



This manual contains important
warnings and information.
READ AND KEEP FOR REFERENCE.

INSTRUCTIONS

First choice when
quality counts.™

Rev. N
Supersedes Rev. M

50:1 RATIO DOUBLE ACTING

Eagle™ Grease Pump

FOR LUBRICATING PRODUCTS ONLY

7500 psi (52 MPa, 517 bar) Maximum Fluid Working Pressure

150 psi (0.9 MPa, 10 bar) Maximum Air Input Pressure

Model 235-888, Series C

35 lb (16 kg) Pail Size

Model 235-889, Series C

120 lb (55 kg) Drum Size

Model 235-890, Series C

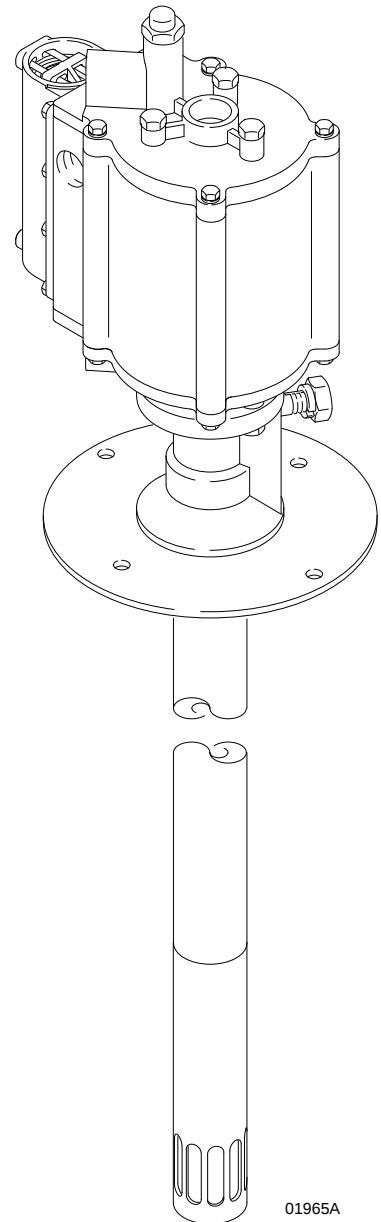
400 lb (180 kg) Drum Size

U.S. Patent No. 5,147,188

R.O.C New Invention Patent No. 075540

Australian Patent No. 672050

Other Foreign Patents Pending



01965A

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Table of Contents

Warnings	2	Parts Drawing	26
Introduction	5	Parts List	27
Installation	6	Technical Data	28
Operation	10	Dimensions and Mounting Hole Layout	29
Troubleshooting Chart	12	Performance Charts	30
Service	14	Graco Standard Warranty	32
		Graco Phone Number	32

Symbols

Warning Symbol



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

Caution Symbol



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

! WARNING



INSTRUCTIONS

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.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure stated on the equipment or in the **Technical Data** for your equipment. Do not exceed the maximum working pressure of the lowest rated component in your system.
- Use fluids and solvents which 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 66°C (150°F) or below -40°C (-40°F).
- Wear hearing protection when operating this equipment.
- Do not move or lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.
- These pumps are designed to be used only in pumping non-corrosive and non-abrasive lubricants and greases. Any other use of the pump can cause unsafe operating conditions and component rupture, which can result in fluid injection or other serious injury, or fire or explosion.

WARNING



INJECTION HAZARD

Fluid dispensed from the 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 valve at anyone or at any part of the body.
- Do not put your hand or fingers over the spray nozzle.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Do not “blow back” fluid; this is not an air spray system.
- Always have the tip guard and the trigger guard on the gun/valve when dispensing.
- Be sure the valve trigger safety operates before dispensing.
- Lock the valve trigger safety when you stop dispensing.
- Follow the **Pressure Relief Procedure** on page 10 if the nozzle 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, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.



MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before checking or servicing the equipment, follow the **Pressure Relief Procedure** on page 10 to prevent the equipment from starting unexpectedly.

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 6.
- 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.



TOXIC FLUID HAZARD

Hazardous fluid 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.
- The air motor exhausts any fluids added to the input air, such as oil or antifreeze.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Introduction

WARNING

These pumps are designed to be used only in pumping non-corrosive and non-abrasive lubricants and greases. Any other use of the pump can cause unsafe operating conditions and component rupture, which can result in fluid injection or other serious injury, or fire or explosion.

NOTE: Be sure that all operators read and understand this entire manual and any separate manuals supplied with components and accessories before using this equipment.

NOTE: Reference numbers and letters used in the text refer to the callouts in the figures and the parts drawing.

Terms

WARNING: Alerts the user to avoid or correct conditions that could cause serious injury.

CAUTION: Alerts the user to avoid or correct conditions that could cause damage to or destroy equipment.

NOTE: Identifies helpful procedures and information.

DISPENSE VALVE: Any fluid dispensing device that can be triggered on and off.

Component Description

This equipment consists of two major components: the air motor (1) and the displacement pump (100). See Fig. 1. The pump is an in-line design, which means that the displacement pump screws directly into the motor, without the use of tie rods or couplers. The displacement pump can be placed directly in the fluid being pumped.

The pump is available in three different lengths, based on the size of the fluid container. Refer to the front cover for available sizes. The pumps differ only in length; operation and packings are the same. All three pumps use Model 235–887 Air Motor.

Make sure the muffler (36) is securely installed in the exhaust port (N) before you operate the pump. See Fig. 1.

CAUTION

Never run the pump without the muffler installed.

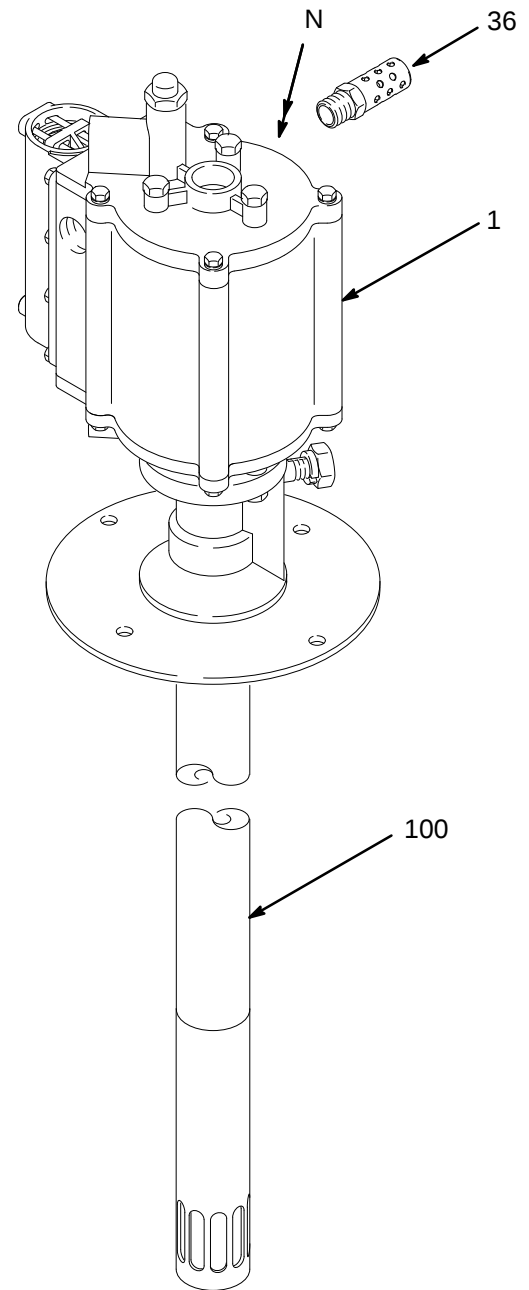


Fig. 1

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Installation

NOTE: Always use Genuine Graco Parts and Accessories, available from your Graco distributor.

Grounding

**WARNING**

**FIRE AND EXPLOSION HAZARD**
Before operating the pump, ground the system as explained below. Also read the section **FIRE OR EXPLOSION HAZARD** on page 4.

Ground all of this equipment:

- *Pump:* Use a ground wire and clamp as shown in Fig. 2. Loosen the grounding lug locknut (W) and washer (X). Insert one end of a 12 ga (1.5 mm²) minimum ground wire (Y) into the slot in lug (Z) and tighten the locknut securely. Connect the other end of the wire to a true earth ground. Order part number 222-011 Grounding Clamp and Wire.
- *Fluid hoses:* Use only grounded fluid hoses.
- *Air hoses:* Use only grounded air hoses.
- *Dispensing Valve:* Obtain grounding through connection to a properly grounded fluid hose and pump.
- *Fluid supply container:* Follow your local code.
- *Air compressor:* Follow your local code.
- *To maintain grounding continuity when flushing or relieving pressure,* hold a metal part of the spray gun firmly to the side of a grounded *metal* pail, then trigger the gun.

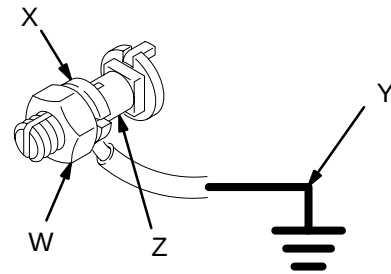


Fig. 2

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Installation

The Typical Installation shown in Fig. 3 is only a guide for selecting and installing system components and accessories. Contact your Graco distributor for assistance in designing a system to suit your particular needs.

If you supply your own accessories, be sure they are adequately sized and pressure-rated to meet the system's requirements. See the **Maximum Working Pressure** warning on page 8.

KEY

- A Pump
- B Bleed-type master air valve (required)
- C Air regulator
- D Air hose
- E Air line quick disconnect
- F Air line filter
- G Bleed-type master air valve (for accessories)
- H Main air line
- J Gun holder
- K Follow plate
- L Fluid hose
- M Dispense valve
- Y Ground wire (required)



The pump intake should be no more than 1/2 in. (13 mm) off the bottom of the fluid container.

**Model 235–889 Pump,
shown mounted on movable cart**

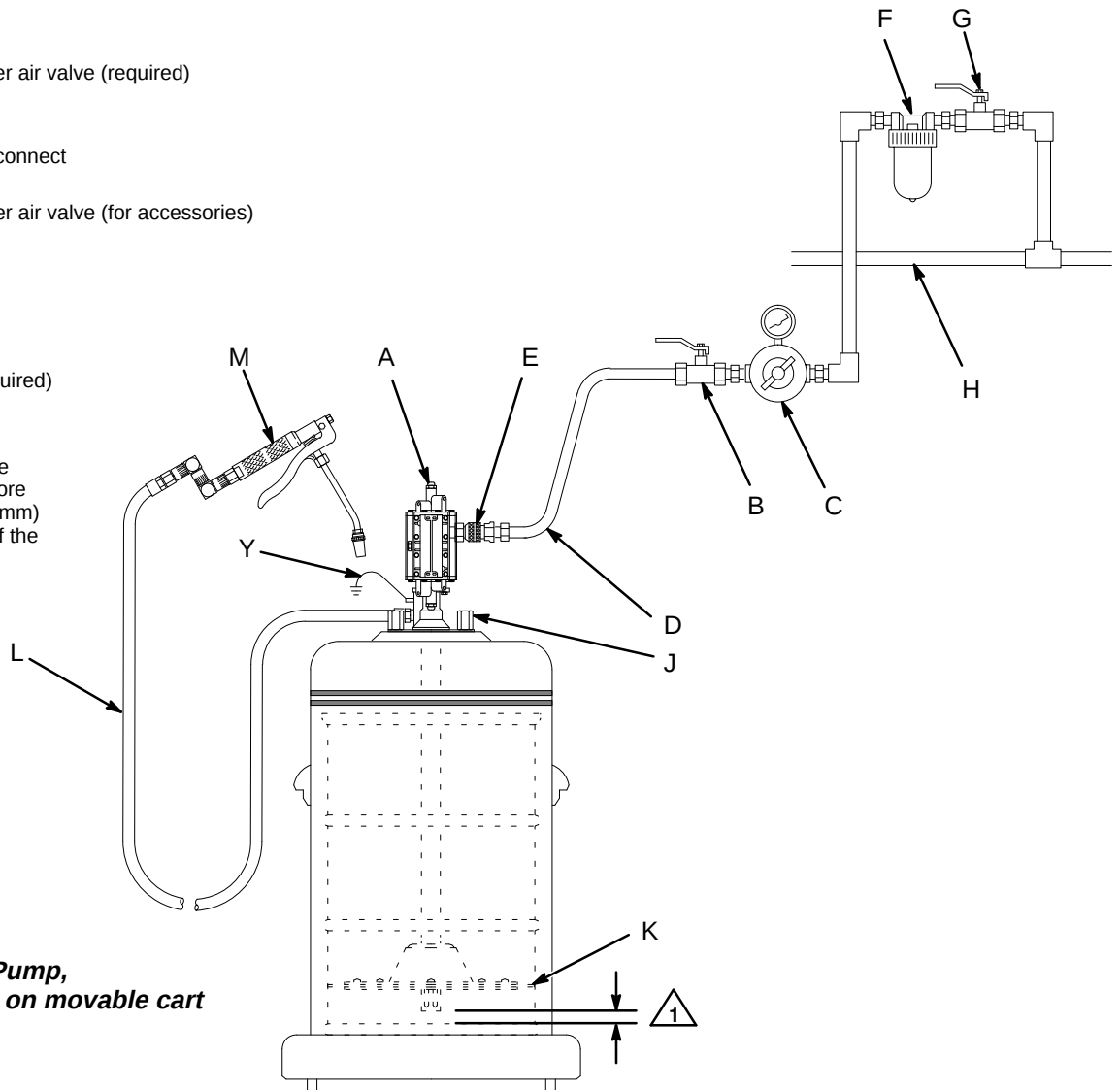


Fig. 3

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Installation

Mounting the Pump

1. Select a convenient location for the equipment, to ensure easy operator access to the pump air controls, sufficient room to change supply containers, and a secure mounting platform.
2. If using a follow plate (K), remove the fluid container cover. To prevent air from being trapped under the follow plate, scoop grease from the center of the container to the sides, to make the surface concave. Place the follow plate on the grease and push down on the plate until grease appears at the center opening (P). See Fig 4.

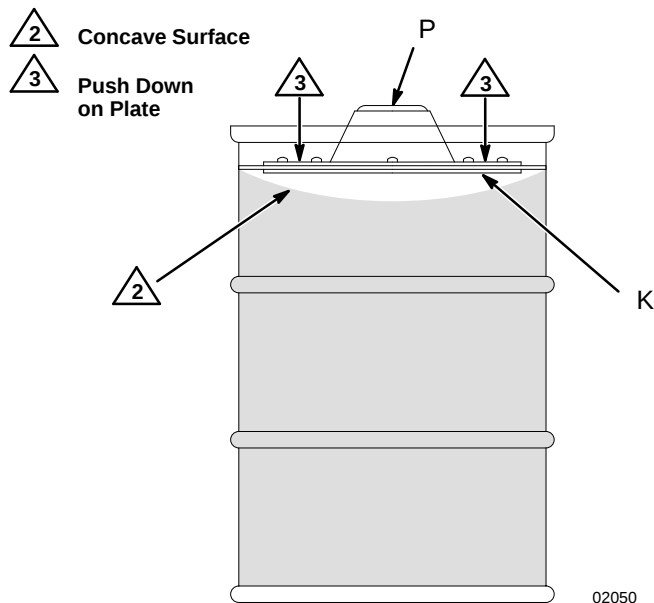


Fig. 4

3. Guide the pump intake valve through the cover and follow plate. Secure the cover to the container.
4. Position the pump (A) so its intake valve is no more than 1/2 in. (13 mm) from the bottom of the container. Mount the pump to the cover or other suitable mounting device.

! 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.

System Accessories

! WARNING

Maximum Working Pressure

The maximum working pressure of each component in your system may not be the same. To reduce the risk of overpressurizing any part of your system, be sure you know the maximum working pressure rating of each component. Never exceed the maximum working pressure of the lowest rated component connected to a pump. Use the following table to limit the air to the pump so that no air line or fluid line component or accessory is overpressurized.

Air Inlet Pressure psi (MPa, bar)	Approximate Fluid Outlet Pressure psi (MPa, bar)
40 (0.28, 2.8)	2000 (14, 140)
60 (0.42, 4.2)	3000 (21, 210)
80 (0.56, 5.6)	4000 (28, 280)
100 (0.7, 7.0)	5000 (35, 350)
120 (0.84, 8.4)	6000 (42, 420)
140 (0.98, 9.8)	7000 (49, 490)
150 (0.9, 10)	7500 (52, 517)

Installation



WARNING

A bleed-type master air valve is required in your system to help reduce the risk of serious injury, including splashing in the eyes or on the skin, and injury from moving parts if you are adjusting or repairing the pump.

The bleed-type master air valve relieves air trapped between this valve and the pump after the air is shut off. Trapped air can cause the pump to cycle unexpectedly. Locate the valve close to the pump.

1. Install a bleed-type master air valve (B), to relieve air trapped between the valve and the motor. See the **WARNING** above).
2. Install an air regulator (C), to control the pump speed and pressure.
3. Install an air line filter (F) to remove harmful dirt and moisture from the compressed air supply.
4. Install a second bleed-type master air valve (G) upstream from all other accessories, to isolate the accessories for servicing.
5. Connect the fluid hose (L) to the dispense valve (M). Use a gun holder (J) to hold the dispense valve when not in use.
6. For ease in connecting the air line to the pump, use an air line quick disconnect (E) at the pump air inlet.
7. Connect the air (D) and fluid hoses (L) to the pump (A). Use only grounded fluid and air hoses. Be sure all hoses are properly sized and pressure-rated for your system.

NOTE: Additional air line lubrication is not required to extend the Eagle™ grease pump air motor life. The air motor is prelubed at the factory and should not require additional lubrication between maintenance schedules. No accessory air line lubricator should be installed.

Operation

Pressure Relief Procedure

WARNING



INJECTION HAZARD

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
- Stop dispensing
- Check or service any of the system equipment
- Install or clean the spray tips/nozzles

1. Close the pump air regulator.
2. Close the bleed-type master air valve (required in your system).
3. Hold a metal part of the dispensing valve firmly to the side of a metal waste container, and trigger the valve to relieve fluid pressure.

*If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, **very slowly** loosen the tip guard retaining nut or hose end coupling and relieve pressure gradually, then loosen completely; then clear the tip or hose.*

Flushing

The pump is tested with lightweight oil, which is left in to protect the pump parts. If the fluid you are using may be contaminated by the oil, flush it out with a compatible solvent before using the pump.

WARNING



For your safety, read the warning section **FIRE AND EXPLOSION HAZARD** on page 4 before flushing, and follow all the recommendations given there.

Operation

Starting and Adjusting the Pump

WARNING

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

1. Close the pump regulator and the bleed-type master air valve.
2. Point the dispense valve into a grounded metal waste container, making firm metal-to-metal contact between the valve and the container. Open the dispense valve.
3. Open the bleed-type master air valve. Open the air regulator slowly, until the pump just starts running.
4. Run the pump until it is primed and all air has been pushed out of the fluid line, then close the dispense valve. The pump will stall against the pressure. With the pump and lines primed, and with adequate air pressure and volume supplied, the pump will start and stop as the dispensing valve is opened and closed.

NOTE: If the pump is difficult to prime, **relieve the pressure** and remove the hose. Prime the pump alone, then reconnect the hose and continue to prime your system.

5. Use the air regulator to control the pump speed and the fluid pressure. Always use the lowest air pressure necessary to get the desired results. Higher pressures cause premature nozzle and pump wear. Never overpressurize any component in the system. See the **Maximum Working Pressure** warning on page 8.
6. Never allow the pump to run dry of the fluid being pumped.

CAUTION

A dry pump quickly accelerates to a high speed, possibly damaging itself. If your pump accelerates quickly or is running too fast, stop it immediately and check the fluid supply. If the supply container is empty and air has been pumped into the lines, refill the container and prime the pump and the lines with fluid, or flush and leave it filled with a compatible solvent. Be sure to eliminate all air from the fluid system.

7. Read and follow the instructions supplied with each component in your system.

Shutting Down the Pump

Before you shut down the pump, follow all the steps of the **Pressure Relief Procedure** at left.

Troubleshooting

WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 10.

Before servicing this equipment, always make sure to **relieve the pressure**.

NOTE: Check all possible problems and solutions before disassembling the pump.

PROBLEM	CAUSE	SOLUTION
Pump fails to operate.	Inadequate air supply pressure or restricted air line.	Increase air supply (see Technical Data on page 30). See Maximum Working Pressure warning on page 8. Clear line.
	Closed or clogged air valves.	Open valves; clean.
	Obstructed fluid hose or gun/valve; fluid hose ID is too small.	Open, clear.* Use hose with larger ID, or use shorter hose.
	Dirty, worn, or damaged air motor parts.	Clean or repair; see pages 20 to 25. Lubricate with grease.
	Obstructed priming tube.	Open, clear.
Pump operates, but output low on both strokes.	Inadequate air supply pressure or restricted air line.	Increase air supply (see Technical Data on page 30). See Maximum Working Pressure Warning on page 8. Clear line.
	Closed or clogged air valves.	Open valves; clean.
	Obstructed fluid hose or gun/valve; fluid hose ID is too small.	Open, clear.* Use hose with larger ID, or use shorter hose.
	Exhausted fluid supply.	Refill and reprime or flush.
	Air leaking into supply container.	Check follow plate or inductor plate seal.
	Fluid too heavy for pump priming.	Use inductor or follow plate.
	Worn seals in displacement pump.	Replace seals. See page 18.
Pump operates, but output low on downstroke.	Fluid too heavy for pump priming.	Use inductor or follow plate.
	Held open or worn intake valve or seal (105).	Clear valve; replace seal. See page 18.
Pump operates, but output low on upstroke.	Held open or worn piston valve or seal (103).	Clear valve; replace seal. See page 18.
Erratic or accelerated pump speed.	Exhausted fluid supply.	Refill and reprime or flush.
	Fluid too heavy for pump priming.	Use inductor or follow plate.
	Held open or worn piston valve or seal (103).	Clear valve; replace seal. See page 18.
	Held open or worn intake valve or seal (105).	Clear valve; replace seal. See page 18.

* **Relieve the pressure**, and disconnect the fluid hose. Turn on the air. If the pump starts when the air is turned on, the clog is in the fluid hose or dispense valve.

Troubleshooting

PROBLEM	CAUSE	SOLUTION
Continuous air exhaust from muffler.	Worn or damaged motor piston o-ring (32).	Inspect and replace. See page 21.
	Air cup (7) not seating properly, or damaged.	Inspect; reseal or replace. See page 24.
Continuous air exhaust from pilot valve vent holes.	Worn or damaged carriage spool u-cups (31).	Inspect and replace. See page 24.
	Worn or damaged actuator valve pin o-rings (23).	Inspect and replace. See page 21.
Air motor not shifting properly; erratic operation/stalling.	Worn or damaged actuator valve pin o-rings (23, top or bottom).	Inspect and replace. See page 21.
	Damaged actuator valve springs (16, top or bottom).	Replace. See page 21.
	Worn or damaged carriage spool u-cups (31). (Characterized by continuous air leakage from actuator valve vents.)	Inspect and replace. See page 24.
	Clogged or obstructed valve porting.	Clean.
	Worn out valve housing (5).	Replace. See page 24.
	Improper seating or damaged port or valve housing o-rings (21, 30).	Inspect o-ring and groove. Clean or replace as necessary.
Air leaking from base vent hole.	Worn or damaged low pressure u-cup seal (19).	Inspect and replace. See page 20.
Fluid leaking from base vent hole.	Worn or damaged high pressure u-cup seal (20).	Inspect and replace. See page 20.

Service

Repair Kit 239–657

Repair Kit 239–657 is available to service the displacement pump and air motor. Purchase the kit separately. For the best results, use all new parts in the kit. Parts included in the kit are denoted with an asterisk, for example (6*). The kit also contains U-cup assembly tool 191–754 and one tube of sealant 111–368. Refer to the text and the notes in the figures for sealant application instructions.

Required Tools

The following tools are required to service the pump:

- Vise, with soft jaws
- Pipe wrench
- Snap-ring pliers
- Needle-nose pliers
- Hammer
- 3/32 in. punch
- O-ring pick
- 9/32 in. or 7 mm socket wrench or nut driver
- 3/8 in. or 10 mm box wrench
- 7/16 in. or 11 mm box wrench
- 1/2 in. or 13 mm box wrench
- 5/8 in. or 16 mm box wrench
- 1–1/16 in. or 27 mm socket wrench or crow's foot
- Adjustable wrench
- Torque wrench
- Phillips screwdriver
- Thread sealant 111–368
(included in Repair Kit 239–657)
- U-cup assembly tool 191–754
(included in Repair Kit 239–657)

Displacement Pump Service

Disconnecting the Air Motor

WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 10.

1. **Relieve the pressure.** Disconnect the fluid hoses and remove the pump from its mounting.
2. Remove the retaining ring (43) and slide the mounting plate (44) off the pump. See Fig. 5.
3. Place the pump in a vise with soft jaws, with the jaws on the cylinder (101). Unscrew the intake cylinder (110) from the pump cylinder (101). See Fig. 6.
4. Use a pipe wrench on the lower part of the outlet housing (18) to loosen the air motor (1) from the cylinder (101). See Fig. 5.
5. Continue to screw the motor (1) off the cylinder (101) by hand, until the pin (112) joining the displacement rod (17) with the connecting rod (102) is accessible. Use a punch to drive the pin (112) out of the rods (17 and 102) See Fig. 7.
6. Hold the air motor (1) to prevent it from falling when performing this step. Using a wrench on the nut (109), unscrew the connecting rod (102) from the displacement rod (17) to release the motor. See Fig. 8.
7. To service the displacement pump, refer to pages 18 and 19. To service the air motor, including the throat packings, refer to pages 20 to 25.

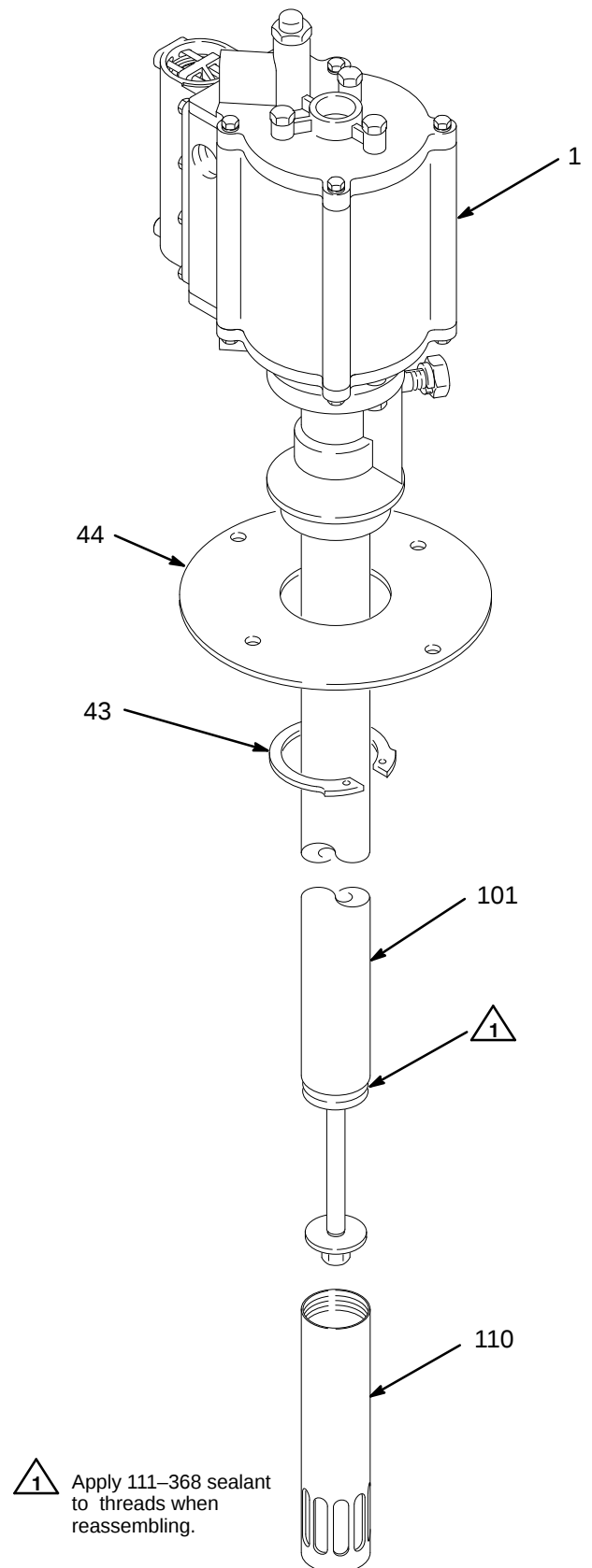


Fig. 5

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Displacement Pump Service

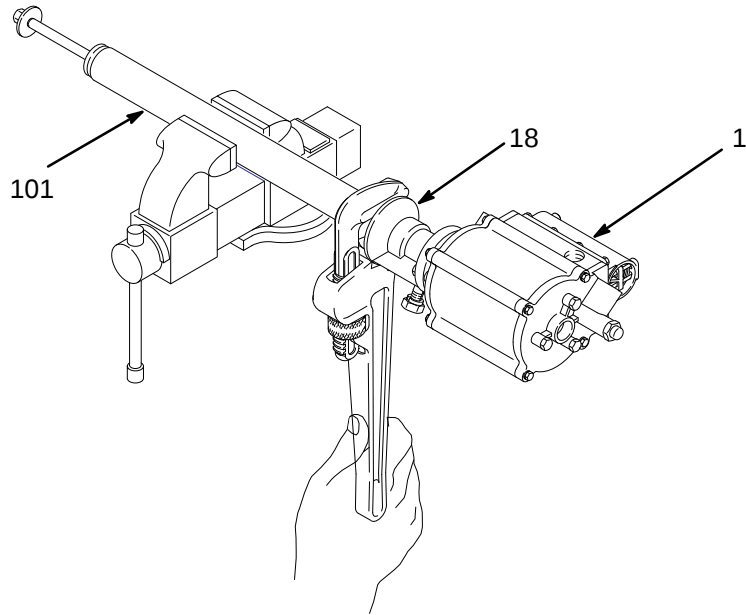


Fig. 6

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Rotate the cylinder (101) 90 degrees so the hole is up.
Run a punch through the hole in the cylinder to drive the
pin (112) out.

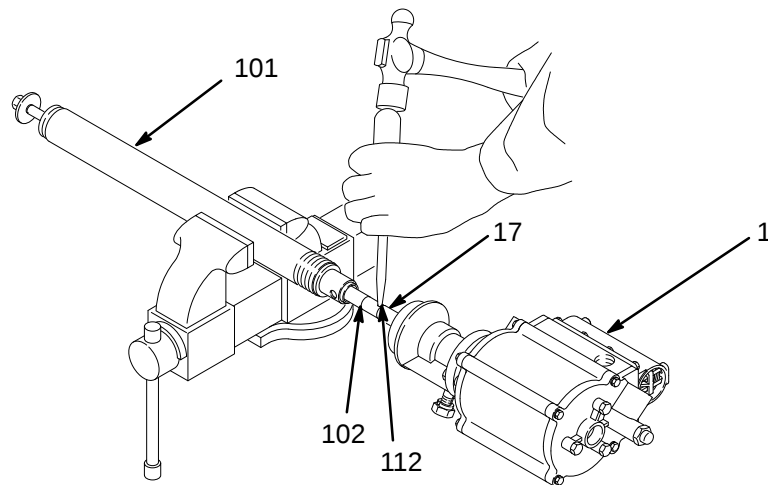


Fig. 7

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Displacement Pump Service

Reconnecting the Displacement Pump

NOTE: Before connecting the displacement pump to the motor, check that a new copper gasket (39) is inserted in the outlet housing (18).

1. Place the displacement pump in a vise, with the jaws on the pump cylinder (101). Position the air motor (1) so the displacement rod (18) engages the threads of the connecting rod (102). Using a wrench on the nut (109), screw the connecting rod into the displacement rod until the pin holes align. See Fig. 8.
2. Install the pin (112*) in the hole to secure the two rods (17 and 102) together. Make sure the pin is flush or below the surface of the rod (17). Screw the motor (1) onto the cylinder (101) by hand. See Fig. 7.
3. Use a pipe wrench on the lower part of the outlet housing (18) to securely tighten the motor (1) to the cylinder (101). See Fig. 6.
4. Apply thread sealant (111–368*) and screw the intake cylinder (110) onto the pump cylinder (101). See Fig. 5.
5. Remove the pump from the vise. Reinstall the mounting plate (44) and secure with the retaining ring (43).
6. Mount the pump. Reconnect the air and fluid hoses and return the pump to service.

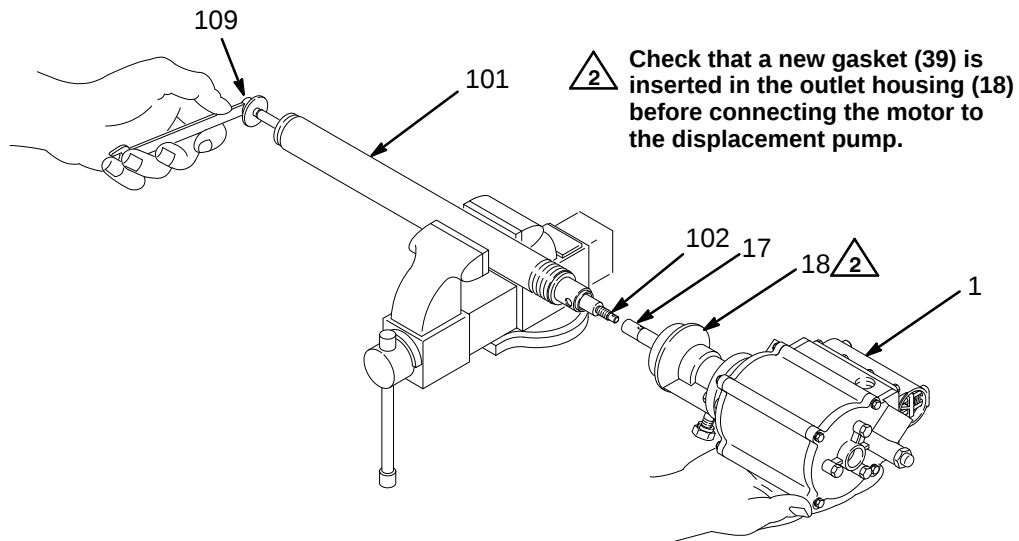


Fig. 8

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Displacement Pump Service

Disassembly

1. Disconnect the displacement pump (100) from the air motor (1), as explained on page 15.
2. Unscrew the packing retainer (106) from the pump cylinder (101). Pull the entire pump assembly out of the bottom of the cylinder. See Fig. 9.
3. Drive the pin (112) out of the connecting rod (102) and piston (104). Unscrew the piston from the rod. Slide the seal (103) off the piston.
4. Drive the pin (112) out of the piston (104) and priming piston rod (107). Unscrew the rod.
5. Slide the intake seal (105) off the rod (107). This may be difficult because there is friction between the seal and rod.
6. Slide the packing retainer (106) off the rod (107). Remove the o-ring (111) from the packing retainer.
7. Examine the o-ring (111) and priming piston (108) for scoring or damage. It is normal for the piston to show some movement on the rod. If either parts needs replacement, go to step 8.
8. If the rod (107) or the priming piston (108) needs to be replaced, insert a punch in the pin hole at the top of the rod to hold it steady. Unscrew the nut (109), and remove the priming piston. **If 107 or 108 do not need to be replaced, leave assembled.**

Reassembly

1. If the priming piston (108) was removed from the priming piston rod (107), reinstall it on the bottom threads of the rod (the end without a pin hole) and secure with the nut (109). Torque to 35 to 45 in-lb (4.0 to 5.1 N-m). Lubricate the rod. See Fig. 9.
2. Lubricate the o-ring (111*) and install it on the packing retainer (106). Slide the retainer onto the rod (107), with the o-ring at the top. Lubricate the intake seal (105*) and slide it onto the rod, with the flat side facing the packing retainer. There should be friction between the seal and the rod. If there is very little or no friction, replace the rod or the seal. It is not necessary to slide the seal all the way down to the retainer.
3. Screw the piston (104) onto the rod (107) until the pin holes align. Install the pin (112*). Be sure that the pin is flush or below the surface of the piston on both sides.
4. Lubricate the seal (103*) and install it on the piston (104), with the large bevel facing the piston.
5. Screw the connecting rod (102) onto the piston (104) until the pin holes align. Install the pin (112*). Be sure that the pin is flush or below the surface of the connecting rod on both sides.
6. Lubricate the inside of the cylinder (101). Slide the rod assembly into the bottom of the cylinder. There may be a lot of friction, but do not use a hammer or rubber mallet to drive the assembly, to avoid damaging the parts.
7. Screw the packing retainer (106) into the cylinder (101). Using a socket wrench or crow's foot wrench, torque to 15 to 20 ft-lb (20 to 27 N-m).
8. Continue to push the rod assembly up as far as possible. Reconnect the displacement pump (100) to the air motor (1) as explained on page 15.

Displacement Pump Service

-  1 Torque to 35 to 45 in-lb (4.0 to 5.1 N-m).
-  2 Lubricate.
-  3 Flat side must face retainer (106).
-  4 Assemble pin (112*) flush or below surface.
-  5 Large bevel must face piston (104).
-  6 Torque to 15 to 20 ft-lb (20 to 27 N-m).
-  7 Lubricate inside diameter.

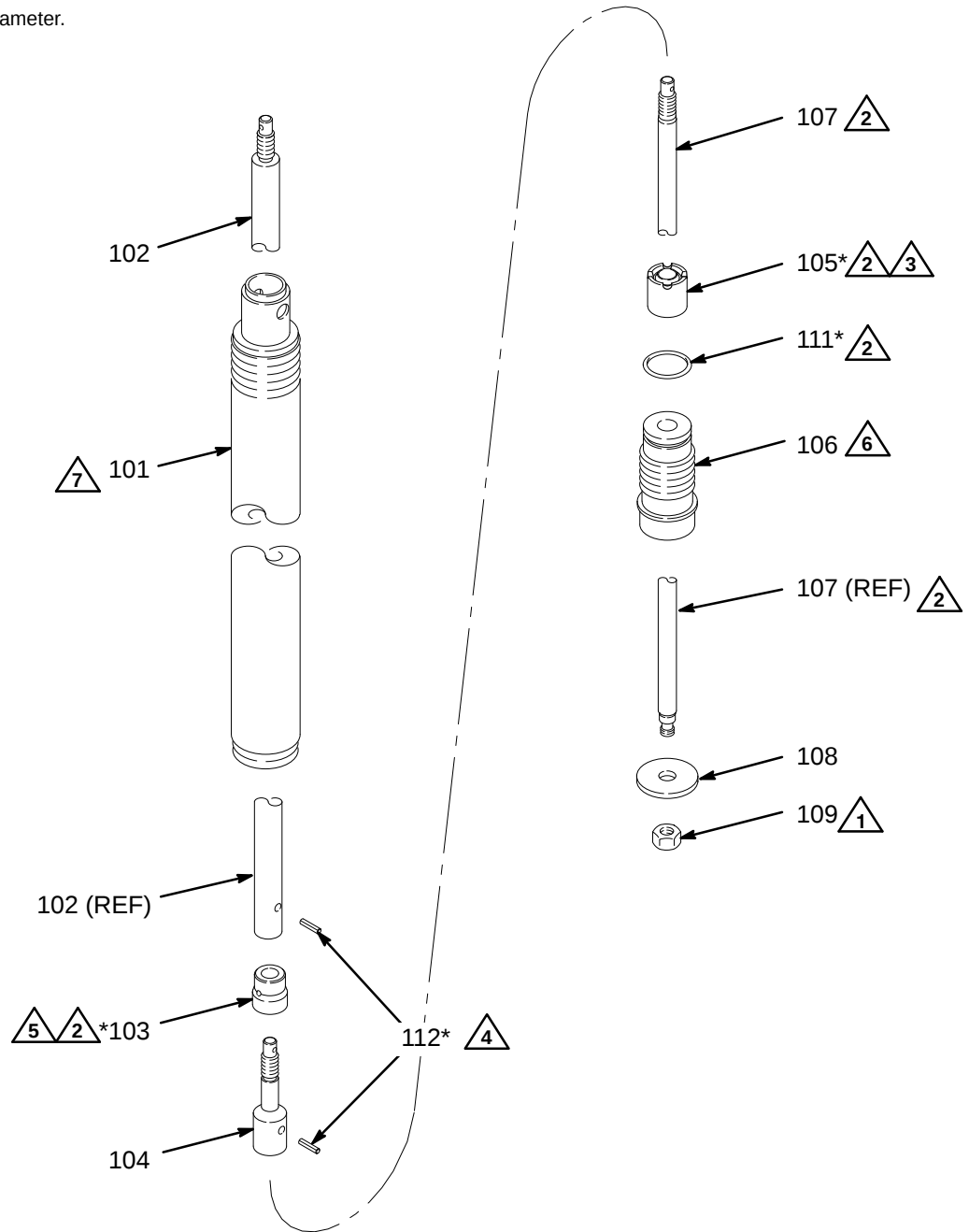


Fig. 9

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Air Motor Service

Throat Packing Service

Disassembly

1. Disconnect the air motor (1) from the displacement pump (100), as explained on page 15.
2. Remove the three screws (29) holding the outlet housing (18) to the bottom cylinder cap (4). Pull the housing off the cap, being careful not to damage the piston rod (17). See Fig. 10.
3. Remove the u-cup packing from the cap (4).
4. Remove the copper gasket (39) and the u-cup packing (20) from the outlet housing (18).

Reassembly

1. Lubricate the u-cup packing (19*) and install it in the bottom cylinder cap (4), with the lips facing up toward the air motor (1). See Fig. 10.
2. Grease and install the u-cup packing (20*) and the copper gasket (39*) in the outlet housing (18). The lips of the u-cup must be facing down, toward the pump.
3. Install the housing (18) on the cap (4).
4. Reconnect the air motor (1) to the displacement pump (100), as explained on page 15.

-  1 Lubricate.
-  2 Lips face up, toward air motor (1).
-  3 Lips face down, toward pump.

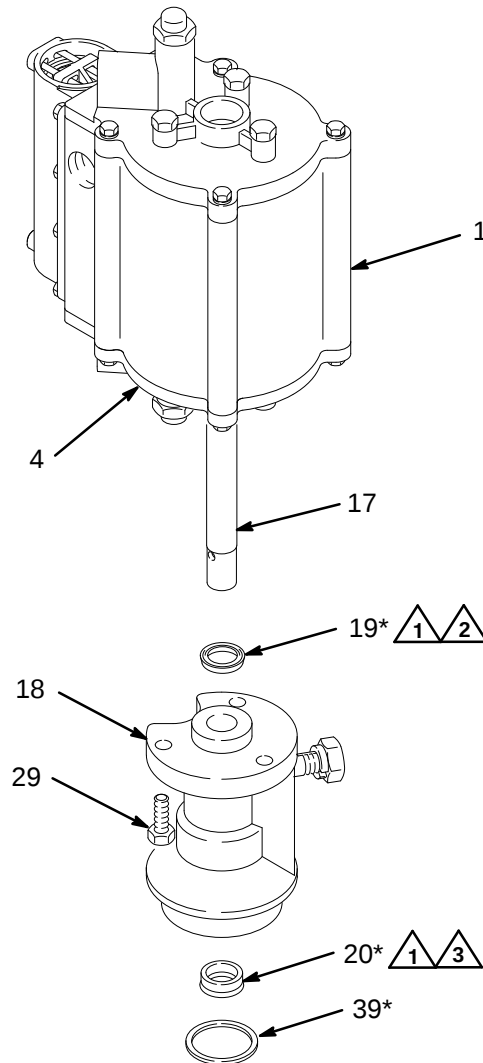


Fig. 10

01970A

Air Motor Service

Cylinder and Piston Service

Disassembly

1. Disconnect the air motor (1) from the displacement pump (100), as explained on page 15.
2. Remove the six screws (25 and 42) holding the bottom cylinder cap (4) to the cylinder (2). Lift the cylinder off the cap to expose the piston (14). See Fig. 11.
3. Pull the piston (14) and piston rod (18) out of the outlet housing (18) and bottom cylinder cap (4).
4. Remove the piston o-ring (32*). Insert a punch in the hole at the end of the piston rod (18) to hold it steady, and unscrew the nut (35) from the rod. Remove the two washers (27), o-ring (30*) and piston (14).
5. Stand the cylinder (2) upright. Remove the six screws (25 and 42) and lift off the top cap (3).
6. Examine the inner surface of the cylinder for scoring or damage.
7. Remove the large o-ring (22*) and two small o-rings (34*) from the inside of the top cylinder cap (3). Repeat for the bottom cylinder cap (4).

Reassembly

1. Grease the large o-ring (22*) and the two small o-rings (34*) and install them on the top cylinder cap (3). Repeat for the bottom cylinder cap (4). See Fig. 11.
2. Install the top cap (3) on the cylinder (2). Be sure that the large o-ring (22*) does not roll out of the groove. Install two M4 screws (25) in the square section of the cap and four M5 screws (42) in the tabs. Torque the two M4 screws (25) to 14 to 17 in-lb (1.6 to 1.9 N-m) and the four M5 screws (42) to 35 to 45 in-lb (4.0 to 5.1 N-m).
3. Install a washer (27), an o-ring (30*), the piston (14), *with the chamfer facing down toward the o-ring (30)*, and a washer (27) on the piston rod (17). Screw the self-locking nut (35) onto the rod. Install the o-ring (32*) on the piston (14), and lubricate the o-ring.
4. Grease the piston rod (17) and the inner wall of the cylinder (2).
5. Insert the piston rod (17) into the bottom cap (4) and the outlet housing (18), being careful not to damage the u-cup packing (19) inside the cap.
6. Install the cylinder (2) down over the piston (14). Be sure that the large o-ring (22*) does not roll out of the groove. Install the screws (25 and 42) in the bottom cap (4), as explained in step 2.
7. Reconnect the air motor (1) to the displacement pump (100), as explained on page 15.

Air Motor Service

Actuator Valve Service

Disassembly

1. Remove the actuator valve plug (11) from the top cap (3). Inspect the sealing gasket (15*) and spring (16*) in place on the plug. If the gasket needs replacement, thread it off the plug (11). See Fig. 11.
2. Pull the pin (12*) out of the top cap (3). Remove the two o-rings (23*) from the pin.
3. If it is necessary to remove the o-ring (24*) from the actuator valve cavity, you must first remove the top cap. See **Cylinder and Piston Service**.
4. Repeat for the bottom cylinder cap (4).

Reassembly

1. If the o-ring (24*) was removed, it must be installed from the inside of the top cap (3). Lubricate the o-ring. See Fig. 11. Reinstall the top cap. See **Cylinder and Piston Service**.
2. Install the two o-rings (23*) on the pin (12*). Grease the pin and insert it in the top cap (3). The long end must point toward the inside of the motor.
3. Thread the gasket (15*) onto the plug (11). Grease the spring (16*) and install it in the plug. Screw the plug into the top cap (3) and torque to 60 to 80 in-lb (6.8 to 9.0 N-m).
4. Repeat for the bottom cylinder cap (4).

Air Motor Service

-  1 Lubricate with grease.
-  2 Torque to 14 to 17 in-lb (1.6 to 1.9 N-m).
-  3 Torque to 60 to 80 in-lb (6.8 to 9.0 N-m).
-  4 Grease inner wall.
-  5 Long end of pin must point toward inside of motor.

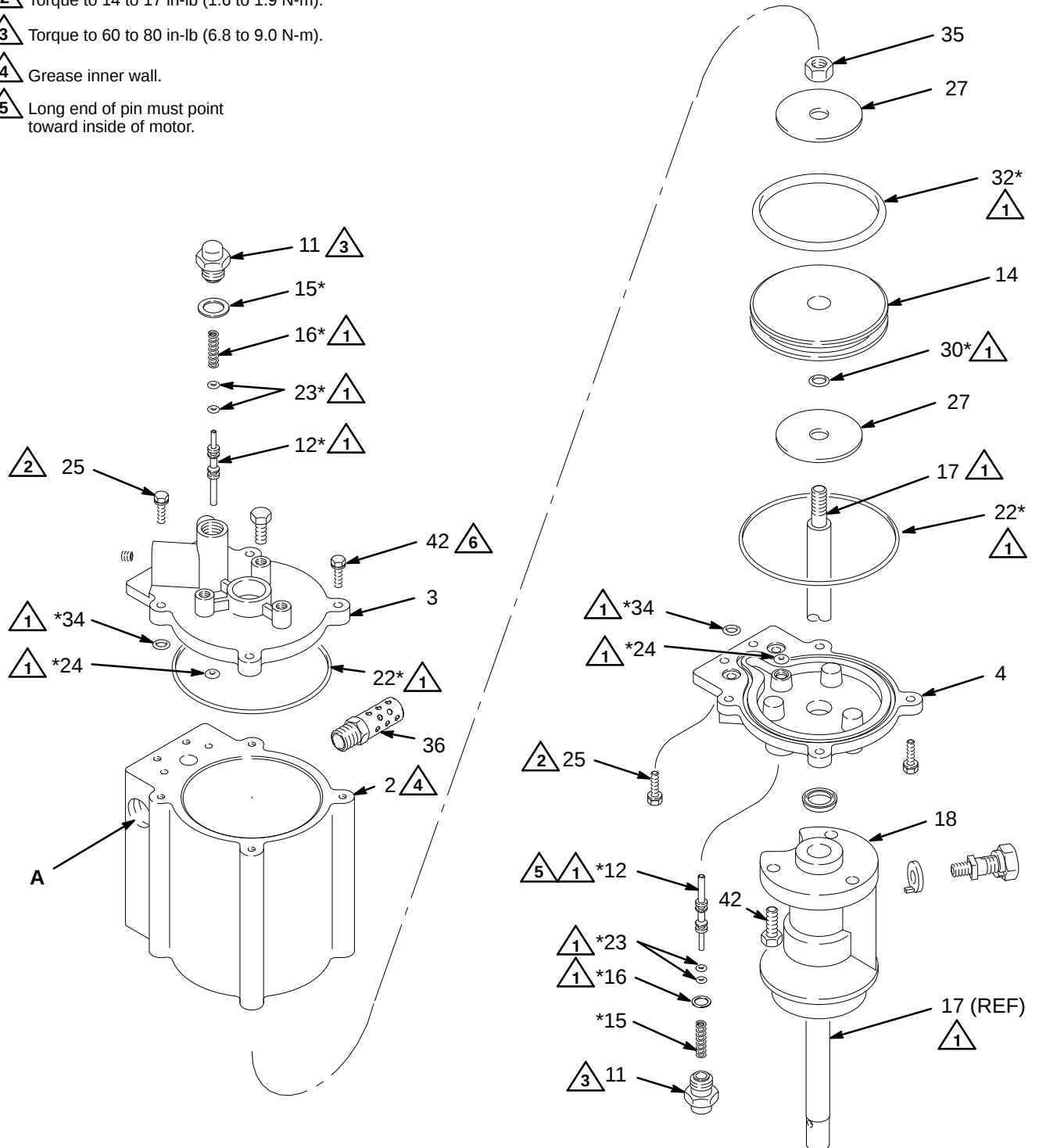


Fig. 11

01969A

Air Motor Service

Air Valve Service

Disassembly

1. Remove the screws (25) holding the air valve housing (5) to the cylinder (2). Be careful not to drop the valve cup (7) as you remove the housing; the cup can be easily damaged. See Fig. 12.
2. Remove the large o-ring (21*), and two small o-rings (30*) from the valve housing (5).
3. Remove the two clips (10) and pull out the spool retainers (9). Note that the clips are inserted through the spool retainers from the inside of the valve housing (5). Remove the o-rings (33) from the spool retainers.
4. Push the spool (6) out of the housing (5). Remove the two u-cups (31) from the spool.
5. Remove the screws (28) holding the air valve plate (8) to the cylinder (2). Be very careful not to drop or damage the plate. Inspect the plate surface for scratches.
6. Remove the gasket (13) from the face of the cylinder (2).

Reassembly

NOTE: u-cup assembly tool 191–754 is available. You must use this tool to properly insert the u-cups. The tool is included in Repair Kit 239–657.

1. Install the air valve gasket (13*) and plate (8) on the cylinder (2). Be sure the surface of the plate facing outward is free of scratches or damage. Torque the screws (28) oppositely and evenly to 4 to 6 in-lb (0.5 to 0.7 N-m).
2. Insert the u-cup assembly tool into the open end of the valve housing until it bottoms out, as shown in the **Detail** in Fig. 12.
3. Install the two u-cups (31*) on the spool (6*) with the u-cup lips facing toward each other. Generously grease the spool and the inner diameter of the housing (5). Install the spool in the housing, positioned at either end of its travel. The spool should not be centered.

NOTE: If the spool slides out of the other end of the housing during assembly, slide the tool over the exposed spool end and u-cup, and re-insert the spool into the housing.

4. Grease the top and bottom recesses of the housing (5). Install an o-ring (33*) on each spool retainer (9). Place the retainers in the recesses and secure with the clips. The clips must be fully inserted from the inside surface of the housing.
5. Lubricate the o-ring grooves in the valve housing (5) with grease, then install the large o-ring (21*) and two small o-rings (30*). The grease holds the o-rings in place.
6. Grease the valve cup (7*) and the valve plate (8). Orient the cup as shown in Fig. 12. Place the cup on the valve plate so its position corresponds to the position of the spool (see step 3).
7. Place the air valve housing (5) on the cylinder (2). The spool (6*) must engage the valve cup (7*), or the valve will not fit correctly. If necessary, move the cup to engage the spool.
8. Install the screws (25) and torque oppositely and evenly to 14 to 17 in-lb (1.6 to 1.9 N-m). Be sure the o-rings (21* and 30*) do not slip out of the grooves on the housing.

Air Motor Service

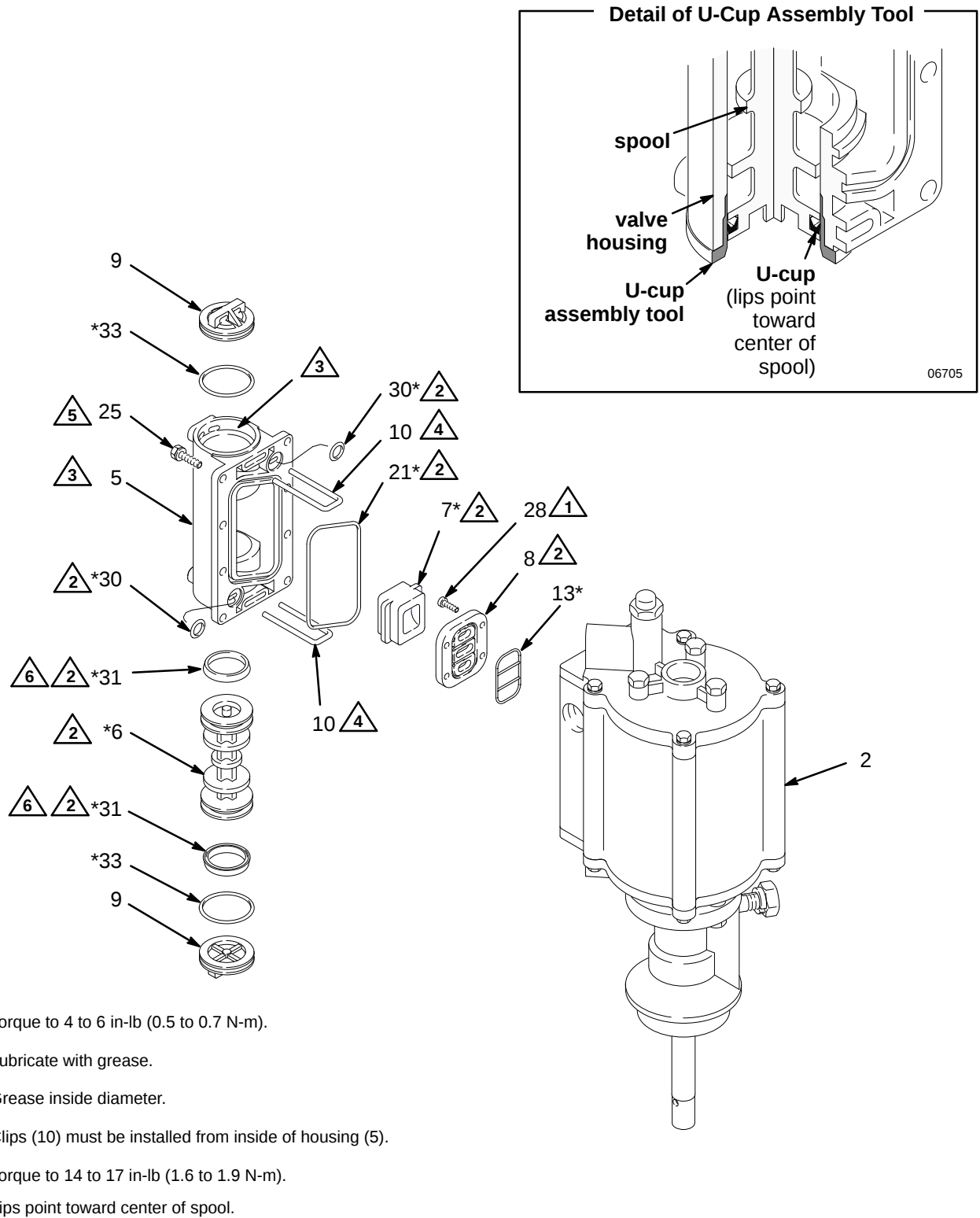
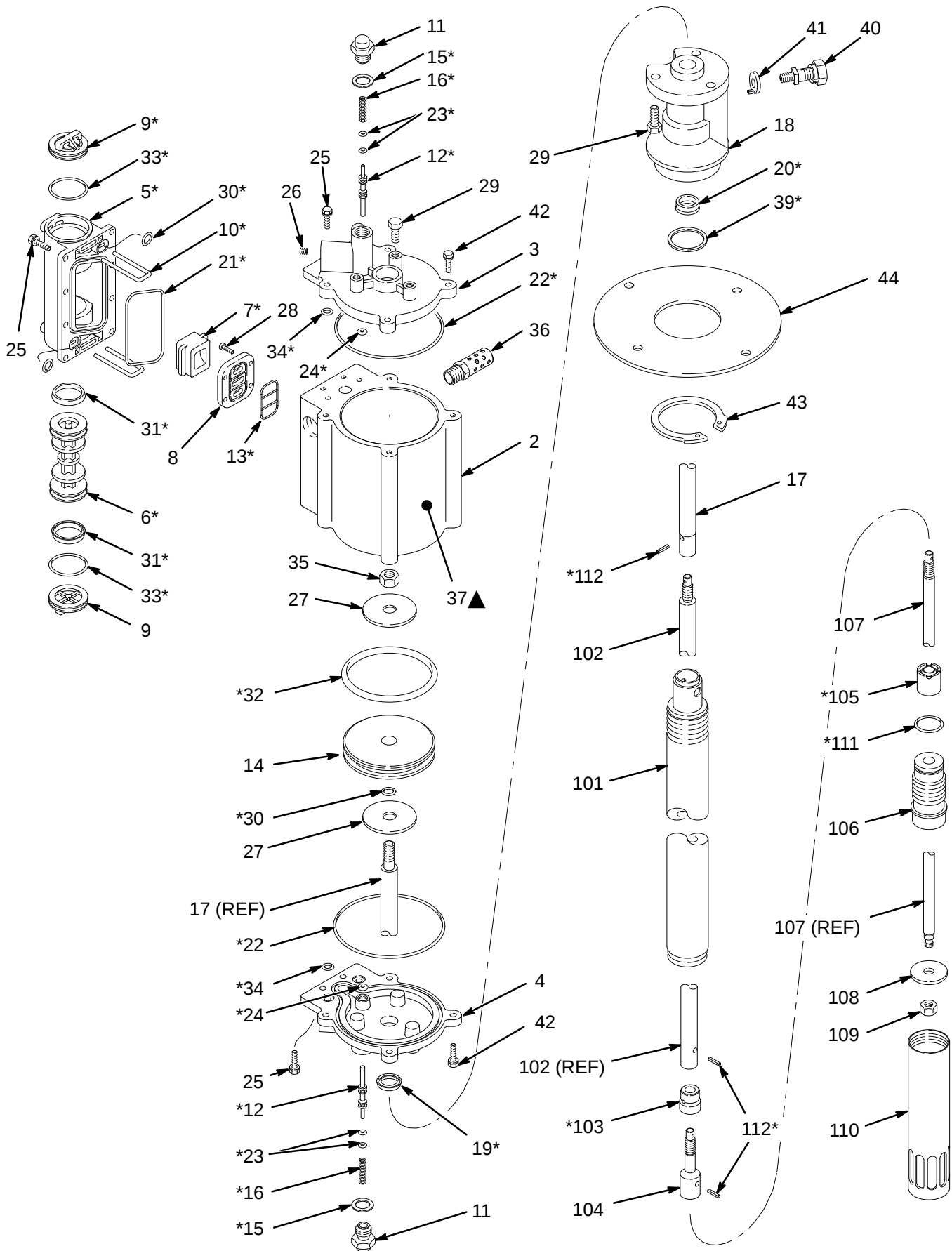


Fig. 12

01968A

Parts Drawing



01964A

Parts List

Model 235–888 Pump, Series C 35 lb (16 kg) Pail Size

Model 235–889 Pump, Series C 120 lb (55 kg) Drum Size

Model 235–890 Pump, Series C 400 lb (180 kg) Drum Size

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	235–887	AIR MOTOR; Series C; Includes items 2 to 44	1	100	235–863	DISPLACEMENT PUMP; Series A; Used on Model 235–888	1
2	191–826	. CYLINDER, motor	1			Includes items 101 to 112	1
3	188–514	. CAP, cylinder, top	1		235–864	DISPLACEMENT PUMP; Series A; Used on Model 235–889	1
4	192–399	. CAP, cylinder, bottom	1			Includes items 101 to 112	1
5*		. HOUSING, valve	1		235–865	DISPLACEMENT PUMP; Series A; Used on Model 235–890	1
6*	276–264	. SPOOL; acetal	1			Includes items 101 to 112	1
7*	188–947	. CUP, air; acetal	1				
8	191–778	. PLATE, valve; stainless steel	1	101	188–516	. CYLINDER, pump; carbon steel; 350.8 mm (13.81 in.) long; Used on Model 235–863 Displ. Pump	1
9*	276–587	. RETAINER, spool; acetal	2		188–385	. CYLINDER, pump; carbon steel; 585.7 mm (23.06 in.) long; Used on Model 235–864 Displ. Pump	1
10*	188–583	. CLIP	2		188–517	. CYLINDER, pump; carbon steel; 762 mm (30 in.) long; Used on Model 235–865 Displ. Pump	1
11	188–539	. PLUG, actuator; aluminum	2				
12*	188–538	. PIN, actuator; stainless steel	2	102	188–518	. ROD, connecting; carbon steel; 146.1 mm (5.75 in.) long; Used on Model 235–863 Displ. Pump	1
13*	191–777	. GASKET, plate, valve; Buna–N	1		188–387	. ROD, connecting; carbon steel; 381 mm (15 in.) long; Used on Model 235–864 Displ. Pump	1
14	191–827	. PISTON, motor; acetal	1		188–519	. ROD, connecting; carbon steel; 557.3 mm (21.94 in.) long; Used on Model 235–865 Displ. Pump	1
15*	188–582	. GASKET, plug; nylon	2				
16*	113–876	. SPRING, compression	2	103*	188–389	. SEAL, piston; UHMWPE	1
17	188–399	. ROD, piston, air motor; stainless steel	1	104	188–384	. PISTON; carbon steel	1
18	192–360	. HOUSING, outlet; zinc-plated ductile iron	1	105*	188–390	. SEAL, intake; UHMWPE	1
19*	112–110	. PACKING, u-cup; nitrile	1	106	188–383	. RETAINER, packing; carbon steel	1
20*	112–029	. PACKING, u-cup; polyurethane/Buna–N	1	107	188–386	. ROD, priming piston; carbon steel	1
21*	191–839	. SEAL, valve housing	1	108	188–388	. PISTON, priming; carbon steel	1
22*	112–106	. o-ring; Buna–N	2	109	102–040	. NUT, hex, self-locking; 1/4–20	1
23*	112–107	. o-ring; polyurethane	4	110	188–510	. CYLINDER, intake; carbon steel	1
24*	112–104	. o-ring; polyurethane	2	111*	112–030	. o-ring; polyurethane	1
25	112–111	. SCREW, cap, hex hd; M4 x 0.7; 14 mm (0.55 in.) long	12	112*	102–411	. PIN; 11 mm (0.438 in.) long	3
26	112–112	. SCREW, set, socket hd; M5 x 0.8; 5 mm (0.20 in.) long	4				
27	112–717	. WASHER, flat; 38 mm (1.5 in.)	2				
28	112–116	. SCREW, machine, pan hd; M3 x 0.5; 10 mm (0.40 in.) long	4				
29	112–117	. SCREW, cap, hex hd; M6 x 1.0; 18 mm (0.71 in.) long	6				
30*	154–741	. o-ring; Buna–N	3				
31*	112–181	. PACKING, u-cup	2				
32*	113–755	. o-ring; Buna–N	1				
33*	108–730	. o-ring; nitrile	2				
34*	156–454	. o-ring; Buna–N	4				
35	112–840	. NUT, hex; M8 x 1.25	1				
36	113–779	. MUFFLER	1				
37▲	188–830	. LABEL, warning	1				
39*	150–694	. GASKET; copper	1				
40	104–029	. LUG, grounding	1				
41	104–582	. WASHER, tab, grounding	1				
42	113–945	. SCREW, flange, hex hd; M5 x 0.8; 20 mm (0.79 in.) long	8				
43	112–086	. RING, retaining	1				
44	188–593	. PLATE, mounting; carbon steel	1				

* Replacements for these parts are available in Repair Kit 239–657. Purchase the kit separately. The kit includes a tube of sealant 111–368. Install the kit as explained in the **Service** section, pages 14 to 25.

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

Technical Data

Maximum fluid working pressure	7500 psi (52 MPa, 517 bar)
Maximum air inlet pressure	150 psi (0.9 MPa, 10 bar)
Ratio	50:1
Pump cycles per lb (0.45 kg)	52
Maximum recommended pump speed	115 cycles per minute
Recommended pump speed for continuous operation	95 cycles per minute
Maximum delivery	2.2 lb/min (1.0 kg/min) at 115 cycles/minute
Stroke length	3.25 in. (82.5 mm)
Maximum pump operating temperature	130°F (54°C)
Air inlet size	3/8 npt(f)
Fluid outlet size	1/4 npt(f)
Wetted parts	carbon steel; zinc plating; ductile iron; polyurethane; ultra-high molecular weight polyethylene; Buna-N
Sound pressure level at 70 psi air and 30 cpm	72.99 dB(A)
* Sound power level at 70 psi air and 30 cpm	85.88 dB(A)
Sound pressure level at 150 psi air and maximum cycle rate	79.36 dB(A)
* Sound power level at 70 psi air and maximum cycle rate	92.25 dB(A)

* Sound power levels measured per ISO Standard 9614-2.

Dimensions

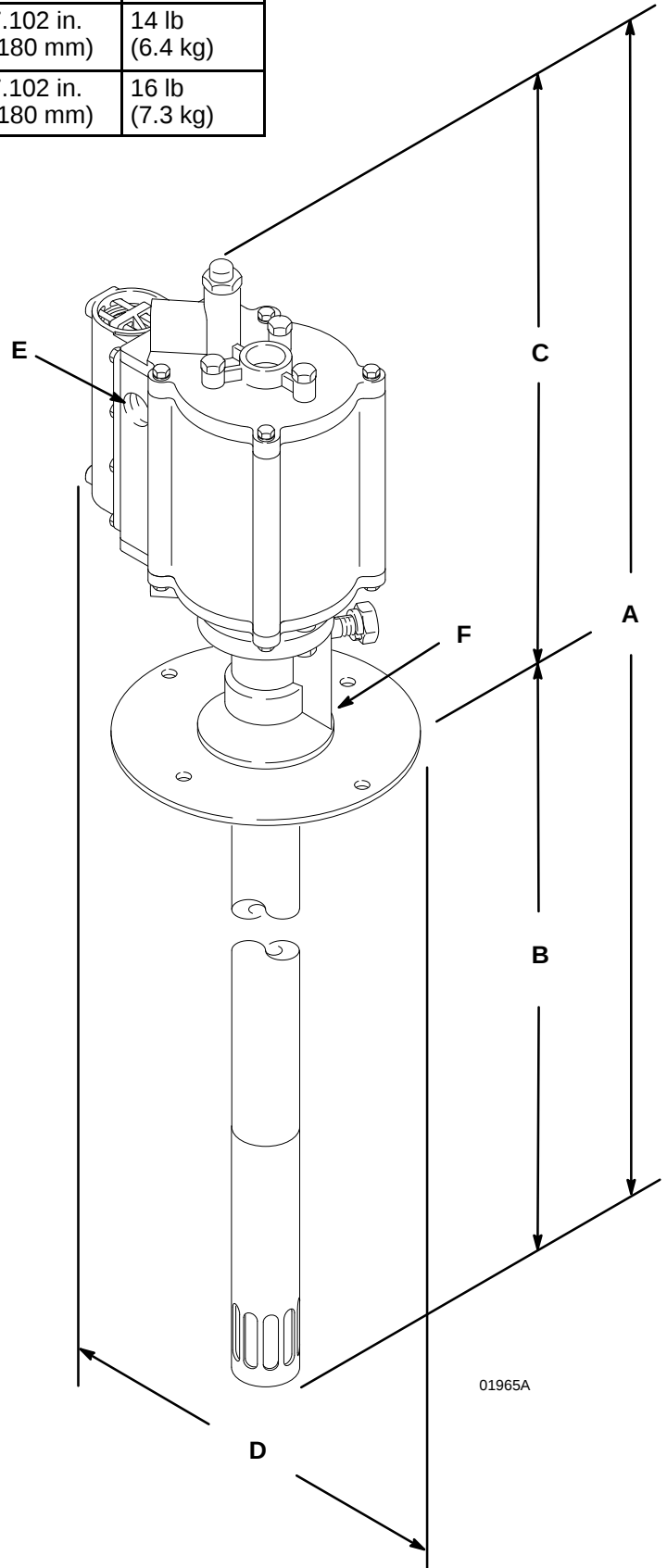
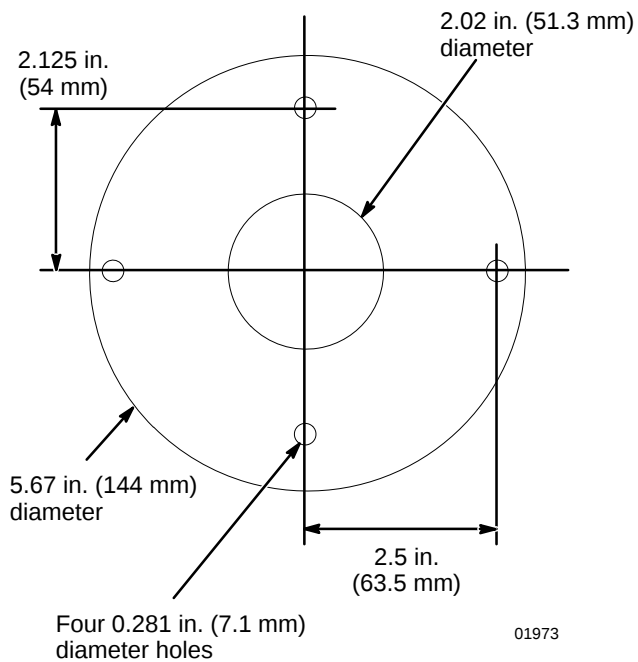
Model No.	A	B	C	D	Weight
235-888	27.369 in. (695 mm)	17.489 in. (444 mm)	9.88 in. (251 mm)	7.102 in. (180 mm)	11 lb (5.0 kg)
235-889	36.619 in. (930 mm)	26.739 in. (679 mm)	9.88 in. (251 mm)	7.102 in. (180 mm)	14 lb (6.4 kg)
235-890	43.559 in. (1106 mm)	33.679 in. (855 mm)	9.88 in. (251 mm)	7.102 in. (180 mm)	16 lb (7.3 kg)

Port Sizes (All Models)

E 3/8 npt(f) Air Inlet

F 1/4 npt(f) Fluid Outlet

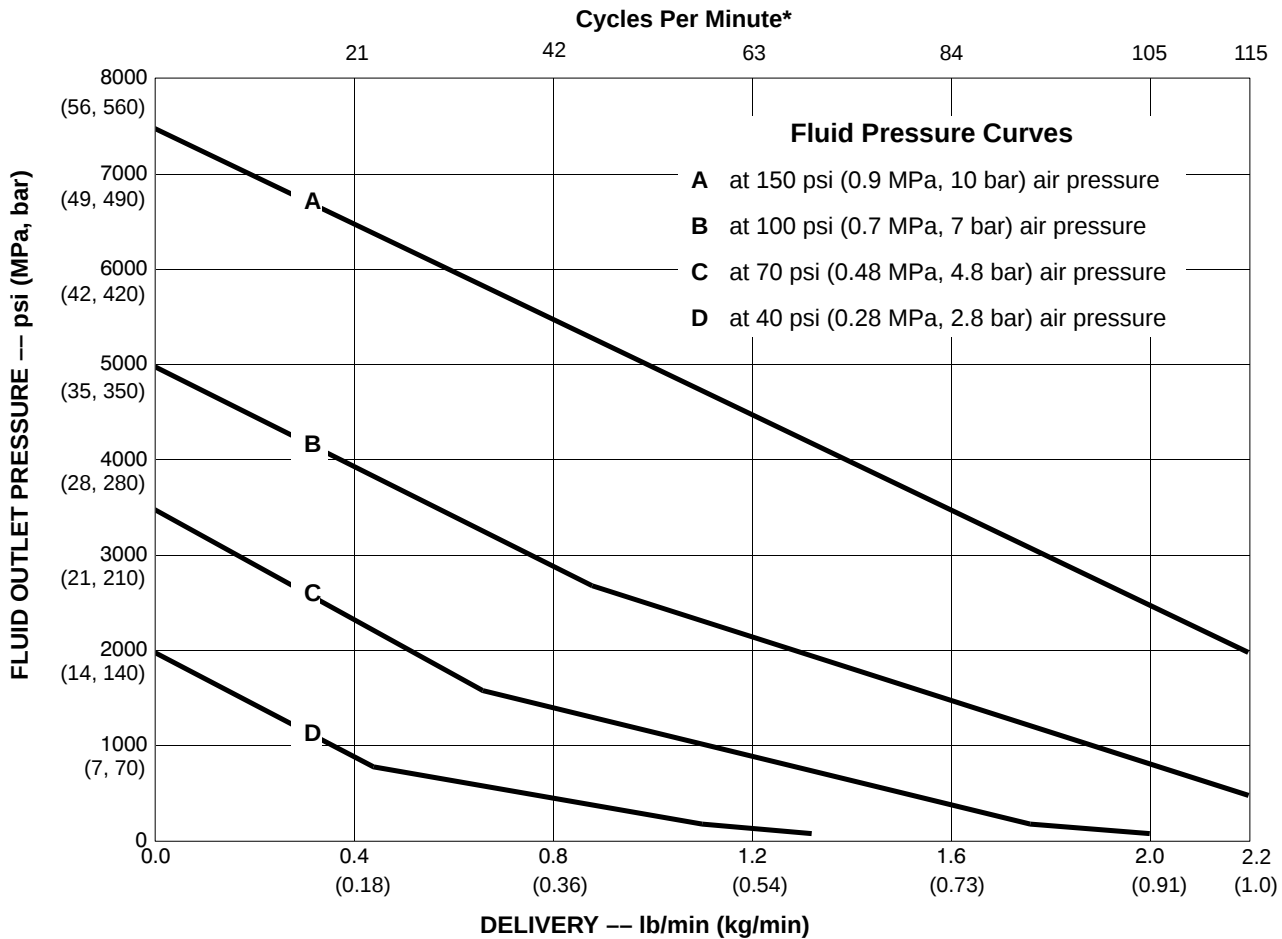
Mounting Hole Layout



Performance Charts

50:1 Eagle Grease Pumps Fluid Outlet Pressure

Test Fluid: No. 2 grease (specific gravity: 0.92)



To find Fluid Outlet Pressure (psi/MPa/bar) at a specific delivery rate (lb/min or kg/min) and operating air pressure (psi/MPa/bar):

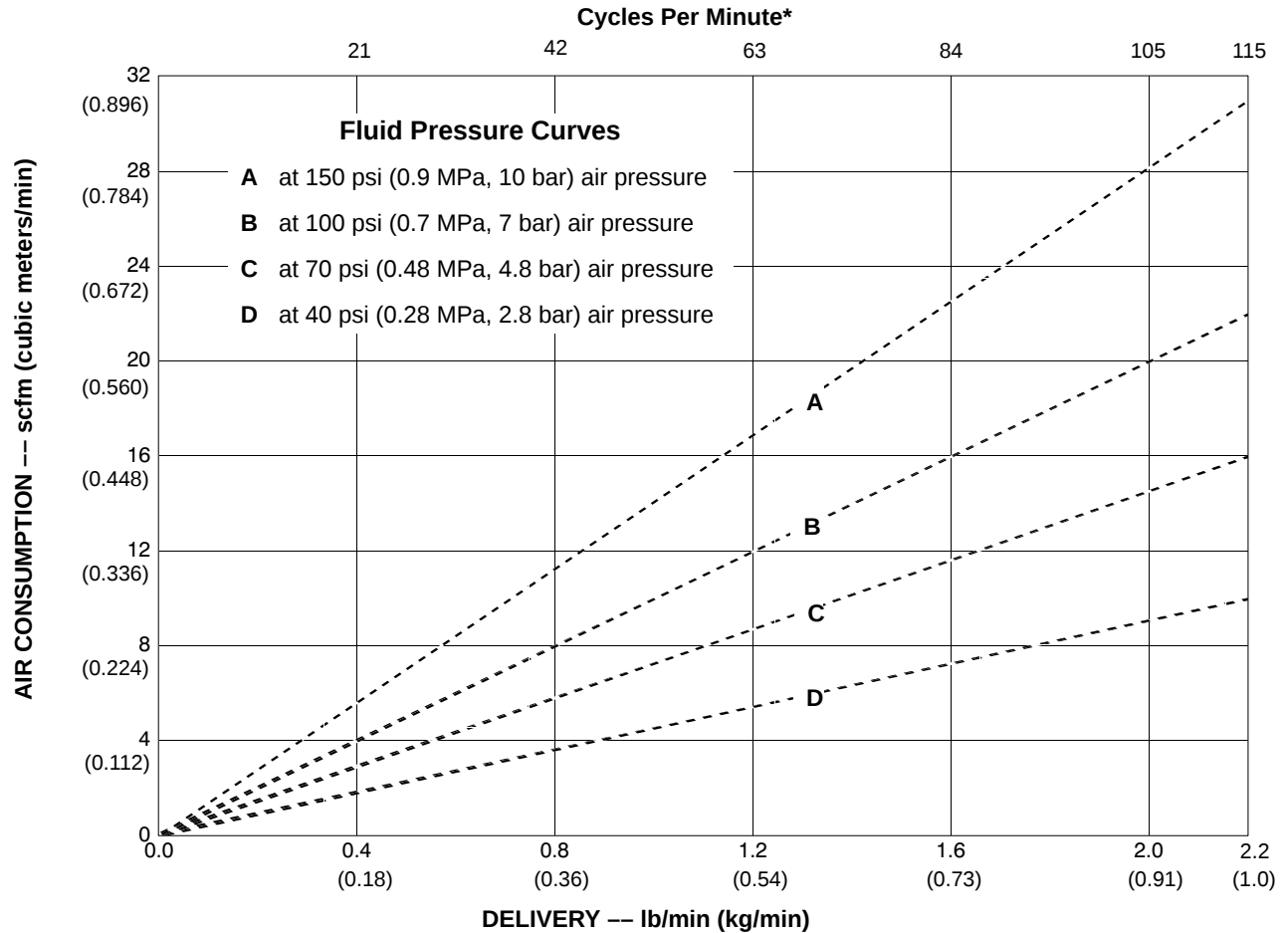
* Recommended pump speed for continuous operation: 95 cpm
Maximum recommended pump speed: 115 cpm

1. Locate delivery rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

Performance Charts

50:1 Eagle Grease Pumps Air Consumption

Test Fluid: No. 2 grease (specific gravity: 0.92)



To find Pump Air Consumption (scfm or m³/min) at a specific delivery rate (lb/min or kg/min) and air pressure (psi/MPa/bar):

1. Locate delivery rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read air consumption.

* Recommended pump speed for continuous operation: 95 cpm
 Maximum recommended pump speed: 115 cpm

Manual Change Summary

This manual went from Rev. M to Rev. N to add the following items to Repair Kit 239–657 (**Parts List**, page 27):

Ref. No.	Part No.	Description	Qty
5		. HOUSING, valve	1
9	276–587	. RETAINER, spool; acetal	2
10	188–583	. CLIP	2

Additionally, fluid pressure and air consumption are graphed separately on two **Performance Charts**.

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.

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