



Instruction Booklet

for

SAGINAW P-SERIES PUMP INSTALLATION

GEARBOX INSTALLATION

ROCK RAM KIT INSTALLATION

BLEEDING AIR FROM THE POWER STEERING SYSTEM

Contents

CHAPTER 1	SAGINAW P-SERIES PUMP INSTALLATION	1
	Removing the Old Pump	1
	Removing the Pulley, Bracket, and Reservoir from the Pump	2
	Inspecting the New Pump	4
	Installing the New Pump	4
CHAPTER 2	GEARBOX INSTALLATION.....	7
	Removing the Old Gearbox	7
	Inspecting the Steering System	9
	Installing the New Gearbox	10
CHAPTER 3	ROCK RAM INSTALLATION.....	12
	Mounting the Rock Ram Cylinder	12
	Installing the Hose Fittings	14
CHAPTER 4	BLEEDING AIR FROM POWER STEERING SYSTEMS.....	16
	When to Bleed	16
	Why Bleed	16
	Before Bleeding	16
	How to Bleed	16
	Special Conditions	17
	Eliminating Air in the Power Steering System	18
	Eliminating Noise in the Power Steering System	18

LIABILITY DISCLAIMER

AGR reserves the right to change the specifications, functions, instructions, or contents of this document, at any time, without notice. AGR has prepared this document for the exclusive use of its employees and customers. The information contained herein is the property of AGR and shall not be reproduced without prior written approval from AGR.

Copyright 2002, 2003
AGR Performance Power Steering, Inc.
Printed in the USA

Rock Ram is a trademark of AGR, PowerGrip SB is a trademark of the Gates Rubber Company, and WD-40 is a registered trademark of the WD-40 Company. All other brand or product names are or may be trademarks or registered trademarks of, and are used to identify products or services of, their respective owners.

SAGINAW P-SERIES PUMP INSTALLATION



Removing the Old Pump

The first step to installing a new pump is to remove the old one from the vehicle.



- Step 1** Begin by removing the power steering belt and disconnecting the pressure and return hoses from the pump. Fluid will drain out of the pump and lines, so have a waste oil container available.
- Step 2** Remove all bolts that retain the pump and its mount brackets to the engine.
- Step 3** Remove the pump assembly from the vehicle.



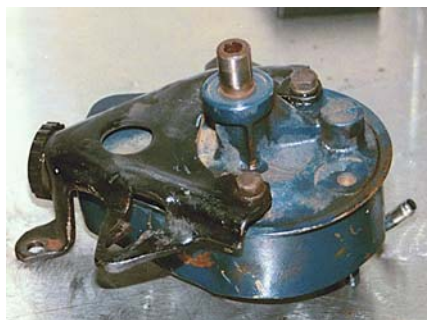
Removing the Pulley, Bracket, and Reservoir from the Pump

Step 1 Using a power steering pump pulley remover, remove the pulley from the pump.



You must use a power steering pump pulley puller. DO NOT use a three-jaw puller, this will destroy the pulley.

Step 2 Remove the mounting bracket from the pump.



Step 3 Remove the bolts or stud bolts from the back of the pump. In most applications there are two, but some only have one.



Step 4 Remove the pressure hose fitting from the pump.

- Step 5** The flow control valve and spring are situated in the pump behind this fitting and can be removed by simply turning the pump up and letting them fall out into your hand. Do not reuse the flow control valve.



- Step 6** Grip the pump by its drive shaft and surrounding case, then use a soft-faced mallet and tap around the edge of the tin reservoir to remove it from the pump.



Be careful not to damage the reservoir.

- Step 7** **ROCK RAM ONLY** — Prepare the reservoir for installing the neck extension. This extension is required to contain the fluid displaced by the shaft in the Rock Ram cylinder. Clean the reservoir thoroughly. The neck extension can be either welded into place or held in place with a Gates PowerGrip SB Shrink Band Hose Clamp. Welding is the preferred method of attaching the extension, but the Gates PowerGrip SB Clamp works fine as long as it's not exposed to extreme temperatures.

If using the Gates Powergrip SB Clamp, refer to the following instructions:

- Remove the PowerGrip SB Shrink Band from the restraint by squeezing the band to collapse it, and then folding and removing it from the cardboard.
- Place the Shrink Band over bottom end of the neck extension, leaving approximately ½ of the band hanging over the end.
- Slide the Shrink Band and neck extension over the reservoir until the neck extension butts up to the reservoir. Be sure the printing on the Shrink Band is facing out and is in full view.
- Using a heat gun, apply heat continuously around the Shrink Band's surface until the printed information on the Shrink Band turns gray, then remove heat. Be careful not to use too much heat, as this will melt the Shrink Band.

- Once the neck extension has cooled, check the connection to be sure a good seal was made by attempting to turn the neck extension with your hand. The neck extension or Shrink Band should not move.

Inspecting the New Pump



Inspect the new pump to make certain it is the proper one for your application. Although all P-type pumps look very similar, there are distinct differences. All 1980 and newer Saginaw equipped vehicles were equipped with metric pumps and an o-ring type pressure fitting. 1979 and earlier vehicles were equipped with SAE pumps containing a flare type fitting.

All threaded holes in a metric pump are 10 x 1.5, while SAE pumps are 3/8 x 16. You can distinguish a metric pump from the SAE pump by the last 2 digits of the number that is cast in the side of the pump. The last 2 digits of a metric casting number are 47, while SAE pumps are 19. Be sure to check!



If you thread an SAE bolt into a metric pump, it will seem to start ok, but when you try to tighten it, it will crack and destroy the pump case.

The pressure hose fitting, whether o-ring or flare, will thread into either pump case.

Installing the New Pump

Once you're sure you have the correct pump, you're ready to install the new pump.

Step 1 Locate the o-rings included with the new pump and spread them out on the workbench.

Step 2 Install the large o-ring in the o-ring groove around the perimeter of the pump.



- Step 3** Install the lathe cut o-rings on the back side of the pump in the recessed areas around the threaded bolt holes and the pressure line port.



TIP

The lathe cut rings can be held in place with a light coat of grease.

- Step 4** Lightly lubricate the o-ring on the perimeter of the pump with power steering fluid, then install the reservoir on the pump. Slip the reservoir over the pump and lightly tap it into place with a soft-faced mallet. Be sure that the bolt holes remain lined up while tapping the reservoir into place.



CAUTION

Do not force the reservoir back onto the pump by installing and tightening the retaining bolts in the back to pull it on. This will bend the reservoir and cause leakage.

- Step 5** Once the reservoir is in place, check to be sure the lathe cut o-rings remained in place.
- Step 6** Install the reservoir retaining bolts into the pump.



CAUTION

Gasket sealer should NOT be used to seal the pump reservoir, this will contaminate the inside of the pump and cause pump failure.

- Step 7** Install the flow control valve, spring, and hose fitting that came with the new pump. The flow control spring goes first, then the flow control valve (the end with the nut goes in first toward the spring), and then thread in the line fitting.
- Step 8** Install the pump mount bracket onto the pump.



- Step 9** Install the pump pulley onto the pump. Always use a pump pulley installer to push the pulley back onto the pump drive shaft. The hub of the pulley should be flush with the end of the drive shaft.



CAUTION

DO NOT press the pulley back onto the pump using a press, this will destroy the pump.

- Step 10** Install the pump on the vehicle by performing the steps in reverse order contained in the section [“Removing the Old Pump” on page 1.](#)

- Step 11** Install and adjust the power steering belt.



CAUTION

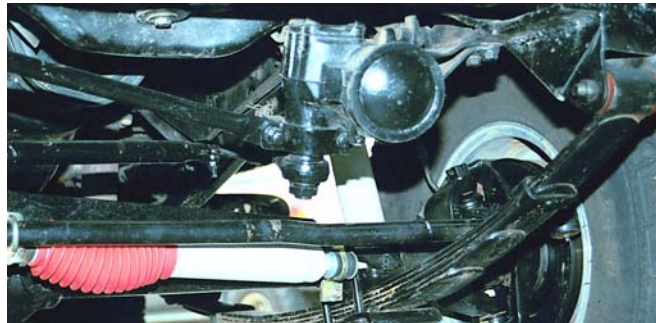
Be sure not to over tighten the belt. A belt that is too tight will cause premature failure of the pump. Refer to the manufacturer’s specifications for the correct amount of tension to apply to the power steering belt.

- Step 12** Bleed the power steering system. Refer to [Chapter 4 “BLEEDING AIR FROM POWER STEERING SYSTEMS”](#) for complete instructions. Failure to follow these bleeding instructions will void the warranty.



Removing the Old Gearbox

Removing the steering gearbox from the vehicle is very similar in most applications.



Step 1 Remove the bolt from the coupler that couples the intermediate shaft to the input shaft of the steering gearbox.



Step 2 Remove the power steering hoses from the steering gearbox.



In some vehicles it is easier to loosen the lines while the gearbox is still mounted and then remove the lines after the gearbox is unbolted from the chassis.

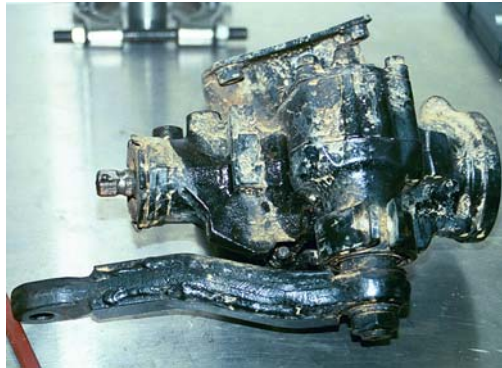
Step 3 Remove the cotter key and nut retaining the tie rod end.



Step 4 Using a tie rod puller, separate the tie rod end from the pitman arm.

Step 5 Remove the tie rod end from the pitman arm.

Step 6 Remove the nut that retains the pitman arm to the sector shaft of the gearbox.



Step 7 Using a pitman arm puller, remove the pitman arm.



Step 8 Remove the mount bolts that retain the gearbox in the chassis. On some vehicles you must remove the steering gearbox with the mount brackets attached and then remove the mount brackets once the gearbox is on the workbench. As you are removing the gearbox, you can then disconnect the intermediate shaft coupler from the input shaft of the gearbox. You might have to use a mallet and tap on the coupler to get it to slide off of the input shaft.



Some vehicles use a bell type coupler; be careful not to separate or damage this coupler while removing it from the gearbox.

Inspecting the Steering System

While you have the steering system disassembled to this point, it is a good idea to inspect the components for wear and damage.

- Step 1** Examine your intermediate shaft for wear and damage. AGR recommends installing a heavy duty intermediate shaft. One advantage to aftermarket intermediate shafts is they are collapsible, meaning you can remove or install them without removing the steering gearbox. In addition, they can be indexed to any position to help align your steering wheel spoke. The O.E. intermediate shaft is designed to collapse only when there is impact.



- Step 2** Inspect the frame and mount brackets for cracks or damage.
- Step 3** Inspect power steering hoses for damage. AGR recommends new hoses on every steering system. Most hose damage is within the hose and cannot be detected with a visual inspection. This damage would be detrimental with the increased flow and pressure sustained in the new system.

Installing the New Gearbox

For the most part, installing the new gearbox is the reverse process of removing the old one.

Step 1 If you removed the old gearbox with the mount brackets attached, attach the mount brackets on the new gearbox.



Step 2 Connect the intermediate shaft coupler to the input shaft of the gearbox.



IMPORTANT

One of the more important things to watch when installing a new gearbox is to make sure your steering gearbox coupler is aligned properly when sliding it back over the input shaft of the gearbox. All mount bolts should be installed with locking washers and grade 8 or O.E. hardware. The O.E. hardware should be sufficient unless damaged. However, AGR recommends new grade 8 hardware.

Step 3 Center the sector shaft of the gearbox by doing the following:

- Align the front tires pointing straight forward.
- Turn the steering wheel fully to the left or right, then turn the steering wheel in the opposite direction and count the number of full rotations until the steering wheel is in the full lock position.
- Turn the steering wheel $\frac{1}{2}$ the number of rotations determined in the previous step. This locates and centers the sector shaft of the of the gearbox.

Step 4 Attach the pitman arm to the sector shaft of the gearbox. The pitman arm can only be installed in four different positions, if you installed it in the wrong position it will be fairly obvious. Torque the pitman arm retaining nut to 180 foot pounds (this is easier to do once the gearbox is mounted) and be sure to use the lock washer provided.

Step 5 Attach the tie rod end to the pitman arm, then install the retaining nut and cotter key.



Step 6 Attach the power steering hoses to the pump and steering gearbox. AGR recommends installing new power steering hoses. Hoses can deteriorate from the inside out, thus making it difficult to determine if they are worn by visually inspecting them. Be sure to use power steering return hose or 250 lb. hydraulic equivalent hose.



IMPORTANT

If not using new hoses, the o-rings on the metric type fittings should be replaced. The flared tube ends of SAE type hoses should also be examined and the hose replaced if there is damage.



CAUTION

Air can be sucked into a hydraulic system around a connection and not leak hydraulic fluid. Air in a power steering system will burn up a power steering pump in a short amount of time and will produce a very annoying whine. So make sure all hose connections are sealed well (and don't use pipe dope or Teflon tape).

Step 7 If you are installing a power steering fluid cooler, now is a good time do so. It is recommended that a power steering fluid cooler be used in all extreme duty applications.

Step 8 Attach the bolt to the coupler that couples the intermediate shaft to the input shaft of the steering gearbox.

Step 9 Once the gearbox is in place and everything is reattached, inspect around the sides of the case and be sure that there is nothing pressing up around the cylinder walls of the gearbox. There might be some installations when a mount bracket will press in on the cylinder wall of the gearbox when the mount bolts are tightened. This can prevent the piston from moving within the gearbox. If this is the case, correct the clearance problem before going forward with the installation. Jack up the front of the vehicle and be sure that when turning the steering wheel from full lock to lock, it turns freely. You will feel a little tightness as you go past center (wheels straight ahead) when turning from full lock to lock, this is normal when properly adjusted. If everything checks out, you're finished. If installing a Rock Ram cylinder, refer to [Chapter 3, "ROCK RAM INSTALLATION."](#)

Step 10 Bleed the power steering system. Refer to [Chapter 4 "BLEEDING AIR FROM POWER STEERING SYSTEMS"](#) for complete instructions. Failure to follow these bleeding instructions will void the warranty.



Mounting the Rock Ram Cylinder

- Step 1** The first step of the installation is to locate where to mount the Rock Ram cylinder. The usual spot to mount the Ram is from the axle housing across to the tie rod. This position is similar to the location that a steering stabilizer bar would be mounted on most vehicles. The Ram cylinder can be mounted with the piston shaft extending to either side of the vehicle. On an installation that is being mounted to the tie rod, be sure that the tie rod is strong enough to handle the extra force that will be applied by the Ram cylinder. Also check that there will be no clearance problems for the Ram cylinder when it is fully extended. Remember that as you turn from side to side the tie rod moves in and away from the axle housing; make sure this movement will not create interference problems. Rams can also be mounted directly to the steering knuckle, an aftermarket hi steer arm off the knuckle, or a custom arm off the back of the knuckle. Mounting the Ram from the frame to the pitman arm is sometimes acceptable, but you will lose some benefit of the Ram. This should only be done if you have a track bar to locate the front end. If you are not able to locate a spot to mount the Ram, give us a call at AGR and we will assist you with other mounting options.
- Step 2** Once you know where you are going to mount the Ram, bolt the mount tabs to the Ram's rod ends and locate the exact points to attach the mount tabs to the vehicle. Be sure that you have the Ram's piston rod centered in its stroke and the front tires are aligned straight. To figure the center of the stroke, do the following:
- Push the piston rod completely into the cylinder (you must remove shipping caps from cylinder ports first), then take a marker and mark the piston rod at the face of the cylinder.
 - Next, fully extend the piston rod and measure the distance from the face of the cylinder to the mark you made on the shaft.
 - Divide the measurement by two, then measure from the face of the cylinder and mark this point. This should be right in the middle.
 - Collapse the shaft to that mark and this should have the stroke centered.
- Step 3** Fully thread the rod ends onto the Ram cylinder and tighten the jam nuts.

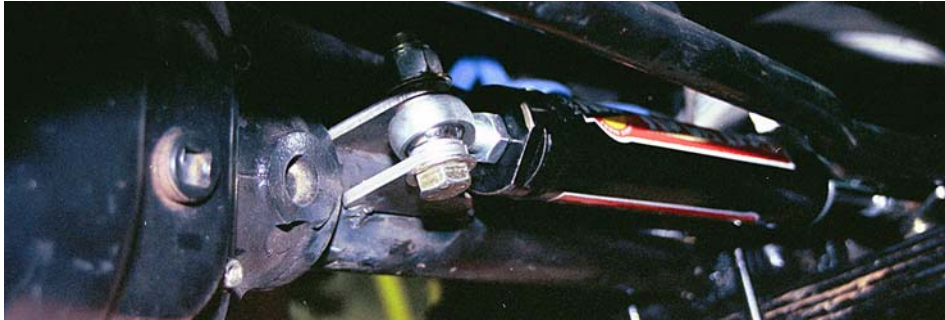
- Step 4** Attach the universal mount tabs to the rod ends using the 5/8 bolts and nuts supplied with the kit. A mount tab should be installed on each side of the rod end, in other words the rod end is sandwiched between the mounts.



IMPORTANT

Make sure the rod ends do not touch the mount tabs at any time. If they rub, install the spacers (provided) on either side of the rod end.

- Step 5** Hold the Ram in the mount spot on the vehicle and tack weld the universal mount brackets to the vehicle (usually the axle housing and the tie rod).



CAUTION

Be sure to disconnect your battery before welding on the vehicle and also if your vehicle is computer equipped, disconnect the computer ground.



NOTE

The Ram is not designed to take any appreciable side loads. It must be mounted so the piston rod is not placed in a bind at any part of the stroke.

- Step 6** After the Ram is tacked in place, remove the bolts that retain the rod ends to the mount brackets and then remove the Ram.

- Step 7** Once the Ram has been removed you can finish welding the mount brackets in place.



TIP

If you are not sure of your welding capabilities you might consider having it professionally welded.

- Step 8** After the brackets are welded in place, remount the Ram cylinder with the hose fittings facing upward.

- Step 9** Once the Ram is mounted, the next step is to prepare the hydraulic hoses supplied in the kit. The hoses are a universal length and will probably need to be cut to length for your particular application. When calculating the length of the hoses, leave enough hose to cover the down travel in the suspension. The hose can be cut with a hacksaw, but it is preferred that you cut it with an abrasive cut-off blade for a cleaner cut. The cleaner the cut, the easier it is to thread the fitting onto the hose. If you have to use a hacksaw, wrap the hose tightly with tape to prevent the hose from fraying when cutting.



Step 10 After the hose has been cut to length, clean out the hose to remove any debris.

Installing the Hose Fittings



TIP

Before installing the hose fitting, lubricate the end of the hose with some type of lubricant such as WD-40.

- Step 1** From the available hose fittings supplied in the kit, select the fitting you want to install and disassemble it. The fitting consists of two components, the outer socket and the nipple that threads into the outer socket.
- Step 2** Once the fitting is disassembled into two pieces, take the outer socket and thread it onto the hose end. The easiest way to do this is to clamp the hose lengthwise in a vise with approximately 1 ½ inches protruding past the vise jaw and then thread the outer socket onto the hose.



NOTE

The outer socket has a left-hand thread. You will need to turn it counter-clockwise and tighten until the hose bottoms out in the socket.

- Step 3** Reposition the hose in the vise, you will want to clamp on the outer socket.

- Step 4** Thread the nipple into the outer socket. The nipple has a standard right-hand thread. Thread it in a clockwise direction until the hex part of the nipple seats against the outer socket. Be sure to use a lot of lubricant inside the hose and on the nipple threads. When installing 90 or 45 degree fittings, you might need to have them clocked in a certain position to get the hose correctly routed. If so, remember this when installing the fitting. The fittings are reusable and can be removed and installed again with no problem.



- Step 5** Once the hoses are completed, attach them to the Ram and the steering gearbox. You will need to determine which hose will be your left turn hose and which will be the right.
- On all standard rotation steering gears, the Ram fitting closest to the input shaft of the steering gearbox is the right turn port. This will connect to the driver's end of the Ram cylinder.
 - On all reverse rotation steering gears, the Ram fitting closest to the input shaft of the steering gearbox is the left turn port. This will connect to the passenger end of the Ram cylinder.



TIP

As a general rule, Ford products are reverse rotation and most other vehicles are standard rotation. However, there are some exceptions. To determine the rotation of your gearbox, turn the input shaft clockwise. If the sector shaft also turns clockwise, then you have a standard rotation gearbox. Conversely, if you turn your input shaft clockwise and the sector shaft turns counter clockwise, then you have a reverse rotation gearbox.

- Step 6** Bleed the power steering system. It is important that you don't skip this step. Bleeding a system with a Ram cylinder installed and a power steering fluid cooler can be frustrating in some cases. Therefore, AGR has created some bleeding instructions to help you get your system in top working order. Refer to [Chapter 4 "BLEEDING AIR FROM POWER STEERING SYSTEMS"](#) for complete instructions. Failure to follow these bleeding instructions will void the warranty.

BLEEDING AIR FROM POWER STEERING SYSTEMS

**IMPORTANT**

When bleeding air from a power steering system, please follow AGR's bleeding Instructions only. AGR has found the following method is the only proper way to bleed a system.

Do not start the engine until system is fully bled.

When to Bleed

- After any steering component replacement.
- If any part of the power steering system is opened for any reason.

Why Bleed

- To prevent pump damage.
- To ensure proper system operation.
- To stop steering system noise.

Before Bleeding

Carefully inspect the steering system.

- Hoses must not touch any other part of vehicle. Steering system noise could be caused by the hose touching the frame, body, or engine.
- All hose connections must be tight. Loose connections might not leak but could allow air into the system. Do not over tighten o-ring hoses as the o-ring might be crushed. Check flare seat type connections for exact fit.

How to Bleed

- Step 1** Turn the engine off. Do not start the engine until the system is fully bled. Doing so may cause damage to the power steering pump.
- Step 2** Raise the front wheels off the ground, or remove the pitman arm or tie rod.
- Step 3** Turn steering wheel fully to the left.

Step 4 Fill fluid reservoir to “full cold” level. Leave cap off.



IMPORTANT

Use only clear name brand premium or synthetic power steering fluid, such as Royal Purple or Red Line. Do not use transmission fluid, as transmission fluid doesn't contain the same friction inhibitors/additives and tends to breakdown and overheat. Use of transmission fluid will void the warranty.

Step 5 While an assistant is checking the fluid level and condition, turn the steering wheel lock to lock at least 20 times.

- On systems with coolers, winches, or Rock Ram assist you may need to cycle in excess of 40 times.
- Trapped air may cause fluid to overflow. Thoroughly clean any spilled fluid to allow for leak check.

Step 6 While turning the wheel, check fluid constantly to ensure proper level and that no bubbles exist.

- If you see any signs of bubbles, recheck all connections then repeat the steps above.
- Fluid level should be steady (Rock Ram's level will vary slightly).

Step 7 Start engine. With engine idling, maintain fluid level.

Step 8 Reinstall reservoir cap.

Step 9 Return wheels to center.

Step 10 Lower front wheels to ground or reinstall pitman arm or tie rod if removed in [Step 2](#).

Step 11 Run engine for two minutes. Turn steering wheel in both directions.

Step 12 Verify the following conditions:

- Smooth power assist
- Noiseless operation
- Proper fluid level
- No system leaks
- Proper fluid condition
- No bubbles, foam, or discoloration

Step 13 If all conditions are satisfied, the bleeding procedure is complete.

Step 14 If any problem exists, turn off engine and see Special Conditions below.

Special Conditions

If you experience any of the conditions listed below, there is still air in the system.

- Foam or bubbles in fluid (fluid must be completely free of bubbles).
- Power steering fluid should not rise in the reservoir when the engine is turned off. If this occurs, there is trapped air in the system.
- Be alert to periodic bubbles that could indicate a loose connection, leaky o-ring, or a bad flare seat in either the pressure or return hose.
- Discolored fluid (milky, opaque, or light tan color).

Eliminating Air in the Power Steering System

Follow the steps below to eliminate air in the power steering system.

- Step 1** Turn ignition off. Wait two minutes. Recheck hose connections. Repeat start up procedures. If problem still exists, replace or check for possible causes including:
- Return hose clamps
 - Return hose o-ring or flare seat
 - Pressure hose o-ring or flare seat
 - All other connections
- Step 2** Fill system and repeat bleeding procedure for each possible cause.

Eliminating Noise in the Power Steering System

If you hear a whining or groaning noise originating from the pump after all air is out of the system (if air is not out, see Special Conditions), then do the following:

- Step 1** Check belts for slippage.
- Step 2** Mark pulley and make sure it is not slipping on the shaft.
- Step 3** With the engine running, recheck hoses for possible contact with frame, body, or engine. If no contact is found, cool fluid and repressurize system.
- Step 4** After cooling fluid, start engine to come up to operating temperature and recheck.