2008 STEERING

Power Steering - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Pitman Arm Nut (at the Relay Rod)	62 N.m	46 lb ft
Pitman Arm Nut (at the Steering Gear)	250 N.m	184 lb ft
Power Brake Booster Inlet Hose Fitting	32 N.m	24 lb ft
Power Steering Fluid Cooler Bolt	9 N.m	80 lb in
Power Steering Fluid Reservoir Stud	58 N.m	44 lb ft
Power Steering Gear Inlet Hose Clip Bolt (6.6 L)	12 N.m	106 lb in
Power Steering Gear Inlet Hose Fitting	32 N.m	24 lb ft
Power Steering Gear Inlet Hose Retaining Plate Bolt	12 N.m	106 lb in
Power Steering Gear Outlet Hose (6.6L)	32 N.m	24 lb ft
Power Steering Pump Bolt	50 N.m	37 lb ft
Power Steering Pump Bracket Bolt (4.3L)	41 N.m	30 lb ft
Power Steering Pump Bracket Bolt (4.8L, 5.3L, 6.0L, and 6.2L)	50 N.m	37 lb ft
Power Steering Pump Bracket Nut	41 N.m	30 lb ft
Power Steering Pump Fitting	75 N.m	55 lb ft
Power Steering Pump Front Bracket Bolt (6.6L)	50 N.m	37 lb ft
Power Steering Pump Rear Bracket Bolt (6.6L)	50 N.m	37 lb ft
Power Steering Pump Rear Bracket Nut (4.3L)	41 N.m	30 lb ft
Steering Gear Bolt (Non-Rack and Pinion)	150 N.m	110 lb ft
Steering Gear Bolt (Rack and Pinion Left Side)	200 N.m	148 lb ft
Steering Gear Bolt (Rack and Pinion Right Side)	100 N.m	74 lb ft
Steering Gear Cylinder Pipe Fitting	34 N.m	25 lb ft
Steering Gear Pitman Shaft and Housing Cover Bolt	62 N.m	46 lb ft
Steering Gear Pitman Shaft Lash Adjuster Lock Nut	49 N.m	36 lb ft
Steering Gear Rack Bearing Adjuster Plug Lock Nut	68 N.m	50 lb ft

Steering Linkage Inner Tie Rod	100 N.m	74 lb ft
Steering Linkage Inner Tie Rod Nut	75 N.m	55 lb ft
Steering Linkage Outer Tie Rod Nut	60 N.m	44 lb ft
Stub Shaft Housing Bolt	62 N.m	46 lb ft

POWER STEERING PUMP SPECIFICATIONS

Vehicle	Engine Size	High Flow (Liters per Minute)	High Flow (Gallons per Minute)	Pressure Relief (kPa)	Pressure Relief (PSI)
C 1500	4.3L	11/12.5	2.9/3.3	9825/10514	1425/1525
K 1500	4.3L	10.2/11.7	2.7/3.1	9825/10514	1425/1525
C/K 15/25	4.8L 5.3L 6.0L 6.2L 6.6L	13.2/14.7	3.5/3.9	9825/10514	1425/1525

COMPONENT LOCATOR

POWER STEERING GEAR DISASSEMBLED VIEW (680 GEAR)

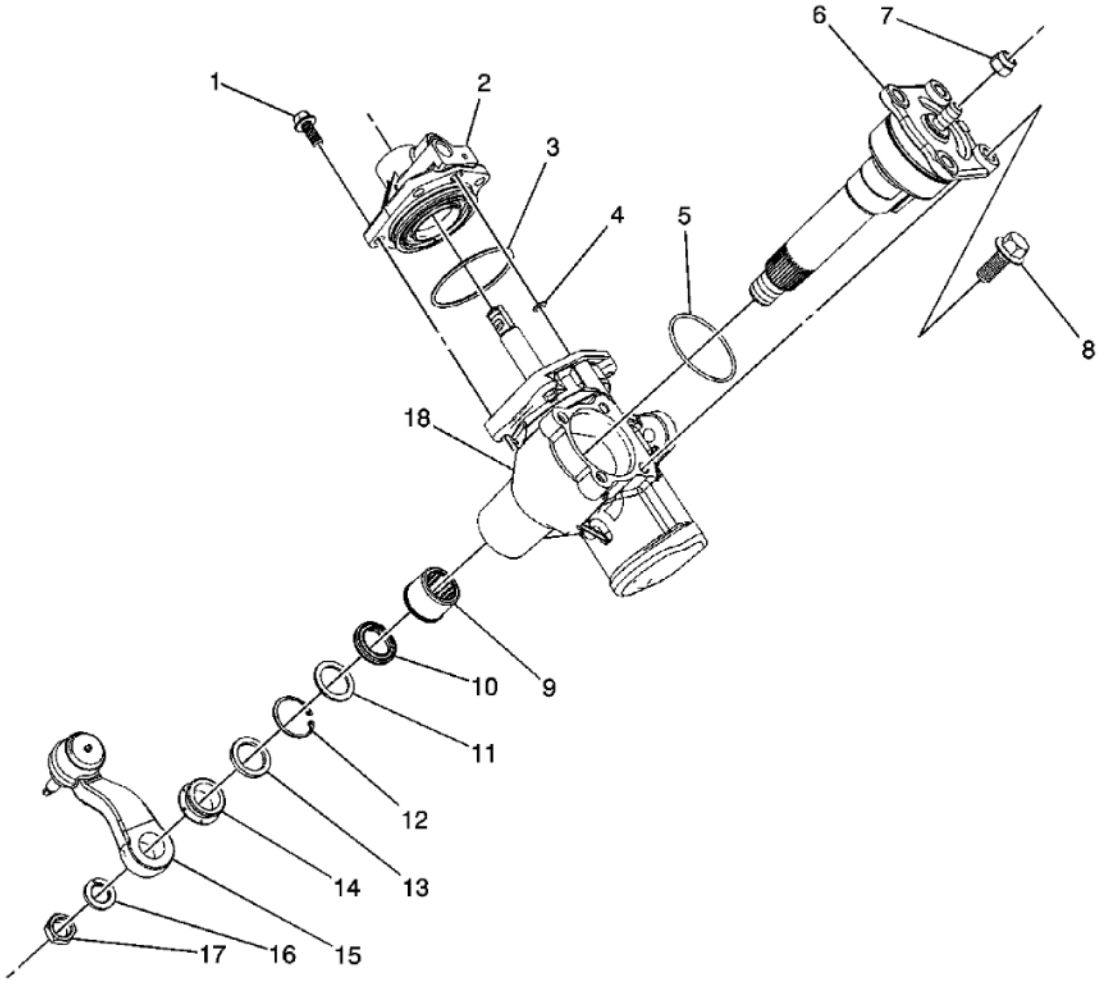


Fig. 1: Identifying Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
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

POWER STEERING GEAR DISASSEMBLED VIEW (RACK AND PINION)

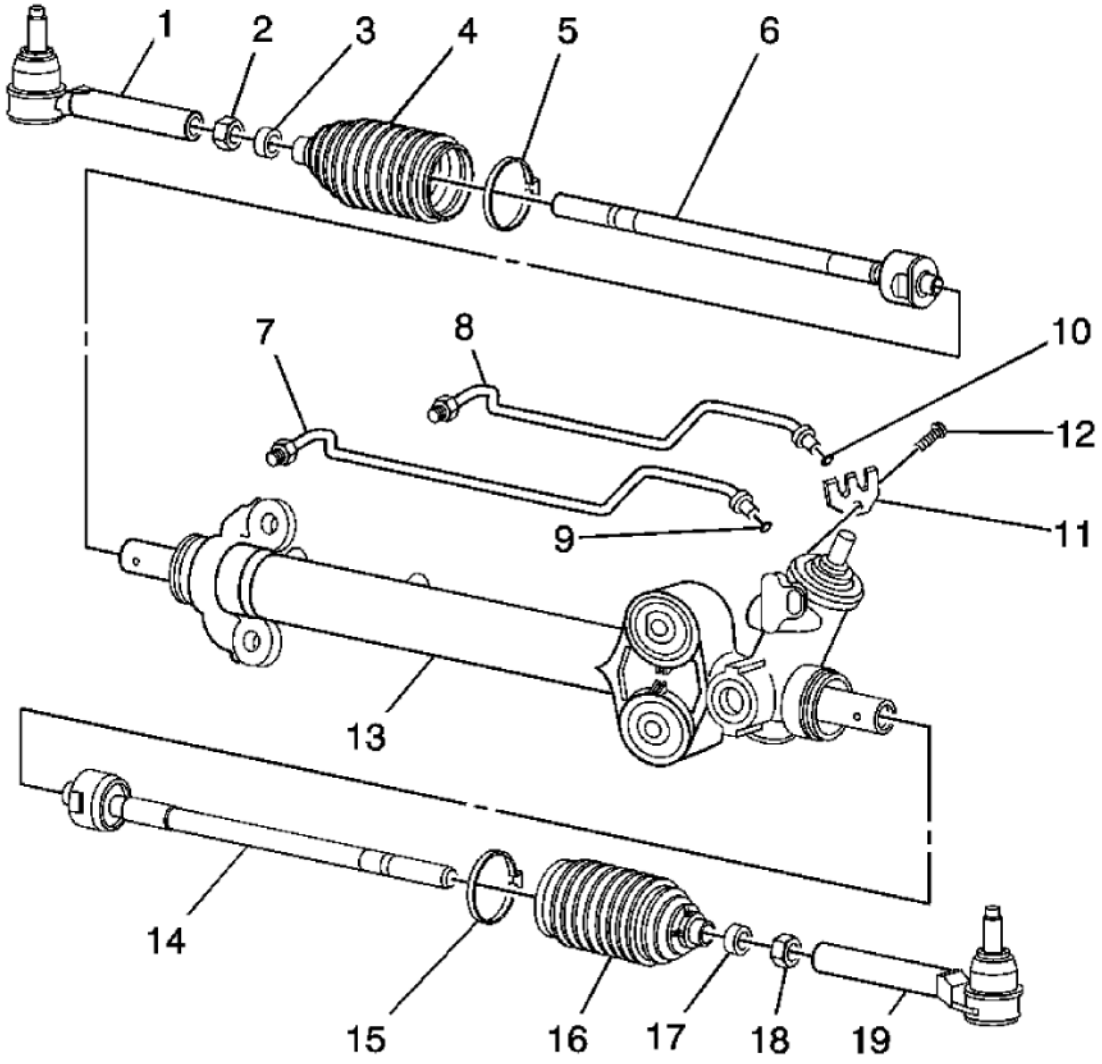


Fig. 2: Power Steering Gear Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Steering Linkage Outer Tie Rod
2	Steering Linkage Inner Tie Rod Nut
3	Steering Gear Boot Clamp
4	Steering Gear Boot
5	Steering Gear Boot Clamp
6	Steering Linkage Inner Tie Rod
7	Steering Gear Cylinder Pipe
8	Steering Gear Cylinder Pipe
9	Steering Gear Cylinder Pipe Seal
10	Steering Gear Cylinder Pipe Seal
11	Power Steering Gear Inlet Hose Retaining Plate
12	Power Steering Gear Inlet Hose Retaining Plate Bolt
13	Steering Gear
14	Steering Linkage Inner Tie Rod
15	Steering Gear Boot Clamp
16	Steering Gear Boot
17	Steering Gear Boot Clamp
18	Steering Linkage Inner Tie Rod Nut
19	Steering Linkage Outer Tie Rod

POWER STEERING PUMP DISASSEMBLED VIEW

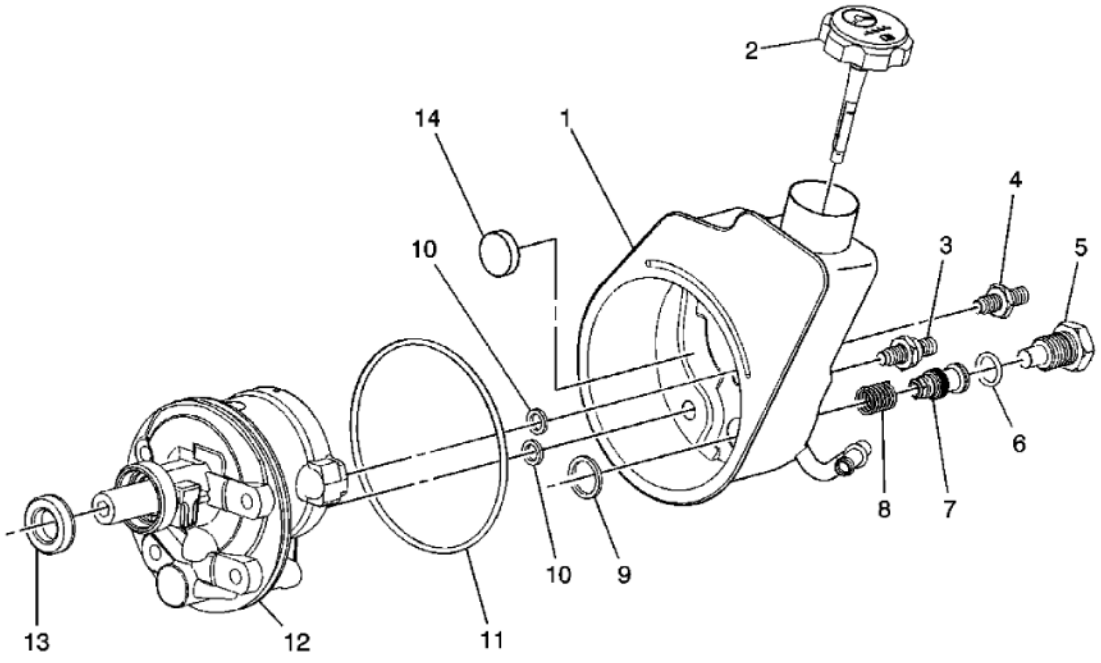


Fig. 3: Power Steering Pump Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Power Steering Fluid Reservoir
2	Power Steering Fluid Reservoir Cap
3	Power Steering Fluid Reservoir Stud
4	Power Steering Fluid Reservoir Stud
5	Power Steering Pump Fitting
6	Power Steering Pump Fitting Seal
7	Power Steering Pump Flow Control Valve
8	Power Steering Pump Flow Control Valve Spring
9	Power Steering Pump Housing Seal
10	Power Steering Pump Housing Seals
11	Power Steering Fluid Reservoir Seal
12	Power Steering Pump
13	Power Steering Pump Shaft Seal
14	Power Steering Fluid Reservoir Magnet

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - POWER STEERING SYSTEM (W/O ELECTRO-HYDRA HYDRAULIC STEERING)

Begin the system diagnosis by reviewing the system Description and Operation. Refer to **Power Steering System Description and Operation**. Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the Description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Power Steering System** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - POWER STEERING SYSTEM

IMPORTANT: Review the system description and operation in order to familiarize yourself with the system functions. Refer to Power Steering System Description and Operation.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the power steering system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect for leaking power steering components. If necessary, refer to **Power Steering Fluid Leaks**.
- Verify the power steering reservoir for the proper operating specification. Refer to **Checking and Adding Power Steering Fluid (With Hydroboost)** or **Checking and Adding Power Steering Fluid (Without Hydroboost)**.
- Inspect the power steering fluid for the following indications of contamination:
  - Milky fluid - water
  - Brown fluid - burnt
  - Debris in fluid - plastic or dirt
- If necessary, flush the power steering system. Refer to **Power Steering System Flushing**.

Symptoms List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Power Steering Fluid Leaks
- Rattle, Clunk, or Shudder Noise from the Power Steering System
- Whine or Growl Noise from the Power Steering System (Without Hydraulic Booster) or Whine or Growl Noise from the Power Steering System (With Hydraulic Booster)
- Poor Return of Steering Wheel
- Steering Effort Hard in One or Both Directions
- Steering Effort Too Easy in One or Both Directions

POWER STEERING SYSTEM TEST

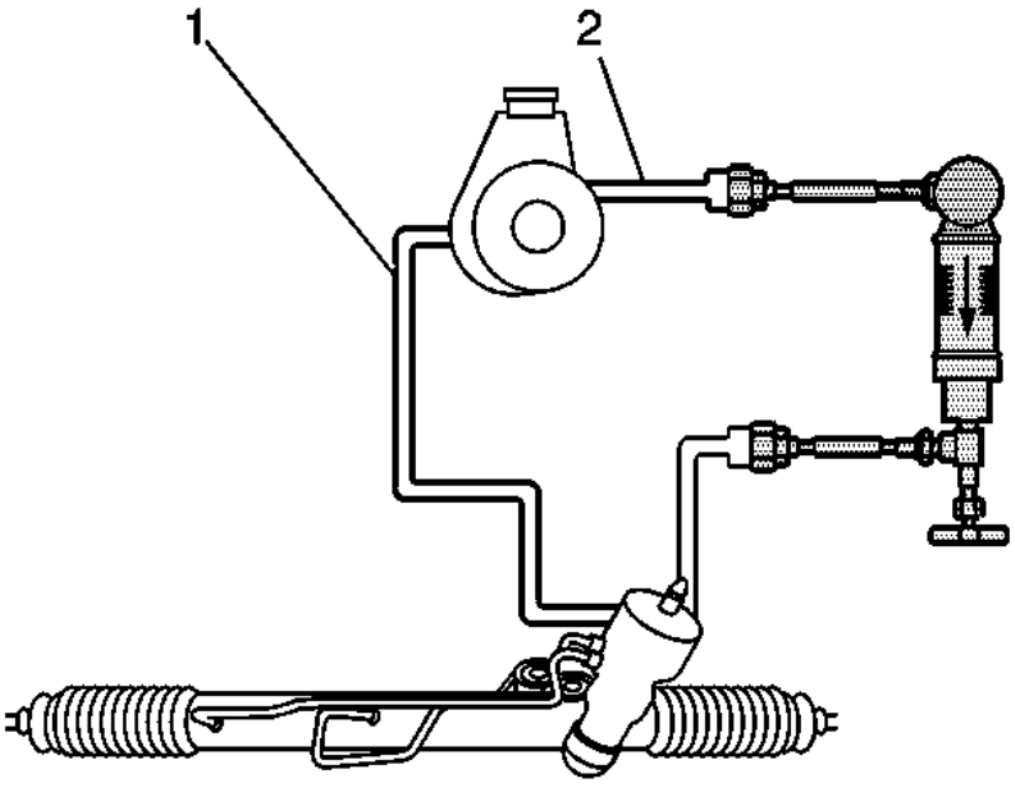


Fig. 4: Testing Rack and Pinion System Pressures
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

1	Power Steering Return Hose
2	Power Steering Pressure Hose

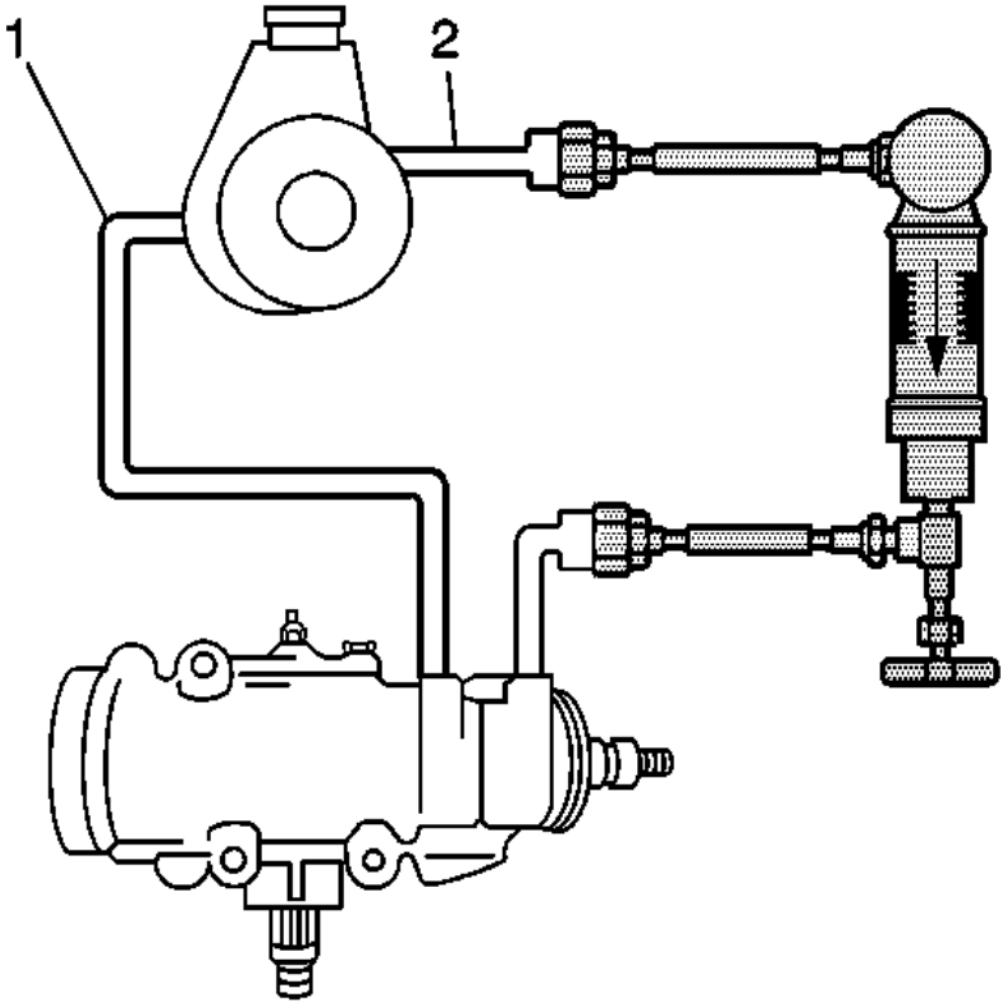


Fig. 5: Testing Recirculating Ball System Pressures
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Power Steering Return Hose
2	Power Steering Pressure Hose

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step tests the system for restrictions.

7: This step tests the following components for the following conditions:

- The pump for internal leaks

IMPORTANT: Power steering hoses may not look kinked, but have a layer separation causing the inner hose to collapse and restrict power steering fluid flow.

- The power steering pipes and hoses for kinks

8: This step tests the ability of the pump to regulate flow at maximum pressure.

10: This step tests the ability of the pump to regulate flow under normal operating conditions.

12: This step tests the internal components of the pump and the gear.

Step	Action	Value(s)	Yes	No
DEFINITION: The Power Steering System Test Procedure will perform the following functions: • Test the operation of the hydraulic power steering system. • Test the operation of the power steering pump and power steering gear. • Identify restrictions in the system.				
1	Inspect the power steering fluid for the following indications of contamination: • Milky fluid - water • Brown fluid - burnt • Debris in fluid - plastic or dirt Is the fluid free of contamination?	-	Go to **Step 3**	Go to **Step 2**
2	Flush the power steering system. Refer to **Power Steering System Flushing**. Did you complete the procedure?	-	Go to **Step 3**	-
	IMPORTANT:			

3	**In order to accurately diagnose the system, the malfunction must be present during the test procedure.** Attempt to duplicate the condition.Is the condition present?	-	Go to **Step 4**	System OK
4	1. Turn the ignition switch to the OFF position. 2. Place a drain pan under the vehicle in order to catch any power steering fluid. 3. Disconnect the power steering pressure pipe/hose from the power steering pump or the power steering gear as necessary. 4. Install the **J 44721** Power Steering System Analyzer. See **Special Tools**. 5. Fill the power steering system. Refer to **Checking and Adding Power Steering Fluid (With Hydroboost)** or **Checking and Adding Power Steering Fluid (Without Hydroboost)**. Did you complete the installation?	-	Go to **Step 5**	-
5	1. Fully open the **J 44721** valve. See **Special Tools**. 2. Start the engine. **NOTE:** **Refer to STEERING WHEEL IN THE FULL TURN POSITION NOTICE .** 3. Turn the steering wheel and BRIEFLY hold the steering wheel against the steering stop in order to release any trapped air from the system.	1525 kPa (221 psi)		

	4. Inspect and ensure that all of the power steering pipe/hose connections are not leaking. 5. Make sure the steering wheel is OFF the steering stop, observe the pressure reading. Is the pressure reading greater than the specified value?		Go to **Step 6**	Go to **Step 7**
6	**IMPORTANT:** **A restriction may be present in the power steering system. Turn OFF the engine IMMEDIATELY.** Locate and repair the restriction.Did you complete the repair?	-	Go to **Step 18**	-
7	1. Allow the engine to run until the engine reaches full operating temperature. 2. Record the pressure reading and flow reading. 3. Partially close the **J 44721** valve until the system pressure reaches the specified value, then record the FLOW reading. See **Special Tools**. 4. Subtract second flow reading from the first flow reading. Is the flow DECREASE greater than 3.8 L (1 gal) per minute?	4827 kPa (700 psi)	Go to **Step 13**	Go to **Step 8**
8	**NOTE:** **Do not leave the valve fully closed for more than 5 seconds, or the pump could be damaged internally.** Fully close then open the **J 44721** valve 3 times. See **Special Tools**. Record all of the high pressure readings. Refer to **Power Steering Pump Specifications** for power	-		

	steering system pressure relief specifications.Are the 3 high pressure readings within specifications?		Go to **Step 9**	Go to **Step 15**
9	Are the three high pressure readings within 245 kPa (50 psi) of each other?	-	Go to **Step 10**	Go to **Step 14**
10	1. Increase the engine speed to approximately 1,500 RPM. 2. Record the flow reading. Refer to **Power Steering Pump Specifications** for power steering system pressure specifications. Is the actual flow reading within specifications?	-	Go to **Step 11**	Go to **Step 13**
11	Is the difference between the actual flow reading and the maximum flow specification more than 3.8 L (1 gal) per minute?	-	Go to **Step 16**	Go to **Step 12**
12	**NOTE:** **Refer to STEERING WHEEL IN THE FULL TURN POSITION NOTICE .** Turn the steering wheel from steering stop to steering stop and record the FLOW readings at each stop.Is the flow LOWER than 3.8 L (1 gal) per minute?	-	Go to **Step 18**	Go to **Step 17**
13	Replace the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**. Did you complete the replacement?	-	Go to **Step 18**	-
	1. Remove the power steering pump flow control valve. Refer to **Power Steering Pump Flow Control Valve Replacement - Off Vehicle**. 2. Inspect the flow control valve.			

14	If any burrs or scratches are noticed on the flow control valve, replace the flow control valve. Do NOT attempt to clean the flow control valve. Refer to **Power Steering Pump Flow Control Valve Replacement - Off Vehicle**. 3. Inspect the flow control valve bore. If any burrs or scratches are present in the control valve bore, replace the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**. Did you complete the repair?	-	Go to **Step 18**	-
15	Replace the power steering pump flow control valve. Refer to **Power Steering Pump Flow Control Valve Replacement - Off Vehicle**. Did you complete the replacement?	-	Go to **Step 18**	-
16	1. Remove the power steering pump flow control valve and inspect for any wear or damage. Do NOT disassemble the flow control valve. 2. If the flow control valve is worn damaged, replace the flow control valve. Refer to **Power Steering Pump Flow Control Valve Replacement - Off Vehicle**. Did you complete the repair?	-	Go to **Step 18**	-
	The power steering gear is leaking across the piston or bypassing the valve circuit.			

17	Replace the power steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**. Did you complete the replacement?	-	Go to **Step 18**	-
18	Test the power steering system for the original condition. Does the original condition still exist?	-	Go to **Step 5**	Go to **Step 19**
19	1. Disconnect and remove the **J 44721** from the vehicle. See **Special Tools**. 2. Connect the vehicle power steering pipes/hoses. 3. Bleed the power steering system and add fluid as necessary. Refer to **Power Steering System Bleeding**. Did you complete the repair?	-	System OK	-

POWER STEERING FLUID LEAKS

Step	Action	Yes	No
1	Did you review the Power Steering System General Description?	Go to **Step 2**	Go to **Power Steering System Description and Operation**
2	Inspect the power steering system for the following: • Inspect the power steering fluid level and condition. • Inspect for aftermarket devices which could affect the operation of the power steering system. • Inspect the power steering system components for obvious damage or conditions which could cause leaks. • If necessary, clean the power steering system components, start the engine, and		

	rotate the steering wheel from stop to stop. Turn the engine off and inspect all power steering system components for leaks. Is the power steering system leaking?	Go to **Step 3**	Go to **Step 15**
3	Inspect the power steering system fittings. Are the fittings leaking?	Go to **Step 9**	Go to **Step 4**
4	Inspect the power steering hoses. Are the hoses leaking?	Go to **Step 10**	Go to **Step 5**
5	Inspect the following power steering pump components for leaks: • Flow control valve seal • Power steering pump shaft seal • Power steering pump reservoir and seals • Power steering pump Is the power steering pump components leaking?	Go to **Step 11**	Go to **Step 6**
6	Inspect the following power steering gear components for leaks: • Power steering cylinder lines and/or seals • Power steering gear stub shaft seals • Power steering gear pitman shaft and/or seals Is the power steering gear components leaking?	Go to **Step 12**	Go to **Step 7**
7	Inspect the power steering cooler for leaks. Is the power steering cooler leaking?	Go to **Step 13**	Go to **Step 8**
8	Inspect the hydraulic brake booster assembly for leaks. Refer to **Power Brake Booster Leak Inspection** . Is the hydraulic brake booster assembly leaking?	Go to **Step 14**	Go to **Step 15**

9	**IMPORTANT:** **If fitting is still to leaking after tightening, inspect for damage to the fitting and seals. Replace the damaged component as necessary.** Tighten the fittings. Refer to **Fastener Tightening Specifications**.Did you complete the repair?	Go to **Step 15**	-
10	Replace the power steering hoses. Refer to the appropriate procedure(s): • **Power Steering Gear Inlet Pipe/Hose Replacement (Gas With Hydroboost)** or **Power Steering Gear Inlet Pipe/Hose Replacement (Gas Without Hydroboost)** or **Power Steering Gear Inlet Pipe/Hose Replacement (Diesel)** • **Power Brake Booster Inlet Hose Replacement** • **Power Brake Booster Outlet Hose Replacement** • **Power Steering Gear Outlet Pipe/Hose Replacement (Gas With Hydroboost)** or **Power Steering Gear Outlet Pipe/Hose Replacement (Gas Without Hydroboost)** or **Power Steering Gear Outlet Pipe/Hose Replacement (Diesel)** Did you complete the repair?	Go to **Step 15**	-
	Replace the leaking power steering pump component. Refer to the appropriate procedure (s): • **Power Steering Pump Flow Control Valve Replacement - Off Vehicle** • **Power Steering Pump Shaft Seal Replacement**		

11	• **Power Steering Fluid Reservoir Replacement - Off Vehicle** • **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)** Did you complete the repair?	Go to **Step 15**	-
12	Replace the leaking power steering gear component. Refer to the appropriate procedure (s): • **Steering Gear Cylinder Pipe Assembly and Seals Replacement - Off Vehicle** • **Steering Gear Pitman Shaft Seal and Bearing Replacement - Off Vehicle** • **Stub Shaft Housing Replacement** • **Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle** • **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)** Did you complete the repair?	Go to **Step 15**	-
13	Replace the power steering fluid cooler. Refer to **Power Steering Fluid Cooler Replacement (Without Hydroboost)** or **Power Steering Fluid Cooler Replacement (With Hydroboost)**. Did you complete the repair?	Go to **Step 15**	-
14	Replace the hydraulic brake booster assembly. Refer to **Power Brake Booster Replacement (Adjustable Pedals)** or **Power Brake Booster Replacement (Non-Adjustable Pedals)** .		

	Did you complete the repair?	Go to **Step 15**	-
15	Start the vehicle and rotate the steering wheel from stop to stop and verify the system is not leaking. Did you correct the condition?	System OK	Go to **Step 2**

RATTLE, CLUNK, OR SHUDDER NOISE FROM THE POWER STEERING SYSTEM

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Power Steering System**
2	Verify that a rattle, clunk or shudder noise is present. Is a rattle, clunk or shudder noise present?	Go to **Step 3**	System OK
3	Inspect the power steering hoses for proper routing and clearance. Is the routing or clearance of the power steering hoses incorrect?	Go to **Step 11**	Go to **Step 4**
4	Inspect the engine drive belt for cracking or excessive wear. Refer to **Drive Belt Falls Off and Excessive Wear Diagnosis** . Is the drive belt cracked or excessively worn?	Go to **Step 12**	Go to **Step 5**
5	Inspect the power steering pump pulley for damage. Is the power steering pump pulley damaged?	Go to **Step 13**	Go to **Step 6**
6	Inspect the power steering pump and the power steering mounting bracket/brace for the proper installation. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**. Is the power steering pump installation incorrect?	Go to **Step 14**	Go to **Step 7**
7	Inspect the power steering gear for the proper installation. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering**		

	Gear Replacement (Non-Rack and Pinion). Is the power steering gear installation incorrect?	Go to **Step 15**	Go to **Step 8**
8	Inspect the steering linkage. Refer to **Steering Linkage Inspection** . Is the steering linkage worn?	Go to **Step 16**	Go to **Step 9**
9	Inspect the suspension. Is the suspension worn?	Go to **Step 17**	Go to **Step 10**
10	Inspect the intermediate shaft. Is the intermediate shaft worn?	Go to **Step 18**	Go to **Step 3**
11	Adjust or replace the hoses. Refer to the appropriate procedure(s): • **Power Steering Fluid Cooler Replacement (Without Hydroboost)** or **Power Steering Fluid Cooler Replacement (With Hydroboost)** • **Power Steering Gear Inlet Pipe/Hose Replacement (Gas With Hydroboost)** or **Power Steering Gear Inlet Pipe/Hose Replacement (Gas Without Hydroboost)** or **Power Steering Gear Inlet Pipe/Hose Replacement (Diesel)** • **Power Brake Booster Inlet Hose Replacement** • **Power Brake Booster Outlet Hose Replacement** Did you complete the repair?	Go to **Step 19**	-
12	Replace the engine drive belt. Refer to or **Drive Belt Replacement - Accessory** . Did you complete the repair?	Go to **Step 19**	-
13	Replace the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**. Did you complete the repair?	Go to **Step 19**	-

14	Install the power steering pump correctly. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**. Did you complete the repair?	Go to **Step 19**	-
15	Install the power steering gear correctly. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**. Did you complete the repair?	Go to **Step 19**	-
16	Replace the worn steering linkage. Refer to **Steering Linkage Inspection** . Did you complete the repair?	Go to **Step 19**	-
17	Replace the worn suspension components. Refer to **Diagnostic Starting Point - Suspension General Diagnosis** . Did you complete the repair?	Go to **Step 19**	-
18	Replace the intermediate shaft. Refer to **Upper Intermediate Steering Shaft Replacement** or **Steering Shaft Coupling Replacement** . Did you complete the repair?	Go to **Step 19**	-
19	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM (WITHOUT HYDRAULIC BOOSTER)

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Power Steering System**
2	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to **Step 3**	System OK
	Inspect the power steering fluid for the following indications of contamination: • Milky fluid - water		

3	• Brown fluid - burnt • Debris in fluid - plastic or dirt Is the fluid free of contamination?	Go to **Step 5**	Go to **Step 4**
4	Flush the power steering system. Refer to **Power Steering System Bleeding**. Did you complete the procedure?	Go to **Step 11**	Go to **Step 5**
5	Inspect the power steering gear for a whine or growl noise using **J 39570** Chassis Ear. Is the noise present at the power steering gear?	Go to **Step 8**	Go to **Step 6**
6	Inspect the power steering pump for a whine or growl noise using **J 39570** . Is the noise present at the power steering pump?	Go to **Step 9**	Go to **Step 7**
7	Inspect the power steering hoses for a whine or growl noise using **J 39570** . Is the noise present at the power steering hoses?	Go to **Step 10**	Go to **Step 2**
8	Replace the power steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**. Did you complete the repair?	Go to **Step 11**	-
9	Replace the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**. Did you complete the repair?	Go to **Step 11**	-
10	Adjust the routing of the power steering hoses. Did you complete the repair?	Go to **Step 11**	-
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM (WITH HYDRAULIC BOOSTER)

Step	Action	Yes	No
	Did you review the Power Steering System		Go to **Symptoms**

1	General Description and perform the necessary inspections?	Go to **Step 2**	**- Power Steering System**
2	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to **Step 3**	System OK
3	Inspect the power steering fluid for the following indications of contamination: • Milky fluid - water • Brown fluid - burnt • Debris in fluid - plastic or dirt Is the fluid free of contamination?	Go to **Step 5**	Go to **Step 4**
4	Flush the power steering system. Refer to **Power Steering System Bleeding**. Did you complete the procedure?	Go to **Step 13**	Go to **Step 5**
5	Inspect the power steering gear for a whine or growl noise using **J 39570** Chassis Ear. Is the noise present at the power steering gear?	Go to **Step 9**	Go to **Step 6**
6	Inspect the power steering pump for a whine or growl noise using **J 39570** . Is the noise present at the power steering pump?	Go to **Step 10**	Go to **Step 7**
7	Inspect the power steering hoses for a whine or growl noise using **J 39570** . Is the noise present at the power steering hoses?	Go to **Step 11**	Go to **Step 8**
8	Inspect the hydraulic brake booster for a whine or growl noise using **J 39570** . Is the noise present at the hydro boost?	Go to **Step 13**	-
9	Replace the power steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**. Did you complete the repair?	Go to **Step 13**	-
10	Replace the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.		-

	Did you complete the repair?	Go to **Step 13**	
11	Adjust the routing of the power steering hoses. Did you complete the repair?	Go to **Step 13**	-
12	Diagnose the hydraulic brake booster. Refer to **Diagnostic Starting Point - Hydraulic Brakes** . Did you correct the condition?	Go to **Step 13**	-
13	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

POOR RETURN OF STEERING WHEEL

Poor Return of Steering Wheel

Step	Action	Yes	No
DEFINITION: After completing a turn, extra steering input is required for the steering wheel to return to center.			
1	Did you review the General Description and perform the necessary inspections?	Go to **Step 2**	Go to **Power Steering System Description and Operation**
2	Verify that poor return of the steering wheel is present. Does the system operate normally?	System OK	Go to **Step 3**
3	1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Lubricate the tie rod ends and ball joints, if applicable. 3. Inspect the suspension system for worn or damaged components. 4. Repair as necessary. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 4**
4	1. Rotate the steering wheel ONE revolution in both directions. 2. Rotate the steering wheel back to the original position.		

	Was the steering wheel abnormally difficult to rotate in either direction?	Go to **Step 5**	Go to **Step 10**
5	**IMPORTANT:** **Position the wheels straight ahead. Do NOT rotate the steering wheel more than one complete revolution from center.** 1. Disconnect the intermediate shaft from the steering column. 2. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. 3. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction?	Go to **Step 11**	Go to **Step 6**
6	Inspect the intermediate shaft for stiff or loose joints. Repair or replace as necessary. Did you find and complete the repair?	Go to **Step 12**	Go to **Step 7**
7	1. Remove the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** . 2. Disconnect both outer tie rod ends from the steering knuckles. 3. Use your hands in order to move the tie rod end studs. 4. If abnormally difficult to move, replace the tie rod end. If equipped with recirculating ball steering, ensure that idler and pitman arm joints are not to stiff. Repair as necessary. Did you find and complete the repair?	Go to **Step 12**	Go to **Step 8**
8	1. Use your hands to rotate the steering knuckle inboard and outboard in order to inspect for a binding strut bearings, ball joints, or axle.		

	2. Repair or replace any abnormally stiff or loose components. Did you find and complete the repair?	Go to **Step 12**	Go to **Step 9**
9	Inspect for binding in the steering gear. If a binding is present repair or replace the steering gear. Did you find and complete the repair?	Go to **Step 12**	Go to **Step 10**
10	Inspect the wheel alignment and adjust as necessary. Refer to **Wheel Alignment Measurement** . Did you find and complete the repair?	Go to **Step 12**	-
11	Inspect the steering column for a binding. If a binding is present, repair or replace the steering column as necessary. Did you find and complete the repair?	Go to **Step 12**	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	-

STEERING EFFORT TOO EASY IN ONE OR BOTH DIRECTIONS

Step	Action	Yes	No
1	Did you review the Power Steering System Description and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Power Steering System**
2	Verify that the steering effort is too easy in one or both directions. Does the system operate normally?	System OK	Go to **Step 3**
3	Perform the power steering test procedure. Refer to **Power Steering System Test**. Did you complete the procedure?	Go to **Step 4**	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS

Step	Action	Yes	No
	Did you review the Power Steering System		Go to **Symptoms**

1	General Description and perform the necessary inspections?	Go to **Step 2**	**- Power Steering System**
2	Verify that the steering effort is hard in one or both directions. Does the system operate normally?	System OK	Go to **Step 3**
3	Perform the power steering test procedure. Refer to **Power Steering System Test**. Did you complete the procedure?	Go to **Step 4**	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

REPAIR INSTRUCTIONS

RACK AND PINION STEERING LINKAGE INSPECTION

Tools Required

- **J 8001** Dial Indicator Set
- **J 42640** Steering Column Anti-Rotation Pin

Outer Tie Rod

1. Inspect the outer tie rod seal. If the outer tie rod seal is torn, replace the outer tie rod.
2. Elevate the left or right front of the vehicle and install a suitable vehicle support, maintaining contact between one front wheel and the shop floor. Refer to **Lifting and Jacking the Vehicle** .

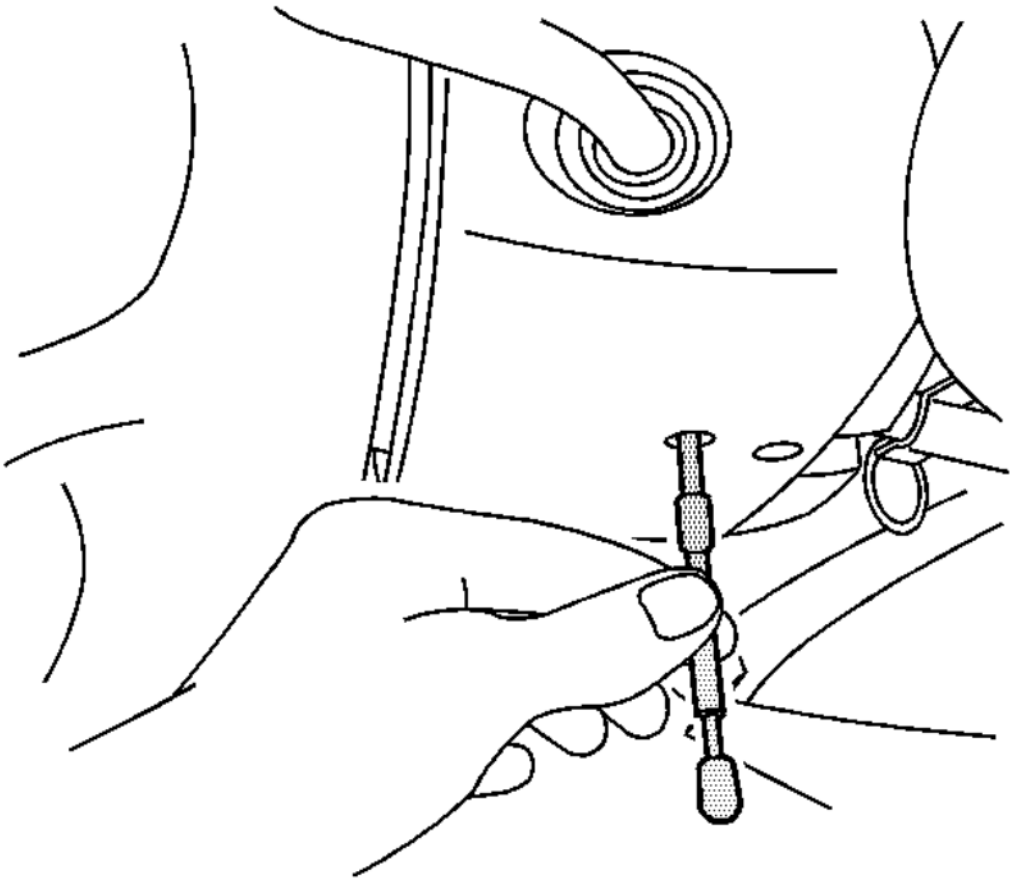


Fig. 6: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

3. Position the wheels in a straight-ahead position and install anti-rotation pin **J 42640** .

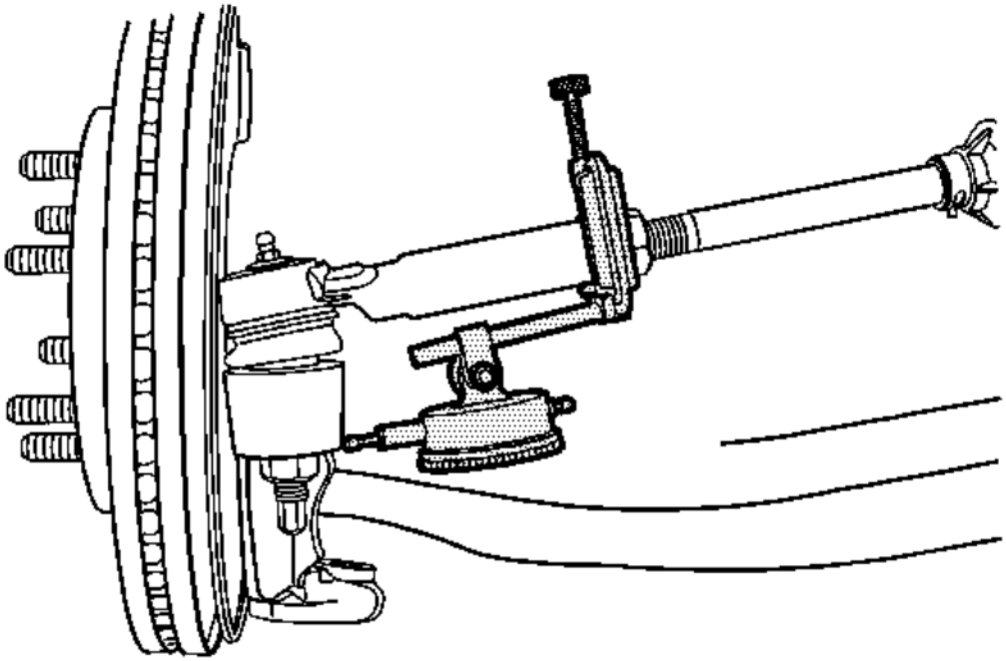


Fig. 7: Checking Tie Rod-To-Steering Knuckle Lash
Courtesy of GENERAL MOTORS CORP.

4. Install dial indicator **J 8001** between the outer tie rod and steering knuckle as shown and push slowly inward with one hand on the tire to remove the lash.

   The wheel and tire are removed for clarity.

5. Place the dial indicator at zero, pull outward on the tire, and note the amount of movement in the joint.

   Movement should not exceed 1.0 mm (0.04 in). If movement exceeds 1.0 mm (0.04 in) then replace the outer tie rod.

6. Repeat steps 3 and 4 for the other side of the vehicle if needed.
7. If tie rod end replacement is needed, refer to **Steering Linkage Outer Tie Rod Replacement**.

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:
   1. Start the engine.
   2. Firmly apply the brake pedal 10-15 times.
   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 (With Hydroboost)** or **Checking and Adding Power**

Steering Fluid (Without Hydroboost).

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 (WITH HYDROBOOST)

NOTE: 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**.

IMPORTANT: 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:
    1. Start the engine.
    2. Firmly apply the brake pedal 2 to 3 times.
    3. Turn the engine OFF.

IMPORTANT: 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.

IMPORTANT: 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. Install the reservoir cap.
7. When checking the fluid level after servicing the steering system, bleed the air from the system. Refer to **Power Steering System Bleeding**.

CHECKING AND ADDING POWER STEERING FLUID (WITHOUT HYDROBOOST)

NOTE: 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 Cold

   1. Remove the reservoir cap.
   2. Inspect the fluid level on the capstick.
   3. Ensure that the fluid level is between the bottom of the COLD/FULL mark and the end of the capstick.

   Fluid Is Hot

   1. Run the engine until the fluid reaches about 80°C (170°F).
   2. Turn the engine OFF.
   3. Remove the reservoir cap.
   4. Inspect the fluid level on the capstick.
   5. Ensure that the fluid level is between the HOT/FULL and the COLD/FULL marks 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 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 PUMP PULLEY REPLACEMENT (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)

Tools Required

- **J 25033-C** Pulley Installer. See **Special Tools**.

- **J 25034-C** Pulley Remover. See **Special Tools**.

Removal Procedure

1. Remove the engine coolant fan upper shroud, if equipped. Refer to **Engine Coolant Fan Upper Shroud Replacement (Mechanical)** or **Engine Coolant Fan Upper Shroud Replacement (Automatic Transmission - Diesel)** .
2. Remove the accessory drive belt. Refer to one of the following:
   - For 4.3L engine, refer to **Drive Belt Replacement** .
   - For 4.8L, 5.3L, 6.0L, and 6.2L engines, refer to **Drive Belt Replacement - Accessory** .

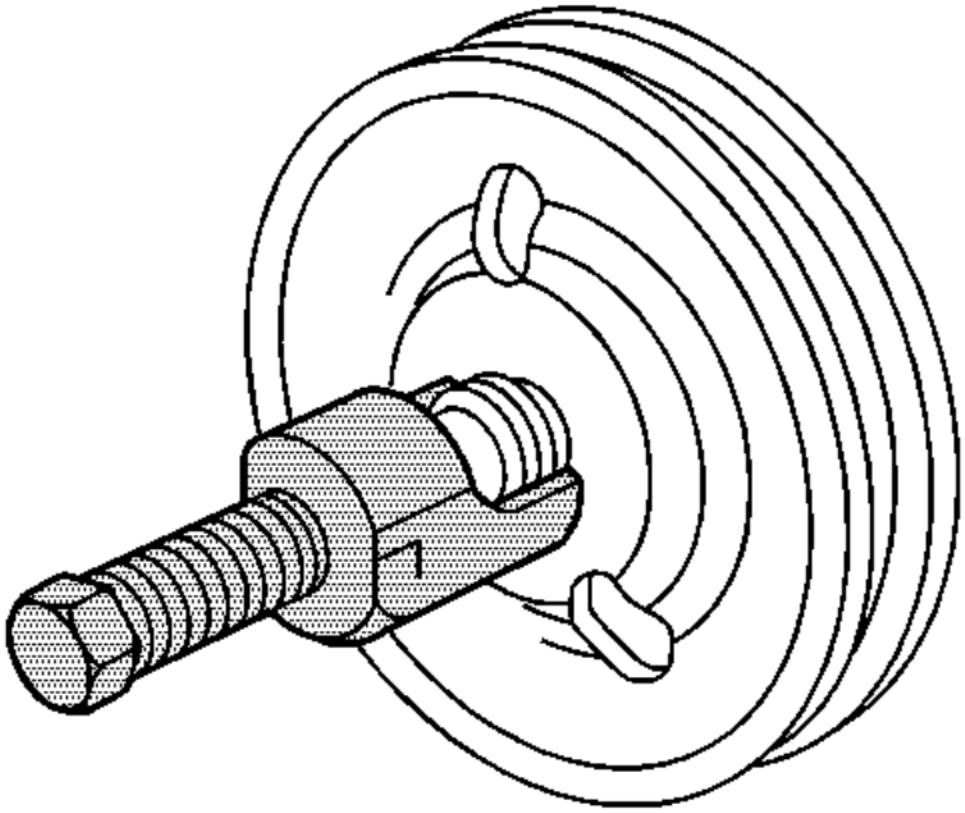


Fig. 8: View Of Power Steering Pump Pulley Remover

Courtesy of GENERAL MOTORS CORP.

3. Use remover **J 25034-C** to remove the power steering pump pulley. See **Special Tools**.

Installation Procedure

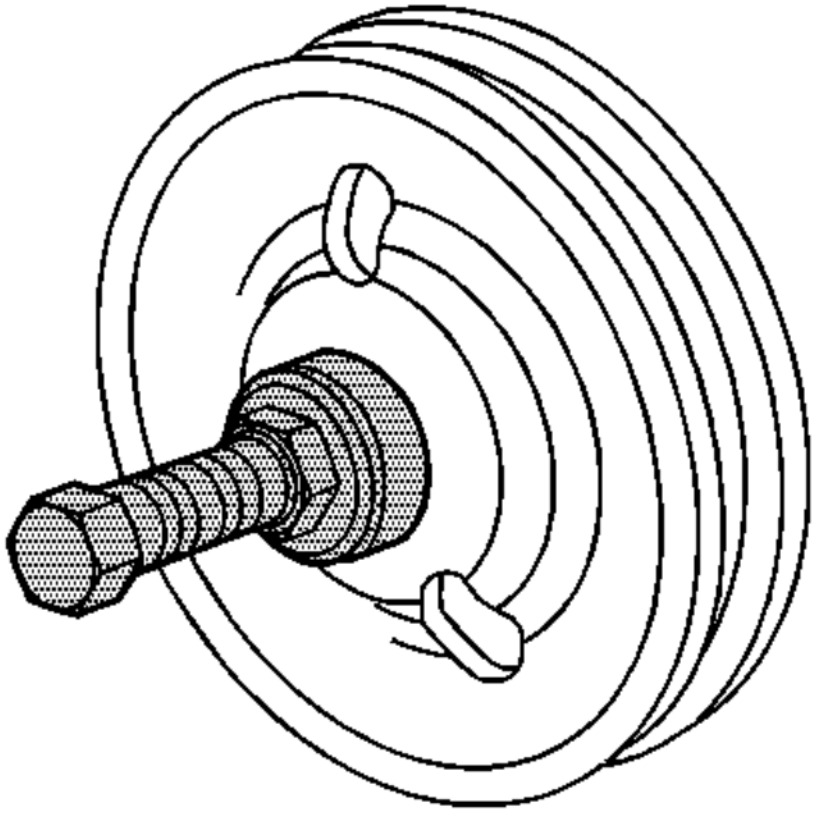


Fig. 9: View Of Power Steering Pump Pulley Installer
Courtesy of GENERAL MOTORS CORP.

1. Place the power steering pump pulley on the end of the power steering pump shaft.
2. Install the power steering pump pulley using installer **J 25033-C** . See **Special Tools**.

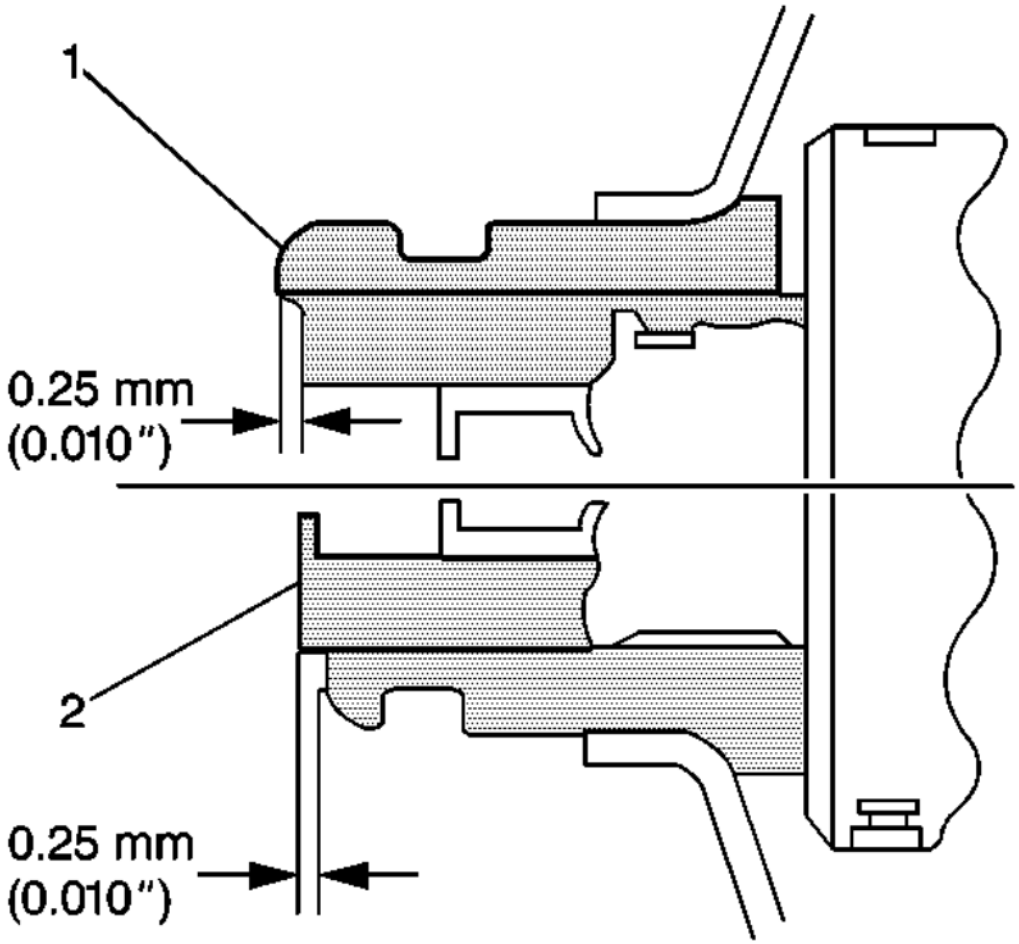


Fig. 10: Checking Power Steering Pump Pulley Installed Depth
Courtesy of GENERAL MOTORS CORP.

3. Ensure that the power steering pump pulley (1) is flush against the power steering pump shaft (2) with an allowable variance of 0.25 mm (0.010 in).
4. Install the accessory drive belt. Refer to one of the following:
   - For 4.3L engine, refer to **Drive Belt Replacement** .
   - For 4.8L, 5.3L, 6.0L, and 6.2L engines, refer to **Drive Belt Replacement - Accessory** .
5. Install the engine coolant fan upper shroud, if equipped. Refer to **Engine Coolant Fan Upper Shroud Replacement (Mechanical)** or **Engine Coolant Fan Upper Shroud**

Replacement (Automatic Transmission - Diesel) .

POWER STEERING PUMP PULLEY REPLACEMENT (6.6L)

Special Tools

- **J 25033-C** Power Steering Pump Pulley Installer. See **Special Tools**.
- **J 25034-C** Power Steering Pump Pulley Remover. See **Special Tools**.

Removal Procedure

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement** .

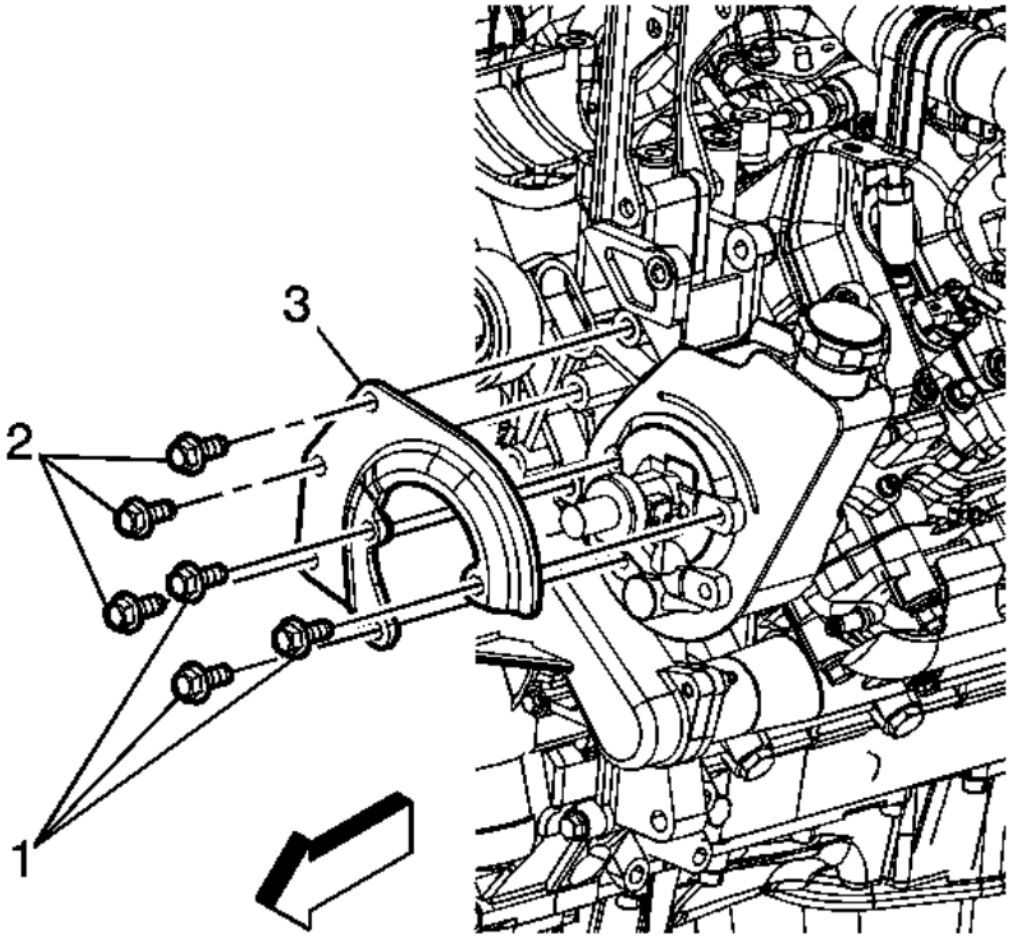


Fig. 11: View Of Power Steering Pump Front Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the power steering pump front bracket bolts (1, 2).

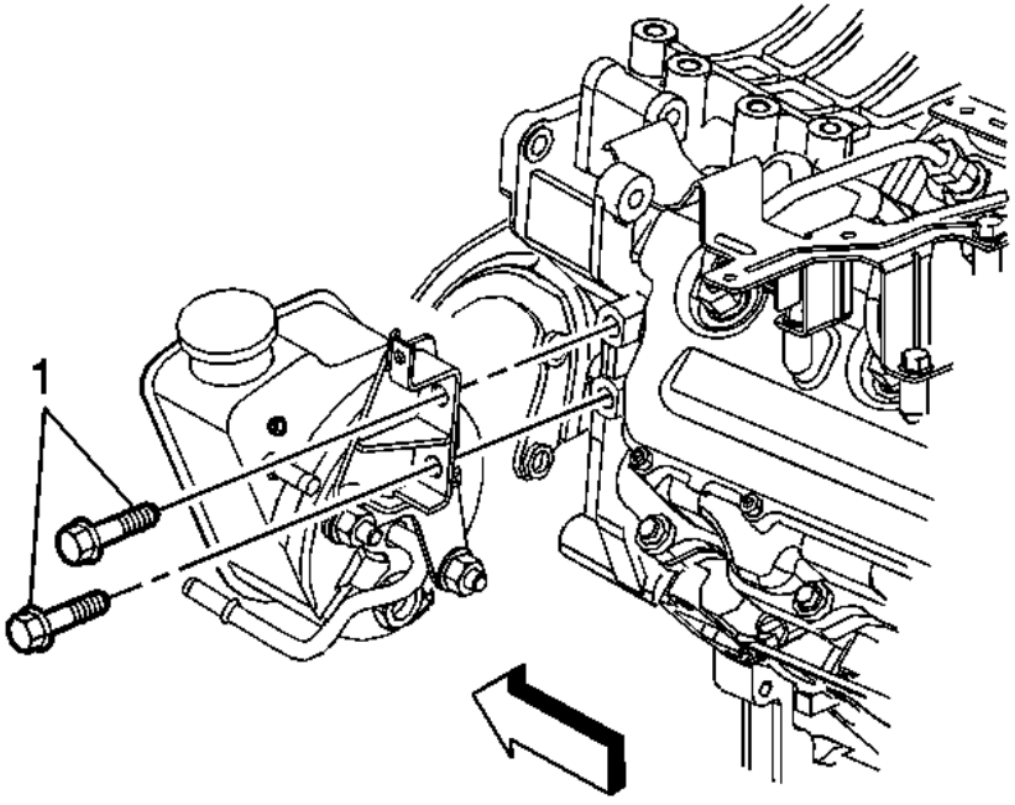


Fig. 12: View Of Power Steering Pump Rear Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the power steering pump rear bracket bolts (1).
4. Pull the power steering pump away from the accessory bracket to gain access to the pulley.

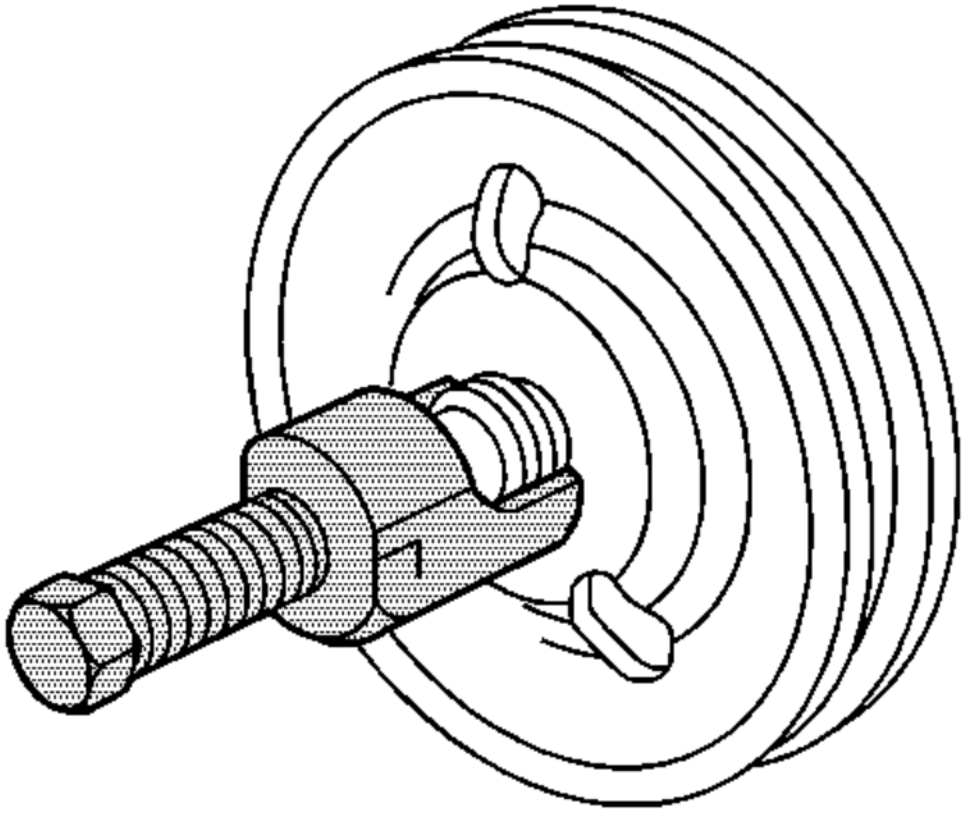


Fig. 13: View Of Power Steering Pump Pulley Remover
Courtesy of GENERAL MOTORS CORP.

5. Use the **J 25034-C** to remove the power steering pump pulley. See **Special Tools**.

Installation Procedure

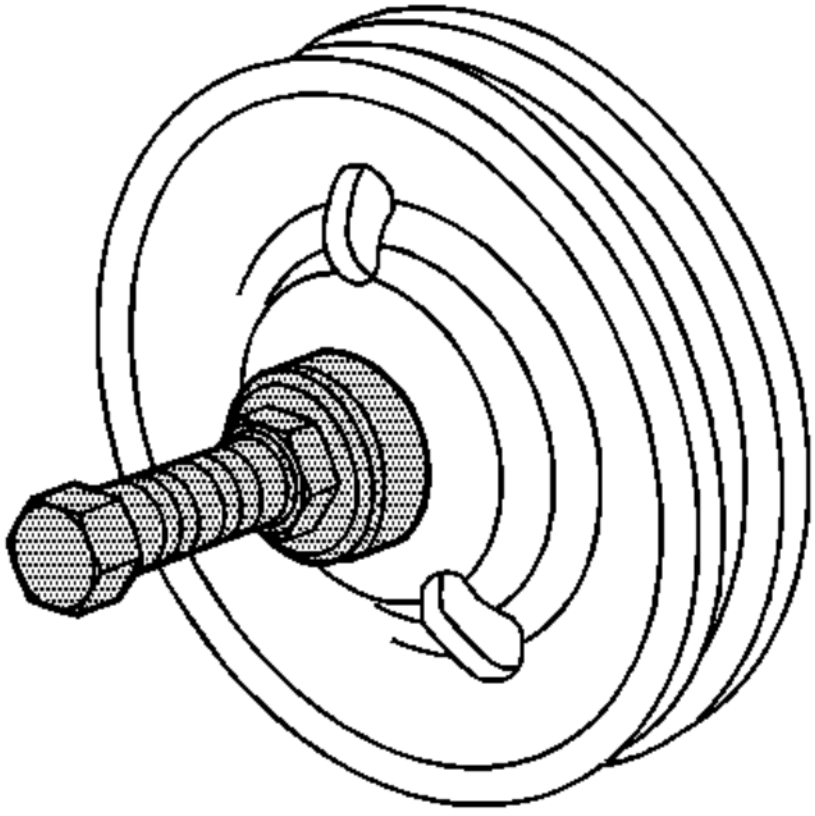


Fig. 14: View Of Power Steering Pump Pulley Installer
Courtesy of GENERAL MOTORS CORP.

1. Place the power steering pump pulley on the end of the power steering pump shaft.
2. Install the power steering pump pulley using the **J 25033-C** . See **Special Tools**.

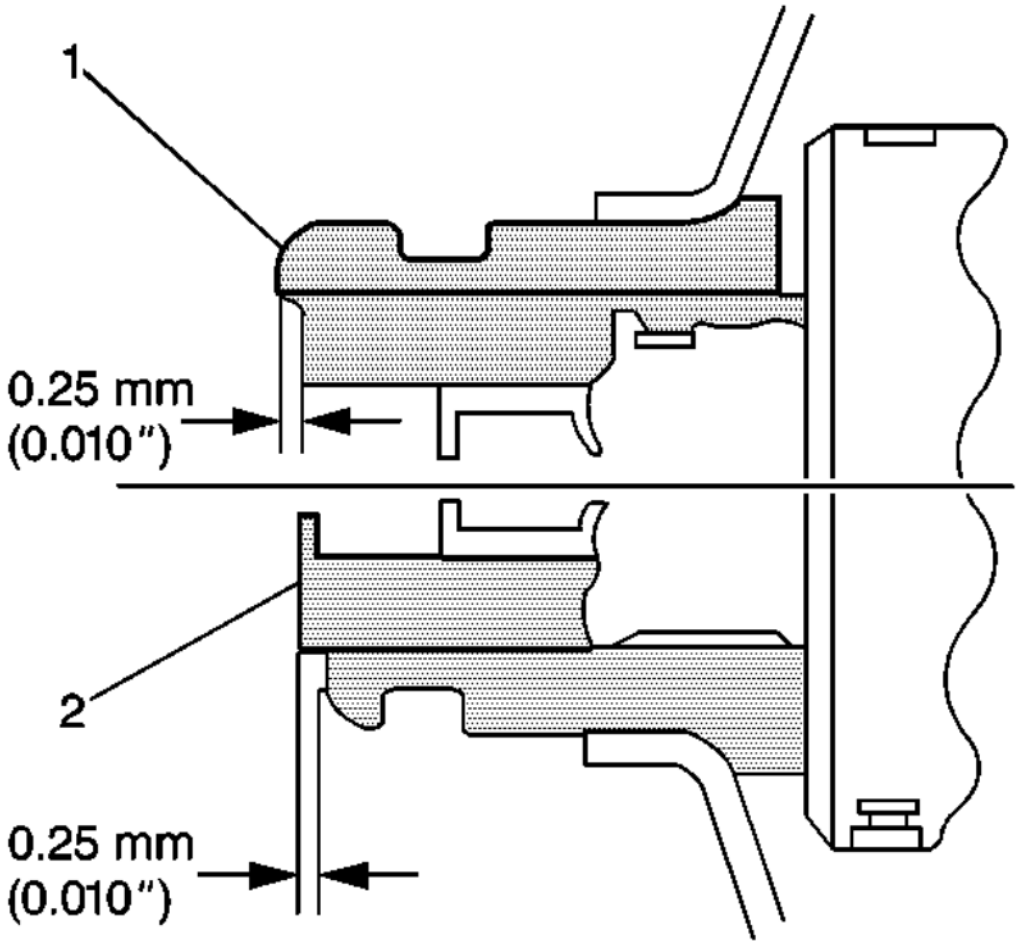


Fig. 15: Checking Power Steering Pump Pulley Installed Depth
Courtesy of GENERAL MOTORS CORP.

3. Ensure that the power steering pump pulley (1) is flush against the power steering pump shaft (2) with an allowable variance of 0.25 mm (0.010 in).
4. Reposition the power steering pump to the accessory bracket.

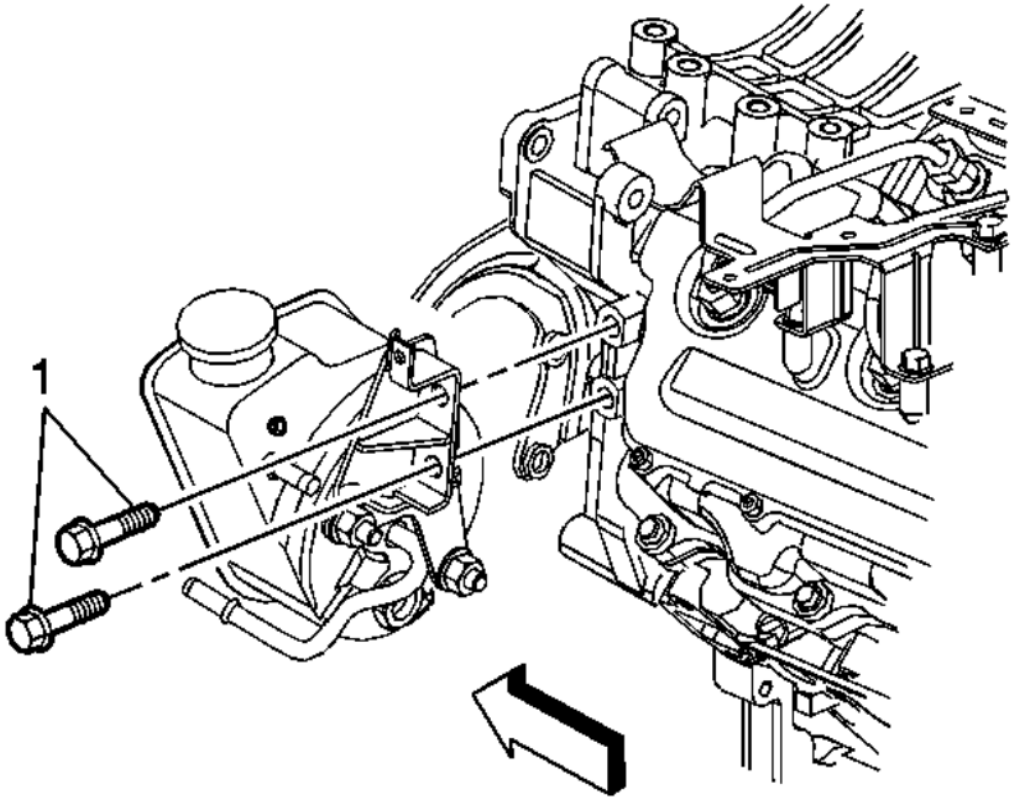


Fig. 16: View Of Power Steering Pump Rear Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

5. Install the power steering pump rear bracket bolts (1).

   Tighten: Tighten the rear bracket bolts to 50 N.m (37 lb ft).

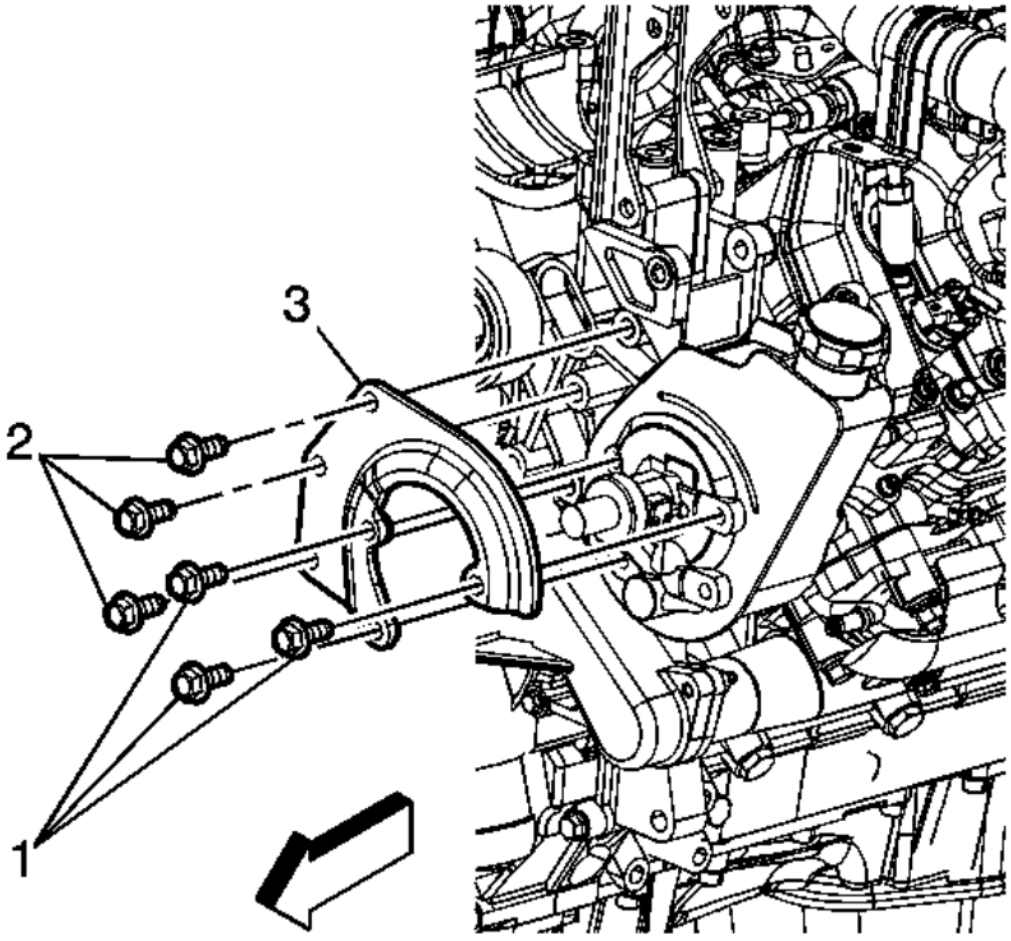


Fig. 17: View Of Power Steering Pump Front Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the power steering pump front bracket bolts (1, 2).

   Tighten: Tighten the front bracket bolts to 50 N.m (37 lb ft).

7. Install the accessory drive belt. Refer to **Drive Belt Replacement** .

POWER STEERING PUMP REPLACEMENT (4.3L)

Removal Procedure

1. Remove the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.
2. Remove as much power steering fluid from the power steering fluid reservoir as possible.
3. Disconnect the steering shaft coupling from the steering gear. Refer to **Steering Shaft Coupling Replacement** .
4. Remove the engine shield. Refer to **Engine Shield Replacement** .
5. Place drain pans under the vehicle as needed.

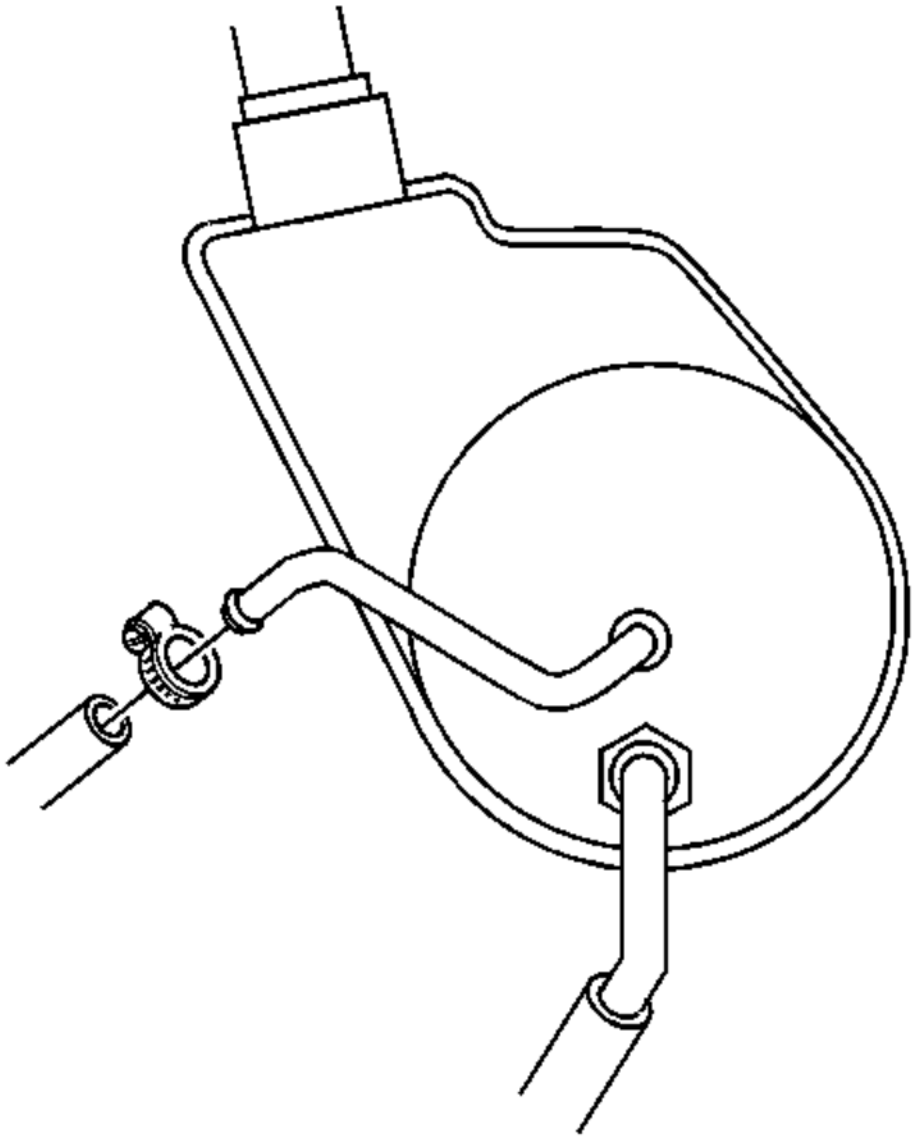


Fig. 18: View Of Power Steering Cooler Hose At Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the power steering fluid cooler hose clamp and the power steering fluid cooler hose from the power steering pump assembly.

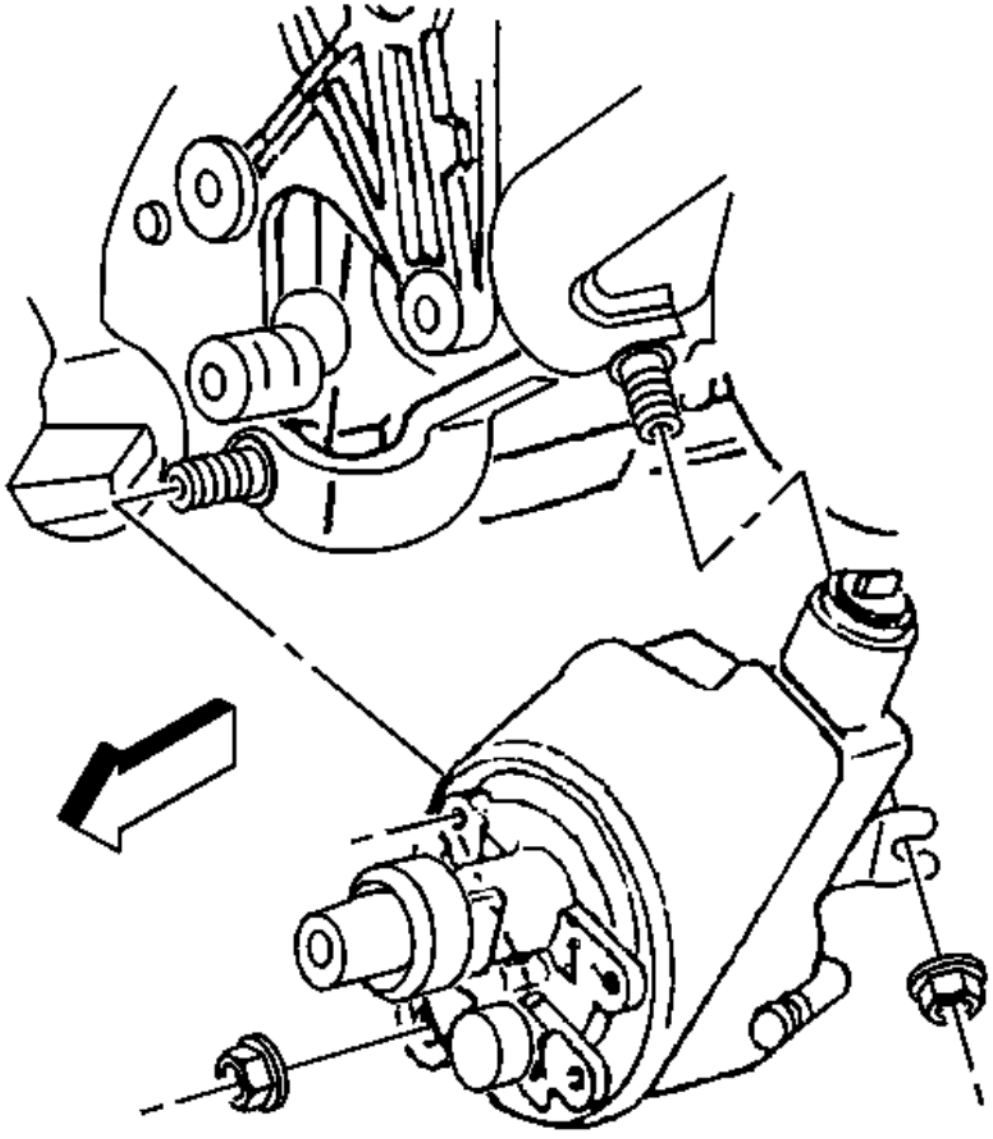


Fig. 19: View Of Power Steering Pump Rear Bracket Retaining Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the power steering pump rear bracket nuts.

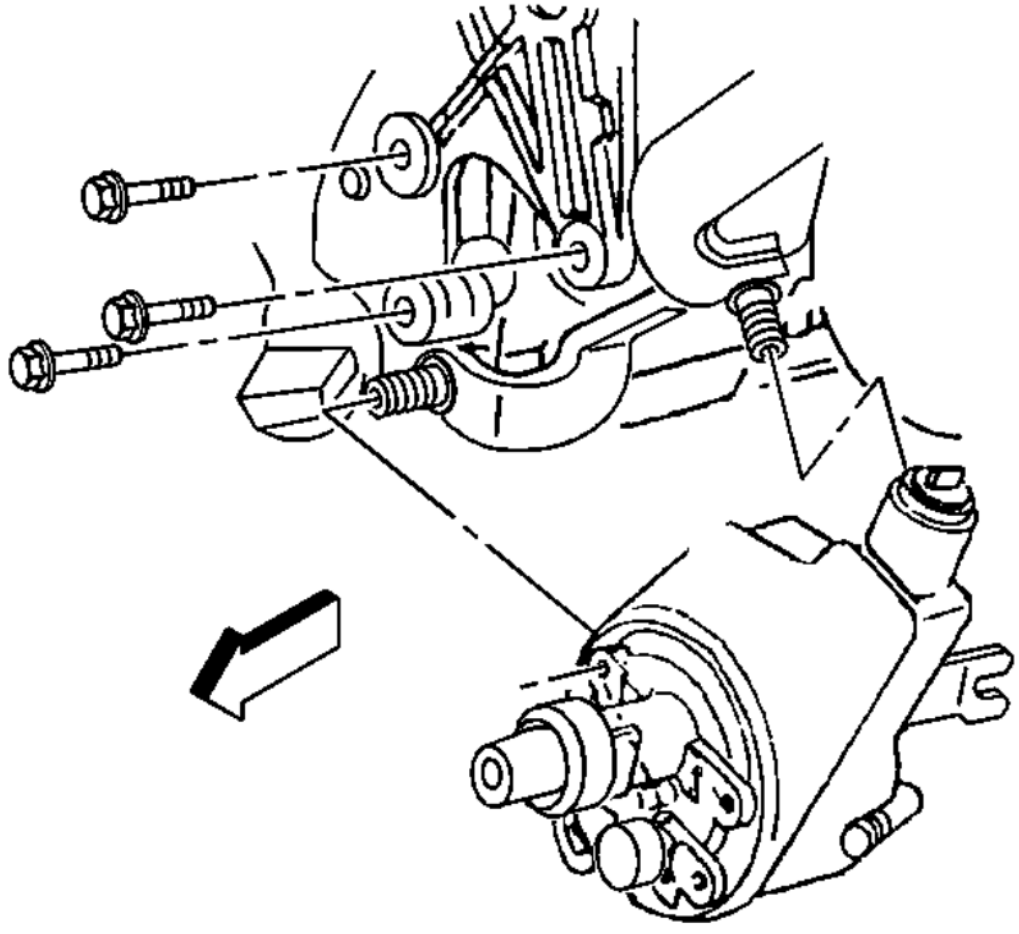


Fig. 20: Power Steering Pump & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the power steering pump bolts.

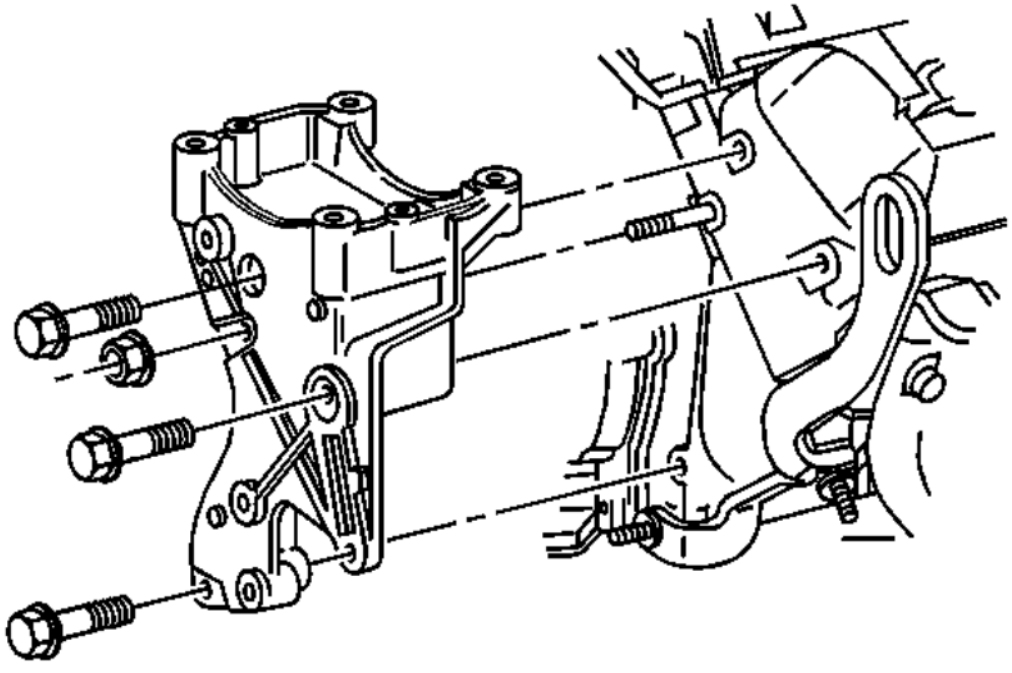


Fig. 21: Accessory Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering pump bracket bolts and nut.
10. Pull the power steering pump bracket forward.
11. Separate the power steering pump assembly from the power steering pump bracket.

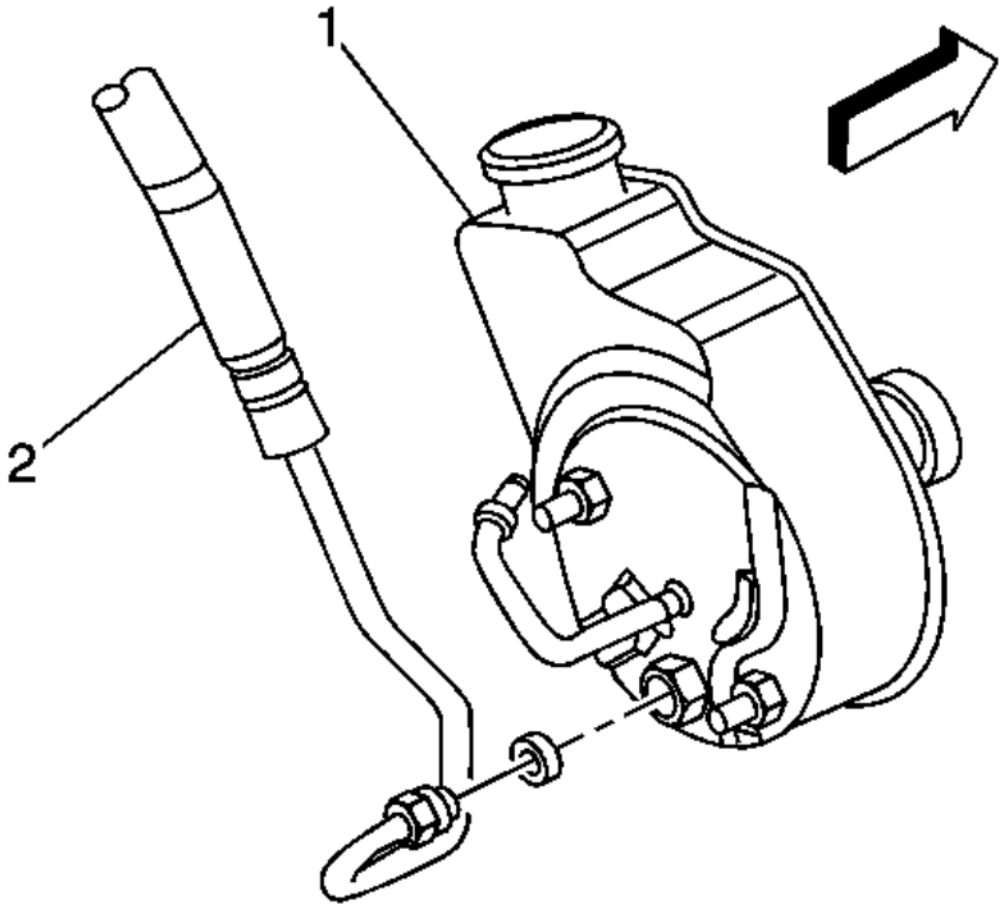


Fig. 22: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

12. Remove the power steering gear inlet hose (2) from the power steering pump assembly (1).
13. Remove the power steering pump assembly from the vehicle.
14. Transfer any parts as needed.

Installation Procedure

1. Position the power steering pump assembly in the vehicle with the power steering pump bracket.

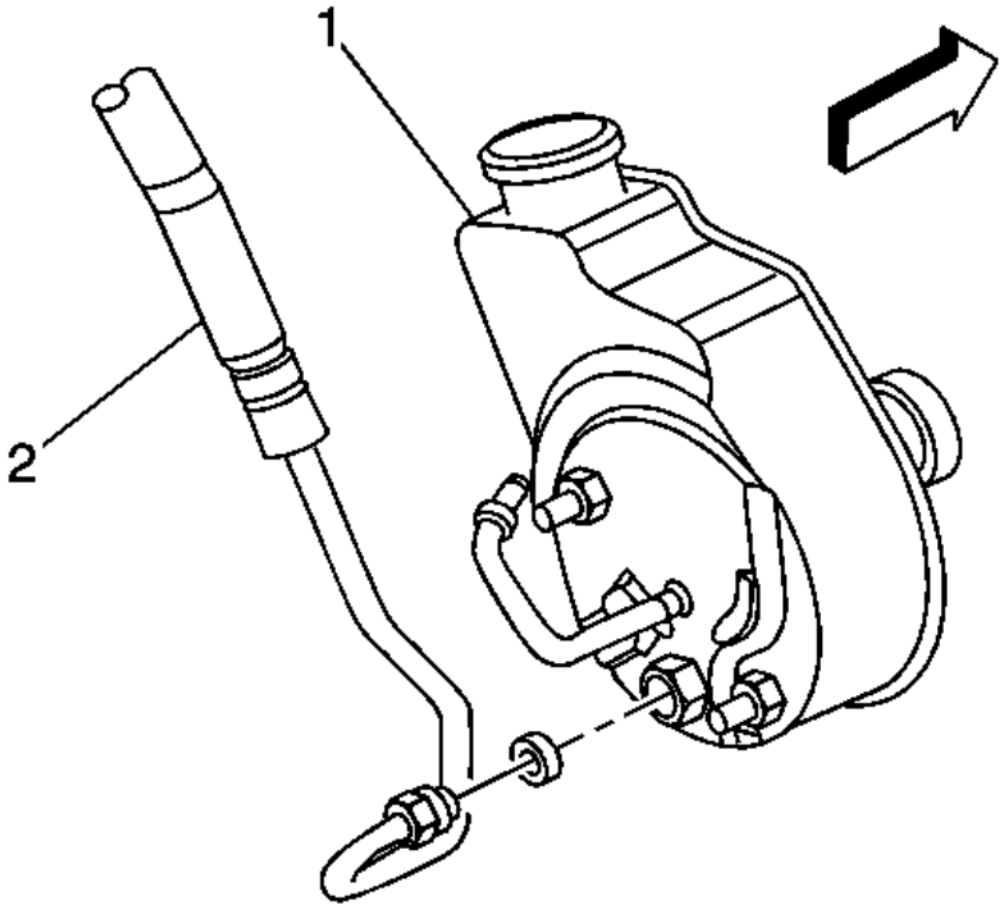


Fig. 23: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

2. Install the power steering gear inlet hose (2) to the power steering pump assembly (1).

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

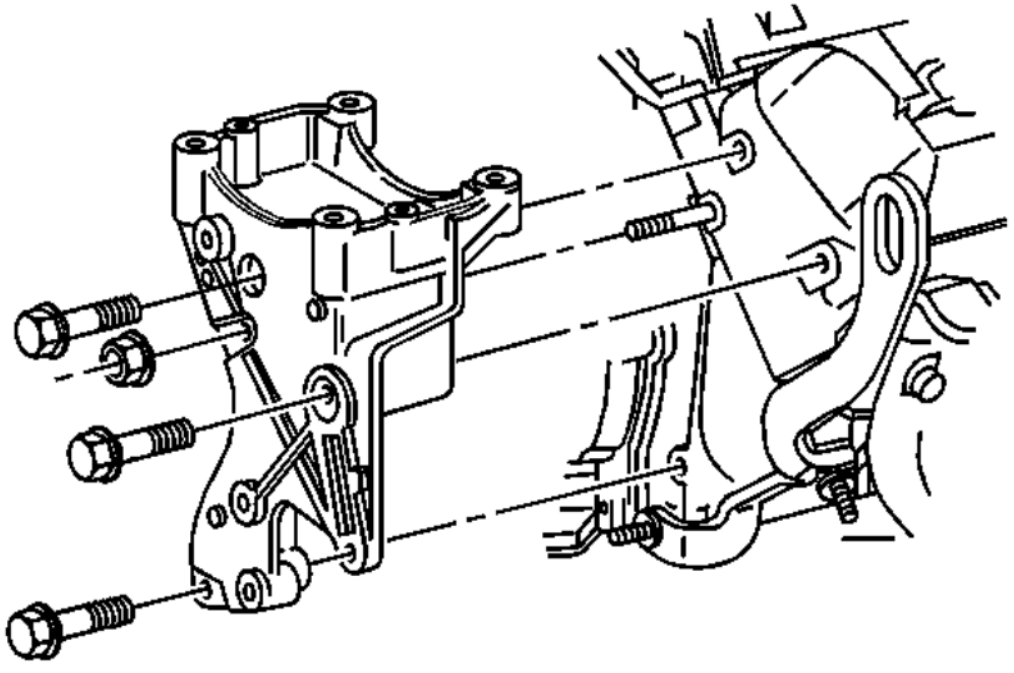


Fig. 24: Accessory Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

3. Install the power steering pump bracket bolts and nut.

   Tighten: Tighten the bolts and nut to 41 N.m (30 lb ft).

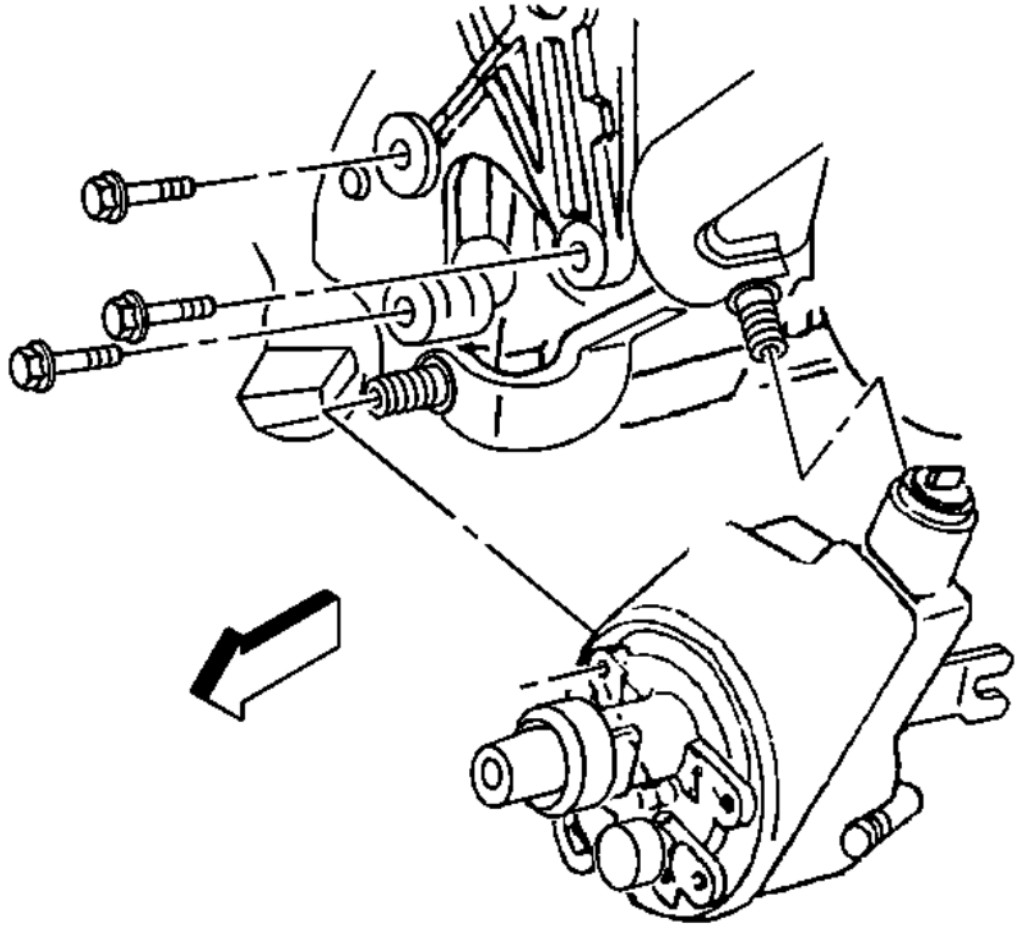


Fig. 25: Power Steering Pump & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the power steering pump bolts.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

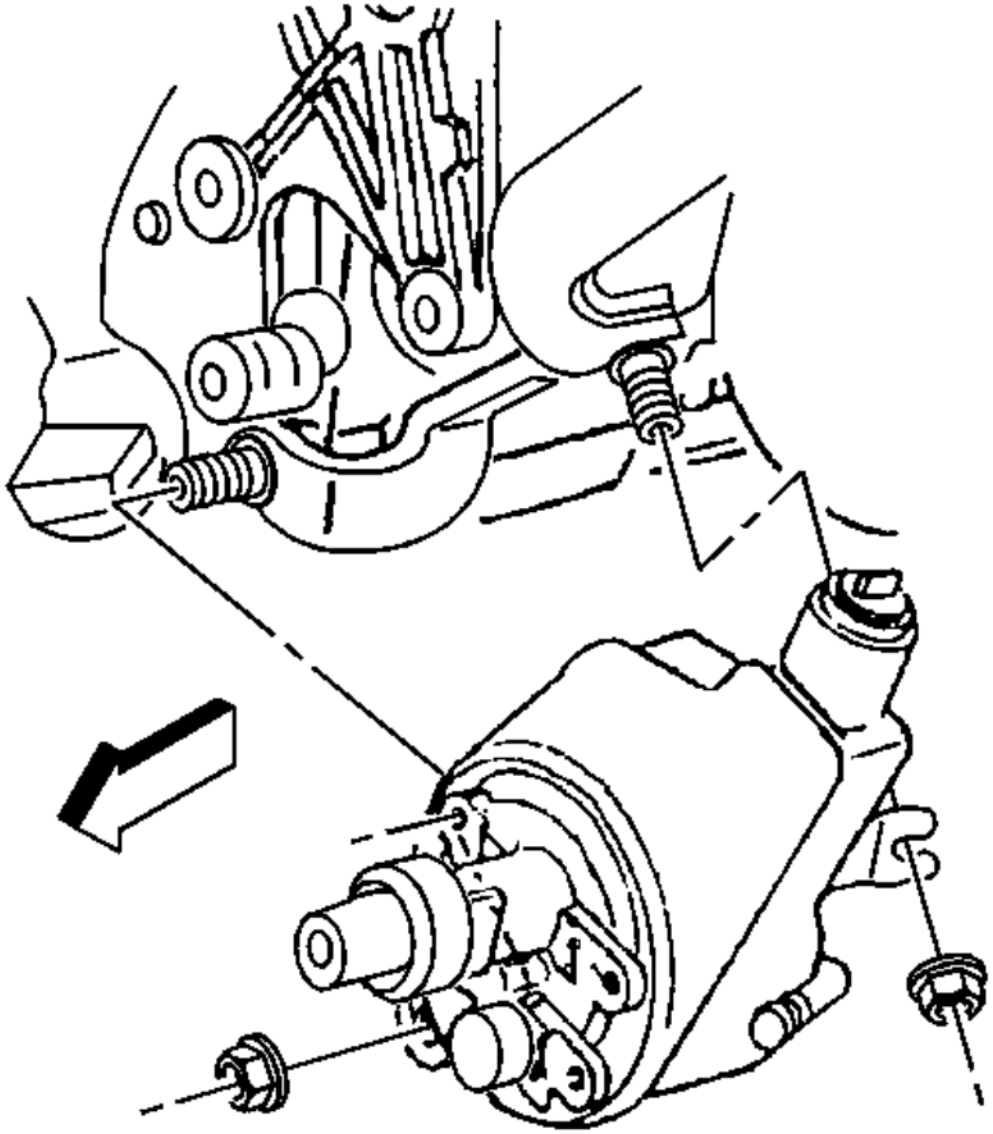


Fig. 26: View Of Power Steering Pump Rear Bracket Retaining Nuts
Courtesy of GENERAL MOTORS CORP.

5. Install the power steering pump rear bracket nuts.

   Tighten: Tighten the nuts to 41 N.m (30 lb ft).

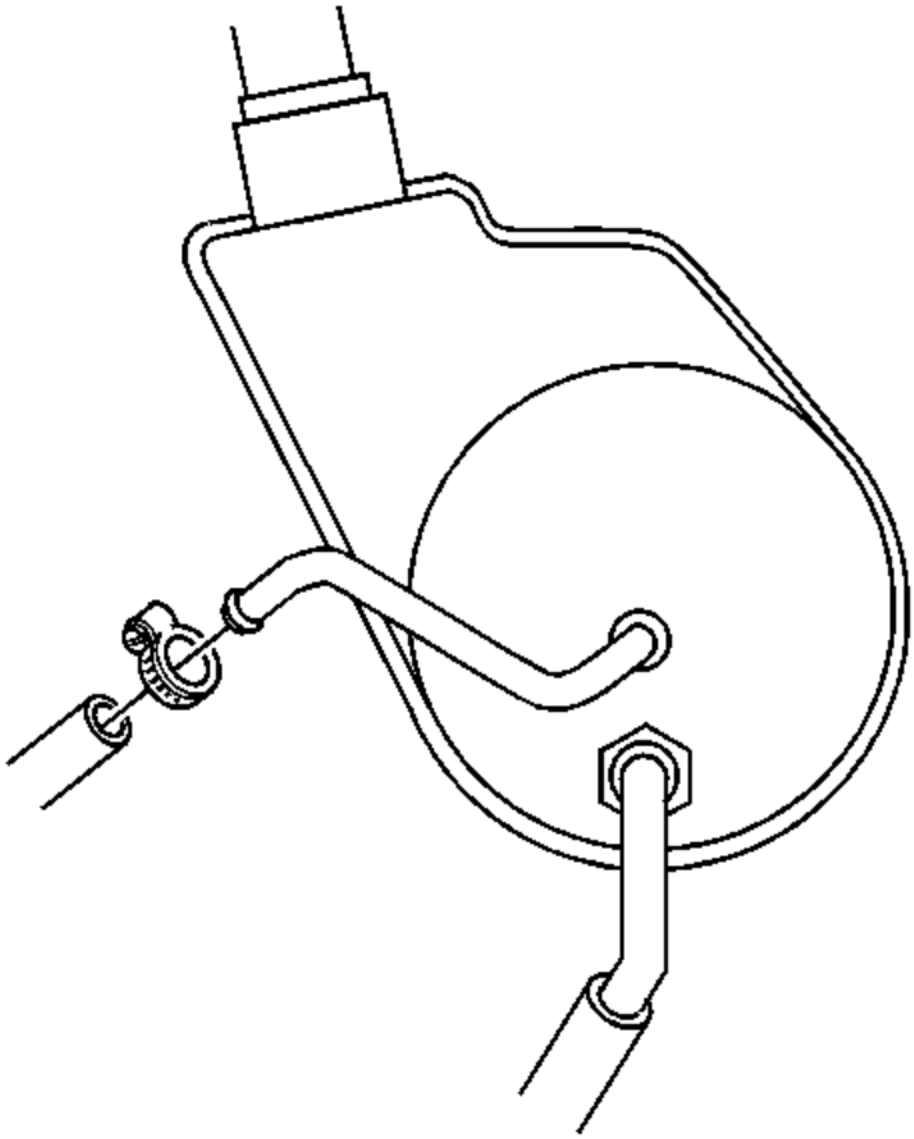


Fig. 27: View Of Power Steering Cooler Hose At Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

6. Connect the power steering fluid cooler hose and the power steering fluid cooler hose clamp to the power steering pump assembly.
7. Clean any excess power steering fluid from the vehicle and remove the drain pans.

8. Connect the steering shaft coupling from the steering gear. Refer to **Steering Shaft Coupling Replacement** .
9. Install the engine shield. Refer to **Engine Shield Replacement** .
10. Install the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.
11. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.
12. Program the power steering control module. Refer to **Control Module References** .

POWER STEERING PUMP REPLACEMENT (4.8L, 5.3L, 6.0L, AND 6.2L)

Removal Procedure

1. Remove the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.
2. Remove as much power steering fluid from the power steering fluid reservoir as possible.
3. Disconnect the steering shaft coupling from the steering gear. Refer to **Steering Shaft Coupling Replacement** .
4. Remove the engine shield. Refer to **Engine Shield Replacement** .
5. Place drain pans under the vehicle as needed.

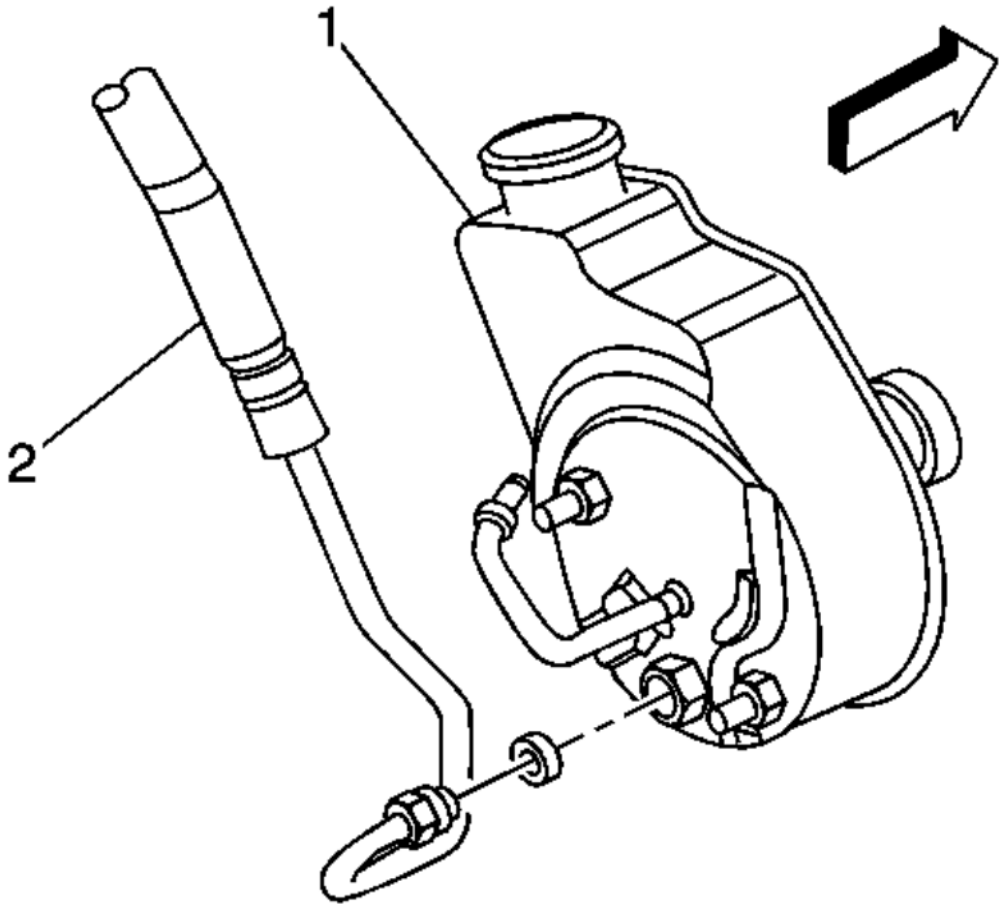


Fig. 28: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the power steering gear inlet hose (2) from the power steering pump assembly from underneath the vehicle.

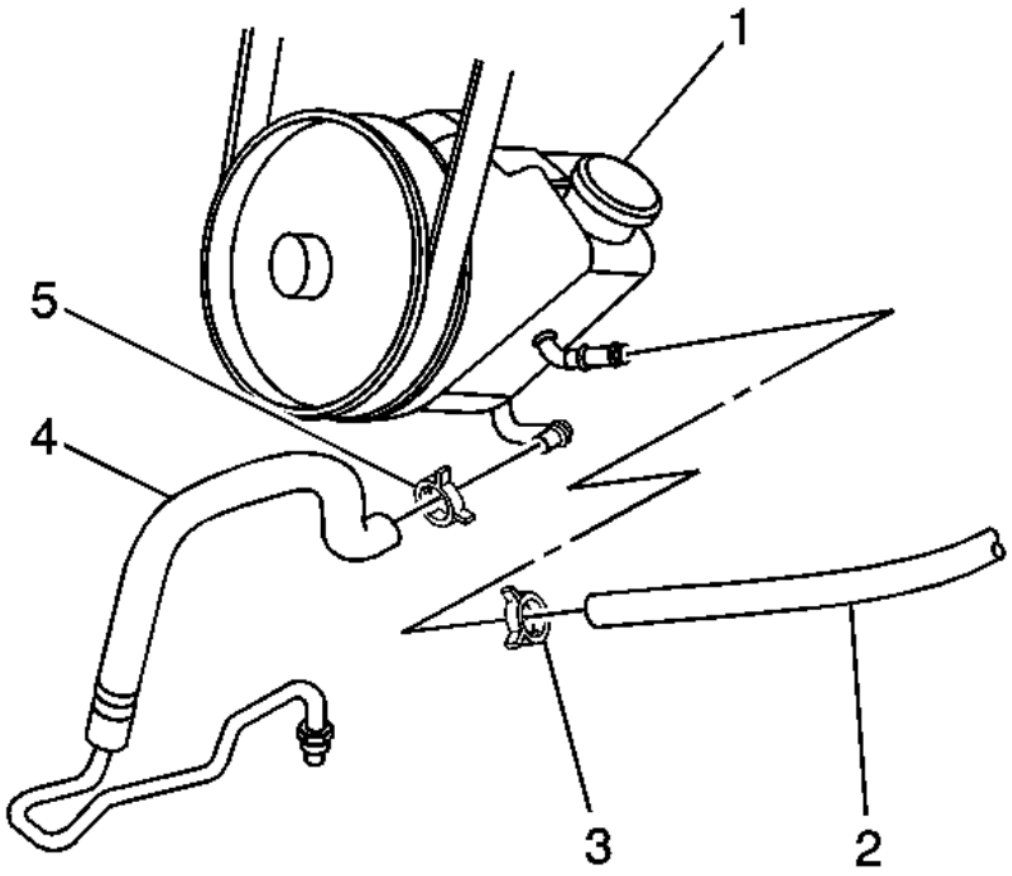


Fig. 29: View Of Power Steering Return Hoses, Clamps & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the power steering fluid cooler hose clamp (5) and the power steering fluid cooler hose (4) from the power steering pump assembly (1).
8. If equipped with hydroboost, disconnect the power brake booster outlet hose clamp (3) and disconnect the power brake booster outlet hose (2) from power steering pump assembly (1).

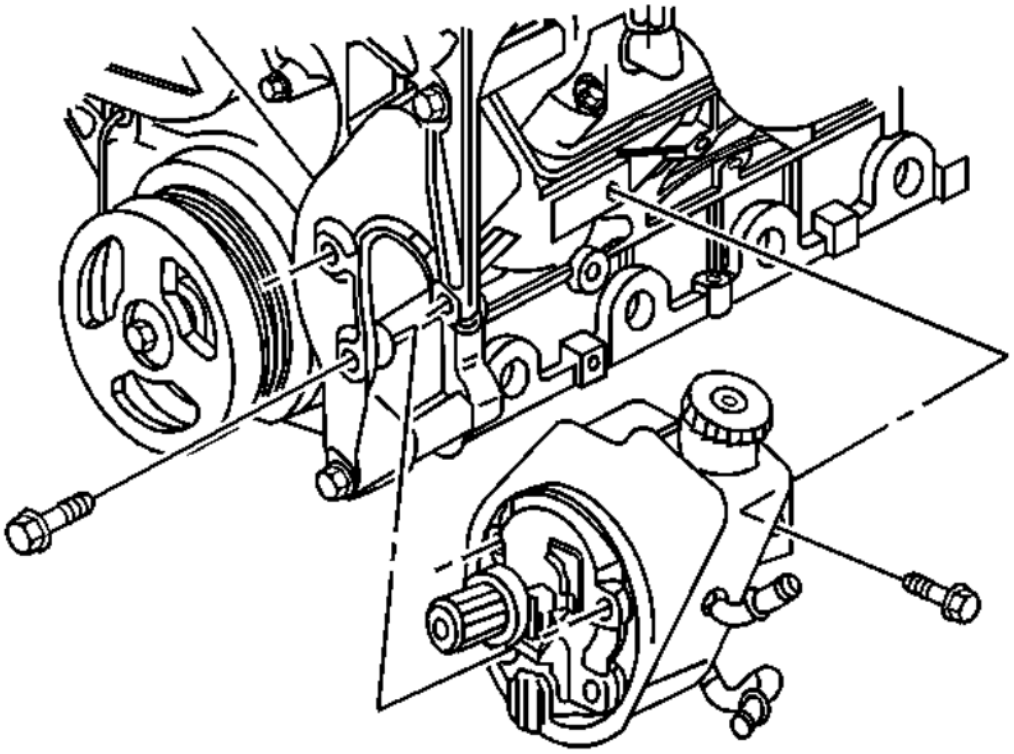


Fig. 30: View Of Power Steering Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering pump bracket bolt from the side of the engine.
10. Remove the power steering pump bolts.
11. Remove the power steering pump assembly from the vehicle.
12. Transfer any parts as needed.

Installation Procedure

1. Install all transferable parts as needed.
2. Install the power steering pump assembly to the vehicle.

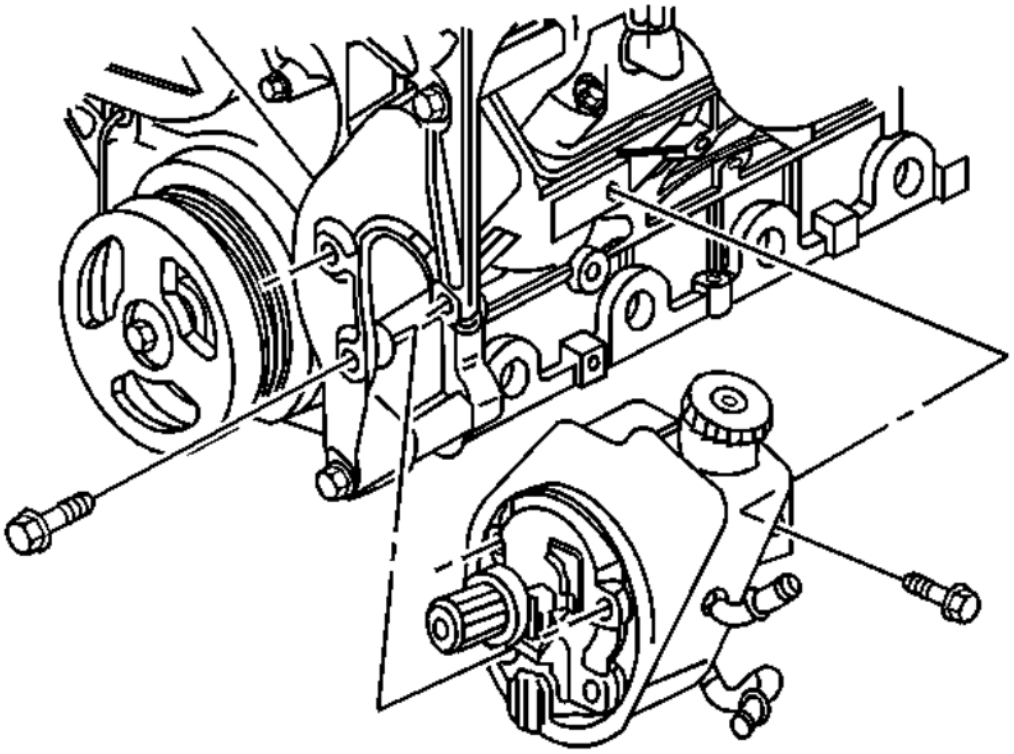


Fig. 31: View Of Power Steering Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

IMPORTANT: Start all the bolts by hand before finalizing each torque.

3. Install the power steering pump bracket bolt to the side of the engine.

   Tighten: Tighten the bolt to 50 N.m (37 lb ft).

4. Install the power steering pump bolts.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

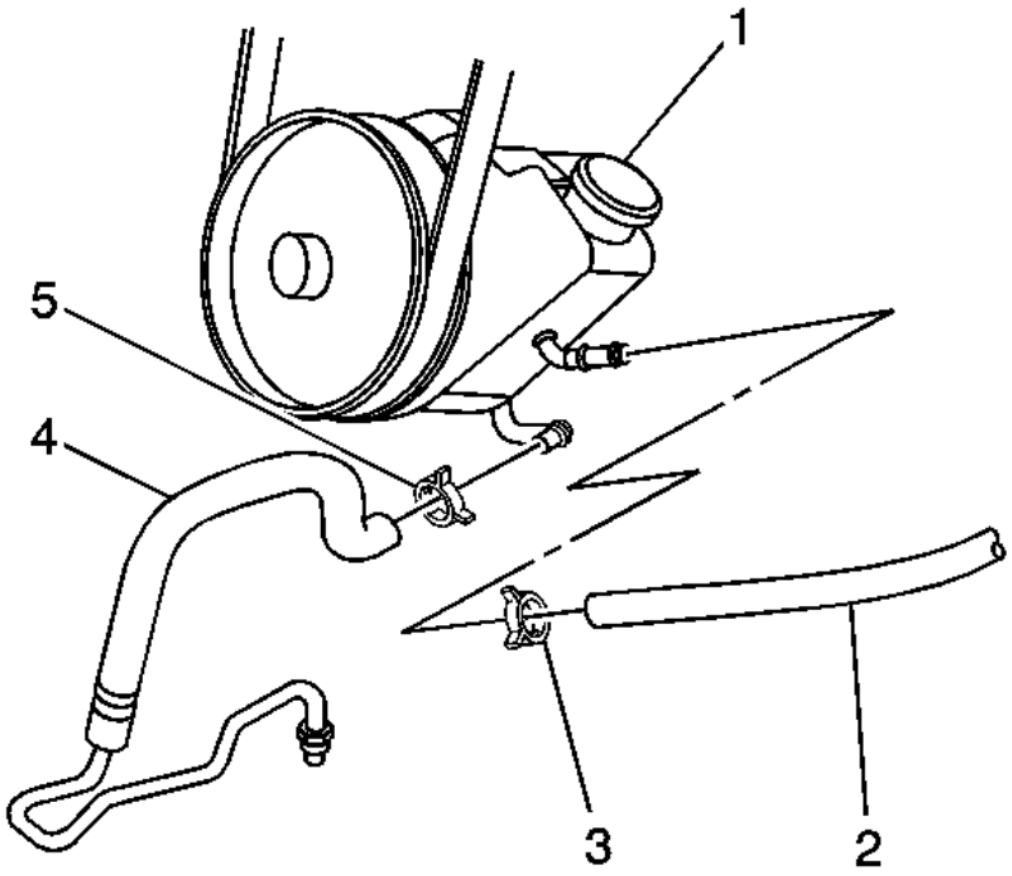


Fig. 32: View Of Power Steering Return Hoses, Clamps & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

5. Connect the power steering fluid cooler hose (4) and the power steering fluid cooler hose clamp (5) to the power steering pump assembly (1).
6. If equipped with hydroboost, connect the power brake booster outlet hose (2) and the power brake booster outlet hose clamp (3) to the power steering pump assembly (1).

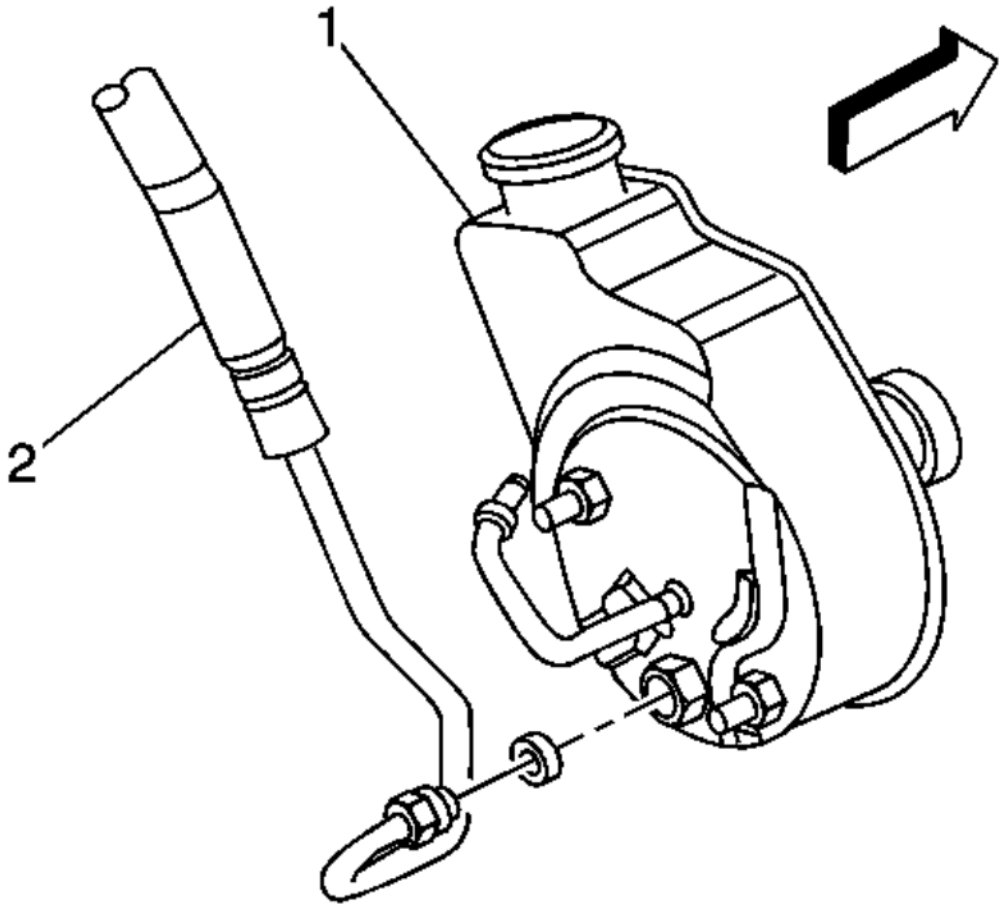


Fig. 33: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

7. Connect the power steering gear inlet hose (2) to the power steering pump assembly (1) from underneath the vehicle.

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

8. Clean any excess fluid power steering fluid from the vehicle and remove the drain pans.
9. Connect the steering shaft coupling. Refer to **Steering Shaft Coupling Replacement** .
10. Install the engine shield. Refer to **Engine Shield Replacement** .

11. Install the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.
12. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING PUMP REPLACEMENT (6.6L)

Removal Procedure

1. Place a drain pan under the vehicle.

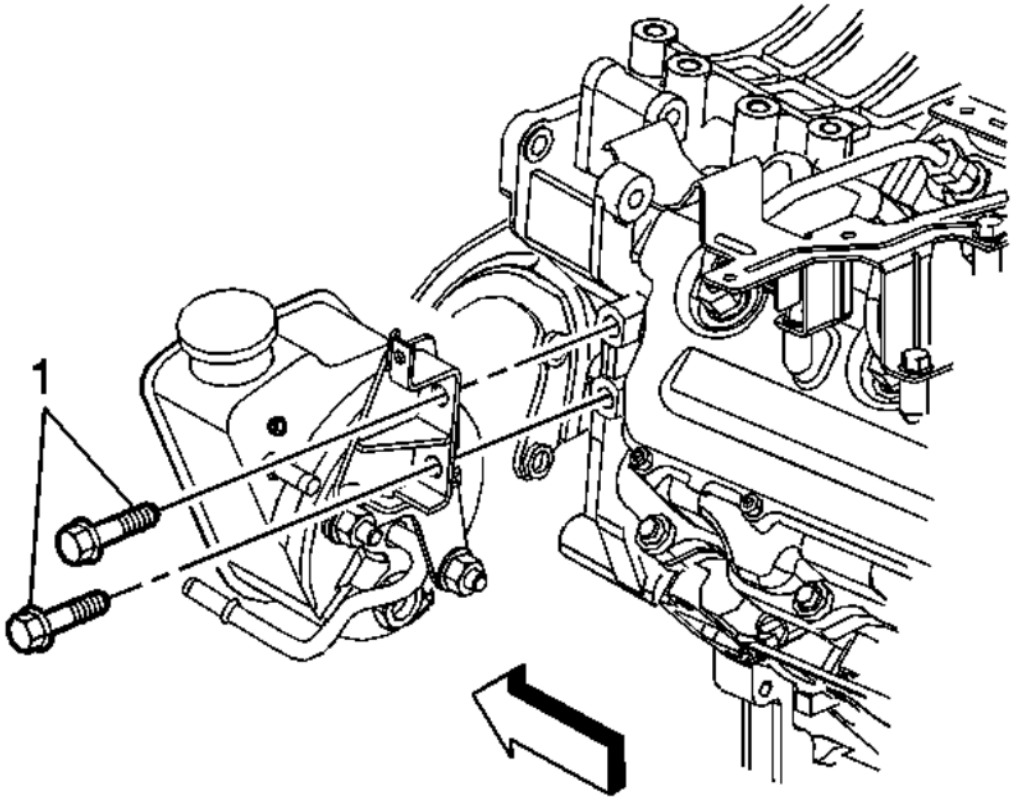


Fig. 34: View Of Power Steering Pump Rear Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolts (1) from the rear of the pump.

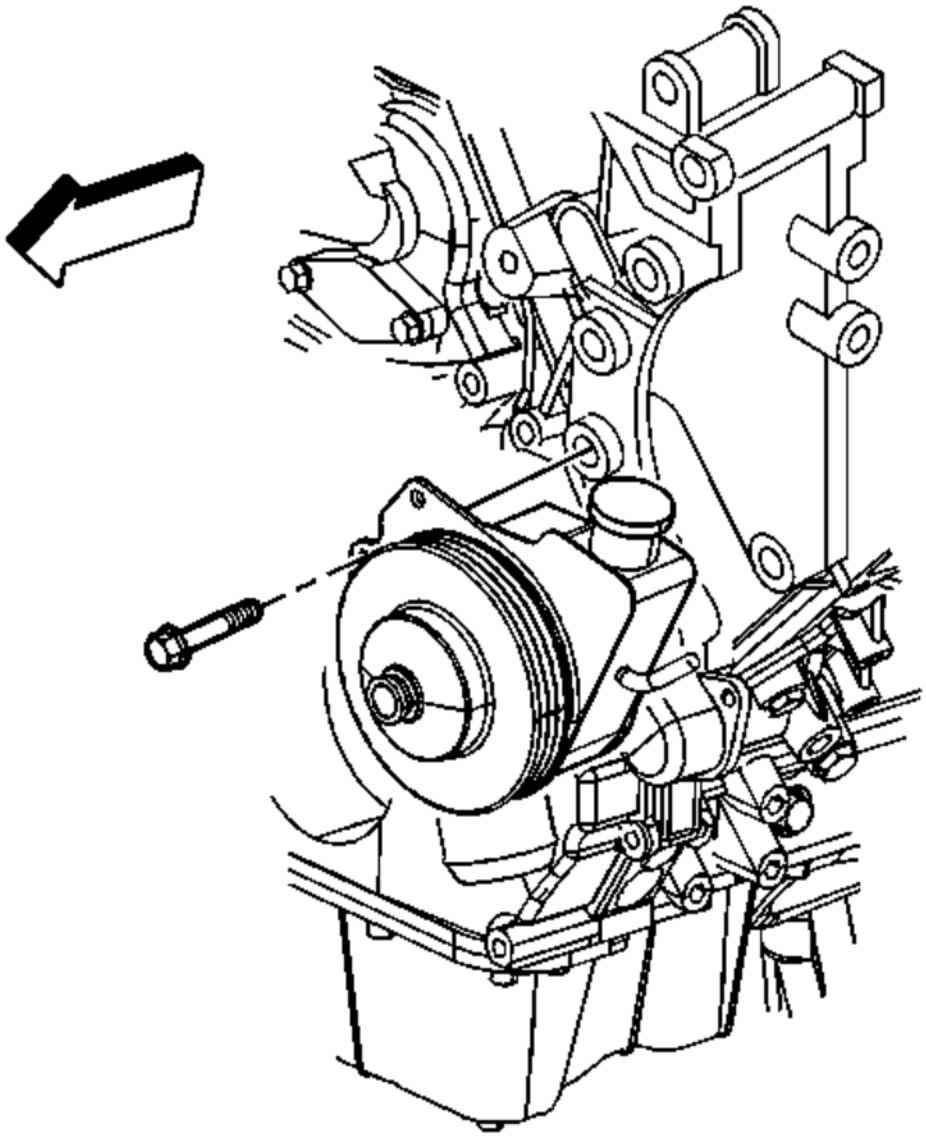


Fig. 35: View Of Power Steering Pump Front Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolts from the front of the pump bracket.

IMPORTANT: Note the location of the battery cables for reinstallation.

4. Disconnect the negative battery clip from the power steering pump front bracket.

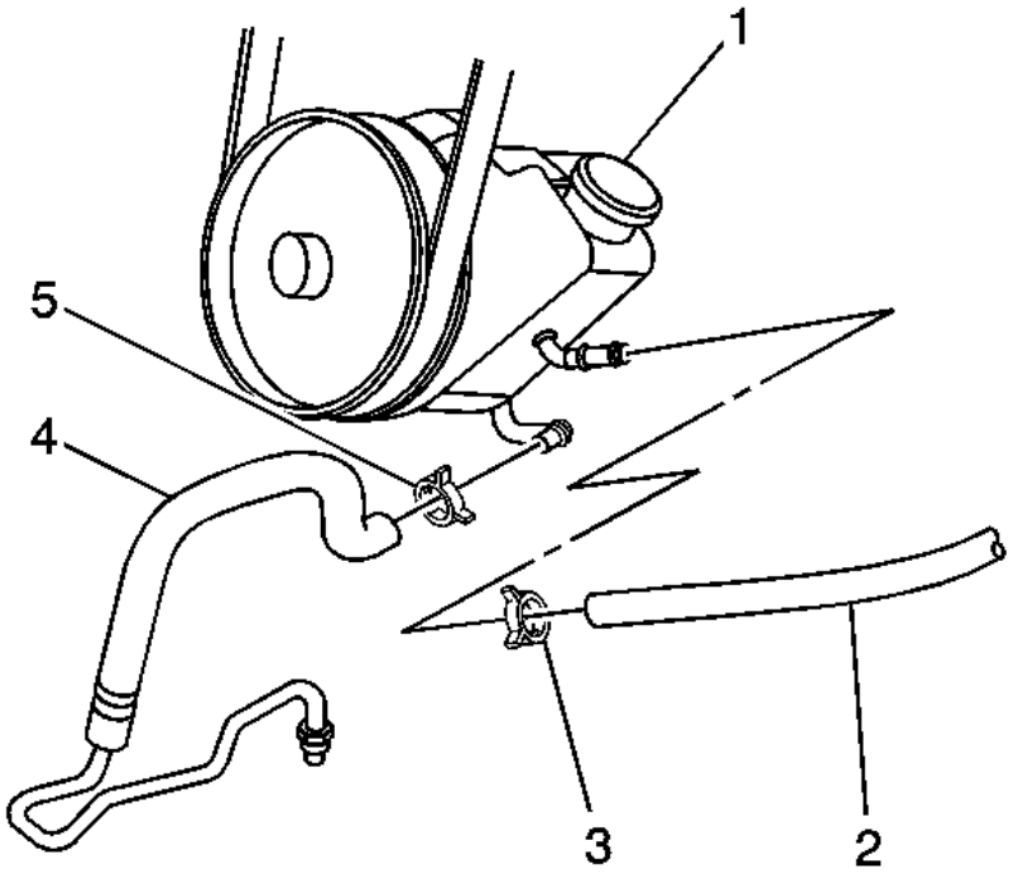


Fig. 36: View Of Power Steering Return Hoses, Clamps & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

5. Remove the power steering return hoses (2, 4) from the power steering pump.

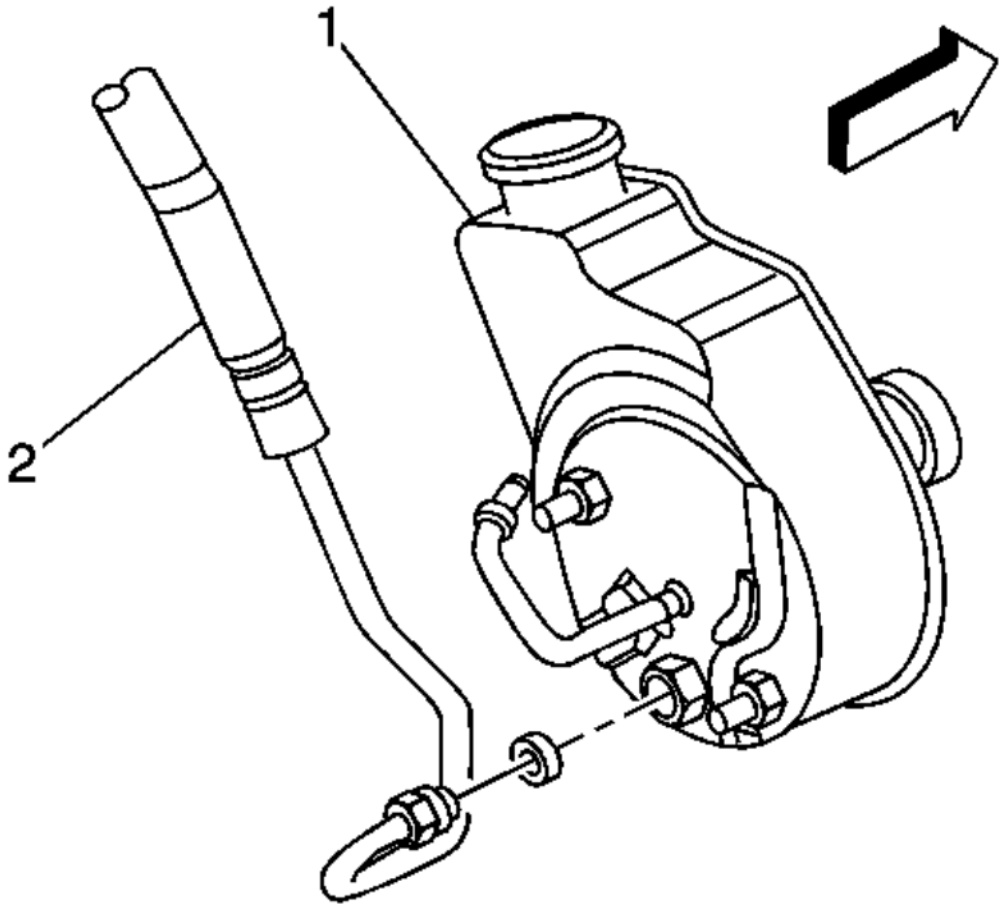


Fig. 37: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

6. Remove the power steering pump from the accessory mounting bracket to gain access to the power brake booster inlet pipe.
7. Remove the power brake booster inlet pipe from the power steering pump.
8. Remove the power steering pump from the vehicle.
9. Remove the power steering pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.
10. Remove the front bracket from the power steering pump.
11. Remove the rear bracket from the power steering pump.

Installation Procedure

NOTE: Refer to Fastener Notice .

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

   Tighten: Tighten the rear bracket retaining nuts to 50 N.m (37 lb ft).

2. Install the front bracket to the power steering pump.

   Tighten: Tighten the front bracket retaining nuts to 50 N.m (37 lb ft).

3. Install the power steering pulley. Refer to **Power Steering Pump Pulley Replacement (4.3L, 4.8L, 5.3L, 6.0L, 6.2L)** or **Power Steering Pump Pulley Replacement (6.6L)**.

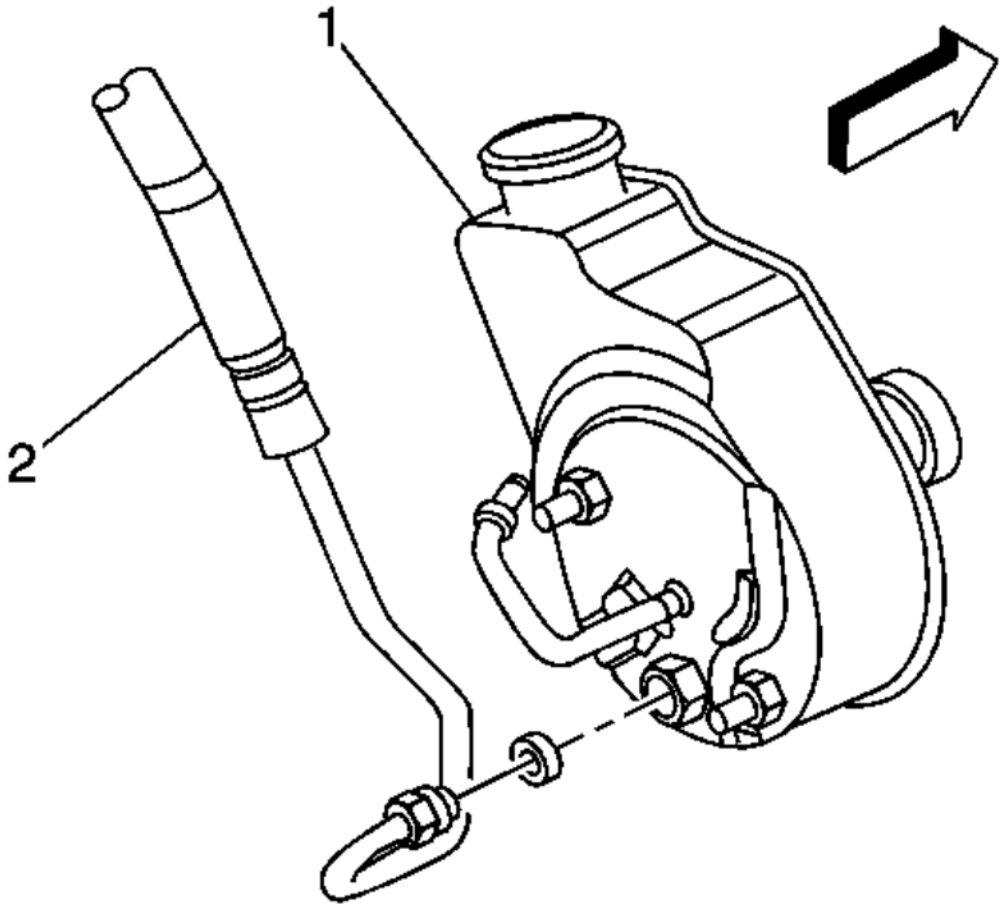


Fig. 38: View Of Power Steering Pressure Hose & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

4. Install the power brake booster inlet pipe (2) to the power steering pump.

   Tighten: Tighten the fittings to 32 N.m (24 lb ft).

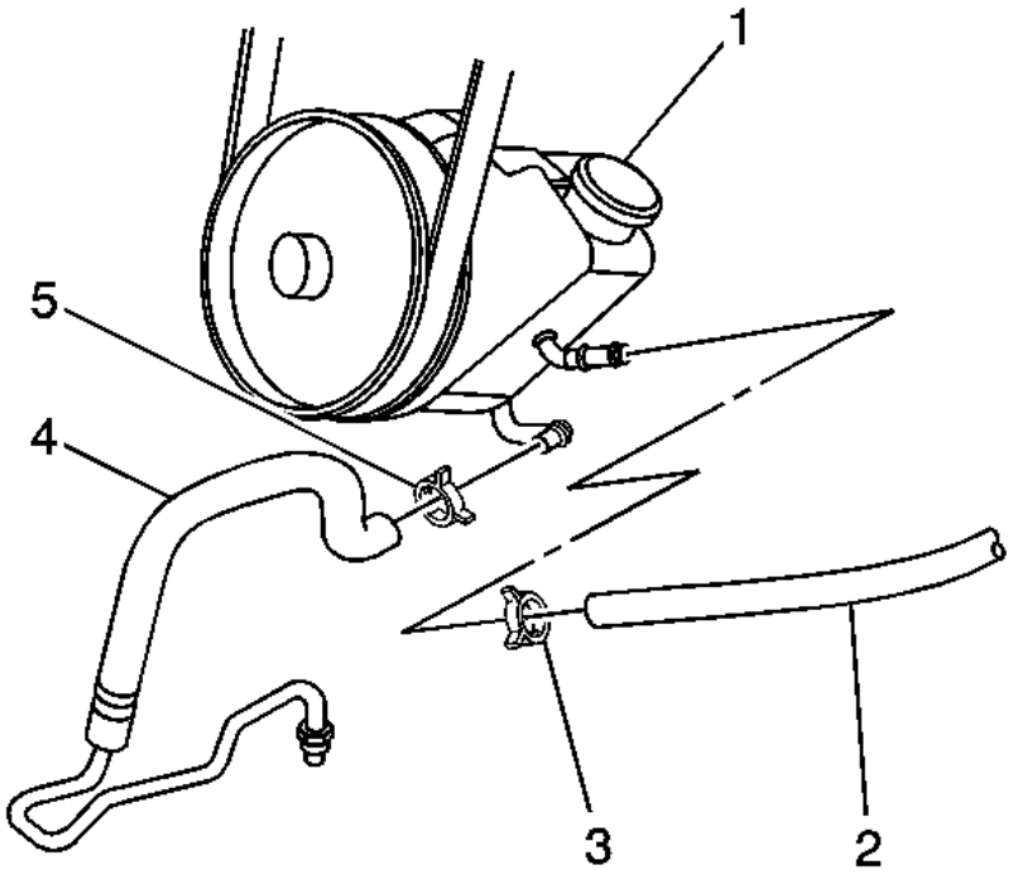


Fig. 39: View Of Power Steering Return Hoses, Clamps & Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

5. Install the power steering return hoses and retaining clamps (3, 5) to the power steering pump.

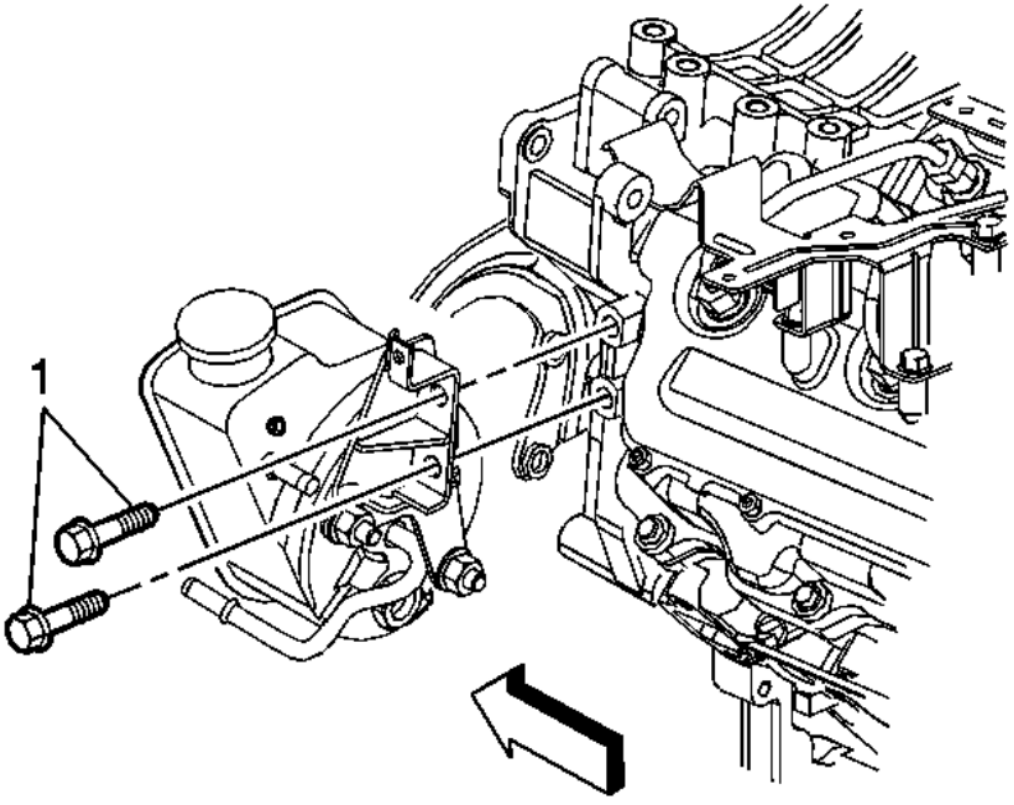


Fig. 40: View Of Power Steering Pump Rear Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Reposition the power steering pump to the accessory bracket and install the bolts (1) to the rear of the power steering pump.

   Tighten: Tighten the rear bolts to 50 N.m (37 lb ft).

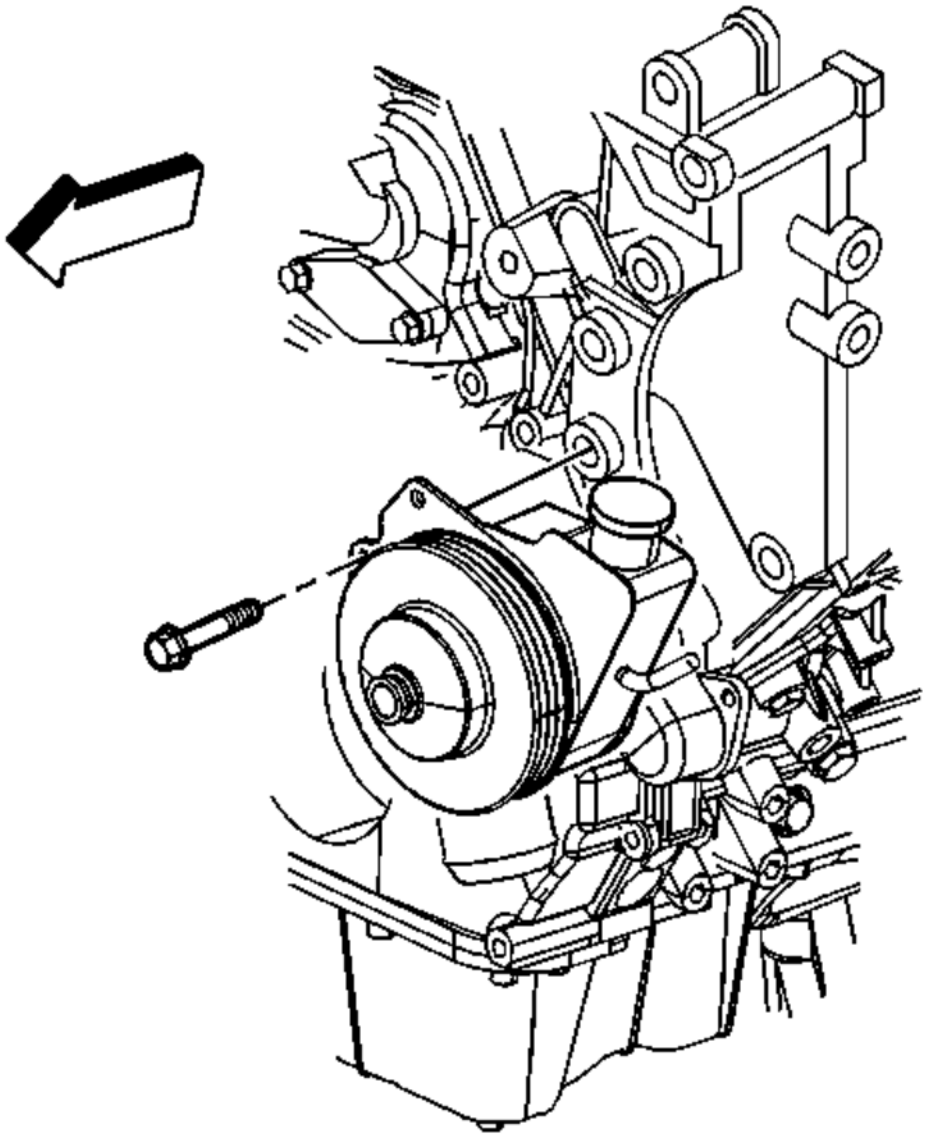


Fig. 41: View Of Power Steering Pump Front Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Install the power steering pump front bracket bolts to the accessory bracket.

   Tighten: Tighten the power steering pump front bracket retaining bolts to 50 N.m (37 lb

ft).

8. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING FLUID RESERVOIR REPLACEMENT - OFF VEHICLE

Disassembly Procedure

1. Remove the power steering pump assembly from the vehicle. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.

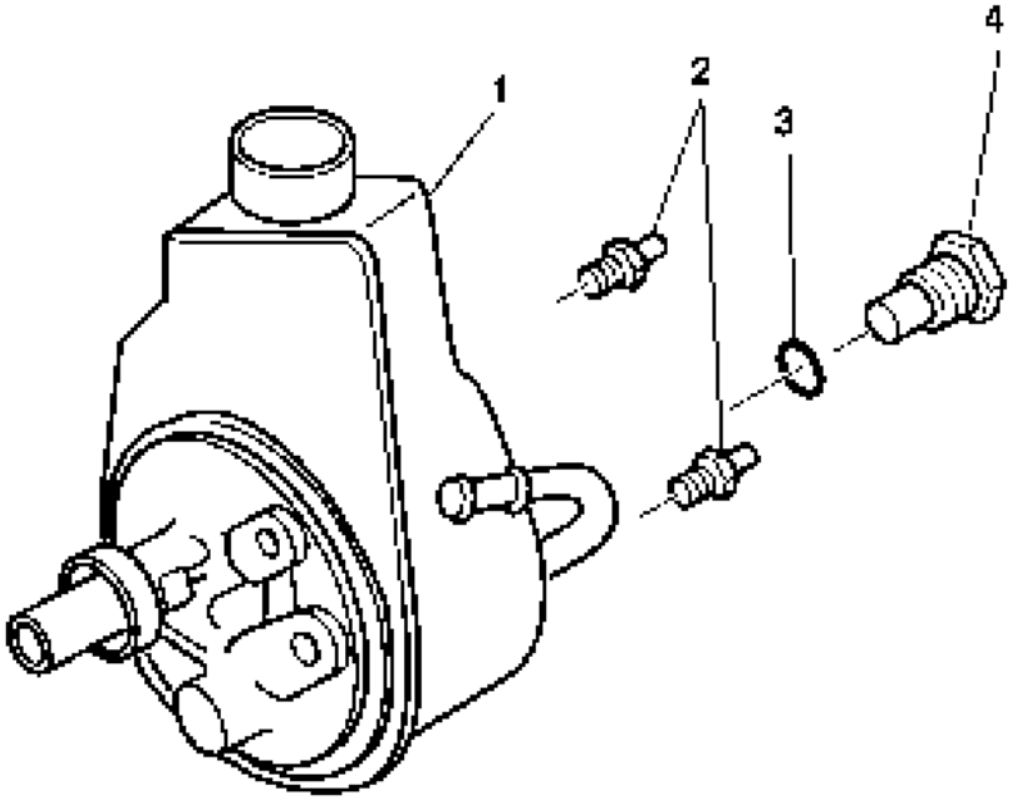


Fig. 42: View Of Pump Housing, Mounting Studs, O-Ring Seal & Connector/Fitting Assembly
Courtesy of GENERAL MOTORS CORP.

2. Remove the power steering fluid reservoir studs (2) from the power steering pump assembly (1).
3. Remove the power steering pump fitting (4).
4. Remove the power steering pump fitting seal (3).

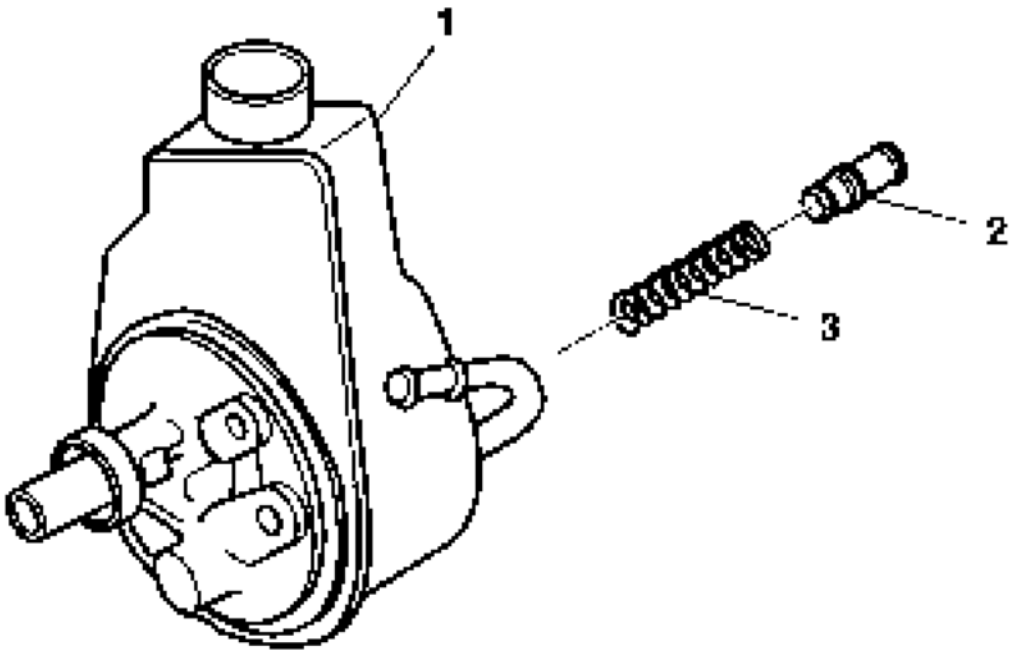


Fig. 43: View Of Pump Housing Assembly, Control Valve Assembly & Flow Control Spring
Courtesy of GENERAL MOTORS CORP.

5. Remove the power steering pump flow control valve (2) and the power steering pump flow control valve spring (3) from the power steering pump assembly (1).

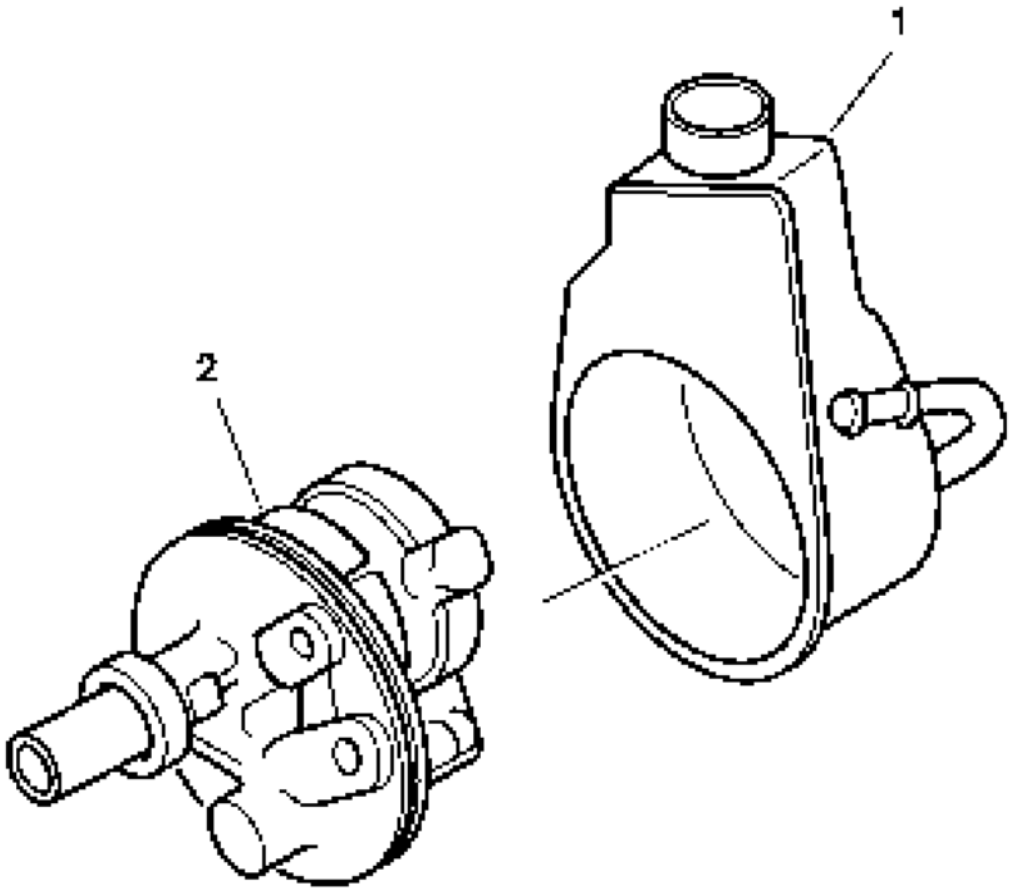


Fig. 44: View Of Reservoir Assembly & Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

6. Separate the power steering fluid reservoir (1) and the power steering pump (2).

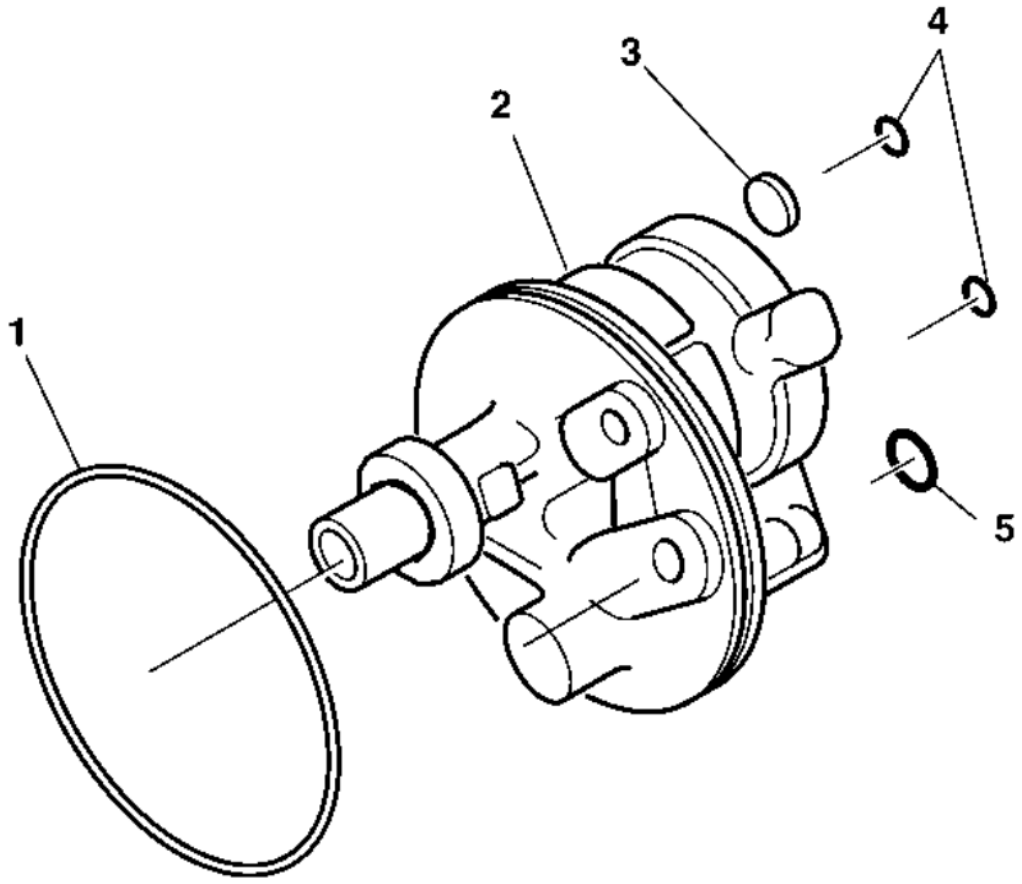


Fig. 45: Reservoir O-ring Seals
Courtesy of GENERAL MOTORS CORP.

7. Remove the power steering pump seals (1, 4, 5).
8. Remove and clean the power steering fluid reservoir magnet (3).
9. Inspect the welch plug in the power steering pump (2). DO NOT REMOVE IT. If the welch plug is deformed or dislodged then replace the power steering pump (2).

Assembly Procedure

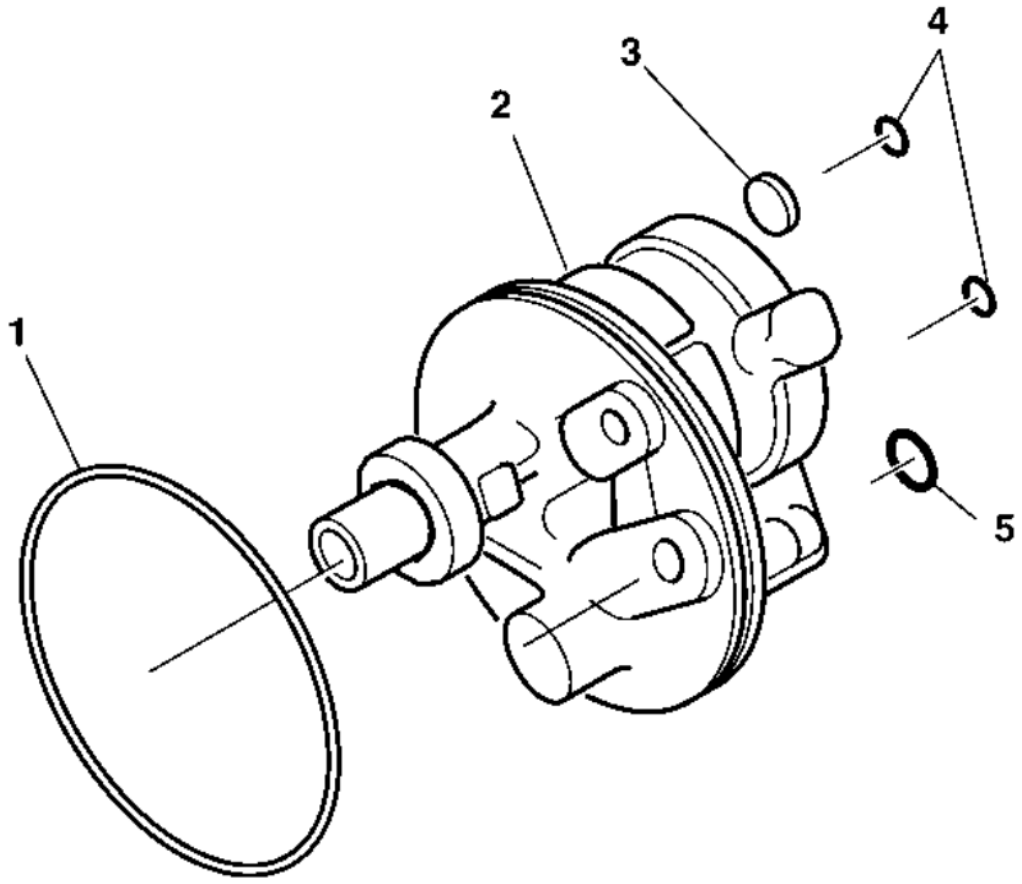


Fig. 46: Reservoir O-ring Seals
Courtesy of GENERAL MOTORS CORP.

1. Clean and install the power steering fluid reservoir magnet (3).
2. Install the power steering pump seals (1, 4, 5) to the power steering pump (2).

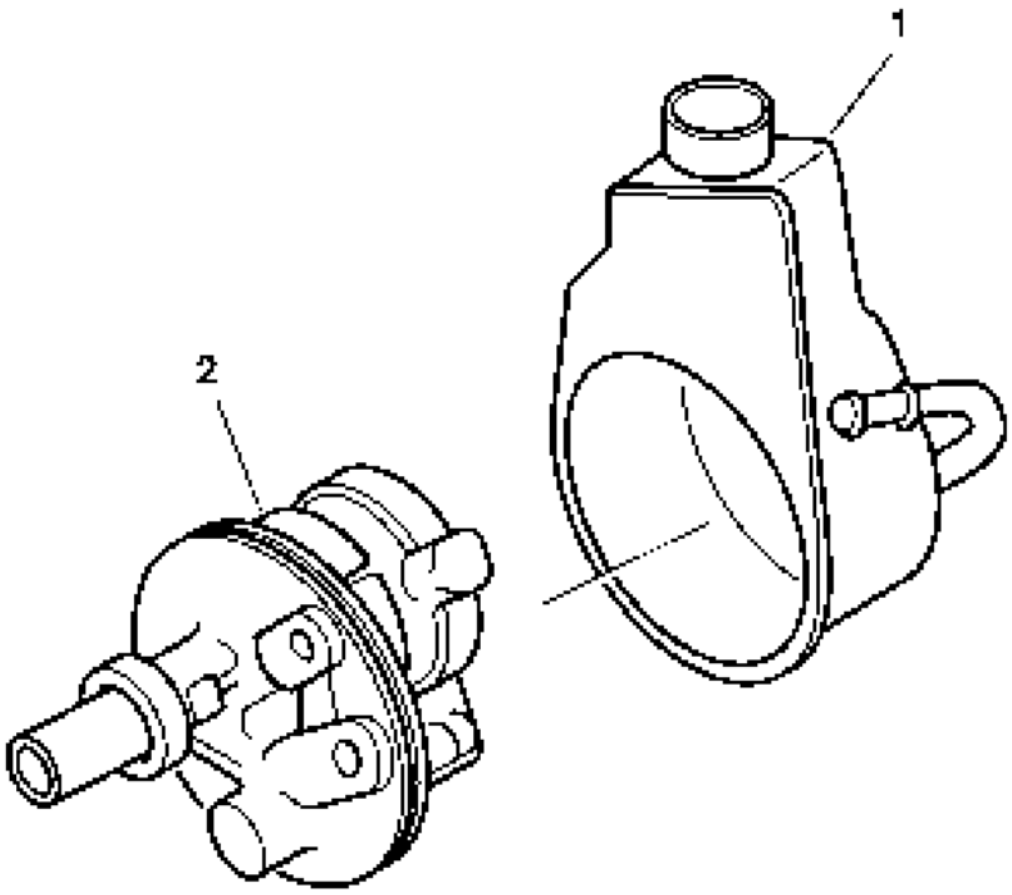


Fig. 47: View Of Reservoir Assembly & Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering fluid reservoir (1) and the power steering pump (2).

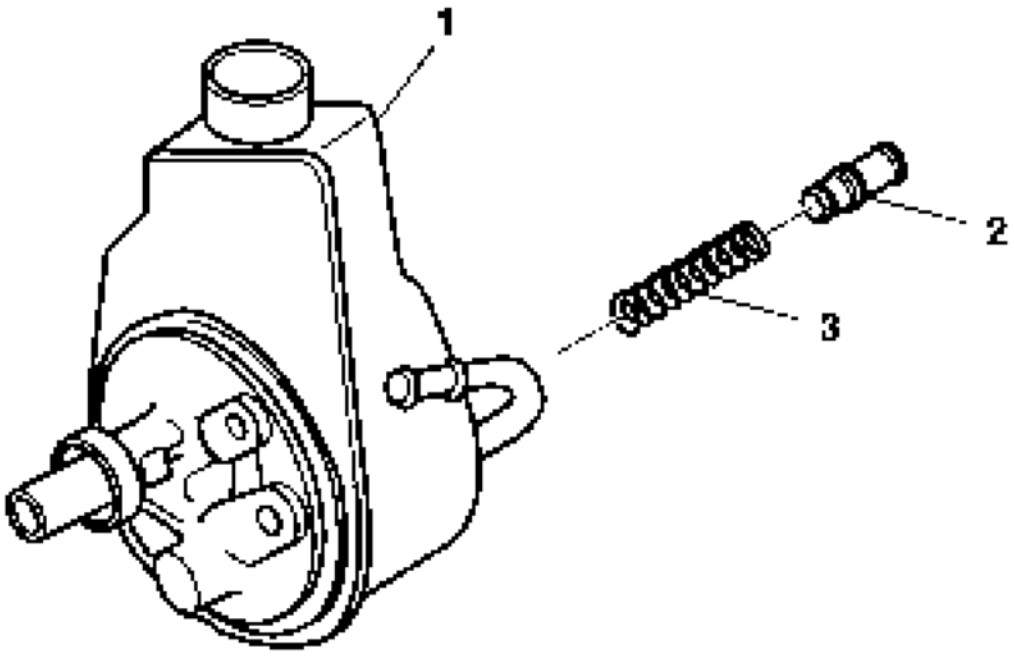


Fig. 48: View Of Pump Housing Assembly, Control Valve Assembly & Flow Control Spring
Courtesy of GENERAL MOTORS CORP.

4. Install the power steering pump flow control valve spring (3) and the power steering pump flow control valve (2) to the power steering pump assembly (1).

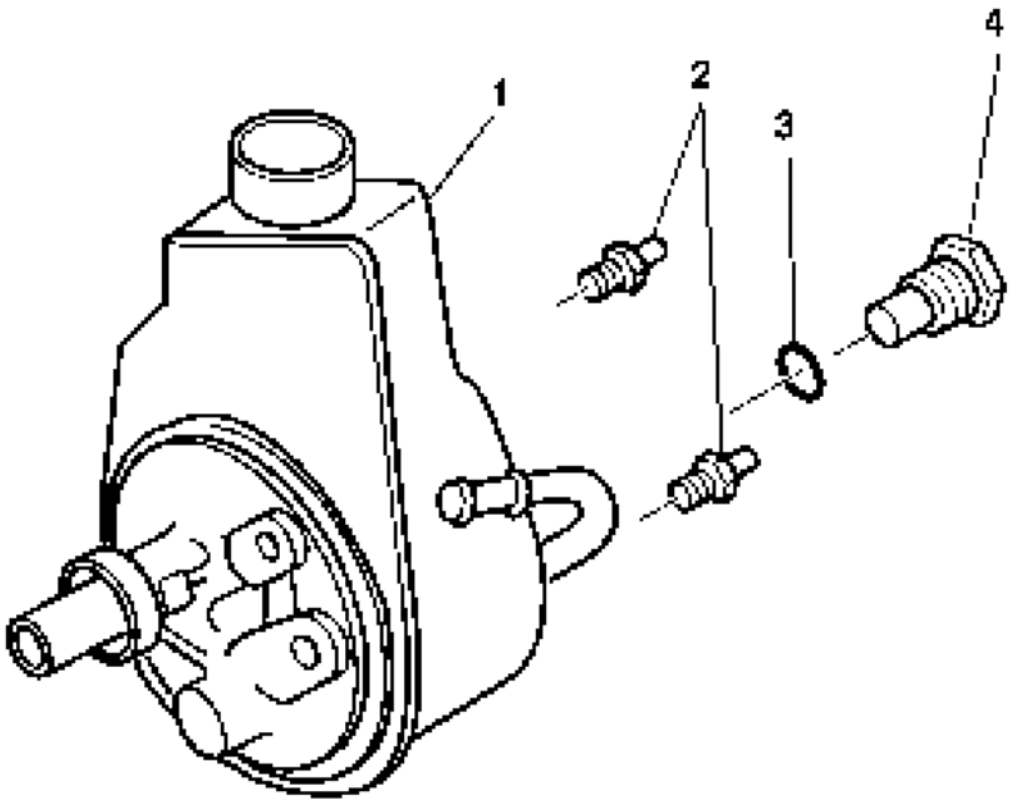


Fig. 49: View Of Pump Housing, Mounting Studs, O-Ring Seal & Connector/Fitting Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the power steering pump fitting seal (3) to the power steering pump assembly (1).

NOTE: **Refer to Fastener Notice .**

IMPORTANT: Start the power steering fluid reservoir studs and the power steering pump flow control valve fitting by hand before finalizing any torques.

6. Install the power steering pump fitting (4) to the power steering pump assembly (1).

Tighten: Tighten the fitting to 75 N.m (55 lb ft).

7. Install the power steering fluid reservoir studs (2) to the power steering pump assembly (1).

   Tighten: Tighten the studs to 58 N.m (44 lb ft).

8. Install the power steering pump assembly to the vehicle. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.

POWER STEERING PUMP FLOW CONTROL VALVE REPLACEMENT - OFF VEHICLE

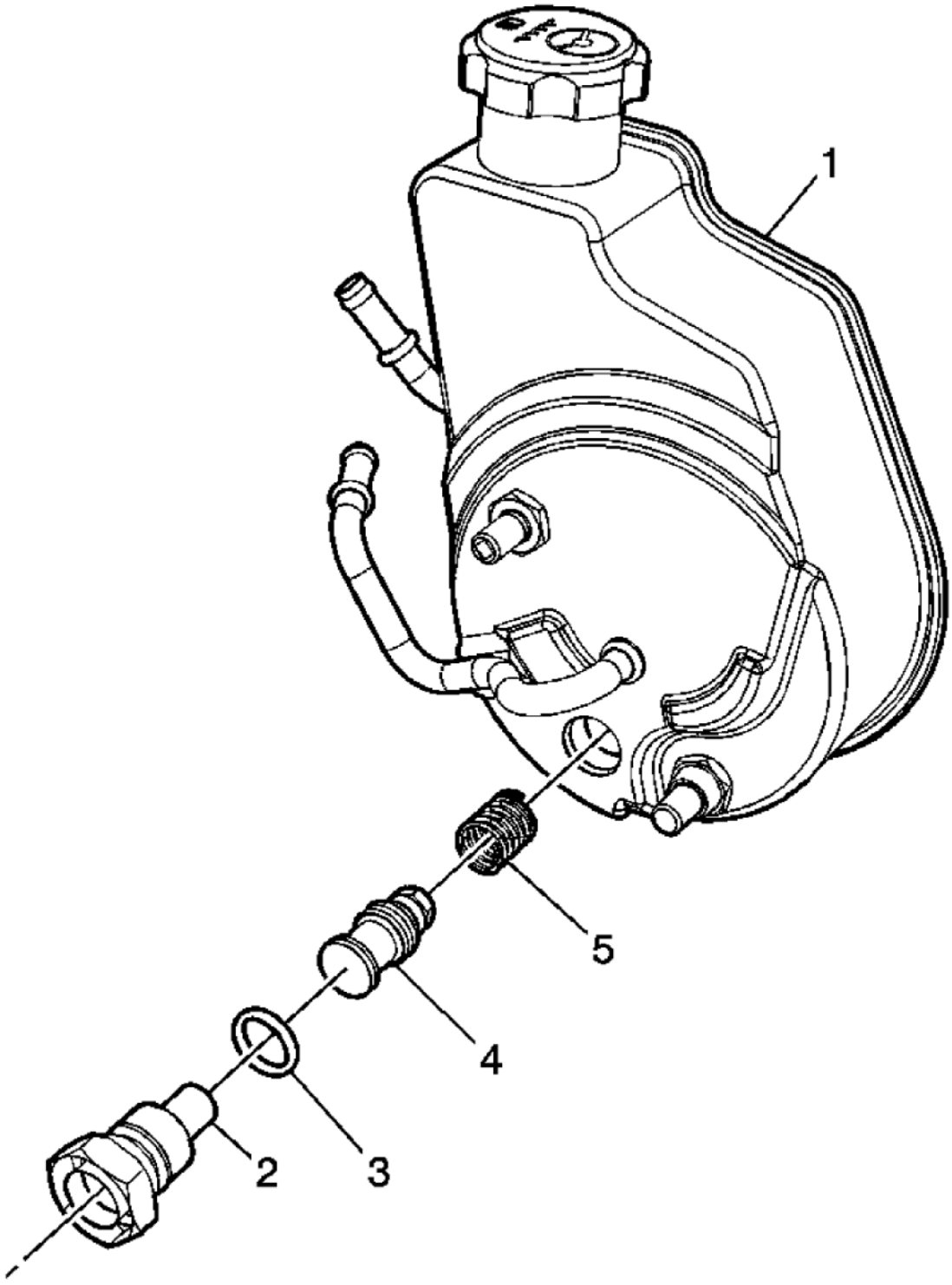


Fig. 50: Power Steering Pump Flow Control Valve Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the power steering pump assembly. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.	
1	Power Steering Fluid Reservoir
2	Power Steering Pump Fitting **NOTE:** **Refer to Fastener Notice .** **Tighten:** 75 N.m (55 lb ft)
3	Power Steering Pump Fitting Seal **Procedure:** Apply power steering fluid to the power steering pump fitting seal before installing.
4	Power Steering Pump Flow Control Valve
5	Power Steering Pump Flow Control Valve Spring

POWER STEERING PUMP SHAFT SEAL REPLACEMENT

Removal Procedure

1. Remove the power steering pump from the vehicle. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.

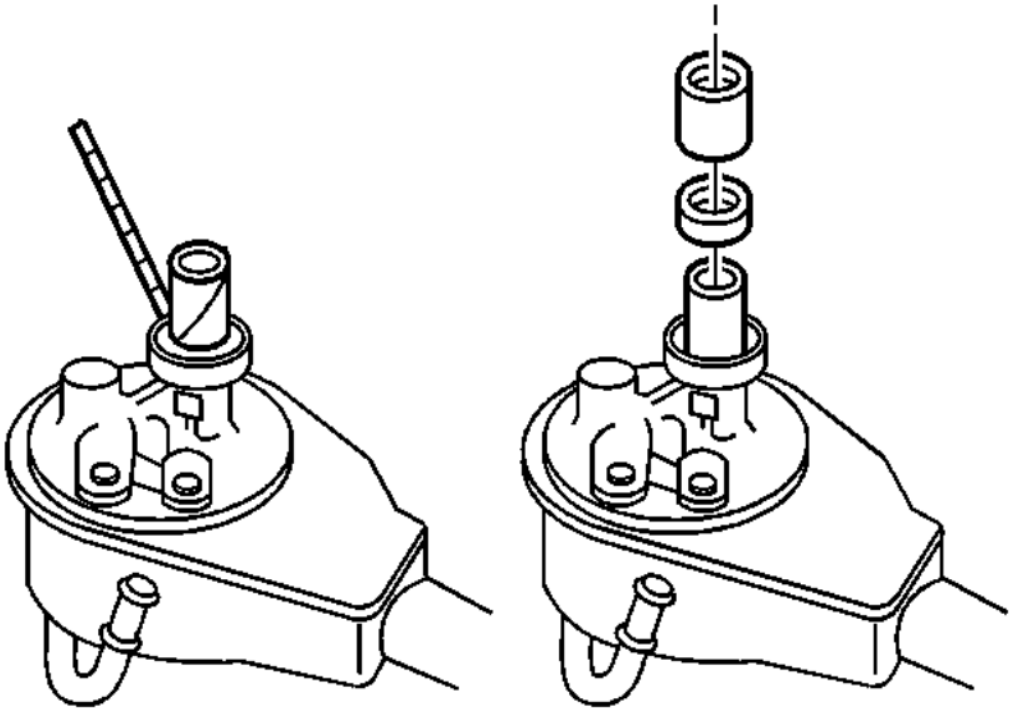


Fig. 51: View Of Power Steering Pump Drive Shaft Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use the shim stock in order to protect the drive shaft.

2. Use a chisel in order to cut and remove the power steering pump shaft seal.

Installation Procedure

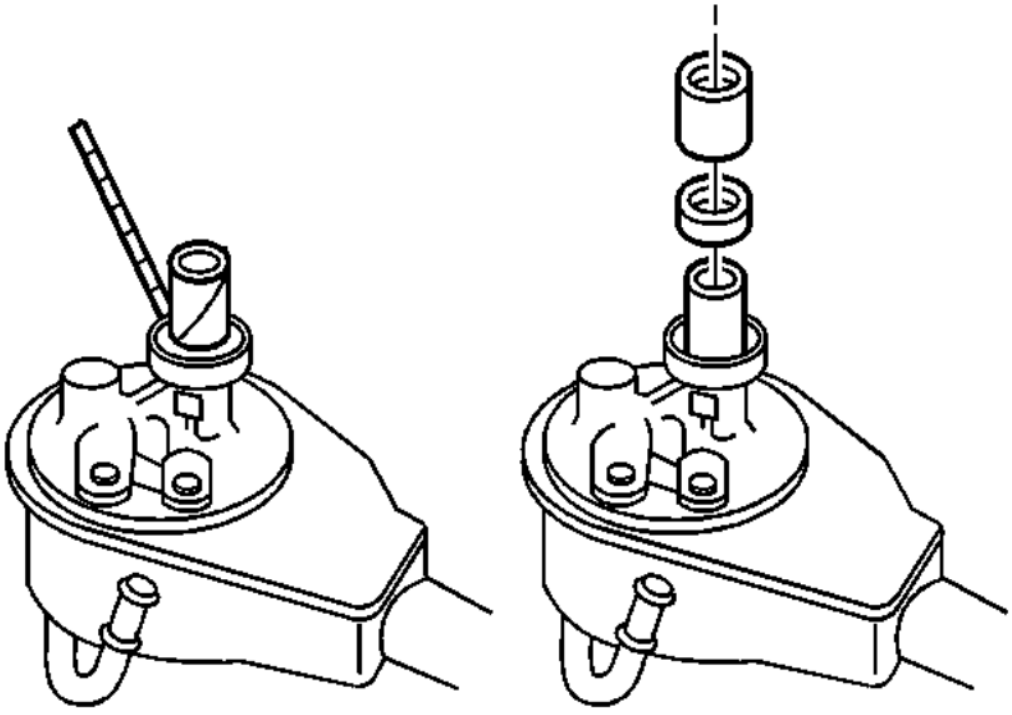


Fig. 52: View Of Power Steering Pump Drive Shaft Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the new power steering pump shaft seal with power steering fluid.
2. Use a deep 1 inch tall socket in order to install the new power steering pump shaft seal.
3. Install the power steering pump. Refer to **Power Steering Pump Replacement (4.3L)** or **Power Steering Pump Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Power Steering Pump Replacement (6.6L)**.

STEERING LINKAGE OUTER TIE ROD REPLACEMENT

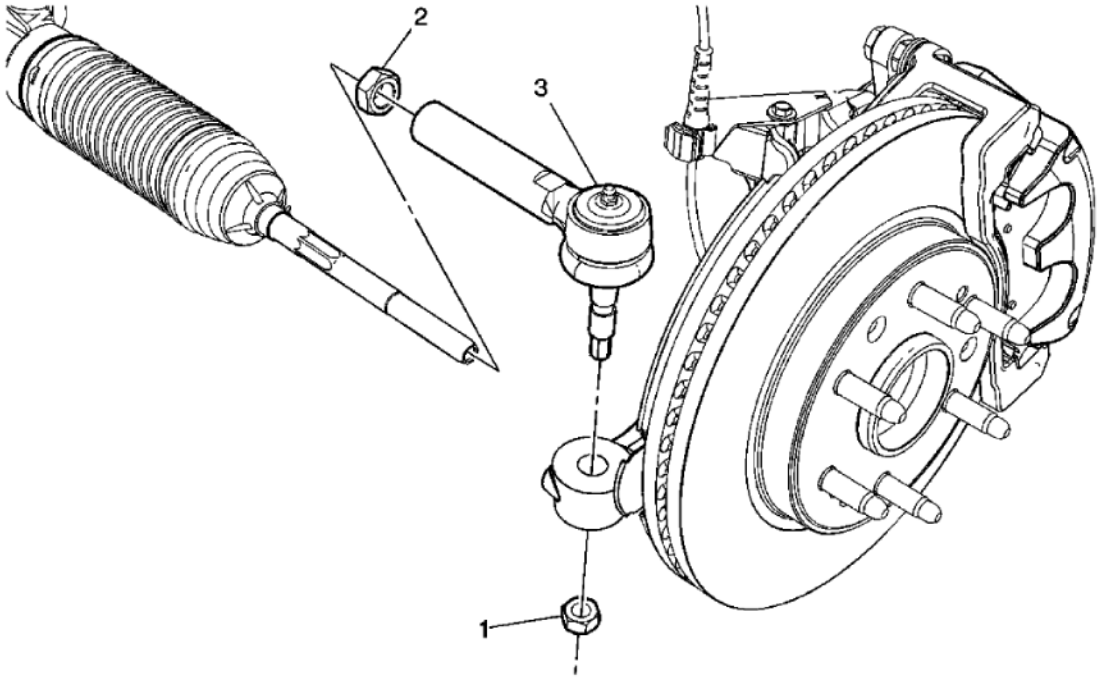


Fig. 53: Rack & Pinion Outer Tie Rod Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front tire/wheel. Refer to **Tire and Wheel Removal and Installation** .	
1	Steering Linkage Outer Tie Rod Nut **NOTE:** **Refer to Fastener Notice .** **Tighten:** 60 N.m (44 lb ft)
2	Steering Linkage Inner Tie Rod Nut **Tighten:** 75 N.m (55 lb ft)
	Steering Linkage Outer Tie Rod **Procedure** 1. Use puller **J 24319-B** to separate the steering linkage outer tie rod from the steering knuckle. See **Special Tools**.

3	2. Inspect the steering linkage inner tie rod for bent or damaged threads. 3. Clean the tapered surface of the steering knuckle. 4. Lubricate the steering linkage inner tie rod threads with chassis lubricant. Refer to **Fluid and Lubricant Recommendations** . 5. Adjust the front toe. Refer to **Front Toe Adjustment** . **Special Tools:** **J 24319-B** Steering Linkage and Tie Rod Puller. See **Special Tools**.

STEERING GEAR BOOT REPLACEMENT - ON VEHICLE

Tools Required

J 22610 Keystone Clamp Pliers. See **Special Tools**.

Removal Procedure

1. Remove the steering linkage outer tie rod. Refer to **Steering Linkage Outer Tie Rod Replacement**.

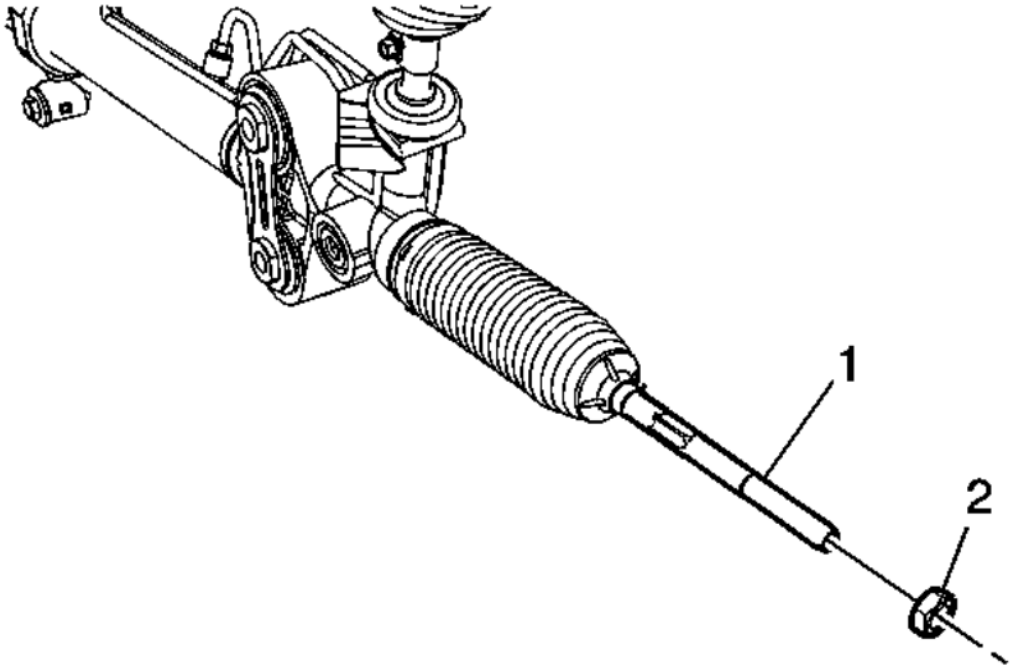


Fig. 54: View Of Inner Tie Rod Assembly & Hex Jam Nut
Courtesy of GENERAL MOTORS CORP.

2. Remove the steering linkage inner tie rod nut (2) from the steering linkage inner tie rod (1).

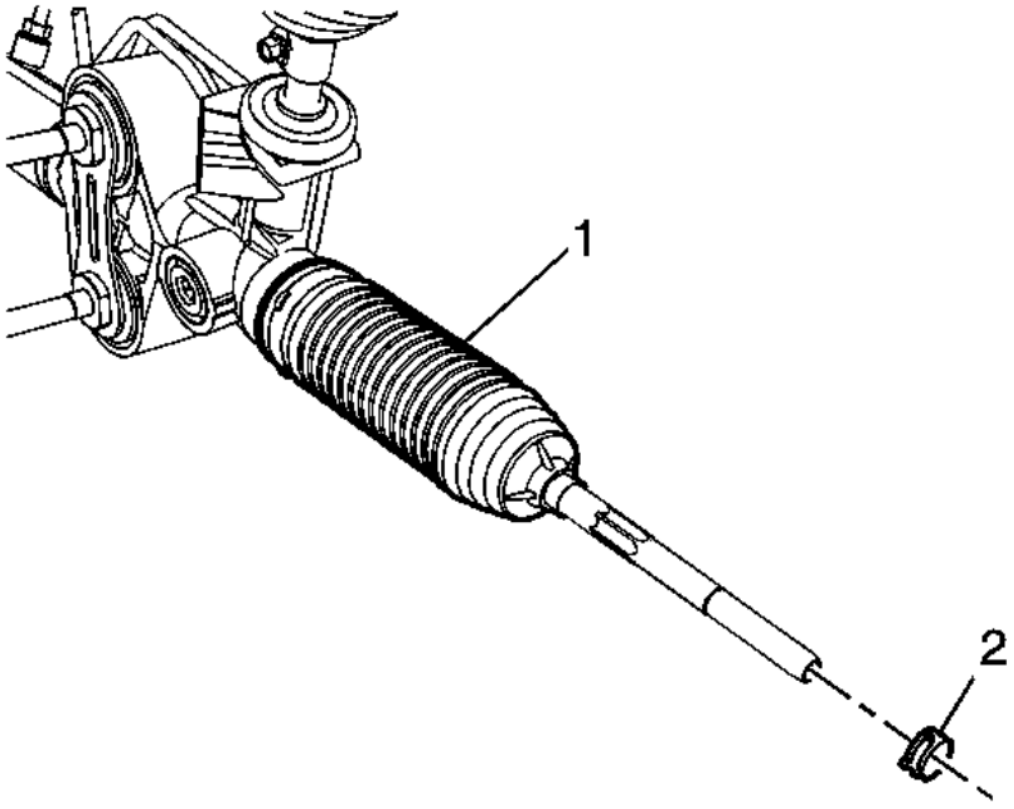


Fig. 55: View Of Rack & Pinion Boot & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Remove the steering gear boot clamp (2) from the steering gear boot (1).

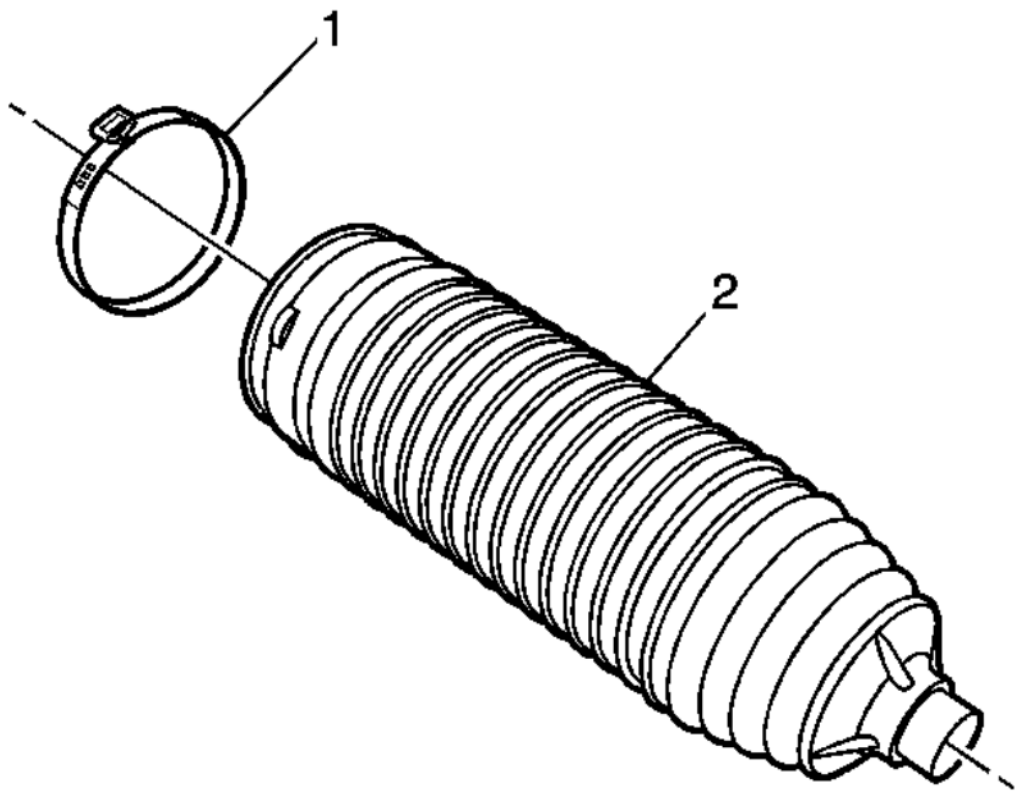


Fig. 56: View Of Rack & Pinion Boot & Boot Clamp
Courtesy of GENERAL MOTORS CORP.

4. Remove the steering gear boot clamp (1) from the steering gear boot (2) with side cutters.
5. Discard the steering gear boot clamp (1).
6. Remove the steering gear boot from the steering gear.

Installation Procedure

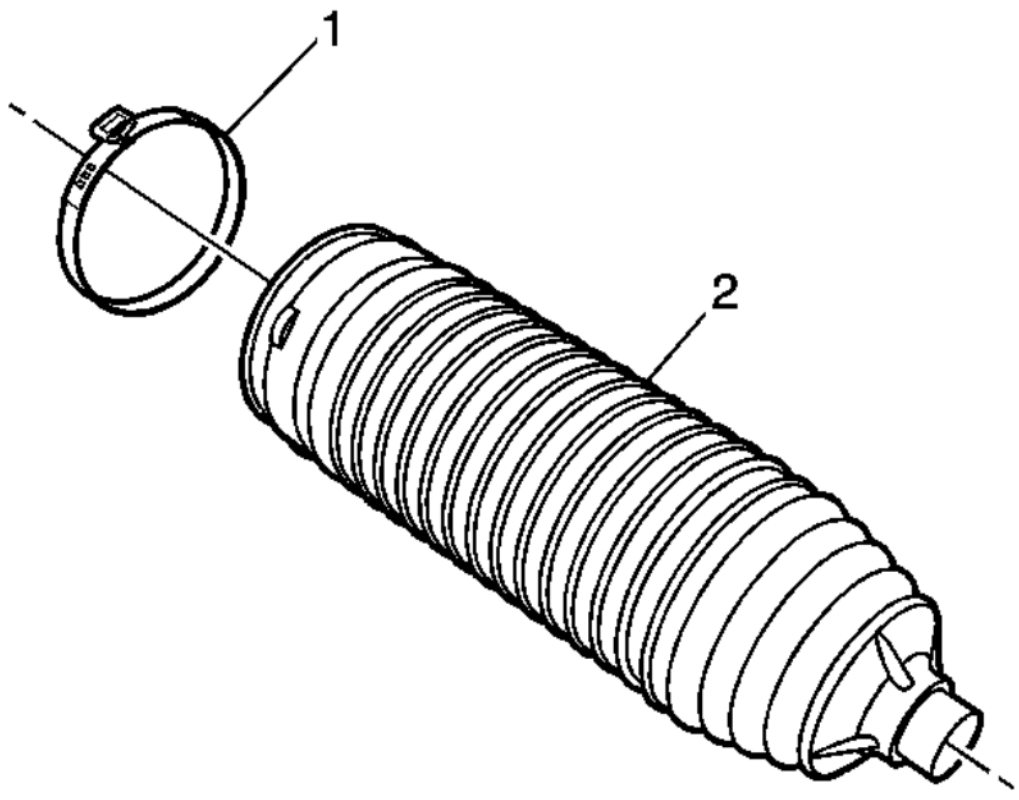


Fig. 57: View Of Rack & Pinion Boot & Boot Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the new steering gear boot clamp (1) onto the steering gear boot (2).

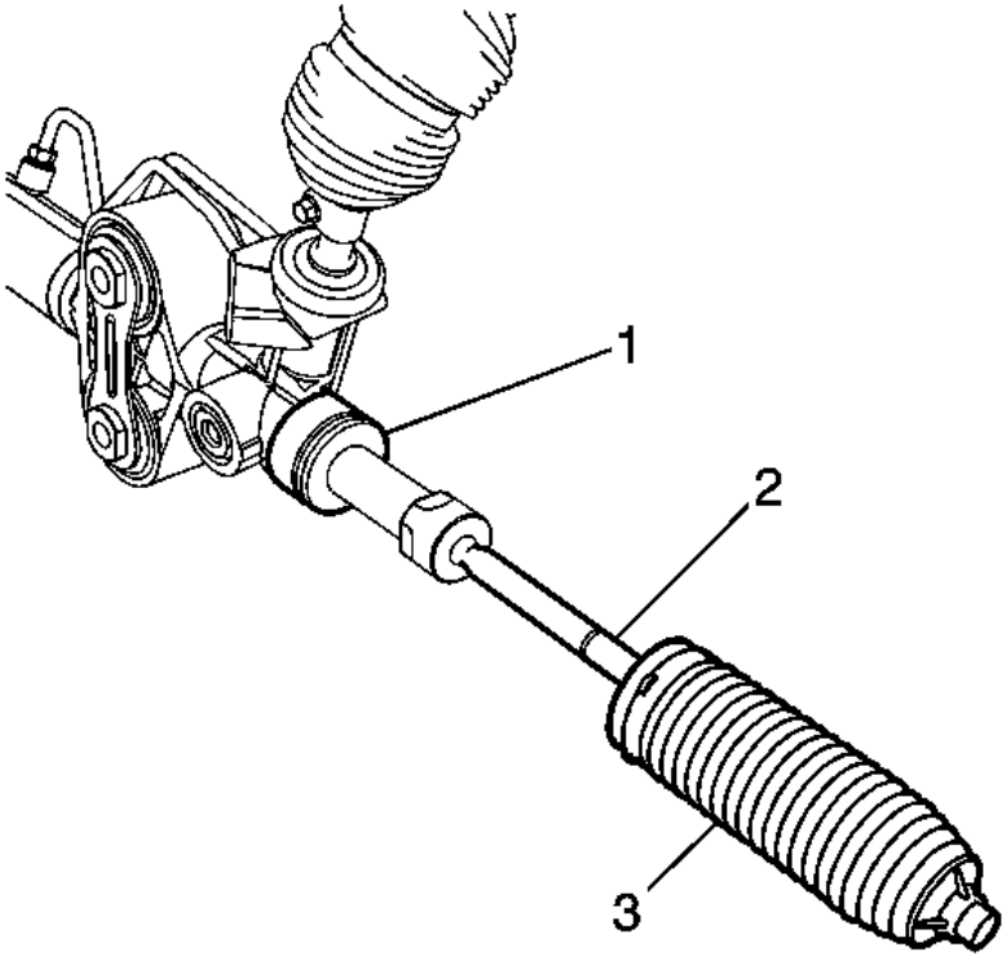


Fig. 58: View Of Rack & Pinion Gear Assembly, Inner Tie Rod Assembly & Rack & Pinion Boot
Courtesy of GENERAL MOTORS CORP.

2. Prior to steering gear boot installation, apply grease to the steering linkage inner tie rod (2) and the steering gear (1).
3. Install the steering gear boot (3) onto the steering linkage inner tie rod (2).

IMPORTANT: The steering gear boot must not be twisted, puckered or out of shape in any way. If the steering gear boot is not shaped properly, adjust it by hand before installing the steering gear

boot clamp.

4. Install the steering gear boot onto the steering gear (1) until the steering gear boot (3) is seated in the groove on the steering gear housing.

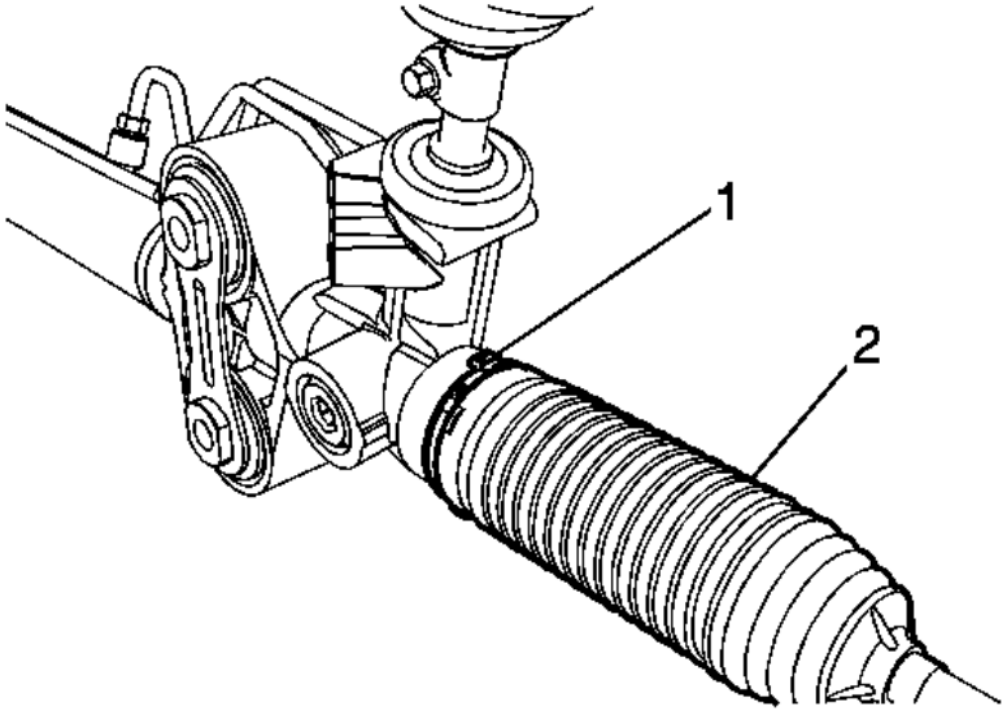


Fig. 59: View Of Rack & Pinion Boot & Boot Clamp
Courtesy of GENERAL MOTORS CORP.

5. Crimp the steering gear boot clamp (1) with pliers **J 22610** or equivalent. See **Special Tools**.
6. Pinch the pliers together on the steering gear boot (2) in order to install the steering gear boot clamp.

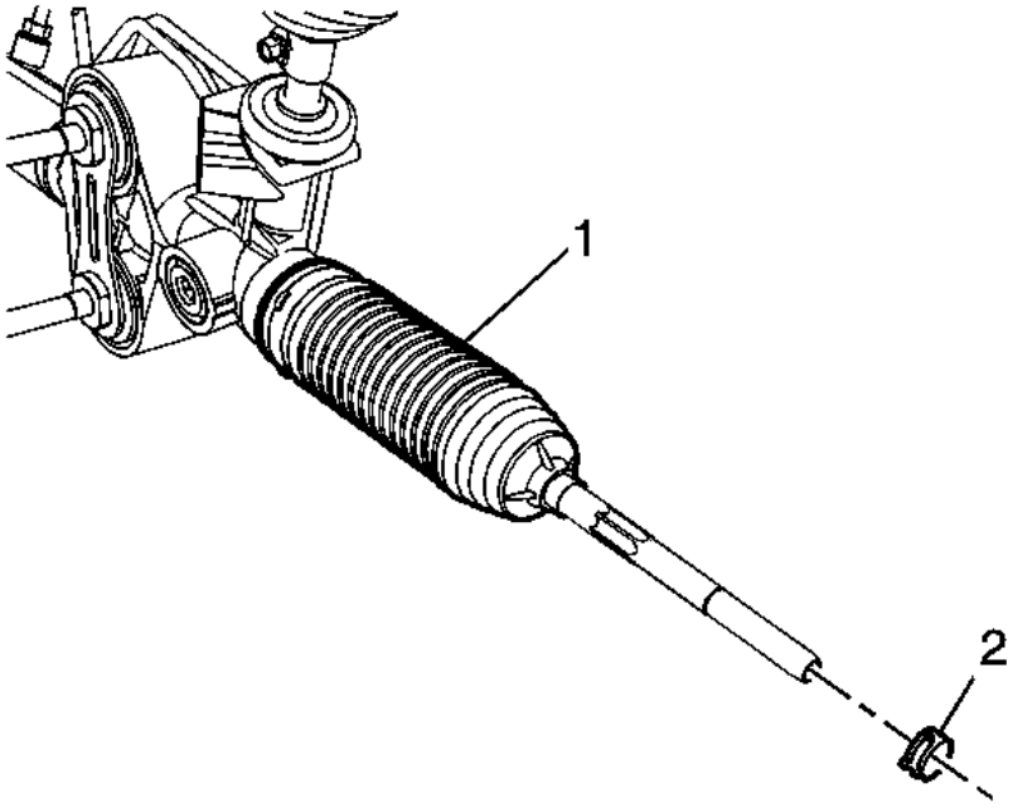


Fig. 60: View Of Rack & Pinion Boot & Clamp
Courtesy of GENERAL MOTORS CORP.

7. Compress the steering gear boot clamp (2) and install it onto the steering gear boot (1).

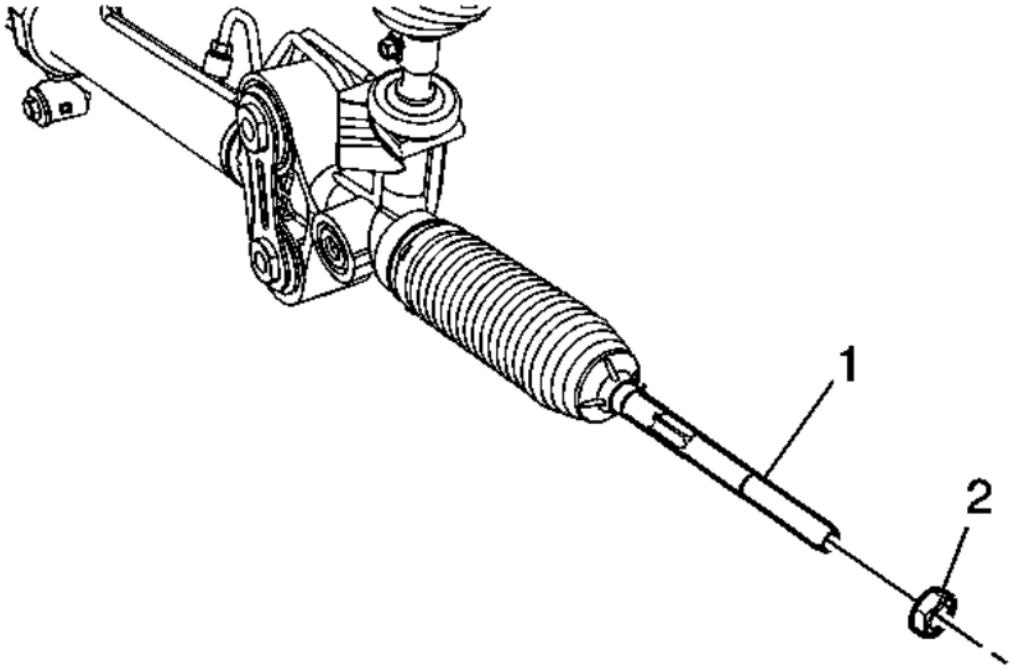


Fig. 61: View Of Inner Tie Rod Assembly & Hex Jam Nut
Courtesy of GENERAL MOTORS CORP.

8. Install the steering linkage inner tie rod nut (2) to the steering linkage inner tie rod (1).
9. Install the steering linkage outer tie rod. Refer to **Steering Linkage Outer Tie Rod Replacement**.

POWER STEERING FLUID COOLER REPLACEMENT (WITHOUT HYDROBOOST)

Removal Procedure

1. Remove the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .
2. Remove as much power steering fluid as possible from the power steering fluid reservoir.
3. Place drain pans under the vehicle as needed.

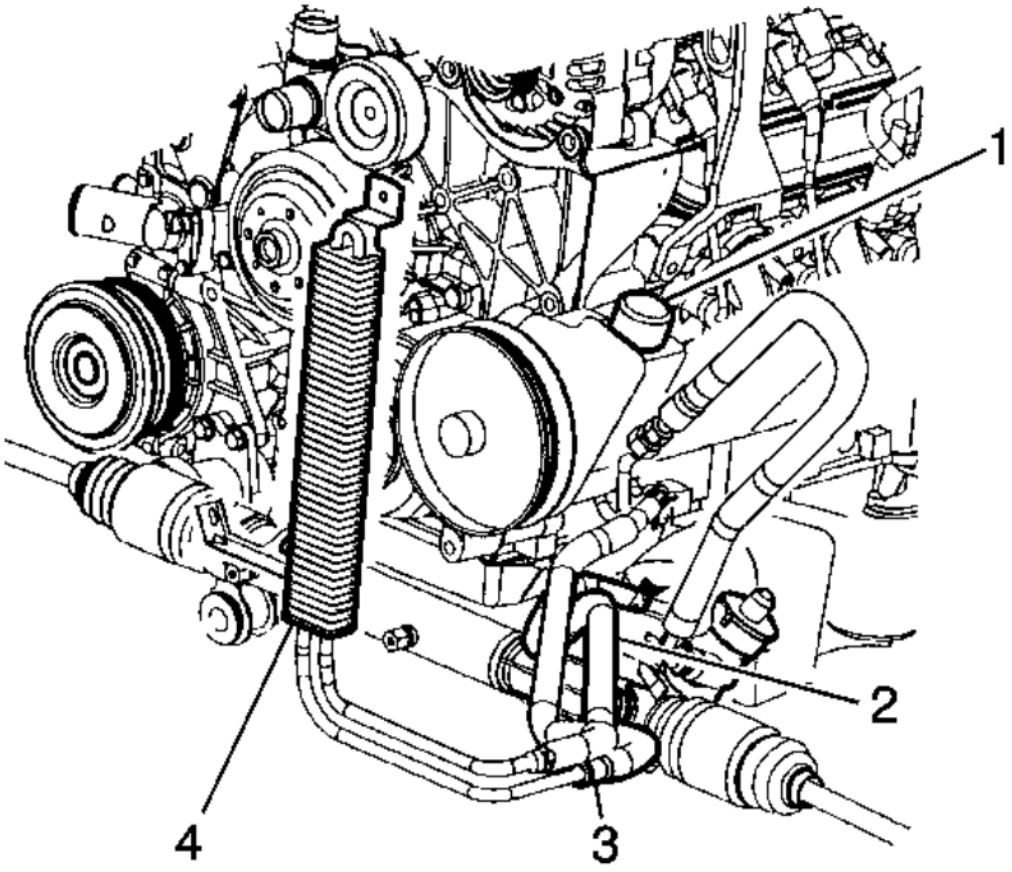


Fig. 62: View Of Power Steering Pump & Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Power Steering Hose Disconnected Notice .

4. Disconnect the power steering gear outlet hose (2) from the power steering fluid cooler (4).
5. Disconnect the power steering fluid cooler hose (3) from the power steering pump (1).

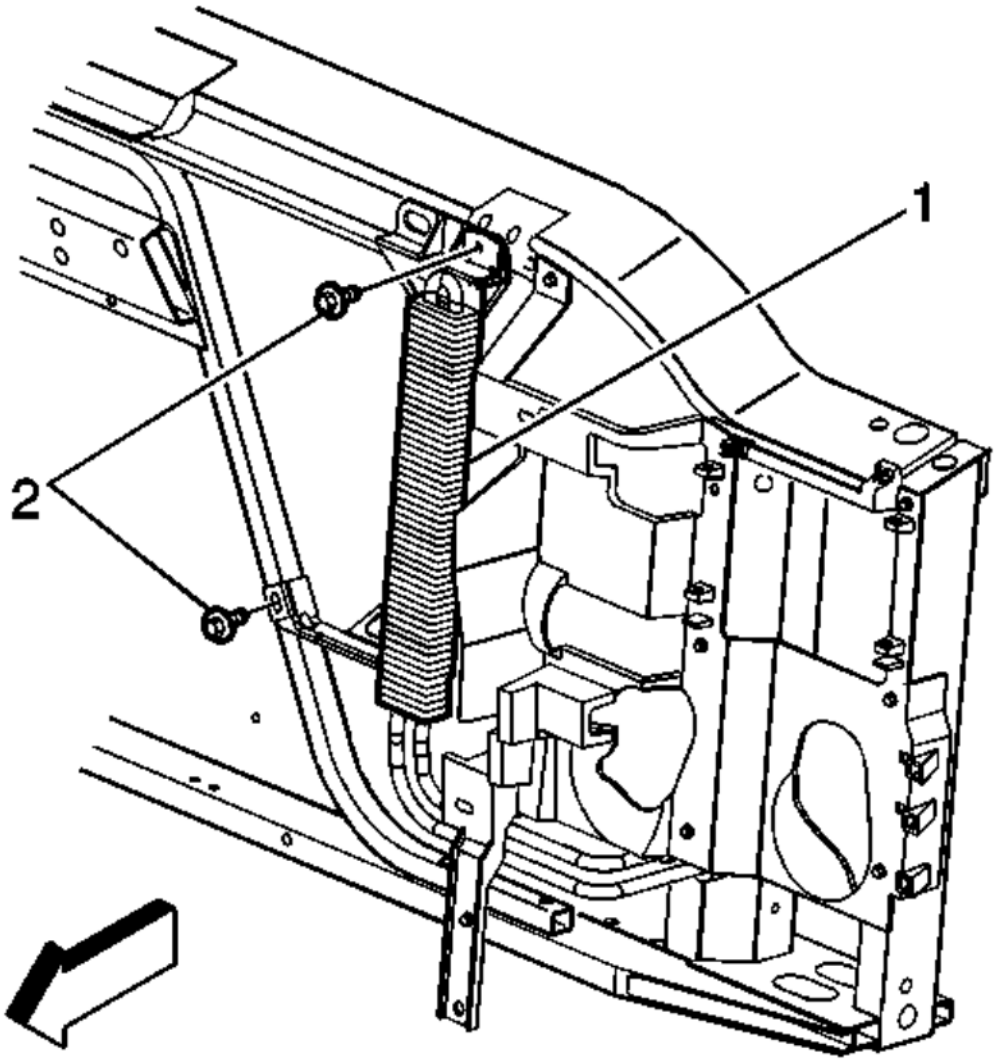


Fig. 63: View Of Power Steering Cooler & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the power steering fluid cooler bolts (2) from the power steering fluid cooler (1).
7. Remove the power steering fluid cooler from the vehicle.

Installation Procedure

1. Install the power steering fluid cooler to the vehicle.

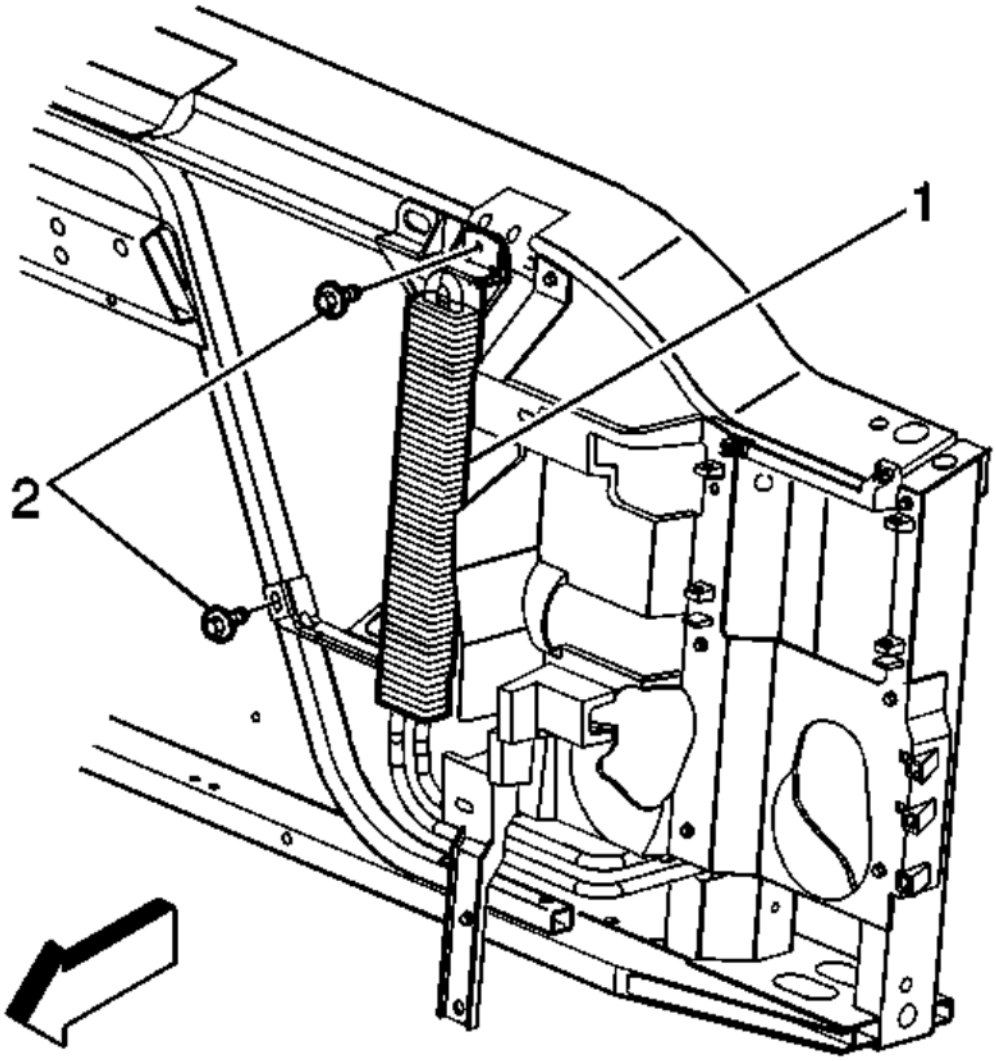


Fig. 64: View Of Power Steering Cooler & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install the power steering fluid cooler bolts (2) to the power steering fluid cooler (1).

Tighten: Tighten the bolts to 9 N.m (80 lb in).

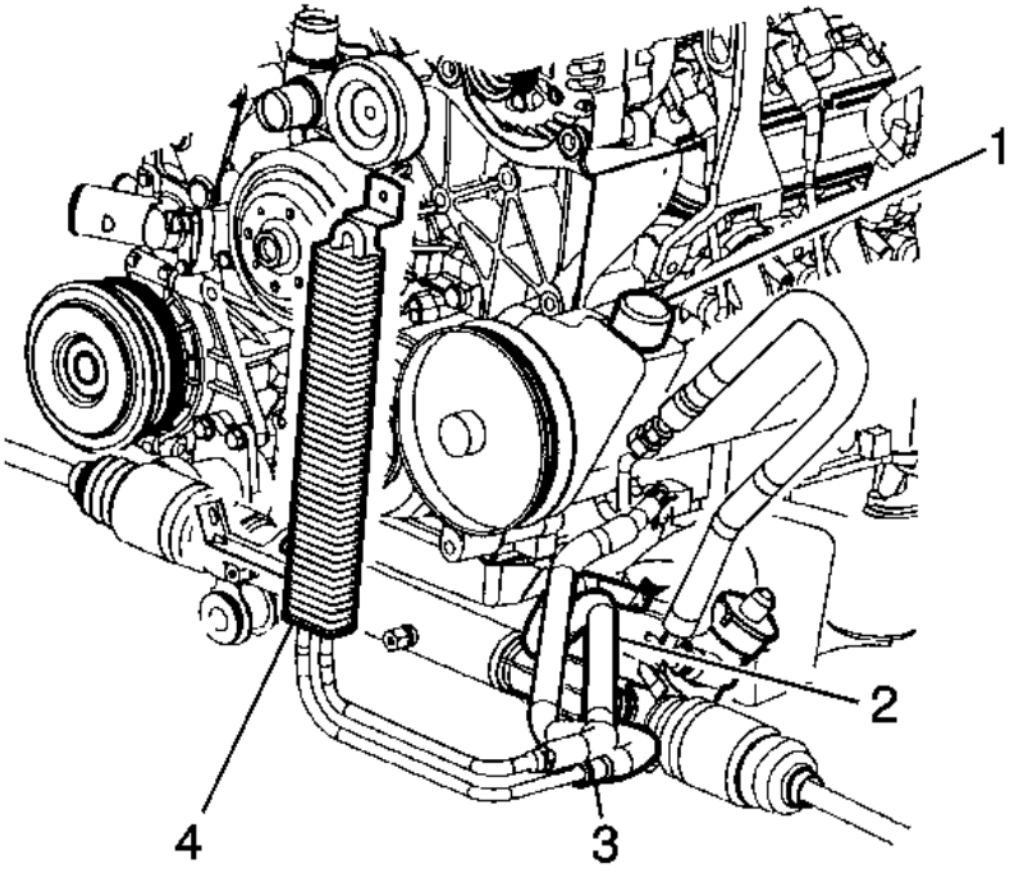


Fig. 65: View Of Power Steering Pump & Components
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering fluid cooler hose (3) to the power steering pump (1).
4. Connect the power steering gear outlet hose (2) to the power steering fluid cooler (4).
5. Clean any excess fluid from the vehicle and remove the drain pans.
6. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.
7. Install the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

POWER STEERING FLUID COOLER REPLACEMENT (WITH HYDROBOOST)

Removal Procedure

1. Remove the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .
2. Remove as much power steering fluid from the power steering fluid reservoir as possible.
3. Place drain pans under the vehicle as needed.

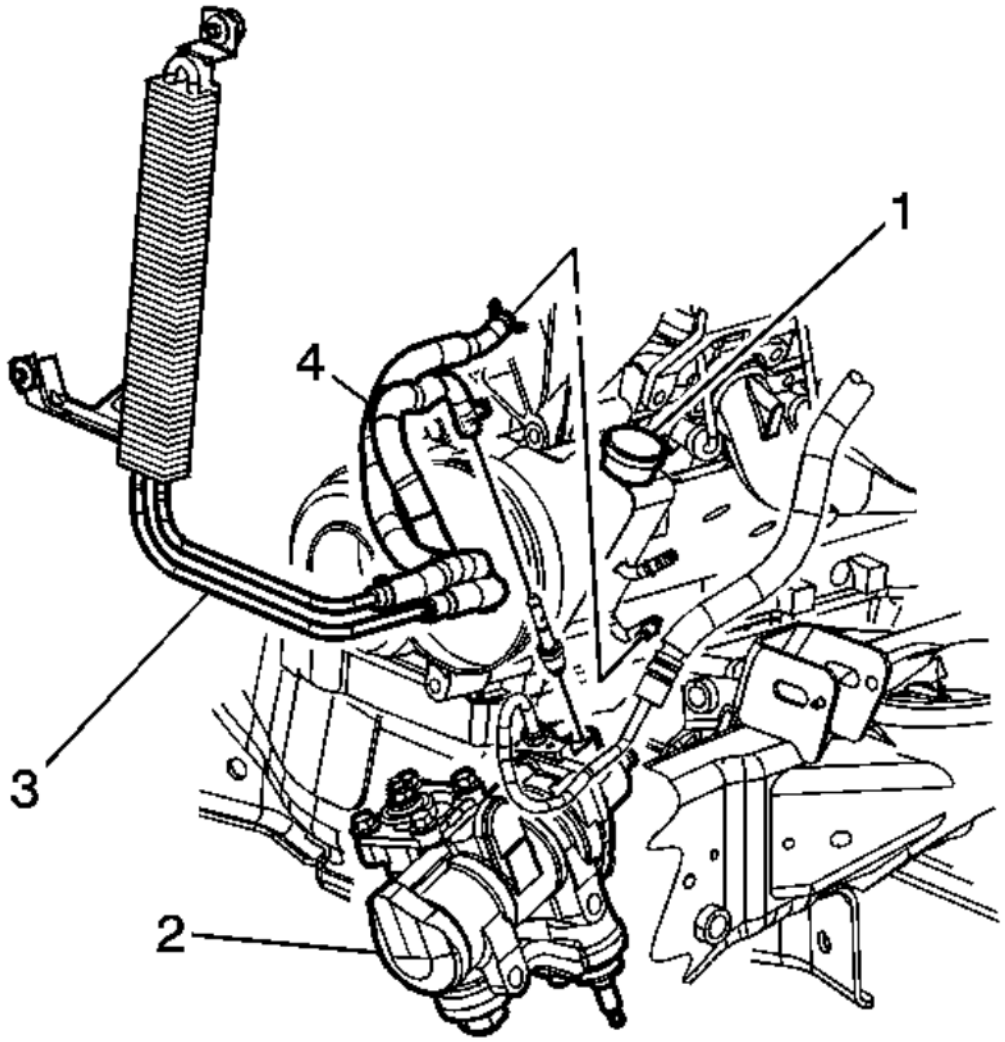


Fig. 66: View Of Power Steering Pump & Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Power Steering Hose Disconnected Notice .

4. Disconnect the power steering fluid cooler hose (3) from the steering gear (2).
5. Disconnect the power steering fluid cooler hose (4) from the power steering pump (1).

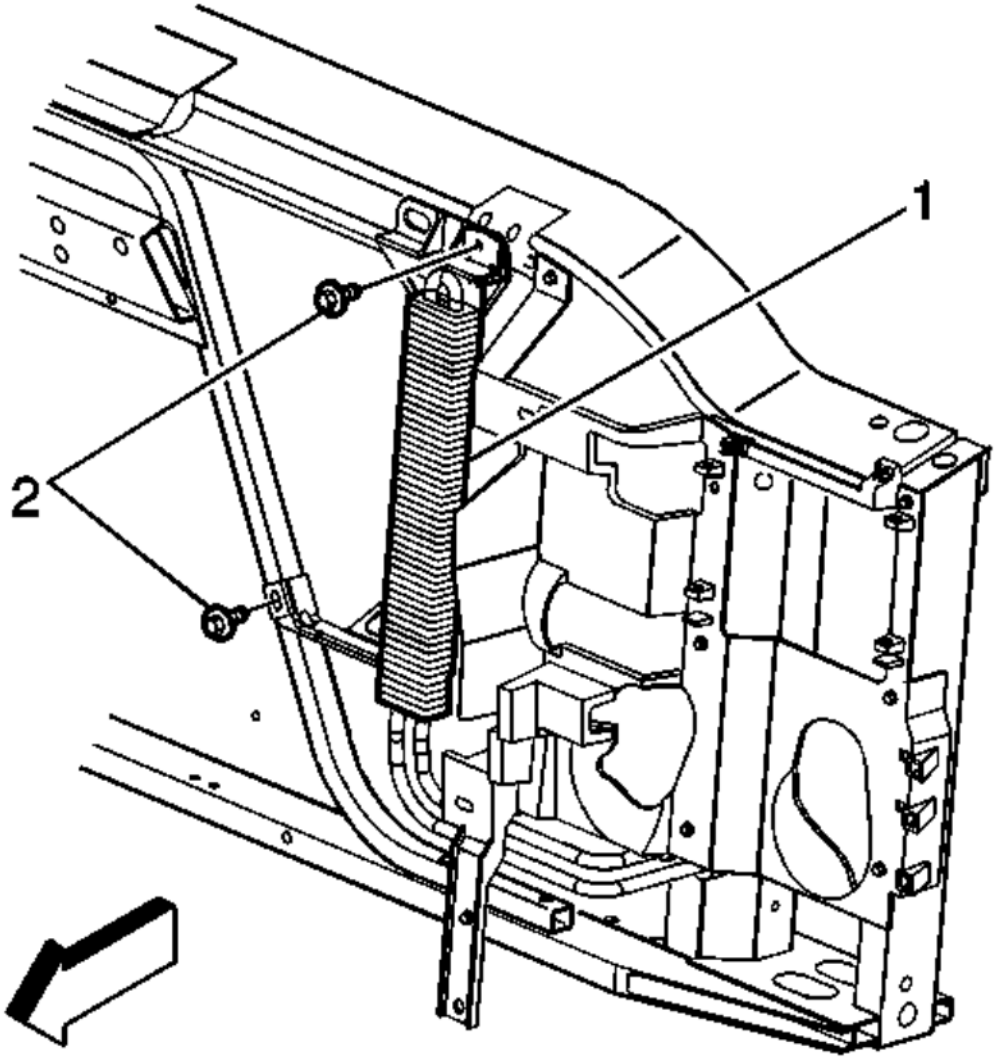


Fig. 67: View Of Power Steering Cooler & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the power steering fluid cooler bolts (2).
7. Remove the power steering fluid cooler (1) from the vehicle.

Installation Procedure

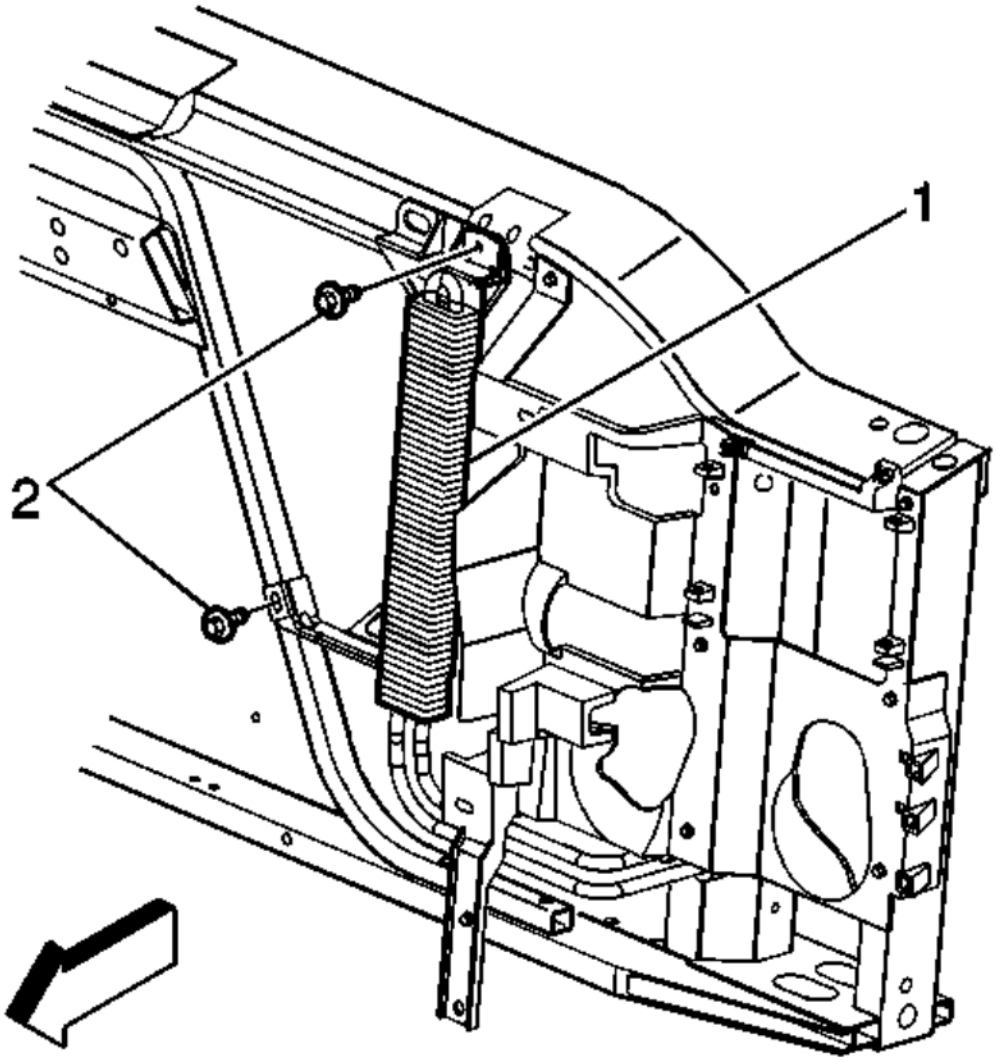


Fig. 68: View Of Power Steering Cooler & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the power steering fluid cooler (1) to the vehicle.

NOTE: Refer to Fastener Notice .

2. Install the power steering fluid cooler bolts (2).

Tighten: Tighten the bolts to 9 N.m (80 lb in)

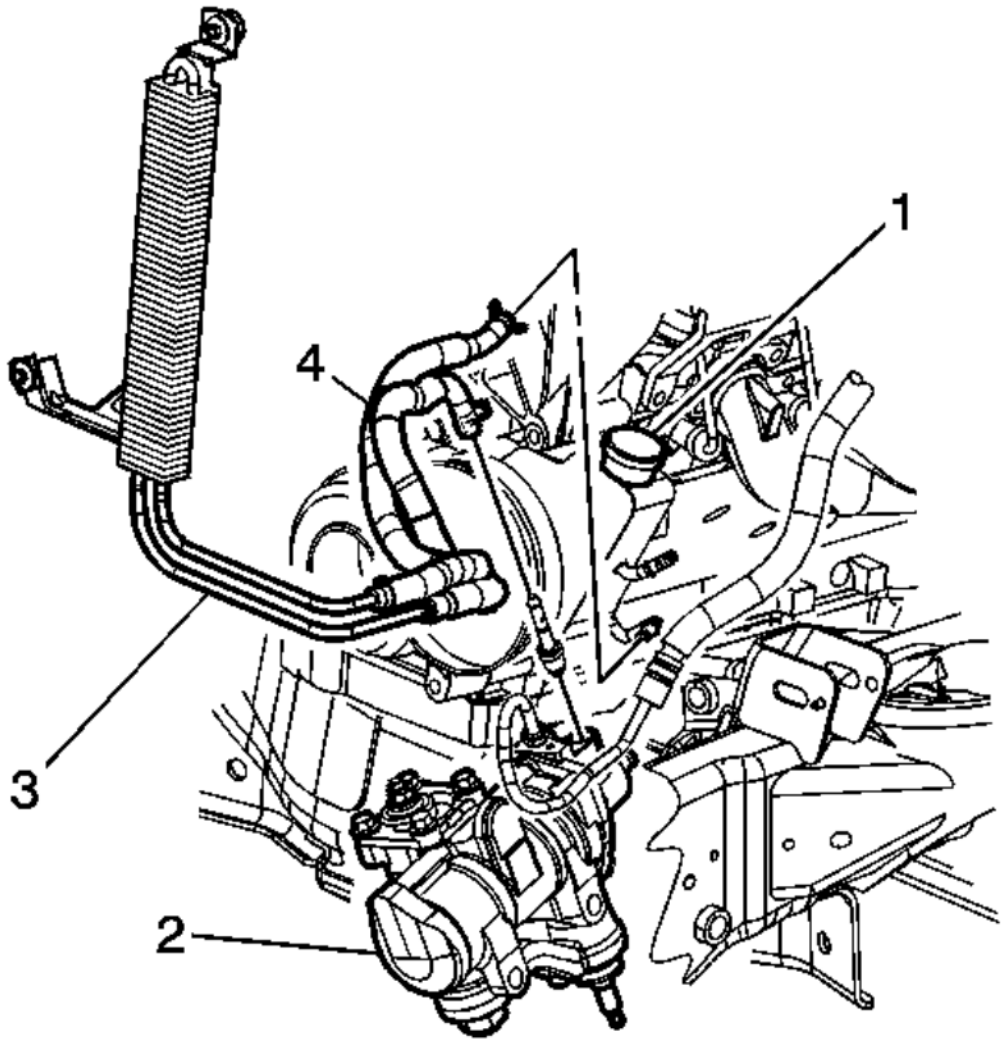


Fig. 69: View Of Power Steering Pump & Components

Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering fluid cooler hose (4) to the power steering pump (1).
4. Connect the power steering fluid cooler hose (3) to the steering gear (2).
5. Clean any excess fluid from the vehicle and remove the drain pans.
6. Install the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .
7. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING GEAR INLET PIPE/HOSE REPLACEMENT (GAS WITH HYDROBOOST)

Removal Procedure

1. Install drain pans under the vehicle as needed.

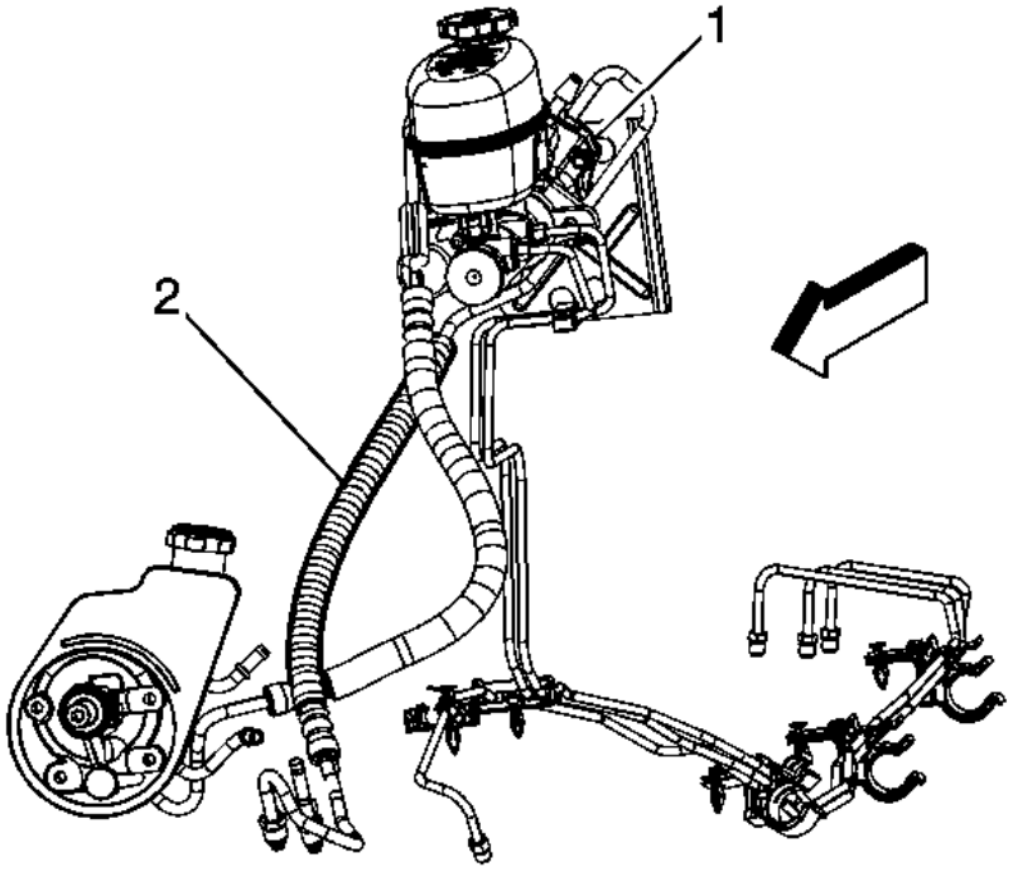


Fig. 70: View Of Power Brake Booster & Power Steering Gear Inlet Hose
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Power Steering Hose Disconnected Notice.

IMPORTANT: Note the routing of the power steering gear inlet hose before removal. It MUST be routed correctly upon installation.

2. Remove the power steering gear inlet hose (2) from the power brake booster (1).
3. Remove the power steering gear inlet hose (2) from the power steering gear.
4. Remove the power steering gear inlet hose (2) from the vehicle.

Installation Procedure

NOTE: **The inlet and outlet hoses must not be twisted during installation. Do not bend or distort the inlet or outlet hoses to make installation easier. Failure to follow these procedures could result in component damage.**

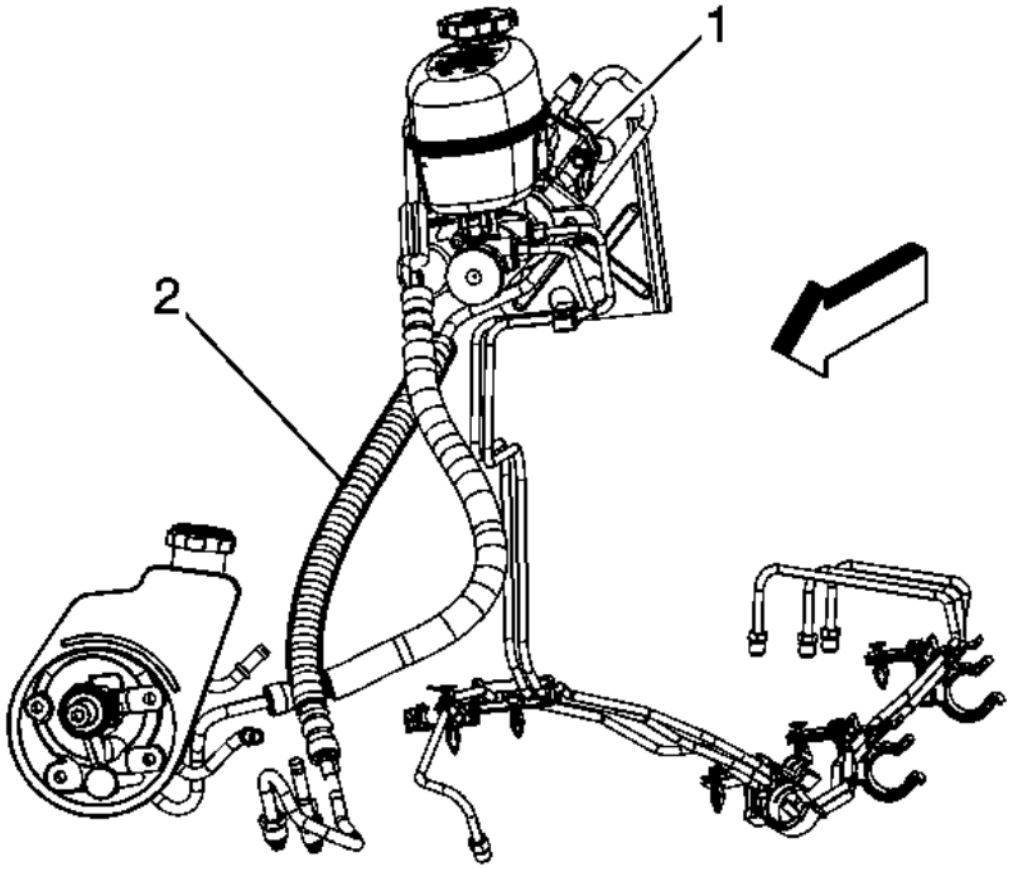


Fig. 71: View Of Power Brake Booster & Power Steering Gear Inlet Hose
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The power steering gear inlet hose cannot be routed between the brake lines and the power brake booster during installation.

1. Route the power steering gear inlet hose in the same position it was in prior to removal.

2. Install the power steering gear inlet hose (2) to the power brake booster (1) and hand tighten only. Rotate the power steering gear inlet hose clockwise until the it contacts the power brake booster housing and then hold it in position while tightening it to the fitting specification.

NOTE: Refer to Fastener Notice .

3. Install the power steering gear inlet hose (2) to the power steering gear.

Tighten: Tighten the fittings to 32 N.m (24 lb ft).

4. Clean any excess fluid from the vehicle and remove the drain pans.
5. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING GEAR INLET PIPE/HOSE REPLACEMENT (GAS WITHOUT HYDRO HYDROBOOST)

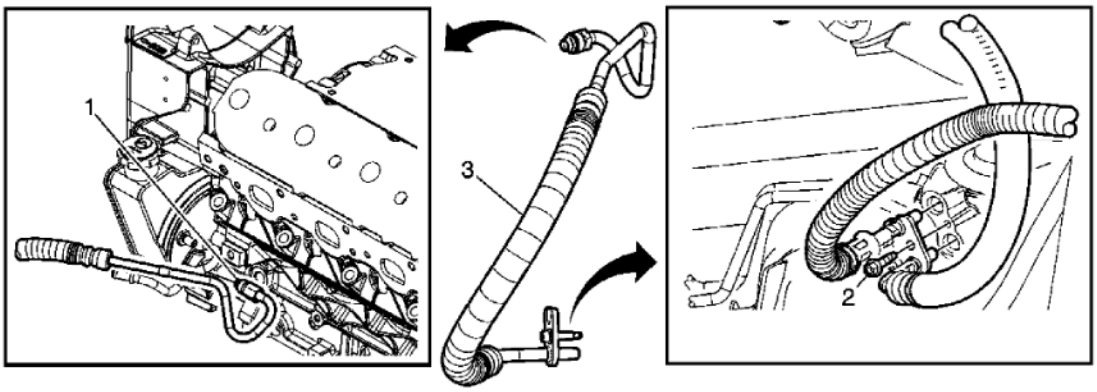


Fig. 72: View Of Power Steering Gear Inlet Pipe/Hose & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine shield. Refer to **Engine Shield Replacement** .	
	Power Steering Gear Inlet Hose Fitting **NOTE:** **Refer to Fastener Notice .** **Procedure**

1	1. Remove as much power steering fluid from the power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed. **Tighten:** 32 N.m (24 lb ft)
2	Power Steering Gear Inlet Hose Retaining Plate Bolt **Tighten:** 12 N.m (106 lb in)
3	Power Steering Gear Inlet Hose **NOTE:** **Refer to Power Steering Hose Disconnected Notice .** **Procedure** 1. Use the remover/installer **J 44586** to replace the steering gear seals if necessary. See **Special Tools**. 2. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**. **Tip:** • Note the routing of the power steering gear inlet hose to ensure proper installation. • Keep all open connections in the power steering system clean and free of debris.

Special Tools:

J 44586 Power Steering Gear Oil Seal Remover/Installer. See **Special Tools**.

POWER STEERING GEAR INLET PIPE/HOSE REPLACEMENT (DIESEL)

Removal Procedure

1. Place drain pans under the vehicle as needed.

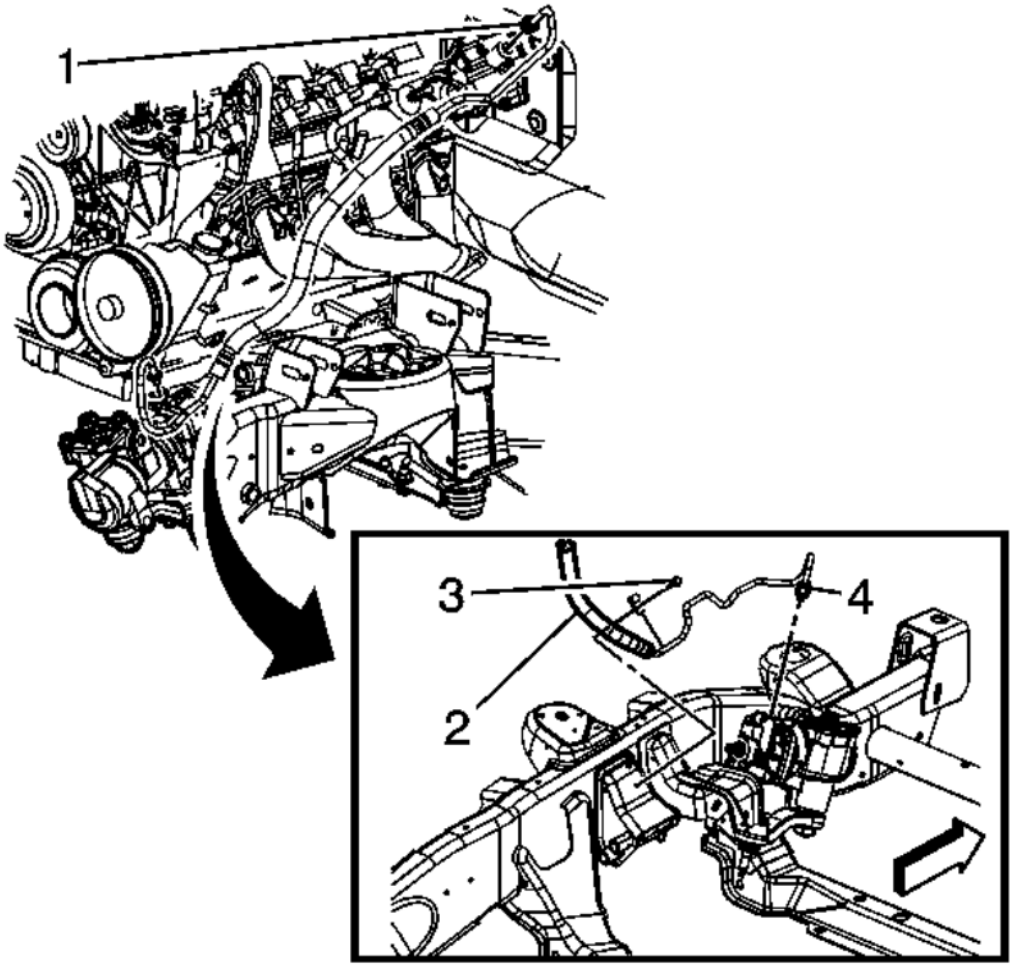


Fig. 73: View Of Power Steering Gear Inlet Hose & Clip Bolt
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the power steering gear inlet hose (1) from the power brake booster.
3. Remove the power steering gear inlet hose clip bolt (3).
4. Disconnect the power steering gear inlet hose (4) from the steering gear.
5. Remove the power steering gear inlet hose (2) from the vehicle.

Installation Procedure

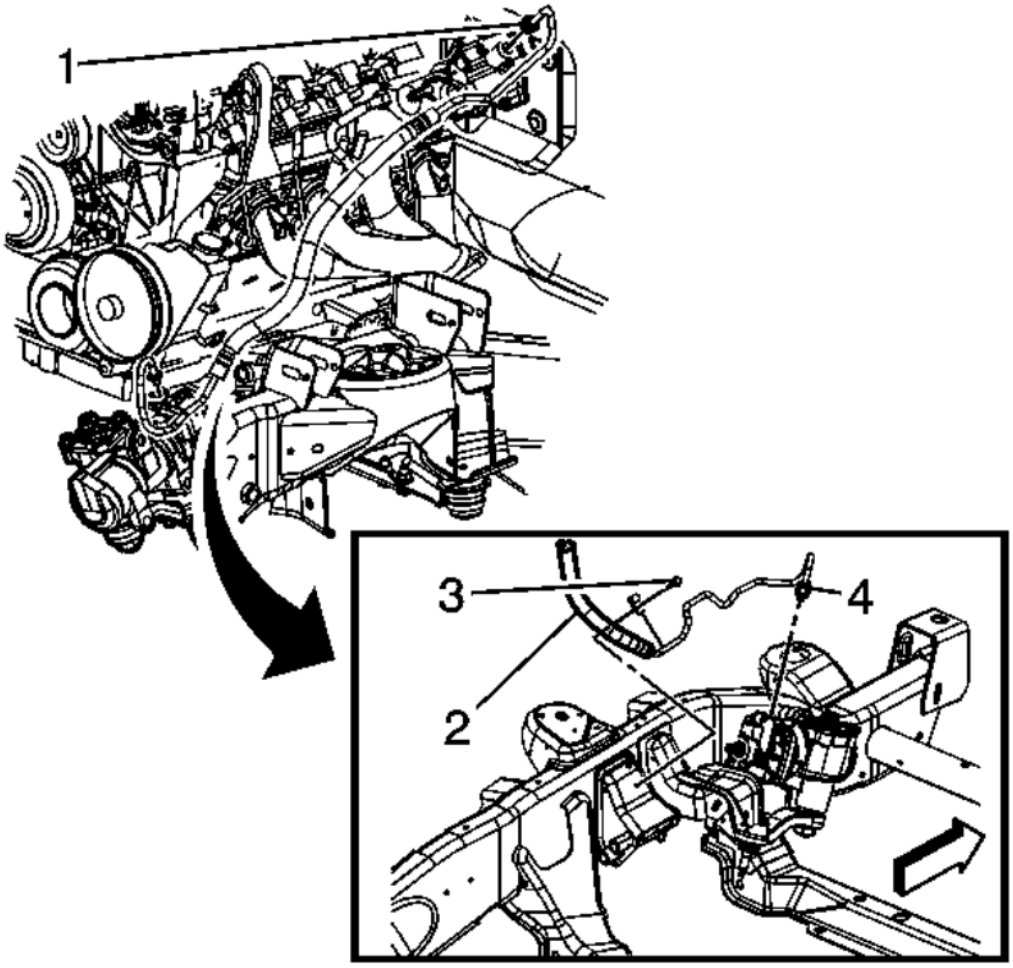


Fig. 74: View Of Power Steering Gear Inlet Hose & Clip Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the power steering gear inlet hose (2) to the vehicle.
2. Connect the power steering gear inlet hose (4) to the steering gear.

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

3. Install the power steering gear inlet hose clip bolt (3).

Tighten: Tighten the bolt to 12 N.m (106 lb in).

4. Connect the power steering gear inlet hose (1) to the power brake booster.

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

5. Clean any excess power steering fluid from the vehicle and remove the drain pans.
6. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING GEAR OUTLET PIPE/HOSE REPLACEMENT (GAS WITH HYDRO HYDROBOOST)

Removal Procedure

1. Place drain pans under the vehicle as needed.

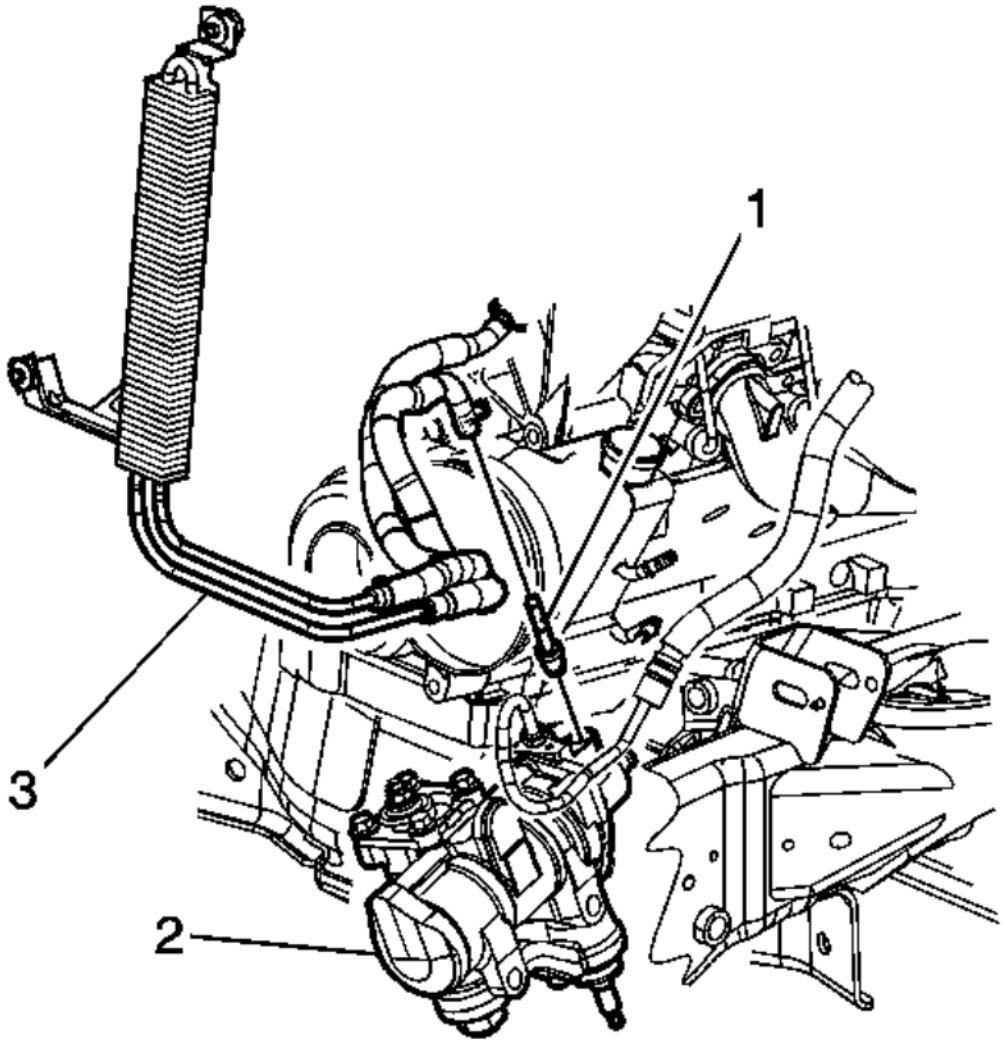


Fig. 75: View Of Power Steering Gear Outlet Pipe/Hose & Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Power Steering Hose Disconnected Notice .

2. Disconnect the power steering fluid cooler hose clamp and hose (3) from the steering gear (2).
3. Remove the power steering gear outlet pipe (1) from the steering gear (2).

Installation Procedure

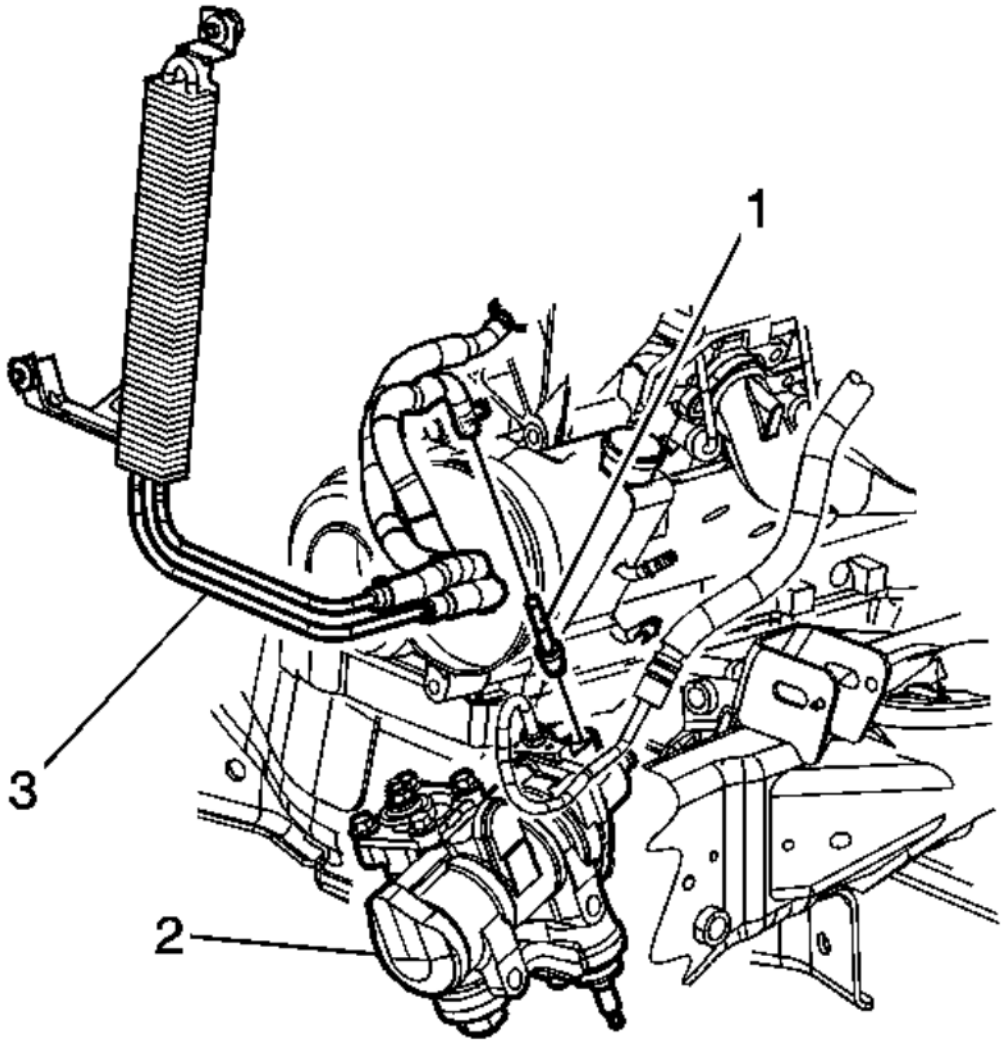


Fig. 76: View Of Power Steering Gear Outlet Pipe/Hose & Components
Courtesy of GENERAL MOTORS CORP.

1. Install the power steering gear outlet pipe (1) to the steering gear (2).
2. Connect the power steering fluid cooler hose (3) and hose clamp to the steering gear (2).
3. Clean any excess fluid from the vehicle and remove the drain pans.
4. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**

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POWER STEERING GEAR OUTLET PIPE/HOSE REPLACEMENT (GAS WITHOUT HYDROBOOST)

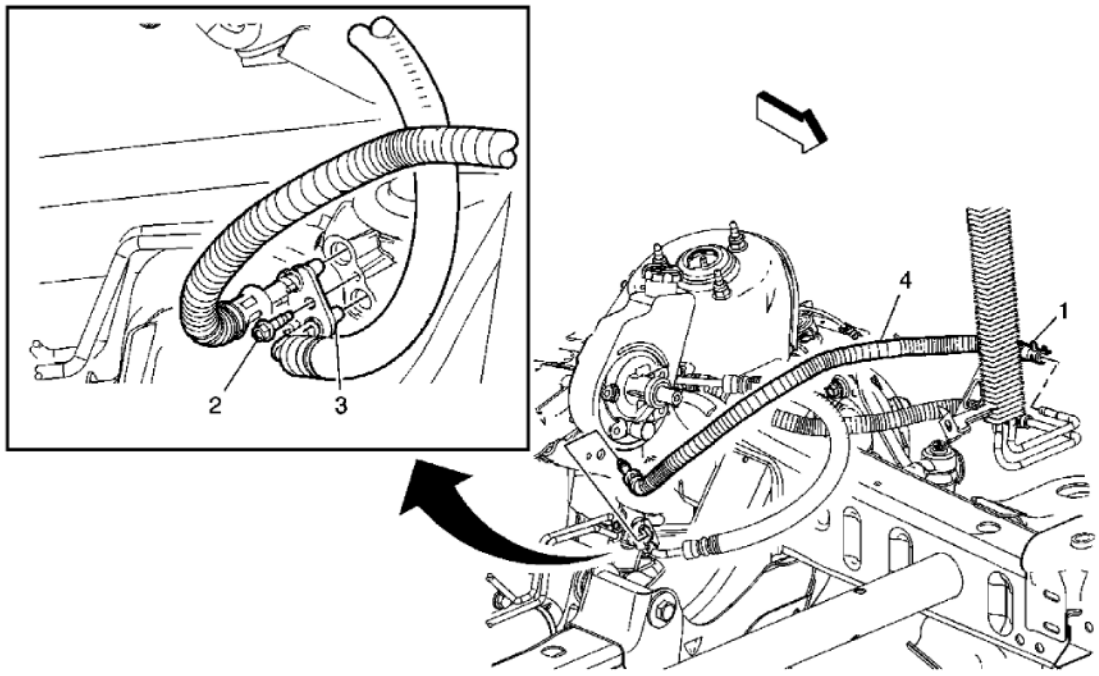


Fig. 77: View Of Power Steering Gear Outlet Pipe/Hose & Components (Without Hydroboost)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine shield. Refer to **Engine Shield Replacement** .	
1	Power Steering Gear Outlet Hose Clamp **Procedure:** Place drain pans under the vehicle as needed.
2	Power Steering Gear Inlet Hose Retaining Plate Bolt **NOTE:** **Refer to Fastener Notice .** **Tighten:** 12 N.m (106 lb in)
3	Power Steering Gear Inlet Hose Retaining Plate

4	Power Steering Gear Outlet Hose **NOTE:** **Refer to Power Steering Hose Disconnected Notice .** **Procedure** 1. Disconnect the power steering gear outlet hose from the power steering fluid cooler. 2. Pull the power steering gear outlet hose out of the steering gear. 3. Keep all open connections in the power steering system clean and free of debris. 4. Use the remover/installer **J 44586** to replace the steering gear seals if necessary. See **Special Tools**. 5. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**. **Special Tools:** **J 44586** Power Steering Gear Oil Seal Remover/Installer. See **Special Tools**.

POWER STEERING GEAR OUTLET PIPE/HOSE REPLACEMENT (DIESEL)

Removal Procedure

1. Remove as much power steering fluid from the power steering fluid reservoir as possible.
2. Place drain pans under the vehicle as needed.

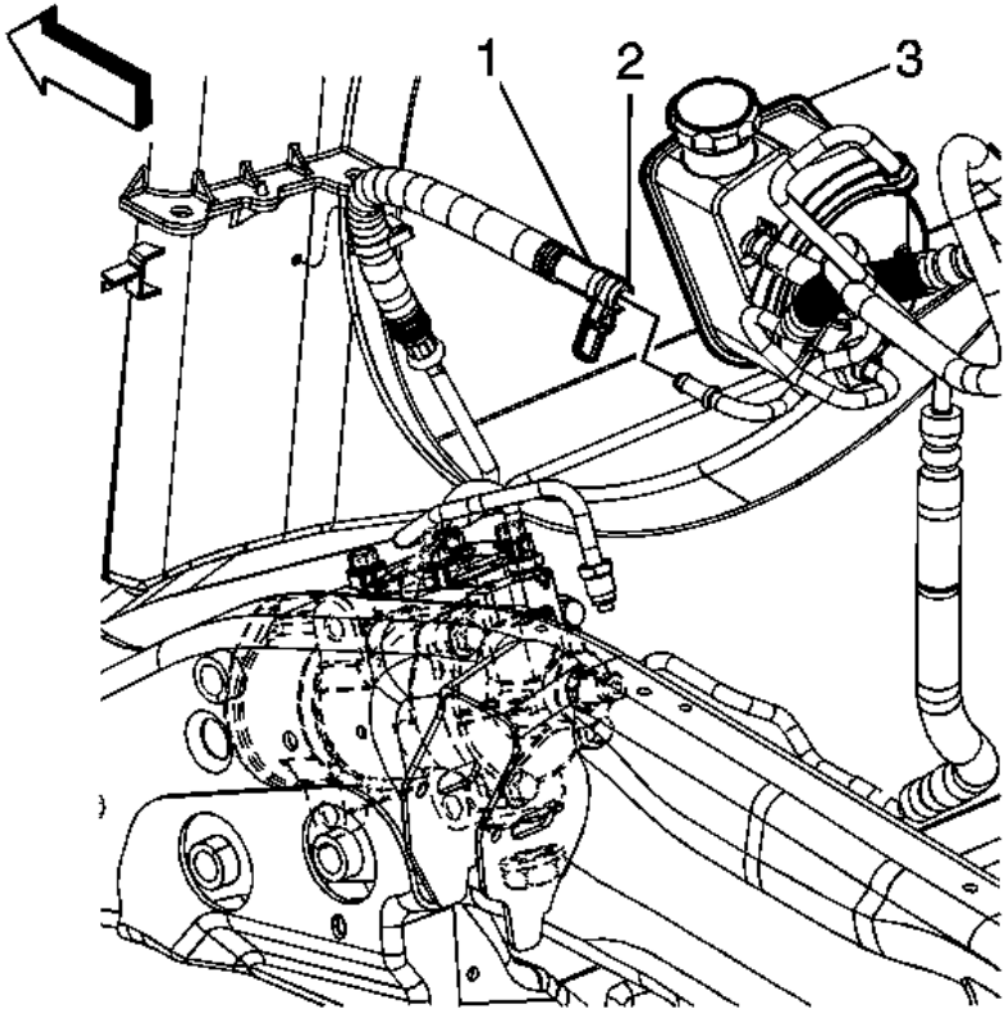


Fig. 78: View Of Power Steering Components
Courtesy of GENERAL MOTORS CORP.

3. Compress the power steering gear outlet hose clamp (2).
4. Disconnect the power steering gear outlet hose (1) from the power steering pump assembly (3).

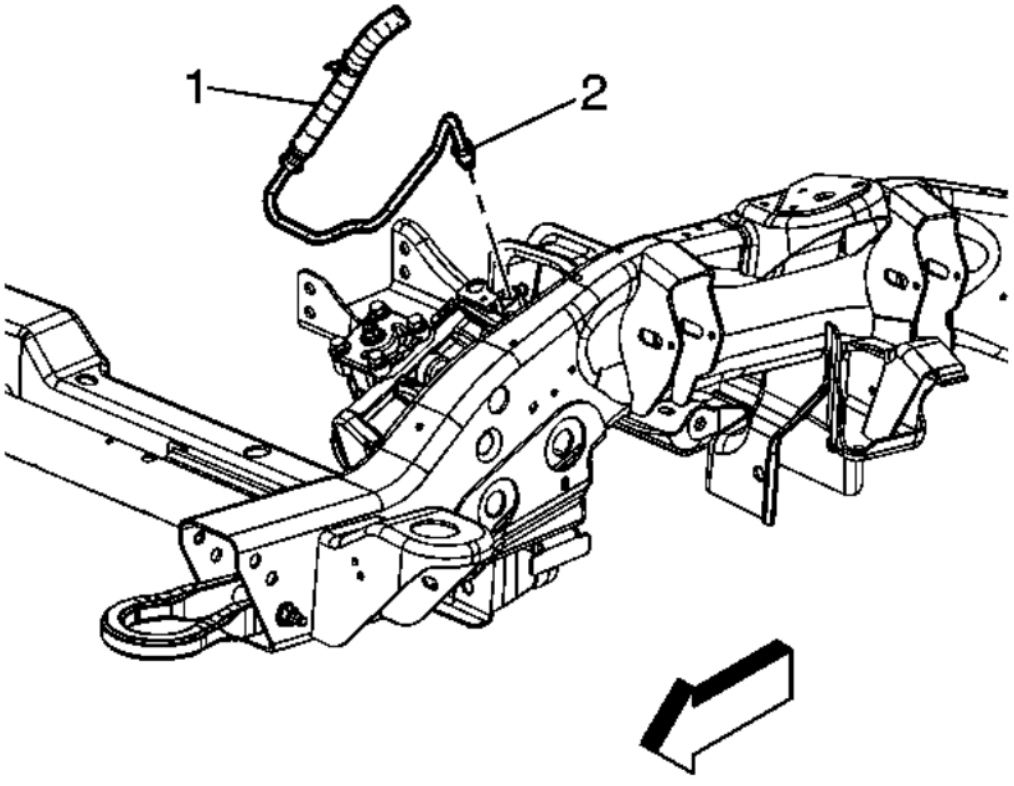


Fig. 79: View Of Power Steering Gear & Outlet Hose
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the power steering gear outlet hose (2) from the steering gear (1).
6. Remove the power steering gear outlet hose (1) from the vehicle.

Installation Procedure

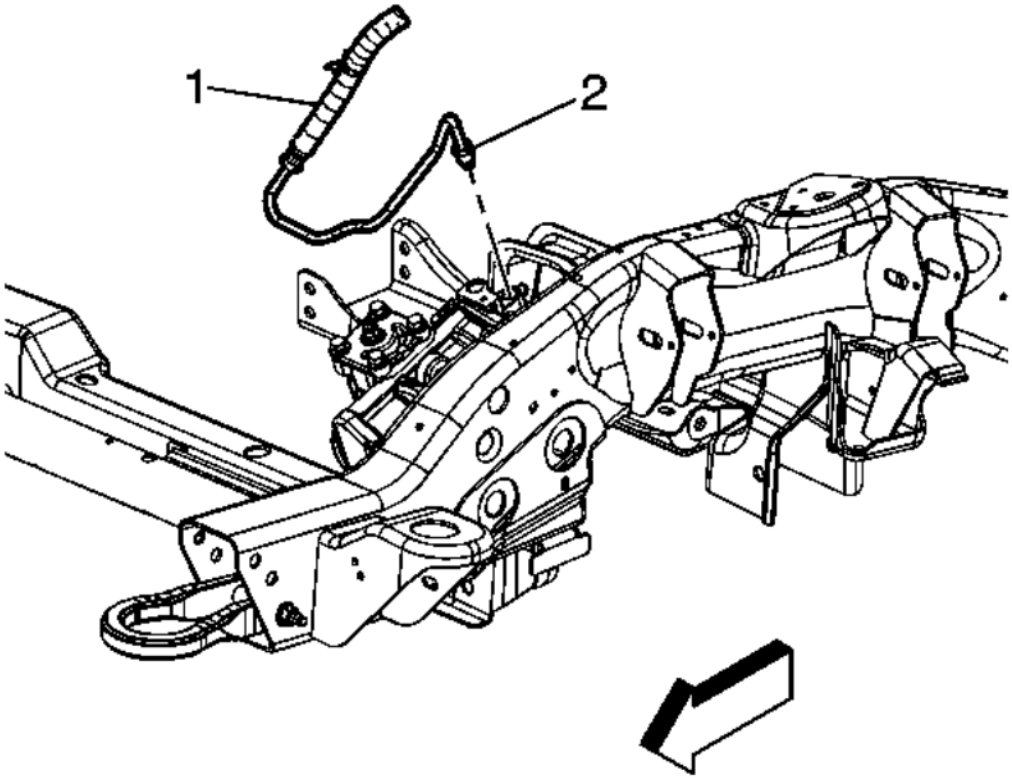


Fig. 80: View Of Power Steering Gear & Outlet Hose
Courtesy of GENERAL MOTORS CORP.

1. Install the power steering gear outlet hose (1) to the vehicle.
2. Connect the power steering gear outlet hose (2) to the steering gear (1).

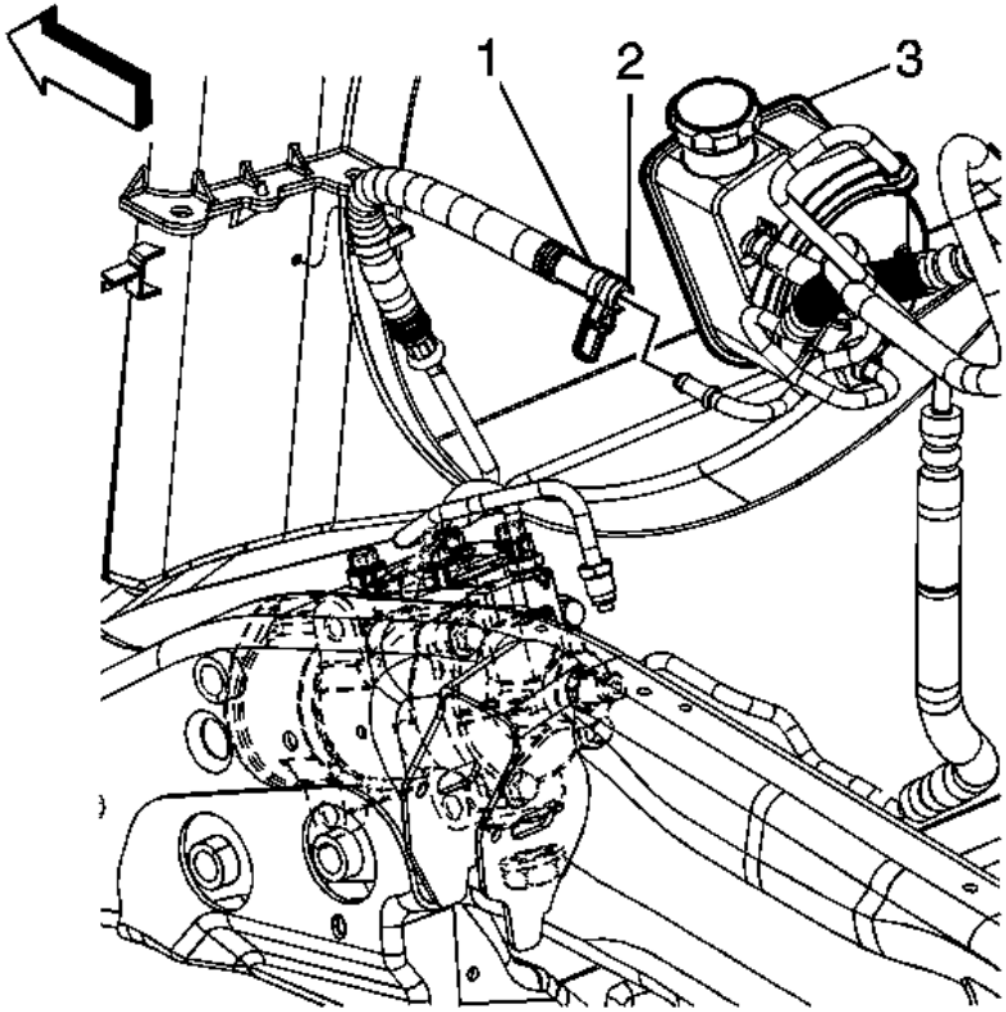


Fig. 81: View Of Power Steering Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

3. Compress the power steering gear outlet hose clamp (2).
4. Connect the power steering gear outlet hose (1) to the power steering pump assembly (3).

Tighten: Tighten the fitting to 32 N.m (24 lb ft).

5. Clean any excessive power steering fluid from the vehicle and remove the drain pans.
6. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

STEERING GEAR REPLACEMENT (RACK AND PINION)

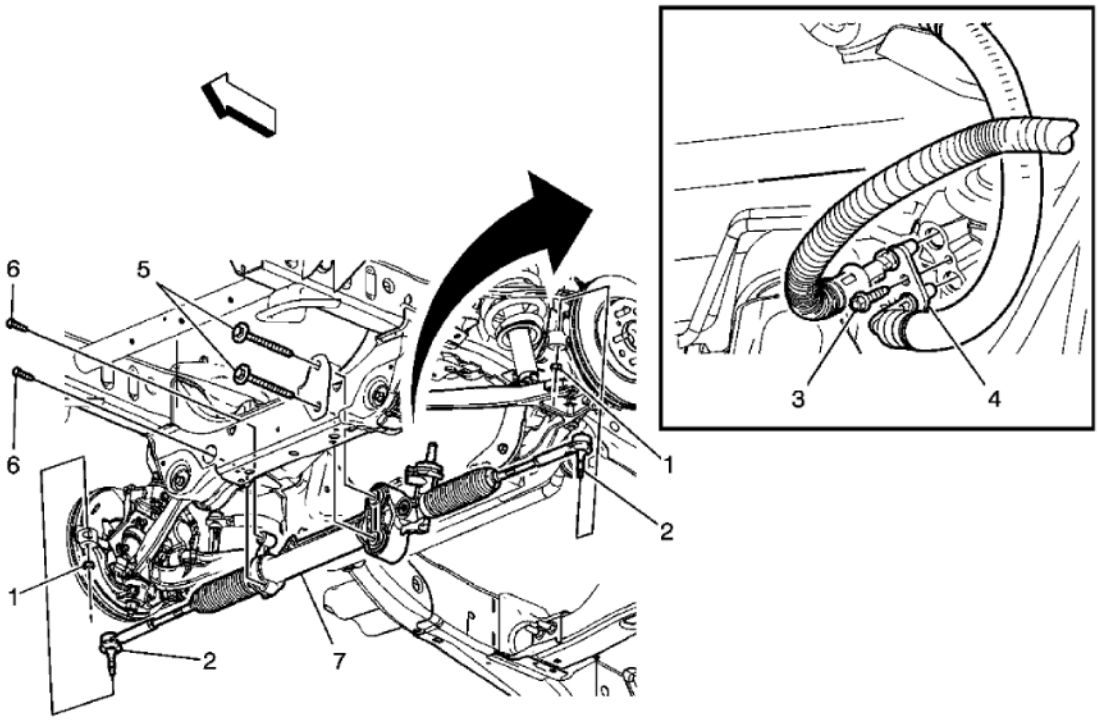


Fig. 82: Power Steering Gear Components (Rack & Pinion)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Remove the front tire/wheel assemblies. Refer to **Tire and Wheel Removal and Installation** . 2. Disconnect the steering shaft coupling from the steering gear. Refer to **Steering Shaft Coupling Replacement** .	
	Steering Linkage Outer Tie Rod Nut (Qty: 2) **NOTE:** **Do not attempt to disconnect a steering linkage joint by driving a wedge between the joint and the attached part. Seal damage may result which will cause premature failure of the joint.**

1	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 60 N.m (44 lb ft)
2	Steering Linkage Outer Tie Rod (Qty: 2) **Procedure:** Use puller **J 24319-B** to separate the steering linkage outer tie rods from the steering knuckles. See **Special Tools**.
3	Power Steering Gear Inlet Hose Retaining Plate Bolt **Procedure** 1. Remove as much power steering fluid from the power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed. **Tighten:** 12 N.m (106 lb in)
4	Power Steering Gear Inlet/Outlet Hose (Qty: 2) **NOTE:** **Refer to Power Steering Hose Disconnected Notice .** **Procedure:** Pull the power steering gear inlet/outlet hoses out of the steering gear. **Tip:** Keep the area around the power steering gear inlet/outlet hoses and the steering gear openings clean.
5	Left Side Steering Gear Bolt (Qty: 2) **Tighten:** 200 N.m (148 lb ft)
6	Right Side Steering Gear Bolt (Qty: 2) **Tighten:** 100 N.m (74 lb ft)
	Steering Gear **Procedure** 1. Use remover/installer **J 44586** to replace the steering gear seals if needed. See **Special Tools**.

	2. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**. 3. Adjust the front toe. Refer to **Front Toe Adjustment** .
7	**Special Tools** • **J 24319-B** Steering Linkage and Tie Rod Puller. See **Special Tools**. • **J 44586** Power Steering Gear Oil Seal Remover/Installer. See **Special Tools**.

STEERING GEAR REPLACEMENT (NON-RACK AND PINION)

Tools Required

J 24319-B Steering Linkage and Tie Rod Puller. See **Special Tools**.

Removal Procedure

1. Remove as much power steering fluid from the power steering fluid reservoir as possible.
2. Place drain pans under the vehicle as needed.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE .

4. Remove the engine shield, if equipped. Refer to **Engine Shield Replacement** .
5. If equipped with a diesel engine, remove the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Left Side (Chevrolet)** or **Front Wheelhouse Liner Replacement - Left Side (GMC)** .
6. Disconnect the steering hoses from the steering gear.
7. Disconnect the steering shaft coupling from the steering gear. Refer to **Steering Shaft Coupling Replacement** .

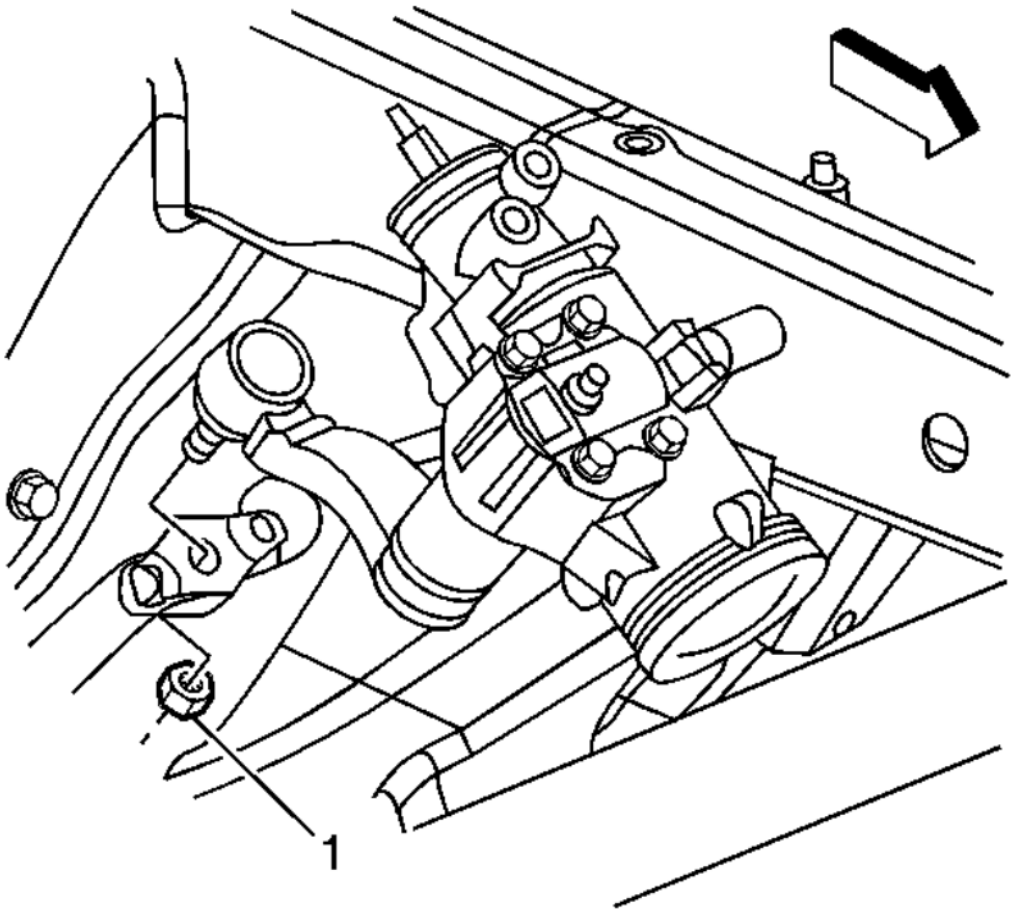


Fig. 83: View Of Pitman Arm Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Discard the pitman arm nut.

8. Remove the pitman arm nut (1).

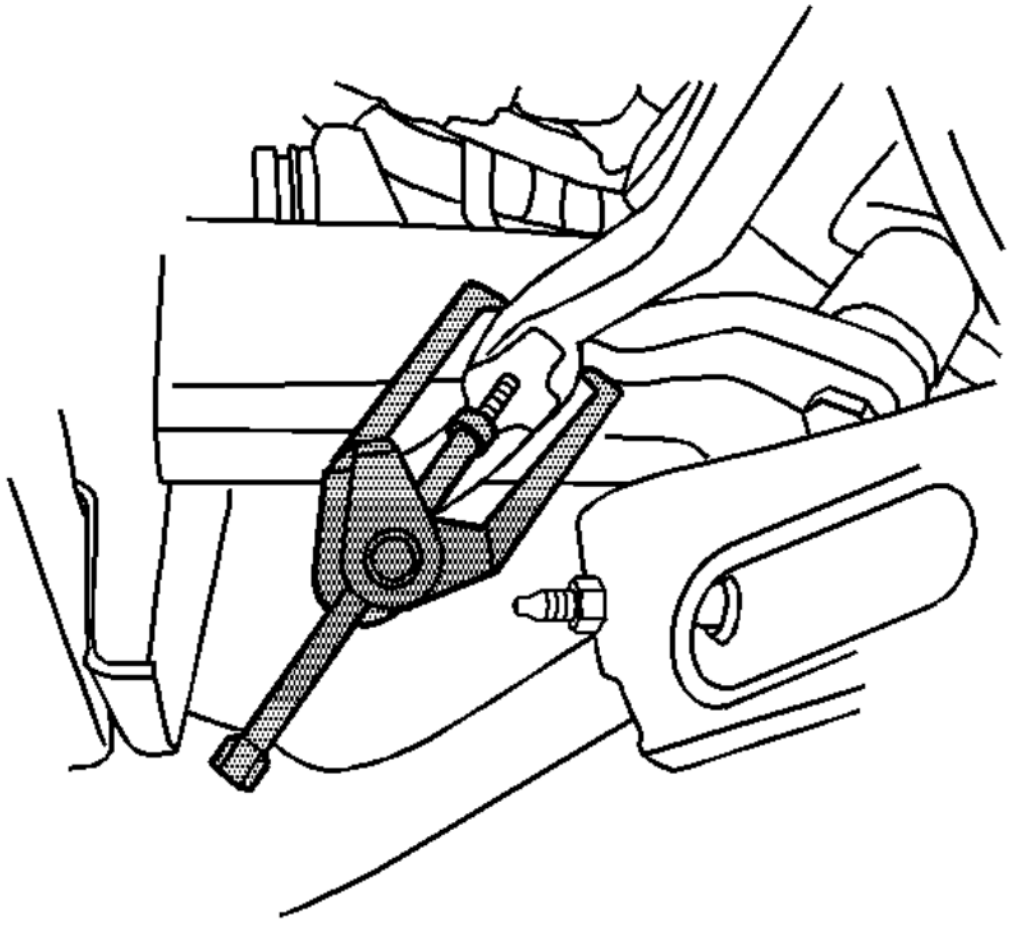


Fig. 84: Disconnect The Pitman Arm From The Relay Rod (Non Rack and Pinion)
Courtesy of GENERAL MOTORS CORP.

9. Separate the pitman arm from the relay rod using puller **J 24319-B** . See **Special Tools**.

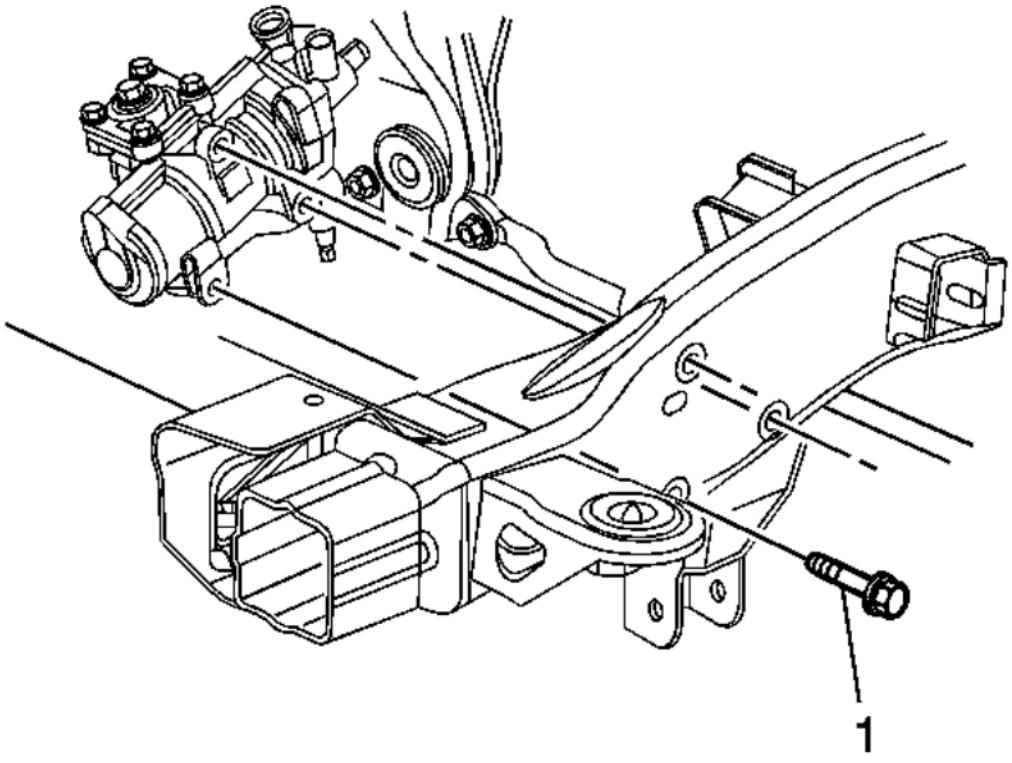


Fig. 85: View Of Steering Gear Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the steering gear bolts (1).
11. Remove the steering gear from the vehicle.
12. Transfer the pitman arm as necessary. Refer to **Pitman Arm Replacement** .

Installation Procedure

1. Install the pitman arm if necessary. Refer to **Pitman Arm Replacement** .
2. Install the steering gear to the vehicle.

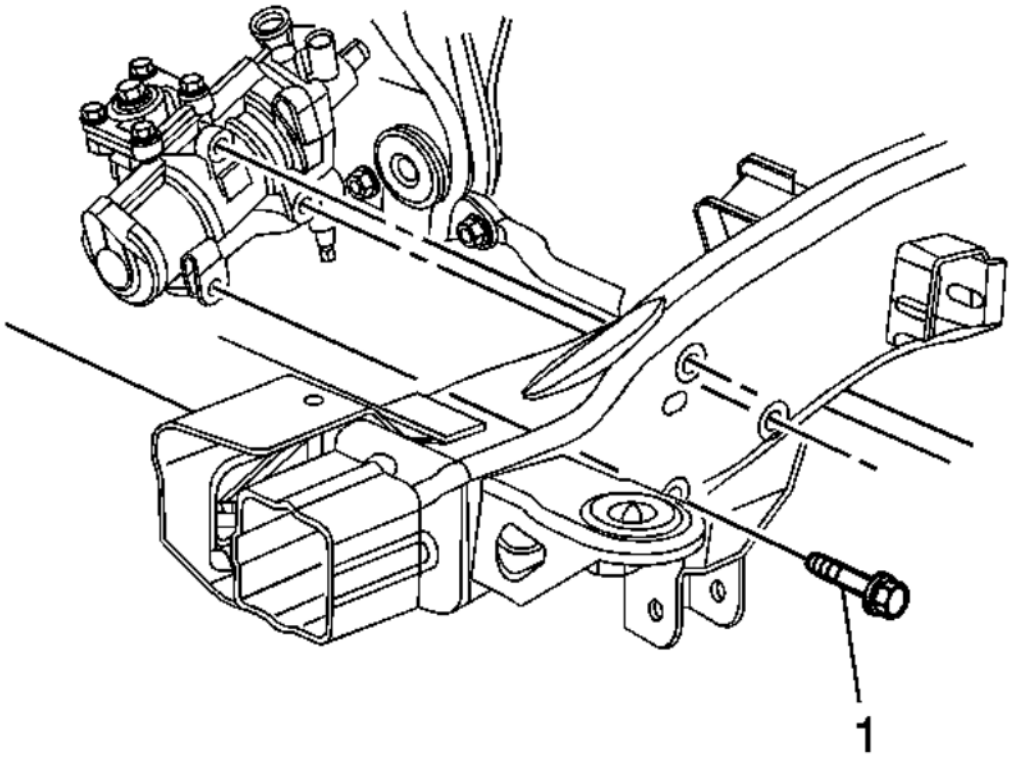


Fig. 86: View Of Steering Gear Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

IMPORTANT: Start all of the steering gear bolts by hand and fully seat them before finalizing the torque.

3. Install the steering gear bolts (1).

Tighten: Tighten the bolts to 150 N.m (110 lb ft).

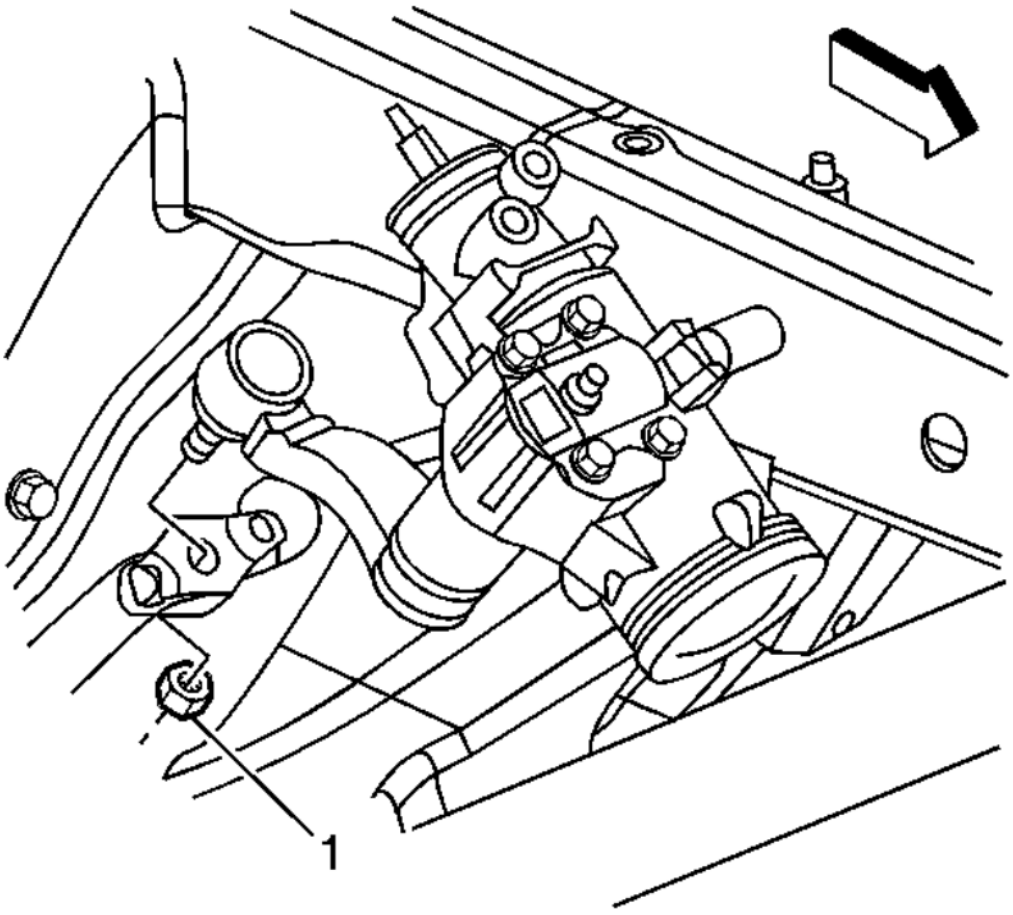


Fig. 87: View Of Pitman Arm Nut
Courtesy of GENERAL MOTORS CORP.

4. Install the pitman arm to the relay rod.
5. Install the pitman arm nut (1).

   Tighten: Tighten the nut to 62 N.m (46 lb ft).

6. Connect the power steering hoses to the steering gear.

   Tighten: Tighten the hoses fittings to 32 N.m (24 lb ft).

7. Connect the steering shaft coupling. Refer to **Steering Shaft Coupling Replacement** .

8. Clean any excess fluid from the vehicle and remove the drain pans.
9. If equipped with a diesel engine, install the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Left Side (Chevrolet)** or **Front Wheelhouse Liner Replacement - Left Side (GMC)** .
10. Install the engine shield, if equipped. Refer to **Engine Shield Replacement** .
11. Lower the vehicle.
12. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

STEERING GEAR RACK BEARING PRELOAD ADJUSTMENT - OFF VEHICLE

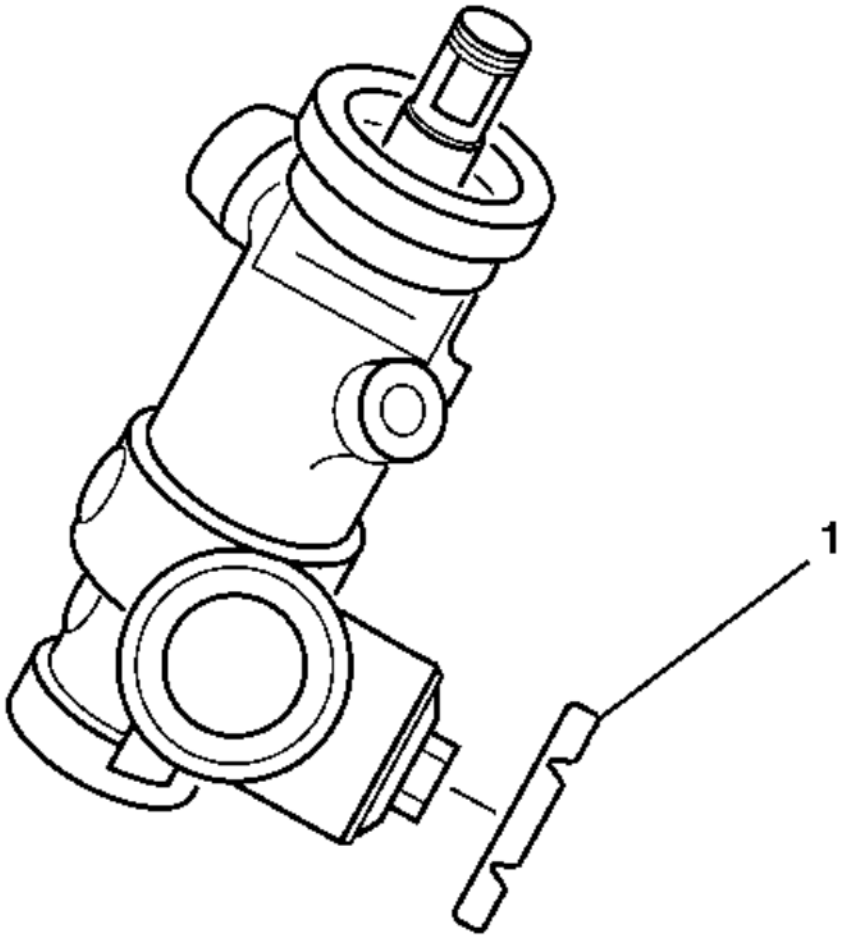


Fig. 88: View Of Adjuster Plug Lock Nut (Rack & Pinion)
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

IMPORTANT: Hold the steering gear rack bearing adjuster plug stationary while tightening the steering gear rack bearing adjuster plug lock nut.

4. Install the steering gear rack bearing adjuster plug lock nut (1).

   Tighten: Tighten the nut to 68 N.m (50 lb ft).

STEERING LINKAGE INNER TIE ROD REPLACEMENT

Removal Procedure

IMPORTANT: 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 steering gear boot. Refer to **Steering Gear Boot Replacement - On Vehicle**.

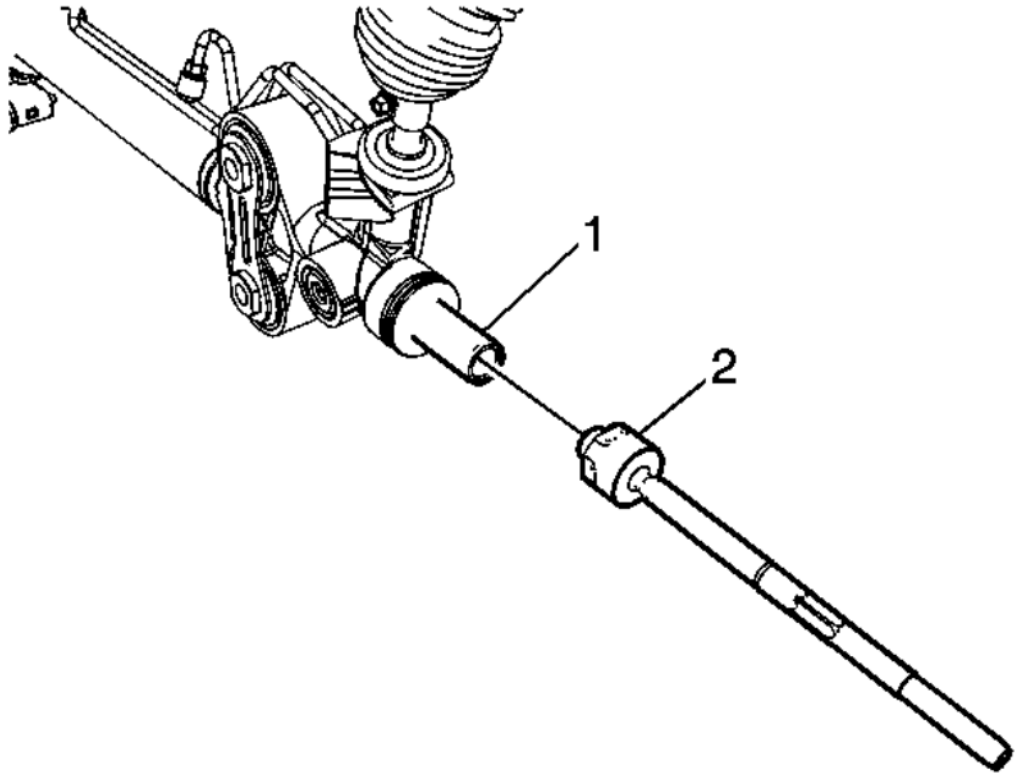


Fig. 89: View Of Inner Tie Rod Housing & Rack
Courtesy of GENERAL MOTORS CORP.

NOTE: 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.

NOTE: 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.

2. Place a pipe wrench on the steering gear rack (1) next to the steering linkage inner tie rod housing (2).

3. Place a wrench on the flats of the steering linkage inner tie rod housing (2).
4. Rotate the steering linkage inner tie rod housing (2) counterclockwise, while holding the steering gear rack stationary, until the steering linkage inner tie rod separates from the steering gear rack (1).

Installation Procedure

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

1. Apply LOCTITE® 262, or equivalent, to the steering gear inner tie rod threads.
2. Attach the steering linkage inner tie rod onto the steering gear rack.

NOTE: Refer to Pipe Wrench Positioning Notice .

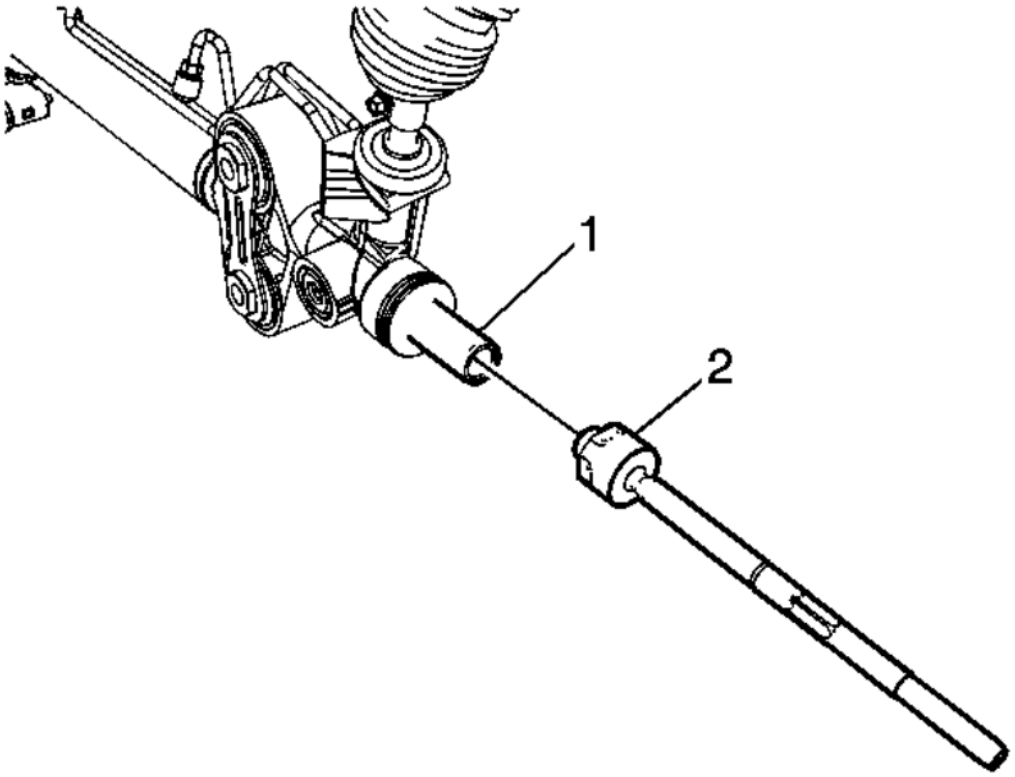


Fig. 90: View Of Inner Tie Rod Housing & Rack
Courtesy of GENERAL MOTORS CORP.

3. Place a pipe wrench on the steering gear rack (1) next to the steering linkage inner tie rod housing (2).

NOTE: **Refer to Fastener Notice .**

4. Tighten the steering linkage inner tie rod housing (2).

   Tighten: Tighten the steering linkage inner tie rod to 100 N.m (74 lb ft).

5. Install the steering gear boot. Refer to **Steering Gear Boot Replacement - On Vehicle**.

STEERING GEAR CYLINDER PIPE ASSEMBLY AND SEALS REPLACEMENT - OFF VEHIC VEHICLE

Removal Procedure

1. Remove the steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

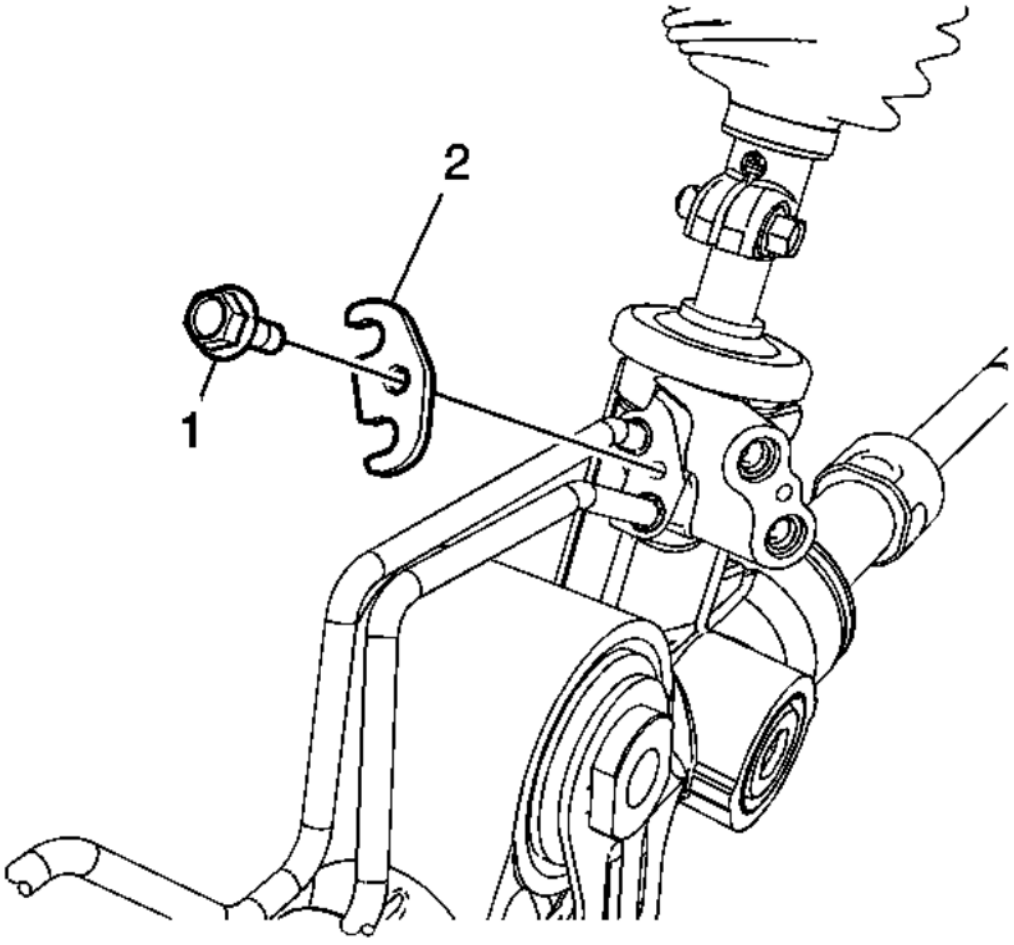


Fig. 91: View Of Cylinder Line Retaining Plate & Bolt
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Protect the steering gear boots from sharp tools and from the sharp edges of surrounding components.

2. Remove the power steering gear inlet hose retaining plate bolt (1) and the power steering

gear inlet hose retaining plate (2).

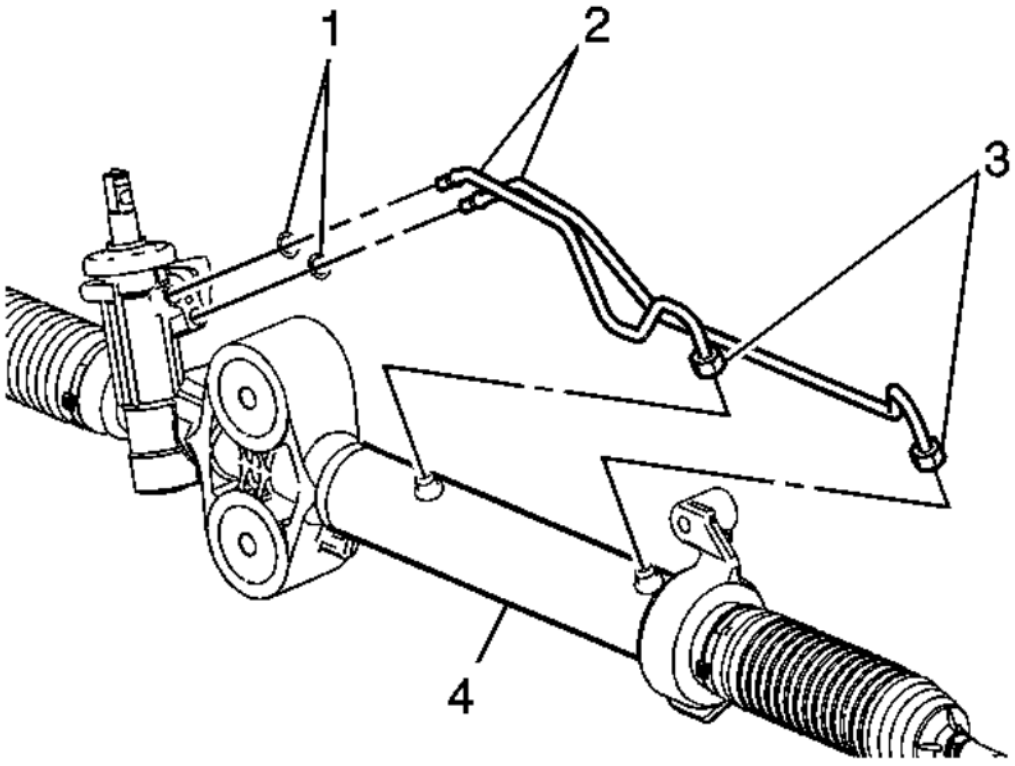


Fig. 92: Steering Gear Cylinder Pipes & Fittings
Courtesy of GENERAL MOTORS CORP.

3. Loosen both steering gear cylinder pipe fittings (3) on the steering gear (4).
4. Remove both steering gear cylinder pipes (2) from the steering gear (4).
5. Remove and discard the steering gear cylinder pipe seals (1) from the steering gear (4).

Installation Procedure

1. Inspect the steering gear cylinder pipes for the following items:
   - Cracks
   - Dents
   - Damage to the threads

2. Replace the steering gear cylinder pipes as needed.

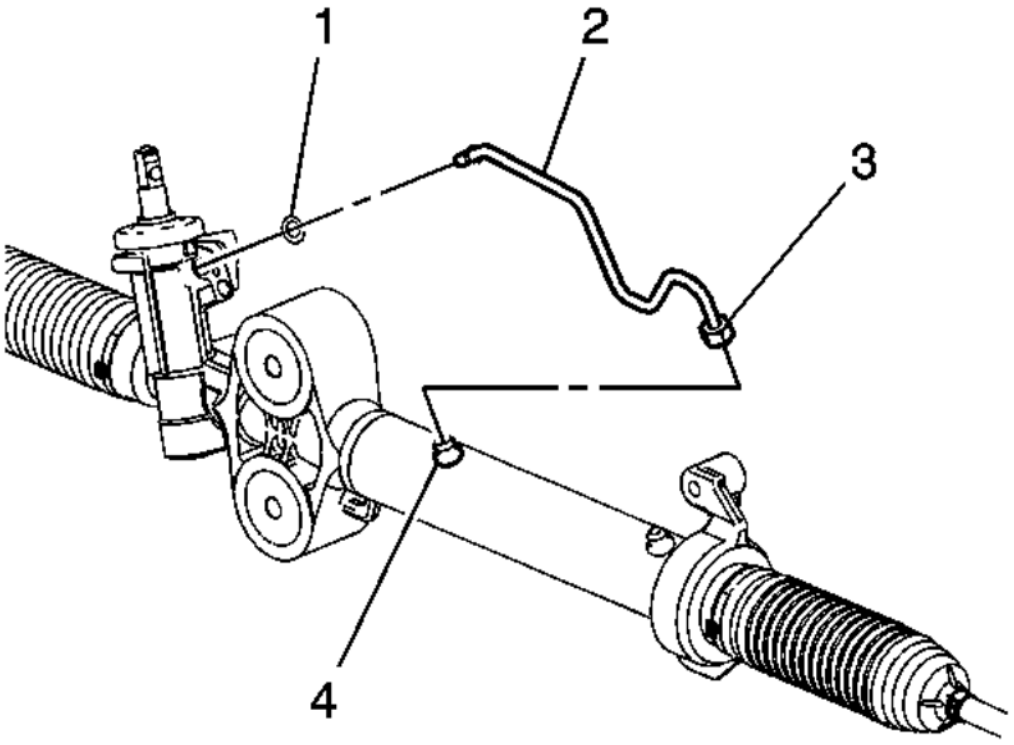


Fig. 93: Steering Gear Cylinder Pipes & Fittings
Courtesy of GENERAL MOTORS CORP.

3. Lubricate and install the new steering gear cylinder pipe seal (1) onto the shorter steering gear cylinder pipe.
4. Place the non-threaded steering gear cylinder pipe end (2) into the steering gear.
5. Place the threaded end of the steering gear cylinder pipe (3) onto the steering gear fitting (4).

   Start the steering gear cylinder pipe fitting (3) but do not tighten it entirely.

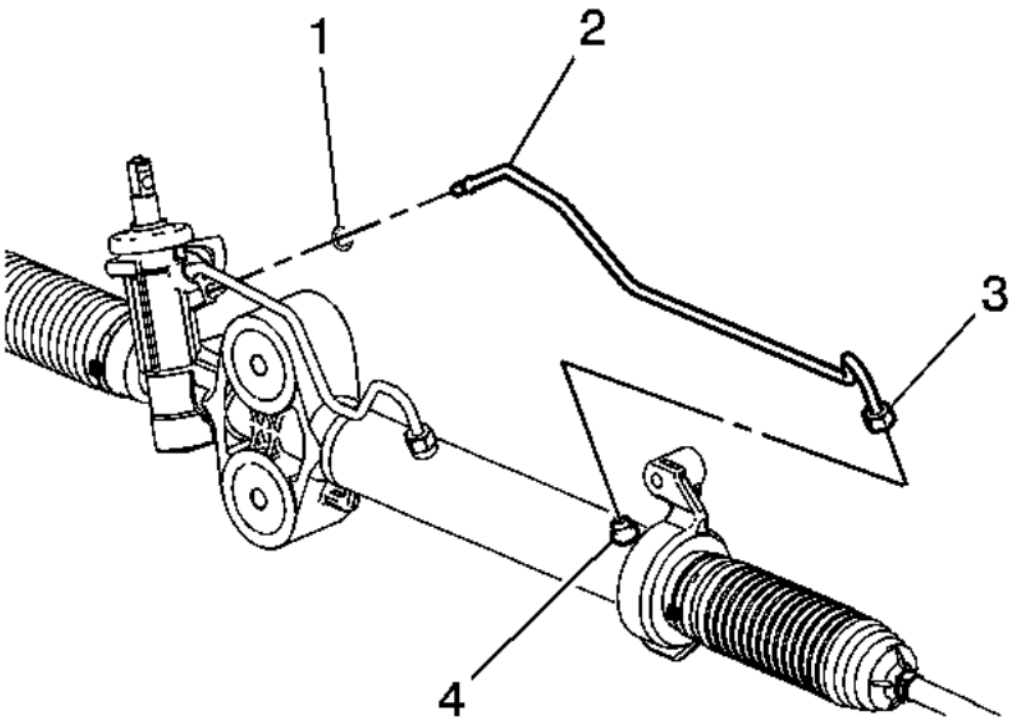


Fig. 94: Steering Gear Cylinder Pipes & Fittings
Courtesy of GENERAL MOTORS CORP.

6. Lubricate and install the new steering gear cylinder pipe seal (1) onto the longer steering gear cylinder pipe.
7. Place the non-threaded steering gear cylinder pipe end (2) into the steering gear.
8. Place the threaded end of the steering gear cylinder pipe (3) onto the steering gear fitting (4).

   Start the steering gear cylinder pipe fitting (3) but do not tighten it entirely.

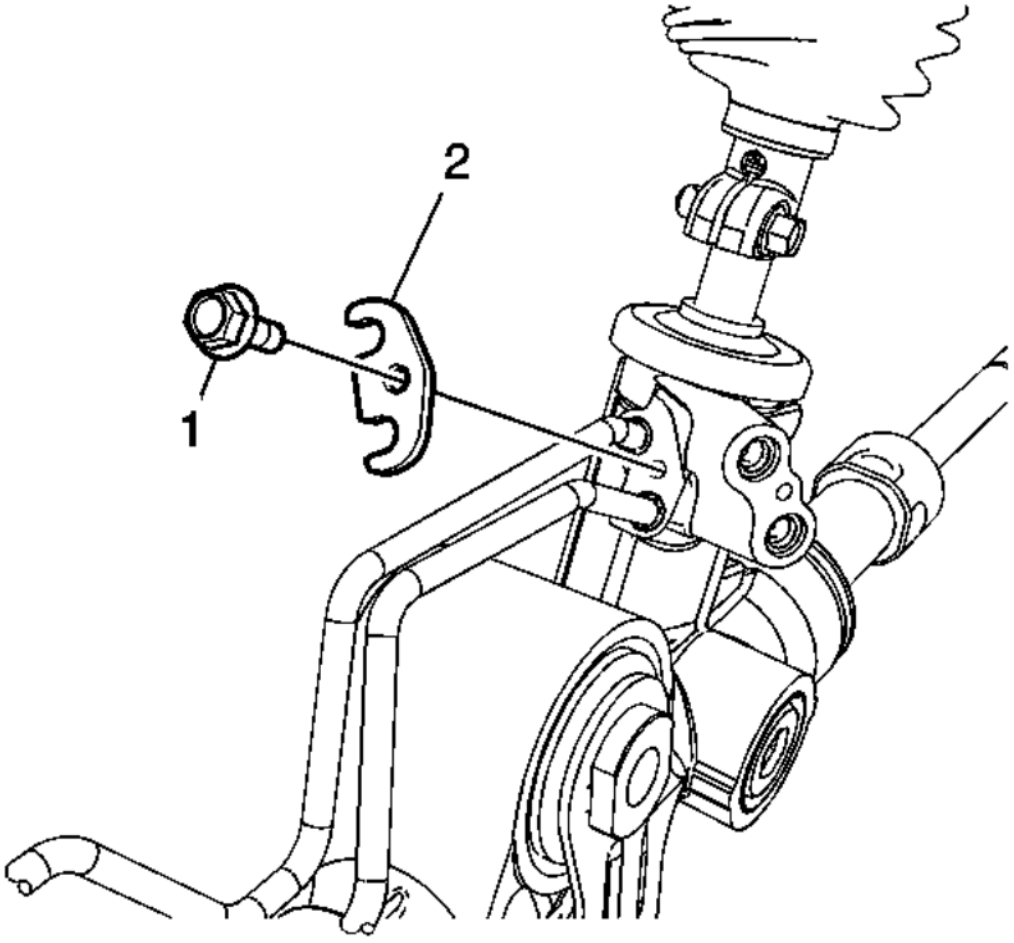


Fig. 95: View Of Cylinder Line Retaining Plate & Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

9. Install the power steering gear inlet hose retaining plate (2) and the power steering gear inlet hose retaining plate bolt (1).

   Tighten: Tighten the bolt to 12 N.m (106 lb in).

10. Tighten the steering gear cylinder pipe fittings.

Tighten: Tighten the fittings to 34 N.m (25 lb ft).

STEERING GEAR PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHIC VEHICLE

1. Remove the steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

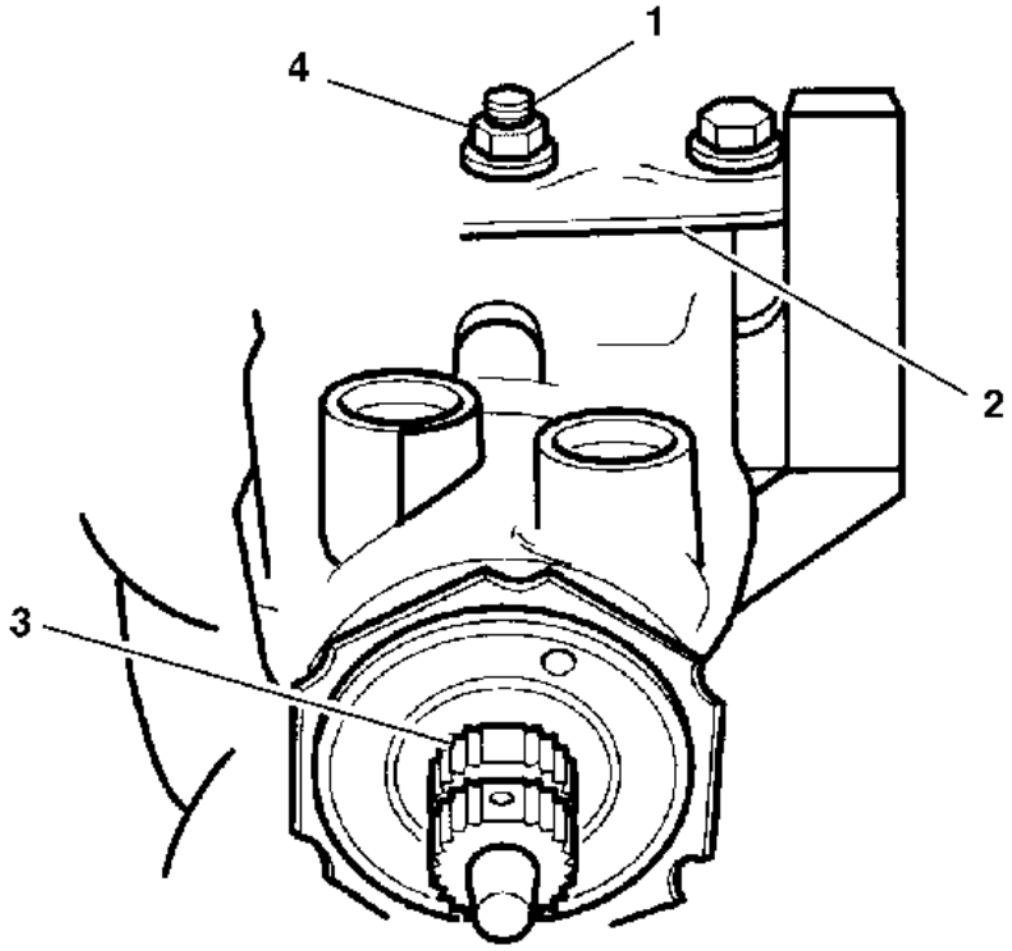


Fig. 96: Identifying Pitman Shaft Adjuster Screw & Lock Nut
Courtesy of GENERAL MOTORS CORP.

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.

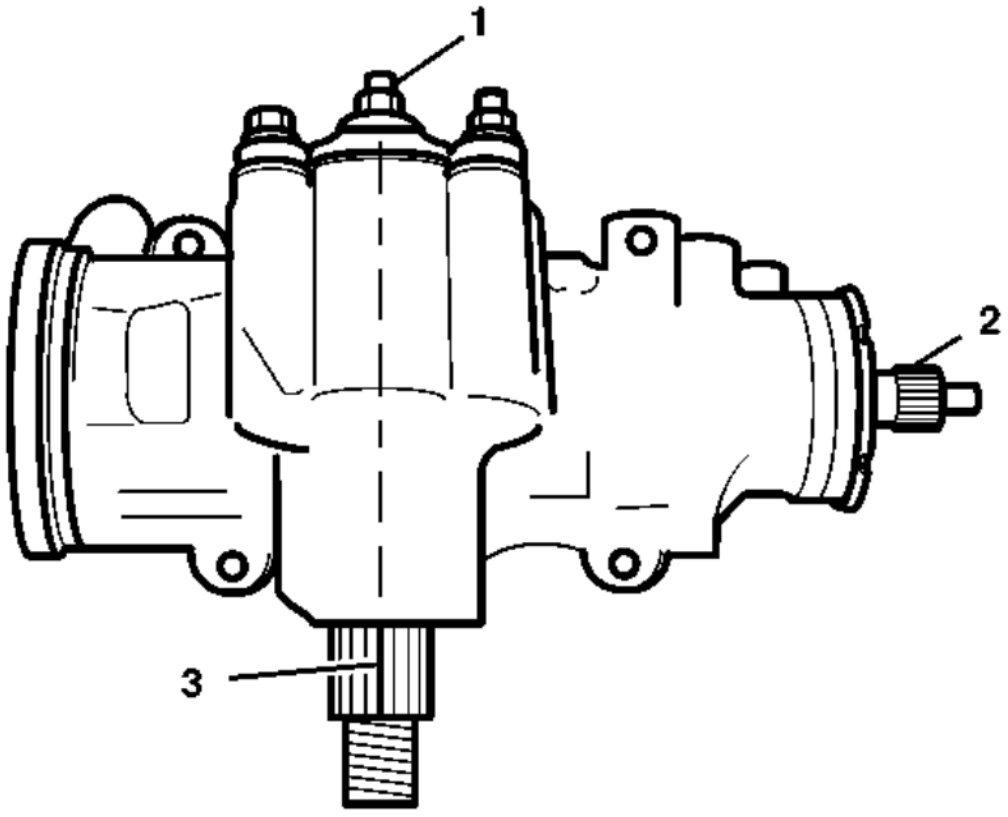


Fig. 97: Centering Steering Gear Stub Shaft
Courtesy of GENERAL MOTORS CORP.

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).

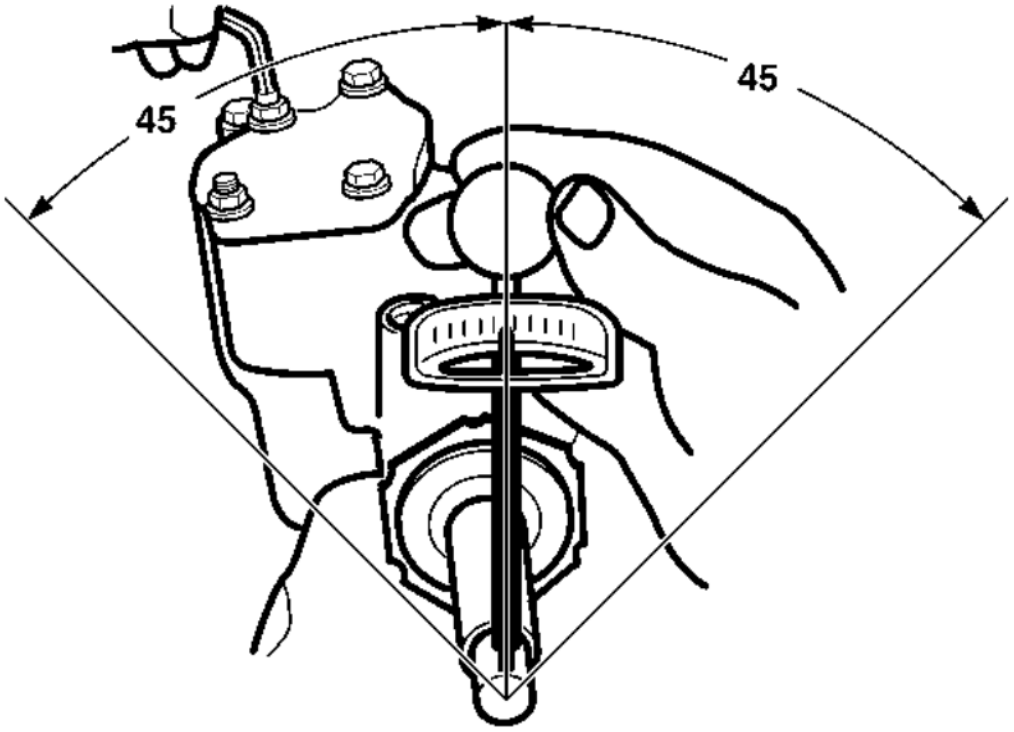


Fig. 98: Rotating Stub Shaft 45 Degrees From Each Side Of Center Of Stub Shaft
Courtesy of GENERAL MOTORS CORP.

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.

IMPORTANT: 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.

NOTE: Refer to Fastener Notice .

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: Tighten the nut to 49 N.m (36 lb ft).

14. Install the steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

STEERING GEAR PITMAN SHAFT AND HOUSING COVER REPLACEMENT - OFF VEHIC VEHICLE

Disassembly Procedure

1. Remove the steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

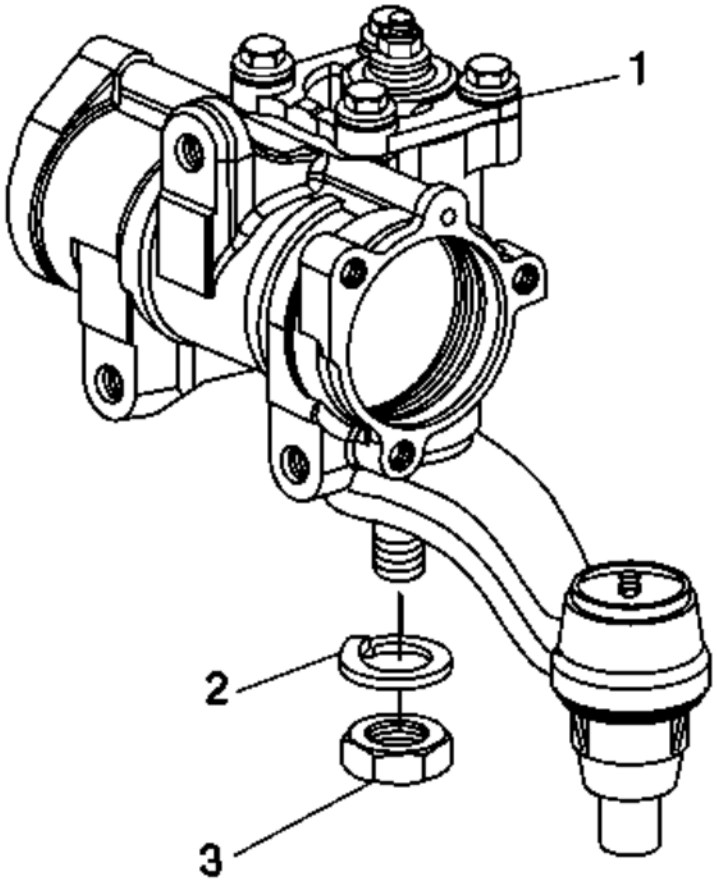


Fig. 99: Cleaning Exposed End Of Pitman Shaft (670 Gear)
Courtesy of GENERAL MOTORS CORP.

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.

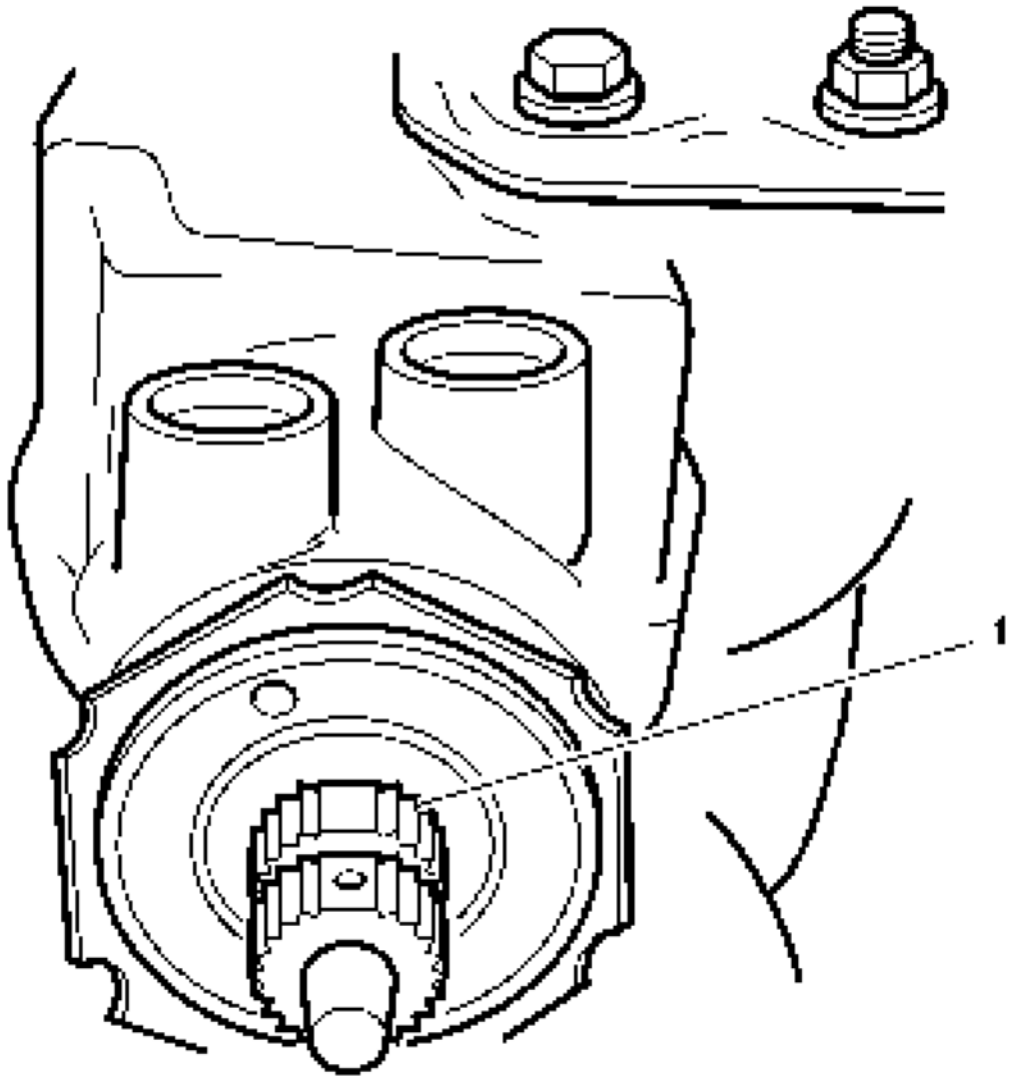


Fig. 100: Centering Stub Shaft (670 Gear)
Courtesy of GENERAL MOTORS CORP.

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

7. To center the steering gear stub shaft:
    1. Rotate the steering gear stub shaft (1) with a wrench from stop to stop.

2. Count the number of turns.
3. Rotate the steering gear stub shaft back 1/2 of the total amount of turns.

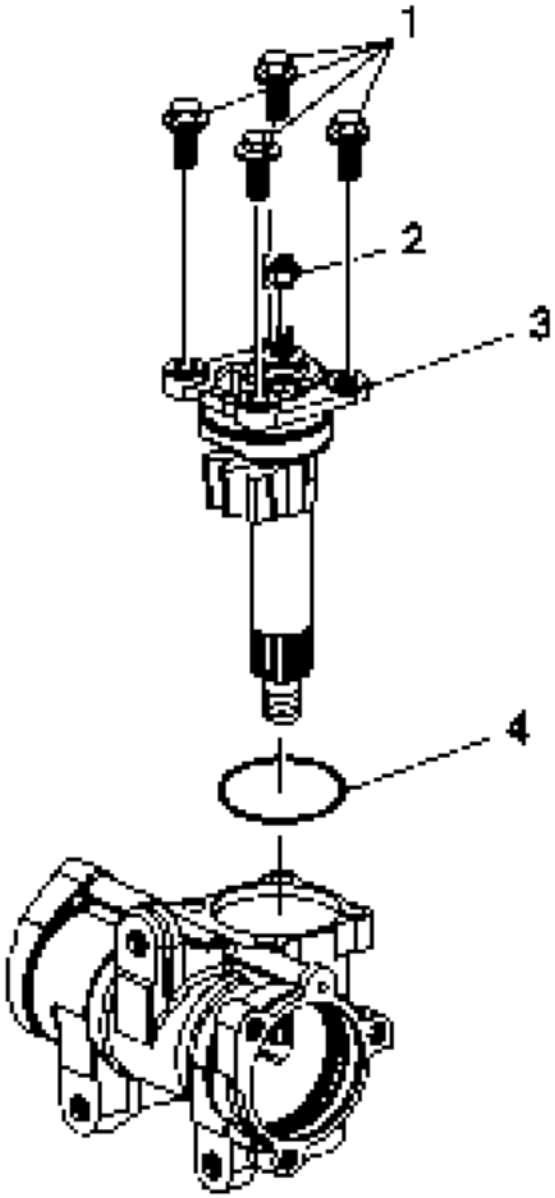


Fig. 101: View Of Pitman Shaft & Cover Assembly

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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

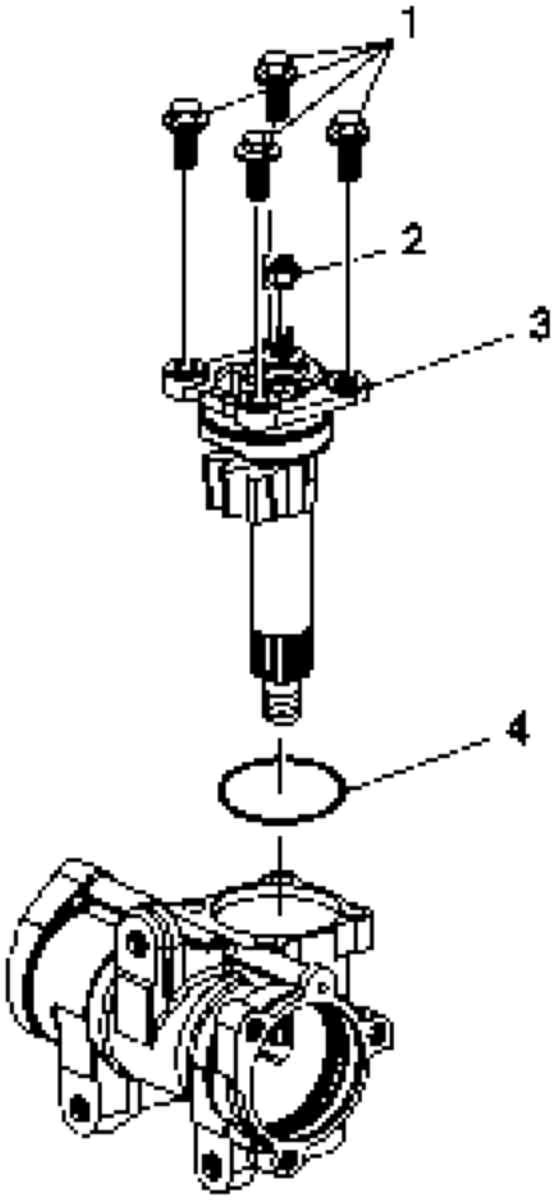


Fig. 102: View Of Pitman Shaft & Cover Assembly
Courtesy of GENERAL MOTORS CORP.

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).

NOTE: **Refer to Fastener Notice .**

4. Install the steering gear pitman shaft housing cover bolts (1).

Tighten: Tighten the bolts to 62 N.m (46 lb ft).

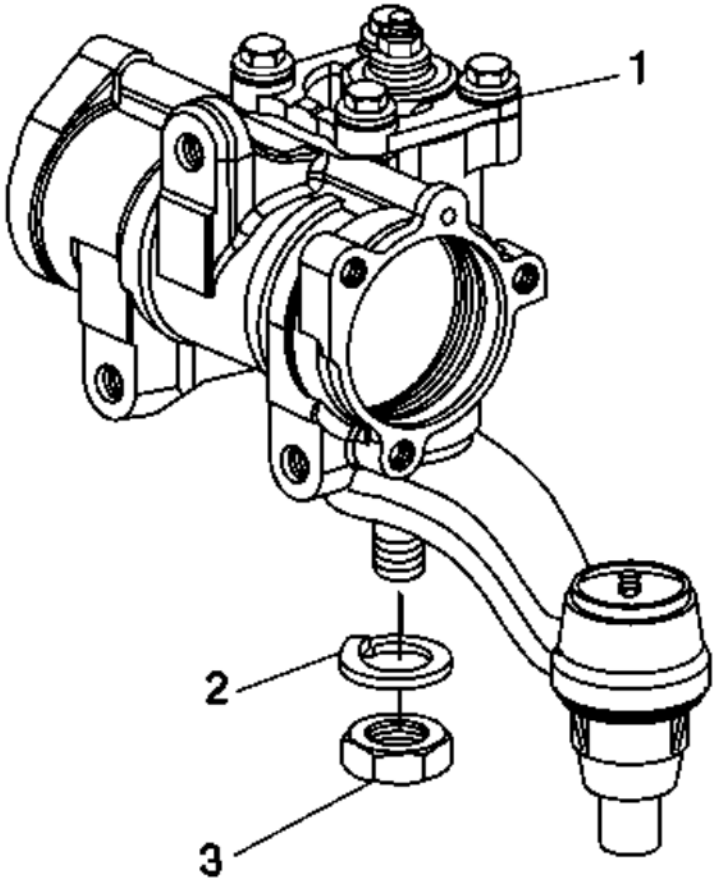


Fig. 103: Cleaning Exposed End Of Pitman Shaft (670 Gear)
Courtesy of GENERAL MOTORS CORP.

5. Install the pitman arm washer (2).
6. Install the pitman arm nut (3).

   Tighten: Tighten the nut 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 (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

STEERING GEAR PITMAN SHAFT SEAL AND BEARING REPLACEMENT - OFF VEHIC VEHICLE

Tools Required

- **J 6278** Pitman Shaft Bearing Remover and Installer. See **Special Tools**.
- **J 6219** Pitman Shaft Oil Seal Installer. See **Special Tools**.
- **J 4245** Internal Snap Ring Pliers. See **Special Tools**.

Disassembly Procedure

1. Remove the steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

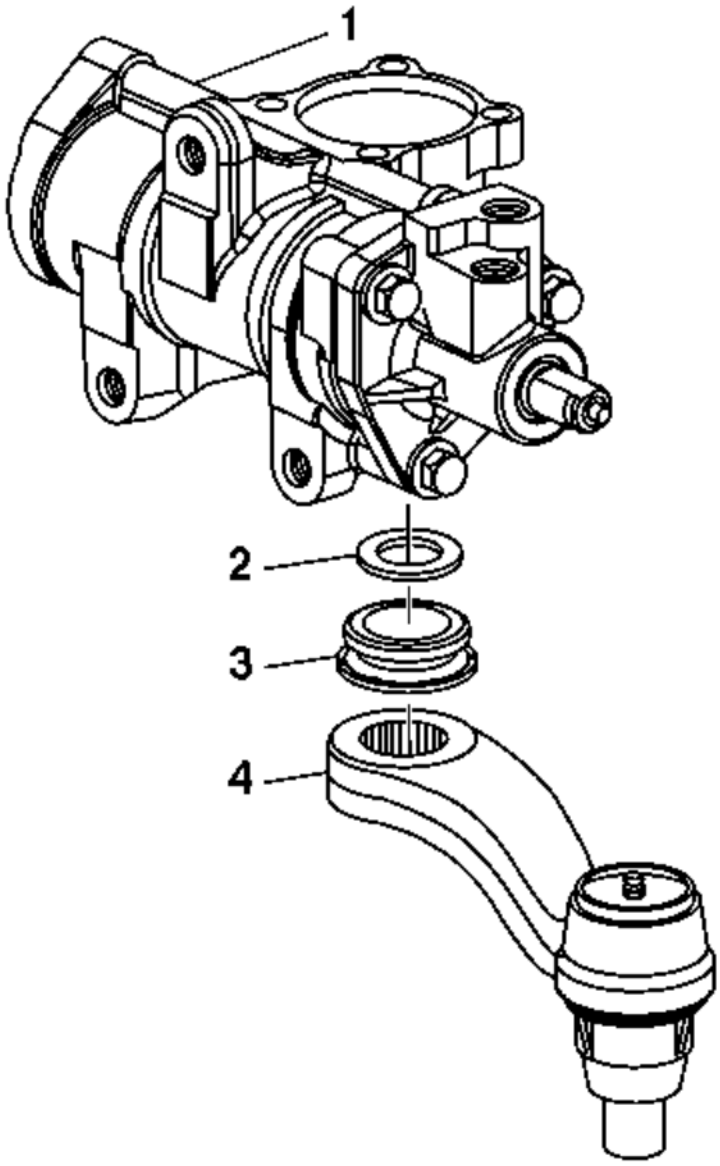


Fig. 104: View Of Pitman Arm, Pitman Shaft Boot, Dust Seal & Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

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).

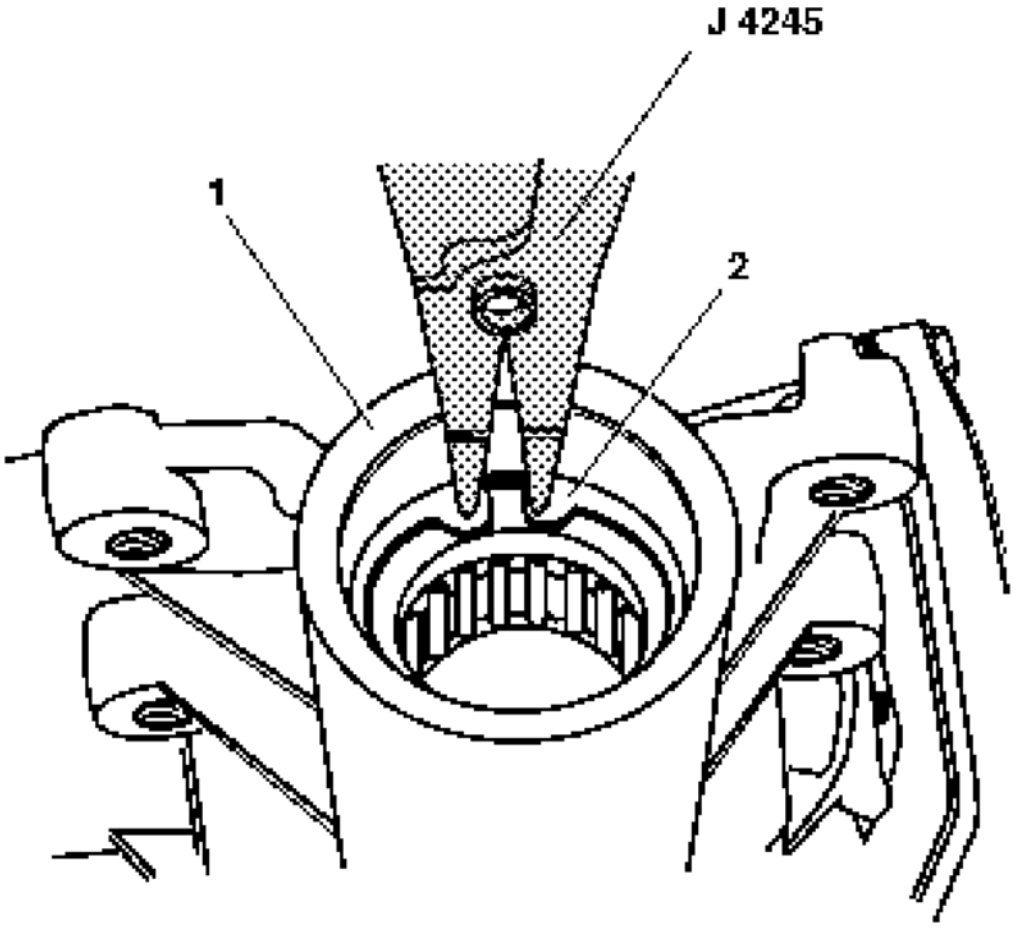


Fig. 105: Pitman Shaft Retaining Ring & Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

6. Remove the steering gear pitman shaft seal retaining ring (2) from the steering gear housing (1) using pliers **J 4245** . See **Special Tools**.

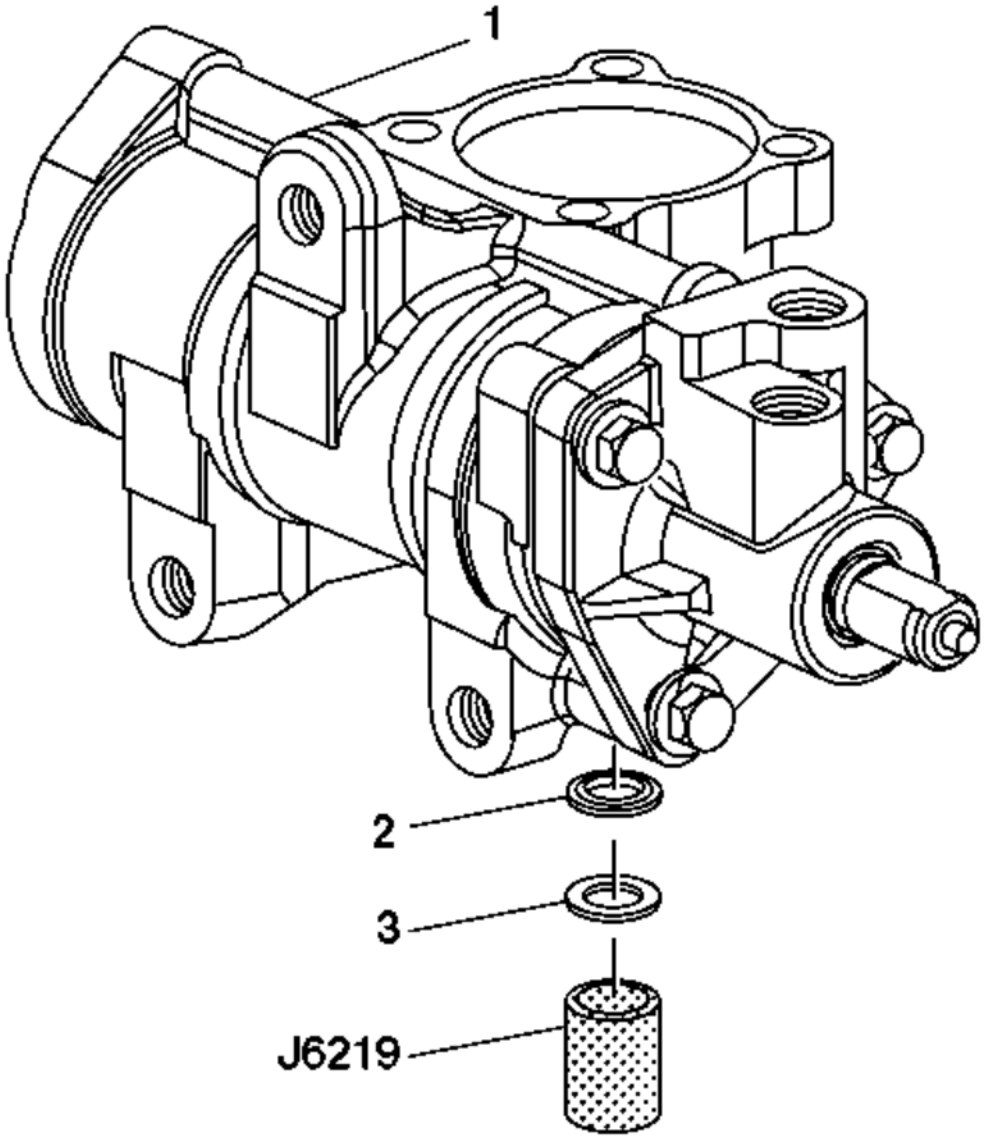


Fig. 106: View Of Backup Washer, Pitman Shaft Seal & J 6219
Courtesy of GENERAL MOTORS CORP.

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.

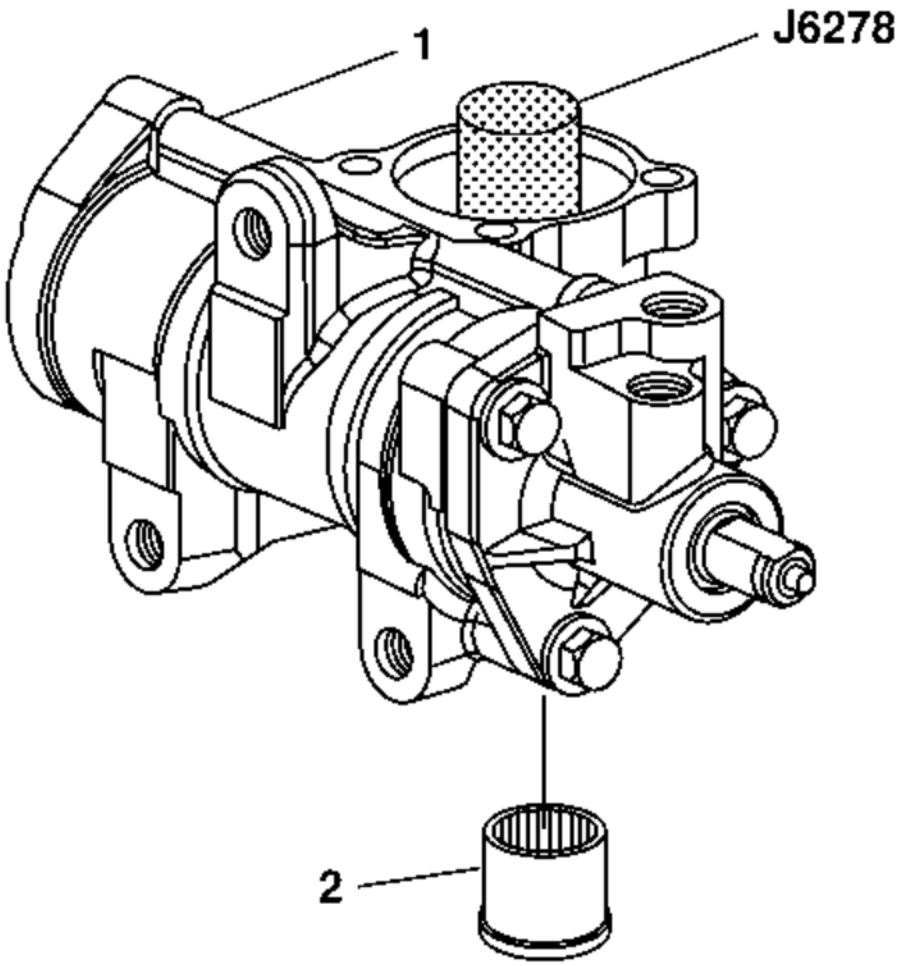


Fig. 107: Driving Out Needle Bearing From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

10. Insert remover/installer **J 6278** through the hole in the top of the steering gear housing (1). See **Special Tools**.

11. Drive out the steering gear pitman shaft bearing (2) from the steering gear housing (1).

Assembly Procedure

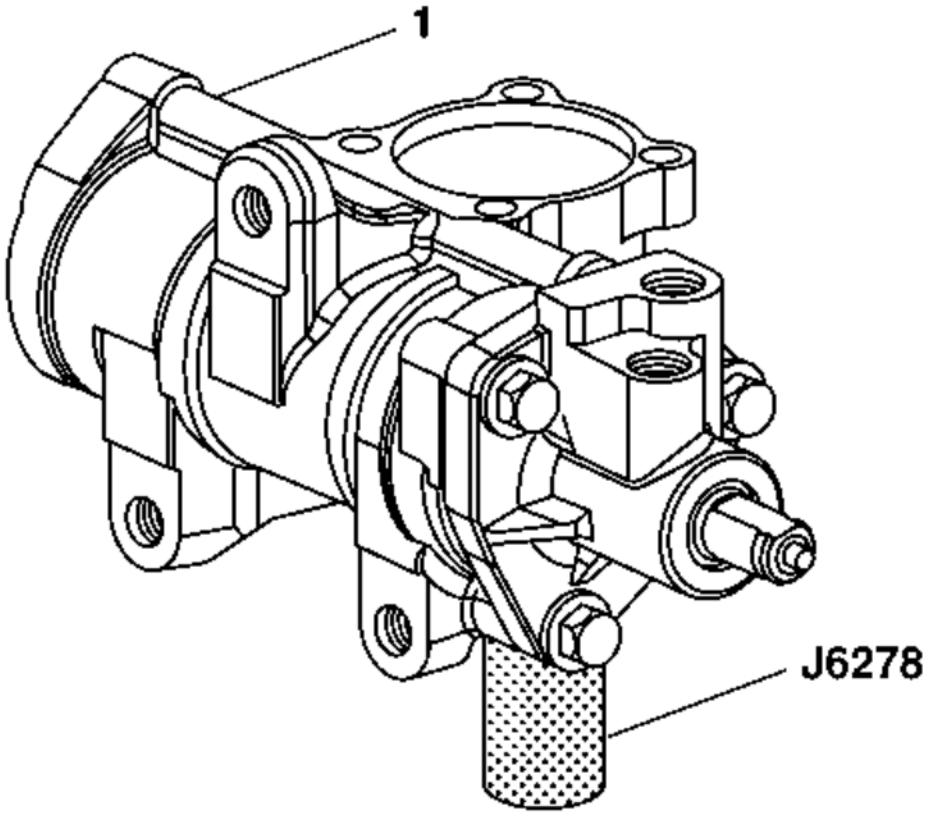


Fig. 108: Installing Needle Bearing Into Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the steering gear pitman shaft bearing into the steering gear housing (1) using remover/installer **J 6278** . See **Special Tools**.
2. Drive the steering gear pitman shaft bearing into the steering gear housing until the shoulder seats properly.

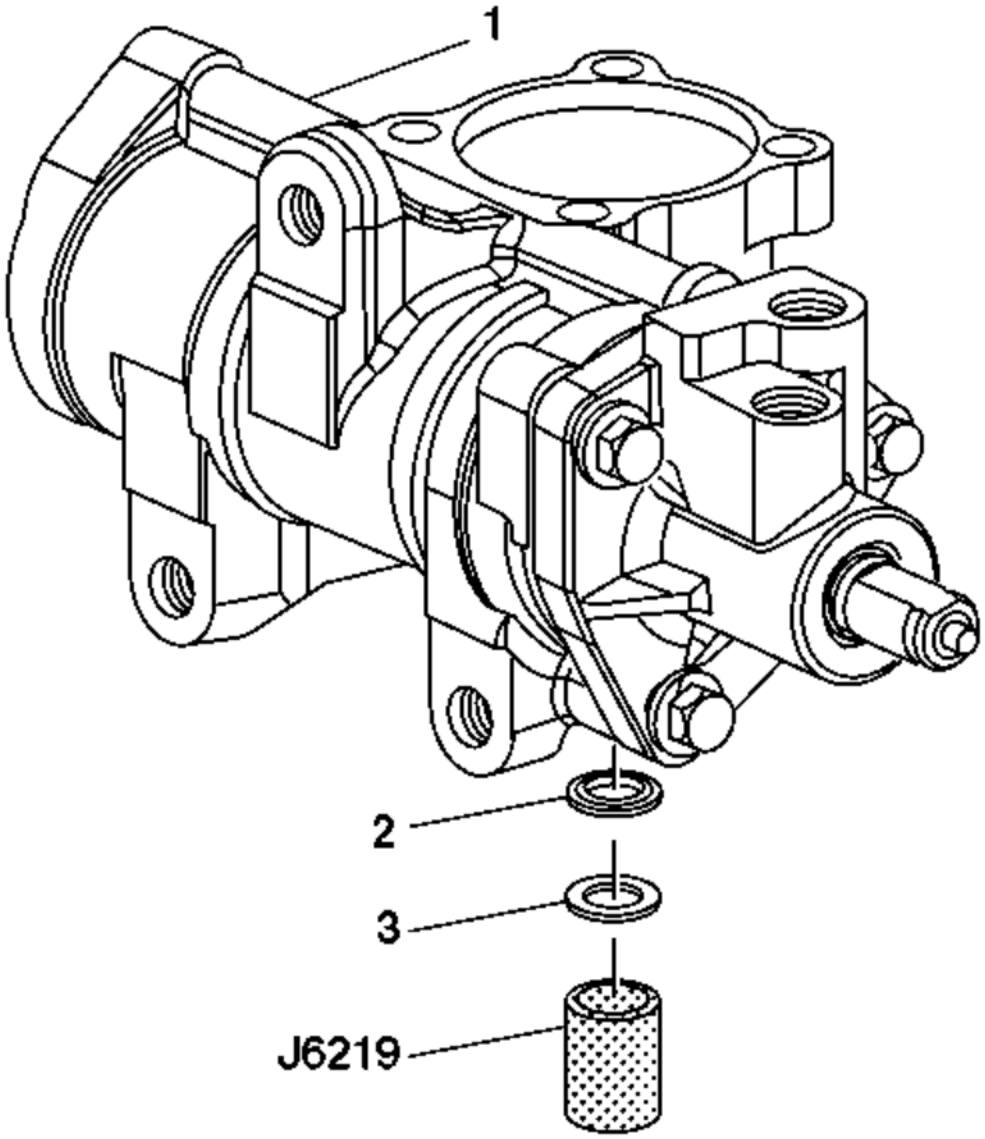


Fig. 109: View Of Backup Washer, Pitman Shaft Seal & J 6219
Courtesy of GENERAL MOTORS CORP.

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 . See **Special Tools**.

5. Install the steering gear pitman shaft washer (3) onto the steering gear housing (1).

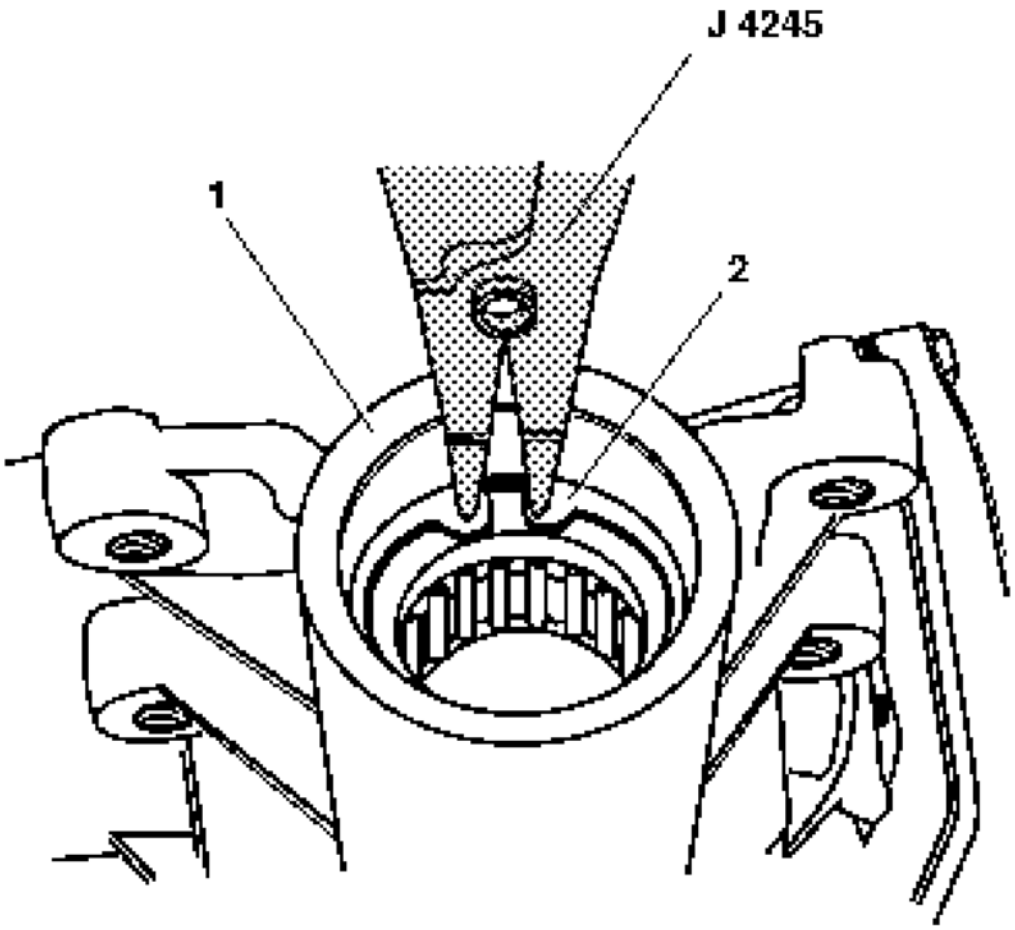


Fig. 110: Pitman Shaft Retaining Ring & Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

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 gearing housing (1) using pliers **J 4245** . See **Special Tools**.

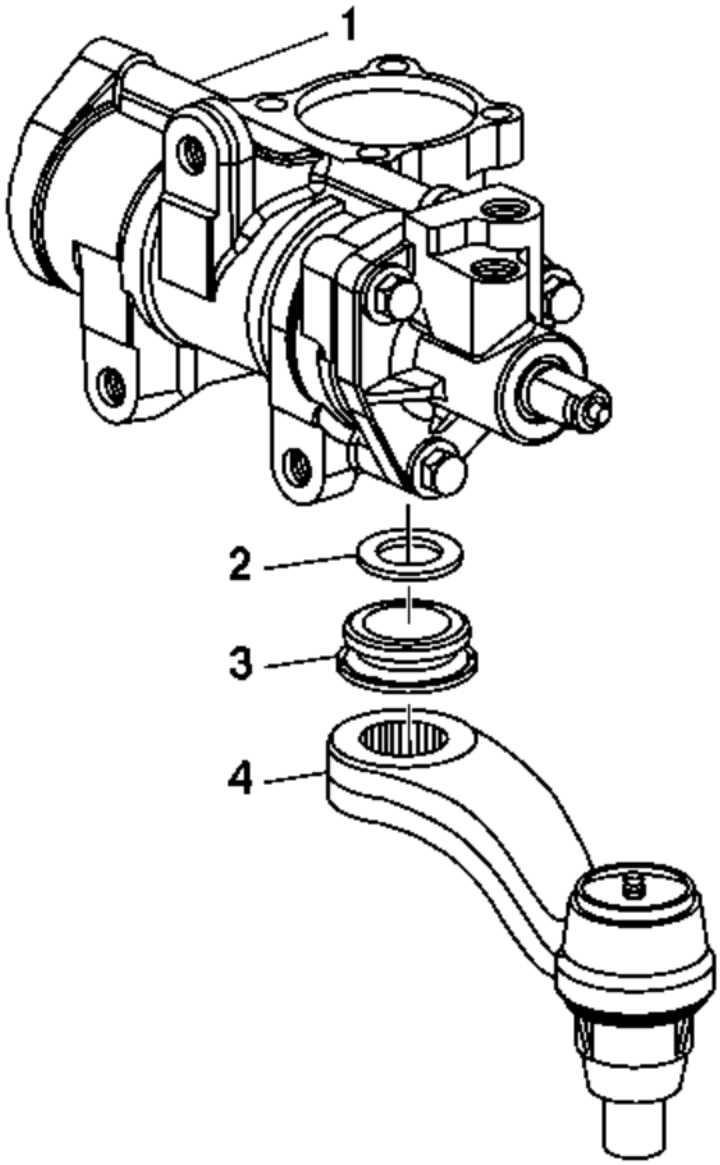


Fig. 111: View Of Pitman Arm, Pitman Shaft Boot, Dust Seal & Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

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 (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.

STUB SHAFT HOUSING REPLACEMENT

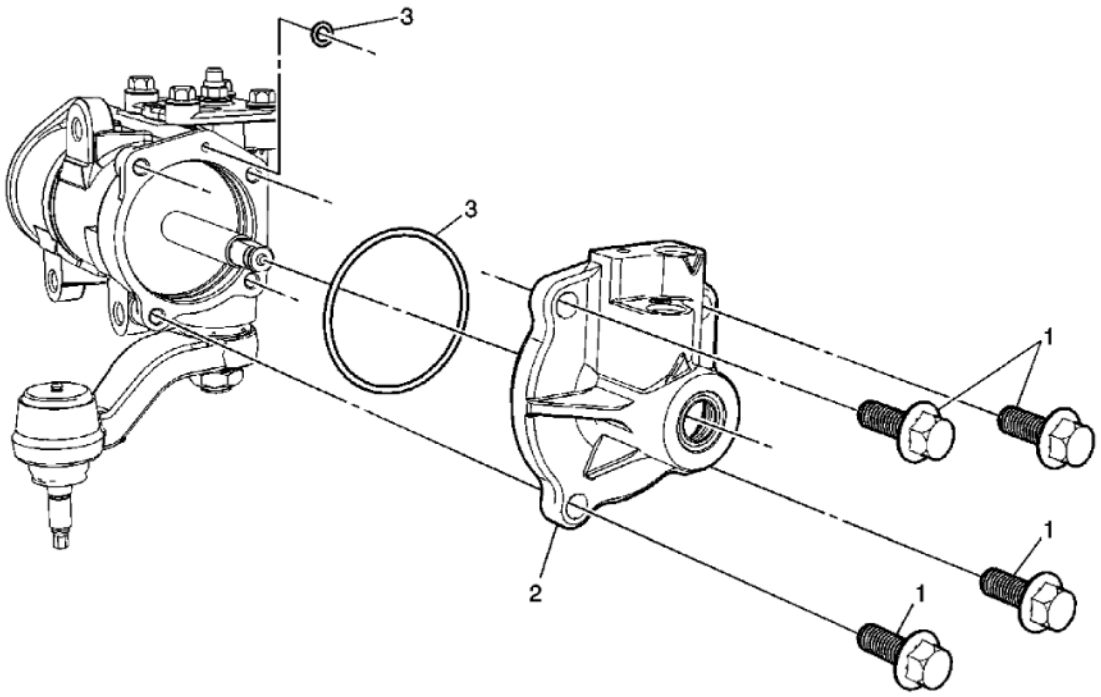


Fig. 112: View Of Stub Shaft Housing, O-Ring & Bolt
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures:	

Remove the power steering gear. Refer to **Steering Gear Replacement (Rack and Pinion)** or **Steering Gear Replacement (Non-Rack and Pinion)**.	
1	Stub Shaft Housing Bolt (Qty: 4) **NOTE:** **Refer to Fastener Notice .** **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

1. Remove the engine shield. Refer to **Engine Shield Replacement** .
2. Place drain pans under the vehicle as needed.
3. Remove as much power steering fluid from the power steering fluid reservoir as possible.

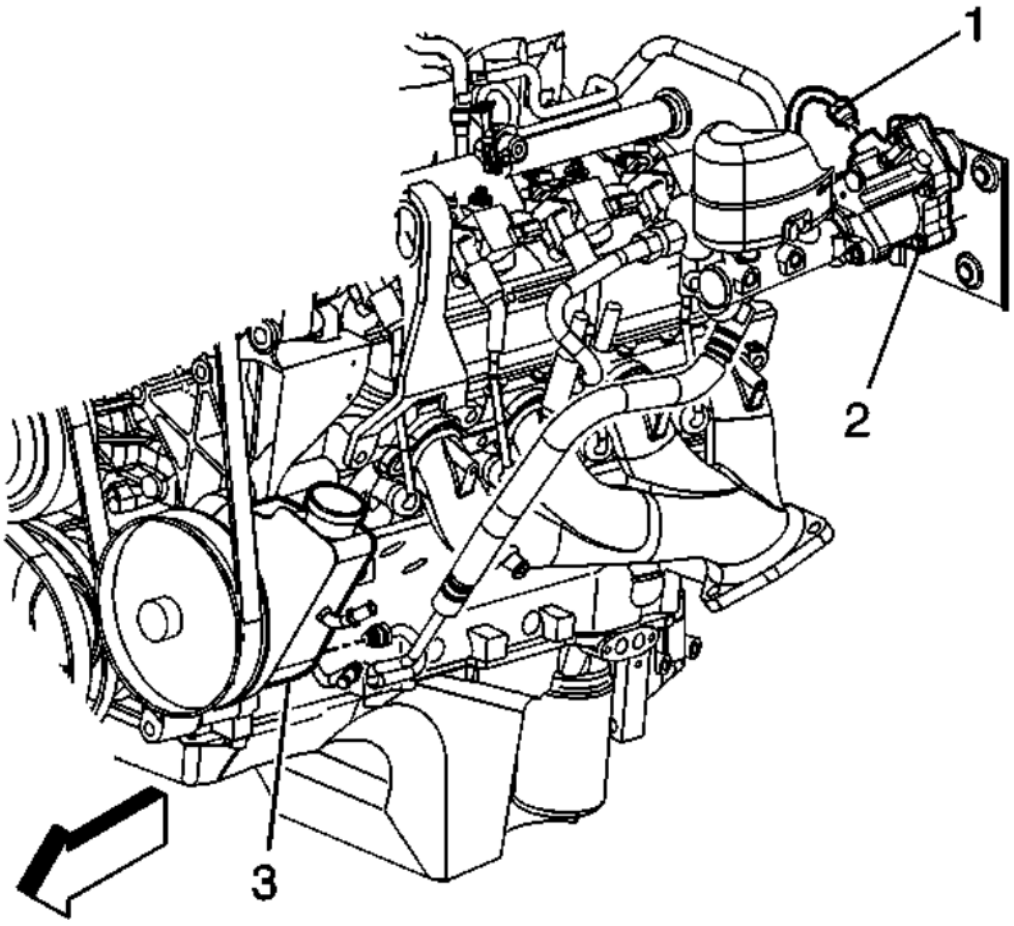


Fig. 113: Power Brake Booster Inlet Hose
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE .

4. Disconnect the power brake booster inlet hose from the power steering pump (3).
5. Disconnect the power brake booster inlet hose (1) from the power brake booster (2).
6. Remove the power brake booster inlet hose (1) from the vehicle.

Installation Procedure

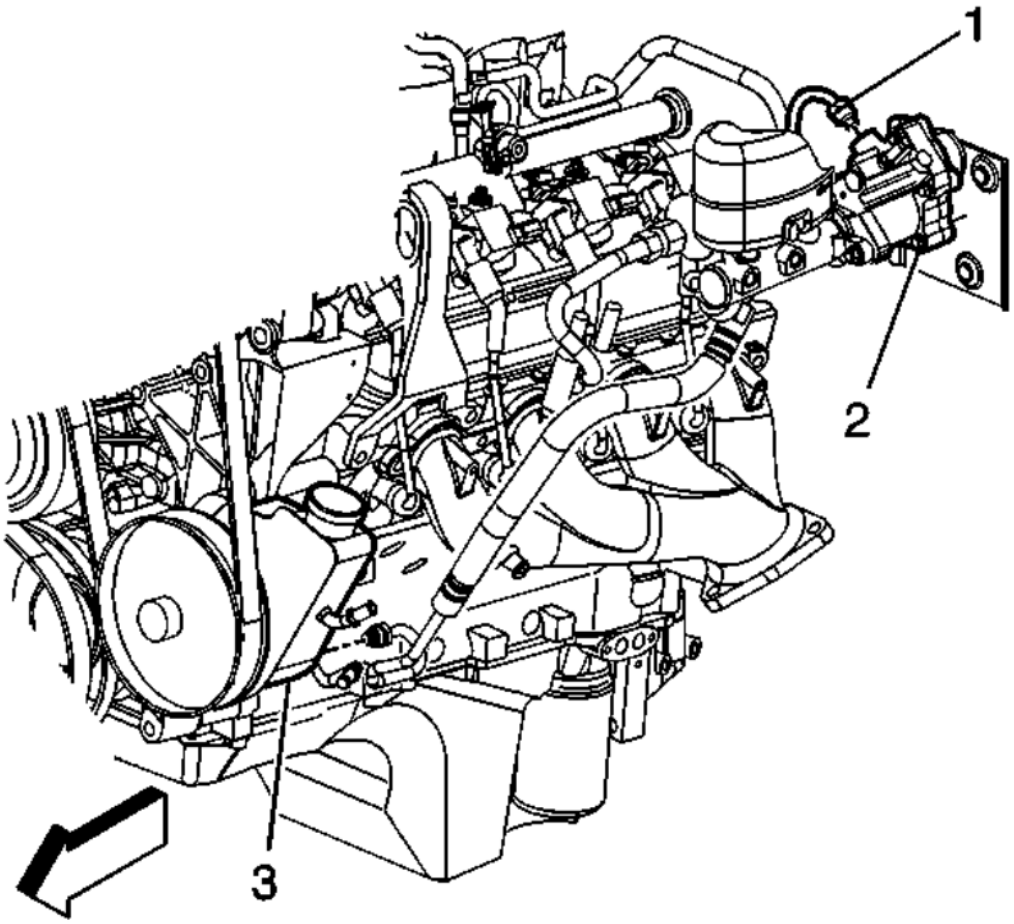


Fig. 114: Power Brake Booster Inlet Hose
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE .

1. Install the power brake booster inlet hose (1) to the vehicle.

NOTE: Refer to Fastener Notice .

IMPORTANT: Start both power brake booster inlet hose fittings by hand before finalizing torques.

2. Connect the power brake booster inlet hose (1) to the power brake booster (2).

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

3. Connect the power brake booster inlet hose (1) to the power steering pump (3).

   Tighten: Tighten the fitting to 32 N.m (24 lb ft).

4. Clean any excess fluid from the vehicle and remove the drain pans.
5. Install the engine shield. Refer to **Engine Shield Replacement** .
6. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER BRAKE BOOSTER OUTLET HOSE REPLACEMENT

Removal Procedure

1. Place drain pans under the vehicle as needed.
2. Remove as much power steering fluid from the power steering fluid reservoir as possible.

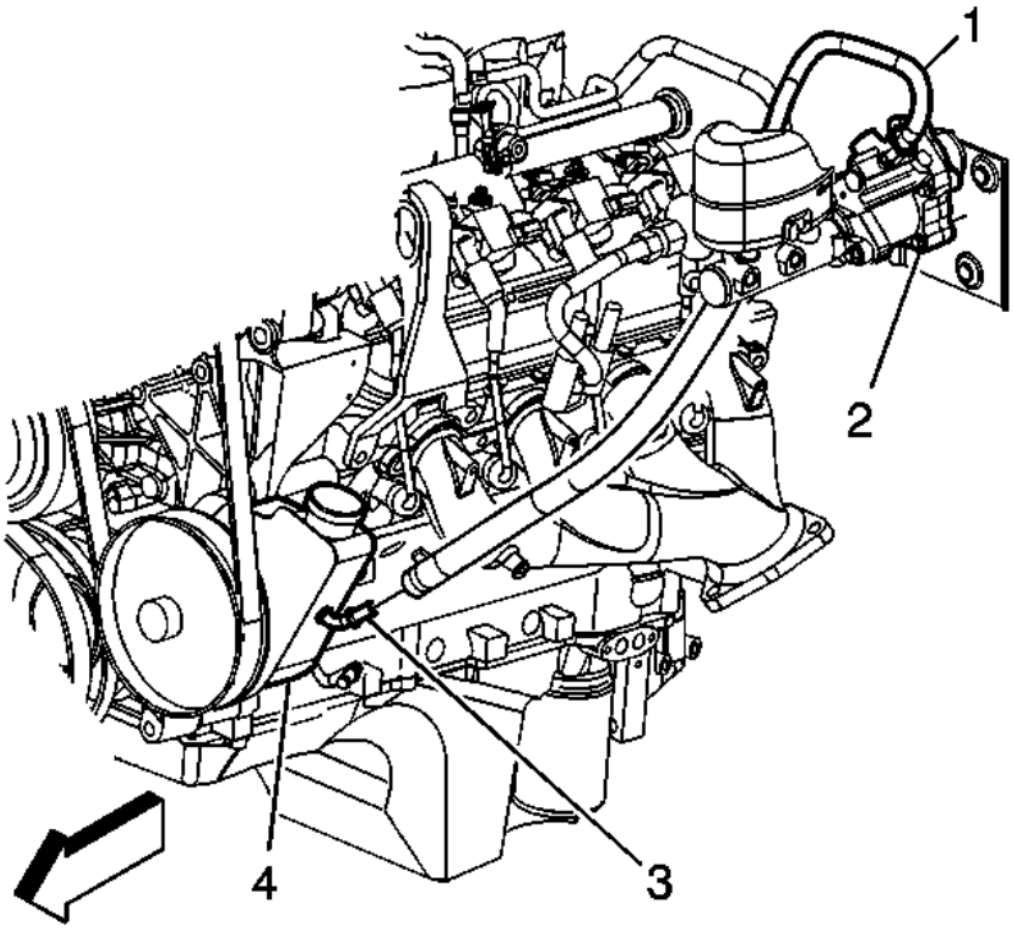


Fig. 115: Power Brake Booster Outlet Hose
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE .

3. Disconnect the power brake booster outlet hose (1) from the power brake booster (2).
4. Disconnect the power brake booster outlet hose (1) from the power steering fluid reservoir (3).
5. Remove the power brake booster outlet hose (1) from the vehicle.

Installation Procedure

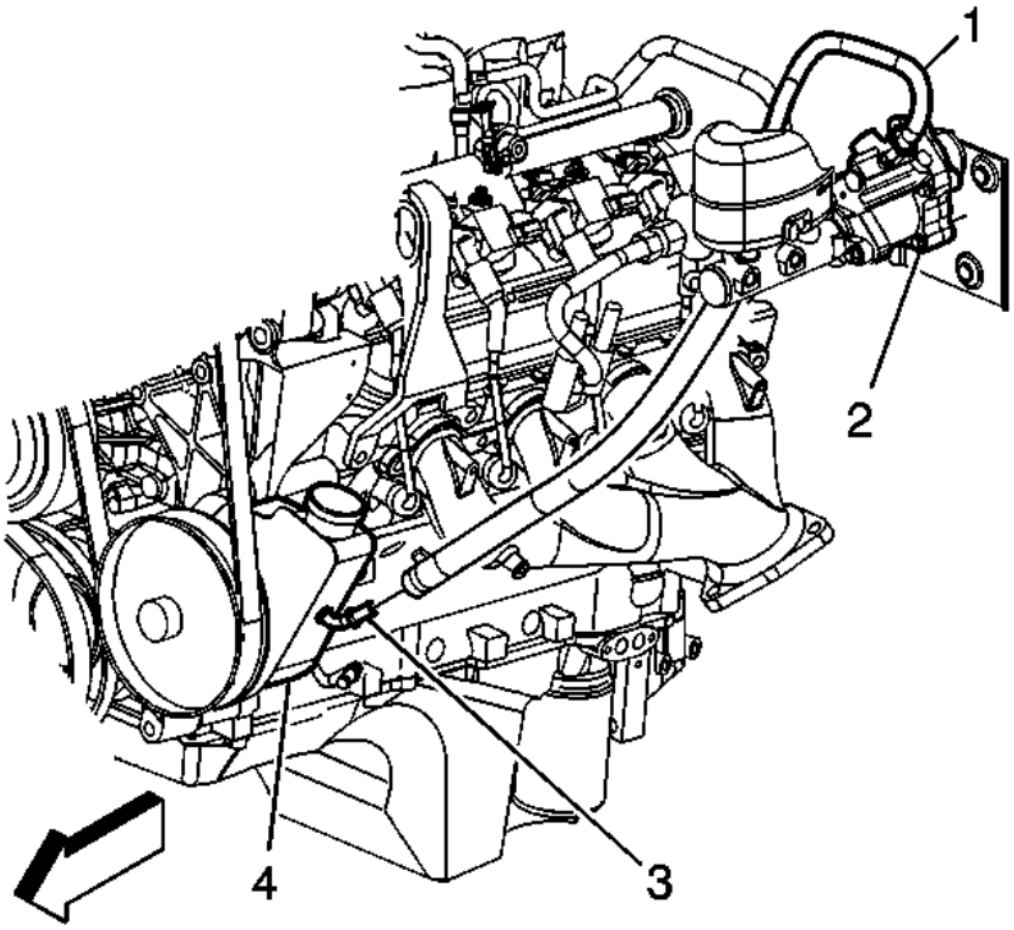


Fig. 116: Power Brake Booster Outlet Hose
Courtesy of GENERAL MOTORS CORP.

NOTE: The inlet and outlet hoses must not be twisted during installation. Do not bend or distort the inlet or outlet hoses to make installation easier. Failure to follow these procedures could result in component damage.

1. Install the power brake booster outlet hose (1) to the vehicle.
2. Connect the power brake booster outlet hose (1) to the power steering fluid reservoir (3).
3. Connect the power brake booster outlet hose (1) to the power brake booster (2).

4. Clean any excess fluid from the vehicle and remove the drain pans.
5. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

DESCRIPTION AND OPERATION

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 pump is belt-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.

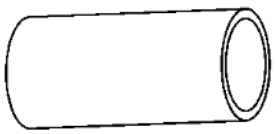
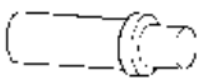
The power steering return hose returns fluid from the power steering gear back to the power steering fluid reservoir. The power steering return line may contain an integral fin-type or line-type power steering fluid cooler.

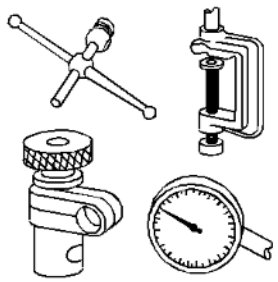
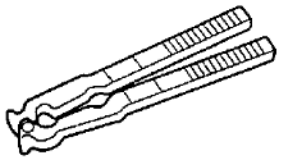
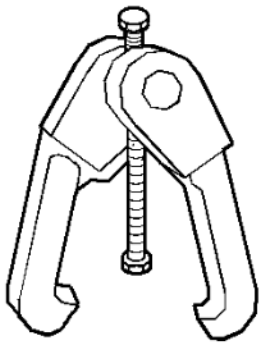
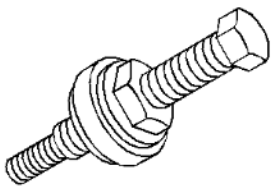
In a typical power steering system, a pump generates hydraulic pressure, causing fluid to flow, via the pressure hose, to the steering gear valve assembly. The steering gear valve assembly regulates the incoming fluid to the right and left chambers in order to assist in right and left turns.

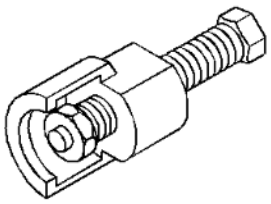
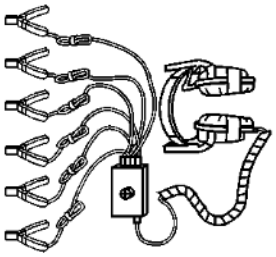
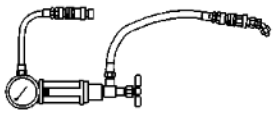
Turning the steering wheel activates the valve assembly, which applies greater fluid pressure and flow to 1 side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front wheels, which turn the vehicle right or left.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 4245 Internal Snap Ring Pliers
	J 6219 Pitman Shaft Seal Installer
	J 6278 Bearing Remover and Installer

	J 8001 Dial Indicator Set
	J 22610 Keystone Clamp Pliers
	J 24319-B Steering Linkage and Tie Rod Puller
	J 25033-C Pulley Installer

	J 25034-C Pulley Remover
	J 39570 Chassis Ear
	J 42640 Steering Column Anti-Rotation Pin
	J 44586 Power Steering Gear Oil Seal Remover/Installer
	J 44721 Power Steering Analyzer