

## 2004 STEERING

### Power Steering System - Hummer H2

## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

#### Fastener Tightening Specifications

Application	Specification	
	Metric	English
Adjuster Lock Nut	44 N.m	32 lb ft
Ball Guide Clamp Screws	6 N.m	53 lb in
Coupling Shield Retainer and Lock Nut	109 N.m	80 lb ft
Pitman Arm to Steering Gear Nut	250 N.m	184 lb ft
Power Steering Cooler Mounting Bolts	5 N.m	44 lb in
Power Steering Gear To Frame Bolts	150 N.m	111 lb ft
Power Steering Pump Bracket Retaining Nuts	50 N.m	37 lb ft
Power Steering Pump Connector and Fitting Assembly	75 N.m	55 lb ft
Power Steering Pump Front Mounting Bolts	50 N.m	37 lb ft
Power Steering Pump Mounting Studs	54 N.m	44 lb ft
Power Steering Pump Rear Mounting Bolt	50 N.m	37 lb ft
Pressure Hose Connections - Threaded	28 N.m	21 lb ft
Rack Piston Plug	150 N.m	111 lb ft
Steering Gear Side Cover Bolts	60 N.m	45 lb ft
Worm Thrust Preload Adjustment Nut	30 N.m	22 lb ft

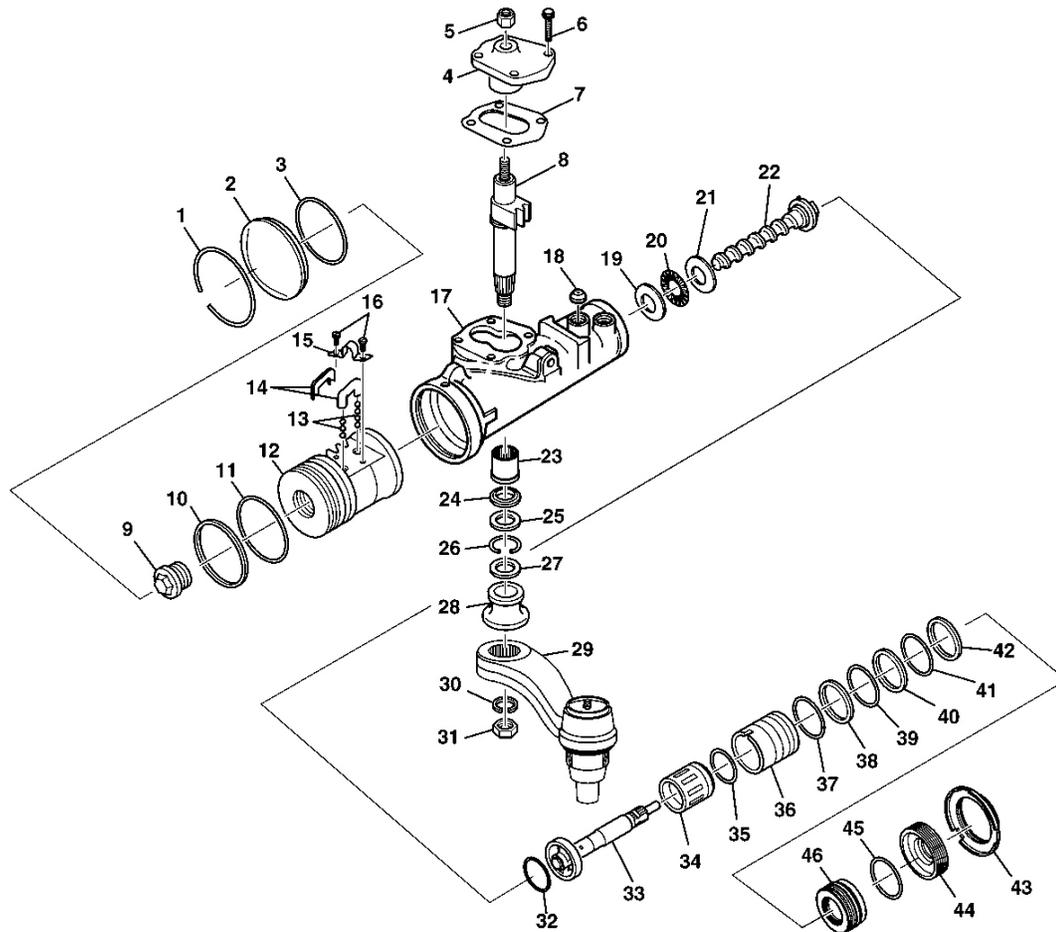
### POWER STEERING PUMP SPECIFICATIONS

#### Power Steering Pump Specifications

Engine Code	Engine Size	High Flow (Liters per Minute)	High Flow (Gallons per Minute)	Pressure Relief (kPa)	Pressure Relief (PSI)
LQ4	6.0L	15.9/17.7	3.5/3.9	9825/10514	1425/1525

## COMPONENT LOCATOR

### POWER STEERING GEAR COMPONENT VIEWS (700 GEAR)



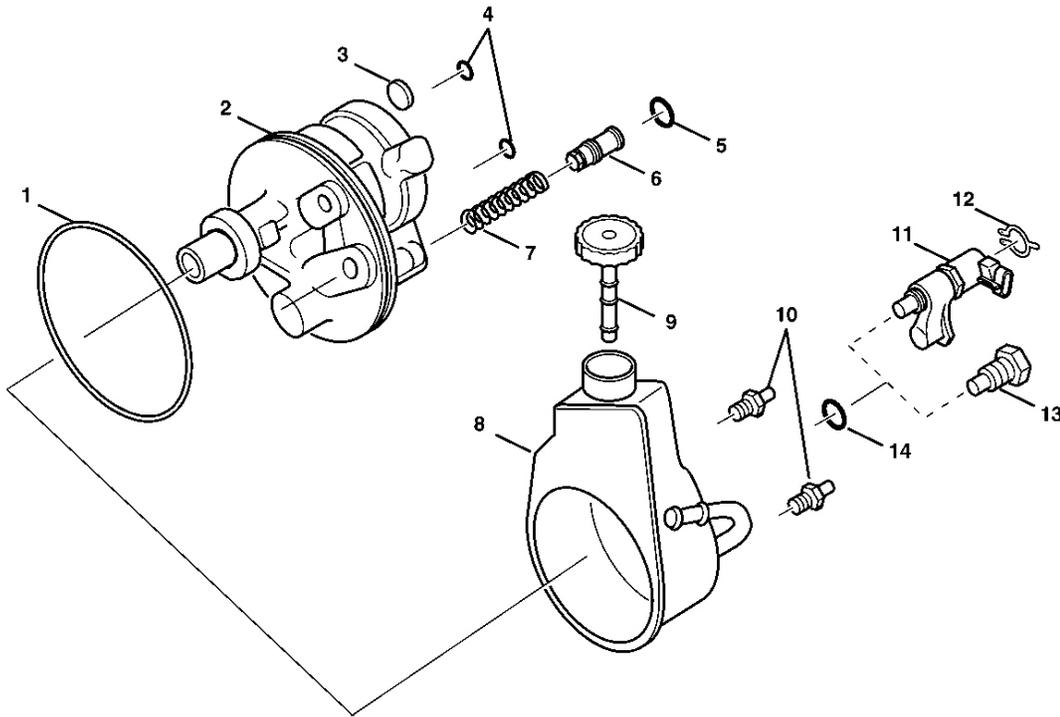
**Fig. 1: Power Steering Gear Component Views**  
 Courtesy of GENERAL MOTORS CORP.

**Callouts For Fig. 1**

Callout	Component Name
1	Retaining Ring
2	Plug
3	O-ring Seal
4	Side Cover
5	Adjuster Lock Nut
6	Bolt
7	Gasket
8	Pitman Shaft
9	Steering Gear Housing End Plug
10	Teflon Ring

11	O-ring Seal
12	Rack Piston
13	Balls
14	Ball Guide
15	Clamp
16	Screw
17	Housing
18	Check Valve
19	Flat Race
20	Thrust Bearing
21	Flat Race
22	Worm Shaft
23	Needle Bearing
24	Pitman Shaft Seal
25	Backup Washer
26	Retaining Ring
27	Dust Seal
28	Pitman Shaft Boot
29	Pitman Shaft Arm
30	Lock Washer
31	Nut
32	Seal
33	Stub Shaft
34	Valve Spool
35	Seal
36	Valve Body
37	O-ring Seal
38	Valve Body Ring
39	O-ring Seal
40	Valve Body Ring
41	O-ring Seal
42	Valve Body Ring
43	Coupling Shield Retainer and Lock Nut
44	Adjuster Nut Assembly
45	O-ring Seal
46	Thrust Support Assembly

**POWER STEERING PUMP COMPONENT VIEWS (REGULAR)**



**Fig. 2: Power Steering Pump Component Views**  
 Courtesy of GENERAL MOTORS CORP.

**Callouts For Fig. 2**

Callout	Component Name
1	O-ring Seal
2	Hydraulic Pump Housing Assembly
3	Magnet
4	O-ring Seals
5	Rectangular Section Seal
6	Control Valve
7	Flow Control Spring
8	Reservoir Assembly
9	Reservoir Capstick
10	Pump Mounting Studs
11	Variable Assist Steering Actuator
12	Retaining Ring
13	Connector and Fitting Assembly
14	O-ring Seal

# DIAGNOSTIC INFORMATION AND PROCEDURES

## DIAGNOSTIC STARTING POINT - POWER STEERING SYSTEM

Begin the system diagnosis by reviewing the 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

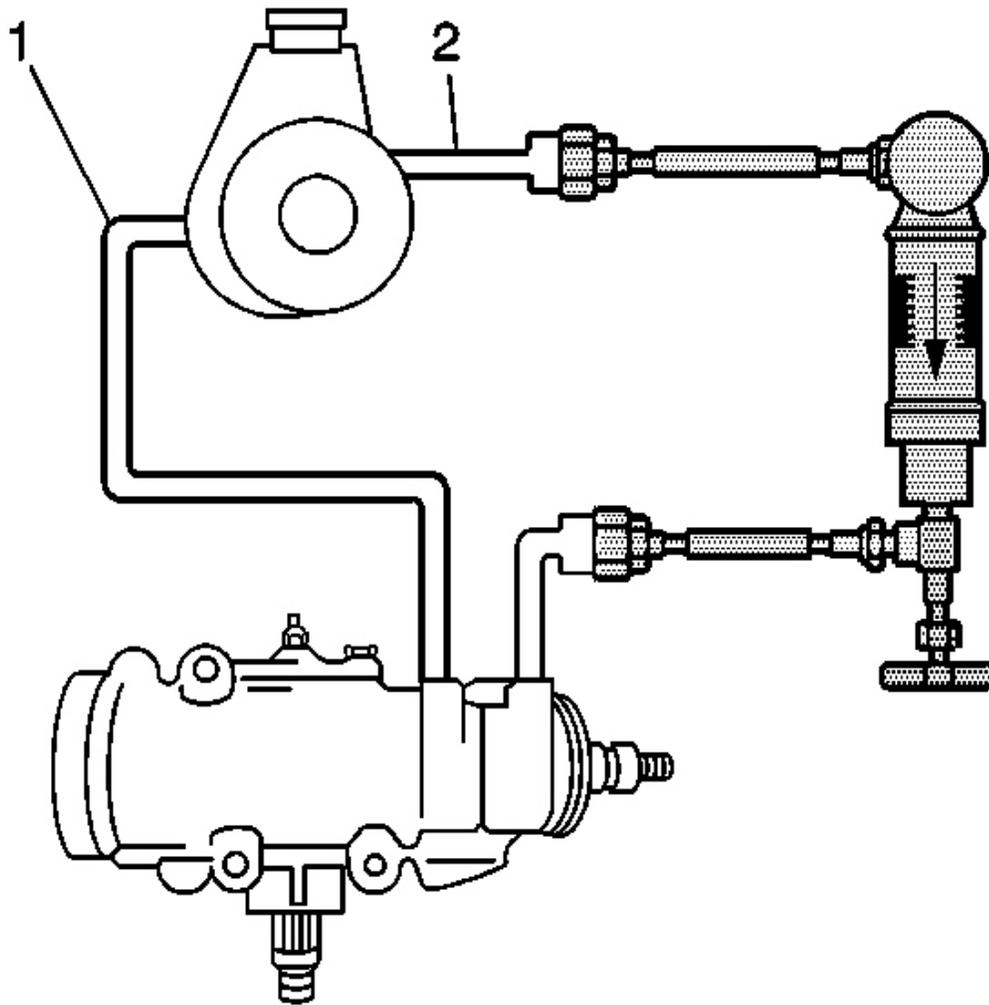
- Inspect for aftermarket devices which could affect the operation of the power steering system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the power steering reservoir for the proper power steering fluid level and condition.

### 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**
- **Steering Effort Hard in One or Both Directions**
- **Steering Effort Too Easy in One or Both Directions**

## POWER STEERING SYSTEM TEST PROCEDURE



**Fig. 3: Recirculating Ball System**  
 Courtesy of GENERAL MOTORS CORP.

**Callouts For Fig. 3**

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
- The power steering pipes 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.

### Power Steering System Test Procedure

Step	Action	Value (s)	Yes	No
<p>DEFINITION: The Power Steering System Test Procedure will perform the following functions:</p> <ul style="list-style-type: none"> <li>• Test the operation of the hydraulic power steering system.</li> <li>• Test the operation of the power steering pump and power steering gear.</li> <li>• Identify restrictions in the system.</li> </ul>				
1	<p>Inspect the power steering fluid for the following indications of contamination:</p> <ul style="list-style-type: none"> <li>• Milky fluid - water</li> <li>• Brown fluid - burnt</li> <li>• Debris in fluid - plastic or dirt</li> </ul> <p>Is the fluid free of contamination?</p>	-	Go to Step 3	Go to Step 2
2	<p>Flush the power steering system. Refer to <b>Flushing the Power Steering System</b> .</p> <p>Did you complete the procedure?</p>	-	Go to Step 3	-
3	<p><b>IMPORTANT:</b></p> <p><b>In order to accurately diagnose the system, the malfunction must be present during the test procedure.</b></p> <p>Attempt to duplicate the condition. Is the condition present?</p>	-	Go to Step 4	System OK
4	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to the OFF position.</li> <li>2. Place a drain pan under the vehicle in order to catch any power steering fluid.</li> <li>3. Disconnect the power steering pressure pipe/hose from the power steering pump or the power steering gear as necessary.</li> <li>4. Install the <b>J 44721</b> Power Steering System Analyzer. See <b>Special Tools and Equipment</b> .</li> <li>5. Fill the power steering system. Refer to <b>Checking and Adding</b></li> </ol>	-		

<b><u>Power Steering Fluid</u></b>				
	Did you complete the installation?		Go to <b>Step 5</b>	-
5	<ol style="list-style-type: none"> <li>1. Fully open the <b>J 44721</b> valve. See <b><u>Special Tools and Equipment</u></b>.</li> <li>2. Start the engine.</li> </ol> <p><b>NOTE:</b> <b>Refer to Steering Wheel in the Full Turn Position Notice in Cautions and Notices.</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>4. Inspect and ensure that all of the power steering pipe/hose connections are not leaking.</li> <li>5. Observe the pressure reading.</li> </ol>	1379 kPa (230 psi)	Go to <b>Step 6</b>	Go to <b>Step 7</b>
	Is the pressure reading greater than the specified value?		<b>Step 6</b>	<b>Step 7</b>
6	<p><b>IMPORTANT:</b> <b>A restriction may be present in the power steering system. Turn off the engine IMMEDIATELY.</b></p> <p>Locate and repair the restriction. Did you complete the repair?</p>	-	Go to <b>Step 18</b>	-
7	<ol style="list-style-type: none"> <li>1. Allow the engine to run until the engine reaches full operating temperature.</li> <li>2. Record the pressure reading and flow reading.</li> <li>3. Partially close the <b>J 44721</b> valve until the system pressure reaches the specified value, then record the FLOW reading. See <b><u>Special Tools and Equipment</u></b>.</li> <li>4. Subtract second flow reading from the first flow reading.</li> </ol>	4827 kPa (700 psi)	Go to <b>Step 13</b>	Go to <b>Step 8</b>
	Is the flow DECREASE greater than 3.8 L (1 gal) per minute?		<b>Step 13</b>	<b>Step 8</b>
8	<p><b>NOTE:</b> <b>Do not leave the valve fully closed for more than 5 seconds, or the pump could be damaged internally.</b></p> <p>Fully close then open the <b>J 44721</b> valve 3 times. Record all of the high pressure readings. Refer to <b><u>Power Steering Pump Specifications</u></b> for power steering system pressure relief specifications. See <b><u>Special Tools and Equipment</u></b>. Are the three high pressure readings within specifications?</p>	-	Go to <b>Step 9</b>	Go to <b>Step 15</b>
9	Are the three high pressure readings within 245 kPa (50 psi) of each	-	Go to	Go to

	other?		Step 10	Step 14
10	<p>1. Increase the engine speed to approximately 1500 RPM.</p> <p>2. Record the flow reading. Refer to <b>Power Steering Pump Specifications</b> for power steering system pressure specifications.</p> <p>Is the actual flow reading within specifications?</p>	-	Go to <b>Step 11</b>	Go to <b>Step 13</b>
11	<p>Is the difference between the actual flow reading and the maximum flow specification more than 3.8 L (1 gal) per minute?</p>	-	Go to <b>Step 16</b>	Go to <b>Step 12</b>
12	<p><b>NOTE:</b> <b>Refer to Steering Wheel in the Full Turn Position Notice in Cautions and Notices.</b></p> <p>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?</p>	-	Go to <b>Step 18</b>	Go to <b>Step 17</b>
13	<p>Replace the power steering pump. Refer to <b>Power Steering Pump Replacement</b> .</p> <p>Did you complete the replacement?</p>	-	Go to <b>Step 18</b>	-
14	<p>1. Remove the power steering pump flow control valve. Refer to <b>Power Steering Pump Flow Control Valve Replacement - Off Vehicle (Regular)</b> .</p> <p>2. Inspect the flow control valve.</p> <p>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 <b>Power Steering Pump Flow Control Valve Replacement - Off Vehicle (Regular)</b> .</p> <p>3. Inspect the flow control valve bore.</p> <p>If any burrs or scratches are present in the control valve bore, replace the power steering pump. Refer to <b>Power Steering Pump Replacement</b> .</p> <p>Did you complete the repair?</p>	-	Go to <b>Step 18</b>	-
15	<p>Replace the power steering pump flow control valve. Refer to <b>Power Steering Pump Flow Control Valve Replacement - Off Vehicle (Regular)</b> .</p> <p>Did you complete the replacement?</p>	-	Go to <b>Step 18</b>	-
16	<p>1. Remove the power steering pump flow control valve and inspect for any wear or damage. Do NOT disassemble the flow control valve.</p> <p>2. If the flow control valve is worn damaged, replace the flow control valve. Refer to <b>Power Steering Pump Flow Control Valve</b></p>	-		

<b><u>Replacement - Off Vehicle (Regular) .</u></b>				
	Did you complete the repair?		<b>Go to Step 18</b>	-
17	The power steering gear is leaking across the piston or bypassing the valve circuit. Replace the power steering gear. Refer to <b><u>Power Steering Gear Replacement</u></b> . Did you complete the replacement?	-	<b>Go to Step 18</b>	-
18	Test the power steering system for the original condition. Does the original condition still exist?	-	<b>Go to Step 5</b>	<b>Go to Step 19</b>
19	1. Disconnect and remove the <b>J 44721</b> from the vehicle. See <b><u>Special Tools and Equipment</u></b> . 2. Connect the vehicle power steering pipes/hoses. 3. Bleed the power steering system and add fluid as necessary. Refer to <b><u>Bleeding the Power Steering System</u></b> .  Did you complete the repair?	-	System OK	-

## **POWER STEERING FLUID LEAKS**

### **Power Steering Fluid Leaks**

<b>Step</b>	<b>Action</b>	<b>Yes</b>	<b>No</b>
1	Did you review the Power Steering System General Description and perform the necessary inspections?	<b>Go to Step 2</b>	<b>Go to <u>Symptoms - Power Steering System</u></b>
2	Verify that power steering fluid leaks are present. Is the power steering system leaking?	<b>Go to Step 3</b>	System OK
3	Inspect the power steering system fittings. Are the fittings leaking?	<b>Go to Step 9</b>	<b>Go to Step 4</b>
4	Inspect the power steering hoses. Are the hoses leaking?	<b>Go to Step 10</b>	<b>Go to Step 5</b>
5	Inspect the power steering pump and the reservoir for leaks. Is the power steering pump or reservoir leaking?	<b>Go to Step 11</b>	<b>Go to Step 6</b>
6	Inspect the power steering gear for leaks. Is the power steering gear leaking?	<b>Go to Step 12</b>	<b>Go to Step 7</b>
7	Inspect the hydraulic brake booster assembly for leaks. Is the hydraulic brake booster assembly leaking?	<b>Go to Step 13</b>	<b>Go to Step 8</b>
8	Inspect the power steering cooler for leaks. Is the power steering cooler leaking?	<b>Go to Step 14</b>	<b>Go to Step 3</b>
9	Tighten the fittings. Refer to <b><u>Fastener Tightening Specifications</u></b> . Did you complete the repair?	<b>Go to Step 15</b>	-
	Replace the power steering hoses. Refer to the appropriate procedure(s):		

10	<ul style="list-style-type: none"> <li>• <b><u>Power Steering Cooler Replacement</u></b></li> <li>• <b><u>Power Steering Gear Inlet Pipe/Hose Replacement</u></b></li> <li>• <b><u>Power Brake Booster Inlet Hose Replacement</u></b></li> <li>• <b><u>Power Brake Booster Outlet Hose Replacement</u></b></li> </ul> <p>Did you complete the repair?</p>	Go to <b>Step 15</b>	-
11	<p>Replace the power steering pump or reservoir. Refer to <b><u>Power Steering Pump Replacement</u></b> or <b><u>Power Steering Reservoir Replacement - Off Vehicle</u></b> .</p> <p>Did you complete the repair?</p>	Go to <b>Step 15</b>	-
12	<p>Replace the power steering gear. Refer to <b><u>Power Steering Gear Replacement</u></b> .</p> <p>Did you complete the repair?</p>	Go to <b>Step 15</b>	-
13	<p>Replace the hydraulic brake booster assembly. Refer to <b><u>Hydraulic Brake Booster Replacement</u></b> in Hydraulic Brakes.</p> <p>Did you complete the repair?</p>	Go to <b>Step 15</b>	-
14	<p>Replace the power steering cooler. Refer to <b><u>Power Steering Cooler Replacement</u></b> .</p> <p>Did you complete the repair?</p>	Go to <b>Step 15</b>	-
15	<p>Operate the system in order to verify the repair.</p> <p>Did you correct the condition?</p>	System OK	Go to <b>Step 3</b>

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

### **Rattle, Clunk, or Shudder Noise from the Power Steering System**

<b>Step or</b>	<b>Action</b>	<b>Yes</b>	<b>No</b>
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to <b>Step 2</b>	Go to <b><u>Symptoms - Power Steering System</u></b>
2	Verify that a rattle, clunk or shudder noise is present. Is a rattle, clunk or shudder noise present?	Go to <b>Step 3</b>	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 <b>Step 11</b>	Go to <b>Step 4</b>
4	Inspect the engine drive belt for cracking or excessive wear. Refer to <b><u>Drive Belt Replacement - Accessory</u></b> in Engine Mechanical. Is the drive belt cracked or excessively worn?	Go to <b>Step 12</b>	Go to <b>Step 5</b>
5	Inspect the power steering pump pulley for damage. Is the power steering pump pulley damaged?	Go to <b>Step 13</b>	Go to <b>Step 6</b>
6	Inspect the power steering pump and the power steering mounting bracket/brace for the proper installation. Refer to <b><u>Power Steering Pump Replacement</u></b> . Is the power steering pump installation incorrect?	Go to <b>Step 14</b>	Go to <b>Step 7</b>

7	Inspect the power steering gear for the proper installation. Refer to <b><u>Power Steering Gear Replacement</u></b> . Is the power steering gear installation incorrect?	Go to <b>Step 15</b>	Go to <b>Step 8</b>
8	Inspect the steering linkage. Refer to <b><u>Steering Linkage Inspection</u></b> in Steering Linkage. Is the steering linkage worn?	Go to <b>Step 17</b>	Go to <b>Step 9</b>
9	Inspect the suspension. Is the suspension worn?	Go to <b>Step 17</b>	Go to <b>Step 10</b>
10	Inspect the intermediate shaft. Is the intermediate shaft worn?	Go to <b>Step 18</b>	Go to <b>Step 3</b>
11	Adjust or replace the hoses. Refer to the appropriate procedure(s): <ul style="list-style-type: none"> <li>• <b><u>Power Steering Cooler Replacement</u></b></li> <li>• <b><u>Power Steering Gear Inlet Pipe/Hose Replacement</u></b></li> <li>• <b><u>Power Brake Booster Inlet Hose Replacement</u></b></li> <li>• <b><u>Power Brake Booster Outlet Hose Replacement</u></b></li> </ul> Did you complete the repair?	Go to <b>Step 19</b>	-
12	Replace the engine drive belt. Refer to <b><u>Drive Belt Replacement - Accessory</u></b> in Engine Mechanical. Did you complete the repair?	Go to <b>Step 19</b>	-
13	Replace the power steering pump pulley. Refer to <b><u>Power Steering Pulley Replacement</u></b> . Did you complete the repair?	Go to <b>Step 19</b>	-
14	Install the power steering pump correctly. Refer to <b><u>Power Steering Pump Replacement</u></b> . Did you complete the repair?	Go to <b>Step 19</b>	-
15	Install the power steering gear correctly. Refer to <b><u>Power Steering Gear Replacement</u></b> . Did you complete the repair?	Go to <b>Step 19</b>	-
16	Replace the worn steering linkage. Refer to <b><u>Steering Linkage Inspection</u></b> in Steering Linkage. Did you complete the repair?	Go to <b>Step 19</b>	-
17	Replace the worn suspension components. Refer to <b><u>Diagnostic Starting Point - Suspension General Diagnosis</u></b> in Suspension General Diagnosis. Did you complete the repair?	Go to <b>Step 19</b>	-
18	Replace the intermediate shaft. Refer to <b><u>Intermediate Steering Shaft Replacement - Upper</u></b> or <b><u>Intermediate Steering Shaft Replacement - Lower</u></b> in Steering Wheel and Column. Did you complete the repair?	Go to <b>Step 19</b>	-
19	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <b>Step 3</b>

## WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM

### Whine or Growl 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 <b>Step 2</b>	Go to <b>Symptoms - Power Steering System</b>
2	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to <b>Step 3</b>	System OK
3	Perform the power steering test procedure in order to diagnose a hydraulic condition and repair or replace a component. Refer to <b>Power Steering System Test Procedure</b> . Is there a hydraulic problem in the system?	Go to <b>Step 12</b>	Go to <b>Step 4</b>
4	Inspect the power steering gear for a whine or growl noise using <b>J 39570</b> . Is the noise present at the power steering gear?	Go to <b>Step 8</b>	Go to <b>Step 5</b>
5	Inspect the power steering pump for a whine or growl noise using <b>J 39570</b> . Is the noise present at the power steering pump?	Go to <b>Step 9</b>	Go to <b>Step 6</b>
6	Inspect the power steering hoses for a whine or growl noise using <b>J 39570</b> . Is the noise present at the power steering hoses?	Go to <b>Step 10</b>	Go to <b>Step 7</b>
7	Inspect the hydraulic brake booster for a whine or growl noise using <b>J 39570</b> . Is the noise present at the hydro boost?	Go to <b>Step 11</b>	Go to <b>Step 3</b>
8	Replace the power steering gear. Refer to <b>Power Steering Gear Replacement</b> . Did you complete the repair?	Go to <b>Step 12</b>	-
9	Replace the power steering pump. Refer to <b>Power Steering Pump Replacement</b> . Did you complete the repair?	Go to <b>Step 12</b>	-
10	Adjust the routing of the power steering hoses. Did you complete the repair?	Go to <b>Step 12</b>	-
11	Diagnose the hydraulic brake booster. Refer to <b>Hydraulic Brake Assist System Noise Inspection</b> in Hydraulic Brakes. Did you correct the condition?	Go to <b>Step 12</b>	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <b>Step 3</b>

## STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS

### Steering Effort Hard in One or Both Directions

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to <b>Step 2</b>	Go to <b>Symptoms - Power Steering System</b>

2	Verify that the steering effort is hard in one or both directions. Does the system operate normally?	System OK	Go to <b>Step 3</b>
3	Perform the power steering test procedure. Refer to <b>Power Steering System Test Procedure</b> . Did you complete the procedure?	Go to <b>Step 4</b>	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <b>Step 3</b>

## STEERING EFFORT TOO EASY IN ONE OR BOTH DIRECTIONS

### 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 <b>Step 2</b>	Go to <b>Symptoms - Power Steering System</b>
2	Verify that the steering effort is too easy in one or both directions. Does the system operate normally?	System OK	Go to <b>Step 3</b>
3	Perform the power steering test procedure. Refer to <b>Power Steering System Test Procedure</b> . Did you complete the procedure?	Go to <b>Step 4</b>	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <b>Step 3</b>

## REPAIR INSTRUCTIONS

### BLEEDING THE POWER STEERING SYSTEM

#### Tools Required

- **J 35555** Metal Mity Vac. See **Special Tools and Equipment** .
- **J 43485** Power Steering Bleeder Adapter. See **Special Tools and Equipment** .

**NOTE:** If the power steering system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the steering system. The air in the fluid may cause pump cavitation noise and may cause pump damage over a period of time.

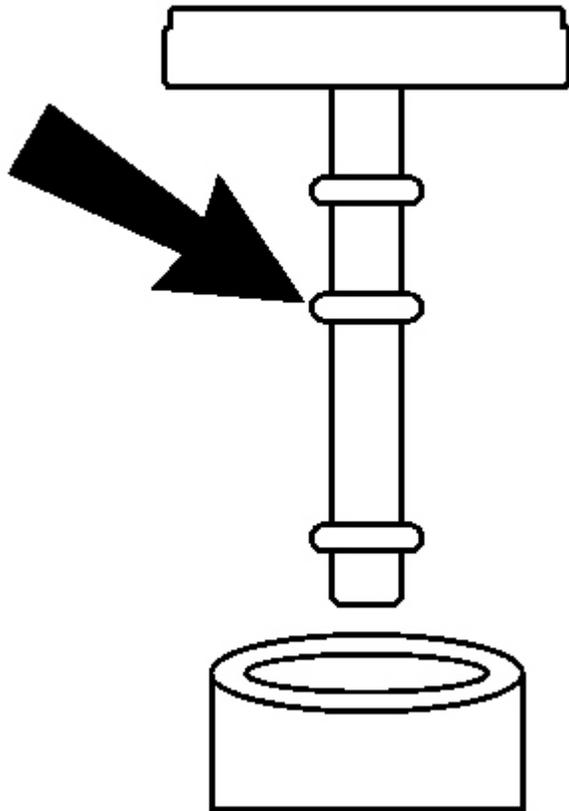
**NOTE:** When adding fluid or making a complete fluid change, always use the proper power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

**IMPORTANT:** Hoses touching the frame, body, or engine may cause system noise.

1. Verify that the hoses do not touch any other part of the vehicle.

**IMPORTANT: Loose connections may not leak, but could allow air into the steering system.**

2. Verify that all hose connections are tight.



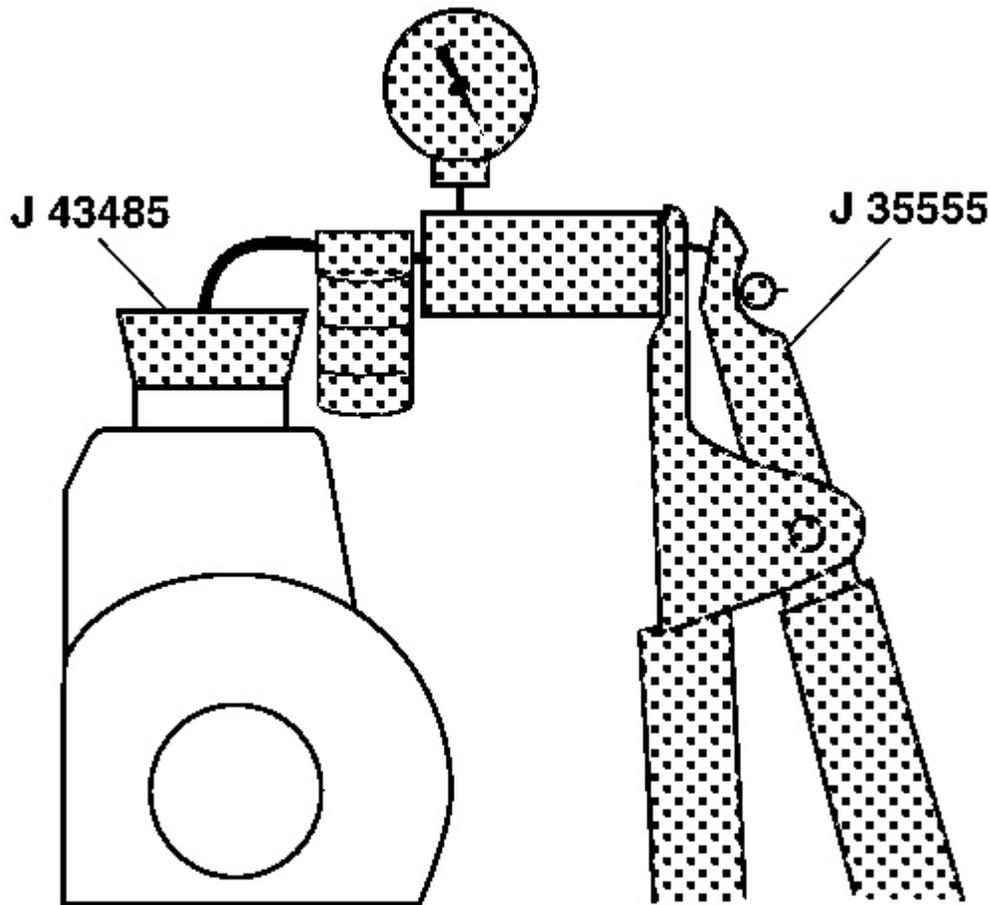
**Fig. 4: Removing Pump Reservoir Cap**  
Courtesy of GENERAL MOTORS CORP.

**IMPORTANT: Maintain the fluid level throughout the bleed procedure.**

3. Remove the pump reservoir cap.

**IMPORTANT: Use clean, new power steering fluid only.**

4. Fill the pump reservoir with fluid to the FULL COLD level.



**Fig. 5: Bleeding Power Steering System**  
Courtesy of GENERAL MOTORS CORP.

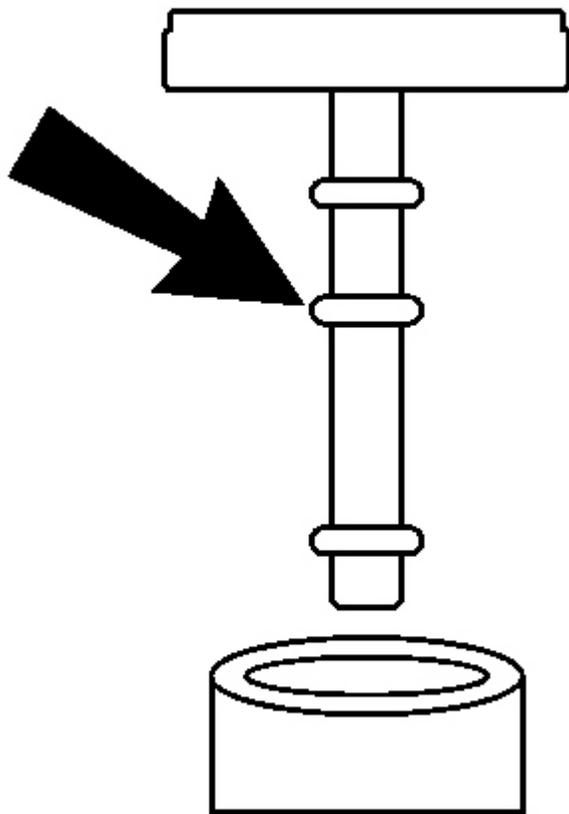
5. Attach the **J 43485** to the **J 35555** or equivalent. See Special Tools and Equipment .
6. Place the **J 43485** on or in the pump reservoir filler neck. See Special Tools and Equipment .
7. Apply a vacuum of 68 kPa (20 in Hg) maximum.
8. Wait 5 minutes.

Typical vacuum drop is 7-10 kPa (2-3 in Hg). If the vacuum does not remain steady, refer to Excessive Vacuum Drop Diagnosis at the end of this procedure.

9. Remove the **J 43485** and the **J 35555** . See **Special Tools and Equipment** .
10. Reinstall the pump reservoir cap.
11. Start the engine. Allow the engine to idle.
12. Turn off the engine.
13. Verify the fluid level. Repeat steps 11-13 until the fluid stabilizes.

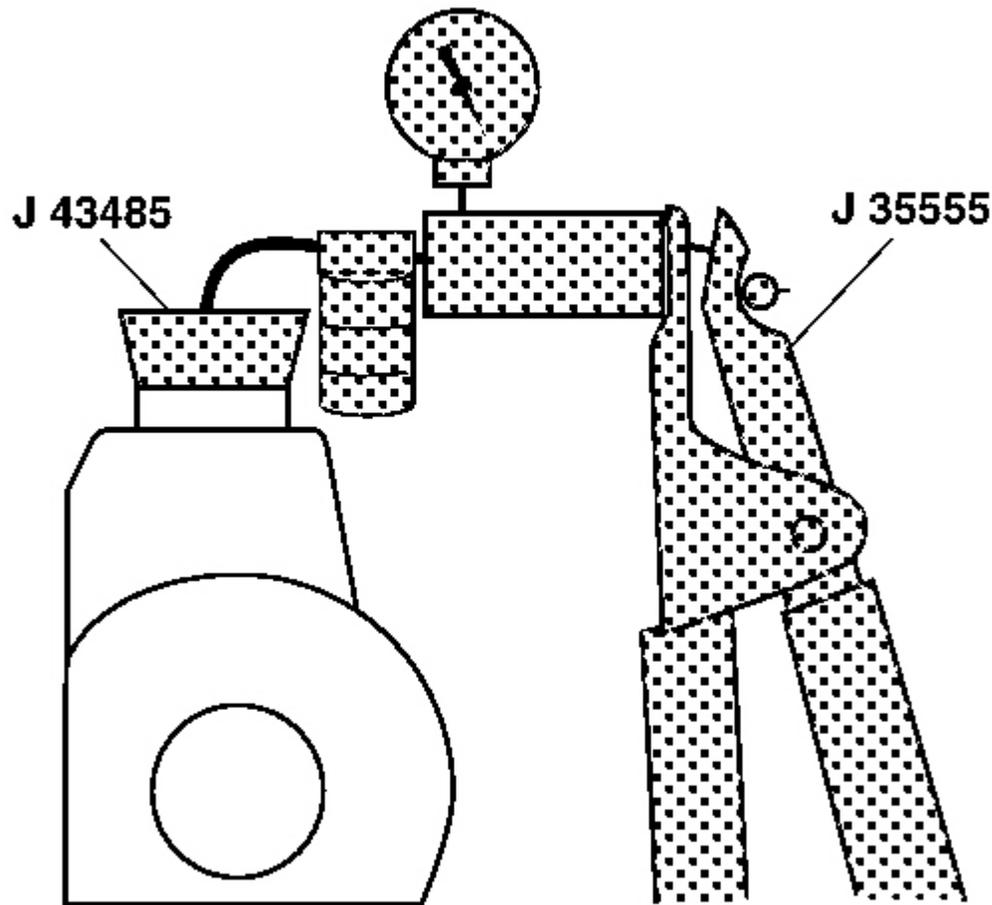
**IMPORTANT: Do not turn steering wheel to lock.**

14. Start the engine. Allow the engine to idle.
15. Turn the steering wheel 180-360 degrees in both directions 5 times.
16. Switch the ignition off.
17. Verify the fluid level.



**Fig. 6: Removing Pump Reservoir Cap**  
Courtesy of GENERAL MOTORS CORP.

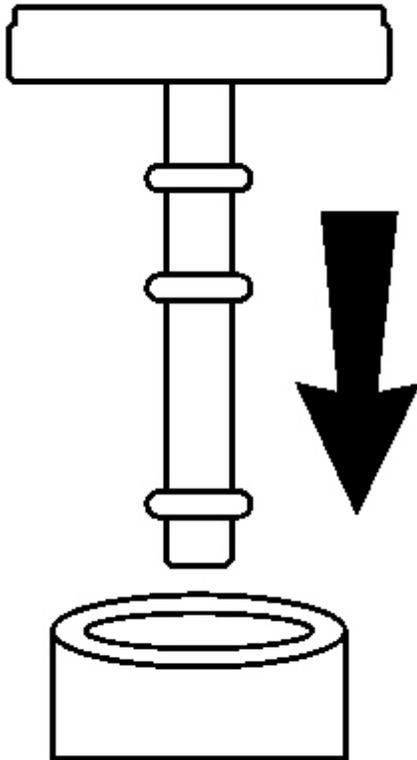
18. Remove the pump reservoir cap.



**Fig. 7: Bleeding Power Steering System**  
Courtesy of GENERAL MOTORS CORP.

19. Attach the **J 43485** to the **J 35555** or equivalent. See Special Tools and Equipment .
20. Place the **J 43485** on or in the pump reservoir filler neck. See Special Tools and Equipment .
21. Apply a vacuum of 68 kPa (20 in Hg) maximum.
22. Wait 5 minutes.

23. Remove the **J 43485** and the **J 35555** . See Special Tools and Equipment .
24. Verify the fluid level.



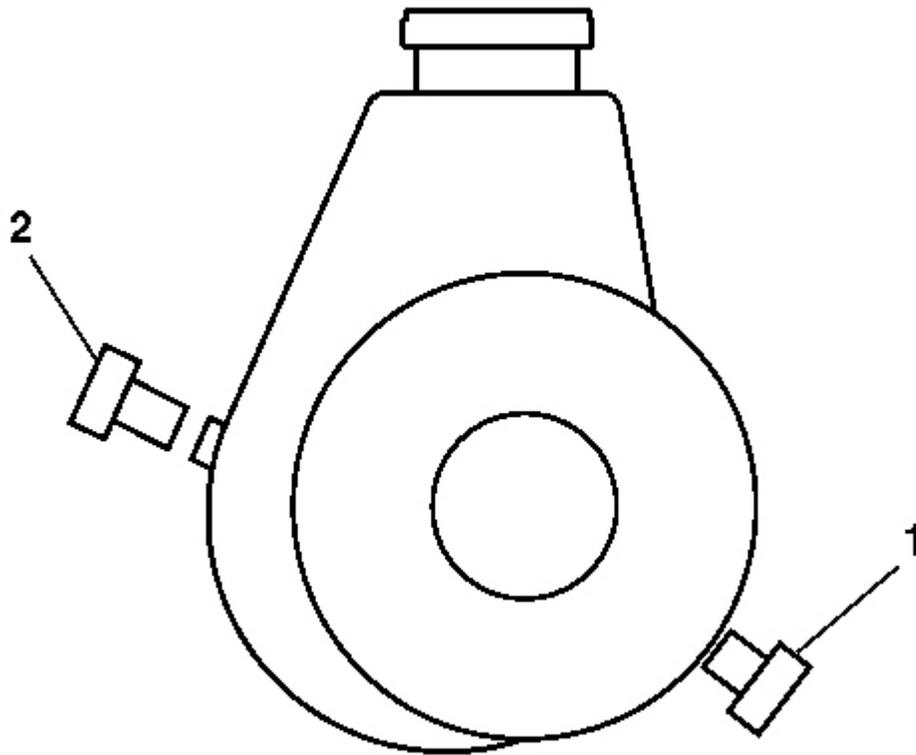
**Fig. 8: Installing Pump Reservoir Cap**  
Courtesy of GENERAL MOTORS CORP.

25. Reinstall the pump reservoir cap.

#### **Tools Required**

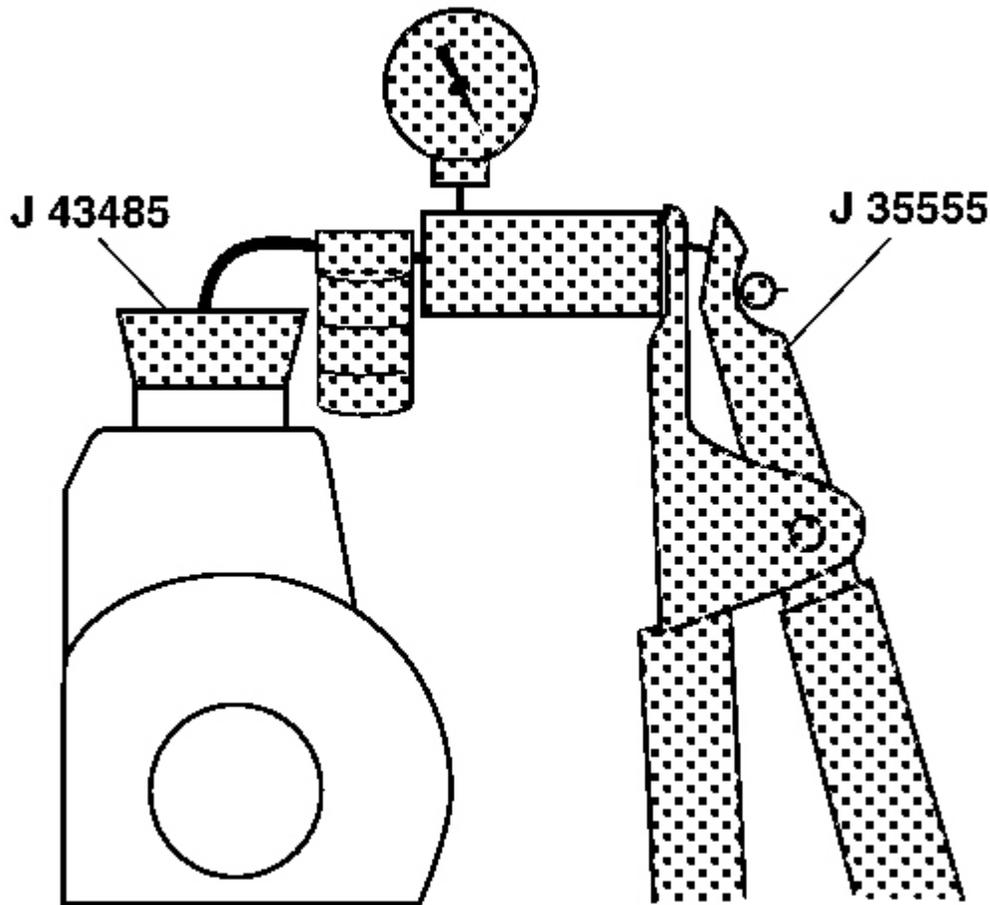
- **J 35555** Metal Mity Vac. See Special Tools and Equipment .
- **J 43485** Power Steering Bleed Adapter. See Special Tools and Equipment .

#### **Excessive Vacuum Drop Diagnosis**



**Fig. 9: Installing Plugs Into The Pressure And Return Port**  
Courtesy of GENERAL MOTORS CORP.

1. If the vacuum continues to drop, remove the pressure and return hose from the pump.
2. Install the plugs (1, 2) supplied with the **J 43485** into the pressure and return port. See **Special Tools and Equipment** .



**Fig. 10: Bleeding Power Steering System**  
Courtesy of GENERAL MOTORS CORP.

3. Attach the **J 43485** to the **J 35555** or equivalent. See **Special Tools and Equipment** .
4. Place the **J 43485** on or in the pump reservoir filler neck. See **Special Tools and Equipment** .
5. Apply a vacuum of 68 kPa (20 in Hg) maximum.
6. If the vacuum drops again, repair or replace the pump. If the vacuum holds steady, continue to check the other parts of the steering system.

**IMPORTANT: Fluid must be free from bubbles and foam. Be aware of periodic bubbles that indicate a loose connection or leaking O-ring seal in the return hose or the pressure hose.**

## **Fluid must be free from discoloration.**

7. Observe the fluid.
8. If condition persists, replace the following parts:
  - The return hose clamps
  - The return hose O-rings
  - The pressure hose O-rings
  - The gear cylinder line O-rings
  - The reservoir to pump O-ring
9. Repeat the bleed procedure from the beginning.
10. Drive the vehicle approximately 16 km (10 mi) in order to warm the system to operating temperature. Evaluate vehicle on a smooth flat surface.
11. Verify the following conditions:
  - There is smooth power assist.
  - The vehicle operates quietly.
  - The pump maintains the proper fluid level.
  - There is no leaking in the steering system.
  - The fluid is free of foam or discoloration.

## **CHECKING AND ADDING POWER STEERING FLUID**

**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** in Maintenance and Lubrication.

### **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 **Bleeding the Power Steering System** .

## **FLUSHING THE POWER STEERING SYSTEM**

**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** in General Information.
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.**
- **Do not run the engine without the power steering fluid level at FULL COLD.**

6. Run the engine at idle while an assistant maintains the fluid level at FULL COLD in the reservoir using new approved power steering fluid.
7. Turn off the engine.
8. Turn the steering wheel fully to the left and to the right.
9. Remove the plug from the pump reservoir inlet connection.
10. Install the fluid return hose to the pump reservoir.
11. Maintain the fluid level at FULL COLD.
12. Operate the engine at idle for approximately 15 minutes.
13. Repeat steps 3-5.
14. Inspect the power steering fluid for the following indications of contamination:
  - Milky fluid - water
  - Brown fluid - burnt
  - Plastic debris or dirt chunks

15. If the fluid is contaminated, repeat steps 6-12 in order to complete a third flush.
16. Remove the plug from the pump reservoir inlet connection.
17. Install the fluid return hose to the pump reservoir.
18. Clean any spilled fluid.
19. Bleed the power steering system. Refer to **Bleeding the Power Steering System** .

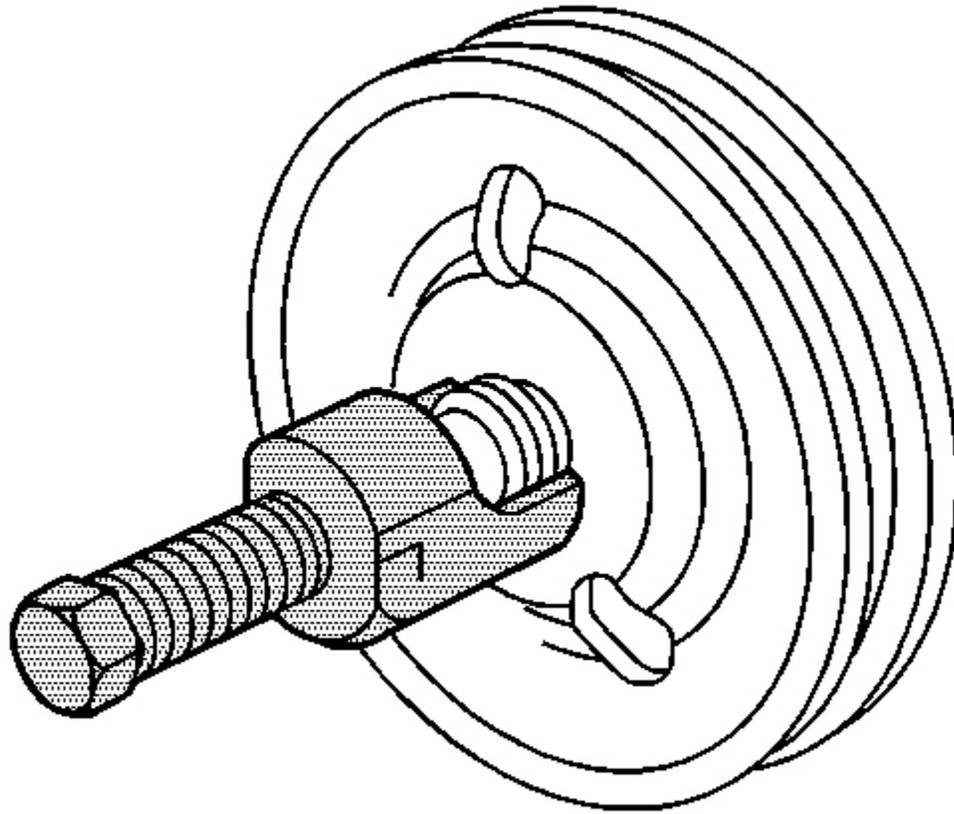
## **POWER STEERING PULLEY REPLACEMENT**

### **Tools Required**

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

### **Removal Procedure**

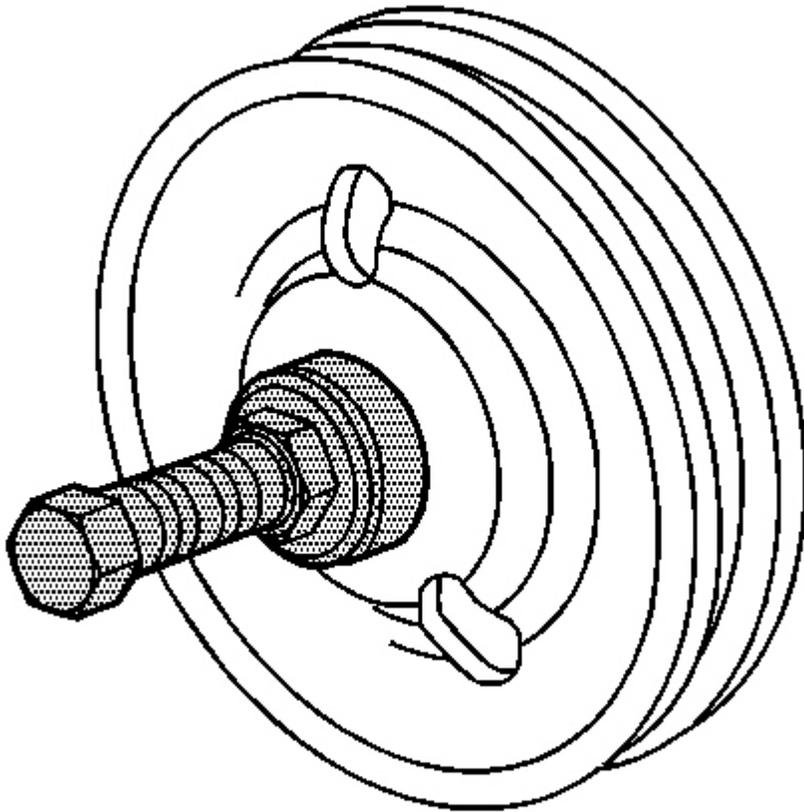
1. Remove the upper fan shroud. Refer to **Fan Shroud Replacement** in Engine Cooling.
2. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical.



**Fig. 11: Removing Power Steering Pump Pulley**  
Courtesy of GENERAL MOTORS CORP.

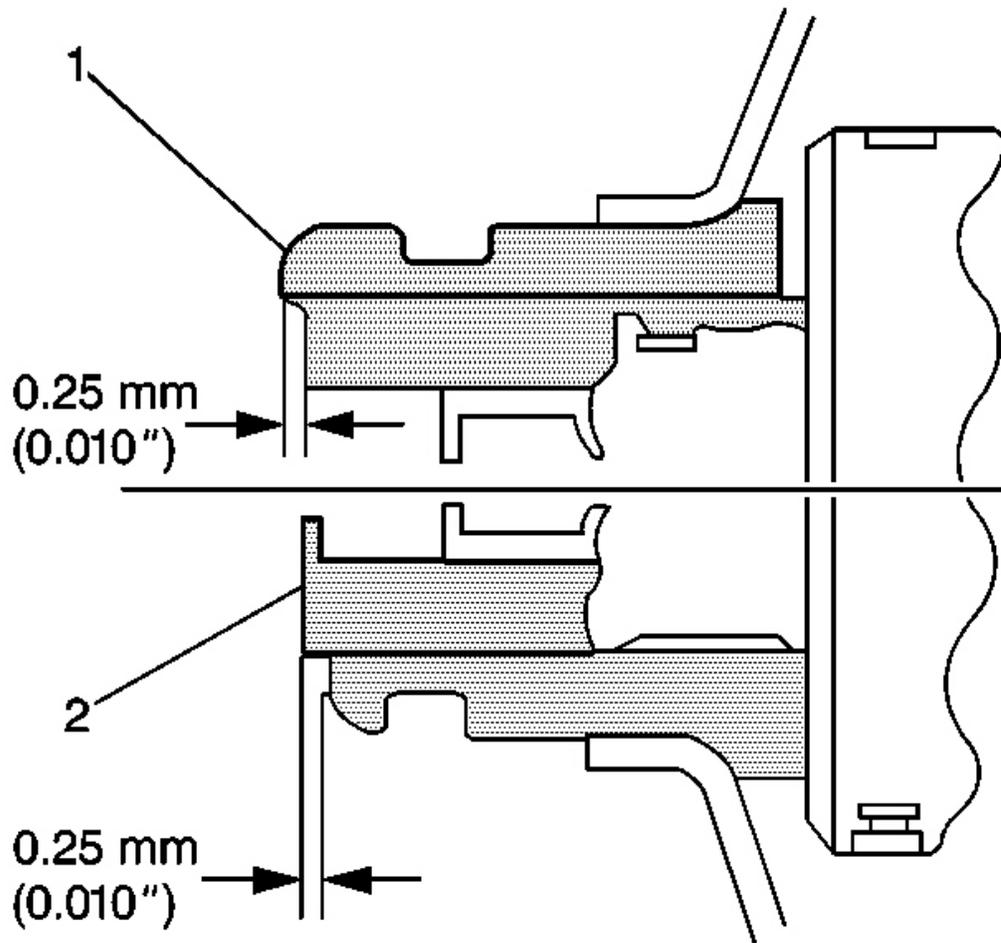
3. Remove the power steering pump pulley using the **J 25034-C** . See **Special Tools and Equipment** .

#### **Installation Procedure**



**Fig. 12: Installing Power Steering Pump Pulley**  
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 **J 25033-C** . See **Special Tools and Equipment** .



**Fig. 13: Checking Power Steering Pump Pulley Installed Depth**  
Courtesy of GENERAL MOTORS CORP.

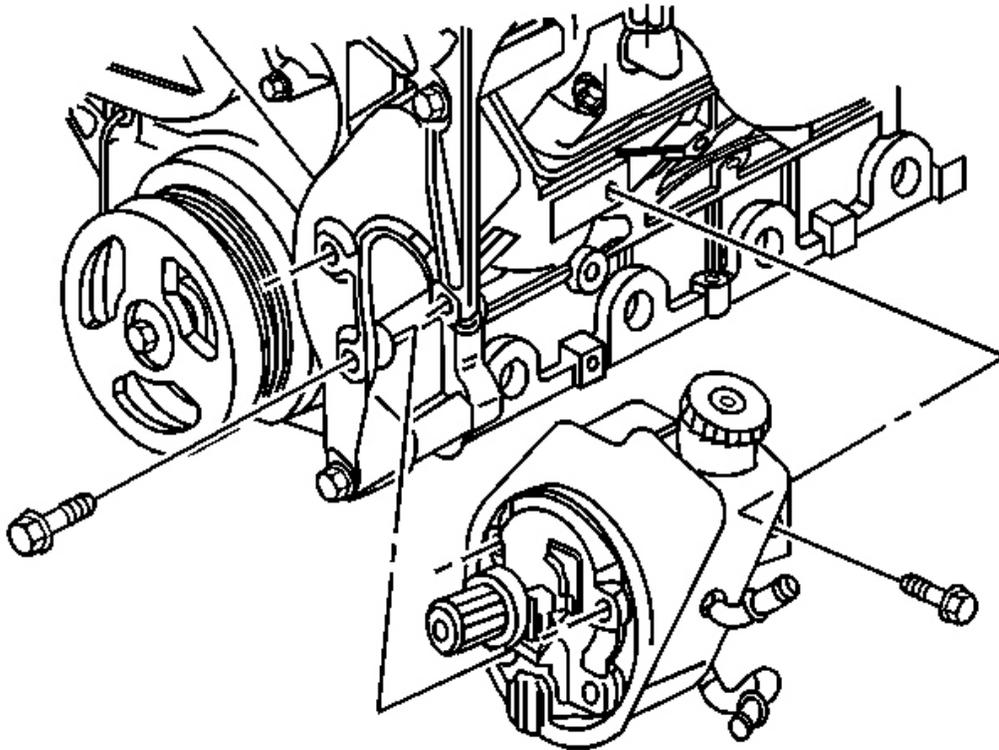
3. Ensure that the power steering pump pulley is flush against the power steering pump shaft, with an allowable variance of 0.25 mm (0.010 in).
4. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical.
5. Install the upper fan shroud. Refer to **Fan Shroud Replacement** in Engine Cooling.

## POWER STEERING PUMP REPLACEMENT

### Removal Procedure

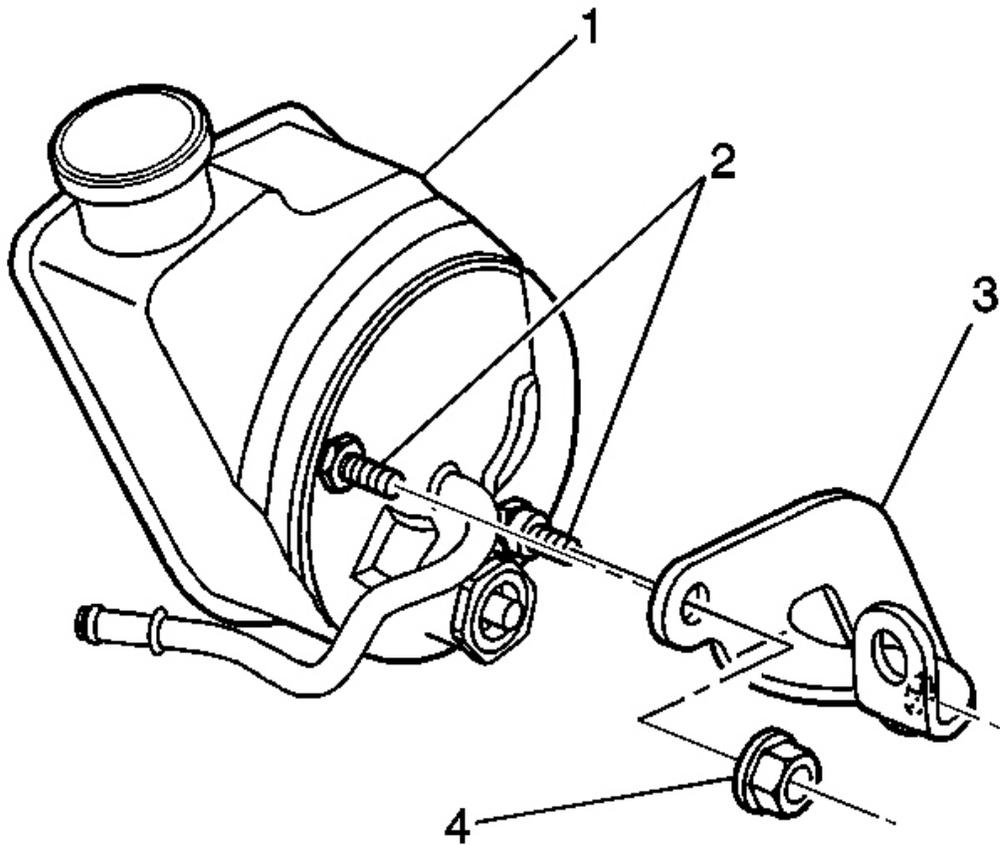
1. Remove the power steering pulley. Refer to **Power Steering Pulley Replacement** .

2. Place a drain pan under the pump.
3. Remove the hose guide bracket from the front of the pump.
4. Remove the hoses from the pump.
5. Remove the bolt retaining the rear bracket to the engine.



**Fig. 14: Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

6. Remove the bolts from the front of the pump.
7. Remove the pump from the vehicle.

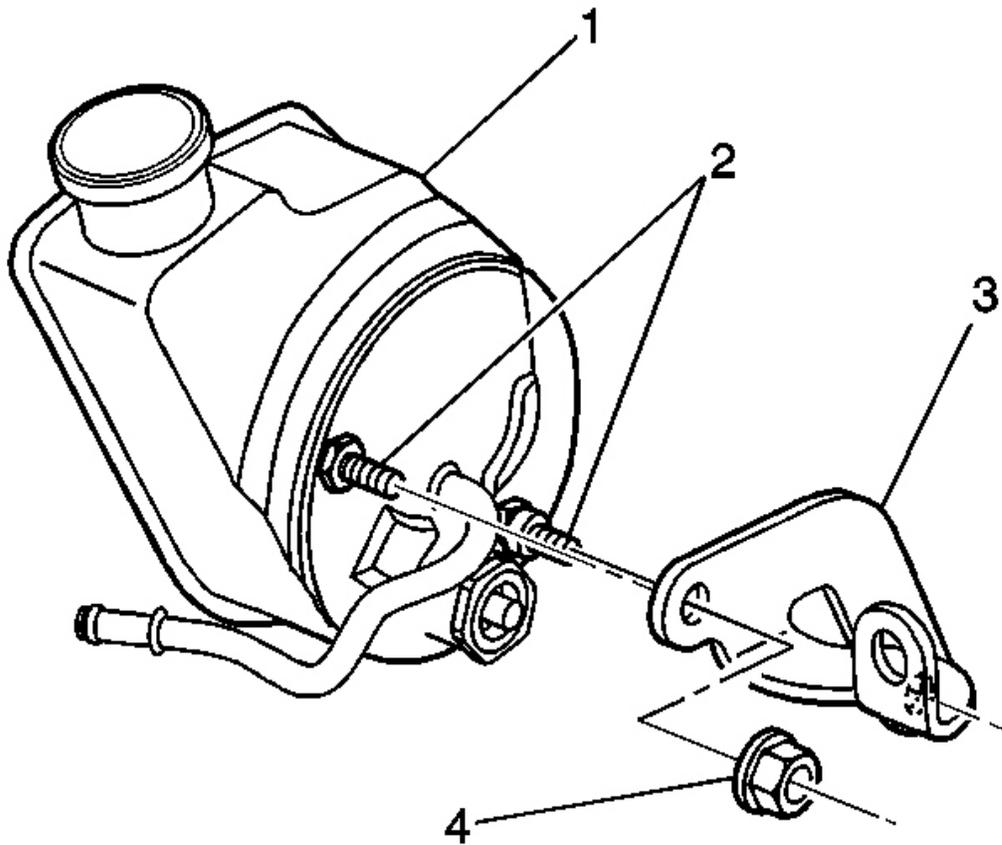


**Fig. 15: Bracket & Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

8. Remove the bracket (3) from the rear of the pump (1).

**Installation Procedure**

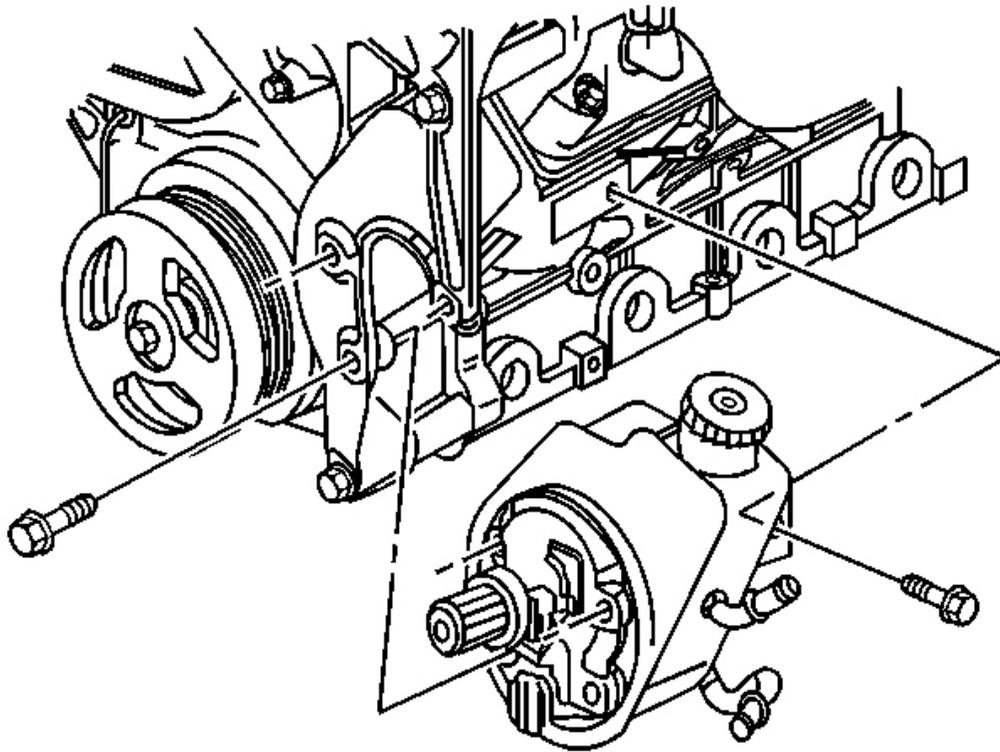
**NOTE:** Refer to Fastener Notice in Cautions and Notices.



**Fig. 16: Bracket & Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

1. Install the bracket (3) to the rear of the pump (1).

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



**Fig. 17: Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

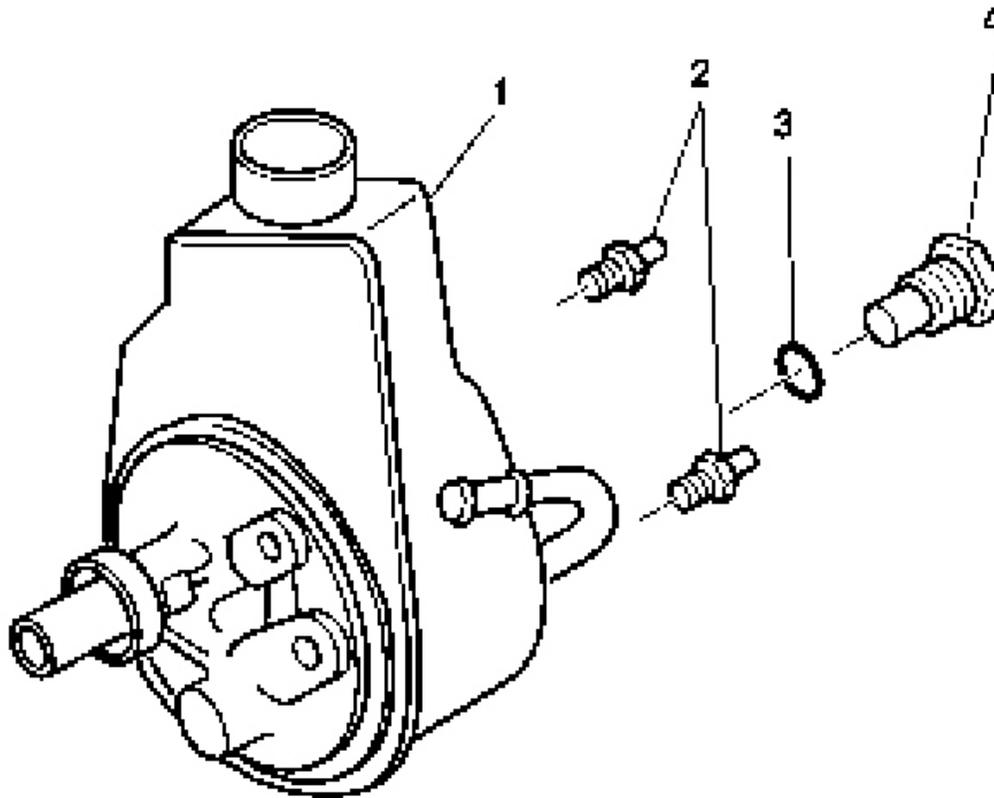
2. Install the pump.
3. Install the hose guide bracket bolt to the pump.
4. Install the bolt retaining the rear bracket to the engine.
5. Install the bolts to the front of the pump.

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

6. Install the hoses to the pump.

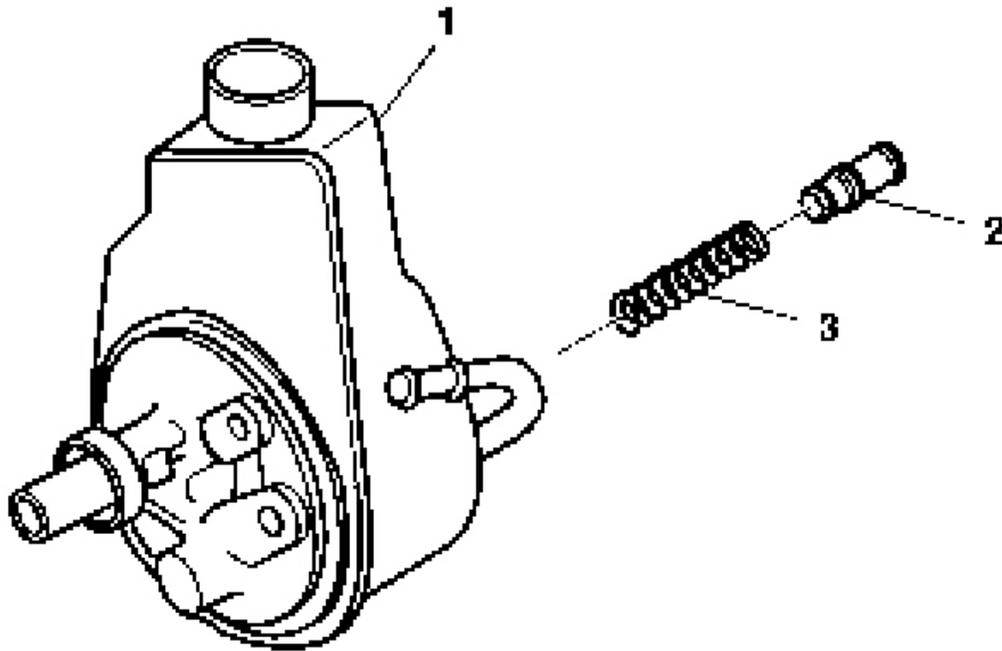
**Tighten:** Tighten the nut to 28 N.m (21 lb ft).

7. Install the power steering pulley. Refer to **Power Steering Pulley Replacement** .
8. Fill and bleed the power steering system. Refer to **Bleeding the Power Steering System** .



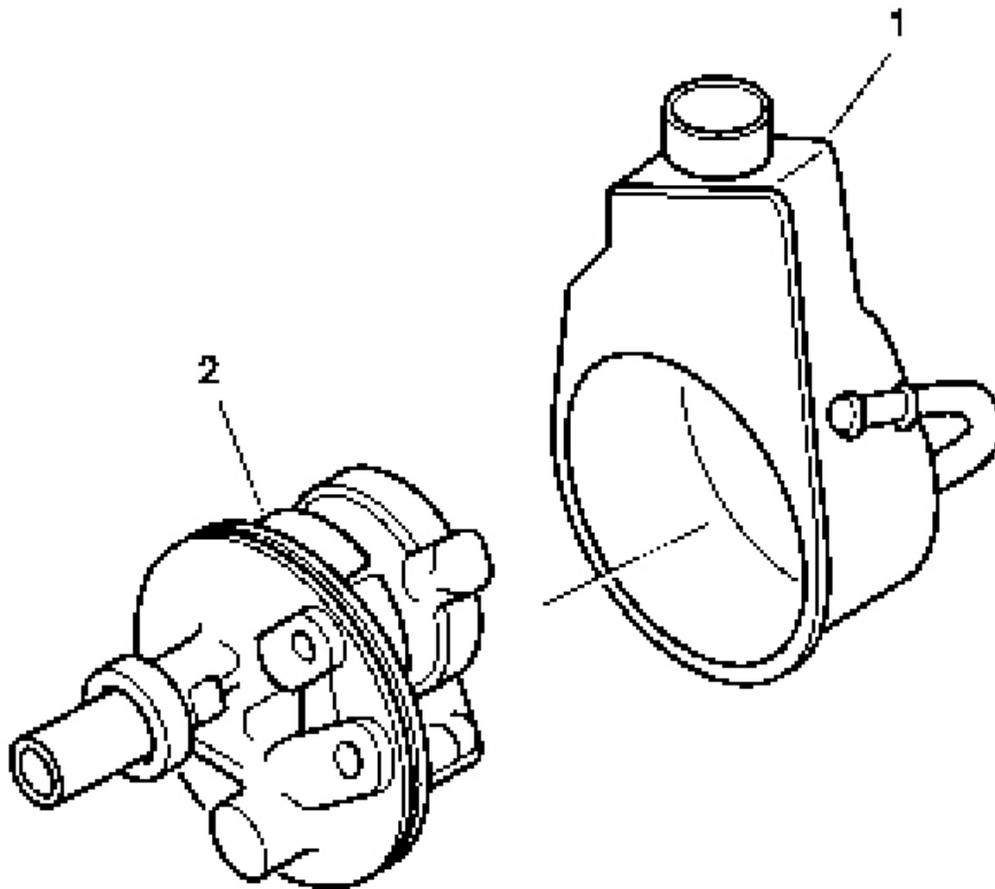
**Fig. 18: Connector & Fitting Assembly**  
Courtesy of GENERAL MOTORS CORP.

1. Drain the power steering fluid from the power steering pump.
2. Remove the pump mounting studs (2).
3. Remove the connector and fitting assembly (4).
4. Remove the O-ring seal (3).



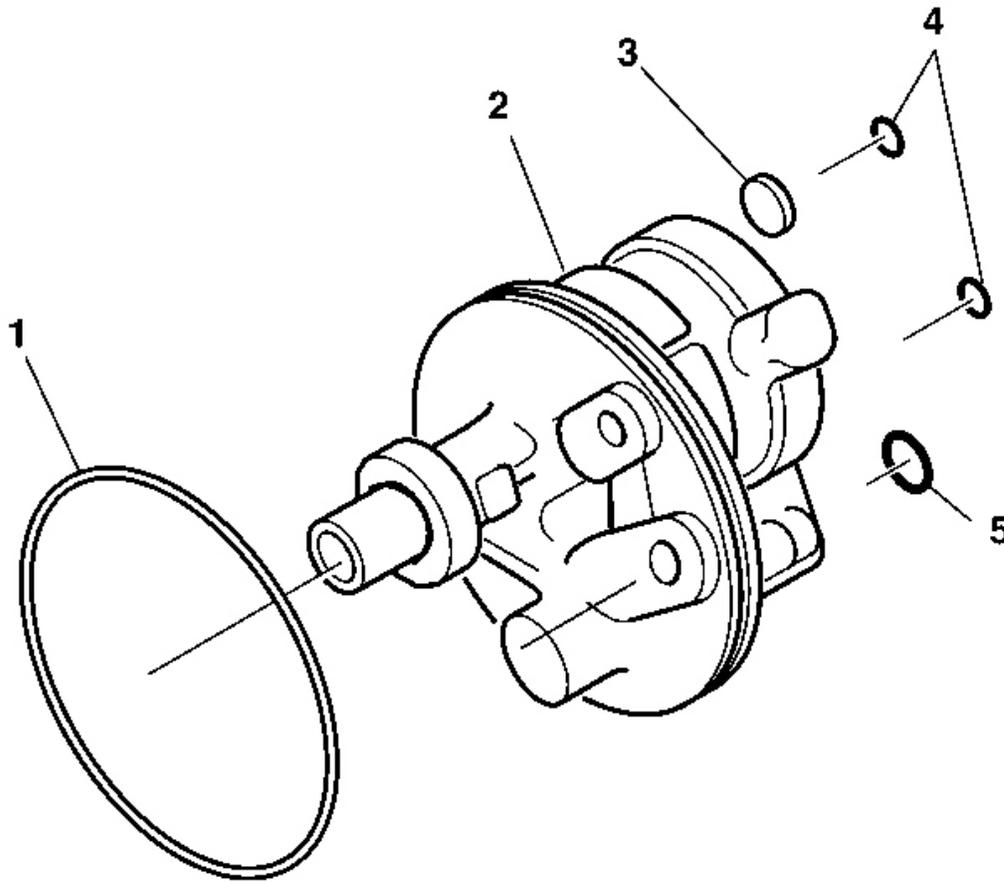
**Fig. 19: Removing Control Valve Assembly & Flow Control Spring From Pump Housing Assembly**  
Courtesy of GENERAL MOTORS CORP.

5. If replacement is required, remove the control valve assembly (2) and the flow control spring (3) from the pump housing assembly (1).



**Fig. 20: Reservoir Assembly & Pump Housing Assembly**  
Courtesy of GENERAL MOTORS CORP.

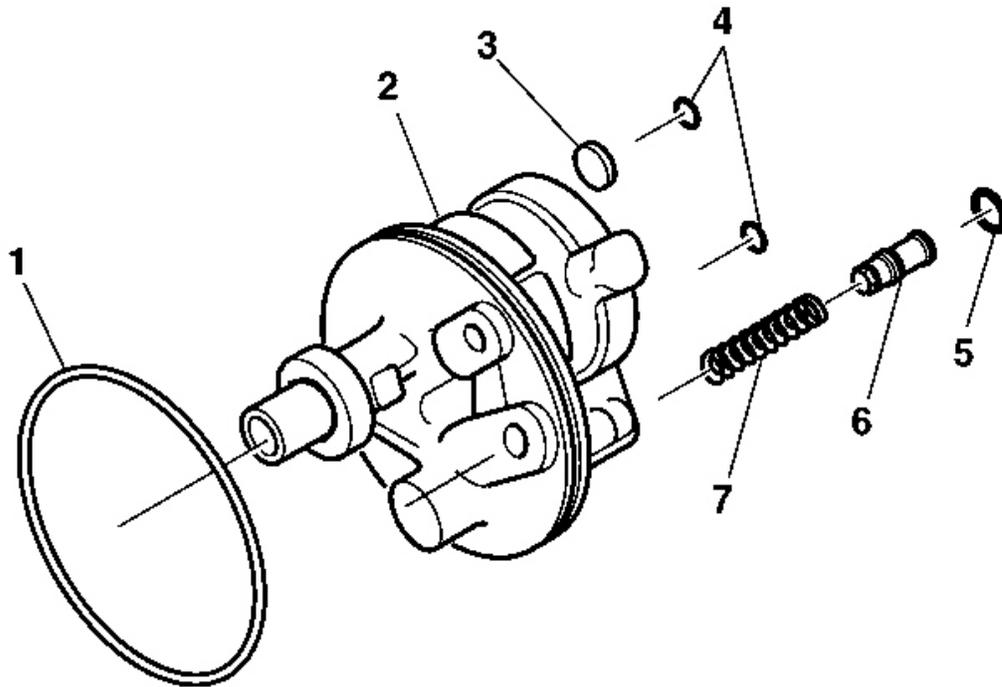
6. Remove the reservoir assembly (1) from the pump housing assembly (2).



**Fig. 21: Reservoir O-ring Seals**  
Courtesy of GENERAL MOTORS CORP.

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

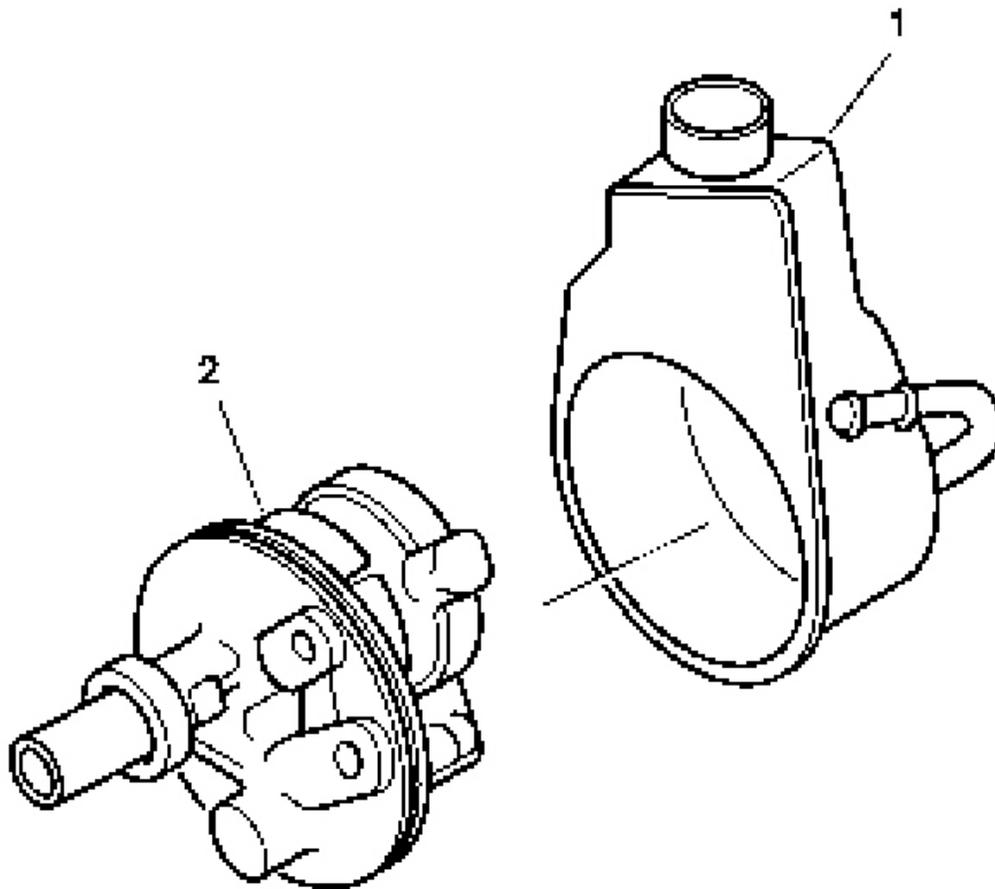
#### **Assembly Procedure**



**Fig. 22: Pump Housing Assembly Components**  
Courtesy of GENERAL MOTORS CORP.

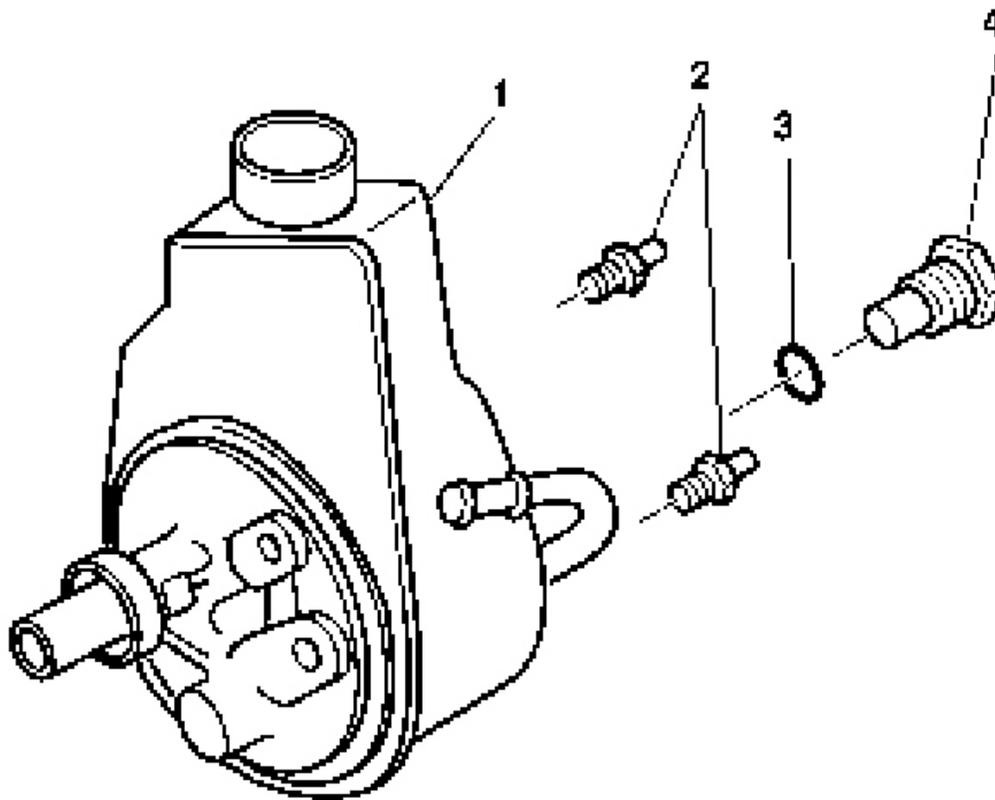
**IMPORTANT: Use new O-ring seals when assembling the power steering pump assembly.**

1. Lubricate the O-ring seals (1) (4) (5) with power steering fluid.
2. Install the flow control spring (7) to the pump housing assembly (2).
3. Install the control valve assembly (6) to the flow control spring (7).
4. Install the O-ring seals (1) (4) (5) to the pump housing assembly.
5. Install the magnet (3) to the pump housing assembly (2).



**Fig. 23: Reservoir Assembly & Pump Housing Assembly**  
Courtesy of GENERAL MOTORS CORP.

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



**Fig. 24: Connector & Fitting Assembly**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

8. Install the connector and fitting assembly (4) to the pump housing (1).
9. Install the pump mounting studs (2) to the pump housing (1).

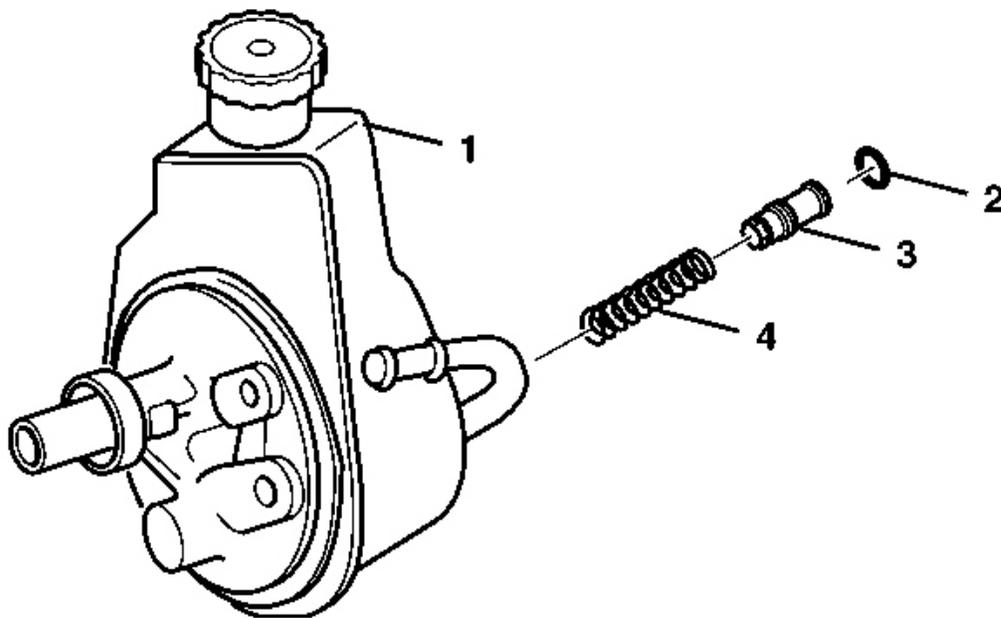
**Tighten:** Tighten the pump mounting studs to 58 N.m (44 lb ft).

10. Tighten the connector and fitting assembly.

**Tighten:** Tighten the connector and fitting assembly to 75 N.m (55 lb ft).

**POWER STEERING PUMP FLOW CONTROL VALVE REPLACEMENT - OFF VEHICLE  
(REGULAR)**

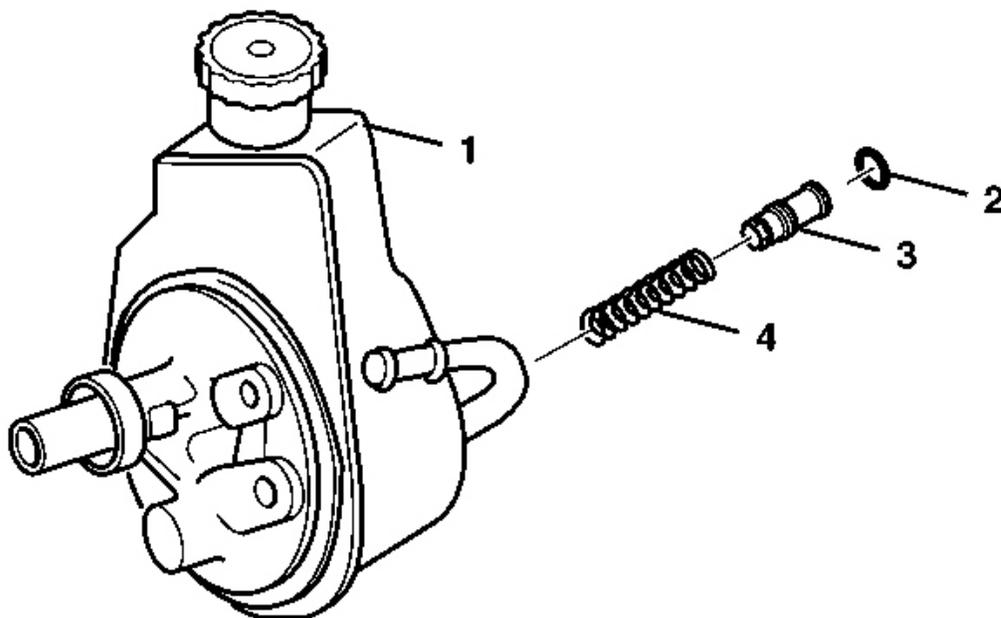
## Disassembly Procedure



**Fig. 25: Power Steering Pump Flow Control Valve Assembly & Pump Housing**  
Courtesy of GENERAL MOTORS CORP.

1. Drain the oil from the reservoir (1).
2. Remove the control valve assembly (3) from the pump housing (1). Make sure the flow control spring (4) does not fall out of the pump housing (1).
3. Remove the rectangular section seal (2) from the control valve assembly (3).

## Assembly Procedure



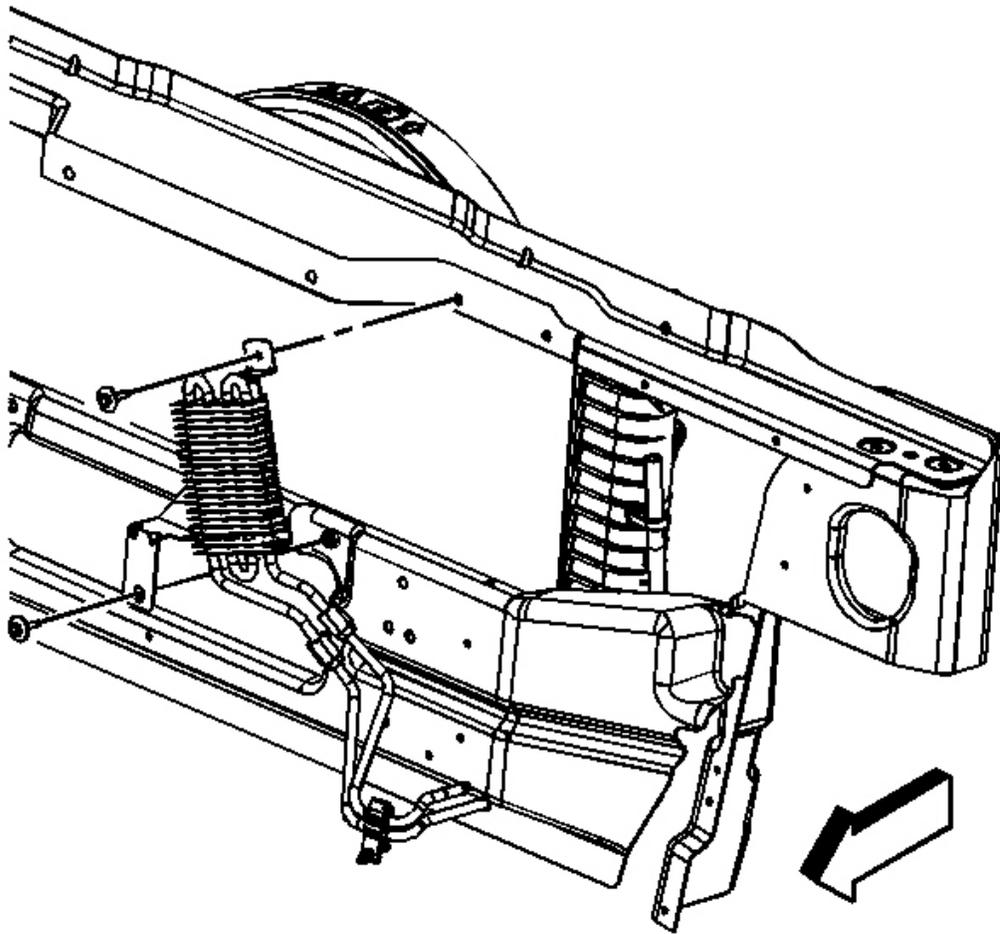
**Fig. 26: Power Steering Pump Flow Control Valve Assembly & Pump Housing**  
Courtesy of GENERAL MOTORS CORP.

1. Install the flow control spring (4) if removed from the pump housing (1).
2. Lubricate the new rectangular section seal (2) with power steering fluid.
3. Install the rectangular section seal (2) onto the control valve assembly (3).
4. Install the control valve assembly (3).

## **POWER STEERING COOLER REPLACEMENT**

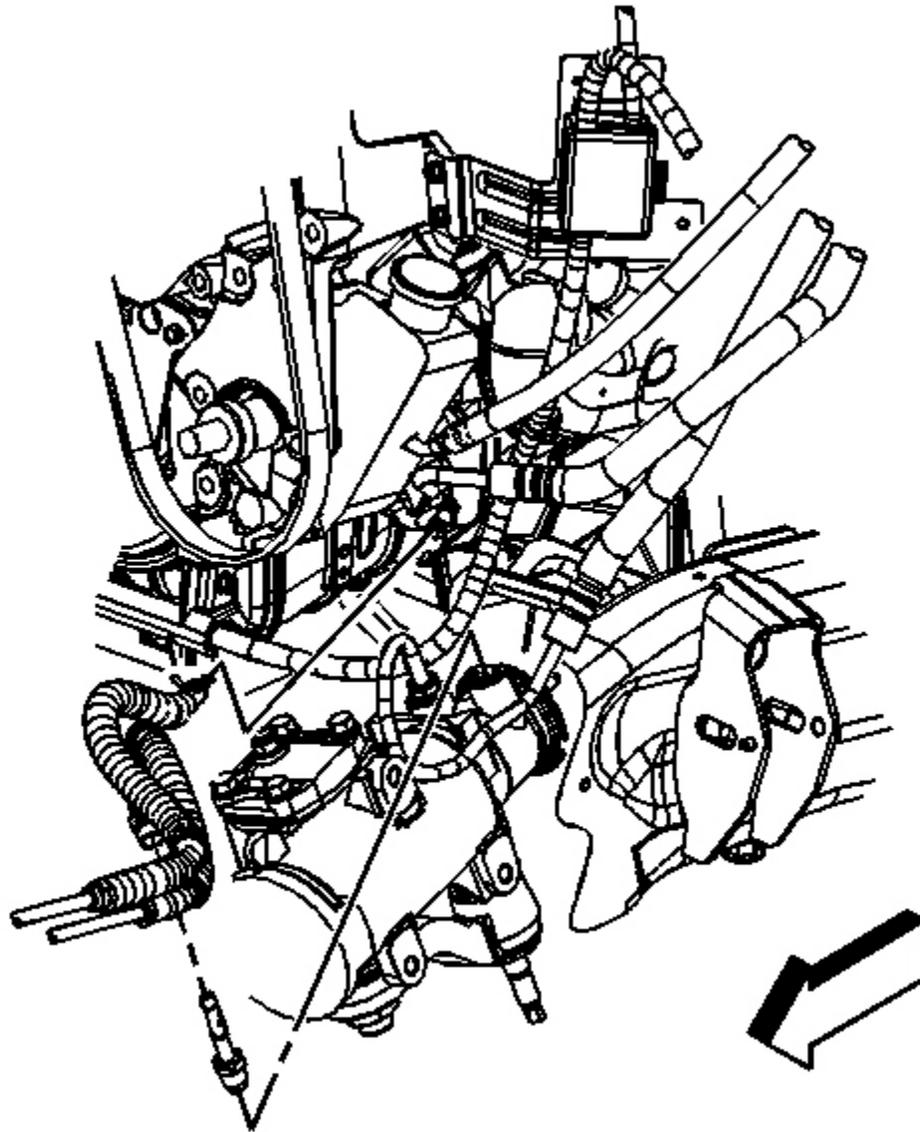
### **Removal Procedure**

1. Open the hood.
2. Place a drain pan under the vehicle.
3. Siphon the fluid from the reservoir to prevent excess spillage.



**Fig. 27: Power Steering Cooler**  
Courtesy of GENERAL MOTORS CORP.

4. Remove the bolts retaining the power steering cooler from the radiator support. Do not discard the upper spacer.
5. Remove the inlet and outlet cooler hoses from the cooler
6. Remove the cooler from the vehicle.



**Fig. 28: Identifying Hoses**

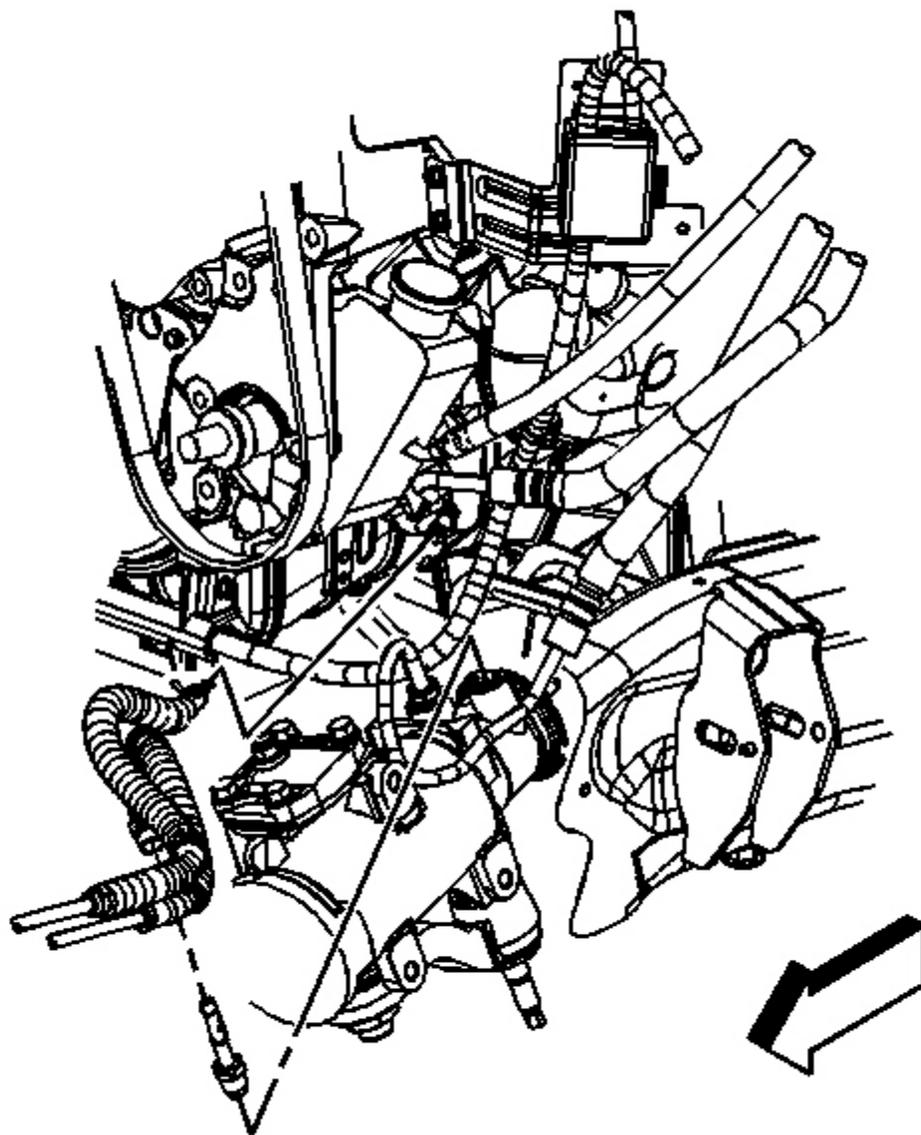
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Power Steering Hose Disconnected Notice in Cautions and Notices.

7. Disconnect the fitting from the power steering cooler inlet hose at the power steering gear.

8. Remove the clamp retaining power steering cooler outlet hose to the power steering pump.
9. Remove the hoses from the vehicle.

### Installation Procedure



**Fig. 29: Identifying Hoses**  
Courtesy of GENERAL MOTORS CORP.

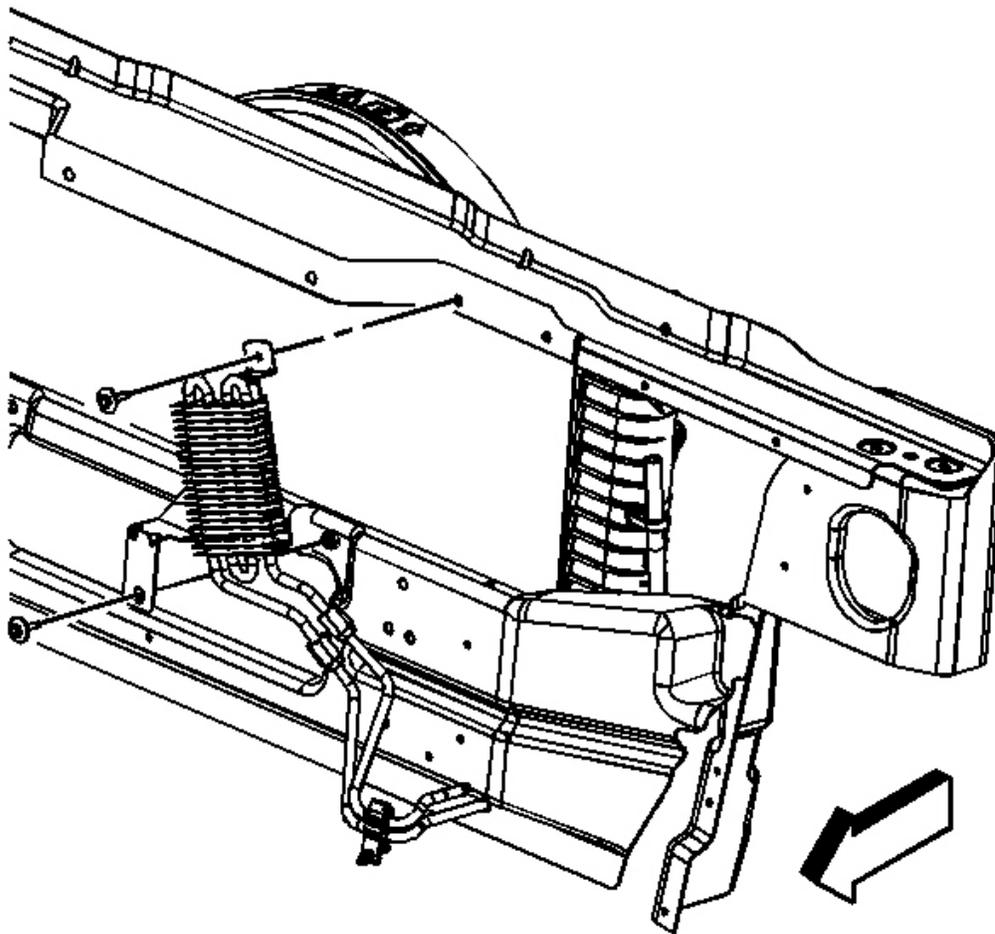
1. Install the hoses to the vehicle.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

2. Connect the fitting from the power steering cooler inlet hose to the power steering gear

**Tighten:** Tighten the fittings to 28 N.m (20 lb ft).

3. Install the clamp retaining power steering cooler outlet hose to the power steering pump.



**Fig. 30: Power Steering Cooler**  
Courtesy of GENERAL MOTORS CORP.

4. Install the power steering cooler to the radiator support.
5. Install the inlet and outlet cooler hoses to the cooler. Verify that the O-Rings are in place

**Tighten:** Tighten the fittings to 28 N.m (20 lb ft).

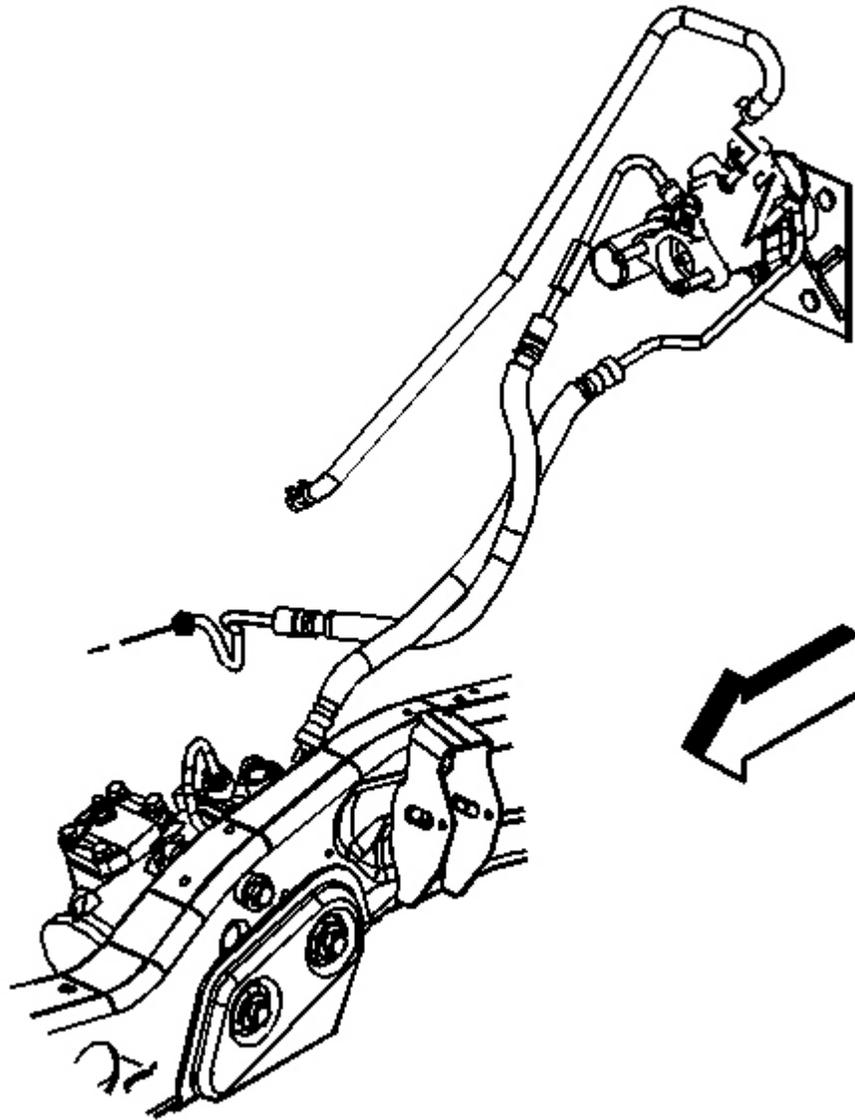
6. Install the power steering cooler mounting bolts. Do not forget to install the upper spacer.

**Tighten:** Tighten the bolts retaining the power steering cooler to 5 N.m (44 lb in).

7. Fill and bleed the power steering system. Refer to **Bleeding the Power Steering System** .
8. Inspect all the hose connections for leaks.
9. Close the hood

## **POWER STEERING GEAR INLET PIPE/HOSE REPLACEMENT**

### **Removal Procedure**

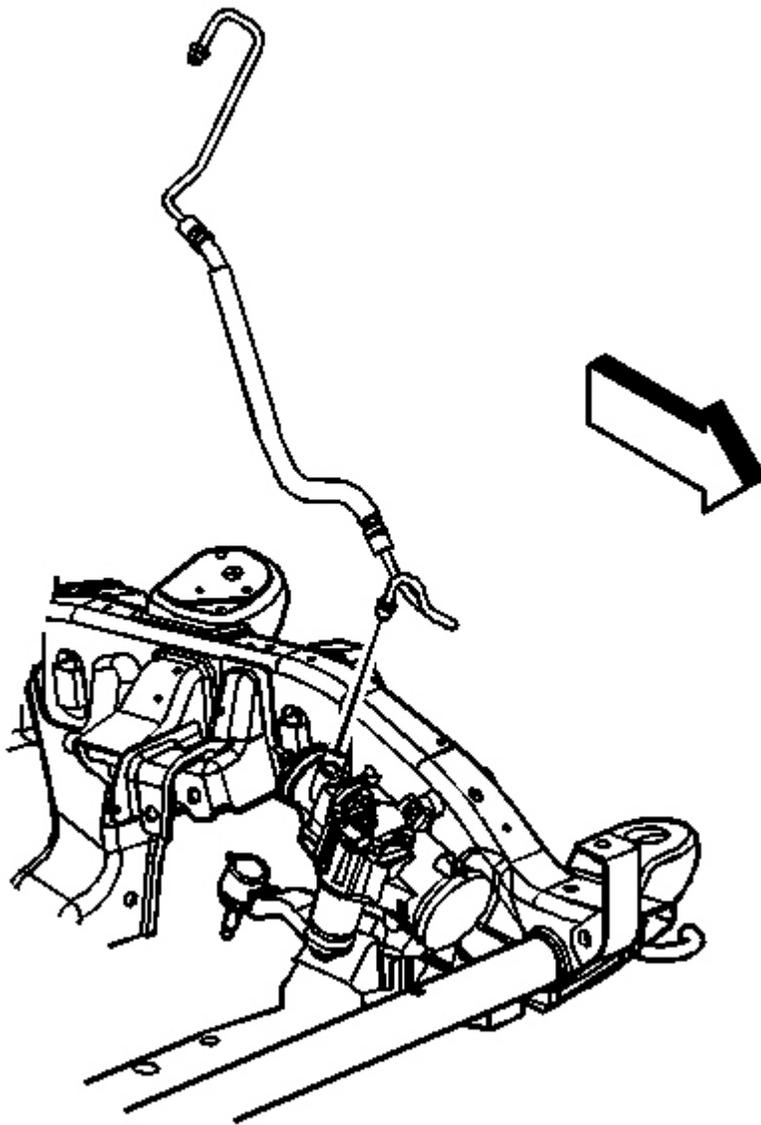


**Fig. 31: Power Steering Gear Inlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Power Steering Hose Disconnected Notice in Cautions and Notices.

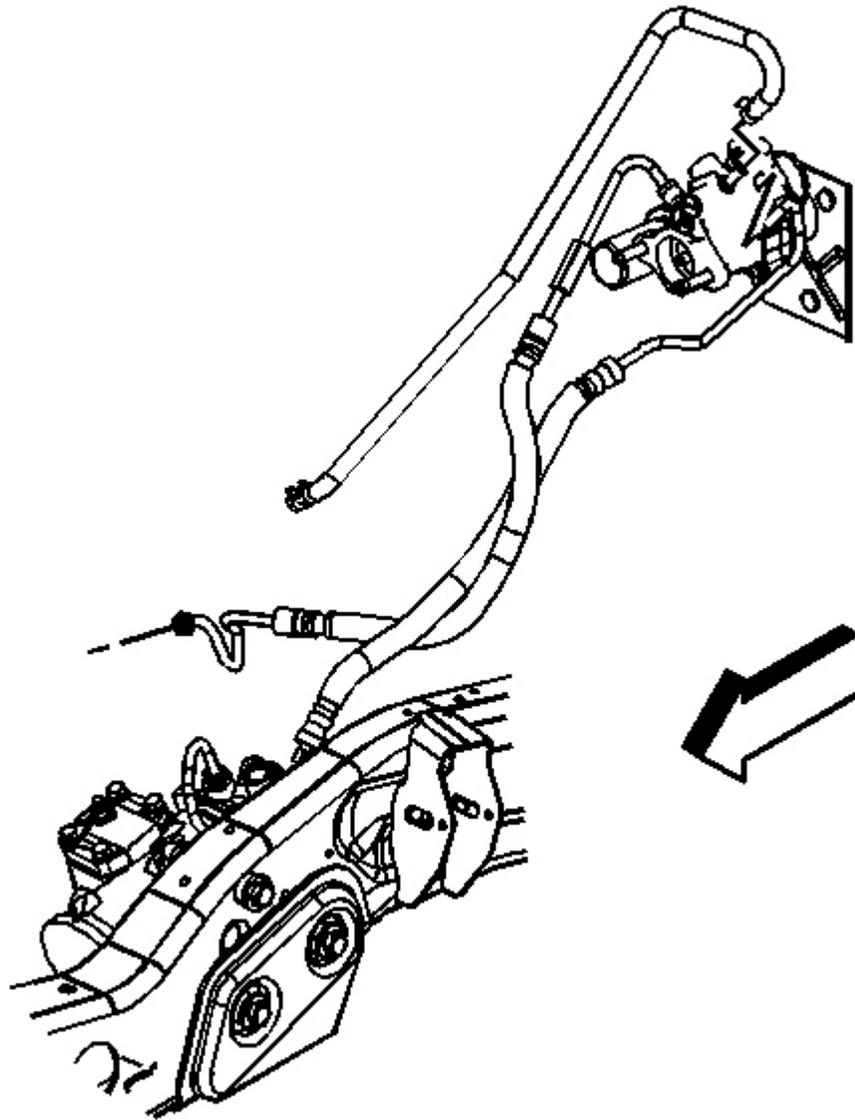
1. Install a drain pan under the vehicle.

2. Remove the power steering gear inlet hose from the brake booster.



**Fig. 32: Power Steering Gear Inlet Hose & Power Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

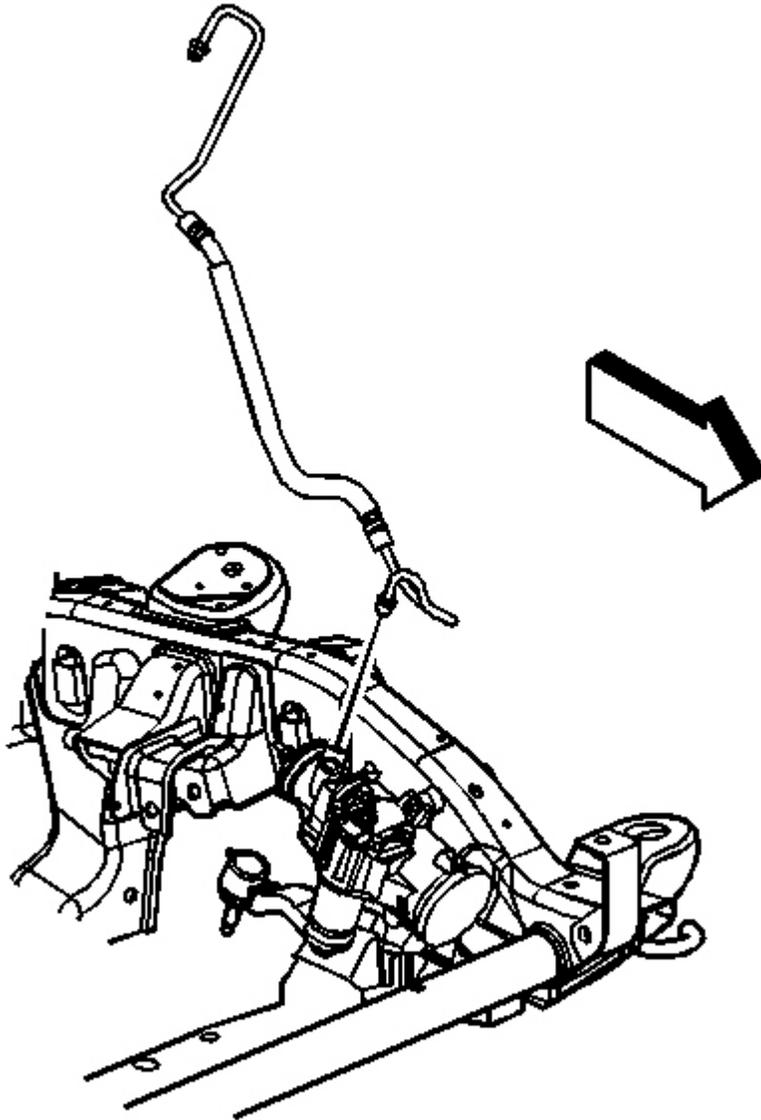
3. Remove the power steering gear inlet hose from the power steering gear.
4. Remove the power steering gear inlet hose from the vehicle.



**Fig. 33: Power Steering Gear Inlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Installing Hoses Without Twists or Bends Notice in Cautions and Notices.

1. Route the hose in the same position the hose occupied prior to removal.
2. Install the power steering gear inlet hose to the brake booster.



**Fig. 34: Power Steering Gear Inlet Hose & Power Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to **Fastener Notice** in Cautions and Notices.

3. Install the power steering gear inlet hose to the power steering gear.

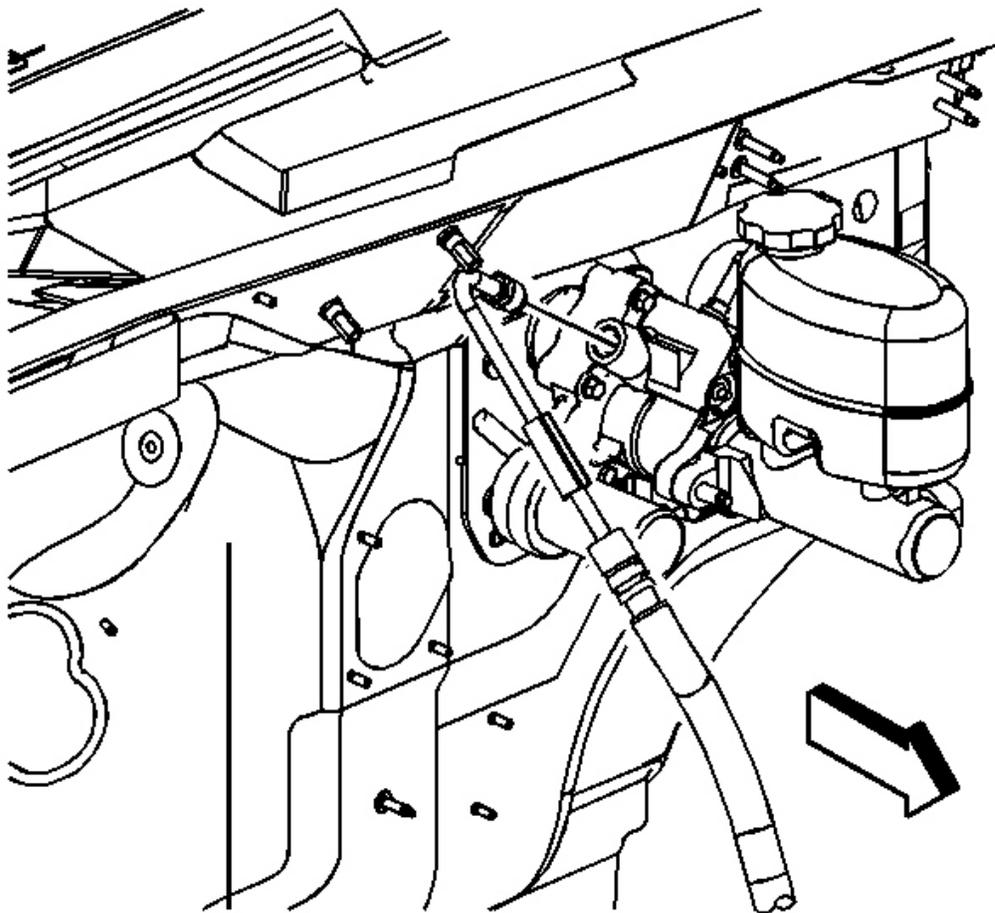
**Tighten:** Tighten the power steering gear inlet hose fittings to 28 N.m (21 lb ft).

4. Remove the drain pan from under the vehicle.

5. Bleed the power steering system. Refer to **Bleeding the Power Steering System** .

## **POWER BRAKE BOOSTER INLET HOSE REPLACEMENT**

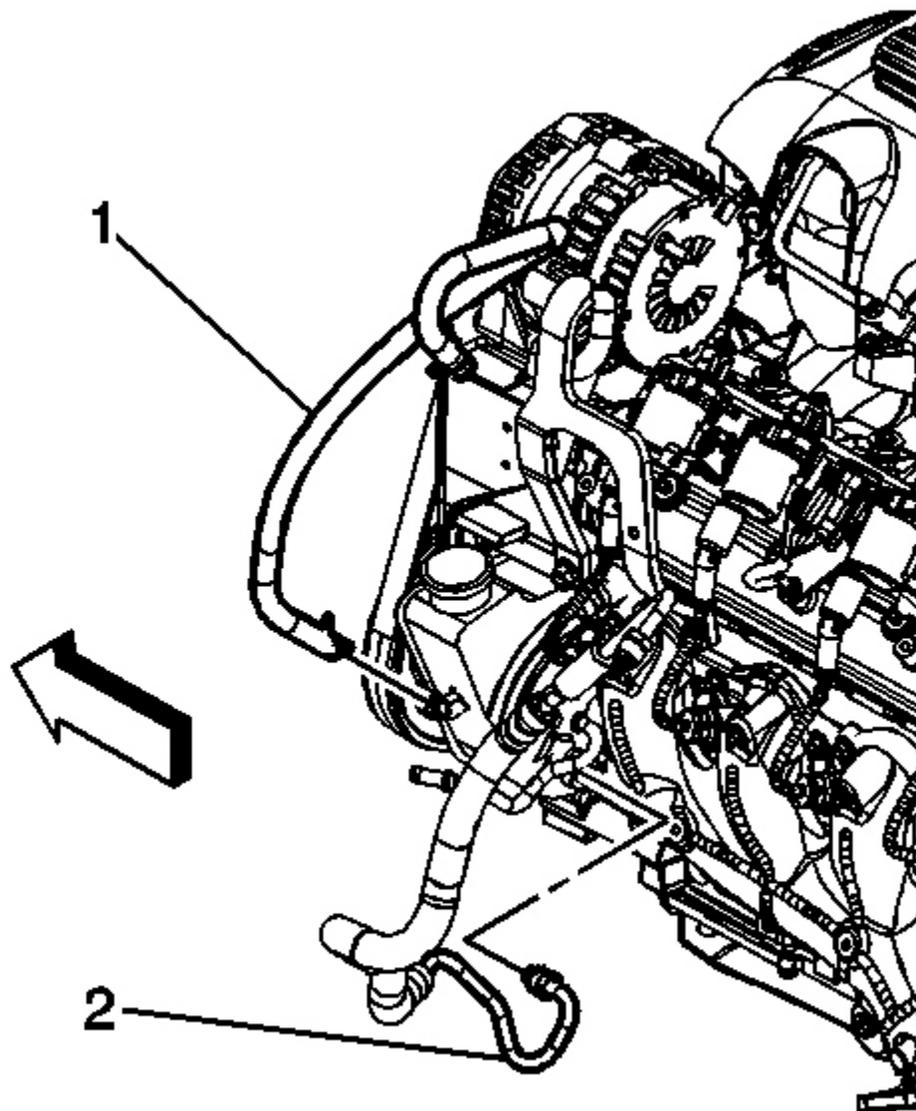
### **Removal Procedure**



**Fig. 35: Brake Booster Inlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Power Steering Hose Disconnected Notice in Cautions and Notices.

1. Install a drain pan under the vehicle.
2. Remove the brake booster inlet hose from the brake booster.

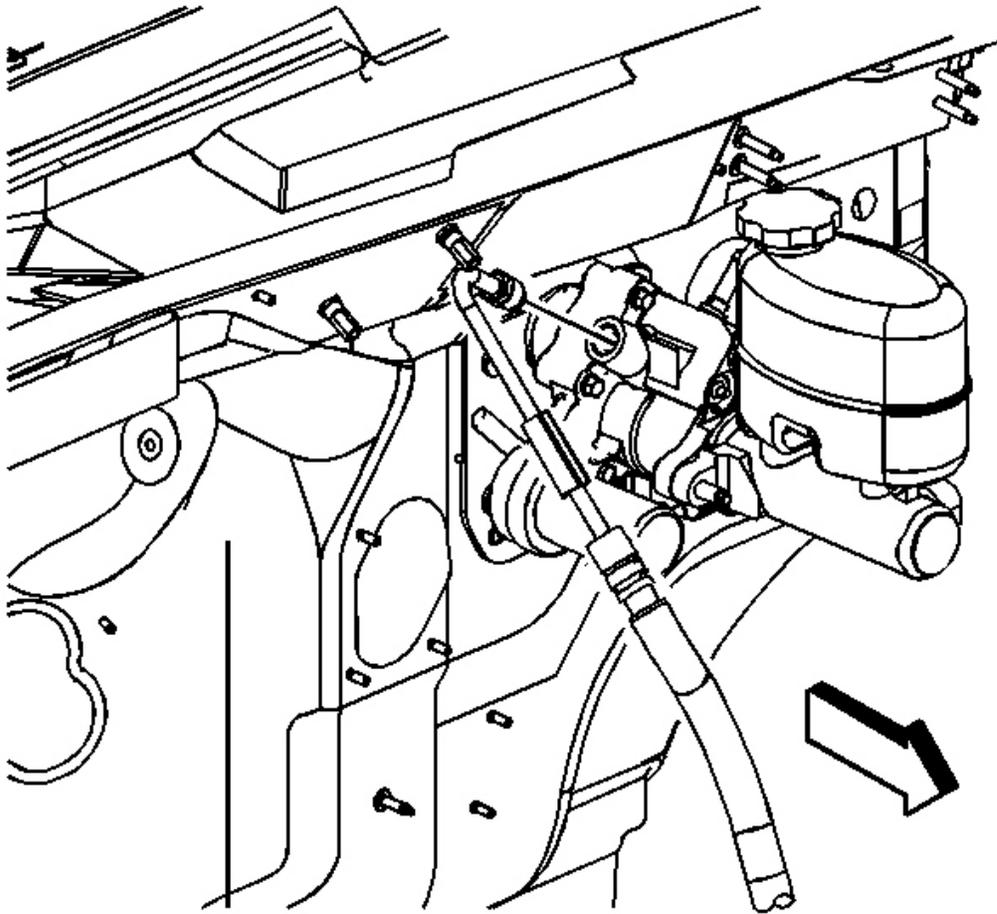


**Fig. 36: Brake Booster Inlet Hose & Power Steering Pump**

Courtesy of GENERAL MOTORS CORP.

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

#### Installation Procedure

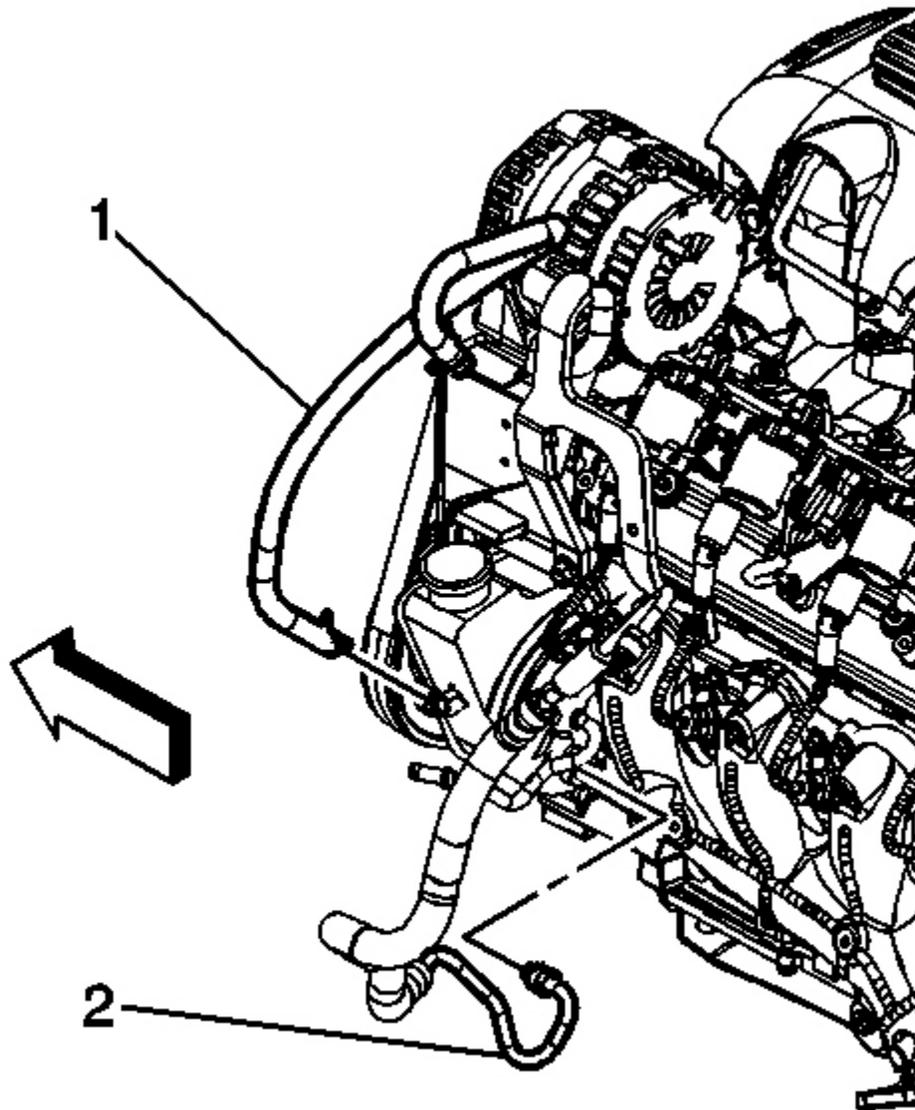


**Fig. 37: Brake Booster Inlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

**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.

**NOTE:** Refer to Installing Hoses Without Twists or Bends Notice in Cautions and Notices.

1. Route the hose in the same position the hose occupied prior to removal.
2. Install the brake booster inlet hose to the brake booster.



**Fig. 38: Brake Booster Inlet Hose & Power Steering Pump**

Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

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

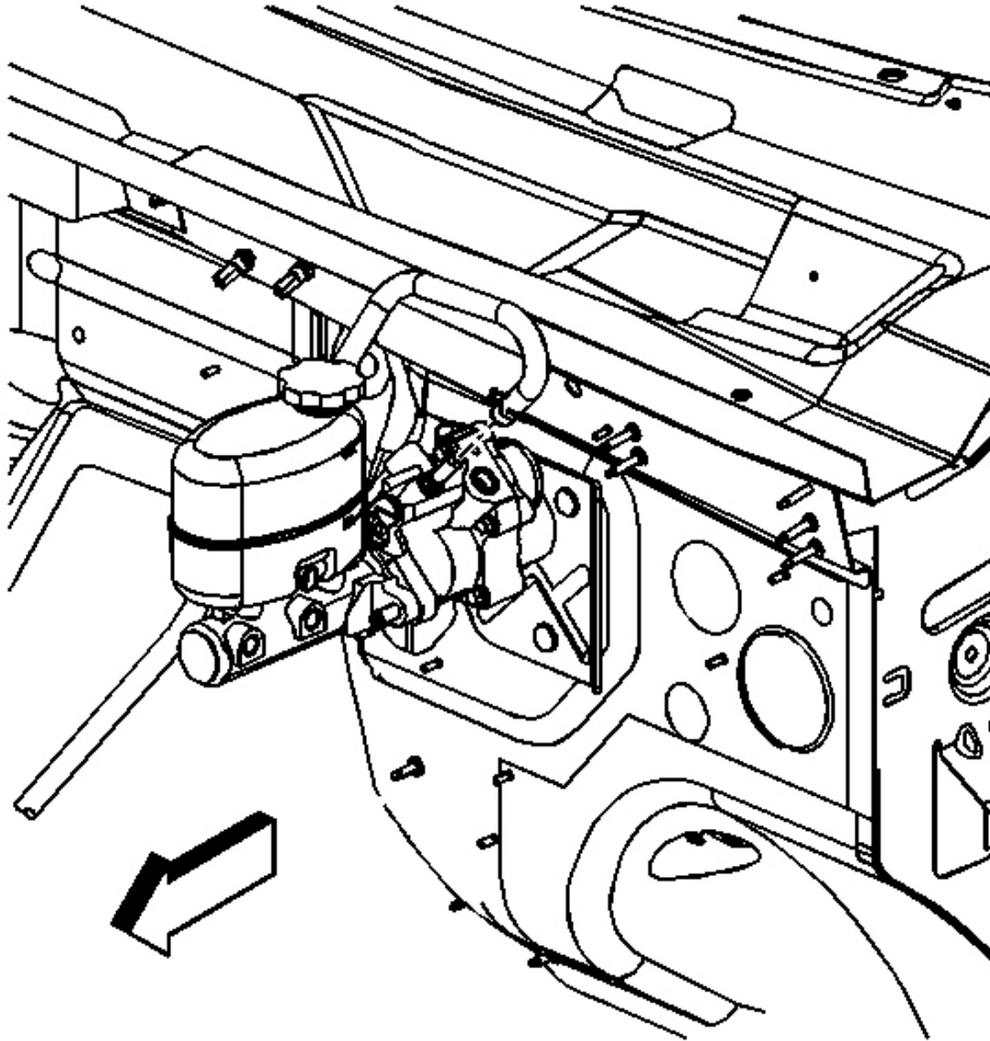
**Tighten:** Tighten the brake booster inlet hose fittings to 28 N.m (21 lb ft).

4. Remove the drain pan from under the vehicle.
5. Bleed the power steering system. Refer to Bleeding the Power Steering System .

## POWER BRAKE BOOSTER OUTLET HOSE REPLACEMENT

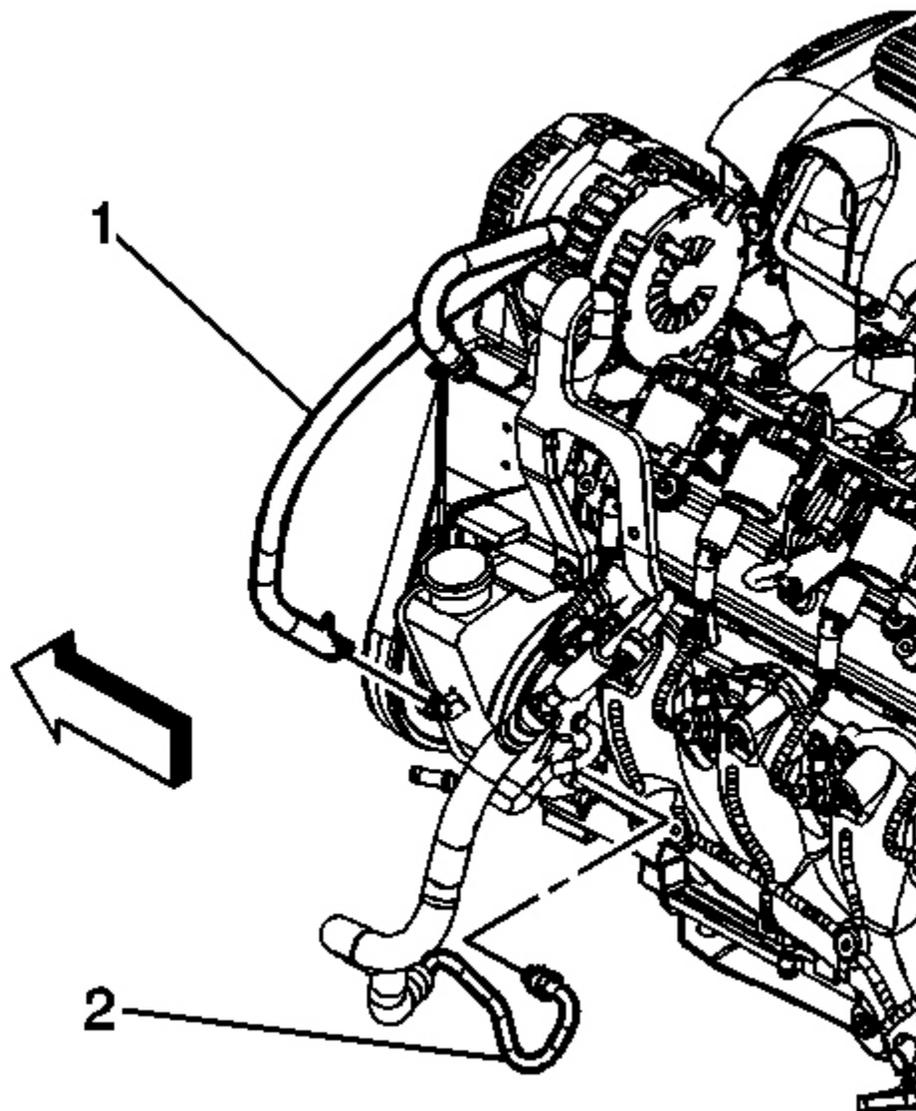
### Removal Procedure

**NOTE:** Refer to Power Steering Hose Disconnected Notice in Cautions and Notices.



**Fig. 39: Brake Booster Outlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

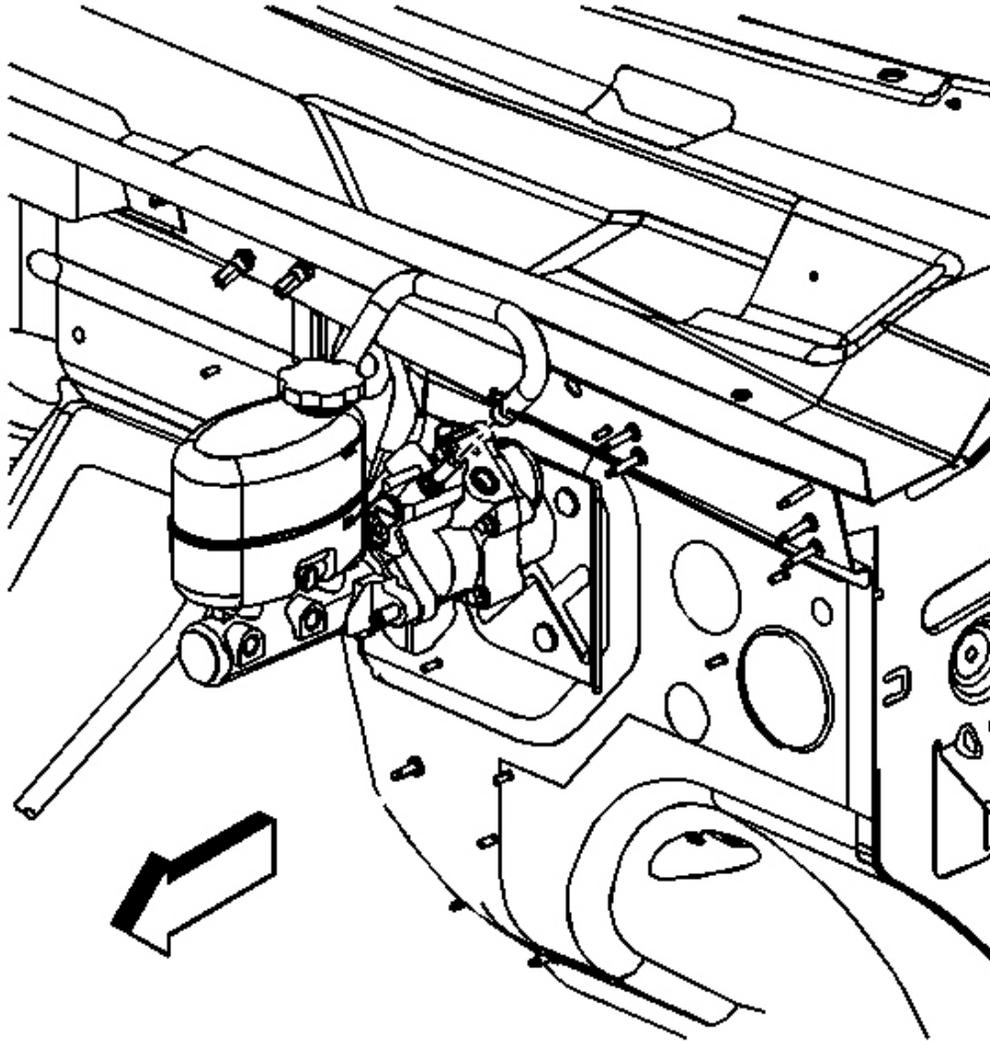
1. Install a drain pan under the vehicle.
2. Remove the brake booster outlet hose from the brake booster.



**Fig. 40: Brake Booster Outlet Hose & Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

3. Remove the clamp retaining the brake booster outlet hose (1) to the power steering pump.
4. Remove the brake booster outlet hose from the vehicle.

#### Installation Procedure

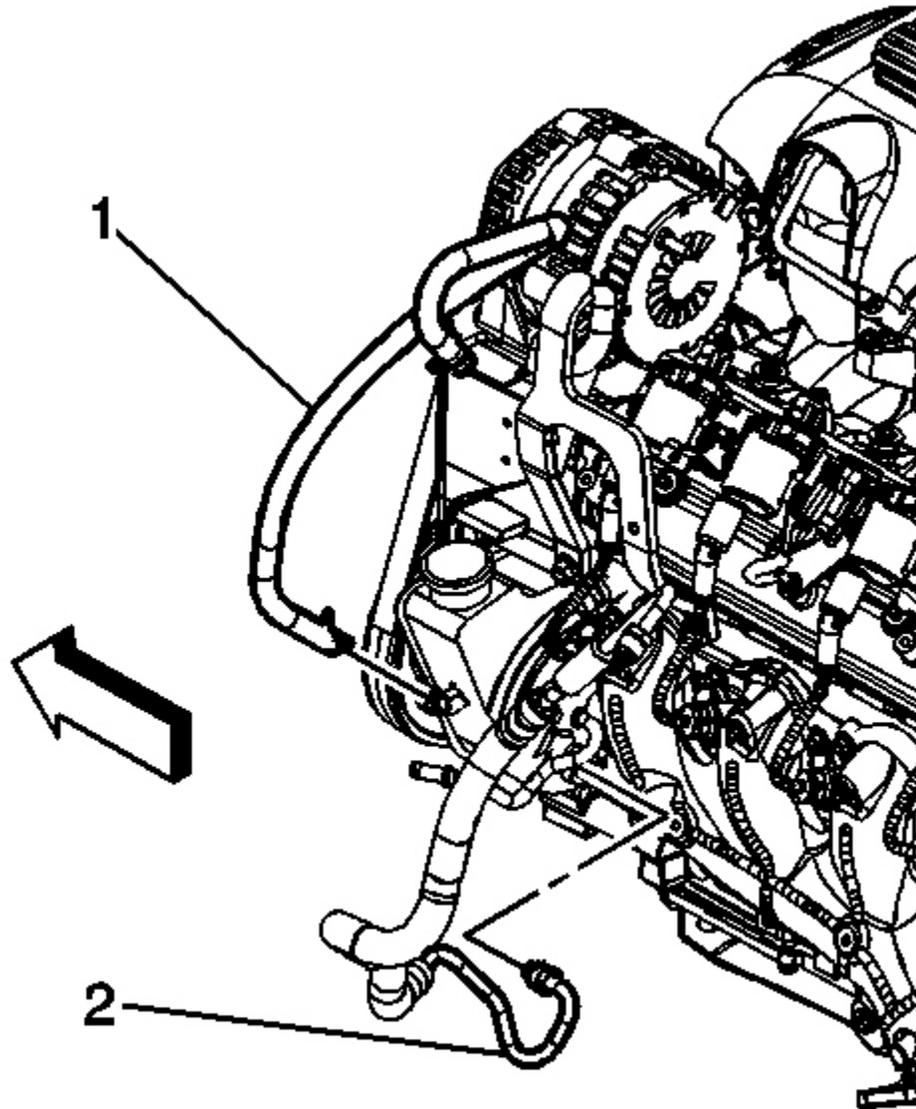


**Fig. 41: Brake Booster Outlet Hose & Brake Booster**  
Courtesy of GENERAL MOTORS CORP.

**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. Route the hose in the same position the hose occupied prior to removal.
2. Install the brake booster outlet hose to the brake booster.

Position the clamp at the end of the hose.



**Fig. 42: Brake Booster Outlet Hose & Power Steering Pump**  
Courtesy of GENERAL MOTORS CORP.

3. Install the brake booster outlet hose (1) to the power steering pump.

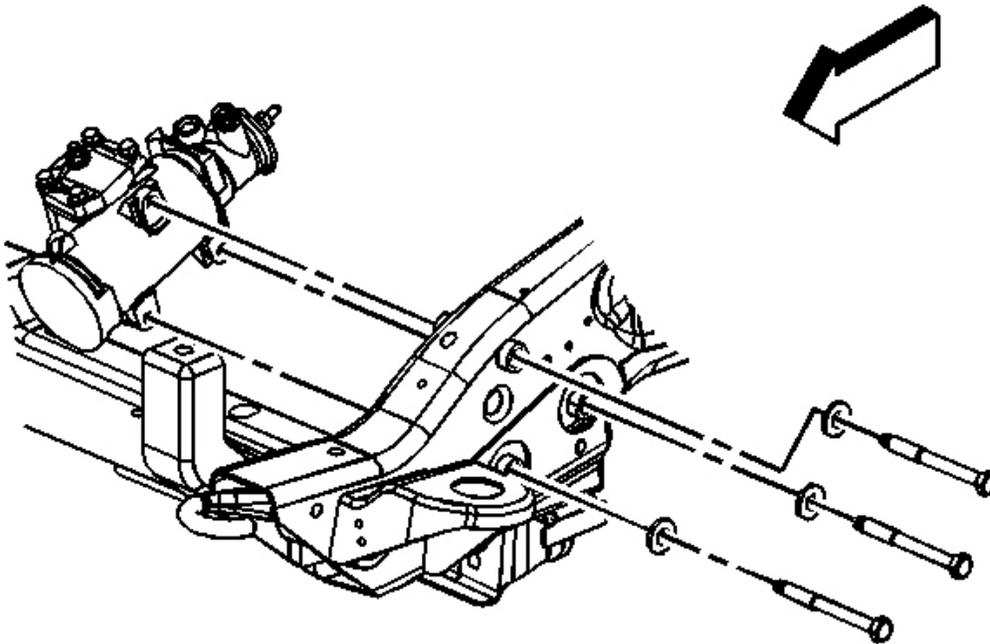
Position the clamp at the end of the hose.

4. Remove the drain pan from under the vehicle.
5. Bleed the power steering system. Refer to **Bleeding the Power Steering System** .

## **POWER STEERING GEAR REPLACEMENT**

### **Removal Procedure**

1. Remove the hoses from the steering gear.
2. Disconnect the intermediate shaft from the steering gear. Refer to **Intermediate Steering Shaft Replacement - Lower** in Steering Wheel and Column.



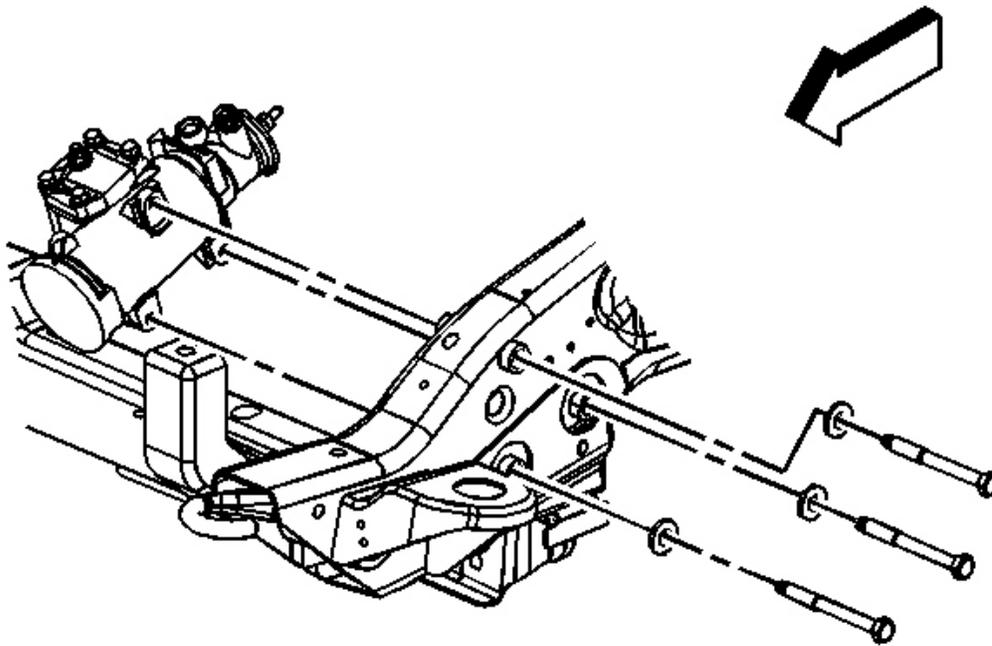
**Fig. 43: Power Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Power Steering Hose Disconnected Notice in Cautions and Notices.

3. Raise the vehicle. Support the vehicle with suitable safety stands.
4. Remove the engine protection shield. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.

5. Remove the pitman arm from the steering gear. Refer to **Pitman Arm Replacement** in Steering Linkage.
6. Remove the bolts retaining the steering gear to the frame.
7. Remove the steering gear from the vehicle.

### Installation Procedure



**Fig. 44: Power Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to **Fastener Notice** in Cautions and Notices.

1. Install the steering gear to the frame and install the retaining bolts.

**Tighten:** Tighten the steering gear retaining bolts to 150 N.m (111 lb ft).

2. Install the pitman arm. Refer to **Pitman Arm Replacement** in Steering Linkage.
3. Install the engine protection shield. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
4. Remove the safety stands.
5. Lower the vehicle.

6. Install the intermediate shaft to the steering gear. Refer to **Intermediate Steering Shaft Replacement - Lower** in Steering Wheel and Column.
7. Remove the caps or plugs from the steering gear and hoses.
8. Install the hoses to the steering gear.

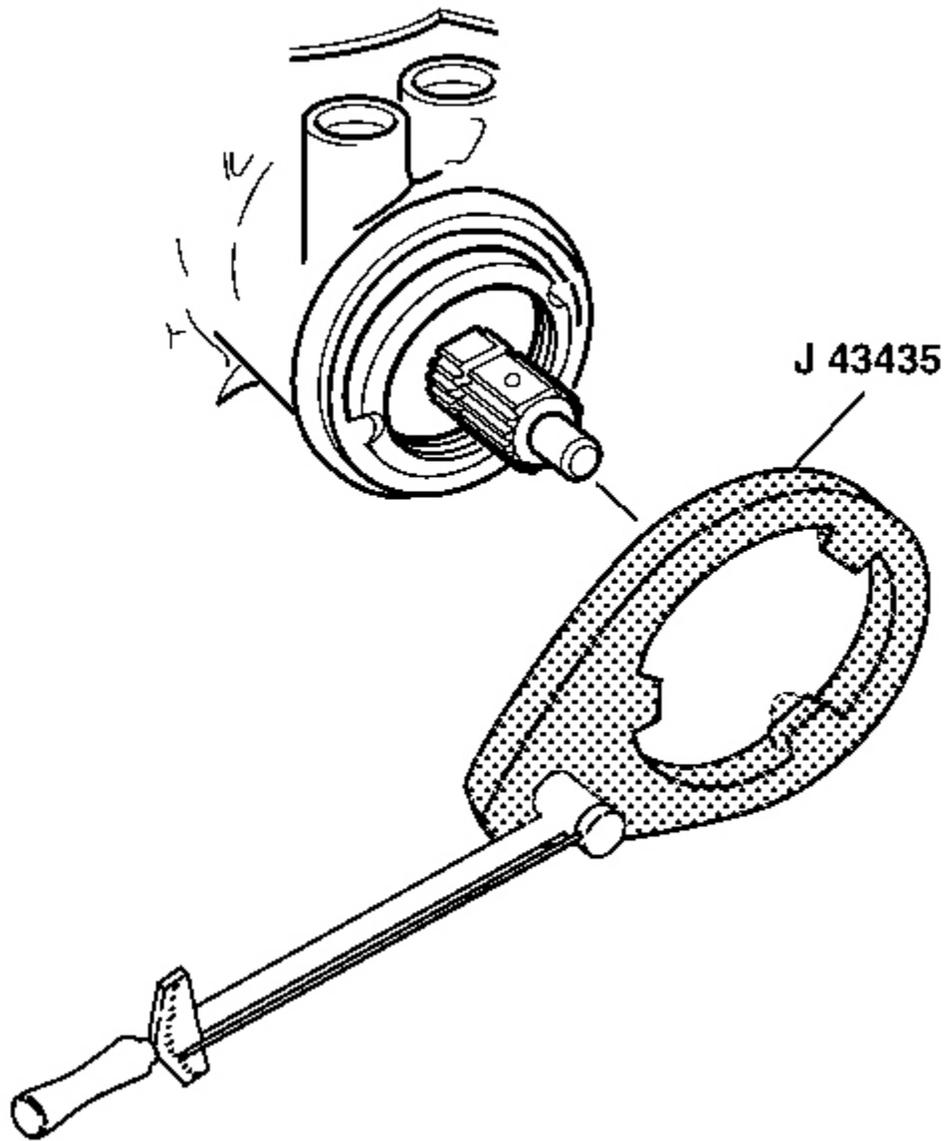
**Tighten:** Tighten the hoses fittings to 28 N.m (21 lb ft).

9. Bleed the power steering system. Refer to **Bleeding the Power Steering System** .

## **WORM THRUST BEARING PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)**

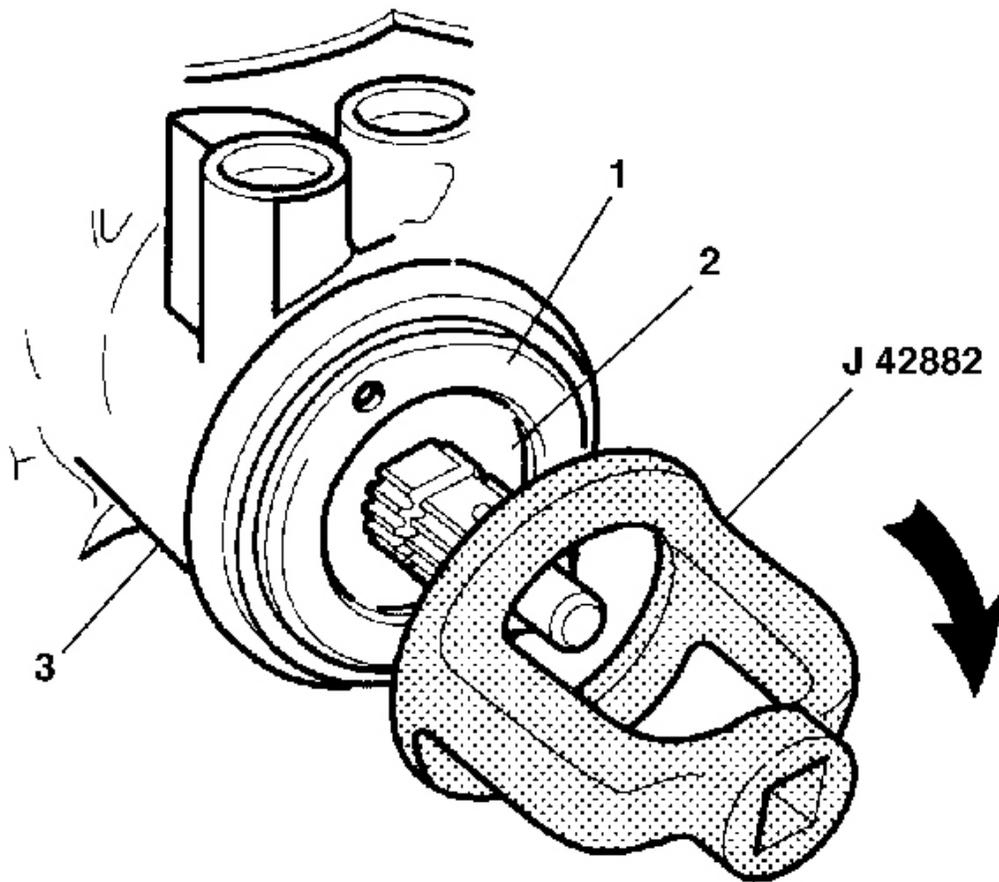
### **Tools Required**

- **J 42882** Adjuster Nut Socket. See **Special Tools and Equipment** .
- J 43435 Adjuster Lock Nut Wrench



**Fig. 45: Removing Coupling Shield Retainer & Lock Nut From Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

1. Rotate the stub shaft back and forth in order to drain the power steering fluid.
2. Remove the coupling shield retainer and the lock nut from the steering gear housing using J 43435 and a torque wrench.

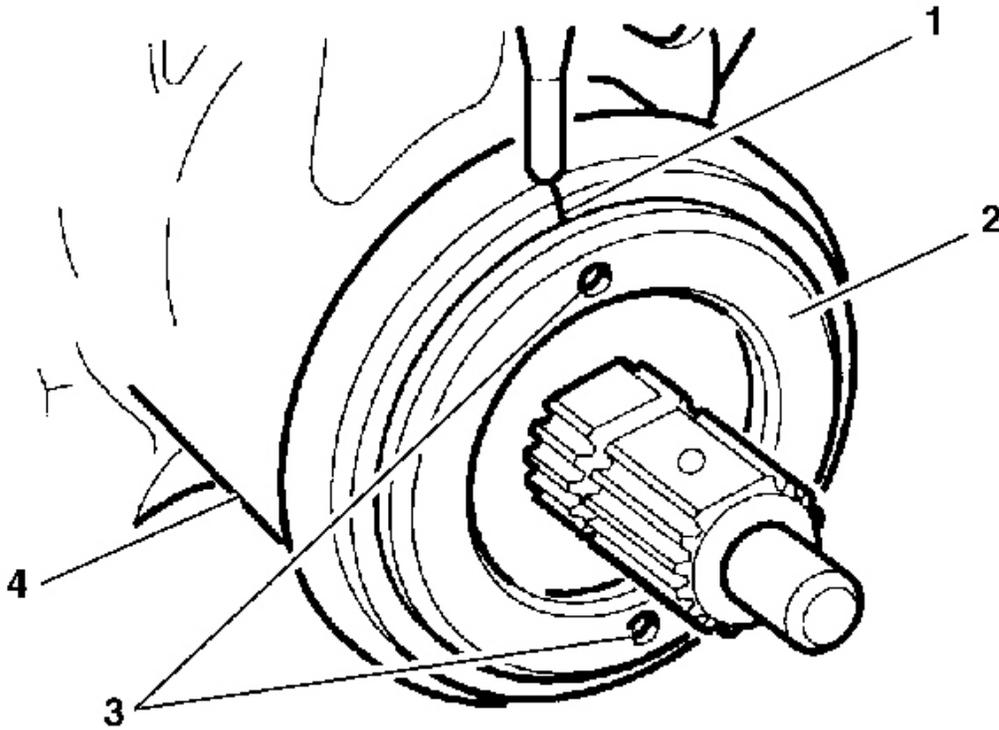


**Fig. 46: Turning Adjuster Nut Assembly Clockwise Using J 42882**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

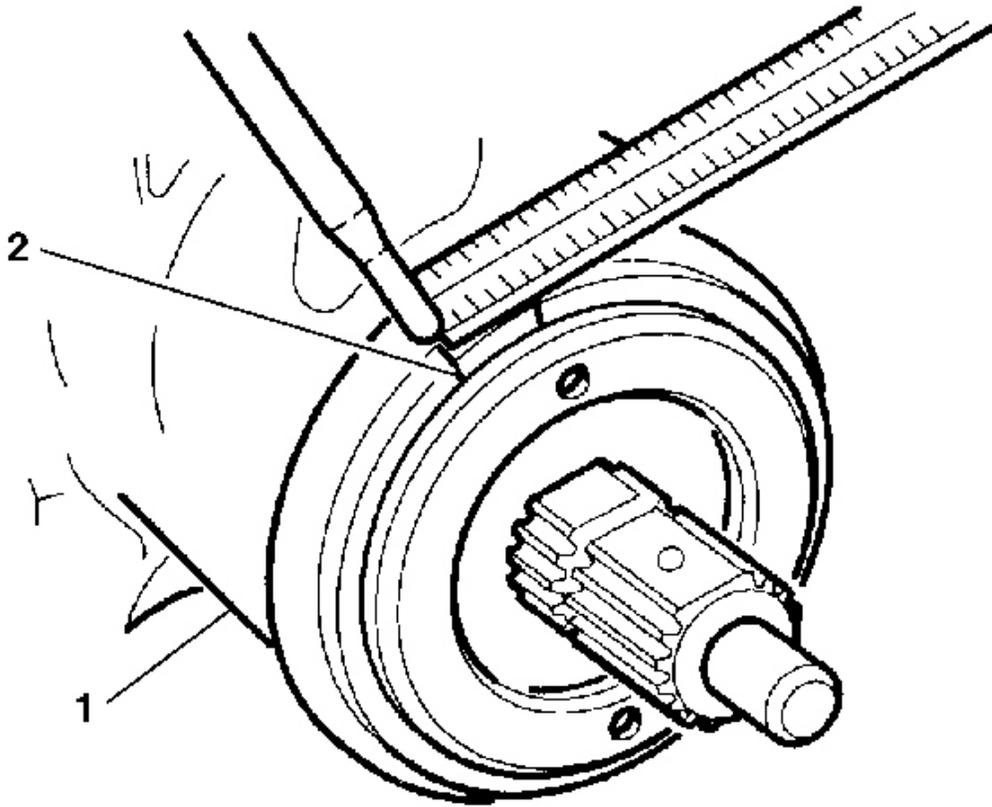
3. Turn the adjuster nut assembly (1) clockwise using **J 42882** until the adjuster nut assembly (1) and the thrust support assembly (2) are firmly bottomed in the steering gear housing (3). See Special Tools and Equipment .

**Tighten:** Tighten the adjuster nut assembly (1) to 30 N.m (22 lb ft).



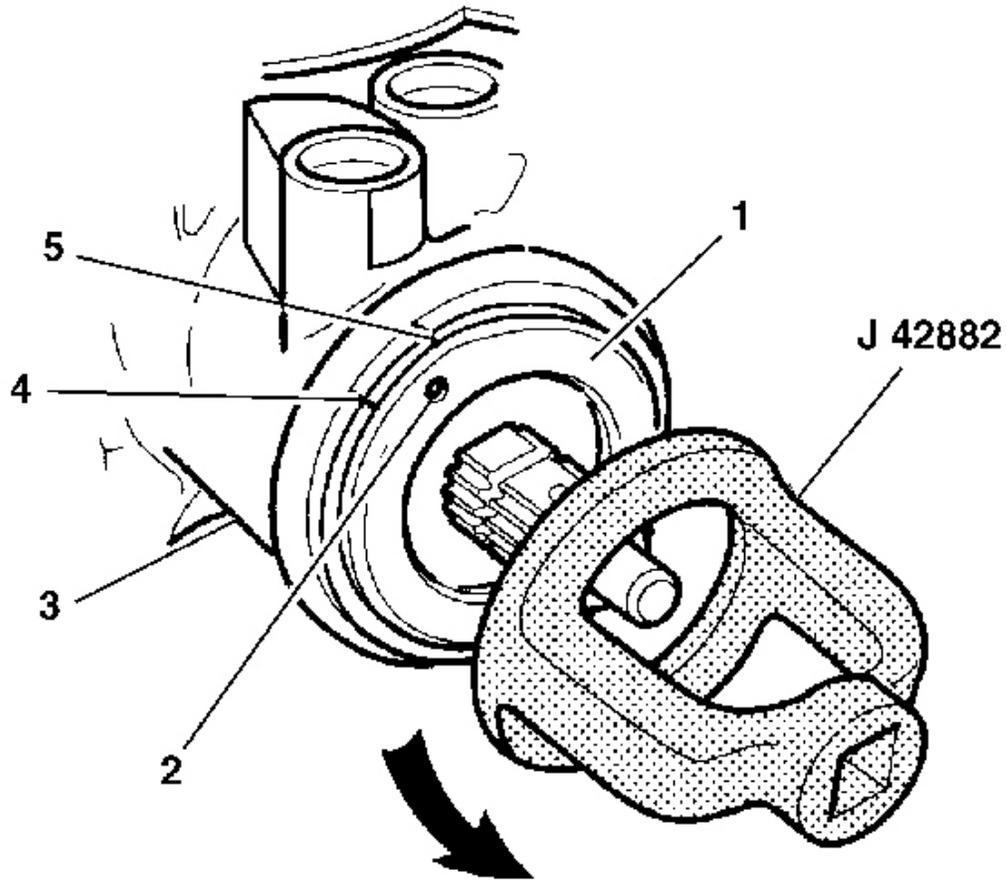
**Fig. 47: Placing Index Mark On Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

4. Place an index mark (1) on the steering gear housing (4) parallel with one of the holes (3) in the adjuster nut assembly (2).



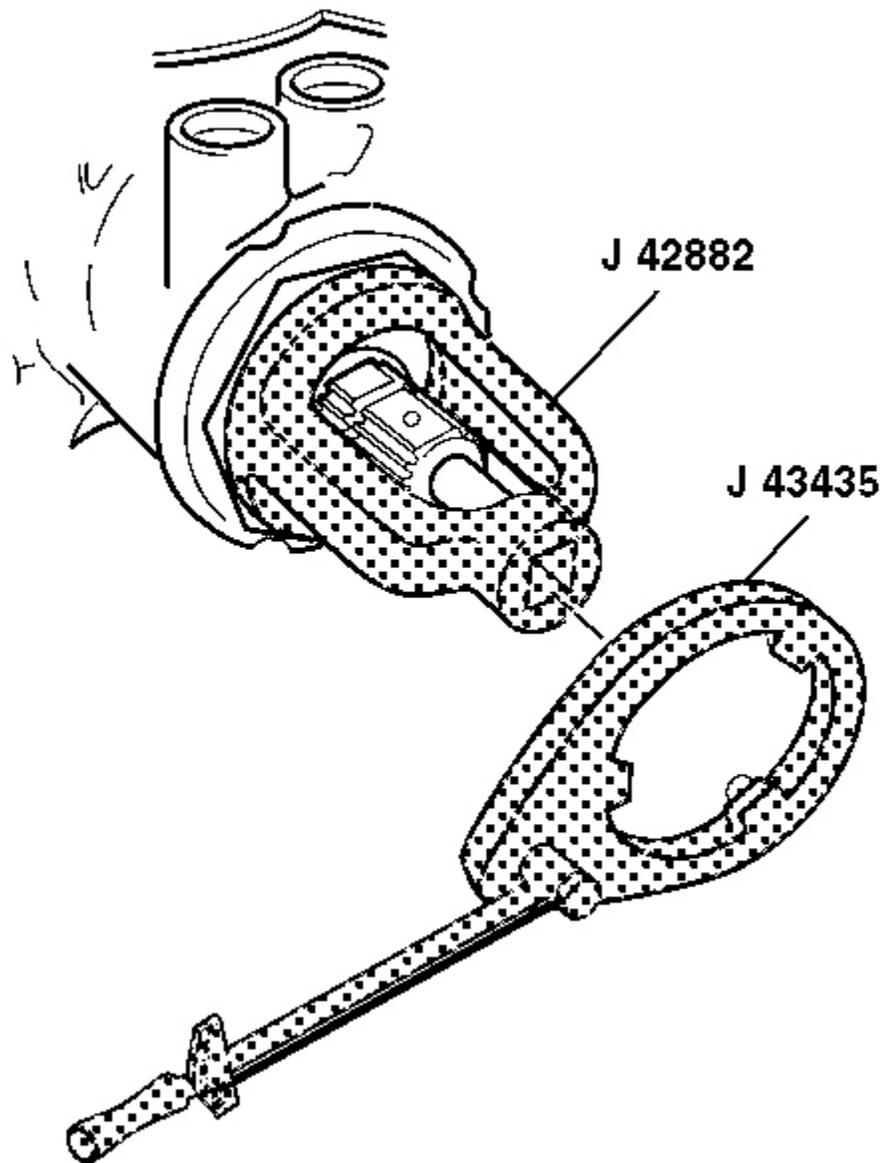
**Fig. 48: Placing Second Mark On Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

5. Measure back counterclockwise 13 mm (1/2 in).
6. Place a second mark (2) on the steering gear housing (1).



**Fig. 49: Using J 42882 & Torque Wrench To Turn Adjuster Nut Assembly Counterclockwise**  
**Courtesy of GENERAL MOTORS CORP.**

7. Using **J 42882** and a torque wrench, turn the adjuster nut assembly (1) counterclockwise 15-25 degrees to align the hole (2) in the adjuster nut assembly (1) with the second mark (4) on the steering gear housing (3). See **Special Tools and Equipment** .



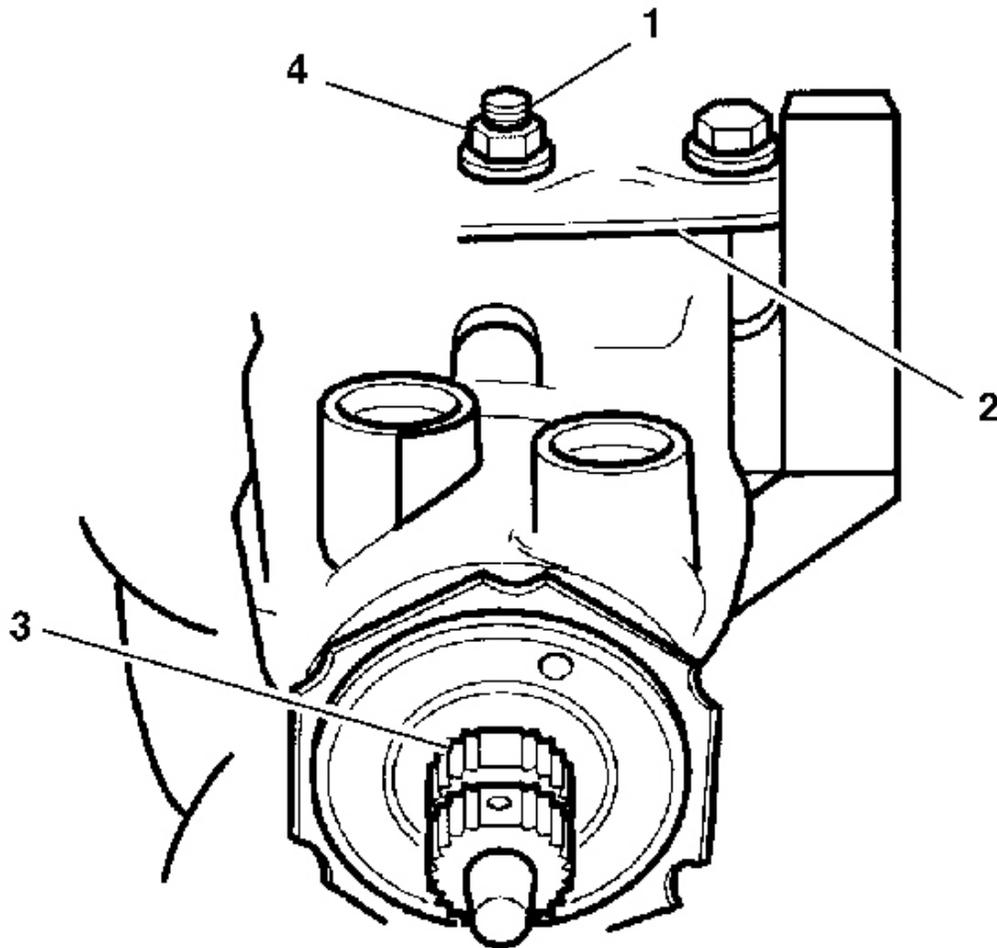
**Fig. 50: Tightening Coupling Shield Retainer & Lock Nut Using J 43435 & Torque Wrench**  
Courtesy of GENERAL MOTORS CORP.

8. Install the coupling shield retainer and the lock nut.
9. Hold the adjuster nut assembly in position to maintain alignment of the marks.
10. Tighten the coupling shield retainer and the lock nut using J 43435 and a torque wrench.

**Tighten:** Tighten the coupling shield retainer and the lock nut to 109 N.m (80 lb ft).

11. To adjust the pitman shaft, refer to **Pitman Shaft Over-Center Preload Adjustment - Off Vehicle (670 Gear)**.

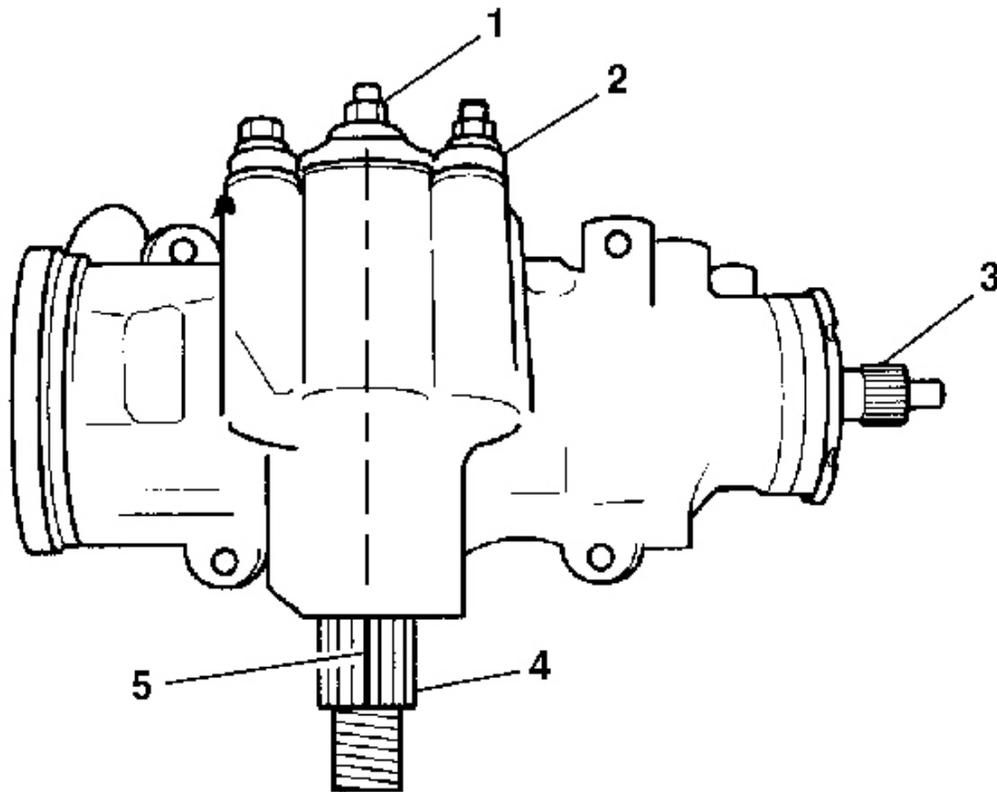
### **PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHICLE (670 GEAR)**



**Fig. 51: Rotating Stub Shaft Back & Forth To Drain Power Steering Fluid**  
Courtesy of GENERAL MOTORS CORP.

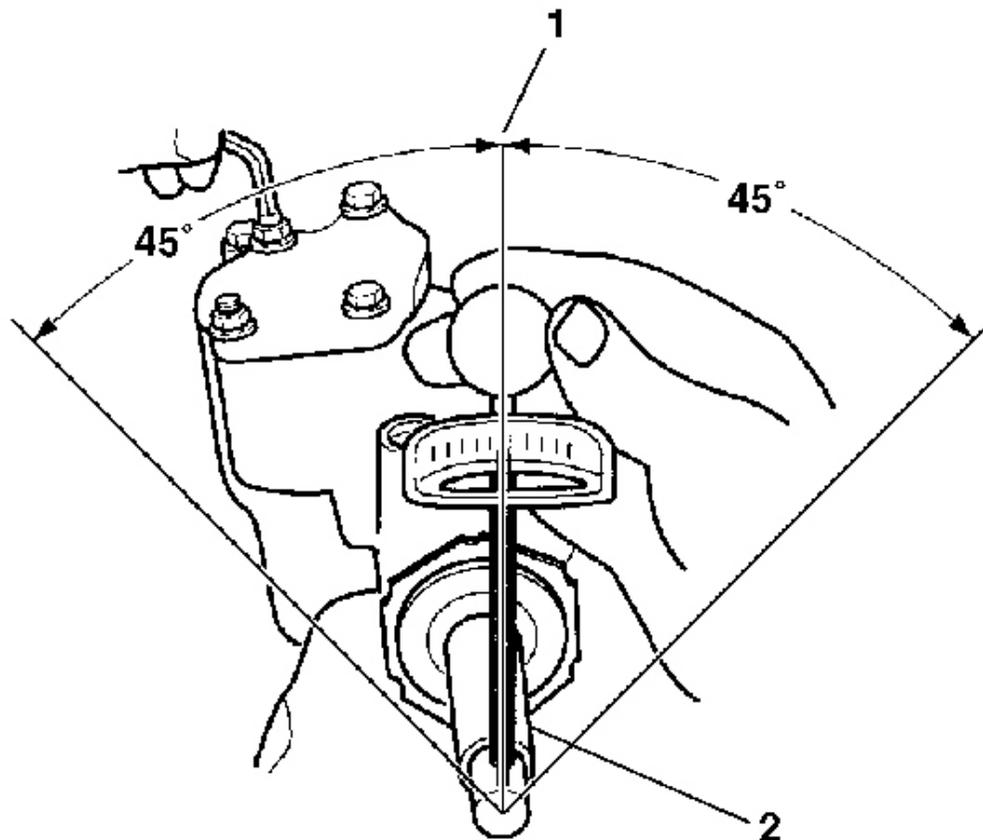
1. Rotate the stub shaft (3) back and forth to drain the power steering fluid.
2. Loosen the adjuster lock nut (4).

3. Turn the pitman shaft adjuster screw (1) counterclockwise until the screw is fully extended.
4. Turn the pitman shaft adjuster screw (1) clockwise 1 full turn.
5. Rotate the 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 stub shaft (3) back half of the total number of turns. This is the center of the gear.



**Fig. 52: Aligning Master Spline On Pitman Shaft With Adjuster Screw**  
Courtesy of GENERAL MOTORS CORP.

7. Make sure that the gear is centered by checking the following items:
  - The flat on the stub shaft (3) faces upward.
  - The flat on the stub shaft (3) is parallel with the side cover (2).
8. Align the master spline (5) on the pitman shaft (4) with the adjuster screw (1).



**Fig. 53: Rotating Stub Shaft 45 Degrees From Each Side Of Center Of Stub Shaft**  
 Courtesy of GENERAL MOTORS CORP.

9. Place a torque wrench on the stub shaft (2) with the handle in the vertical position.
10. Rotate the stub shaft (2) 45 degrees from each side of the center of the stub shaft. The stub shaft (2) must rotate smoothly.
11. Record the worm bearing preload measured on or near the center (1). The recorded bearing preload must be 1.2 N.m (10.5 lb in) with the worm and the ball nut installed. If the torque is outside of this range, readjust or repair the steering gear assembly as required.
12. To obtain the correct preload torque, adjust the over-center torque by turning the pitman shaft adjuster screw clockwise.

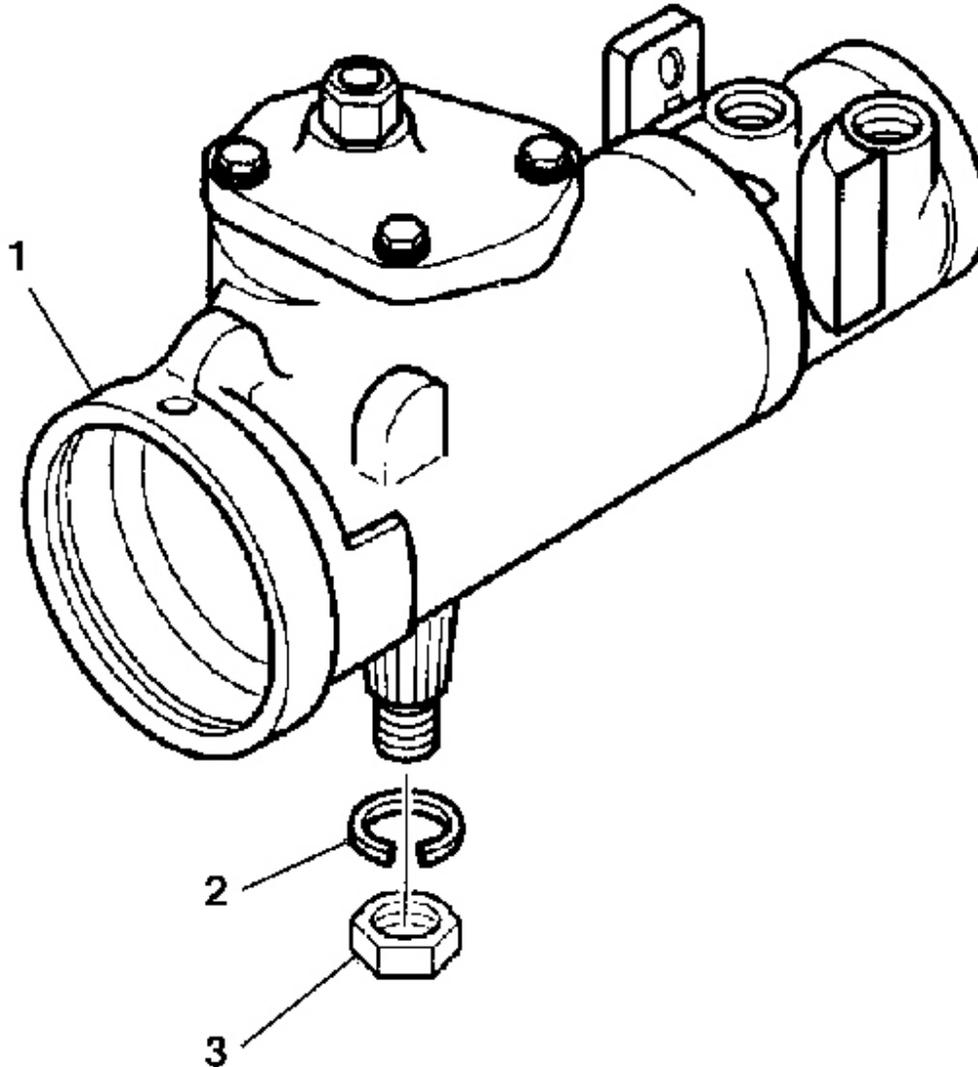
**NOTE:** Refer to Fastener Notice in **Cautions and Notices**.

13. Add 0.9 N.m (8 lb in) torque to the previously measured worm bearing preload torque.

**Tighten:** Tighten the adjuster lock nut to 44 N.m (32 lb ft). Prevent the adjuster screw from turning while tightening the adjuster lock nut.

## STEERING GEAR PITMAN SHAFT AND HOUSING COVER REPLACEMENT - OFF VEHICLE (700 GEAR)

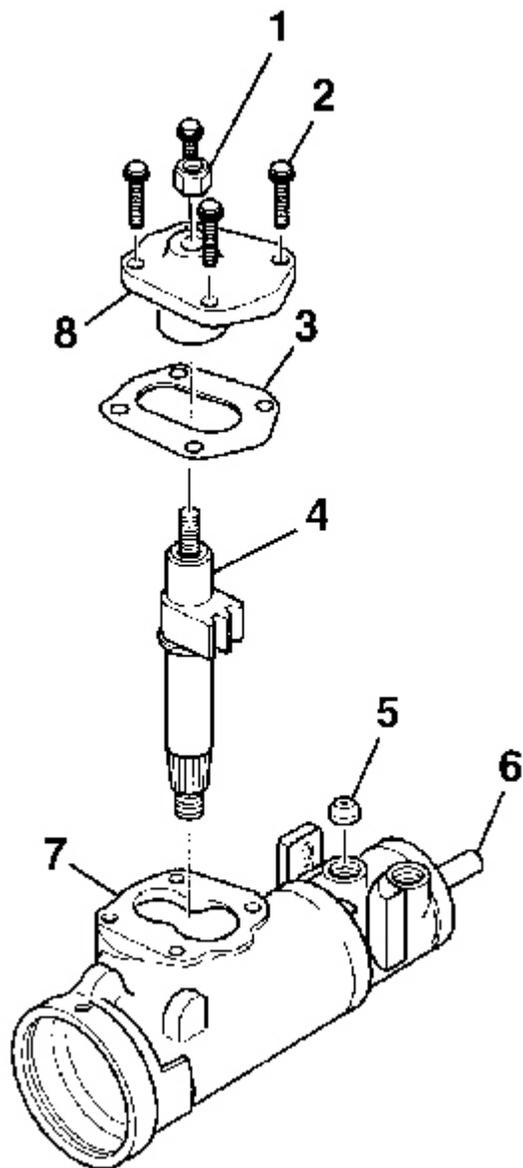
### Disassembly Procedure



**Fig. 54: Installing The Lock Washer And Nut (700 Gear)**

**Courtesy of GENERAL MOTORS CORP.**

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



**Fig. 55: Pitman Shaft Assembly (700 Gear)**  
**Courtesy of GENERAL MOTORS CORP.**

6. Loosen the adjuster lock nut (1).
7. Remove the bolts (2).
8. Remove the nut.

9. Rotate the stub shaft (6) using a 12-point socket to center the steering gear (7).

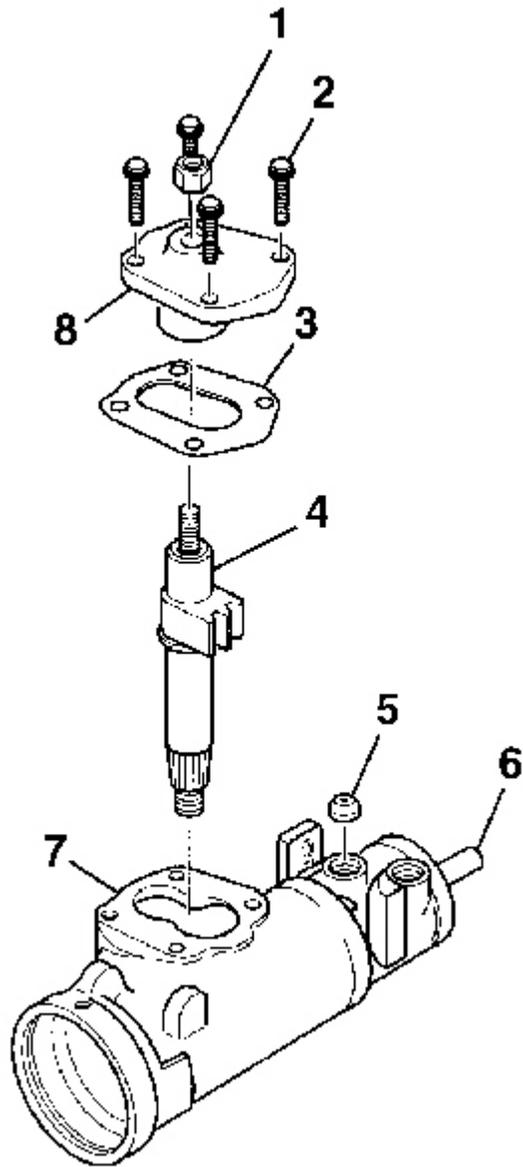
**IMPORTANT: When removing the pitman shaft assembly, the pitman arm and its components may fall from the steering gear housing. Support the pitman arm and its components while removing the pitman shaft assembly.**

10. Remove the following items as an assembly:

- The side cover (8)
- The gasket (3)
- The pitman shaft (4)

11. Remove the pitman shaft (4) from the side cover (8).

### **Assembly Procedure**



**Fig. 56: Pitman Shaft Assembly (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

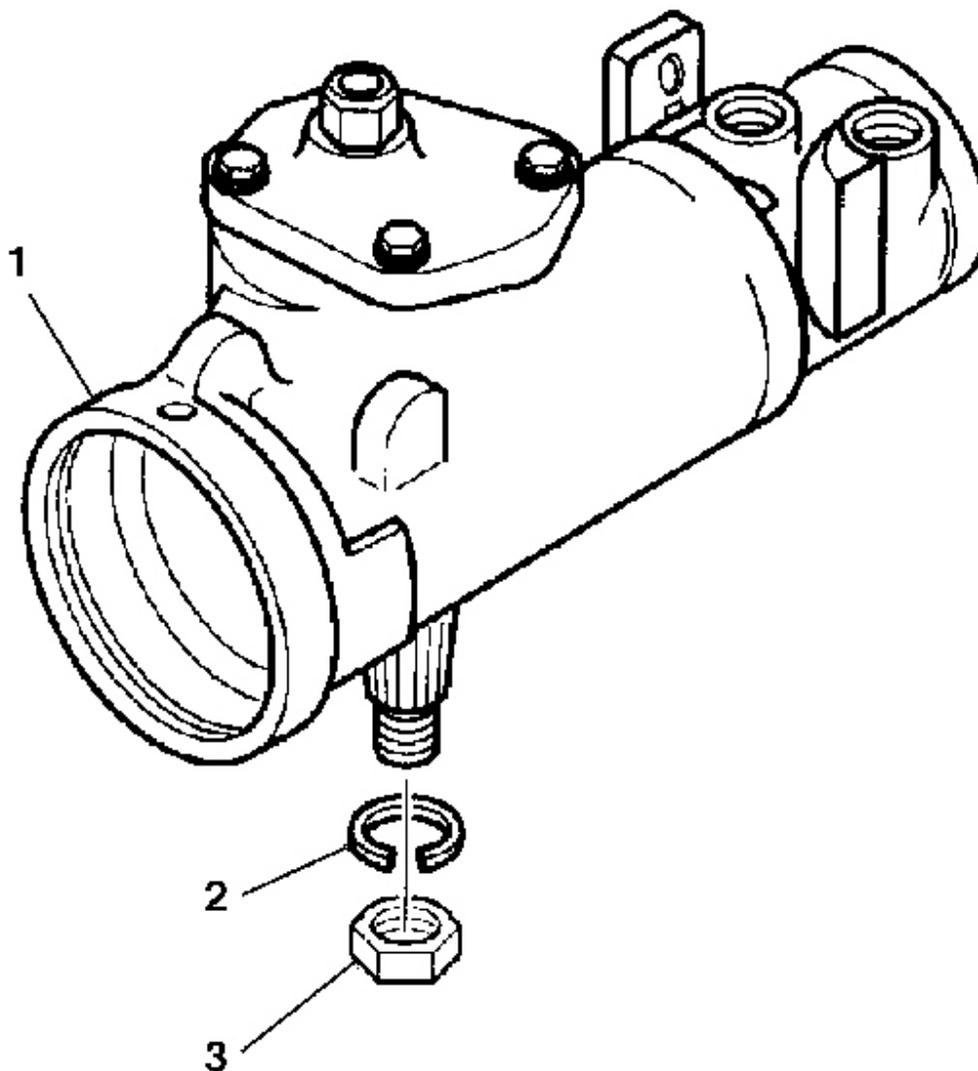
1. Screw the pitman shaft (4) to the side cover (8) until it fully seats to the side cover (8).
2. Install the adjuster lock nut (1). Do not tighten the adjuster lock nut (1) until the pitman shaft adjustment is completed.

3. Install the pitman shaft assembly (4) and the side cover (8) to the steering gear housing (7).

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

4. Install the bolts (2).

**Tighten:** Tighten the bolts (2) to 60 N.m (45 lb ft).

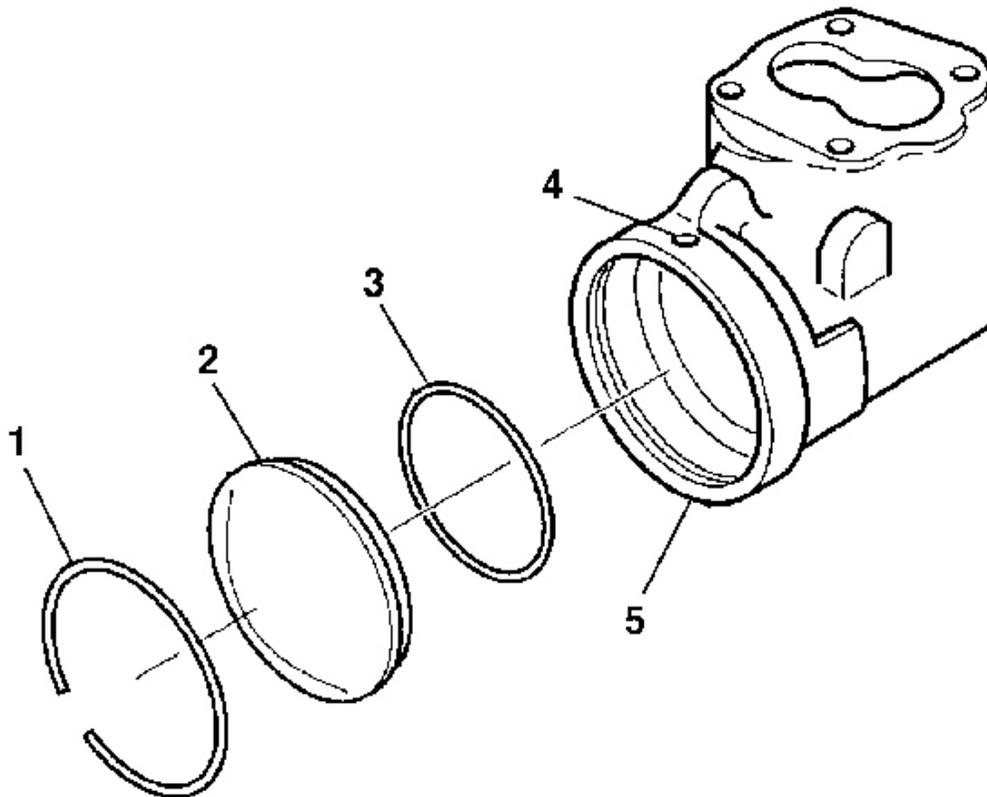


**Fig. 57: Installing The Lock Washer And Nut (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

5. Install the lock washer (2).
6. Install the nut (3).
7. If necessary, adjust the pitman shaft. Refer to **Pitman Shaft Over-Center Preload Adjustment - Off Vehicle (670 Gear)** to adjust the pitman shaft.

## **STEERING GEAR HOUSING END PLUG REPLACEMENT - OFF VEHICLE**

### **Disassembly Procedure**

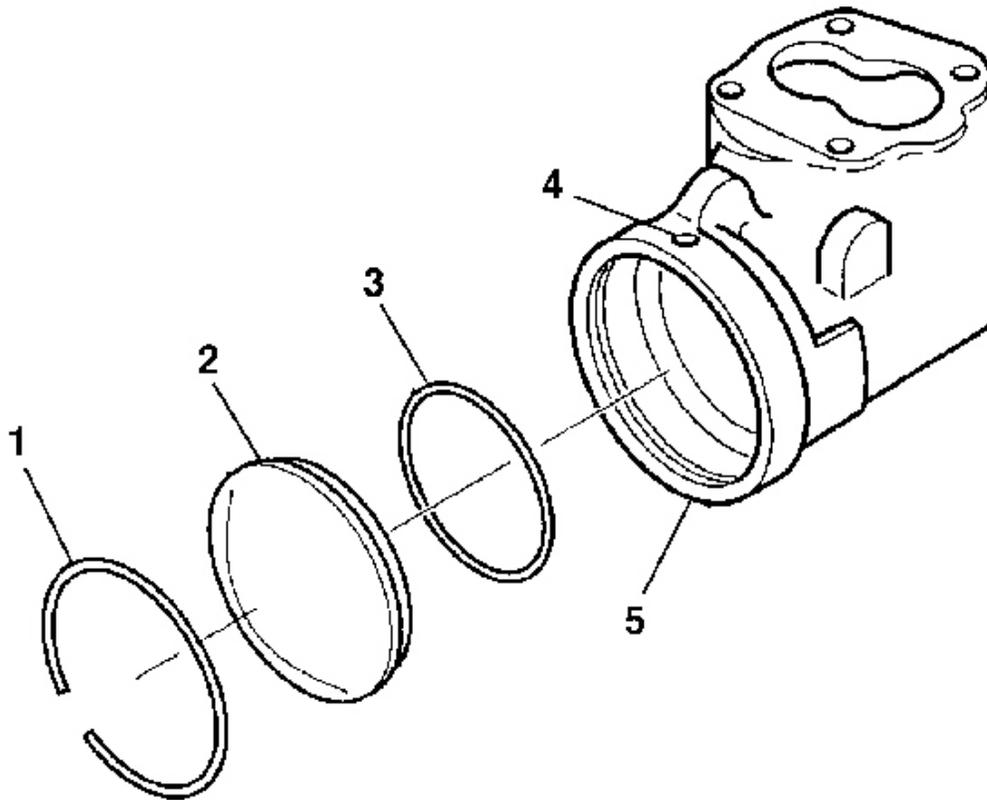


**Fig. 58: Steering Gear Housing End Plug Assembly**  
Courtesy of GENERAL MOTORS CORP.

1. Rotate the stub shaft back and forth to drain the fluid.

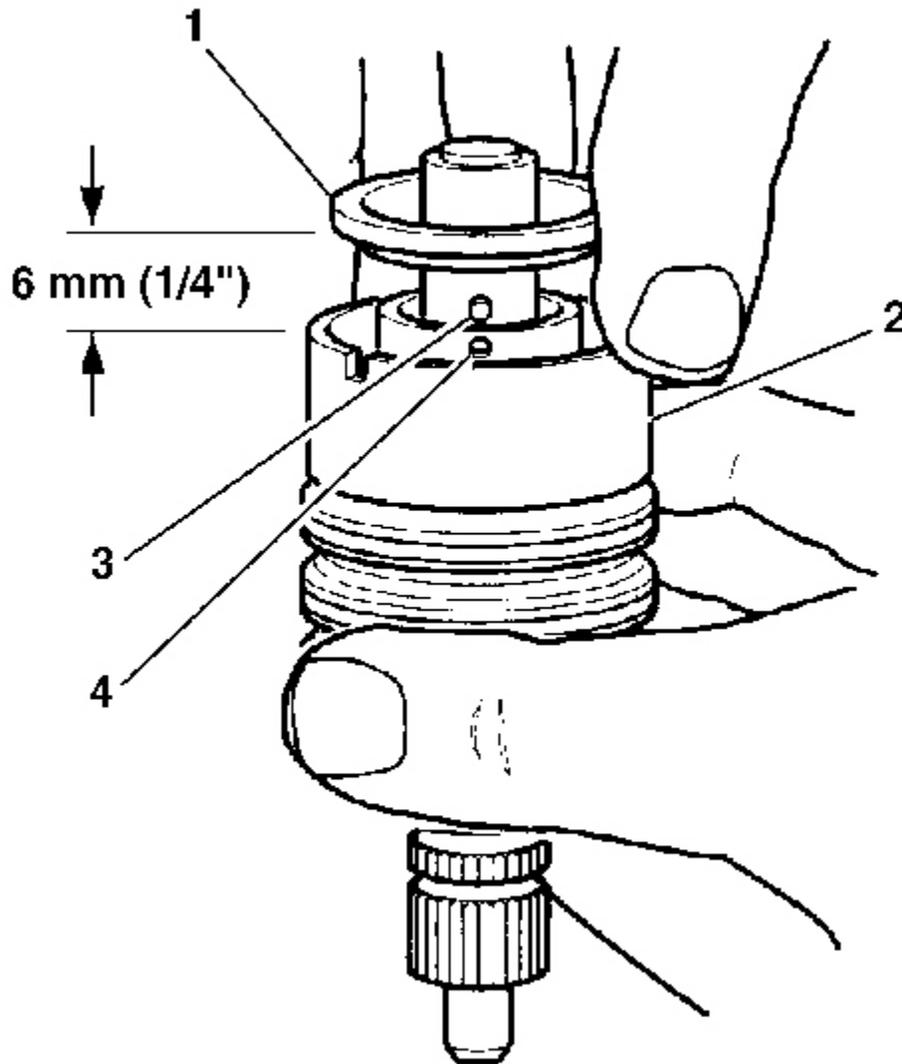
2. Insert a punch into the housing access hole to unseat the retaining ring (1).
3. Remove the plug (2).
4. Remove the O-ring seal (3).

#### Assembly Procedure



**Fig. 59: Steering Gear Housing End Plug Assembly**  
Courtesy of GENERAL MOTORS CORP.

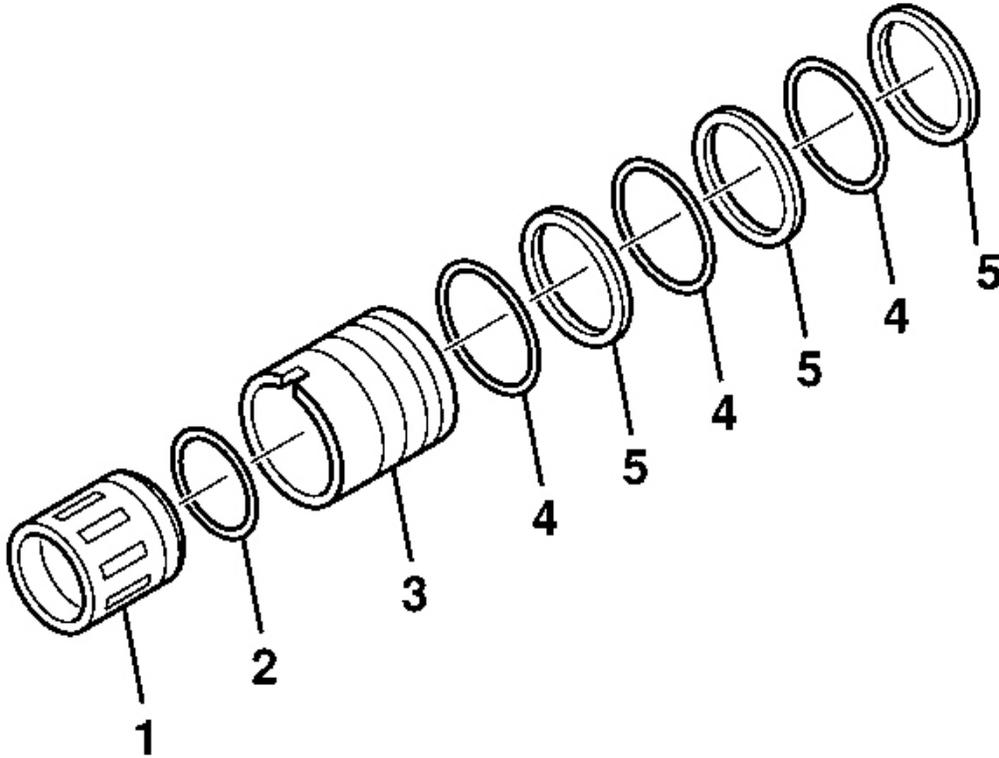
1. Lubricate the O-ring seal (3) with power steering fluid.
2. Install the O-ring seal (3) into the steering gear housing (5).
3. Install the plug (2).
4. Install the retaining ring (1). Ensure that the retaining ring open end is approximately 25 mm (1 in) from the access hole in the steering gear housing (5).



**Fig. 60: Removing Stub Shaft & Valve Assembly From Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

1. Remove the thrust support assembly. Refer to **Steering Gear Thrust Support Replacement - Off Vehicle (700 Gear)** .
2. Remove the stub shaft (1) and the valve assembly (2) from the steering gear housing.
3. If necessary, remove the stub shaft (1) from the valve assembly (2) in the following manner:

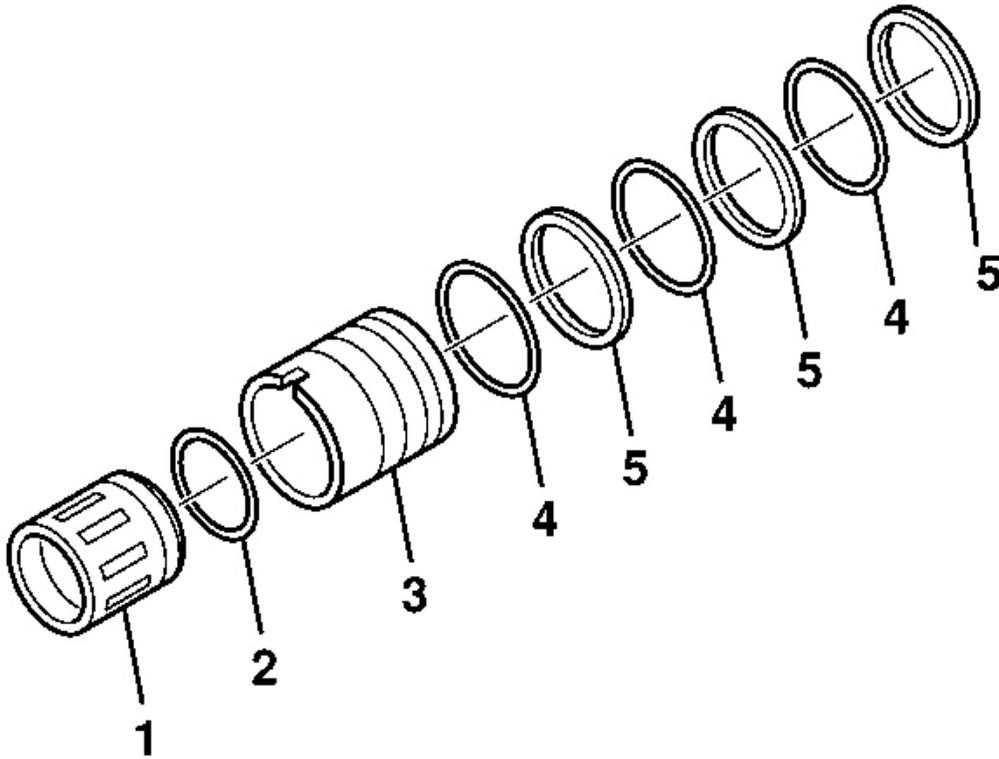
1. Tap the stub shaft (1) lightly on a wood block in order to loosen the cap.
2. Pull the cap and the valve spool out from valve body (2) 6 mm (1/4 in).
3. Disengage the stub shaft pin (3) from the hole in the valve spool (4).



**Fig. 61: Exploded View Of Valve Assembly (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

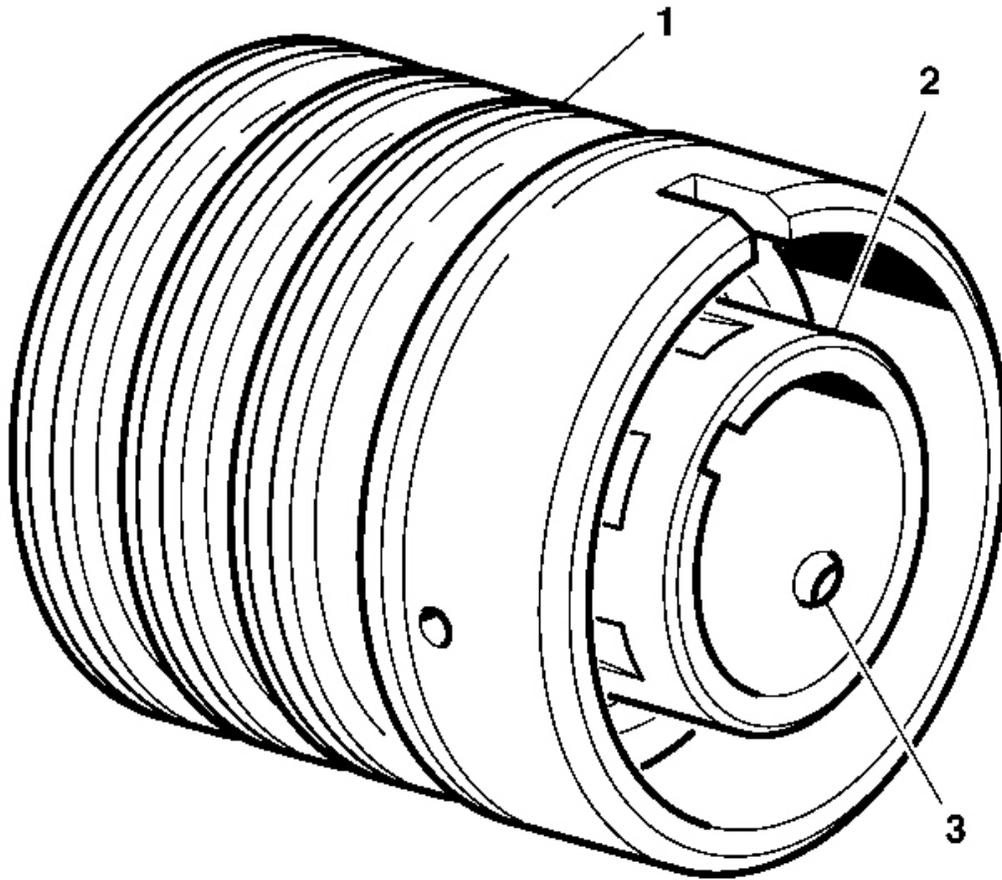
4. If the valve assembly needs repair, disassemble the valve in the following manner:
  1. Simultaneously pull and rotate the valve spool (1) from the valve body (3).
  2. Remove the valve spool O-ring seal (2).
  3. Alternately remove the valve body teflon rings (5) and the O-ring seals (4).

#### Assembly Procedure



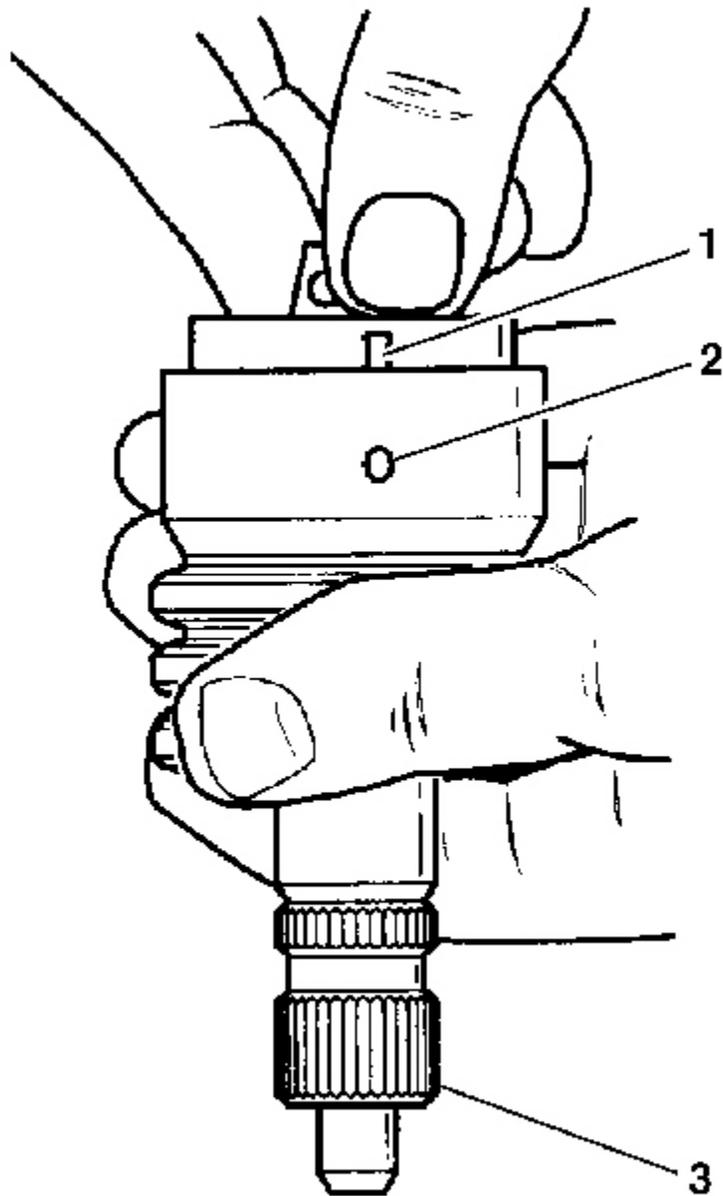
**Fig. 62: Exploded View Of Valve Assembly (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

1. If disassembled, reassemble the valve assembly in the following manner:
  1. Alternately install the valve body teflon rings (5) and the O-ring seals (4).
  2. Install the valve spool O-ring seal (2) to the valve spool (1).
  3. Lubricate the valve spool (1) and O-ring seal (2) with power steering fluid.



**Fig. 63: Pushing & Rotating Valve Spool Into Valve Body**  
Courtesy of GENERAL MOTORS CORP.

2. Simultaneously push and rotate the valve spool (2) into the valve body (1) until the hole (3) in the valve spool (2) for the stub shaft pin is accessible from the opposite end of the valve body (1).



**Fig. 64: Installing Stub Shaft To Valve Spool**  
Courtesy of GENERAL MOTORS CORP.

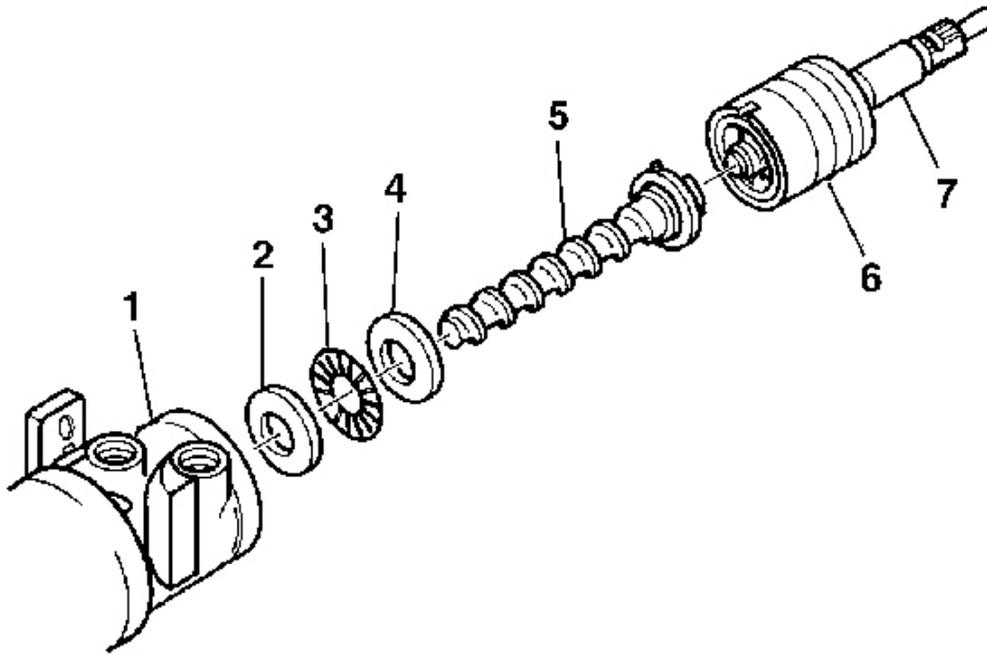
3. If necessary, install the stub shaft to the valve spool in the following manner:

Lubricate the stub shaft assembly (3).

1. Insert the stub shaft (3) into the valve spool.
2. Insert the pin.

**IMPORTANT: Make sure that the shaft cap notch (1) is mated with the valve body pin before installing the valve body into the steering gear assembly.**

3. The notch in the cap (1) must fully engage the valve body pin (2). Seat the cap against the valve body shoulder.



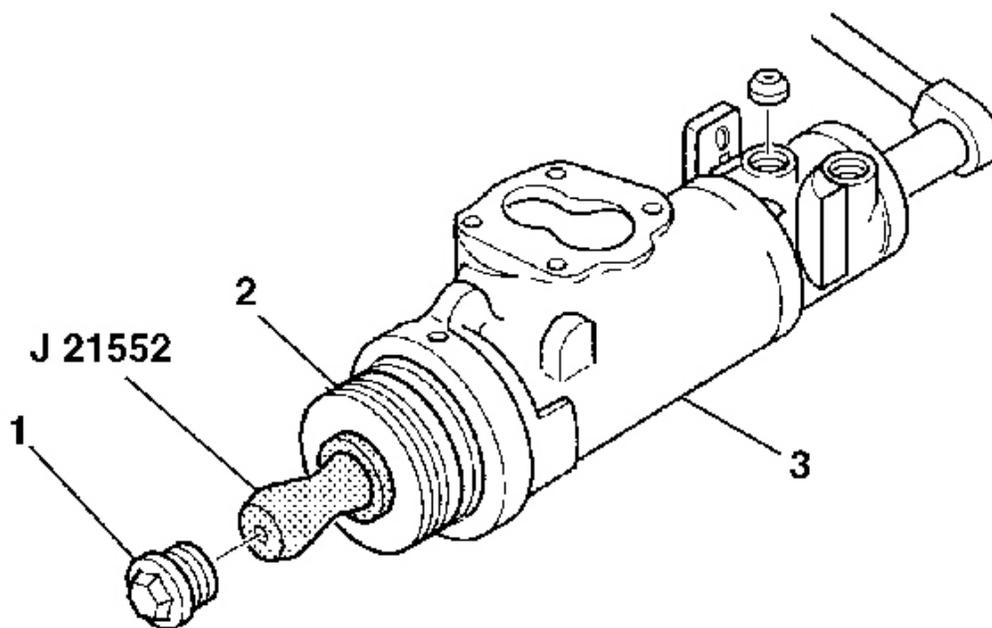
**Fig. 65: Installing Stub Shaft & Valve Assembly To Worm Shaft**  
Courtesy of GENERAL MOTORS CORP.

4. Install the stub shaft (7) and valve assembly (6) to the worm shaft (5). Ensure the pin fits in the worm shaft to the slot in the valve assembly.
5. Install the thrust support assembly. Refer to **Steering Gear Thrust Support Replacement - Off Vehicle (700 Gear)** .

## Tools Required

- **J 21552** Rack Piston Arbor. See **Special Tools and Equipment** .
- J 8947 Rack Piston Teflon Ring Compressor

## Disassembly Procedure



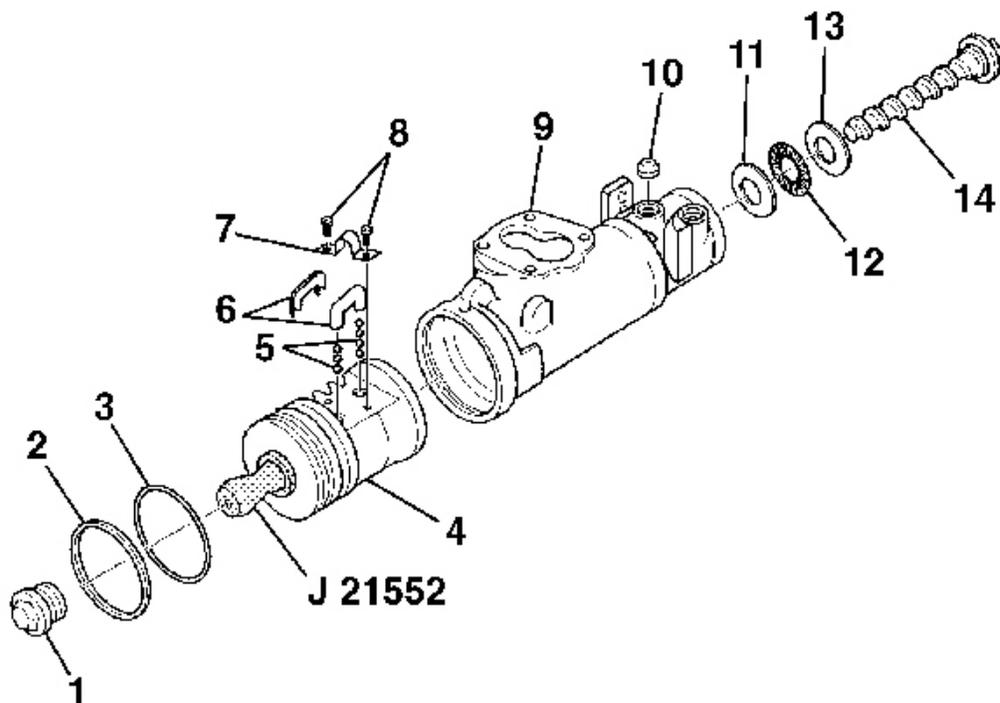
**Fig. 66: Turning Stub Shaft Counterclockwise Until Rack Piston Begins To Come Out Of Steering Gear Housing**

Courtesy of GENERAL MOTORS CORP.

**IMPORTANT: Do not remove the needle bearing when removing the pitman shaft arm and its components.**

1. Remove the pitman shaft seals and bearing. Refer to **Pitman Shaft Seals and Bearing Replacement - Off Vehicle (700 Gear)** .
2. Remove the housing end plug. Refer to **Steering Gear Housing End Plug Replacement - Off Vehicle** .
3. Turn the stub shaft counterclockwise until the rack piston (2) begins to come out of the steering gear housing (3).
4. Remove the rack piston plug (1).
5. Insert **J 21552** into the bore of the rack piston (2). See **Special Tools and Equipment** .

6. Hold **J 21552** tightly against the worm shaft while turning the stub shaft counterclockwise. Turning the stub shaft forces the rack piston (2) onto **J 21552** . The rack piston balls remain in place. See **Special Tools and Equipment** .



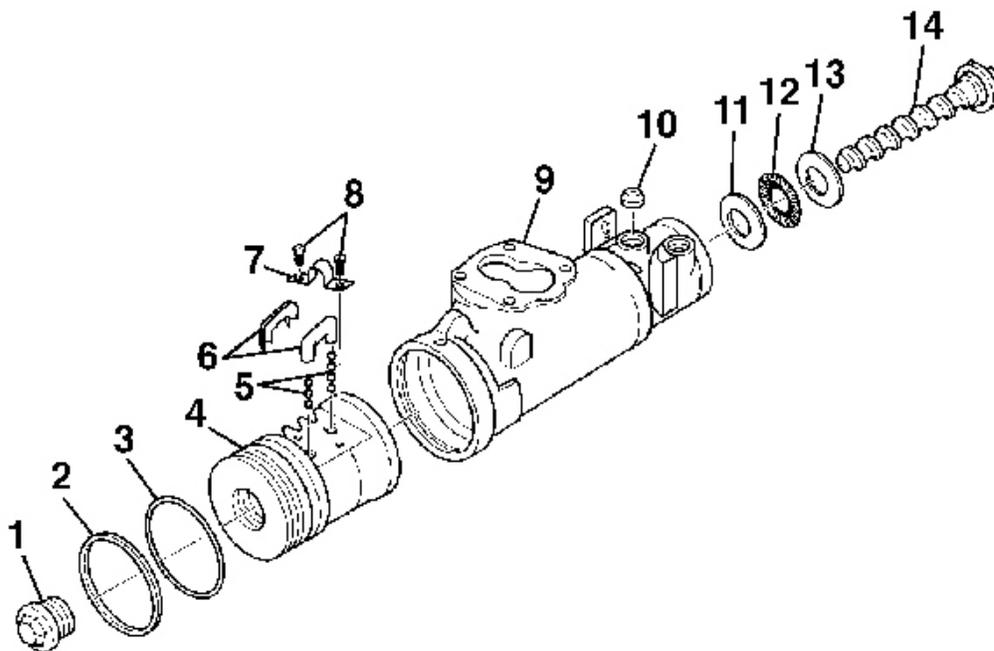
**Fig. 67: Removing Steering Gear Housing Components**  
Courtesy of GENERAL MOTORS CORP.

7. Remove the following items as an assembly from the steering gear housing (9):
- The rack piston (4)
  - The rack piston screws (8), clamp (7), ball guide (6) and balls (5)
  - **J 21552** . See **Special Tools and Equipment** .
8. Remove the spool valve assembly. Refer to **Steering Gear Valve Replacement - Off Vehicle (700 Gear)** .
9. Remove the worm shaft (14).
10. Remove the thrust bearing (12) and the flat races (11, 13).

**IMPORTANT: When removing J 21552 , watch for falling piston balls (5) from inside the rack piston (4). See Special Tools and Equipment .**

11. Remove **J 21552** from the rack piston (4). See **Special Tools and Equipment** .
12. Remove the rack piston balls (5).
13. Remove the following items from the rack piston (4):
  1. The screws (8)
  2. The clamp (7)
  3. The ball guide (6)
  4. The remaining rack piston balls (5) in the ball guide (6)
14. Remove the teflon ring (2).
15. Remove the O-ring seal (3).
16. Clean all of the disassembled parts.
17. Inspect all of the disassembled parts for wear.
18. Replace the parts if necessary.

#### Assembly Procedure

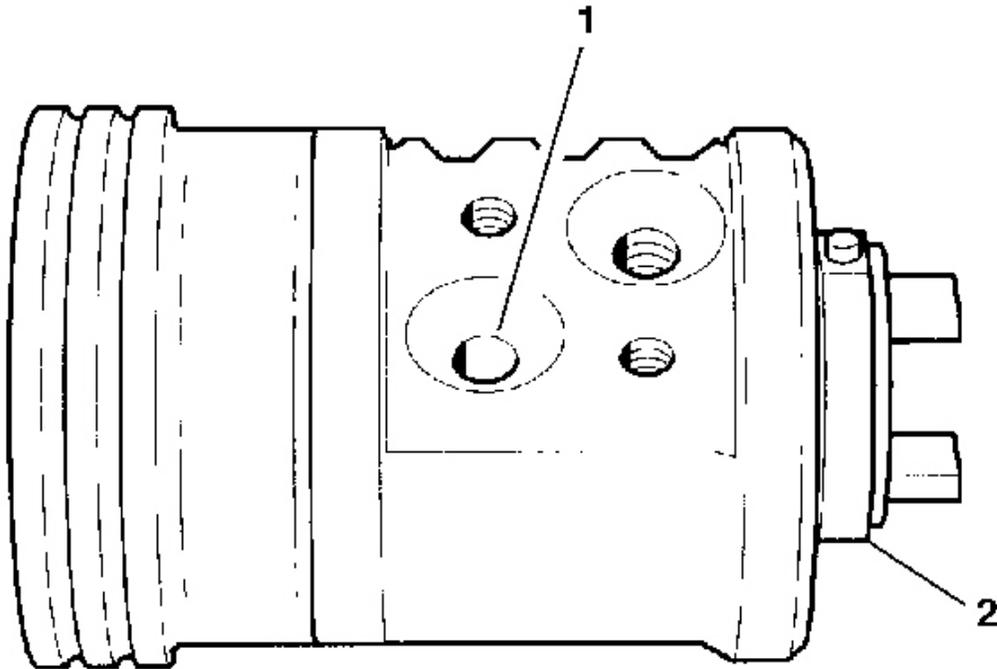


**Fig. 68: Installing O-Ring Seal & Teflon Ring**  
Courtesy of GENERAL MOTORS CORP.

1. Install the O-ring seal (3) and the teflon ring (2).

2. Lubricate both parts with power steering fluid.
3. Install the worm shaft (14) to the rack piston (4) outside of the steering gear housing (9).

Fully seat the worm shaft to the rack piston.

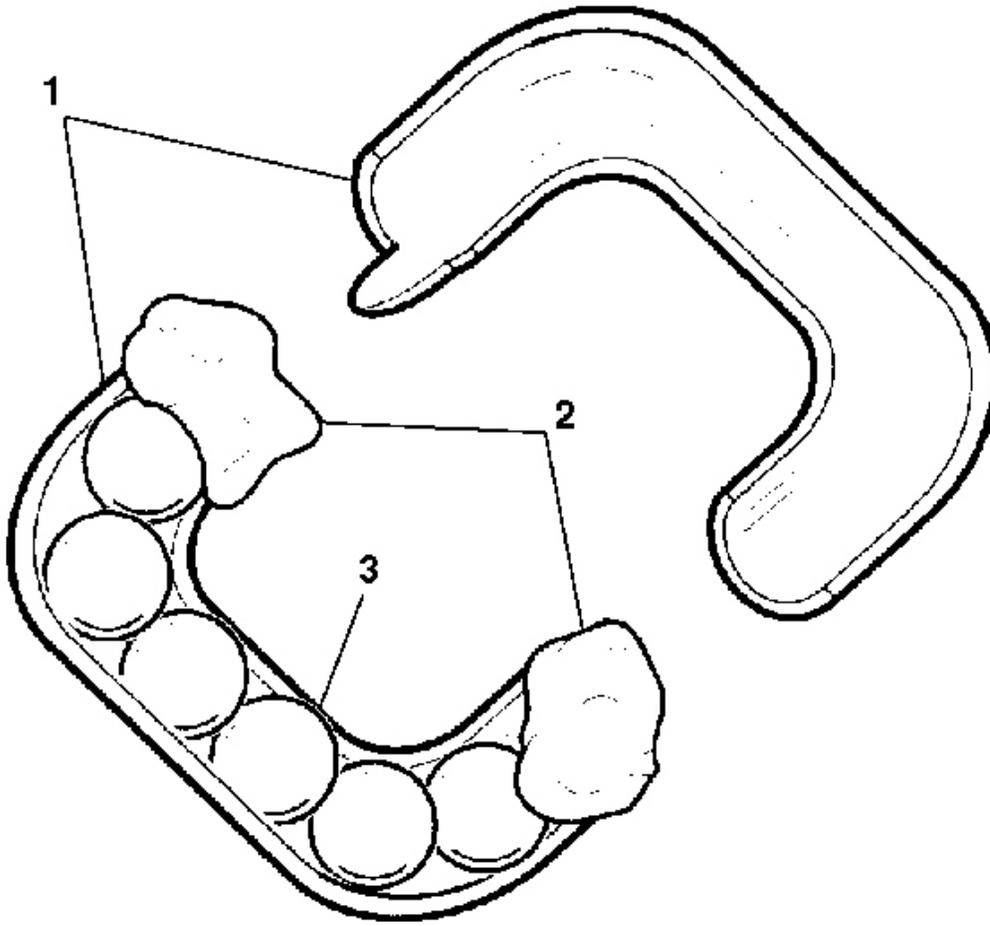


**Fig. 69: Aligning Worm Shaft Spiral Groove With Rack Piston Ball Return Guide Hole**  
Courtesy of GENERAL MOTORS CORP.

4. Align the worm shaft spiral groove with the rack piston ball return guide hole (1).

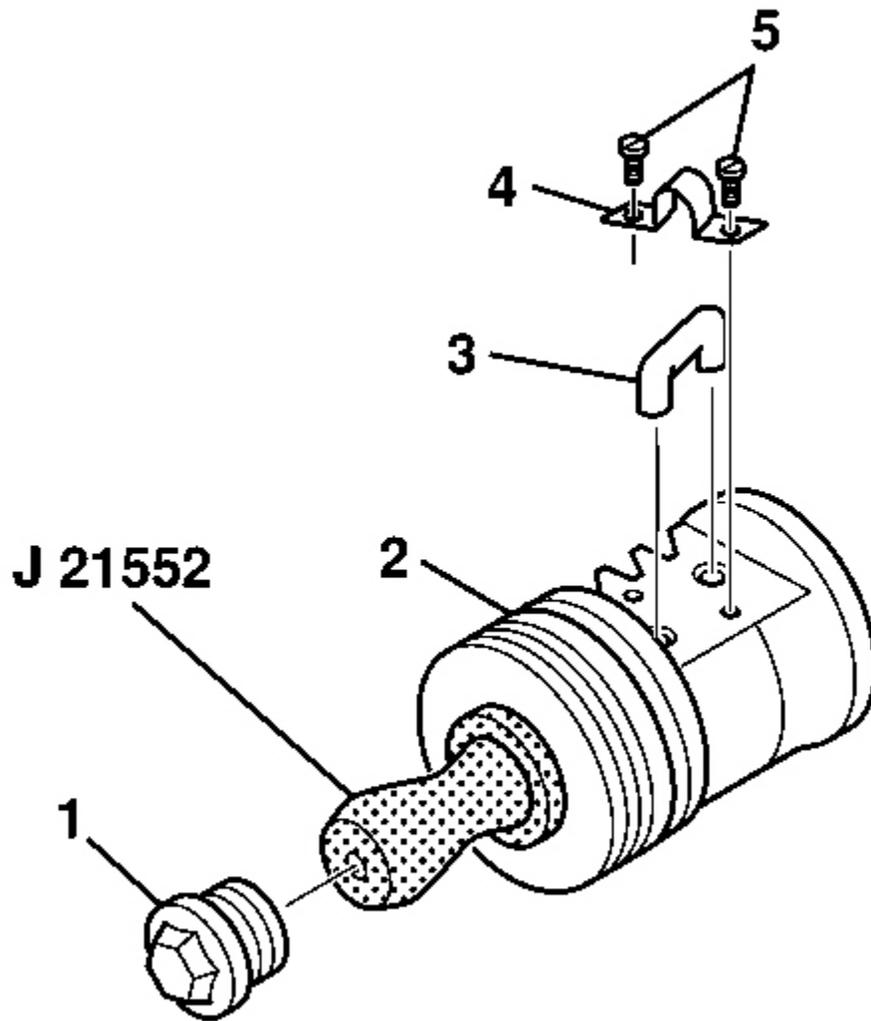
**CAUTION:** In order to avoid injury and/or component damage, install all of the rack piston balls into the rack piston. Install the rack piston balls in the correct order. If you do not correctly install all of the rack piston balls, the steering gear may not operate or may wear out quickly.

5. Lubricate the rack piston balls with power steering fluid.
6. Insert the rack piston balls through the ball return guide hole (1) while turning worm shaft (2) counterclockwise in order to install the rack piston balls into the rack piston. Install the black and the silver rack piston balls alternately into the rack piston and the ball guide to maintain the rack piston to the worm shaft preload.



**Fig. 70: Installing Rack Piston Balls Into Ball Guide Using Grease**  
Courtesy of GENERAL MOTORS CORP.

7. Install the remaining rack piston balls (3) into the ball guide (1) using grease at each end (2) to retain the rack piston balls (3).



**Fig. 71: Installing Ball Guide To Rack Piston**  
Courtesy of GENERAL MOTORS CORP.

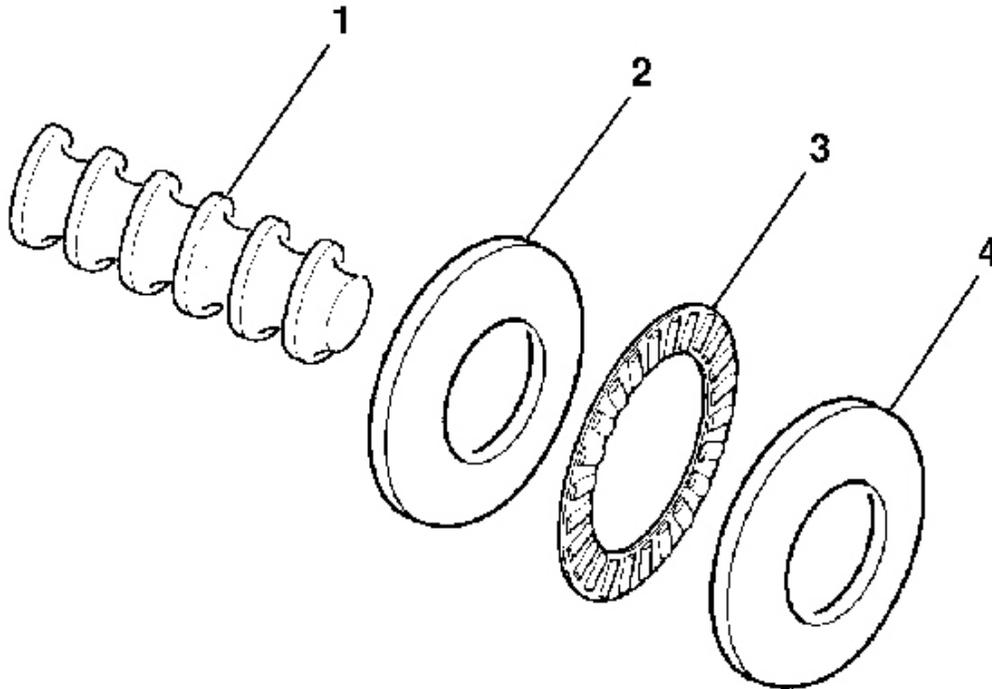
8. Install the ball guide (3) to the rack piston (2).
9. Install the ball guide clamp (4).

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

10. Install the screws (5).

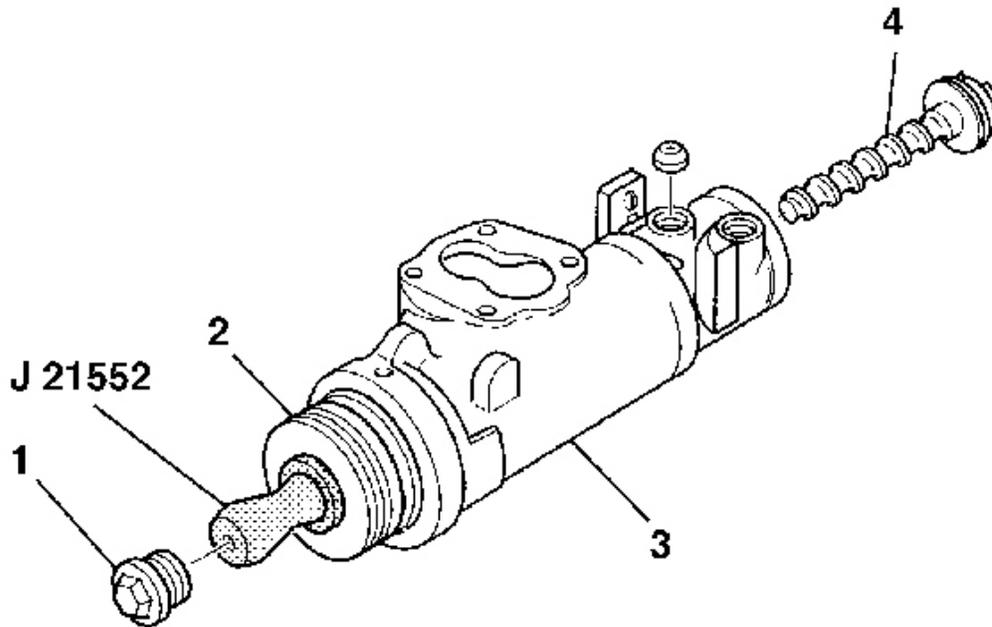
**Tighten:** Tighten the screws (5) to 6 N.m (53 lb in).

11. Insert **J 21552** into the bore of the rack piston while turning the worm shaft counterclockwise. The turning of the worm shaft forces the rack piston onto **J 21552** . The rack piston balls remain in place. See **Special Tools and Equipment** .



**Fig. 72: Installing Flat Races & Thrust Bearing Onto Worm Shaft (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

12. Install the flat races (2, 4) and the thrust bearing (3) onto the worm shaft (1).



**Fig. 73: Installing Worm Shaft To Steering Gear Housing**  
 Courtesy of GENERAL MOTORS CORP.

13. Install the worm shaft (4) to the steering gear housing (3).

**IMPORTANT: Do not adjust the worm shaft until all components are installed onto the steering gear housing.**

14. Install the spool valve. Refer to Steering Gear Valve Replacement - Off Vehicle (700 Gear) .
15. Install the rack piston (2) to the worm (4) from **J 21552** using J 8947 to compress the seals.
16. Hold **J 21552** tightly against the worm shaft (4). See Special Tools and Equipment .
17. Turn the stub shaft clockwise until the rack piston (2) is seated on the worm shaft (4).
18. Remove **J 21552** from the rack piston (1). See Special Tools and Equipment .
19. Install the rack piston plug (1).

**Tighten:** Tighten the rack piston plug to 150 N.m (111 lb ft).

20. Install the housing end plug. Refer to Steering Gear Housing End Plug Replacement - Off Vehicle .

**IMPORTANT: Do not adjust the pitman shaft until all components are installed onto the**

## **steering gear housing.**

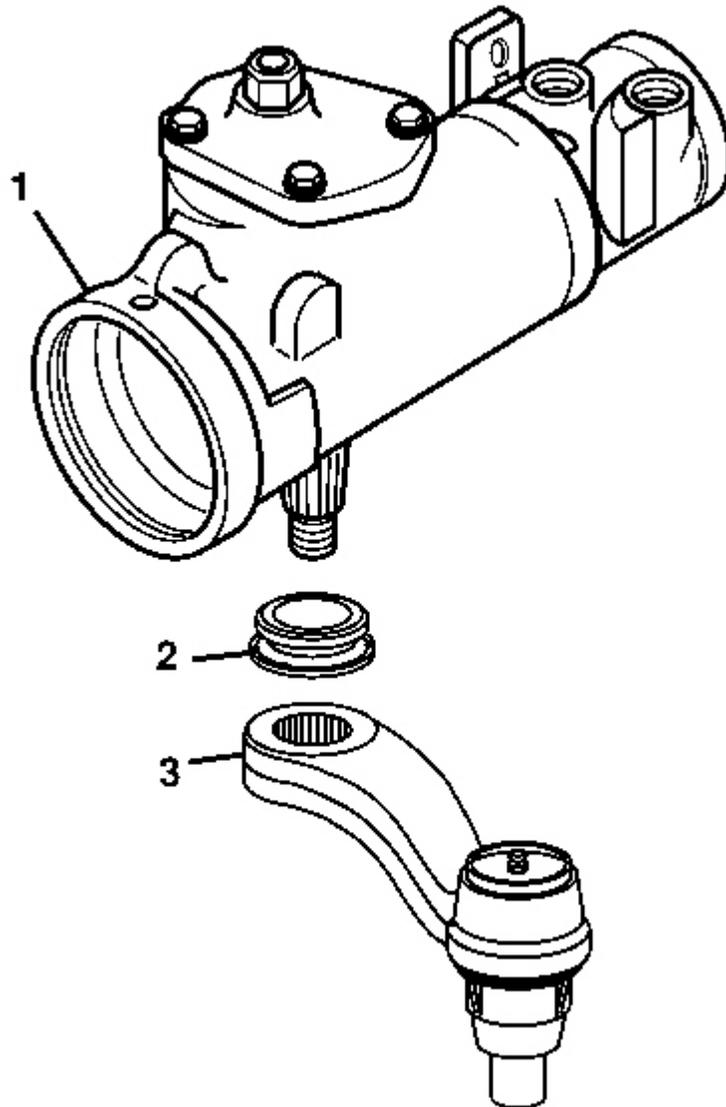
21. Install the pitman shaft seals and bearing. Refer to **Pitman Shaft Seals and Bearing Replacement - Off Vehicle (700 Gear)** .
22. To adjust the steering gear; refer to one of the following procedures:
  - **Worm Thrust Bearing Preload Adjustment - Off Vehicle (700 Gear)**
  - **Pitman Shaft Over-Center Preload Adjustment - Off Vehicle (670 Gear)**

## **PITMAN SHAFT SEALS AND BEARING REPLACEMENT - OFF VEHICLE (700 GEAR)**

### **Tools Required**

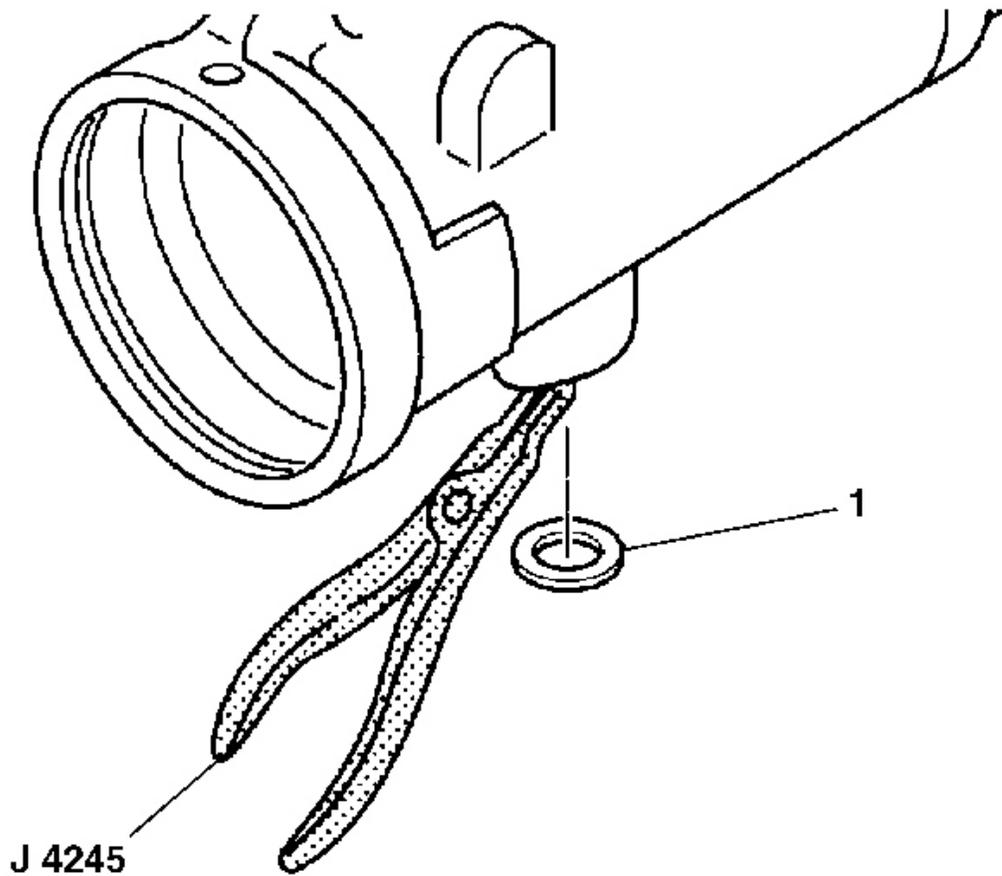
- **J 6278** Pitman Shaft Bearing Remover and Installer. See **Special Tools and Equipment** .
- **J 4245** Internal Snap Ring Pliers. See **Special Tools and Equipment** .

### **Disassembly Procedure**



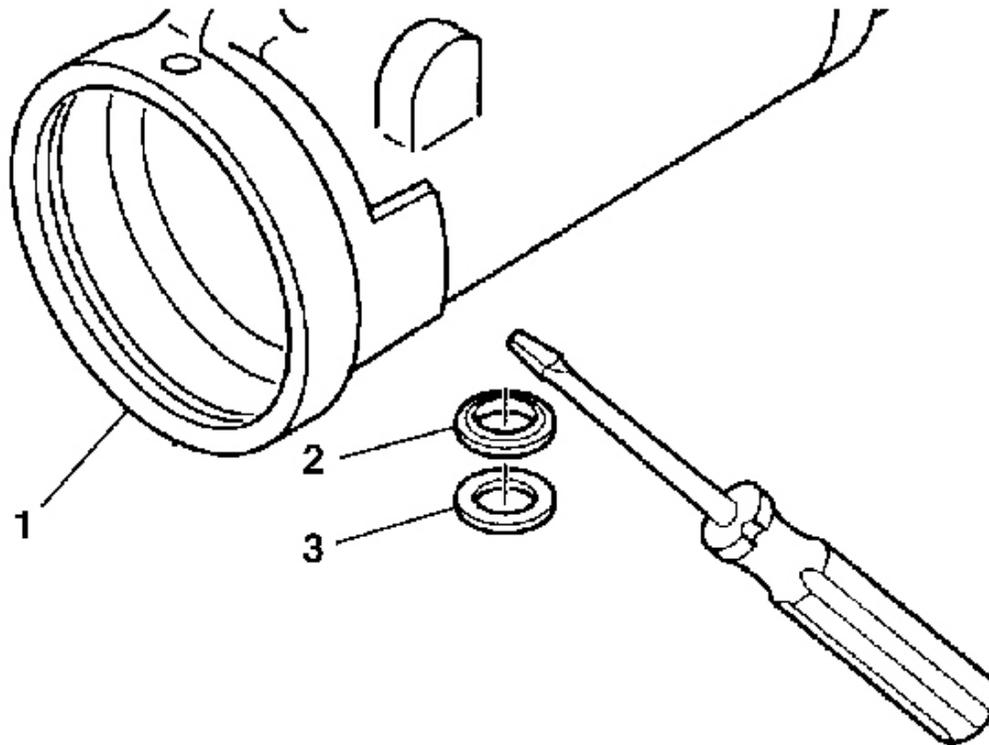
**Fig. 74: Removing Pitman Arm & Pitman Shaft Boot From Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

1. Remove the pitman shaft and the side cover. Refer to **Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle (700 Gear)** .
2. Remove the pitman arm (3) from the steering gear (1).
3. Remove the pitman shaft boot (2).



**Fig. 75: Installing Retaining Ring Using J 4245 (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

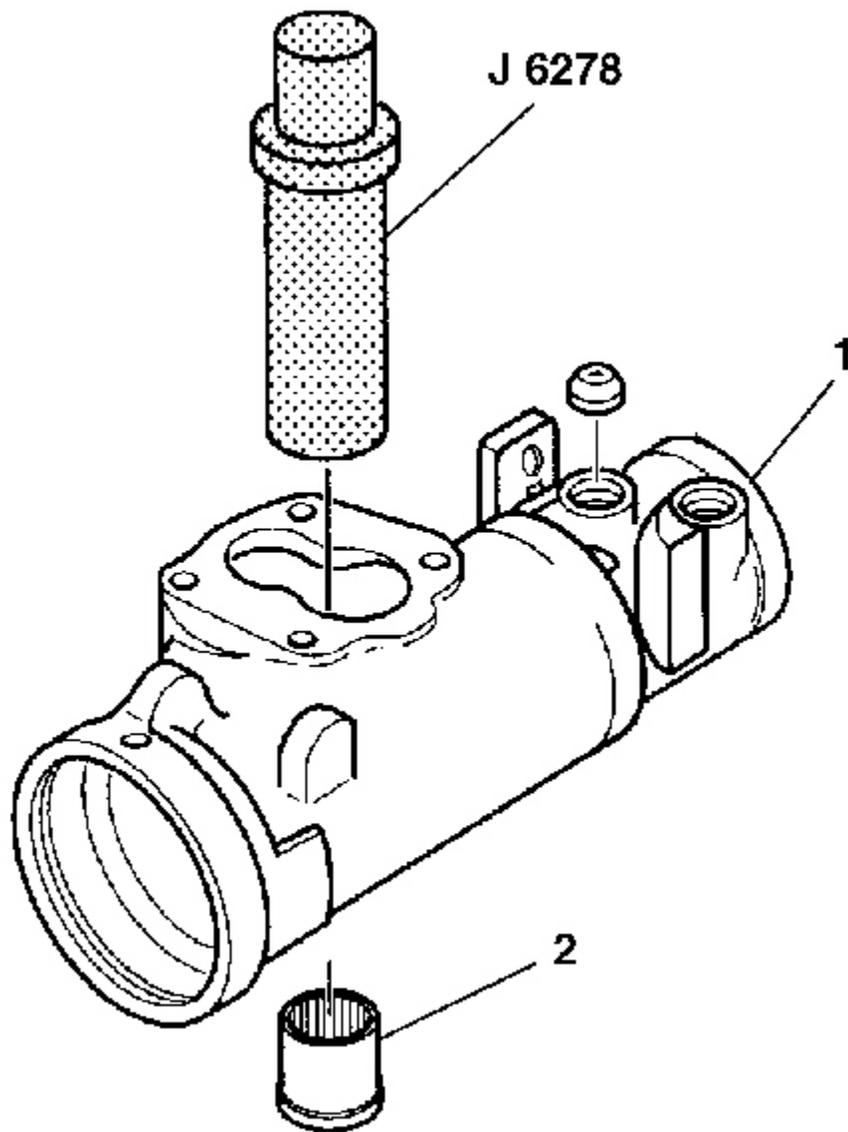
4. Remove the dust seal (1).
5. Remove the retaining ring using the **J 4245** . See **Special Tools and Equipment** .



**Fig. 76: Prying Backup Washer & Double Lip Seal From Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

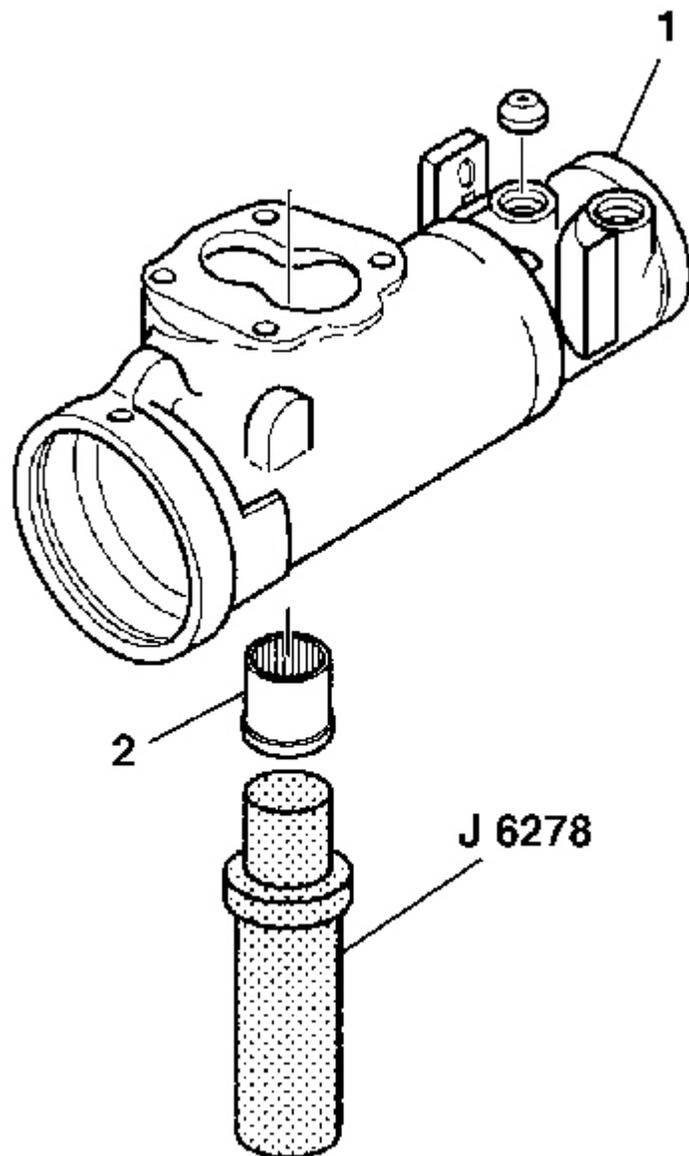
**IMPORTANT: Use care not to score the steering gear housing bore when prying out the seals and the washers.**

6. Use a screwdriver to pry the backup washer (3) and the double lip seal (2) from the steering gear housing (1).
7. Inspect the steering gear housing (1) for burrs.



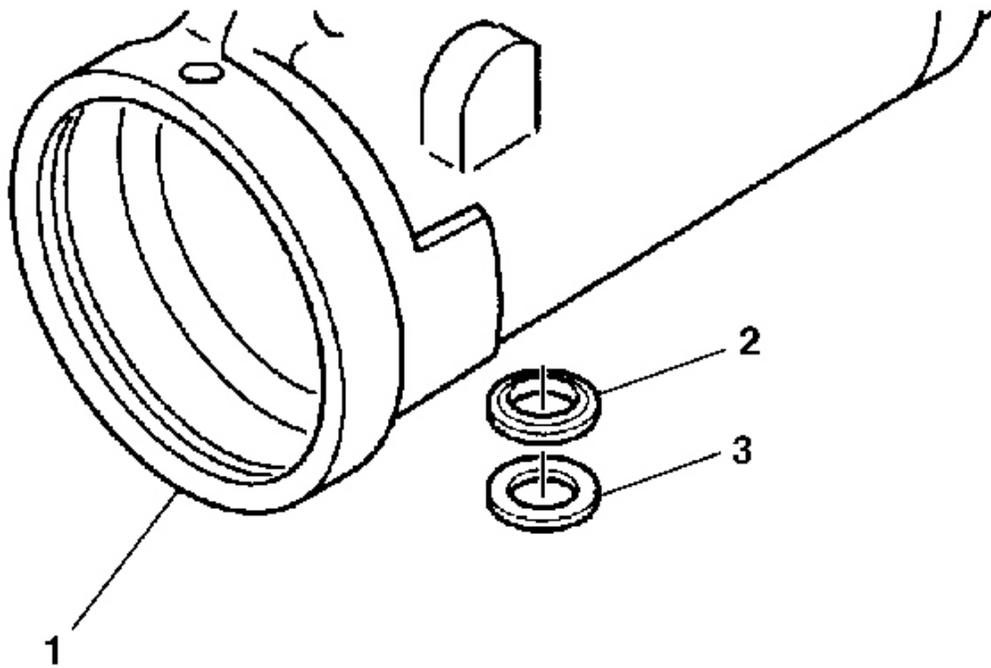
**Fig. 77: Inserting J 6278 Through Hole In Top Of Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

8. Insert **J 6278** through the hole in the top of the steering gear housing (1). See **Special Tools and Equipment** .
9. Drive out the needle bearing (2).



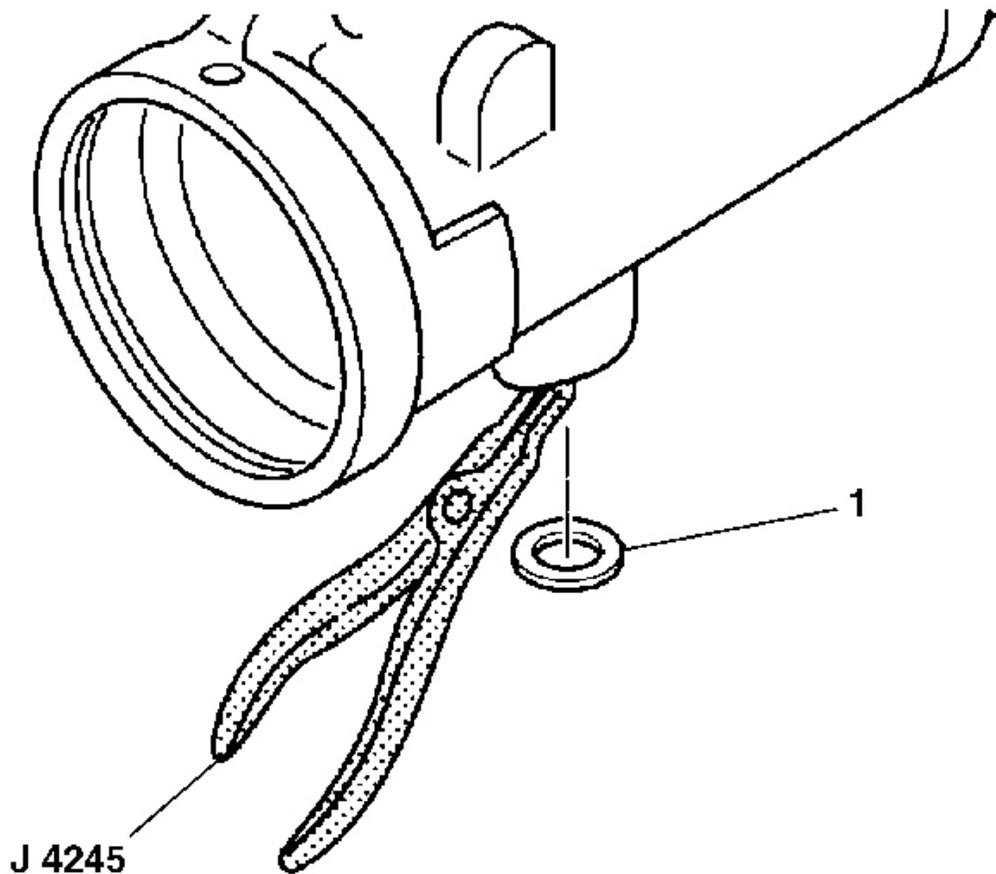
**Fig. 78: Installing Needle Bearing To Steering Gear Housing Using J 6278**  
Courtesy of GENERAL MOTORS CORP.

1. Install the needle bearing (2) to the steering gear housing (1) using the **J 6278** . See **Special Tools and Equipment** .



**Fig. 79: Double Lip Seal & Backup Washer**  
**Courtesy of GENERAL MOTORS CORP.**

2. Coat the double lip seal (2) and the washer (3) with grease.
3. Install the double lip seal (2).
4. Install the backup washer (3).

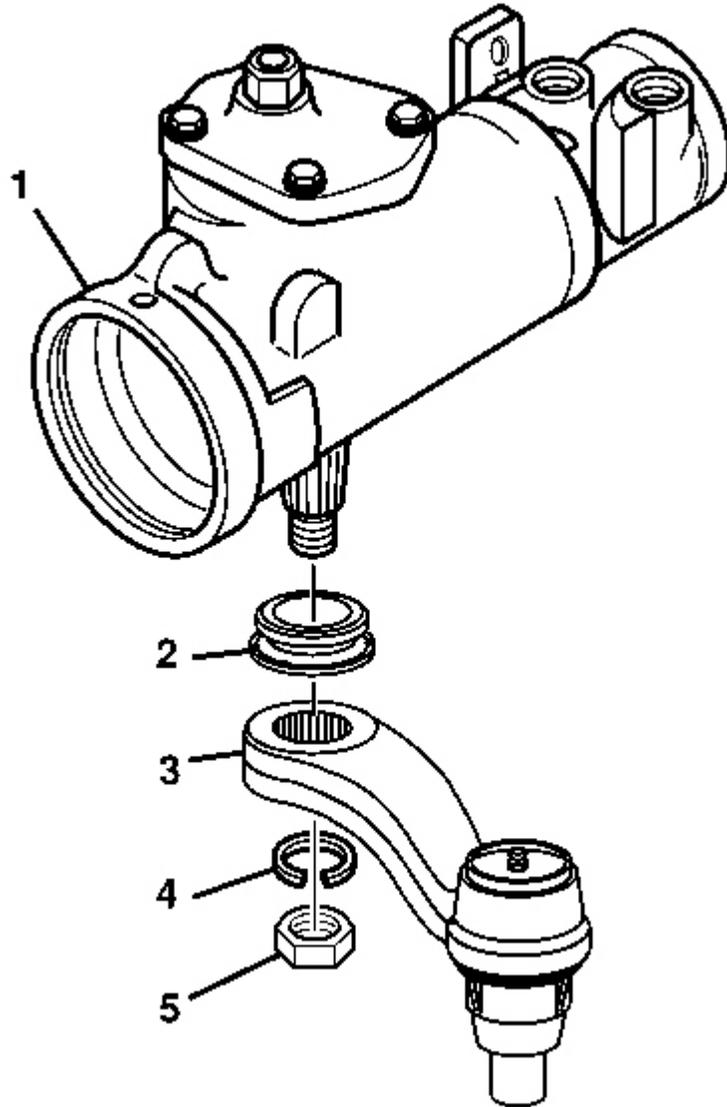


**Fig. 80: Installing Retaining Ring Using J 4245 (700 Gear)**  
Courtesy of GENERAL MOTORS CORP.

5. Install the retaining ring using the J 4245 . See Special Tools and Equipment .

**IMPORTANT:** Do not install the lock washer and nut until complete installation of the pitman arm and its components have been installed. Do not adjust the pitman shaft until all components have been installed on the steering gear housing.

6. Install the pitman shaft and the side cover. Refer to Steering Gear Pitman Shaft and Housing Cover Replacement - Off Vehicle (700 Gear) .
7. Install the dust seal (1).



**Fig. 81: Installing Pitman Shaft Boot, Pitman Arm & Lock Washer To Steering Gear**  
Courtesy of GENERAL MOTORS CORP.

8. Install the pitman shaft boot (2).
9. Install the pitman arm (3) to the steering gear (1).
10. Install the lock washer (4).

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

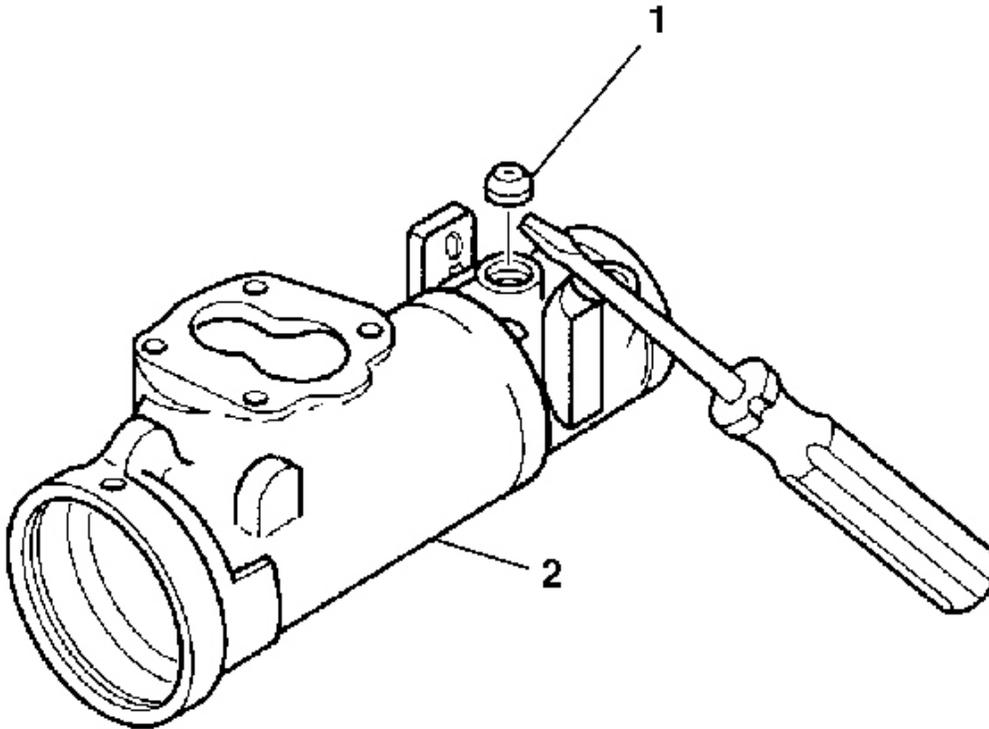
11. Install the nut (5).

**Tighten:** Tighten the pitman arm nut to 250 N.m (184 lb ft).

12. Refer to Pitman Shaft Over-Center Preload Adjustment - Off Vehicle (670 Gear) to adjust the pitman shaft.

## STEERING GEAR CHECK VALVE REPLACEMENT - OFF VEHICLE

### Disassembly Procedure

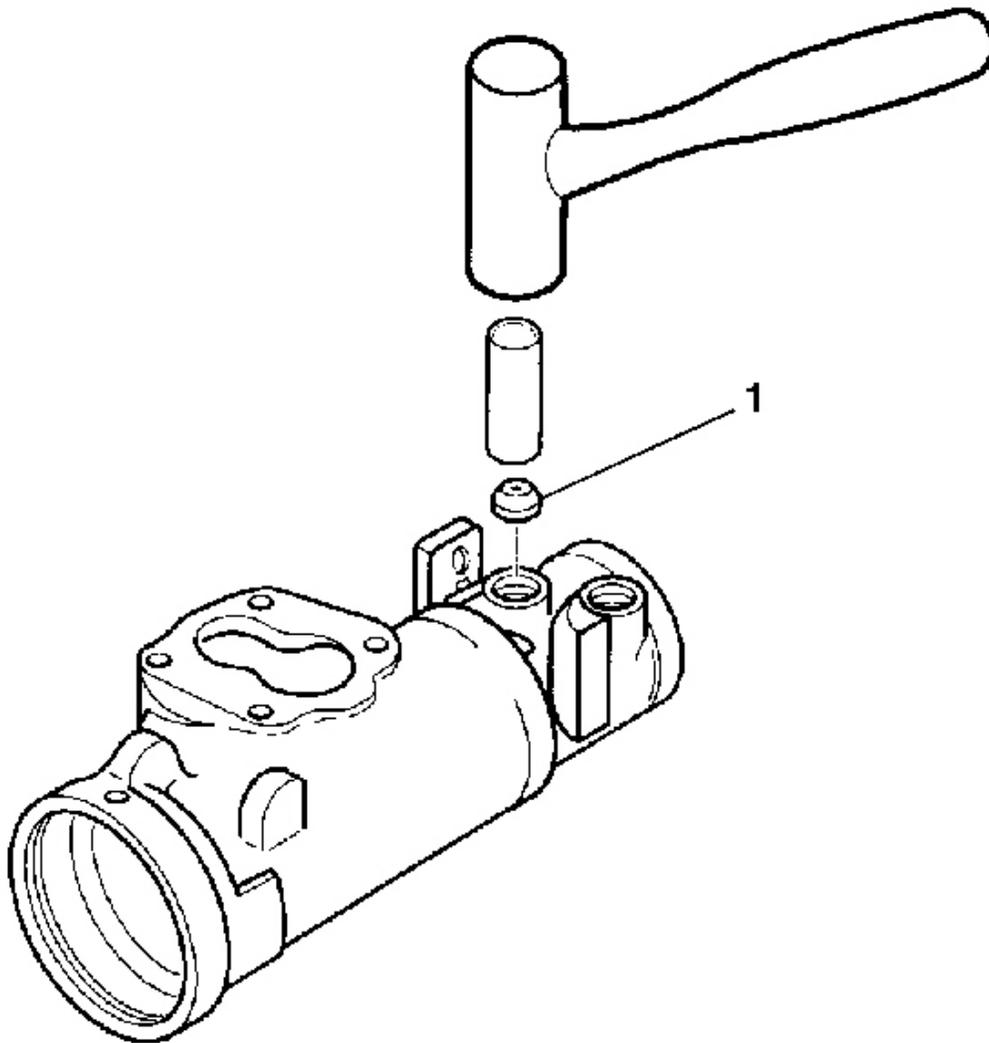


**Fig. 82: Removing Check Valve From Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

**IMPORTANT:** Do not to damage the threads of the steering gear housing when removing the check valve.

Remove the check valve (1) from the steering gear housing (2) using a small screwdriver.

#### Assembly Procedure



**Fig. 83: Installing Check Valve**  
Courtesy of GENERAL MOTORS CORP.

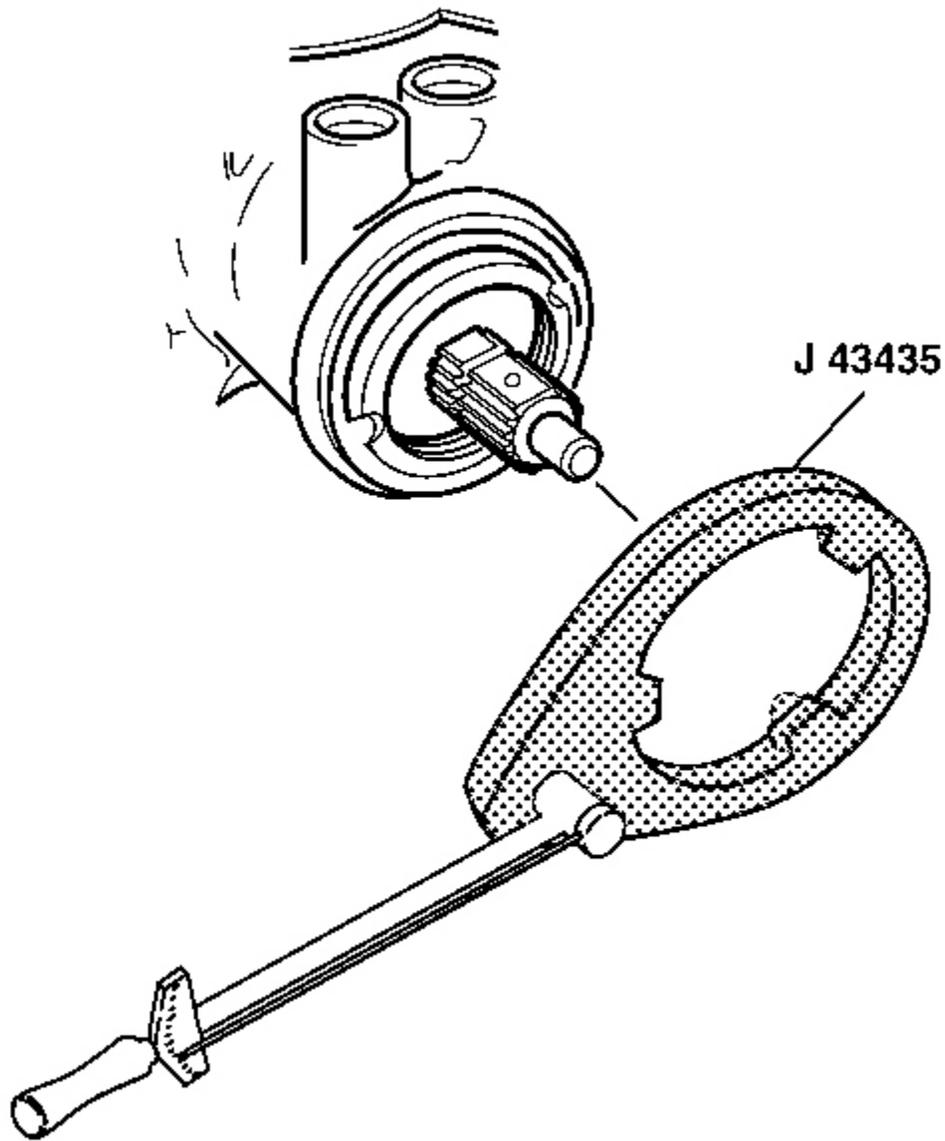
Install the check valve (1) using a 9.52mm inch diameter piece of tubing 100 mm (4 in) long to drive into the steering gear housing.

## **STEERING GEAR THRUST SUPPORT REPLACEMENT - OFF VEHICLE (700 GEAR)**

### **Tools Required**

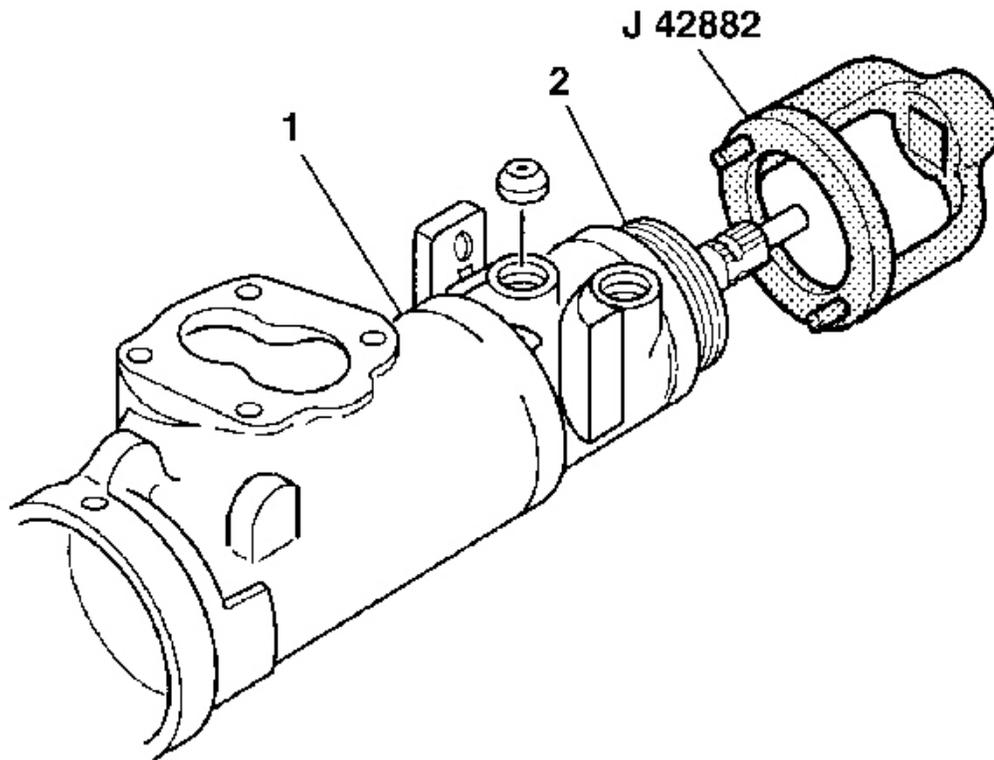
- **J 42882** Adjuster Nut Socket. See **Special Tools and Equipment** .
- J 43435 Adjuster Lock Nut Wrench

### **Disassembly Procedure**



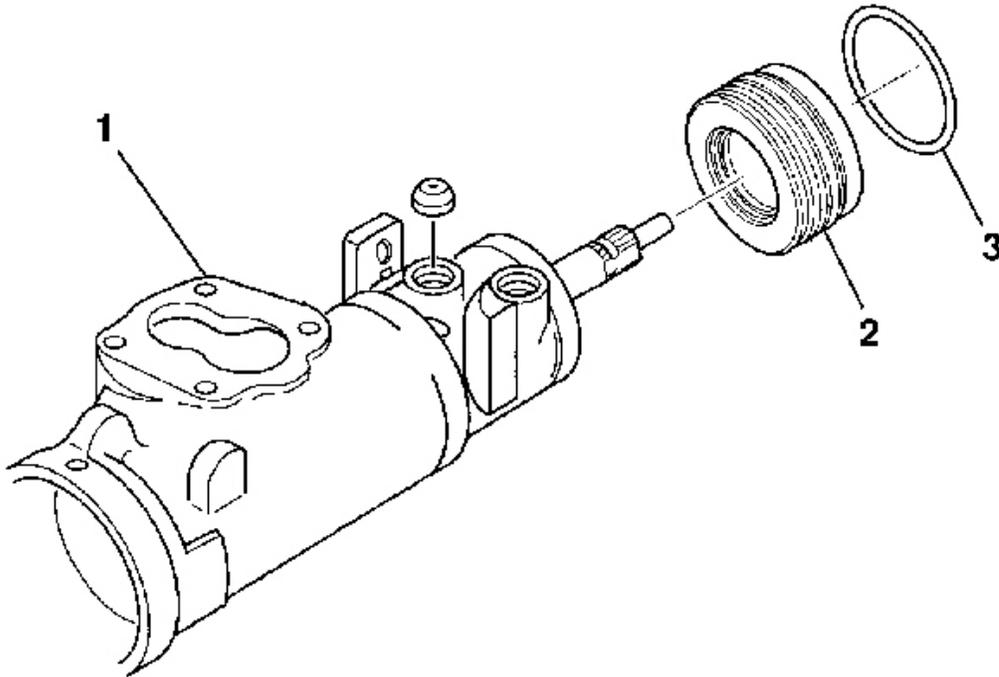
**Fig. 84: Removing Coupling Shield Retainer & Lock Nut From Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

1. Rotate the stub shaft back and forth in order to drain the power steering fluid.
2. Remove the coupling shield retainer and the lock nut from the steering gear housing using J 43435 and a torque wrench.



**Fig. 85: Connecting The Adjuster Nut Assembly To The Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

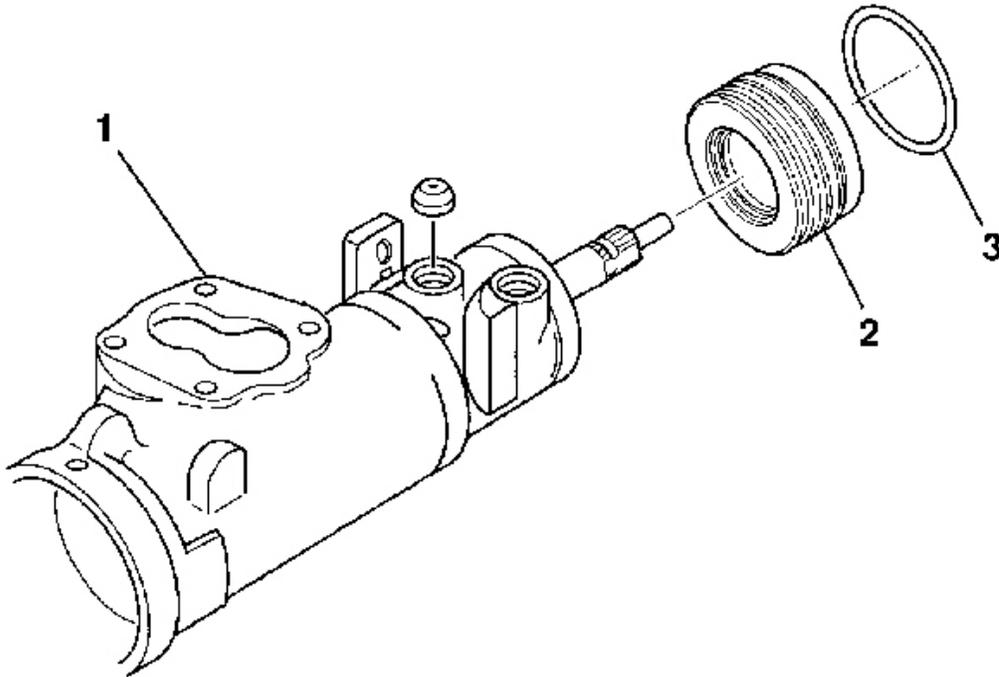
3. Remove the adjuster nut assembly (2) from the steering gear housing (1) using **J 42882** . See **Special Tools and Equipment** .



**Fig. 86: O-Ring Seal & Thrust Support Assembly**  
Courtesy of GENERAL MOTORS CORP.

4. Remove the thrust support assembly (2) from the steering gear housing (1).
5. Remove the O-ring seal (3) from the thrust support assembly (2).

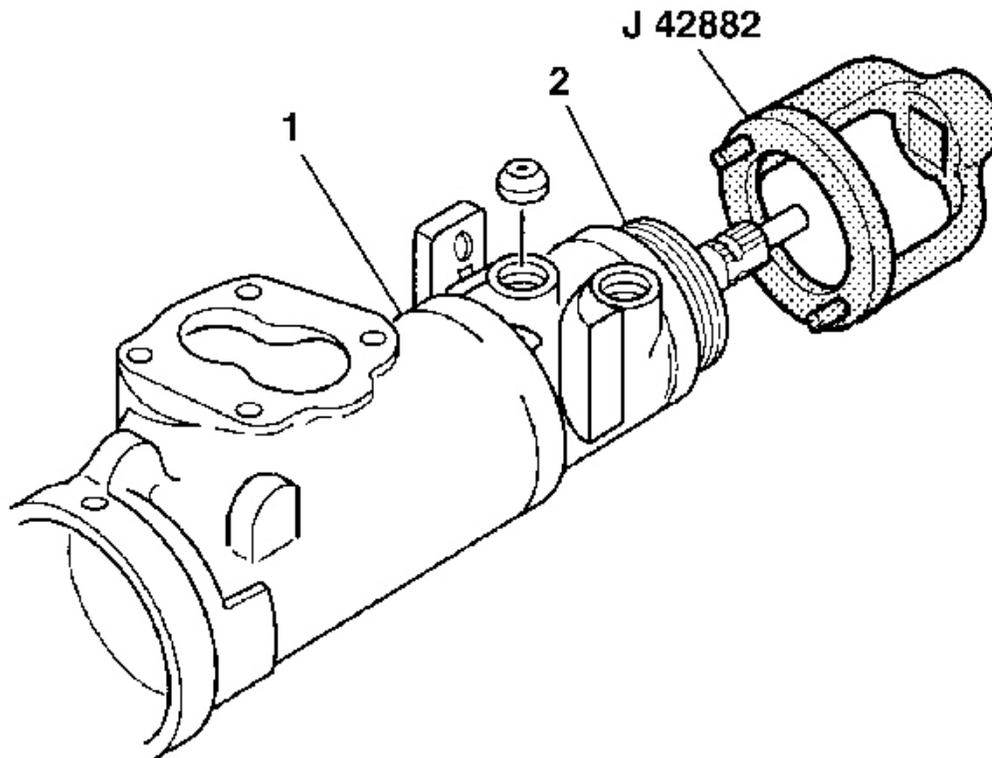
**Assembly Procedure**



**Fig. 87: O-Ring Seal & Thrust Support Assembly**  
Courtesy of GENERAL MOTORS CORP.

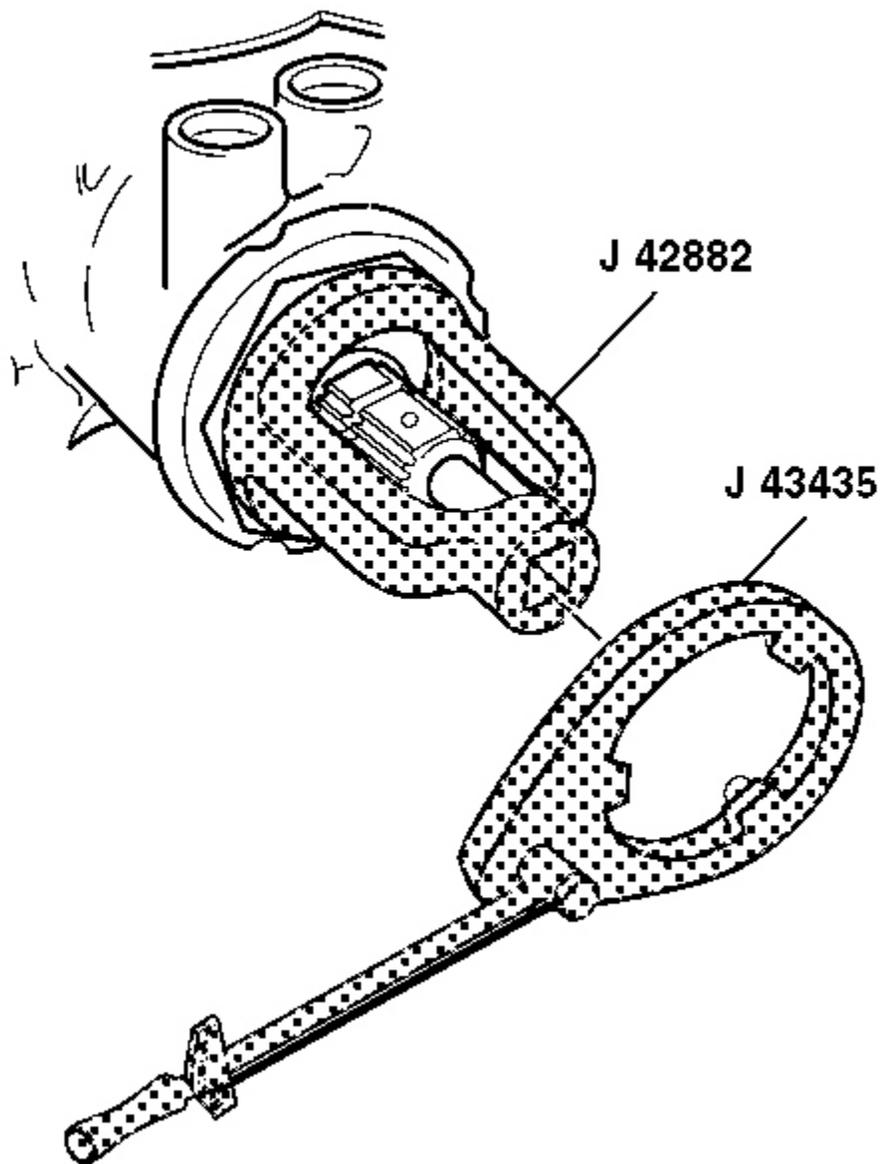
**IMPORTANT: Install a new O-ring seal each time the thrust support assembly is removed from the steering gear.**

1. Lubricate the new O-ring seal (3).
2. Install the new O-ring seal (3) on the thrust support assembly (2).
3. Install the thrust support assembly (2).



**Fig. 88: Connecting The Adjuster Nut Assembly To The Steering Gear Housing**  
Courtesy of GENERAL MOTORS CORP.

4. Connect the adjuster nut assembly (2) to the steering gear housing (1) using **J 42882** . See **Special Tools and Equipment** .
5. Install the coupling shield retainer and the lock nut (1) to the adjuster nut assembly.
6. Refer to **Worm Thrust Bearing Preload Adjustment - Off Vehicle (700 Gear)** to adjust the thrust bearing preload.



**Fig. 89: Tightening Coupling Shield Retainer & Lock Nut Using J 43435 & Torque Wrench**  
Courtesy of GENERAL MOTORS CORP.

7. Hold the adjuster nut assembly in position to maintain alignment of the marks.

**NOTE:** Refer to **Fastener Notice** in **Cautions and Notices**.

8. Tighten the coupling shield retainer and the lock nut using J 43435 and a torque wrench.

**Tighten:** Tighten the retainer and the lock nut to 109 N.m (80 lb ft).

## 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.

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 moves an intermediate rod assembly. This assembly consists of inner and outer tie rod ends that are replaceable independent of each other.

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 contains an integral fin-type power steering fluid cooler.

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

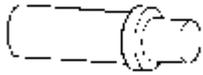
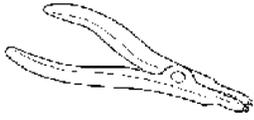
Turning the steering wheel activates the valve assembly, which applies greater fluid pressure and flow to one side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front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

## SPECIAL TOOLS AND EQUIPMENT

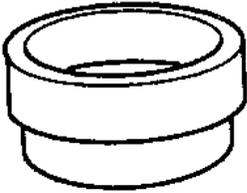
### SPECIAL TOOLS

#### Special Tools

Illustration	Tool Number/Description
	<p>J 4245 Internal Snap Ring Pliers</p>



J 6278  
Pitman Shaft Bearing Remover and Installer

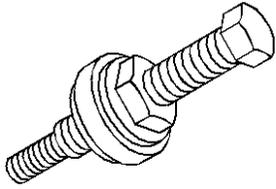


J 8947  
Rack Piston Teflon Ring Compression

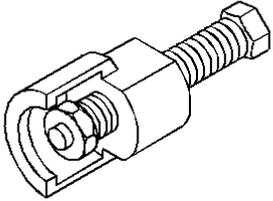


J 21552  
Rack Piston Arbor

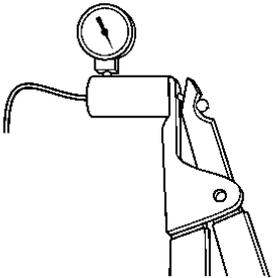
Power Steering Pump Pulley Installer



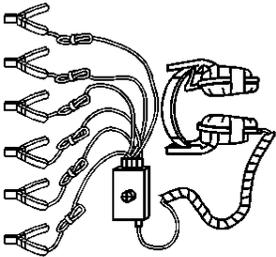
J 25034-C  
Power Steering Pump Pulley Remover

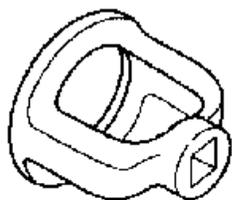


J 35555  
Mity Vac

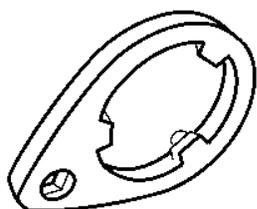


J 39570  
Chassis Ear

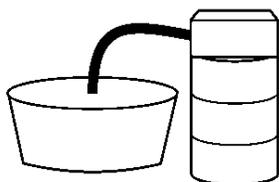




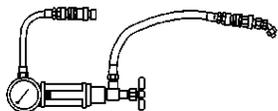
J 42882  
Adjuster Nut Socket



J 43435  
Adjuster Lock Nut Wrench



J 43485  
Power Steering Bleeder Adaptor



J 44721  
Power Steering System Analyzer