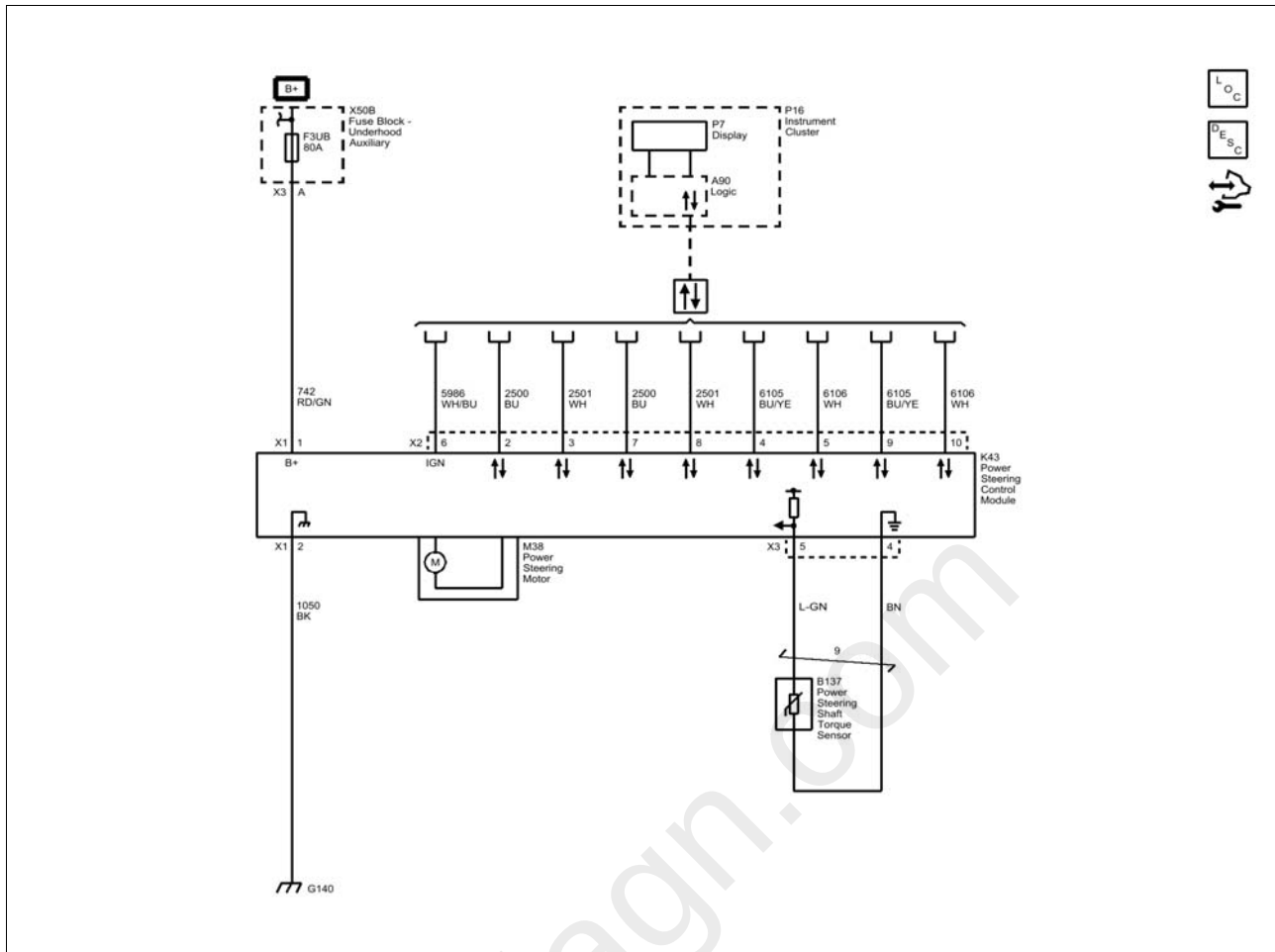


SPECIFICATIONS > FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Steering Gear Nut (Requires a NEW Bolt.)		
• First Pass:	58 N.m	43 lb ft
• Final Pass:	90-105 Degrees	
Steering Linkage Inner Tie Rod	105 N.m	77 lb ft
Steering Linkage Outer Tie Rod		
• First Pass:	35 N.m	26 lb ft
• Final Pass:	40-50 Degrees	

**SCHEMATIC WIRING DIAGRAMS > POWER STEERING WIRING SCHEMATICS >
ELECTRIC POWER STEERING**

Fig 1: Electric Power Steering



Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > DTC DESCRIPTOR

DTC C0176 54

Control Module Temperature Sensor High Temperature

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > CONDITIONS FOR RUNNING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > CONDITIONS FOR SETTING THE DTC

The power steering control module detects a high system temperature.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > REFERENCE INFORMATION

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Connector End View Reference

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- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > 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.

1. 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.

1. If the DTC is set

1. Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to Steering Effort Hard or Too Easy in One or Both Directions

1. If steering components are mechanically binding, replace the mechanically binding steering components.

2. If no steering components are mechanically binding, replace the Steering Gear.

1. If the DTC is not set

3. All OK.

1. If the DTC set outside of the conditions for running and setting

2. All OK. The power steering is operating as designed.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0176: CONTROL MODULE TEMPERATURE SENSOR HIGH TEMPERATURE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > DTC DESCRIPTOR

DTC C0460 00

Steering Wheel Angle Sensor Malfunction

DTC C0460 4B

Steering Wheel Angle Sensor Calibration Not Learned

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition circuit	U0126, C0710 71	U0126, C0710 71	-	C0710 5A
Ground	-	U0126, C0710 71	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > CIRCUIT/SYSTEM DESCRIPTION

The steering wheel angle sensor receives a 12 V reference from the electronic brake control module. The electronic brake control module receives serial data message inputs from the steering angle sensor identifying the position and direction of the steering wheel rotation. The module utilizes this signal to calculate the driver intended driving direction.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > CONDITIONS FOR RUNNING THE DTC

The condition for running the DTC will not occur until the initialization phase has been completed. The initialization of the electronic brake control module occurs when the following conditions have been met:

- Ignition voltage is greater than 8 V.
- The initialization happens once each ignition cycle when the vehicle speed is greater than 20 km/h (12 MPH) and the vehicle is driven in a straight line without the brake pedal being applied.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > CONDITIONS FOR SETTING THE DTC

DTC C0460 00

- Steering angle signal is not valid.
- Steering angle signal line is open.
- Angle signal cycle time is out of range.
- Angle signal duty is out of range.

DTC C0460 4B

Steering sensor zero position is not set.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > ACTION TAKEN WHEN THE DTC SETS

- DTC C0460 is stored in memory.
- No steering assist.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C0460 00 or C0460 4B is not set.
 1. **If DTC C0460 4B is set**
Perform the Steering Angle Sensor Centering .
 1. **If DTC C0460 00 is set**
Refer to DTC C0710
 1. **If DTC C0460 00 or C0460 4B is not set**
3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0460: STEERING WHEEL ANGLE SENSOR > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for Control Module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > DTC DESCRIPTORS

DTC C0475 00

Electric Steering Motor Circuit Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > CIRCUIT/SYSTEM DESCRIPTION

C0475 00

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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > CONDITIONS FOR SETTING THE DTC

C0475 00

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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > CONDITIONS FOR CLEARING THE DTC

C0475 00

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the K43 Power Steering Control Module. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

1. If 10 Ω or greater

1. Ignition OFF.
2. Test for less than 2 Ω in the ground circuit end to end.
 1. If 2 Ω or greater, repair the open/high resistance in the circuit.
 2. If less than 2 Ω , repair the open/high resistance in the ground connection.

1. If less than 10 Ω

3. Verify a test lamp illuminates between the B+ circuit terminal 1 and ground.

1. If the test lamp does not illuminate and the circuit fuse is good

1. Ignition OFF.
2. Test for less than 2 Ω in the B+ circuit end to end.
 1. If 2 Ω or greater, repair the open/high resistance in the circuit.
 2. If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.

1. If the test lamp does not illuminate and the circuit fuse is open

1. Ignition OFF.
2. Test for infinite resistance between the B+ circuit and ground.
 1. If less than infinite resistance, repair the short to ground on the circuit.

2. If infinite resistance, replace the Steering Gear.

1. If the test lamp illuminates

4. Replace the Steering Gear.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0475: ELECTRIC STEERING MOTOR CIRCUIT MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for control module programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > DTC DESCRIPTOR

DTC C047A 00

Electric Steering Motor Position Sensor Circuit Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C047A is not set.

1. If the DTC is set

Replace the K43 Power Steering Control Module.

1. If the DTC is not set

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C047A: ELECTRIC STEERING MOTOR POSITION SENSOR CIRCUIT MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.

- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > DTC DESCRIPTOR

DTC C0544 5A

Steering Wheel Angle Sensor Signal Not Plausible

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > CIRCUIT/SYSTEM DESCRIPTION

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > CONDITIONS FOR SETTING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL

ANGLE SENSOR SIGNAL NOT PLAUSIBLE > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that no other DTCs are set except for C0544.

1. If any other DTCs are set

Refer to Diagnostic Trouble Code (DTC) List - Vehicle

1. If no other DTCs are set

3. Verify that DTC C0544 is not set.

1. If the DTC is set

1. Program the K43 Power Steering Control Module.
2. Verify the DTC does not set.
 1. If the DTC sets, replace the B99 Steering Wheel Angle Sensor.
 1. If the DTC does not set
3. All OK.

1. If the DTC is not set

4. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0544: STEERING WHEEL ANGLE SENSOR SIGNAL NOT PLAUSIBLE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > DTC DESCRIPTORS

DTC C0545 00

Steering Wheel Torque Sensor

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > CONDITIONS FOR RUNNING THE DTC

The ignition is ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > REFERENCE INFORMATION

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Scan Tool Reference

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > CIRCUIT/SYSTEM VERIFICATION

1. Verify that DTC C0545 is not set.

1. If the DTC is set



NOTE:

Check the torque sensor terminal connections for signs of corrosion or damage.

Replace the steering gear.

1. If the DTC is not set

2. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0545: STEERING WHEEL TORQUE SENSOR > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > DTC DESCRIPTOR

Steering System Temperature Sensor Circuit Internal Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > CIRCUIT/SYSTEM DESCRIPTION

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > CONDITIONS FOR RUNNING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > CONDITIONS FOR SETTING THE DTC

The power steering control module detects a high system temperature.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > DIAGNOSTIC AIDS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC C0546 is not set.

1. If DTC C0546 is set

1. Verify that no steering components down stream of the power steering column

assembly are mechanically binding. Refer to Steering Effort Hard or Too Easy in One or Both Directions

1. If steering components are mechanically binding, replace the mechanically binding steering components.

1. If no steering components are mechanically binding

2. Replace the Steering Gear.

1. If DTC C0546 is not set

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0546: STEERING SYSTEM TEMPERATURE SENSOR CIRCUIT INTERNAL MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > DTC DESCRIPTOR

DTC C055C 00

Steering Gear Performance Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > CIRCUIT/SYSTEM DESCRIPTION

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

the friction is too high the clutch between motor and rack slips and the internal angle is not longer valid.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > CONDITIONS FOR SETTING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > DIAGNOSTIC AIDS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C055C is not set.

1. If the DTC is set

1. Verify that no steering components down stream of the power steering column assembly are mechanically binding. Refer to Steering Effort Hard or Too Easy in One or Both Directions
 1. If steering components are mechanically binding, replace the mechanically binding steering components.
 2. If no steering components are mechanically binding, replace the steering gear.

1. If the DTC is not set

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C055C: STEERING GEAR PERFORMANCE MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > DIAGNOSTIC INSTRUCTIONS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > DTC DESCRIPTOR

DTC C0565 5A

Vehicle Identification Number Not Plausible

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > CIRCUIT/SYSTEM DESCRIPTION

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > CONDITIONS FOR SETTING THE DTC

The power steering control module is properly not programmed.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > ACTION TAKEN WHEN THE DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE

IDENTIFICATION NUMBER NOT PLAUSIBLE > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > REFERENCE INFORMATION

Schematic Reference

Power Steering Schematics

Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C0565 is not set.

1. If the DTC C0565 is set

1. Program the K43 Power Steering Control Module.
2. Verify the DTC does not set.
 1. If the DTC sets, replace the Steering Gear.
 1. If the DTC does not set
3. All OK.

1. If the DTC C0565 is not set

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0565: VEHICLE IDENTIFICATION NUMBER NOT PLAUSIBLE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > DTC DESCRIPTORS

DTC C0569 31

Internal Check Sum Error

DTC C0569 42

Calibration Not Programmed

DTC C0569 46

Configuration Not Programmed

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > 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. The configuration is not complete from supplier.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > CONDITIONS FOR SETTING THE DTC

Electronic power steering control module configuration is not complete.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > ACTION TAKEN WHEN THE DTC SETS

- DTC C0569 is stored in memory.
- No steering assist.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > REFERENCE INFORMATION

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Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C0569 is not set.
 1. **If the DTC C0569 is set**
Replace the steering gear.
 1. **If the DTC C0569 is not set**
3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0569: INTERNAL CHECK SUM ERROR, CALIBRATION NOT PROGRAMMED, CONFIGURATION NOT PROGRAMMED > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > DTC DESCRIPTOR

DTC C056D

Electronic Control Unit Hardware

For symptom byte information, refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > CONDITIONS FOR SETTING THE DTC

The power steering control module has detected an internal malfunction.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > ACTION TAKEN

WHEN THE DTC SETS

The power steering control module refuses all additional inputs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > DIAGNOSTIC AIDS

- This DTC may be stored as a history DTC without affecting the operation of the device.
- If stored only as a history DTC and not retrieved as a current DTC, do not replace the device.
- If this DTC is retrieved as both a current and history DTC, replace the device that set the DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > REFERENCE INFORMATION

Schematic Reference

Power Steering Schematics

Connector End View Reference

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- Wiring Repairs

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > CIRCUIT/SYSTEM VERIFICATION



NOTE:

Verify that all harness connectors are properly connected and free of damage or corrosion.

1. Ignition ON.
2. Verify DTC C056D is not set.
 1. **If DTC C056D is set with symptom byte 34, 35, or 3C**
 1. Program the K43 Power Steering Control Module.
 2. Verify the DTC does not set.
 1. If the DTC sets, replace the K43 Power Steering Control Module.
 1. If the DTC does not set
 3. All OK.
 1. **If DTC C056D is set with symptom byte 36, 37, 38, 39, or 3B**

Replace the K43 Power Steering Control Module
 1. **If DTC C056D is not set**
3. All OK

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056D (POWER STEERING CONTROL MODULE): ELECTRONIC CONTROL UNIT HARDWARE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > DTC DESCRIPTORS

DTC C056E 36

Electronic Control Unit Software EEPROM Performance/Malfunction

DTC C056E 42

Electronic Control Unit Software Configuration Not Programmed

DTC C056E 46

Electronic Control Unit Software Calibration Not Learned

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > CONDITIONS FOR RUNNING THE DTC

Ignition OFF, ACCESSORY, or RUN mode.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > CONDITIONS FOR SETTING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > ACTIONS TAKEN WHEN DTC SETS

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > CONDITIONS FOR CLEARING THE DTC

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

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > REFERENCE INFORMATION

Schematic Reference

Power Steering Schematics

Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify that DTC C056E is not set.

1. If the DTC C056E is set

1. Program the K43 Power Steering Control Module.

2. Verify the DTC does not set.

1. If the DTC sets, replace the Steering Gear.

1. If the DTC does not set

3. All OK.

1. If the DTC C056E is not set

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C056E: ELECTRONIC CONTROL UNIT SOFTWARE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
- Control Module References for power steering control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 .

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - POWER STEERING SYSTEM > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - POWER STEERING SYSTEM > 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 or Too Easy in One or Both Directions

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 Symptoms - Steering Wheel and Column
2	Verify a rattle noise is present by driving the vehicle on a rough road. Verify a clunk noise is present by turning the steering wheel to the left and to the right several times with the key in the ON position. Is a rattle or a clunk noise present?	Go to Step 3	System OK
3	Inspect the steering gear for the proper installation. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) . Is the steering gear installation incorrect?	Go to Step 6	Go to Step 4
4	Inspect the intermediate steering shaft. Is the intermediate steering shaft worn?	Go to Step 8	Go to Step 5
5	Inspect the front suspension. Refer to Noise Diagnosis - Front Suspension . Is the front suspension worn?	Go to Step 7	Go to Step 3
6	Install the steering gear correctly. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) . Did you complete the repair?	Go to Step 9	-
7	Replace the worn front suspension component that is causing the noise. Did you complete the repair?	Go to Step 9	-
8	Replace the intermediate steering shaft. Refer to Intermediate Steering Shaft Replacement . Did you complete the repair?	Go to Step 9	-

9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3
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DIAGNOSTIC INFORMATION AND PROCEDURES > WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM

Special Tools

CH-39570 Chassis Ear

Equivalent regional tools:Special Tools

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	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to Step 3	System OK
3	Inspect the power steering gear fasteners for looseness and inspect the power steering gear mounting surface for damage. Are the steering gear fasteners loose and/or the mounting surface damaged?	Go to Step 6	Go to Step 4
4	Inspect the power steering assist motor for a whine or growl noise using the CH-39570 chassis ear. Is the noise present at the power steering assist motor?	Go to Step 7	Go to Step 5
5	Inspect the power steering gear for a whine or growl noise using the CH-39570 chassis ear. Is the noise present at the power steering gear?	Go to Step 7	Go to Step 3
6	If the mounting surface on the power steering gear is NOT damaged then replace the power steering gear fasteners. If the mounting surface on the power steering gear IS damaged then replace the power steering gear AND power steering gear fasteners. Refer to: - Fastener Specifications - Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) Did you complete the repair?	Go to Step 8	-

7	Replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) . Did you complete the repair?	Go to Step 8	-
8	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

DIAGNOSTIC INFORMATION AND PROCEDURES > 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	Verify that poor return of the steering wheel is present. Does the system operate normally?	System OK	Go to Step 3
3	Perform the following steps: 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) . 2. Lubricate the steering linkage outer tie rods and front suspension ball joints, if applicable. 3. Inspect the front suspension system for worn or damaged components. 4. Repair any worn or damaged front suspension components as necessary. Did you find and correct the condition?	Go to Step 12	Go to Step 4
4	Perform the following steps: 1. Rotate the steering wheel ONE revolution in both directions. 2. Rotate the steering wheel back to the original position.	Go to Step 5	Go to Step 10

	Was the steering wheel abnormally difficult to rotate in either direction?		
5	 NOTE: • <i>Once the intermediate steering shaft is disconnected, do NOT rotate the steering wheel more than one complete revolution from center.</i> • <i>Ensure the steering column is locked before connecting the intermediate steering shaft.</i> Perform the following steps: 1. Position the front wheels straight ahead and lock the steering wheel to prevent rotation. 2. Disconnect the intermediate steering shaft from the steering column. 3. Note the position of the steering wheel and rotate the steering wheel ONE complete revolution in both directions. 4. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction?	Go to Step 11	Go to Step 6
6	Inspect the intermediate steering shaft(s) for wear or a binding condition. Did you find and complete the repair?	Go to Step 12	Go to Step 7
7	Perform the following steps: 1. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation . 2. Disconnect both steering linkage outer tie rods from the steering knuckles. 3. Use your hands in order to move the steering linkage outer tie rod studs. 4. If abnormally difficult to move, replace the steering linkage outer tie rod(s). Did you find and complete the repair?	Go to Step 12	Go to Step 8

8	Perform the following steps: 1. Turn each steering knuckle and strut assembly inboard and outboard to inspect for binding strut components, ball joints or drive axles. 2. Repair or replace any abnormally stiff or loose components.		
	Did you find and complete the repair?	Go to Step 12	Go to Step 9
9	Perform the following steps: 1. Inspect for binding in the power steering gear. 2. If binding is present, repair or replace the power steering gear.		
	Did you find and complete the repair?	Go to Step 12	Go to Step 10
10	Inspect the wheel alignment and adjust as necessary. Refer to Wheel Alignment Measurement . Did you find and complete the repair?	Go to Step 12	-
11	Perform the following steps: 1. Inspect the steering column for binding. 2. If binding is present, repair or replace the steering column as necessary.		-
	Did you find and complete the repair?	Go to Step 12	
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	-

DIAGNOSTIC INFORMATION AND PROCEDURES > STEERING WHEEL SURGES/JERKS WHILE TURNING

Step	Action	Yes	No
1	Did you review the Power Steering System Description and Operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Power Steering System
2	Verify that the steering wheel surges/jerks while turning. Does the system operate normally?	System OK	Go to Step 3

3	Inspect for worn or binding front suspension components. Did you find and correct the condition?	Go to Step 14	Go to Step 4
4	Perform the following steps: 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) . 2. Inspect the steering linkage outer tie rods for wear or a binding condition. Are the steering linkage outer tie rods worn or binding?	Go to Step 10	Go to Step 5
5	Inspect for worn or binding intermediate steering shaft(s). Are the intermediate steering shaft(s) worn or binding?	Go to Step 11	Go to Step 6
6	Inspect for a worn or binding power steering gear. Is the power steering gear worn or binding?	Go to Step 12	Go to Step 7
7	Check for a worn or binding steering column. Is the steering column worn or binding?	Go to Step 13	Go to Step 8
8	Check for excessive heat in the power steering assist motor. Does the power steering assist motor appear to be overheated?	Go to Step 09	Go to Step 12
9	 NOTE: • Do NOT perform excessive parking lot maneuvers during testing. • Excessive parking lot maneuvers can cause the power steering assist motor to heat up. Allow the power steering assist motor to cool and retest the system.Did you correct the condition?	Go to Step 14	Go to Step 12
10	Replace the steering linkage outer tie rod(s). Refer to Steering Linkage Outer Tie Rod Replacement . Did you complete the repair?	Go to Step 14	-
11	Replace the intermediate steering shaft(s). Refer to: • Upper Intermediate Steering Shaft Replacement (Without Rolloboot, On/After VIN 1G1FB1RSXG0140963)Upper Intermediate Steering Shaft Replacement (With Rolloboot, Before VIN 1G1FB1RSXG0140963) • Mid Intermediate Steering Shaft Replacement	Go to Step 14	-

	Intermediate Steering Shaft Replacement		
	Did you complete the repair?		
12	Replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) . Did you complete the repair?	Go to Step 14	-
13	Replace the steering column. Refer to Steering Column Replacement . 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

DIAGNOSTIC INFORMATION AND PROCEDURES > STEERING EFFORT HARD OR TOO EASY IN ONE OR BOTH DIRECTIONS

Condition	Action
The battery power is low.	Ensure proper battery voltage.
The intermediate steering shaft dash seal is binding.	Adjust the intermediate steering shaft dash seal or replace the intermediate shaft. Refer to Intermediate Steering Shaft Replacement .
The intermediate steering shaft joints and/or fasteners are loose, worn or binding.	Tighten or replace the intermediate steering shaft joints and/or fasteners. Refer to Intermediate Steering Shaft Replacement .
The power steering gear is binding.	Replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) .
The steering column shaft is bent.	Replace the steering column. Refer to Steering Column Replacement .
The connectors to the power steering assist motor are damaged or disconnected.	Perform the following steps: 1. Verify the connectors are properly connected. 2. Verify the connectors are not damaged. 3. If the connectors are damaged, replace the connectors.
The power steering gear sensor wire is damaged.	Replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering

	Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) .
The power steering control module is malfunctioning.	Confirm the DTC and replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) .
The power steering assist motor shaft is binding.	Confirm the DTC and replace the power steering gear. Refer to Electric Belt Drive Rack and Pinion Steering Gear Replacement (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1) .

REPAIR INSTRUCTIONS > WIRE TO WIRE REPAIR - STEERING

Special Tools

- **EL-38125-10** Splice Sleeve Crimping Tool (non GMNA)
- **J-38125-5A** Ultra Torch Special Tool
- **J-38125-8** Splice Sleeve Crimping Tool (GMNA)

For equivalent regional tools, refer to Special Tools .

WARNING:

In order to reduce the risk of personal injury, loss of high voltage isolation to ground and higher system impedance, do not attempt to repair any HV wiring, connector, or terminal that is damaged. High voltage coaxial type cables are not repairable. Never attempt to repair a coaxial type cable. The entire cable/harness or component must be replaced. In order to maintain system integrity and personal safety, never attempt to repair any high voltage wiring, cables, or terminals. Performing this procedure on high voltage circuits may result in serious injury or death.

NOTE:

If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to repair the internal transmission wires, connectors, or terminals could result in performance issues.

**NOTE:**

Do not splice wires in Door Harness Grommets.

**NOTE:**

The DuraSeal splice sleeves have the following 2 critical features:

- *A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.*
- *A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.*

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except high voltage and specialty cables. Use DuraSeal splice sleeves where there are special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm ² / (AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19300089	Red (1) or Red/Green (1)	Red (2)	0.22-0.8/(18-26)
Blue 19168447	Blue (2)	Blue (3)	1.0-2.0/(14-16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0-5.0/(10-12)

**NOTE:**

You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

1. Open the harness by removing any tape:

1. Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
2. Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.

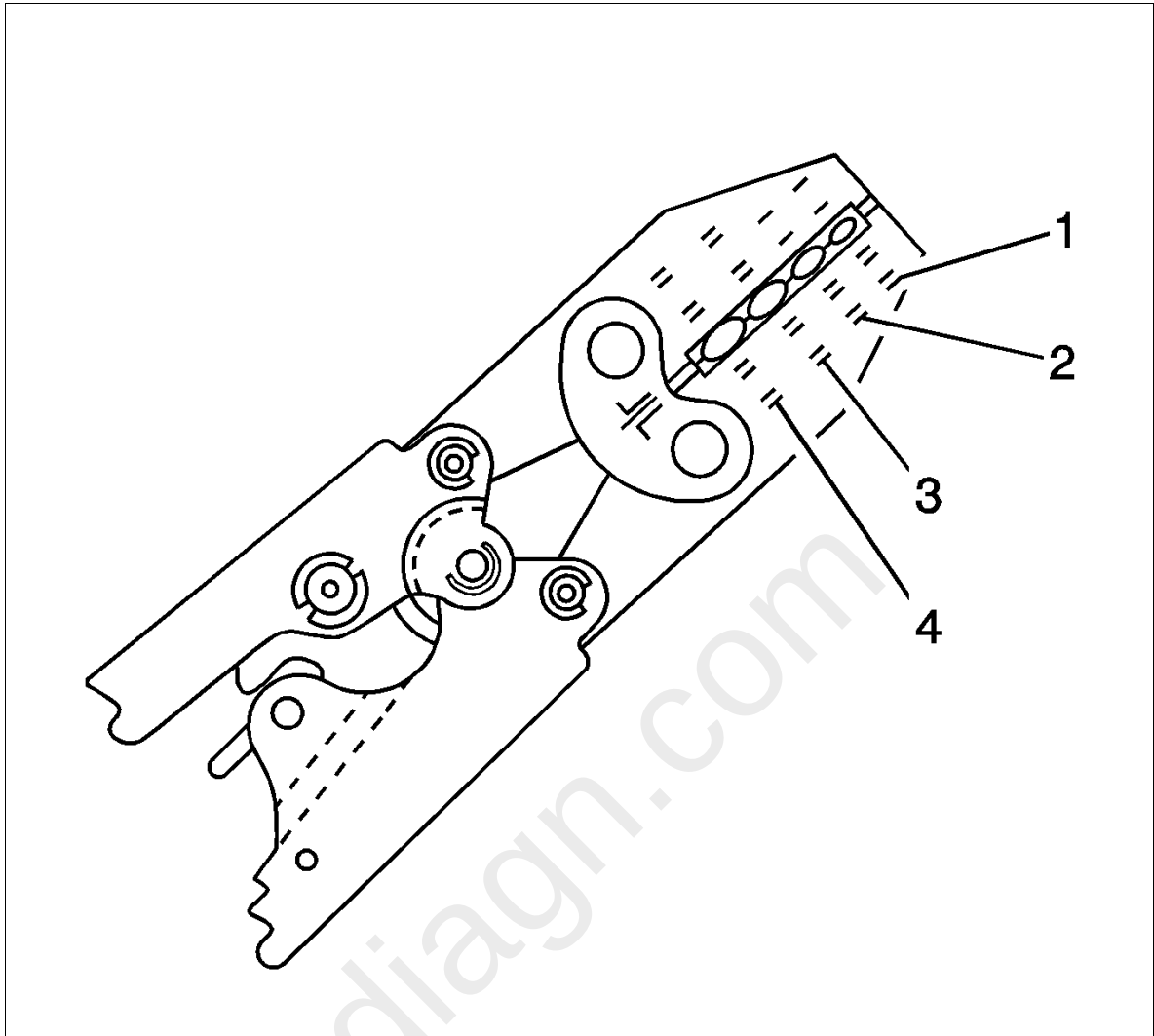
3. Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches, or connectors.

3. Strip the insulation:

1. When adding a length of wire to the existing harness, use the same size wire as the original wire.
2. Perform one of the following items in order to find the correct wire size:
 1. Find the wire on the schematic and convert to regional wiring gauge size.
 2. If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
3. Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
4. Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
5. If the wire is damaged, repeat this procedure after removing the damaged section.
4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice procedure.
5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.

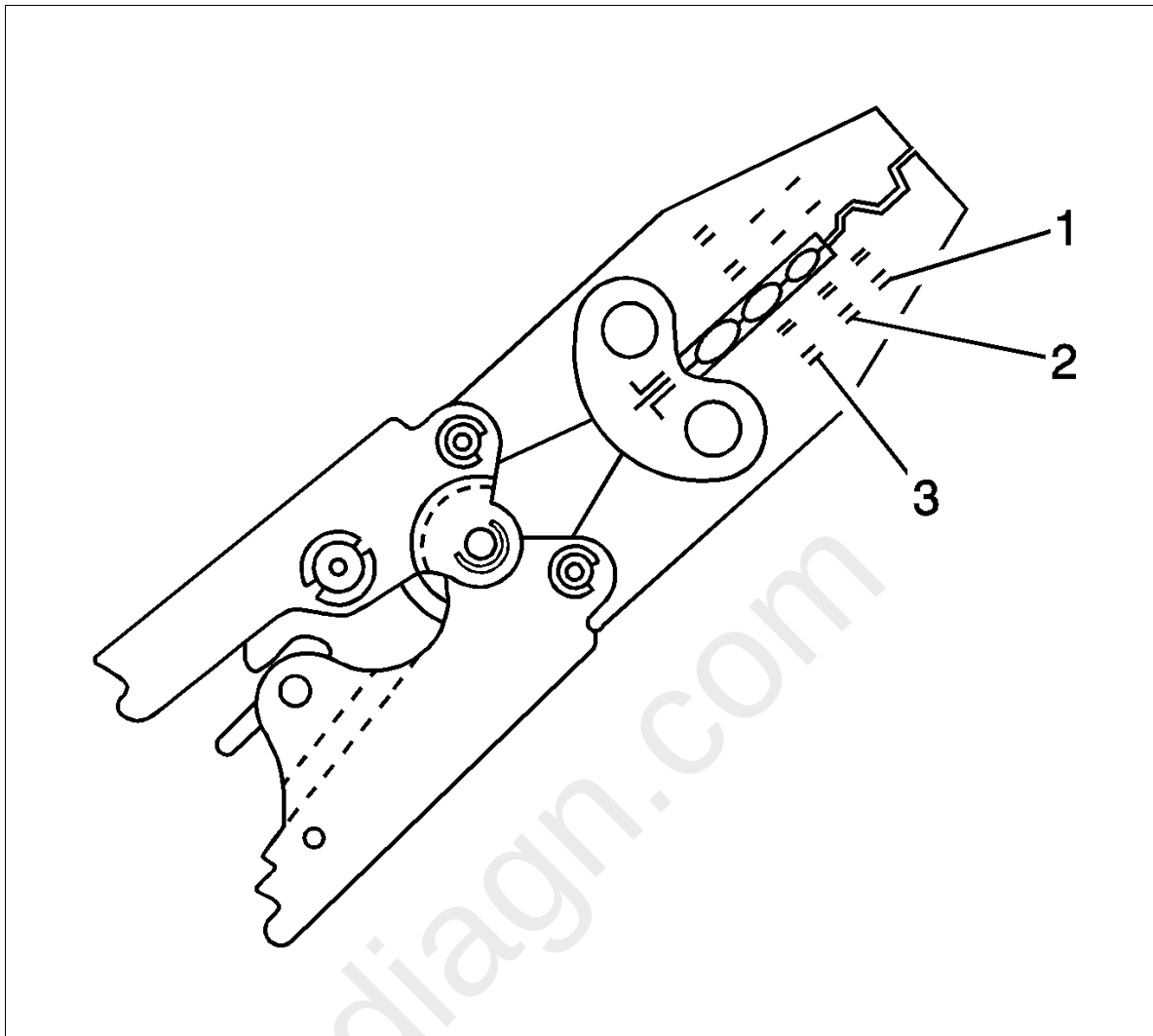
Fig 1: Crimping Tool



Courtesy of GENERAL MOTORS COMPANY

6. The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

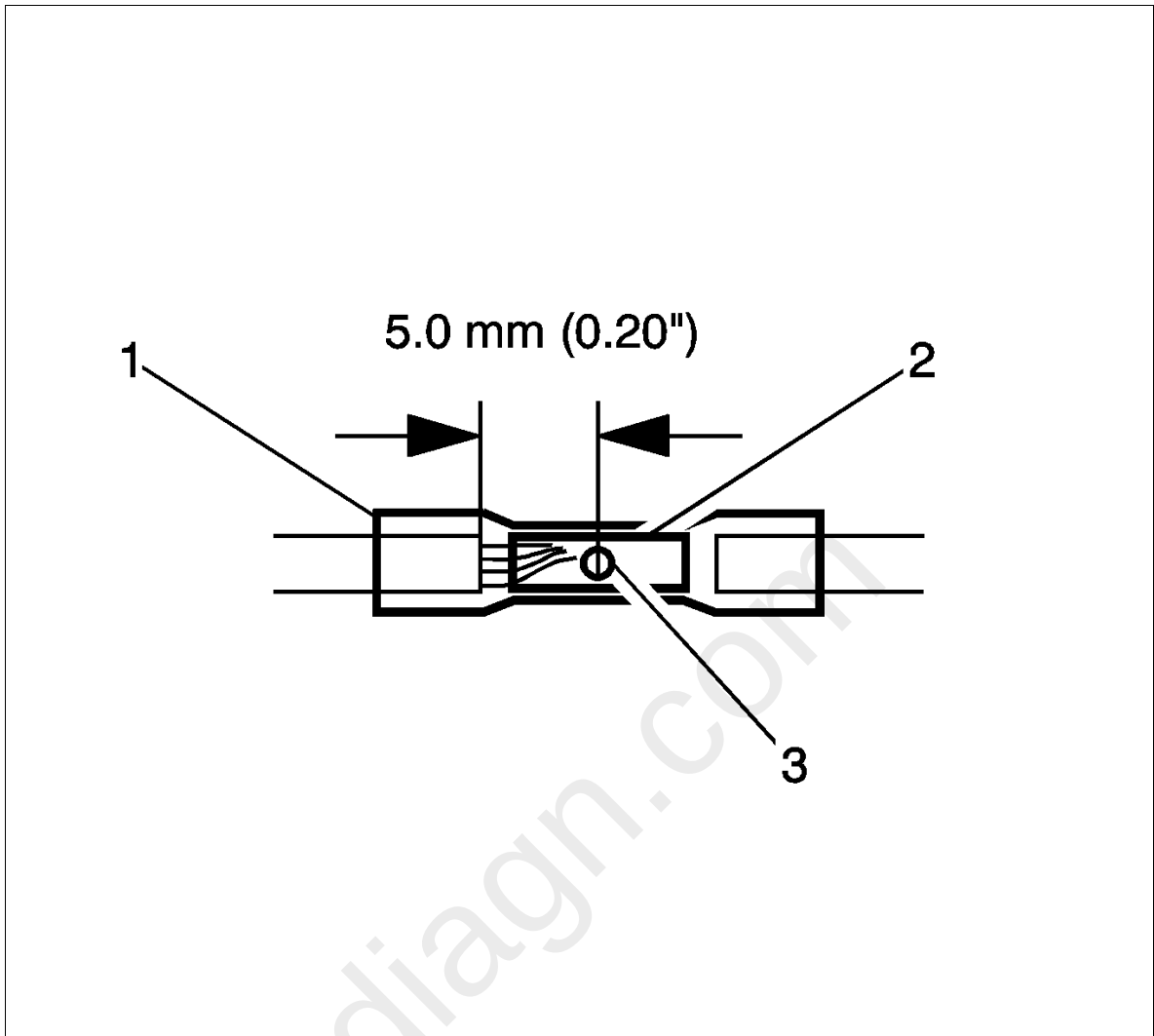
Fig 2: Splice Crimp Tool Nests Terminal Identification



Courtesy of GENERAL MOTORS COMPANY

7. The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.
8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).

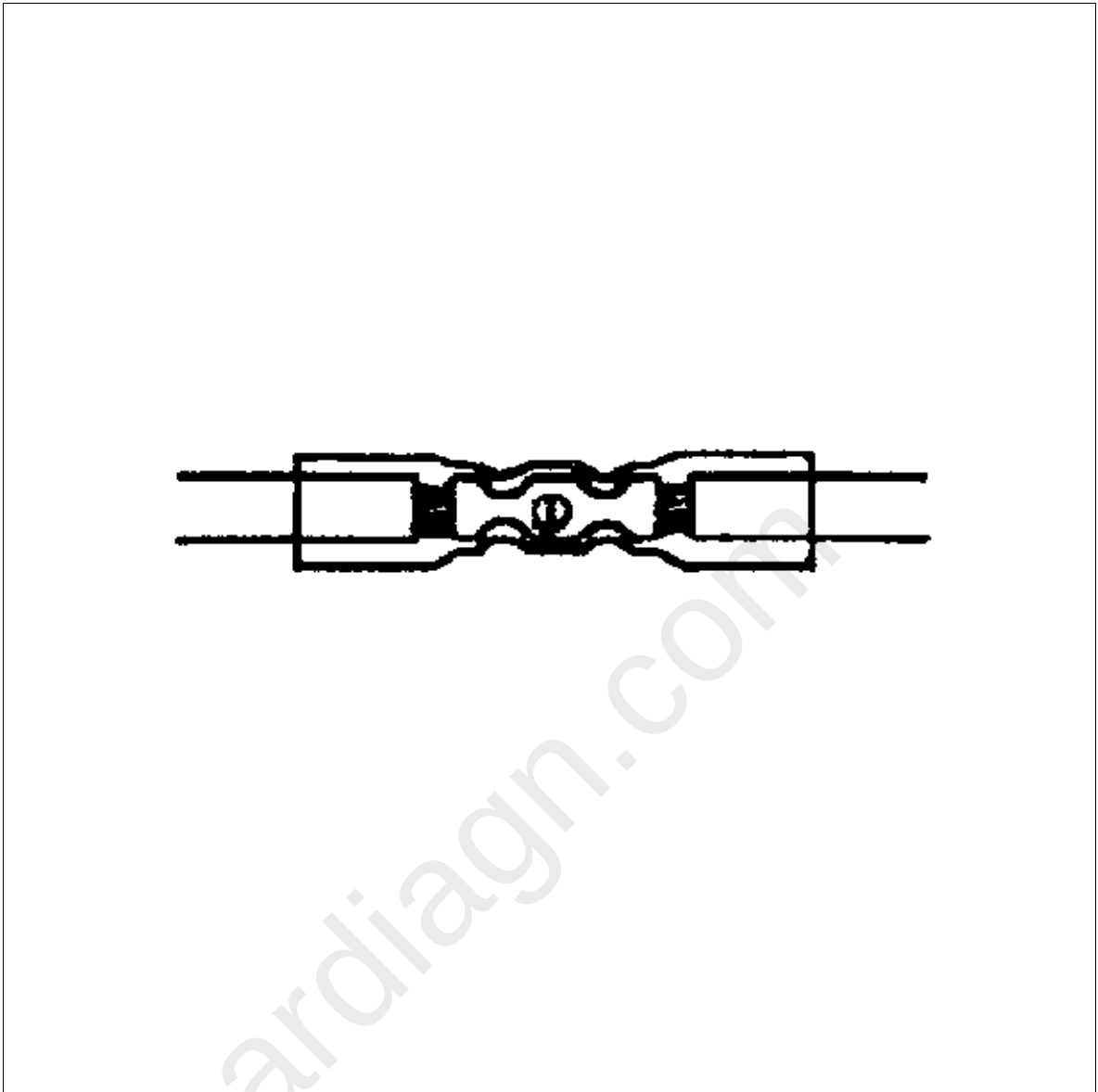
Fig 3: Duraseal Splice Sleeve



Courtesy of GENERAL MOTORS COMPANY

9. Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.

Fig 4: Crimped Duraseal Splice Sleeve



Courtesy of GENERAL MOTORS COMPANY

10. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to Folded-Over Wire Repair for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.
11. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

Fig 5: Crimped Duraseal Splice Sleeve



Courtesy of GENERAL MOTORS COMPANY

12. Using the heat torch, apply heat to the crimped area of the barrel.
13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
 1. The tubing will shrink completely as the heat is moved along the insulation.
 2. A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

REPAIR INSTRUCTIONS > WIRE TO WIRE REPAIR - STEERING > HIGH TEMPERATURE WIRING REPAIRS

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
 1. The tubing will shrink completely as the heat is moved along the insulation.
 2. A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
4. Replace any reflective tape and clips that may have been removed during the repair.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to Special Tools .

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself, and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut, or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to Inducing Intermittent Fault Conditions in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to Testing for Electrical Intermittents for test procedures to detect intermittent open, high resistance, short to ground, and short to voltage conditions.
- Refer to Scan Tool Snapshot Procedure for advanced intermittent diagnosis and Vehicle Data Recorder operation.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > TESTING FOR TERMINAL FRETTING

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel, and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease / lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > TESTING FOR PROPER TERMINAL CONTACT

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself, or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves, or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal

resistance, intermittent contact, or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals, and connector body.

3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > CONTROL MODULE/COMPONENT VOLTAGE AND GROUNDS

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses, and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to Circuit Testing , and Power Distribution Schematics .
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point. Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to Circuit Testing , and Ground Distribution Schematics .

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > TEMPERATURE SENSITIVITY

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold, or only when

the component/connection is hot.

- Freeze Frame, Failure Records, Snapshot, or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection, or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to Inducing Intermittent Fault Conditions in order to duplicate the conditions required.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > ELECTROMAGNETIC INTERFERENCE AND ELECTRICAL NOISE

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay, or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to Checking Aftermarket Accessories .
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

REPAIR INSTRUCTIONS > CONNECTOR RECONNECTION - STEERING > INCORRECT CONTROL MODULE

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.



NOTE:

DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.

- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to Control Module References for replacement, setup, and programming.

REPAIR INSTRUCTIONS > STEERING LINKAGE INNER TIE ROD INSPECTION

Special Tools

GE-8001 Dial Indicator Set

For equivalent regional tools, refer to Special Tools .

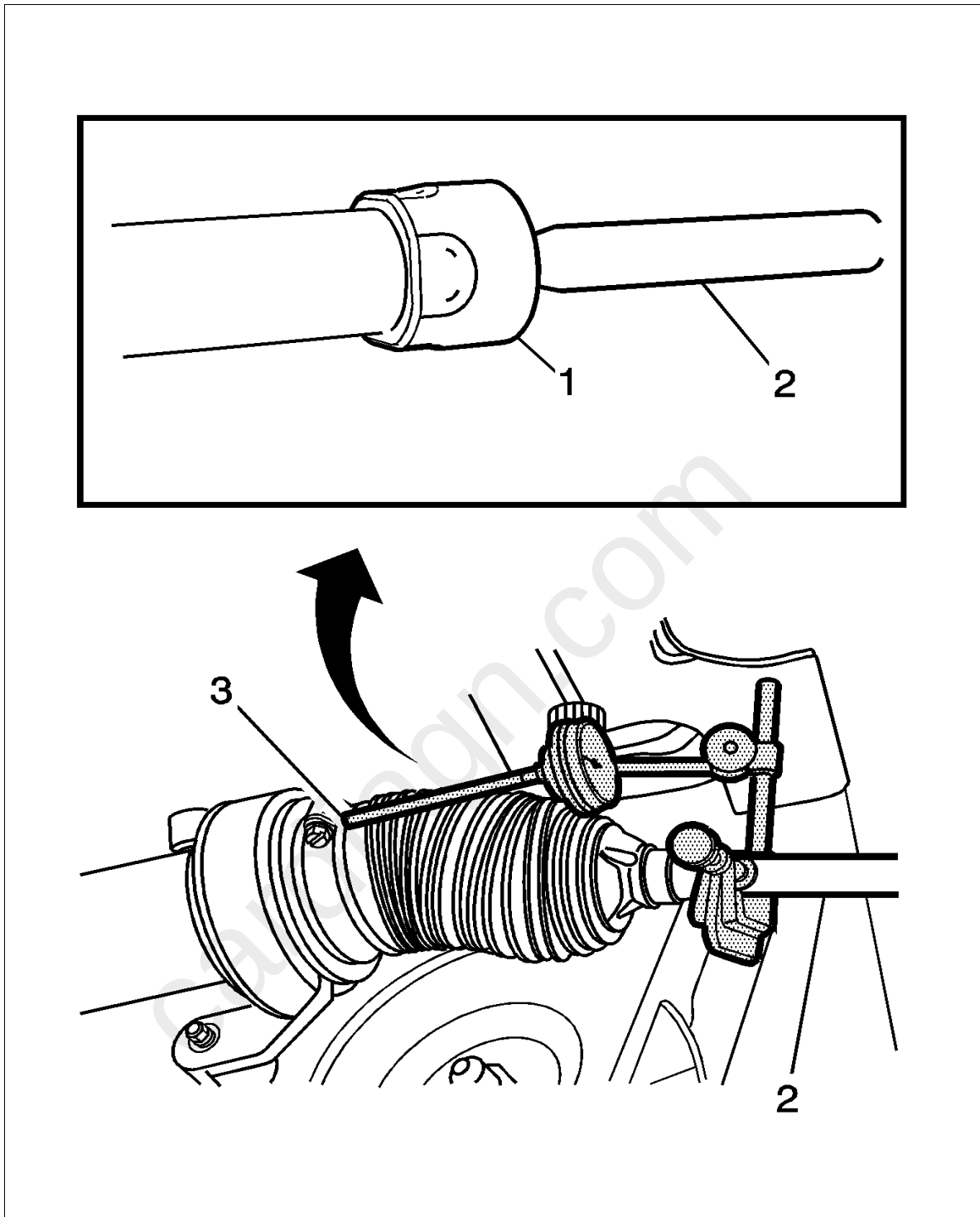


NOTE:

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.

Fig 1: Lash Between Inner Tie Rod & Steering Gear Housing

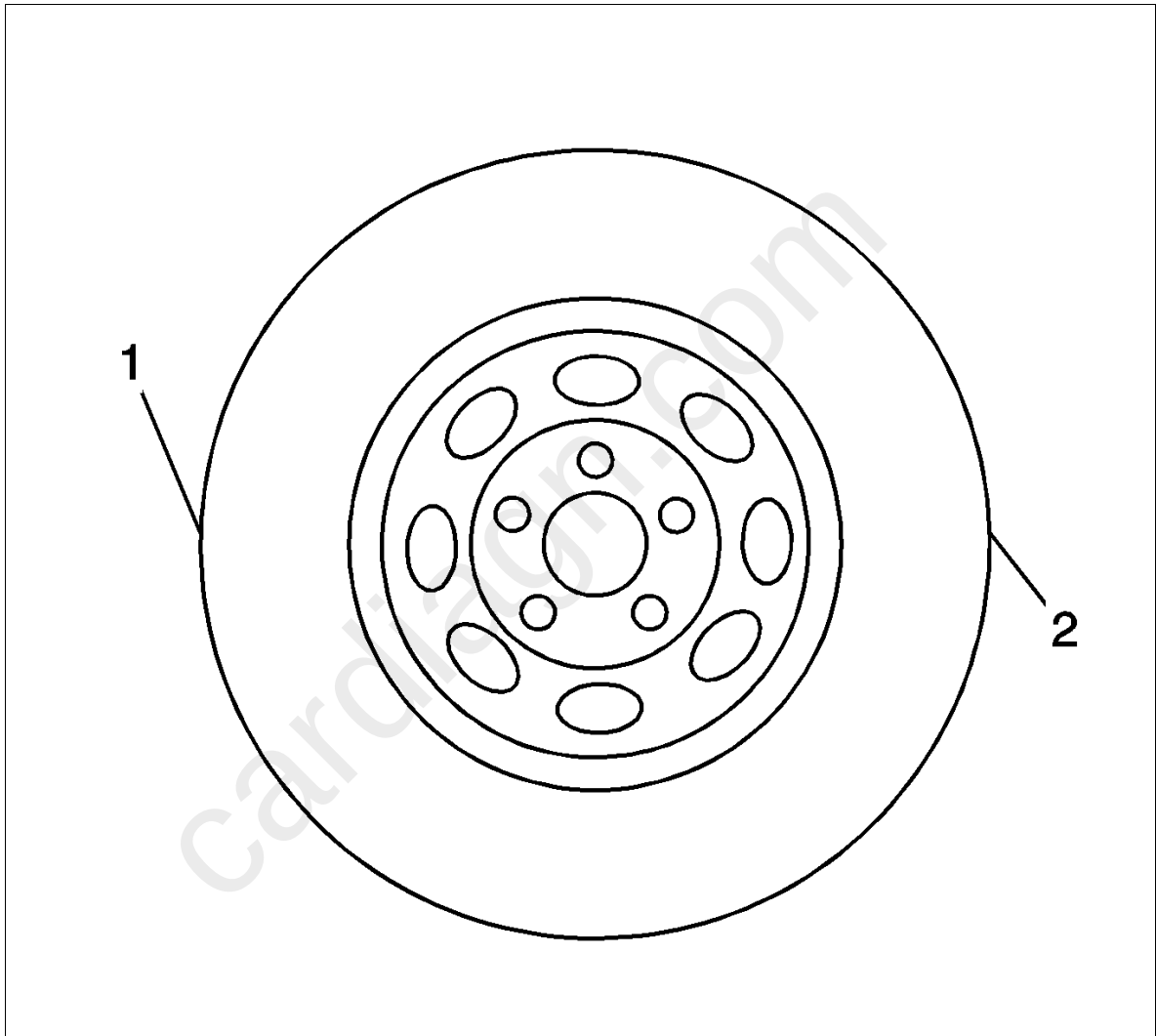


Courtesy of GENERAL MOTORS COMPANY

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 (Base)Lifting and Jacking the Vehicle (HP) .

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.

Fig 2: Tire Grasping Positions



Courtesy of GENERAL MOTORS COMPANY



NOTE:

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

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

the tire in order to remove any lash.

7. Zero the **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 .
11. Repeat the procedure for the other side.

REPAIR INSTRUCTIONS > STEERING LINKAGE OUTER TIE ROD INSPECTION

Special Tools

GE-8001 Dial Indicator Set

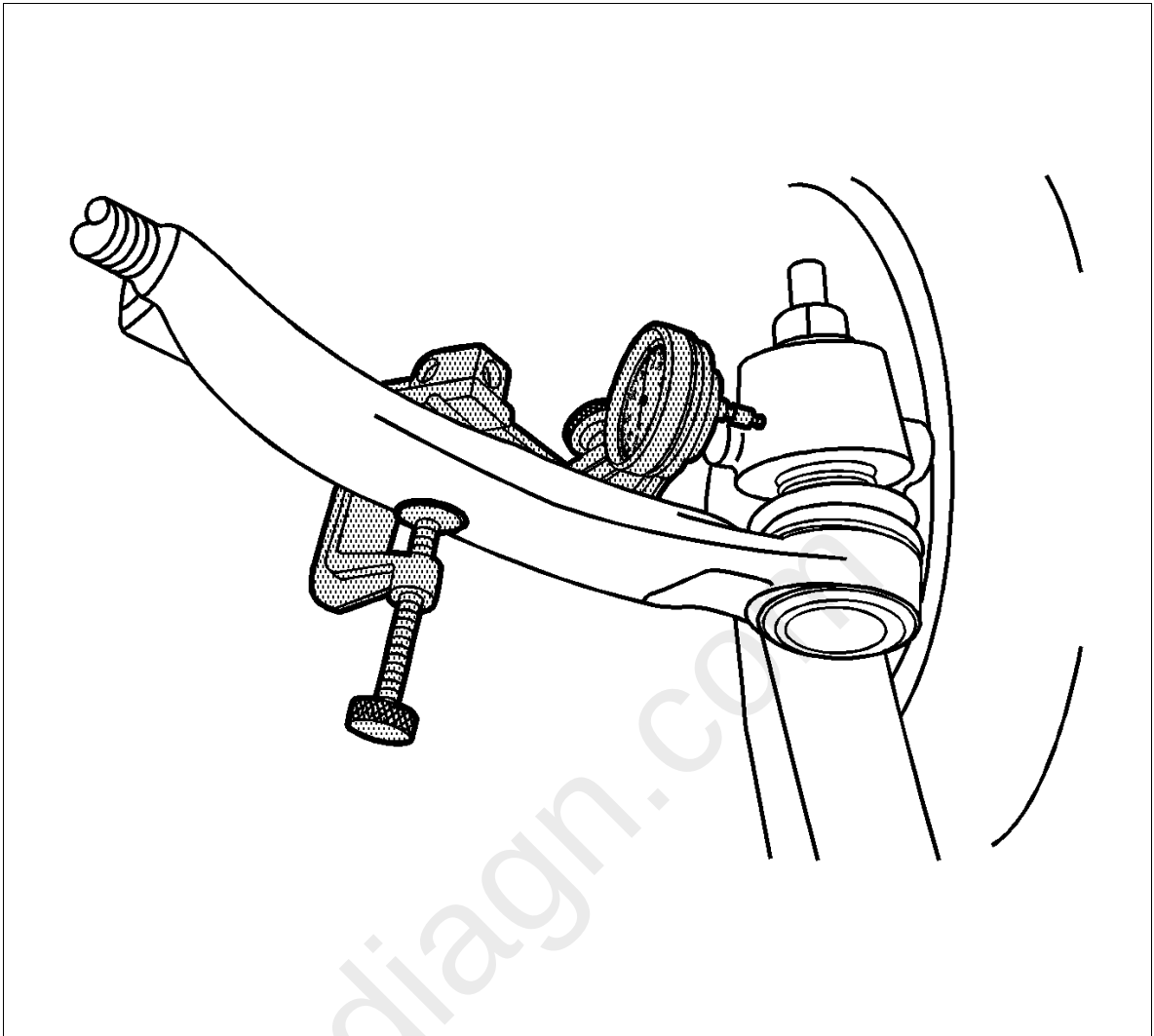
For equivalent regional tools, refer to Special Tools .

 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 .
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 (Base)Lifting and Jacking the Vehicle (HP) .

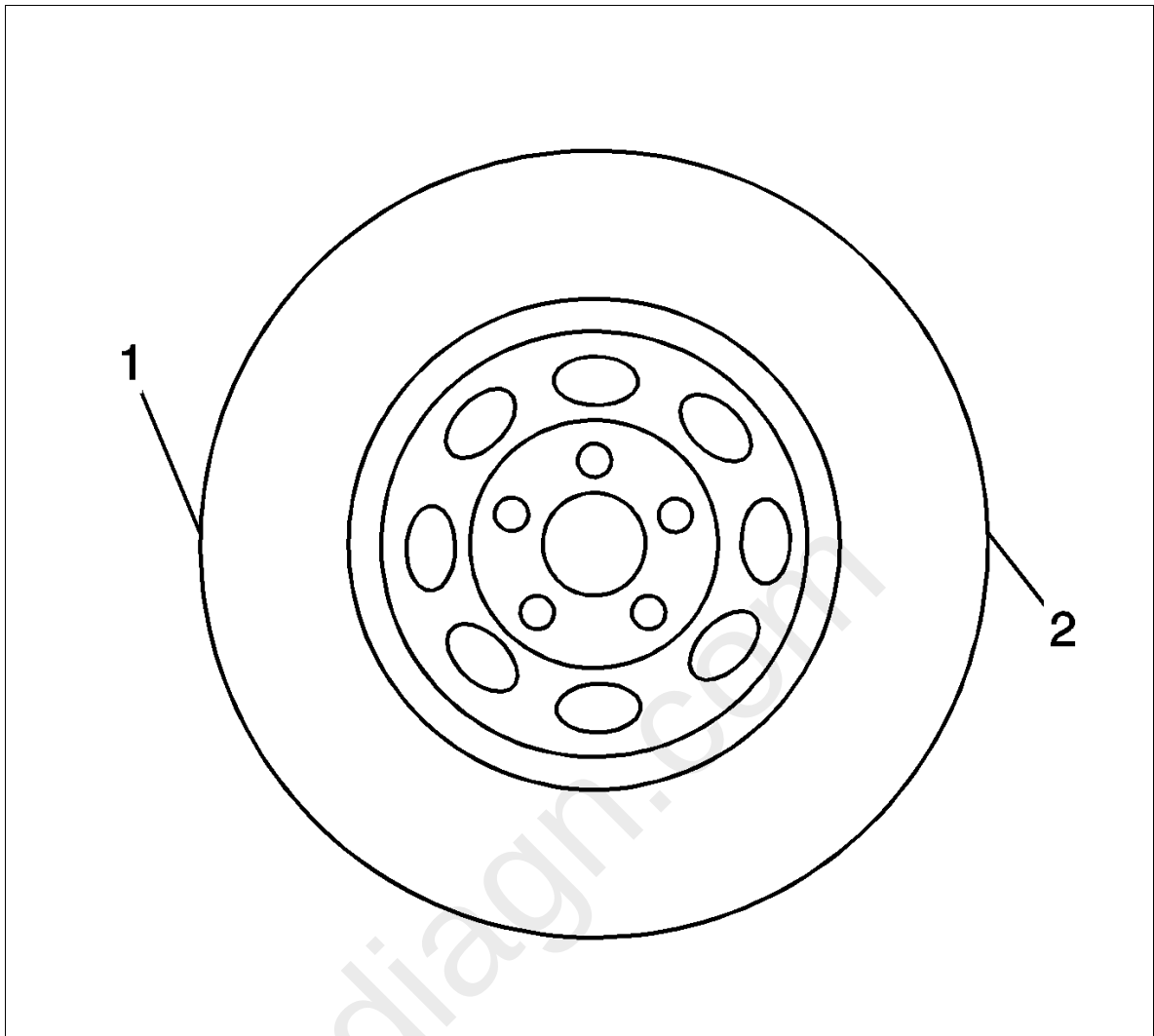
Fig 1: Outer Tie Rod Lash



Courtesy of GENERAL MOTORS COMPANY

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.

Fig 2: Tire Grasping Positions

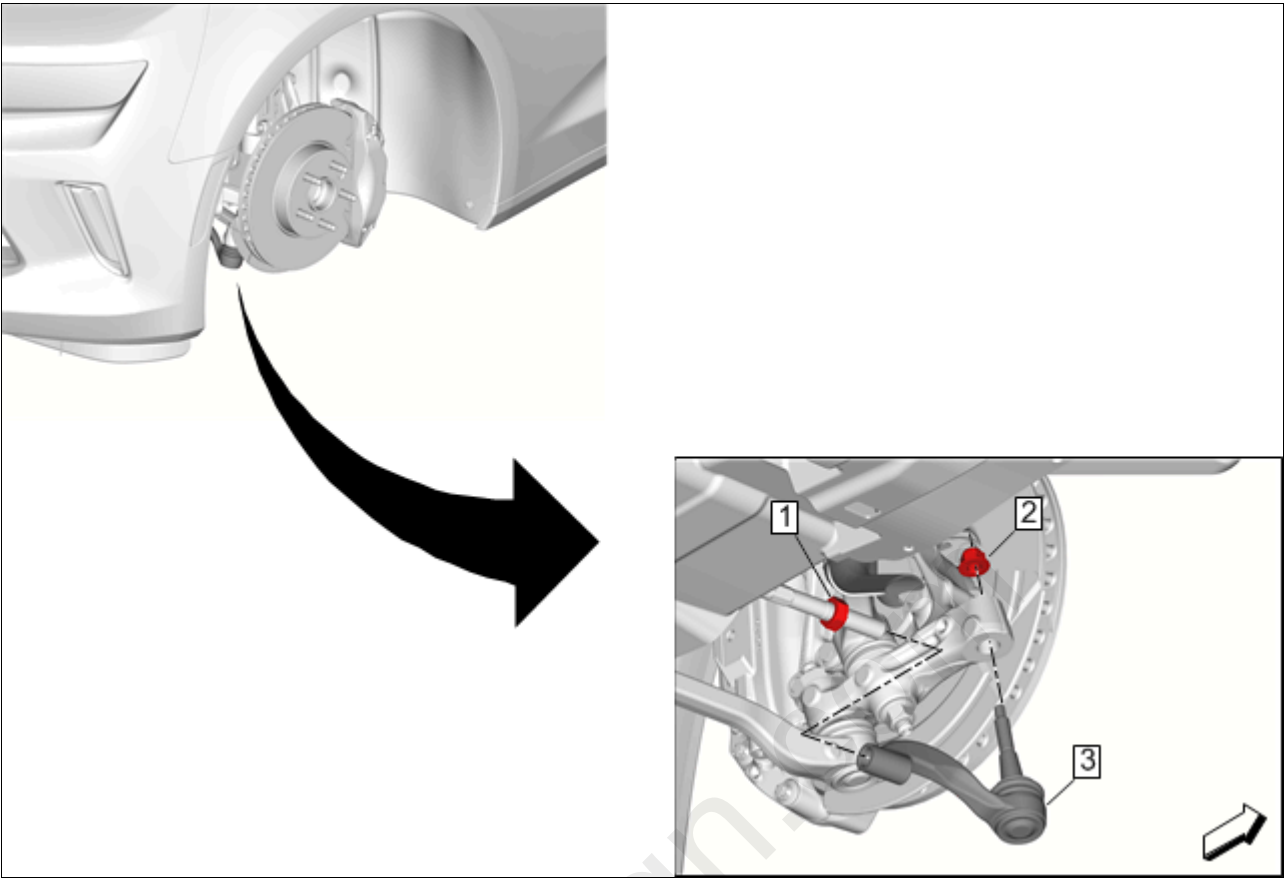


Courtesy of GENERAL MOTORS COMPANY

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

REPAIR INSTRUCTIONS > STEERING LINKAGE OUTER TIE ROD REPLACEMENT

Fig 1: Steering Linkage Outer Tie Rod



Courtesy of GENERAL MOTORS COMPANY

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: <i>Do NOT tighten the steering linkage inner tie rod nut during installation. Tighten the nut after adjusting the front toe.</i>
2	Steering Linkage Outer Tie Rod Nut

CAUTION:

Refer to Fastener Caution .

Tighten

First Pass: 35 N.m (26 lb ft)

Final Pass: (40-50 degrees)

Steering Linkage Outer Tie Rod

CAUTION:

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

Procedure

1. Use the **CH-42188-B** separator 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**
4. Install the front tire and wheel assembly. **Tire and Wheel Removal and Installation**
5. Measure and adjust the front toe. **Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment**

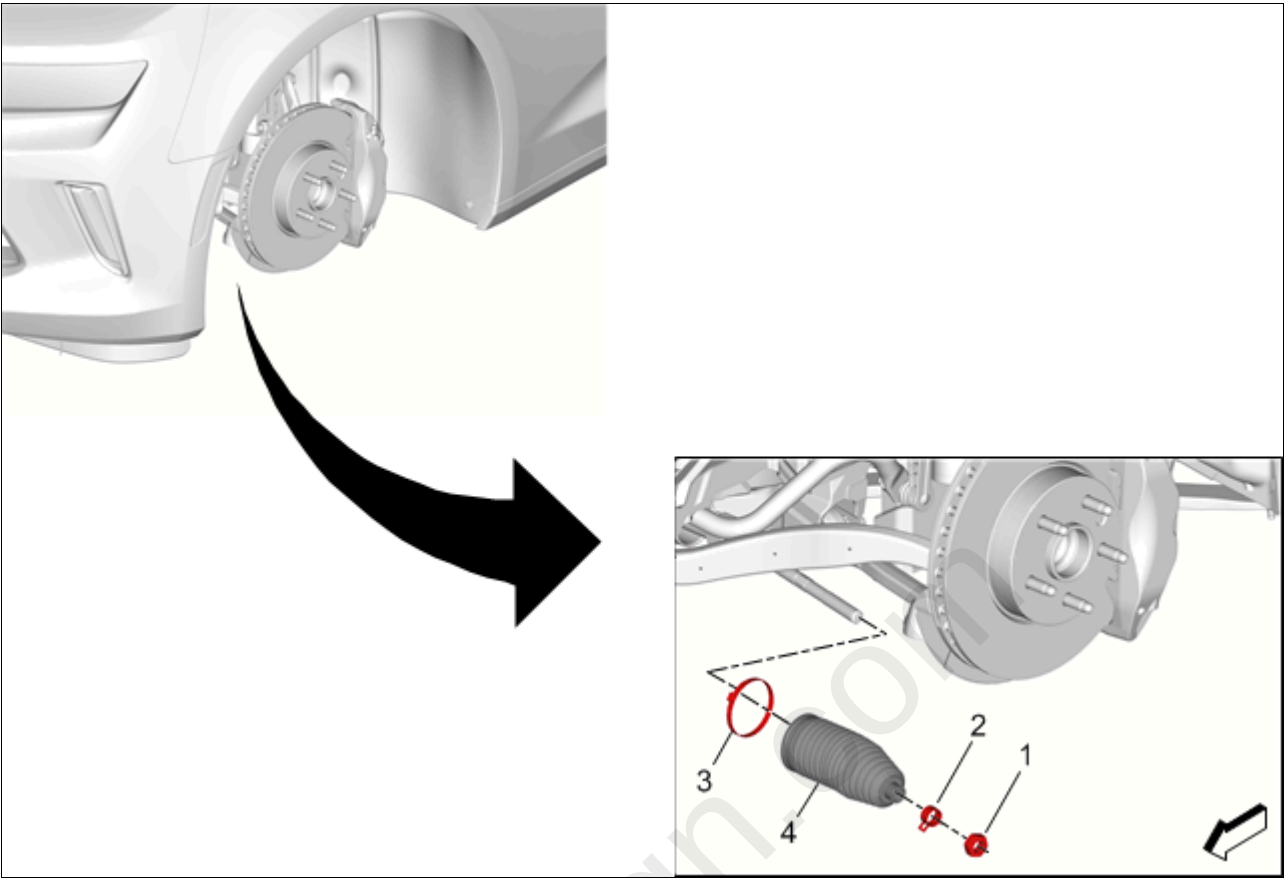
Special Tools

CH-42188-B Ball Joint Separator

Equivalent regional tools: Special Tools

REPAIR INSTRUCTIONS > STEERING GEAR BOOT REPLACEMENT

Fig 1: Steering Gear Boot



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG) 2. Steering Linkage Outer Tie Rod Replacement	
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.
2	Steering Gear Boot Outer Clamp
3	Steering Gear Boot Inner Clamp Procedure 1. Cut the steering gear boot inner clamp. - DISCARD the clamp. 2. Use the DT-39510 pliers to install the NEW steering gear boot inner clamp.

**NOTE:**

Position the NEW steering gear boot inner clamp on the steering gear boot before installing the boot on the steering gear.

Special Tools

DT-35910 Drive Axle Boot Clamp Pliers

Equivalent regional tools: Special Tools

Steering Gear Boot**Procedure**

4

1. 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 (LGX, LTG) Electric Belt Drive Rack and Pinion Steering Gear Replacement (LT1)
2. Install the steering gear boot and ensure the boot is seated in the assembly groove of the steering gear before installing the steering gear boot clamps.

REPAIR INSTRUCTIONS > ELECTRIC BELT DRIVE RACK AND PINION STEERING GEAR REPLACEMENT (LGX, LTG) > 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:

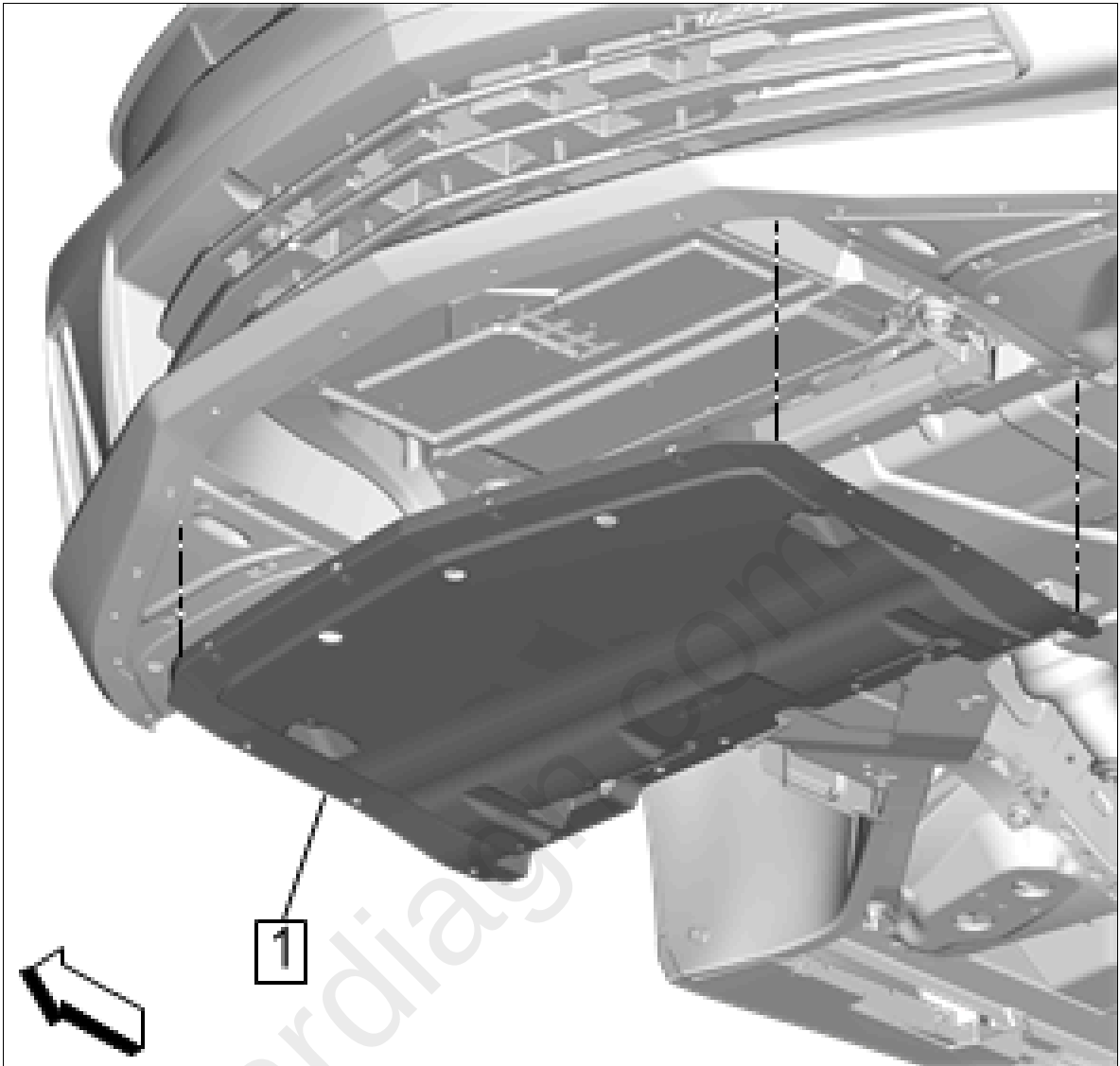
With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured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

- 1. The steering column*
- 2. The intermediate shaft(s)*
- 3. 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 wheels of the vehicle in the straight ahead position, LOCK the steering column.
2. Remove the front tire and wheel assemblies. Tire and Wheel Removal and Installation

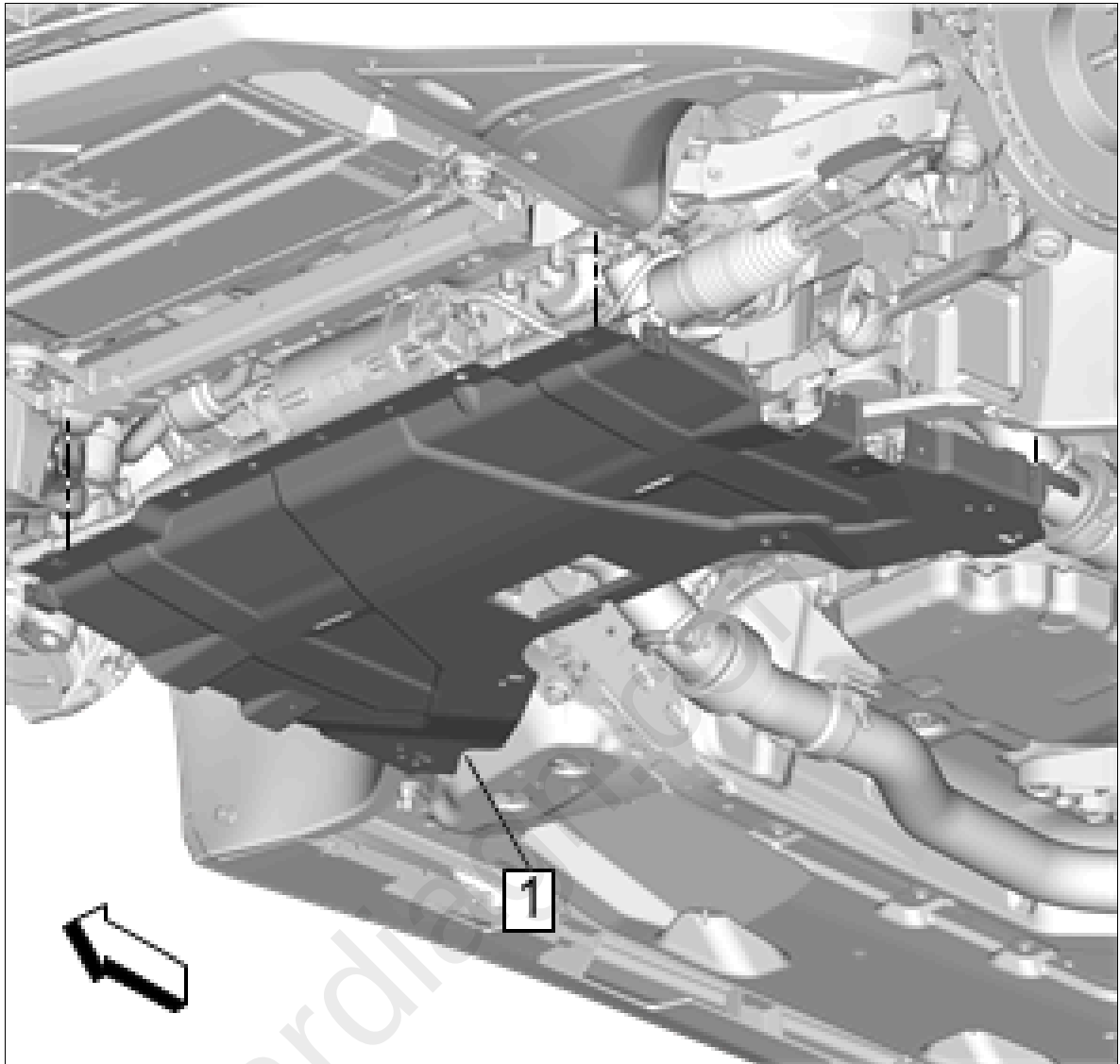
Fig 1: Front Compartment Air Deflector



Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Air Deflector (1) - Front Compartment Air Deflector Replacement (Convertible - LGX, LTG)Front Compartment Air Deflector Replacement (Coupe - LGX, LTG)Front Compartment Air Deflector Replacement (Coupe - LT1)

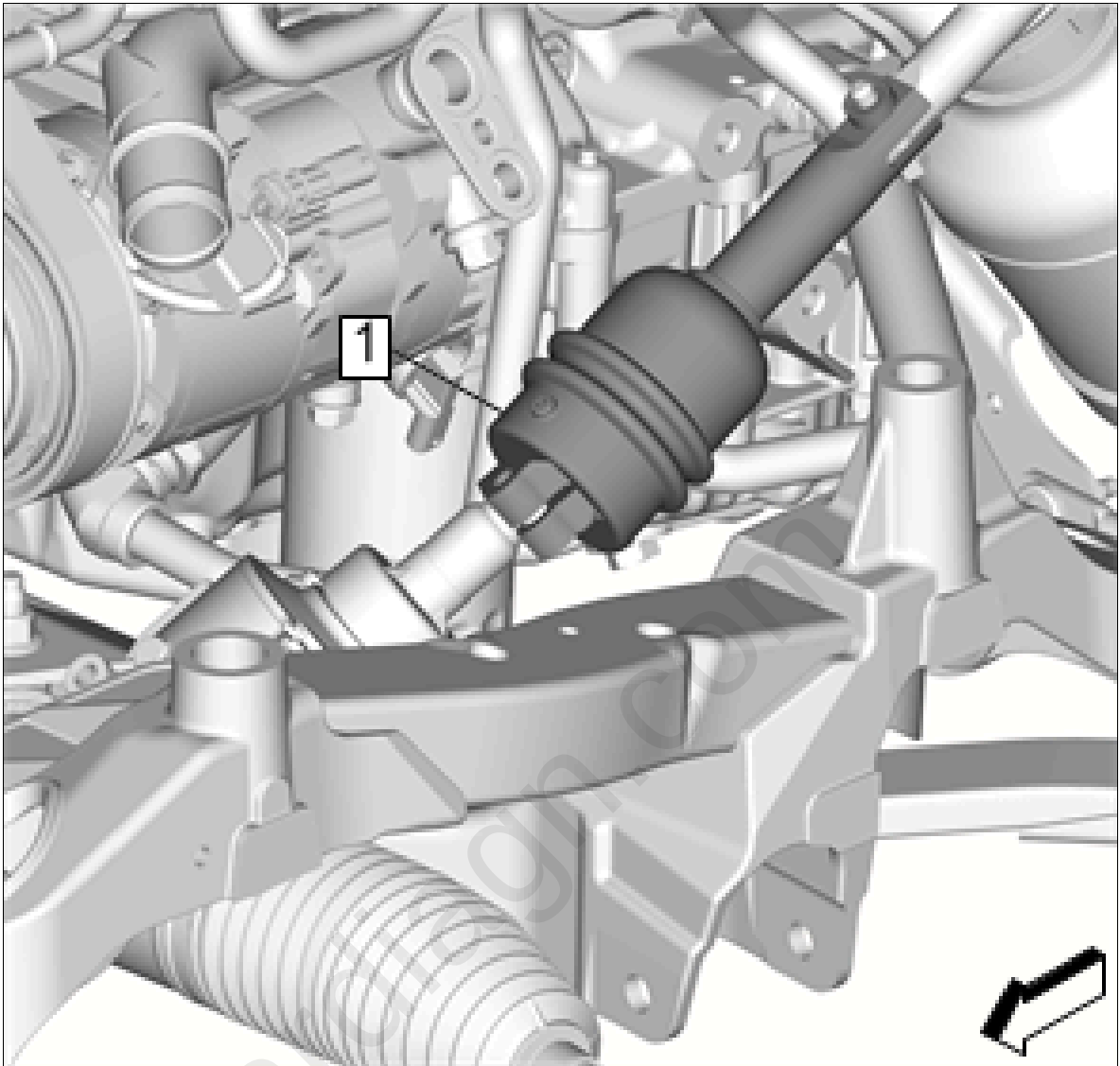
Fig 2: Front Compartment Lower Noise Shield



Courtesy of GENERAL MOTORS COMPANY

4. Remove Front Compartment Lower Noise Shield (1) - Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)

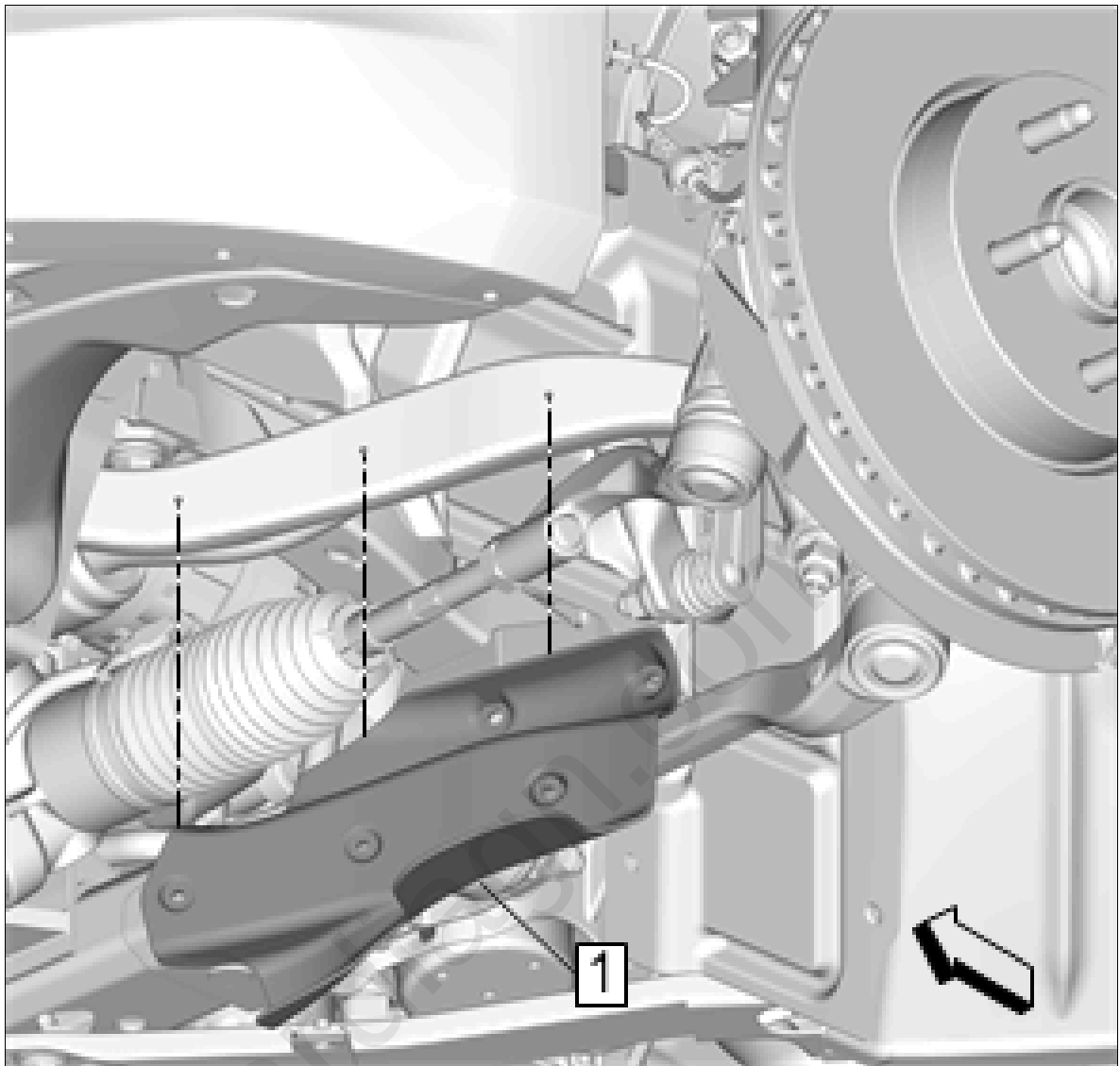
Fig 3: Intermediate Steering Shaft



Courtesy of GENERAL MOTORS COMPANY

5. Separate Intermediate Steering Shaft (1) at Steering Gear - Intermediate Steering Shaft Replacement

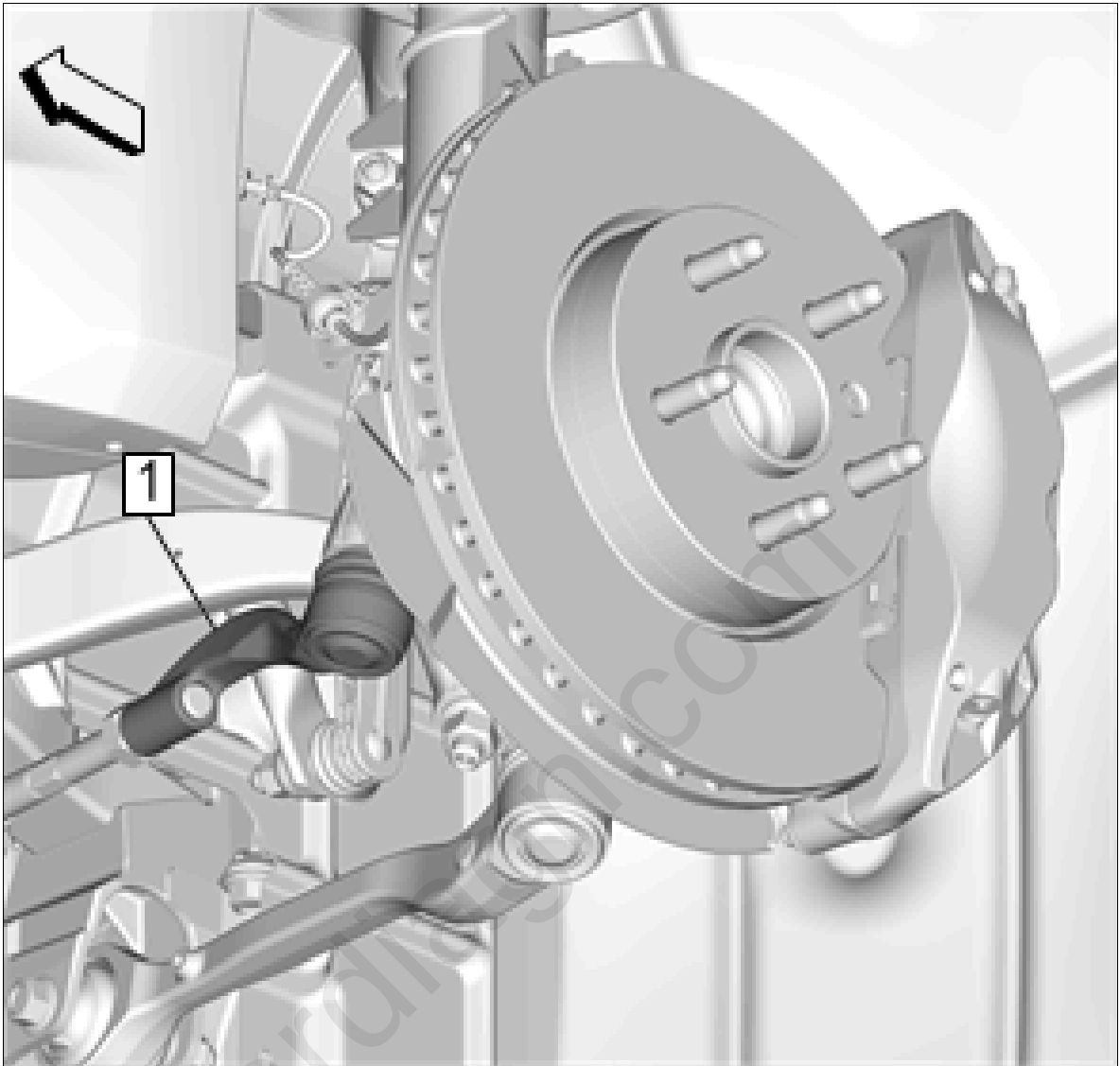
Fig 4: Front Brake Rotor Cooling Duct Deflector



Courtesy of GENERAL MOTORS COMPANY

6. Remove Front Brake Rotor Cooling Duct Deflector (1) - Front Brake Rotor Cooling Duct Deflector Replacement

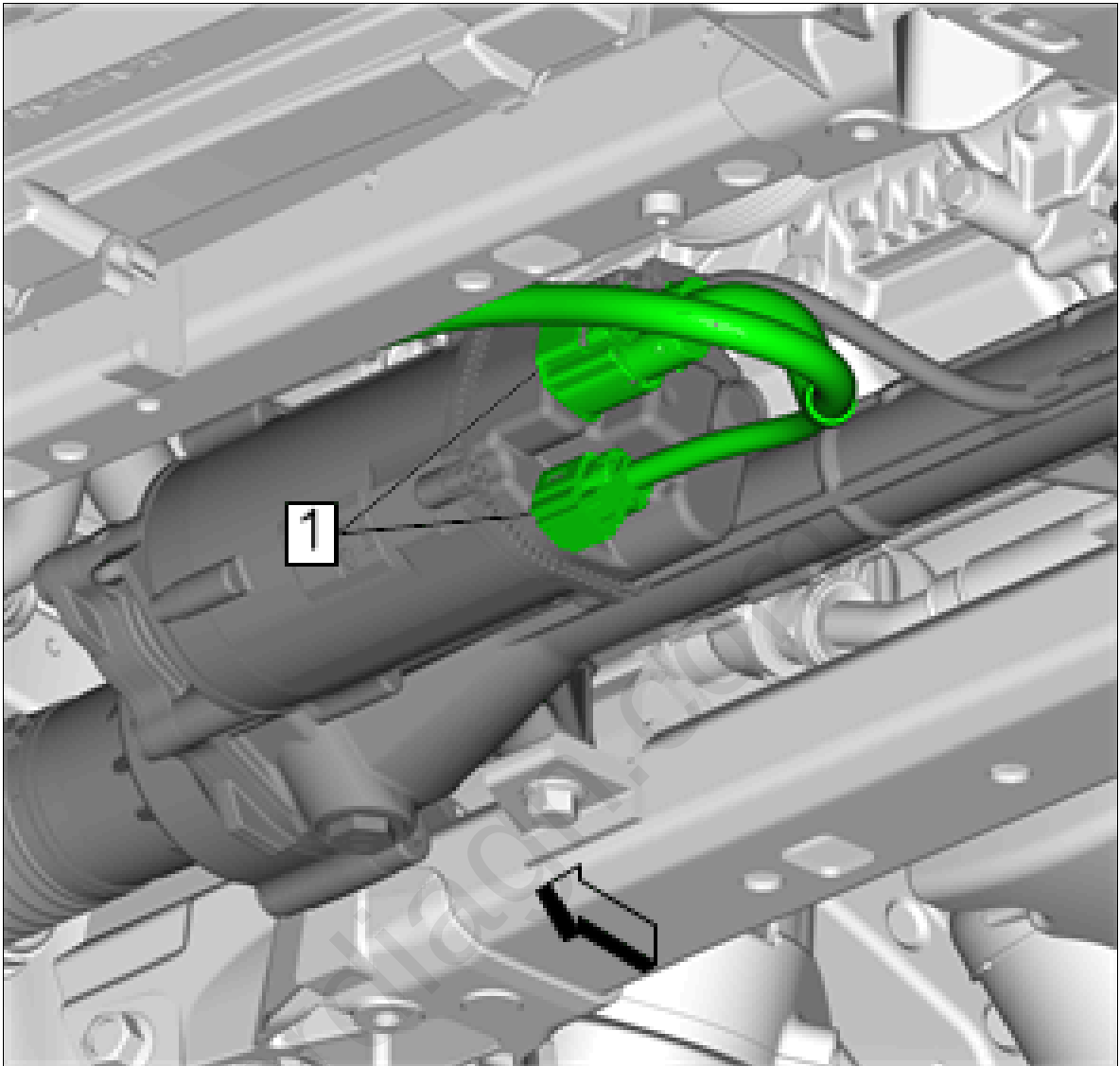
Fig 5: Steering Linkage Outer Tie Rod



Courtesy of GENERAL MOTORS COMPANY

7. Separate Steering Linkage Outer Tie Rod (1) at Steering Knuckle - Steering Linkage Outer Tie Rod Replacement

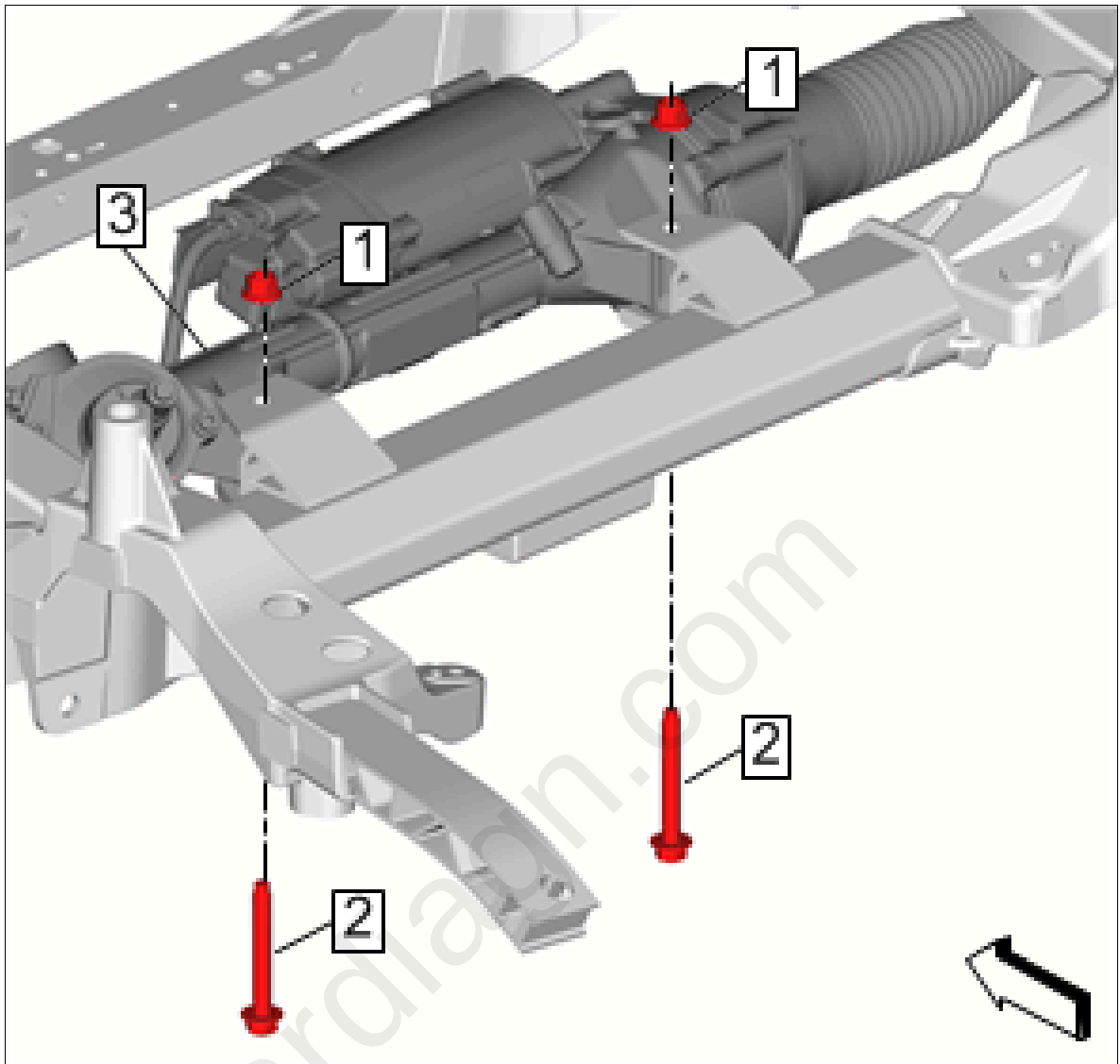
Fig 6: Steering Gear Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the steering gear electrical connectors (1)

Fig 7: Steering Gear Nut

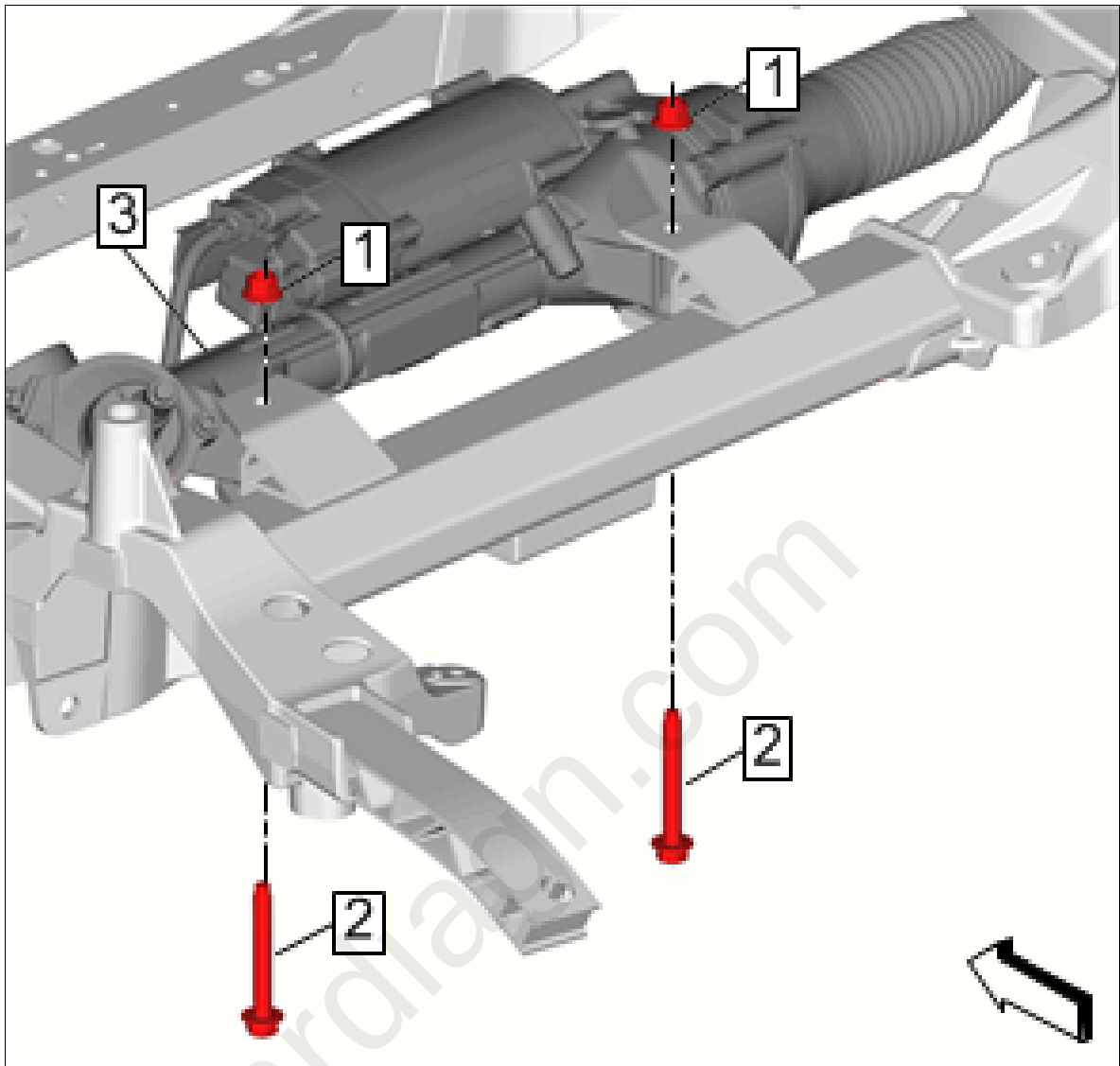


Courtesy of GENERAL MOTORS COMPANY

9. Remove Steering Gear Nut (1) (Qty: 2)
10. Remove Steering Gear Bolt (2) (Qty: 2)
- DISCARD the bolts.
11. Remove the steering gear (3) from the vehicle.

**REPAIR INSTRUCTIONS > ELECTRIC BELT DRIVE RACK AND PINION STEERING
GEAR REPLACEMENT (LGX, LTG) > INSTALLATION PROCEDURE**

Fig 1: Steering Gear



Courtesy of GENERAL MOTORS COMPANY

1. Position the steering gear (3) on the vehicle.

 CAUTION:

This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

2. Install Steering Gear Bolt (2) (Qty: 2)

Use NEW bolts.

 CAUTION:

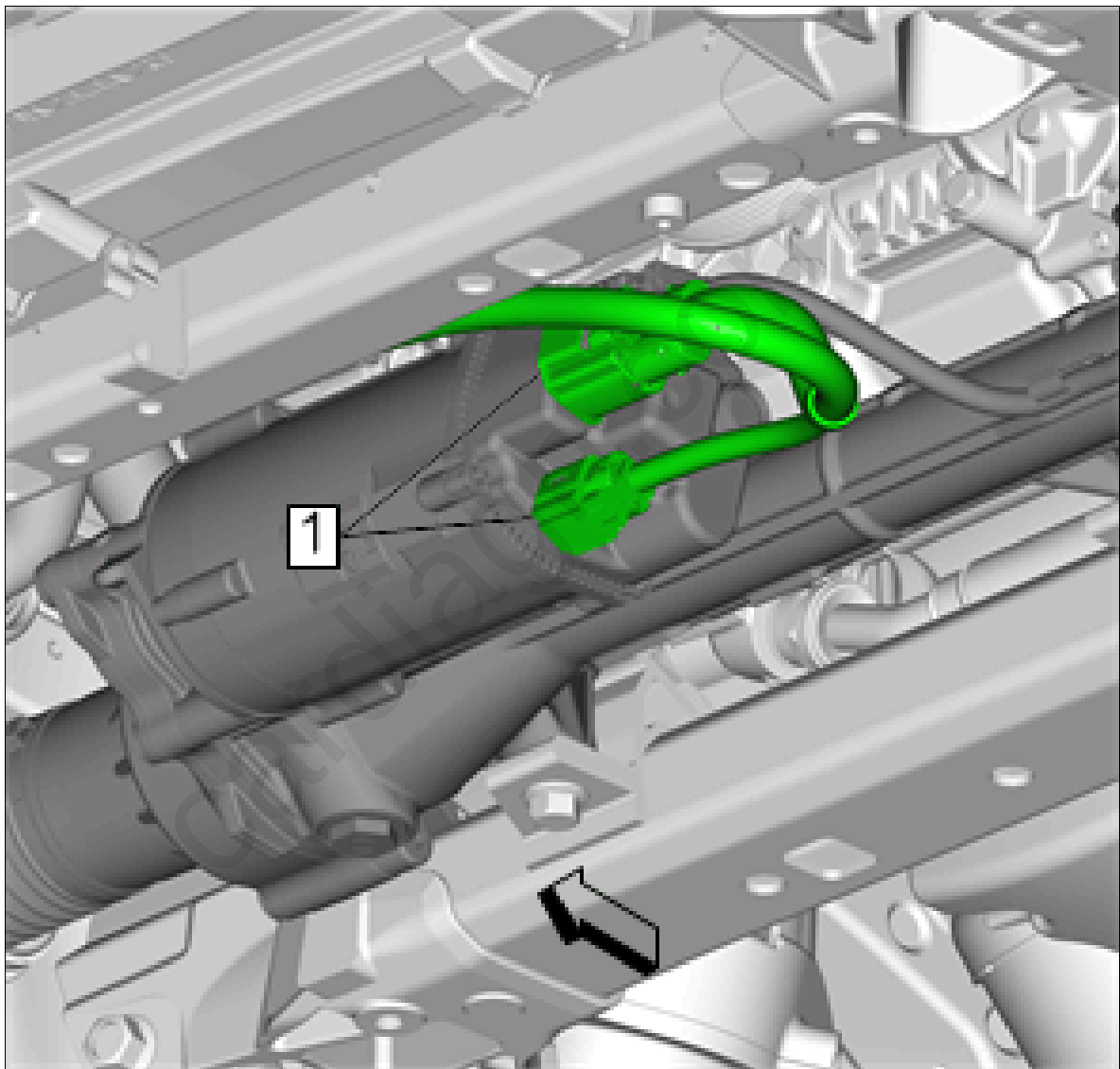
Refer to Fastener Caution .

3. Install and tighten Steering Gear Nut (1) (Qty: 2)

Tighten

1. First Pass: 58 N.m (43 lb ft)
2. Final Pass: (90-105 degrees)

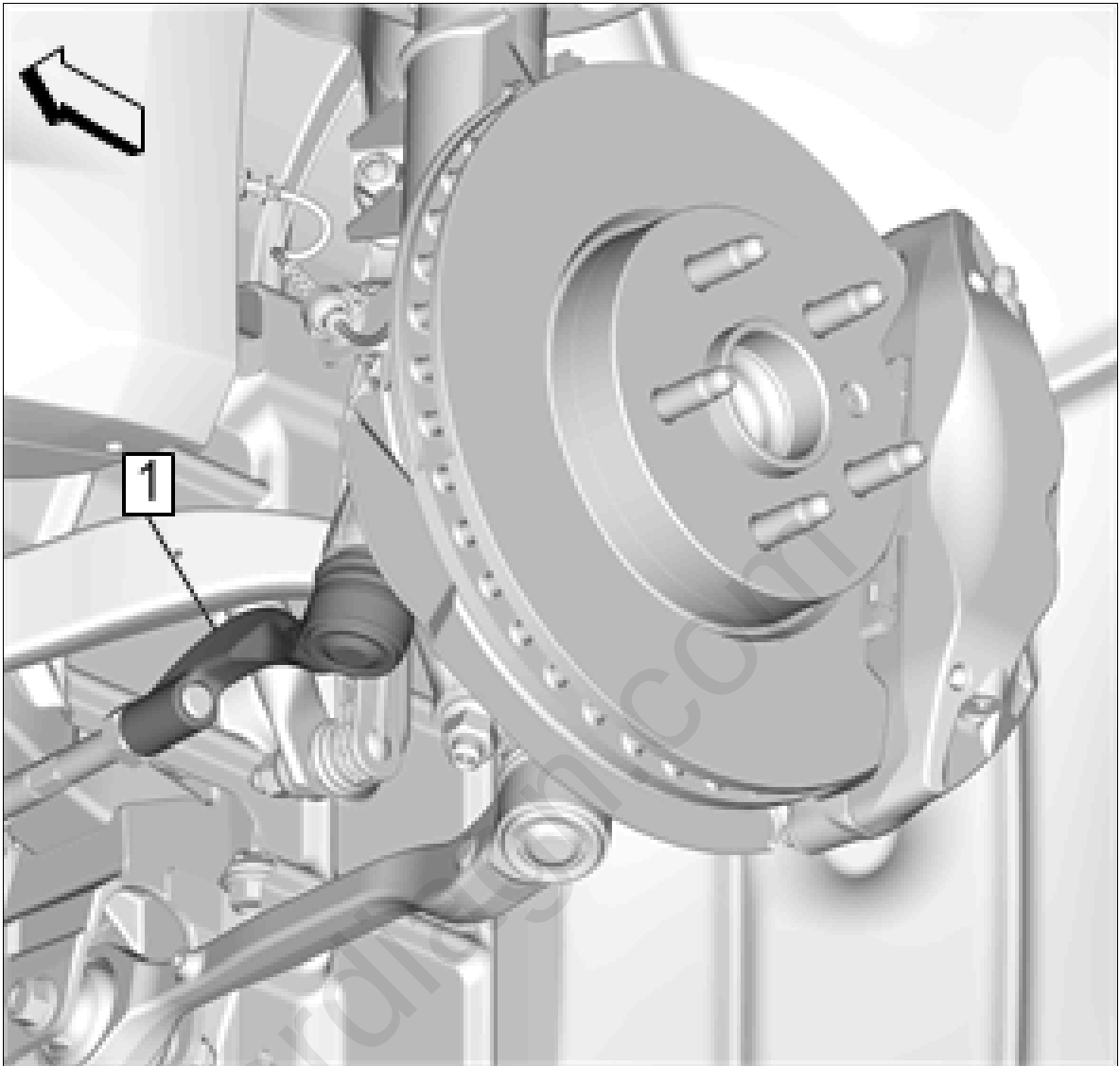
Fig 2: Steering Gear Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

4. Connect the steering gear electrical connectors (1).

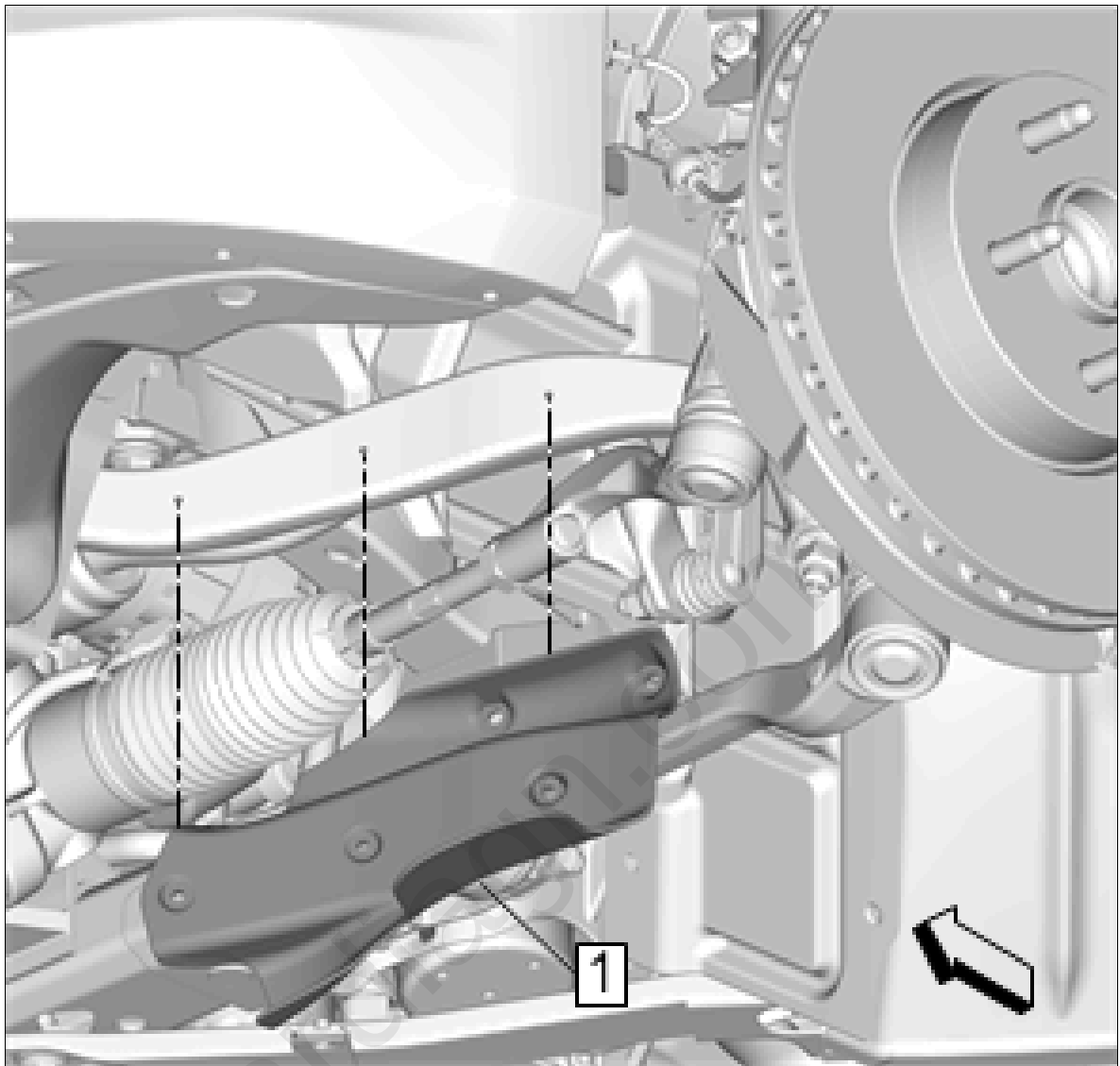
Fig 3: Steering Linkage Outer Tie Rod



Courtesy of GENERAL MOTORS COMPANY

5. Install Steering Linkage Outer Tie Rod (1) at Steering Knuckle - Steering Linkage Outer Tie Rod Replacement

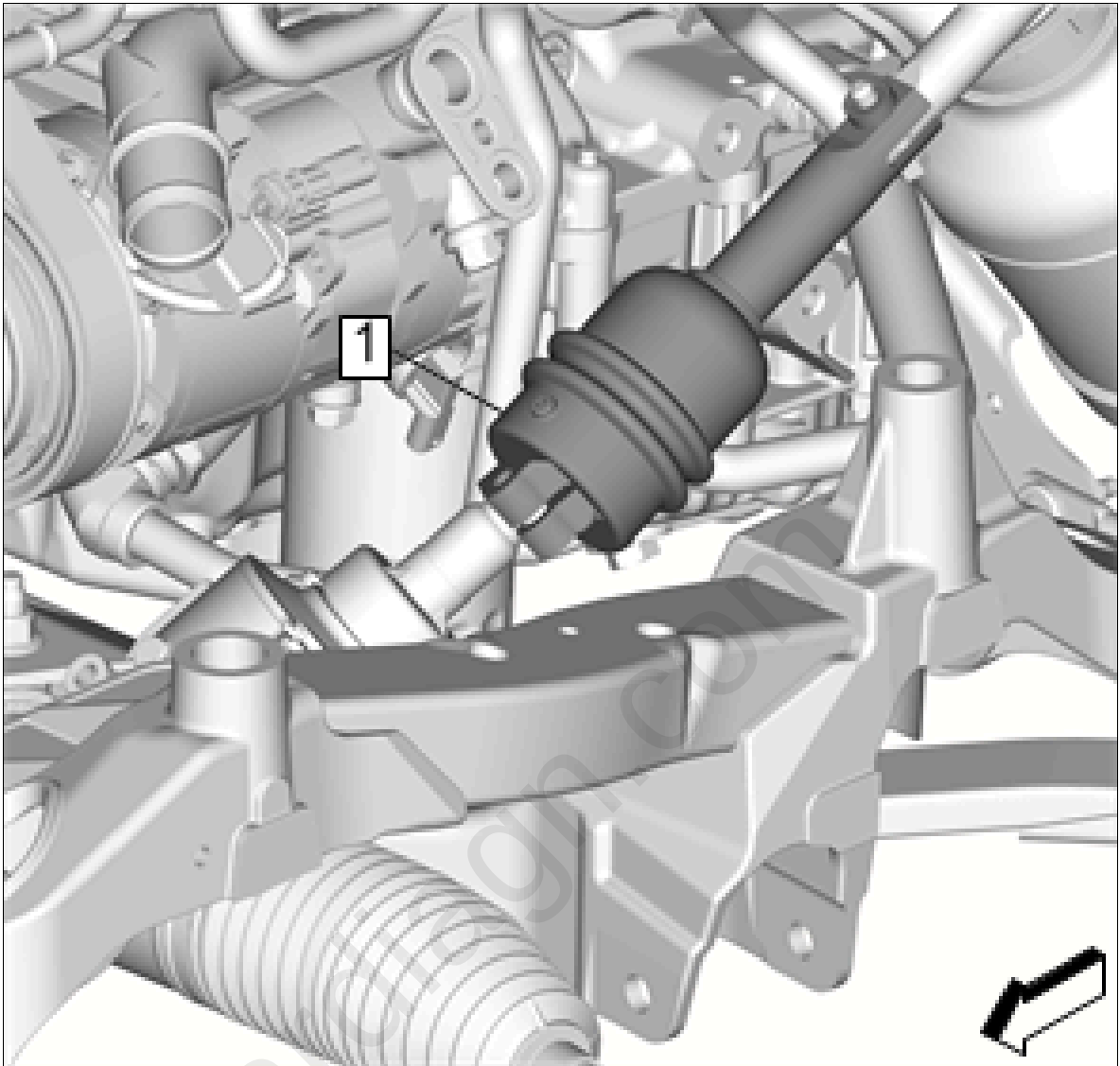
Fig 4: Front Brake Rotor Cooling Duct Deflector



Courtesy of GENERAL MOTORS COMPANY

6. Install Front Brake Rotor Cooling Duct Deflector (1) - Front Brake Rotor Cooling Duct Deflector Replacement

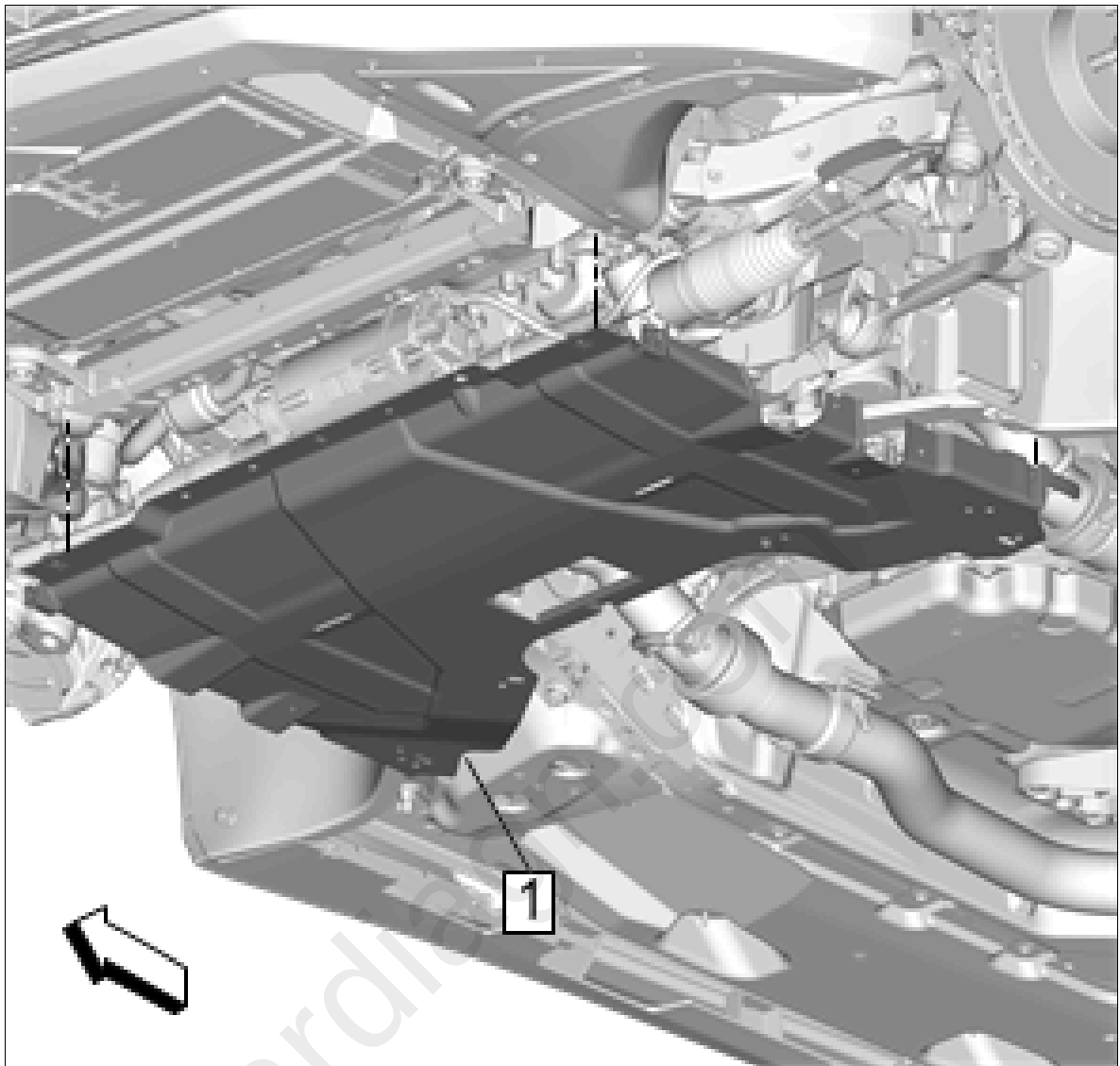
Fig 5: Intermediate Steering Shaft



Courtesy of GENERAL MOTORS COMPANY

7. Install Intermediate Steering Shaft (1) at Steering Gear - Intermediate Steering Shaft Replacement

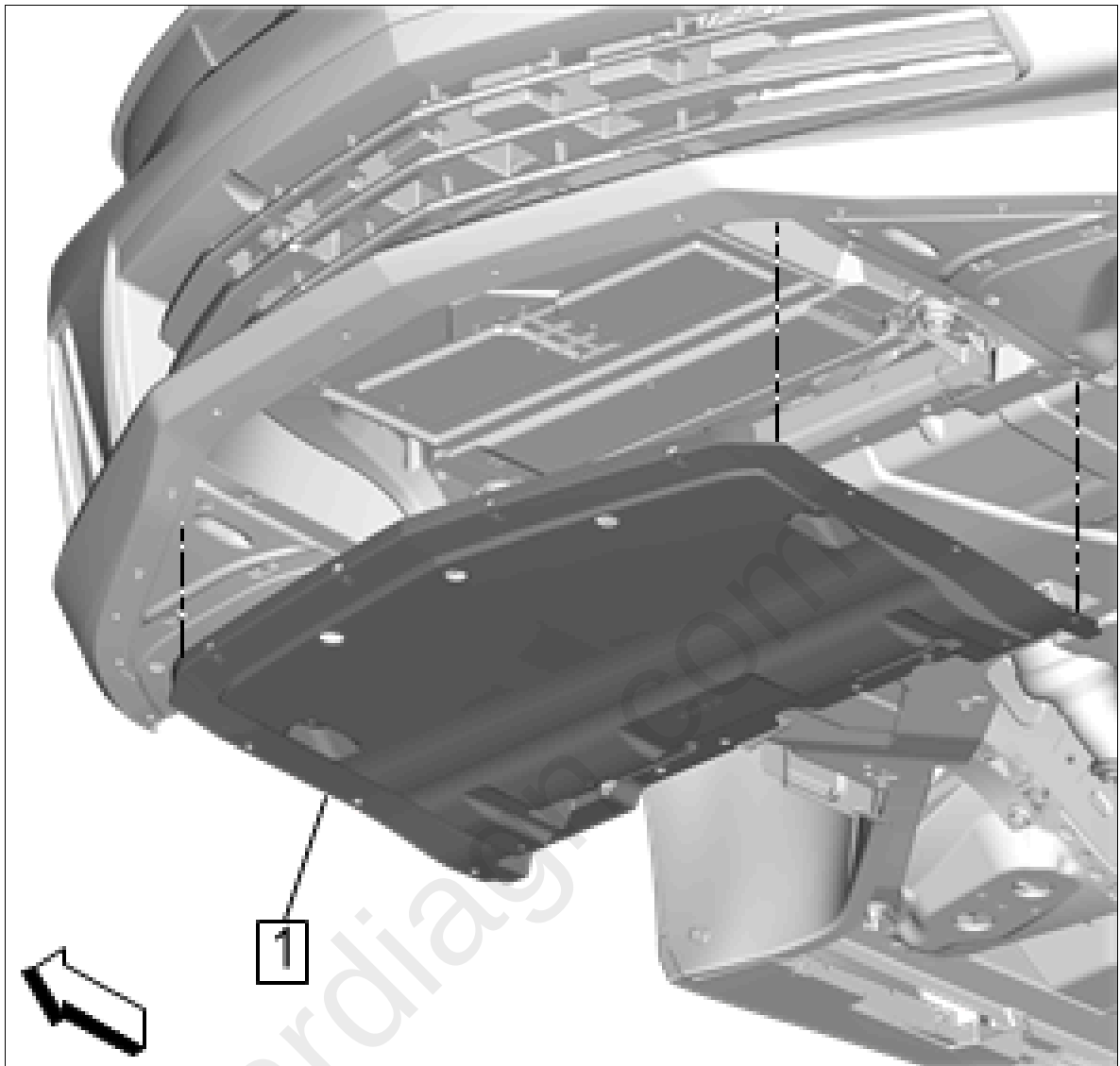
Fig 6: Front Compartment Lower Noise Shield



Courtesy of GENERAL MOTORS COMPANY

8. Install Front Compartment Lower Noise Shield (1) - Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)

Fig 7: Front Compartment Air Deflector



Courtesy of GENERAL MOTORS COMPANY

9. Install Front Compartment Air Deflector (1) - Front Compartment Air Deflector Replacement (Convertible - LGX, LTG)Front Compartment Air Deflector Replacement (Coupe - LGX, LTG)Front Compartment Air Deflector Replacement (Coupe - LT1)
10. Install the front tire and wheel assemblies. Tire and Wheel Removal and Installation
11. Program the power steering control module. Control Module References
12. Measure and adjust the front toe. Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment

**REPAIR INSTRUCTIONS > ELECTRIC BELT DRIVE RACK AND PINION STEERING
GEAR REPLACEMENT (LT1) > 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:

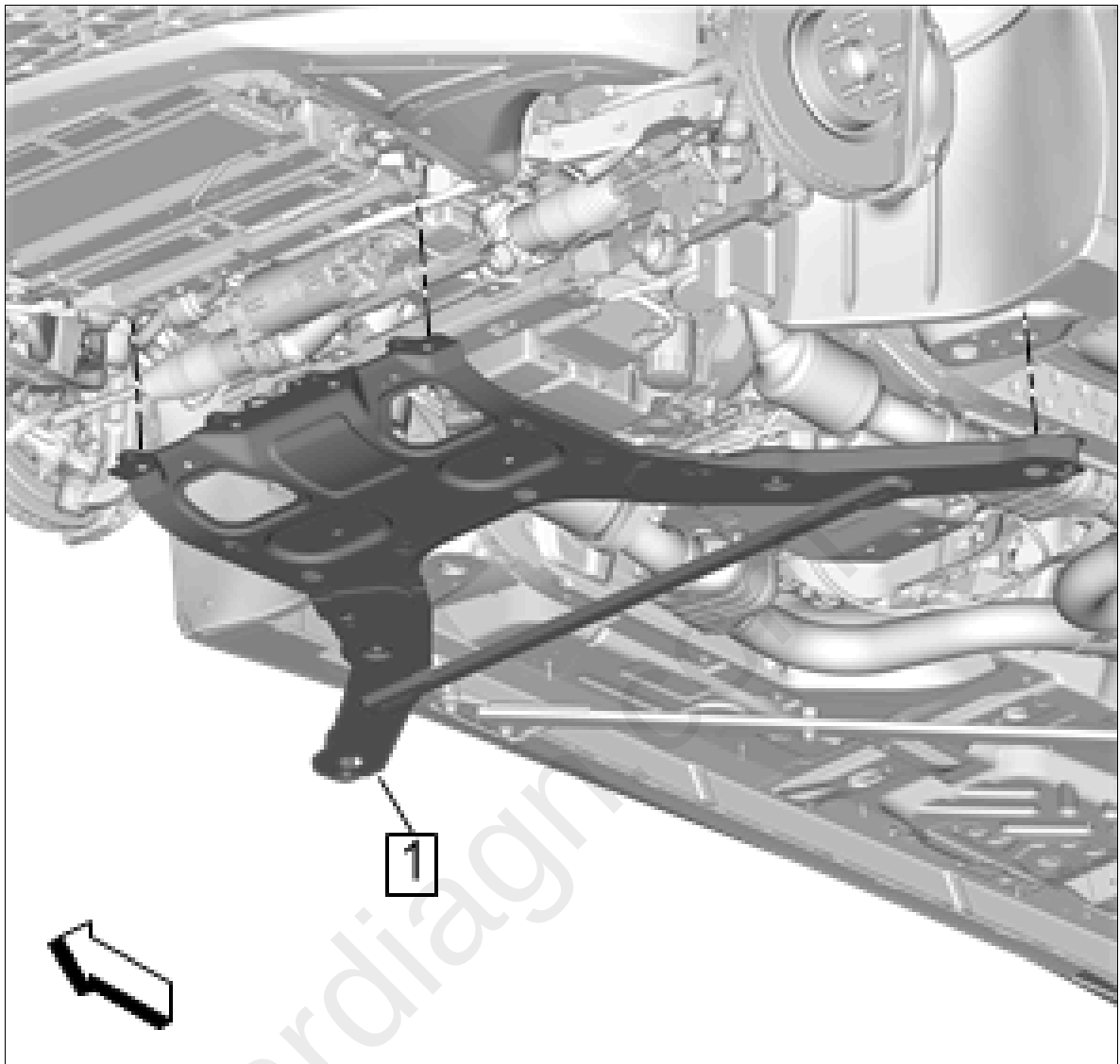
With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured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

- 1. The steering column*
- 2. The intermediate shaft(s)*
- 3. 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 wheels of the vehicle in the straight ahead position, LOCK the steering column.
2. Remove the front tire and wheel assemblies. Tire and Wheel Removal and Installation

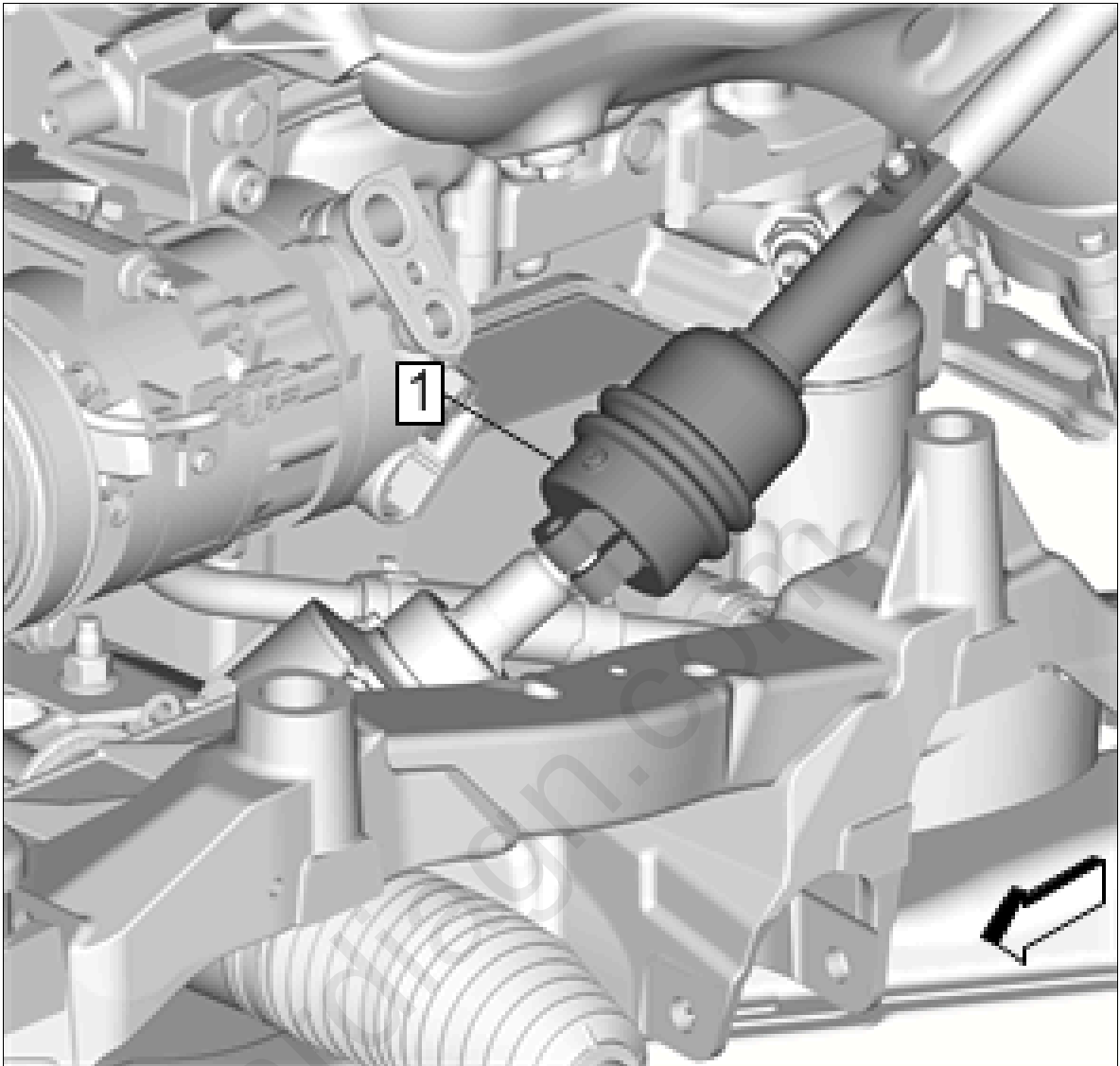
Fig 1: Front Cradle Shear Plate



Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Cradle Shear Plate (1) - Front Cradle Shear Plate Replacement

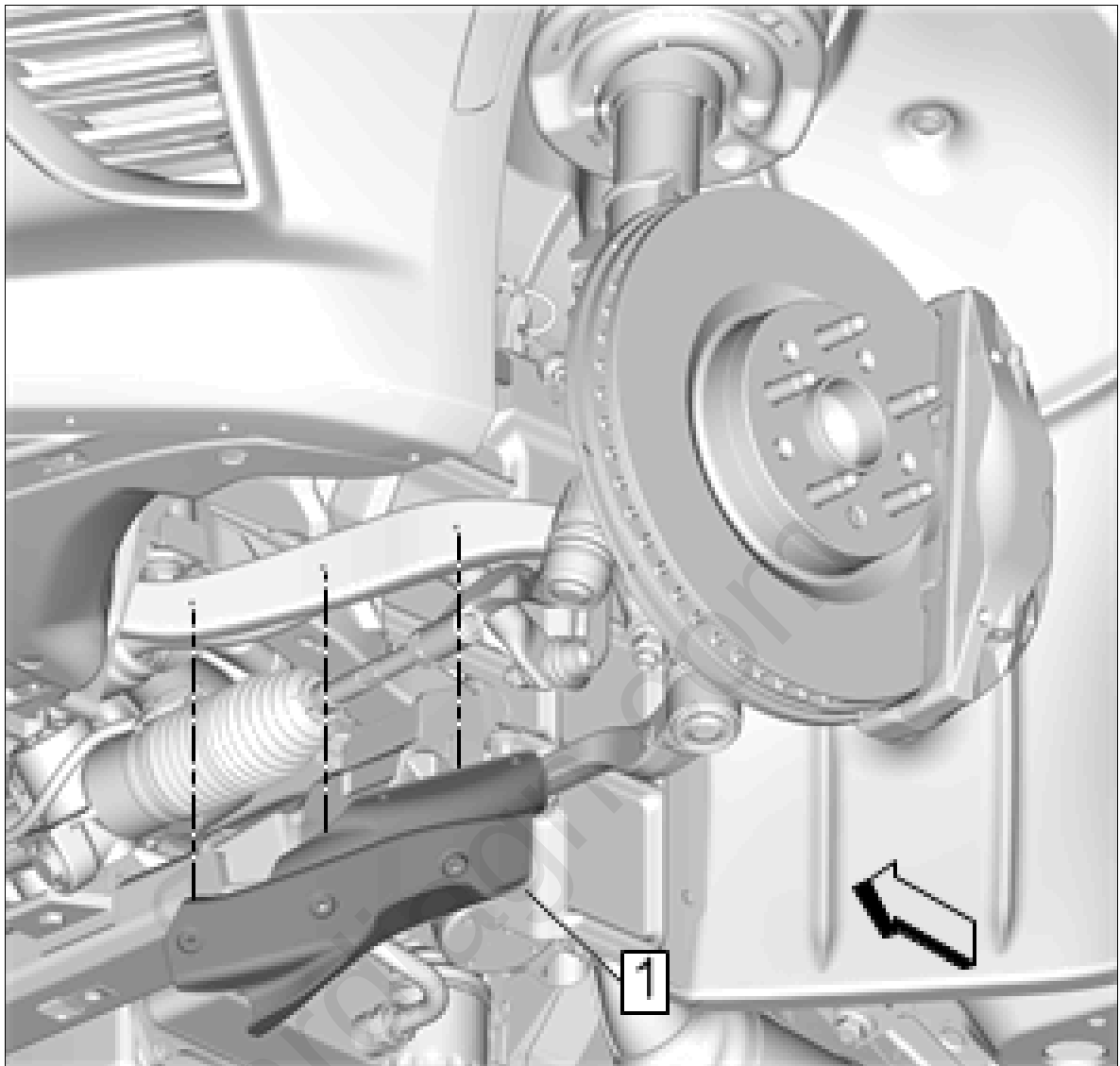
Fig 2: Intermediate Steering Shaft



Courtesy of GENERAL MOTORS COMPANY

4. Separate Intermediate Steering Shaft (1) at Steering Gear - Intermediate Steering Shaft Replacement

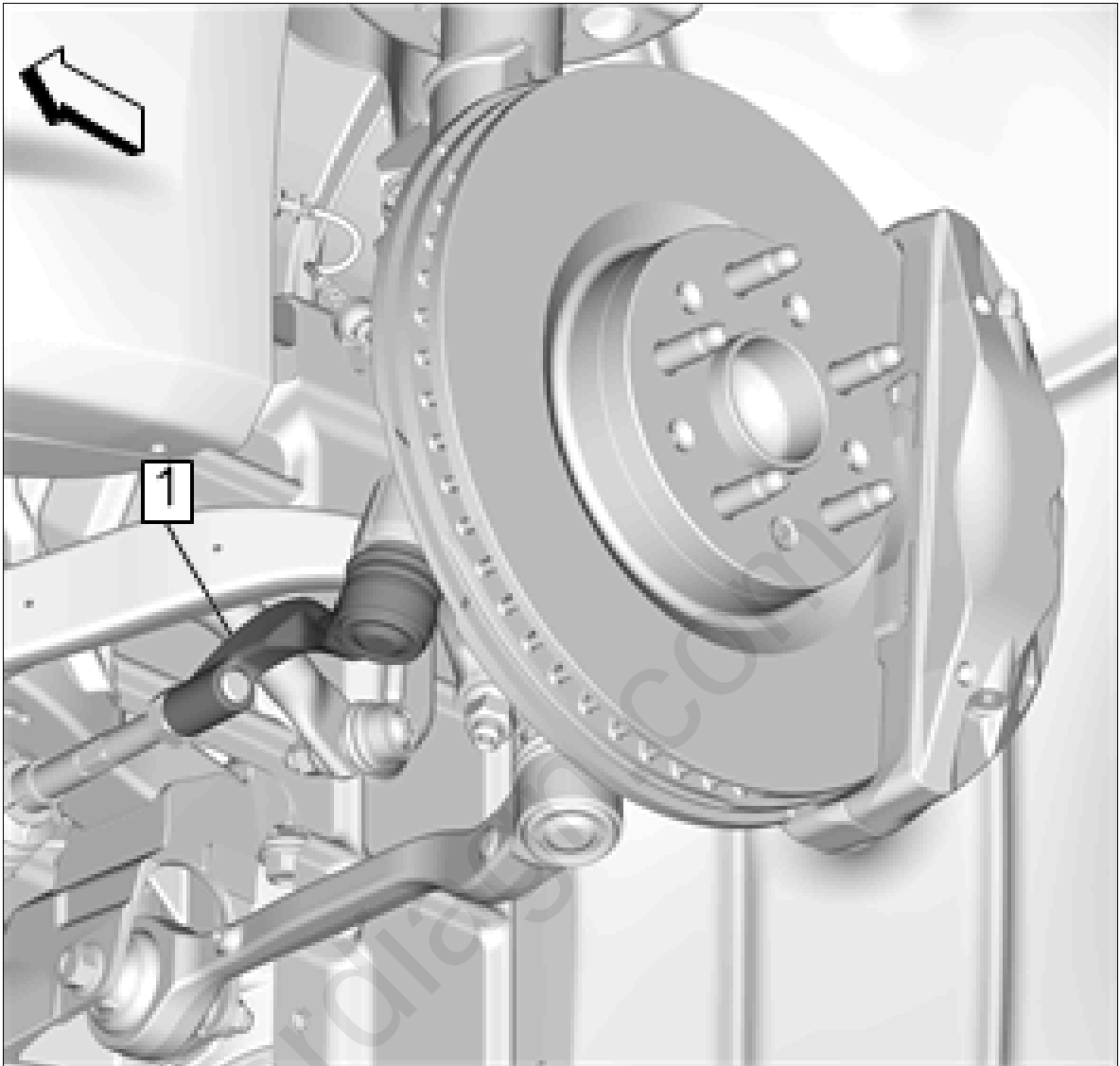
Fig 3: Front Brake Rotor Cooling Duct Deflector



Courtesy of GENERAL MOTORS COMPANY

5. Remove Front Brake Rotor Cooling Duct Deflector (1) - Front Brake Rotor Cooling Duct Deflector Replacement

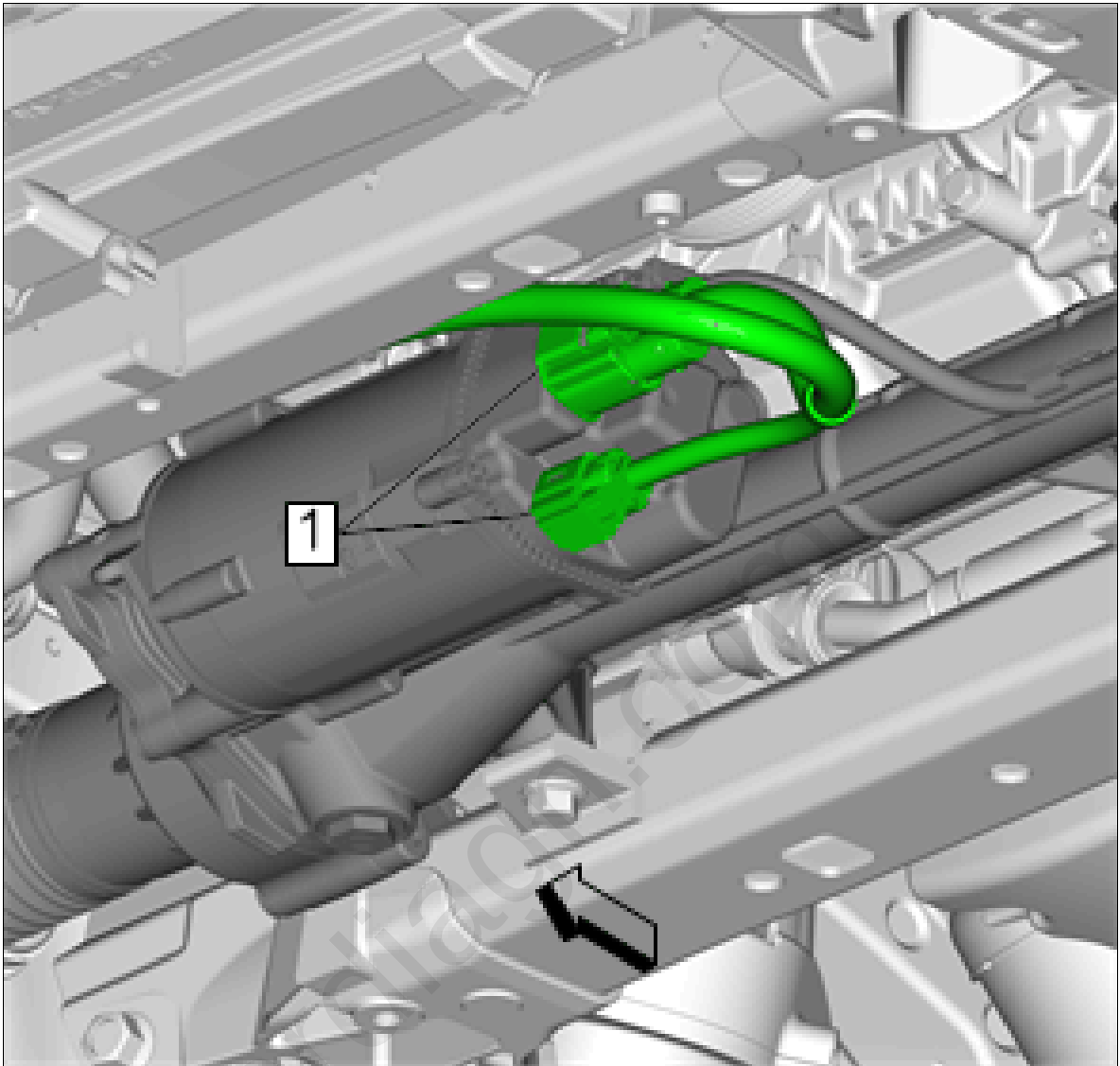
Fig 4: Steering Linkage Outer Tie Rod



Courtesy of GENERAL MOTORS COMPANY

6. Separate Steering Linkage Outer Tie Rod (1) at Steering Knuckle - Steering Linkage Outer Tie Rod Replacement

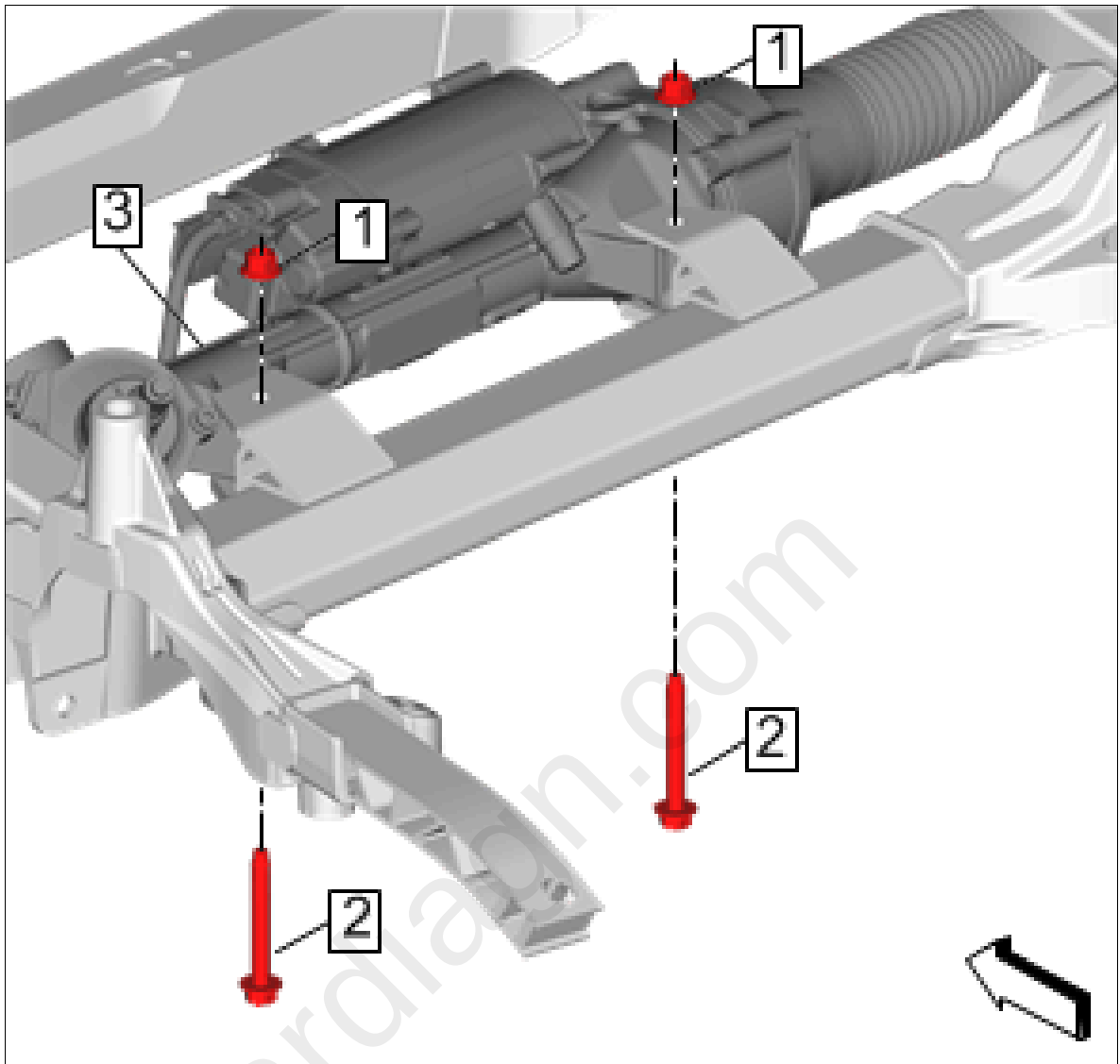
Fig 5: Steering Gear Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

7. Disconnect the steering gear electrical connectors (1).

Fig 6: Steering Gear Nut

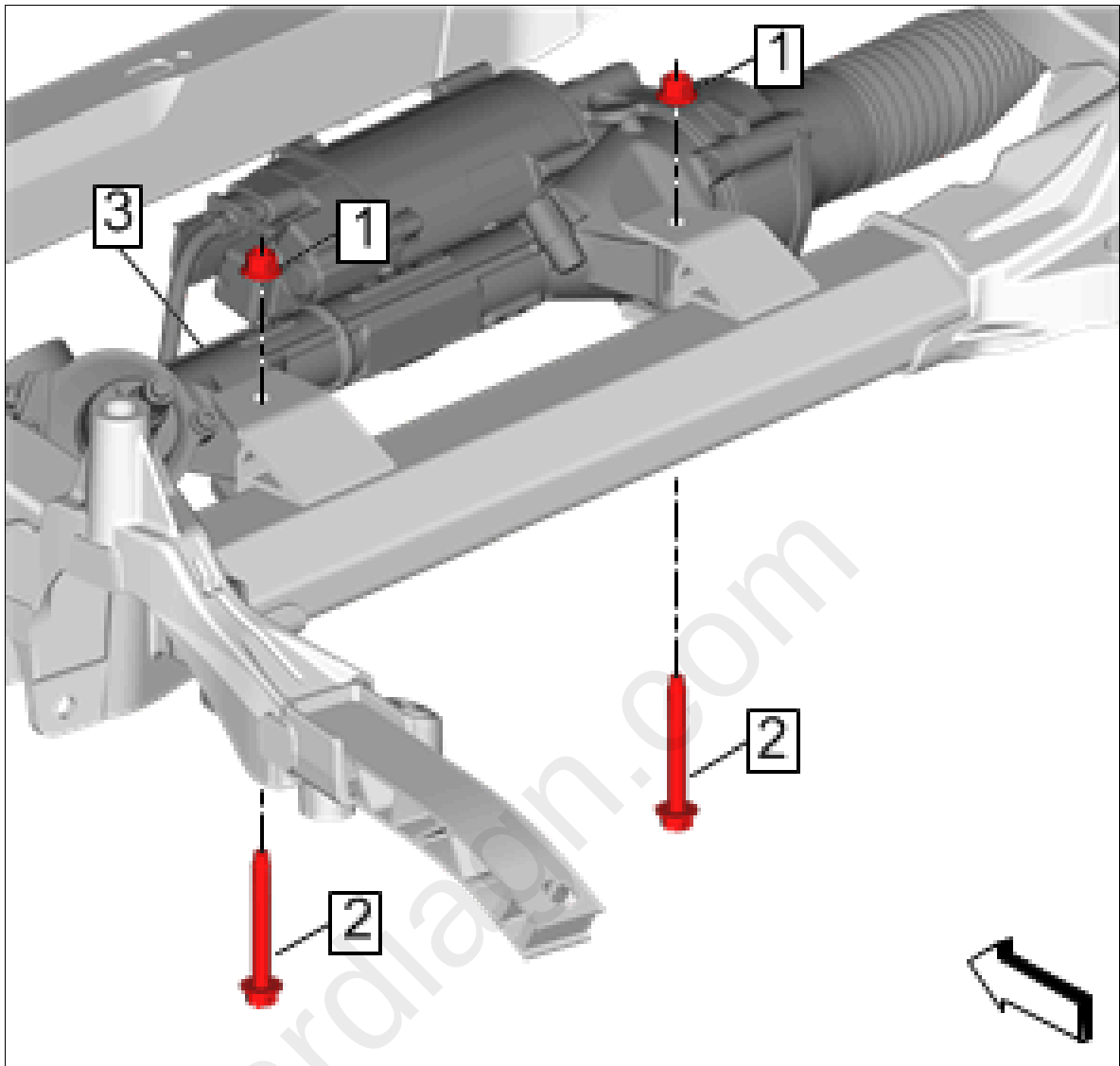


Courtesy of GENERAL MOTORS COMPANY

8. Remove Steering Gear Nut (1) (Qty: 2)
9. Remove Steering Gear Bolt (2) (Qty: 2)
- DISCARD the bolts.
10. Remove the steering gear (3) from the vehicle.

**REPAIR INSTRUCTIONS > ELECTRIC BELT DRIVE RACK AND PINION STEERING
GEAR REPLACEMENT (LT1) > INSTALLATION PROCEDURE**

Fig 1: Steering Gear



Courtesy of GENERAL MOTORS COMPANY

1. Position the steering gear (3) on the vehicle.

 CAUTION:

This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

2. Install Steering Gear Bolt (2) (Qty: 2)

Use NEW bolts.

 CAUTION:

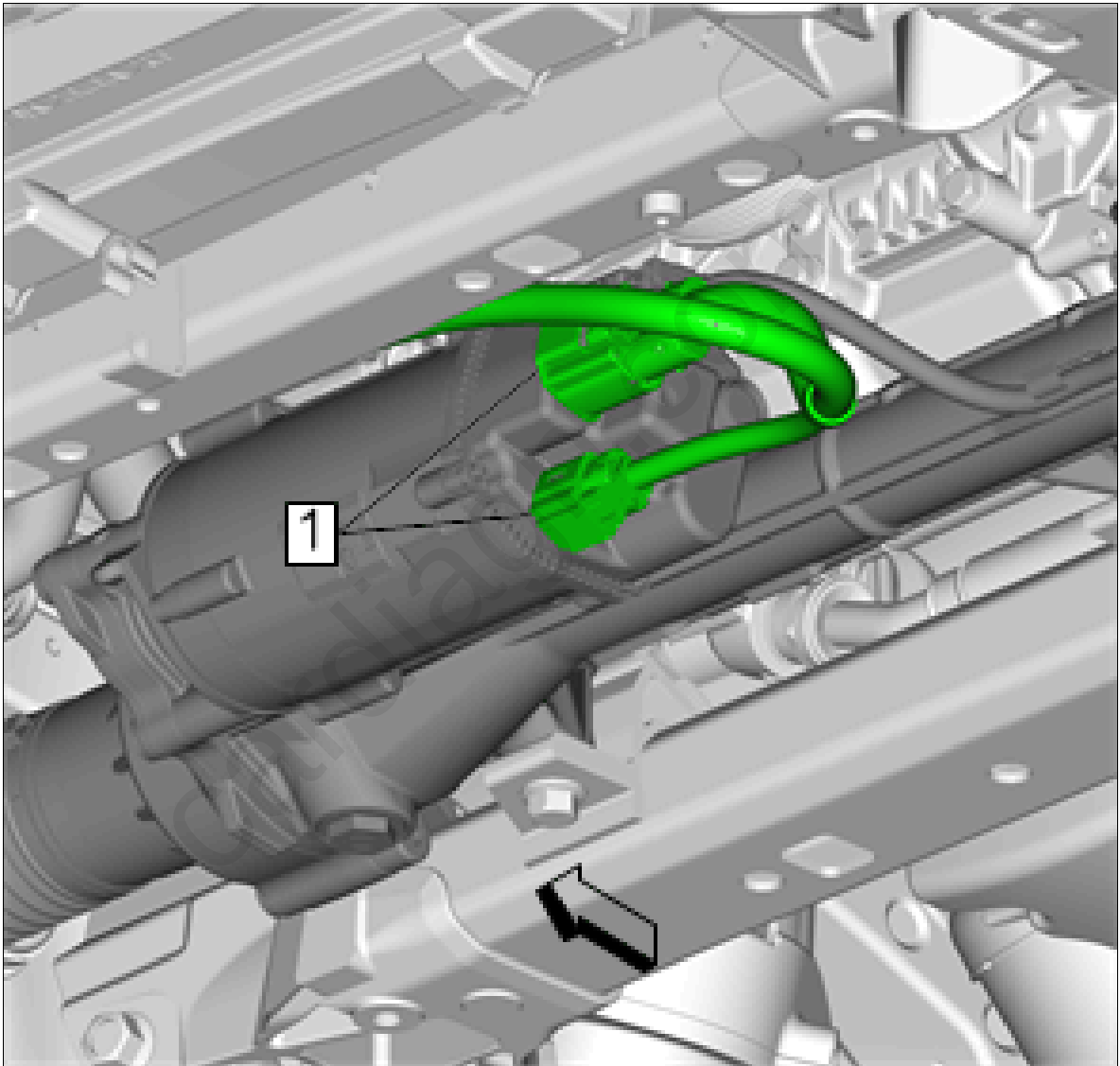
Refer to Fastener Caution .

3. Install and tighten Steering Gear Nut (1) (Qty: 2)

Tighten

1. First Pass: 58 N.m (43 lb ft)
2. Final Pass: (90-105 degrees)

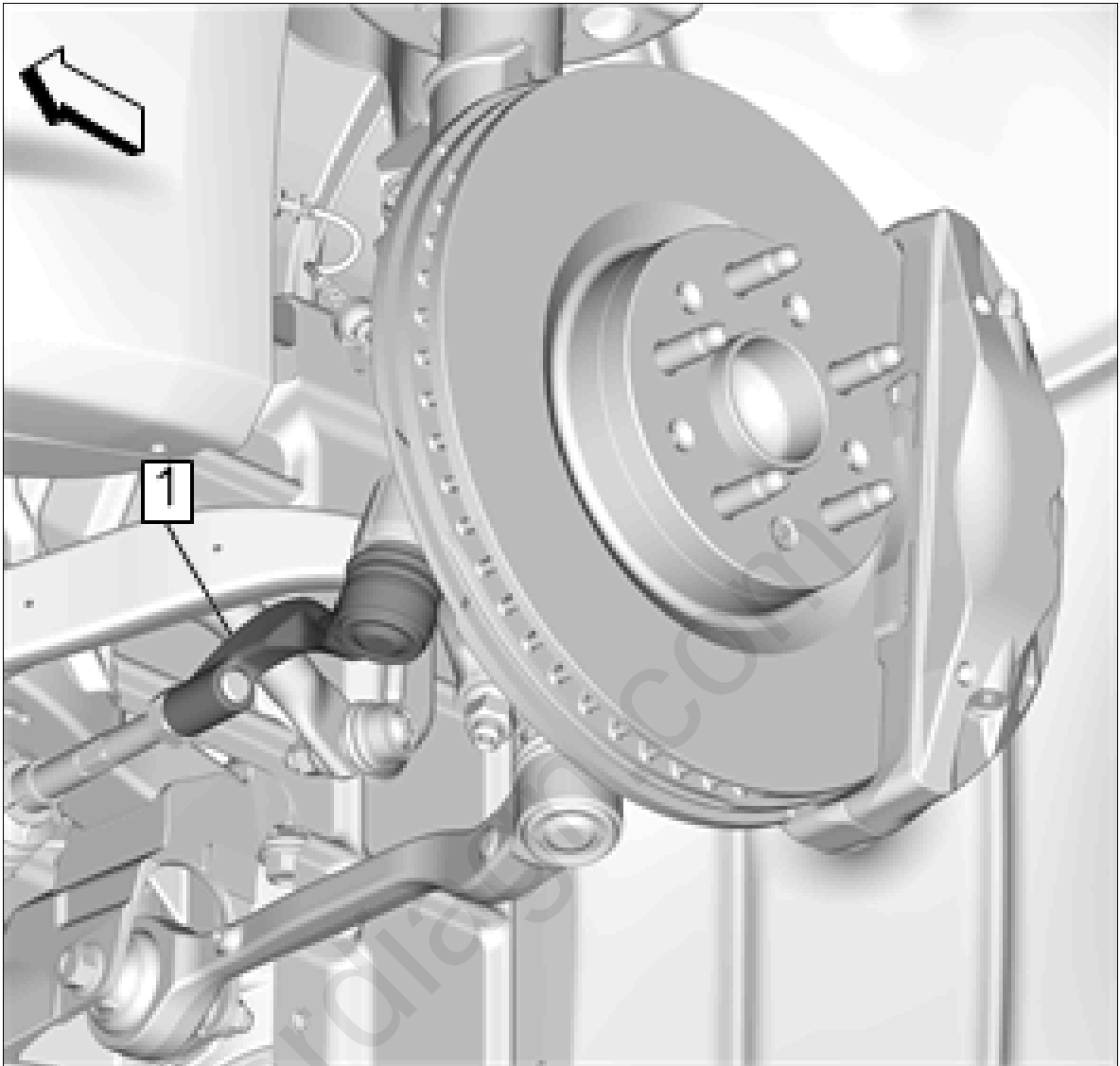
Fig 2: Steering Gear Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

4. Connect the steering gear electrical connectors (1).

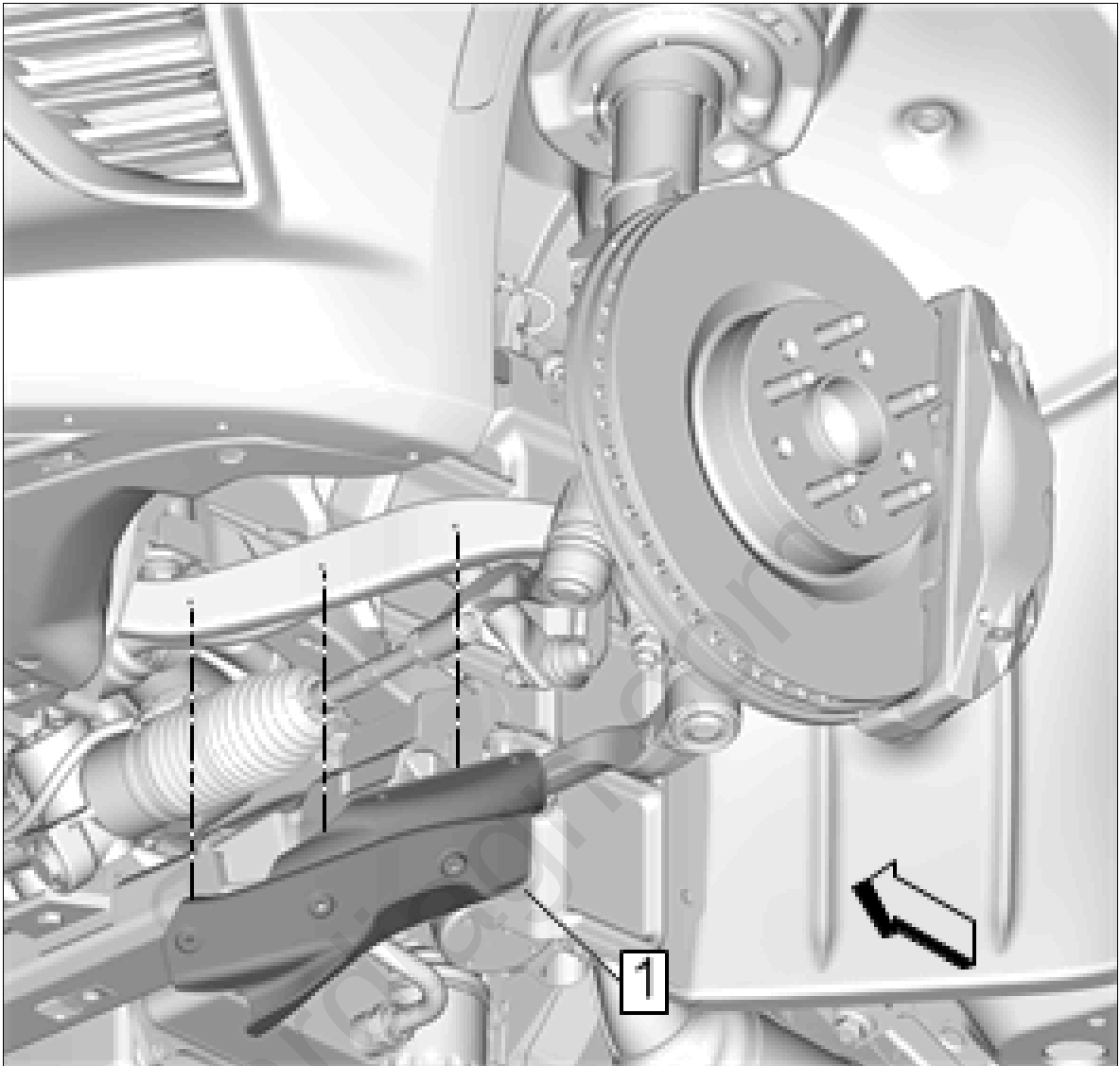
Fig 3: Steering Linkage Outer Tie Rod



Courtesy of GENERAL MOTORS COMPANY

5. Install Steering Linkage Outer Tie Rod (1) at Steering Knuckle - Steering Linkage Outer Tie Rod Replacement

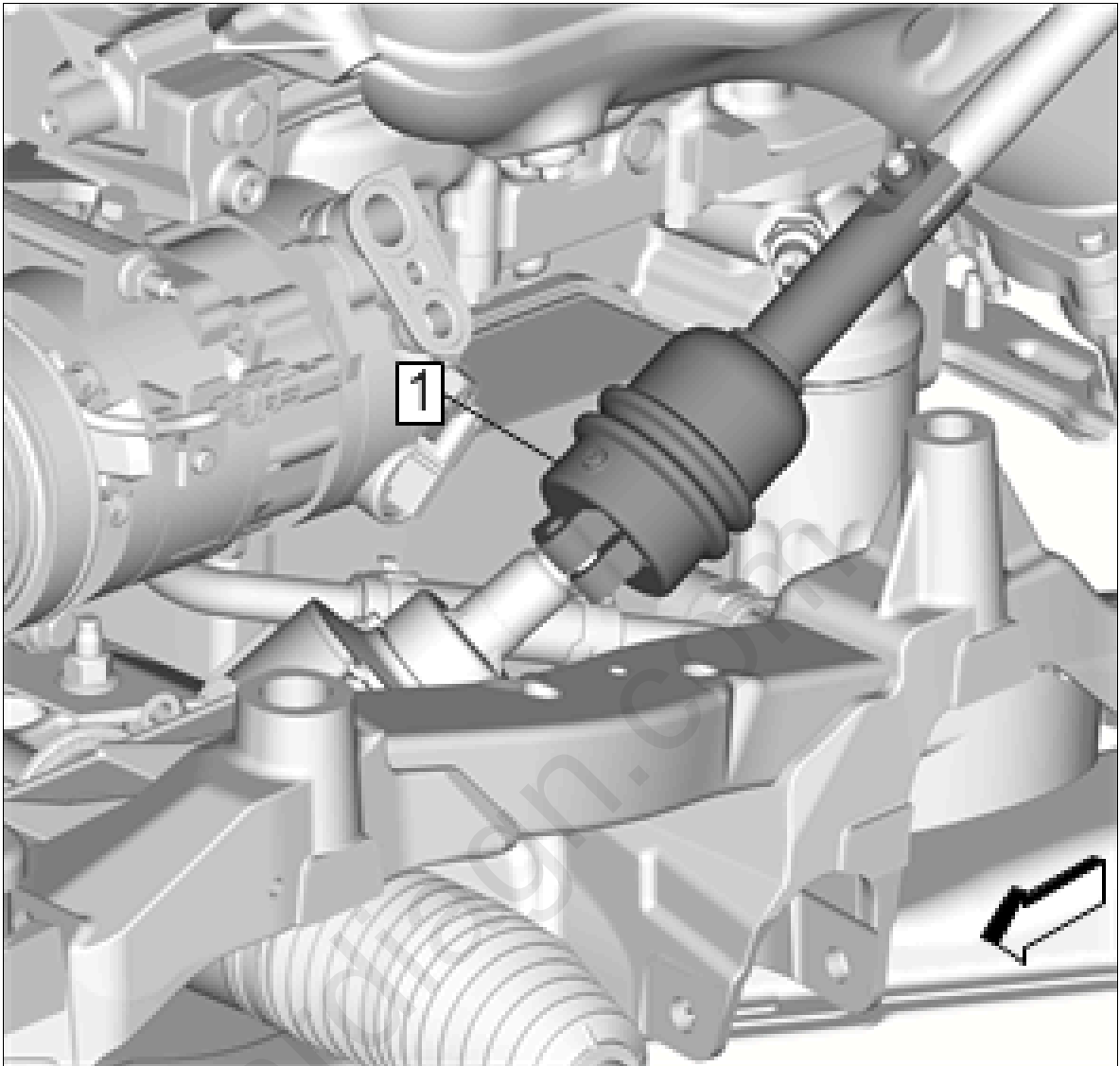
Fig 4: Front Brake Rotor Cooling Duct Deflector



Courtesy of GENERAL MOTORS COMPANY

6. Install Front Brake Rotor Cooling Duct Deflector (1) - Front Brake Rotor Cooling Duct Deflector Replacement

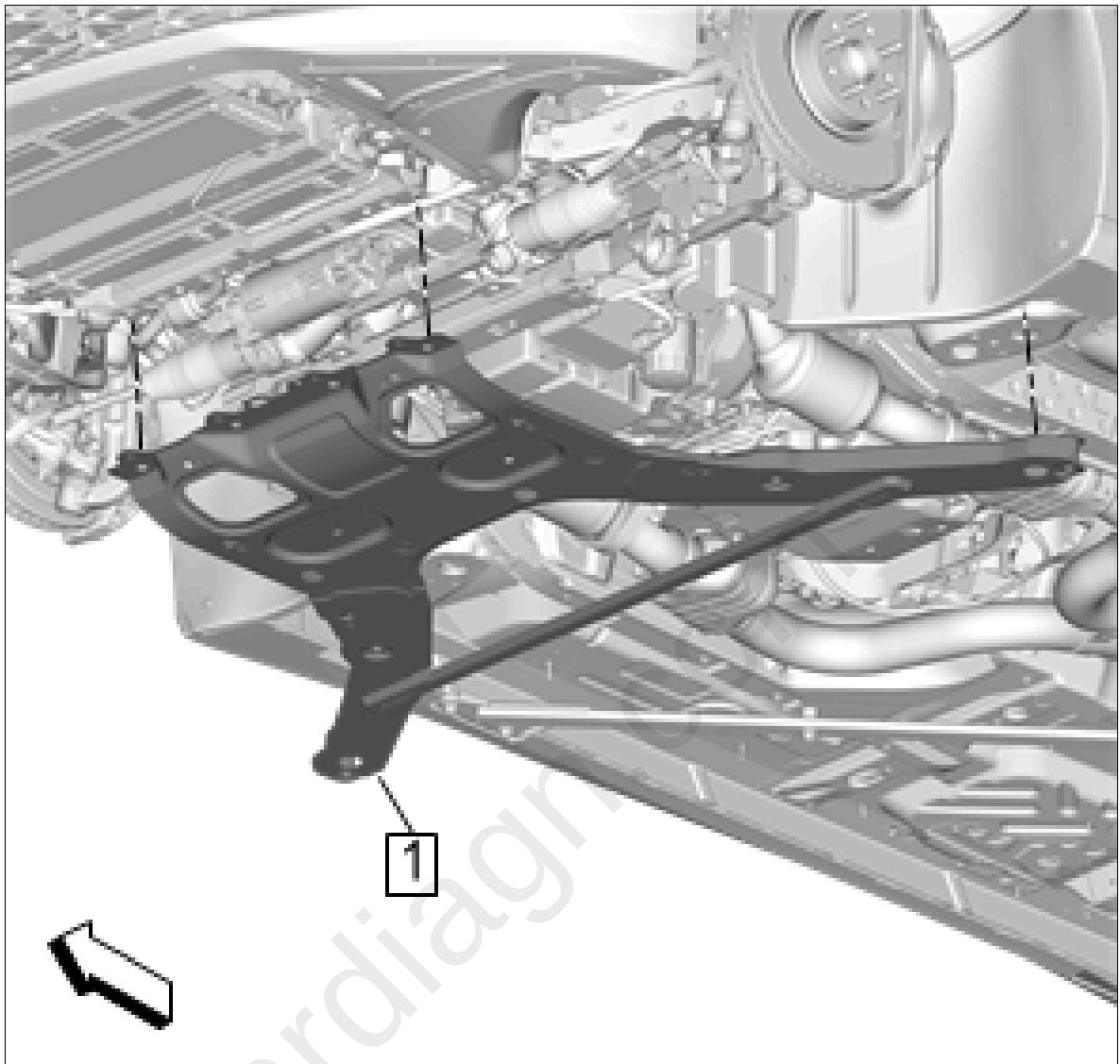
Fig 5: Intermediate Steering Shaft



Courtesy of GENERAL MOTORS COMPANY

7. Install Intermediate Steering Shaft (1) at Steering Gear - Intermediate Steering Shaft Replacement

Fig 6: Front Cradle Shear Plate

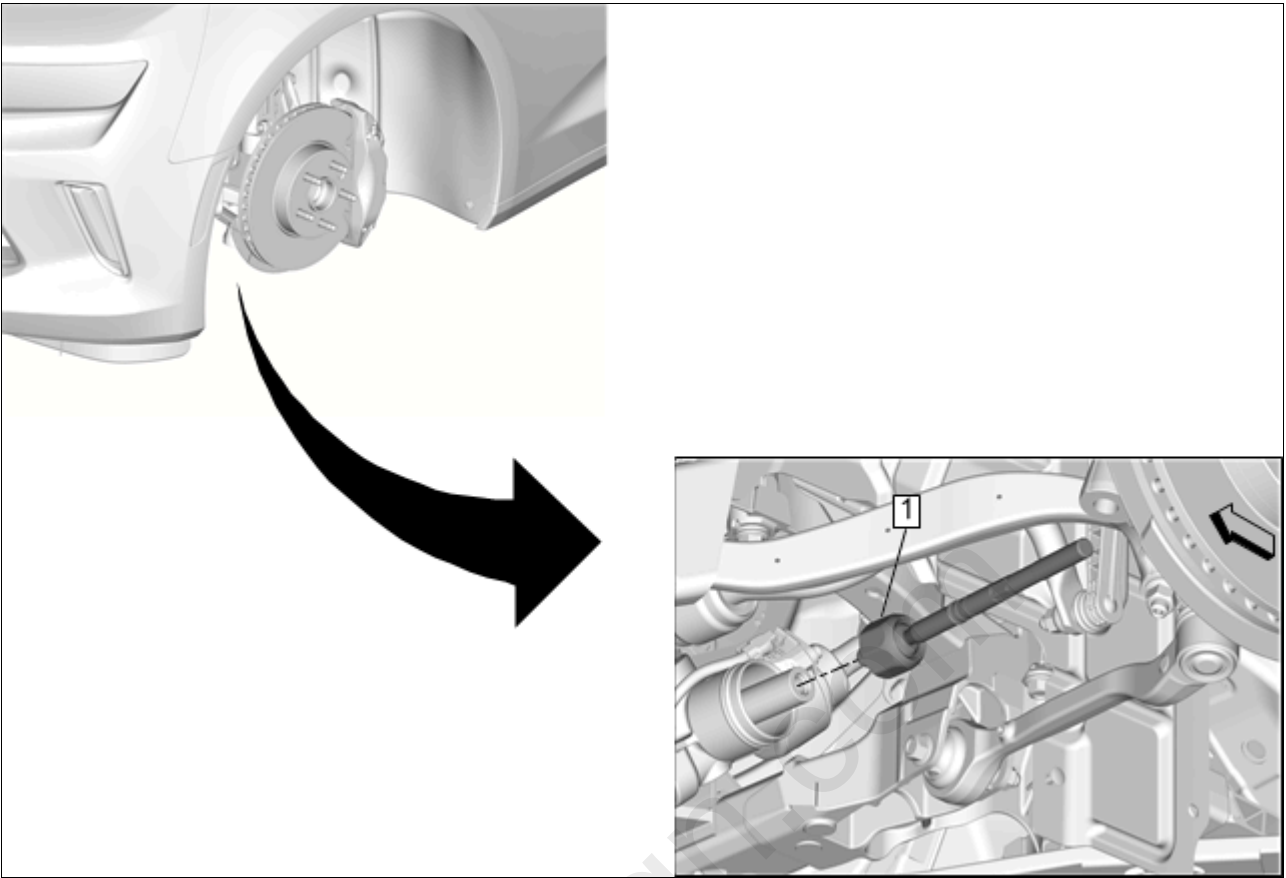


Courtesy of GENERAL MOTORS COMPANY

8. Install Front Cradle Shear Plate (1) - Front Cradle Shear Plate Replacement
9. Install the front tire and wheel assemblies. Tire and Wheel Removal and Installation
10. Program the power steering control module. Control Module References
11. Measure and adjust the front toe. Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment

REPAIR INSTRUCTIONS > STEERING LINKAGE INNER TIE ROD REPLACEMENT

Fig 1: Steering Linkage Inner Tie Rod



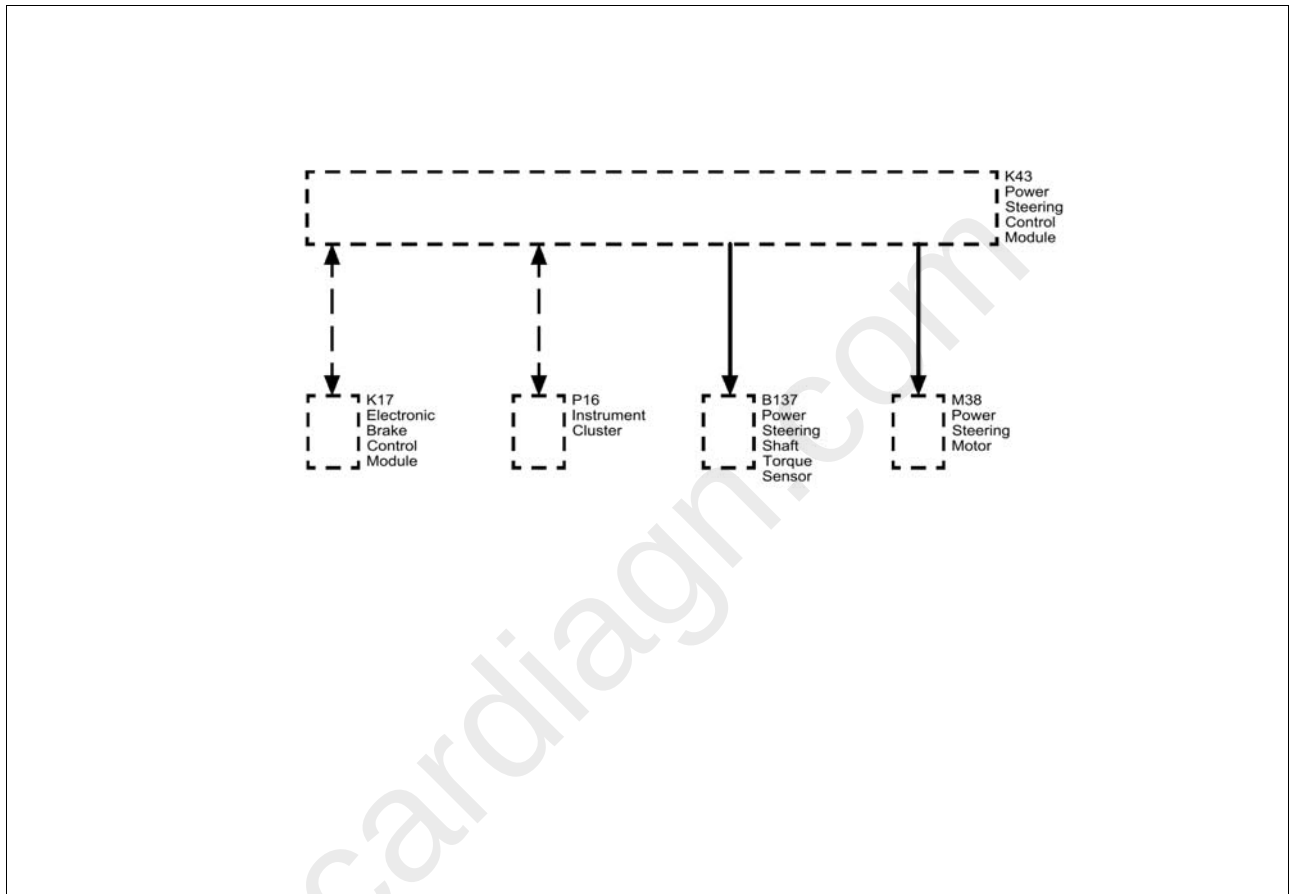
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Steering Gear Boot Replacement	
	Steering Linkage Inner Tie Rod
	CAUTION: Refer to Component Fastener Tightening Caution .
1	Procedure 1. Place a 42 mm wrench on the flats of the steering linkage inner tie rod and rotate the tie rod counterclockwise to remove it from the steering gear rack. 2. Place a 42 mm wrench on the flats of the steering linkage inner tie rod and rotate the tie rod clockwise to install to install it to the steering gear rack. 3. Measure and adjust the front toe. Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment

Tighten
105 N.m (77 lb ft)

DESCRIPTION AND OPERATION > POWER STEERING SYSTEM DESCRIPTION AND OPERATION

Fig 1: Power Steering System Diagram



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
K43	K43 Power Steering Control Module
K17	K17 Electronic Brake Control Module
P16	P16 Instrument Cluster
B137	B137 Power Steering Shaft Torque Sensor
M38	M38 Power Steering Motor

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

- A belt drive and a ball nut mechanism

- A power pack; containing the power steering control module, its sensors, the power steering motor
- A torque sensor
- The steering gear (rack and pinion)

The belt driven electric power steering system reduces the amount of effort needed to steer the vehicle by utilizing the power steering control module to control the power steering motor to maneuver the steering rack. The power steering control module uses input from the torque sensor, motor rotational sensor, battery voltage circuit and GMLAN serial data circuit to determine the level of motor assist. Vehicle speed and engine speed from the GMLAN serial data circuit is also used to adjust the amount of steering assist needed to steer the vehicle. At low speeds more assist is provided for easy turning during parking maneuvers. At higher speeds less assist is provided for improved road feel and directional stability

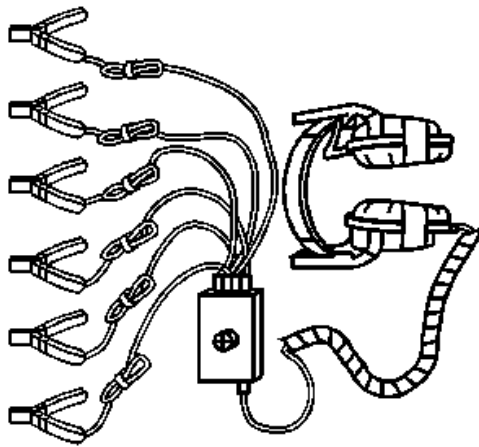
The torque sensor is attached to the steering gear housing near the input shaft, and is critical to proper operation of the electronic power steering system. As the steering wheel is turned and torque is applied to the steering shaft, the torque sensor monitors the amount of input torque.

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

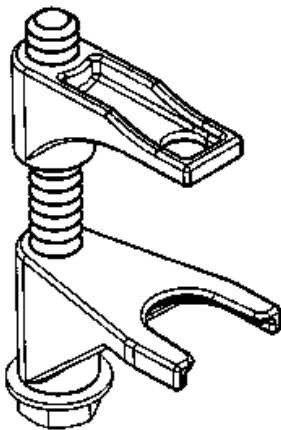
The power steering control module and motor are attached to the base of the steering gear housing, and applies power assist through the belt drive and ball nut mechanism to the steering rack. The ball nut mechanism translates the rotational movement of the belt drive system to lateral movement of the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

SPECIAL TOOLS AND EQUIPMENT > SPECIAL TOOLS

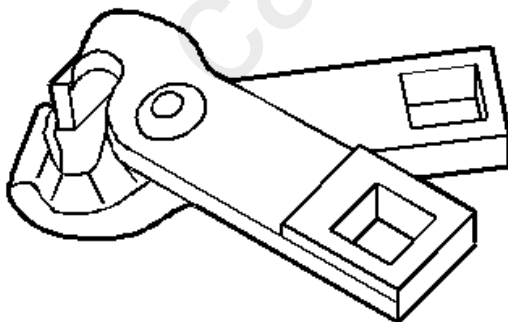
Illustration	Tool Number/ Description
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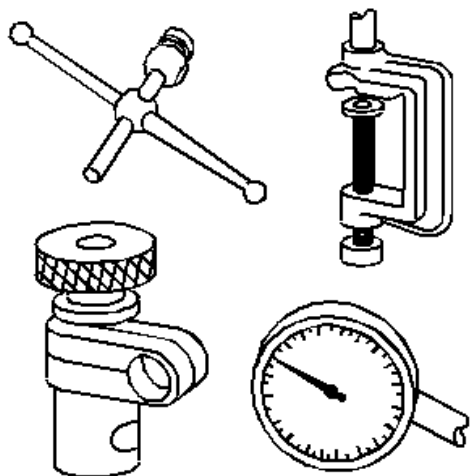
CH-39570
J-39570
Chassis Ear



CH-42188-B
J-42188-B
Ball Joint Separator



DT-35910
J-35910
Drive Axle Boot Clamp Pliers



GE-8001
J-8001
Dial Indicator Set

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