

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

2007 STEERING**Power Steering - Outlook****SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS****Fastener Tightening Specifications**

Application	Specification	
	Metric	English
Front Frame Mounting Bolt	100 N.m	74 lb ft
Front Frame Reinforcement Mounting Bolt	50 N.m	37 lb ft
Power Steering Fluid Cooler Nut	9 N.m	80 lb in
Power Steering Gear Inlet and Outlet Pipe Clip Bolt	9 N.m	80 lb in
Power Steering Gear Inlet Hose Bracket Nut	9 N.m	80 lb in
Power Steering Gear Inlet Hose Fitting	27 N.m	20 lb ft
Power Steering Gear Inlet Hose Retaining Plate Bolt	9 N.m	80 lb in
Power Steering Gear Outlet Hose Bracket Bolt	9 N.m	80 lb in
Power Steering Gear Outlet Hose Bracket Nut	9 N.m	80 lb in
Power Steering Pump Bolt	50 N.m	37 lb ft
Rear Front Frame Mounting Bolt	100 N.m	74 lb ft
Remote Power Steering Fluid Reservoir Bolt	9 N.m	80 lb in
Remote Power Steering Fluid Reservoir Bracket Bolt	9 N.m	80 lb in
Steering Gear Bolt (at the right side)	100 N.m	74 lb ft
Steering Gear Nut (at the left side)	75 N.m	55 lb ft
Steering Gear Heat Shield Bolt	7 N.m	62 lb in
Steering Linkage Inner Tie Rod Housing	100 N.m	74 lb ft
Steering Linkage Inner Tie Rod Nut	75 N.m	55 lb ft
Steering Linkage Outer Tie Rod Nut	30 N.m plus 120 degrees	22 lb ft plus 120 degrees

POWER STEERING PUMP SPECIFICATIONS**Power Steering Pump Specifications**

		High Flow	Pressure Relief

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

Engine Code	Engine Size	LPM	GPM	kPa	PSI
LY7	V6 - 3.6L	12.72	3.36	9308/10342	1350/1500

COMPONENT LOCATOR

POWER STEERING GEAR DISASSEMBLED VIEW

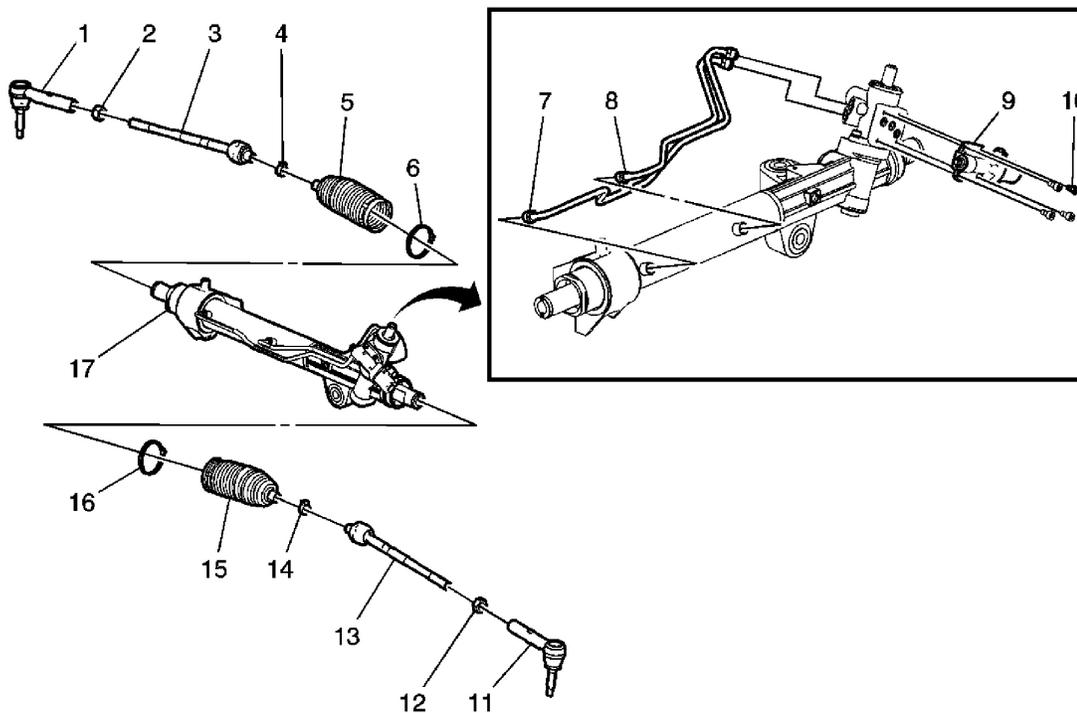


Fig. 1: Disassembled View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 1

Callout	Component Name
1	Steering Linkage Outer Tie Rod
2	Steering Linkage Inner Tie Rod Nut
3	Steering Linkage Inner Tie Rod
4	Steering Gear Boot Clamp
5	Steering Gear Boot
6	Steering Gear Boot Clamp
7	Steering Gear Pipe

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

8	Steering Gear Pipe
9	Steering Gear Valve Solenoid
10	Steering Gear Valve Solenoid Bolt
11	Steering Linkage Outer Tie Rod
12	Steering Linkage Inner Tie Rod Nut
13	Steering Linkage Inner Tie Rod
14	Steering Gear Boot Clamp
15	Steering Gear Boot
16	Steering Gear Boot Clamp
17	Steering Gear Assembly

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - POWER STEERING SYSTEM

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

SYMPTOMS - POWER STEERING SYSTEM

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the power steering system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect for leaking power steering components. If necessary, refer to **Power Steering Fluid Leaks**.
- Verify the power steering reservoir for the proper operating specification. Refer to

Checking and Adding Power Steering Fluid.

- Inspect the power steering fluid for the following indications of contamination:
 - Milky fluid - water
 - Brown fluid - burnt
 - Debris in fluid - plastic or dirt
- If necessary, flush the power steering system. Refer to **Power Steering System Flushing.**

Symptoms List

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

- **Power Steering Fluid Leaks**
- **Rattle, Clunk or Shudder Noise from the Power Steering System**
- **Whine or Growl Noise from the Power Steering System**
- **Steering Effort Hard in One or Both Directions**
- **Steering Effort Too Easy in One or Both Directions**

POWER STEERING SYSTEM TEST

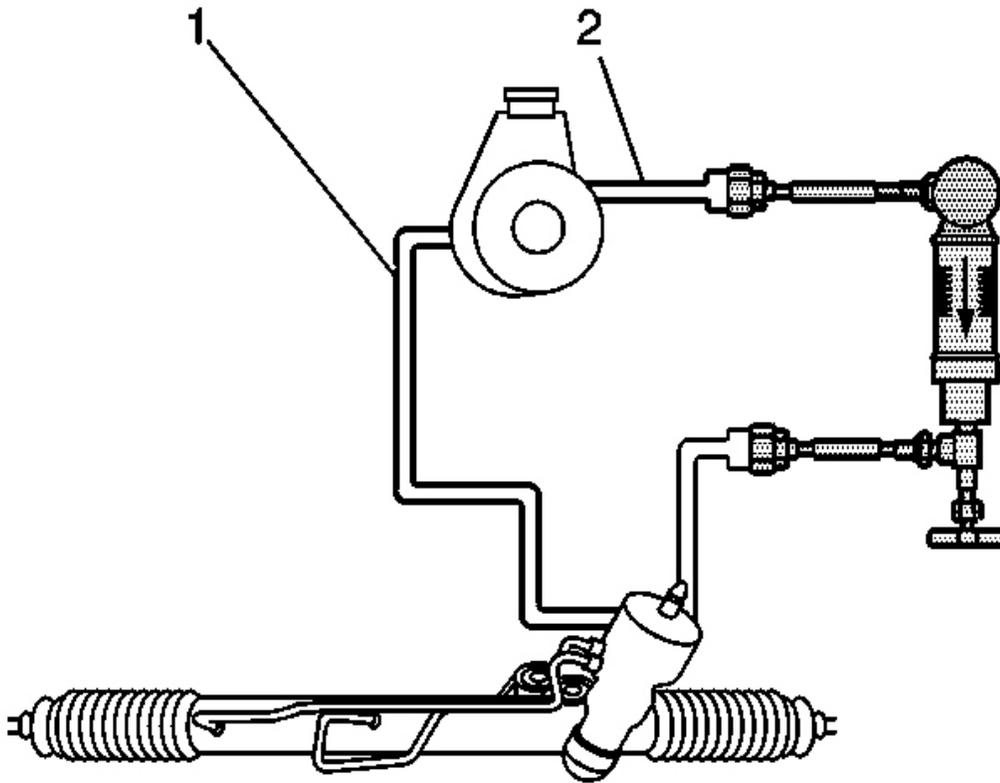


Fig. 2: View Of Power Steering Return & Pressure Hoses
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

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

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"> • Test the operation of the hydraulic power steering system. • Test the operation of the power steering pump and power steering gear. • Identify restrictions in the system. 				
1	<p>Inspect the power steering fluid for the following indications of contamination:</p> <ul style="list-style-type: none"> • Milky fluid - water • Brown fluid - burnt • Debris in fluid - plastic or dirt <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 Power Steering System Flushing.</p> <p>Did you complete the procedure?</p>	-	Go to Step 3	-
3	<p>IMPORTANT: In order to accurately diagnose the system, the malfunction must be present during the test procedure.</p> <p>Attempt to duplicate the condition. Is the condition present?</p>	-	Go to Step 4	System OK
	<p>1. Turn the ignition switch to the OFF position.</p>			

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

<p>4</p>	<ol style="list-style-type: none"> 2. Place a drain pan under the vehicle in order to catch any power steering fluid. 3. Disconnect the power steering pressure pipe/hose from the power steering pump or the power steering gear as necessary. 4. Install the SA9134C Power Steering System Analyzer. See <u>Special Tools</u>. 5. Fill the power steering system. Refer to <u>Checking and Adding Power Steering Fluid</u>. <p>Did you complete the installation?</p>	<p>-</p>	<p>Go to Step 5</p>	<p>-</p>
<p>5</p>	<ol style="list-style-type: none"> 1. Fully open the SA9134C valve. See <u>Special Tools</u>. 2. Start the engine. <p>NOTE: Do not hold the steering wheel in the full turn position longer than 5 seconds, as damage to the steering pump may result.</p> <ol style="list-style-type: none"> 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. 4. Inspect and ensure that all of the power steering pipe/hose connections are not leaking. 5. Observe the pressure reading. <p>Is the pressure reading greater than</p>	<p>1379 kPa (200 psi)</p>		

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	the specified value?		Go to Step 6	Go to Step 7
6	<p>IMPORTANT: A restriction may be present in the power steering system. Turn off the engine IMMEDIATELY.</p> <p>Locate and repair the restriction. Did you complete the repair?</p>	-	Go to Step 15	-
7	<ol style="list-style-type: none"> 1. Allow the engine to run until the engine reaches full operating temperature. 2. Record the pressure reading and flow reading. 3. Partially close the SA9134C valve until the system pressure reaches the specified value, then record the FLOW reading. See Special Tools. 4. Subtract second flow reading from the first flow reading. <p>Is the flow DECREASE greater than 3.8L (1 gal) per minute?</p>	4827 kPa (700 psi)	Go to Step 11	Go to Step 8
8	<p>NOTE: Do not leave the valve fully closed for more than 5 seconds or the pump could be damaged internally.</p> <p>Fully close then open the SA9134C valve 3 times. See Special Tools. Record all of the high pressure readings. Refer to Power Steering Pump Specifications for power steering system pressure relief specifications. Are the three high pressure readings within specifications?</p>	-	Go to Step 9	Go to Step 13
9	Are the three high pressure readings within 245 kPa (50 psi) of each	-	Go to Step	Go to Step

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	other?		10	13
10	<p>1. Increase the engine speed to approximately 1600 RPM.</p> <p>2. Record the flow reading. Refer to <u>Power Steering Pump Specifications</u> for power steering system pressure specifications.</p> <p>Is the actual flow reading within specifications?</p>	-	Go to Step 11	Go to Step 13
11	<p>Is the difference between the actual flow reading and the maximum flow specification more than 3.8L (1 gal) per minute?</p>	-	Go to Step 13	Go to Step 12
12	<p>NOTE: Do not hold the steering wheel in the full turn position longer than 5 seconds, as damage to the steering pump may result.</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 3.8L (1 gal) per minute?</p>	-	Go to Step 15	Go to Step 14
13	<p>Replace the power steering pump. Refer to <u>Power Steering Pump Replacement</u>.</p> <p>Did you complete the replacement?</p>	-	Go to Step 15	-
14	<p>The power steering gear is leaking across the piston or bypassing the valve circuit. Replace the power steering gear. Refer to <u>Steering Gear Replacement</u>.</p> <p>Did you complete the replacement?</p>	-	Go to Step 15	-
15	<p>Test the power steering system for the original condition.</p> <p>Does the original condition still</p>	-		Go to Step

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	exist?		Go to Step 5	16
16	<ol style="list-style-type: none"> 1. Disconnect and remove the SA9134C from the vehicle. See <u>Special Tools</u>. 2. Connect the vehicle power steering pipes/hoses. 3. Fill the power steering system. Refer to <u>Checking and Adding Power Steering Fluid</u>. 	-		
	Did you complete the procedure?		System OK	-

POWER STEERING FLUID LEAKS

Power Steering Fluid Leaks

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to Step 2	Go to <u>Steering Wheel and Column Description and Operation</u>
2	Verify that power steering fluid leaks are present. Is the power steering system leaking?	Go to Step 3	System OK
3	Inspect the power steering system fittings. Are the fittings leaking?	Go to Step 8	Go to Step 4
4	Inspect the power steering hoses. Are the hoses leaking?	Go to Step 9	Go to Step 5
5	Inspect the power steering sensors. Are the sensors leaking?	Go to Step 10	Go to Step 6
6	Inspect the power steering pump, shaft seal and the remote power steering fluid reservoir for leaks. Is the power steering pump, shaft seal or the remote power steering fluid reservoir leaking?	Go to Step 11	Go to Step 7
	Inspect the steering gear for leaks.		

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

7	Is the steering gear leaking?	Go to Step 12	Go to Step 8
8	Tighten the fittings. Refer to <u>Fastener Tightening Specifications</u> . Did you complete the repair?	Go to Step 13	-
9	Replace the power steering hoses. Refer to the appropriate procedures: <ul style="list-style-type: none"> • <u>Power Steering Cooler Pipe/Hose Replacement</u> • <u>Power Steering Reservoir Inlet Pipe/Hose Replacement</u> • <u>Power Steering Fluid Reservoir Outlet Hose Replacement</u> • <u>Power Steering Gear Inlet Pipe/Hose Replacement</u> • <u>Power Steering Gear Outlet Pipe/Hose Replacement</u> 		
	Did you complete the repair?	Go to Step 13	-
10	Replace the power steering sensors. Did you complete the repair?	Go to Step 13	-
11	Replace the power steering pump, shaft seal or remote power steering fluid reservoir. Refer to the appropriate procedures: <ul style="list-style-type: none"> • <u>Power Steering Pump Replacement</u> • <u>Remote Power Steering Fluid Reservoir Replacement</u> 		
	Did you complete the repair?	Go to Step 13	-
12	Replace the steering gear. Refer to <u>Steering Gear Replacement</u> . Did you complete the repair?	Go to Step 13	-
13	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

RATTLE, CLUNK OR SHUDDER NOISE FROM THE POWER STEERING SYSTEM**Rattle, Clunk or Shudder Noise from the Power Steering System**

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to Step 2	Go to <u>Steering Wheel and Column Description and Operation</u>
2	Verify that a rattle, clunk or shudder noise is present. Is a rattle, clunk or shudder noise present?	Go to Step 3	System OK
3	Inspect the power steering hoses for proper routing and clearance. Is the routing or clearance of the power steering hoses incorrect?	Go to Step 10	Go to Step 4
4	Inspect the engine drive belt for excessive wear. Refer to <u>Drive Belt Falls Off and Excessive Wear Diagnosis</u> . Is the drive belt cracked or excessively worn?	Go to Step 11	Go to Step 5
5	Inspect the power steering pump pulley for damage. Is the power steering pump pulley damaged?	Go to Step 12	Go to Step 6
6	Inspect the power steering pump for the proper installation. Refer to <u>Power Steering Pump Replacement</u> . Is the power steering pump installation incorrect?	Go to Step 13	Go to Step 7
7	Inspect the steering gear for the proper installation. Refer to <u>Steering Gear Replacement</u> . Is the power steering gear installation incorrect?	Go to Step 14	Go to Step 8
8	Inspect the suspension. Is the suspension worn?	Go to Step 15	Go to Step 9
9	Inspect the intermediate shaft.		

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	Is the intermediate shaft worn?	Go to Step 16	Go to Step 3
10	<p>Adjust or replace the hoses. Refer to the appropriate procedure(s):</p> <ul style="list-style-type: none"> • <u>Power Steering Cooler Pipe/Hose Replacement</u> • <u>Power Steering Reservoir Inlet Pipe/Hose Replacement</u> • <u>Power Steering Fluid Reservoir Outlet Hose Replacement</u> • <u>Power Steering Gear Inlet Pipe/Hose Replacement</u> • <u>Power Steering Gear Outlet Pipe/Hose Replacement</u> 		
	Did you complete the repair?	Go to Step 17	-
11	<p>Replace the engine drive belt. Refer to <u>Drive Belt Replacement</u> .</p> <p>Did you complete the repair?</p>	Go to Step 17	-
12	<p>Replace the power steering pump pulley. Refer to <u>Power Steering Pump Pulley Replacement</u>.</p> <p>Did you complete the repair?</p>	Go to Step 17	-
13	<p>Install the power steering pump correctly. Refer to <u>Power Steering Pump Replacement</u>.</p> <p>Did you complete the repair?</p>	Go to Step 17	-
14	<p>Install the steering gear correctly. Refer to <u>Steering Gear Replacement</u>.</p> <p>Did you complete the repair?</p>	Go to Step 17	-
15	<p>Replace the worn suspension components. Refer to <u>Diagnostic Starting Point - Suspension General Diagnosis</u> .</p> <p>Did you complete the repair?</p>	Go to Step 17	-
16	<p>Replace the intermediate shaft. Refer to <u>Intermediate Steering Shaft</u></p>		

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	Replacement . Did you complete the repair?	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM

Whine or Growl Noise from the Power Steering System

Step	Action	Yes	No
1	Did you review the Power Steering System Description and perform the necessary inspections?	Go to Step 2	Go to Steering Wheel and Column Description and Operation
2	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to Step 3	System OK
3	Inspect the power steering fluid for the following indications of contamination: <ul style="list-style-type: none"> • Milky fluid - water • Brown Fluid - burnt • Debris in fluid - plastic or dirt Is the fluid free of contamination?	Go to Step 5	Go to Step 4
4	Flush the power steering system. Refer to Power Steering System Bleeding. Did you complete the procedure?	Go to Step 11	Go to Step 5
5	Using the J 39570 Chassis Ear, inspect the power steering gear for a whine or growl noise. Is the noise present at the power steering gear?	Go to Step 8	Go to Step 6
6	Using the J 39570 , inspect the power steering pump for a whine or growl noise. Is the noise present at the power steering		

2007 Saturn Outlook XE

2007 STEERING Power Steering - Outlook

	pump?	Go to Step 9	Go to Step 7
7	Using the J 39570 , inspect the power steering hoses for a whine or growl noise. Is the noise present at the power steering hoses?	Go to Step 10	Go to Step 2
8	Replace the power steering gear. Refer to Steering Gear Replacement . Did you complete the repair?	Go to Step 11	-
9	Replace the power steering pump. Refer to Power Steering Pump Replacement . Did you complete the repair?	Go to Step 11	-
10	Adjust the routing of the power steering hoses. Did you complete the repair?	Go to Step 11	-
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

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 Step 2	Go to Steering Wheel and Column Description and Operation
2	Verify that the steering effort is too easy in one or both directions. Does the system operate normally?	System OK	Go to Step 3
3	Perform the power steering test procedure. Refer to Power Steering System Test . Did you complete the procedure?	Go to Step 4	-
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS

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

REPAIR INSTRUCTIONS**POWER STEERING SYSTEM BLEEDING****IMPORTANT:**

- Use clean, new power steering fluid type only. Refer to **Fluid and Lubricant Recommendations** .
- Hoses touching the frame, body or engine may cause system noise. Verify that the hoses do not touch any other part of the vehicle.
- Loose connections may not leak, but could allow air into the steering system. Verify that all hose connections are tight.

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

1. Fill pump reservoir with fluid to minimum system level, FULL COLD level or middle of hash mark on cap stick fluid level indicator.
2. Raise the vehicle until the front wheels are off the ground. Refer to **Lifting and Jacking the Vehicle** .
3. Start the engine and turn the steering wheel from stop to stop 4 times.

4. Verify power steering fluid level per operating specification. Refer to **Checking and Adding Power Steering Fluid**.
5. Rotate steering wheel from left to right another 8 times. Check for signs of cavitation or fluid aeration (pump noise/whining).
6. Verify the fluid level. Repeat the bleed procedure, if necessary.

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** .

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 at the HOT/FULL mark on the capstick.
4. If the fluid level is low, add power steering fluid to the proper level.
5. Install the reservoir cap.
6. When checking the fluid level after servicing the steering system, bleed the air from the system. Refer to **Power Steering System Bleeding**.

POWER STEERING SYSTEM FLUSHING

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

1. Turn OFF the engine.

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

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

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

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

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

REMOTE POWER STEERING FLUID RESERVOIR REPLACEMENT

Removal Procedure

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .
2. Remove as much power steering fluid from the remote power steering fluid reservoir as possible.
3. Place drain pans under the vehicle as needed.

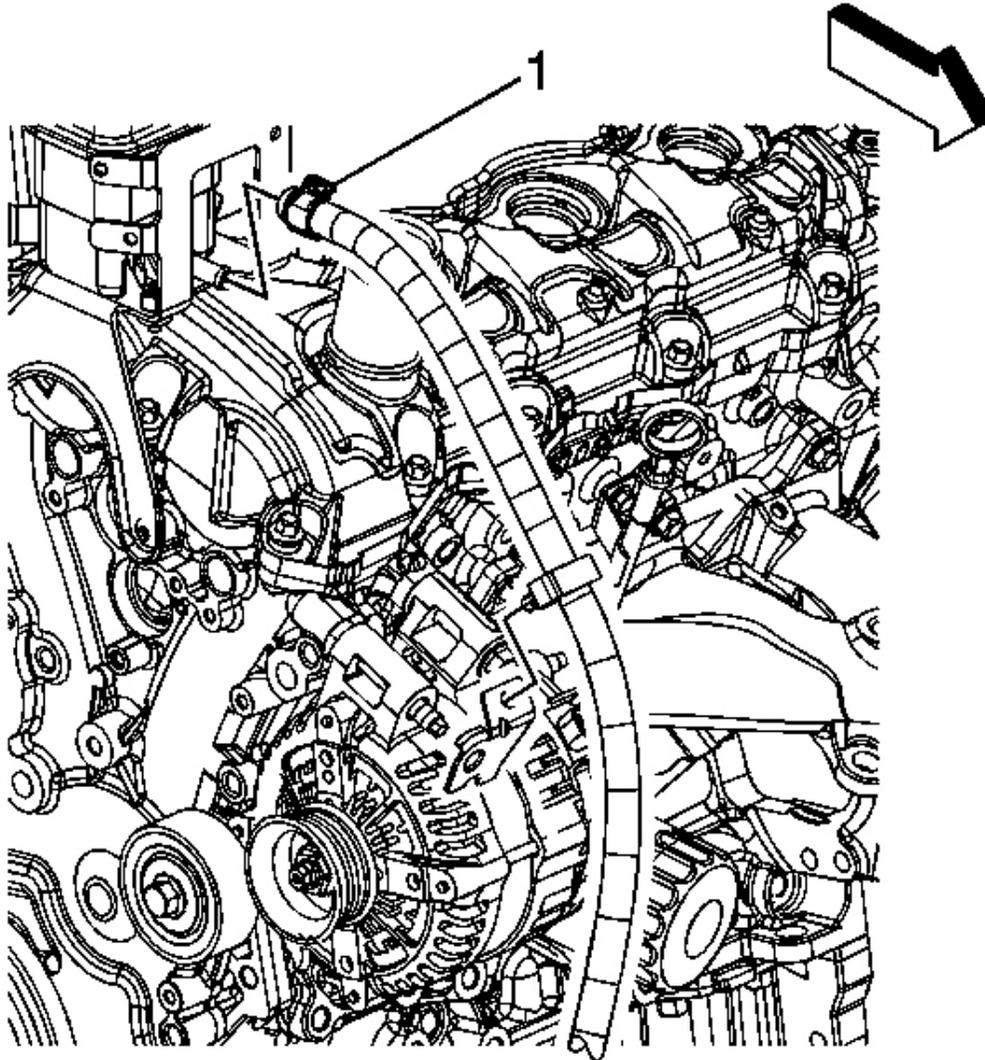


Fig. 3: Identifying Power Steering Reservoir Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering reservoir inlet hose (1).

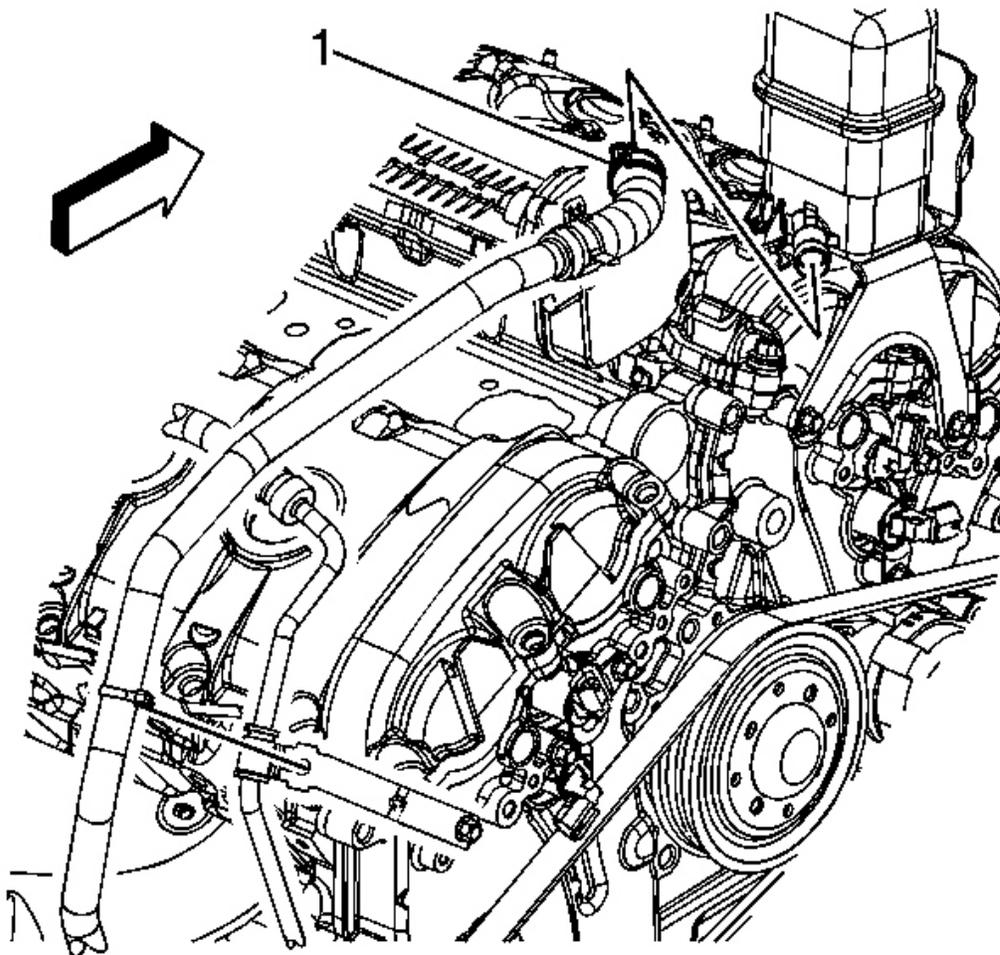


Fig. 4: View Of Power Steering Fluid Reservoir Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the power steering fluid reservoir outlet hose (1).

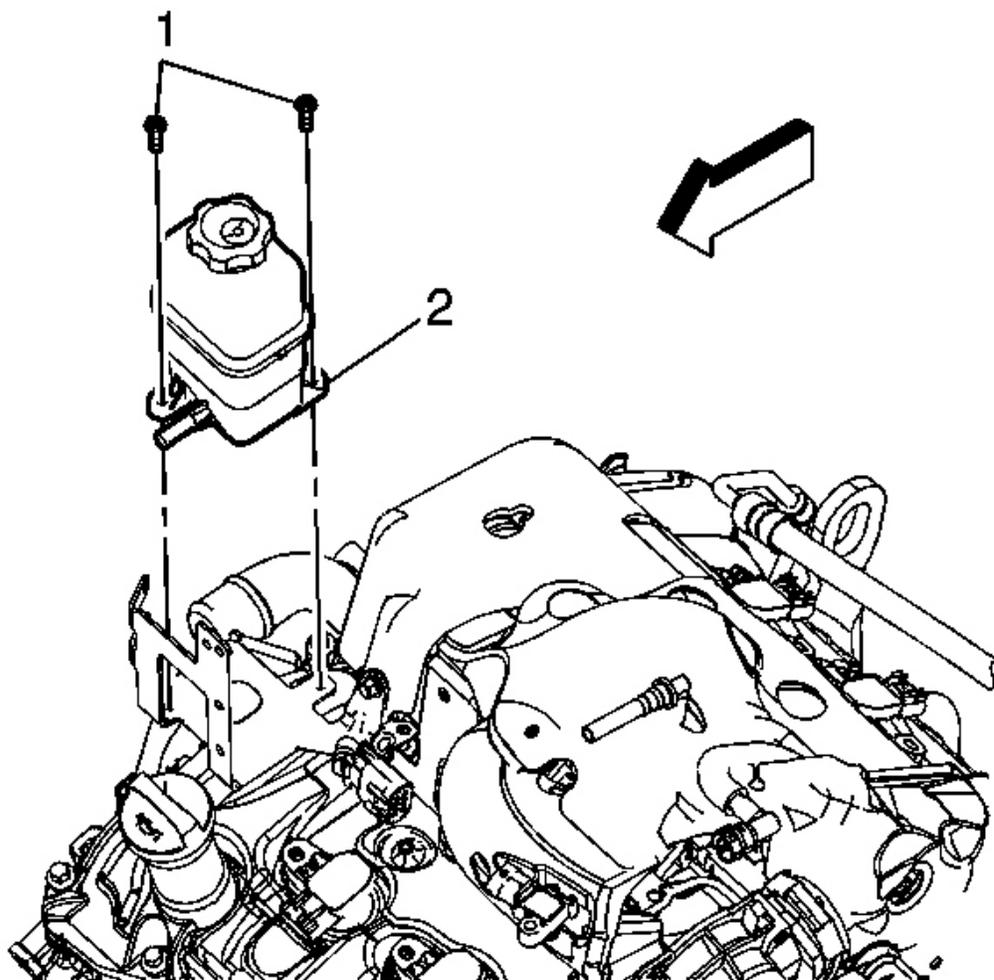


Fig. 5: Locating Power Steering Fluid Reservoir & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the remote power steering fluid reservoir bolts (1).
7. Remove the remote power steering fluid reservoir (2).

Installation Procedure

NOTE: Refer to Fastener Notice .

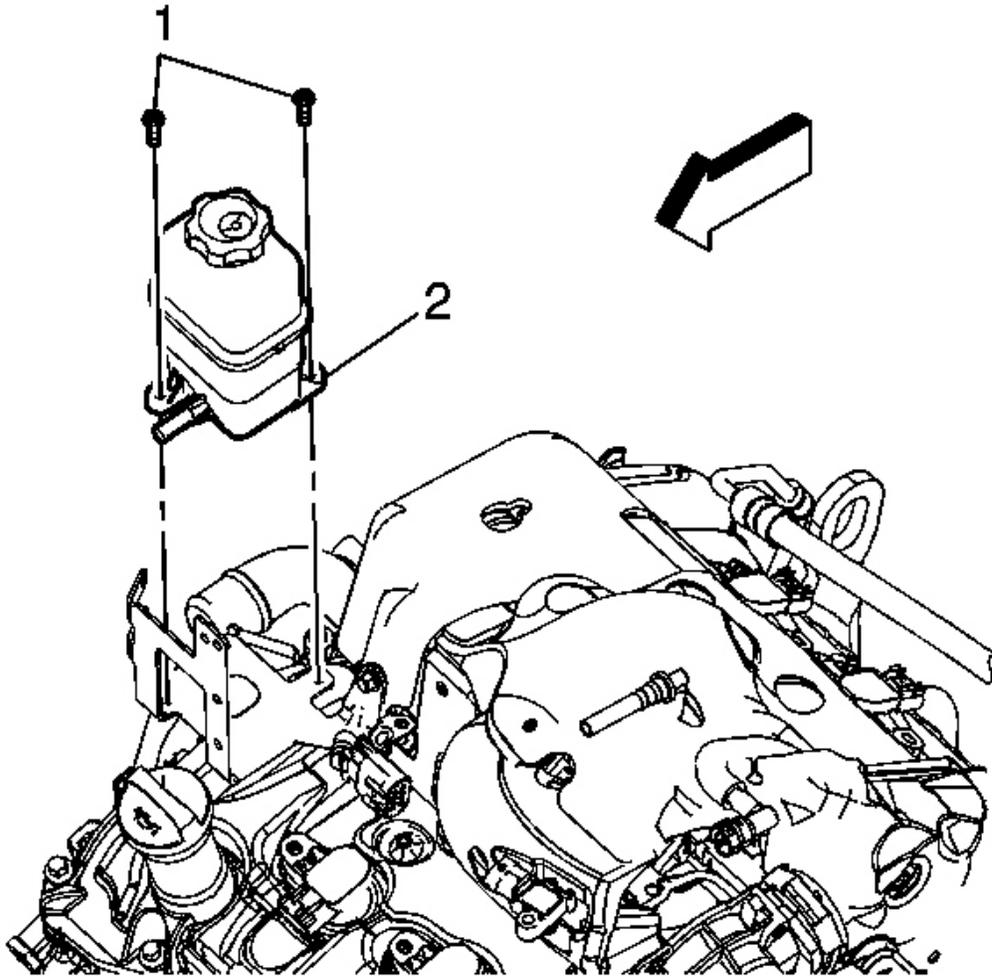


Fig. 6: Locating Power Steering Fluid Reservoir & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the remote power steering fluid reservoir (2).
2. Install the remote power steering fluid reservoir bolts (1).

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

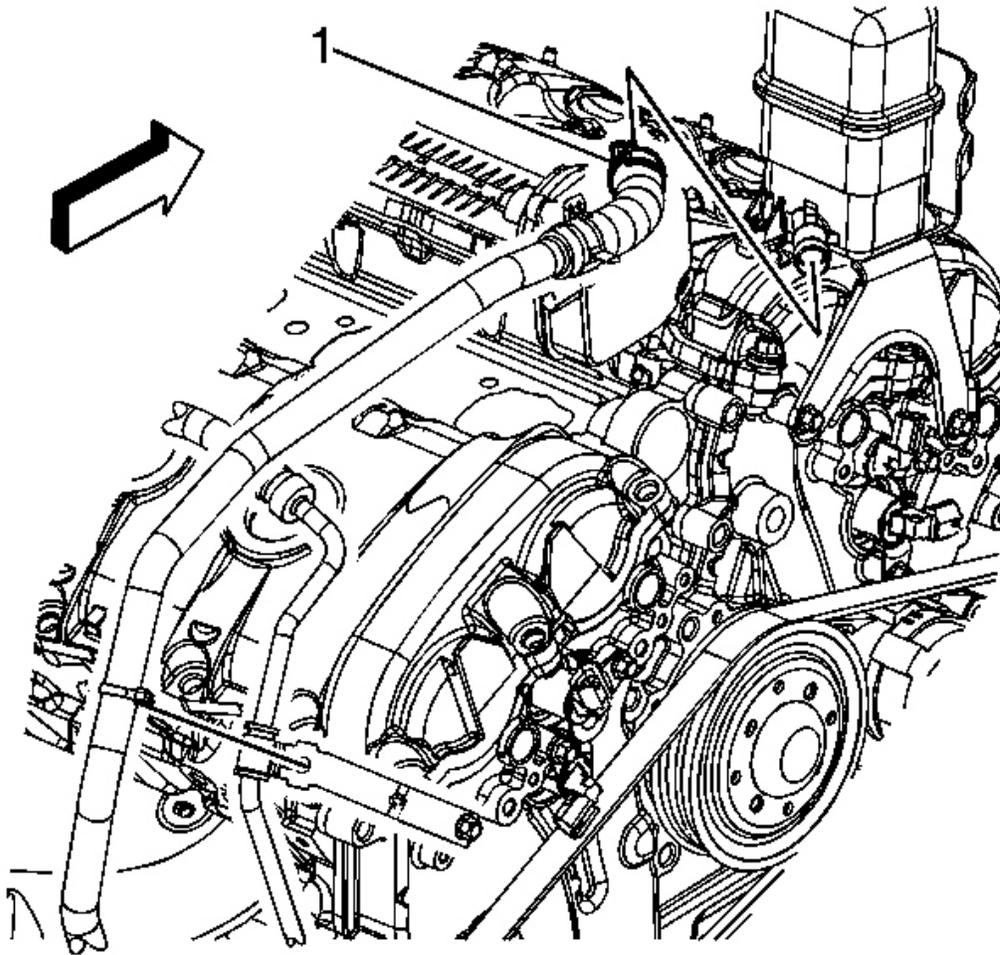


Fig. 7: View Of Power Steering Fluid Reservoir Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering fluid reservoir outlet hose (1).

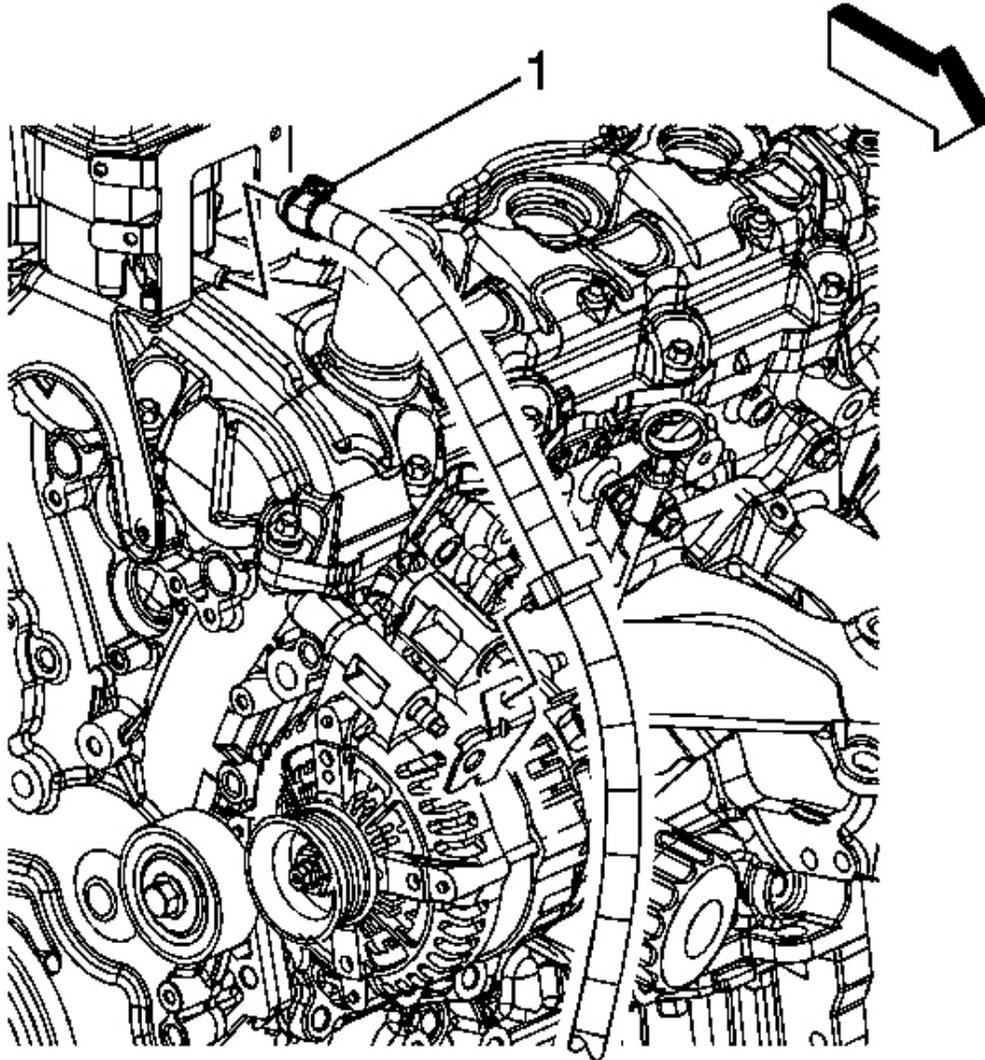


Fig. 8: Identifying Power Steering Reservoir Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Connect the power steering reservoir inlet hose (1).
5. Clean all excess fluid from the vehicle and remove the drain pans.
6. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.
7. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

REMOTE POWER STEERING FLUID RESERVOIR BRACKET REPLACEMENT

Removal Procedure

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .
2. Remove the right side engine mount strut bracket. Refer to **Engine Mount Strut Bracket Replacement - Right Side**
3. Remove as much power steering fluid from the remote power steering fluid reservoir as possible.
4. Place drain pans under the vehicle as needed.

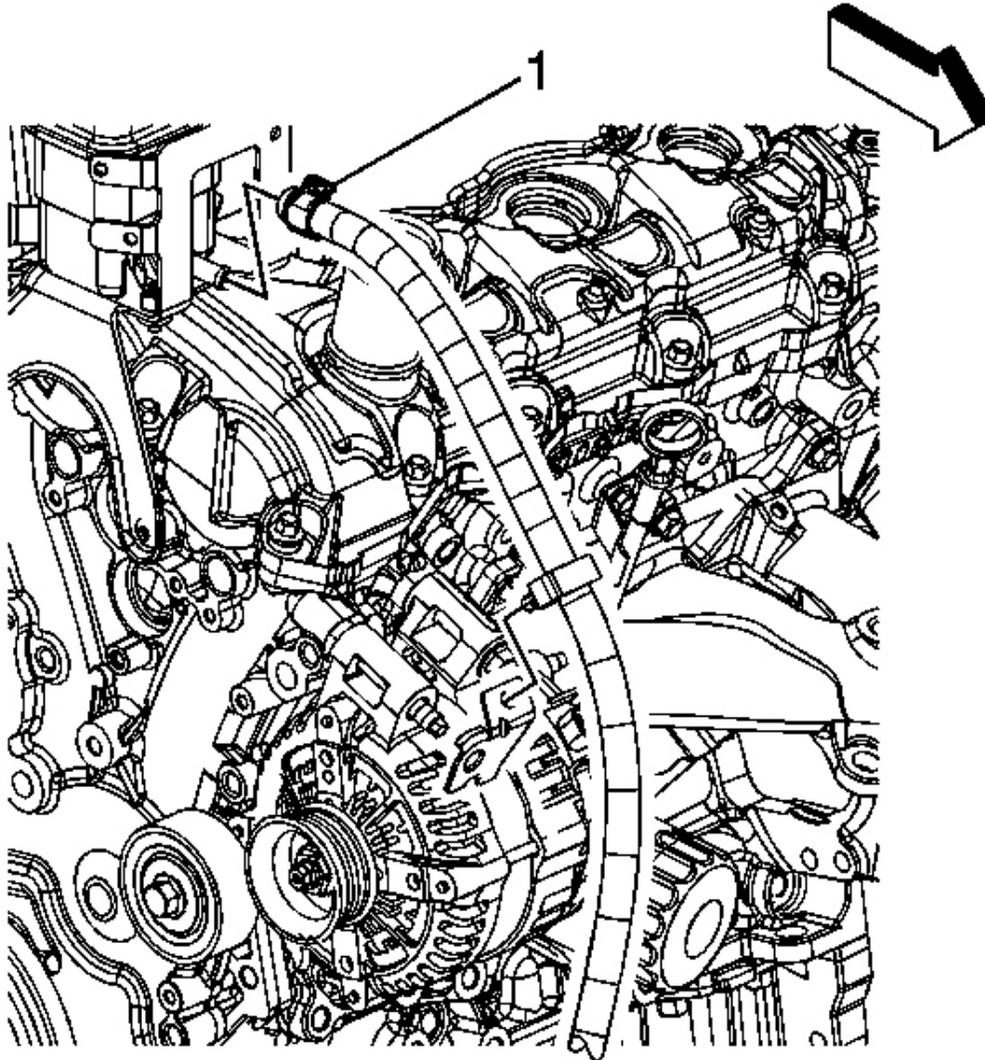


Fig. 9: Identifying Power Steering Reservoir Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the power steering reservoir inlet hose (1).

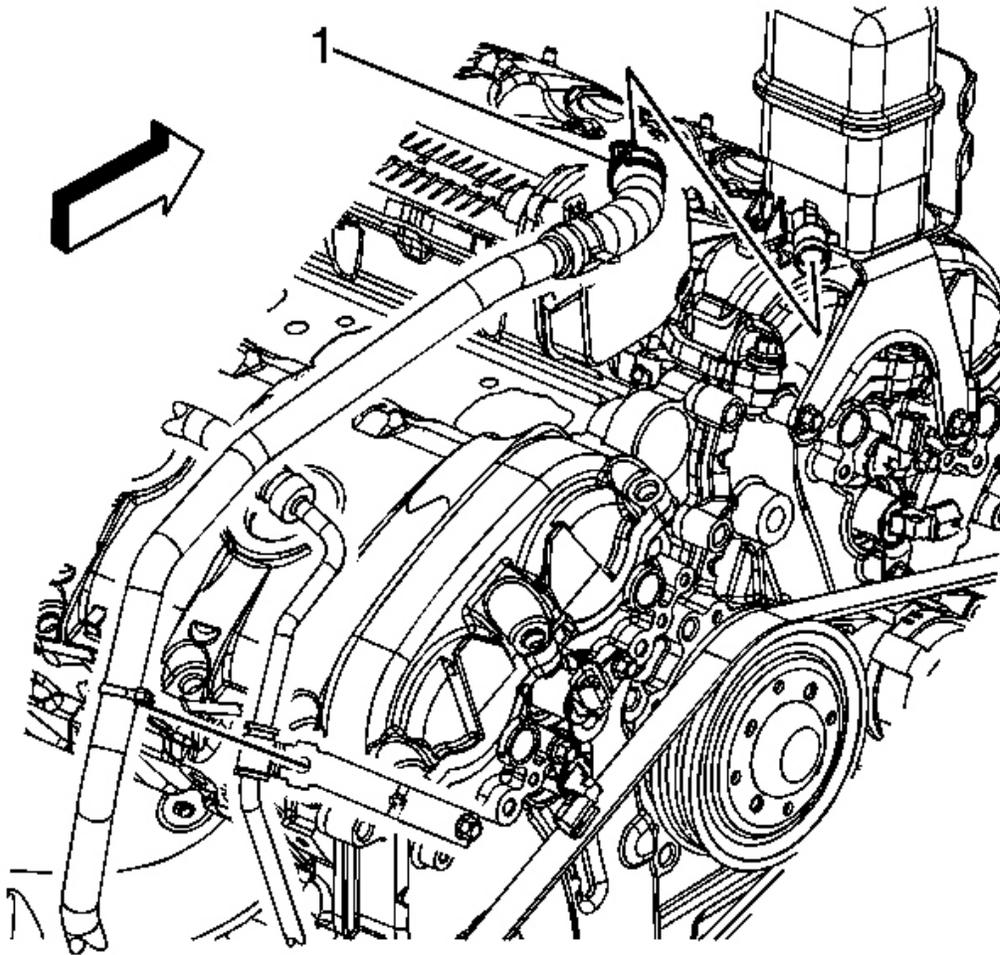


Fig. 10: View Of Power Steering Fluid Reservoir Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the power steering fluid reservoir outlet hose (1).

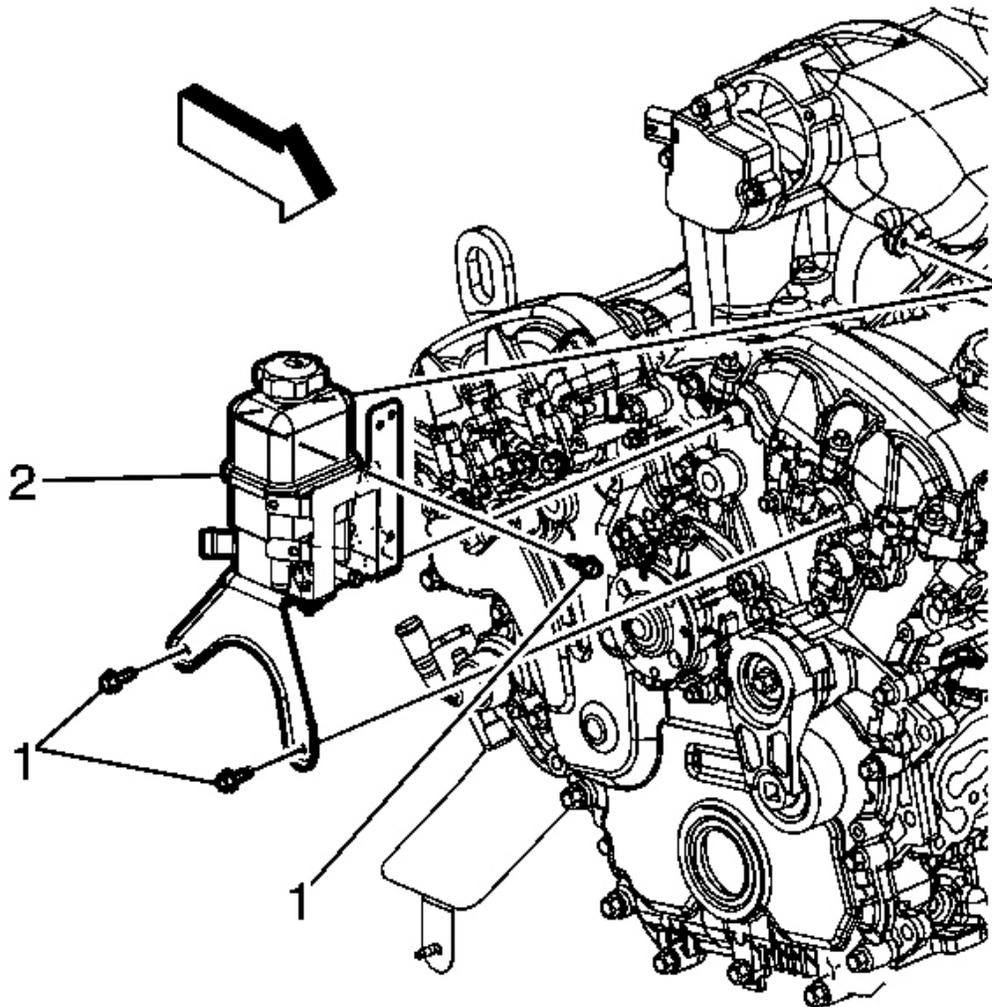


Fig. 11: Identifying Remote Power Steering Fluid Reservoir, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the remote power steering fluid reservoir bracket bolts (1).
8. Remove the remote power steering fluid reservoir bracket (2).
9. Transfer any parts as needed.

Installation Procedure

NOTE: Refer to Fastener Notice .

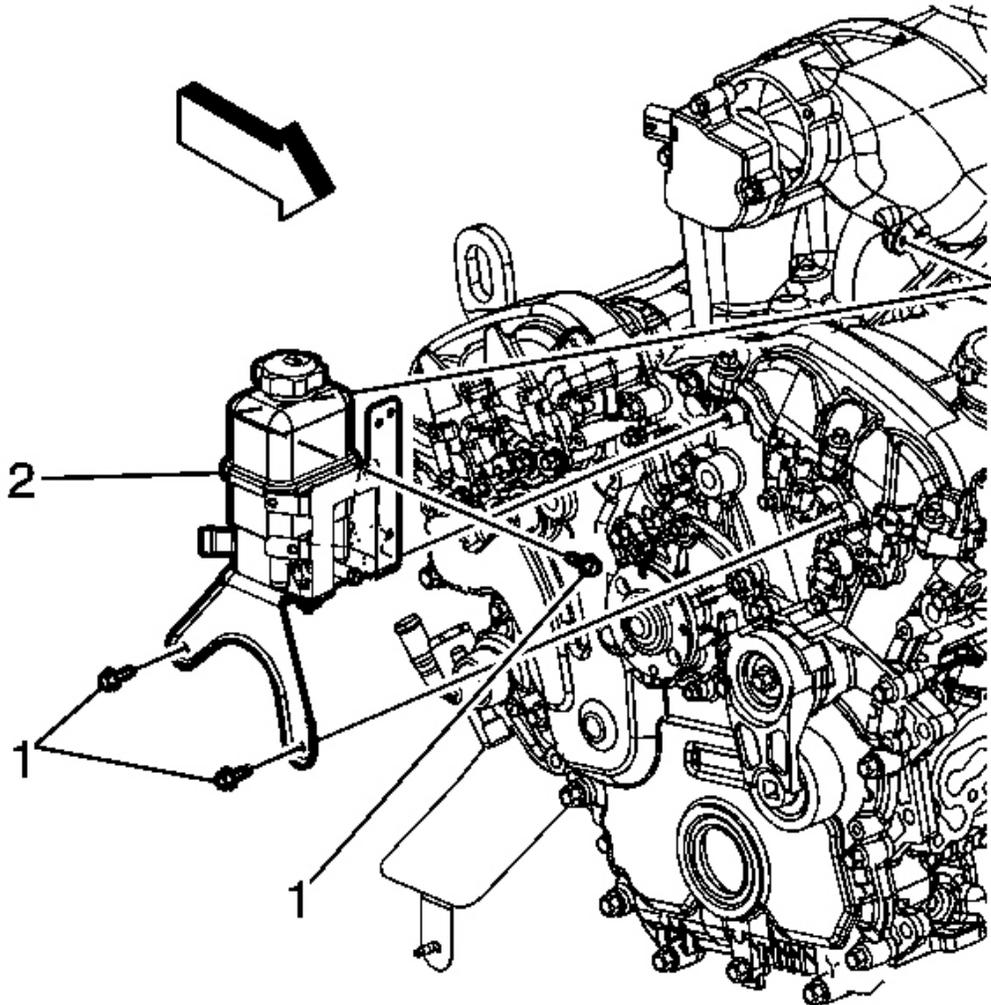


Fig. 12: Identifying Remote Power Steering Fluid Reservoir, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the remote power steering fluid reservoir bracket (2).
2. Install the remote power steering fluid reservoir bracket bolts (1).

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

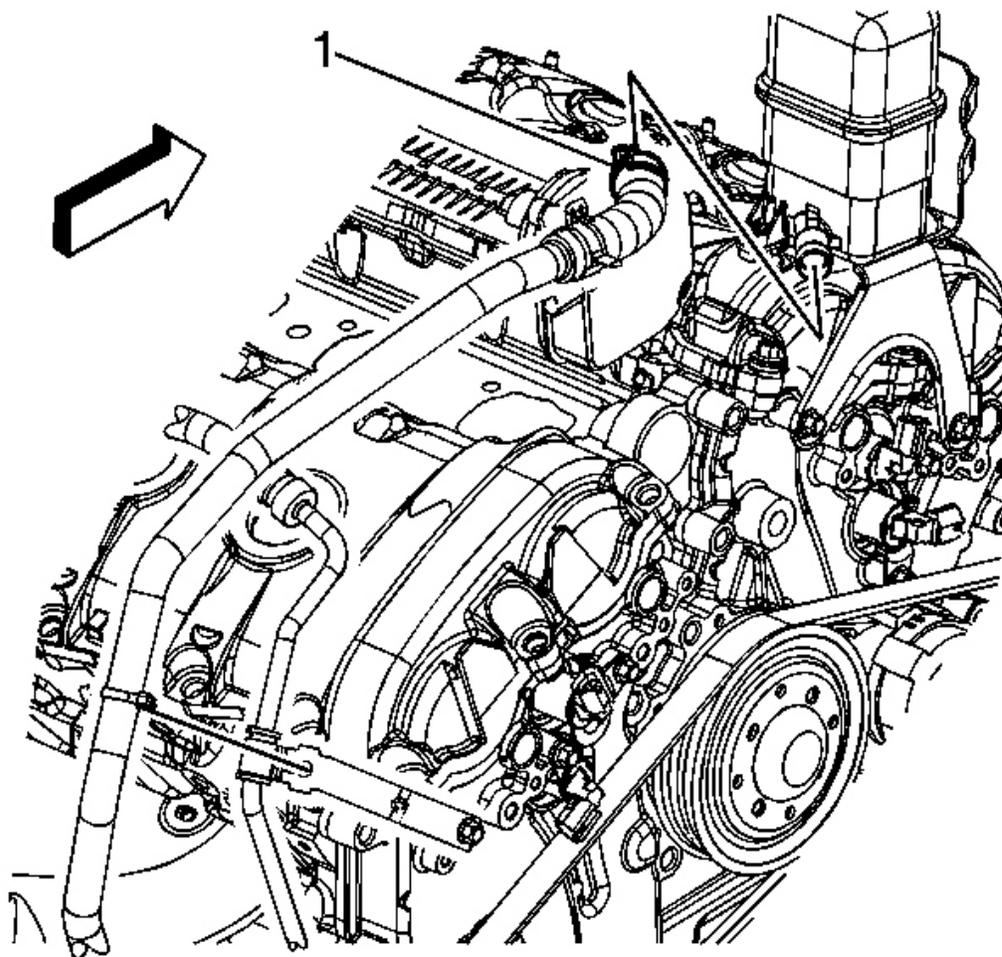


Fig. 13: View Of Power Steering Fluid Reservoir Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering fluid reservoir outlet hose (1).

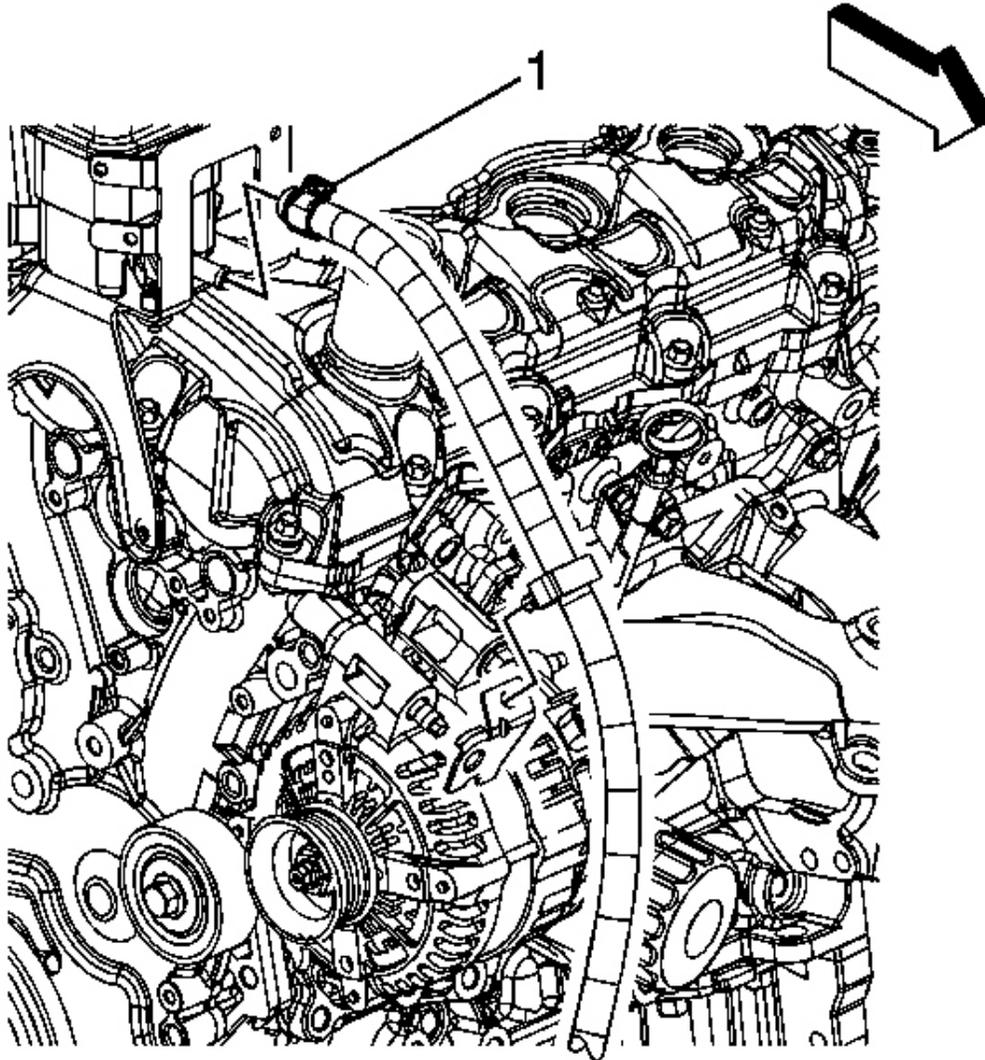


Fig. 14: Identifying Power Steering Reservoir Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Connect the power steering reservoir inlet hose (1).
5. Clean all excess fluid from the vehicle and remove the drain pans.
6. Install the right side engine mount strut bracket. Refer to **Engine Mount Strut Bracket Replacement - Right Side**
7. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding.**

8. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .

POWER STEERING PUMP PULLEY REPLACEMENT

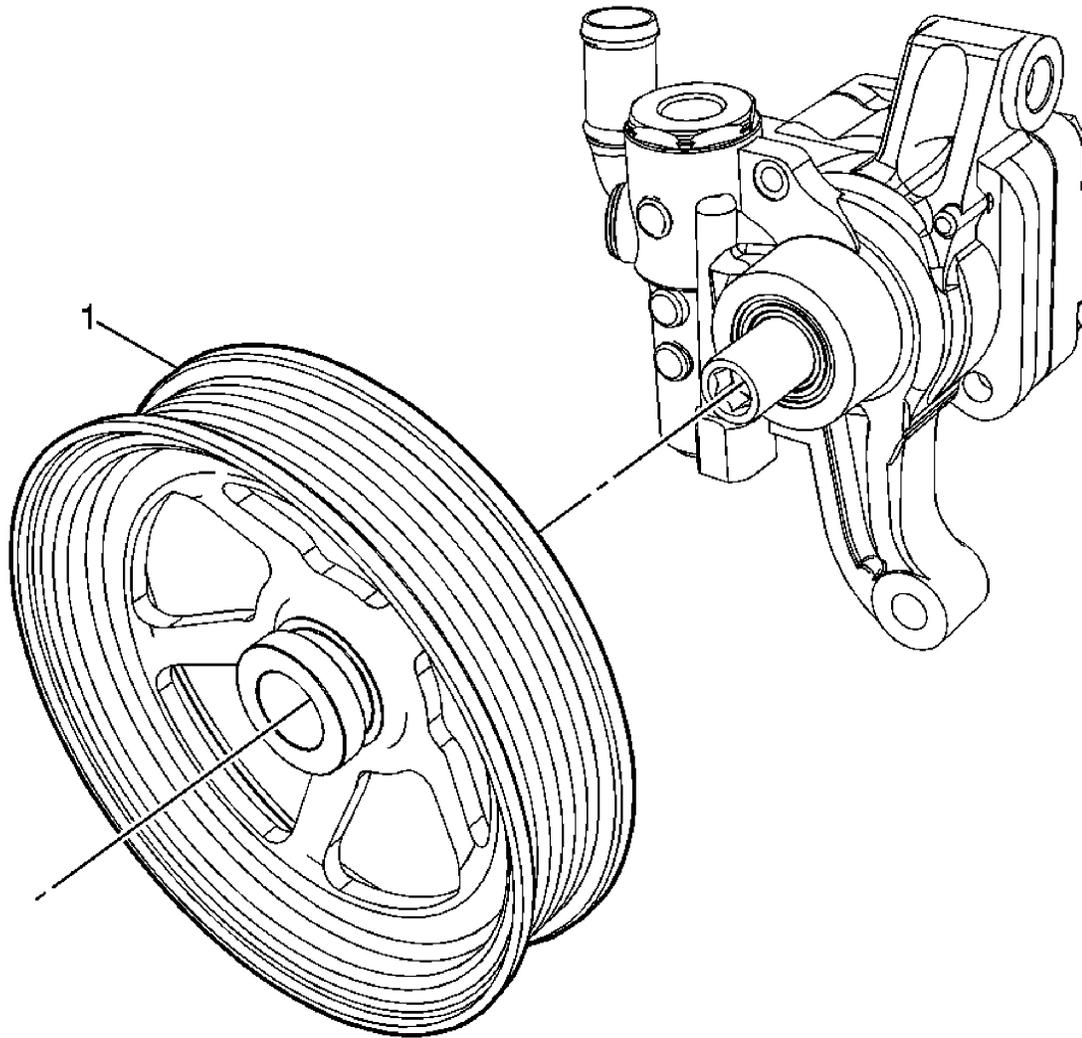


Fig. 15: View Of Power Steering Pump Pulley
 Courtesy of GENERAL MOTORS CORP.

Power Steering Pump Pulley Replacement

Callout	Component Name
Preliminary Procedure: Remove the power steering pump. Refer to <u>Power Steering Pump Replacement</u> .	
	Power Steering Pump Pulley

Procedure

1

1. Use remover **SA9162C** to remove the power steering pump pulley. See **Special Tools**.
2. Use installer **SA9162C** to install the power steering pump pulley. See **Special Tools**.

Special Tools:

SA9162C Power Steering Pump Pulley Remover/Installer. See **Special Tools**.

POWER STEERING PUMP REPLACEMENT

Removal Procedure

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .
2. Remove as much power steering fluid from the remote power steering fluid reservoir as possible.
3. Place drain pans under the vehicle as needed.
4. Remove the drive belt. Refer to **Drive Belt Replacement** .
5. Remove the steering gear heat shield. Refer to **Steering Gear Heat Shield Replacement**.
6. Remove the right side catalytic convertor. Refer to **Catalytic Converter Replacement - Right Side** .

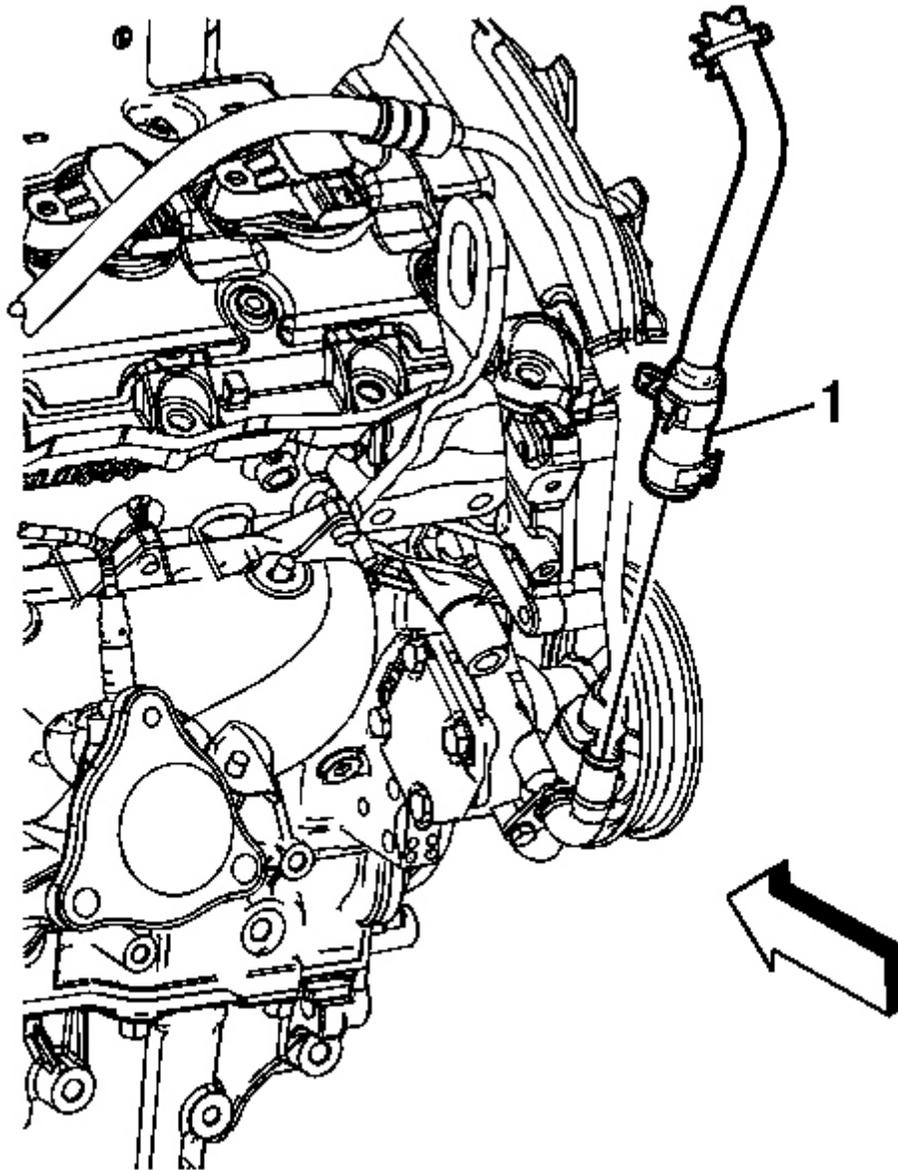


Fig. 16: Identifying Power Steering Fluid Reservoir Outlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the power steering fluid reservoir outlet hose (1) from the power steering pump.

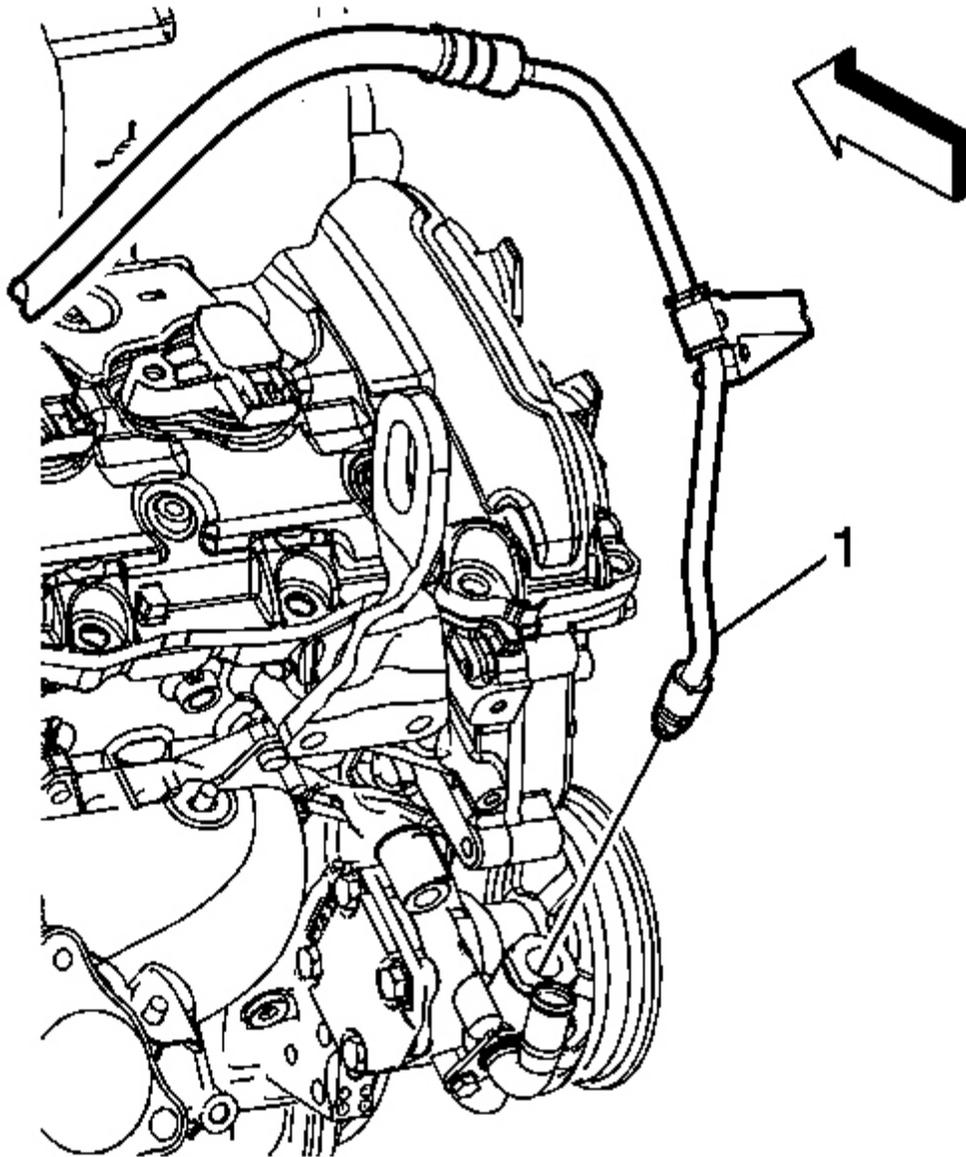


Fig. 17: View Of Power Steering Gear Inlet Hose
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the power steering gear inlet hose (1) from the power steering pump.

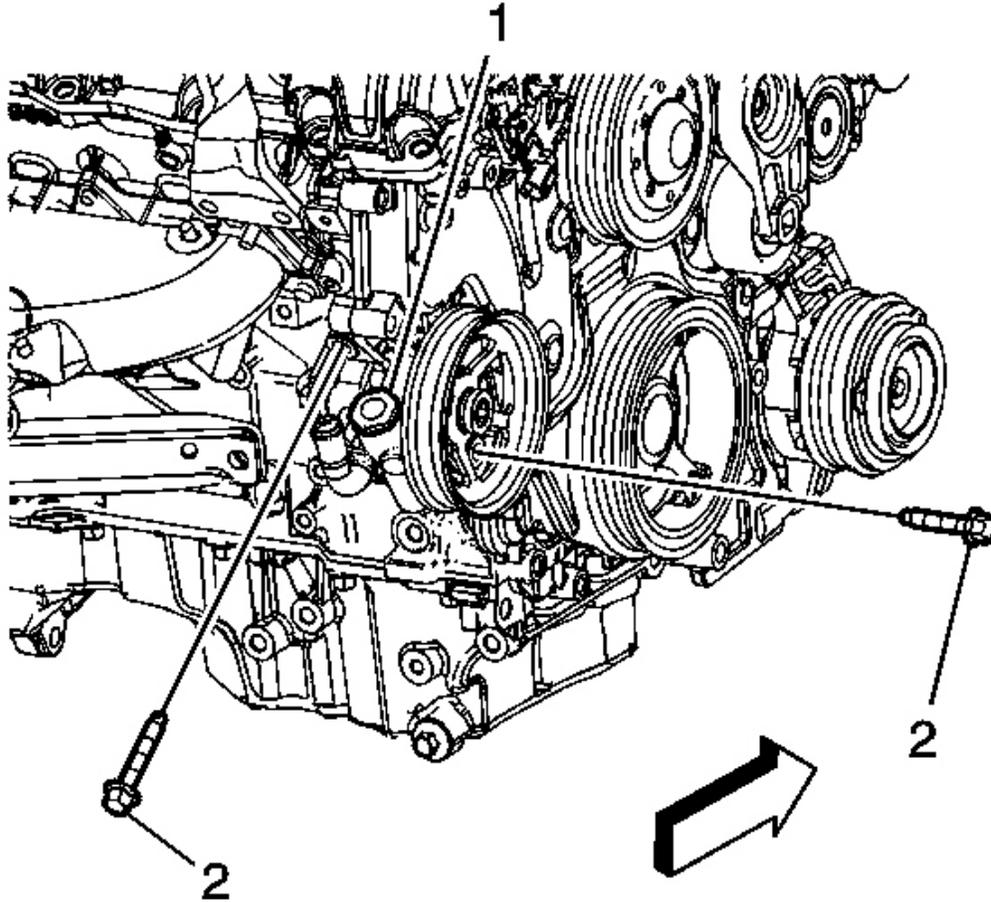


Fig. 18: View Of Power Steering Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering pump bolts (2).
10. Remove the power steering pump (1) from the vehicle.

Installation Procedure

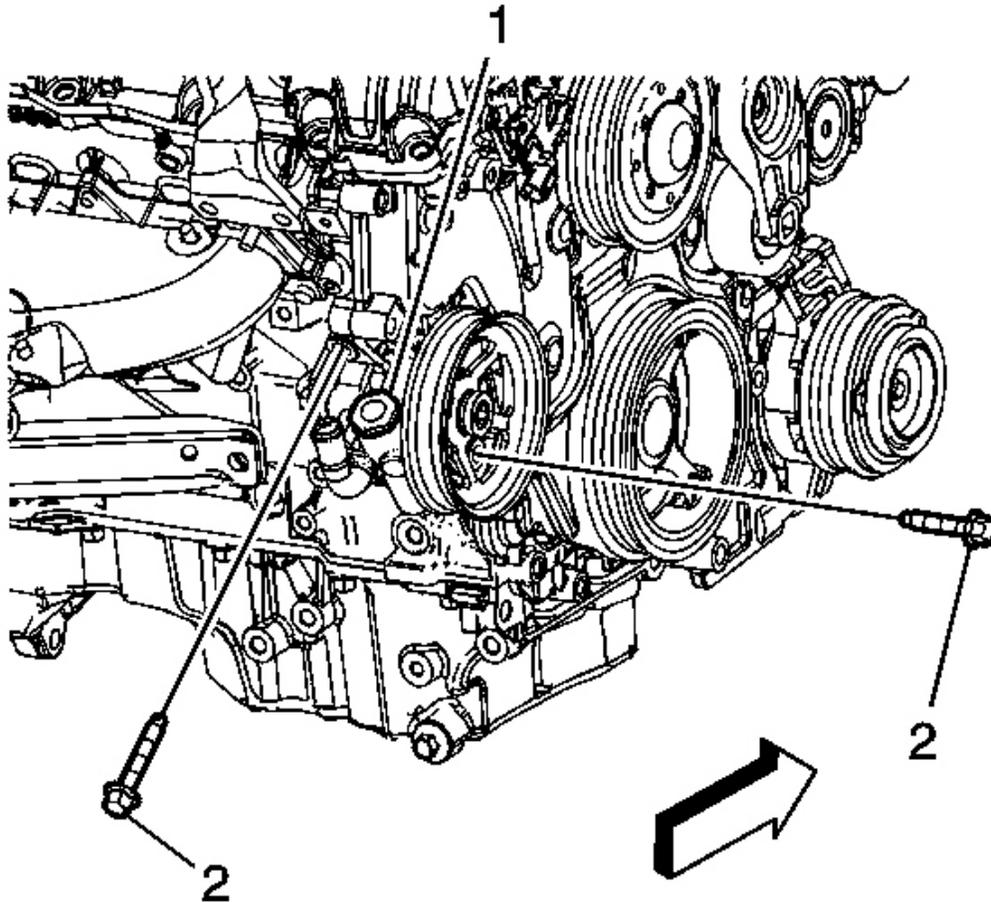


Fig. 19: View Of Power Steering Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the power steering pump (1) to the vehicle.

NOTE: Refer to Fastener Notice .

2. Install the power steering pump bolts (2).

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

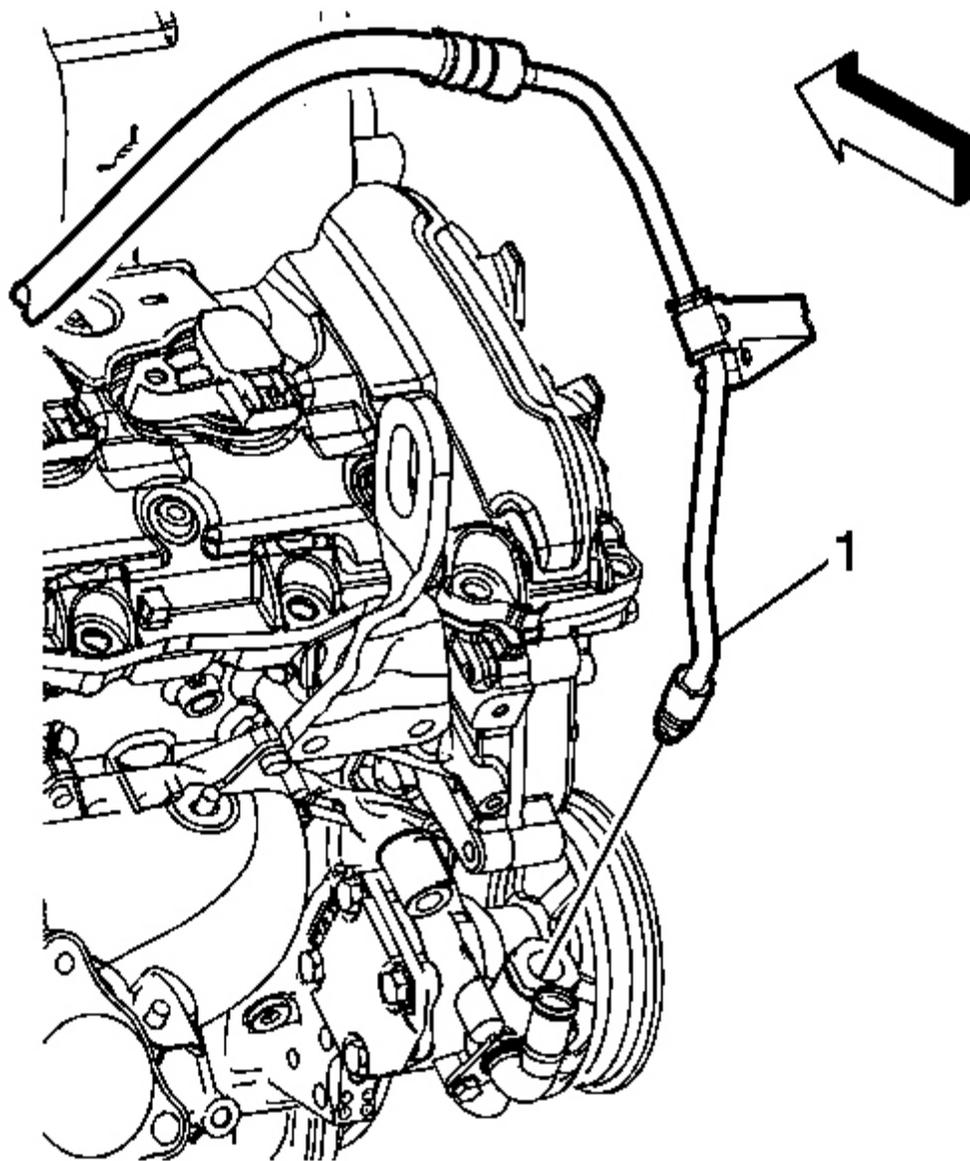


Fig. 20: View Of Power Steering Gear Inlet Hose
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering gear inlet hose fitting (1) to the power steering pump.

Tighten: Tighten the fitting to 27 N.m (20 lb ft).

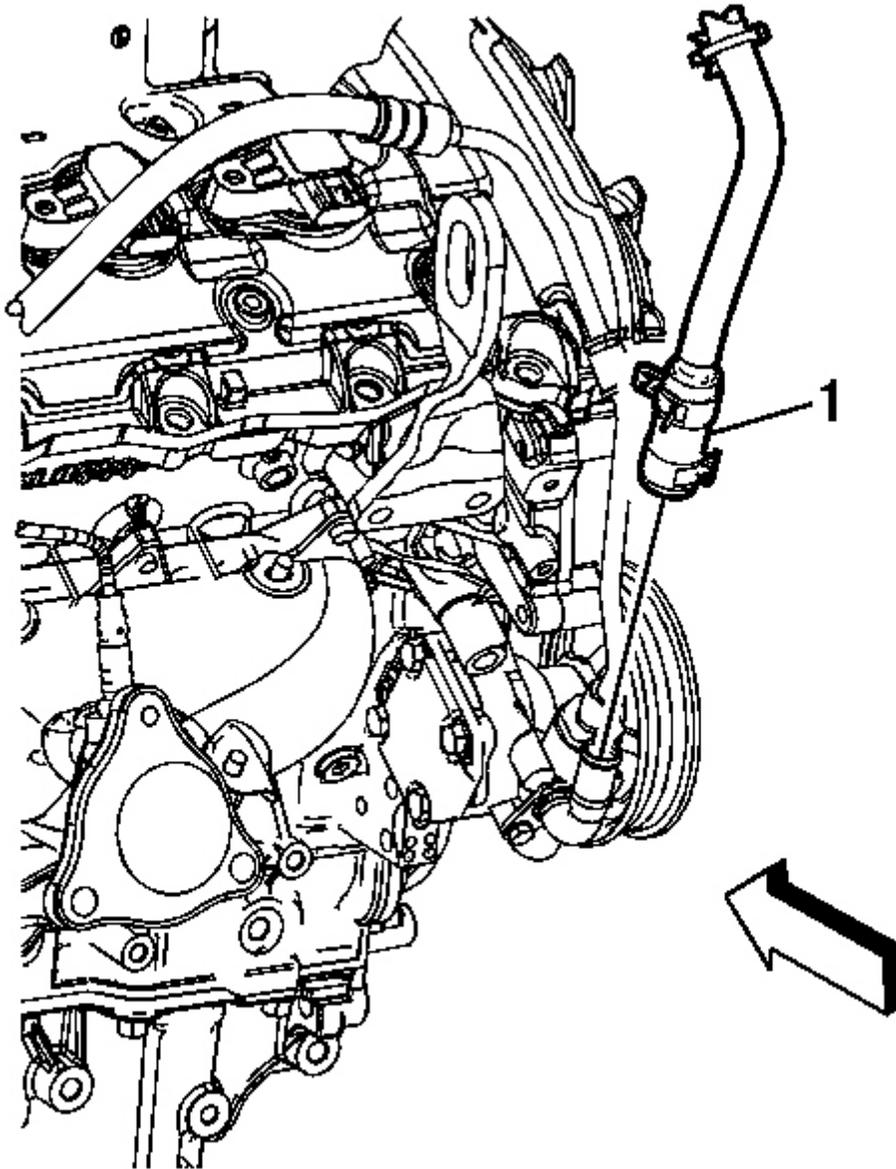


Fig. 21: Identifying Power Steering Fluid Reservoir Outlet Hose
Courtesy of GENERAL MOTORS CORP.

4. Connect the power steering fluid reservoir outlet hose (1) to the power steering pump.
5. Clean any excess fluid from the vehicle and remove the drain pans.

6. Install the right side catalytic convertor. Refer to **Catalytic Converter Replacement - Right Side** .
7. Install the steering gear heat shield. Refer to **Steering Gear Heat Shield Replacement**.
8. Install the drive belt. Refer to **Drive Belt Replacement** .
9. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.
10. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .

STEERING LINKAGE OUTER TIE ROD REPLACEMENT

Tools Required

SA91100C Tie Rod Separator. See **Special Tools**.

Removal Procedure

1. Remove the front tire/wheel. Refer to **Tire and Wheel Removal and Installation** .

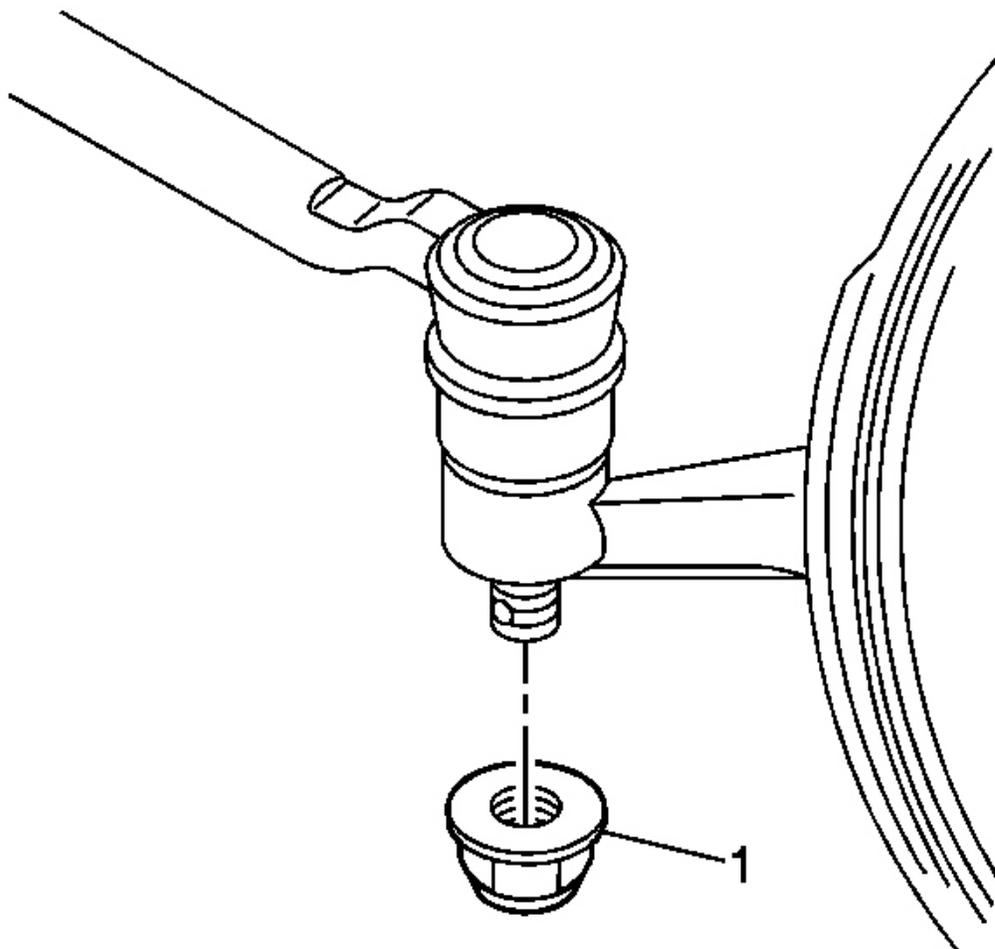


Fig. 22: Identifying Steering Linkage Outer Tie Rod Nut
Courtesy of GENERAL MOTORS CORP.

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

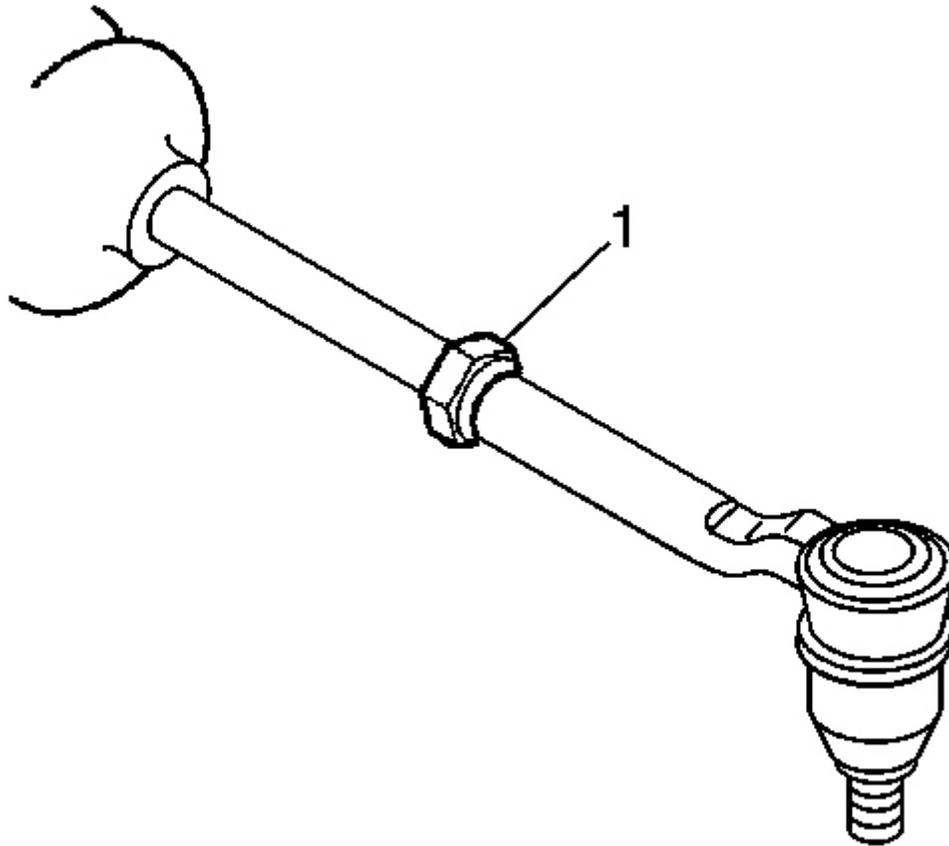


Fig. 23: View Of Steering Linkage Inner Tie Rod Nut
Courtesy of GENERAL MOTORS CORP.

3. Loosen the steering linkage inner tie rod nut (1).

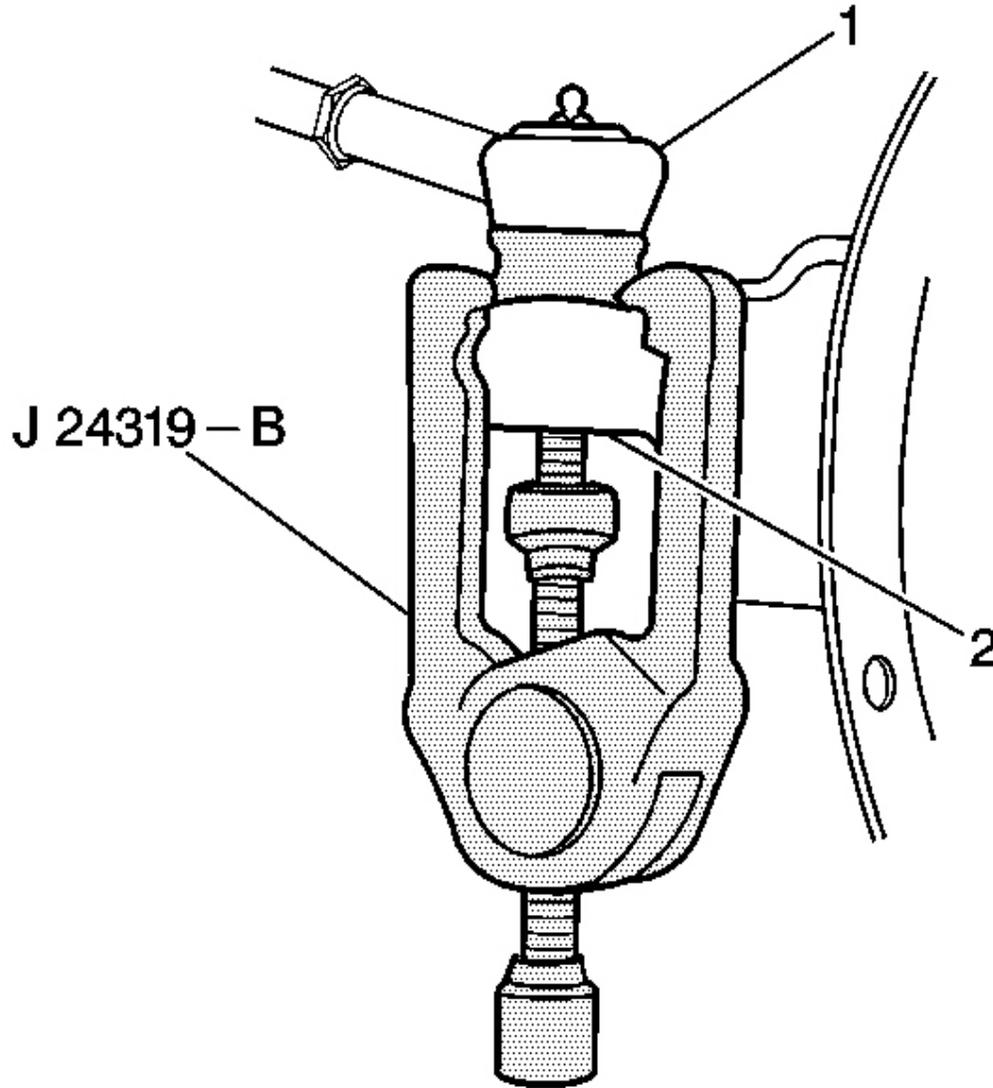


Fig. 24: Identifying Special Tool - J 24319-B
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not attempt to free the ball stud by using a pickle fork or wedge type tool, because seal or bushing damage could result. Use the proper tool to separate all ball joints.

4. Use separator **SA91100C** to separate the steering linkage outer tie rod (1) from the steering knuckle (2). See **Special Tools**.

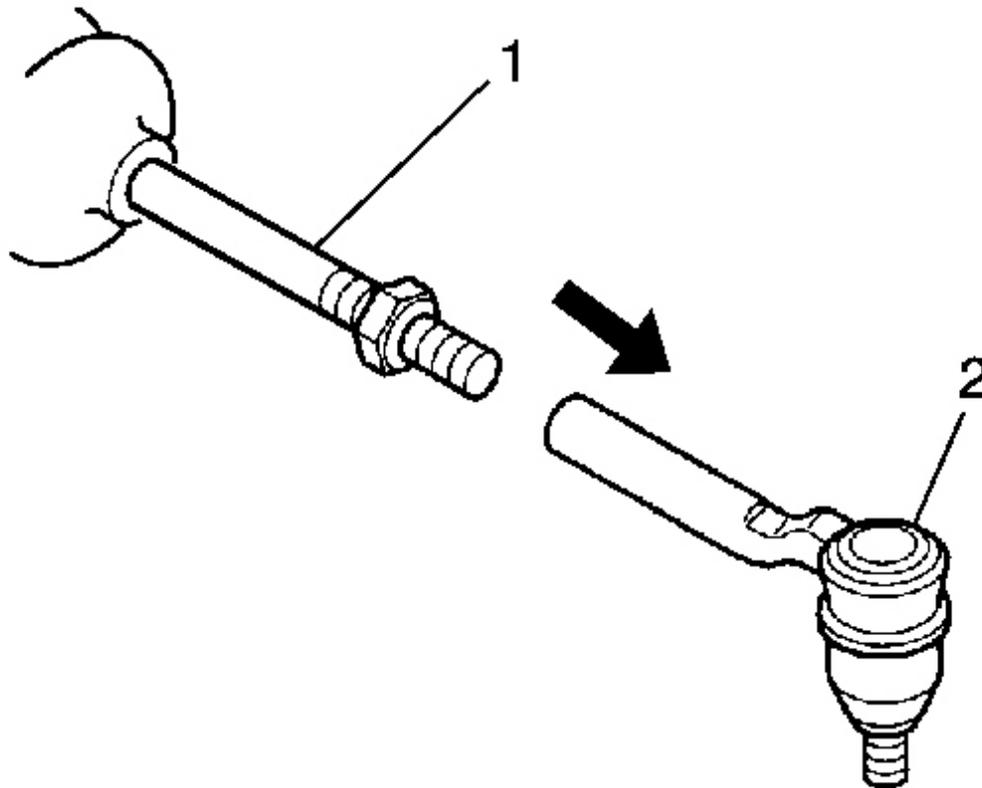


Fig. 25: Identifying Steering Linkage Inner & Outer Tie Rod
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Count the total number of complete rotations needed to remove the steering linkage outer tie rod from the steering linkage inner tie rod.

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

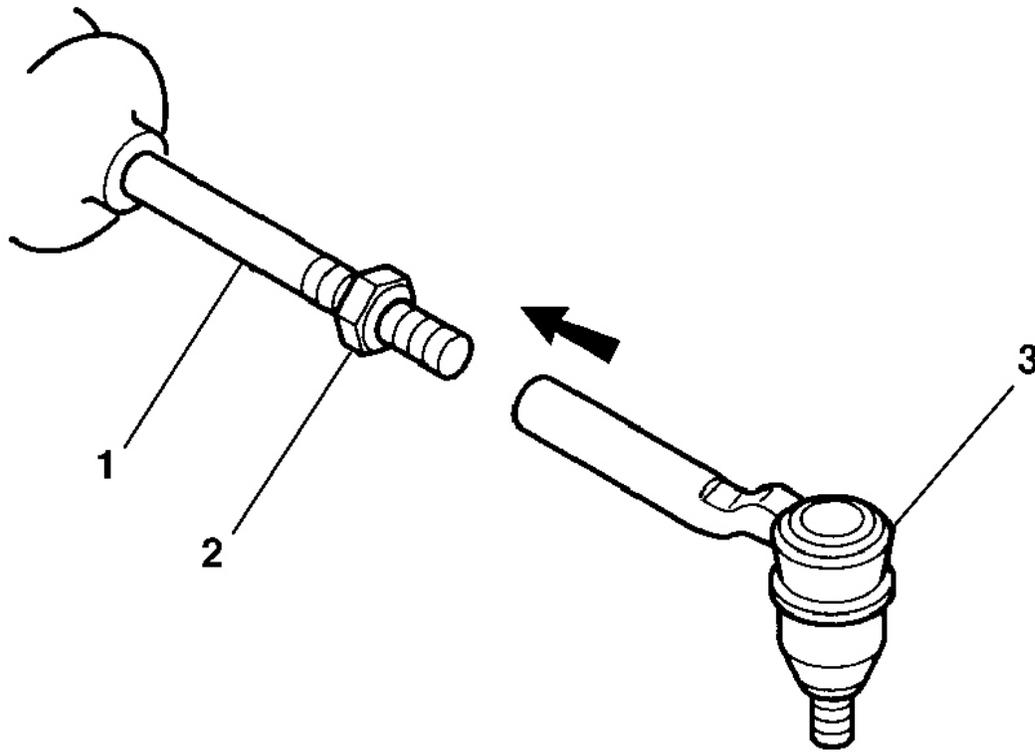


Fig. 26: Installing Outer Tie Rod Assembly To Inner Tie Rod Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the steering linkage outer tie rod the same number of complete rotations counted when removing it prior.

1. Install the steering linkage outer tie rod (3) to the steering linkage inner tie rod (1) but do not tighten the steering linkage inner tie rod nut (2).

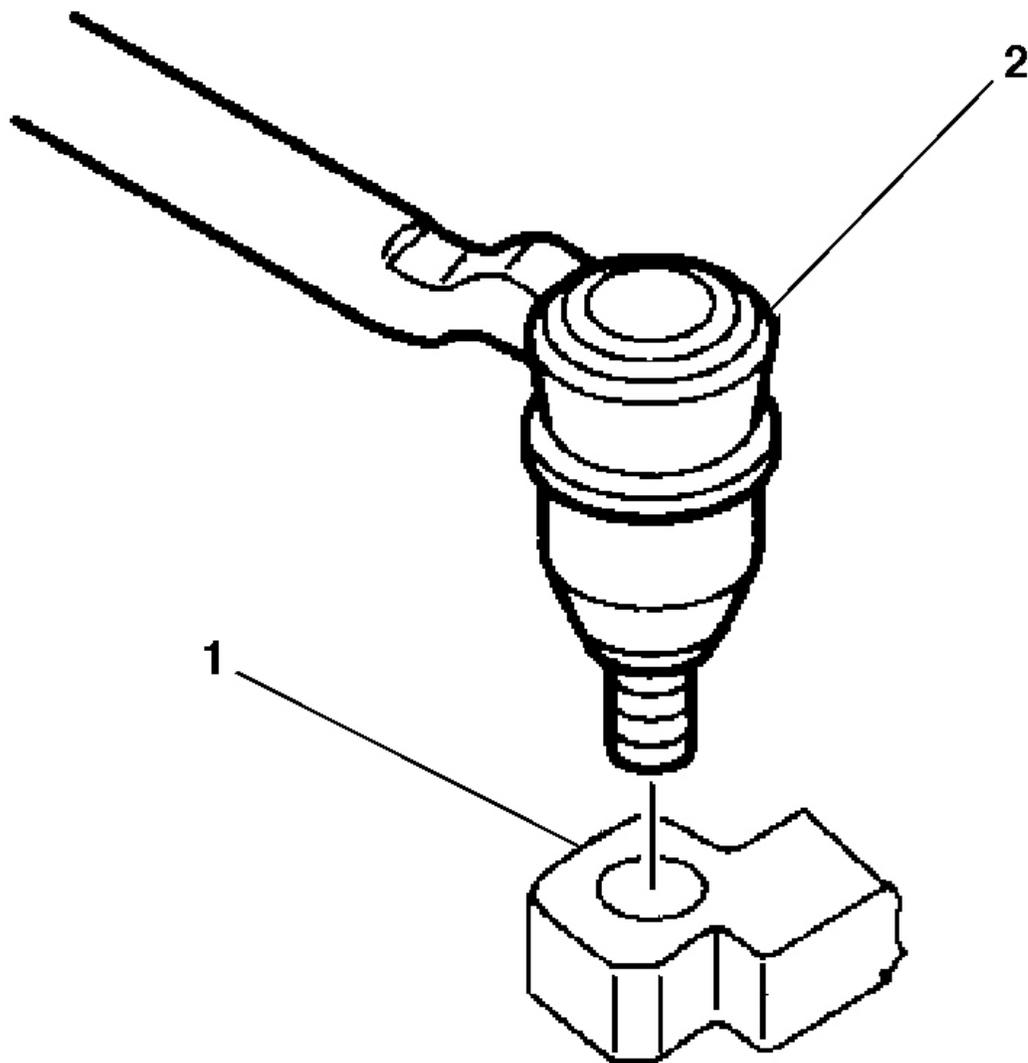


Fig. 27: View Of Outer Tie Rod & Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

2. Install the steering linkage outer tie rod (2) to the steering knuckle (1).

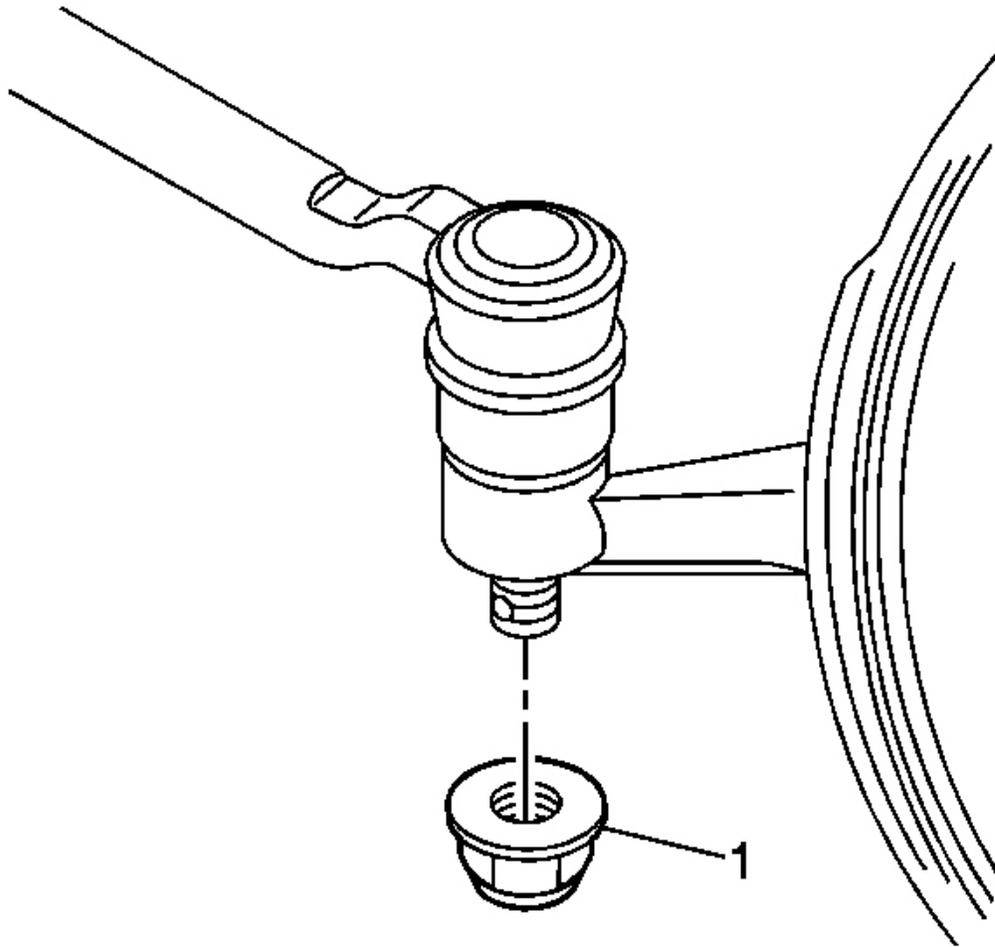


Fig. 28: Identifying Steering Linkage Outer Tie Rod Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: This is a prevailing torque type fastener. This fastener may be reused **ONLY** if:

- The fastener and its counterpart are clean and free from rust.
- The fastener develops 2 N.m (18 lb in) of torque (drag) against its counterpart prior to the fastener seating.

If the fastener does not meet these criteria then REPLACE the fastener.

NOTE: Refer to Fastener Notice .

IMPORTANT: Ensure that 2.5-4.5 steering linkage outer tie rod end threads are visible beyond the steering linkage outer tie rod nut nylon.

3. Install the steering linkage outer tie rod nut (1).

Tighten: Tighten the nut to 30 N.m (22 lb ft) plus 120 degrees (2 flats).

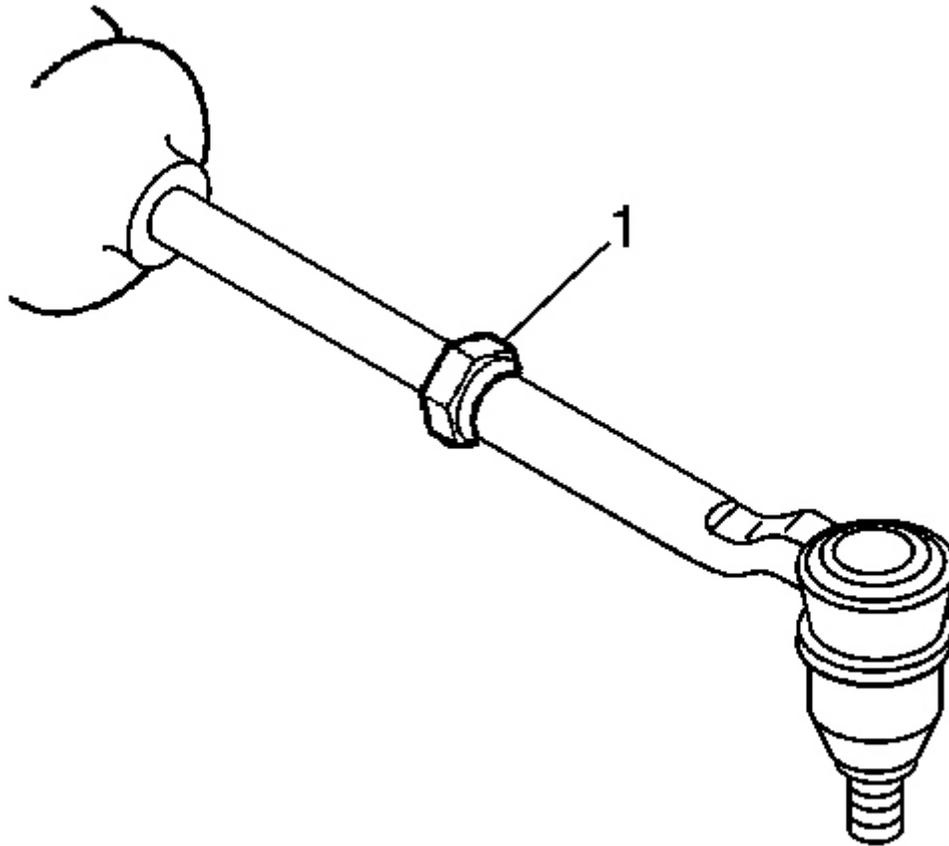


Fig. 29: View Of Steering Linkage Inner Tie Rod Nut
Courtesy of GENERAL MOTORS CORP.

4. Tighten the steering linkage inner tie rod nut (1).

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

5. Install the front tire/wheel. Refer to **Tire and Wheel Removal and Installation** .
6. Adjust the front toe. Refer to **Front Toe Adjustment** .

POWER STEERING COOLER PIPE/HOSE REPLACEMENT

Removal Procedure

1. Hoist the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Place drain pans under the vehicle as needed.

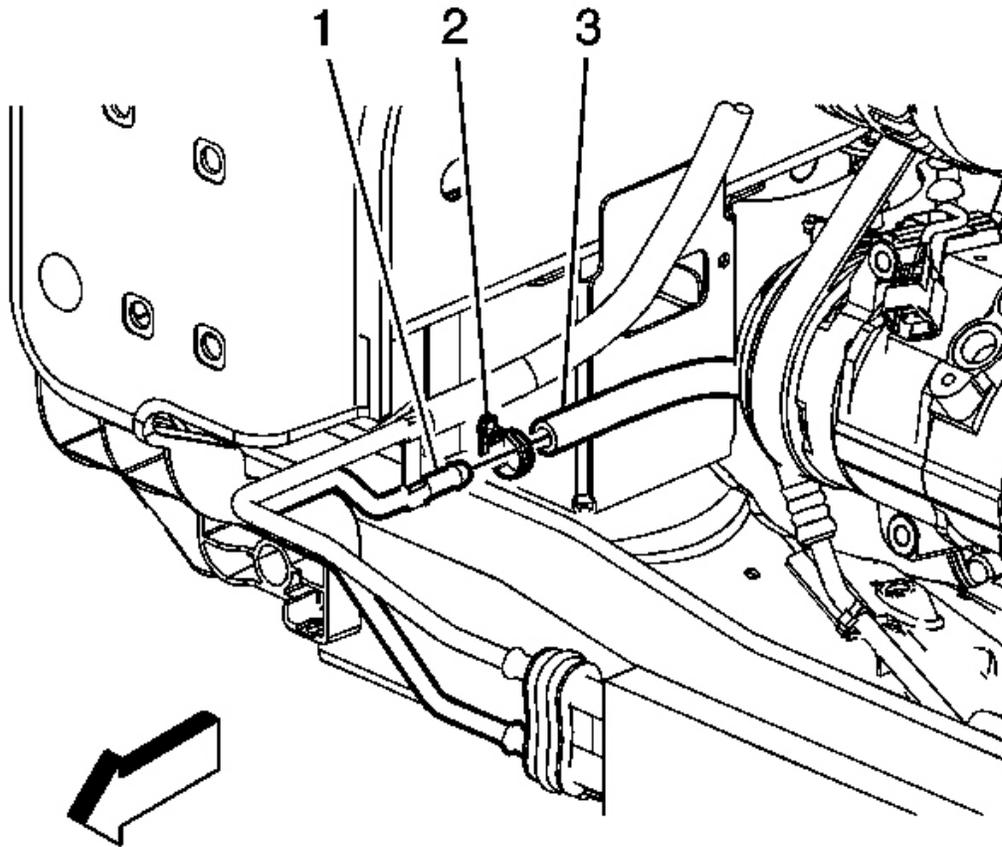


Fig. 30: Identifying Power Steering Fluid Cooler, Power Steering Cooler Pipe & Clamp

Courtesy of GENERAL MOTORS CORP.

3. Loosen the power steering cooler pipe clamp (2) and disconnect the power steering cooler pipe (3) from the power steering fluid cooler (1).

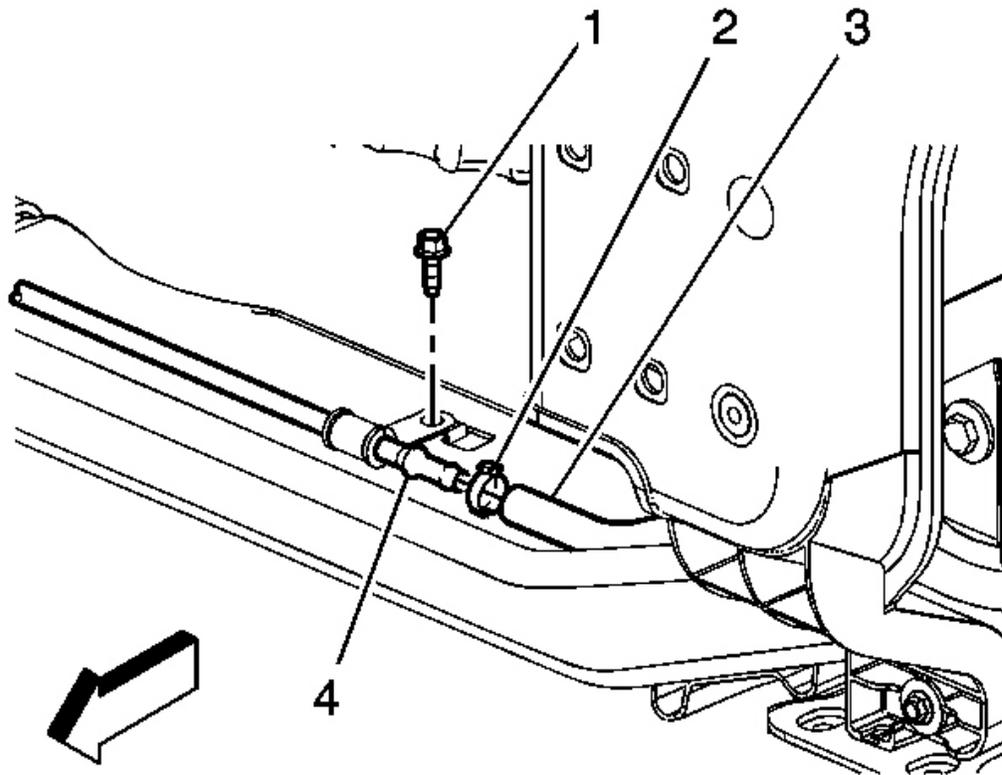


Fig. 31: View Of Power Steering Gear Outlet Hose Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the power steering gear outlet hose bracket bolt (1).
5. Remove and discard the power steering gear outlet hose clamp (2).
6. Disconnect the power steering cooler pipe from the power steering gear outlet hose (3,4).
7. Remove any plastic retaining clips on the power steering cooler pipe and discard them.
8. Remove the power steering cooler pipe from the vehicle.

Installation Procedure

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

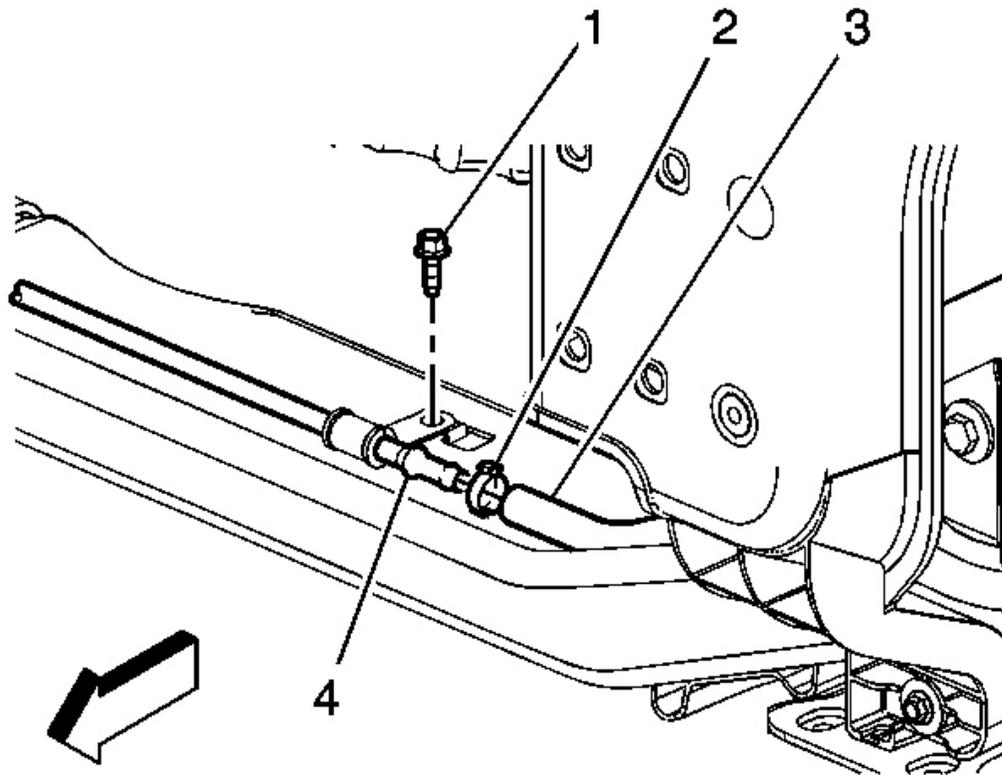


Fig. 32: View Of Power Steering Gear Outlet Hose Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install a new power steering cooler pipe clamp (2).
3. Connect the power steering cooler pipe to the power steering gear outlet hose (3,4).
4. Install the power steering gear outlet hose bracket bolt (1).

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

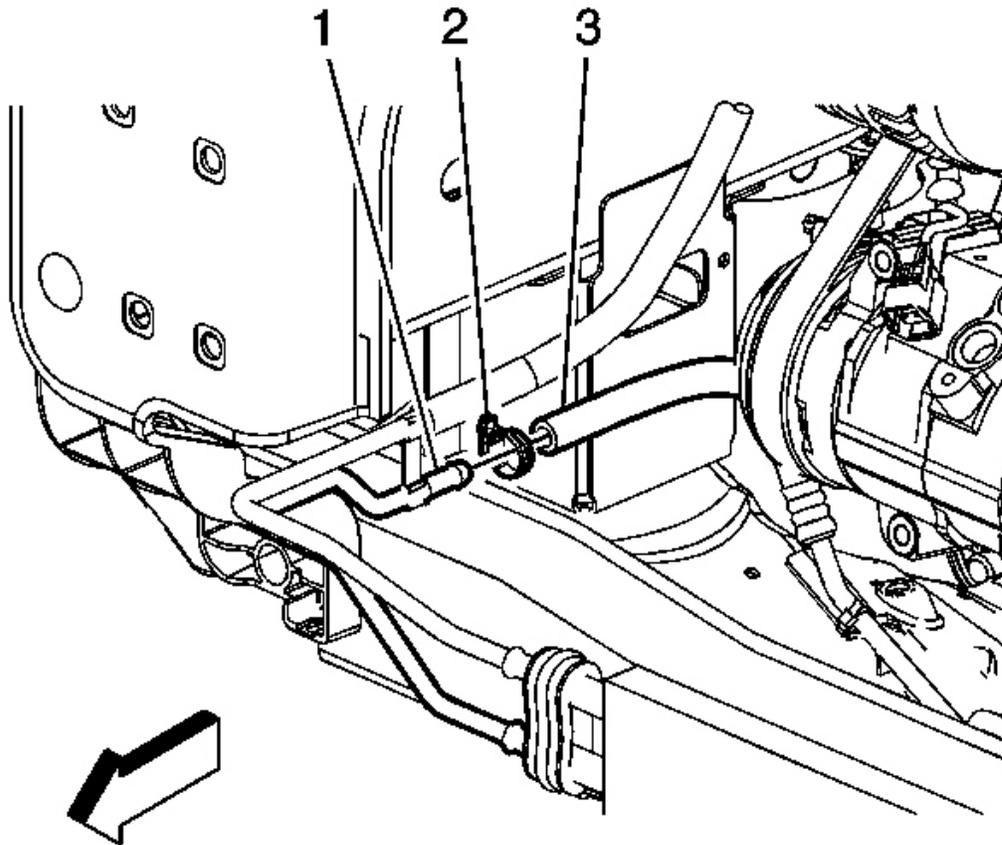


Fig. 33: Identifying Power Steering Fluid Cooler, Power Steering Cooler Pipe & Clamp

Courtesy of GENERAL MOTORS CORP.

5. Connect the power steering cooler pipe (3) to the power steering fluid cooler (1) and tighten the power steering cooler pipe clamp (2).
6. Clean any excess fluid from the vehicle and remove the drain pans.
7. Fill and bleed the power steering system. Refer to **Power Steering System Bleeding**.

POWER STEERING FLUID COOLER REPLACEMENT

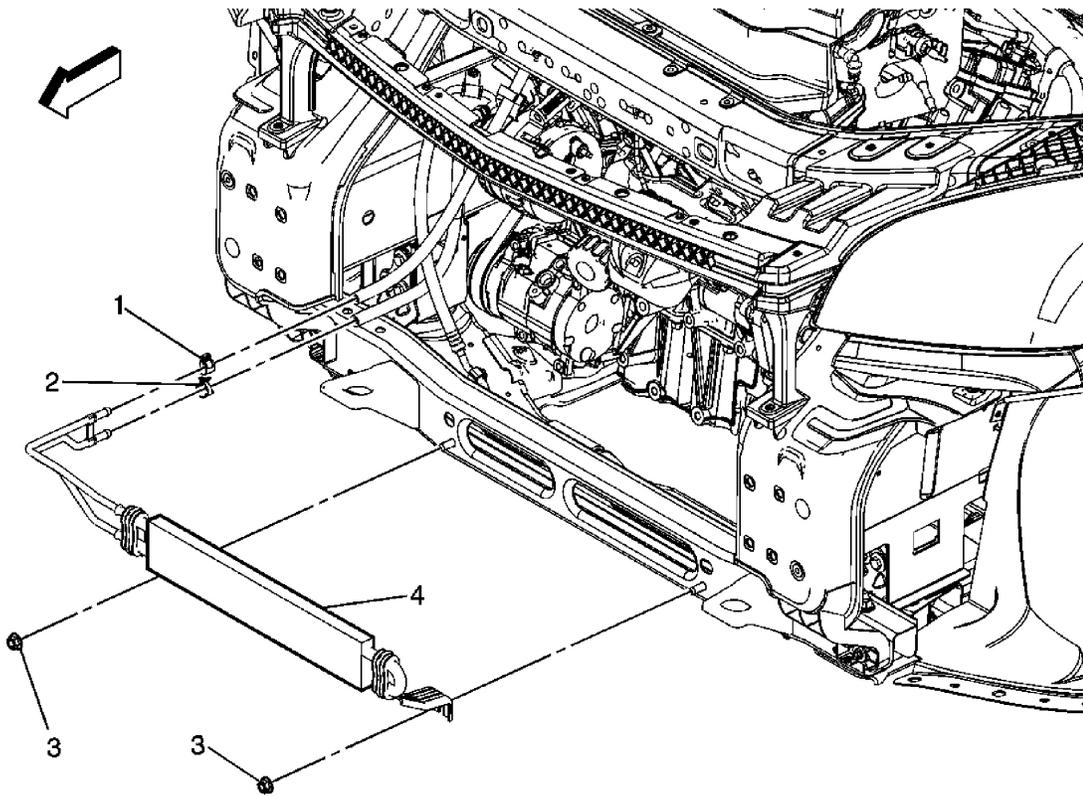


Fig. 34: View Of Power Steering Fluid Cooler
 Courtesy of GENERAL MOTORS CORP.

Power Steering Fluid Cooler Replacement

Callout	Component Name
Preliminary Procedure:	
Remove the front bumper fascia. Refer to Front Bumper Fascia Replacement .	
1	Power Steering Reservoir Inlet Hose Clamp Procedure 1. Remove as much power steering fluid from the remote power steering fluid reservoir as possible. 2. Place drain pans under the vehicle as needed.
2	Power Steering Cooler Hose Clamp
3	Power Steering Fluid Cooler Nuts (Qty 2) NOTE: Refer to Fastener Notice .