

# Dyna-Star™ Hydraulic Reciprocator and Pump

308156R  
EN

For lubricating fluids only. For professional use only.

## 5:1 Ratio Universal Pump and Reciprocator

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

7500 psi (51 MPa, 517 bar) Maximum Fluid Outlet Pressure

### Model 224912, Series C

35 lb. pail size

### Model 224751, Series C

120 lb. drum size

### Model 224752, Series C

400 lb. drum size

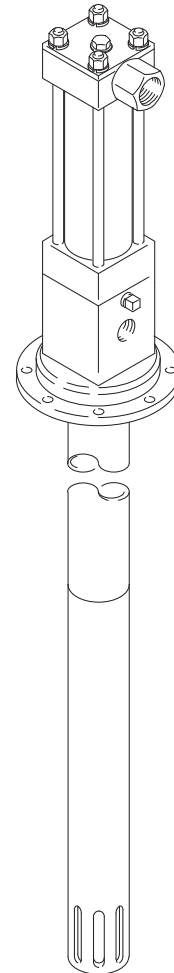
### Model 239883, Series A

reciprocator only



### Important Safety Instructions

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






# Contents

<b>Warnings</b> .....	<b>3</b>
<b>Installation</b> .....	<b>5</b>
Grounding .....	5
Pump Accessories .....	7
Hydraulic System .....	7
Hydraulic Power Supply .....	7
Hydraulic Lines .....	8
<b>Operation</b> .....	<b>9</b>
Pressure Relief Procedure .....	9
Before Starting the Pump .....	9
To Start the Pump .....	9
Shutdown .....	10
If the Pump Leaks at the Fluid Fittings .....	10
<b>Troubleshooting</b> .....	<b>11</b>
<b>Repair</b> .....	<b>12</b>
Replacing the Throat Seals .....	12
Disconnecting the Reciprocator and Displacement Pump .....	13
Reciprocator Repair .....	13
Displacement Pump Repair .....	18
<b>Parts - Displacement Pumps</b> .....	<b>20</b>
Parts - Reciprocator .....	21
<b>Technical Data</b> .....	<b>24</b>
<b>Dimensions and Mounting Hole Layout</b> .....	<b>25</b>
<b>Graco Standard Warranty</b> .....	<b>26</b>

# 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.

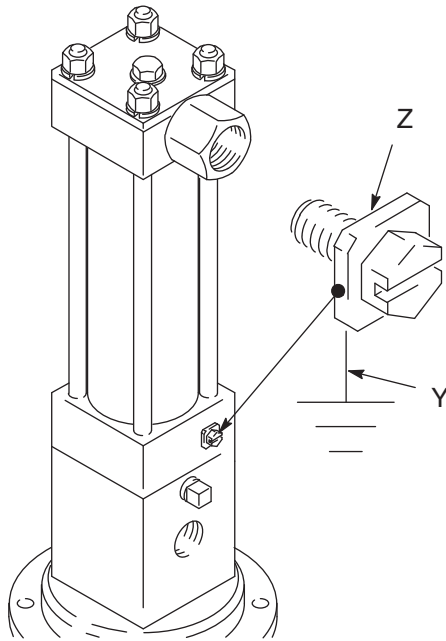
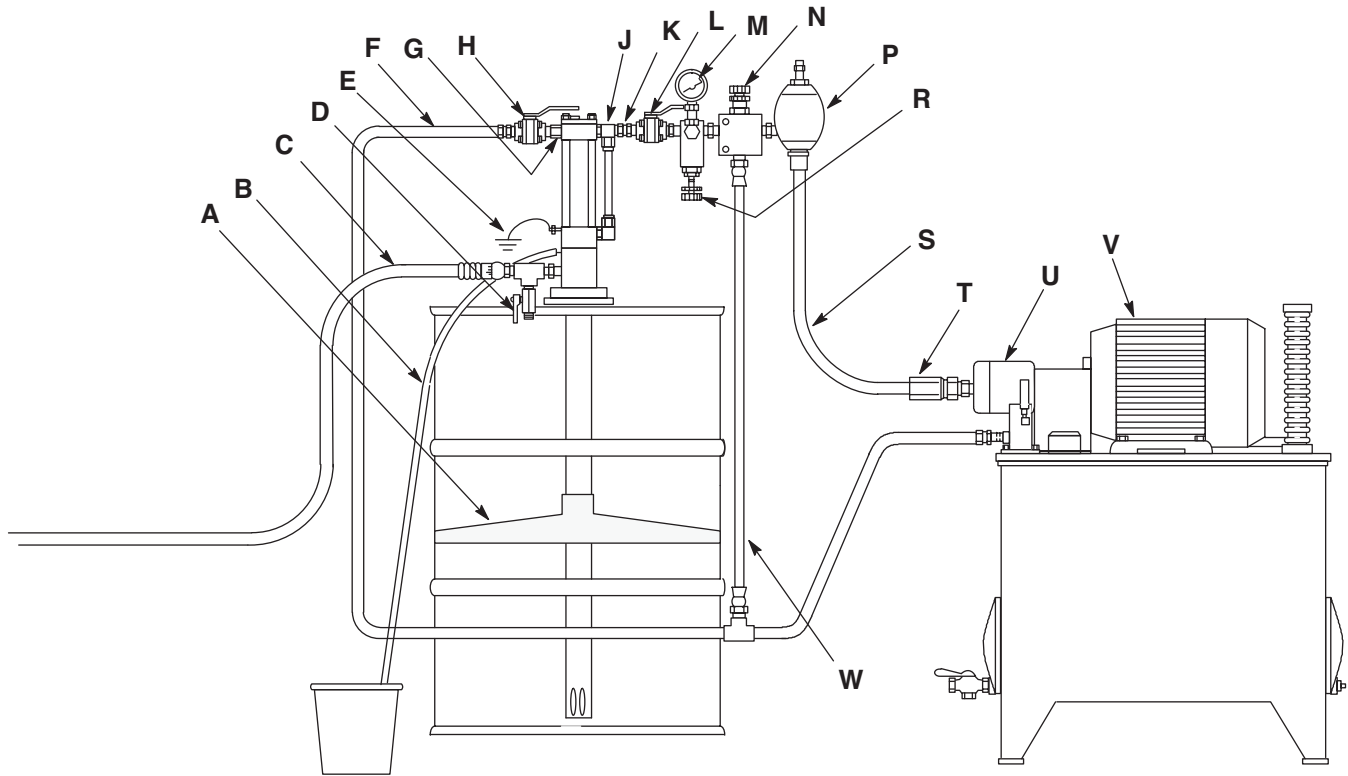


FIG. 1

**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 | Follow-up plate                                     | 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                            |   |  |
| K | Tee, 3/4 npt  |   |  |
| 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><b>Maximum Working Pressure of Accessories</b>                  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.</p> <p>All accessories added to the pump fluid outlet side must have at least a 7500 psi (51 MPa, 517 bar) maximum working pressure.</p>						

## 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.

<b>NOTICE</b>
<p><b>Pump Outlet Drain Valve</b>                  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.</p>


## 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>						

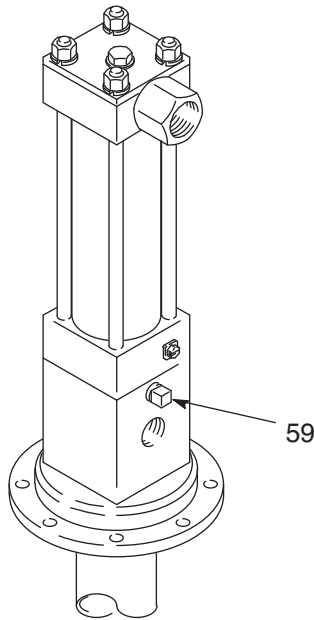
The hydraulic power supply system (V) must have a pressure reducing valve and a pressure-compensated flow control. A flow control valve (R) is required to limit the incoming flow to the reciprocator to a maximum of 3 gpm (11 lpm).

**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: 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. (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 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 supply.
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.

### NOTICE

Always use Graco approved hydraulic oil or equivalent, Part No. 169236 (5 gallon) or 207428 (1 gallon). Do not substitute lower grade oil.

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 24. 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). Increasing the inlet pressure increases the outlet pressure. Decreasing the inlet pressure decreases the outlet pressure.
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.

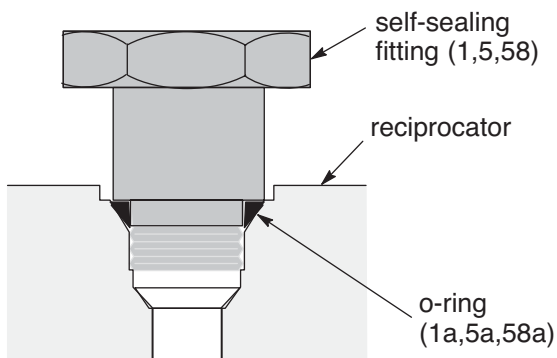
## Shutdown



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

## 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**

# Troubleshooting



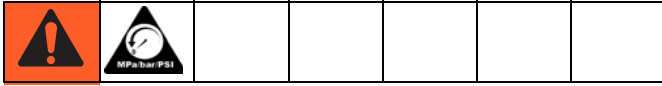
1. Follow **Pressure Relief Procedure**, page 9, before checking or repairing gun.
2. Check all possible problems and causes before disassembling gun.

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 19.
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. 5 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. 5.
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.

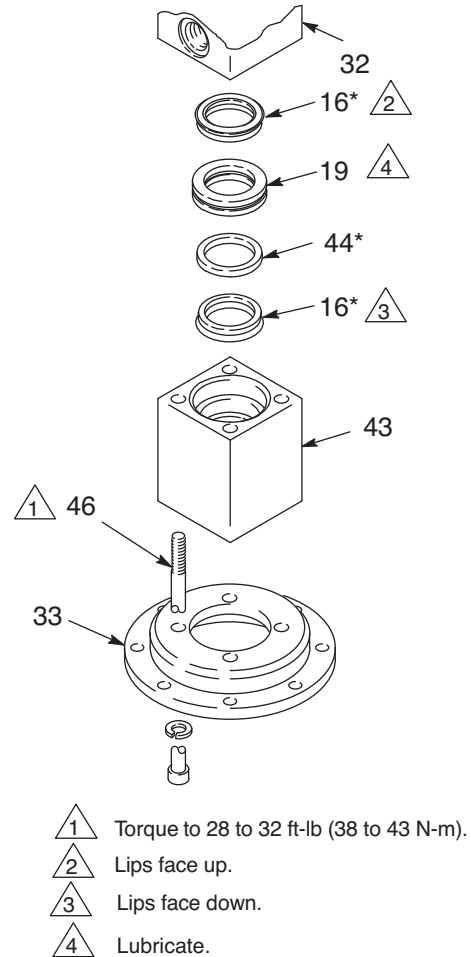


FIG. 5

### 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. 6 for the following instructions.



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

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 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 (35) down as far as it will go.
7. Remove the cotter pin (204) from the bottom of the displacement rod assembly (34), and unscrew the connecting rod until it is free.

**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).

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

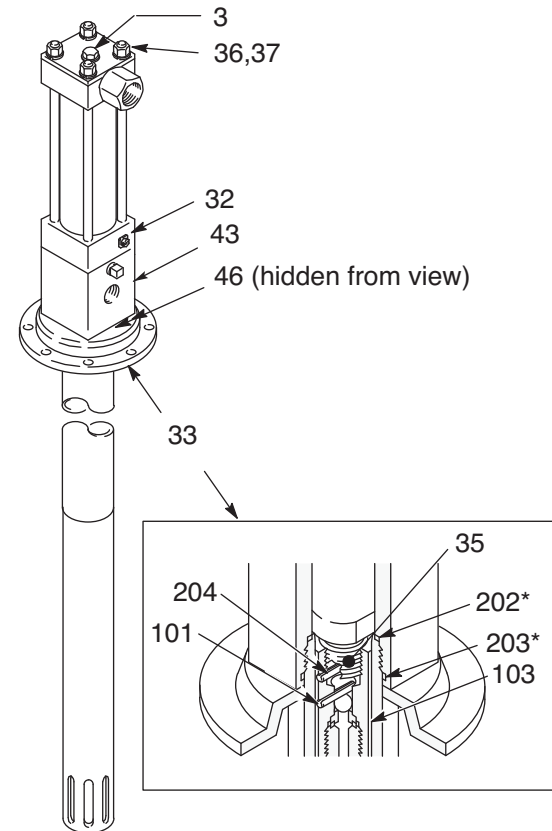


FIG. 6

## Reciprocator Repair

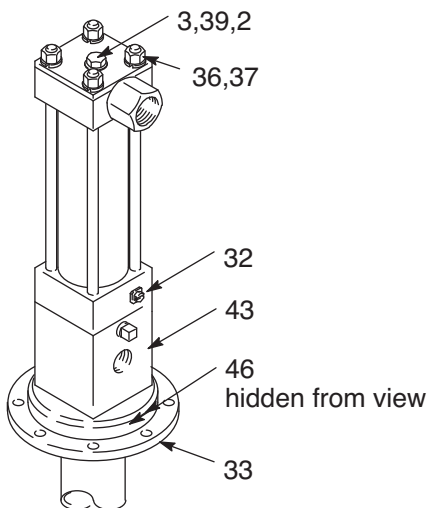
### NOTE:

- 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 self life is within the manufacturer's recommendations.

**NOTE:** Use Loctite® 609 on yoke (9) and rod (12) on page 14, step 10 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. 7. 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. 7)
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)
4. Remove the capscrew (3), nuts (36) and lockwashers (37) on top of the reciprocator. See FIG. 7.



**FIG. 7**

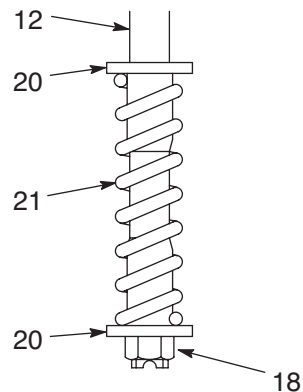
**NOTE:** See FIG. 9 for steps 4 to 20, except where noted.

5. Tap on the bottom of the displacement rod (34) with a plastic mallet to loosen the cylinder (25).
6. 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.

7. 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.
8. 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.

9. 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. 8)



**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).

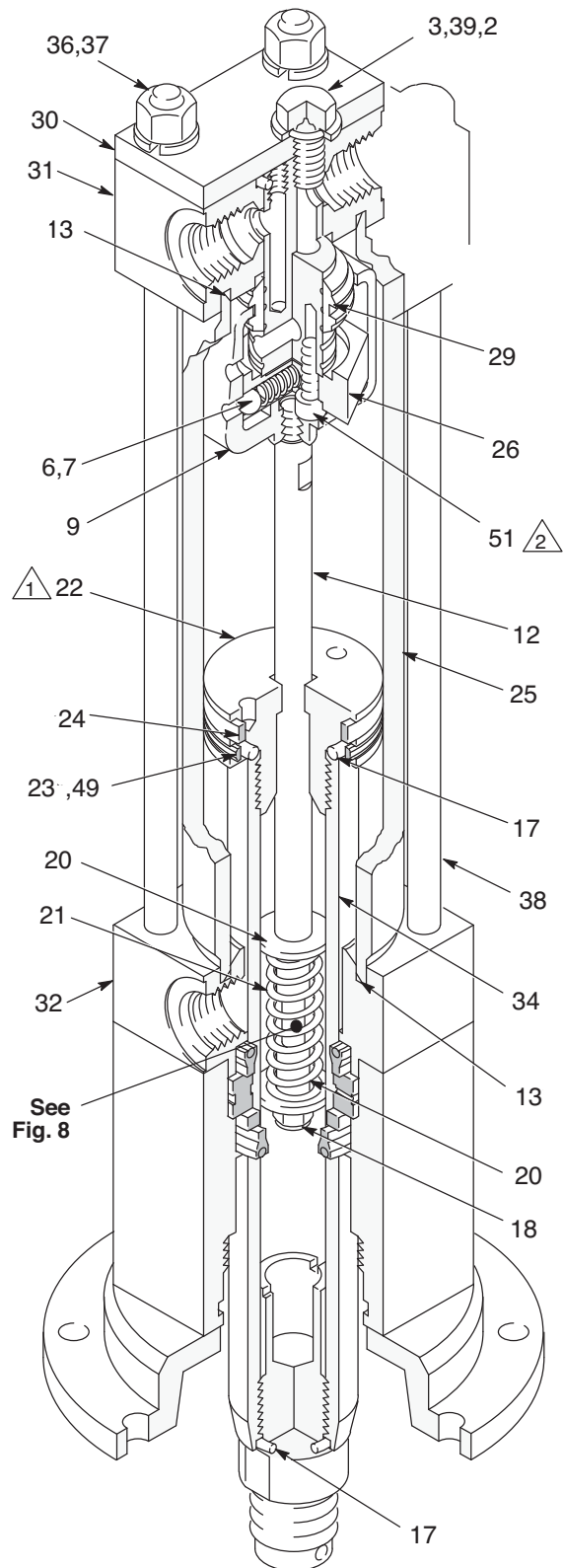
Thread sealant and primer are required. See Reciprocator Repair Notes on page 13 for specifications. Loctite® 609 is used only in STEP 10.

10. 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 54 to 56 in-lbs (6.1 to 6.3 N.m). Remove excess sealant. *Allow 24 hours to cure before operating the reciprocator.*

11. 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 it dry for three or four minutes, assemble, and remove excess sealant. *Allow 24 hours for the thread sealant to cure before you operate the reciprocator.*
12. Remove the o-ring (13) from the bottom of the spool valve assembly (31), and replace it with a new o-ring.
13. 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).

**NOTICE**

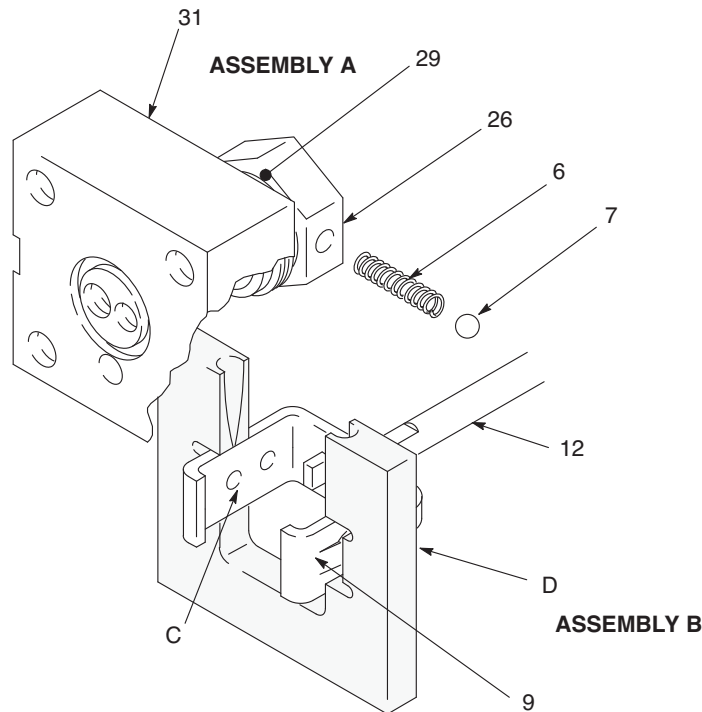
When inserting the piston into the cylinder, carefully guide the piston seal (23) and bearing (24) to prevent damaging these parts.



1 Torque to 30 to 40 ft-lb (41 to 54 N-m)

2 Torque to 42 to 45 in-lb (4.7 to 5.1 N-m)

**FIG. 9**



**FIG. 10**

14. Lay Assembly A and Assembly B on the work bench. (FIG. 10)
15. 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. 10)
16. 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. (FIG. 10)
17. 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. 10) Slide the tool (D) back over the rod (12) to remove it.
18. Place the adapter (43) in a vise, and install the seals as described on page 12. Install the cylinder cap (32). (FIG. 12)
19. 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. 12)

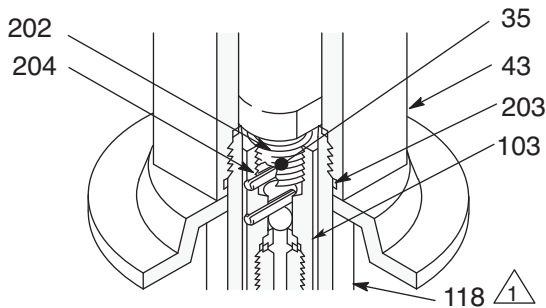
- NOTE:** When reinstalling the cylinder (25), be sure the "P" port in the valve spool (31) and the port in the bottom cylinder cap (32) are in line with each other. Be sure the o-rings (13) are in place in the valve spool and cylinder cap.
20. Place the cylinder (25) on the cylinder cap (32). Install the piston (22) and valve assembly (31).
  21. 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. 12)
  22. 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.



23. 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 20.
24. Pull the displacement rod (34) in and out to be sure it moves easily. (FIG. 12)
25. 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. (FIG. 11)

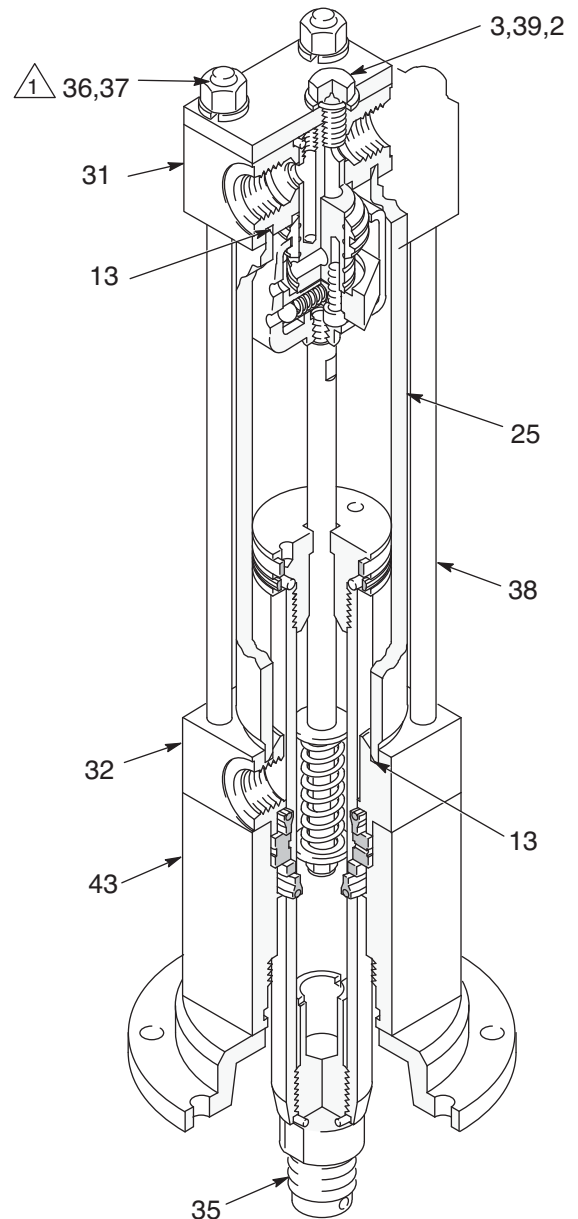


1 Torque to 150 to 160 ft-lb (205 to 220 N-m)

**FIG. 11**

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>					



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

**FIG. 12**

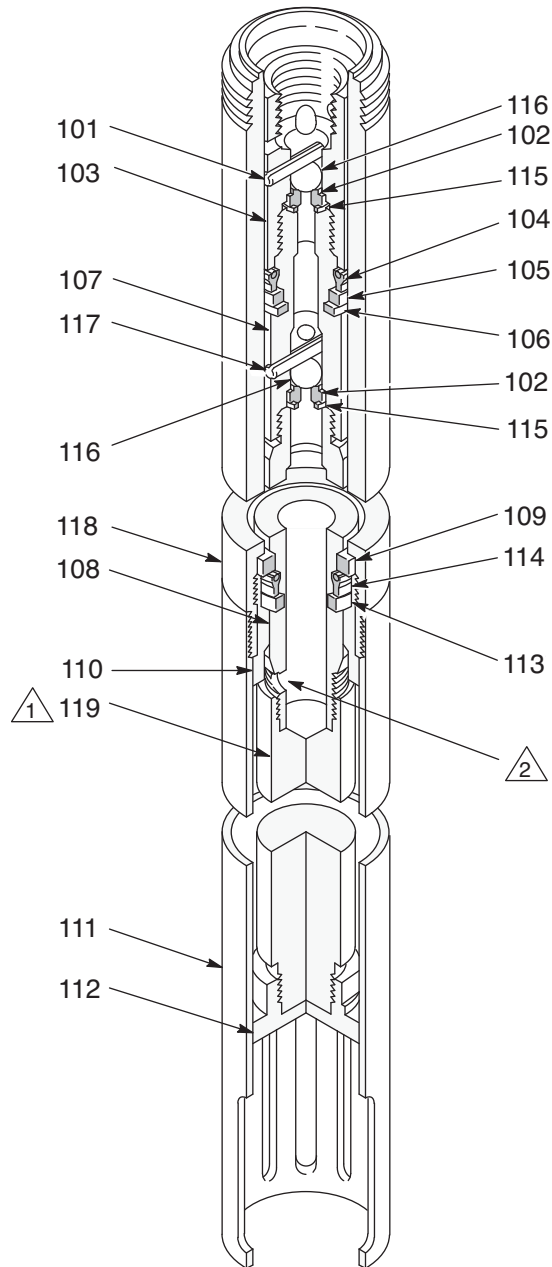
# Displacement Pump Repair



## Disassembly

Refer to FIG. 13.



1. If possible, flush the pump. Relieve the pressure, see Pressure Relief Procedure, page 9.
2. Follow Disconnecting the Reciprocator and Displacement Pump procedure on page 13.
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) cause premature packing wear and leaking.



-  Only used on Models 223513 and 223514.
-  Insert 1/4" dia. rod through hole to hold priming tube (108) when removing or installing parts connected to it.

**FIG. 13**

## Reassembly

Refer to FIG. 14. for the following instructions.

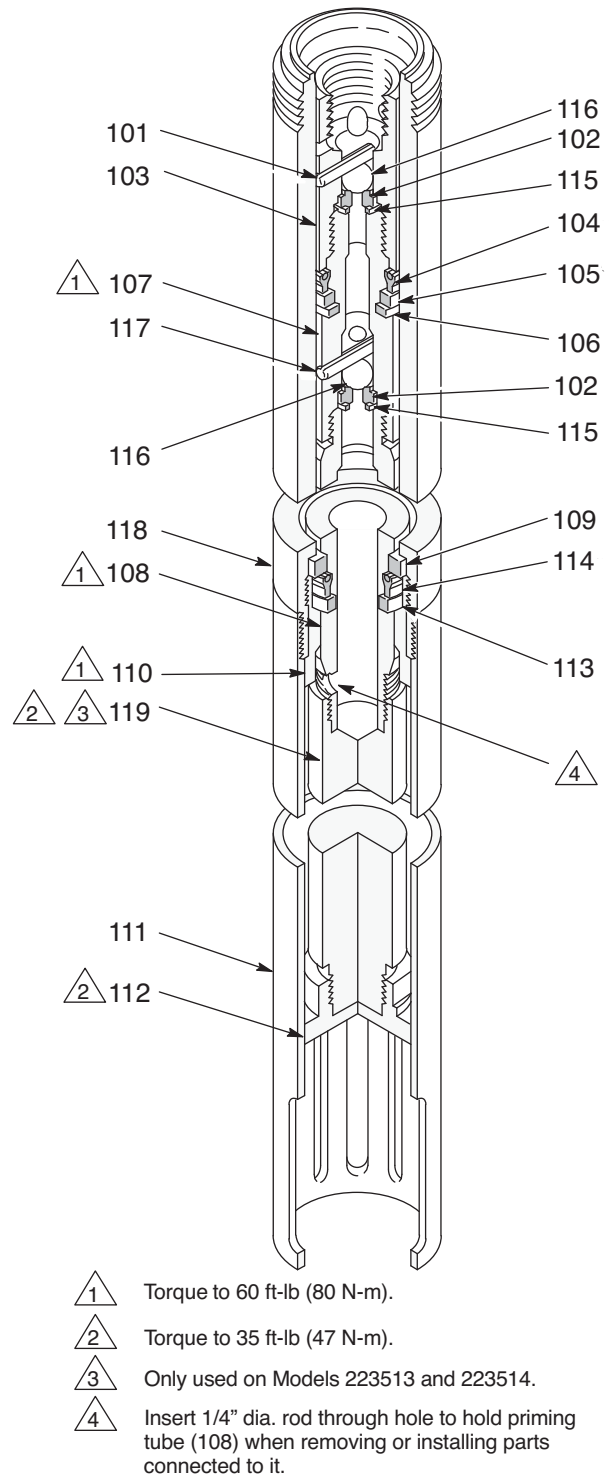


### NOTE:

- The balls (116) cannot be re-seated on the hardened seats (102). The seats can be reversed and used a second time however.

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-lbs (80 N.m).
3. Turn the pump piston (107) over in the vise and insert the ball (116), seat (102), and gasket (105).
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-lbs (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-lbs (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-lbs (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.



**FIG. 14**

# Parts - Displacement Pumps

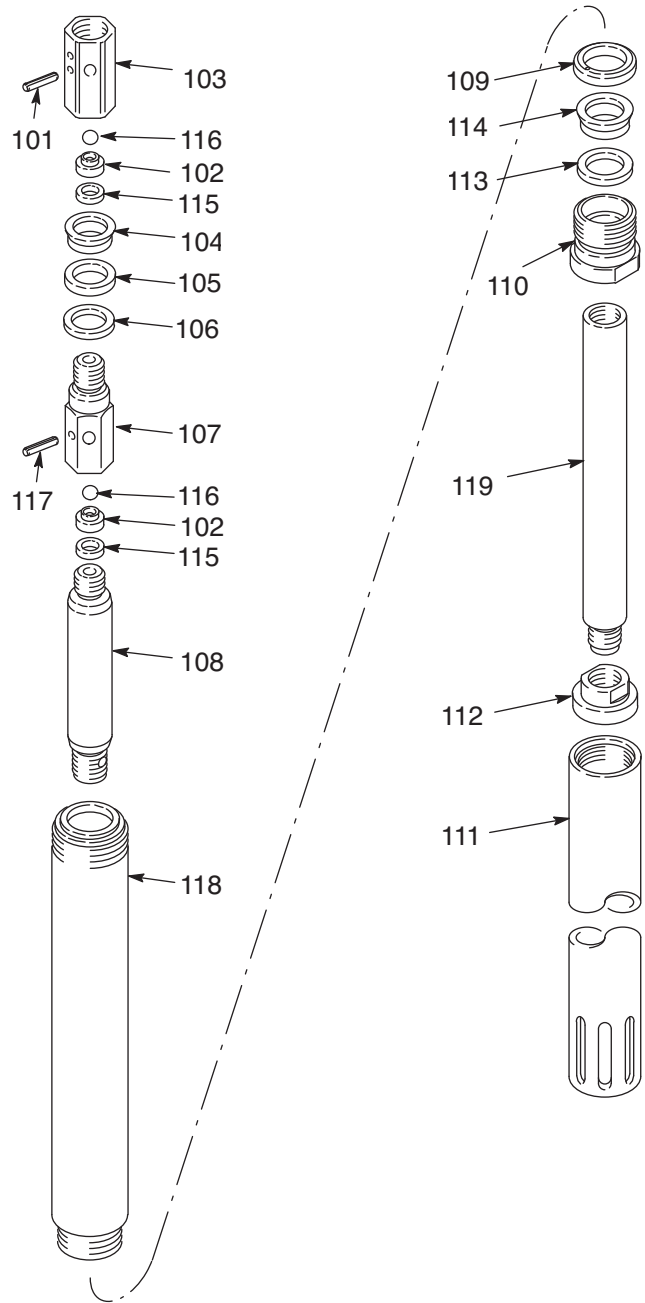
**Model 223513, Series A, 120 lb,** Includes items 101 to 119

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

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

Ref.	Part	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, back up	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	183673	CYLINDER, priming, model 223513	1
	185999	CYLINDER, priming, model 223514	1
	187312	CYLINDER, priming, model 224914	1
112	183672	PISTON, priming	1
113†	108988	SEAL, back up	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	186002	ROD, piston, model 223513	1
	185998	ROD, piston, model 223514	1

† Parts included in Kit 223427 (purchase separately).



## Parts - Reciprocator

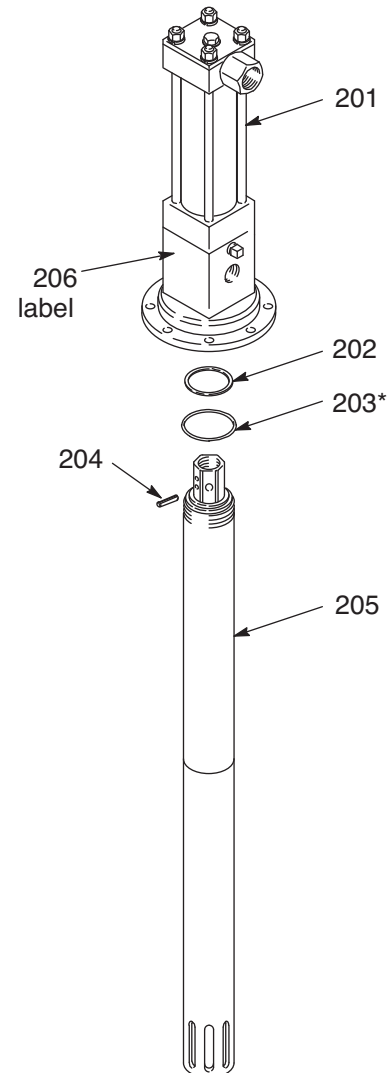
**Model 224752, Series C, 400 lb drum size**

**Model 224751, Series C, 120 lb drum size**

**Model 224912, Series C, 35 lb drum size**

Ref.	Part	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 20, model 224752 and 224912	1
	223513	DISPLACEMENT PUMP, see page 20, model 224751 only	1
206	183741	LABEL, identification	1

\* Parts included in Kit 223426 and 223427 (purchase separately).



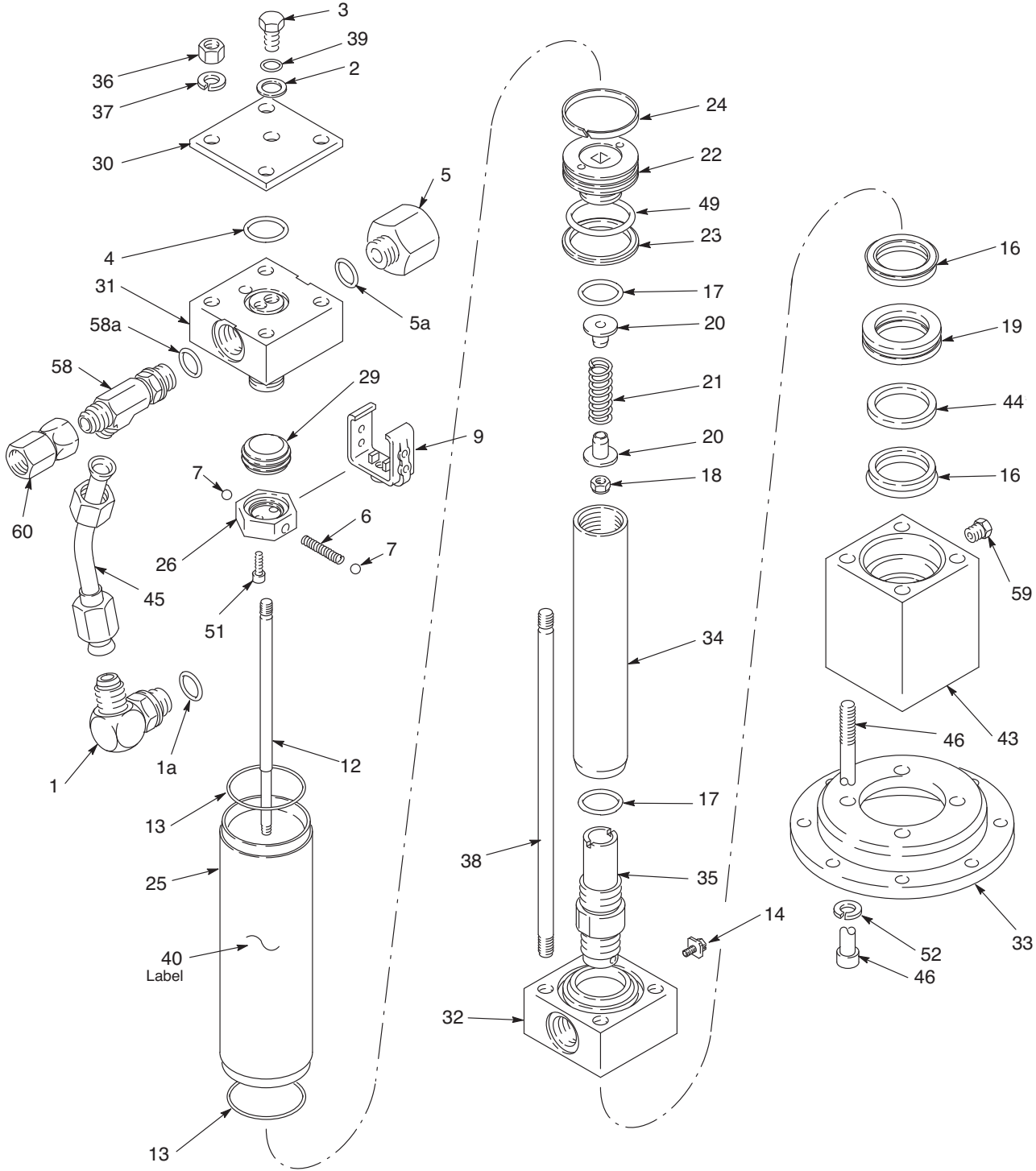
**Model 239883, Series A, Includes items 1 to 60**

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
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, nitrile rubber	1
5	112568	ADAPTER, pipe, 3/4 unf(m), 1/2 npt(f), steel, includes item 5a	1
5a	10987	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	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, 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	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	LOCKERWASHER, 3/8"	4
38	187405	ROD, tie, 8.5" shoulder to shoulder, 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
52	106115	LOCKWASHER, spring 3/8"	4
58	107197	TEE, includes item 58a	
58a	110987	O-RING	1
59	110064	PLUG, pipe, vented, 1/8-27 nptf	1
60	112569	UNION, swivel, steel	1

❖ *Parts included in Kit 223426 (purchase separately).*

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

**Assembly Tool 189305** required for repair the reciprocator.



# Technical Data

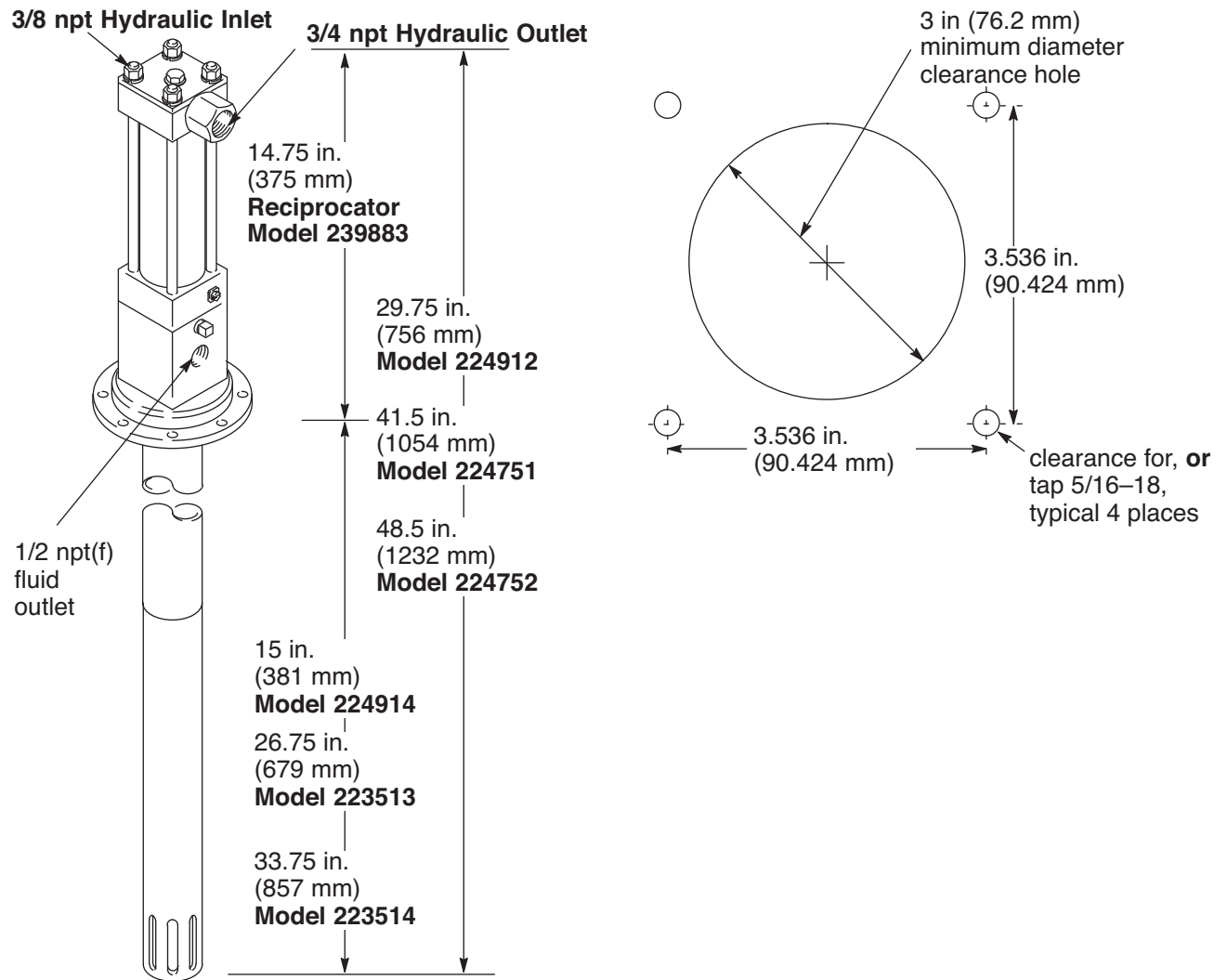
<b>Dyna-Star™</b>		
	<b>US</b>	<b>Metric</b>
Maximum Hydraulic Fluid Input Pressure	1500 psi	10 MPa, 102 bar
Maximum Grease Output Pressure	7500 psi	51 MPa, 517 bar
Maximum Hydraulic Fluid Input Volume	3 gpm	11.7 lpm
Hydraulic Fluid Consumption Rate	6.5 ounces per cycle or 1 gallon per 19.5 cycles	0.195 liters per cycle or 1 gallon per 19.5 cycles
Maximum Fluid Temperature	130°F	55°C
Effective Piston Area	1.48 in. <sup>2</sup>	9.55 cm. <sup>2</sup>
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; at 3000 psi: 4 lb/min	With No. 2 grease at 60 cpm free flow: 2.25 kg /min; at 21 MPa, 21 bar: 1.8 kg/min
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, polyurethane, buna-N, polyester elastomer	
Weight		
Model 224752	42 lb	18.9 kg
Model 224751	37.5 lb	1639 kg
Model 224912	32.5 lb	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



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Original instructions. This manual contains English. MM 308156

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