

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accessory Mounting Bracket Bolts and Nut	50 N·m	37 lb ft
Adjuster Lock Nut	49 N·m	36 lb ft
Adjuster Plug Lock Nut	68 N·m	50 lb ft
Cylinder Lines to Gear Fitting-Cylinder End	27 N·m	20 lb ft
Cylinder Lines to Gear Fitting-Valve End	17 N·m	13 lb ft
Hydraulic Brake Booster Inlet and Outlet Hose Fittings	33 N·m	24 lb ft
Inner Tie Rod to Power Steering Gear	100 N·m	74 lb ft
Lower Intermediate Steering Shaft to Steering Gear Retaining Bolt	61 N·m	45 lb ft
Outer Tie Rod to Steering Knuckle Retaining Nut	63 N·m	47 lb ft
Pitman Arm to Power Steering Gear Mounting Nut	250 N·m	184 lb ft
Pitman Arm to Relay Rod Retaining Nut	63 N·m	47 lb ft
Pitman Shaft Side Cover Bolts	62 N·m	46 lb ft
Power Steering Cooler Hose to Power Steering Gear	33 N·m	24 lb ft
Power Steering Cooler Mounting Bolts (GT4)	5 N·m	44 lb in
Power Steering Cooler Mounting Nuts (GT5)	28 N·m	21 lb ft
Power Steering Gear End Housig Bolts	62 N·m	46 lb ft
Power Steering Gear Mounting Bolts	150 N·m	111 lb ft
Power Steering Gear Outlet Hose to the Steering Gear	33 N·m	24 lb ft
Power Steering Pump Flow Control Valve to Power Steering Pump	75 N·m	55 lb ft
Power Steering Pump Front Mounting Bolts	50 N·m	37 lb ft
Power Steering Pump Lower and Rear Mounting Nuts (4.3L)	41 N·m	30 lb ft
Power Steering Pump Mounting Studs	58 N·m	43 lb ft
Power Steering Pump Rear Bracket Mounting Nuts	50 N·m	37 lb ft
Power Steering Pump Rear Mounting Bolt (4.8L, 5.3L, 6.0L, and 6.6L)	41 N·m	30 lb ft
Power Steering Remote Reservoir Retaining Nuts	11 N·m	97 lb in

[2009 Chevrolet Express - AWD](#) | [Express, Savana \(VIN G/H\) Service Manual](#) | [Steering](#) | [Power Steering](#) | [Specifications](#) |

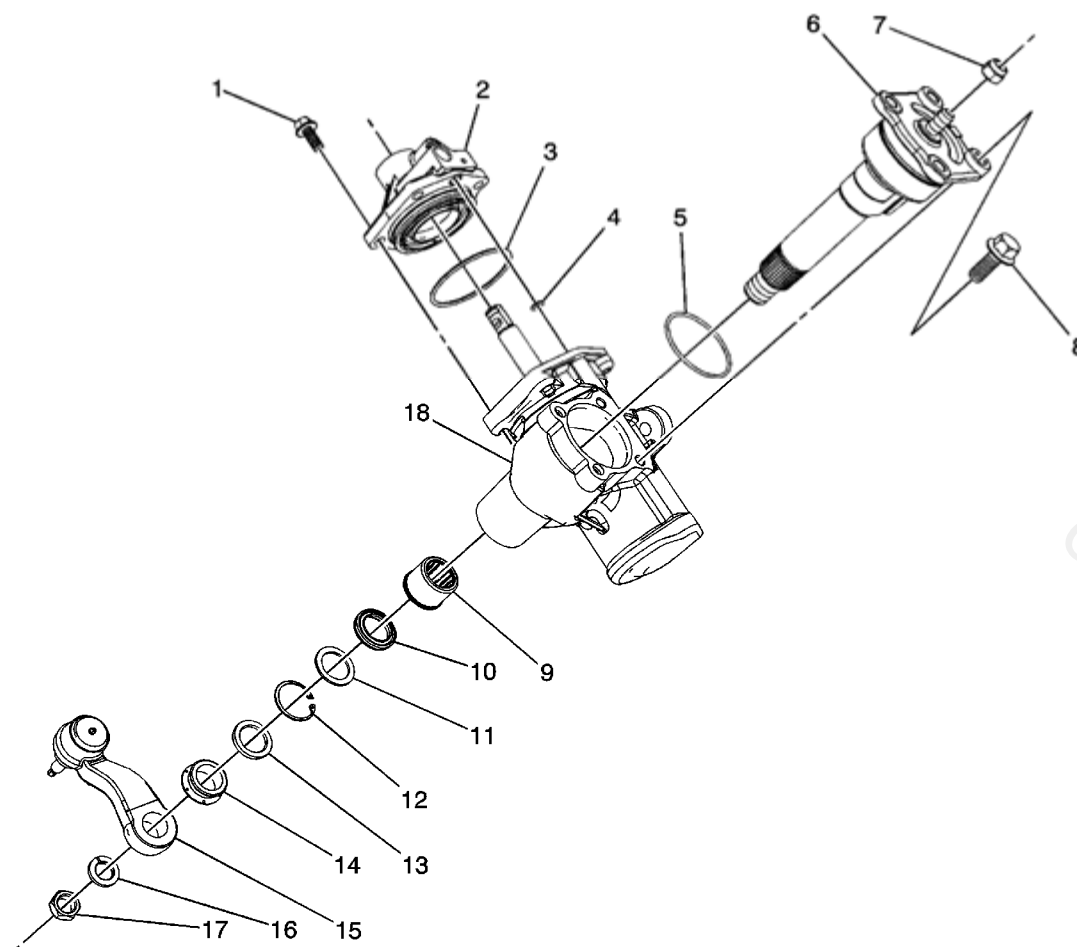
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Power Steering Pump Specifications

Vehicle	Engine Code	Engine Size	High Flow (Liters per Minute)	High Flow (Gallons per Minute)	Pressure Relief(kPa)	Pressure Relief (PSI)
G 15/25/35 Series 7200/8600 GVW	LU3	4.3L	12.2/14.0	2.7/3.1	9825/10514	1425/1525
	LR4	4.8L				
	LM7	5.3L				
	LQ4	6.0L				
	LLY	6.6L				

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Power Steering Gear Disassembled View (680 Gear)



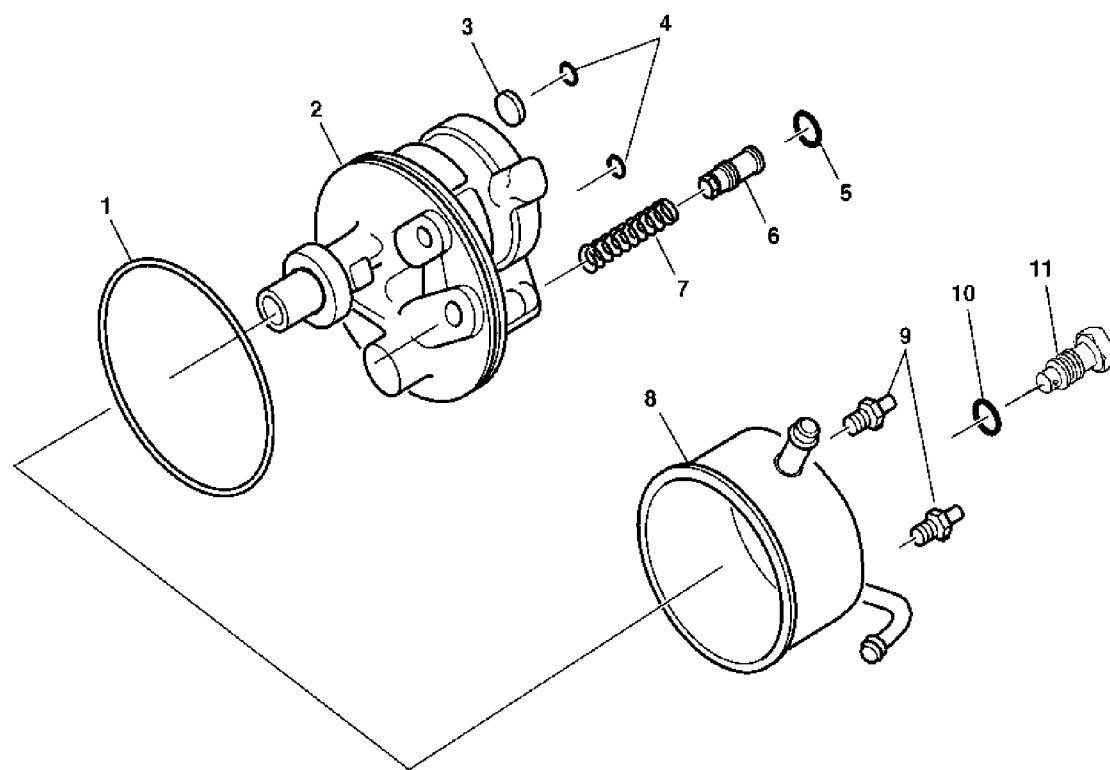
- (1) Stub Shaft Housing Bolt
- (2) Stub Shaft Housing
- (3) Stub Shaft Housing O-Ring
- (4) Stub Shaft Housing O-Ring
- (5) Steering Gear Pitman Shaft Housing Cover O-Ring
- (6) Steering Gear Pitman Shaft and Housing Cover
- (7) Steering Gear Pitman Shaft Lash Adjuster Nut
- (8) Steering Gear Pitman Shaft Housing Cover Bolt
- (9) Steering Gear Pitman Shaft Bearing
- (10) Steering Gear Pitman Shaft Seal
- (11) Steering Gear Pitman Shaft Washer
- (12) Steering Gear Pitman Shaft Seal Retaining Ring

- (13) Dust Seal
- (14) Pitman Arm Boot
- (15) Pitman Arm
- (16) Pitman Arm Washer
- (17) Pitman Arm Nut
- (18) Steering Gear Housing

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Power Steering Pump Disassembled View

Power Steering Pump



- (1) O-ring Seal
- (2) Hydraulic Pump Housing Assembly
- (3) Magnet
- (4) Rectangular Section Seal
- (5) Rectangular Section Seal
- (6) Control Valve Assembly
- (7) Flow Control Spring
- (8) Hydraulic Pump Reservoir Assembly
- (9) Pump Mounting Studs
- (10) O-ring Seal
- (11) Connector and Fitting Assembly

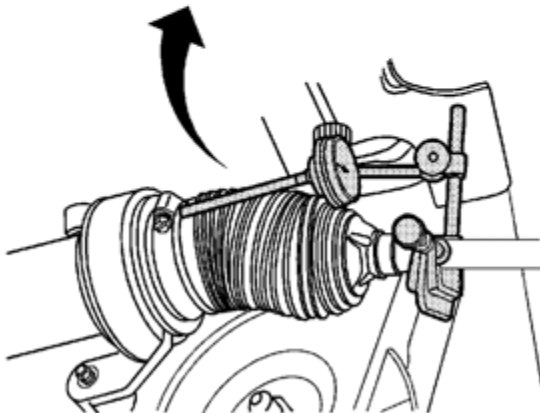
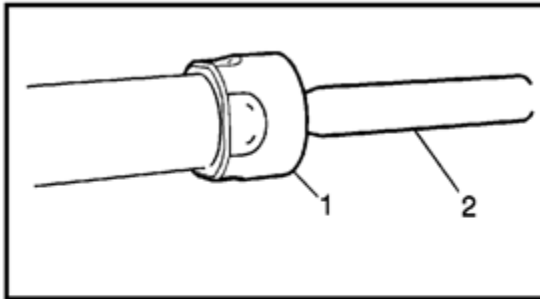
Steering Linkage Inner Tie Rod Inspection

Special Tools

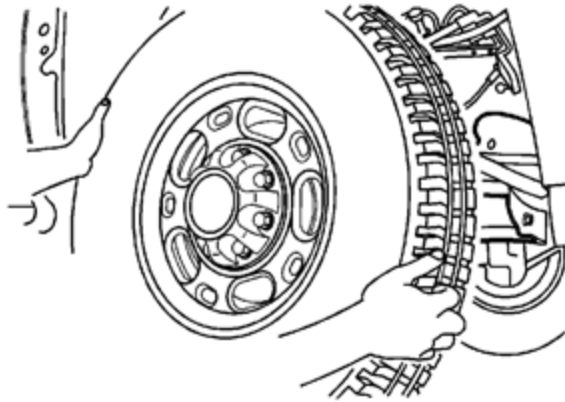
[J 8001](#) Dial Indicator Set

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

1. Turn the ignition key to the on position with the engine off.
2. With the aid of an assistant, turn the steering wheel to the full stop position and hold it in that position until the test is complete. The tie rod being tested should be inside the steering gear housing seated against the steering stop.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).



4. If there is not a good location for the dial indicator pointer at the steering gear housing, install a large worm gear hose clamp to the steering gear housing over the larger steering gear boot clamp and align the clamp so that the screw can be a location for the dial indicator pointer.
5. Install a dial indicator between the inner tie rod (2) and the steering gear housing or the worm gear clamp in such a way as to measure the lash between the inner tie rod and the steering gear housing.



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 and 9 o'clock positions, gently push in on one side of the tire to remove any lash.
7. Zero the dial indicator.
8. On the same side of the tire previously pushed inwards, gently pull outwards and measure the lash.
9. Record the measurement seen on the dial indicator.
10. If the measured value exceeds 1.0 mm (0.04 in) then replace the inner tie rod. Refer to [Steering Linkage Inner Tie Rod Replacement - Off Vehicle](#).
11. Repeat the procedure for the other side.

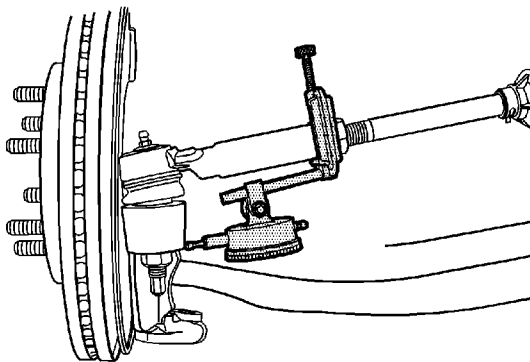
Steering Linkage Outer Tie Rod Inspection

Special Tools

[J 8001](#) Dial Indicator Set

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

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



3. Install dial indicator [J 8001](#) or equivalent between the outer tie rod end and the steering knuckle as shown in the graphic. Note that the tire and wheel assembly is shown removed only for clarification of the dial indicator position.
4. Grasping the tire at the 3 o'clock and 9 o'clock positions, gently push in on one side of the tire to remove any lash.
5. Zero the dial indicator.
6. On the same side of the tire previously pushed inwards, gently pull outwards and measure the lash.
7. Record the measurement seen on the dial indicator.
8. Movement should not exceed 1 mm (0.04 in). If the movement exceeds 1 mm (0.04 in) then replace the outer tie rod. Refer to [Steering Linkage Outer Tie Rod Replacement](#).
9. Repeat this procedure for the other side of the vehicle.

Power Steering System Bleeding

Important:

- Use clean, new power steering fluid type only. See the Maintenance and Lubrication subsection for fluid specifications. Refer to [Fluid and Lubricant Recommendations](#).
- 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.

Important: 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.

Important: 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.

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. If the power steering system has been serviced, bleed the power steering system to remove any trapped air from the system. Refer to [Power Steering System Bleeding](#).

Note : 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. Fully charge the hydro-boost accumulator using the following procedure:
 - Start the engine.
 - Firmly apply the brake pedal 2 to 3 times.
 - Turn the engine Off.

Note: The Add and Cold Full marks on the capstick are calculated for oil at ambient temperature. If the oil is hot, the oil level may appear slightly high.

3. Clean the area surrounding the reservoir cap.
4. Remove the reservoir cap.

Note: The ideal oil level is between the Add and the Full Cold marks. Since overfilling is just as undesirable as underfilling, there is no reason to fill all the way up to the Full Cold mark.

5. Inspect the power steering pump fluid level at regular intervals.

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

6. If the fluid level is low, add power steering fluid to the proper level.
7. Install the reservoir cap.
8. When checking the fluid level after servicing the steering system, bleed the air from the system. Refer to [Power Steering System Bleeding](#).

Power Steering System Flushing

Important: Do not reuse any drained power steering fluid regardless of appearance or condition.

1. Turn OFF the engine.
2. Raise the front end of the vehicle off the ground until the tires and wheels turn freely. Refer to [Lifting and Jacking the Vehicle](#).
3. Place a large container under the fluid return hose in order to collect the draining fluid.
4. Remove the fluid return hose at the power steering pump reservoir inlet connection.
5. Plug the reservoir return hose inlet connection on the power steering pump.

Important: This step may require 4 L (4 qt) of power steering fluid until the draining fluid appears clear.

6. With the key on engine off, turn the steering wheel fully to the left and to the right while an assistant maintains the minimum fluid level in the reservoir using new approved power steering fluid. Continue until the fluid from the return hose runs clear.
7. Remove the plug from the pump reservoir inlet connection and install the fluid return hose to the pump reservoir.

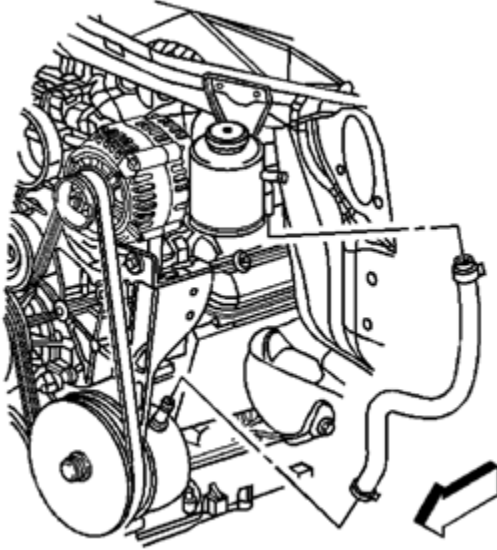
Important: Do NOT run the engine without the power steering fluid at a minimum system level.

8. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
9. Inspect the power steering fluid for the following indications of contamination:
 - Milky fluid - water
 - Brown fluid - burnt
 - Plastic debris or dirt chunks
10. If the fluid is contaminated, repeat steps 2-9.
11. Lower the vehicle and check the Power Steering system for leaks.

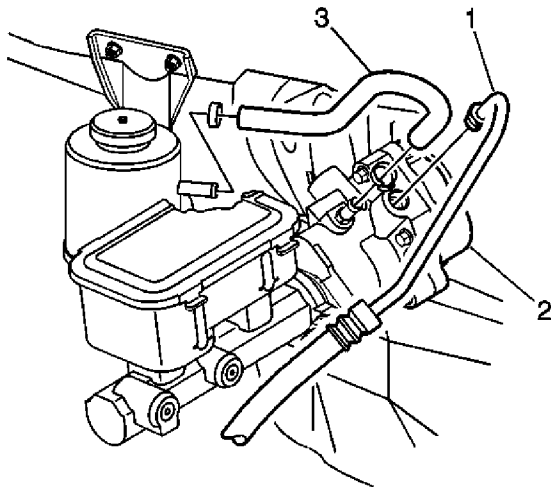
Power Steering Fluid Reservoir Replacement

Removal Procedure

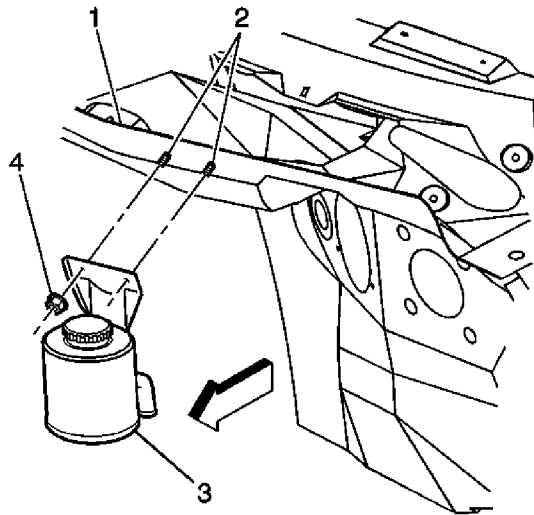
1. Siphon the power steering fluid from the reservoir.



2. Disconnect the reservoir outlet hose from the reservoir.

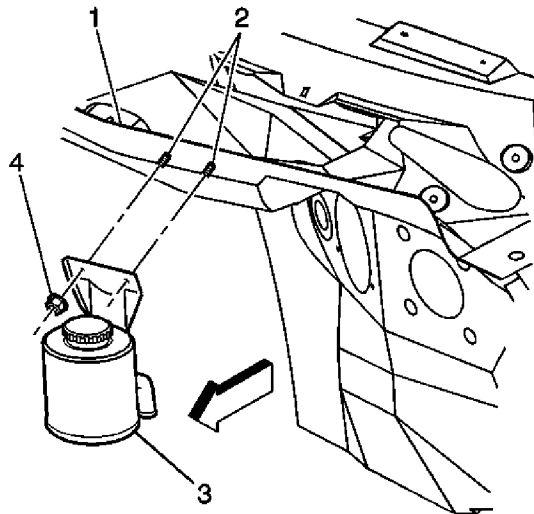


3. Remove the reservoir inlet hose (3) from the reservoir.



4. Remove the power steering pump remote reservoir mounting nuts (4).
5. Remove the power steering pump remote reservoir (3).

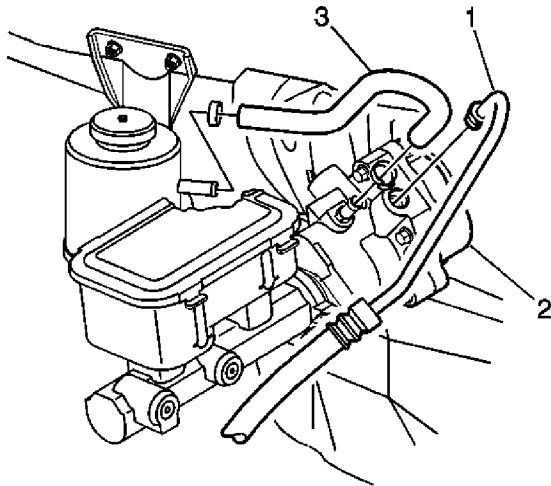
Installation Procedure



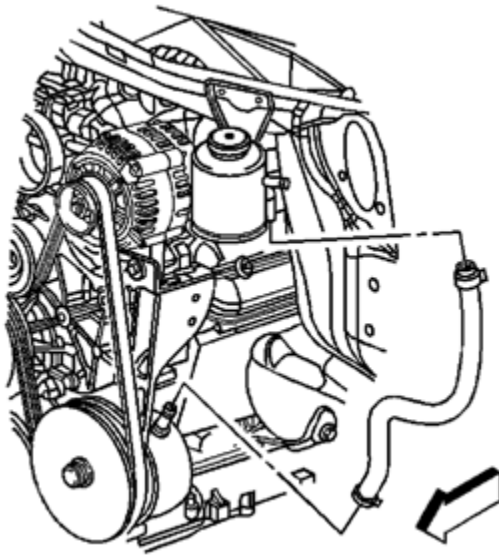
1. Install the power steering pump remote reservoir (3) to the vehicle.

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

2. Install the power steering pump remote reservoir (4) mounting nuts and tighten to **11 N·m (97 lb in)**.



3. Install the reservoir inlet hose (3) to the reservoir.



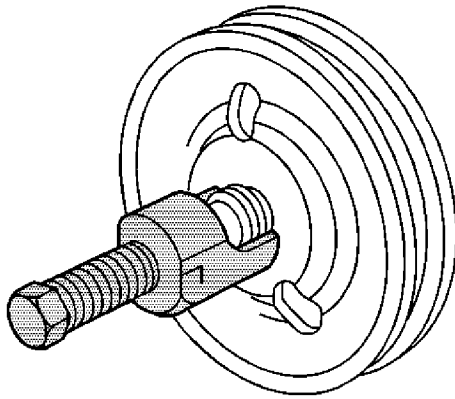
4. Connect the reservoir outlet hose to the reservoir.
5. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).

Power Steering Pump Pulley Replacement

Special Tools

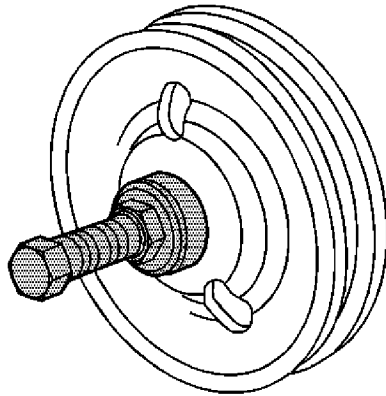
- [J 25033-C](#) Power Steering Pump Pulley Installer
- [J 25034-C](#) Power Steering Pump Pulley Remover

Removal Procedure

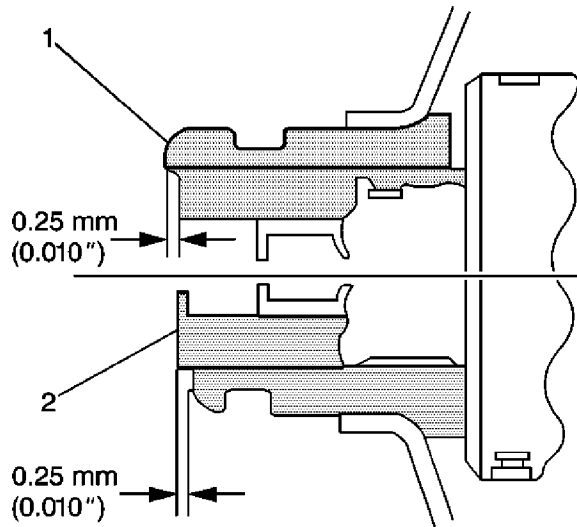


1. Remove the upper fan shroud. Refer to [Engine Coolant Fan Upper Shroud Replacement](#) .
2. Remove the drive belt. Refer to [Drive Belt Replacement](#) for the 4.3L engine, or to [Drive Belt Replacement - Accessory](#) , or to [Air Conditioning Compressor Belt Replacement](#) for the 4.8L, 5.3L, 6.0L engine, or to [Drive Belt Replacement](#) for the 6.6L engine.
3. Remove the power steering pump pulley using the [J 25034-C](#) .

Installation Procedure



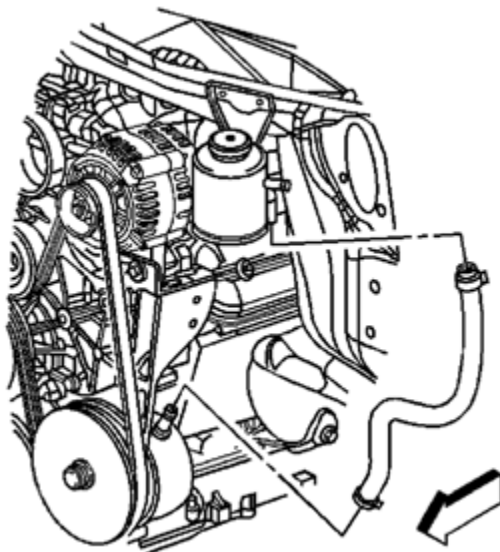
1. Place the power steering pump pulley on the end of the power steering pump shaft.
2. Install the power steering pump pulley using [J 25033-C](#).



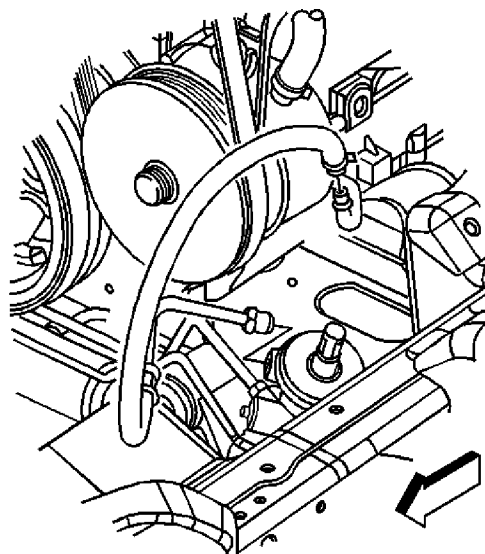
3. Ensure that the power steering pump pulley is flush against the power steering pump shaft (2), with an allowable variance of 0.25 mm (0.010 in).
4. Install the drive belt. Refer to [Drive Belt Replacement](#) for the 4.3L engine, or to [Drive Belt Replacement - Accessory](#), or to [Air Conditioning Compressor Belt Replacement](#) for the 4.8L, 5.3L, 6.0L engine, or to [Drive Belt Replacement](#) for the 6.6L engine.
5. Install the upper fan shroud. Refer to [Engine Coolant Fan Upper Shroud Replacement](#).

Power Steering Pump Replacement (4.3L)

Removal Procedure



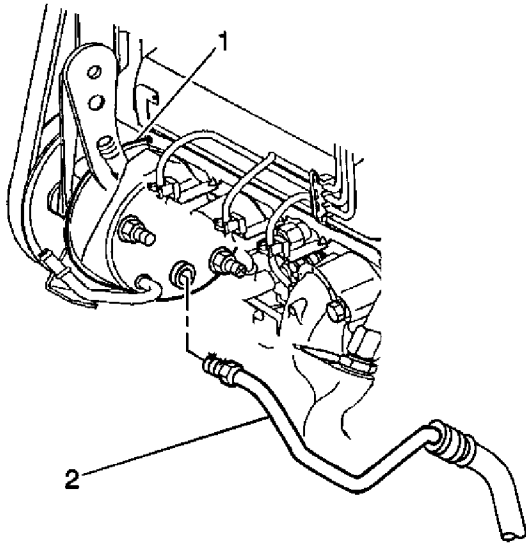
1. Place a drain pan below under the vehicle.
2. Remove the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
4. Disconnect the reservoir outlet hose from the power steering pump through the wheel well.



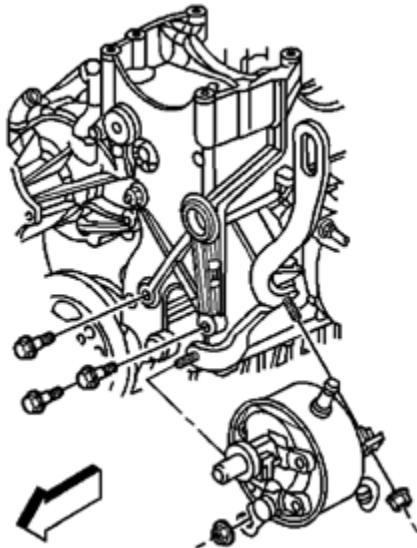
5. Disconnect the power steering gear outlet hose or cooler hose from the power steering pump

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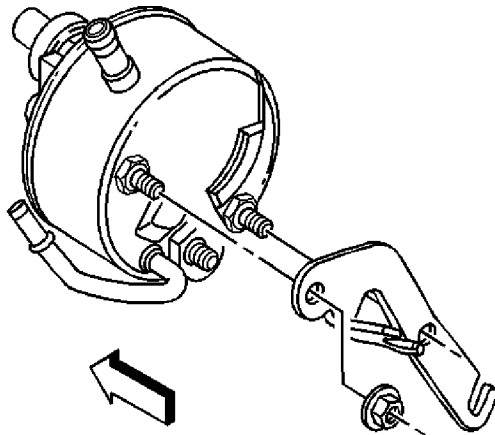
through the wheel well.



6. Disconnect the power brake booster inlet hose (2) from the power steering pump (1) through the wheel well.
7. Cap the ends of the hose and the power steering pump in order to prevent the entrance of dirt.

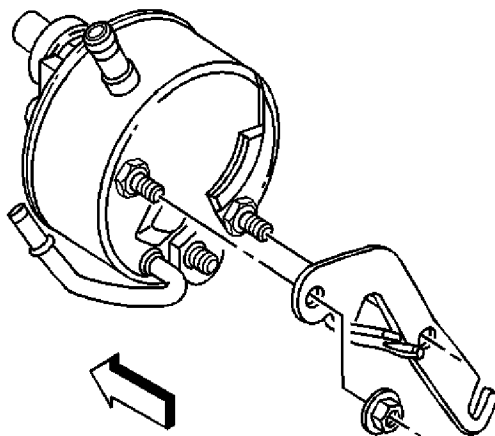


8. Remove the power steering pump mounting bolts and the nuts.
9. Remove the power steering pump from the vehicle.



10. Remove the power steering pump rear bracket mounting nuts.
11. Remove the power steering pump rear bracket.

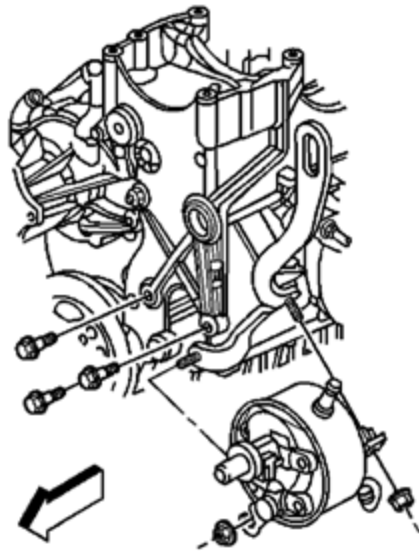
Installation Procedure



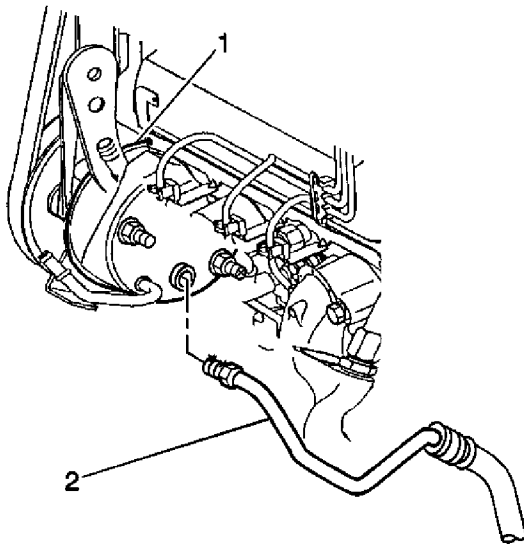
1. Install the rear bracket to the power steering pump.

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

2. Install the power steering pump rear bracket mounting nuts and tighten to **50 N·m (37 lb ft)**.

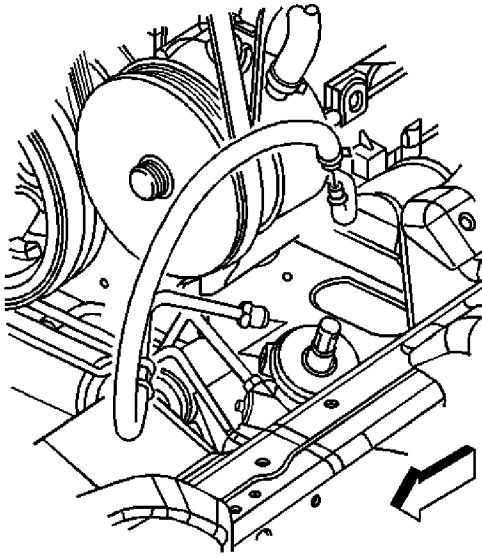


3. Install the power steering pump to the vehicle.
4. Install the power steering pump front mounting bolts **50 N·m (37 lb ft)**.
5. Install the power steering pump lower and rear nuts and tighten to **41 N·m (30 lb ft)**.
6. Uncap the power steering hoses.

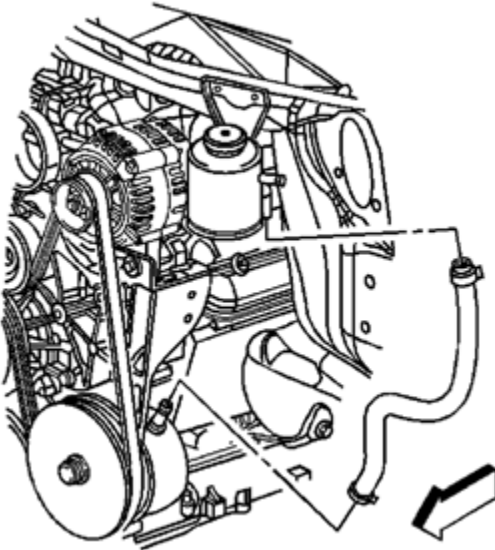


Note: Route the power steering hoses in the same location in which they were removed.

7. Install the power brake booster inlet hose (2) to the power steering pump through the wheel well and tighten **33 N·m (24 lb ft)**.



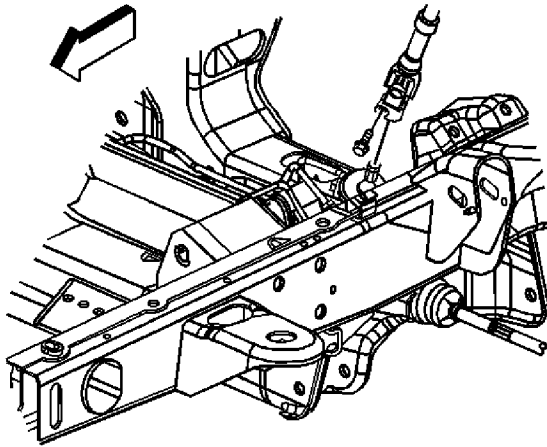
8. Install the power steering gear outlet hose or cooler hose to the power steering pump through the wheel well.



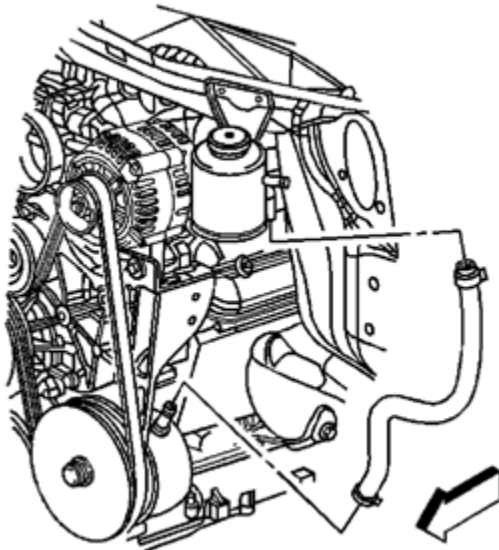
9. Install the reservoir outlet hose to the power steering pump through the wheel well.
10. Install the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).
11. Bleed the system. Refer to [Power Steering System Bleeding](#).
12. Remove the drain pan from under the vehicle.

Power Steering Pump Replacement (4.8L, 5.3L, 6.0L)

Removal Procedure



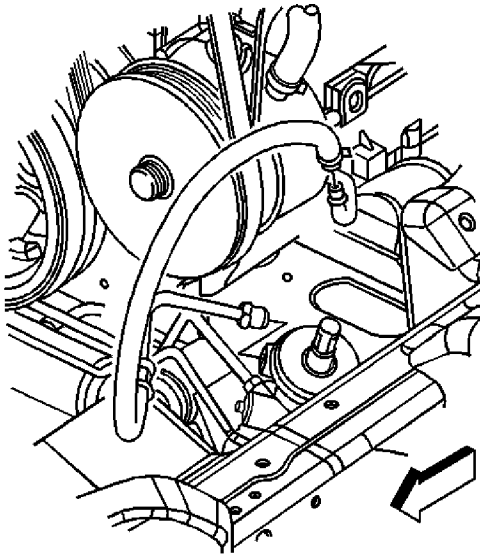
1. Place a drain pan below under the vehicle.
2. Remove the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).
3. Remove the lower intermediate shaft to the power steering gear retaining bolt.
4. Disconnect the lower intermediate shaft from the power steering gear.



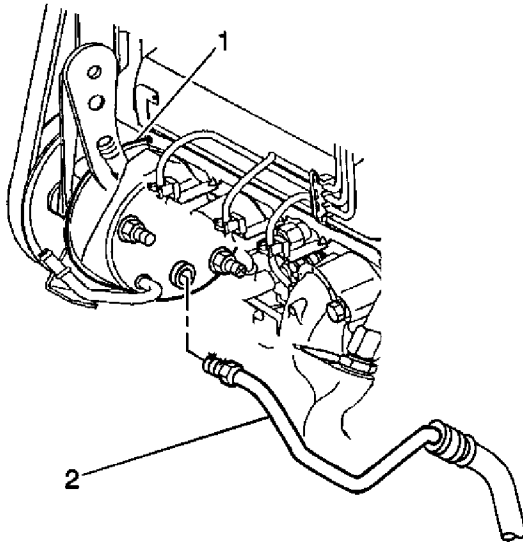
5. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).

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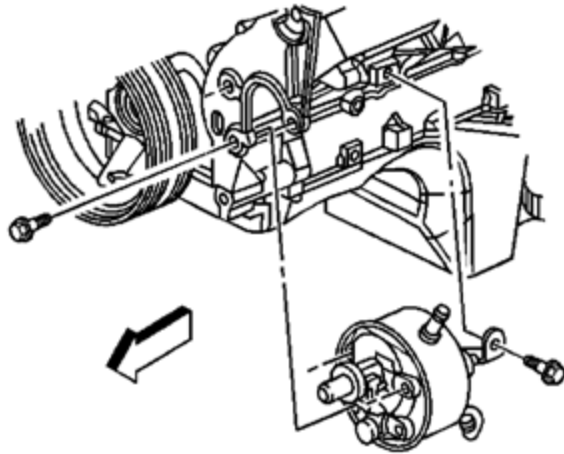
6. Remove the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).
7. Disconnect the reservoir outlet hose from the power steering pump through the wheel well.



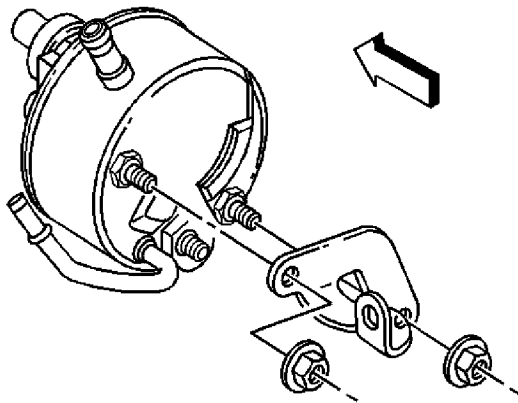
8. Disconnect the power steering gear outlet hose or cooler hose from the power steering pump through the wheel well.



9. Disconnect the power brake booster inlet hose (2) from the power steering pump through the wheel well.
10. Cap the ends of the hose and the pump in order to prevent the entrance of dirt.
11. Lower the vehicle.

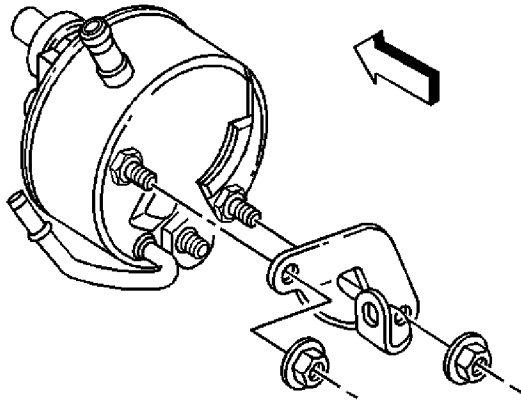


12. Remove the rear power steering pump mounting bolt.
13. Remove the front power steering pump mounting bolts.
14. Remove the power steering pump from the vehicle.



15. Remove the power steering pump rear bracket mounting nuts.
16. Remove the power steering pump rear bracket from the power steering pump.

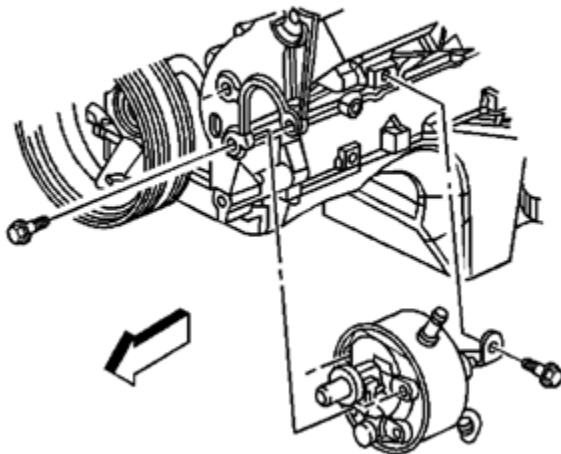
Installation Procedure



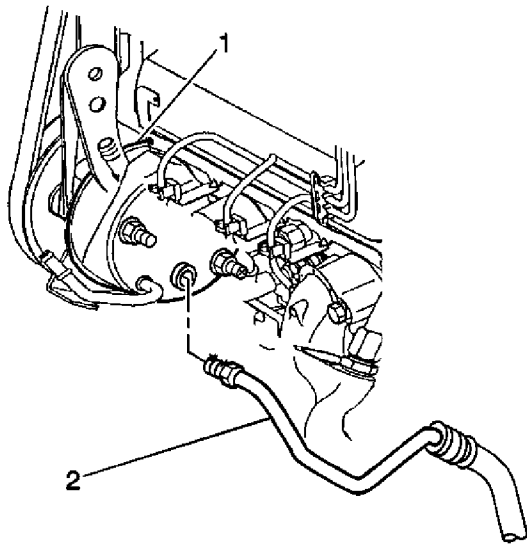
1. Install the power steering pump rear bracket to the power steering pump.

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

2. Install the power steering pump rear bracket mounting nuts and tighten to **50 N·m (37 lb ft)**.



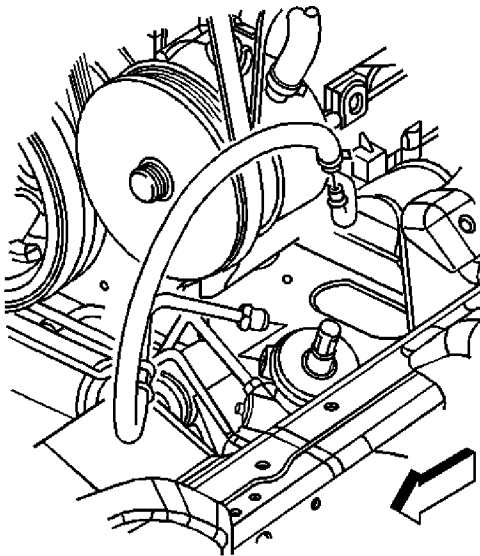
3. Install the power steering pump to the vehicle.
4. Install the front power steering pump mounting bolts and tighten to **50 N·m (37 lb ft)**.
5. Install the rear power steering pump mounting bolt and tighten to **41 N·m (30 lb ft)**.
6. Uncap the power steering hoses.



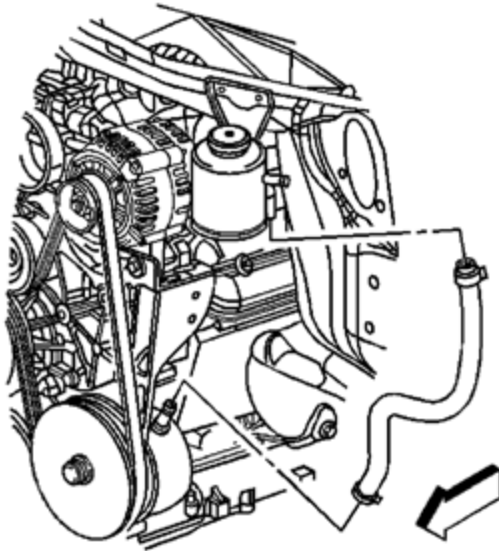
7. Raise the vehicle.

Note: Route the power steering hoses in the same location in which they were removed.

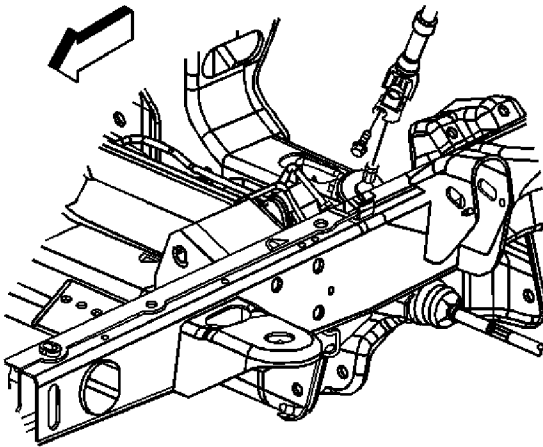
8. Install the power brake booster inlet hose (2) to the power steering pump through the wheel well and tighten to **33 N·m (24 lb ft)**.



9. Install the power steering gear outlet hose or cooler hose to the power steering pump through the wheel well.



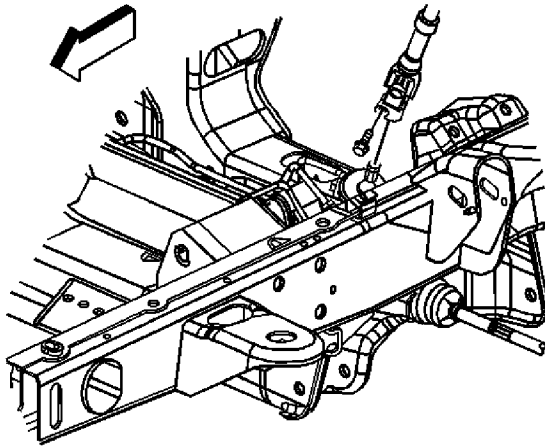
10. Install the reservoir outlet hose to the power steering pump through the wheel well.
11. Install the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).
12. Lower the vehicle.



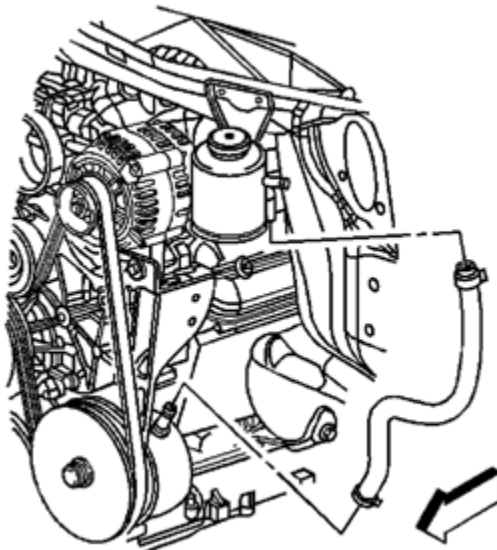
13. Connect the lower intermediate shaft to the power steering gear.
14. Install the lower intermediate shaft to the power steering gear retaining bolt and tighten to **61 N·m (45 lb ft)**.
15. Install the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).
16. Bleed the system. Refer to [Power Steering System Bleeding](#).
17. Remove the drain pan from under the vehicle.

Power Steering Pump Replacement (6.6L Diesel)

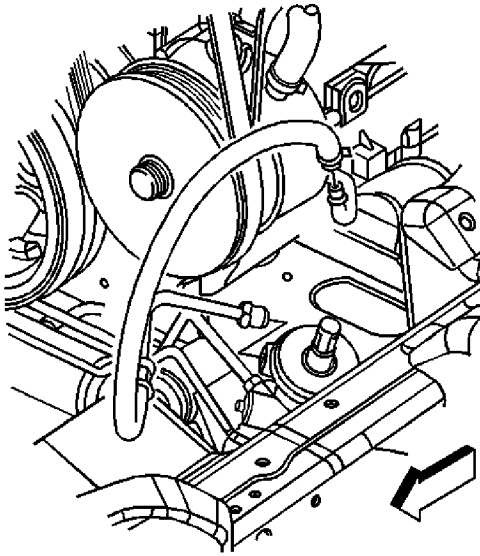
Removal Procedure



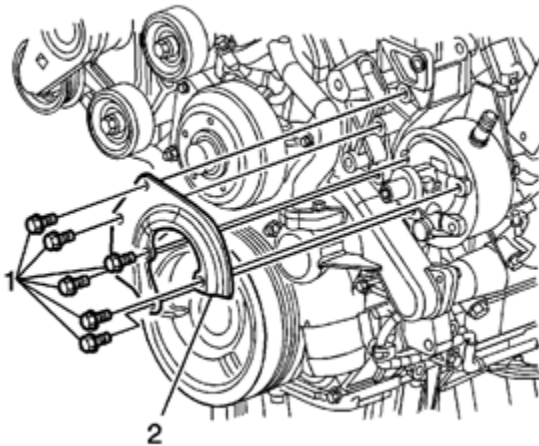
1. Place a drain pan below under the vehicle.
2. Remove the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).



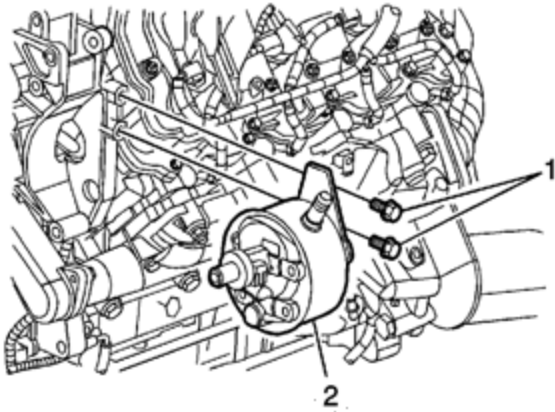
3. Disconnect the reservoir outlet hose from the power steering pump through the wheel well.
4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).



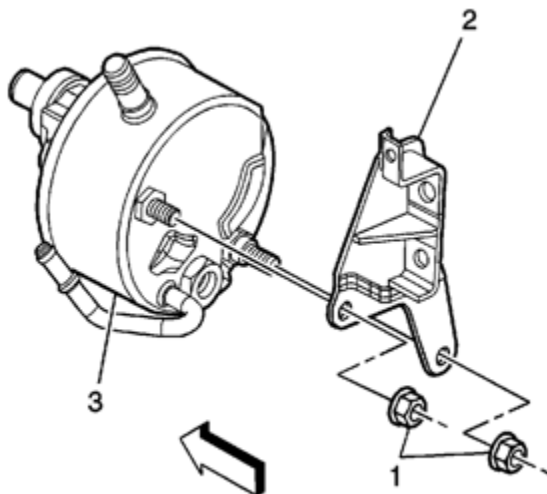
5. Disconnect the power steering gear outlet hose or cooler hose at the power steering pump through the wheel well.
6. Disconnect the power brake booster inlet hose from the power steering pump through the wheel well.
7. Cap the ends of the hose and the pump in order to prevent the entrance of dirt.
8. Remove the rear power steering pump bracket bolts from the bracket through the wheel well.
9. Lower the vehicle.



10. Remove the power steering pump and bracket bolts (1).
11. Remove the power steering pump bracket (2) from the pump.



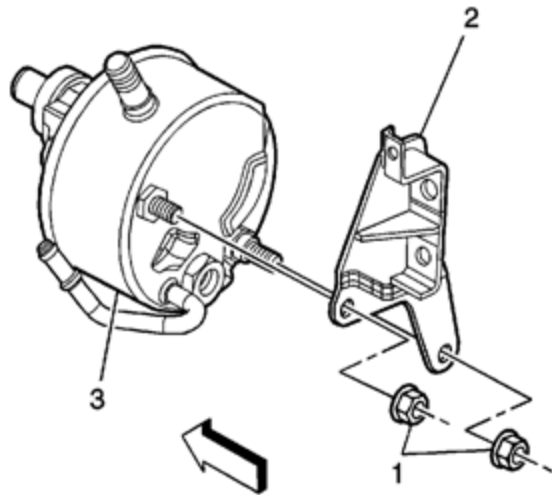
12. Remove the power steering pump (2) from the vehicle.



13. Remove the rear power steering pump bracket nuts (1) from the pump.

14. Remove the rear power steering pump bracket (2) from the pump (3).

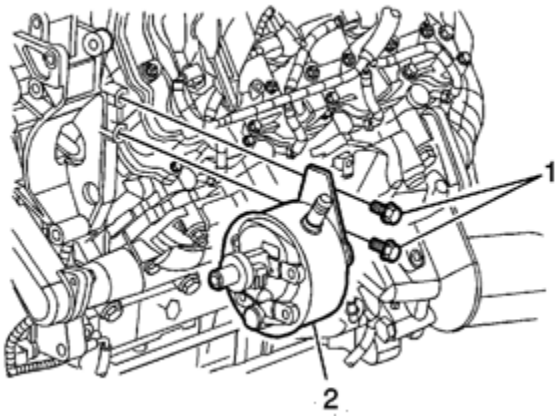
Installation Procedure



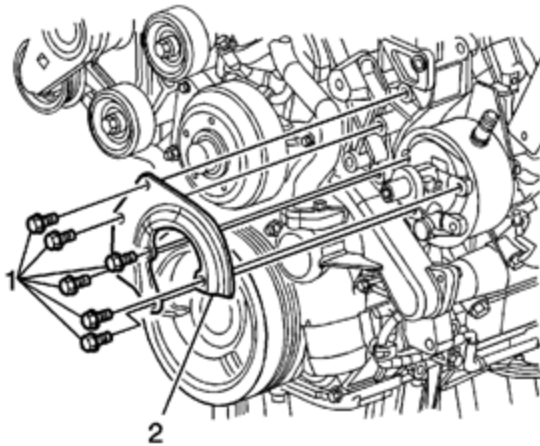
1. Install the rear power steering pump bracket (2) to the pump (3).

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

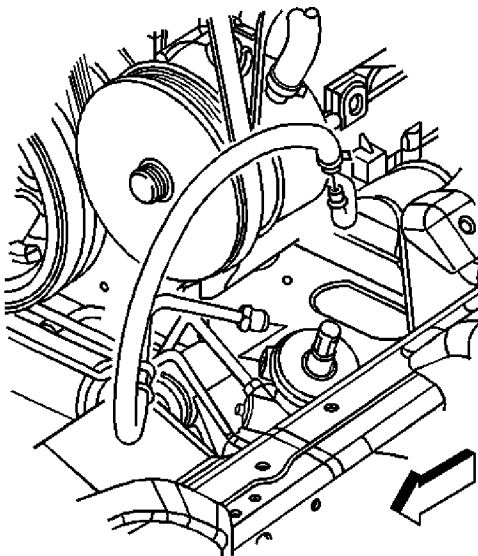
2. Install the power steering pump rear bracket nuts (1) to the pump studs and tighten to **50 N·m (37 lb ft)**.



3. Position the power steering pump (2) to the vehicle.



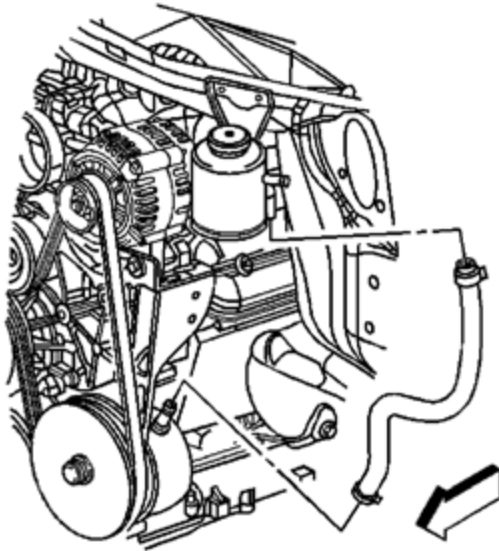
4. Position the front power steering pump bracket (2) to the pump.
5. Install the power steering pump bracket bolts (1) to the bracket and pump and tighten to **50 N·m (37 lb ft)**.



6. Raise the vehicle.
7. Install the power steering pump rear bracket bolts (1) to the bracket and tighten to **41 N·m (30 lb ft)**.

Note: Route the power steering hoses in the same location in which they were removed.

8. Install the power brake booster inlet hose (2) to the power steering pump through the wheel well and tighten to **33 N·m (24 lb ft)**.
9. Install the power steering gear outlet hose or cooler hose to the power steering pump through the wheel well.

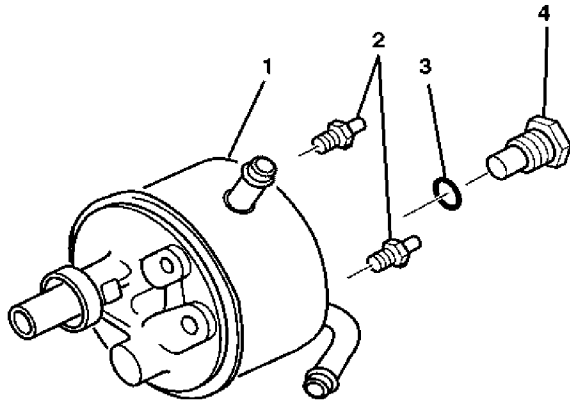


10. Lower the vehicle.
11. Install the reservoir outlet hose to the power steering pump through the wheel well.
12. Install the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#).
13. Bleed the system. Refer to [Power Steering System Bleeding](#).
14. Remove the drain pan from under the vehicle.

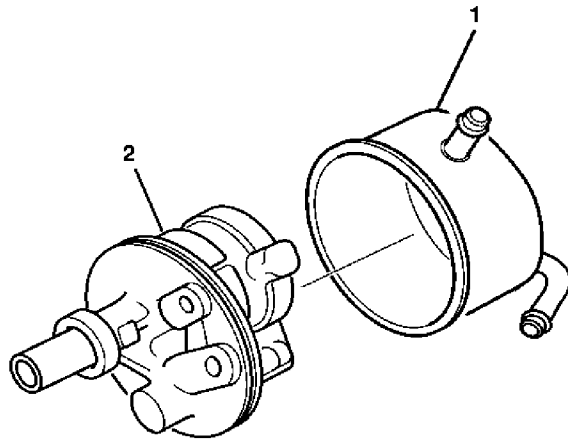
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Power Steering Fluid Reservoir Replacement - Off Vehicle

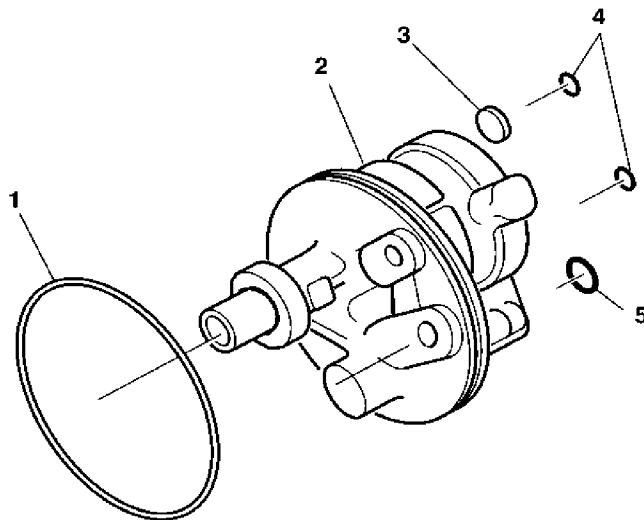
Disassembly Procedure



1. Drain the power steering fluid from the power steering pump.
2. Remove the pump mounting studs (2).
3. Remove the connector and fitting assembly (4).
4. Remove the O-ring seal (3) from the connector and fitting assembly (4).
5. If replacement is required, remove the control valve assembly and the flow control spring from the pump housing assembly. Refer to [Power Steering Pump Flow Control Valve Replacement - Off Vehicle](#).

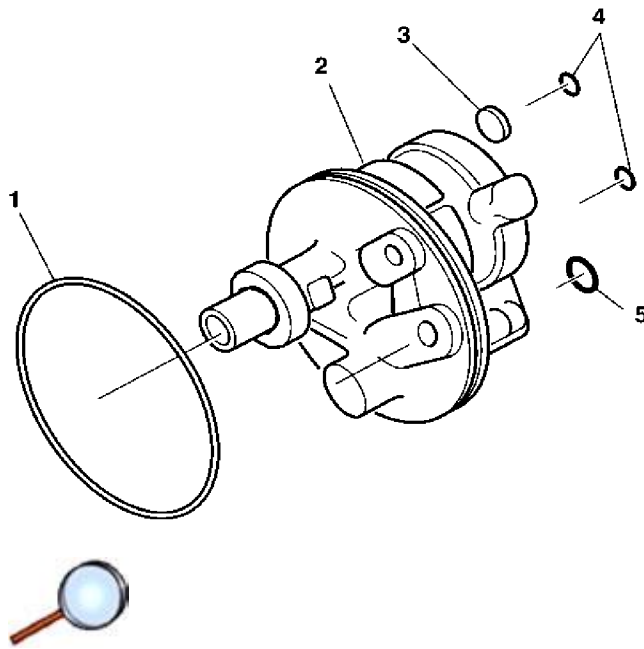


6. Remove the reservoir assembly (1) from the pump housing assembly (2).



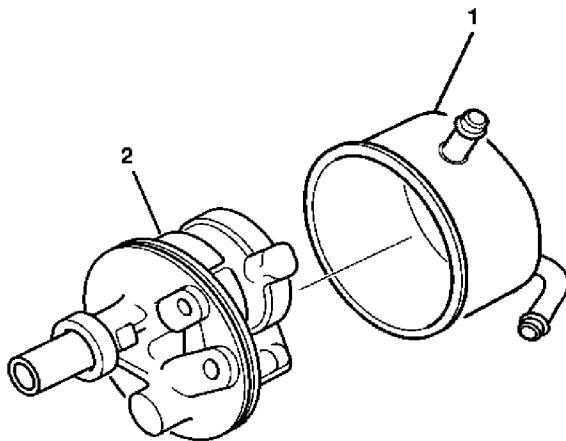
7. Remove the O-ring seals (1, 4 and 5).
8. Remove the magnet (3).
9. Clean the magnet (3).
10. Inspect the Welch plug in the power steering pump housing (2). Do not remove. If the Welch plug is deformed or dislodged, replace the power steering pump.

Assembly Procedure



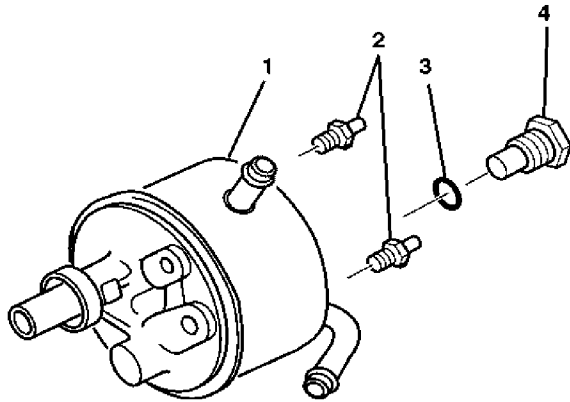
Note: Use new O-ring seals when assembling the power steering pump assembly.

1. Lubricate the O-ring seals (1, 4 and 5) with power steering fluid.
2. To install the control valve assembly and flow control spring to the pump housing assembly (2). Refer to [Power Steering Pump Flow Control Valve Replacement - Off Vehicle](#).
3. Install the O-ring seals (1, 4 and 5) to the pump housing assembly (2).
4. Install the magnet (3) to the pump housing assembly (2).



5. Connect the reservoir assembly (1) to the pump housing assembly (2).
6. Install the O-ring seal.

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

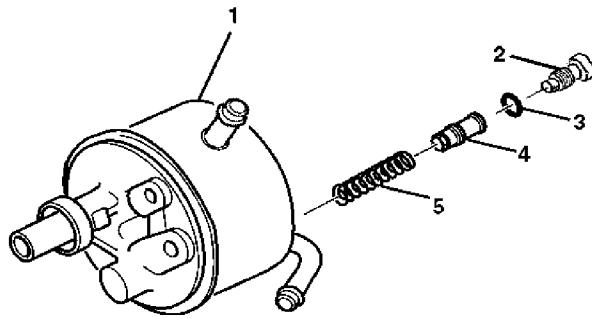


7. Install the connector and fitting assembly (4) to the pump housing (1).
8. Install the pump mounting studs (2) to the pump housing (1).
 - Tighten the pump mounting studs (2) to **58 N·m (43 lb ft)**.
 - Tighten the connector and fitting assembly (4) to **75 N·m (55 lb ft)**.

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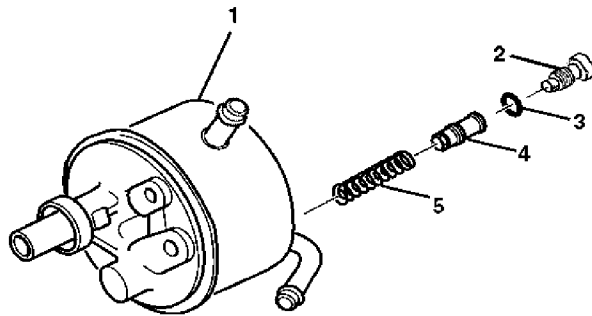
Power Steering Pump Flow Control Valve Replacement - Off Vehicle

Disassembly Procedure



1. Drain the oil from the reservoir (1).
2. Remove the connector and fitting assembly (2).
3. Remove the control valve assembly (4) from the pump housing (1). Make sure the flow control spring (5) does not fall out of the pump housing (1).
4. Remove and discard the O-ring seal (3) from the connector and fitting assembly (2).

Assembly Procedure



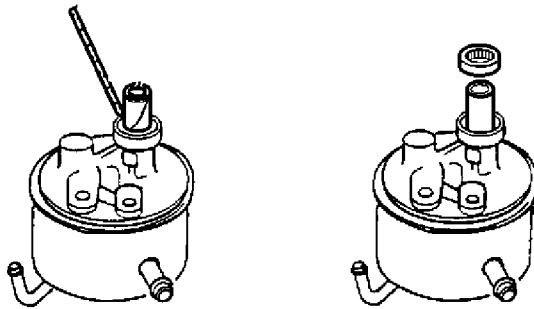
1. Install the flow control spring (5), if removed from the pump housing (1).
2. Lubricate the new O-ring seal (3) with power steering fluid.
3. Install the O-ring seal (3) onto the connector and fitting assembly (2).
4. Install the control valve assembly (4).

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

5. Install the connector and fitting assembly (2) and tighten to **75 N·m (55 lb ft)**.

Power Steering Pump Shaft Seal Replacement

Removal Procedure

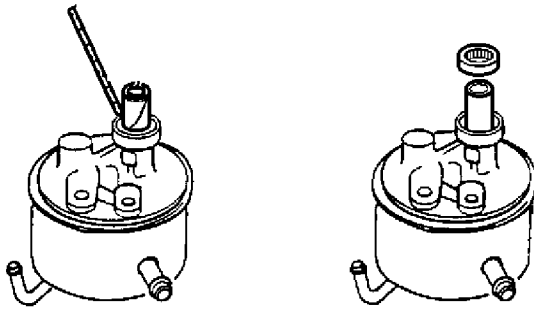


1. Remove the power steering pump. Refer to [Power Steering Pump Replacement](#).

Important: Protect the drive shaft with a shim stock.

2. Cut the seal with a chisel in order to remove it.

Installation Procedure



1. Lubricate the seal with power steering fluid.
2. Install the seal using a deep socket.
3. Install the power steering pump. Refer to [Power Steering Pump Replacement](#).

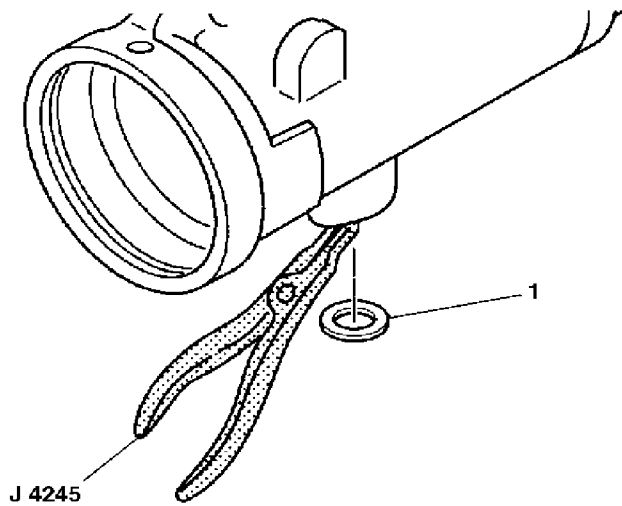
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Steering Gear Pitman Shaft Seal Replacement (Non Rack and Pinion)

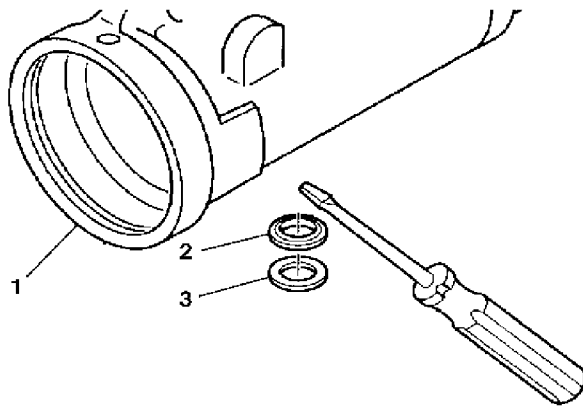
Tools Required

- [J 4245](#) Internal Snap Ring Pliers
- [J 6278](#) Pitman Shaft Bearing Remover and Installer

Removal Procedure

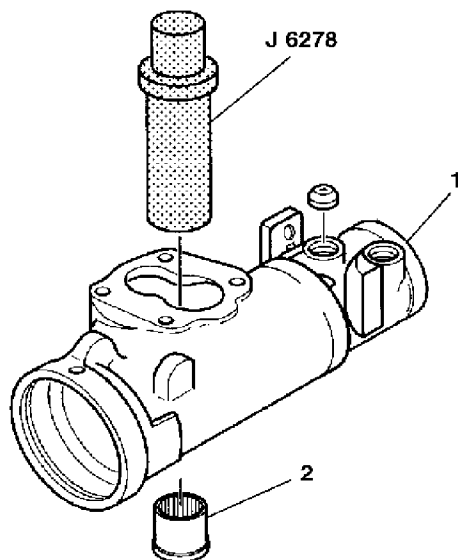


1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Mark the position of the pitman arm to the pitman shaft.
3. Remove the Pitman Arm. Refer to [Pitman Arm Replacement](#) .
4. Drain the power steering fluid from the system.
5. Remove the pitman shaft and side cover. Refer to [Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle](#) .
6. Clean the exposed end of the pitman shaft.
7. Clean the steering gear housing.
8. Use a wire brush to clean the pitman shaft splines.
9. Remove the dust seal (1).
10. Remove the retaining ring using [J 4245](#) .



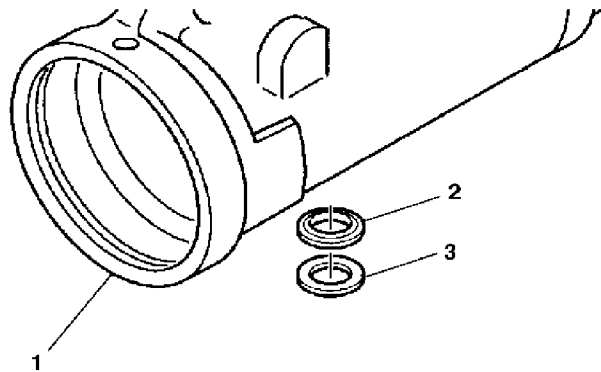
Important: Use care not to score the power steering gear housing bore when prying out the seals and the washers.

11. Use a screwdriver to pry the backup washer (3) and the double lip seal (2) from the power steering gear housing (1).
12. Inspect the power steering gear housing (1) for burrs.
13. Remove the power steering gear housing (1) if necessary.

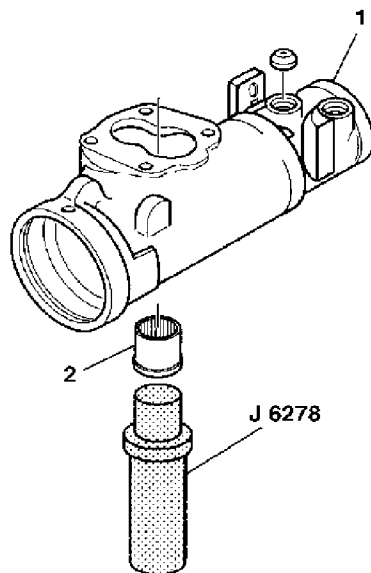


14. Insert the [J 6278](#) through the hole in the top of the power steering gear housing (1).
15. Drive out the needle bearing (2).

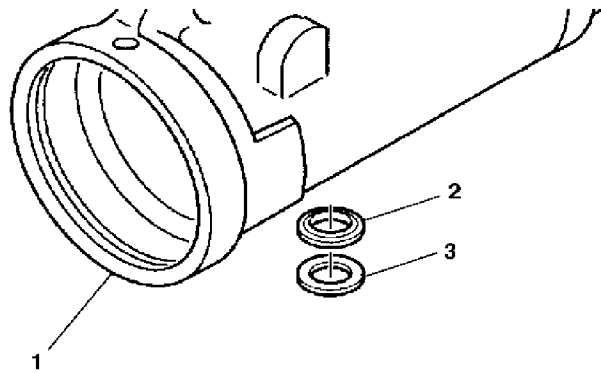
Installation Procedure



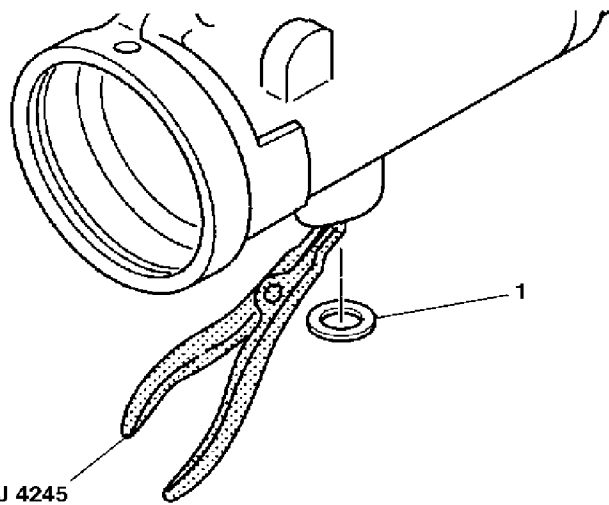
1. Coat the double lip seal (2) and the washer (3) with grease.



2. Install the needle bearing (2) to the power steering gear housing (1) using [J 6278](#) .



3. Install the double lip seal (2).
4. Install the backup washer (3).



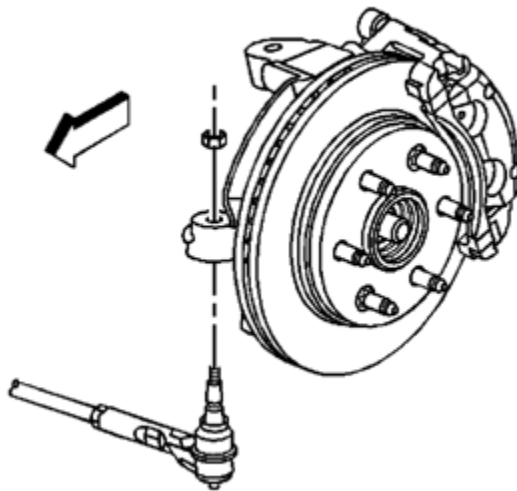
5. Install the retaining ring using the [J 4245](#) .
6. Install the pitman shaft and the side cover. Refer to [Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle](#) .
7. Install the dust seal (1).
8. Install the Pitman Arm. Refer to [Pitman Arm Replacement](#) .
9. Bleed the power steering system. Refer to [Power Steering System Bleeding](#) .
10. Lower the vehicle.

Steering Linkage Outer Tie Rod Replacement

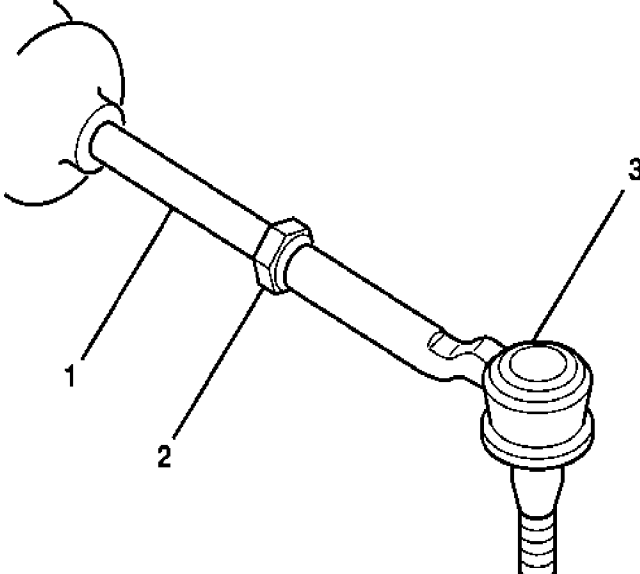
Special Tools

[J 24319-B](#) Steering Linkage and Tie Rod Puller

Removal Procedure

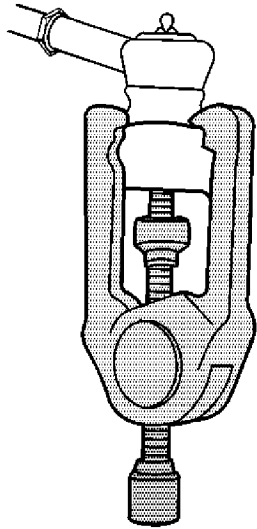


1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the outer tie rod stud retaining nut.

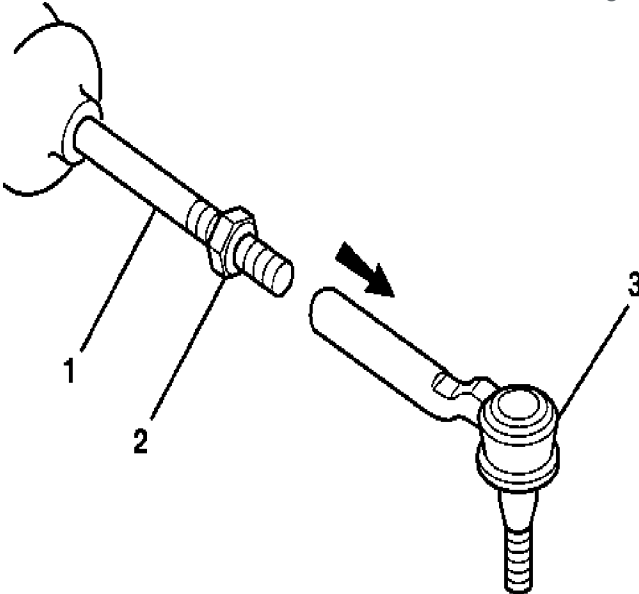




4. Loosen the jam nut (2) on the inner tie rod (1).

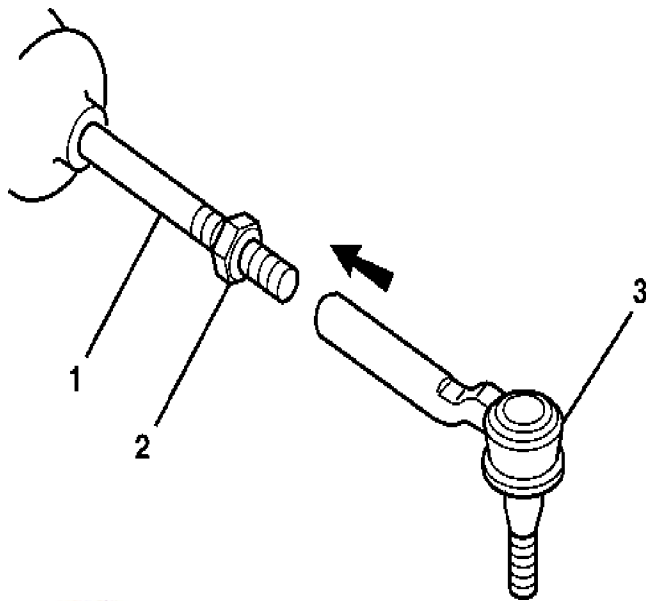


5. Disconnect the outer tie rod from the steering knuckle using [J 24319-B](#).



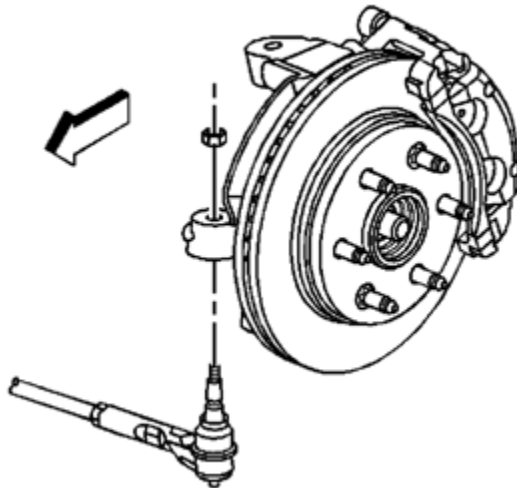
6. Remove the outer tie rod (3) from the inner tie rod (1).

Installation Procedure



1. Connect the outer tie rod (3) to the inner tie rod (1). Do not tighten the jam nut (2).

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



2. Connect the outer tie rod to the steering knuckle.
3. Install the outer tie rod retaining nut and tighten to **63 N·m (47 lb ft)**.

Note: Be sure the power steering gear boot is not twisted after the toe adjustment.

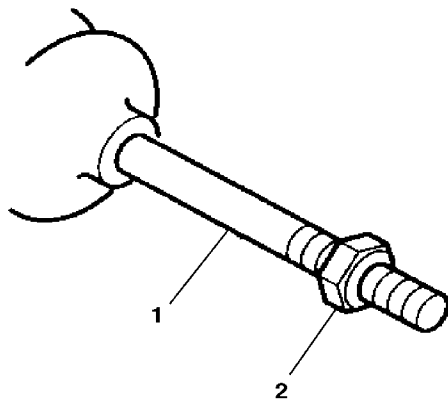
4. Check the wheel alignment. Refer to [Wheel Alignment Measurement](#).

Steering Gear Boot Replacement

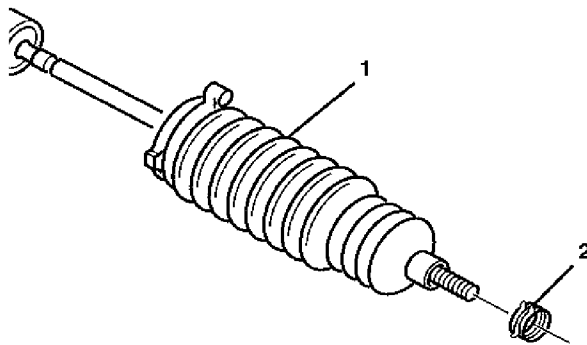
Tools Required

[J 22610](#) Keystone Clamp Pliers

Removal Procedure

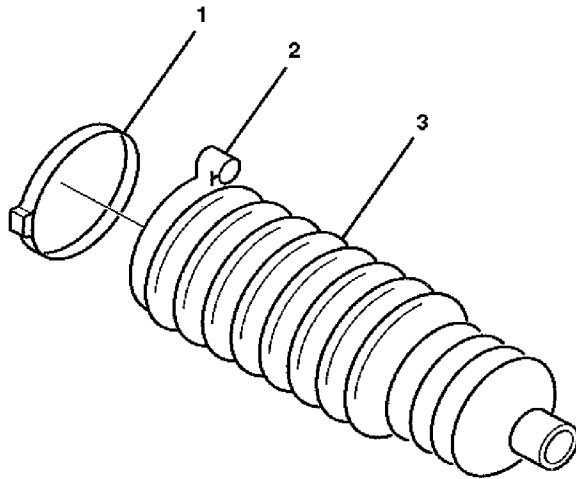


1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the outer tie rod. Refer to [Rack and Pinion Outer Tie Rod End Replacement](#) .
3. Remove the hexagon jam nut (2) from the inner tie rod (1).

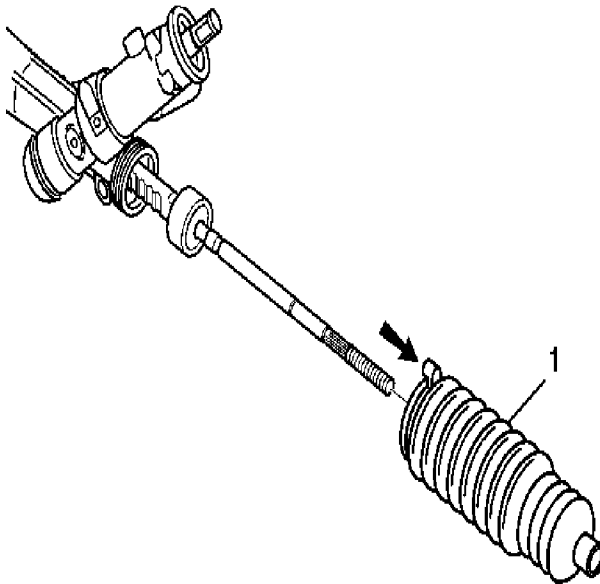




4. Remove the tie rod end clamp (2) from the rack and pinion boot (1).



5. Remove the boot clamp (1) from the rack and pinion boot with side cutters.
6. Discard the boot clamp (1).

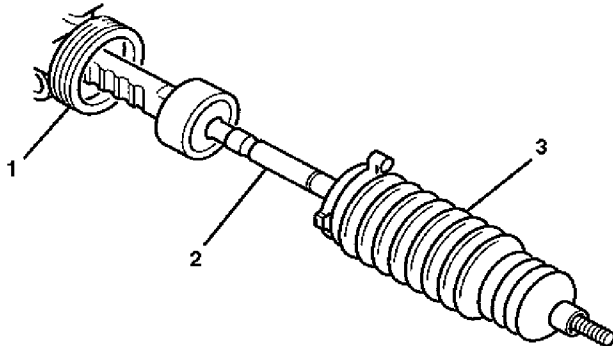
**Important:**

- Prior to removing the breather tube or the rack and pinion boot, mark the location of the breather tube on the power steering gear.
- After removing the boot, inspect the inner tie rod for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the steering gear.

7. Disconnect the breather tube from the rack and pinion boot (1).

Remove the rack and pinion boot (1) from the power steering gear.

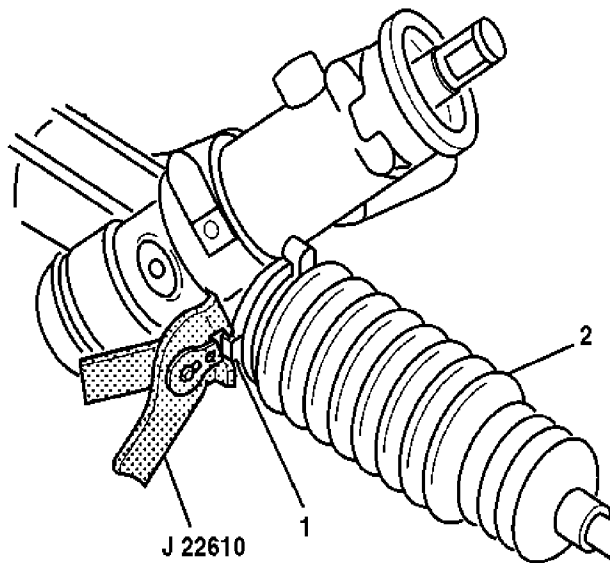
Installation Procedure



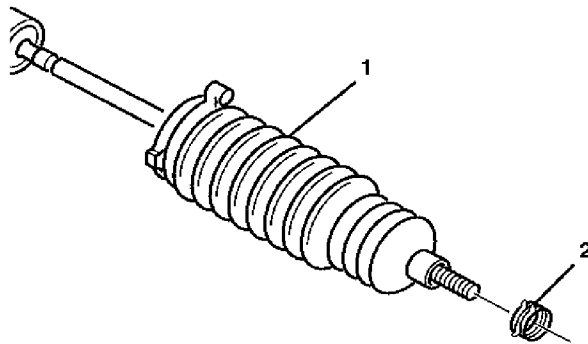
1. Prior to the rack and pinion boot installation, apply grease to the inner tie rod (2) and the power steering gear (1).
2. Install the rack and pinion boot (3) onto the inner tie rod (2).
3. Install the breather tube while aligning the breather tube with the mark made during removal and the molded nipple of the rack and pinion boot.

Important: The rack and pinion boot (3) must not be twisted, puckered or out of shape in any way. If the rack and pinion boot (3) is not shaped properly, adjust the rack and pinion boot (3) by hand before installing the boot clamp.

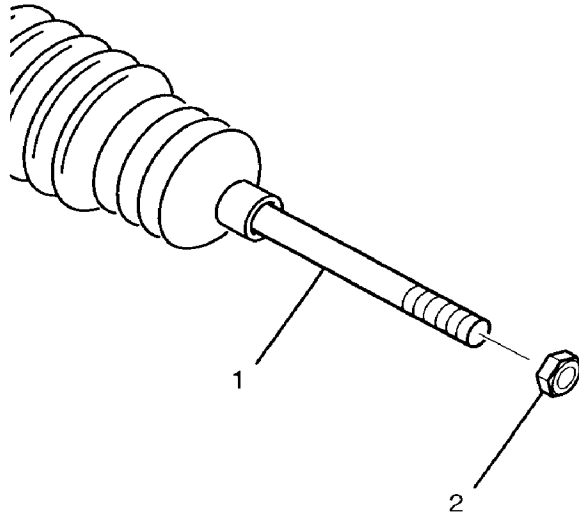
4. Install the rack and pinion boot onto the power steering gear (1) until the rack and pinion boot (3) is seated in the power steering gear groove.



5. Install the boot clamp (1) on the rack and pinion boot (2).
6. Crimp the boot clamp (1) using the [J 22610](#).



7. Install the new boot clamp (2) onto the rack and pinion boot (1).

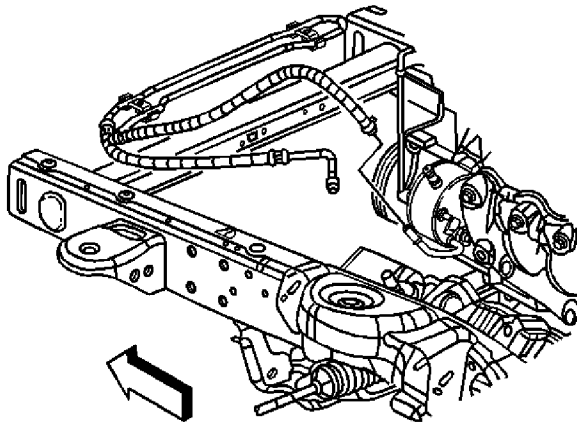


8. Install the hexagon jam nut (2) to the inner tie rod (1).
9. Install the outer tie rod. Refer to [Rack and Pinion Outer Tie Rod End Replacement](#) .
10. Check the wheel alignment. Refer to [Wheel Alignment Measurement](#) .

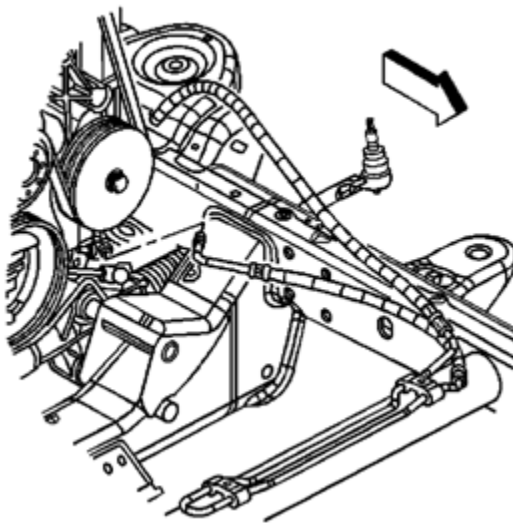
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Power Steering Cooler Pipe / Hose Replacement (GT4) Removal Procedure

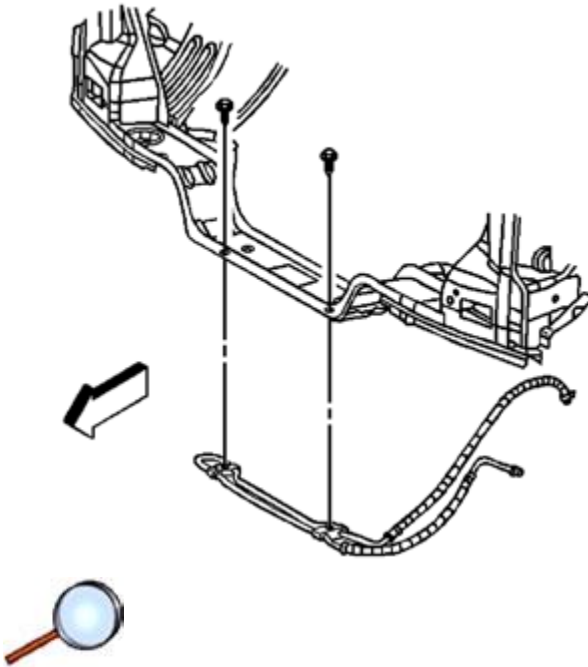
Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Install drain pan under the vehicle.
2. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
3. Disconnect the power steering cooler hose from the power steering pump.

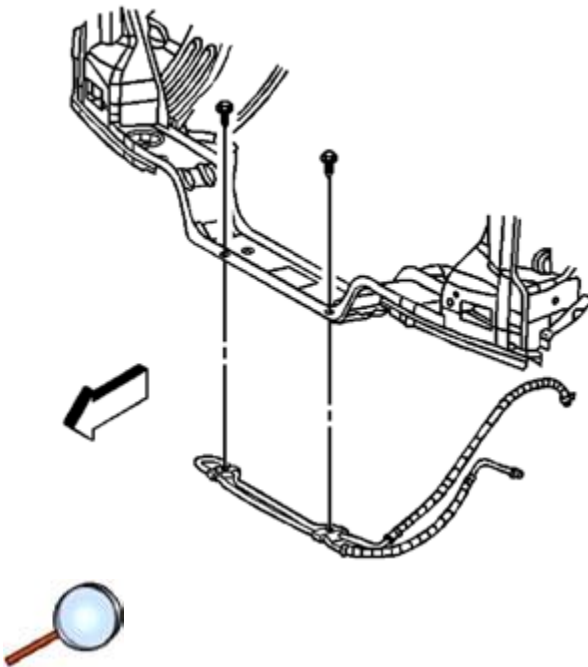


4. Disconnect the power steering cooler hose from the power steering gear.
5. Cap the power steering cooler ends in order to prevent the entry of dirt.



6. Remove the power steering cooler mounting bolts.
7. Remove the power steering cooler from the vehicle.

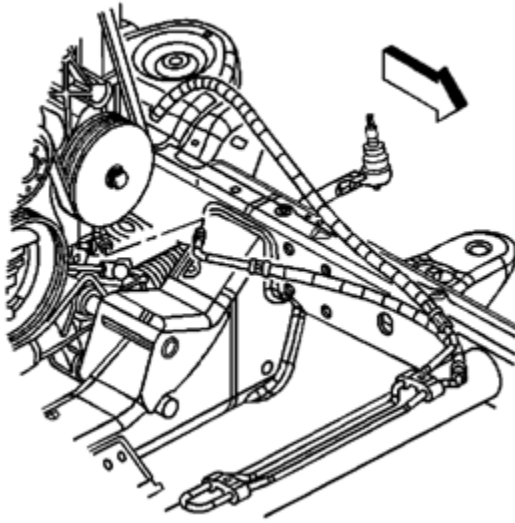
Installation Procedure



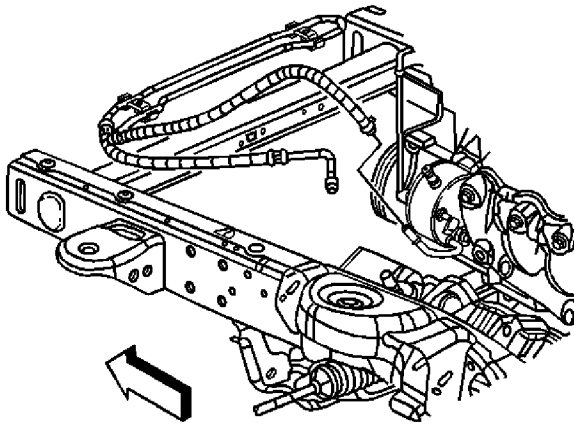
1. Install the power steering cooler to the vehicle.

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

2. Install the power steering cooler mounting bolts and tighten to **5 N·m (44 lb in)**.



3. Connect the power steering cooler hose to the power steering gear and tighten to **33 N·m (24 lb in)**.

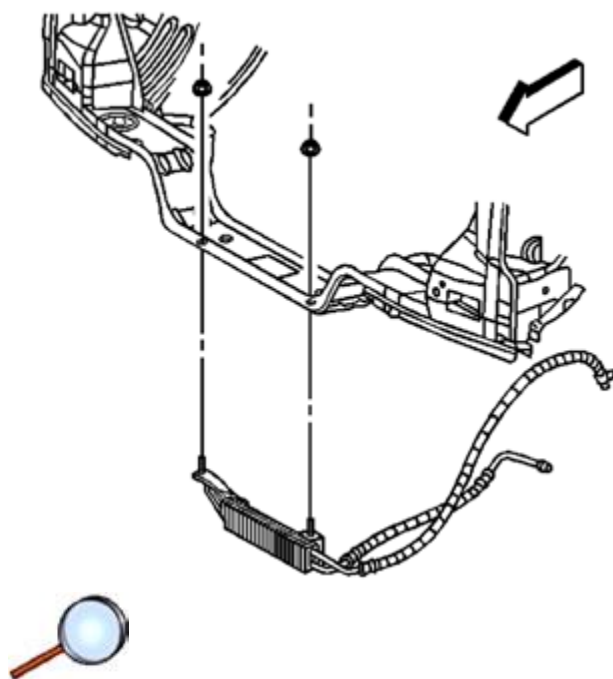


4. Connect the power steering cooler hose to the power steering pump.
5. Lower the vehicle.
6. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
7. Remove the drain pan from under the vehicle.

Power Steering Cooler Pipe / Hose Replacement (GT5)

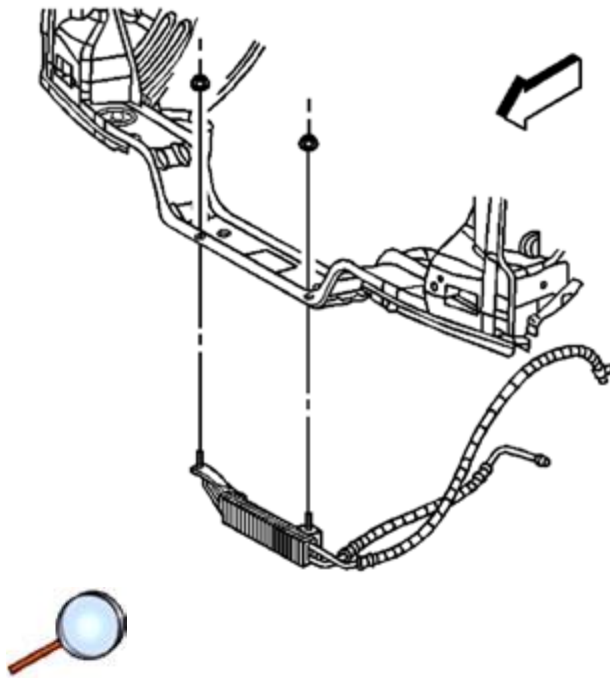
Removal Procedure

Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Install drain pan under the vehicle.
2. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
3. Disconnect the power steering cooler hose from the power steering pump.
4. Disconnect the power steering cooler hose from the power steering gear.
5. Cap the power steering pipes and cooler ends in order to prevent the entry of dirt.
6. Remove the power steering cooler mounting nuts.
7. Remove the power steering cooler from the vehicle.

Installation Procedure



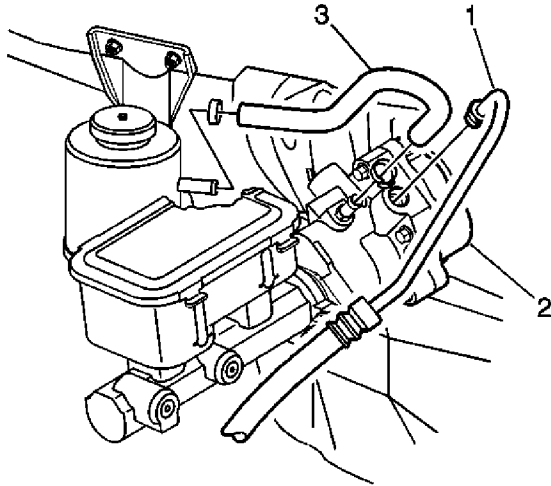
1. Install the power steering cooler to the vehicle.

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

2. Install the power steering cooler mounting nuts and tighten to **28 N·m (21 lb ft)**.
3. Connect the power steering cooler hose to the power steering gear and tighten to **33 N·m (24 lb ft)**.
4. Connect the power steering cooler hose to the power steering pump.
5. Lower the vehicle.
6. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
7. Remove the drain pan from under the vehicle.

Power Steering Fluid Reservoir Inlet Hose Replacement Removal Procedure

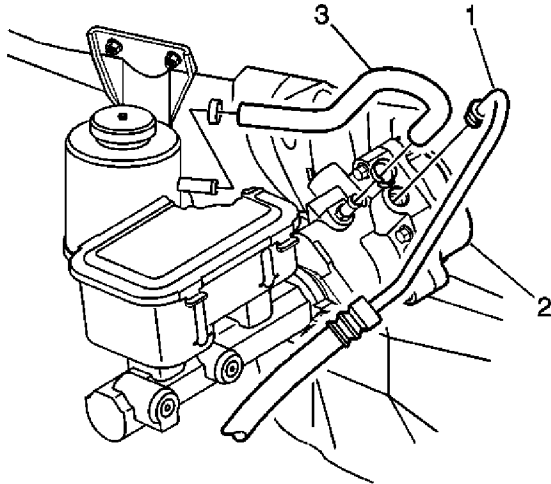
Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Install a drain pan under the vehicle.
2. Siphon the fluid from the reservoir to prevent excessive spillage.
3. Remove the reservoir inlet hose (3) from the power brake booster (2). DO NOT reuse clamps.
4. Remove the reservoir inlet hose (3) from the reservoir. DO NOT reuse clamps.
5. Remove the reservoir inlet hose from the vehicle.

Installation Procedure

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

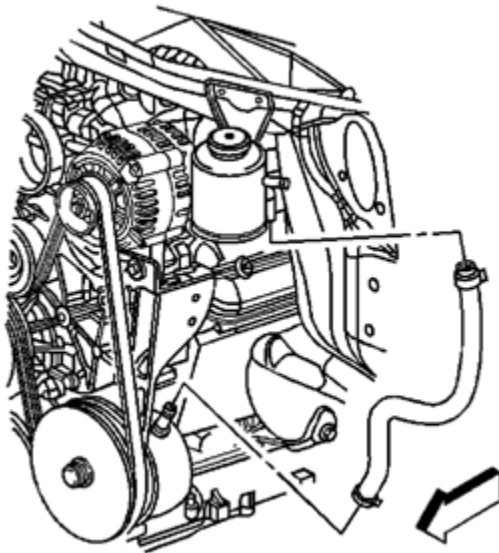


1. Route the hose in the same position the hose occupied prior to removal.
2. Install the reservoir inlet hose (3) to the reservoir. Reposition and secure clamps.
3. Install the reservoir inlet hose (3) to the power brake booster (2). Reposition and secure clamps.
4. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
5. Remove the drain pan from under the vehicle.

Power Steering Fluid Reservoir Outlet Hose Replacement

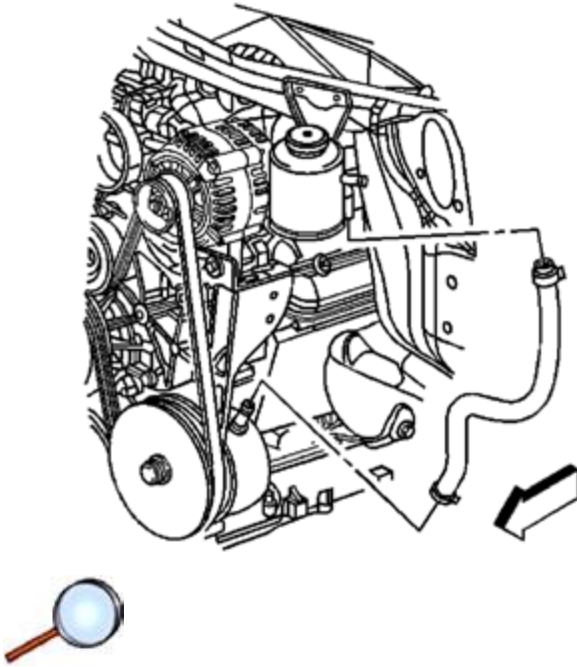
Removal Procedure

Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Siphon the power steering fluid from the reservoir.
2. Disconnect the power steering reservoir outlet hose from the power steering pump.
3. Disconnect the power steering reservoir outlet hose from the power steering gear remote reservoir.
4. Remove the power steering reservoir outlet hose from the vehicle.

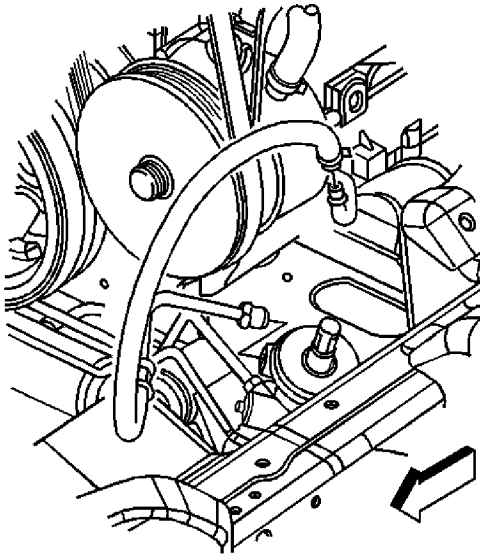
Installation Procedure



1. Install the power steering reservoir outlet hose to the vehicle
2. Install the power steering reservoir outlet hose to the power steering pump.
3. Install the power steering reservoir outlet hose to the power steering gear remote reservoir.
4. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).

Power Steering Gear Outlet Pipe / Hose Replacement Removal Procedure

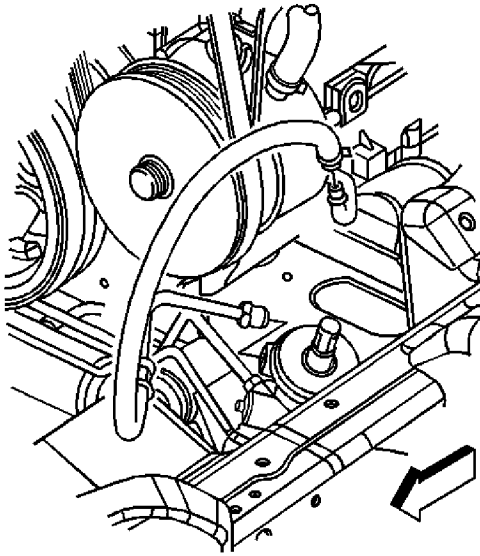
Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Install a drain pan under the vehicle.
2. Siphon the power steering fluid from the reservoir to prevent excessive spillage.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
4. Remove the power steering outlet hose from the power steering pump.
5. Remove the power steering gear outlet hose from the power steering gear.
6. Remove the power steering gear outlet hose from the vehicle.

Installation Procedure

Caution: Refer to [Installing Hoses without Twists or Bends Caution](#) in the Preface section.



1. Route the hose in the same position the hose occupied prior to removal.

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

2. Install the steering gear outlet hose to the power steering gear and tighten to **33 N·m (24 lb ft)**.
3. Install the power steering outlet hose to the power steering pump.
4. Lower the vehicle.
5. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
6. Remove the drain pan from under the vehicle.

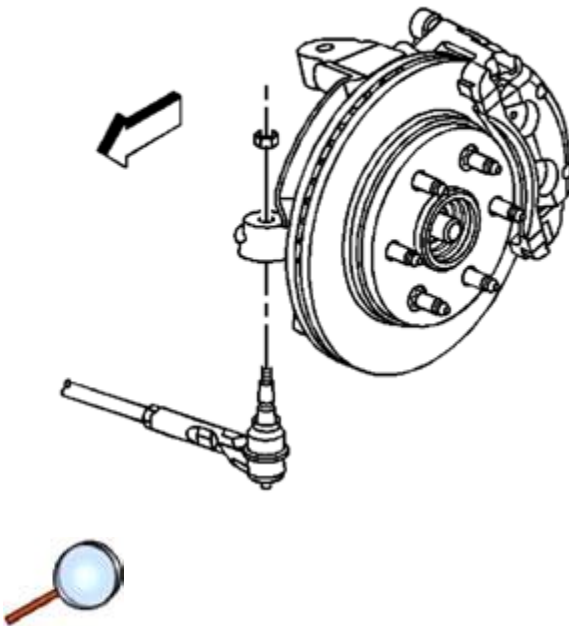
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Steering Gear Replacement (Rack and Pinion)

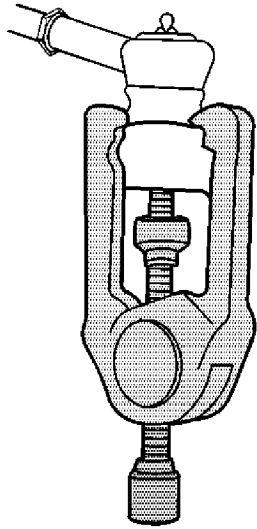
Special Tools

[J 24319-B](#) Steering Linkage and Tie Rod Puller

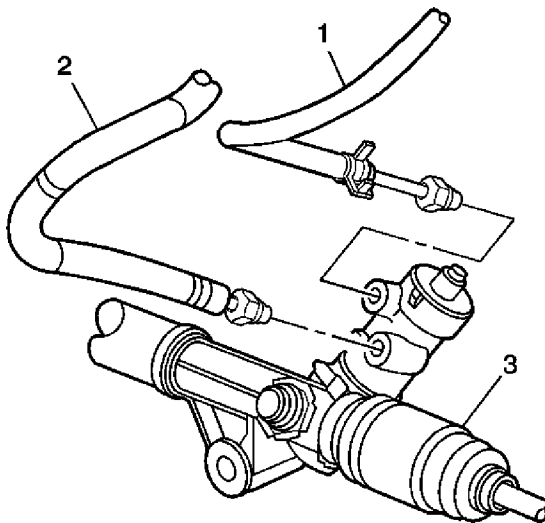
Removal Procedure



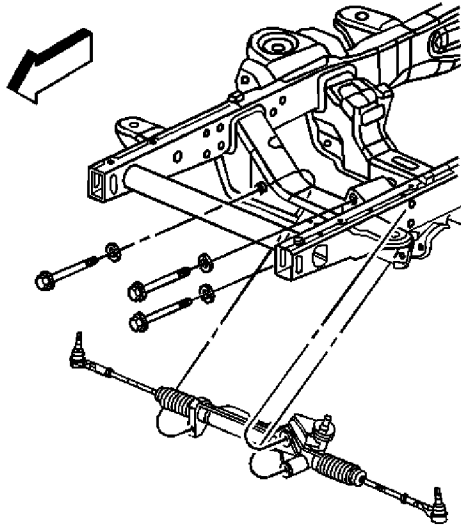
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Place a drain pan under the vehicle.
3. Remove the front tires and wheels. Refer to [Tire and Wheel Removal and Installation](#).
4. Remove the engine protection shield. Refer to [Engine Protection Shield Replacement](#).
5. Remove the outer tie rods retaining nuts.



6. Disconnect the outer tie rods from the steering knuckles using [J 24319-B](#).
7. Disconnect the lower intermediate shaft from the power steering gear. Refer to [Lower Intermediate Steering Shaft Replacement](#).

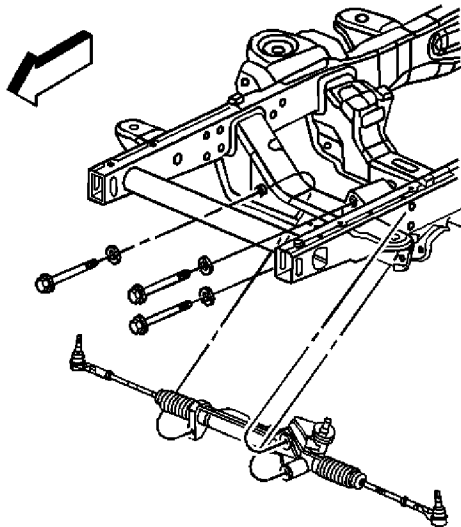


8. Disconnect the power brake booster outlet hose (2) and power steering gear outlet hose (1) or the power steering cooler hose (1) from the power steering gear (3).
9. Cap the ends of the hoses and the power steering gear fittings in order to prevent the entrance of dirt.



10. Remove the power steering gear mounting bolts.
11. Remove the power steering gear from the vehicle.

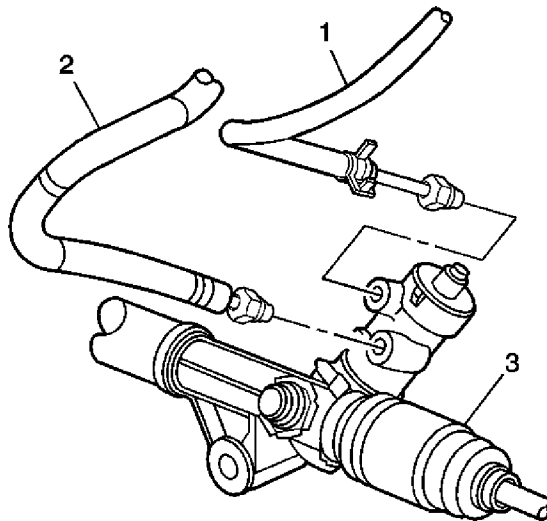
Installation Procedure



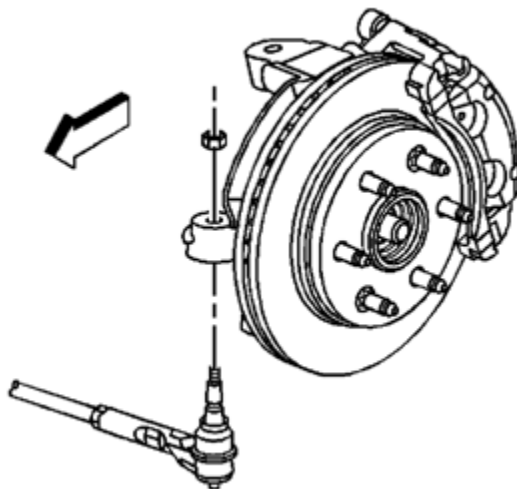
1. Install the power steering gear to the vehicle.

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

2. Install the power steering gear to the frame mounting bolts and tighten to **150 N·m (111 lb ft)**.



3. Remove the caps from the steering gear and hoses.
4. Connect the power brake booster outlet hose (2) and power steering gear outlet hose (1) or the power steering cooler hose (1) to the power steering gear (3). Tighten the hose fittings to **33 N·m (24 lb ft)**.
5. Connect the lower intermediate shaft to the power steering gear. Refer to [Lower Intermediate Steering Shaft Replacement](#).



6. Install the outer tie rods retaining nuts and tighten to **63 N·m (47 lb ft)**.
7. Install the engine protection shield. Refer to [Engine Protection Shield Replacement](#).
8. Install the front tires and wheels. Refer to [Tire and Wheel Removal and Installation](#).
9. Lower the vehicle.
10. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
11. Remove the drain pan from under the vehicle.
12. Check the wheel alignment. Refer to [Wheel Alignment Measurement](#).

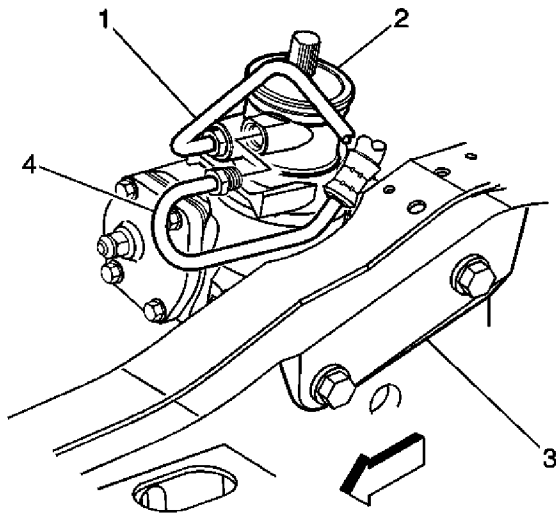
Steering Gear Replacement (Non-Rack and Pinion)

Special Tools

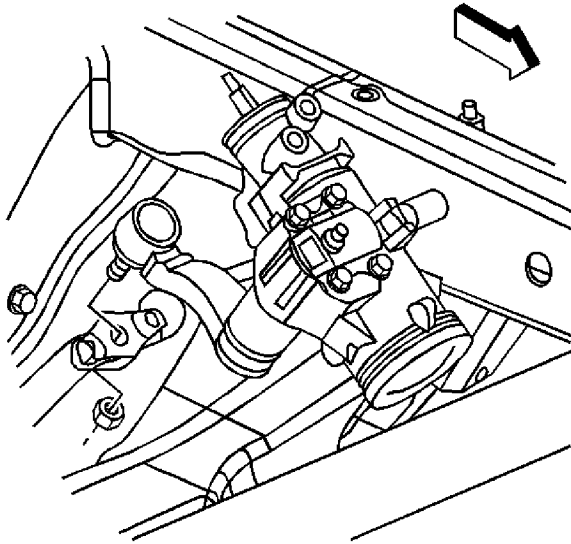
- [J 6632-01](#) Pitman Arm Puller
- [J 24319-B](#) Steering Linkage and Tie Rod Puller
- [J 29107-A](#) Pitman Arm Puller

Removal Procedure

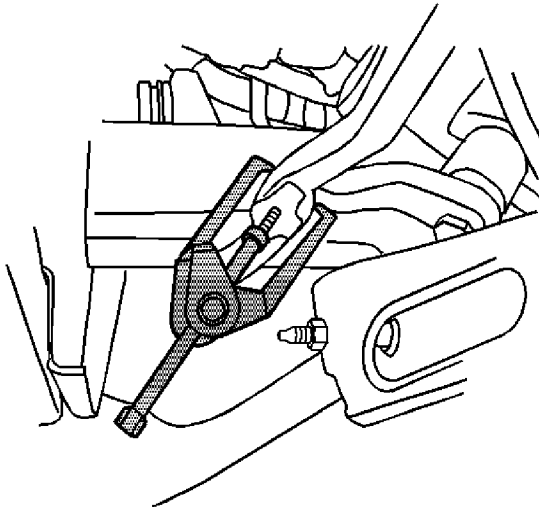
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Place a drain pan under the vehicle.
3. Remove the engine protection shield. Refer to [Engine Protection Shield Replacement](#).
4. Disconnect the lower intermediate shaft from the power steering gear. Refer to [Lower Intermediate Steering Shaft Replacement](#).



5. Disconnect the power brake booster outlet hose (4) and power steering gear outlet hose or the power steering cooler hose (1) from the power steering gear (2).
6. Cap the ends of the hoses and the power steering gear fittings in order to prevent the entrance of dirt.

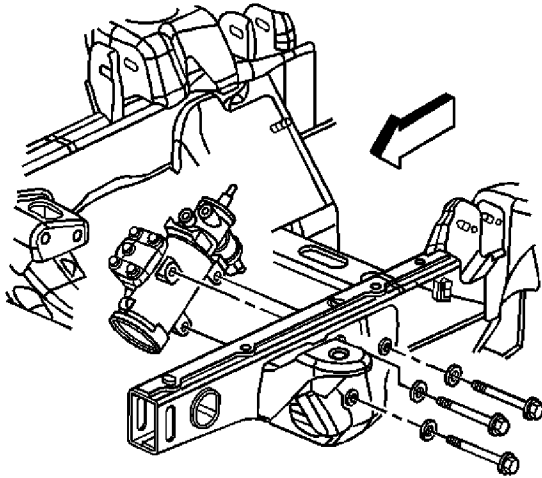


7. Remove the pitman arm to relay rod retaining nut.

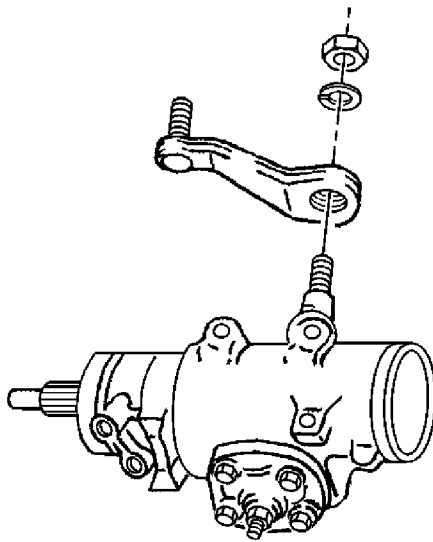


8. Disconnect the pitman arm from the relay rod using [J 24319-B](#).

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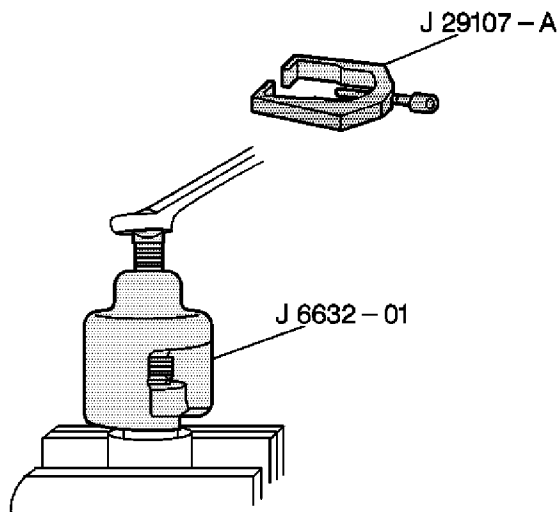


9. Remove the power steering gear mounting bolts.
10. Remove the power steering gear from the vehicle.



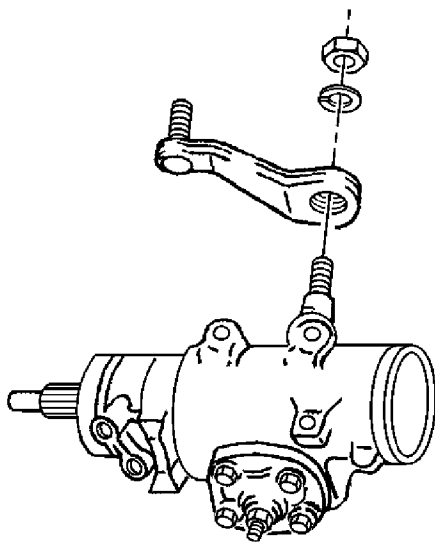
11. Remove the pitman arm to power steering gear retaining nut and washer.

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12. Remove the pitman arm from the power steering gear using [J 6632-01](#) or [J 29107-A](#).

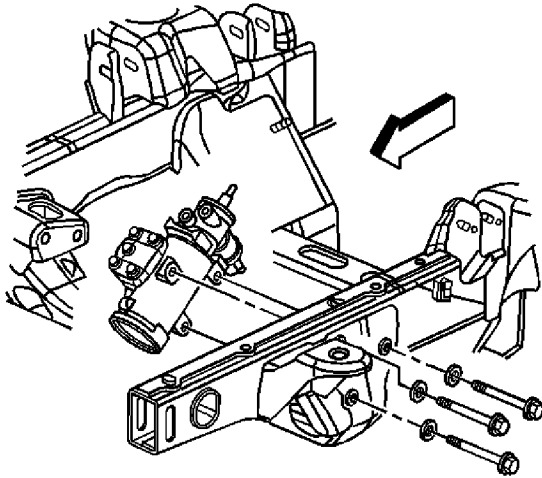
Installation Procedure



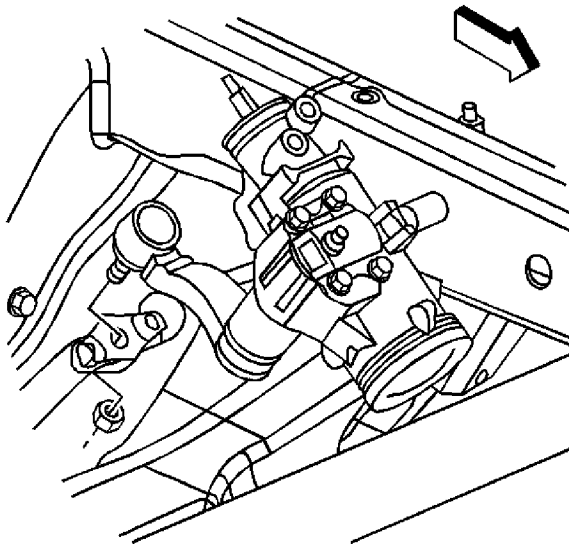
1. Install the pitman arm to the power steering gear.

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

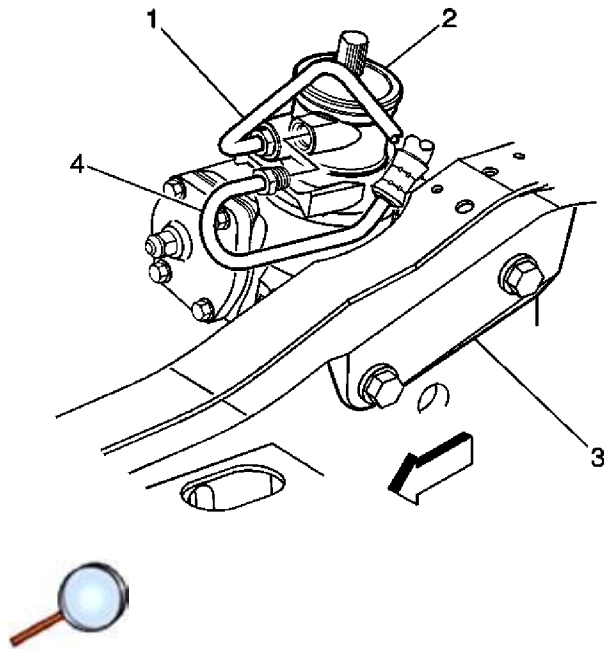
2. Install the pitman arm to power steering gear retaining nut and washer and tighten to **250 N·m (184 lb ft)**.



3. Install the power steering gear to the vehicle.
4. Install the power steering gear to the frame mounting bolts and tighten to **150 N·m (111 lb ft)**.

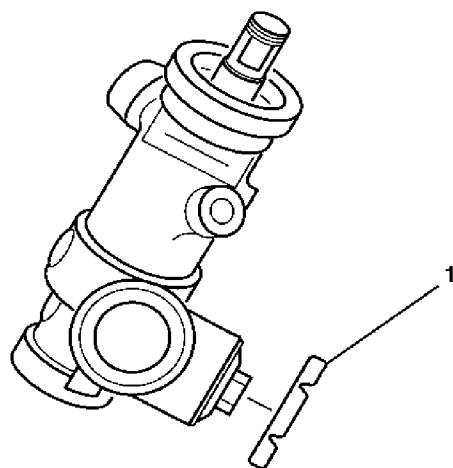


5. Install the pitman arm to relay rod.
6. Install the pitman arm to relay rod retaining nut and tighten to **63 N·m (47 lb ft)**.



7. Remove the caps from the steering gear and hoses.
8. Connect the power brake booster outlet hose (4) and power steering gear outlet hose or the power steering cooler hose (1) to the power steering gear (2). Tighten the hose fittings to **33 N·m (24 lb ft)**.
9. Connect the lower intermediate shaft to the power steering gear. Refer to [Lower Intermediate Steering Shaft Replacement](#).
10. Install the engine protection shield. Refer to [Engine Protection Shield Replacement](#).
11. Lower the vehicle.
12. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
13. Remove the drain pan from under the vehicle.

Steering Gear Rack Bearing Preload Adjustment - Off Vehicle



1. Loosen the adjuster plug lock nut (1).
2. Turn the adjuster plug clockwise until the adjuster plug bottoms in the gear assembly.
3. Turn the adjuster plug back 50 degrees to 70 degrees (approximately one flat).

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

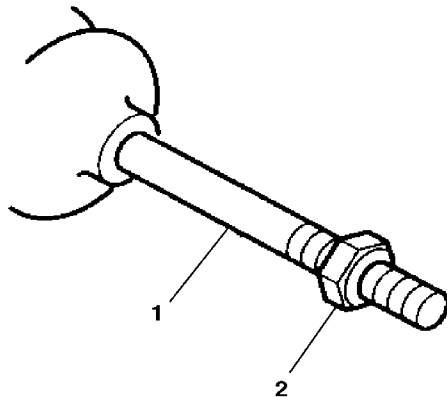
4. Install the adjuster plug lock nut (1) to the adjuster plug. Hold the adjuster plug stationary while tightening the adjuster plug lock nut (1) to **68 N·m (50 lb ft)**.

Steering Gear Boot and Breather Tube Replacement - Off Vehicle

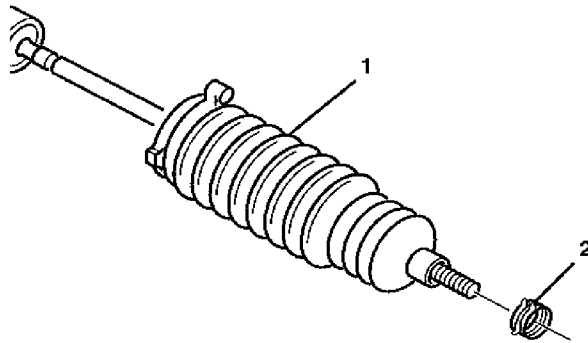
Tools Required

[J 22610](#) Keystone Clamp Pliers.

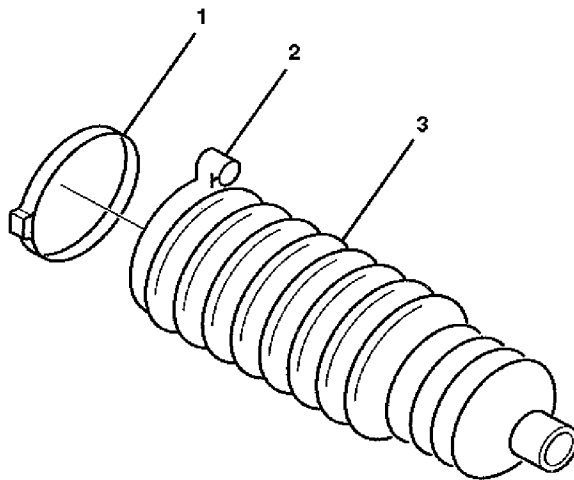
Disassembly Procedure



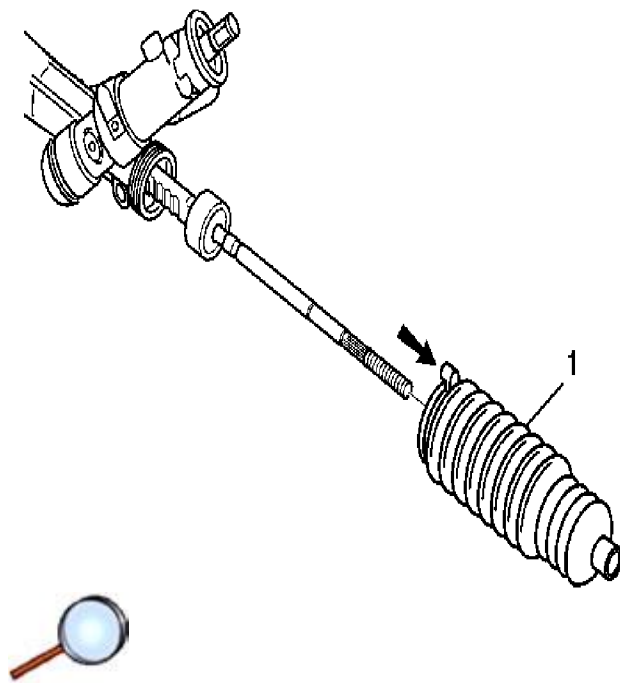
1. To remove the outer tie rod. Refer to [Rack and Pinion Outer Tie Rod End Replacement](#) .
2. Remove the hexagon jam nut (2) from the inner tie rod assembly (1).



3. Remove the tie rod end clamp (2) from the rack and pinion boot (1).



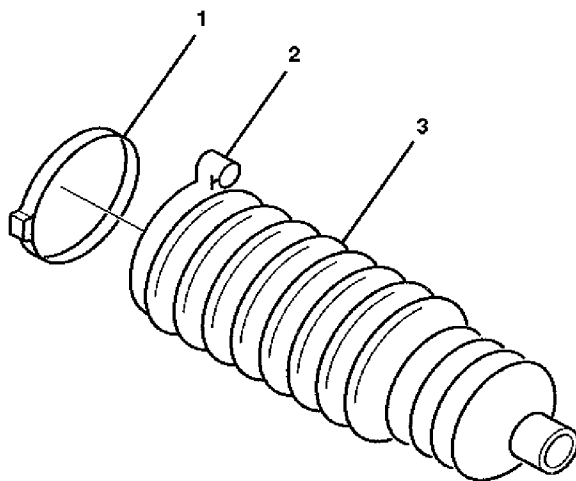
4. Remove the boot clamp (1) from the rack and pinion boot with side cutters.
5. Discard the boot clamp (1).

**Important:**

- If a breather tube is present, mark the location of the breather tube on the gear assembly before removal of the rack and pinion boot.
- After removing the boot, inspect the inner tie rod for evidence of corrosion or contamination. If none is evident, continue with the repair. If corrosion or contamination is evident, replace the steering gear.

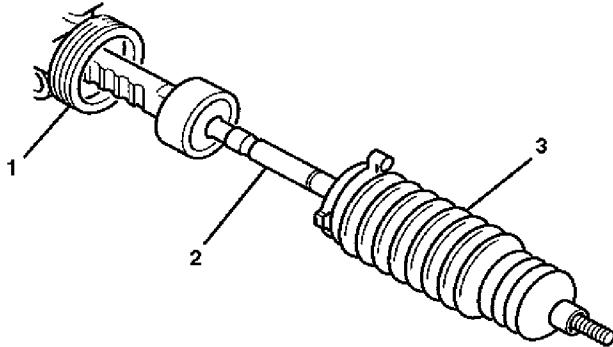
6. Remove the rack and pinion boot (1) and the breather tube, if present, from the rack and pinion gear assembly.

Assembly Procedure





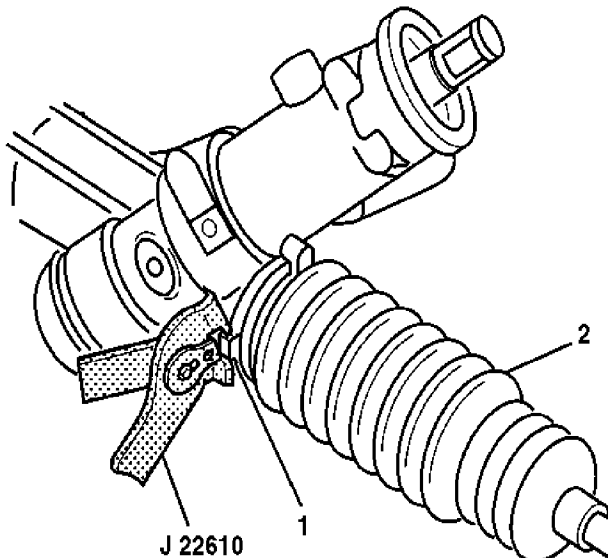
1. Install the new boot clamp (1) onto the rack and pinion boot (3).



2. Prior to rack and pinion boot installation, apply grease to the inner tie rod assembly (2) and the rack and pinion gear assembly (1).
3. Install the rack and pinion boot (3) onto the inner tie rod assembly (2).
4. If present, install the breather tube while aligning the breather tube with the mark made during removal and the molded nipple of the rack and pinion boot.

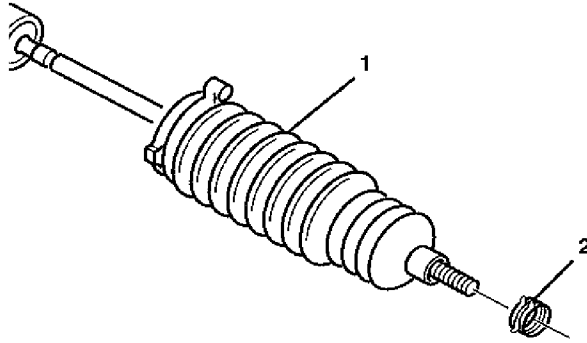
Important: The rack and pinion boot (3) must not be twisted, puckered or out of shape in any way. If the rack and pinion boot (3) is not shaped properly, adjust the rack and pinion boot (3) by hand before installing the boot clamp.

5. Install the rack and pinion boot onto the gear assembly (1) until the rack and pinion boot (3) is seated in the gear assembly groove.

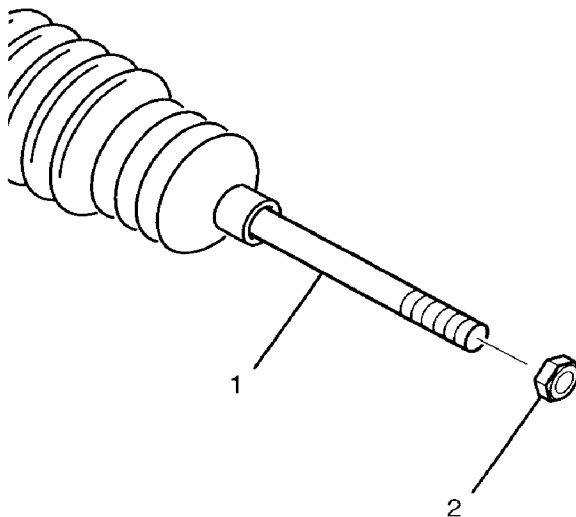




6. Install the boot clamp (1) on the rack and pinion boot (2) with [J 22610](#) .
7. Crimp the boot clamp (1).
8. Pinch the pliers together on the rack and pinion boot (2) in order to install the tie rod end clamp.



9. Install the tie rod end clamp (2) onto the rack and pinion boot (1).



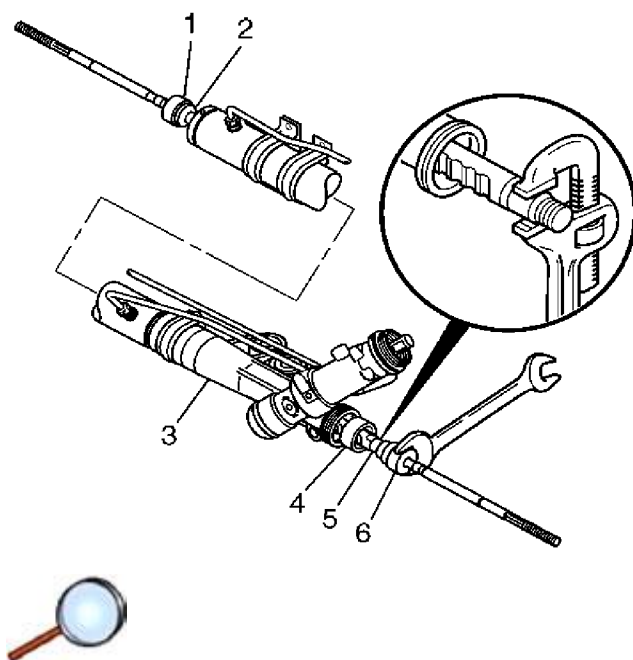
10. Install the hexagon jam nut (2) to the inner tie rod assembly (1).
11. To assemble the outer tie rod assembly. Refer to [Rack and Pinion Outer Tie Rod End Replacement](#) .

Steering Linkage Inner Tie Rod Replacement - Off Vehicle (Quiet Valve)

Special Tools

J-34028 Inner Tie Rod Wrench

Disassembly Procedure



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

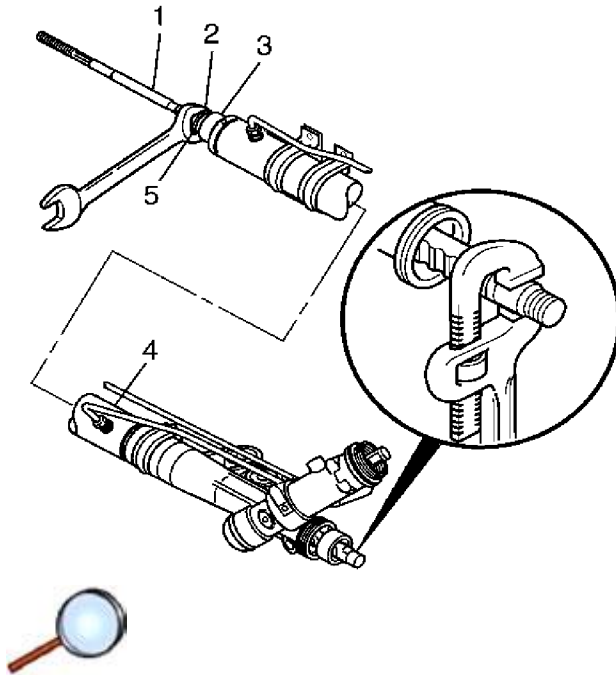
1. Remove the rack and pinion boot. Refer to [Steering Gear Boot and Breather Tube Replacement - Off Vehicle](#) .
2. Place the gear in a vise.

Caution: Do not change the steering gear preload adjustment before moving the inner tie rod from the steering gear. Changing the steering gear preload adjustment before moving the inner tie rod could result in damage to the pinion and the steering gear.

3. Remove the shock dampener (4) from the inner tie rod assembly (6).
4. Slide the shock dampener (4) back on the rack (5).

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

5. Place a pipe wrench on the rack (5) next to the inner tie rod housing (6).
6. Place a wrench on the flats of the inner tie rod housing (6).
7. Rotate the inner tie rod housing (6) counterclockwise, while holding the rack stationary, until the inner tie rod separates from the rack (5).

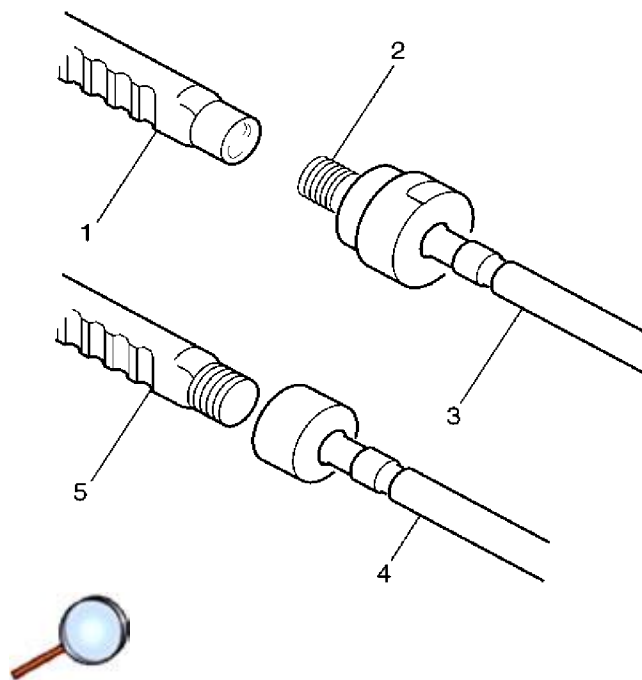


Caution: Do not change the steering gear preload adjustment before moving the inner tie rod from the steering gear. Changing the steering gear preload adjustment before moving the inner tie rod could result in damage to the pinion and the steering gear.

8. Remove the shock dampener (3) from the inner tie rod housing (2).
9. Slide the shock dampener (3) back on the rack (5).

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

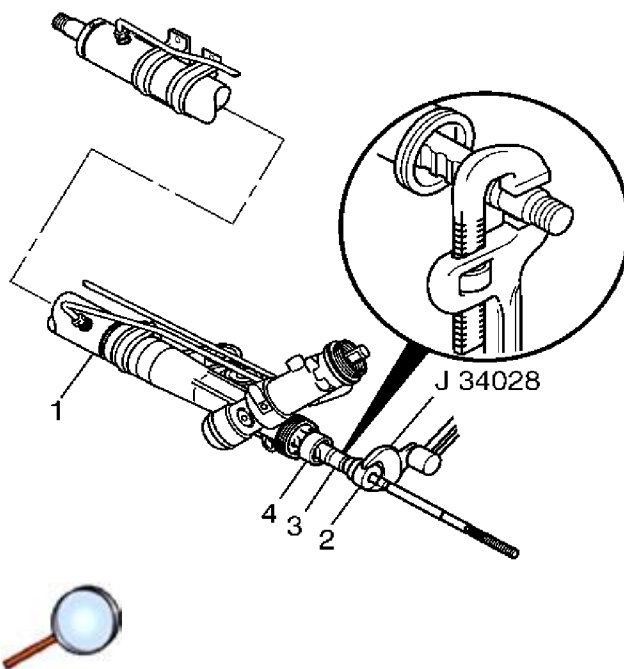
10. Place a pipe wrench on the rack.
11. Place a wrench on the flats of the inner tie rod housing (2).
12. Rotate the inner tie rod housing (2) counterclockwise, while holding the rack stationary, until the inner tie rod (1) separates from the rack (5).



13. If female rack (1) and male inner tie rod (3), remove the old LOCTITE® from the threads (2) of the inner tie rod and the rack.

If male rack (5) and female inner tie rod (4) LOCTITE® will not be present.

Assembly Procedure



1. Slide the shock dampener (4) forward onto the rack (3).

Note: Threads must be clean prior to LOCTITE® application. Check LOCTITE® or equivalent container for expiration date. Use only enough LOCTITE® to evenly coat threads.

If male rack (3) and female inner tie rod (2) do not apply LOCTITE®.

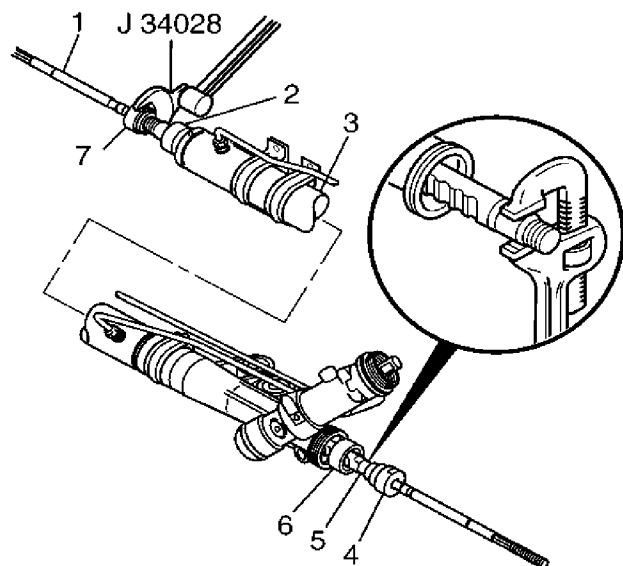
2. If female rack (3) and male inner tie rod (2), apply LOCTITE® 262 or equivalent to the inner tie rod threads.
3. Attach the inner tie rod onto the rack (3).

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

4. Place a pipe wrench on the rack (3) next to the inner tie rod housing (2).

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

5. Place a torque wrench and J-34028 Inner Tie Rod Wrench on the flats of the inner tie rod housing (2) and tighten the inner tie rod to **100 N·m (74 lb ft)**.



6. Slide the shock dampener (2) forward onto the rack.

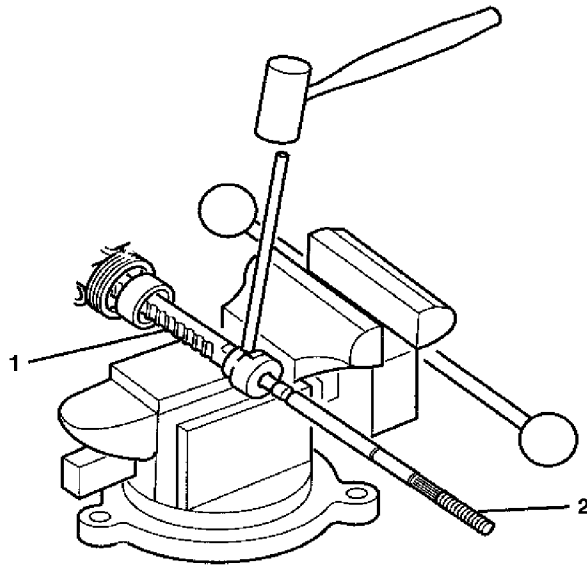
Note: Threads must be clean prior to LOCTITE® application. Check LOCTITE® or equivalent container for expiration date. Use only enough LOCTITE® to evenly coat threads.

If male rack and female inner tie rod (1) do not apply LOCTITE®.

7. If female rack and male inner tie rod (1), apply LOCTITE® 262 or equivalent to the inner tie rod threads.
8. Attach the inner tie rod (1) onto the rack.

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

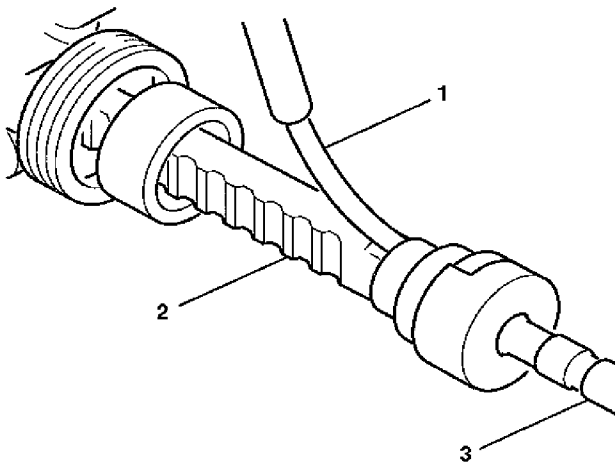
9. Place a pipe wrench on the rack next to the inner tie rod housing (4).
10. Place a torque wrench and J-34028 Wrench on the flats of the inner tie rod housing (7) and tighten the inner tie rod to **100 N·m (74 lb ft)**.



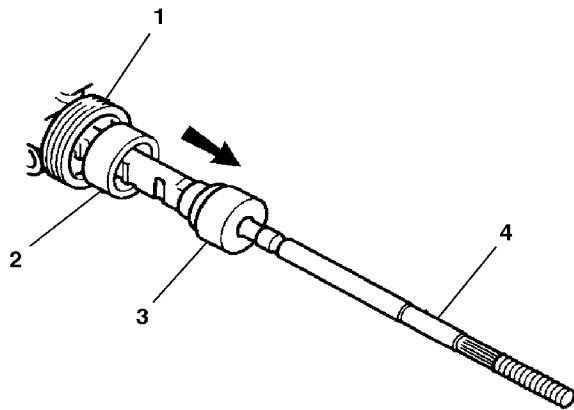
11. Place the inner tie rod assembly (2) in a vise.

Note: If female rack (1) and male inner tie rod (2) do not stake. If male rack (1) and female inner tie rod (2) you must stake.

12. Stake both sides of the female inner tie rod assembly housing to the male rack.



13. Insert a 0.25 mm gage (1) between the rack (2) and the inner tie rod housing in order to check both stakes. The feeler gage (1) must not pass between the rack and the housing stake.



14. Slide the shock dampener (2) over the inner tie rod housing (3) until the front lip of the shock dampener (2) bottoms against the inner tie rod housing (3).
15. To assemble the rack and pinion boot. Refer to [Steering Gear Boot and Breather Tube Replacement - Off Vehicle](#) .

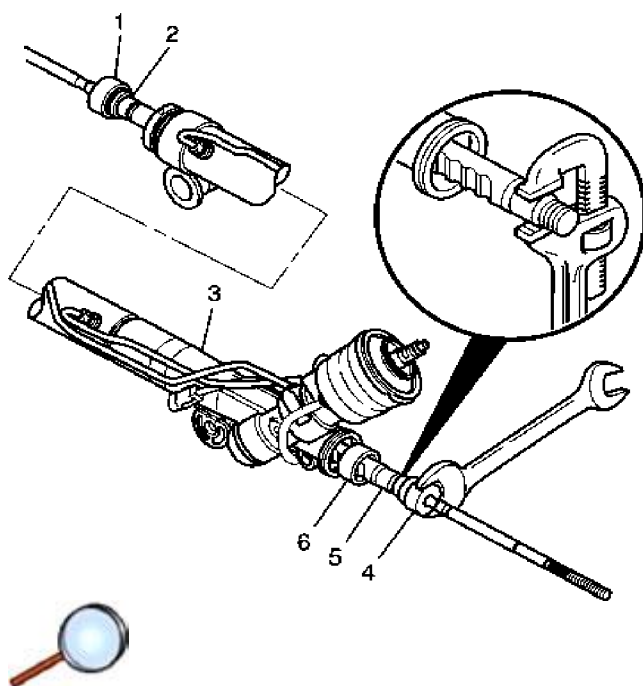
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Steering Linkage Inner Tie Rod Replacement - Off Vehicle (Magnasteer)

Special Tools

[J 34028](#) Inner Tie Rod Wrench

Disassembly Procedure



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

1. To remove the rack and pinion boot, refer to [Steering Gear Boot and Breather Tube Replacement - Off Vehicle](#).
2. Place the gear in a vise.

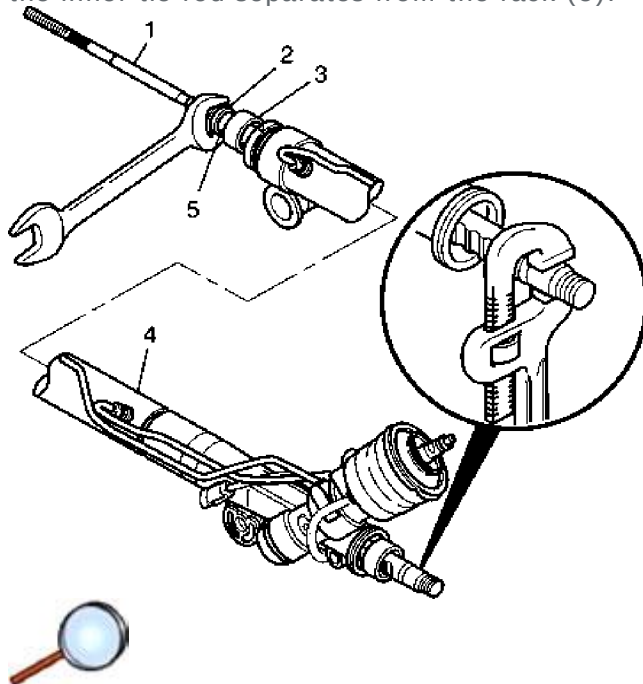
Caution: Do not change the steering gear preload adjustment before moving the inner tie rod from the steering gear. Changing the steering gear preload adjustment before moving the inner tie rod could result in damage to the pinion and the steering gear.

3. Remove the shock dampener (6) from the inner tie rod housing (4).
4. Slide the shock dampener (6) back on the rack (5).

Caution: The pipe wrench must be placed at the valve end of the steering gear and positioned up against the inner tie rod housing. Placing the pipe wrench in any other location will cause damage to the steering gear.

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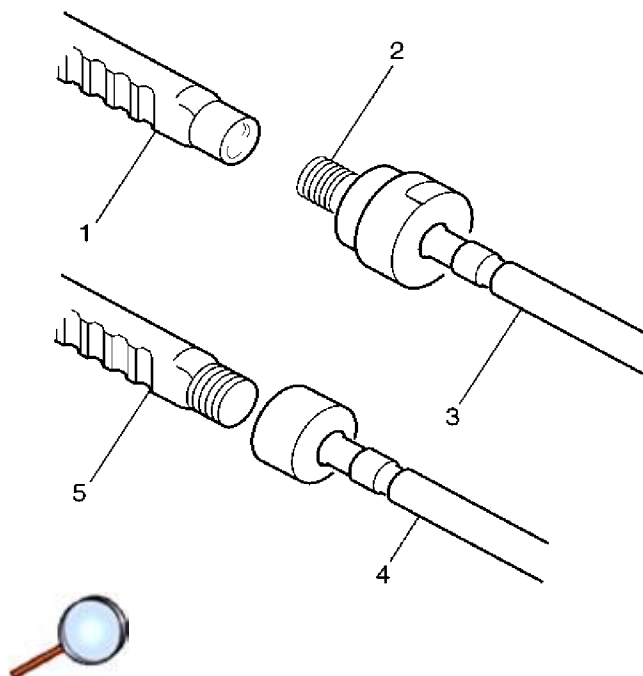
5. Place a pipe wrench on the rack (5) next to the inner tie rod housing (4).
6. Place a wrench on the flats of the inner tie rod housing (4).
7. Rotate the inner tie rod housing (4) counterclockwise, while holding the rack stationary, until the inner tie rod separates from the rack (5).



8. Remove the shock dampener (3) from the inner tie rod housing (2).
9. Slide the shock dampener (3) back on the rack (5).

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

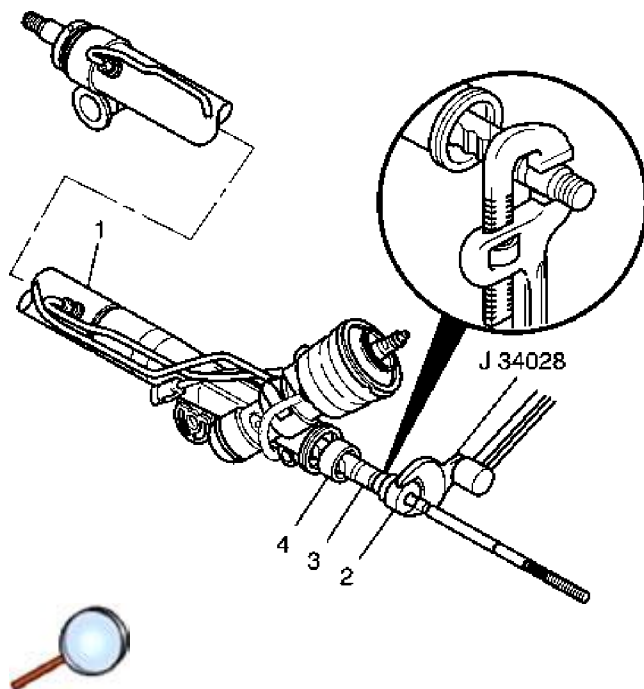
10. Place a pipe wrench on the rack.
11. Place a wrench on the flats of the inner tie rod housing (2).
12. Rotate the inner tie rod housing (2) counterclockwise, while holding the rack stationary, until the inner tie rod (1) separates from the rack (5).



13. If female rack (1) and male inner tie rod (3), remove the old LOCTITE® from the threads (2) of the inner tie rod (3) and the rack (1).

If male rack (5) and female inner tie rod (4) LOCTITE® will not be present.

Assembly Procedure



1. Slide the shock dampener (4) forward onto the rack (3).

Note: Threads must be clean prior to LOCTITE® application. Check LOCTITE®, or equivalent, container for expiration date. Use only enough LOCTITE® to evenly coat threads.

If male rack (3) and female inner tie rod (2) do not apply LOCTITE®.

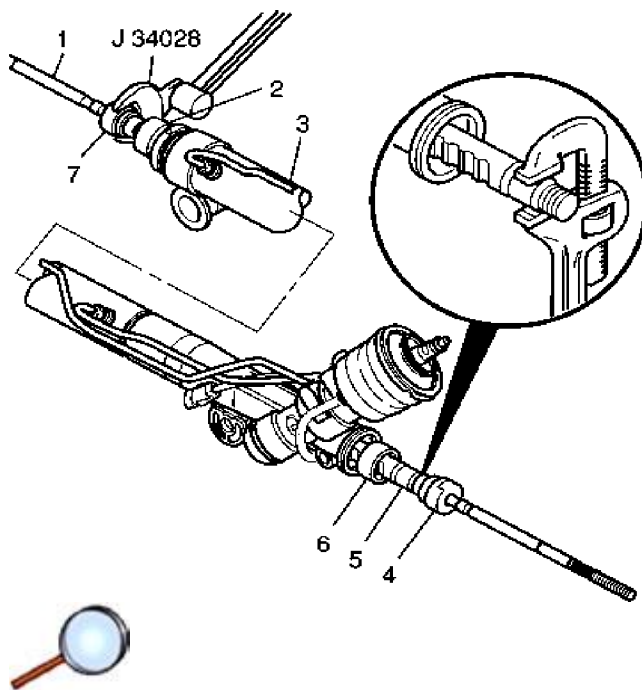
2. If female rack (3) and male inner tie rod (2), apply LOCTITE® 262, or equivalent, to the inner tie rod threads.
3. Attach the inner tie rod onto the rack (3).

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

4. Place a pipe wrench on the rack (3) next to the inner tie rod housing (2).

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

5. Place a torque wrench and [J 34028](#) on the flats of the inner tie rod housing (2). Tighten the inner tie rod to **100 N·m (74 lb ft)**.



6. Slide the shock dampener (2) forward onto the rack.

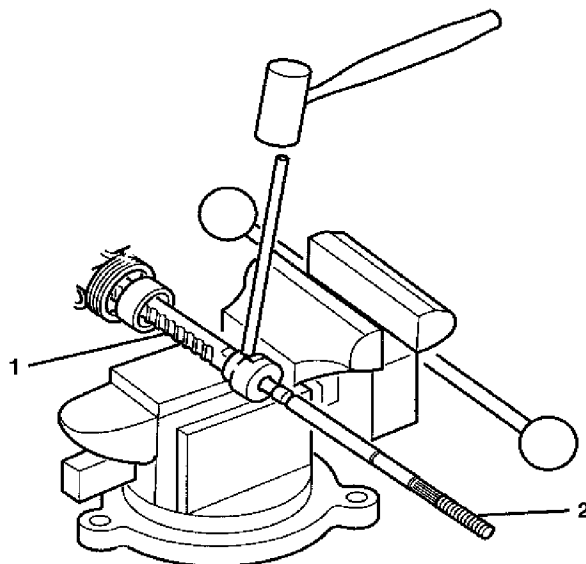
Note: Threads must be clean prior to LOCTITE® application. Check LOCTITE®, or equivalent, container for expiration date. Use only enough LOCTITE® to evenly coat threads.

If male rack and female inner tie rod (1) do not apply LOCTITE®.

7. If female rack and male inner tie rod (1), apply LOCTITE® 262, or equivalent, to the inner tie rod threads.
8. Attach the inner tie rod (1) onto the rack.

Caution: Refer to [Pipe Wrench Positioning Caution](#) in the Preface section.

9. Place a pipe wrench on the rack next to the inner tie rod housing (4).
10. Place a torque wrench and [J 34028](#) on the flats of the inner tie rod housing (7). Tighten the inner tie rod to **100 N·m (74 lb ft)**.

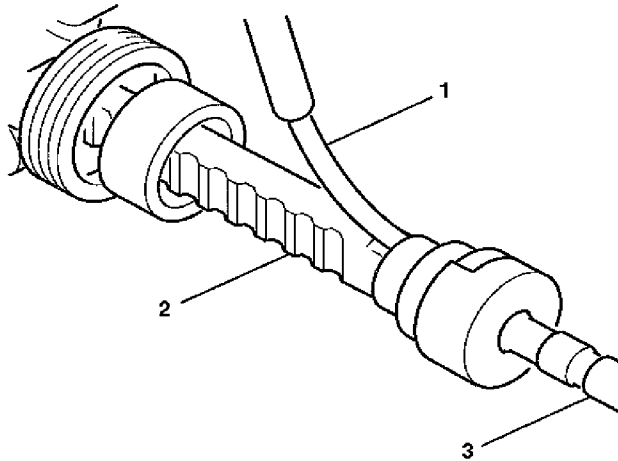




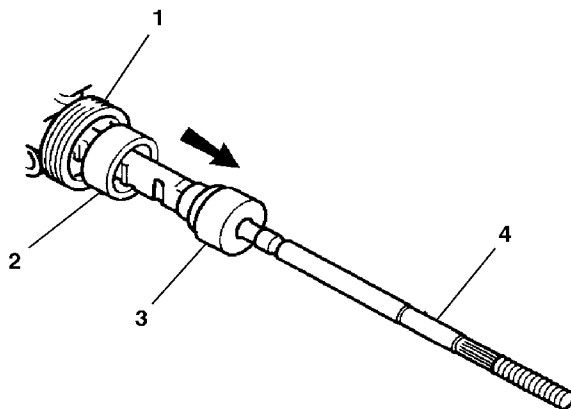
11. Place the inner tie rod assembly (2) in a vise.

Note: If female rack (1) and male inner tie rod (2) do not stake. If male rack (1) and female inner tie rod (2) you must stake.

12. Stake both sides of the female inner tie rod assembly housing to the male rack (1).



13. Insert a 0.25 mm gage (1) between the rack (2) and the inner tie rod housing in order to check both stakes. The feeler gage (1) must not pass between the rack and the housing stake.



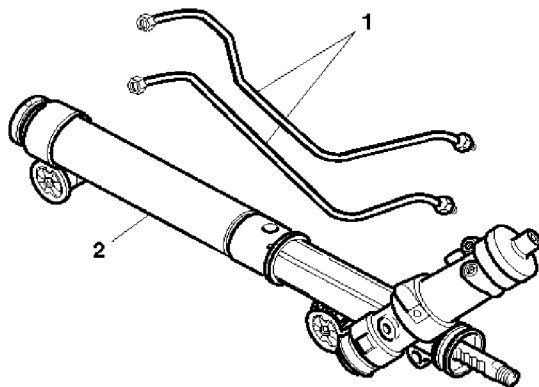
14. Slide the shock dampener (2) over the inner tie rod housing (3) until the front lip of the shock dampener (2) bottoms against the inner tie rod housing (3).

15. To assemble the rack and pinion boot. Refer to [Steering Gear Boot and Breather Tube Replacement - Off Vehicle](#).

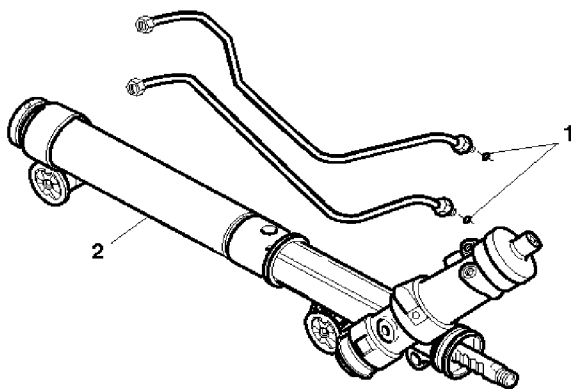
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Steering Gear Cylinder Pipe Assembly and Seals Replacement - Off Vehicle (Quiet Valve)

Disassembly Procedure



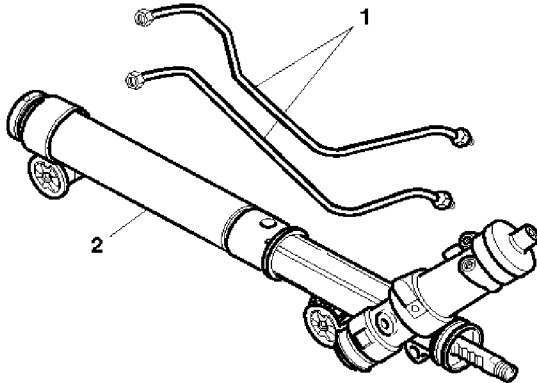
1. Loosen both cylinder line fittings on the cylinder end of the gear assembly.
2. Loosen both fittings on the cylinder line assemblies (1) at the valve end of the gear assembly.
3. Remove both cylinder line assemblies (1) from the rack and pinion gear assembly (2).



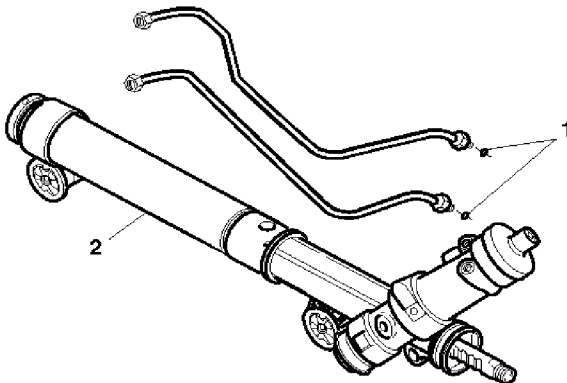


4. Remove the O-ring seals (1) from the valve end of line.
5. Discard the O-ring seals (1).

Assembly Procedure



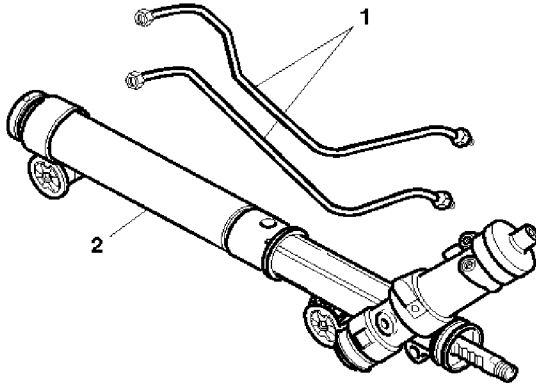
1. Inspect the cylinder lines (1) for the following items:
 - Cracks
 - Dents
 - Damage to the threads
2. Replace the parts as needed.





3. Install the new O-ring seals (1) to the valve end of the cylinder lines.

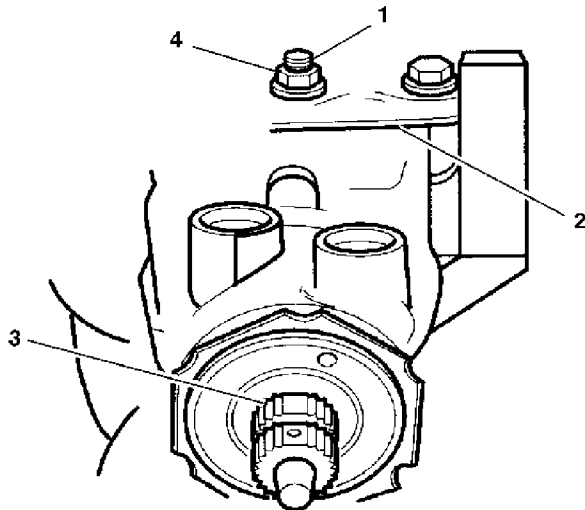
Caution: Refer to [Fastener Caution](#) in the Preface section.



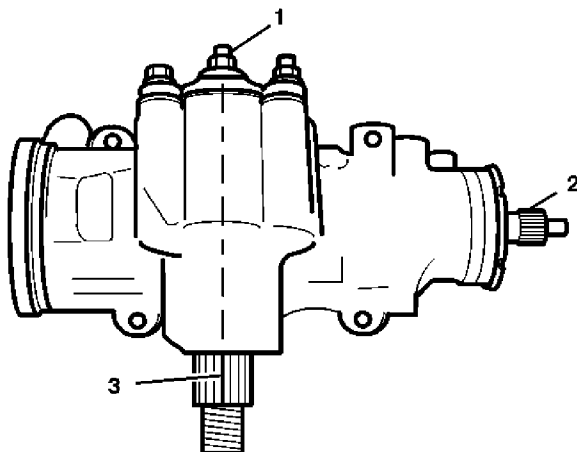
4. Install the cylinder line assemblies (1) to the gear assembly (2) and tighten.
 - Valve end fittings to **17 N·m (13 lb ft)**
 - Cylinder end fittings to **27 N·m (20 lb ft)**

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Steering Gear Pitman Shaft Over-Center Preload Adjustment - Off Vehicle

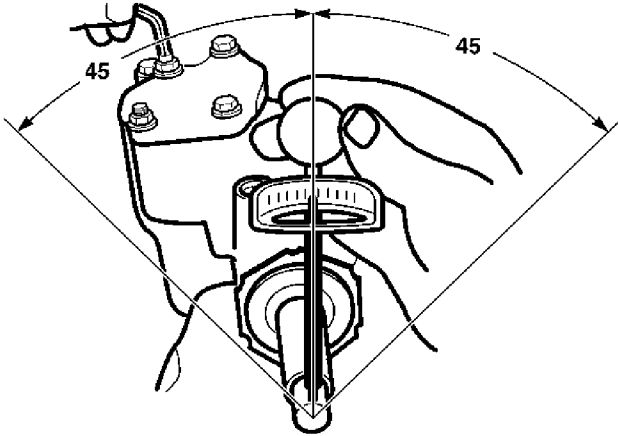


1. Remove the steering gear. Refer to [Steering Gear Replacement](#).
2. Loosen the steering gear pitman shaft lash adjuster nut (4).
3. Turn the steering gear pitman shaft lash adjuster screw (1) counterclockwise until fully extended.
4. Turn the steering gear pitman shaft lash adjuster screw (1) clockwise one full turn.
5. Rotate the steering gear stub shaft (3) from stop to stop, using a 12-point socket while counting the number of turns.
6. Starting at either stop, turn the steering gear stub shaft (3) back half the total number of turns counted previously. This is the centered position.





7. Make sure the steering gear pitman shaft is centered by checking the following items:
 - The flat on the steering gear stub shaft (2) faces upward.
 - The flat on the steering gear stub shaft is parallel with the steering gear side cover.
 - The master spline (3) on the steering gear pitman shaft is in line with the steering gear pitman shaft lash adjuster screw (1).



8. Place a torque wrench on the stub shaft with the handle in the vertical position.
9. Rotate the steering gear stub shaft 45 degrees from each side of the center of the steering gear stub shaft. The steering gear stub shaft must rotate smoothly and must not stick or bind.
10. Record the steering gear worm bearing preload measured on or near the center.

Note: Prevent the steering gear pitman shaft lash adjuster screw from turning while tightening the steering gear pitman shaft lash adjuster nut.

11. Recorded steering gear worm bearing preload must be 0.8-1.7 N·m (7.1-15.1 lb in), with the steering gear pitman shaft lash adjuster nut installed. If the torque is outside this range, readjust or repair the steering gear assembly as required.
12. To obtain the correct reload torque, adjust the over center preload by turning the steering gear pitman shaft lash adjuster screw clockwise.

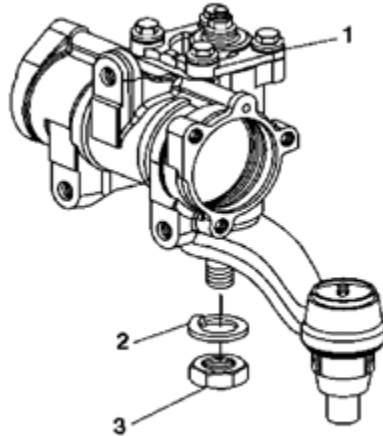
Caution: Refer to [Fastener Caution](#) in the Preface section.

13. Add increments of 0.7-1.1 N·m (6-10 lb in) torque to the previously measured steering gear worm bearing preload torque. Tighten the nut to **49 N·m (36 lb ft)**.
14. Install the steering gear. Refer to [Steering Gear Replacement](#).

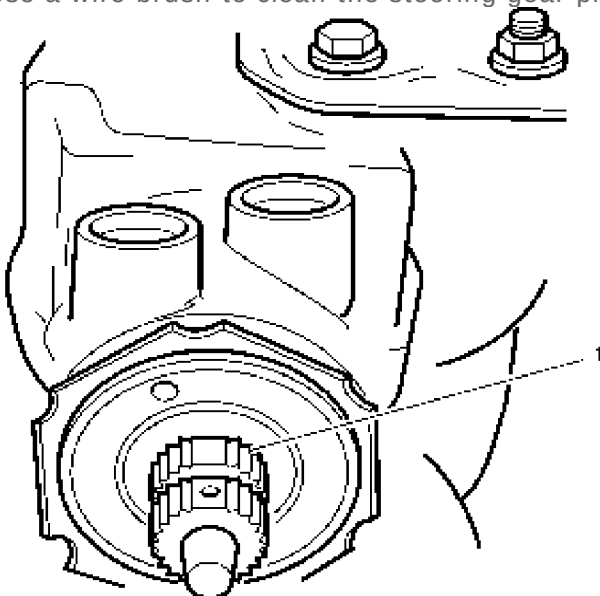
Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle

Disassembly Procedure

1. Remove the steering gear. Refer to [Steering Gear Replacement](#).



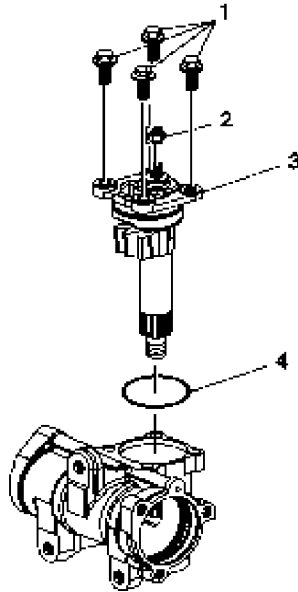
2. Remove the pitman arm nut (3).
3. Remove the pitman arm washer (2).
4. Clean the exposed end of the pitman shaft.
5. Clean off the steering gear housing (1).
6. Use a wire brush to clean the steering gear pitman shaft splines.





Note: The steering gear pitman shaft will not clear the housing if it is not centered.

7. To center the steering gear stub shaft:
 - 7.1. Rotate the steering gear stub shaft (1) with a wrench from stop to stop.
 - 7.2. Count the number of turns.
 - 7.3. Rotate the steering gear stub shaft back $\frac{1}{2}$ of the total amount of turns.



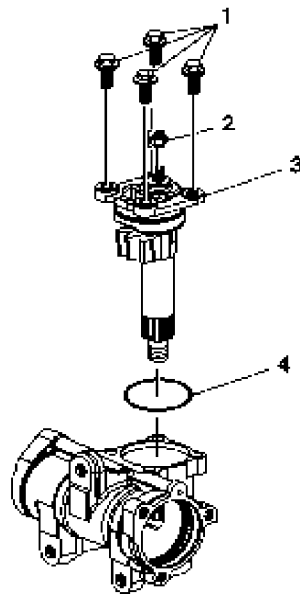
Note: When removing the steering gear pitman shaft, the pitman arm and its components may fall from the steering gear housing. Support the pitman arm and its components while removing the steering gear pitman shaft.

8. Remove the steering gear pitman shaft housing cover bolts (1).

Remove the steering gear pitman shaft lash adjuster nut (2).

9. Remove the steering gear pitman shaft housing cover (3).
10. Remove the steering gear pitman shaft housing cover O-ring (4).

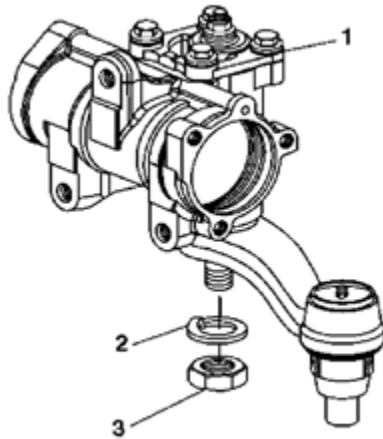
Assembly Procedure



1. Install the new steering gear pitman shaft housing cover O-ring (4).
2. Install the steering gear pitman shaft housing cover (3).
3. Install the steering gear pitman shaft lash adjuster nut (2).

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

4. Install the steering gear pitman shaft housing cover bolts (1) and tighten to **62 N·m (46 lb ft)**.



5. Install the pitman arm washer (2).
6. Install the pitman arm nut (3) and tighten to **250 N·m (184 lb ft)**.
7. If necessary adjust the steering gear pitman shaft over-center preload. Refer to [Steering Gear Pitman Shaft Over-Center Preload Adjustment - Off Vehicle](#).
8. Install the steering gear. Refer to [Steering Gear Replacement](#).

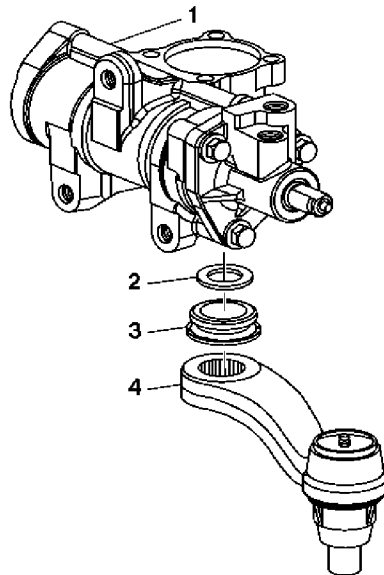
Steering Gear Pitman Shaft Seal and Bearing Replacement - Off Vehicle

Tools Required

- [J 6278](#) Pitman Shaft Bearing Remover and Installer
- [J 6219](#) Pitman Shaft Oil Seal Installer
- [J 4245](#) Internal Snap Ring Pliers

Disassembly Procedure

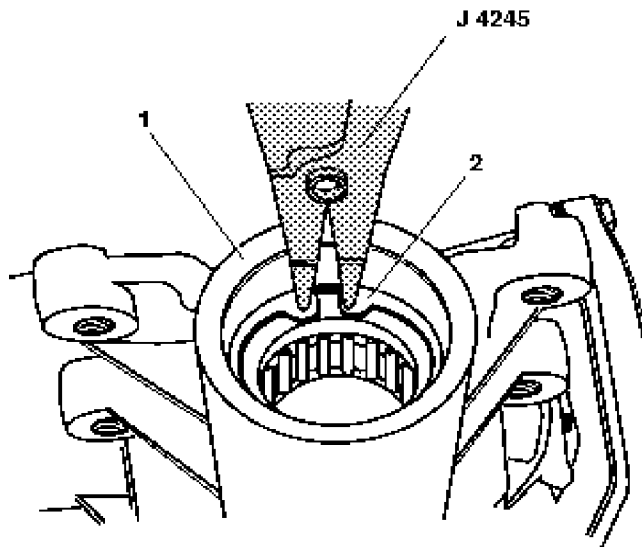
1. Remove the steering gear. Refer to [Steering Gear Replacement](#).



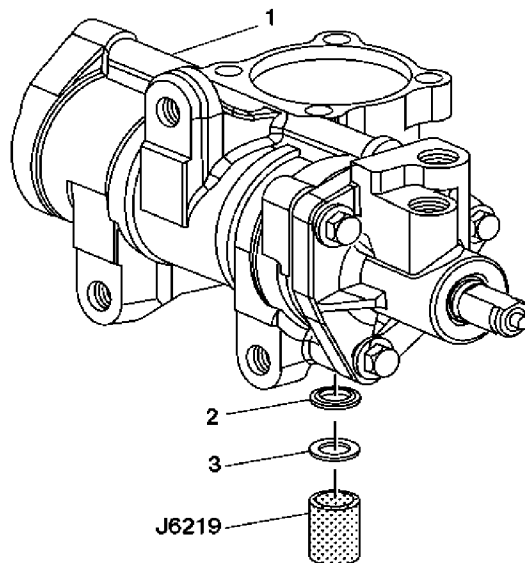
2. Remove the steering gear pitman shaft and housing cover. Refer to [Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle](#).
3. Remove the pitman arm (4) from the steering gear (1). Refer to [Pitman Arm Replacement](#).
4. Remove the pitman arm boot (3) from the steering gear housing (1).

Important: Do not score the steering gear housing bore when prying out the seals and washers.

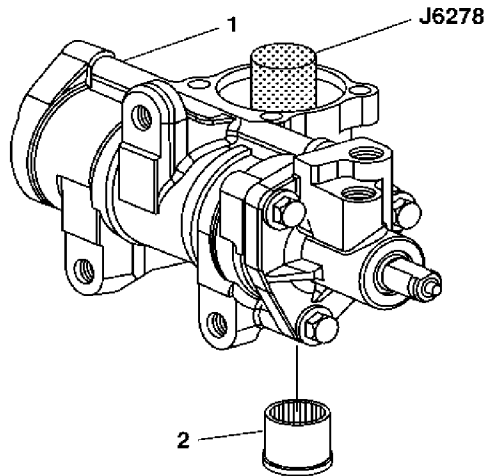
5. Remove the dust seal (2) from the steering gear housing (1).



6. Remove the steering gear pitman shaft seal retaining ring (2) from the steering gear housing (1) using pliers [J 4245](#).

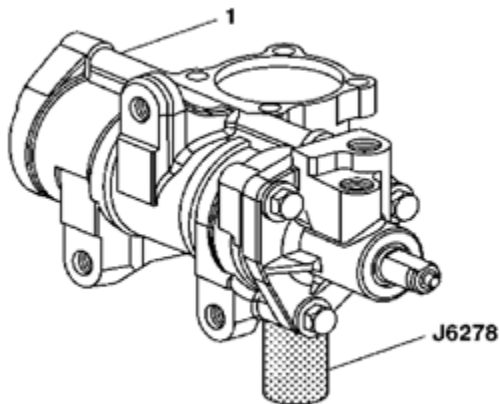


7. Remove the steering gear pitman shaft washer (3) from the steering gear housing (1).
 8. Pry the steering gear pitman shaft seal (2) from the steering gear housing (1) using a screwdriver.
 9. Inspect the housing for burrs and replace if necessary.

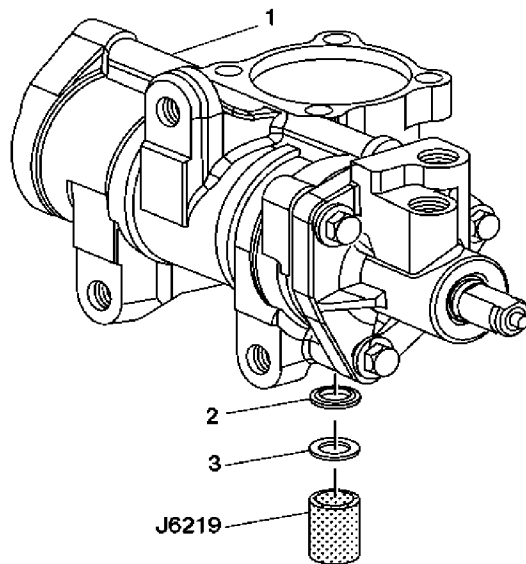


10. Insert remover/installer [J 6278](#) through the hole in the top of the steering gear housing (1).
11. Drive out the steering gear pitman shaft bearing (2) from the steering gear housing (1).

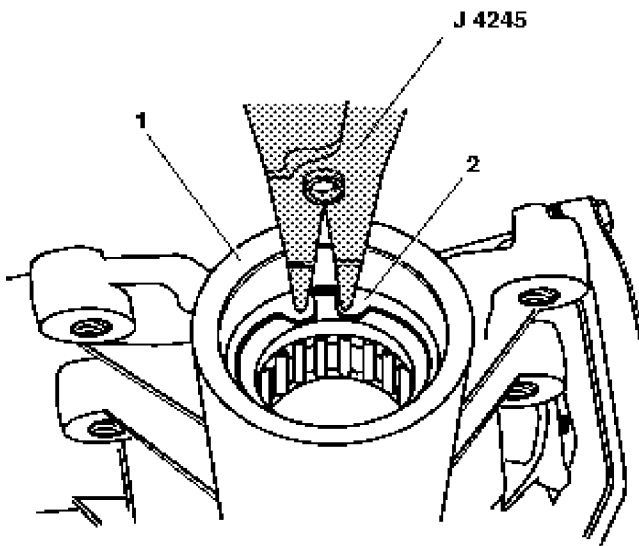
Assembly Procedure



1. Install the steering gear pitman shaft bearing into the steering gear housing (1) using remover/installer [J 6278](#).
2. Drive the steering gear pitman shaft bearing into the steering gear housing until the shoulder seats properly.

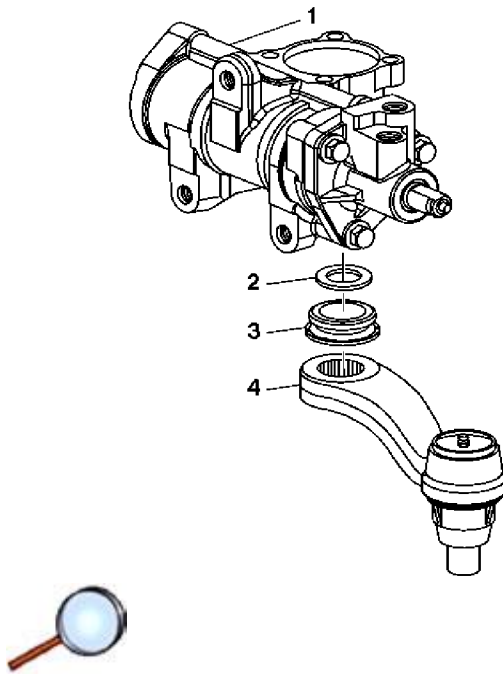


3. Coat the steering gear pitman shaft seal (2) and steering gear pitman shaft washer (3) with grease.
4. Install the steering gear pitman shaft seal (2) into the steering gear housing (1) using installer [J 6219](#).
5. Install the steering gear pitman shaft washer (3) onto the steering gear housing (1).



Important: The steering gear pitman shaft seal must not contact the steering gear pitman shaft bearing.

6. Install the steering gear pitman shaft seal retaining ring (2) into the steering gear housing (1) using pliers [J 4245](#).

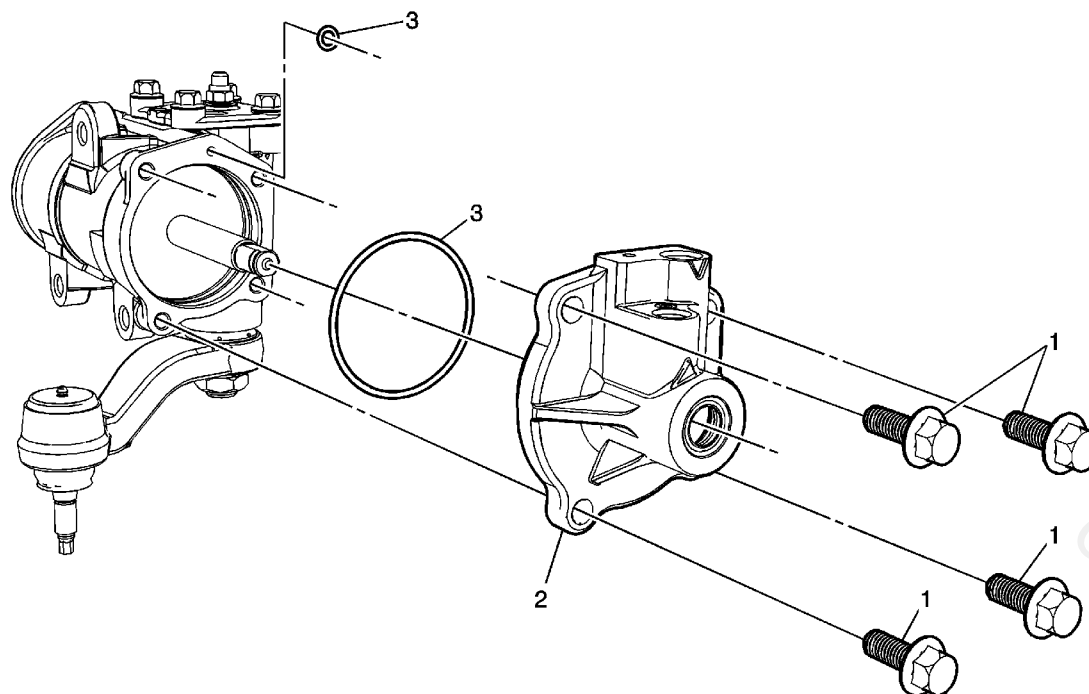


7. Coat the dust seal (2) with grease and install it into the steering gear housing (1).
8. Install the pitman arm boot (3) onto the steering gear housing (1).

Important: Do not install the pitman arm until all components have been installed onto the steering gear housing.

9. Install the steering gear pitman shaft and housing cover. Refer to [Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle](#).
10. Install the pitman arm (4) to the steering gear (1). Refer to [Pitman Arm Replacement](#).
11. Adjust the steering gear pitman arm shaft over center pre-load as needed. Refer to [Steering Gear Pitman Shaft Over-Center Preload Adjustment - Off Vehicle](#).
12. Install the steering gear. Refer to [Steering Gear Replacement](#).

Stub Shaft Housing Replacement

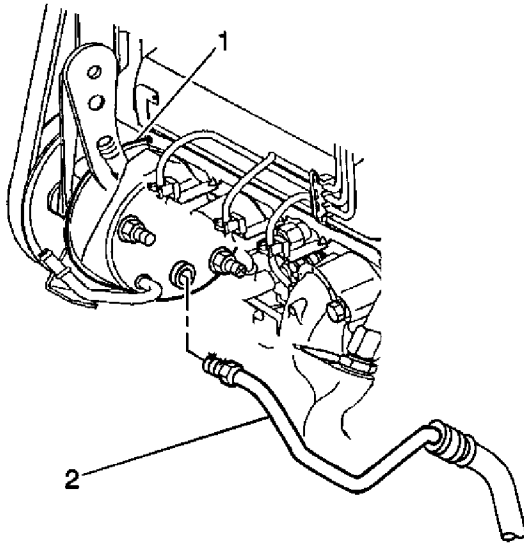


Callout	Component Name
Preliminary Procedures Remove the power steering gear. Refer to Steering Gear Replacement .	
1	Stub Shaft Housing Bolt (Qty: 4) Caution: Refer to Fastener Caution in the Preface section. Tighten 62 N·m (46 lb ft)
2	Stub Shaft Housing
3	Stub Shaft Housing O-Ring (Qty: 2) Tip Grease the stub shaft housing O-Rings with the special grease supplied in the service kit.

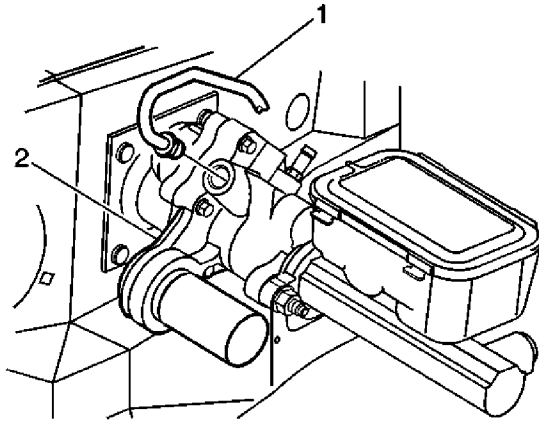
Power Brake Booster Inlet Hose Replacement

Removal Procedure

Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



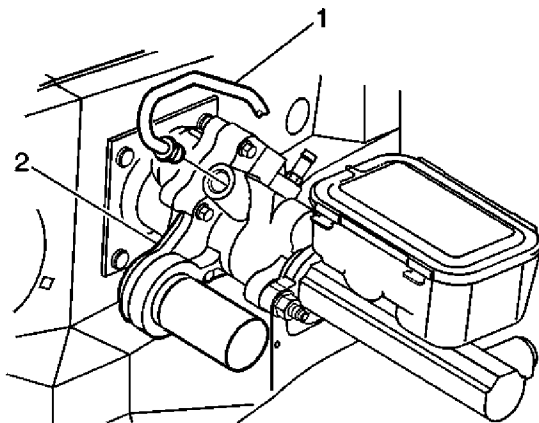
1. Install a drain pan under the vehicle.
2. Siphon the power steering fluid from the reservoir to prevent excessive spillage.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
4. Remove the power brake booster inlet hose (2) from the power steering pump (1) through the wheel well.
5. Lower the vehicle.



6. Remove the power brake booster inlet hose (1) from the power brake booster (2).
7. Remove the power brake booster inlet hose from the vehicle.

Installation Procedure

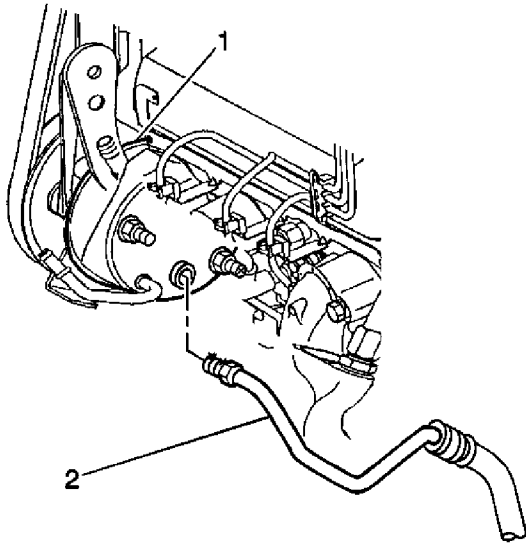
Caution: Refer to [Installing Hoses without Twists or Bends Caution](#) in the Preface section.



1. Route the hose in the same position the hose occupied prior to removal.

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

2. Install the power brake booster inlet hose (1) to the power brake booster (2). Hand tighten.
3. Raise the vehicle.

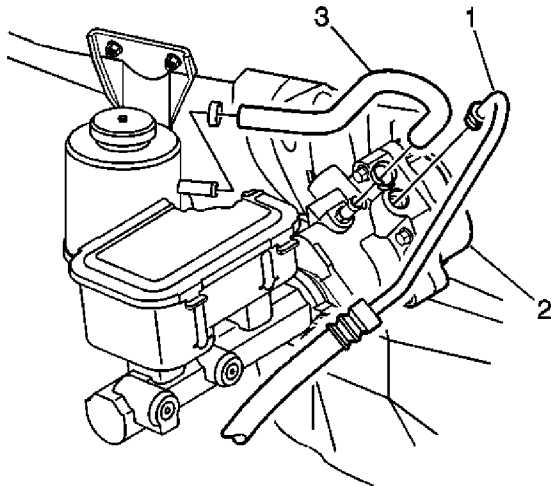


4. Install the power brake booster inlet hose (2) to the power steering pump (1) through the wheel well. Tighten the hose fitting to **33 N·m (24 lb ft)**.
5. Lower the vehicle.
6. Tighten the power brake booster inlet hose to the power brake booster to **33 N·m (24 lb ft)**.
7. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
8. Remove the drain pan from under the vehicle.

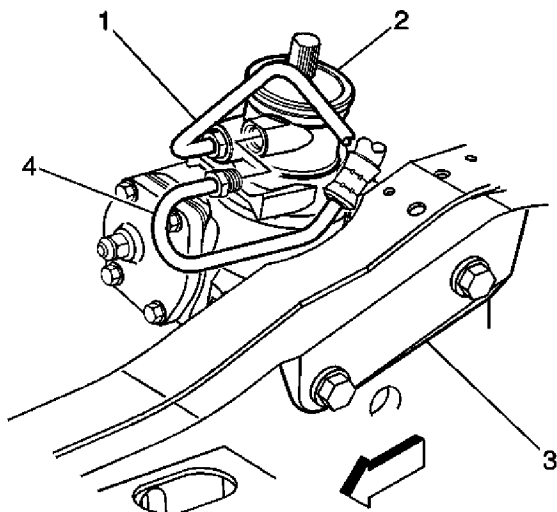
Power Brake Booster Outlet Hose Replacement

Removal Procedure

Caution: Refer to [Power Steering Hose Disconnected Caution](#) in the Preface section.



1. Install a drain pan under the vehicle.
2. Siphon the power steering fluid from the reservoir to prevent excessive spillage.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).



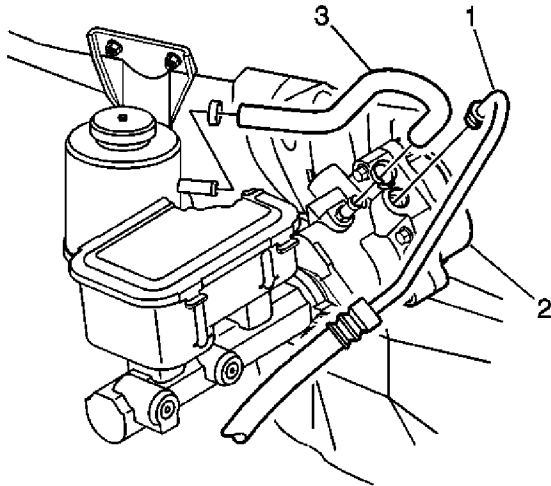
4. Through the wheel well, disconnect the power brake booster outlet hose (1) from the power steering gear (2).
5. Lower the vehicle.
6. Remove the water deflector from the fender.
7. Remove the power brake booster outlet hose (1) from the power brake booster (2).
8. Remove the power brake booster outlet hose from the vehicle.

Installation Procedure

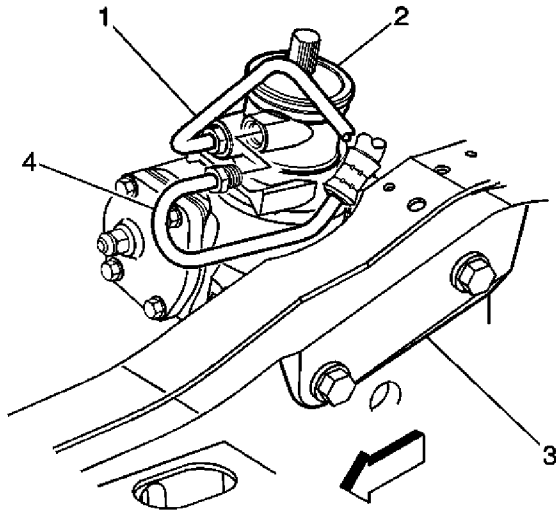
Caution: Refer to [Installing Hoses without Twists or Bends Caution](#) in the Preface section.

1. Route the hose in the same position the hose occupied prior to removal.

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



2. Install the power brake booster outlet hose (1) to the power brake booster (2). Hand tighten.
3. Raise the vehicle.



4. Through the wheel well, connect the power brake booster outlet hose to the power steering gear (2) and tighten to **33 N·m (24 lb ft)**.
5. Lower the vehicle.
6. Tighten the power brake booster outlet hose at the power brake booster to **33 N·m (24 lb ft)**.
7. Install the water deflector to the fender.
8. Bleed the power steering system. Refer to [Power Steering System Bleeding](#).
9. Remove the drain pan from under the vehicle.