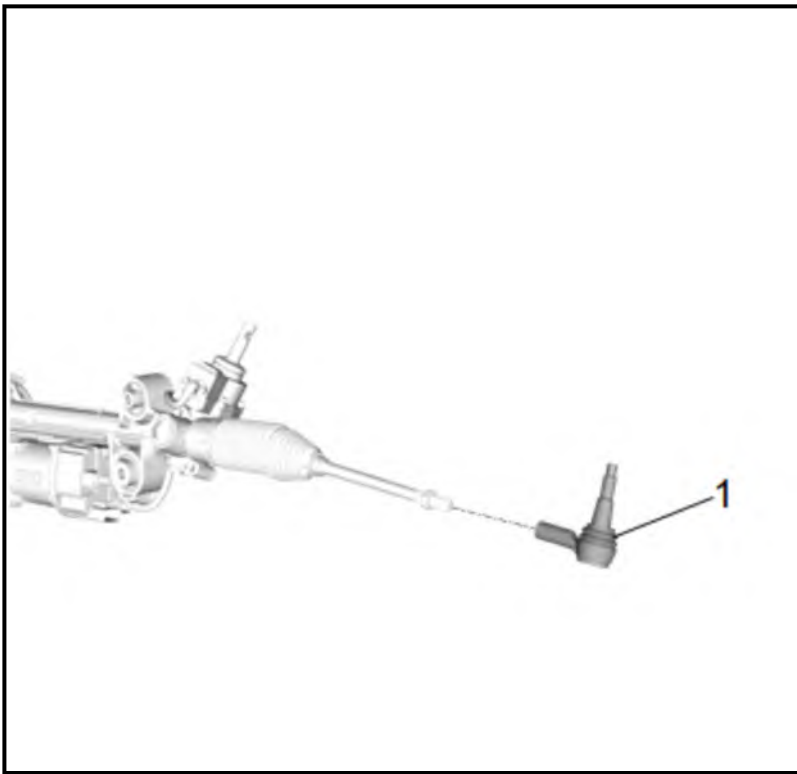
14. With the assistance of a helper, pull the inter/outer tie rod assembly all the way to the right side. Position the gear as far right as possible and lower gear from left side.



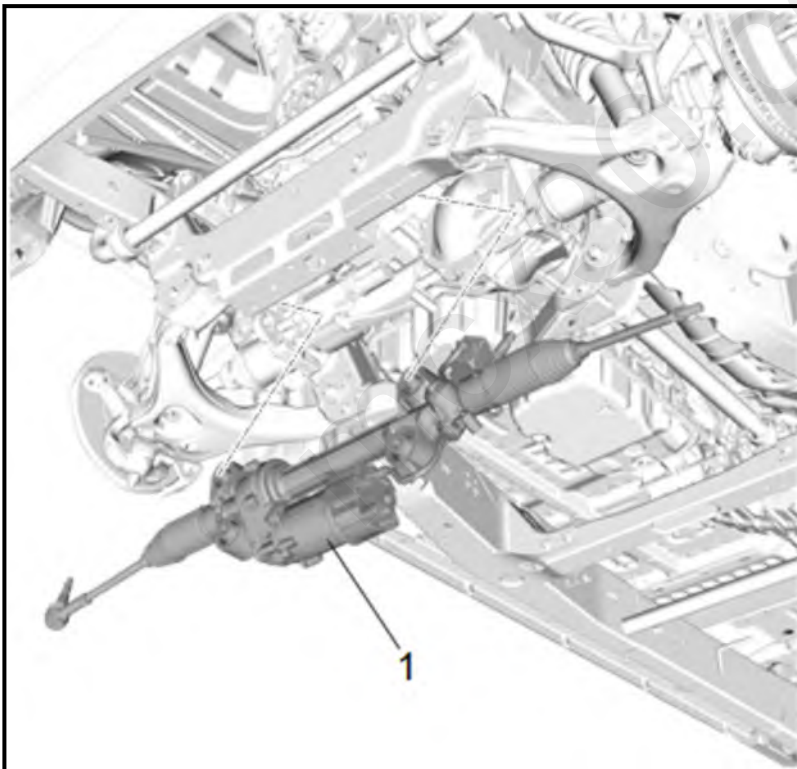
15. Carefully remove the steering gear (1) from the vehicle.
16. Transfer components as necessary.

Installation Procedure

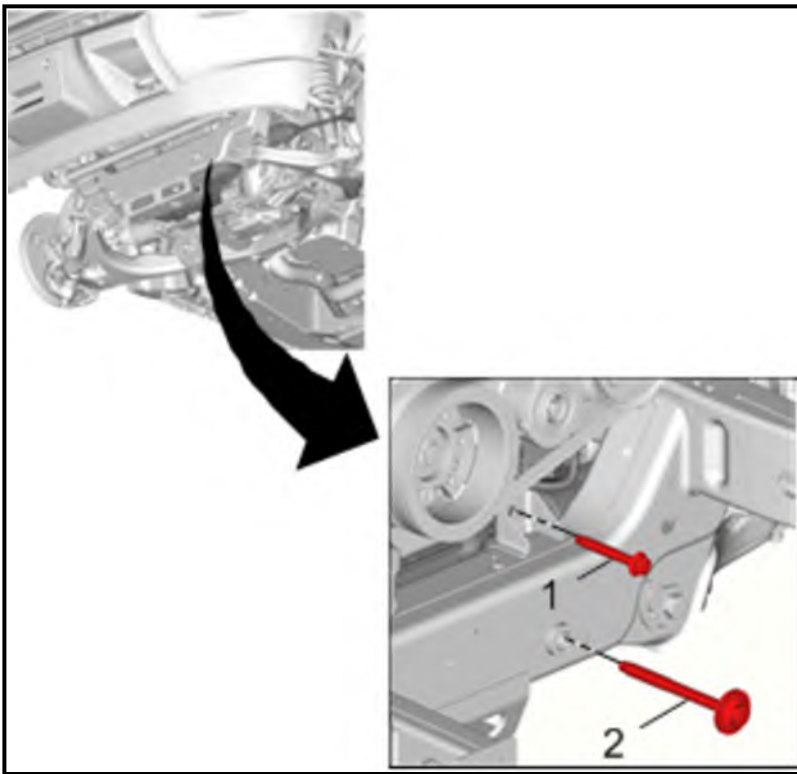
1. If replacing the steering gear, remove the left side steering linkage outer tie rod (1). [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).



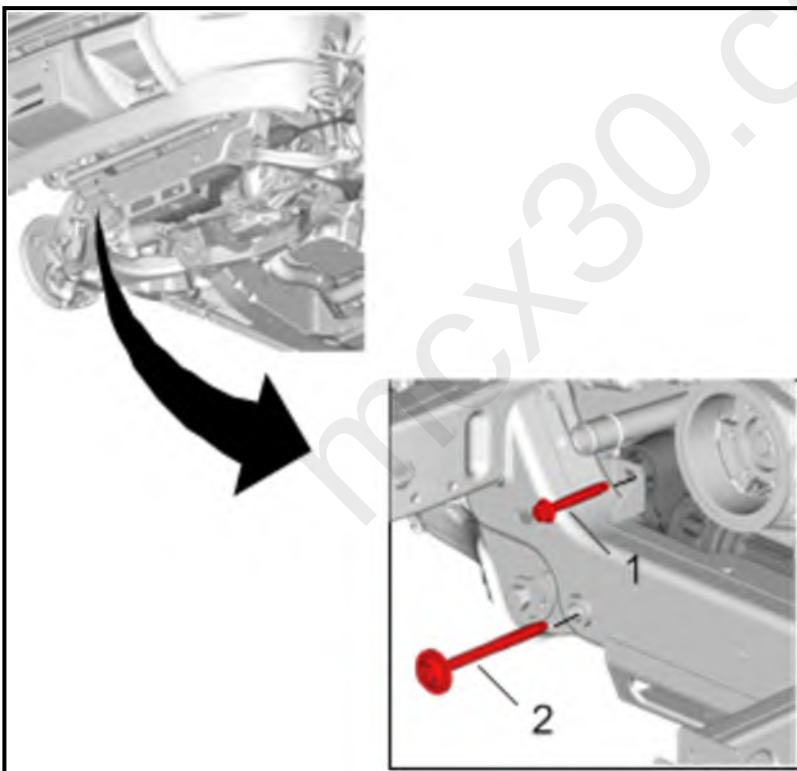
2. With the assistance of a helper, insert the right side of the gear assembly through the opening above the right side lower control arm and position in place.



3. Carefully position the steering gear (1) on the vehicle and support the assembly with a suitable support.
4. On the left side of the vehicle, loosely install the lower steering gear bolt (2) and the upper steering gear bolt (1).



5. On the right side of the vehicle, loosely install the lower steering gear bolt (2) and the upper steering gear bolt (1).



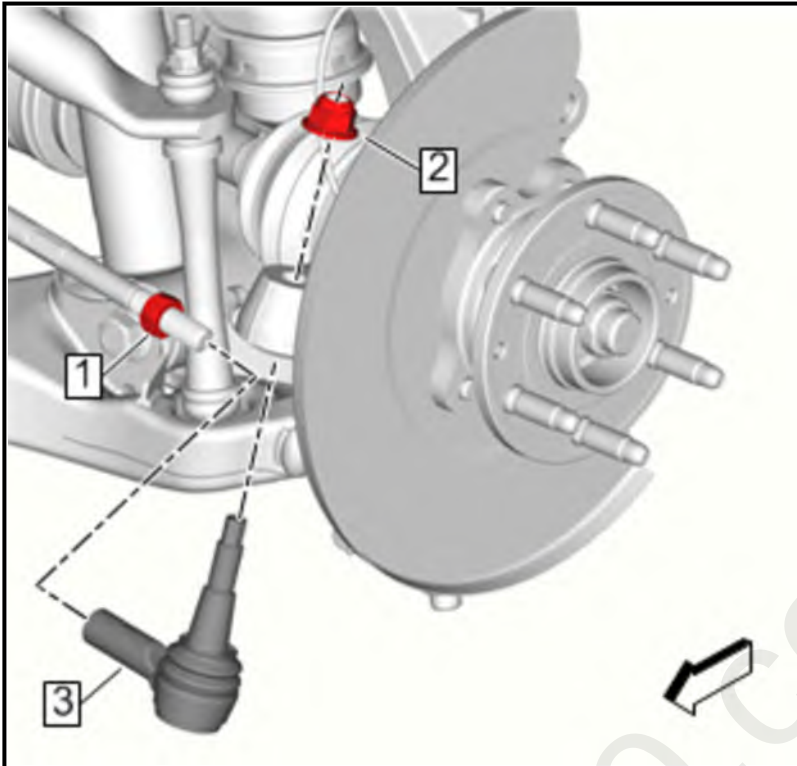
CAUTION: Refer to [Fastener Caution](#) .

6. After all steering gear bolts are installed, tighten the upper 2 steering gear bolts (1) to 100 N.m (74 lb ft).
7. After all steering gear bolts are installed, use the **EN-45059** meter to tighten the lower 2 steering gear bolts (2).

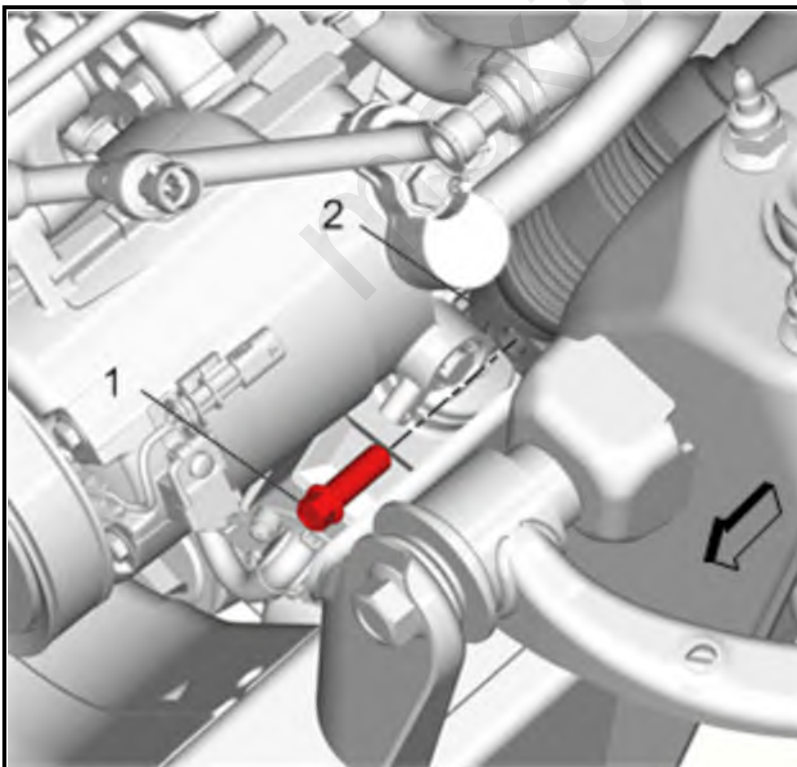
Tighten

1. First Pass: 150 N.m (111 lb ft)
2. Final Pass: (30 - 45 degrees)

8. Remove the support from underneath the vehicle.
9. Connect the vehicle wiring harnesses and retainers to the steering gear and the front drive axle.
10. Rotate one of the steering knuckles to center the steering gear.
11. Steering Linkage Outer Tie Rod-Left Side (3) - Install - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).



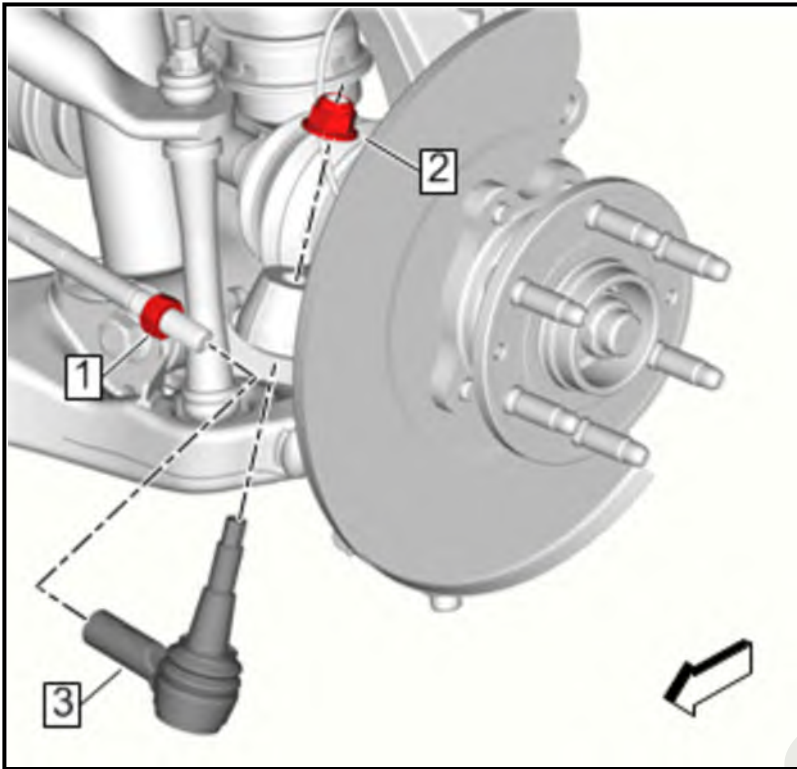
12. Lower Steering Shaft Assembly - (2) @ Steering Gear - Install



NOTE: Refer to the procedure link for torque specification.

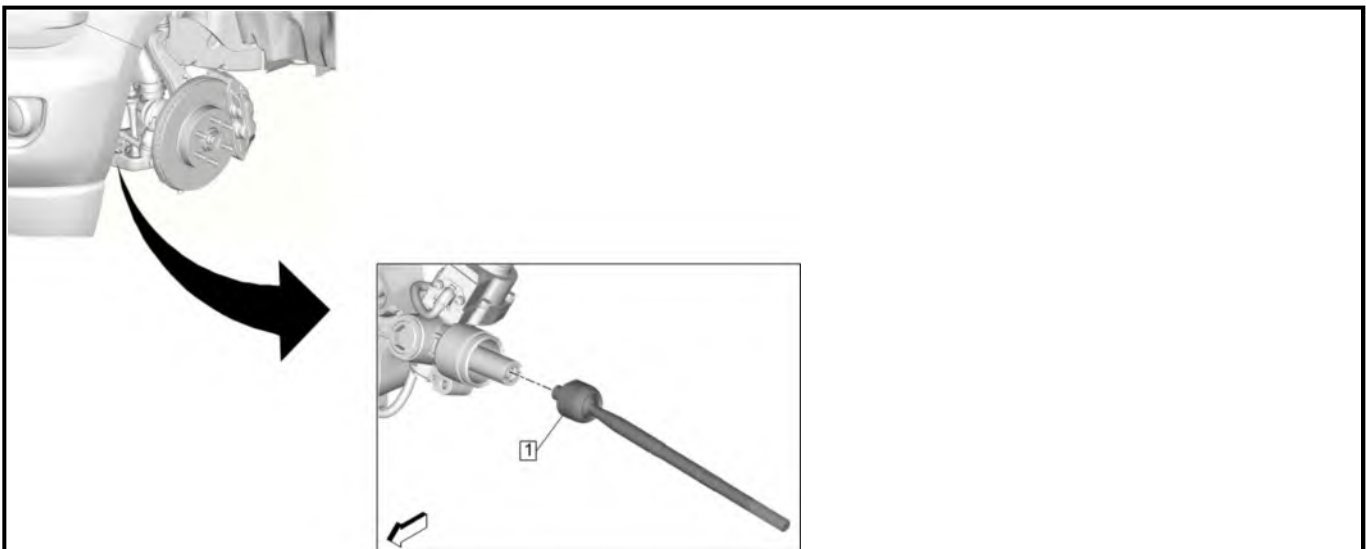
13. Lower Steering Shaft Assembly Lower Bolt - (1) Install and tighten - [Lower Steering Shaft Assembly Replacement](#)

14. Steering Linkage Outer Tie Rod-Right Side (3) @ Steering Knuckle - Install - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#).



15. Steering Gear Skid Shield - Install - [Steering Gear Skid Shield Replacement \(without ZR2\)](#), or [Steering Gear Skid Shield Replacement \(with ZR2\)](#), or [Steering Gear Skid Shield Replacement \(Bison\)](#)
16. Underbody Splash Shield - Install - [Underbody Splash Shield Replacement \(without ZR2\)](#), or [Underbody Splash Shield Replacement \(with ZR2\)](#), or [Underbody Splash Shield Replacement \(Bison\)](#)
17. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)
18. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)
19. Program the power steering control module. [K43 Power Steering Control Module: Programming and Setup](#)

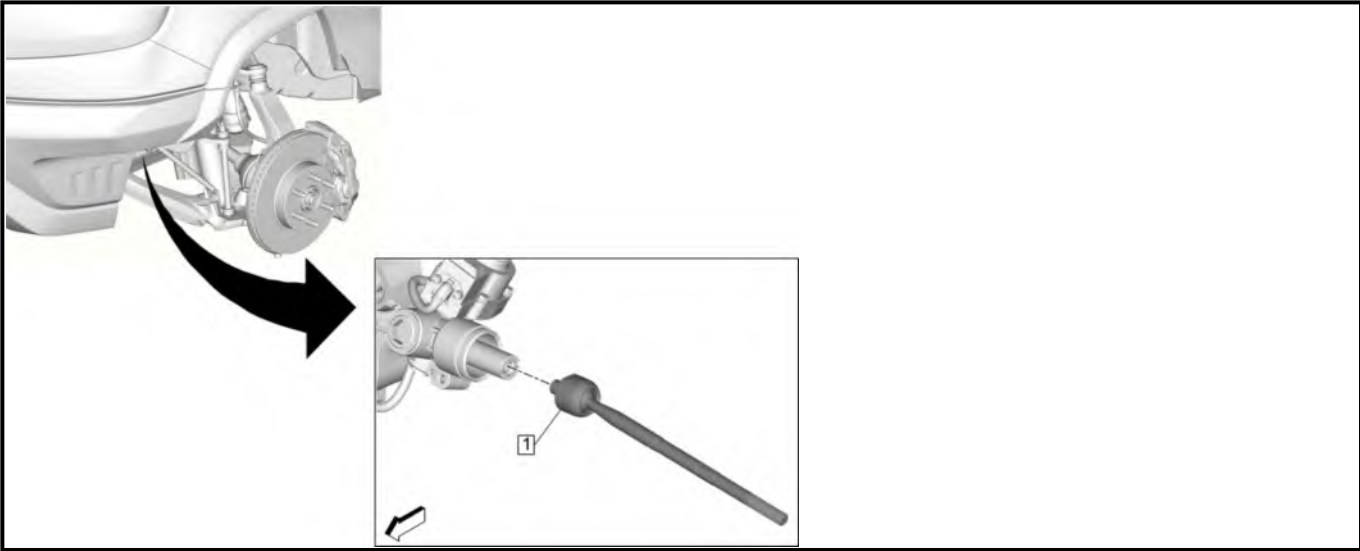
STEERING LINKAGE INNER TIE ROD REPLACEMENT (WITHOUT ZR2)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. <u>Steering Gear Boot Replacement (Without ZR2)</u>. 2. After removing the steering gear boot, inspect the steering linkage inner tie rod for evidence of corrosion or contamination. If corrosion or contamination is evident, replace the steering gear. <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD)</u>, or <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD)</u>.	
1	Steering Linkage Inner Tie Rod CAUTION: Refer to <u>Component Fastener Tightening Caution</u> . CAUTION: The pipe wrench must be placed at the input shaft end of the steering gear and positioned up against the inner tie rod housing. Placing the pipe wrench in any other location will cause damage to the steering gear. Procedure 1. Place a pipe wrench on the input shaft end of the steering gear rack next to the steering linkage inner tie rod housing and an appropriate size wrench on the flats of the inner tie rod housing. 2. Rotate the steering linkage inner tie rod housing counterclockwise while holding the steering gear rack stationary until the inner tie rod separates from the rack. 3. Rotate the steering linkage inner tie rod housing clockwise while holding the steering gear rack stationary until the inner tie rod tightens to the rack. 4. Measure and adjust the front toe. <u>Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment</u> Tighten 90 N.m (66 lb ft)

STEERING LINKAGE INNER TIE ROD REPLACEMENT (WITH ZR2)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures Steering Gear Boot Replacement (With ZR2). - After removing the steering gear boot, inspect the steering linkage inner tie rod for evidence of corrosion or contamination. If corrosion or contamination is evident, replace the steering gear. Electric Belt Drive Rack and Pinion Steering Gear Replacement (2WD), or Electric Belt Drive Rack and Pinion Steering Gear Replacement (4WD).	
1	Steering Linkage Inner Tie Rod CAUTION: Refer to Component Fastener Tightening Caution . CAUTION: The pipe wrench must be placed at the input shaft end of the steering gear and positioned up against the inner tie rod housing. Placing the pipe wrench in any other location will cause damage to

Callout	Component Name
	the steering gear. Procedure 1. Place a pipe wrench on the input shaft end of the steering gear rack next to the steering linkage inner tie rod housing and an appropriate size wrench on the flats of the inner tie rod housing. 2. Rotate the steering linkage inner tie rod housing counterclockwise while holding the steering gear rack stationary until the inner tie rod separates from the rack. 3. Rotate the steering linkage inner tie rod housing clockwise while holding the steering gear rack stationary until the inner tie rod tightens to the rack. 4. Measure and adjust the front toe. <u>Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment</u> Tighten 90 N.m (66 lb ft)

POWER STEERING ASSIST MOTOR REPLACEMENT (2WD)

Special Tools

GE-50576 - A Acoustic Belt Tension Tester

Equivalent regional tools: [Special Tools](#)

Removal Procedure

CAUTION:

Electrostatic discharge (ESD) can damage many solid-state electrical components. ESD susceptible components may or may not be labeled with the ESD symbol. Handle all electrical components carefully. Use the following precautions in order to avoid ESD damage:

- Touch a metal ground point in order to remove your body's static charge before servicing any electronic component; especially after sliding across the vehicle seat.
- Do not touch exposed terminals. Terminals may connect to circuits susceptible the ESD damage.
- Do not allow tools to contact exposed terminals when servicing connectors.
- Do not remove components from their protective packaging until required to do so.
- Avoid the following actions unless required by the diagnostic procedure:
 - Jumpering or grounding of the components or connectors.
 - Connecting test equipment probes to components or connectors. Connect the ground lead first when using test probes.
- Ground the protective packaging of any component before opening. Do not rest solid-state components on metal workbenches, or on top of TVs, radios, or other electrical devices.

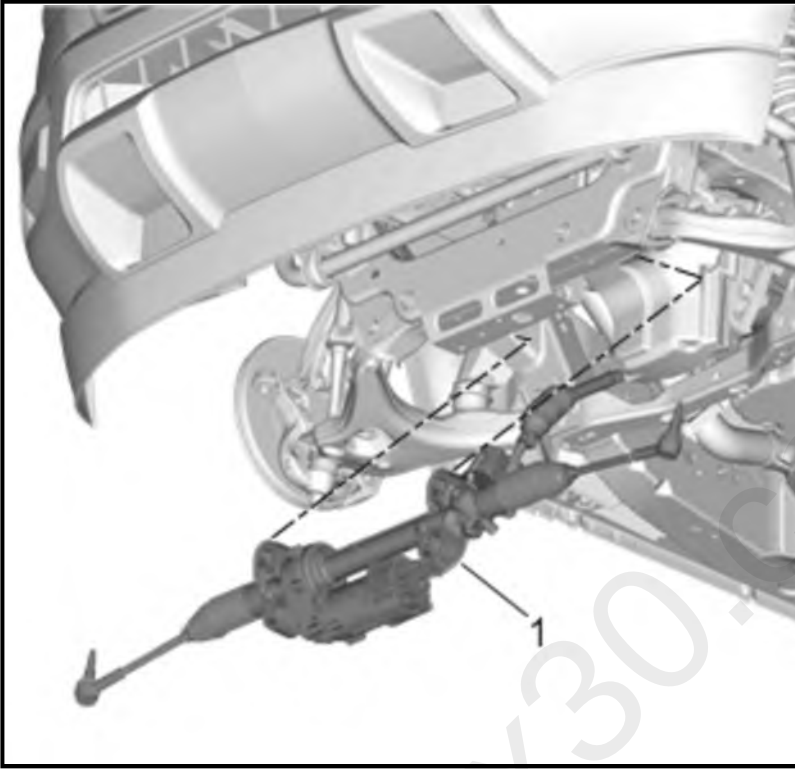
CAUTION:

During removal and installation, all EPS components including mechanical and/or electrical is extremely susceptible to damage. Dropping or prying on any

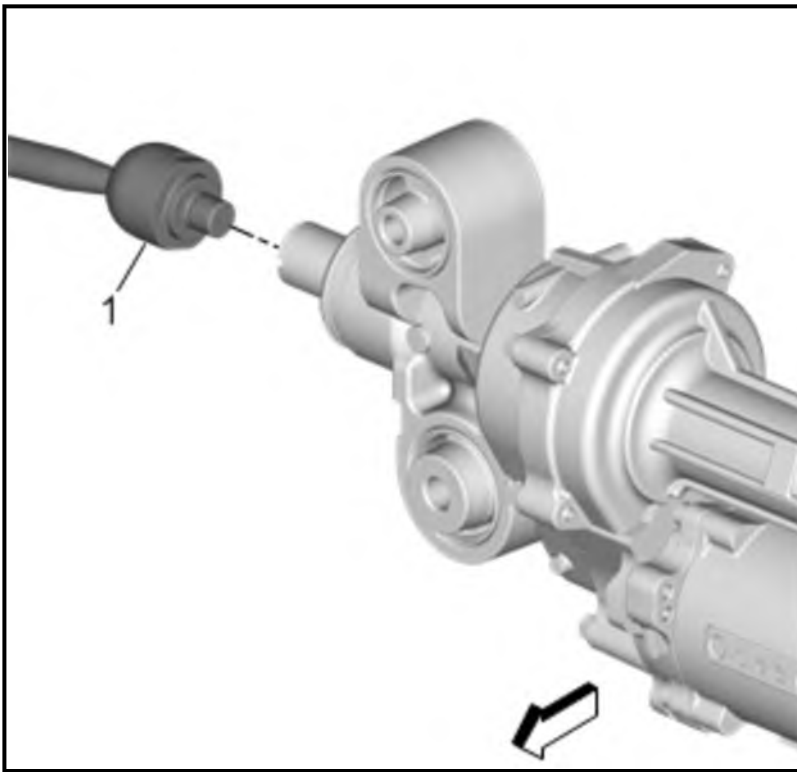
EPS component may cause internal damage. If damage occurs or a part is dropped, the EPS component must be replaced.

CAUTION: Care must be taken during removal and installation of the Electronic Power Steering (EPS) components to not hit or break the EPS motor/controller module or module harness connectors. If the EPS motor/ controller module or module connectors are damaged, the complete component must be replaced.

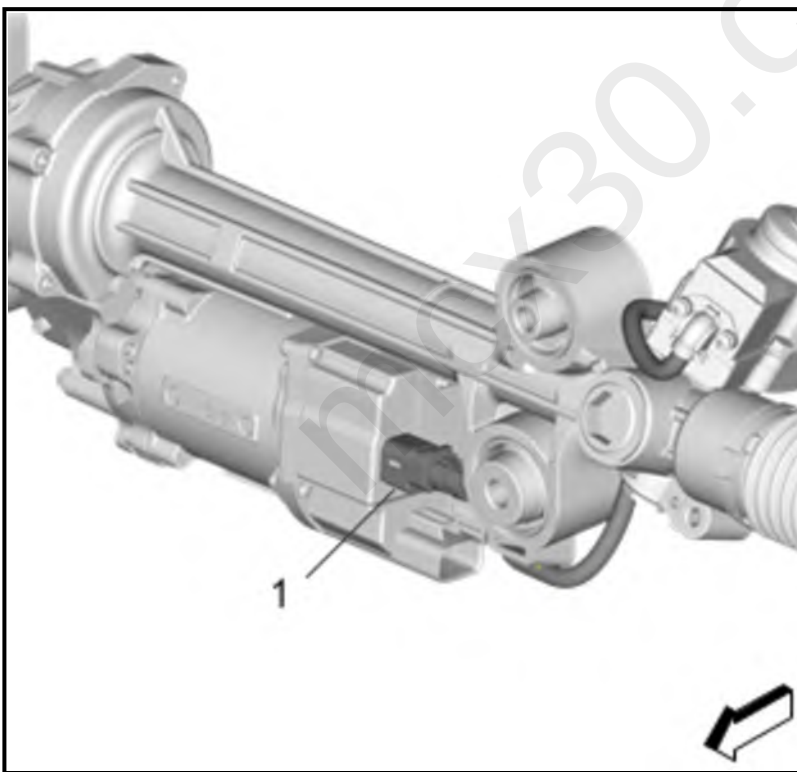
1. Steering Gear (1) - Remove - [Electric Belt Drive Rack and Pinion Steering Gear Replacement \(2WD\)](#).



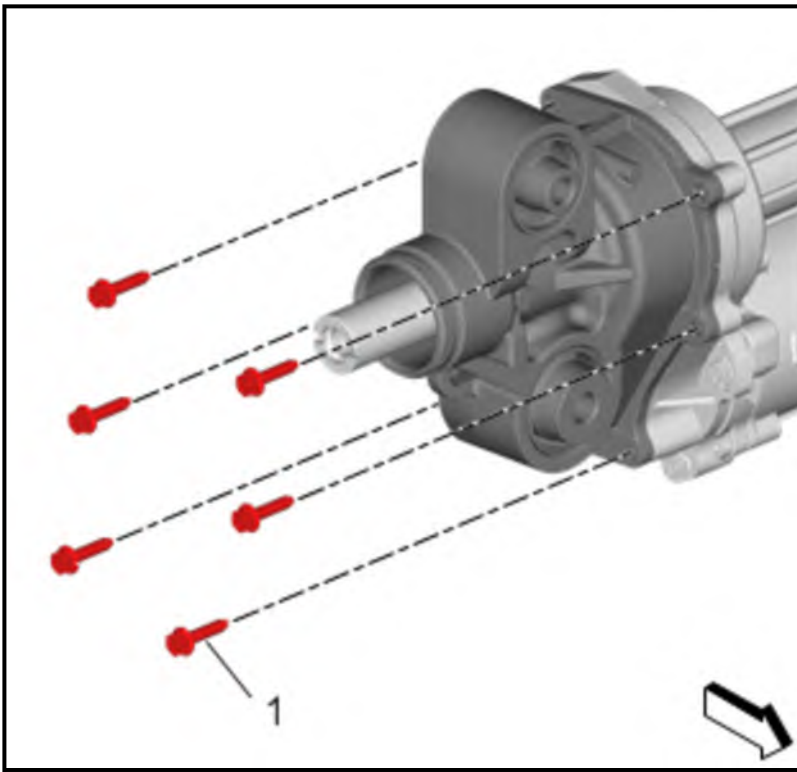
2. Remove any dirt or debris from the steering gear. Cleaning the entire area of dirt and debris will ensure no contaminants enter the steering gear.
3. Place the steering gear in a vise or on a clean bench.
4. Remove the right side steering linkage inner tie rod (1). [Steering Linkage Inner Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Inner Tie Rod Replacement \(With ZR2\)](#).



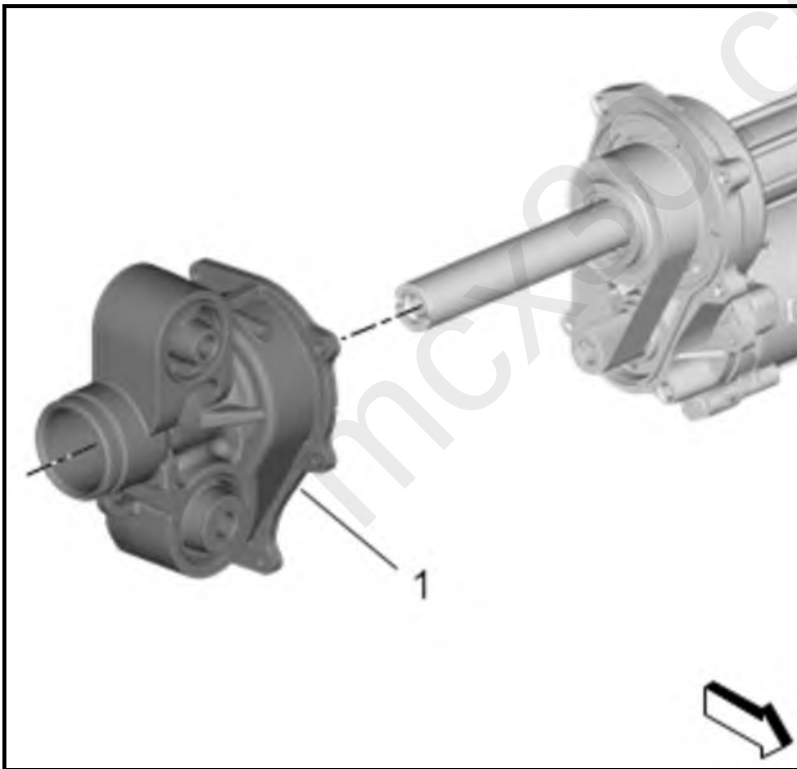
5. Disconnect the torque sensor wiring harness connector (1) from the power steering assist motor. The wiring harness is NOT repairable. Do NOT attempt to repair the harness under any circumstances. If either harness is damaged then the steering gear MUST be replaced.



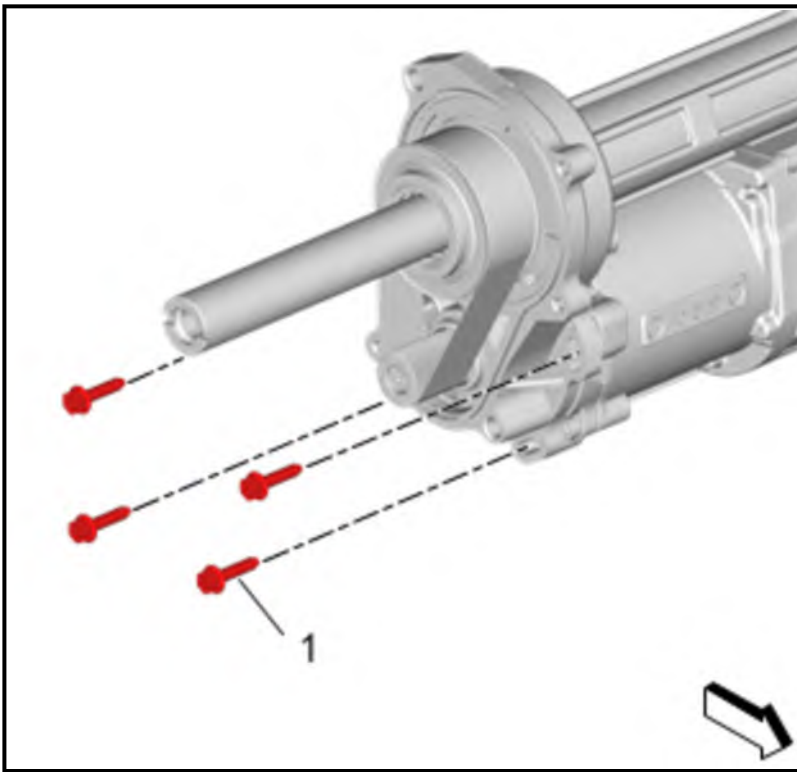
6. Remove the steering gear housing cover bolts (1).



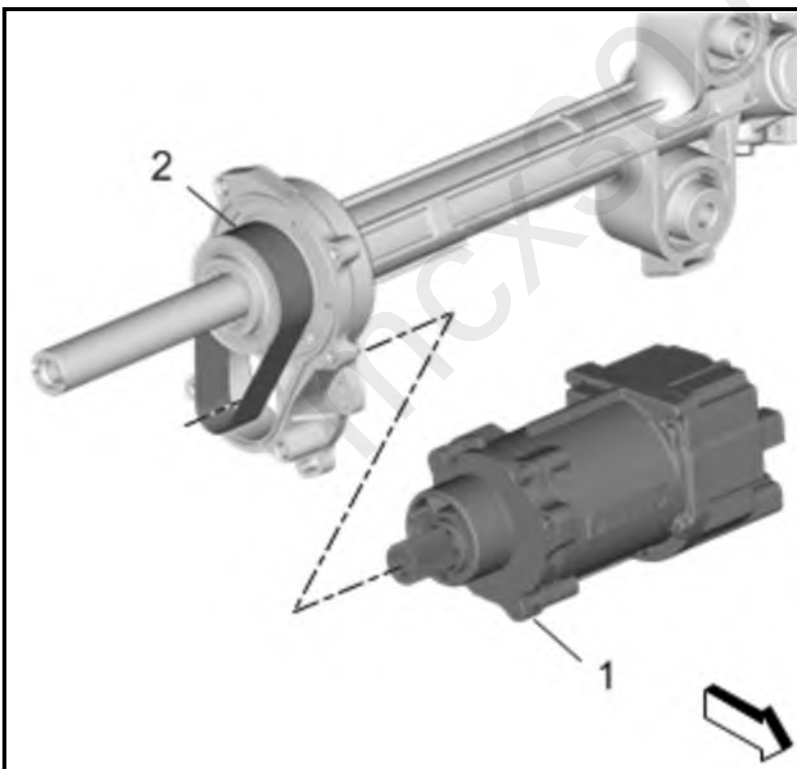
7. Use a rubber mallet to separate the steering gear housing cover (1) from the steering gear housing and remove the cover.



8. Remove the power steering assist motor pivot bolts (1).

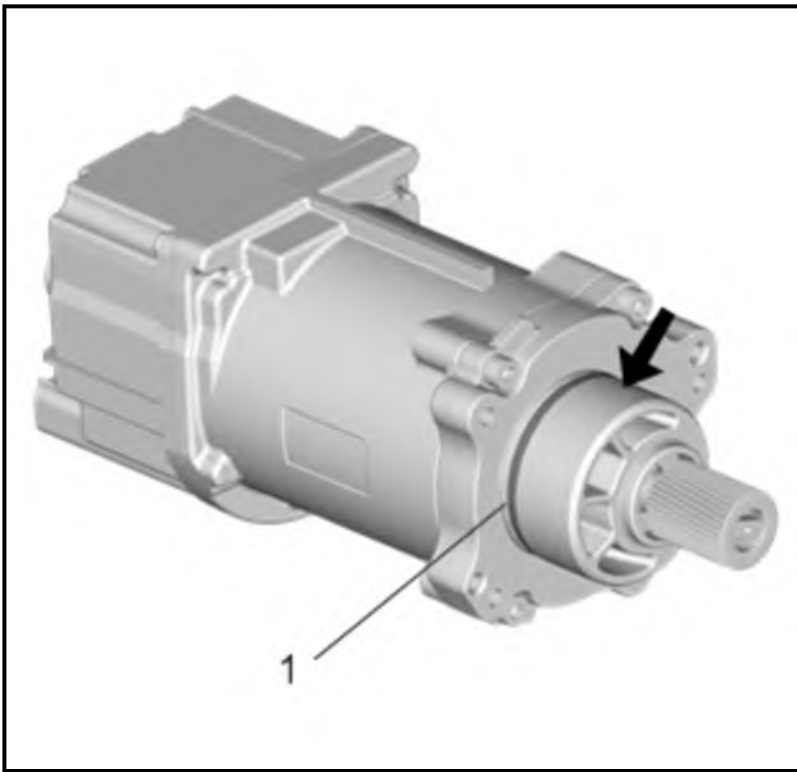


9. Rotate the power steering assist motor (1) toward the steering gear and then pull the motor toward the steering gear input shaft until the motor is released from the steering gear housing. Then, lower the nose of the motor to release the steering gear belt (2) from the pulley and remove the motor from the belt. DISCARD the belt.

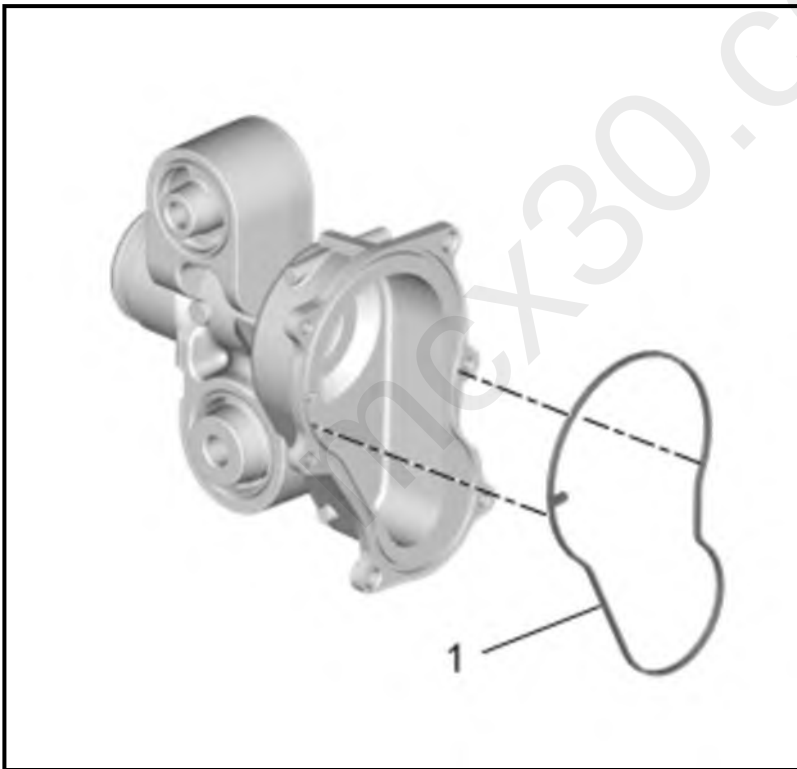


Installation Procedure

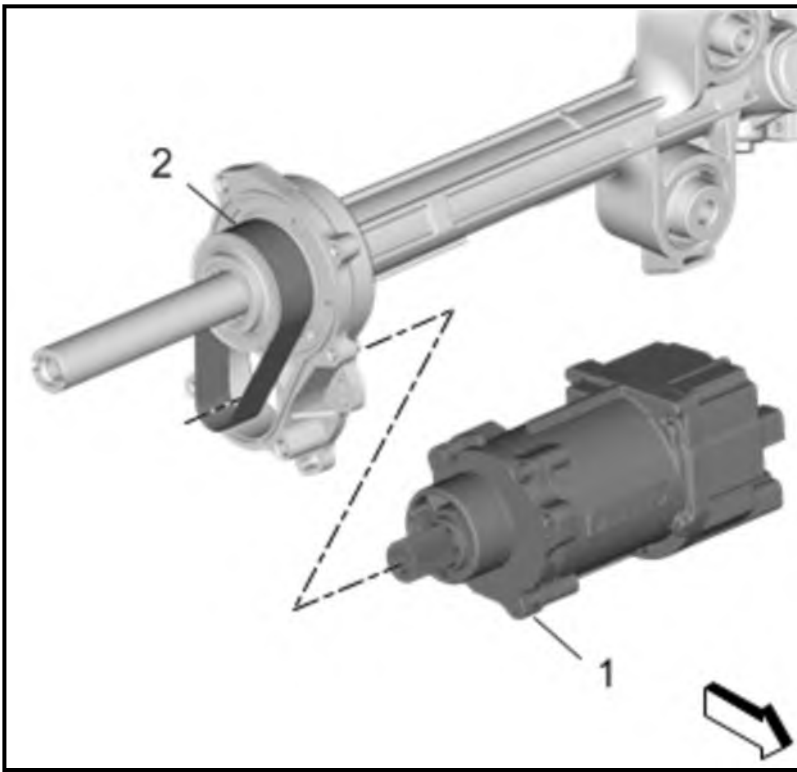
1. Use a clean shop rag to clean the surfaces where the power steering assist motor and the steering gear housing mate of any old grease or loose particles. Also clean the surfaces where the steering gear housing cover and the steering gear housing mate of any old grease or loose particles.
2. Install a NEW power steering assist motor seal (1) on the power steering assist motor. Add a light film of lithium grease to the nose of the motor.



3. Inspect the steering gear housing cover seal (1) and ensure the seal is seated correctly. If the seal is damaged, install a NEW seal.



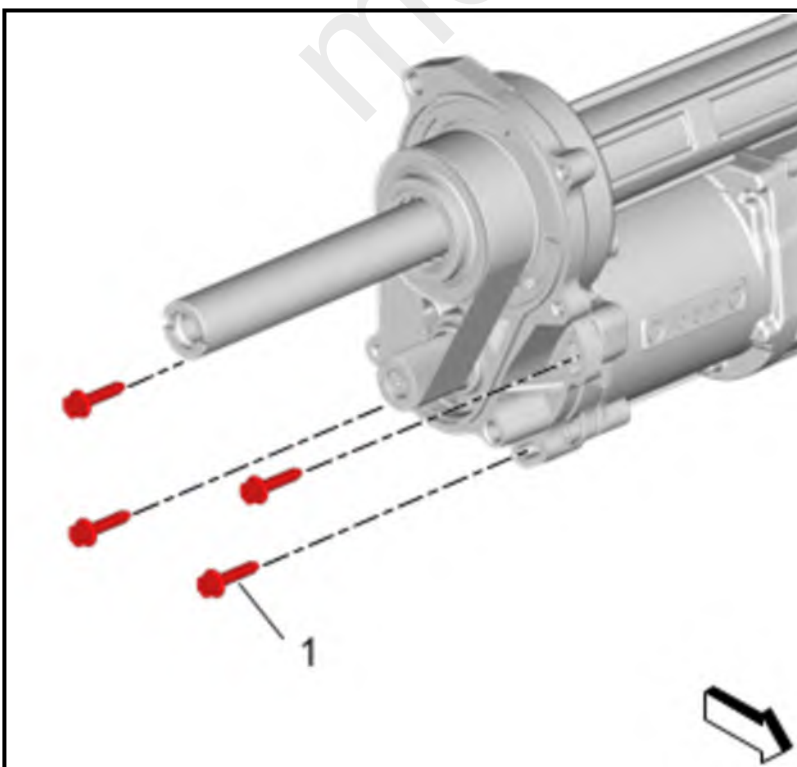
4. Hang the NEW steering gear belt (2) on the pulley.



5. Lower the nose of the power steering assist motor (1) and install the nose of the motor into the steering gear belt. Do NOT allow the belt to come into contact with any of the grease in the steering gear housing.

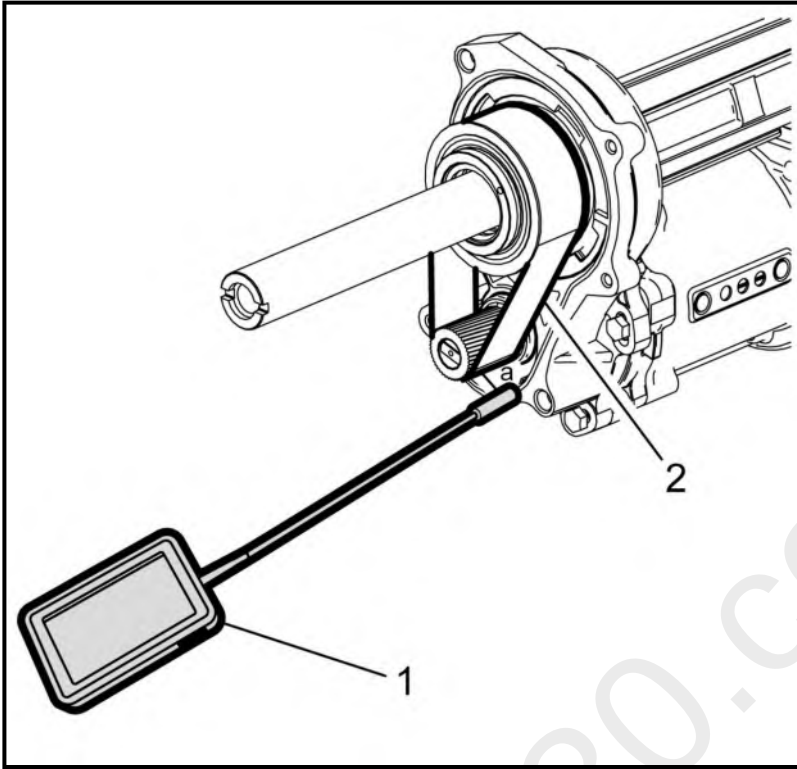
CAUTION: Ensure that the belt is completely installed on to the power steering assist motor pulley. Misalignment of the belt on the pulley will damage the belt and the electric belt drive rack and pinion steering gear will need to be replaced.

6. After the power steering assist motor (1) is installed in the steering gear and steering gear belt, rotate the motor clockwise, while making sure the screw holes in the motor and slotted holes in steering gear housing are aligned properly.
7. Install the power steering assist motor pivot bolts (1) and hand tighten. Ensure the power steering assist motor is snug to the steering gear housing but can still turn.



NOTE: A suitable clamp may be necessary to help draw the power steering assist motor into the steering gear housing completely. Ensure the motor is flush with the housing before continuing the installation process.

8. Install a wrench on the steering gear input shaft and rotate the input shaft one half of a full revolution in each direction from the centered position to seat the belt.
9. Place body of the **GE-50576 - A** tension tester (1) on a flat surface or secure it to the steering gear housing. NEVER hold the tester by hand while taking measurements or the reading will be inaccurate.



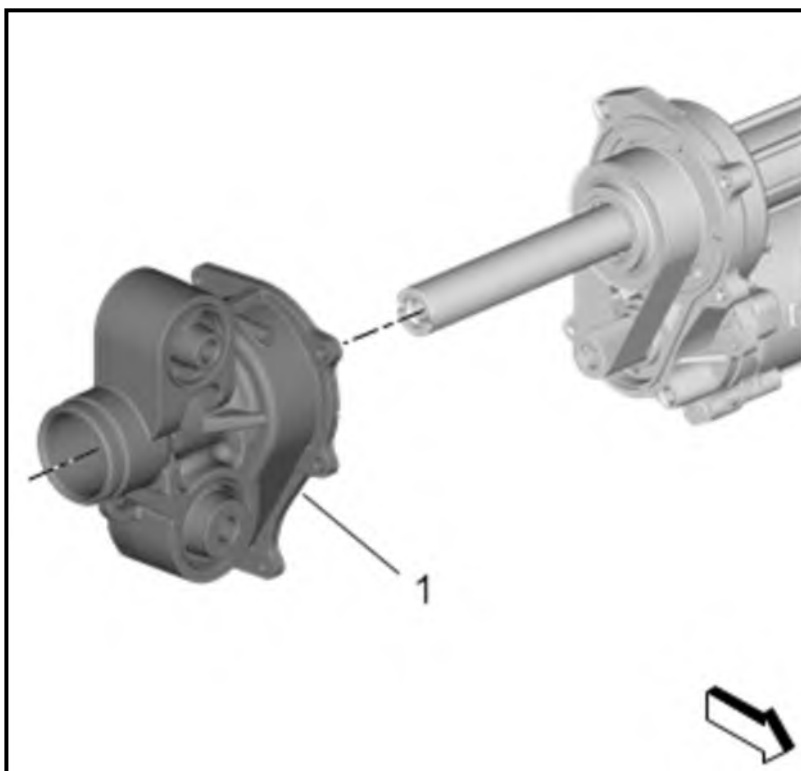
10. Position the microphone of the **GE-50576 - A** tension tester approximately 6 mm (0.25 in) (a) from the steering gear belt (2).

CAUTION: Never use a sharp object to strum the belt as belt damage may occur. If the belt is damaged, the electric belt drive rack and pinion steering gear will need to be replaced.

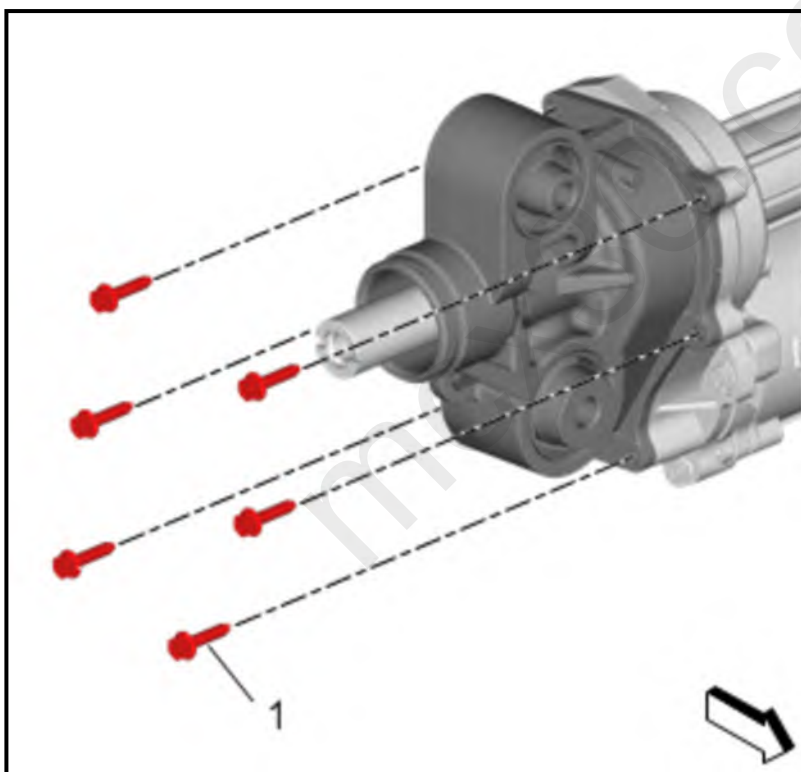
11. Use an allen wrench or finger to strum the steering gear belt (1) at the center location between the pulleys three times to get an average belt tension measurement.
12. If the average steering gear belt tension measurement is between 260 - 320 Hz then continue to the next step. If the average of the measurements is lower or higher than the specification, then rotate the motor clockwise to tighten or counterclockwise to loosen and take the average of another set of three measurements. Repeat this step until the average of the measurements is within the range specified.

CAUTION: Refer to [Fastener Caution](#) .

13. Tighten the power steering assist motor pivot bolts to 12 N.m (106 lb in) and recheck the belt tension using the **GE-50576 - A** tension tester. If the average of the measurements is not between 260 - 320 Hz then loosen the pivot bolts and readjust the belt tension. If the measurement is still within the specified range then continue to the next step.
14. Ensure that the steering gear housing cover seal is in position and install the steering gear housing cover (1).



15. Install the steering gear housing cover bolts (1) and hand tighten.



16. Tighten the steering gear housing cover bolts in the sequence shown to 12 N.m (106 lb in).

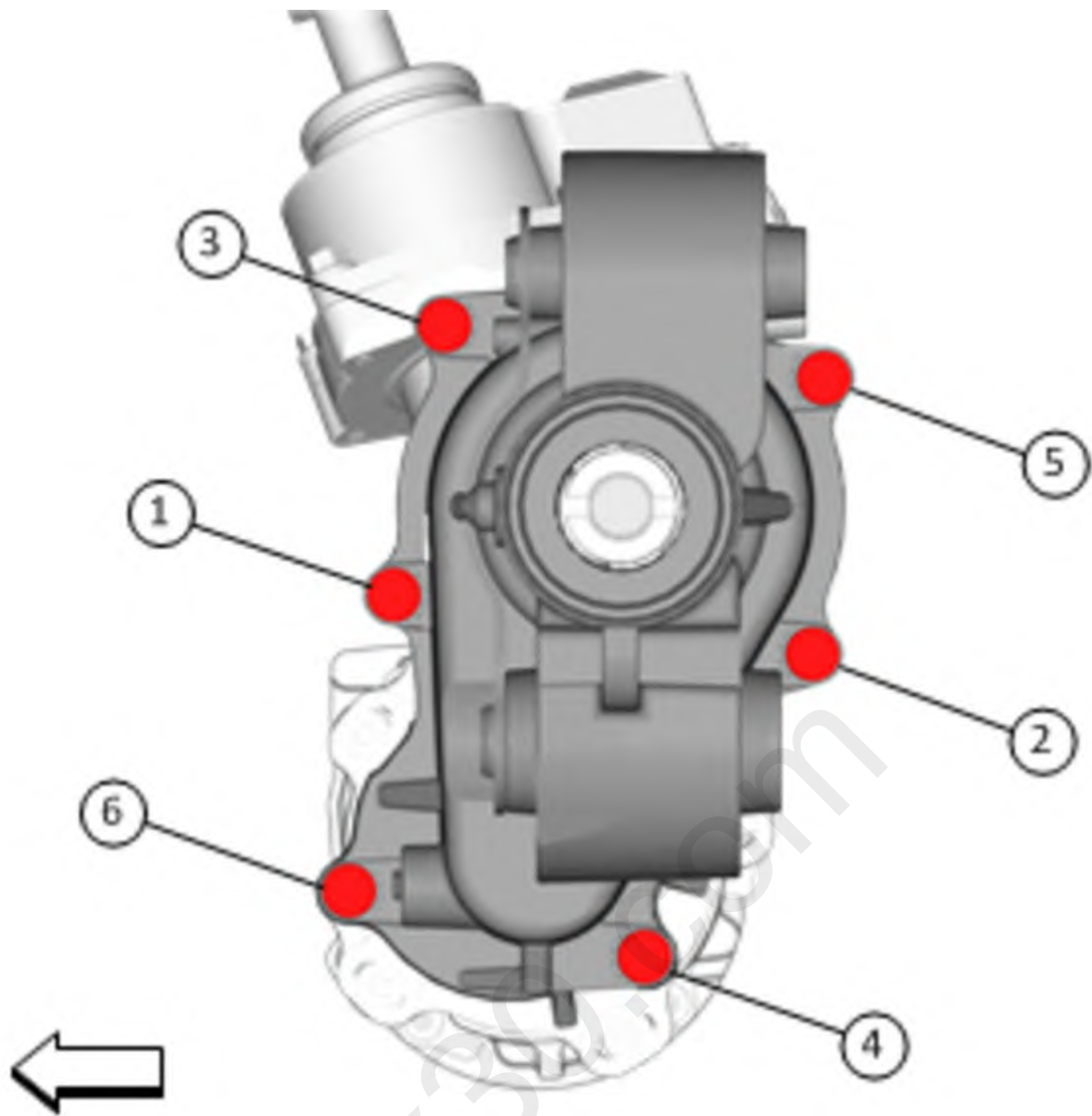
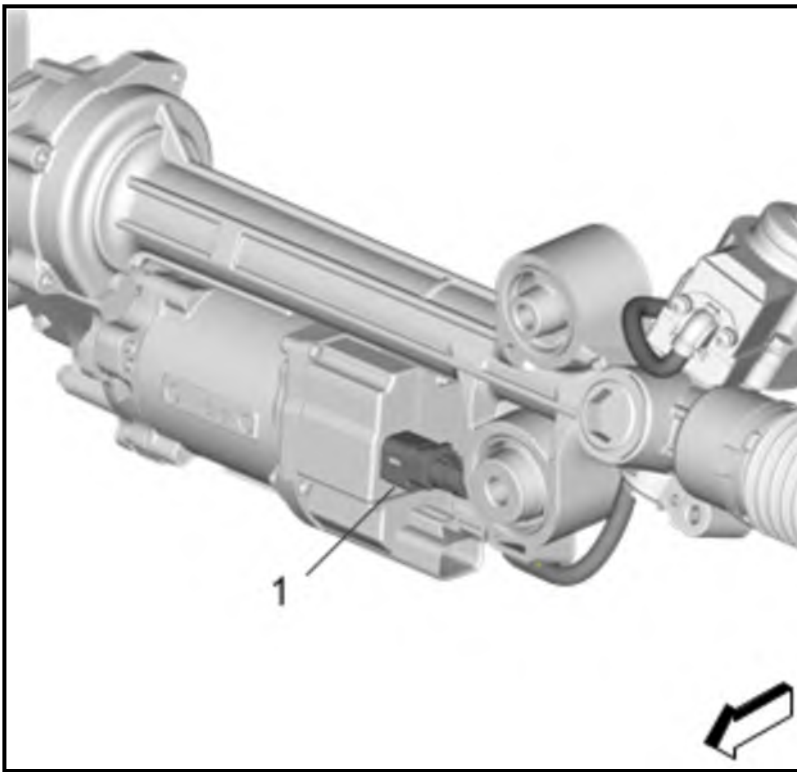
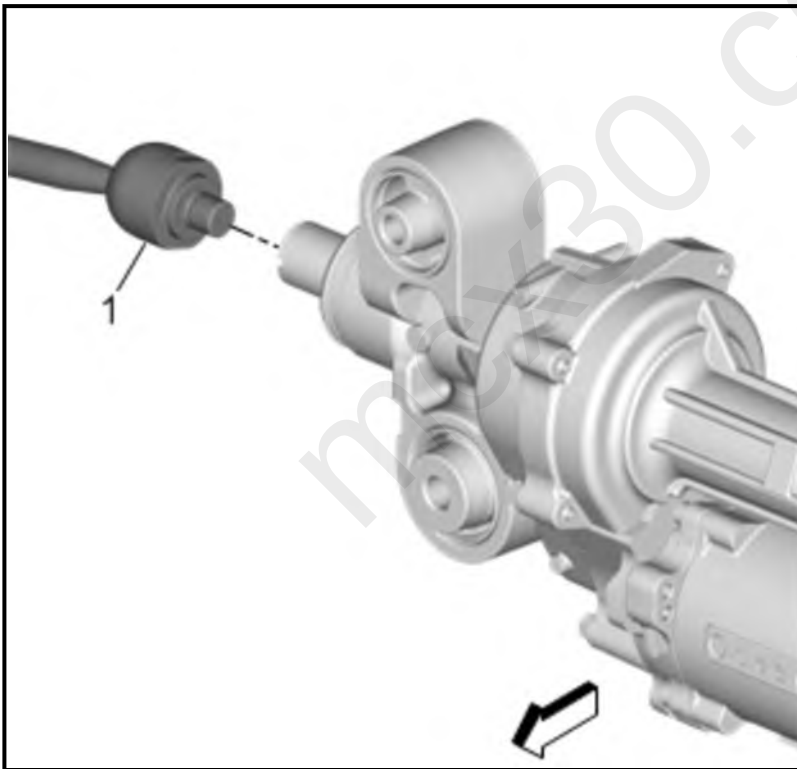


Fig. 1: Steering Gear Housing Cover Bolts Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

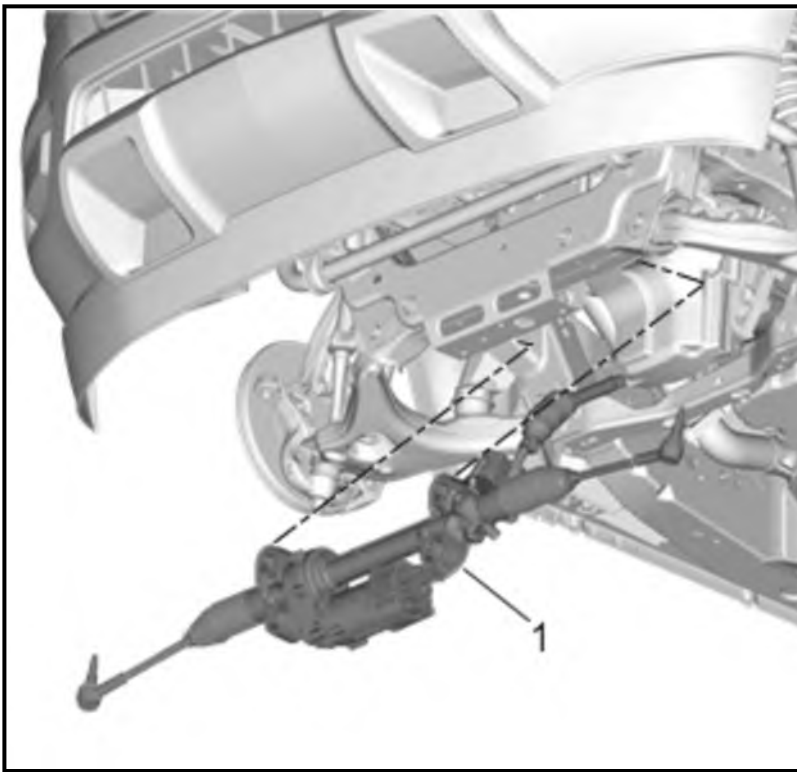
17. Connect the torque sensor wiring harness connector (1) to the power steering assist motor. Ensure the connector lock is engaged.



18. Install the right side steering linkage inner tie rod (1). [Steering Linkage Inner Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Inner Tie Rod Replacement \(With ZR2\)](#).

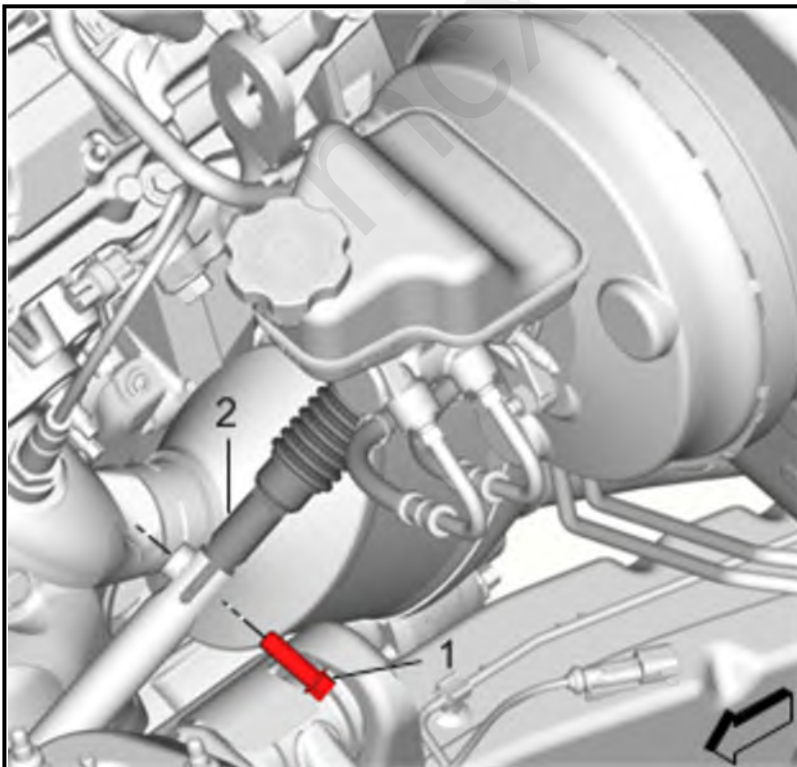


19. Install the steering gear (1) and steering gear fasteners, but leave the steering linkage outer tie rods and intermediate steering shaft disconnected. [Electric Belt Drive Rack and Pinion Steering Gear Replacement \(2WD\)](#).

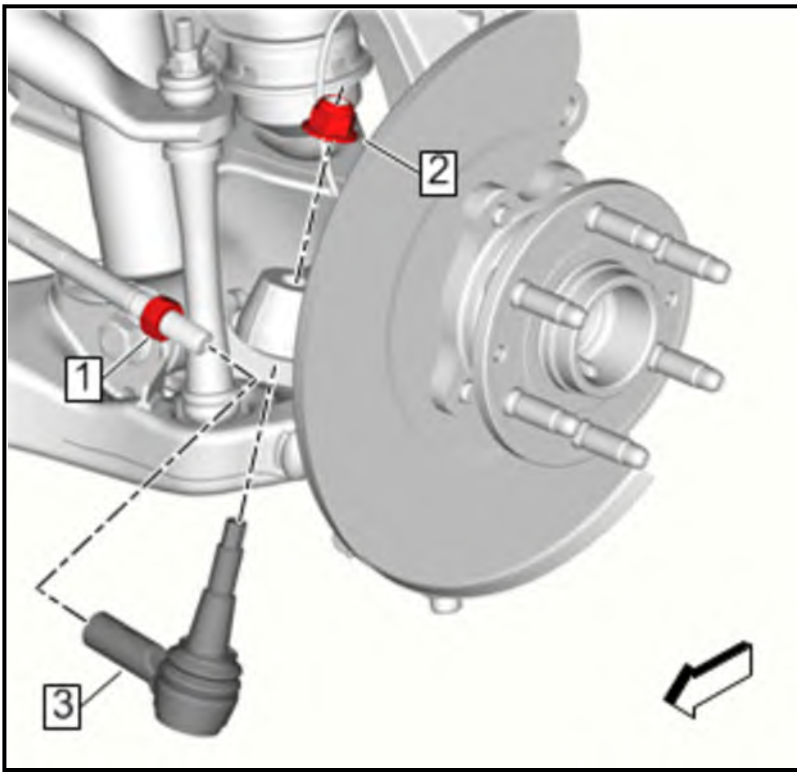


NOTE: The steering linkage outer tie rods and the intermediate steering shaft **MUST** be disconnected and able to move freely during the power steering control module programming and setup procedure to properly calibrate the torque sensor in the steering gear.

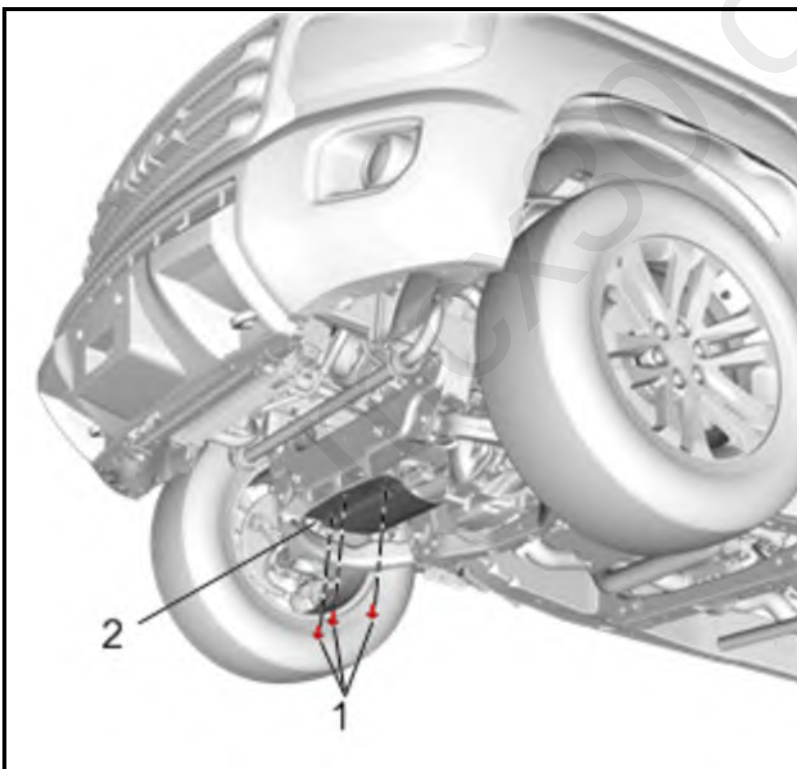
20. Program the power steering control module. [K43 Power Steering Control Module: Programming and Setup](#)
21. Intermediate Steering Shaft (2) @ Lower Steering Shaft Assembly - Install - [Lower Steering Shaft Assembly Replacement](#)



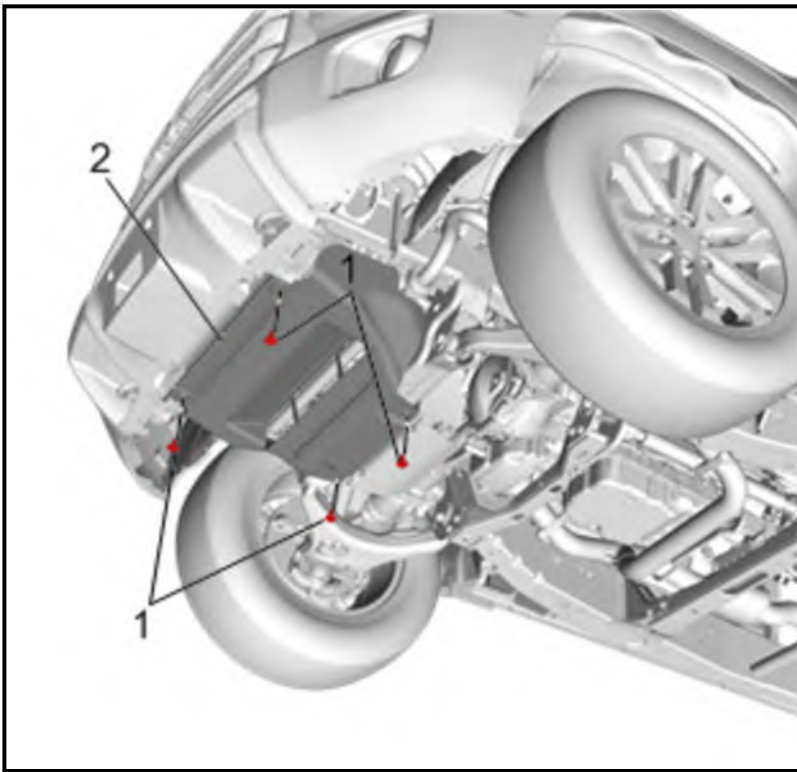
22. Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Install [2x] - [Steering Linkage Outer Tie Rod Replacement \(Without ZR2\)](#), or [Steering Linkage Outer Tie Rod Replacement \(With ZR2\)](#)



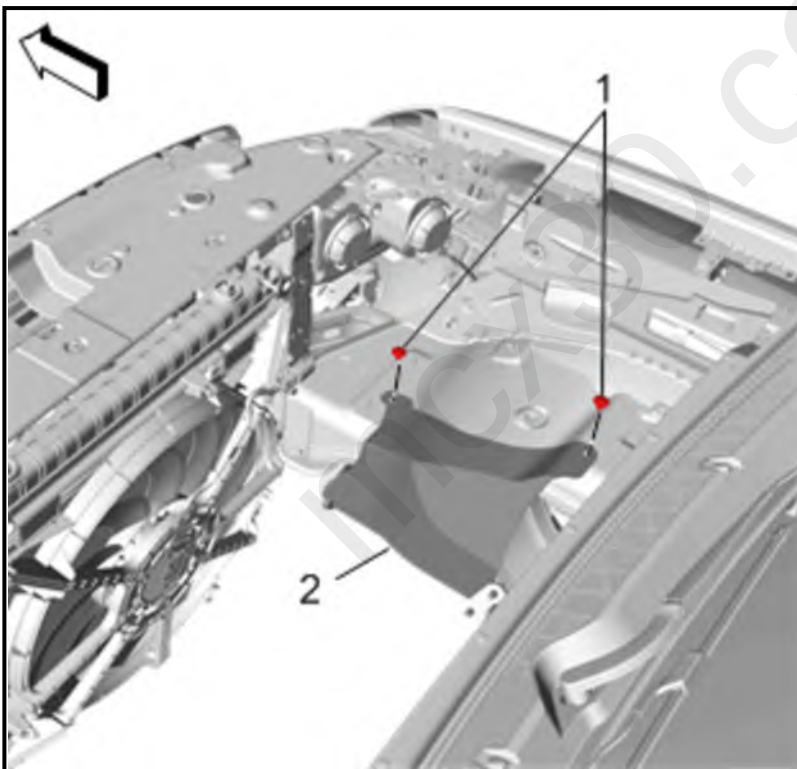
23. Steering Gear Skid Shield (2) - Install - [Steering Gear Skid Shield Replacement \(without ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(with ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(Bison\)](#)



24. Underbody Splash Shield (2) - Install - [Underbody Splash Shield Replacement \(without ZR2\)](#) , or [Underbody Splash Shield Replacement \(with ZR2\)](#) , or [Underbody Splash Shield Replacement \(Bison\)](#)



25. Engine Front Splash Shield (2) - Install - [Engine Front Splash Shield Replacement](#)



26. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)

27. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)

28. Center the steering angle sensor. [Steering Wheel Angle Sensor Centering](#)

POWER STEERING ASSIST MOTOR REPLACEMENT (4WD)

Special Tools

GE-50576 - A Acoustic Belt Tension Tester

Equivalent regional tools: [Special Tools](#)

Removal Procedure

CAUTION:

Electrostatic discharge (ESD) can damage many solid-state electrical components. ESD susceptible components may or may not be labeled with the ESD symbol. Handle all electrical components carefully. Use the following precautions in order to avoid ESD damage:

- Touch a metal ground point in order to remove your body's static charge before servicing any electronic component; especially after sliding across the vehicle seat.
- Do not touch exposed terminals. Terminals may connect to circuits susceptible the ESD damage.
- Do not allow tools to contact exposed terminals when servicing connectors.
- Do not remove components from their protective packaging until required to do so.
- Avoid the following actions unless required by the diagnostic procedure:
 - Jumpering or grounding of the components or connectors.
 - Connecting test equipment probes to components or connectors. Connect the ground lead first when using test probes.
- Ground the protective packaging of any component before opening. Do not rest solid-state components on metal workbenches, or on top of TVs, radios, or other electrical devices.

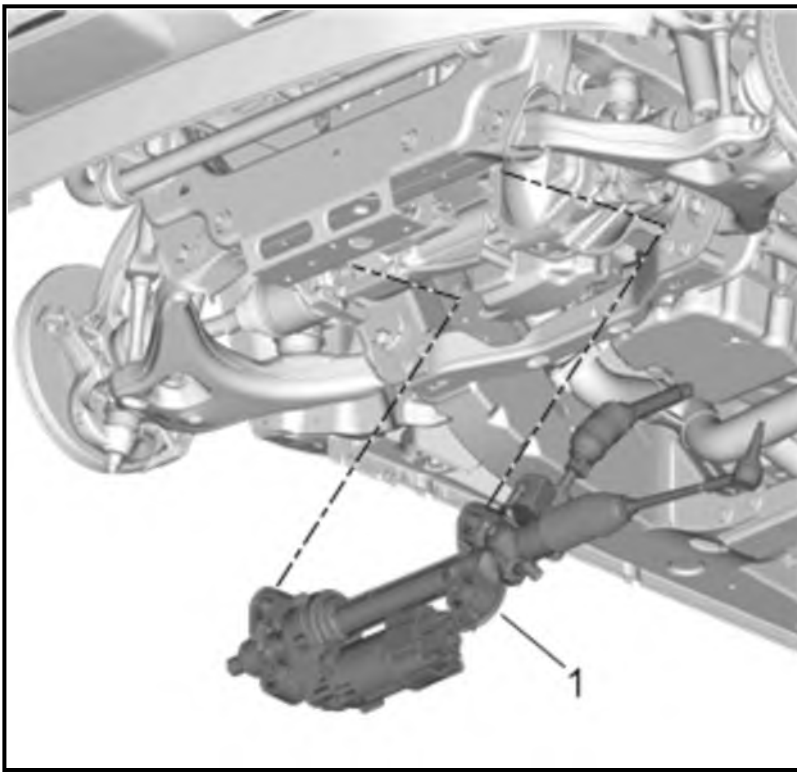
CAUTION:

During removal and installation, all EPS components including mechanical and/or electrical is extremely susceptible to damage. Dropping or prying on any EPS component may cause internal damage. If damage occurs or a part is dropped, the EPS component must be replaced.

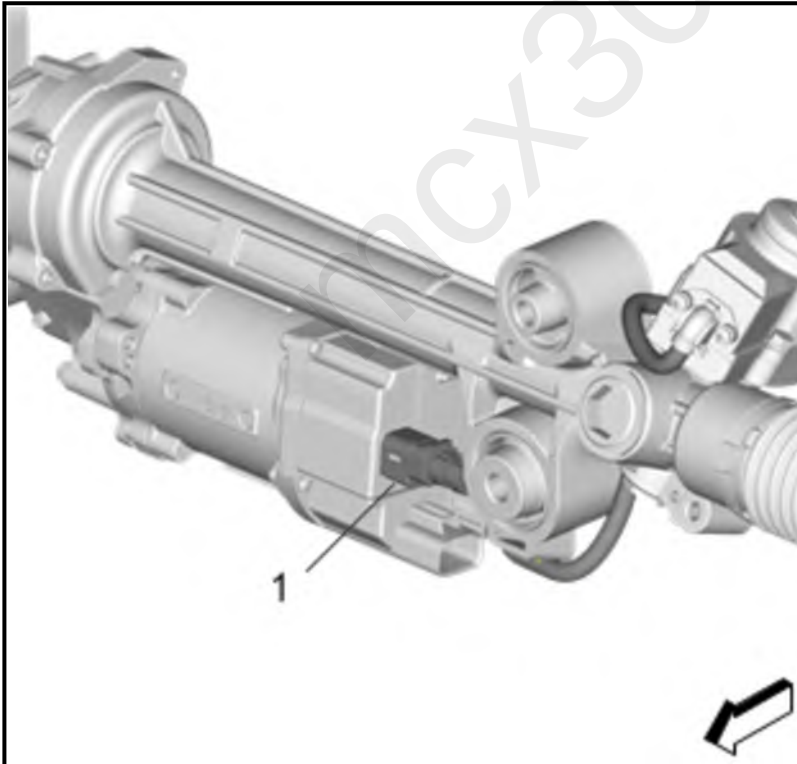
CAUTION:

Care must be taken during removal and installation of the Electronic Power Steering (EPS) components to not hit or break the EPS motor/controller module or module harness connectors. If the EPS motor/ controller module or module connectors are damaged, the complete component must be replaced.

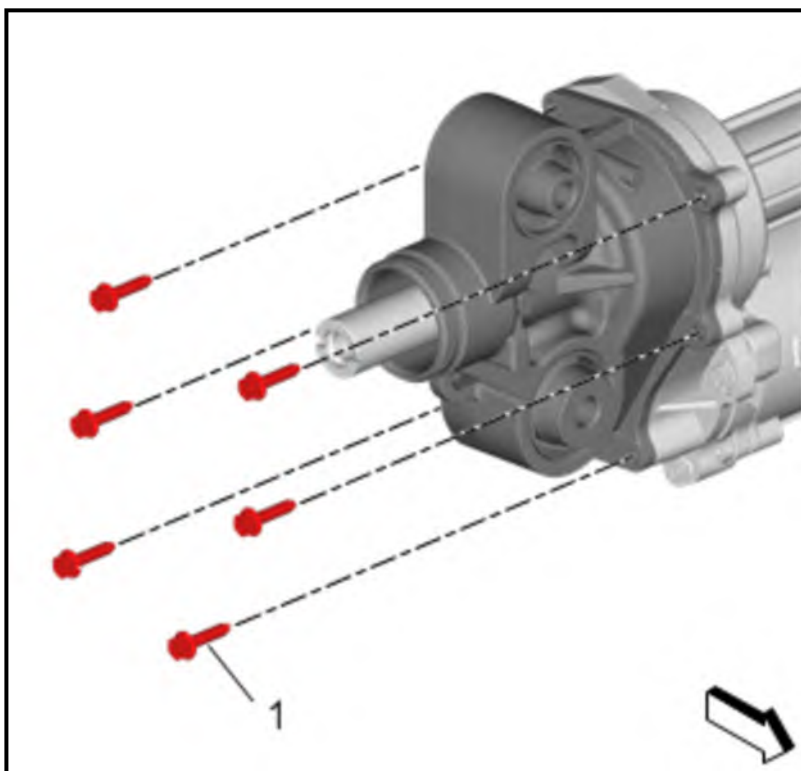
1. Steering Gear (1) - Remove - [Electric Belt Drive Rack and Pinion Steering Gear Replacement \(4WD\)](#)



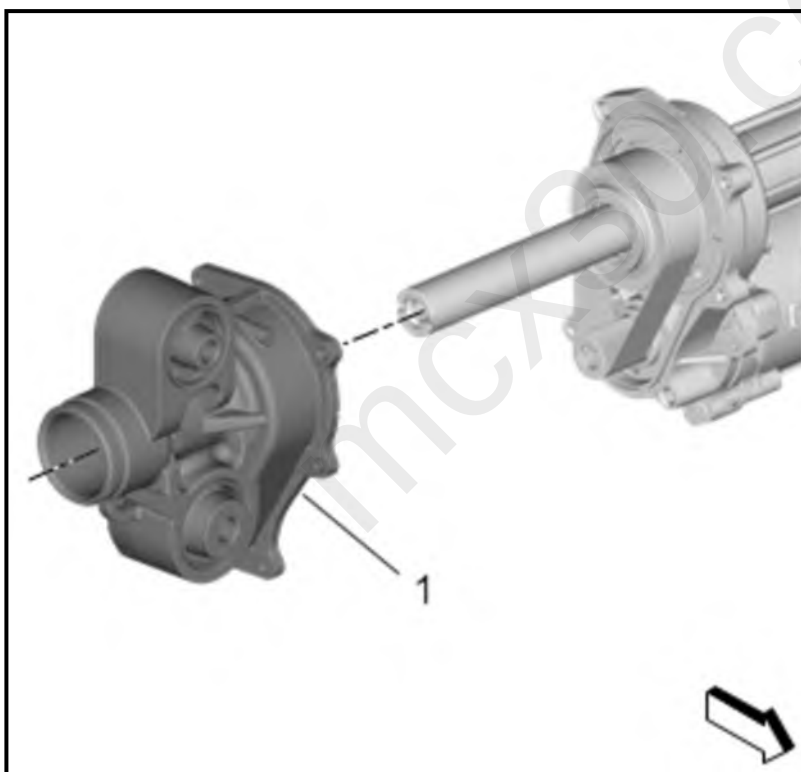
2. Remove any dirt or debris from the steering gear. Cleaning the entire area of dirt and debris will ensure no contaminants enter the steering gear.
3. Place the steering gear in a vise or on a clean bench.
4. Disconnect the torque sensor wiring harness connector (1) from the power steering assist motor. The wiring harness is NOT repairable. Do NOT attempt to repair the harness under any circumstances. If either harness is damaged then the steering gear MUST be replaced.



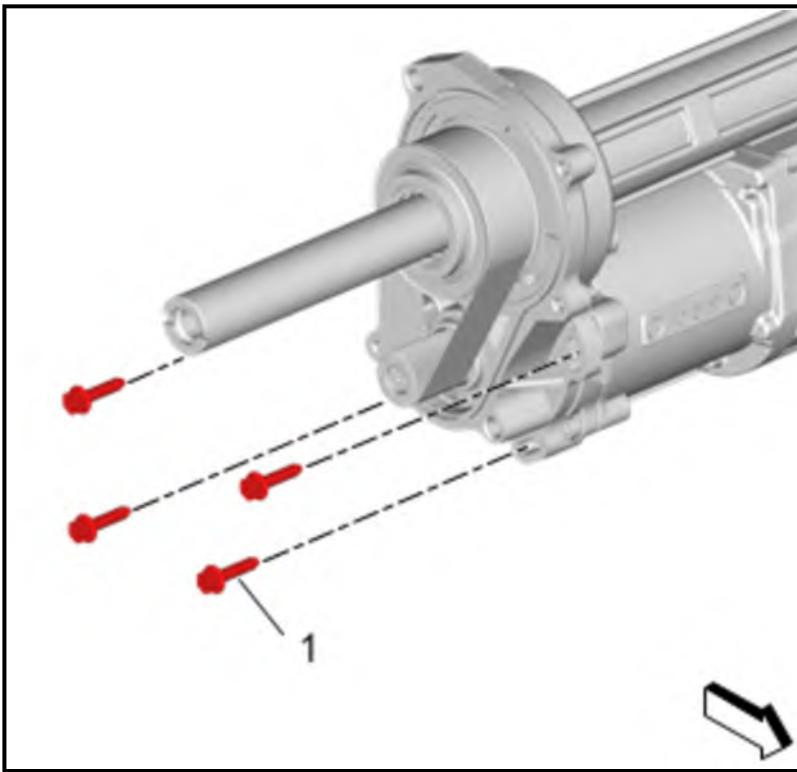
5. Remove the steering gear housing cover bolts (1).



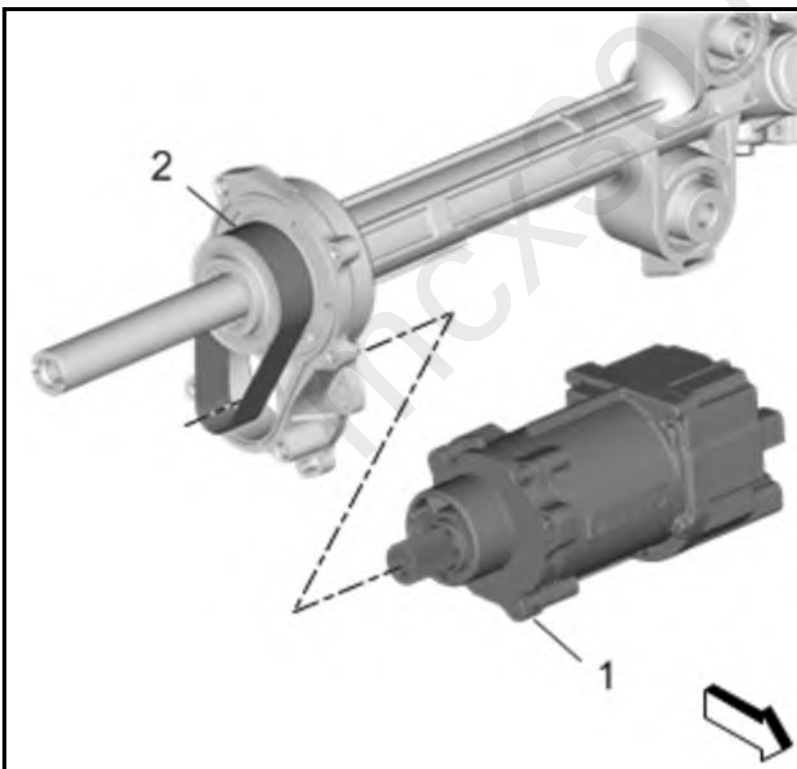
6. Use a rubber mallet to separate the steering gear housing cover (1) from the steering gear housing and remove the cover.



7. Remove the power steering assist motor pivot bolts (1).

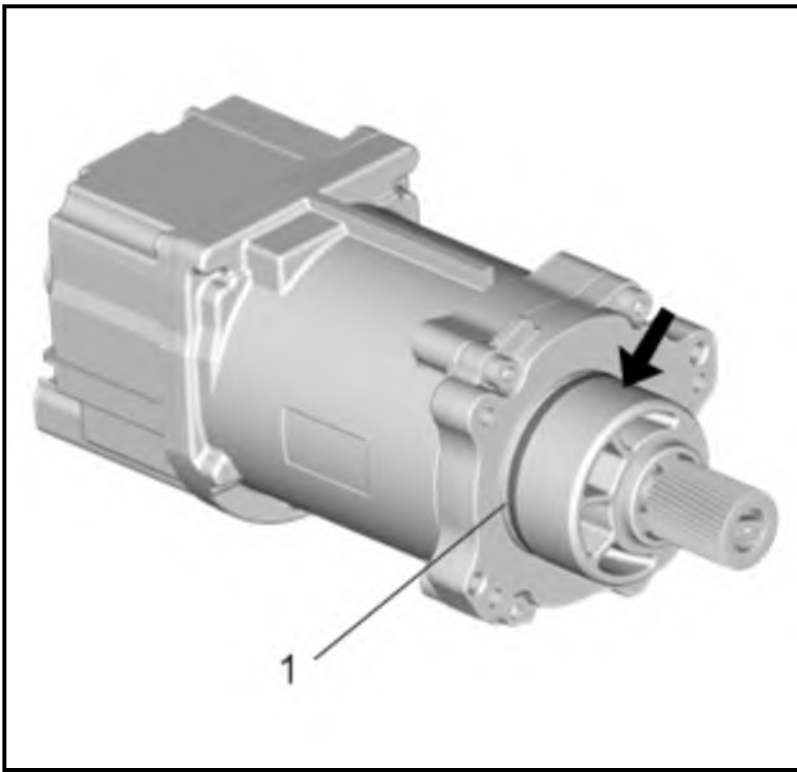


8. Rotate the power steering assist motor (1) toward the steering gear and then pull the motor toward the steering gear input shaft until the motor is released from the steering gear housing. Then, lower the nose of the motor to release the steering gear belt (2) from the pulley and remove the motor from the belt. DISCARD the belt.

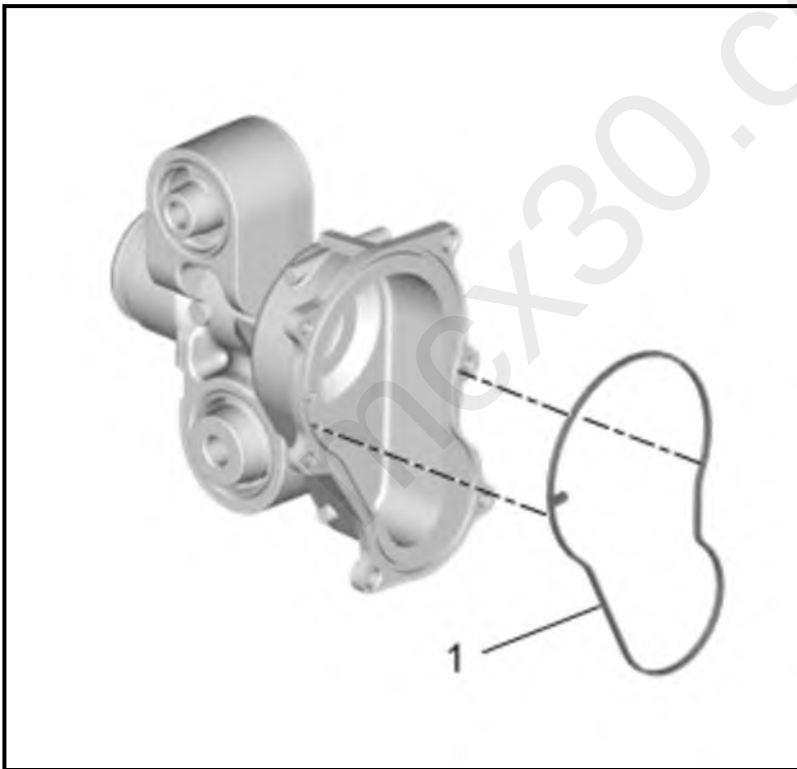


Installation Procedure

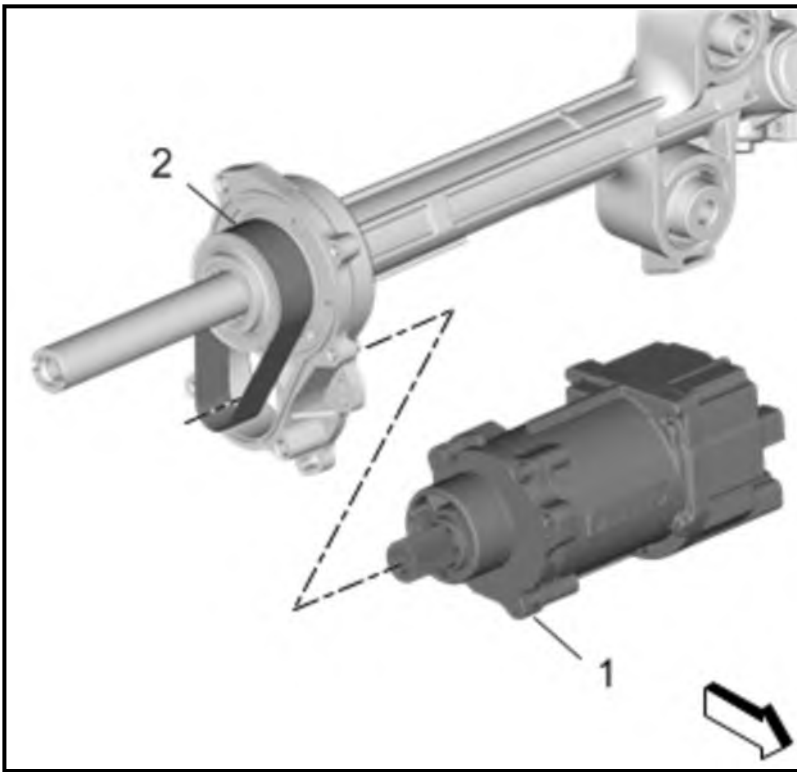
1. Use a clean shop rag to clean the surfaces where the power steering assist motor and the steering gear housing mate of any old grease or loose particles. Also clean the surfaces where the steering gear housing cover and the steering gear housing mate of any old grease or loose particles.
2. Install a NEW power steering assist motor seal (1) on the power steering assist motor. Add a light film of lithium grease to the nose of the motor.



3. Inspect the steering gear housing cover seal (1) and ensure the seal is seated correctly. If the seal is damaged, install a NEW seal.



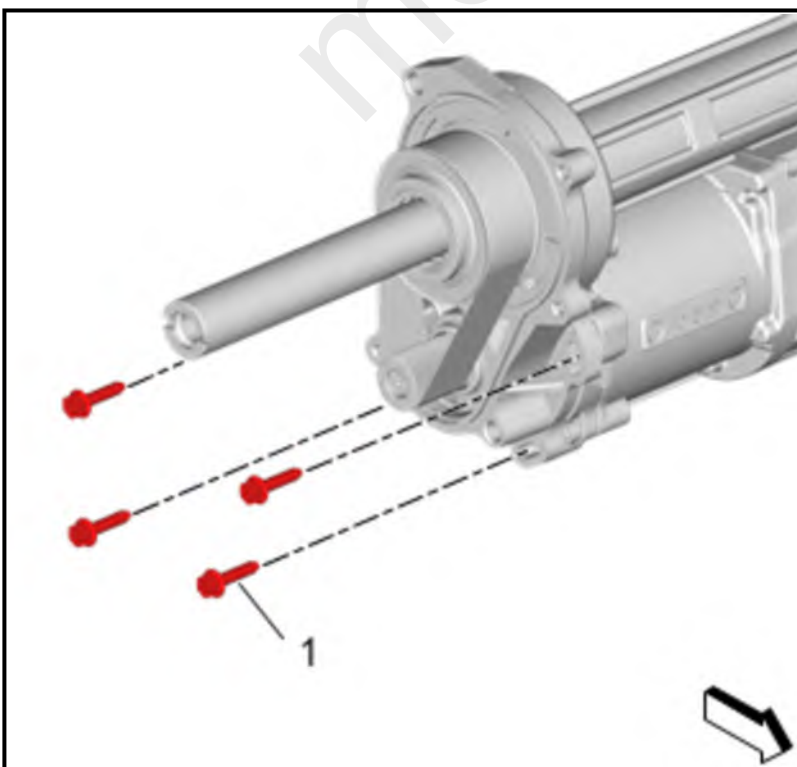
4. Hang the NEW steering gear belt (2) on the pulley.



5. Lower the nose of the power steering assist motor (1) and install the nose of the motor into the steering gear belt. Do NOT allow the belt to come into contact with any of the grease in the steering gear housing.

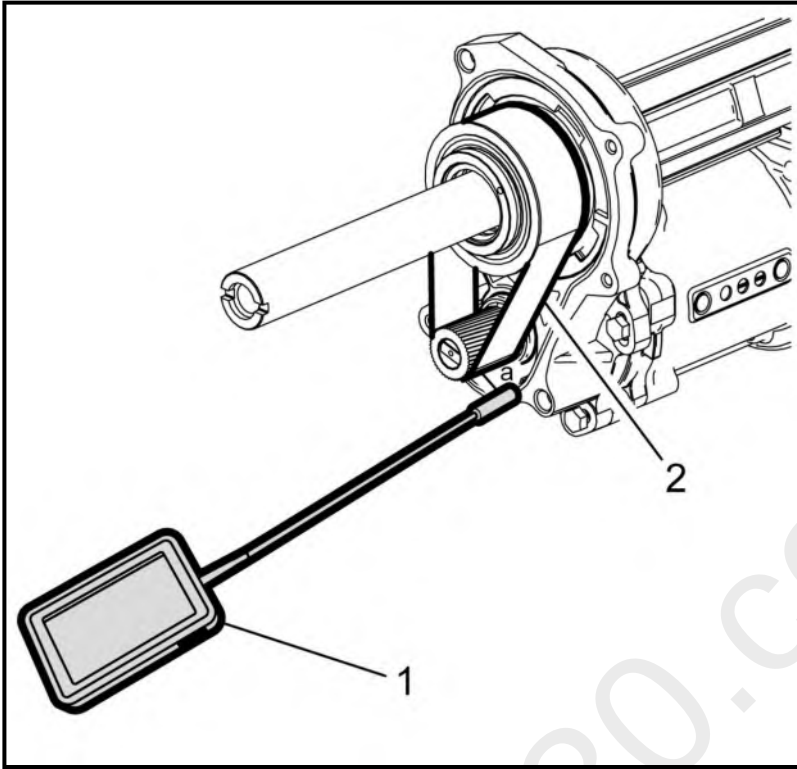
CAUTION: Ensure that the belt is completely installed on to the power steering assist motor pulley. Misalignment of the belt on the pulley will damage the belt and the electric belt drive rack and pinion steering gear will need to be replaced.

6. After the power steering assist motor (1) is installed in the steering gear and steering gear belt, rotate the motor clockwise, while making sure the screw holes in the motor and slotted holes in steering gear housing are aligned properly.
7. Install the power steering assist motor pivot bolts (1) and hand tighten. Ensure the power steering assist motor is snug to the steering gear housing but can still turn.



NOTE: A suitable clamp may be necessary to help draw the power steering assist motor into the steering gear housing completely. Ensure the motor is flush with the housing before continuing the installation process.

8. Install a wrench on the steering gear input shaft and rotate the input shaft one half of a full revolution in each direction from the centered position to seat the belt.
9. Place body of the **GE-50576 - A** tension tester (1) on a flat surface or secure it to the steering gear housing. NEVER hold the tester by hand while taking measurements or the reading will be inaccurate.



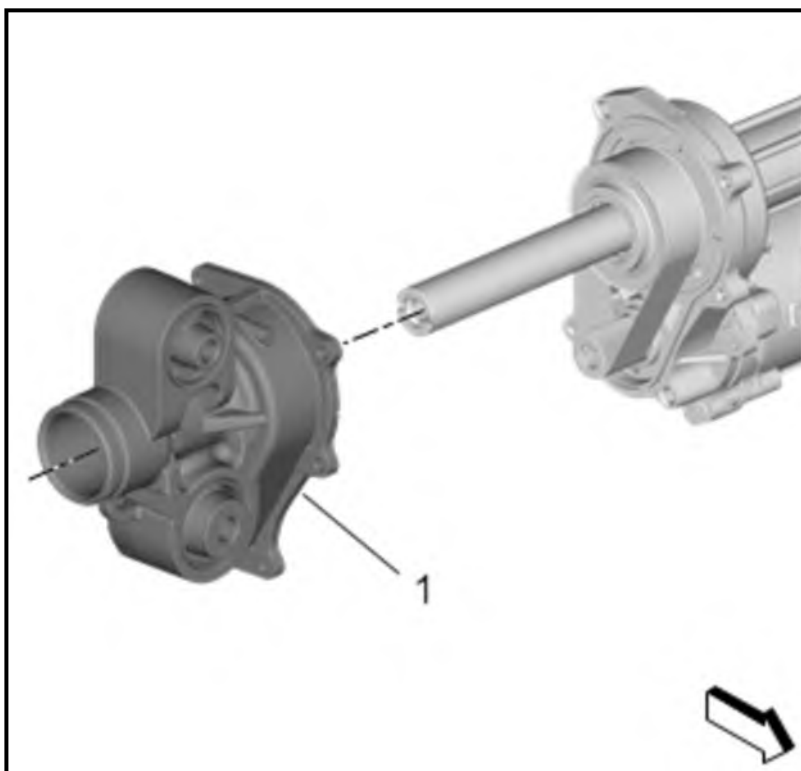
10. Position the microphone of the **GE-50576 - A** tension tester approximately 6 mm (0.25 in) (a) from the steering gear belt (2).

CAUTION: Never use a sharp object to strum the belt as belt damage may occur. If the belt is damaged, the electric belt drive rack and pinion steering gear will need to be replaced.

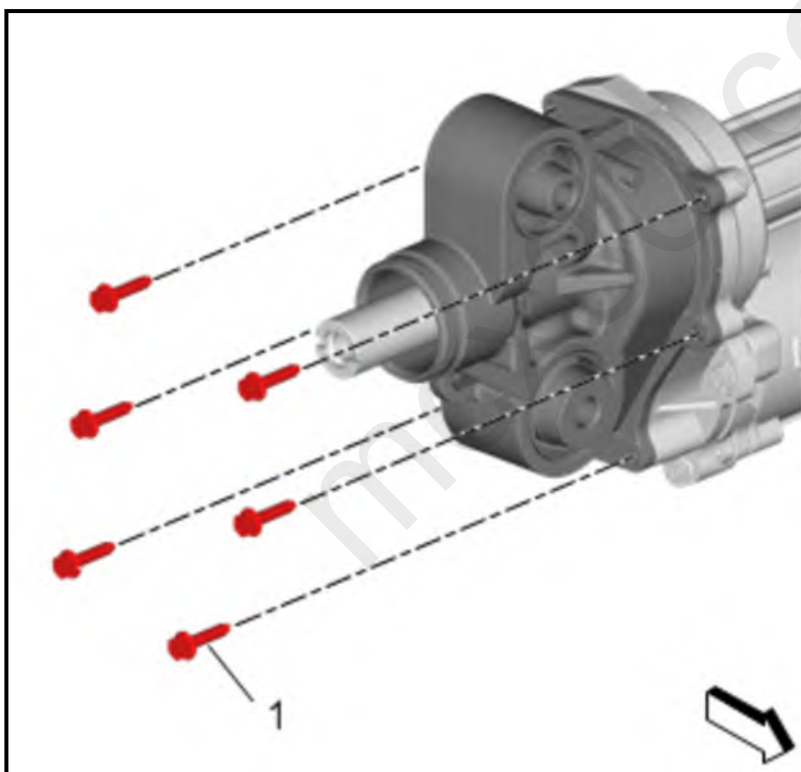
11. Use an allen wrench or finger to strum the steering gear belt (1) at the center location between the pulleys three times to get an average belt tension measurement.
12. If the average steering gear belt tension measurement is between 260 - 320 Hz then continue to the next step. If the average of the measurements is lower or higher than the specification, then rotate the motor clockwise to tighten or counterclockwise to loosen and take the average of another set of three measurements. Repeat this step until the average of the measurements is within the range specified.

CAUTION: Refer to **Fastener Caution** .

13. Tighten the power steering assist motor pivot bolts to 12 N.m (106 lb in) and recheck the belt tension using the **GE-50576 - A** tension tester. If the average of the measurements is not between 260 - 320 Hz then loosen the pivot bolts and readjust the belt tension. If the measurement is still within the specified range then continue to the next step.
14. Ensure that the steering gear housing cover seal is in position and install the steering gear housing cover (1).



15. Install the steering gear housing cover bolts (1) and hand tighten.



16. Tighten the steering gear housing cover bolts in the sequence shown to 12 N.m (106 lb in).

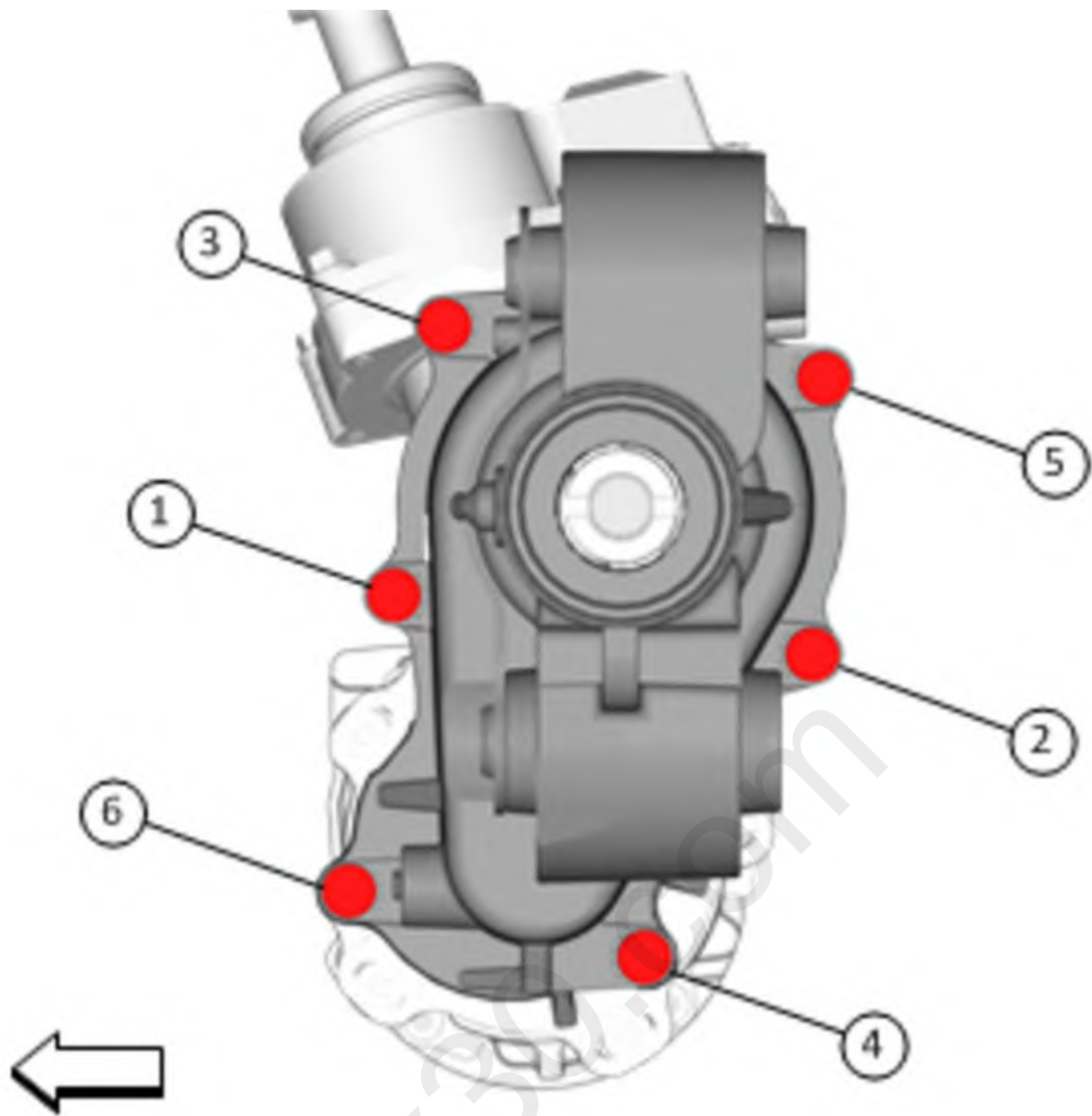
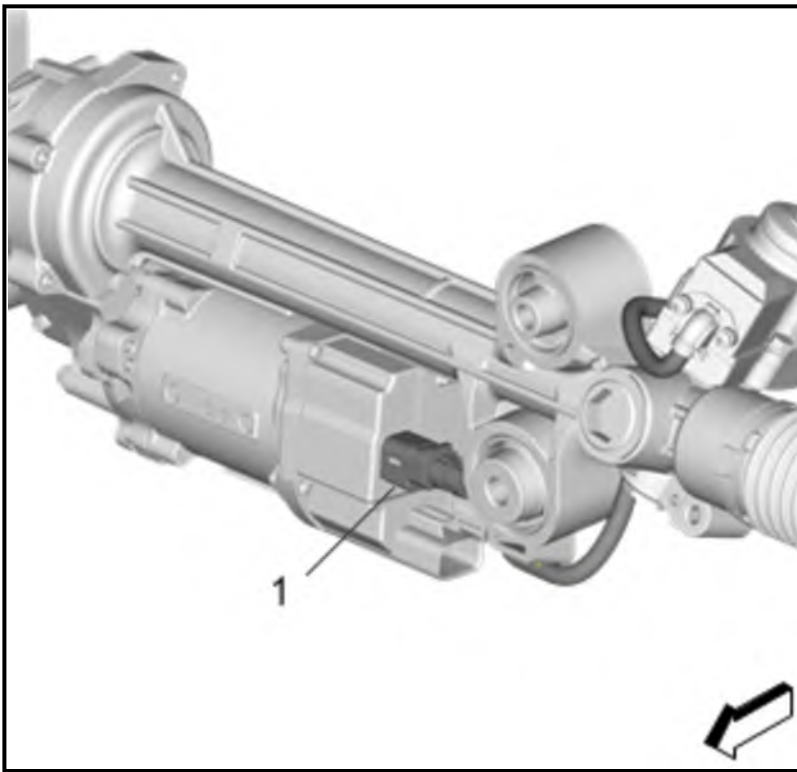
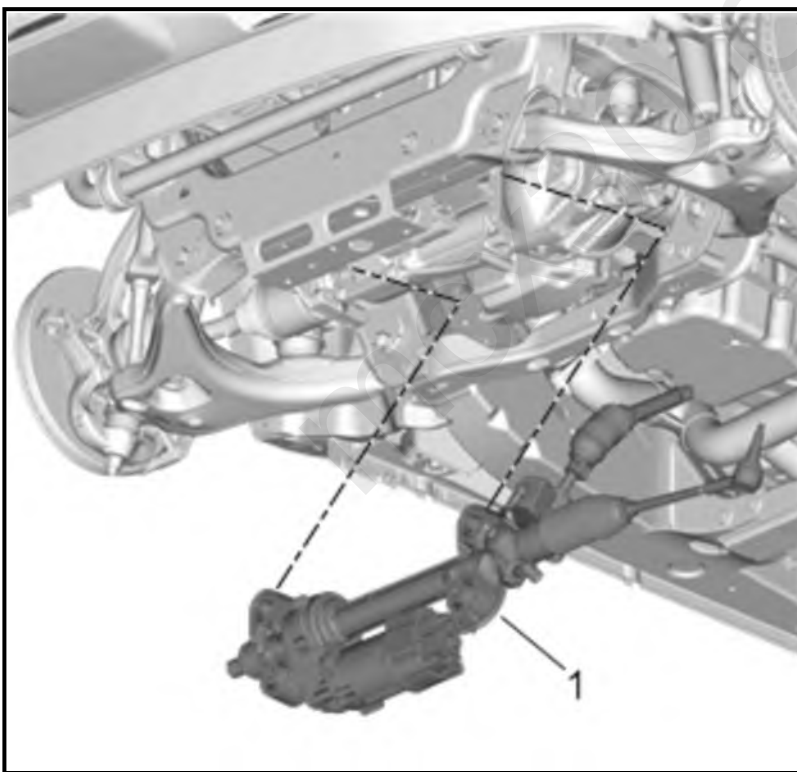


Fig. 2: Steering Gear Housing Cover Bolts Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

17. Connect the torque sensor wiring harness connector (1) to the power steering assist motor. Ensure the connector lock is engaged.

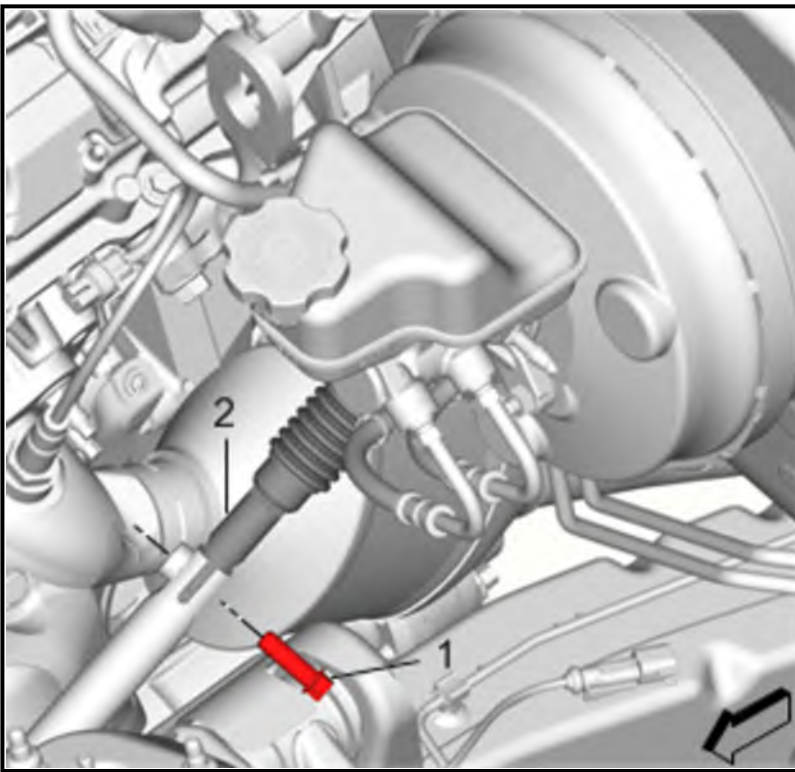


18. Install the steering gear (1) and steering gear fasteners, but leave the steering linkage outer tie rods and intermediate steering shaft disconnected. [Electric Belt Drive Rack and Pinion Steering Gear Replacement \(4WD\)](#)

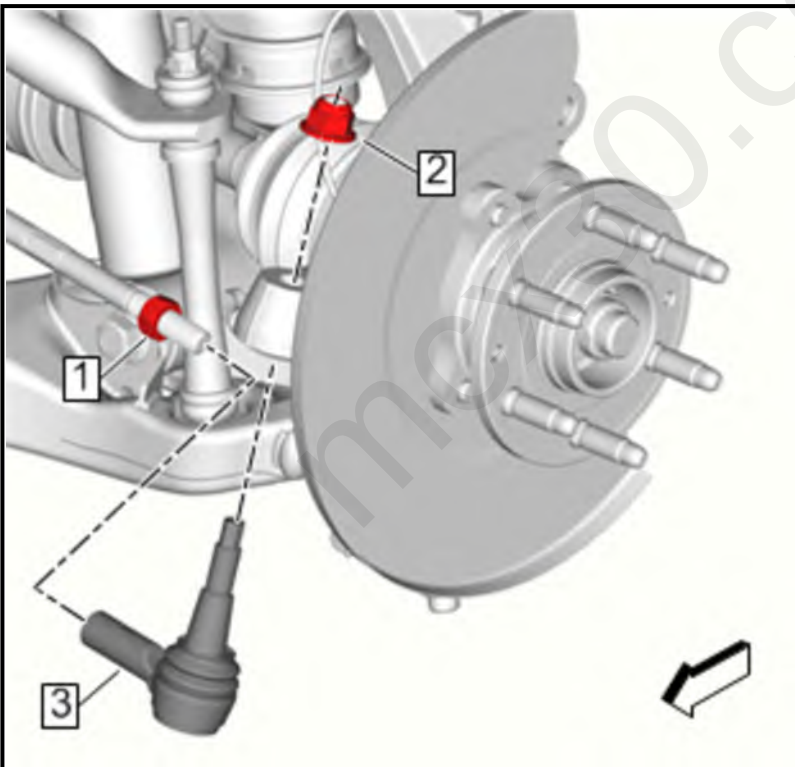


NOTE: The steering linkage outer tie rods and the intermediate steering shaft **MUST** be disconnected and able to move freely during the power steering control module programming and setup procedure to properly calibrate the torque sensor in the steering gear.

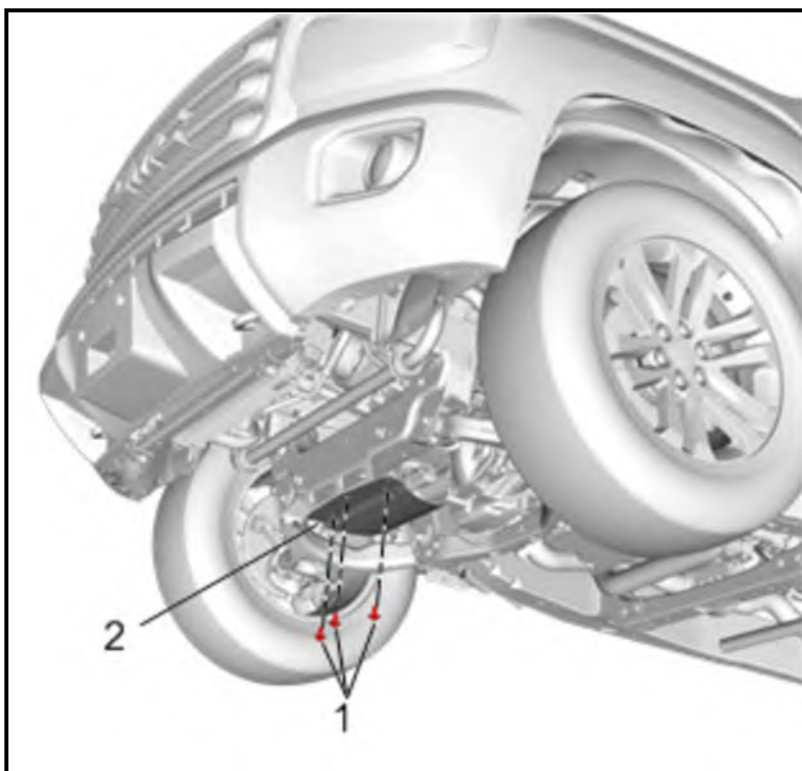
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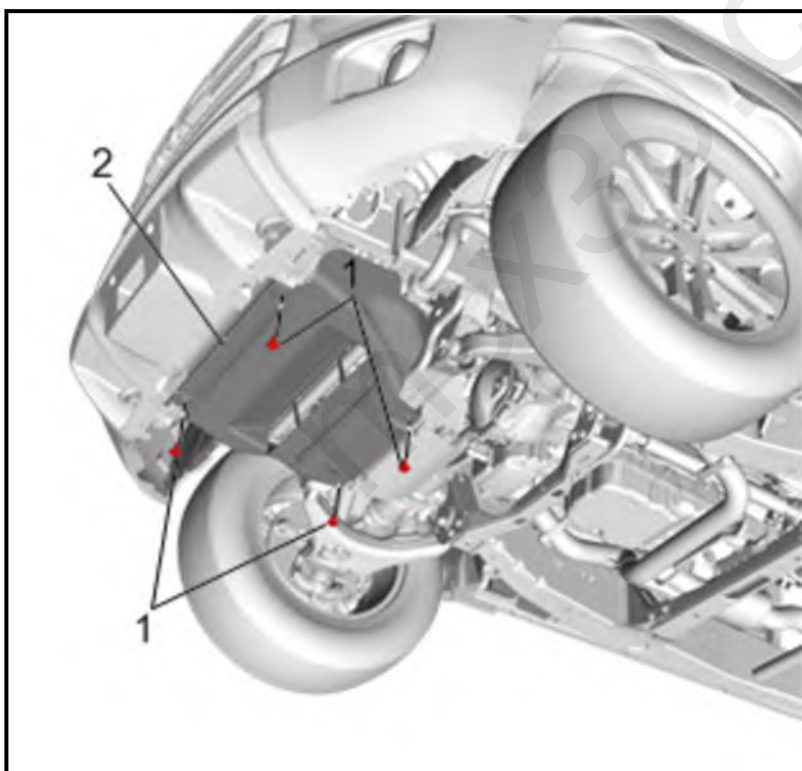
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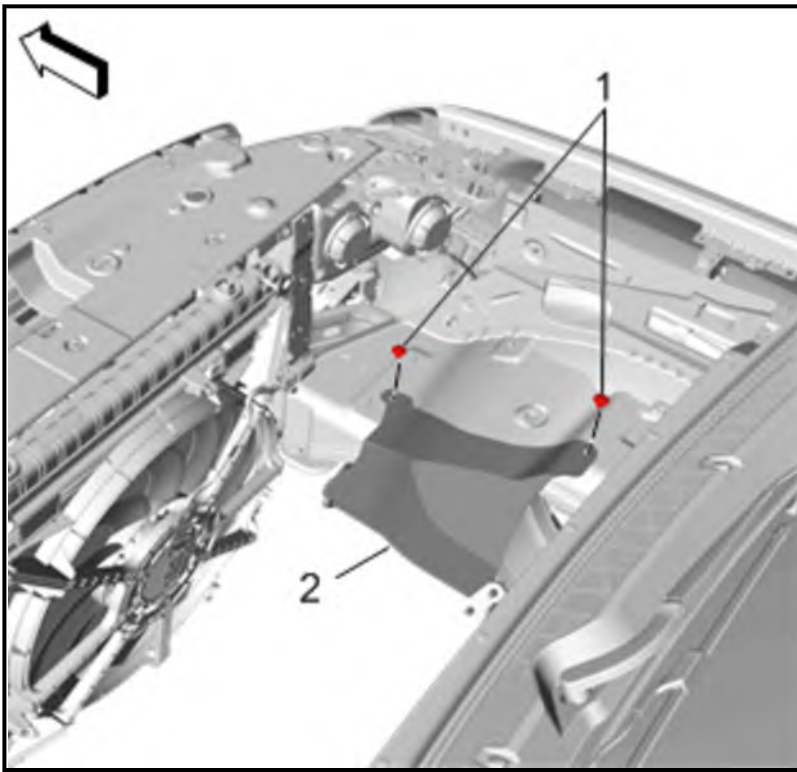
22. Steering Gear Skid Shield (2) - Install - [Steering Gear Skid Shield Replacement \(without ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(with ZR2\)](#) , or [Steering Gear Skid Shield Replacement \(Bison\)](#).



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25. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)
26. Measure and adjust the front toe. [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)
27. Center the steering angle sensor. [Steering Wheel Angle Sensor Centering](#)

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM DESCRIPTION AND OPERATION

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

- The integrated electromechanical power steering unit, containing the power steering control module, its sensors, the power steering motor, a belt drive and a ball nut mechanism.
- The steering gear (rack and pinion)

The power steering control module is part of the power steering assist motor assembly and is replaceable as a complete unit independent of the steering gear assembly. The steering wheel torque and angle sensor is integrated with the steering gear pinion and is serviced as part of the steering gear.

The belt driven electric power steering system reduces the amount of effort needed to steer the vehicle utilizing the power steering control module to control the power steering motor to maneuver the steering gear. The power steering control module also uses a combination of the torque sensor, motor rotational sensor, battery voltage circuit and serial data circuit to perform the system functions. 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 power steering control module continuously monitors the digital torque sensor's torque and index current signals. As the steering wheel is turned and torque 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. The voltage signals of the motor position sensor and the digital torque sensor's index current signal are both processed by the power steering control module to detect and calculate the steering wheel angle.

The power steering control module responds to the change in the digital torque sensor signals as well as the motor rotational sensor's voltage signals by commanding current to the power steering motor. The power steering control module controls the motor drive circuit to drive the alternating current motor. The power

steering control module and motor assembly is attached to the base of the steering gear housing and applies power assist directly to the rack with a belt drive and a ball nut mechanism to maneuver the rack laterally depending on the direction the steering wheel is turned.

The power steering control module has advanced software features referred to as Active Pull Compensation and Smooth Road Shake Compensation.

Active Pull Compensation constantly measures steering wheel torque being applied by the driver to maintain the vehicle's path. When the software detects extra effort being used, the steering assist motor adds torque in the proper direction to prevent the driver from having to make corrections to keep the vehicle on course. The torque assistance reduces driver fatigue and effort and makes steering easier. The software automatically resets itself to compensate for changing road conditions or the vehicle turning on curves. This software feature will compensate for a specific range of lead/pull up to its maximum limit within a set of parameters. The feature can be disabled during diagnostics for appropriate root cause of a complaint vehicle.

Smooth Road Shake Compensation reduces steering wheel rotational vibration caused by an imbalance from the front tire/wheel assemblies. The rotational vibration transmitted to the steering wheel is referred to as Smooth Road Shake and is a phenomenon that occurs only at highway speeds and on smooth roads. The power steering control module employs active controls to sense and reduce the periodic torque component applied to the steering wheel caused by the wheel imbalance force. This software feature will compensate for a specific range of imbalance. If the imbalance is above a certain level, the power steering control module will disable the smooth road shake compensation software feature.

The power steering control module has the ability to calculate an internal system temperature to protect the power steering system from potential damage. To reduce a high system temperature, the power steering control module will reduce the amount of current commanded to the power steering motor, which reduces the amount of steering assist and will set DTC C0176.

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 or STEERING ASSIST IS REDUCED DRIVE WITH CARE message to be displayed on the driver information center.

SPECIAL TOOLS AND EQUIPMENT

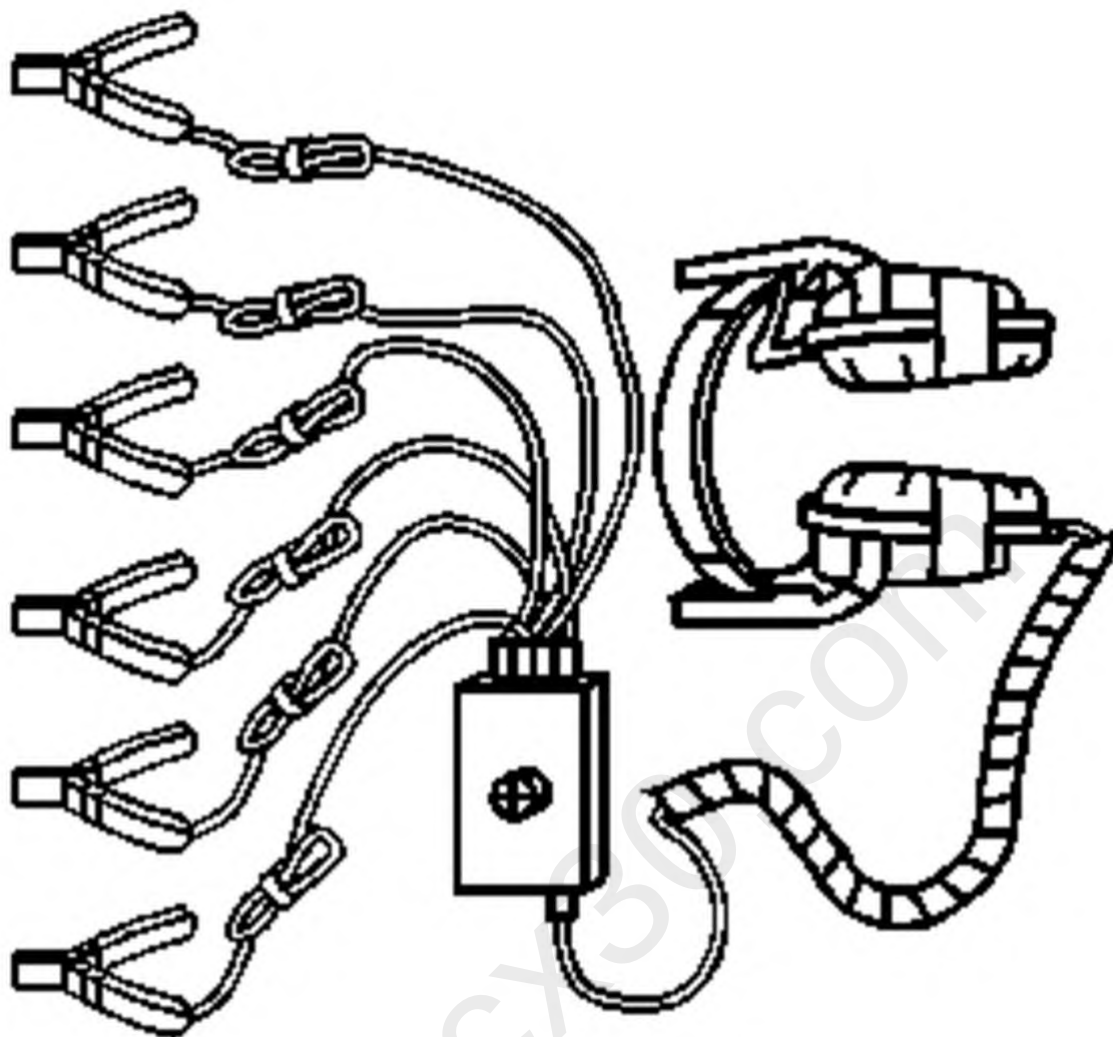
SPECIAL TOOLS

Illustration	Tool Number/ Description
	CH-22610 J-22610 KM-J-22610 SA9164C Keystone Clamp Pliers

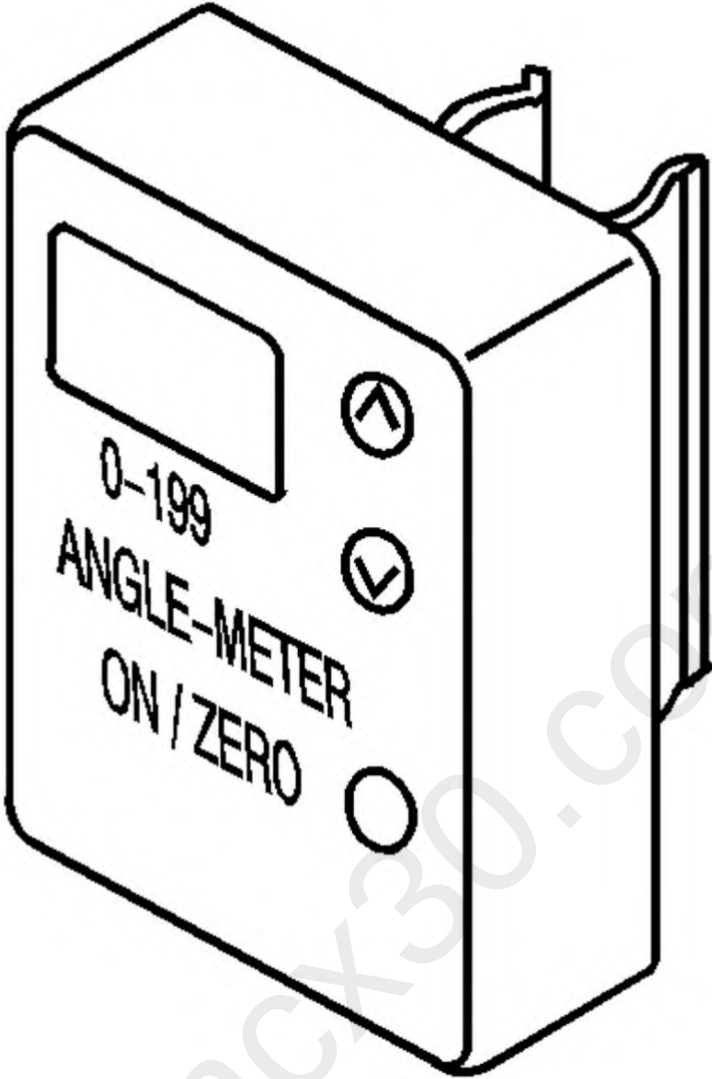
Illustration	Tool Number/ Description
	CH-24319 - B J-24319 - B SA91100C 7503 Universal Steering Linkage and Tie Rod Puller

Illustration

Tool
Number/
Description

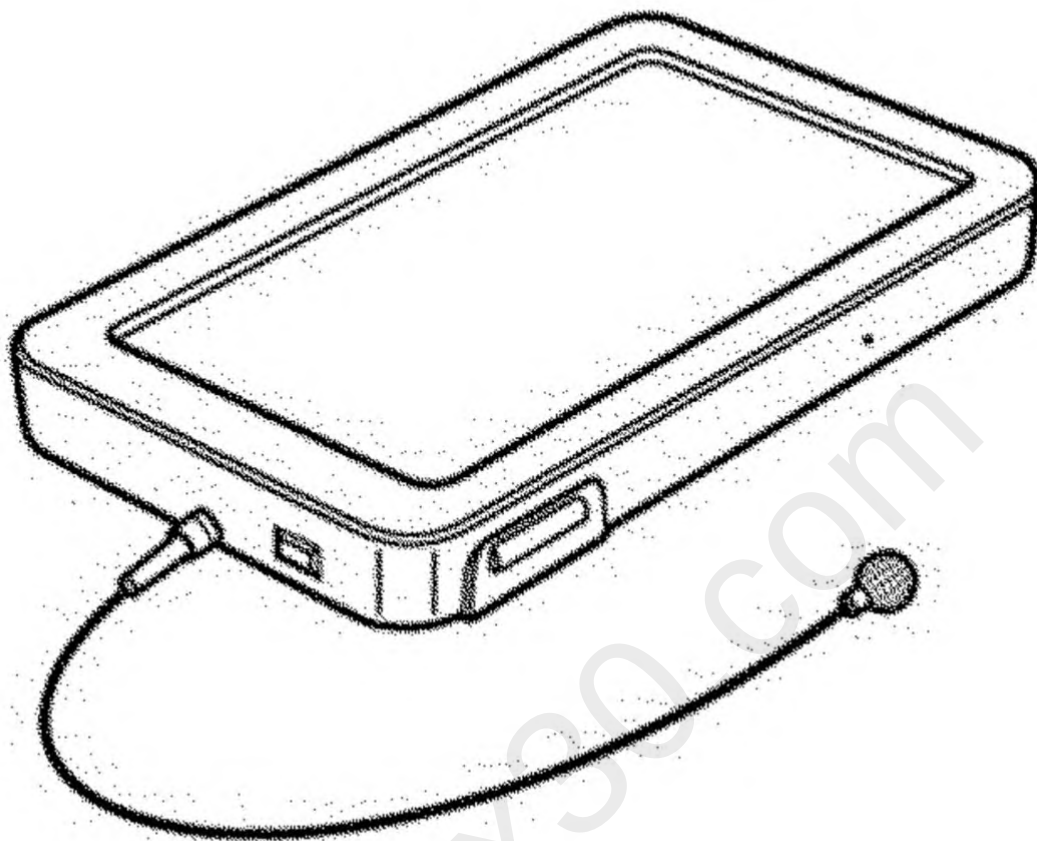


CH-39570
J-39570
SA9217NE
Electronic
Listening
Chassis Ear

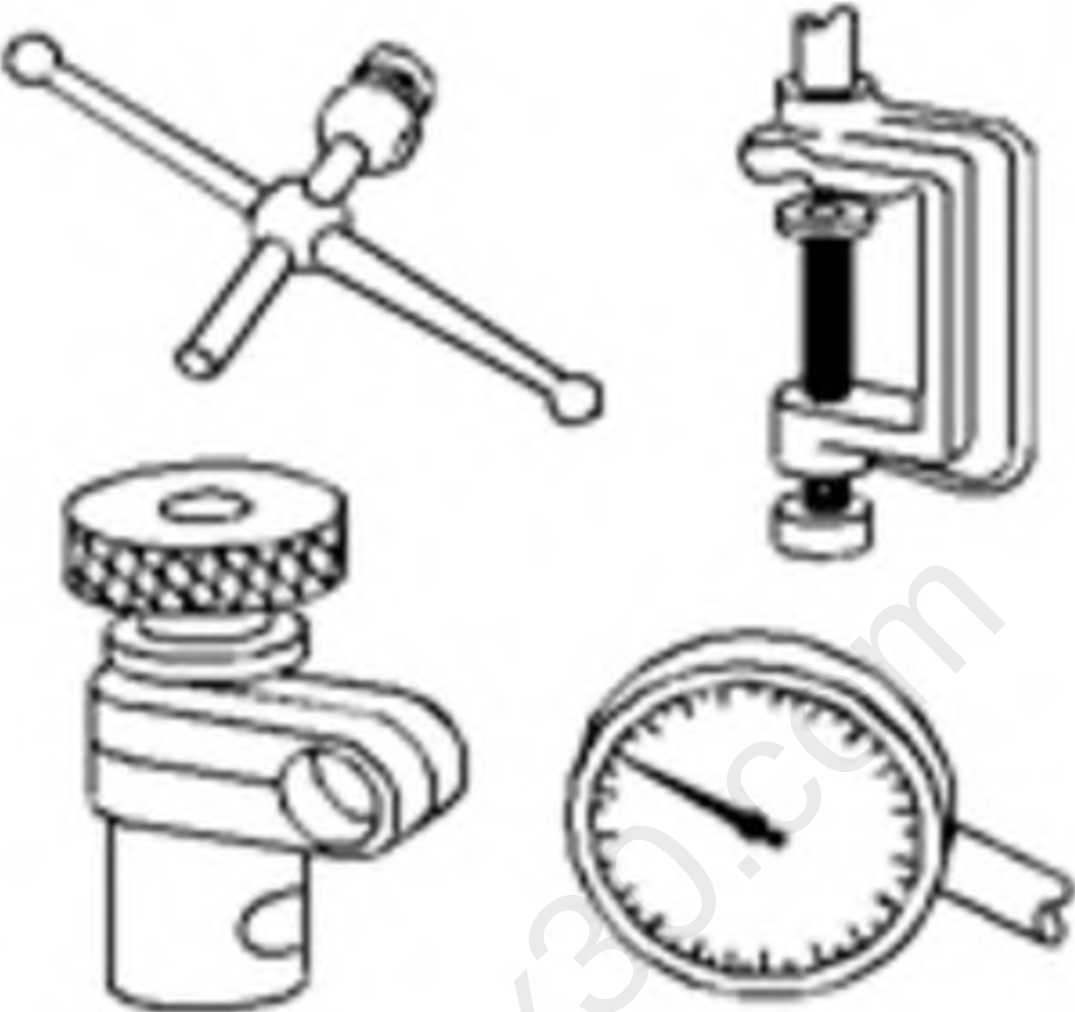
Illustration	Tool Number/ Description
	EN-45059 J-45059 Torque Angle Meter

Illustration

**Tool
Number/
Description**



GE-50576 -
A
Acoustic
Belt
Tension
Tool

Illustration	Tool Number/ Description
 The illustration shows four mechanical tools. At the top left is a four-way alignment tool with a central hub and four long, thin arms, each ending in a small circular tip. At the top right is a C-clamp with a U-shaped frame and a threaded rod with a conical foot. At the bottom left is a dial indicator assembly consisting of a cylindrical base, a horizontal arm with a curved tip, and a large knurled adjustment wheel on top. At the bottom right is a circular dial gauge with a scale around the perimeter and a single needle pointing to the left.	J-8001 GE-8001 Dial Indicator Set