

# Dyna-Star™ Hydraulic Reciprocator and Pump

308155V  
EN

For lubricating fluids only. For professional use only.

## 1:1 Ratio Universal Pump and Reciprocator

### Model 239882, Series A,

#### Reciprocator Only

1500 psi (10 MPa, 102 bar) Maximum Hydraulic Input Pressure

1500 psi (10 MPa, 102 bar) Maximum Fluid Outlet Pressure

### Model 224741, Series C,

#### Stubby Length

1500 psi (10 MPa, 102 bar) Maximum Hydraulic Input Pressure

1500 psi (10 MPa, 102 bar) Maximum Fluid Outlet Pressure

### Model 224742, Series C,

#### 55 Gallon Length

1500 psi (10 MPa, 102 bar) Maximum Hydraulic Input Pressure

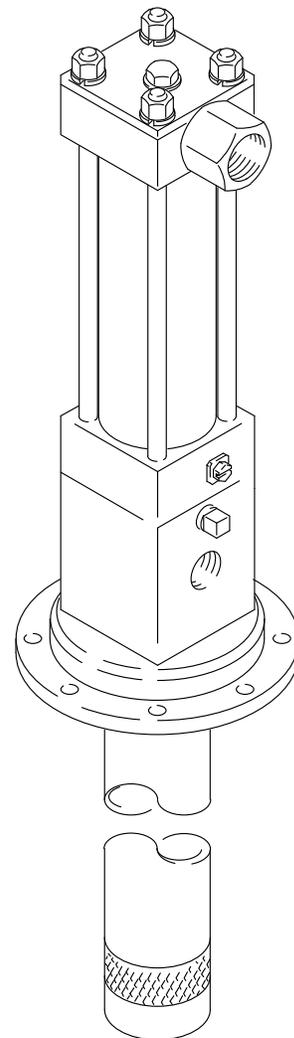
1500 psi (10 MPa, 102 bar) Maximum Fluid Outlet Pressure

### Model 237653, Series B,

#### Stainless Steel Stubby Length Pump

1000 psi (7 MPa, 70 bar) Maximum Hydraulic Input Pressure

1000 psi (7 MPa, 70 bar) Maximum Fluid Outlet Pressure



### Important Safety Instructions

Read all warnings and instructions in this manual. Save these instructions.

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# Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 <h2 style="margin: 0;">WARNING</h2>	
 	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>When flammable fluids are present in the work area, such as gasoline and windshield wiper fluid, be aware that flammable fumes can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well ventilated area.</li> <li>• Eliminate all ignition sources, such as cigarettes and portable electric lamps.</li> <li>• Keep work area free of debris, including rags and spilled or open containers of solvent and gasoline.</li> <li>• Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.</li> <li>• Ground all equipment in the work area.</li> <li>• Use only grounded hoses.</li> <li>• <b>Stop operation immediately</b> if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.</li> <li>• Keep a working fire extinguisher in the work area.</li> </ul>
  	<p><b>SKIN INJECTION HAZARD</b></p> <p>High-pressure fluid from dispensing device, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. <b>Get immediate surgical treatment.</b></p> <ul style="list-style-type: none"> <li>• Do not point dispensing device at anyone or at any part of the body.</li> <li>• Do not put your hand over the fluid outlet.</li> <li>• Do not stop or deflect leaks with your hand, body, glove, or rag.</li> <li>• Follow the <b>Pressure Relief Procedure</b> when you stop dispensing and before cleaning, checking, or servicing equipment.</li> <li>• Tighten all fluid connections before operating the equipment.</li> <li>• Check hoses and couplings daily. Replace worn or damaged parts immediately.</li> </ul>



# WARNING



## EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See Technical Data in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS from distributor or retailer.
- Do not leave the work area while equipment is energized or under pressure.
- Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.



## TOXIC FLUID OR FUMES HAZARD

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

- Read MSDSs to know the specific hazards of the fluids you are using.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.
- Always wear chemically impermeable gloves when spraying, dispensing, or cleaning equipment.



## MOVING PARTS HAZARD

Moving parts can pinch, cut or amputate fingers and other body parts.

- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the **Pressure Relief Procedure** and disconnect all power sources.



## PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. This protective equipment includes but is not limited to:

- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer

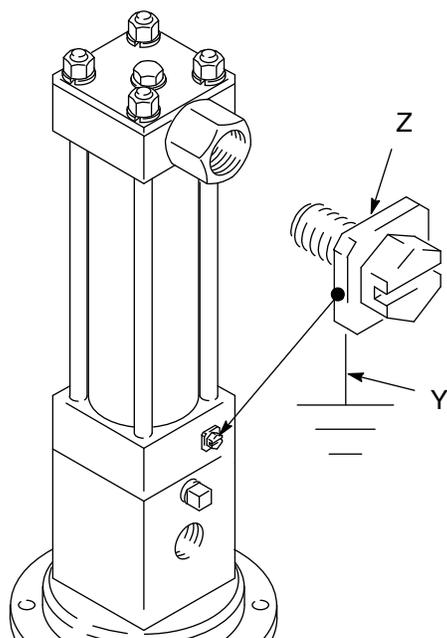
# Installation

## Grounding

						
<p>The equipment must be grounded to reduce the risk of static sparking and electric shock. Electric or static sparking can cause fumes to ignite or explode. Improper grounding can cause electric shock. Grounding provides an escape wire for the electric current.</p>						

**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 ground wire to a true earth ground. (FIG. 1)

**Pump:** Use ground wire and clamp as shown in FIG. 1.

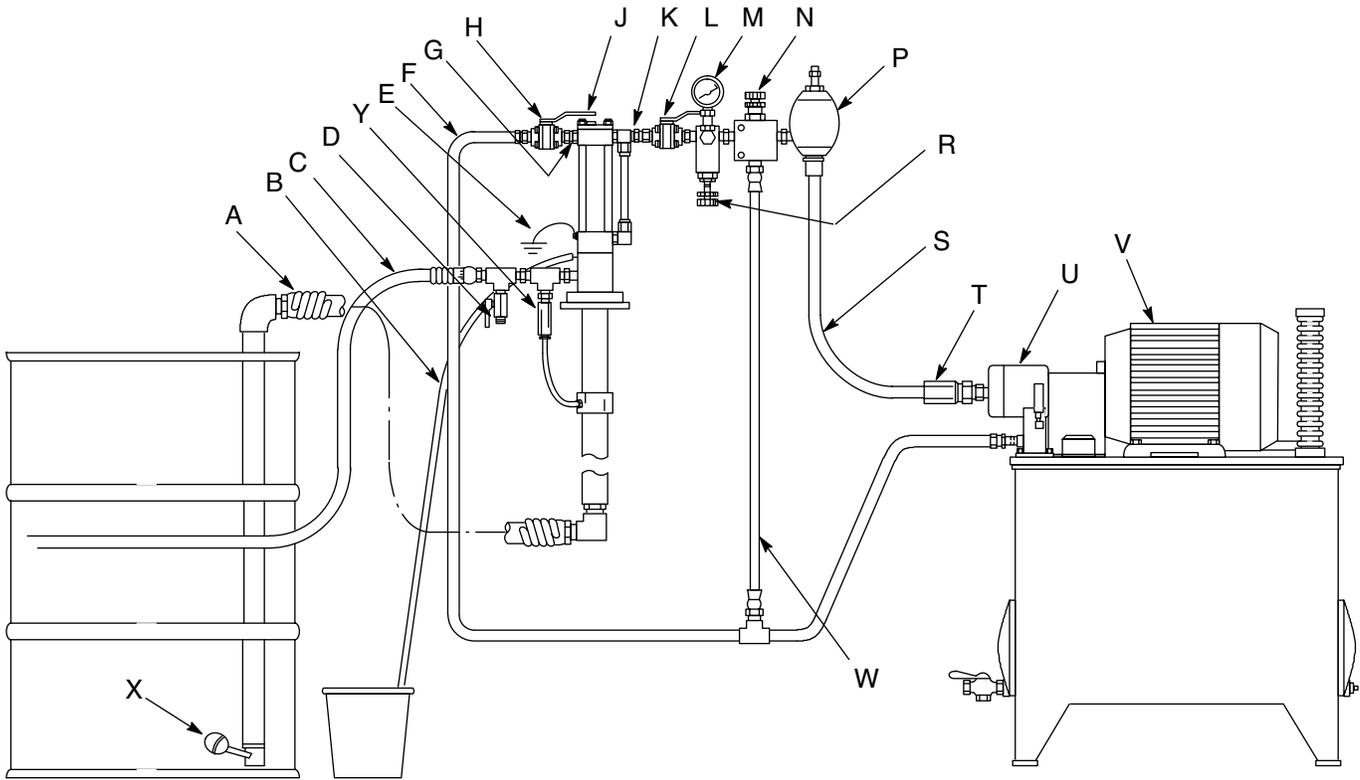


**FIG. 1**

**Hydraulic hose 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 metal part of the dispense valve and the pail. Use the lowest possible pressure.



**FIG. 2: Typical Installation**

**Key:**

- |   |  |
|---|--|
| A Suction hose  | N *Pressure reducing valve (required in systems over 1500 psi [10.2 MPa, 102 bar]) |
| B Weep tube   | P Accumulator  |
| C Fluid outlet line (to gun)                          | R *Flow control valve (required in systems over 3 gpm [11 lpm])                    |
| D Drain valve (required)                              | S Hydraulic supply line  |
| E Ground wire   | T Check valve  |
| F Hydraulic return line, minimum 3/4" I.D. (required) | U Variable volume pressure compensated pump  |
| G Hydraulic outlet, 1/2 npt                           | V Hydraulic power supply   |
| H Return line shut-off valve, minimum 3/4" (required) | W Drain line, accumulator  |
| J Hydraulic inlet, 1/2 npt                            | X Low-level cut-off valve  |
| K Tee, 3/4 npt  | Y Thermal Relief Kit (required)  |
| L *Supply line shut-off valve                         |  |
| M *Pressure gauge                                     |  |

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

Although the installation shown in FIG. 2 is only a guide for selecting and installing system components and accessories, some 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.

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

## Pump Accessories

- A suction hose kit (A) is available for siphoning from 55 gallon containers.
- Intake tube (not shown). To install, apply PTFE tape to the female threads at the top of the tube. Screw the tube tightly into the intake housing of the stubby pump.
- Low-level cut-off valve (X) closes the pump intake when the fluid level is low, causing the pump to stall to avoid running dry. To install, screw the valve into the bottom of the pump intake tube or the suction tube.
- A pump outlet drain valve (D) is installed close to the pump fluid outlet to help relieve fluid pressure in the pump when the pump is shut off.
- Thermal relief kit (Y). Install at the pump fluid outlet.

### NOTICE

#### **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 the system is shut down and if the outlet hose gets clogged. Install the valve close to the pump outlet.

## Hydraulic System

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 blow out with air again before you connect the lines to the reciprocator.

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

Carefully follow the manufacturer's recommendations on cleaning the reservoir and filter and periodically changing the hydraulic fluid.

## Hydraulic Power Supply

						
<p><b>Limit Fluid Flow to Reciprocator</b> To reduce the risk of over-pressurizing 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 (10.2 MPa, 102 bar).</p>						

The hydraulic power supply system (V) must have a pressure reducing valve and a pressure-compensated flow control. A flow control valve (R) 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 (R), are including in the Hydraulic Fluid Control Kit, 236864, which can be ordered separately.

## Hydraulic Lines

Refer to FIG. 2 for the parts mentioned in the following instructions.

- Shut off valves (H and L): Installed in the hydraulic supply and return lines.
- Drain Line (W): Remove the plug (59) from the pump adapter, and install a 1/8-27 npt(f) tube fitting and 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. (FIG. 3)

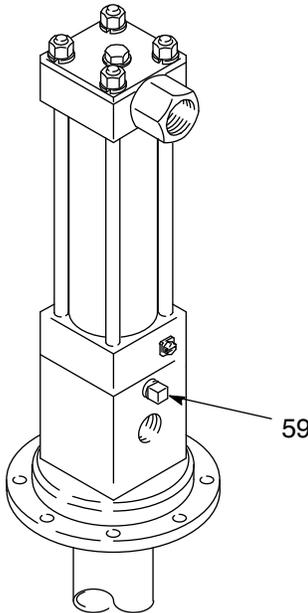


FIG. 3

- Hose: 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.
- 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 (10.2 MPa, 102 bar).
- Accumulator (P): Reduces the hammering effect caused by the motor when it reverses direction.

- Fluid-filled pressure gauge (M): Monitors hydraulic pressure to the reciprocator during start up. Use the gauge for initial adjustment of the reciprocator. It can be removed after adjustment is made.

# Operation

## Pressure Relief Procedure



Follow the Pressure Relief Procedure whenever you see this symbol.



This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection, splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop spraying and before cleaning, checking, or servicing the equipment.

1. Shut off the hydraulic power.
2. Close the supply line shut-off valve (L, FIG. 2).
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 Starting 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.
2. Flush the pump before you use 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 26. 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), and slowly open the hydraulic supply shut-off valve (L).
3. Adjust the flow control valve (R) to limit the hydraulic flow to no more than 3 gpm (11 lpm), which is approximately 60 cycles per minutes.

**NOTE:** If Graco Part No. 236864 hydraulic fluid control is used, no adjustment is necessary.

4. By adjusting the pressure reducing valve (N), adjust the hydraulic inlet pressure from 50 to 1500 psi (0.34 to 10.2 MPa, 3.4 to 102 bar) for models 239882, 224741, and 224742. Increasing the inlet pressure increases the outlet pressure. Decreasing the inlet pressure decreases the outlet pressure.

**NOTE:** For model 237653, adjust the hydraulic inlet pressure from 50 to 1000 psi (0.34 to 7 MPa, 3.4 to 7 bar).

5. Always use the lowest pressure possible to obtain the desired results. This reduces pump wear.

### NOTICE

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.

To prevent the pump from running dry, use a low-level cut off valve (X).

## Shutdown



Relieve the pressure whenever you shut down. See Pressure Relieve Procedure on page 9.

## If the Pump Leaks at the Fluid Fittings

**Models 239882, 224741, and 224742:** Tighten the fittings (1, 5, 58) which are self sealing and have replaceable o-rings. If leaking persists, change the o-rings. (FIG. 4)

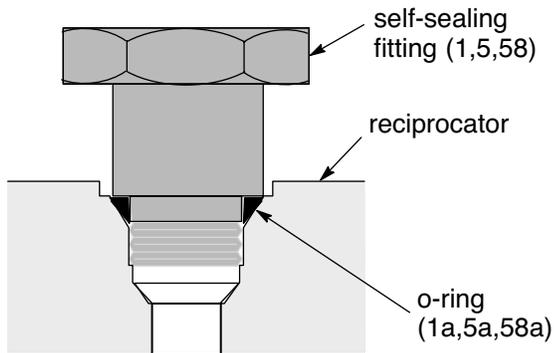


FIG. 4

**Model 237653:** Tighten fittings (B or K). These fittings are self sealing and have replaceable o-rings. If leaking persists, change the o-rings. (FIG. 5)

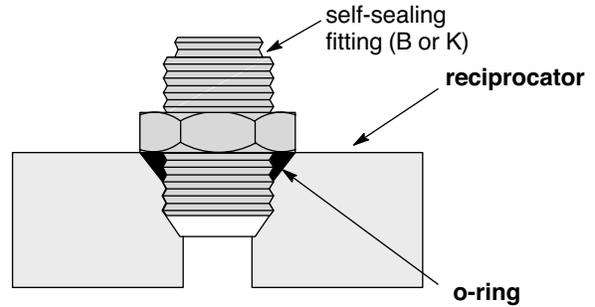


FIG. 5

# Troubleshooting



1. Follow **Pressure Relief Procedure**, page 9, before checking or repairing gun.
2. Check all possible problems and causes before disassembling gun.

Problem	Cause	Solution
Pump won't 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 obstruction.
	Reciprocator damaged	Repair. See page 12.
Pump speeds up or runs erratically	Pump piston and/or intake valve is worn	Relieve pressure. Check and repair. See page 12
	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 12.
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	Relive pressure. Check; clear obstructions.
Excessive weepage from weep tube (B)	Worn throat packings	Repair. See page 12.
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.

# Repair

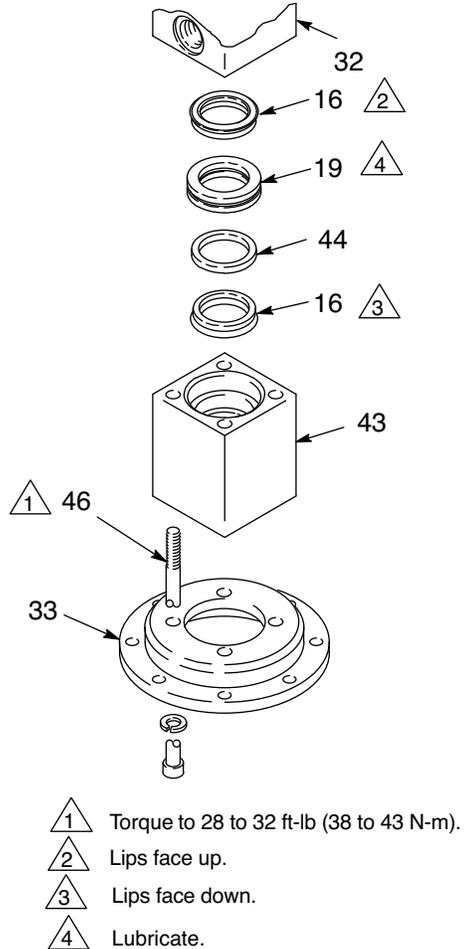
## Replacing the Throat Seals

Refer to FIG. 6 for the following instructions.



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

1. Relieve the pressure. See Pressure Relief Procedure, page 9.
2. Disconnect the reciprocator from the pump. See Disconnecting the Reciprocator and Displacement Pump on page 13.
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).
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. 6.
6. Reassemble. Torque the capscrews (46) to 28 to 32 ft-lbs (38 to 43 N.m). Install the displacement pump. Follow Step 24, page 18.



**FIG. 6**

### NOTICE

#### 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 hoe end whenever fluid lines are disconnected to prevent contamination.

## Disconnecting the Reciprocator and Displacement Pump

Refer to FIG. 7 for the following instructions.



### Models 239882, 224741, and 224742

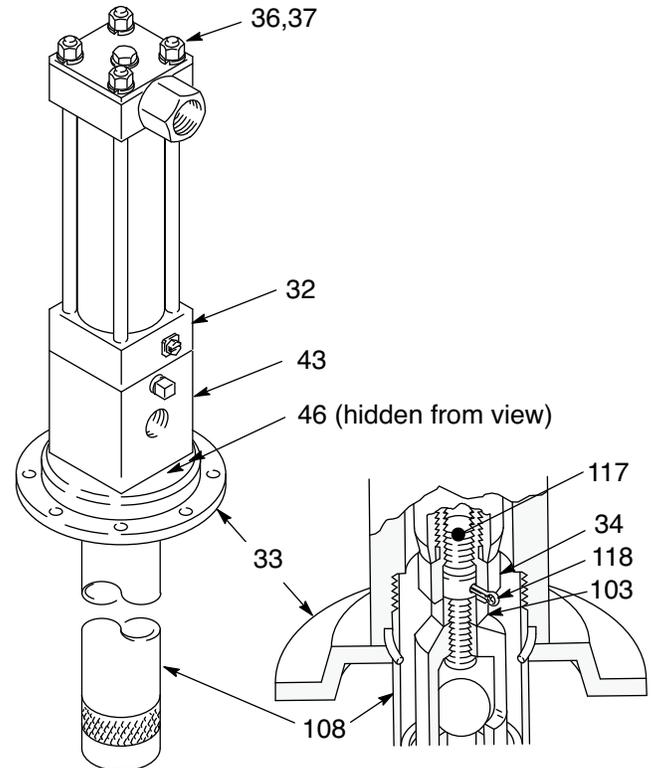
1. Flush the pump if possible and stop it with the displacement rod in the lowest position.
2. Relieve the pressure, see Pressure Relief Procedure, page 9.
3. Disconnect the outlet hose from the displacement pump.
4. Slowly loosen the hydraulic supply (58) and return (5) fittings to relieve any pressure, and 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 FIG. 5 and the Parts Drawing.
5. Using a strap wrench on the displacement cylinder (108), screw it out of the pump adapter (43), and pull it off the pump.
6. Pull the connecting rod (117) down as far as it will go. Remove the cotter pin (118) from the bottom of the displacement rod assembly (34), and unscrew the connecting rod until it is free.

### Model 237653

1. Flush the pump if possible, and stop it with the displacement rod in the lowest position.
2. Relieve the pressure, see Pressure Relief Procedure, page 9.
3. If the pump is removed from its mounting, disconnect the hydraulic hoses, and plug all hydraulic connections and lines to prevent contamination.
4. Remove the cotter pin (A) from the top of the displacement rod (B).
5. Loosen and remove the three lock nuts (C), and pull the displacement pump down and away from the motor.

6. Unscrew the displacement rod (B) from the reciprocator connecting rod (D).

### Models 239882, 224741, and 224742



### Model 237653

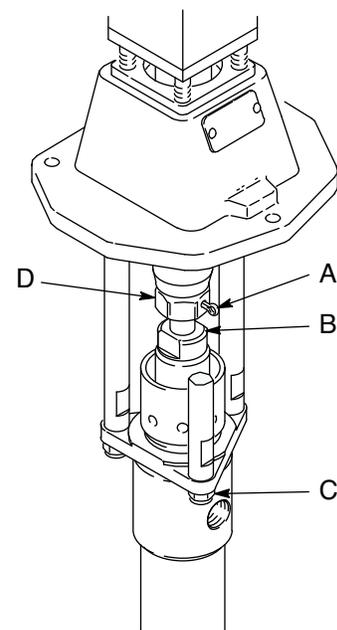


FIG. 7

## Reciprocator Repair

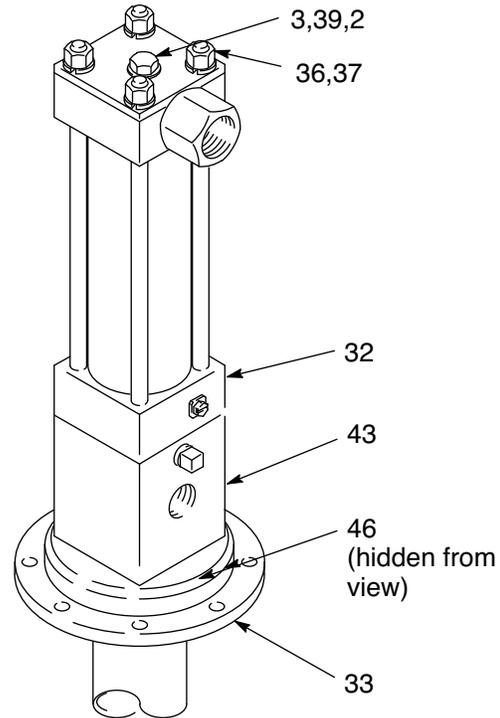
### NOTE:

- The following reciprocator repair instructions are for models 239882, 224741, and 224742. For Model 237653 instructions, see accompanying manual 307654.
- 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.
- 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 1 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 15, 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 the adapter. See FIG. 8. If needed, replace the seals as described in Repair on page 12.
2. Remove the capscrew (3), nuts (36), and lockwashers (37) on top of the reciprocator. (FIG. 8)
3. Loosen both nuts on the fluid tube (45). Use a wrench to rotate the tube fittings (1, 58) to the side, and 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. (FIG. 4 and FIG. 5)



**FIG. 8**

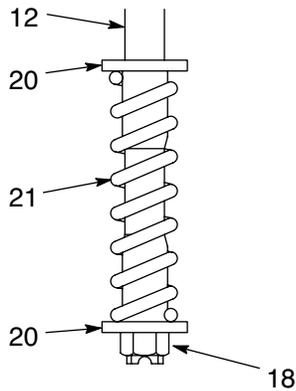
**NOTE:** See FIG. 10 for Steps 4 to 12, except where noted.

4. Tap on the bottom of the displacement rod (34) with a plastic mallet to loosen the cylinder (25).
5. Grasp the spool valve assembly (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 rod 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 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 a piston (22) to screw it off the rod.

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

8. Visually inspect the spring (21) if there is wear or damage, proceed with this step. 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. (FIG. 9)



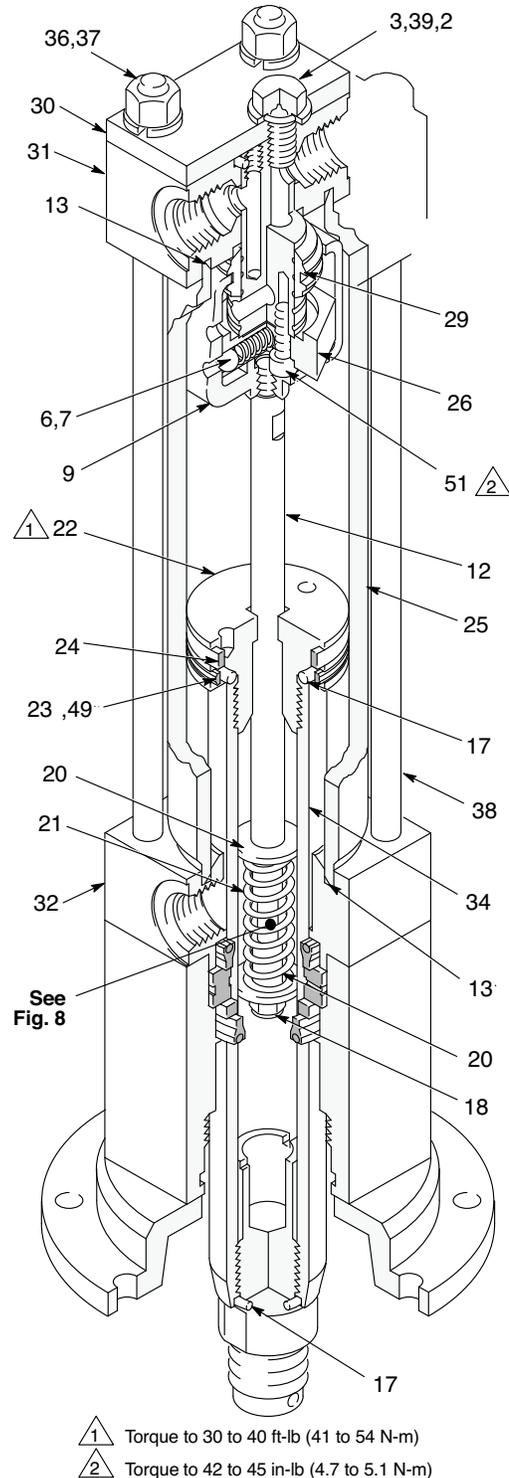
**FIG. 9**

**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).

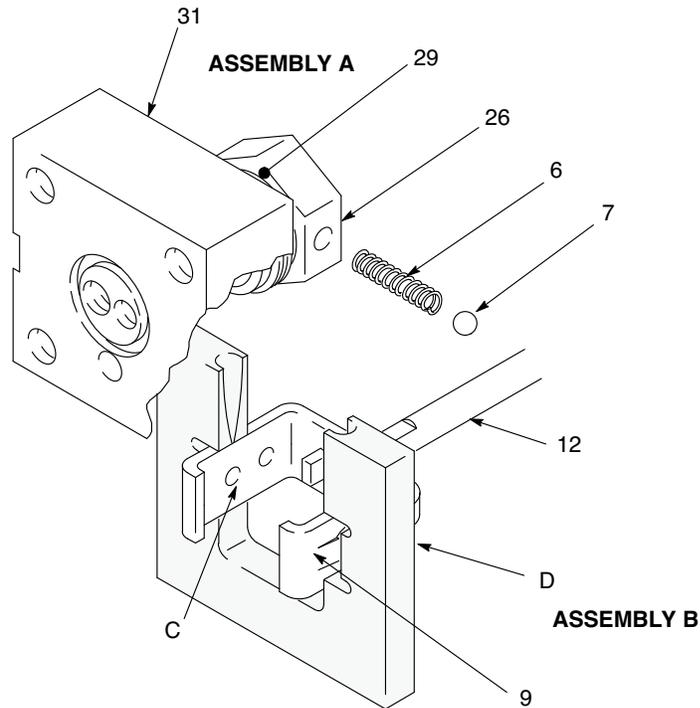
Thread sealant and primer are required. See Reciprocator Repair Notes on page 14 for specifications. Loctite® 609 is used only in STEP 9.

9. Apply fresh Loctite® 609 thread sealant to the first two or three internal threads of the yoke (9). Apply primer to the external threads of the rod (12). Let dry for three or four minutes. Assemble, torquing screws to 96 to 100 in-lbs (10.8 to 11.2 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 thread sealant to the first two or three internal threads of the valve assembly (31). **If you removed the capscrew (51)**, apply primer to its external threads, let it dry for four minutes and torque the capscrews to 42 to 45 in-lbs (4.7 to 5.1 N.m). Remove excess sealant. *Allow 24 hours for the thread sealant to cure before you operate the reciprocator.*
11. Remove the o-ring (13) from the bottom of the spool valve assembly (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-lbs (41 to 54 N.m).



**FIG. 10**



**FIG. 11**

13. Lay Assembly A and Assembly B on the work bench. (FIG. 11)
14. Slide Assembly B into the center of the tool (D). Align the upper detent holes (C) of the guide yoke (9) with the center line of the tool (D). (FIG. 11)
15. Insert the spring (6) and one ball (7) into the vane 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 assembling together. (FIG. 11)
16. Slide the valve stop assembly down onto the tool. Make sure the balls (7) snap into the upper set of holes (C) in the guide yoke (9), and the curved ends of the guide clamp have engaged the valve sleeve (29) groove. (FIG. 11) Slide the tool (D) back over the rod (12) to remove it.
17. Place the adapter (43) in a vise, and install the seals as described on page 12. Install the cylinder cap (32). (FIG. 13)
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). (FIG. 13)

19. 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. (FIG. 13)

**NOTICE**

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

20. Place the cylinder (25) on the cylinder cap (32). Install the piston (22) and the valve assembly (31). (FIG. 13)

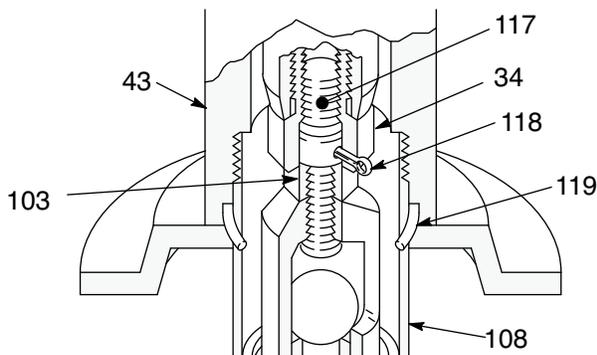
**NOTE:** When the cylinder is reinstalled, be sure the "P" port in the top cylinder cap of the spool valve assembly (31) and the port in the bottom cylinder cap (32) are in line with each other. Be sure the o-rings (13) are in place in the valve spool assembly (31) and cylinder cap.

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-lbs (36 to 43 N.m).

**NOTICE**

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

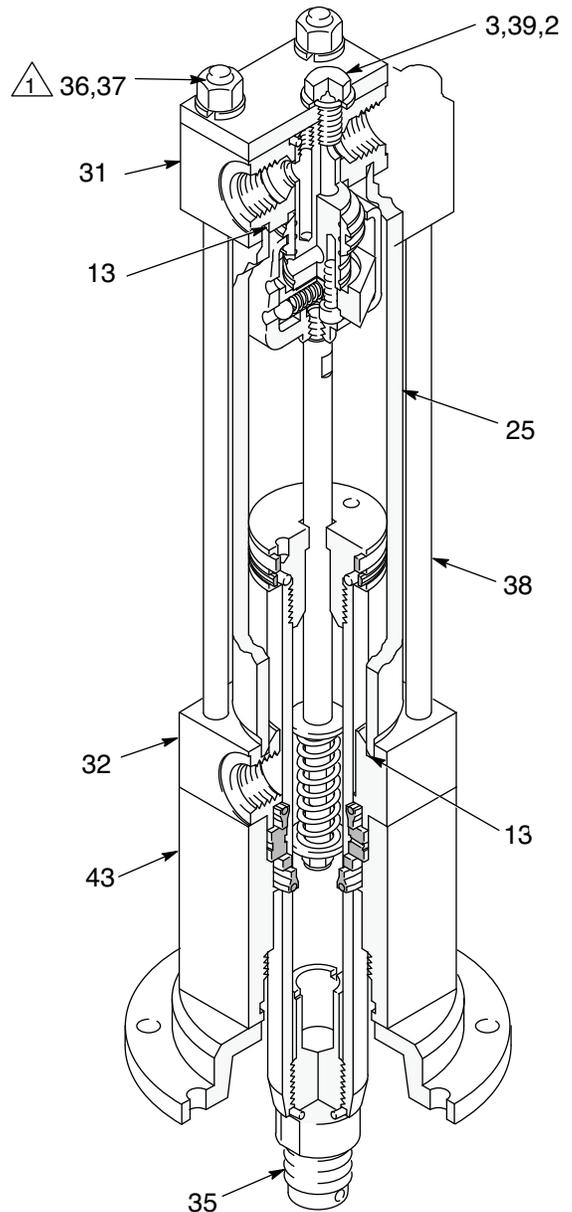
22. Reinstall the fluid tube (45) and fittings (1). Torque the fittings to 25 to 35 ft-lbs (34 to 48 N.m) See Parts Drawing, page 21.
23. Pull the displacement rod (34) in and out to be sure it moves easily. (FIG. 13)
24. Grease the inside top of the displacement cylinder (108) opening. Thread the guide collar, Part No. 168085, onto the displacement cylinder. Slide the packing assembly into the collar/cylinder. Remove the guide collar. (FIG15)
25. To reconnect the reciprocator and pump, screw the connecting rod (117) into the displacement rod (34). Install the cotter pin (118). make sure the o-ring (119) 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. (FIG. 12)



**FIG. 12**

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

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



Torque to 28 to 32 ft-lb (36 to 43 N-m)

**FIG. 13**

# Displacement Pump Repair (Models 239882, 224741, and 224742)

## Intake Valve

Refer to FIG. 14.



1. If possible, flush the pump. Relieve the pressure, see Pressure Relief Procedure, page 9.
2. Unscrew the valve body (110). Remove the o-ring (111), ball (109), and retainer (112).
3. Inspect the parts for wear or damage. If the ball is nicked, replace it. Reassemble, using liquid thread sealant on the male threads.

## Displacement Pump

Refer to FIG. 14.



**NOTE:** Clean and inspect all parts for wear or damage as you disassemble them. Replace parts as needed. For the best results, always replace all the o-rings and packings when you disassemble the pump. The parts list on page X give the recommended parts to keep on hand.

A guide collar is required for installing the piston in the displacement cylinder. Order Guider Collar Tool (Part No. 168085) or make a collar using shim stock having a 0.016 inch (0.41 mm) maximum thickness.

1. If possible flush the pump. Relieve the pressure. See Pressure Relief Procedure, page 9.
2. Remove the intake valve. Follow Disconnect the Reciprocator and Displacement Pump procedure on page 13.
3. Carefully inspect the smooth, inner surface of the cylinder (108) for scoring or irregular surfaces. Such damage causes premature packing wear and leaking, replace the part as needed.

4. Place the piston housing (104) in a vise. Unscrew the piston seat (107) and remove the packings.
5. Grease the new piston packings and stack them one at a time on the piston seat (107), making sure all parts face the way shown in FIG. 14. Install the ball (116). Apply liquid sealant to the male threads of the seat (107), and screw on the piston housing (104).
6. Remove the ball retainer (112) from the intake housing assembly by grabbing the open leg and pulling it toward the center of the housing. Inspect the ball (109) and seat, and replace as needed.

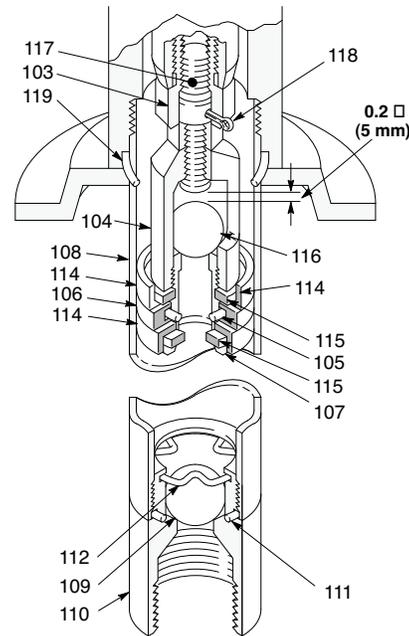
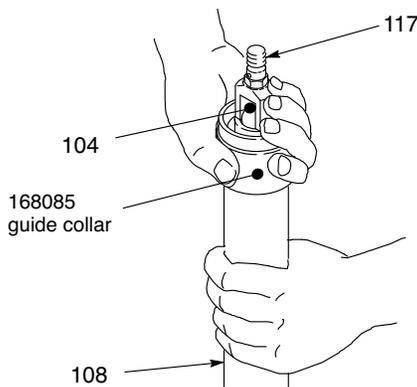


FIG. 14

## Intake Valve Reassembly

1. Grease the inside top of the displacement cylinder (108) opening. Thread the guide collar onto the displacement cylinder. Slide the packing assembly into the collar/cylinder. See FIG. 15. Remove the collar guide.



**FIG. 15**

**NOTE:** If you removed or turned the next nut (103), check the ball travel. It should be 0.2 inches (5 mm), as shown in FIG. 14.

2. To reconnect the reciprocator and pump, screw the connecting rod (117) into the displacement rod (34). Install the cotter pin (118). Make sure the o-ring (119) 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. (FIG. 14)
3. Reinstall the intake valve assembly by doing the reverse of Step 6 of the section Displacement Pump.

## Displacement Pump Repair (Model 237653)

### Disassembly

When disassembling the pump, lay out all removed parts in sequence to ease reassembly.

**NOTE:** Clean all parts thoroughly when disassembling. Check them carefully for damage or wear, replacing parts as needed.

1. Remove the displacement pump from the reciprocator. See page 13 for instructions on removing.
2. Unscrew the locking ring (17) from the cylinder (11). Remove the intake valve housing (13).
3. Remove the o-ring (12), ball stop pin (5), ball guide (22), and ball (2) from the intake valve housing (13).

4. Loosen the packing nut (15). Push the displacement rod (7) down as far as possible, then pull it out the bottom of the cylinder (11).
5. Secure the flats of the piston (14) in a vise. Using a wrench on the flats of the piston mounting stud (28), screw the piston stud off the piston.
6. Remove the piston packings (25, 26), glands (24, 27), shim (29), and washer (23).
7. Remove the packing nut (15), throat packings (9, 19) and glands (6, 8) from the outlet housing (16).
8. Inspect all parts for damage. Clean all parts and threads with a compatible solvent before reassembling. Inspect the polished surfaces of the displacement rod (7) and cylinder (11) for scratches, scoring or other damage, which can cause premature packing wear and leaking. To check, run a finger over the surface or hold the part up to the light at an angle. Be sure the ball seats of the piston (14) and intake valve housing (13) are not chipped or nicked. Replace any worn or damaged parts.

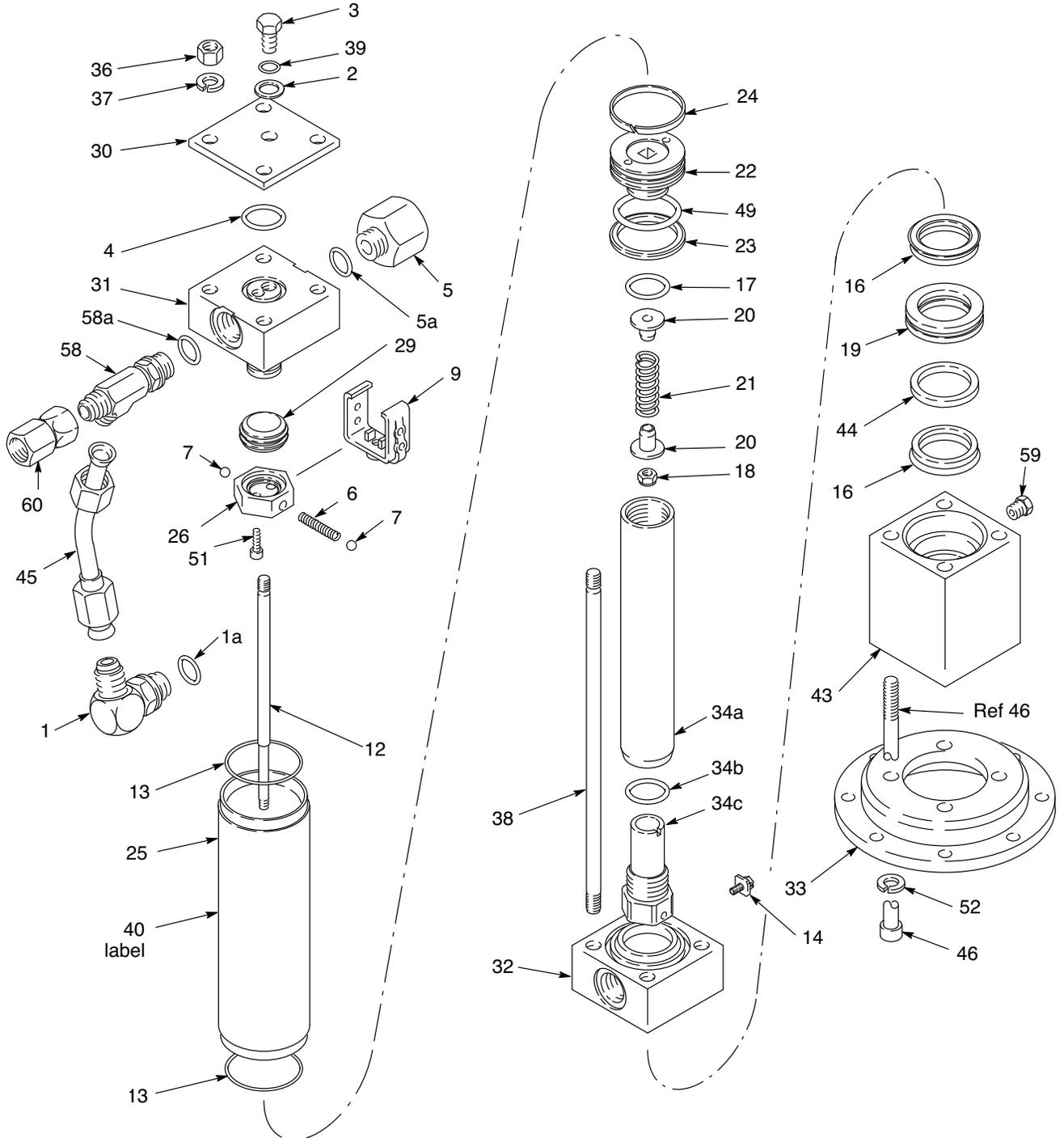
### Reassembly

1. Lubricate the throat packings and install them in the outlet housing (16) one at a time as follows, *with the lips of the v-packings facing down*: the male gland (6), two neoprene v-packings (9), one UHMWPE v-packing (19), and the female gland (8). Apply thread lubricant and install the packing nut (15) loosely.
2. Lubricate the piston packings and install them onto the piston stud (14) one at a time in the following order, *with the lips of the v-packings facing up*: the female gland (27), one UHMWPE v-packing (25), one neoprene v-packing (26), one UHMWPE v-packing (25), the male gland (24), the shim (30), and the washer (23).
3. Place the flats of the displacement rod (7) in a vise and screw the piston stud (14) onto the displacement rod. Torque to 50 to 70 ft-lbs (68 to 95 N.m).
4. Slide the ball stop pin (10) into the desired set of holes and secure with the new cotter pins (1). Install the piston ball (2) in the piston mounting stud.
5. Screw the piston stud (14) onto the piston mounting stud (28). Torque to 50 to 70 ft-lbs (68 to 95 N.m).

## Repair

6. Insert the displacement rod (7) into the top of the cylinder (11), being careful not to scratch the cylinder. Insert only until the packings are in the cylinder.
7. Lubricate the o-ring and apply thread lubricant to the cylinder, then reinstall the cylinder in the outlet housing (16).
8. Install the ball (2), guide (22), o-ring (12), and ball stop pin (5) in the intake valve housing (13). Place the intake valve assembly in the cylinder (11). Apply thread lubricant to the locking ring and cylinder (11), and screw the ring onto the cylinder.
9. Reconnect the displacement pump to the reciprocator by performing the reverse of the disassembly procedure on page 13. (FIG. 7)

# Parts



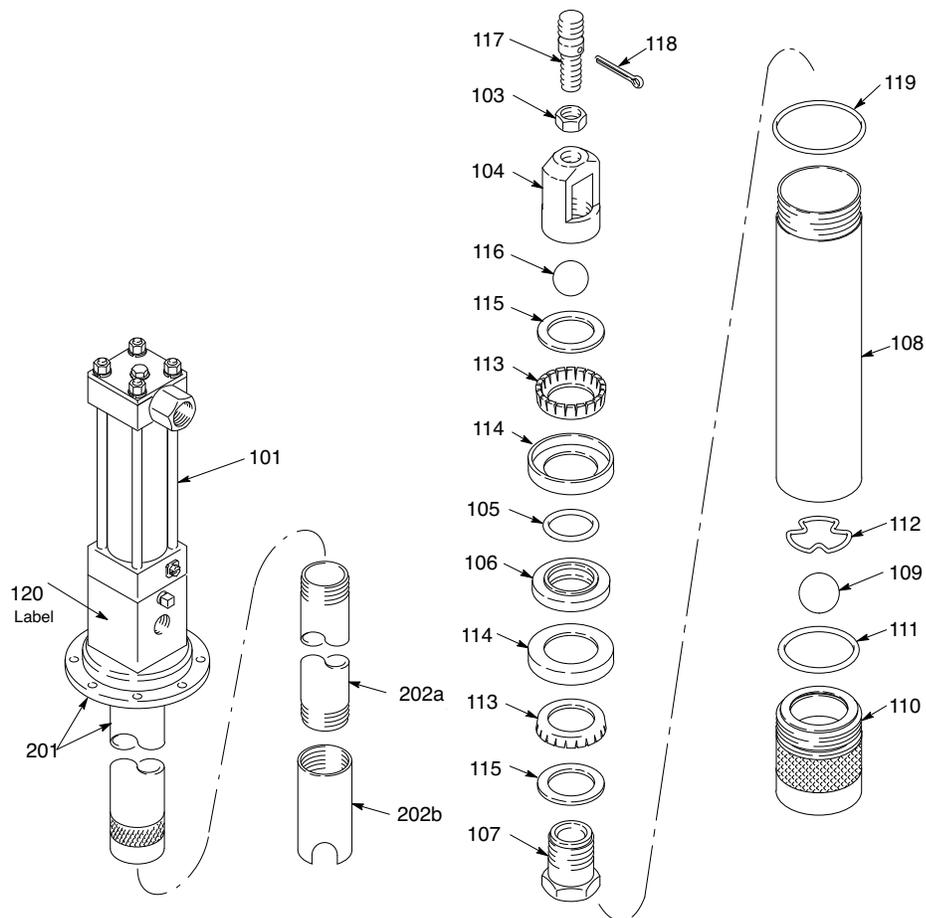
**Model 239882, Series A, Hydraulic Reciprocator**

Ref.	Part	Description	Qty.	Ref.	Part	Description	Qty.
1	106470	ELBOW, straight thread, 3/4-16 unf-2a x 3/4-16 unf-2a, 37° flare, includes item 1a	1	52	106115	LOCKWASHER, spring 3/8"	4
1a†	110987	O-RING	1	58	107197	TEE, includes item 58a	
2	178179	WASHER, sealing	1	58a†	110987	O-RING	1
3	106276	CAPSCREW, hex hd, 3/8-24 x 5/8"	1	59	110064	PLUG, pipe, vented, 1/8-27 nptf	1
4❖	104093	O-RING, nitrile rubber	1	60	112569	UNION, swivel, steel	1
5	112568	ADAPTER, pipe, 3/4 npt(f)	1	▲ <i>Replacement Danger and Warning labels, tags, and cards are available at no cost.</i>			
6	108437	SPRING, compression, steel	1	❖ <i>Parts included in Kit 223426 (purchase separately).</i>			
7	100069	BALL, 1/4" dia. steel	2	† <i>Keep these parts on hand to reduce downtime.</i>			
9	189007	YOKE, valve	1	<b>Assembly tool 189305</b> required for repairing the recip- rocator.			
12	18A423	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	1				
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	1				
24❖	178207	BEARING, piston, bronze-filled PTFE	1				
25	178229	CYLINDER, motor, cs	1				
26	192654	STOP, valve, cs	1				
29	192654	SLEEVE, valve, steel	1				
30	178181	PLATE, cap	1				
31	239874	SPOOL VALVE ASSEMBLY	1				
32	186225	CAP, cylinder, bottom, cs	1				
33	183833	BASE, aluminum	1				
34	222301	DISPLACEMENT ROD ASSEM- BLY, contacts 34a to 34c					
34a	118078	ROD, displacement	1				
34b	105765	PACKING, o-ring	1				
34c	178232	STOP, displacement rod	1				
36	100307	NUT, full, hex, 3/8-16 unc-2b	4				
37	100133	LOCKERWASHER, 3/8"	4				
38	187405	ROD, tie, 8.5" shoulder to shoul- der, 3/8-16 unc-2a, cs	4				
39	155685	O-RING					
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				

**Model 224741, Series C, Universal 1:1 Ratio Pump, Includes items 101 to 120**  
**Model 224742, Series C, Hydraulic Reciprocator, Includes items 201 and 202**

Ref.	Part	Description	Qty	Ref.	Part	Description	Qty
101	239882	HYDRAULIC RECIPROCATOR, see parts on page 19	.	117	183529	ROD, connecting	1
103	100111	NUT, hex jam, 1/2-20	1	118	100103	PIN, cotter, 0.125" (3.2 mm) dia, 1.5" (38 mm) long	1
104	157184	HOUSING, piston	1	119	108993	O-RING, buna-N	1
105†	154662	O-RING, buna-N	1	120	183741	LABEL	1
106	158857	SPACER, fluid piston packing	1	201	224741	1:1 RATIO DYNA-STAR RECIPROCATOR PUMP, See 101 through 120	.
107	156989	SEAT, piston	1	202	222346	DROP TUBE, includes items 202a and 202b	1
108	183010	CYLINDER, displacement	1	202a	185151	TUBE	1
109	101190	BALL, steel, 1" (25 mm) dia	1	202b	110127	SPACER, foot	1
110	183009	BODY, valve	1				
111	156633	O-RING, nitrile rubber	1				
112	157182	RETAINER, ball	1				
113†	171590	WASHER, spreader	2				
114†	158402	PACKING, leather cup	2				
115†	171594	WASHER, back-up	2				
116	100279	STEEL, ball 0.88" (22.2 mm) dia	1				

❖ Parts included in Kit 223426 (purchase separately).  
 † Keep these parts on hand to reduce downtime.

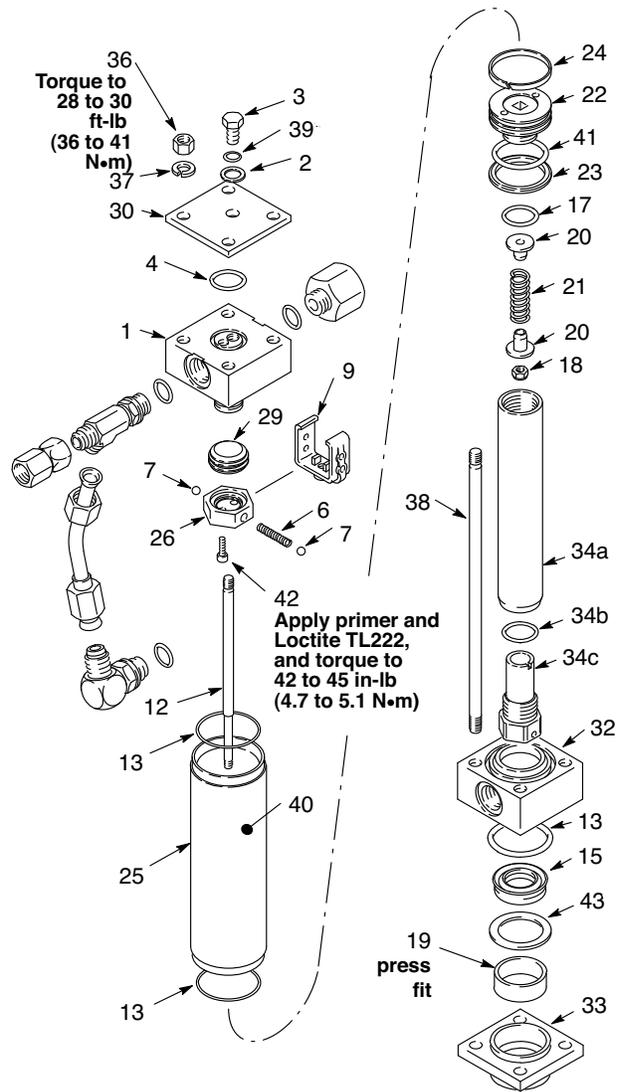


**Model 237653, Series B**

Ref.	Part	Description	Qty
1	239874	CYLINDER CAP ASSY, upper	1
2	178179	WASHER, sealing	1
3	106276	CAPSCREW, hex hd, 3/8" thd x 0.625" long	1
4*	104093	O-RING, nitrile rubber	1
6*	108437	SPRING, compression, steel	1
7*	100069	BALL, steel, 1/4" dia	2
9	189007	YOKE, valve	1
12	18A423	ROD, trip	1
13*	106274	O-RING, buna-N	3
15*	109194	V-PACKING, block	1
17*	105765	O-RING, buna-N	2
18*	114231	LOCKNUT, hex, 1/4-28 unf-3b, steel/nylon	1
19	178185	BEARING, sleeve	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
32	178235	CAP, cylinder, bottom	1
33	178233	RETAINER, housing	1
34	222301	DISPLACEMENT ROD ASSY, includes 34a to 34c	1
34a	188078	ROD, displacement	1
34b	105765	PACKING, o-ring	1
34C	178232	STOP, displacement rod	1
36	106292	NUT, hex, 3/8" thread	4
37	100133	WASHER, lock, 3/8"	4
38	178228	ROD, tie, 12/28" (312 mm), cs	4
39*	155685	O-RING, buna-N	1
40▲	179885	LABEL, warning	1
41*	108014	O-RING, buna-N	1
42		CAPSCREW, sch, 10-24 unrc-3a x 5/8"	1
43*	183915	WASHER	1

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

\* Parts included in Kit 218210 (purchase separately).

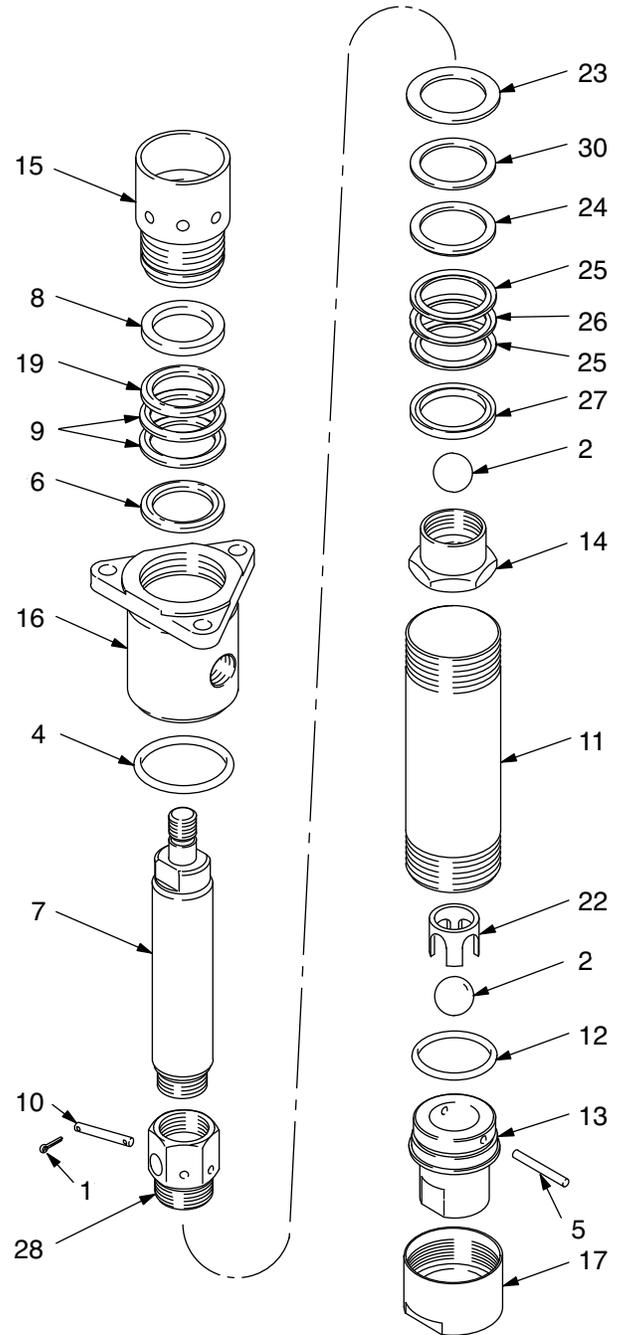


**Model 237653, Series B**

**NOTE:** Reciprocator/pump Model 237653, Series B, has displacement pump Model 224344, Series F, which is shown here.

Ref.	Part	Description	Qty
1★	100063	PIN, cotter, 1/16" x 1/2", sst	2
2★	101917	BALL, 0.875" (22 mm), sst	2
4	164782	O-RING, PTFE	1
5★	162947	PIN, ball stop, intake, sst	1
6★	186987	GLAND, throat, male, sst	1
7	186997	ROD, displacement, sst	1
8★	186988	GLAND, throat, female, sst	1
9★	166133	V-PACKING, throat, female, sst	2
10★	176637	PIN, ball stop, piston, sst	1
11	186994	CYLINDER, sst	1
12	164846	O-RING, PTFE	1
13	186992	HOUSING, valve, intake, sst	1
14	186993	STUD, piston, sst	1
15	186995	PACKING NUT/WET-CUP, sst	1
16	205999	HOUSING, outlet, sst	1
17	164630	RING, locking, sst	1
19★	170625	V-PACKING, throat, UHMWPE	1
22	164679	GUIDER, ball, intake, sst	1
23★	176634	WASHER, piston, sst	1
24★	186990	GLAND, piston, male, sst	1
25★	176638	V-PACKING, piston, UHMWPE	2
26★	111293	V-PACKING, piston, neoprene	1
27★	186989	GLAND, piston, female, sst	1
28	176644	STUD, mounting, piston, sst	1
30★	111790	SHIM, sst	1

★ Parts included in Kit 224402 (purchase separately).



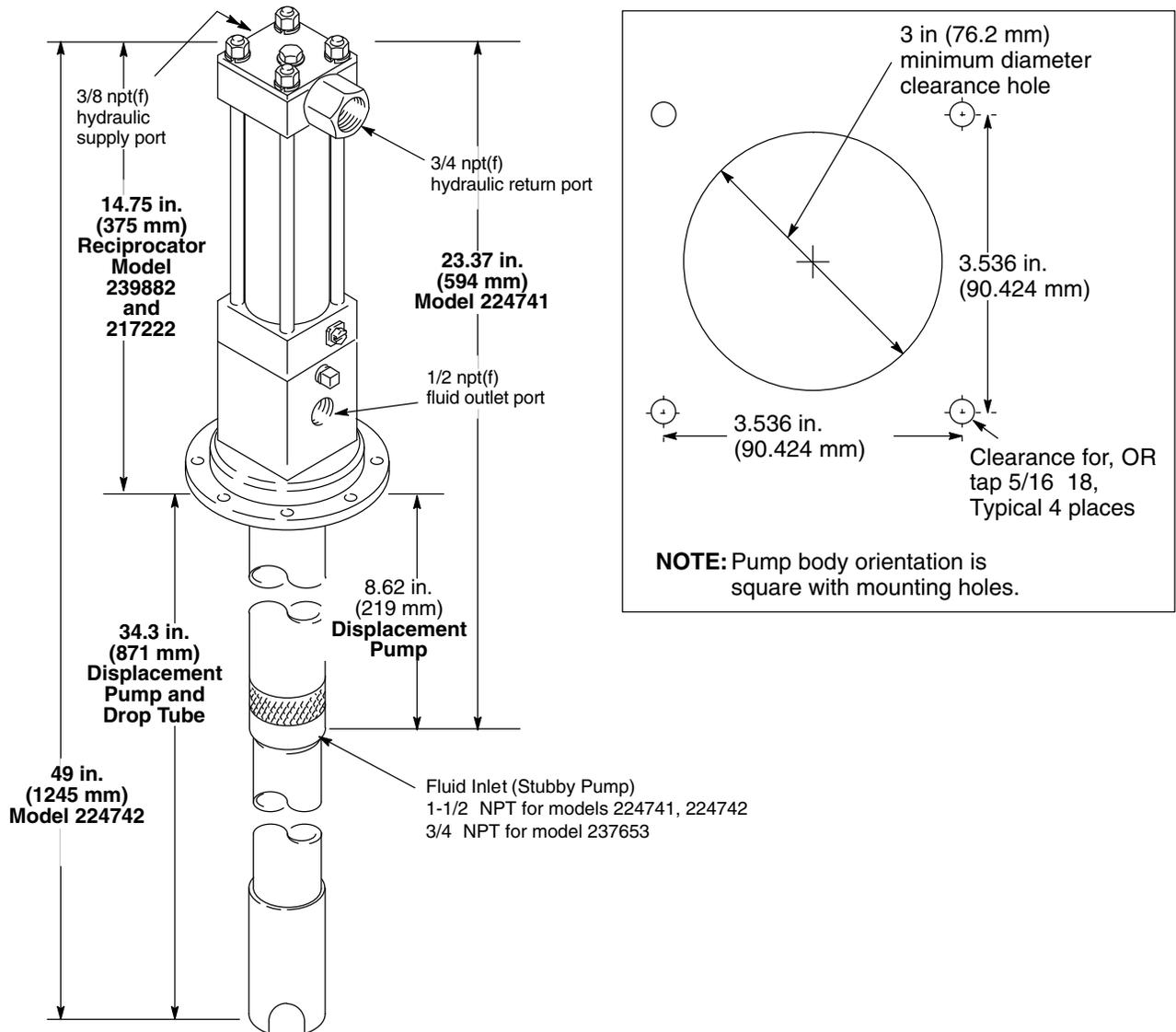
# Technical Data

<b>Dyna-Star™</b>		
	<b>US</b>	<b>Metric</b>
Maximum Hydraulic Fluid Input Pressure and Maximum Fluid Output Pressure		
Models 239882, 224741, and 224742	1500 psi	10 MPa, 102 bar
Model 237653	1000 psi	6.9 MPa, 69 bar
Maximum Hydraulic Fluid Input Volume	6 gpm	11.7 lpm
Fluid Consumption Rate	6.5 ounces per cycle or 1 gallon per 19.5 cycles	0.195 liters per cycle or 1 gallon per 19.5 cycles
Maximum Fluid Temperature	130°F	55°C
Pressure Reducing Valve Adjustment Range	50 to 1500 psi	0.34 to 10 MPa, 3.4 to 102 Bar
Effective Piston Area	1.48 in. <sup>2</sup>	9.55 cm. <sup>2</sup>
Piston Rod Diameter	1.375 in.	34.9 mm
Output Per Cycle	0.055 gpm with No. 30 oil at 60 cpm	
Stroke	4 in.	101.6 mm
Thrust at 1000 psi (6.9 MPa, 69 bar)	1480 lb	673 kg
Maximum Suction Lift	13 ft	4 m
Displacement Pump Wetted Parts	Steel, Copper, Leather	
Weight	24 lb	11kg
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



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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.

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**TO PLACE AN ORDER**, contact your Graco distributor or call to identify the nearest distributor.

**Phone:** 612-623-6928 or **Toll Free:** 1-800-533-9655, **Fax:** 612-378-3590

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*For patent information, see [www.graco.com/patents](http://www.graco.com/patents).*

Original instructions. This manual contains English. MM 308155

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**International Offices:** Belgium, China, Japan, Korea

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