Instructions – Parts List

Parts

Dyna–Star ™

308156 Rev.L

HYDRAULIC RECIPROCATOR AND PUMP

1500 psi (10 MPa, 102 bar) Maximum Hydraulic Input Pressure
7500 psi (51 MPa, 517 bar) Maximum Fluid Outlet Pressure

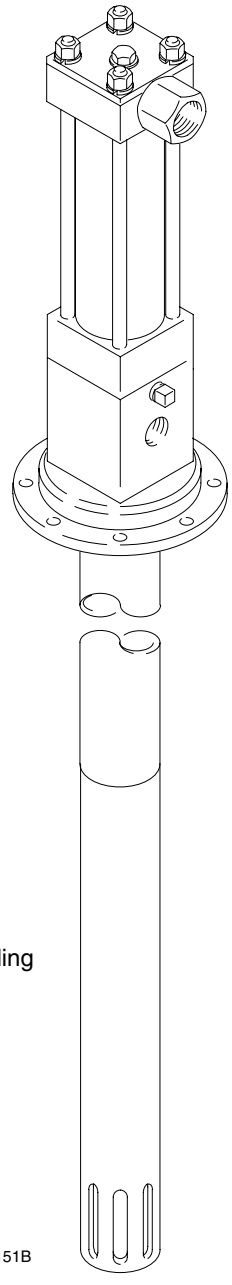
FOR LUBRICATING FLUIDS ONLY

5:1 Ratio Universal Pump and Reciprocator

Model 224912, Series C, 35 lb. pail size
Model 224751, Series C, 120 lb. drum size
Model 224752, Series C, 400 lb. drum size
Model 239883, Series A, reciprocator only

Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.

See page 23 for Maximum Working Pressures.



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Patent No. 4,383,475
Foreign Patents Pending
Patent 1984 Canada
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PROVEN QUALITY. LEADING TECHNOLOGY.

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GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440–1441

Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the corresponding instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the corresponding instructions.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are not sure, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated component in your system. This equipment has a **1500 psi (10 MPa, 102 bar) maximum hydraulic input pressure and 7500 psi (51 MPa, 517 bar) maximum fluid outlet pressure.**
- Use fluids and solvents that are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Handle hoses carefully. Do not pull on hoses to move equipment.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below –40°C (–40°F).
- Do not lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ WARNING

FLUID INJECTION HAZARD

Fluid from the dispensing valve, leaks or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid splashed in the eyes or on the skin can also cause serious injury.

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate medical attention.**
- Do not point the dispensing valve at anyone or at any part of the body.
- Do not put your hand or fingers over the end of the dispensing valve.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Use only extensions and couplers that are designed for use with your dispensing valve.
- Do not use a low pressure flexible nozzle with this equipment.
- Follow the **Pressure Relief Procedure** on page 8 if the grease fitting coupler clogs and before cleaning, checking or servicing the equipment.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn or damaged parts immediately. Do not repair high pressure couplings; you must replace the entire hose.
- Fluid hoses must have spring guards on both ends, to help protect them from rupture caused by kinks or bends near the couplings.

TOXIC FLUID HAZARD

Hazardous fluids or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames, or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment and the object being dispensed to. Refer to **Grounding** on page 7.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop dispensing immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being dispensed.
- Keep the dispense area free of debris, including solvent, rags, and gasoline.
- Do not smoke in the dispense area.
- Do not turn on or off any light switch in the dispense area while dispensing or while operating if fumes are present.

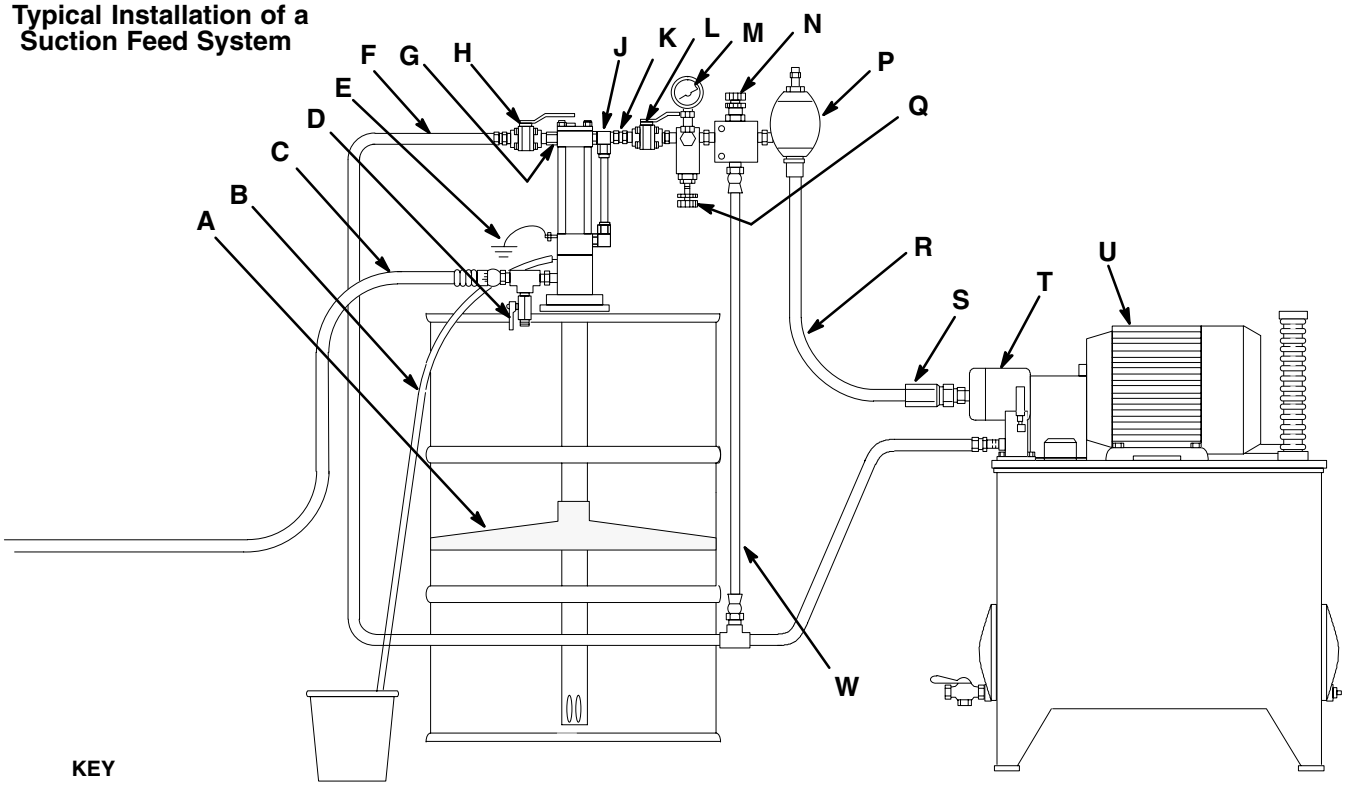
MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before servicing the equipment, follow the **Pressure Relief Procedure** on page 8 to prevent the equipment from starting unexpectedly.

Installation

Typical Installation of a Suction Feed System



KEY

- **A** Follower plate
- **B** Weep tube
- **C** Fluid outlet line (to gun)
- **D** Drain valve (required)
- **E** Ground wire
- **F** Hydraulic return line, minimum 3/4" I.D. (required)
- **G** Hydraulic outlet, 1/2 npt
- **H** Return line shut-off valve, minimum 3/4" (required)
- **J** Hydraulic inlet, 1/2 npt
- **K** Tee, 3/4 npt
- **L*** Supply line shut-off valve
- **M*** Pressure gauge
- **N*** Pressure reducing valve (required in systems over 1500 psi [10 MPa, 102 bar])
- **P** Accumulator
- **Q*** Flow control valve (required in systems over 3 gpm [11 lpm])
- **R** Hydraulic supply line
- **S** Check valve
- **T** Variable volume pressure compensated pump
- **U** Hydraulic power supply
- **W** Drain line, accumulator

* Included in Hydraulic Fluid Control Kit 236864, which can be ordered separately.

Fig. 1 04477A

Although the installation shown in Fig. 1 is only a guide for selecting and installing system components and accessories, some of the equipment is required, as noted in the key. For assistance in designing a system to suit your needs, contact your Graco distributor.

Mount the pump to suit the type of installation planned.

⚠ WARNING

Maximum Working Pressure of Accessories
To reduce the risk of serious injury including fluid injection and splashing in the eyes or on the skin, which may be caused if a component ruptures, all accessories added to the reciprocator power supply side must have at least a *1500 psi (10 MPa, 102 bar) maximum working pressure.*

All accessories added to the pump fluid outlet side must have at least a *7500 psi (51 MPa, 517 bar) maximum working pressure.*

Pump Accessories

- **Follower plate (A)** ensures a good prime. Place the plate on the grease and rotate while pressing firmly to level the material.
- **Pump outlet drain valve (D)** helps relieve fluid pressure in the pump when the pump is shut off. Install the valve close to the pump fluid outlet. Order Part No. 111229, valve.

⚠ WARNING

Pump Outlet Drain Valve
A pump outlet drain valve (D) is required in your system. This valve helps relieve pressure in the displacement pump and hose when shutting down the system and in case of a clogged outlet hose. Install the valve close to the pump outlet.

Installation

⚠ WARNING

Mount the pump securely so that it cannot move around during operation. Failure to do so could result in personal injury or equipment damage.

NOTE: Refer to Fig. 1 to locate the parts mentioned below.

⚠ CAUTION

Keep the Hydraulic System Clean

The hydraulic supply system must be kept clean at all times to reduce the risk of damaging the reciprocator hydraulic power supply. Blow out all hydraulic lines with air, flush thoroughly with solvent, and then blow out with air again before connecting the lines to the reciprocator.

Always plug the hydraulic inlets, outlets and lines when disconnecting them for any reason to avoid introducing dirt and other contaminants into the system.

Carefully follow the manufacturer's recommendations on reservoir and filter cleaning, and periodic changes of hydraulic fluid.

Hydraulic Power Supply

⚠ WARNING

Limit Fluid Flow to Reciprocator
To reduce the risk of overpressurizing the hydraulic reciprocator, which could cause a rupture and serious injury, including fluid injection, the hydraulic system must have a means to limit the incoming fluid flow to the reciprocator to a maximum of 3 gpm (11 lpm) and 1500 psi (10 MPa, 102 bar). See the description below.

The hydraulic power supply system (U) must have a pressure reducing valve and a pressure-compensated flow control. A flow control valve (Q) is required to limit the incoming flow to the reciprocator to a *maximum of 3 gpm (11 lpm)*.

NOTE: A supply line shut-off valve (L), pressure gauge (M), pressure reducing valve (N), and a flow control valve (Q) are included in the Hydraulic Fluid Control Kit 236864, which can be ordered separately.

Hydraulic Lines

- **Shut-off valves (H and L)** are installed in the hydraulic supply and return lines. Order Part No. 108537.
- **Drain Line:** Remove the plug (59) from the pump adapter and install a 1/8" diameter weep tube (B), ending in a waste container. Monitor the weepage of hydraulic fluid. If it seems excessive or increases suddenly, the reciprocator/pump seals may need to be changed. See Fig. 2.

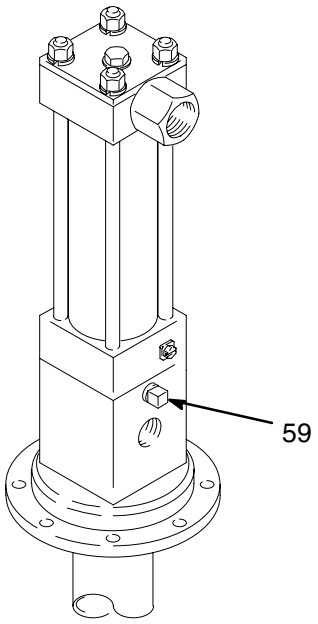


Fig. 2

- **Hoses:** Use a minimum 1/2" supply line (R) and minimum 3/4" return line (F) on the reciprocator. Contact your Graco representative for details of line sizing.
- **A pressure reducing valve (N)** circulates excess hydraulic fluid pressure back to the hydraulic power supply. Install this valve (N) in the hydraulic supply line with a drain hose (W) teed into the hydraulic return line (F). Limit supply pressure to a maximum of 1500 psi (10 MPa, 102 bar).
- **An accumulator (P)** reduces the hammering effect caused by the motor when it reverses direction.
- **A fluid-filled pressure gauge (M), Part No. 112567**, monitors hydraulic pressure to the reciprocator during startup. See Fig. 1. Use the gauge for initial adjustment of the reciprocator. It can be removed after adjustment is made.

Installation

Grounding

To reduce the risk of static sparking, ground the pump. Check your local electrical code for detailed grounding instructions for your area and type of equipment.

- *Pump:* Use ground wire and clamp as shown in Fig. 3. To order a Grounding Wire and Clamp Kit, order Part No. 222011.
- *Hydraulic Hoses and Fluid Outlet Hoses:* Use only electrically conductive hoses.
- *Hydraulic Power Supply:* Follow manufacturer's recommendations.
- *Any pails used when flushing:* Use only metal, grounded pails when flushing. Make firm metal to metal contact between the a metal part of the dispense valve and the pail. Use the lowest possible pressure.

To ground the pump, remove the ground screw (Z) and insert through the eye of the ring terminal at end of ground wire (Y). Fasten the ground screw back onto the pump and tighten securely. Connect the other end of the wire to a true earth ground.

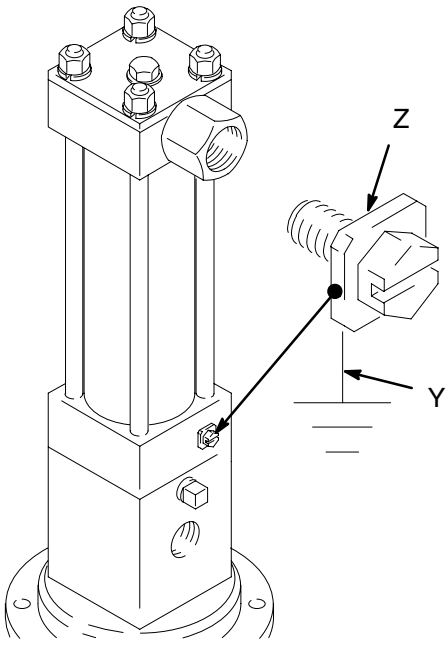


Fig. 3

Operation

Pressure Relief Procedure

⚠ WARNING

INJECTION HAZARD
The system pressure must be manually relieved to prevent the system from starting or dispensing accidentally. Fluid under high pressure can be injected through the skin and cause serious injury. To reduce the risk of an injury from injection, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you

- Are instructed to relieve the pressure
- Check or service any of the system equipment
- Install or clean the nozzle

1. Shut off the hydraulic power supply.
2. Close the supply line shut-off valve (L in Fig. 1).
3. Open the dispensing valve to relieve pressure.
4. Open the pump outlet drain valve, and have a container ready to catch the drainage.
5. Close the return line shut-off valve (H).

NOTE: Leave the drain valve open until you are ready to dispense again.

If you suspect that the nozzle or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, **very slowly** loosen the hose end coupling to relieve pressure, then clear the obstruction.

Before You Start the Pump

1. *Check the hydraulic fluid level in the hydraulic power supply* before each use*,* and add fluid as necessary to fill the lines.

⚠ CAUTION

Always use Graco approved hydraulic oil or equivalent, Part Numbers 169236 (5 gallon) or 207428 (1 gallon). Do not substitute lower grade oil.

2. *Flush the pump before using it for the first time* to remove the light oil that was left in after factory testing to protect the pump from corrosion. Be sure the solvent used is compatible with the fluid to be pumped and the pump wetted parts. See **Technical Data**, page 23. Flush until clean solvent comes from the outlet hose.

To start the pump

1. Turn on the hydraulic power supply.
2. Open the return line shut-off valve (H) first and slowly open the hydraulic supply shut-off valve (L).
3. Adjust the flow control valve (Q) to limit the hydraulic flow to no more than 3 gpm (11 lpm), which is approximately 60 cycles per minute.

   NOTE: If Graco Part No. 236864 hydraulic fluid control is used, no adjustment is necessary.
4. By adjusting the pressure reducing valve (N), increase the hydraulic inlet pressure from 50 to 1500 psi (0.34 to 10 MPa, 3.4 to 103 bar). Increasing the inlet pressure increases the outlet pressure. Decreasing the inlet pressure decreases the outlet pressure.
5. Open the drain valve while priming the pump; close it when the pump is primed.
6. Always use the lowest pressure possible to obtain the desired results. This reduces pump wear.

⚠ CAUTION

Never allow a pump to run dry of the fluid being pumped. A dry pump quickly speeds up and can damage itself. If it speeds up, shut off the power supply to the reciprocator immediately. Refill the supply container, and prime the pump to eliminate air.

⚠ CAUTION

Maximum Working Temperature
Do not exceed 130° F (54° C) hydraulic oil temperature. The reciprocator seals will wear faster and leakage may occur if the pump is operated at higher oil temperatures.

Operation

⚠ WARNING

MAXIMUM WORKING PRESSURES

To reduce the risk of serious injury, including fluid injection and splashing in the eyes or on the skin, which may be caused if a component ruptures:

Never exceed *1500 psi (10 MPa, 102 bar) Maximum Hydraulic Pressure* to the reciprocator.

Never exceed *7500 psi* (51 MPa, 517 bar) *Maximum Outlet Pressure* from the displacement pump.

Be sure all accessories added to the reciprocator power supply side have at least a *1500 psi (10 MPa, 102 bar) Maximum Working Pressure.* Accessories added to the pump fluid outlet side should have at least a *7500 psi (51 MPa, 517 bar) Maximum Working Pressure.*

The working pressure of the displacement pump has a 5:1 ratio to the pressure at which the reciprocator is operated. Therefore, if the fluid supplied to the reciprocator is 1000 psi (7 MPa, 69 bar), the pump fluid outlet pressure will be 5 times the hydraulic pressure, or 5000 psi (34 MPa, 345 bar).

If the Pump Leaks at the Fluid Fittings

Tighten the fittings (1, 5, 58), which are self-sealing and have replaceable o-rings. If leaking persists, change the o-rings.

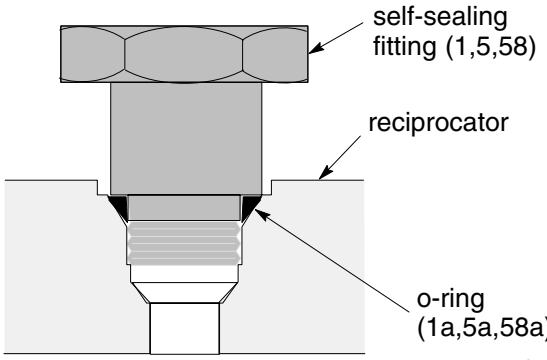


Fig. 4

Shutdown

Relieve the pressure whenever you shut down.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 8.

Troubleshooting

Problem	Cause	Solution
Pump does not run.	Closed dispense valve.	Pump only runs with valve open.
	Pressure too low.	Increase supply pressure using a pressure adjusting valve.
	Insufficient hydraulic fluid supply.	Check hydraulic supply. Adjust to a maximum of 3 gpm (11 lpm) flow.
	Clogged fluid outlet line, intake valve, dispense valve, suction line.	Relieve pressure. Check; clear obstructions.
	Reciprocator damaged.	Repair. See page 13.
Pump speeds up or runs erratically.	Pump piston and/or intake valve worn.	Relieve pressure. Check and repair. See pages 17 and 18.
	Empty supply container.	Refill and reprime. Do not allow pump to run dry. Monitor closely or use a low-level cutoff valve.
Pump runs, but output low on up and/or down stroke.	Pump piston and/or intake valve worn.	Relieve pressure. Check and repair. See page 17 and 18.
Pump runs but output low on both strokes.	Insufficient hydraulic fluid supply.	Check hydraulic supply. Adjust to maximum 3 gpm (11 lpm) flow.
	Pressure too low.	Increase supply pressure using a pressure adjusting valve.
	Clogged fluid outlet line, intake valve, dispense valve, suction line.	Relieve pressure. Check; clear obstructions.
Excessive weepage from weep tube (B).	Worn throat packings.	Repair. See page 11.
Hydraulic oil leaks from fittings in the upper or lower reciprocator blocks (31,32).	Fittings (1,5,58) are loose, or their o-rings are worn or damaged.	Tighten the self-sealing fittings. If leaking persists, change the o-rings.

Service

Replacing the Throat Seals

See Fig. 5.

NOTE: Replace these seals if fluid leaks excessively through the weep tube (B). This procedure can be done without disassembling the entire reciprocator.

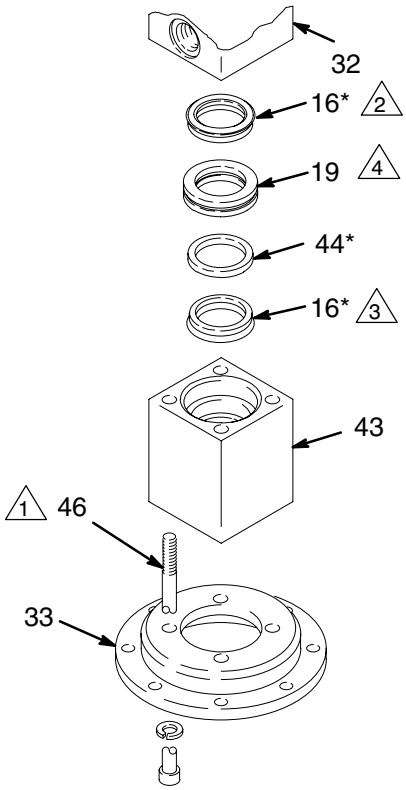
⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 8.

1. Relieve the pressure.
2. Disconnect the reciprocator from the pump. See the procedure on page 12.
3. Remove the four capscrews (46) from the bottom of the adapter (43). Tap the adapter to loosen it and pull it off the bottom cap (32).
4. Remove the seals (16*,44*) and guide (19) from the top of the adapter (43).

NOTE: Items 16 and 44 are included in the Reciprocator Repair Kit, 223426.

5. Lubricate the guide (19) and install the seals and guide in the adapter (43), one at a time in the order shown in Fig. 5**.**
6. Reassemble. Torque the capscrews (46) to 28 to 32 ft-lb (38 to 43 N-m). Install the displacement pump. Follow Step 24, page 16.



1 Torque to 28 to 32 ft-lb (38 to 43 N-m).
2 Lips face up.
3 Lips face down.
4 Lubricate.

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Fig. 5

Service

Disconnecting the Reciprocator and Displacement Pump

See Fig. 6.

NOTE: When displacement pump 224914 is purchased separately, it comes with the priming piston (112) and priming cylinder (111) unassembled. Connect the displacement pump to the hydraulic reciprocator before assembling the priming piston and cylinder. Torque the priming piston to 35 ft-lb (47 N-m).

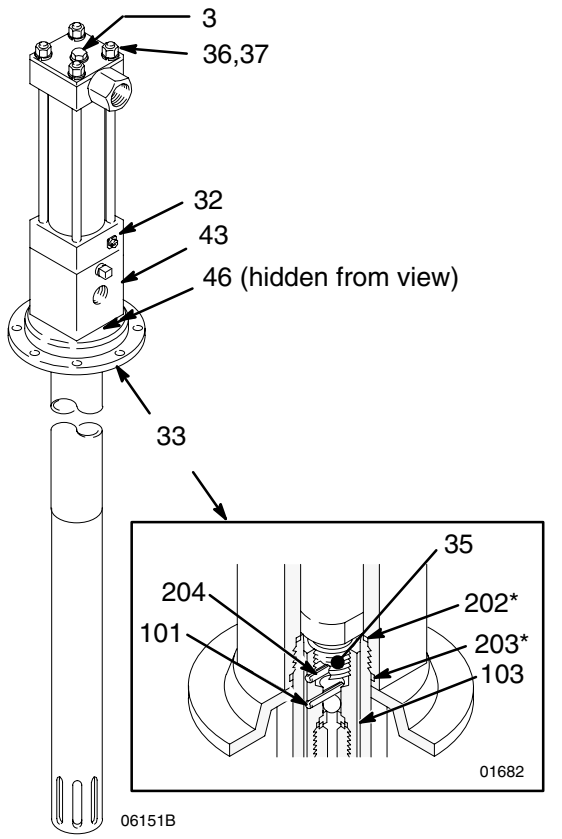


Fig. 6

⚠ CAUTION

Keep The Hydraulic System Clean
It is essential to keep the hydraulic oil system clean and free of contaminants to reduce the risk of damaging the hydraulic reciprocator. Always install a plug in each tube fitting and on each hose end whenever fluid lines are disconnected to prevent contamination.

1. Flush the pump if possible and stop it with the displacement rod in the lowest position.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 8.

2. Relieve the pressure.
3. Disconnect the outlet hose from the displacement pump.
4. Slowly loosen the hydraulic supply (58) and return (5) fittings to relieve any pressure, and then remove the hoses. Install plugs on the tube fittings and in the hose ends. Check the o-rings (5a, 58a) on the fittings and replace them if they are worn or damaged. See Fig. 4 and the Parts Drawing.
5. Using a strap wrench on the displacement cylinder (108), screw it out of the pump adapter (43), and slide it down as far is it will go.
6. Pull the connecting rod (35) down as far as it will go. Remove the cotter pin (204).

NOTE: For the 35 lb. length pump, the priming cylinder (111) and the priming piston (112) must be completely removed before you can pull down the displacement cylinder (108) far enough to remove the cotter pin (204).

7. Unscrew the piston coupling (103) to remove the pump.

Reciprocator Repair

NOTES

- Clean and inspect all parts for wear or damage. Replace parts as needed. For the best results, always replace all the o-rings and seals when you disassemble the pump. **Repair Kit 223426** is available. Parts included in the kit are marked with one asterisk, for example (23*), in the text and drawings. Always replace the seals (23*,24*) and the seals (16*, 44*) together.
- **Assembly Tool 189305** is required for reassembling the reciprocator.
- Loctite® 242 thread sealant and Loctite® Primer T **or** Perma-Loc® 115 thread sealant and Perma-Bond® Surface Conditioner I are required. Be sure their shelf life is within the manufacturer's recommendations.
  Note: Use Loctite® 609 on yoke (9) and rod (12) on page 14, step 9 only. Use Loctite® 242 or Perma-Loc® 115 on other threaded surfaces as required.

Before you begin, drain the oil out of the reciprocator as follows: Place the reciprocator in a drain pan, push the piston all the way up/in, then all the way down/out.

1. Place the adapter (43) in a vise. Remove the four capscrews (46) and the base (33). Pull the bottom cap (32) off of the adapter (43). See Fig. 7. If needed, replace the seals as described on page 11.

2. Loosen both nuts on the fluid tube (45). Use a wrench to rotate the tube fittings (1,58) to the side, and then remove the tube (45). Check the o-rings (1a,58a) on the fittings and replace them if they are worn or damaged. Install plugs in the fittings to prevent contamination. See Fig. 4 and the Parts Drawing.

3. Remove the capscrew (3), nuts (36) and lockwashers (37) on top of the reciprocator. See Fig. 7.

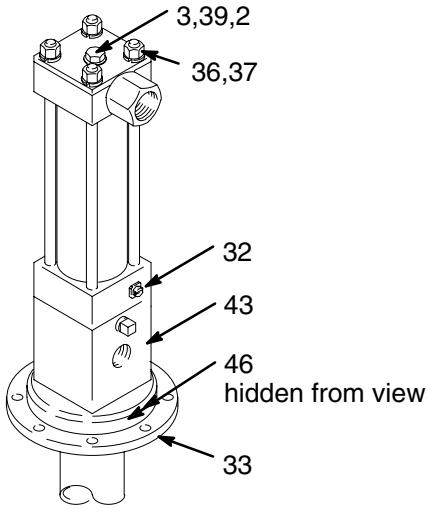


Fig. 7

See Fig. 9 for Steps 4 to 20, except where noted.

4. Tap on the bottom of the displacement rod (34) with a plastic mallet to loosen the cylinder (25).

5. Grasp the valve spool (31) and pull it off the cylinder and tie rods (38). Pull the cylinder and piston off the bottom cap (32). It is not necessary to remove the tie rods from the bottom cap.

6. Lay the assembly on its side. Place a clean rag around the yoke (9) to prevent losing the detent balls. Slide the yoke (9) sideways off the valve sleeve (29) while holding the balls (7) and spring (6) in place.

7. Slide the cylinder (25) off the displacement rod (34). Hold the hex end of the displacement rod in a vise and use a spanner wrench in the pin holes of the piston (22) to screw it off the rod.

⚠ CAUTION

Be careful not to scratch the outside of the displacement rod or the inside of the cylinder.

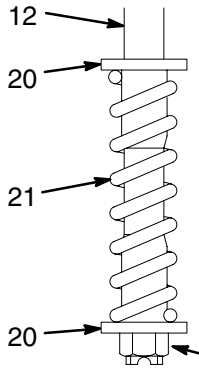


Fig. 8

Reciprocator Repair

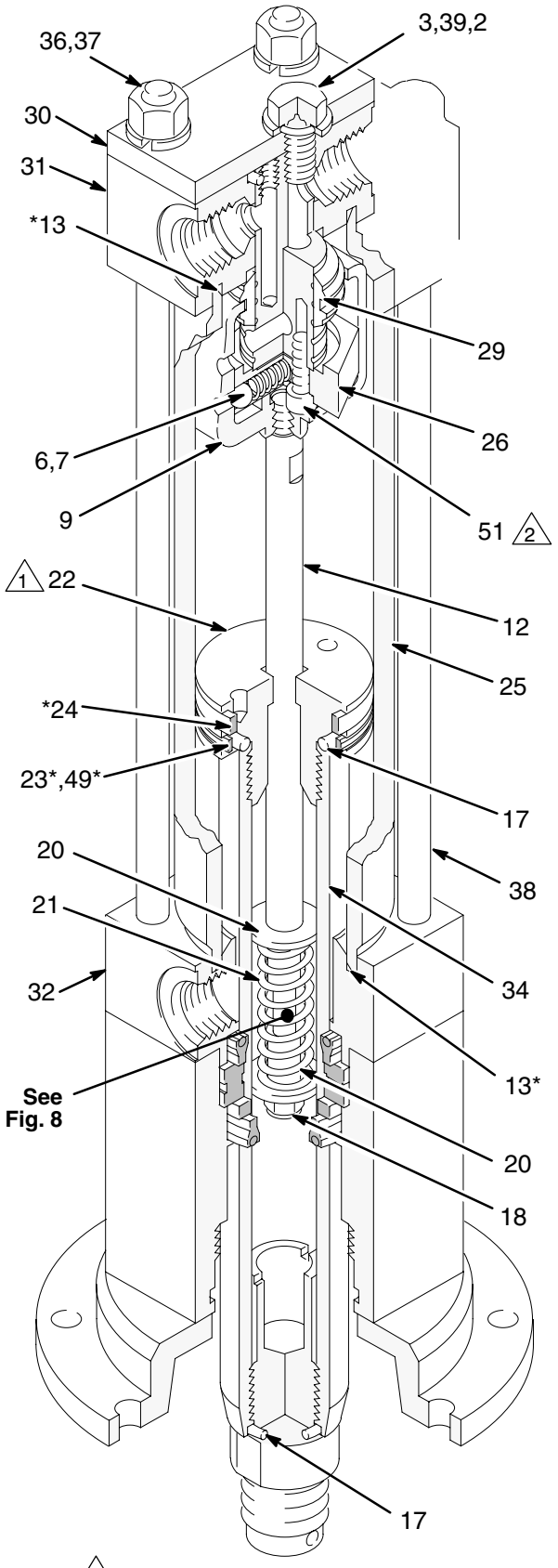


Fig. 9

8. Visually inspect the spring (21). If there is wear or damage, remove the nut (18), spring (21) and retainers (20) from the trip rod (12). Reassemble with a retainer (20) on each end of the new spring (21). You must thread the nut onto the rod until it runs out of thread, so that it bottoms out on the shoulder of the rod. See Fig. 8.

NOTE: If you are re-using or reassembling any parts, use a surface cleaner such as chlorinated solvent on the threads, and blow with compressed air. A 1/4–28 UNF–2A tap can be used to remove adhesive from the internal threads of the yoke (9).

NOTE: Thread sealant and primer are required. See **Reciprocator Repair Notes** on page NO TAG for specifications. Loctite® 609 is used only in step 9 below.

9. Apply fresh Loctite® 609 thread sealant to the first two or three internal threads of the yoke (9). Apply primer to the external thread of the rod (12). Let dry for three or four minutes. Assemble, torquing the screw to 54 to 56 in-lb (6.1 to 6.3 N-m). Remove excess sealant. Allow 24 hours to cure before operating the reciprocator.

10. Clean all sealant from the threads of any part you are reusing, and apply Loctite® 242 or Perma-Loc® 115 thread sealant to the first two or three internal threads of the valve assembly (31). **If you removed the capscrew (51)**, apply thread sealant to the first two or three internal threads of the valve stop (26). Apply primer to the external threads of the valve sleeve (29). Let dry for three or four minutes, assemble, and remove excess sealant. *Allow 24 hours to cure before operating the reciprocator.*

11. Remove the o-ring (13*) from the bottom of the spool valve (31) and replace it with a new o-ring.

12. Use a spanner wrench to screw the piston (22) onto the displacement rod (34). Torque to 30 to 40 ft-lb (41 to 54 N-m).

⚠ CAUTION

When inserting the piston into the cylinder, carefully guide the piston seal (23*) and bearing (24*) to prevent damaging these parts.

13. Lay Assembly A and Assembly B on the workbench.

14. Slide Assembly B into the center of the tool (D), Part No. 189305. Align the upper detent holes (C) of the yoke (9) with the center line of the tool (D). See Fig. 10.

Reciprocator Repair

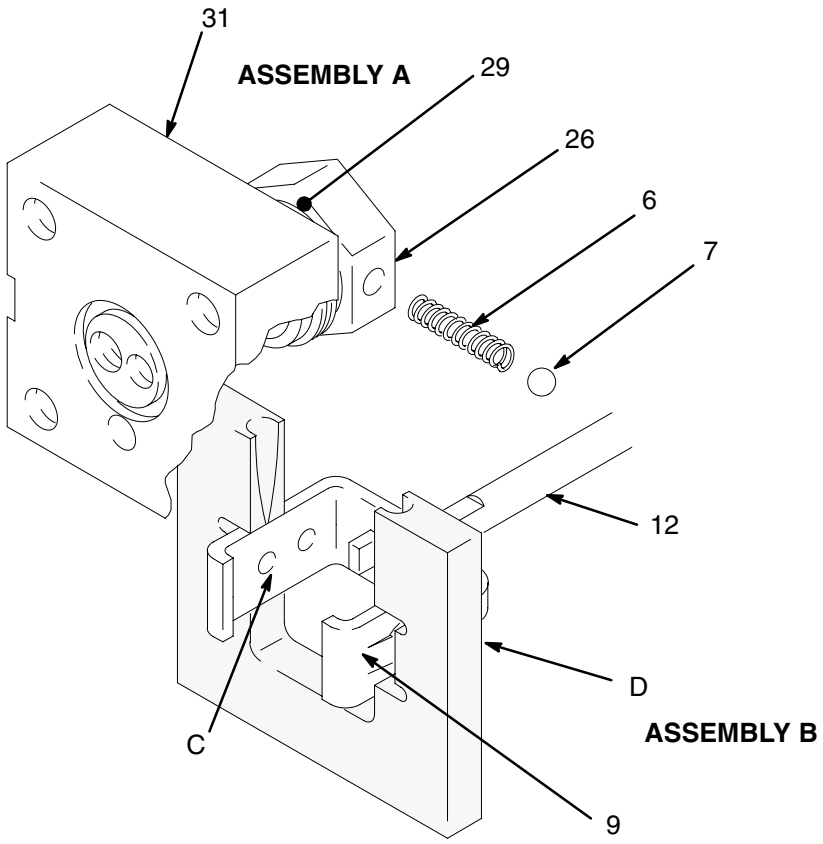


Fig. 10

15. Insert the spring (6) and one ball (7) into the valve stop (26) of Assembly A. Tilt the valve stop and start guiding it into the tool (D), making sure the ball is sliding into the rounded slot in the tool (D). Place the other ball at the other end of the spring and push it in with your thumb while rotating the valve stop (26) until the spring is horizontal and the balls are in place. Continue holding this assembly together. See Fig. 10.

16. Slide the valve stop assembly down into the tool. Make sure the balls (7) snap into the upper set of holes (C) in the yoke (9), and the curved ends of the guide clamp have engaged the valve sleeve (29) groove. See Fig. 10. Slide the tool (D) back over the rod (12) to remove it.

Refer to Fig. 11 for Steps 17 to 24.

17. Place the adapter (43) in a vise, and install the seals as described on page 11. Install the cylinder cap (32).

18. If the tie rods (38) were removed, reinstall them with the short threaded end up. The other end should be screwed about 9/16” into the bottom cylinder cap (32).

NOTE: When reinstalling the cylinder (25) (Step 19), be sure the “P” port in the valve spool (31) and the port in the bottom cylinder cap (32) are in line with each other. Be sure the o-rings (13*) are in place in the valve spool and cylinder cap.

19. Place the cylinder (25) on the cylinder cap (32). Install the piston (22) and valve assembly (31).

20. Install the o-ring (49*) in the deep lower groove of the piston (22) and install the seal (23*) over the o-ring. Install the piston bearing (24*) around the upper groove of the piston. Holding the piston bearing in place to avoid damage, slide the cylinder over the piston and press it down.

Reciprocator Repair

21. Install the capscrew (3), o-ring (39) and washer (2). Install the lockwashers (37) and nuts (36). Torque the nuts to 28 to 32 ft-lb (36 to 43 N-m).

⚠ CAUTION

Never install the fluid tube (45) before torquing the tie rods. Doing so could cause misalignment and damage the reciprocator when it is operated.

22. Reinstall the fluid tube (45) and fittings (1). Torque the fittings to 25 to 35 ft-lb (34 to 48 N-m). See the Parts Drawing on page 20.

23. Pull the displacement rod (34) in and out to be sure it moves easily with only a little resistance from the rod seal.

24. To reconnect the reciprocator and pump, install the o-ring (17). Screw the connecting rod (35) into the displacement rod (34). Install the cotter pin (204). Install a new copper gasket (202*). Make sure the seal (203*) in the bottom of the adapter (43) is in good condition. Push the cylinder up into the adapter and engage the threads. Screw in the pump, using a strap wrench for the final tightening. See Fig. 12.

25. Connect the hydraulic supply and return hoses to the fittings (5, 60).

⚠ WARNING

To reduce the risk of static sparking be sure to re-connect the ground wire before operating the pump.

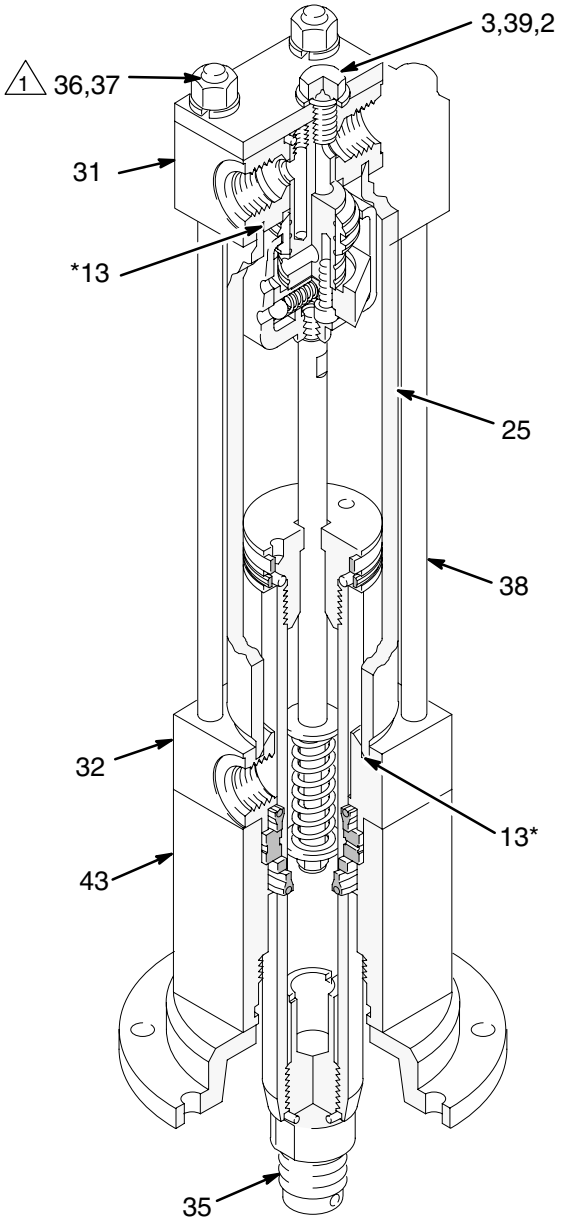


Fig. 11

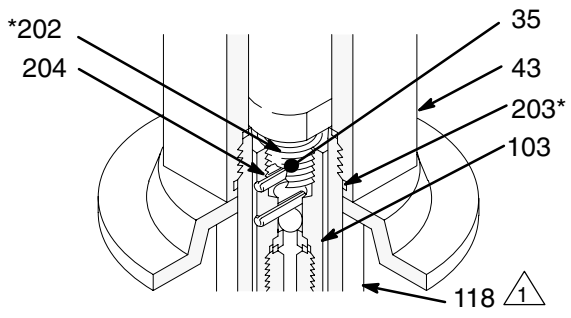


Fig. 12

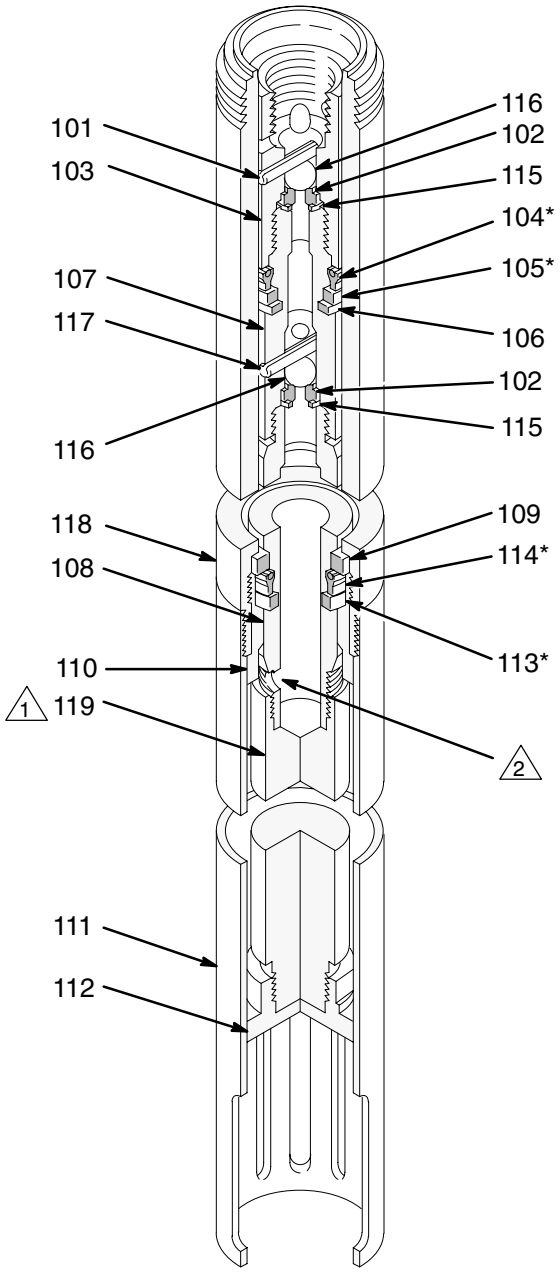
Displacement Pump Repair

Disassembly

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 8.

1. If possible, flush the pump. Relieve the pressure.
2. Follow **Disconnecting the Reciprocator and Displacement Pump** procedure on page 12.
3. Place the pump in a vise. Unscrew the priming cylinder (111).
4. Push the priming piston (112) into the pump until the hex of the piston coupling (103) is exposed.
5. Hold the piston coupling (103), and unscrew the piston rod (119).
6. Unscrew the packing housing (110) and remove all parts.
7. Pull the piston (107) and the priming tube (108) assembly out of the pump housing.
8. Unscrew the priming tube (108), and remove all parts.
9. Unscrew the piston (107), and remove all parts.
10. Clean all parts thoroughly with a compatible solvent. Inspect the parts for wear, and replace as needed. Scoring or irregular surfaces on the priming tube (108), or inside the cylinder (118) causes premature packing wear and leaking.



1 Only used on Models 223513 and 223514.

2 Insert 1/4" dia. rod through hole to hold priming tube (108) when removing or installing parts connected to it.

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Fig. 13

Displacement Pump Repair

Reassembly

NOTE: Repair Kit 223427 is available. Reference numbers marked with an asterisk are included in the kit.

NOTE: The balls (116) cannot be reseated on the hardened seats (102). However, the seats can be reversed and used a second time.

NOTE: Lubricate all parts with a light, waterproof grease.

1. Insert the pin (101) into the piston coupling (103), and insert the pin (117) into the pump piston (107).

2. Put the pump piston (107) in a vise, and stack the spacer (106), seal (105*), packing (104*), gasket (115), seat (102), and ball (116) on it in the order shown in Fig. 14. Thread the piston coupling (103) onto the pump piston (107), and torque it to 60 ft-lb (80 N-m).

3. Turn the pump piston (107) over in the vise, and insert the ball (116), seat (102), and gasket (115).

4. Assemble the seal (113), packing (114) and bearing (109) on the packing housing (110). Screw the packing housing into the cylinder (118), and torque to 60 ft-lb (80 N-m).

5. Slide the assembly into the cylinder **from the top**. Use your finger to guide the assembly through the lower seals.

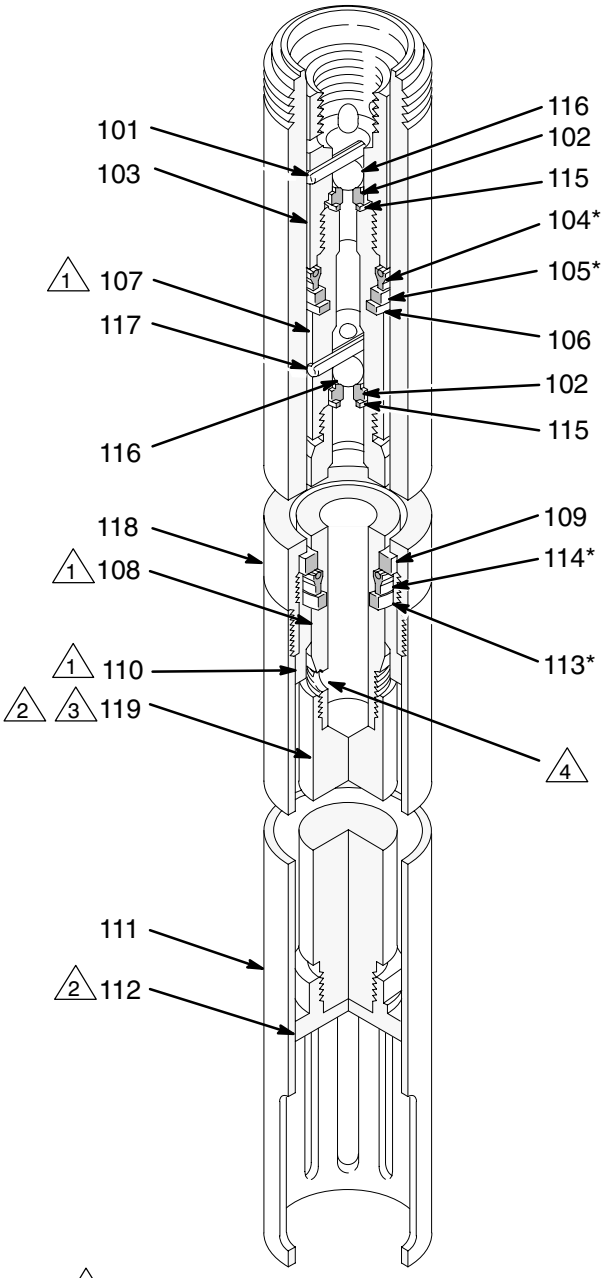
6. **Models 223513, 223514 only:** Screw the piston rod (119) onto the priming tube (108). Torque to 35 ft-lb (47 N-m).

7. Place the gasket (202*) in the base of the reciprocator. Place the o-ring (203*) into the groove of the pump adapter (43). Screw the cylinder into the pump adapter.

8. Firmly screw the priming piston (112) onto the piston rod (119). Torque to 35 ft-lb (47 N-m).

9. Firmly screw the priming cylinder (111) onto the cylinder (118).

10. Reconnect the ground wire to the reciprocator if it is disconnected.



1 Torque to 60 ft-lb (80 N-m).

2 Torque to 35 ft-lb (47 N-m).

3 Only used on Models 223513 and 223514.

4 Insert 1/4" dia. rod through hole to hold priming tube (108) when removing or installing parts connected to it.

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Fig. 14

Displacement Pump Parts

Model 223513, Series A, 120 lb.
Includes items 101 to 119

Model 223514, Series A, 400 lb.
Includes items 101 to 119

Model 224914, Series A, 35 lb.
Includes items 101 to 118

Ref. No.	Part No.	Description	Qty.
101	108992	PIN, spring	1
102	162559	SEAT, valve	2
103	183670	COUPLING, piston	1
104*	108990	PACKING, block	1
105*	108989	SEAL, backup	1
106	183669	SPACER, piston	1
107	183676	PISTON, pump	1
108	183677	TUBE, priming	1
109	183668	BEARING, priming	1
110	183675	HOUSING, packing	1
111		CYLINDER, priming	1
	183673	Model 223513	
	185999	Model 223514	
	187312	Model 224914	
112	183672	PISTON, priming	1
113*	108988	SEAL, backup	1
114*	108987	PACKING, block	1
115	150451	GASKET, copper	2
116	100170	BALL	2
117	108991	PIN, spring	1
118	183678	CYLINDER, pump	1
119		ROD, piston	1
	186002	Model 223513	
	185998	Model 223514	
	None	Model 224914	

* *These parts and items 202, 203 on page 22, are included in Repair Kit 223427, which may be purchased separately.*

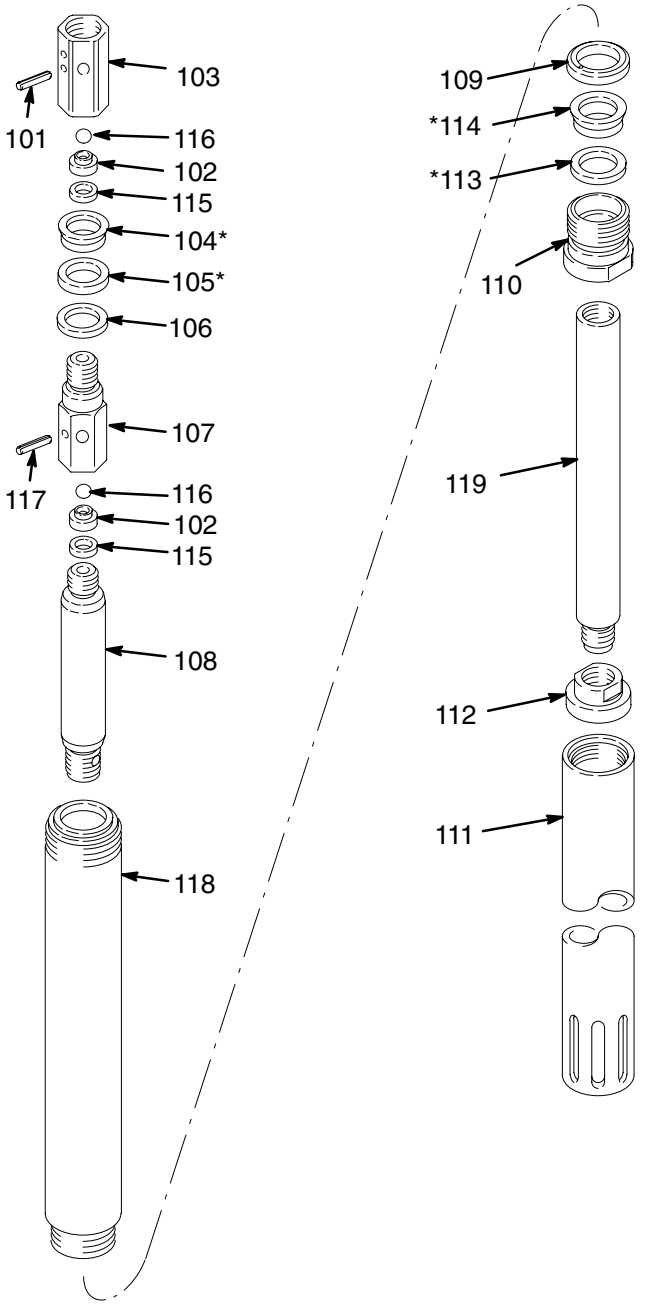

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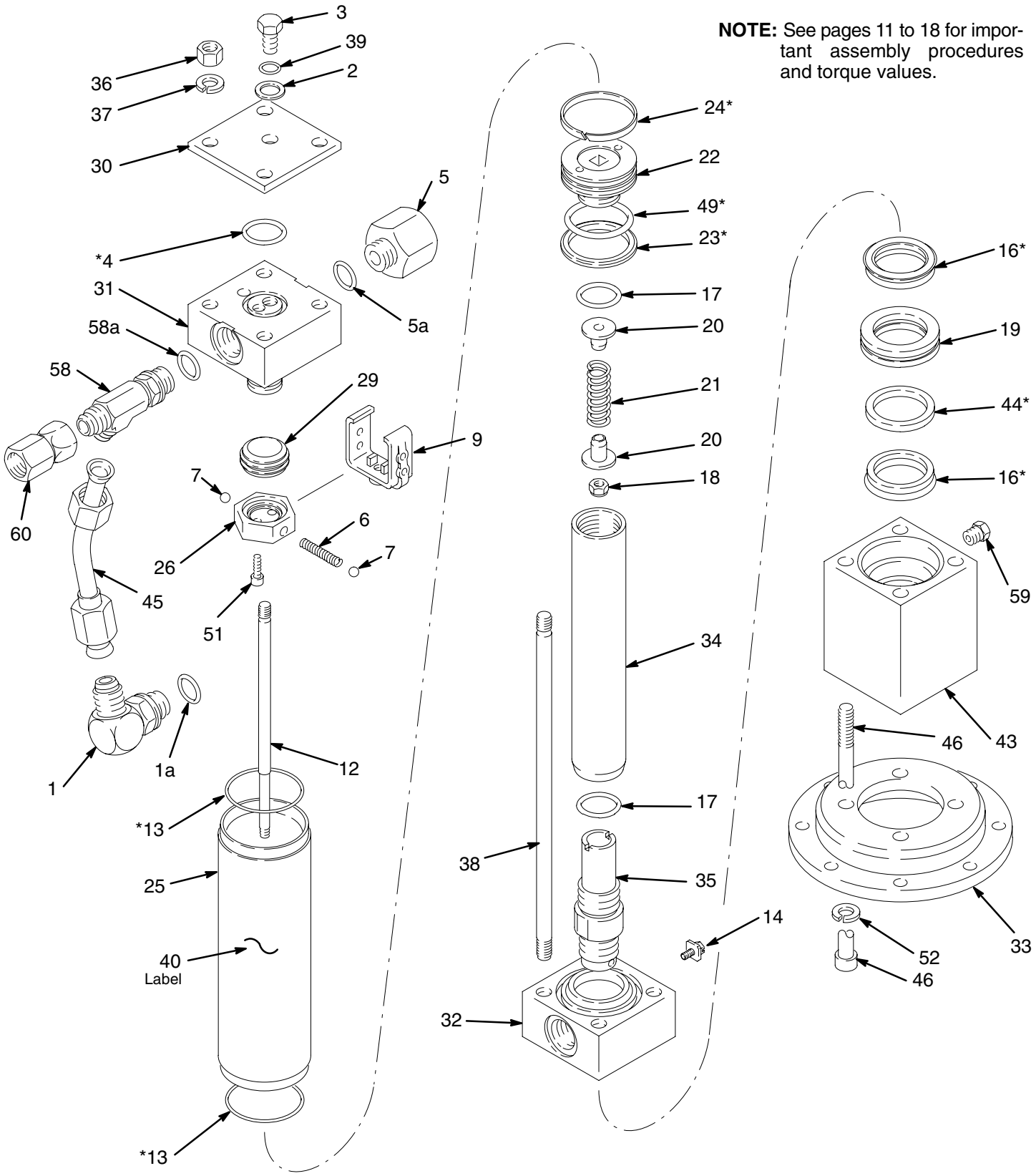
Fig. 15

Reciprocator Parts

Model 239883, Series A
Includes items 1 to 60



NOTE: See pages 11 to 18 for important assembly procedures and torque values.

06154B

Reciprocator Parts

Model 239883, Series A

Includes items 1 to 60

Ref. No.	Part No.	Description	Qty.
1	106470	ELBOW, straight thread, 3/4–16 unf–2a x 3/4–16 unf–2a, 37° flare includes item 1a	1
1a	110987	.O-RING	1
2	178179	WASHER, sealing	1
3	106276	CAPSCREW, hex hd, 3/8–24 x 5/8”	1
4	104093	O-RING	1
5	112568	ADAPTER, pipe,3/4 unf(m) 1/2 npt(f), steel includes item 5a	1
5a	110987	.O-RING	1
6	108437	SPRING, compression, steel	1
7	100069	BALL, 1/4” dia. steel	2
9	189077	YOKE, valve	1
12	192657	ROD, stop, cs	1
13*	106274	O-RING, buna–N	2
14	116343	SCREW, grounding	1
16*	108952	PACKING, v-block	2
17	105765	O-RING	2
18	114231	LOCKNUT, hex, 1/4–28 unf–3b steel and nylon	1
19	183531	GUIDE, rod, bronze	1
20	192655	RETAINER, spring, cs	2
21	178189	SPRING, compression, steel	1
22	192656	PISTON, cs	1
23*	178226	SEAL, piston glass-filled PTFE	1
24*	178207	BEARING, piston bronze-filled PTFE	1
25	178229	CYLINDER, motor, cs	1
26	192654	STOP, valve, cs	1
29	189072	SLEEVE, valve, steel	1
30	178181	PLATE, cap	1
31	239874	SPOOL, valve assembly 3/4–16 unf –2b(f)	1
32	186225	CAP, cylinder, bottom, cs	1
33	183833	BASE, aluminum	1
34	188078	ROD, displacement, cs	1
35	183671	CONNECTING ROD	1
36	100307	NUT, full, hex; 3/8–16 unc–2b	4
37	100133	LOCKWASHER, 3/8”	4
38	187405	ROD, tie, 8.5” shoulder to shoulder, 3/8–16 unc–2a,cs	4
39	155685	O-RING	1
40▲	179885	LABEL, Warning	1
43	183533	ADAPTER, pump, cs	1
44*	108951	SEAL, polyester elastomer	1
45	217221	TUBE, inlet	1
46	108986	CAPSCREW, sch, 3/18–16 unc–2a x 4.5”	4
49*	108014	O-RING, buna–N	1
51	104092	CAPSCREW, sch; 10–24 unrc–3a x 5/8”	2
52	106115	LOCKWASHER, spring; 3/8”	4
58	107197	TEE includes item 58a	1
58a	110987	.O-RING	1
59	110064	PLUG, pipe, vented, 1/8–27 nptf	1
60	112569	UNION, swivel; steel	1

* *These parts and items 202, 203 on page 22 are included in Repair Kit 223426, which may be purchased separately.*

▲ *Replacement Danger and Warning labels, tags and cards are available at no cost.*

Assembly Tool 189305 required for repairing the reciprocator.

Pump Parts

Model 224752, Series C

400 pound drum size

Ref. No.	Part No.	Description	Qty.
201	239883	RECIPROCATOR, see page 21	1
202*	183715	GASKET, copper	1
203*	108993	O-RING	1
204	108992	PIN	1
205	223514	DISPLACEMENT PUMP see page 19	1
206	183741	LABEL, identification	1

Model 224751, Series C

120 pound drum size

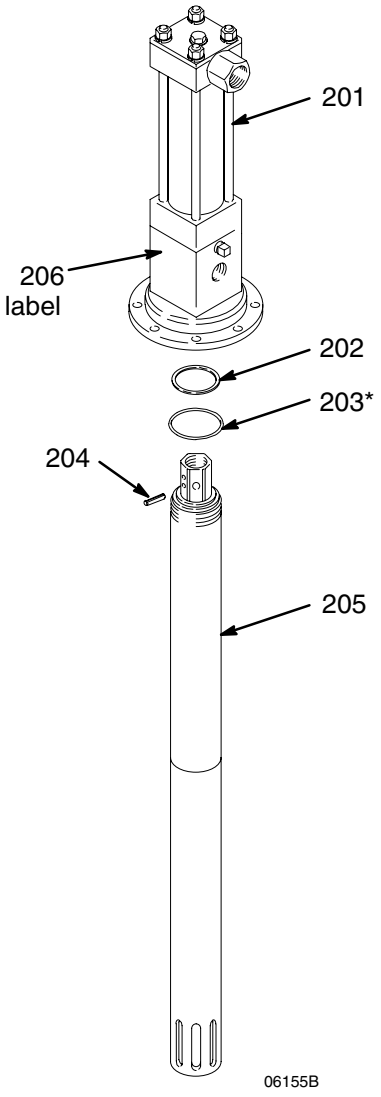
Ref. No.	Part No.	Description	Qty.
201	239883	RECIPROCATOR, see page 21	1
202*	183715	GASKET, copper	1
203*	108993	O-RING	1
204	108992	PIN	1
205	223513	DISPLACEMENT PUMP see page 19	1
206	183741	LABEL	1

Model 224912, Series C

35 pound drum size

Ref. No.	Part No.	Description	Qty.
201	239883	RECIPROCATOR, see page 21	1
202*	183715	GASKET, copper	1
203*	108993	O-RING	1
204	108992	PIN	1
205	224914	DISPLACEMENT PUMP see page 19	1
206	183741	LABEL	1

* *These parts are included in Repair Kits 223426 and 223427, which may be purchased separately.*



Technical Data

Max. grease output pressure	7500 psi (51 MPa, 517 bar)
Max. hydraulic fluid input pressure	1500 psi (10 MPa, 102 bar)
Max. hydraulic fluid input volume	3 gpm (11.7 lpm), 60 cpm
Hydraulic fluid consumption rate	6.5 ounces (0.195 liter) per cycle or 1 gallon per 19.5 cycles
Maximum fluid temperature	130° F (55° C)
Effective piston area	1.48 sq in. (9.55 cm^2)
Piston rod diameter	1 3/8 in. (34.9 mm)
Output per cycle	with No. 2 grease at 60 cpm free flow: 5 lb/min (2.25 kg/min) *at 3000 psi (21 MPa, 207 bar):* 4 lb/min (1.8 kg/min)
Stroke	4 in. (101.6 mm)
Thrust at 1000 psi (7 MPa, 69 bar)	1480 lb (673 kg)
Maximum suction lift	13 feet (4 m)
Displacement pump wetted parts	steel, copper, polyurethane, buna–N, polyester elastomer
Weight	Model 224752: 42 lb (18.9 kg) Model 224751: 37.5 lb (16.9 kg) Model 224912: 32.5 (17.7 kg)
Sound pressure*	77 dB(A)

* *Sound pressure reading taken with pump operating at 66 cycles per minute. Sound pressure measured per CAGI-PNEUROP, 1971.*

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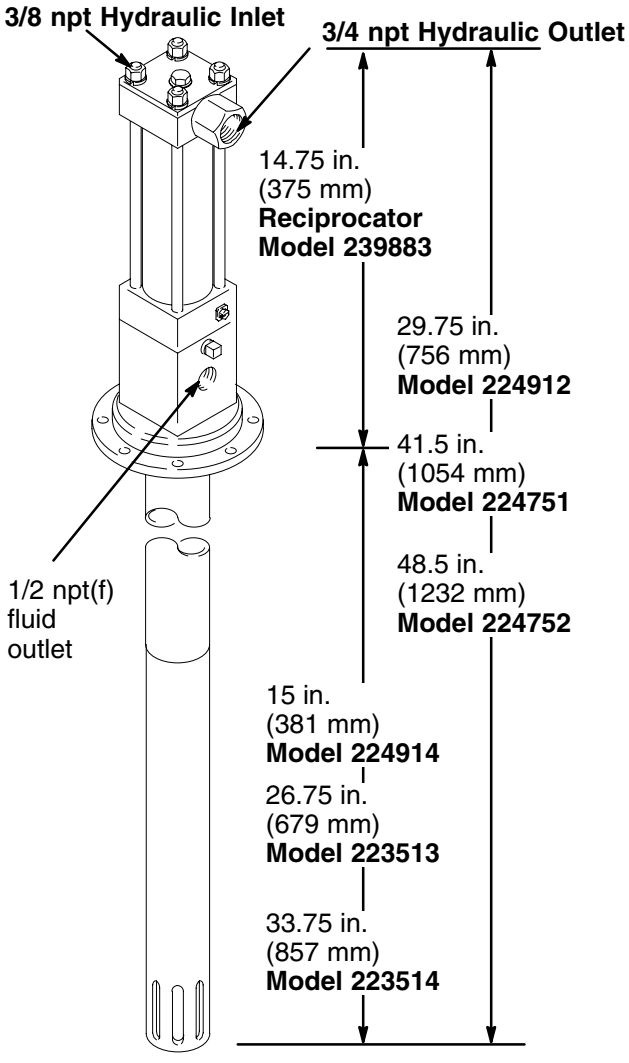
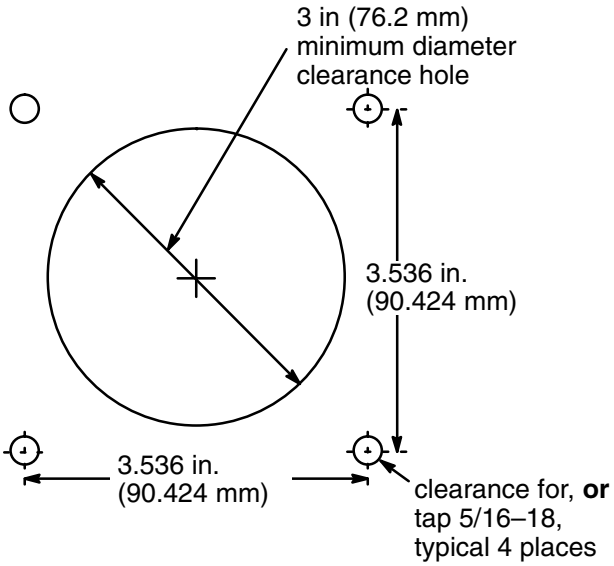
Dimensions and Mounting Hole Layout





NOTE: Pump body orientation is square with mounting holes.

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Graco Standard Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non–Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

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