



Select a Service Category:

-  [Power Steering](#)
-  [Steering Wheel and Column](#)



Select a Document:

-  [Specifications](#)
-  [Power Steering System Bleeding](#)
-  [Checking and Adding Power Steering Fluid](#)
-  [Power Steering Fluid Reservoir Replacement](#)
-  [Power Steering Pump Pulley Replacement](#)
-  [Power Steering Pump Replacement](#)
-  [Power Steering Pump Bracket Replacement](#)
-  [Steering Linkage Outer Tie Rod Replacement](#)
-  [Steering Gear Boot Replacement](#)
-  [Power Steering Fluid Reservoir Outlet Hose Replacement](#)
-  [Power Steering Gear Inlet Pipe/Hose Replacement](#)
-  [Power Steering Gear Outlet Pipe/Hose Replacement](#)
-  [Steering Gear Replacement \(Hydraulic Power Steering\)](#)
-  [Steering Linkage Inner Tie Rod Replacement \(Hydraulic Power Steering\)](#)
-  [Steering Linkage Inner Tie Rod Replacement \(Electronic Power Steering\)](#)
-  [Power Steering System Description and Operation](#)
-  [Variable Effort Steering System Description and Operation](#)
-  [Special Tools and Equipment](#)

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Intermediate Steering Shaft Lower Bolt	34 N·m	25 lb ft
Intermediate Steering Shaft Upper Bolt	34 N·m	25 lb ft
Power Steering Fluid Cooling Pipe Bracket Nut	9 N·m	80 lb in
Power Steering Fluid Reservoir Screw	9 N·m	80 lb in
Power Steering Gear Inlet and Outlet Hose Bolt	11 N·m	97 lb in
Power Steering Pump Bolt	22 N·m	16 lb ft
Steering Gear Bolt	125 N·m	92 lb in
Steering Gear to Steering Knuckle Nut	35 N·m	26 lb in
Steering Linkage Inner Tie Rod	90 N·m	66 lb in
Steering Linkage Inner Tie Rod Nut	60 N·m	44 lb ft
Steering Wheel Bolt	35 N·m	26 lb ft

cardiagn.com

Power Steering Pump Specifications

Vehicle	Engine Code	High Flow		Pressure Relief	
		LPM	GPM	mPa	PSI
Daewoo Lacetti	LXV/LLW	8.0	2.11	12.0-12.8	1740-1856

Power Steering System Bleeding

Note:

- Use clean, new power steering fluid type only. See the Maintenance and Lubrication subsection for fluid specifications.
- Hoses touching the frame, body or engine may cause system noise. Verify that the hoses do not touch any other part of the vehicle.
- Loose connections may not leak, but could allow air into the steering system. Verify that all hose connections are tight.

Note: Power steering fluid level must be maintained throughout bleed procedure.

1. Fill pump reservoir with fluid to minimum system level, FULL COLD level, or middle of hash mark on cap stick fluid level indicator.

Note: With hydro-boost only, the oil level will appear falsely high if the hydro-boost accumulator is not fully charged. Do not apply the brake pedal with the engine OFF. This will discharge the hydro-boost accumulator.

2. If equipped with hydro-boost, fully charge the hydro-boost accumulator using the following procedure:
 - 2.1. Start the engine.
 - 2.2. Firmly apply the brake pedal 10-15 times.
 - 2.3. Turn the engine OFF.
3. Raise the vehicle until the front wheels are off the ground. Refer to [Lifting and Jacking the Vehicle](#).
4. Key on engine OFF, turn the steering wheel from stop to stop 12 times.

Note: Vehicles equipped with hydro-boost systems or longer length power steering hoses may require turns up to 15 to 20 stop to stops.

5. Verify power steering fluid level per operating specification. Refer to [Checking and Adding Power Steering Fluid](#).
6. Start the engine. Rotate steering wheel from left to right. Check for sign of cavitation or fluid aeration (pump noise/whining).
7. Verify the fluid level. Repeat the bleed procedure, if necessary.

Checking and Adding Power Steering Fluid

Caution: When adding fluid or making a complete fluid change, always use the proper power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

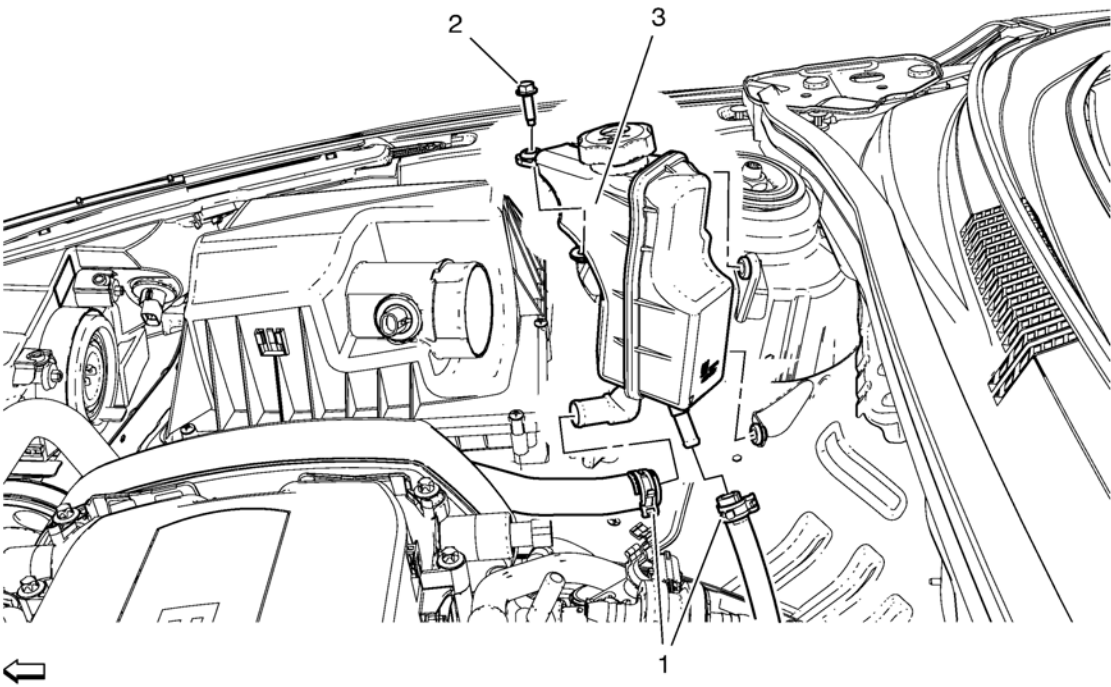
1. Clean the area surrounding the reservoir cap.
2. Remove the reservoir cap.
3. Inspect the power steering pump fluid level at regular intervals. Use the appropriate procedure below.

Add fluid when required. Refer to [Fluid and Lubricant Recommendations](#).

Fluid Is Hot

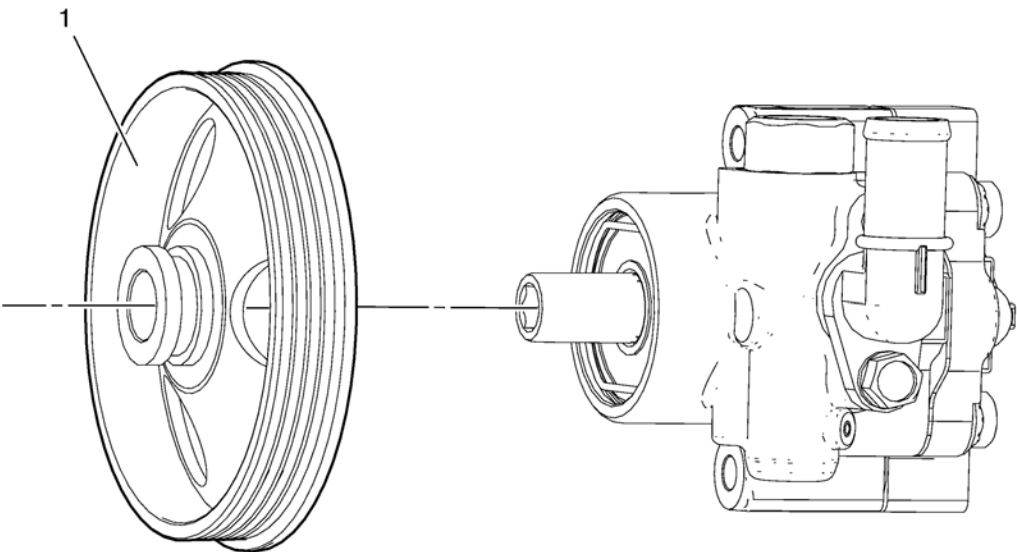
- 3.1. Run the engine until the fluid reaches about 80°C (170°F).
- 3.2. Turn the engine OFF.
- 3.3. Remove the reservoir cap.
- 3.4. Inspect the fluid level on the capstick.
- 3.5. Ensure that the fluid level is at the HOT/FULL/MAX mark on the capstick.
4. If the fluid level is low, add power steering fluid to the proper level.
5. Install the reservoir cap.
6. When checking the fluid level after servicing the steering system, bleed the air from the system. Refer to [Power Steering System Bleeding](#).

Power Steering Fluid Reservoir Replacement



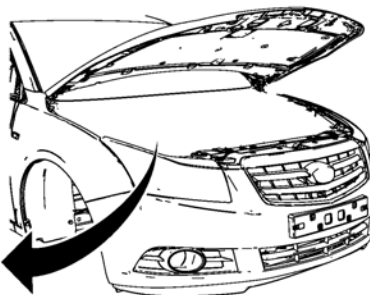
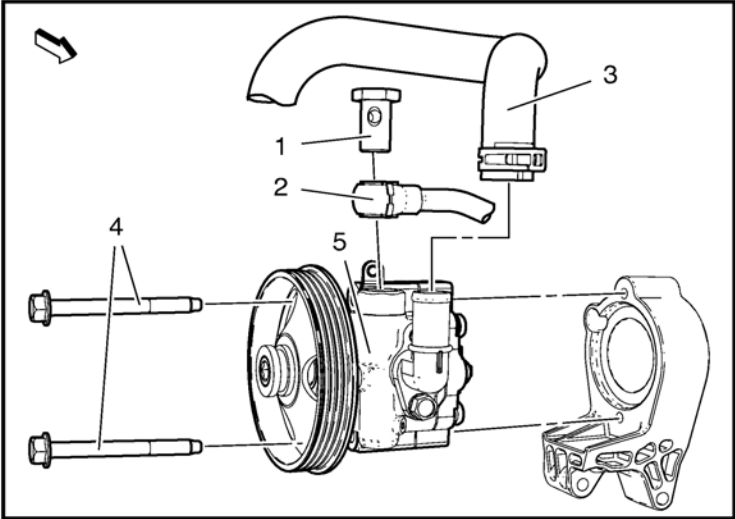
Callout	Component Name
Preliminary Procedure 1. Remove as much power steering fluid from the remote power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed.	
1	Hose Clamp Procedure 1. Compress the power steering fluid reservoir outlet and inlet hose clamp from the power steering fluid reservoir. 2. Remove outlet and inlet hose from power steering fluid reservoir.
2	Power Steering Fluid Reservoir Screw Caution: Refer to Fastener Caution in the Preface section. Tighten 9 N·m (80 lb in)
3	Power Steering Fluid Reservoir Procedure Fill and bleed the power steering system. Refer to Power Steering System Bleeding. Tip Clean any excess power steering fluid from the vehicle.

Power Steering Pump Pulley Replacement



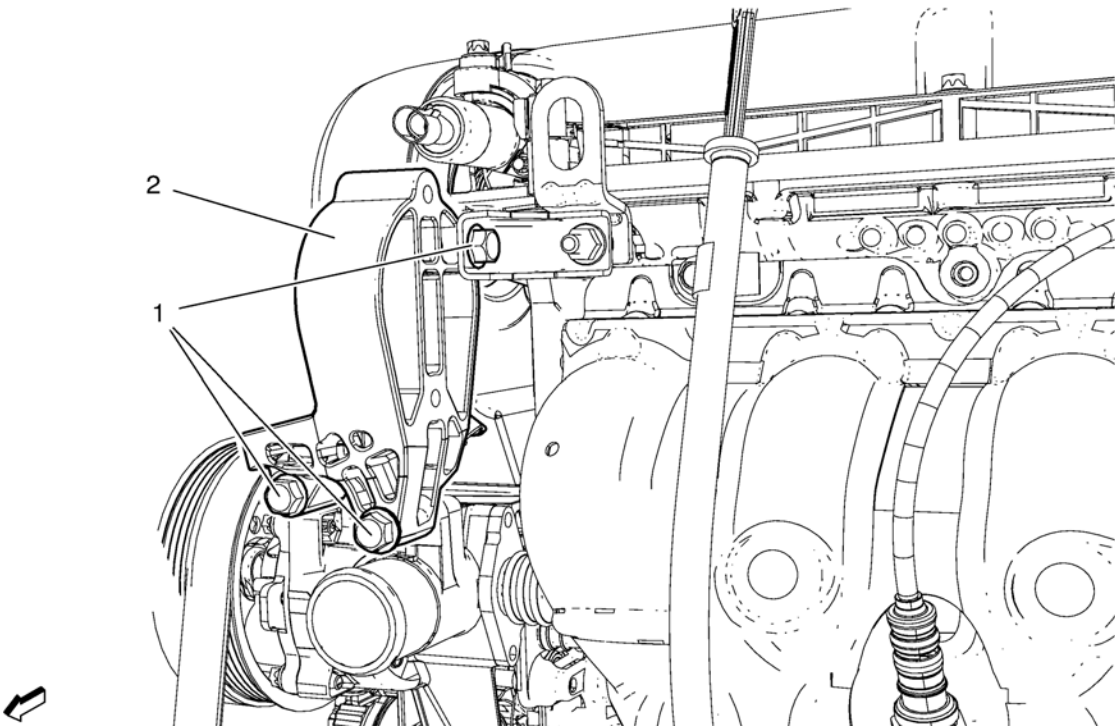
Callout	Component Name
Preliminary Procedure Remove the power steering pump. Refer to Power Steering Pump Replacement .	
1	Power Steering Pump Pulley Procedure 1. Use <i>CH 25034-D</i> Pulley Remover to remove the power steering pump pulley. 2. Use <i>CH 25033-C</i> Pulley Installer to install the power steering pump pulley. Special Tools • <i>CH 25034-D</i> Pulley Remover • <i>CH 25033-C</i> Pulley Installer For equivalent regional tools, refer to Special Tools.

Power Steering Pump Replacement



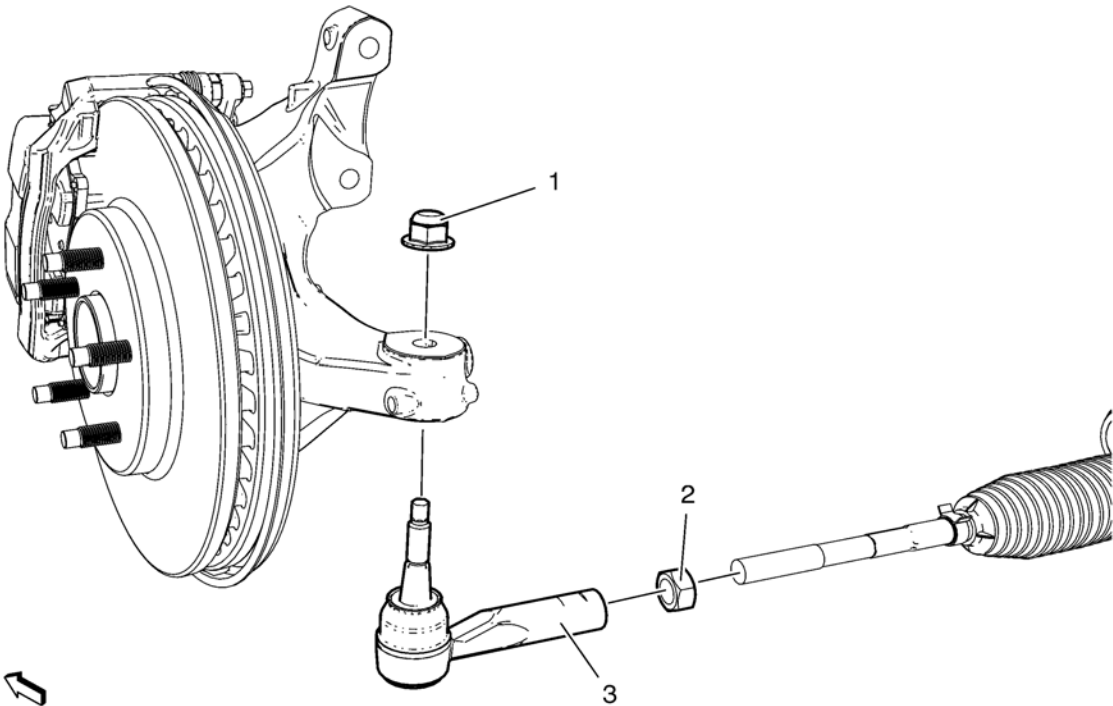
Callout	Component Name
Preliminary Procedure 1. Remove the power steering pump belt. Refer to Power Steering Pump Belt Replacement . 2. Place drain pans under the vehicle as needed.	
1	Power Steering Gear Inlet Hose Hollow Screw Caution: Refer to Fastener Caution in the Preface section. Tighten 21 N·m (16 lb in)
2	Power Steering Gear Inlet Hose
3	Power Steering Reservoir Outlet Hose
4	Power Steering Pump Bolt (Qty: 2) Tighten 22 N·m (17 lb ft)
5	Power Steering Pump Procedure Fill and bleed the power steering system. Refer to Power Steering System Bleeding . Tip Clean any excess power steering fluid from the vehicle.

Power Steering Pump Bracket Replacement



Callout	Component Name
Preliminary Procedure Remove the power steering pump. Refer to Power Steering Pump Replacement .	
1	Power Steering Pump Bracket Screw Caution: Refer to Fastener Caution in the Preface section. Tighten 22 N·m (16 lb ft)
2	Power Steering Pump Bracket

Steering Linkage Outer Tie Rod Replacement



Callout	Component Name
Preliminary Procedure Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .	
1	Steering Linkage Tie Rod Nut Caution: Refer to Fastener Caution in the Preface section. Tighten 35 N·m (26 lb ft)
2	Steering Linkage Inner Tie Rod Nut Tighten 60 N·m (44 lb ft)
3	Steering Linkage Outer Tie Rod Procedure 1. Use <i>CH-161-B</i> puller to separate the steering linkage outer tie rod from the steering knuckle. 2. Inspect the steering linkage inner tie rod for bent or damaged threads. 3. Clean the tapered surface of the steering knuckle. 4. Center the steering angle sensor. Refer to Steering Angle Sensor Centering. 5. Check and adjust wheel alignment. Refer to Wheel Alignment Measurement. Special Tools <i>CH-161-B</i> Puller For equivalent regional tools, refer to Special Tools .

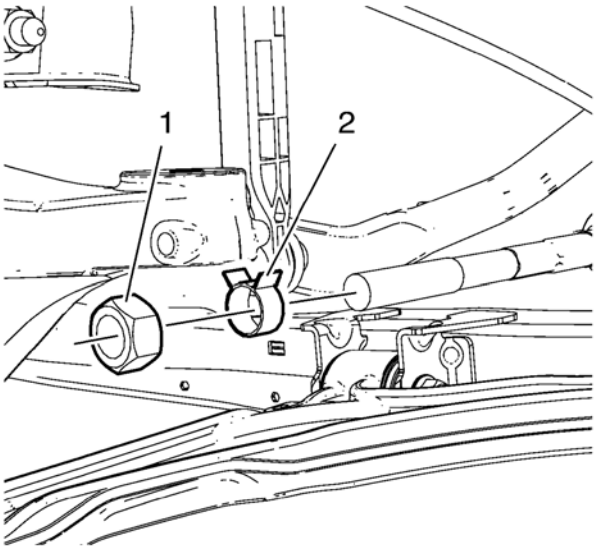
Steering Gear Boot Replacement

Special Tools

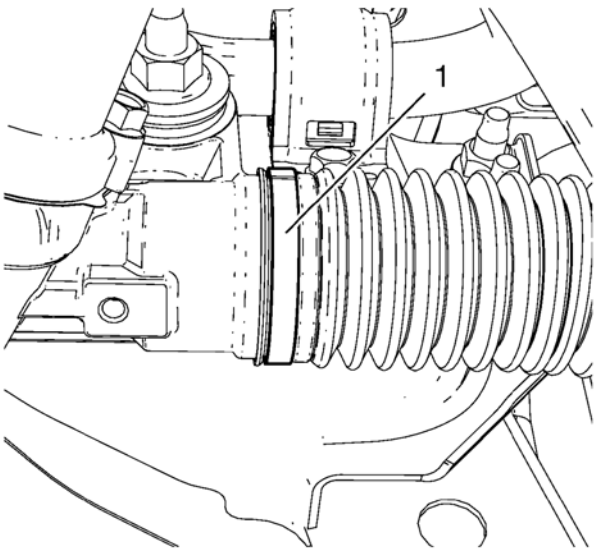
CH-804 Drive Axle Seal Clamp Pliers

Removal Procedure

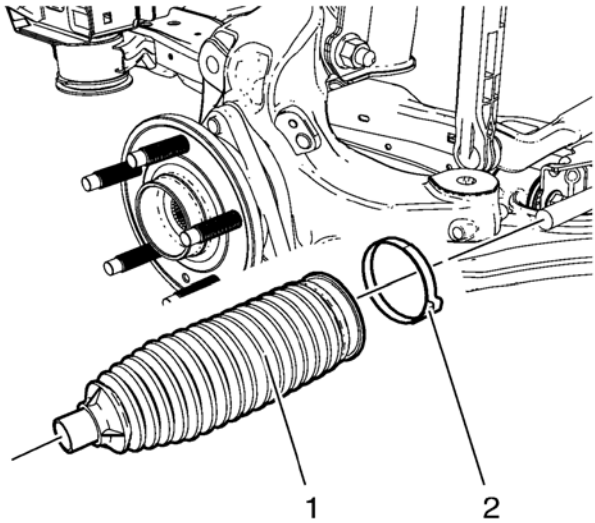
1. Remove the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).



2. Remove the steering linkage inner tie rod nut (1).
3. Remove the steering gear outer boot clamp (2).



4. Loosen the steering gear inner boot clamp (1). Mark installation position of boot clamp (1) on steering gear.

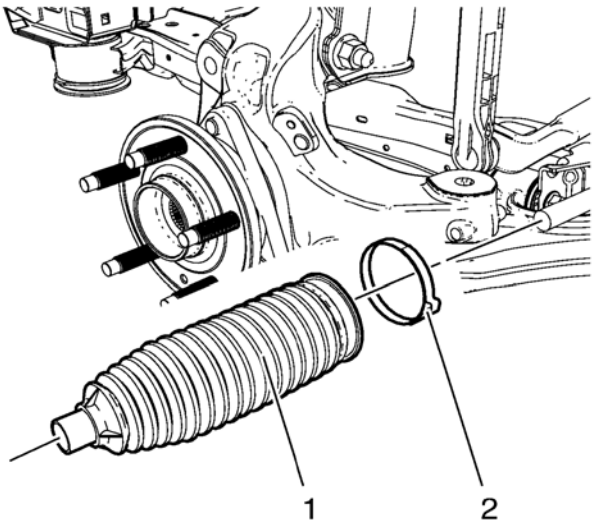


5. Remove the steering gear boot (1).

Note: After removing the boot, inspect the steering linkage inner tie rod for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the inner tie rod.

6. Remove the steering gear inner boot clamp (2).

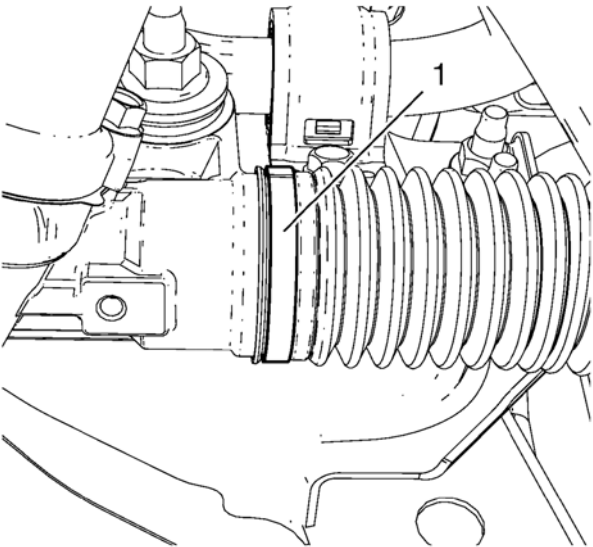
Installation Procedure



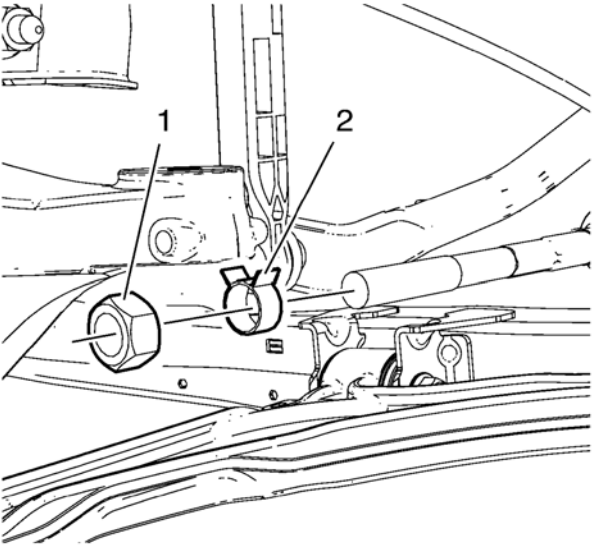
- 1. Install a new clamp (2) loosely on the inner part of the steering gear boot.
- 2. Apply grease from the service kit to the indicated locations.

Note: The steering gear boot must seat in the appropriate groove on the steering gear.

- 3. Install the steering gear boot (1) over the steering linkage inner tie rod and onto the steering gear.

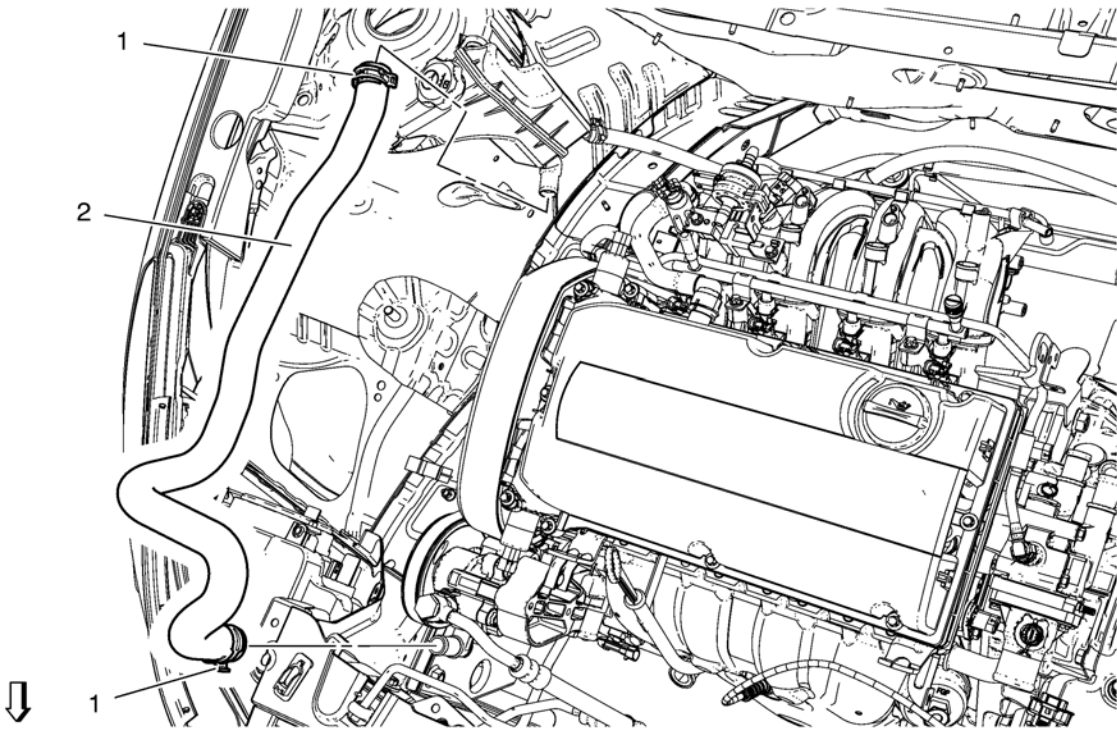


- 4. Adjust boot clamp (1) to marking on steering gear to keep correct installation position.
- 5. Using CH-804 pliers crimp the inner steering gear boot clamp (1).



- 6. Install the steering gear outer boot clamp (2).
- 7. Install the steering linkage inner tie rod nut (1).
- 8. Install the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).

Power Steering Fluid Reservoir Outlet Hose Replacement

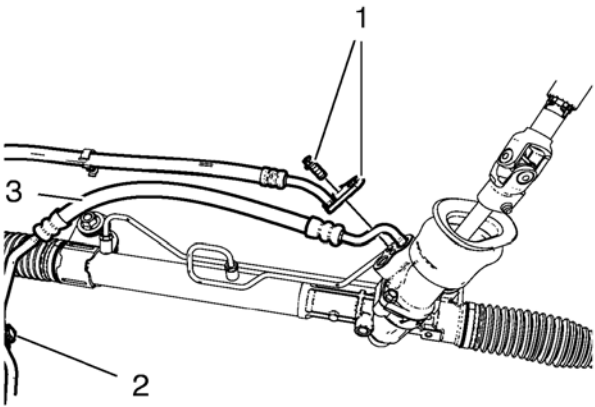


Callout	Component Name
Preliminary Procedure 1. Remove as much power steering fluid from the remote power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed.	
1	Hose Clamp Procedure Compress the power steering fluid reservoir outlet hose clamp from the power steering pump and power steering fluid reservoir.
2	Power Steering Fluid Reservoir Outlet Hose Procedure Fill and bleed the power steering system. Refer to Power Steering System Bleeding. Tip Clean any excess power steering fluid from the vehicle.

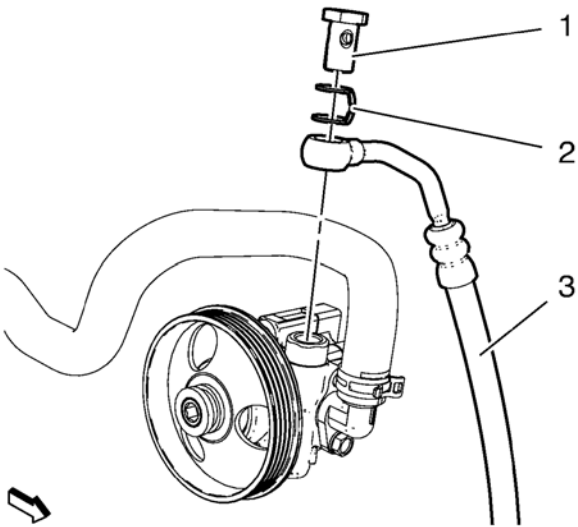
Power Steering Gear Inlet Pipe/Hose Replacement

Removal Procedure

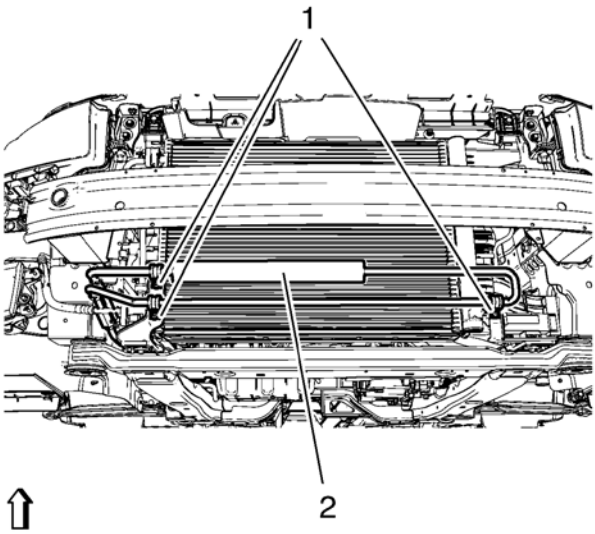
1. Remove front bumper fascia. Refer to [Front Bumper Fascia Replacement](#)
2. Remove as much power steering fluid from the remote power steering fluid reservoir as possible.
3. Place drain pans under the vehicle as needed.



4. Remove power steering gear inlet hose bolt (1).
5. Remove inlet hose (3) from clip (2).

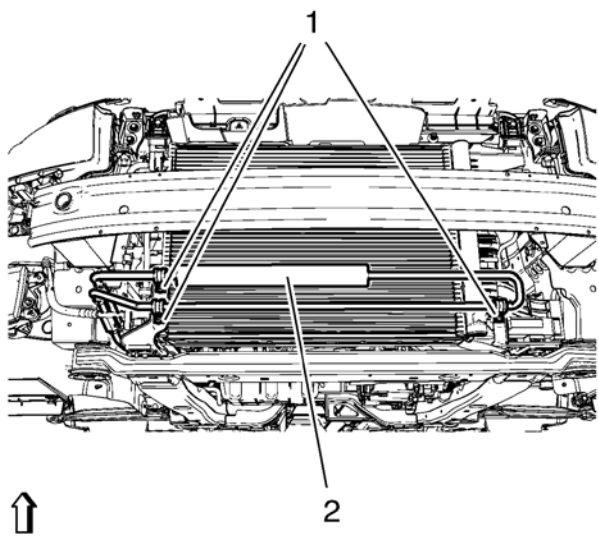


6. Unscrew hollow screw (1).
7. Remove gasket (2).
8. Remove inlet pipe (3) from power steering pump.



9. Unscrew 3 bracket nuts (1).
10. Remove power steering gear inlet pipe (2) from vehicle.
11. Extract the steering gear oil seal from the steering gear.

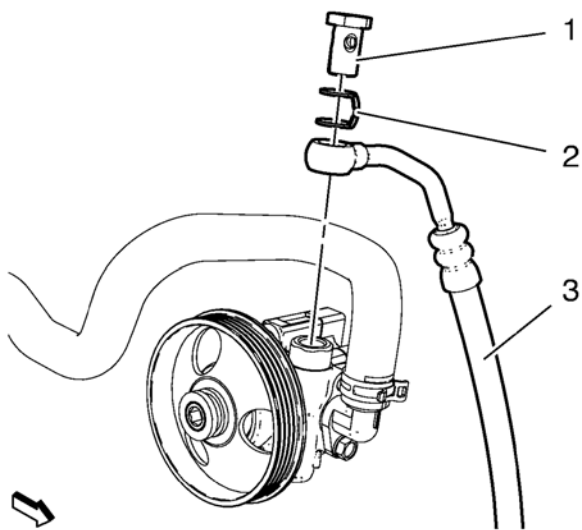
Installation Procedure



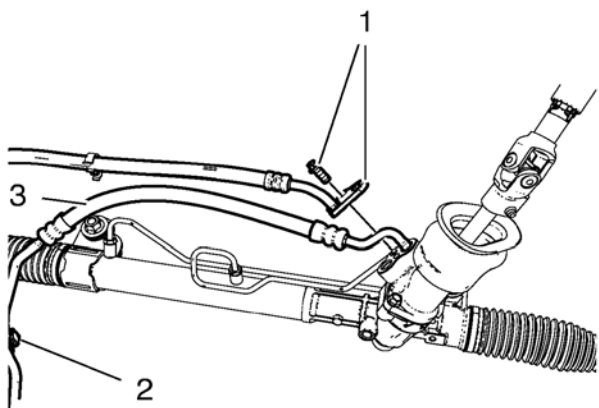
1. Install the NEW steering gear oil seal to the steering gear.
2. Ensure the steering gear oil seals are fully seated in the steering gear.
3. Install power steering gear inlet pipe (2) to vehicle.

Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install 3 bracket nuts (1) and tighten to **9 N·m (80 lb in)**.

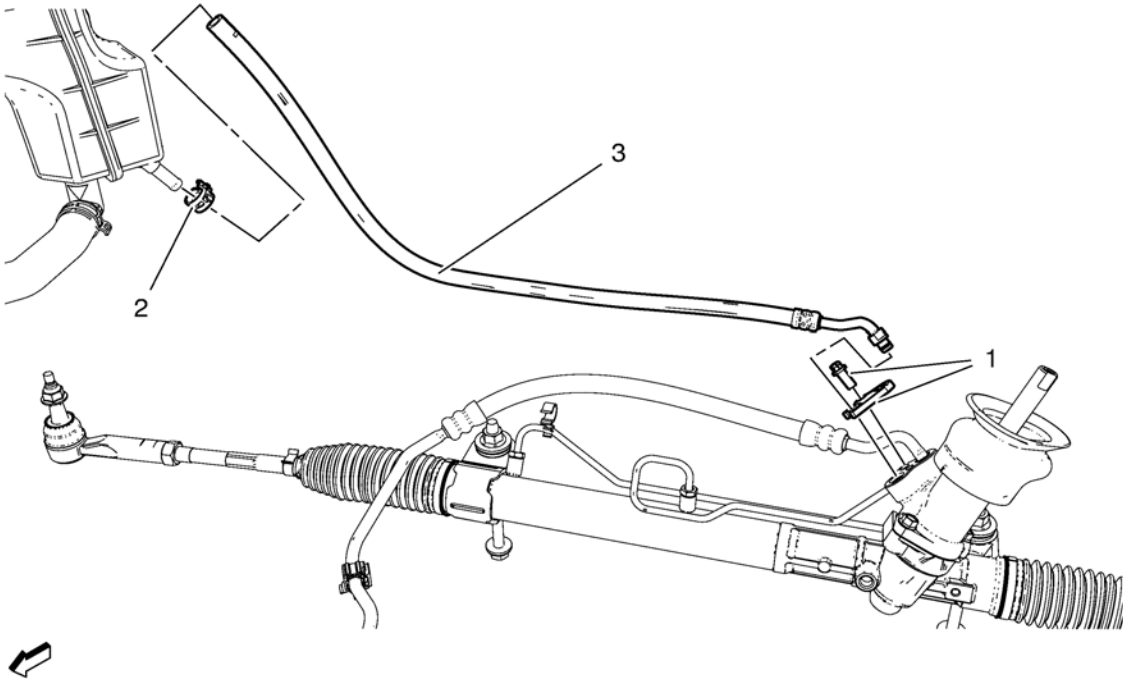


5. Install inlet pipe (3) to power steering pump.
6. Install gasket (2).
7. Install hollow screw (1) and tighten to **21 N·m (16 lb ft)**.



8. Install inlet hose (3) to clip (2).
9. Install power steering gear inlet hose bolt (1) and tighten to **11 N·m (98 lb in)**.
10. Clean any excess power steering fluid from the vehicle and remove the drain pans.
11. Install front bumper fascia. Refer to [Front Bumper Fascia Replacement](#)
12. Fill and bleed the power steering system. Refer to [Power Steering System Bleeding](#)

Power Steering Gear Outlet Pipe/Hose Replacement



Callout	Component Name
Preliminary Procedure 1. Remove as much power steering fluid from the remote power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed.	
1	Power Steering Gear Inlet Hose Bolt Caution: Refer to Fastener Caution in the Preface section. Tighten 11 N·m (98 lb in).
2	Hose Clamp Procedure Compress the power steering fluid reservoir outlet hose clamp from the power steering fluid reservoir.
3	Power Steering Gear Outlet Hose Procedure Fill and bleed the power steering system. Refer to Power Steering System Bleeding. Tip Clean any excess power steering fluid from the vehicle.

Steering Gear Replacement (Hydraulic Power Steering)

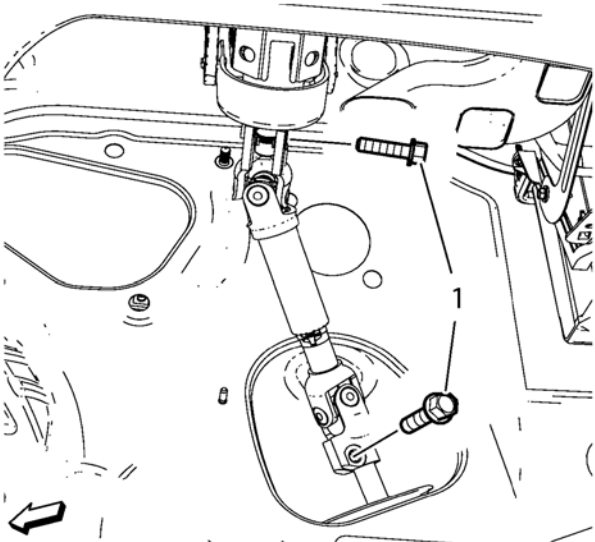
Special Tools

EN 45059 Torque Angle Sensor Kit

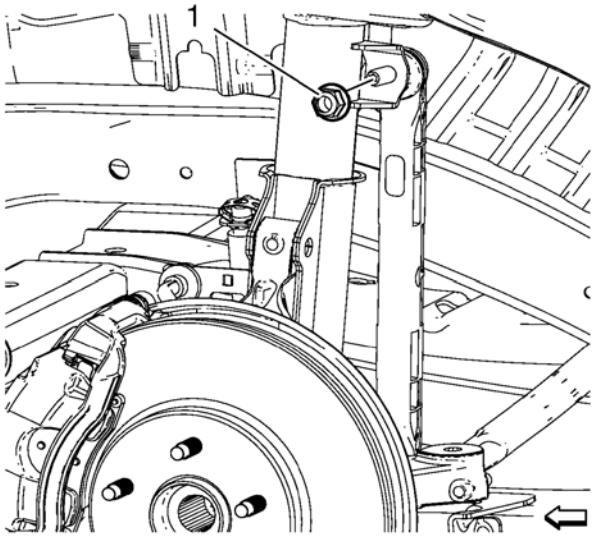
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

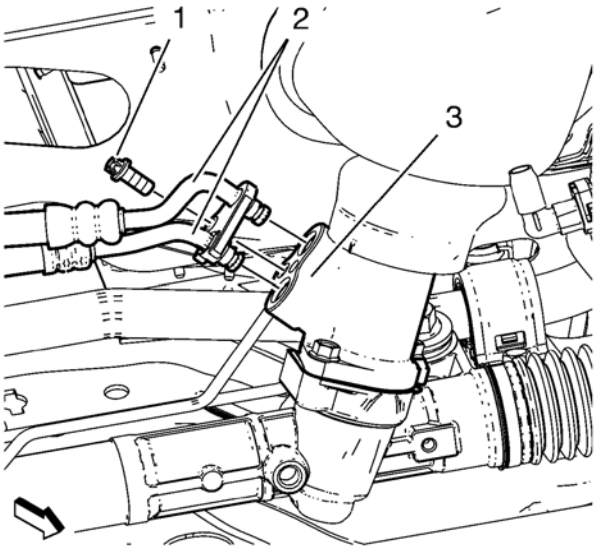
1. Turn the front wheels to the straight forward position and secure the steering wheel from moving.



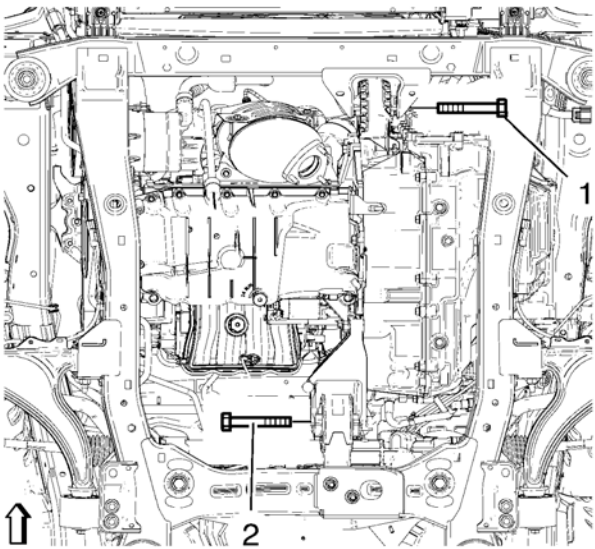
2. Remove the lower steering intermediate shaft bolt (1).
3. Remove the steering intermediate shaft from the steering gear.
4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
5. Remove the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
6. Remove the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).
7. Remove the front compartment splash shield. Refer to [Front Compartment Splash Shield Replacement](#).
8. Remove the front compartment insulator, if equipped. Refer to [Front Compartment Insulator Replacement](#).
9. Remove the steering linkage inner tie rod. Refer to [Steering Linkage Inner Tie Rod Replacement](#).



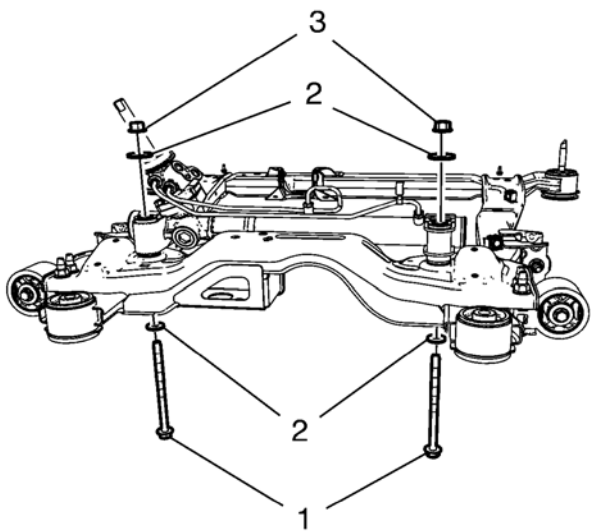
10. Remove and discard the stabilizer link shaft nut (1) from the strut.
11. Remove the stabilizer link shaft from the strut.
12. Place a large container under the vehicle in order to collect the draining fluid.



13. Remove the power steering gear inlet and outlet hose bolt (1), remove the inlet and outlet hose (2) from the steering gear (3).



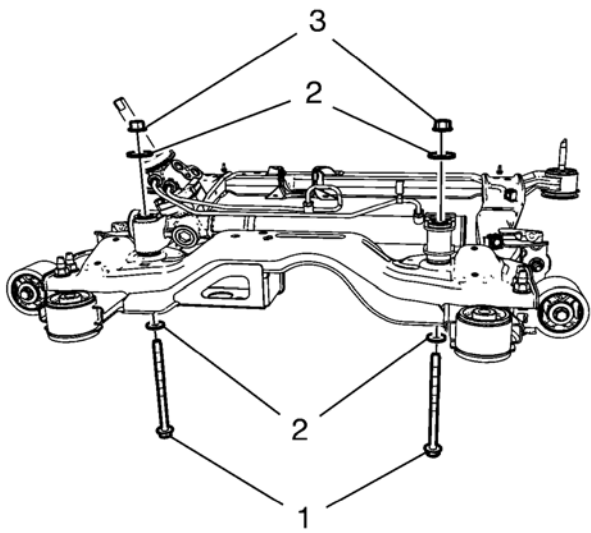
- 14. Remove the front (1) and the rear (2) transmission mount bracket bolts.
- 15. Remove the rear frame to body bolts. Refer to drivetrain and front suspension frame replacement [Drivetrain and Front Suspension Frame Replacement](#).
- 16. Lower the rear of the frame max. 50 mm (1.968 in) in order to gain clearance to the steering gear.



- 17. Remove and discard the steering gear bolts (1), nuts (3) and washers (2) from the steering gear.
- 18. Remove the steering gear.

Installation Procedure

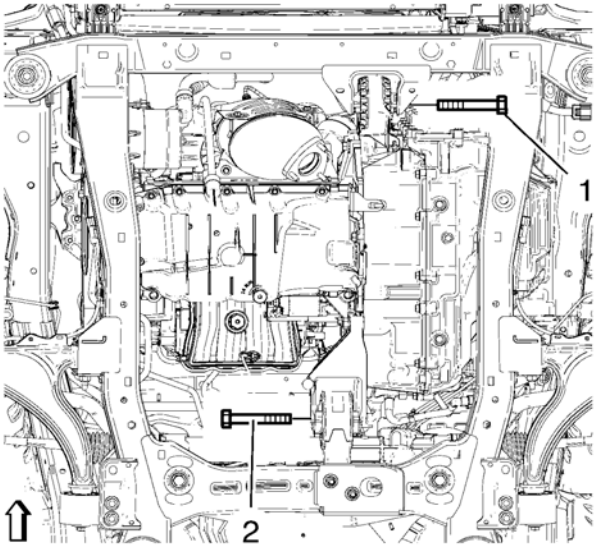
- 1. Install the steering gear.



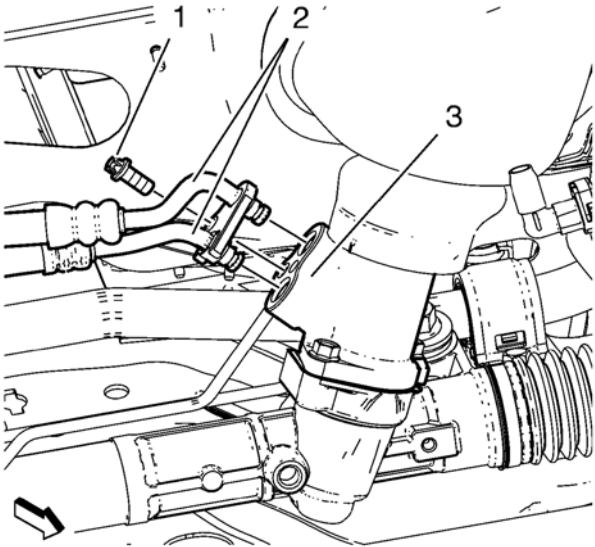
- 2. Install steering gear bolts (1), washers (2) and nuts (3) to the steering gear.

Caution: Refer to [Fastener Caution](#) in the Preface section.

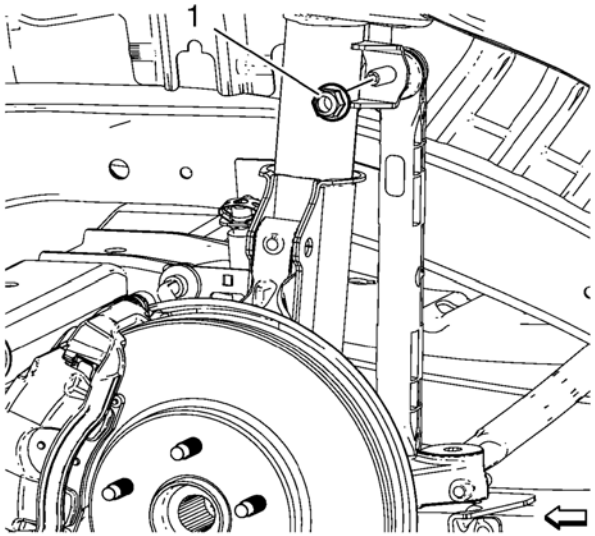
- 3. Tighten the NEW steering gear bolts to **125 N·m (93 lb ft) + 160°** , using the *EN 45059* kit .
- 4. Raise the frame with hydraulic jack.
- 5. Install the rear frame to body bolts. Refer to drivetrain and front suspension frame replacement [Drivetrain and Front Suspension Frame Replacement](#).



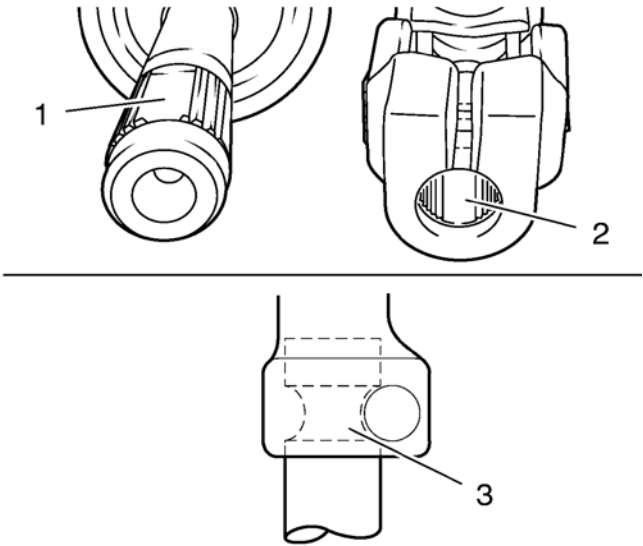
- 6. Install the front transmission mount bolt (1) and tighten to **58 N·m (43 lb ft)**.
- 7. Install the rear transmission mount bracket bolt (2) and tighten to **100 N·m (74 lb ft)**.



- 8. Replace the O-rings of the inlet and outlet hoses. Lubricate O-rings with a small amount of hydraulic oil.
- 9. Install the inlet and outlet hose (2) to the steering gear (3) and install the power steering gear inlet and outlet hose bolt (1). Tighten the power steering inlet and outlet hose bolt to **11 N·m (98 lb in)**.
- 10. Install the stabilizer shaft link to the strut.

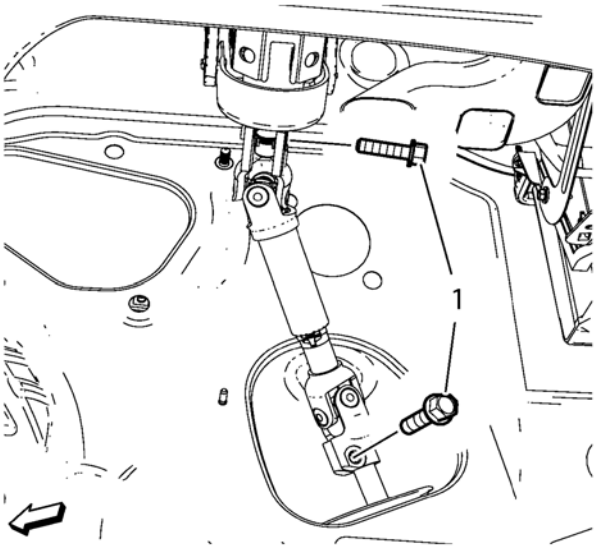


- 11. Install the NEW stabilizer shaft link nut (1) and tighten to **65 N·m (48 lb ft)**.
- 12. Install the steering linkage inner tie rod. Refer to [Steering Linkage Inner Tie Rod Replacement](#).
- 13. Install the front compartment insulator, if equipped. Refer to [Front Compartment Insulator Replacement](#).
- 14. Install the front compartment splash shield. Refer to [Front Compartment Splash Shield Replacement](#).
- 15. Install the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).
- 16. Install the front tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
- 17. Lower the vehicle.



Note: The recess (2) of the fine tothing in the universal joint have to align precisely with the recess (1) of the fine tothing on the steering pinion. The bore in the universal joint have to align with the groove on the steering pinion (3).

18. Check alignment of fine tothing of universal joint and steering pinion.



19. Install the lower intermediate steering shaft bolts and tighten to **34 N·m (26 lb ft)**.
20. Adjust the front toe. Refer to [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#).
21. Bleed the hydraulic steering system. Refer to [Power Steering System Bleeding](#).

Steering Linkage Inner Tie Rod Replacement (Hydraulic Power Steering)

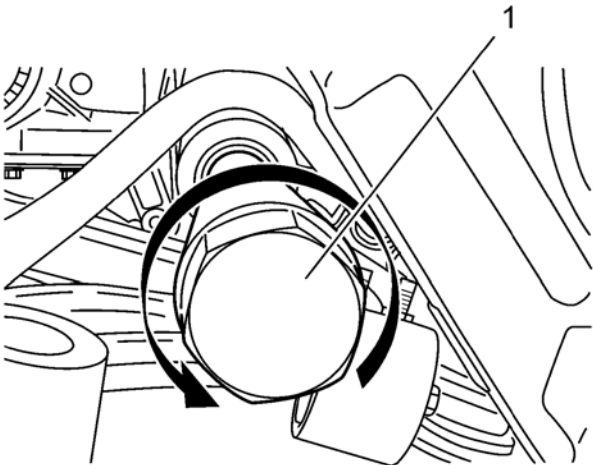
Special Tools

CH-6247 Removal and Installation Tool for the Steering Linkage Inner Tie Rod

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

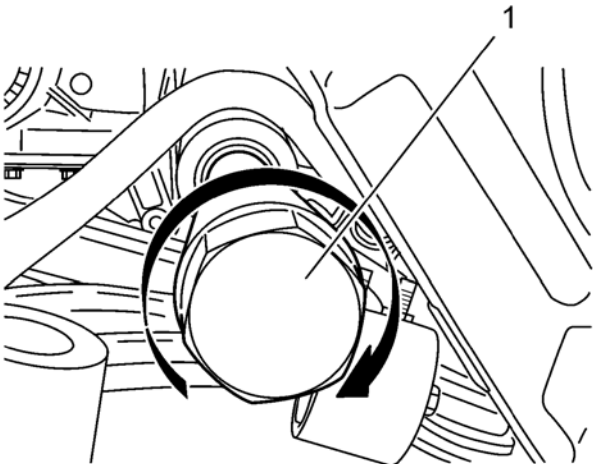
Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).
4. Remove the steering gear boot. Refer to [Steering Gear Boot Replacement](#).



5. Remove the steering linkage inner tie rod with CH-6247 remover/installer .

Installation Procedure



1. Apply threadlock compound to the threads of the inner tie rod.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the steering linkage inner rod using the CH-6247 remover/installer and tighten to **90 N·m (64 lb ft)**.
3. Install the steering gear boot. Refer to [Steering Gear Boot Replacement](#).
4. Install the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).
5. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
6. Measure the wheel alignment. Refer to [Wheel Alignment Measurement](#).
7. Adjust front toe. Refer to [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#).
8. Center the steering angle sensor. Refer to [Steering Angle Sensor Centering](#).

Steering Linkage Inner Tie Rod Replacement (Electronic Power Steering)

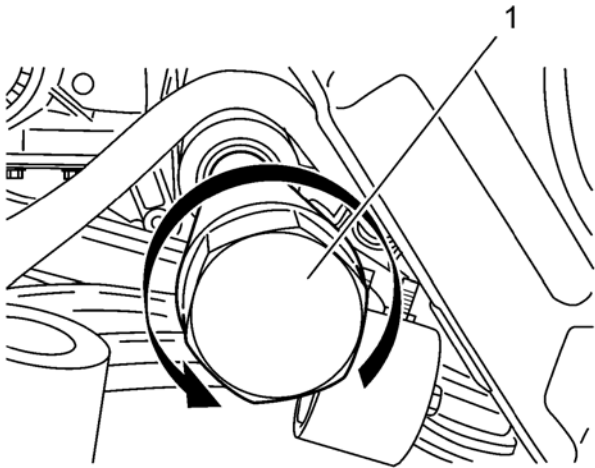
Special Tools

CH-6247 Removal and Installation Tool for the Steering Linkage Inner Tie Rod

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

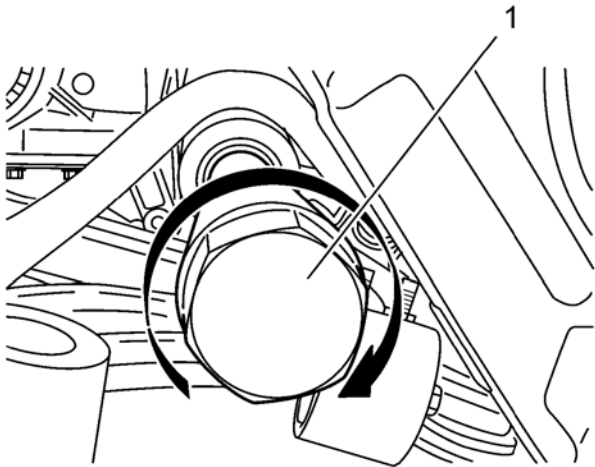
Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).
4. Remove the steering gear boot. Refer to [Steering Gear Boot Replacement](#).



5. Remove the steering linkage inner tie rod with CH-6247 remover/installer .

Installation Procedure



1. Apply threadlock compound to the threads of the inner tie rod.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the steering linkage inner rod using the CH-6247 remover/installer and tighten to **105 N·m (77 lb ft)**.
3. Install the steering gear boot. Refer to [Steering Gear Boot Replacement](#).
4. Install the steering linkage outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).
5. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
6. Measure the wheel alignment. Refer to [Wheel Alignment Measurement](#).
7. Adjust front toe. Refer to [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#).
8. Center the steering angle sensor. Refer to [Steering Angle Sensor Centering](#).

Power Steering System Description and Operation

The hydraulic power steering pump is a constant displacement vane-type pump that provides hydraulic pressure and flow for the power steering gear. The hydraulic power steering pumps are either belt-driven or direct-drive, cam-driven.

The power steering fluid reservoir holds the power steering fluid and may be integral with the power steering pump or remotely located. The following locations are typical locations for the remote reservoir:

- Mounted to the front of the dash panel
- Mounted to the inner fender
- Mounted to a bracket on the engine

The 2 basic types of power steering gears are listed below:

- A recirculating ball system
- A rack and pinion system

In the recirculating ball system, a worm gear converts steering wheel movement to movement of a sector shaft. A pitman arm attached to the bottom of the sector shaft actually moves one tie rod and an intermediate rod move the other tie rod.

In the rack and pinion system, the rack and the pinion are the 2 components that convert steering wheel rotation to lateral movement. The steering shaft is attached to the pinion in the steering gear. The pinion rotates with the steering wheel. Gear teeth on the pinion mesh with the gear teeth on the rack. The rotating pinion moves the rack from side to side. The lateral action of the rack pushes and pulls the tie rods in order to change the direction of the vehicle's front wheels.

The power steering pressure hose connects the power steering pump union fitting to the power steering gear and allows pressurized power steering fluid to flow from the pump to the gear.

The power steering return hose returns fluid from the power steering gear back to the power steering fluid reservoir. The power steering return line may contain an integral fin-type or line-type power steering fluid cooler.

In a typical power steering system, a pump generates hydraulic pressure, causing fluid to flow, via the pressure hose, to the steering gear valve assembly. The steering gear valve assembly regulates the incoming fluid to the right and left chambers in order to assist in right and left turns.

Turning the steering wheel activates the valve assembly, which applies greater fluid pressure and flow to one side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front wheels, which turn the vehicle right or left.

Variable Effort Steering System Description and Operation

The Variable Effort Steering (VES) system or MAGNASTEER® varies the amount of effort required to steer the vehicle as vehicle speed changes. At low speeds, the system provides minimal steering effort for easy turning and parking maneuvers. Steering effort is increased at higher speeds to provide firmer steering (road feel) and directional stability. VES works in parallel with the base torsion bar in the power steering system.

The VES control module communicates on the high speed bus and uses vehicle speed and the steering wheel angle speed to command a current that is most appropriate for each speed to the VES actuator in the steering rack and pinion. The actuator is a variable electromagnetic actuator, which consists of one multiple-pole ring-style permanent magnet, with a pole piece, and an electromagnetic coil assembly on each side. By commanding currents between -3 to +3 Amps through the coils the steering effort will be adapted to the vehicle's speed.

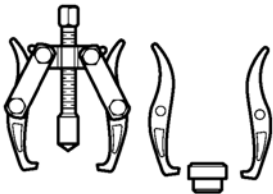
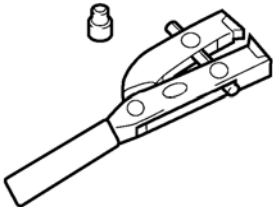
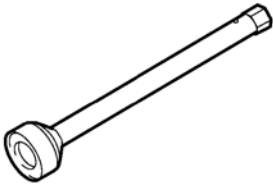
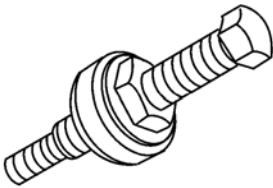
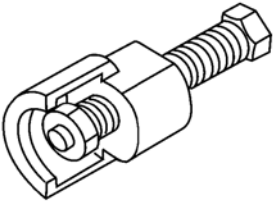
At lowest speed, around 5 km/h (3 mph) the coils are polarized in such a way that the magnetic forces are repelling each others and hardly any effort is required to turn the ring magnet between them.

At mid speed, around 70 km/h (45 mph), no current is sent through the coils and steering is assisted by hydraulics only. At high speeds the coils are polarized in such a way that the magnetic forces are attracting each others and high effort is required to turn the ring magnet between them.

The VES control module communicates on the HS GMLAN bus.

The VES control module has the ability to detect malfunctions in the actuator. Any malfunctions detected will cause the system to ramp to zero amps. Steering will be assisted by hydraulics only and a DTC is set.

Special Tools

Illustration	Tool Number / Description
	CH-161-B KM-161-B 87 91 343 J-22888-20A & J-22888-35 Puller
	CH-804 MKM-804 J-35566 Drive Axle Seal Clamp Pliers
	CH-6247 KM-4267 Removal and Installation Tool for the Steering Linkage Inner Tie Rod
	CH-25033-C KMJ-25033-C J-25033-C 89 96 415 Pulley Installer
	CH-25034-D KM-J-25034-D J-25034-D 89 96 423 Pulley Remover

Select a Document:

-  [Specifications](#)
-  [Column Lock Schematics](#)
-  [Intermediate Steering Shaft Replacement](#)
-  [Steering Column Upper Trim Cover Replacement](#)
-  [Steering Column Lower Trim Cover Replacement](#)
-  [Turn Signal Switch Replacement](#)
-  [Steering Wheel Replacement](#)
-  [Steering Column Replacement \(Right Hand Drive\)](#)
-  [Steering Angle Sensor Replacement](#)
-  [Steering Wheel and Column Description and Operation](#)

Fastener Tightening Specifications

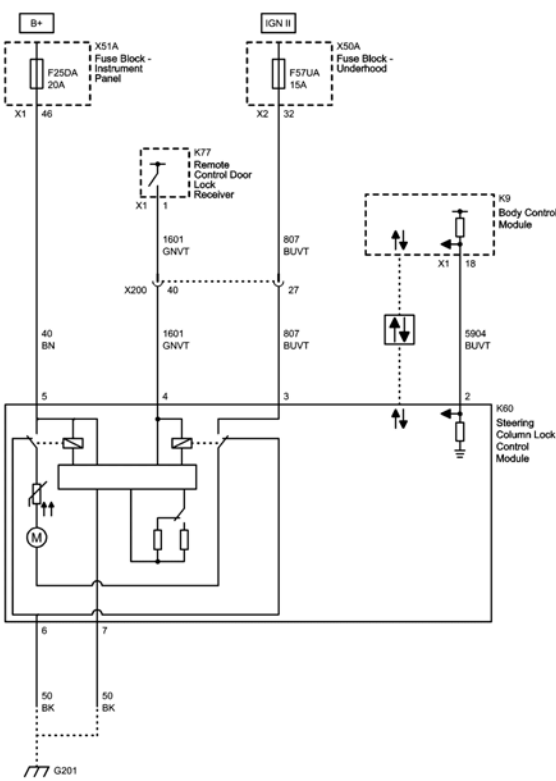
Application	Specification	
	Metric	English
Intermediate Steering Shaft Lower Bolt	34 N·m	26 lb ft
Intermediate Steering Shaft Upper Bolt	34 N·m	26 lb ft
Steering Wheel Bolt	35 N·m	26 lb ft

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number
Steering Wheel Bolt	Locking Compound	Refer to Electronic Parts Catalog

Column Lock Schematics

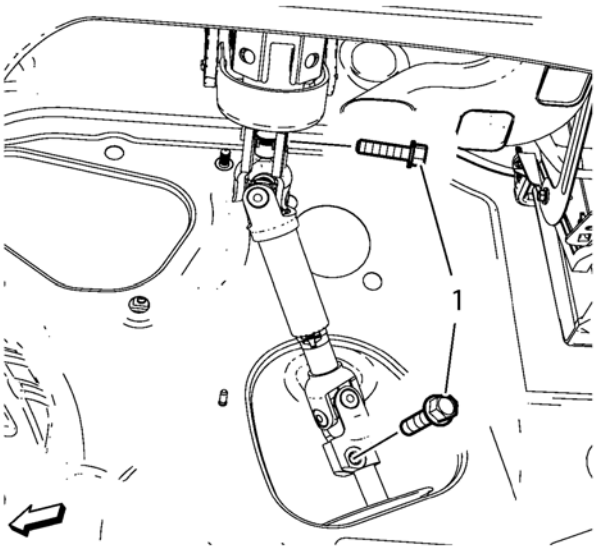
Assembly Column Lock



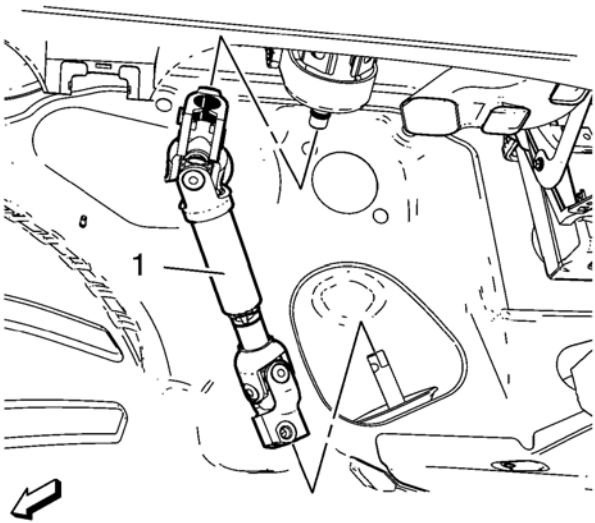
Intermediate Steering Shaft Replacement

Removal Procedure

1. Turn the steering wheel to the straight forward position and support it from movement.

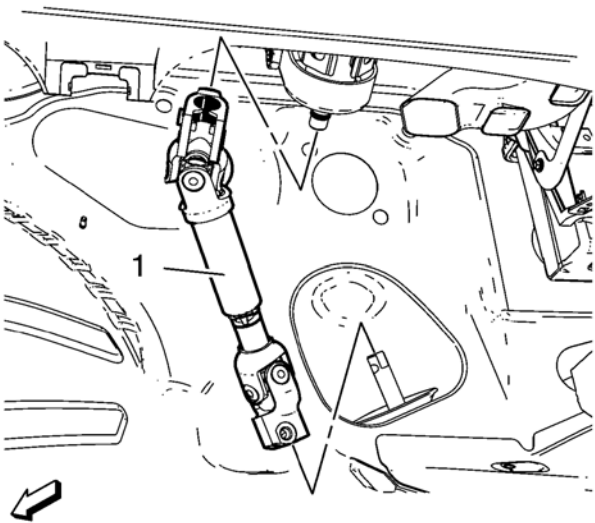


2. Remove the 2 intermediate steering shaft bolts (1).

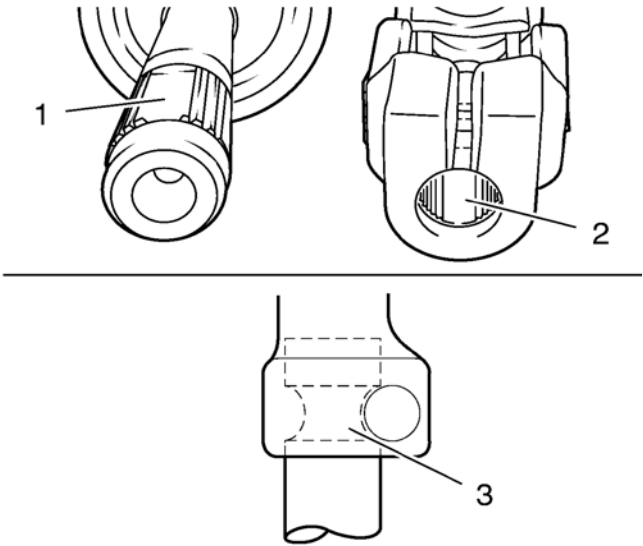


3. Remove the intermediate steering shaft (1).

Installation Procedure



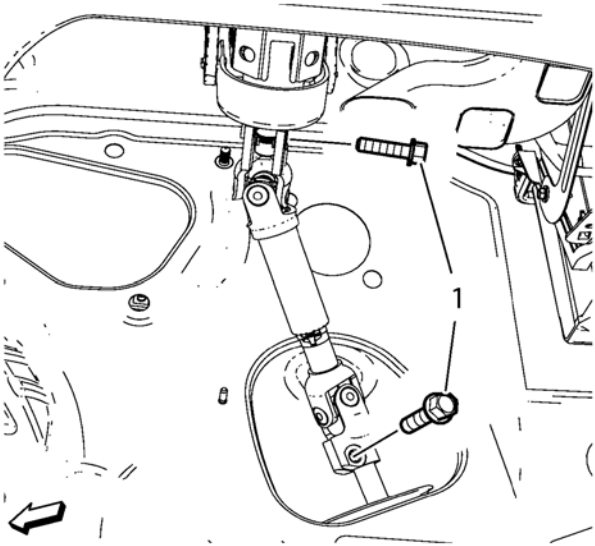
1. Install the intermediate steering shaft (1).



Note: The recess (2) of the fine tothing in the universal joint have to align precisely with the recess (1) of the fine tothing on the steering pinion. The bore in the universal joint has to align with the groove on the steering pinion (3).

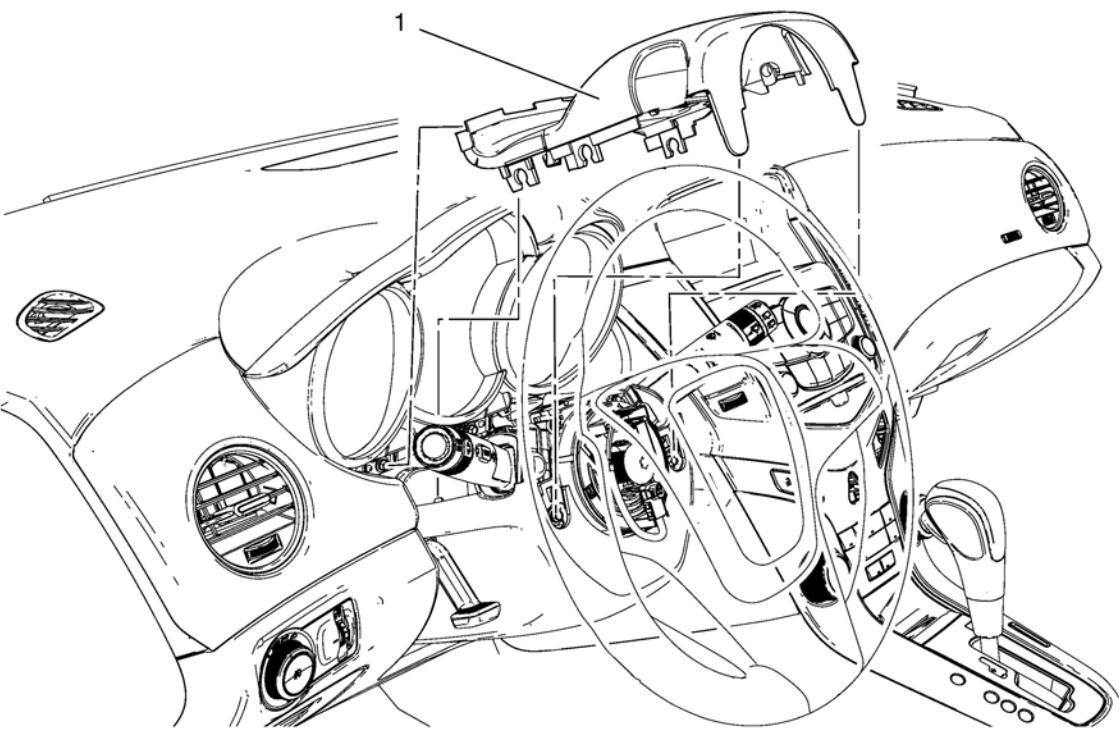
2. Push universal joint onto steering pinion carefully as desribed above inthe note.

Caution: Refer to [Fastener Caution](#) in the Preface section.



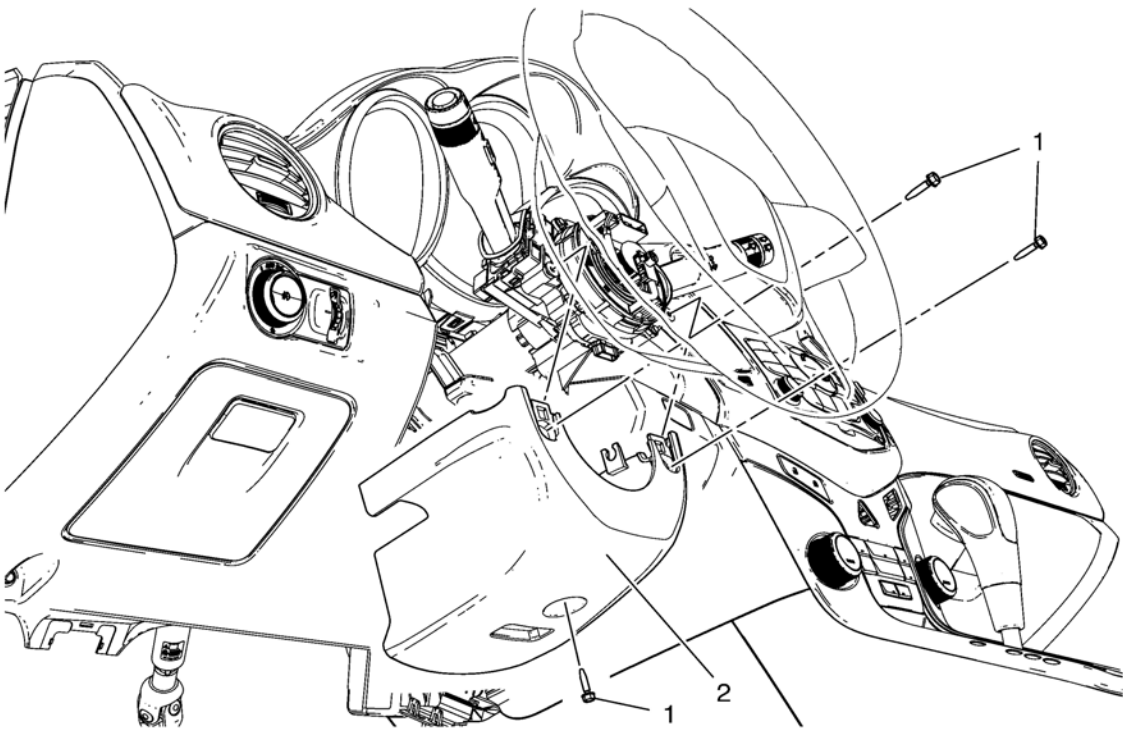
3. Install the 2 intermediate steering shaft bolts (1). Tighten the intermediate steering shaft bolts **34 N·m (25 lb ft)**.

Steering Column Upper Trim Cover Replacement



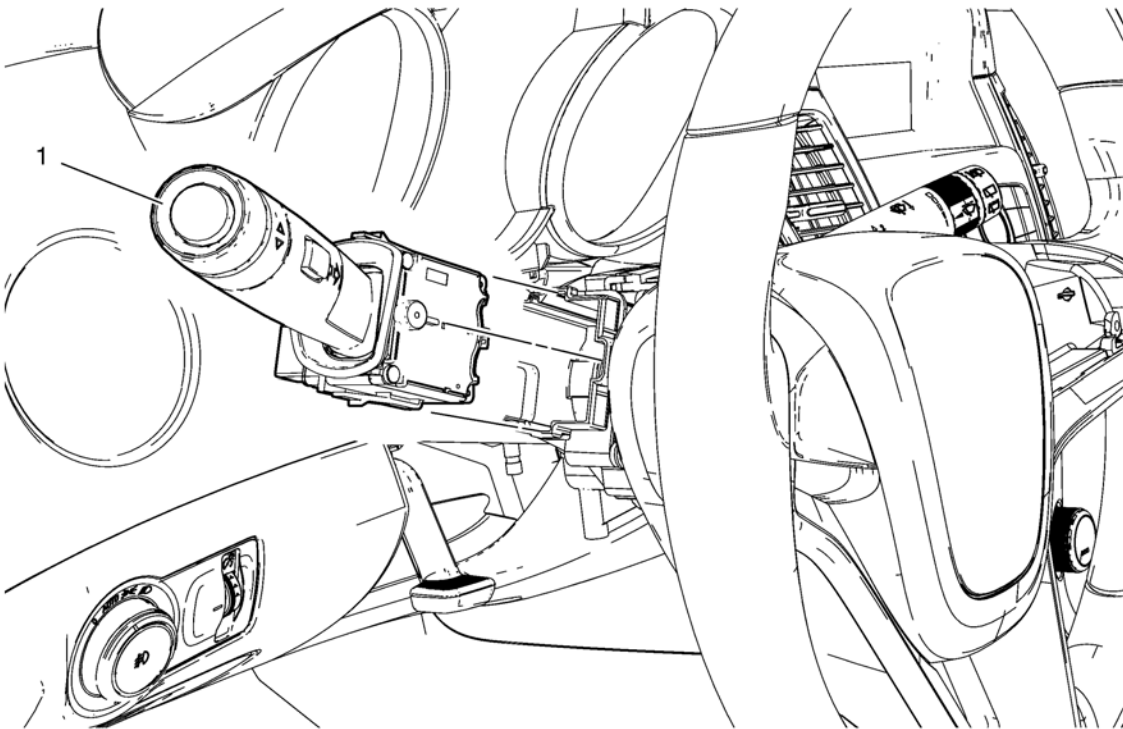
Callout	Component Name
1	Steering Column Upper Trim Cover Procedure Unclip the steering column upper trim cover from the steering column lower trim cover.

Steering Column Lower Trim Cover Replacement



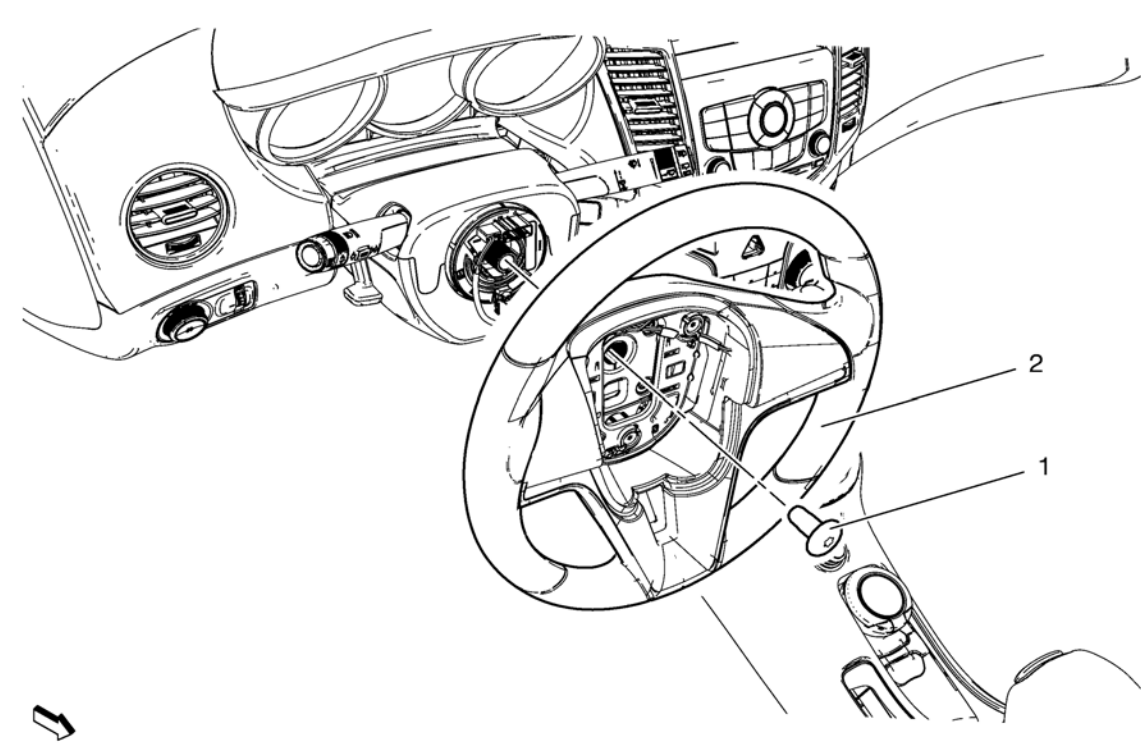
Callout	Component Name
Preliminary Procedure Remove the steering column upper trim cover. Refer to Steering Column Upper Trim Cover Replacement .	
1	Steering Column Lower Trim Cover Bolt (Qty: 3) Caution: Refer to Fastener Caution in the Preface section. Tighten 2.5 N·m (22 lb in)
2	Steering Column Lower Trim Cover Procedure Turn the steering wheel until the bolts are reachable.

Turn Signal Switch Replacement



Callout	Component Name
Preliminary Procedure 1. Remove the steering column upper trim cover. Refer to Steering Column Upper Trim Cover Replacement. 2. Remove the steering column lower trim cover. Refer to Steering Column Lower Trim Cover Replacement.	
1	Turn Signal Switch Procedure 1. Disconnect any electrical connectors as needed. 2. Release the plastic retaining tabs to release the turn signal switch from steering wheel inflatable restraint module coil.

Steering Wheel Replacement



Callout	Component Name
Preliminary Procedure Remove the inflatable restraint steering wheel module. Refer to Steering Wheel Inflatable Restraint Module Replacement .	
1	Steering Wheel Bolt Caution: Refer to Fastener Caution in the Preface section. Procedure - Clean thread of the bolt. - Apply locking compound to the thread. Refer to Adhesives, Fluids, Lubricants, and Sealers Tighten 30 N·m (23 lb ft)
2	Steering Wheel Procedure - Disconnect electrical connectors as needed. - Remove the steering wheel carefully.

Steering Column Replacement (Right Hand Drive)

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

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

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.

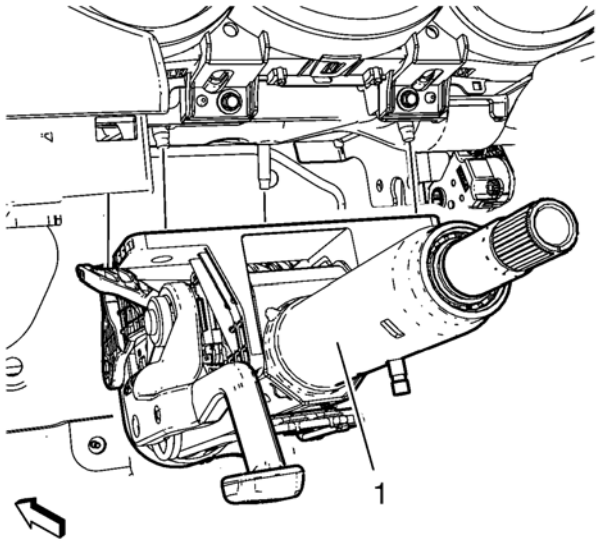
Caution: Once the steering column is removed from the car, the column is extremely susceptible to damage. Dropping the column on its end could collapse the steering shaft or loosen the plastic injections which maintain column rigidity. Leaning on the column could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon as hammering could loosen plastic injections which maintain column rigidity.

Removal Procedure

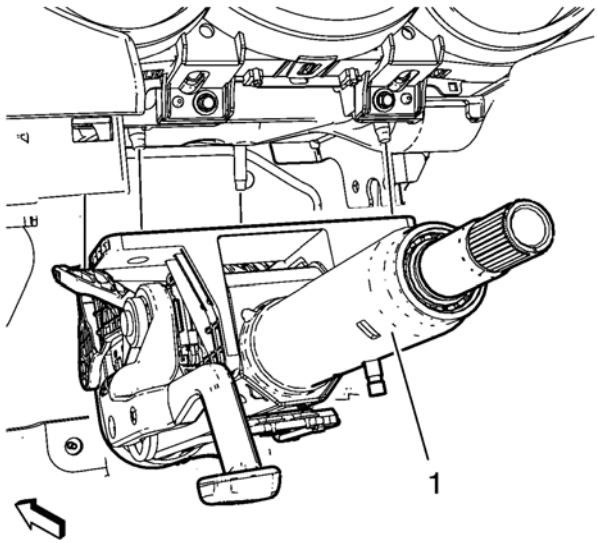
1. Remove the instrument panel lower trim pad cover. Refer to [Instrument Panel Lower Trim Panel Replacement - Left Side](#).
2. Remove the intermediate steering shaft. Refer to [Intermediate Steering Shaft Replacement](#).
3. Remove the steering wheel. Refer to [Steering Wheel Replacement](#).
4. Remove the steering column upper trim cover. Refer to [Steering Column Upper Trim Cover Replacement](#).
5. Remove the steering column lower trim cover. Refer to [Steering Column Lower Trim Cover Replacement](#).
6. Disconnect any electrical connectors as needed.

Note: Install tie straps between the tilt lever bracket and the base of the steering column to prevent the steering column jacket from pulling apart. The tilt lever **MUST** be in the LOCK (FULL UP) position during the steering column removal and installation to ensure that the tilt lever bracket remains rigid. Also install tie straps around the tilt lever and the steering column jacket to keep the tilt lever in the LOCK position. Do not bend the steering column energy absorbing straps located on the upper steering column mounting bracket.

7. Install tie straps as described above.



8. Remove the steering column nuts (1).

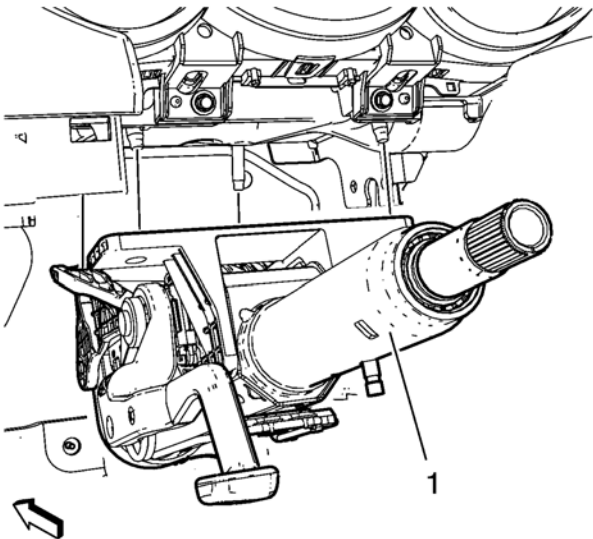


9. Remove the steering column.

Installation Procedure

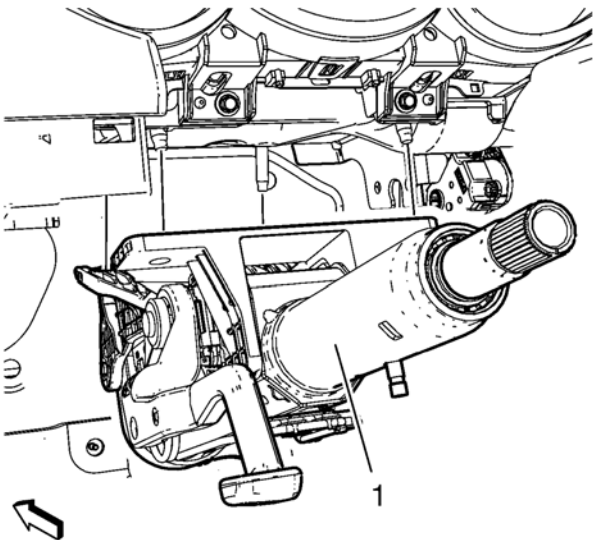
Note: Start all nuts by hand before finalizing any torques.

Note: Do not bend the steering column energy absorbing straps located on the upper steering column mounting bracket during installation.



1. Install the steering column.

Caution: Refer to [Fastener Caution](#) in the Preface section.



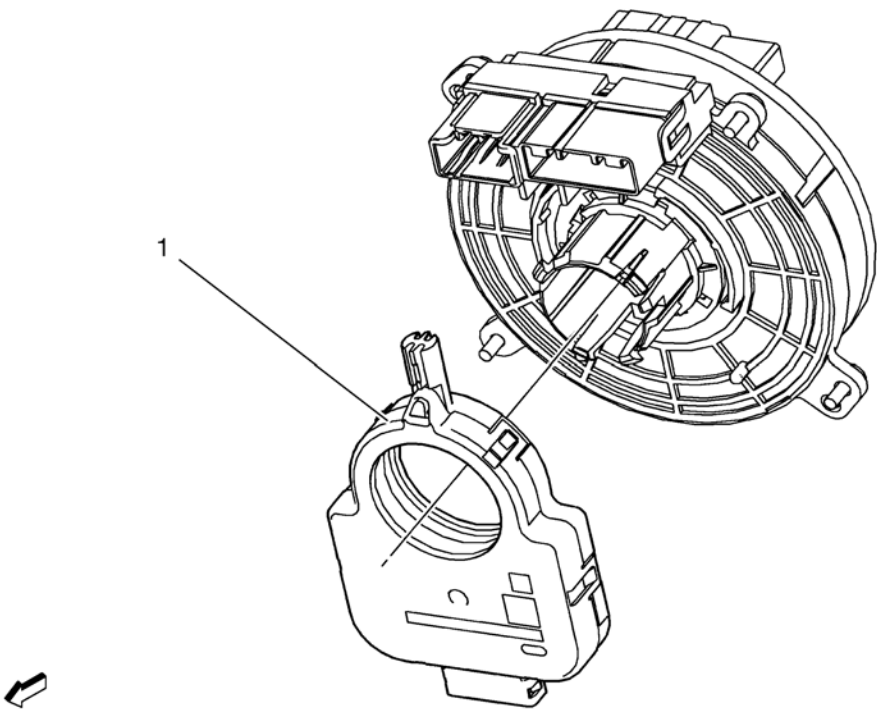
2. Install the steering column nuts (1). Tighten the steering column nuts **22 N·m (16 lb ft) + 45°**.

Warning: In order to ensure the intended function of the steering column in a vehicle during a crash and in order to avoid personal injury to the driver, perform the following:

- Tighten the steering column lower fasteners before you tighten the steering column upper fasteners. Failure to do this can damage the steering column.
- Tighten the steering column fasteners to the specified torque. Overtightening the upper steering column fasteners could affect the steering column collapse.

3. Remove the tie straps.
4. Connect any electrical connectors as needed.
5. Install the steering column lower trim cover. Refer to [Steering Column Lower Trim Cover Replacement](#).
6. Install the steering column upper trim cover. Refer to [Steering Column Upper Trim Cover Replacement](#).
7. Install the steering wheel. Refer to [Steering Wheel Replacement](#).
8. Install the intermediate steering shaft. Refer to [Intermediate Steering Shaft Replacement](#).
9. Install the instrument panel lower trim pad cover. Refer to [Instrument Panel Lower Trim Panel Replacement - Left Side](#).
10. Calibrate the steering angle sensor. Refer to [Power Steering Control Module Calibration](#).

Steering Angle Sensor Replacement



Callout	Component Name
Preliminary Procedure Remove the steering wheel inflatable restraint module coil. Refer to Steering Wheel Inflatable Restraint Module Coil Replacement.	
1	Steering Wheel Position Sensor Warning: Never rotate the steering angle sensor. Rotating the steering angle sensor could limit the operation of the electronic power steering (EPS) system, and result in personal injury. Procedure - Press in the clip on the inflatable restraint steering wheel module clock-spring coil to remove the sensor. - Calibrate the steering angle sensor. Refer to Power Steering Control Module Calibration.

Steering Wheel and Column Description and Operation

The steering wheel and column has 4 primary functions:

- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Vehicle Steering

The steering wheel is the first link between the driver and the vehicle. The steering wheel is fastened to a steering shaft within the column. At the lower end of the column, the intermediate shaft connects the column to the steering gear.

Vehicle Security, Found on Some Vehicle Models

Theft deterrent components are mounted and designed into the steering column. The following components allow the column to be locked in order to minimize theft:

- The ignition switch--location varies
- The steering column lock--content varies
- The ignition cylinder--location varies
- The theft deterrent module--location varies

Driver Convenience

The steering wheel and column may also have driver controls attached for convenience and comfort. The following controls may be mounted on or near the steering wheel or column.

- The turn signal switch
- The hazard switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad/cruise control switch
- The redundant radio/entertainment system controls
- The manual/power tilt or tilt/telescoping functions
- The power pedal adjustment control switch
- The navigation
- The HVAC controls

Driver Safety

The steering wheel and column has safety features to protect the driver. The following components may be mounted on or near the steering column:

Energy-Absorbing Steering Column: The energy-absorbing steering column compresses in the event of a front-end collision, which reduces the chance of injury to the driver. The energy-absorbing feature, collapsible steering shaft, and break away mounting features help reduce the injury in the event of an accident. In addition to these features, the following driver safety features may be on the steering column:

Electronic Park Lock (EPL) / Ignition Lock Cylinder Control Actuator: If the vehicle is equipped with automatic transmission and a floor mounted console gear shift, it has an ignition lock cylinder control actuator system in the steering column. The ignition lock cylinder control actuator purpose is to prevent the ignition key from being turned to the OFF position when the transmission is in any position other than PARK and the vehicle may still be moving. The column ignition lock system consists of an ignition lock cylinder control actuator, and a park position switch that is located in the automatic transmission shift lock control switch. The ignition lock cylinder control actuator contains a pin that is spring loaded to mechanically prevent the ignition key cylinder from being turned to the lock position when the vehicle transmission is not in the PARK position. If vehicle power is lost, and/or the transmission is not in the PARK position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column.

SIR Coil and Module: For additional information on the operation of the SIR coil and module, refer to [SIR System Description and Operation](#).

Steering Wheel Angle Sensor or Steering Wheel Position Sensor: The steering wheel position sensor is located somewhere along the steering shaft assembly. The sensor measures the position of the steering wheel and the speed at which it is rotated. A signal representing this measurement is provided to the vehicle stability enhancement system (VSES) module. The VSES module uses this signal, along with several others representing different vehicle conditions, to monitor the driving behavior of the vehicle and ensure that it stays in control. If the VSES module determines that the vehicle is out of control it provides signals to the powertrain control module (PCM) and the ABS module. These output signals are used to modulate the transmission torque and brake pressure of each of the vehicles wheels in order to regain control of the vehicle.