INSTRUCTIONS–PARTS LIST

GRACO

308–108
Rev B
Supersedes A

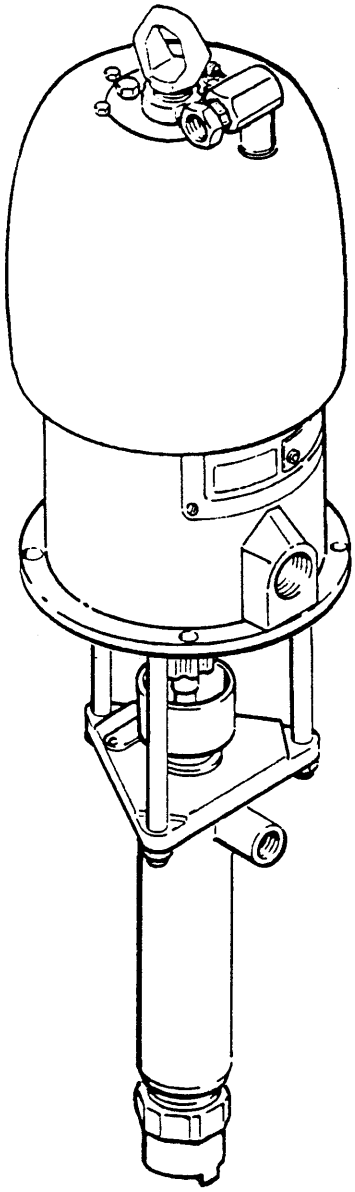
This manual contains IMPORTANT WARNINGS AND INSTRUCTIONS
READ AND RETAIN FOR REFERENCE

SEVERE-DUTY
STAINLESS STEEL PUMP

Model 223–585, Series A
30:1 Ratio Bulldog® Pump, with Standard Air Motor
3000 psi (210 bar) MAXIMUM WORKING PRESSURE
100 psi (7 bar) MAXIMUM AIR INPUT PRESSURE

Model 224–386, Series A
30:1 Ratio Bulldog® Pump, with Quiet Air Motor
3000 psi (210 bar) MAXIMUM WORKING PRESSURE
100 psi (7 bar) MAXIMUM AIR INPUT PRESSURE

Severe–Duty Displacement Pumps have an abrasion and corrosion–resistant displacement rod and sleeve. Refer to **Technical Data** on page 19 for Wetted Parts information.



MODEL 223–585 SHOWN

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

SAFETY WARNINGS

HIGH PRESSURE FLUID CAN CAUSE SERIOUS INJURY. FOR PROFESSIONAL USE ONLY.
OBSERVE ALL WARNINGS. Read And Understand All Instruction Manuals Before Operating Equipment.

FLUID INJECTION HAZARD

General Safety

This equipment generates very high fluid pressure. Spray from the spray gun/dispensing valve, leaks or ruptured components can inject fluid through your skin and into your body and cause extremely serious bodily injury, including the need for amputation. Also, fluid injected or splashed into the eyes or on the skin can cause serious damage.

NEVER point the spray gun/dispensing valve at anyone or at any part of the body. NEVER put hand or fingers over the spray tip/nozzle.

ALWAYS have the tip guard in place on the spray gun when spraying.

ALWAYS follow the **Pressure Relief Procedure**, right, before cleaning or removing the spray tip/nozzle or servicing any system equipment.

NEVER try to stop or deflect leaks with your hand or body.

Be sure all equipment safety devices are operating properly before each use.

Medical Alert--Airless Spray Wounds

If any fluid appears to penetrate your skin, get **EMERGENCY MEDICAL CARE AT ONCE. DO NOT TREAT AS A SIMPLE CUT.** Tell the doctor exactly what fluid was injected.

Note to Physician: *Injection in the skin is a traumatic injury.* **It is important to treat the injury surgically as soon as possible.** *Do not delay treatment to research toxicity. Toxicity is a concern with some exotic coatings injected directly into the blood stream. Consultation with a plastic surgeon or reconstructive hand surgeon may be advisable.*

Spray Gun/Dispensing Valve Safety Devices

Be sure all spray gun/dispensing valve safety devices are operating properly before each use. Do not remove or modify any part of the gun/valve; this can cause a malfunction and result in serious bodily injury.

Safety Latch

Whenever you stop spraying/dispensing, even for a moment, always set the spray gun/dispensing valve safety latch in the closed or "safe" position, making the gun/valve inoperative. Failure to set the safety latch can result in accidental triggering of the gun/valve.

Trigger Guard (if so equipped)

Never operate the spray gun/dispensing valve with the trigger guard removed. This guard helps prevent the gun/valve from triggering accidentally if it is dropped or bumped.

Diffuser (only on spray guns)

The spray gun diffuser breaks up spray and reduces the risk of fluid injection when the tip is not installed. Check the diffuser operation regularly. Follow the **Pressure Relief Procedure**, below, then remove the spray tip. Aim the spray gun into a grounded metal pail, holding the spray gun firmly to the pail. Using the lowest possible pressure, trigger the spray gun. If the fluid emitted *is not* diffused into an irregular stream, replace the diffuser immediately.

Tip Guard (only on spray guns)

ALWAYS have the tip guard in place on the spray gun while spraying. The tip guard alerts you to the fluid injection hazard and helps reduce, **but does not prevent,** the risk of accidentally placing your fingers or any part of your body close to the spray tip.

Spray Tip/Nozzle Safety

Use extreme caution when cleaning or changing spray tips/nozzles. If the spray tip/nozzle clogs while spraying/dispensing, engage the safety latch immediately. ALWAYS follow the **Pressure Relief Procedure** and then remove the spray tip/nozzle to clean it.

NEVER wipe off build-up around the spray tip/nozzle until pressure is fully relieved and the safety latch is engaged.

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing in the eyes or on the skin, or injury from moving parts, always follow this procedure whenever you shut off the pump, when checking or servicing any part of the spray/dispensing system, when installing, cleaning or changing spray tips/nozzles, and whenever you stop spraying/dispensing.

1. Engage the spray gun/dispensing valve safety latch.
2. Shut off the air to the pump.
3. Close the bleed-type master air valve (required in your system).
4. Disengage the gun/valve safety latch.
5. Hold a metal part of the gun/valve firmly to the side of a grounded metal pail, and trigger the gun/valve to relieve pressure.
6. Engage the gun/valve safety latch.
7. Open the drain valve (required in your system), having a grounded metal container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray/dispense again.

If you suspect that the spray tip/nozzle 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. Now clear the tip/nozzle or hose.

EQUIPMENT MISUSE HAZARD

General Safety

Any misuse of the spray/dispensing equipment or accessories, such as overpressurizing, modifying parts, using incompatible chemicals and fluids, or using worn or damaged parts, can cause them to rupture and result in fluid injection, splashing in the eyes or on the skin, or other serious bodily injury, or fire, explosion or property damage.

NEVER alter or modify any part of this equipment; doing so could cause it to malfunction.

CHECK all spray/dispensing equipment regularly and repair or replace worn or damaged parts immediately.

Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

System Pressure

The 30:1 ratio pump develops 3000 psi (210 bar) MAXIMUM WORKING PRESSURE at 100 psi (7 bar) maximum air input pressure. NEVER exceed 100 psi (7 bar) air supply pressure to the pump.

Be sure that all spray/dispensing equipment and accessories are rated to withstand the maximum working pressure of the pump. DO NOT exceed the maximum working pressure of any component or accessory used in the system.

Fluid Compatibility

BE SURE that all fluids and solvents used are chemically compatible with the wetted parts shown in the **TECHNICAL DATA** on page 19. Always read the manufacturer's literature before using fluid or solvent in this pump.

FIRE OR EXPLOSION HAZARD

Static electricity is created by the high velocity flow of fluid through the pump and hose. If every part of the spray/dispensing equipment is not properly grounded, sparking may occur, and the system may become hazardous. Sparking may also occur when plugging in or unplugging a power supply cord. Sparks can ignite fumes from solvents and the fluid being sprayed, dust particles and other flammable substances, whether you are spraying/dispensing indoors or outdoors, and can cause a fire or explosion and serious bodily injury and property damage. Do not plug in or unplug any power supply cords in the spray/dispensing area when there is any chance of igniting fumes still in the air.

If you experience any static sparking or even a slight shock while using this equipment, **STOP SPRAYING/DISPENSING IMMEDIATELY.** Check the entire system for proper grounding. Do not use the system again until the problem has been identified and corrected.

Grounding

To reduce the risk of static sparking, ground the pump, object being sprayed, and all other spray/dispensing equipment used or located in the spray/dispensing area. CHECK your local electrical code for detailed grounding instructions for your area and type of equipment. BE SURE to ground all of this spray/dispensing equipment:

1. *Pump:* use a ground wire and clamp. See Fig 1.
2. *Air and fluid hoses:* use only grounded hoses with a maximum of 500 ft (150 m) combined hose length to ensure grounding continuity. Refer to **Hose Grounding Continuity.**
3. *Air compressor:* follow manufacturer's recommendations.
4. *Spray gun or dispensing valve:* grounding is obtained through connection to a properly grounded fluid hose and pump.
5. *Object being sprayed:* according to your local code.
6. *Fluid supply container:* according to your local code.
7. *All solvent pails used when flushing,* according to your local code. Use only metal pails, which are conductive, placed on a grounded surface. Do not place the pail on a nonconductive surface, such as paper or cardboard, which interrupts the grounding continuity.
8. *To maintain grounding continuity when flushing or relieving pressure,* always hold a metal part of the spray gun/dispensing valve firmly to the side of a grounded *metal* pail, then trigger the gun/valve.

To ground the pump:
To ground the pump, 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. See Fig 1. Connect the other end of the wire to a true earth ground. See the ACCESSORIES section to order a ground wire and clamp.

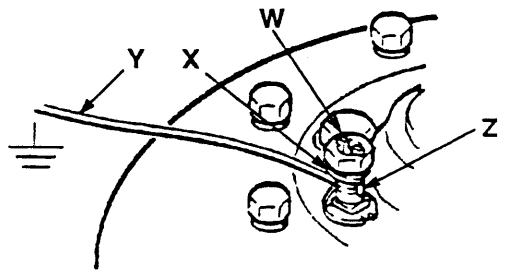


Fig 1

Flushing Safety

Before flushing, be sure the entire system and flushing pails are properly grounded. Refer to **Grounding,** at left. Follow the **Pressure Relief Procedure** on page 2, and *remove the spray tip/nozzle from the spray gun/dispensing valve.* Always use the lowest possible fluid pressure, and maintain firm metal-to-metal contact between the gun/valve and the pail during flushing to reduce the risk of fluid injection injury, static sparking and splashing.

HOSE SAFETY

High pressure fluid in the hoses can be very dangerous. If the hose develops a leak, split or rupture due to any kind of wear, damage or misuse, the high pressure spray emitted from it can cause a fluid injection injury or other serious bodily injury or property damage.

ALL FLUID HOSES MUST HAVE SPRING GUARDS ON BOTH ENDS! The spring guards help protect the hose from kinks or bends at or close to the coupling which can result in hose rupture.

TIGHTEN all fluid connections securely before each use. High pressure fluid can dislodge a loose coupling or allow high pressure spray to be emitted from the coupling.

NEVER use a damaged hose. Before each use, check the entire hose for cuts, leaks, abrasion, bulging cover, or damage or movement of the hose couplings. If any of these conditions exist, replace the hose immediately. DO NOT try to recouple high pressure hose or mend it with tape or any other device. A repaired hose cannot safely contain the high pressure fluid.

HANDLE AND ROUTE HOSES CAREFULLY. Do not pull on hoses to move equipment. Do not use fluids which are not compatible with the inner tube and cover of the hose. DO NOT expose Graco hoses to temperatures above 180°F (82°C) or below -40°F (-40°C).

Hose Grounding Continuity

Proper hose grounding continuity is essential to maintaining a grounded spray/dispensing system. Check the electrical resistance of your air and fluid hoses at least once a week. If your hose does not have a tag on it which specifies the maximum electrical resistance, contact the hose supplier or manufacturer for the maximum resistance limits. Use a resistance meter in the appropriate range for your hose to check the resistance. If the resistance exceeds the recommended limits, replace it immediately. An ungrounded or poorly grounded hose can make your system hazardous. Also, read **FIRE OR EXPLOSION HAZARD,** above.

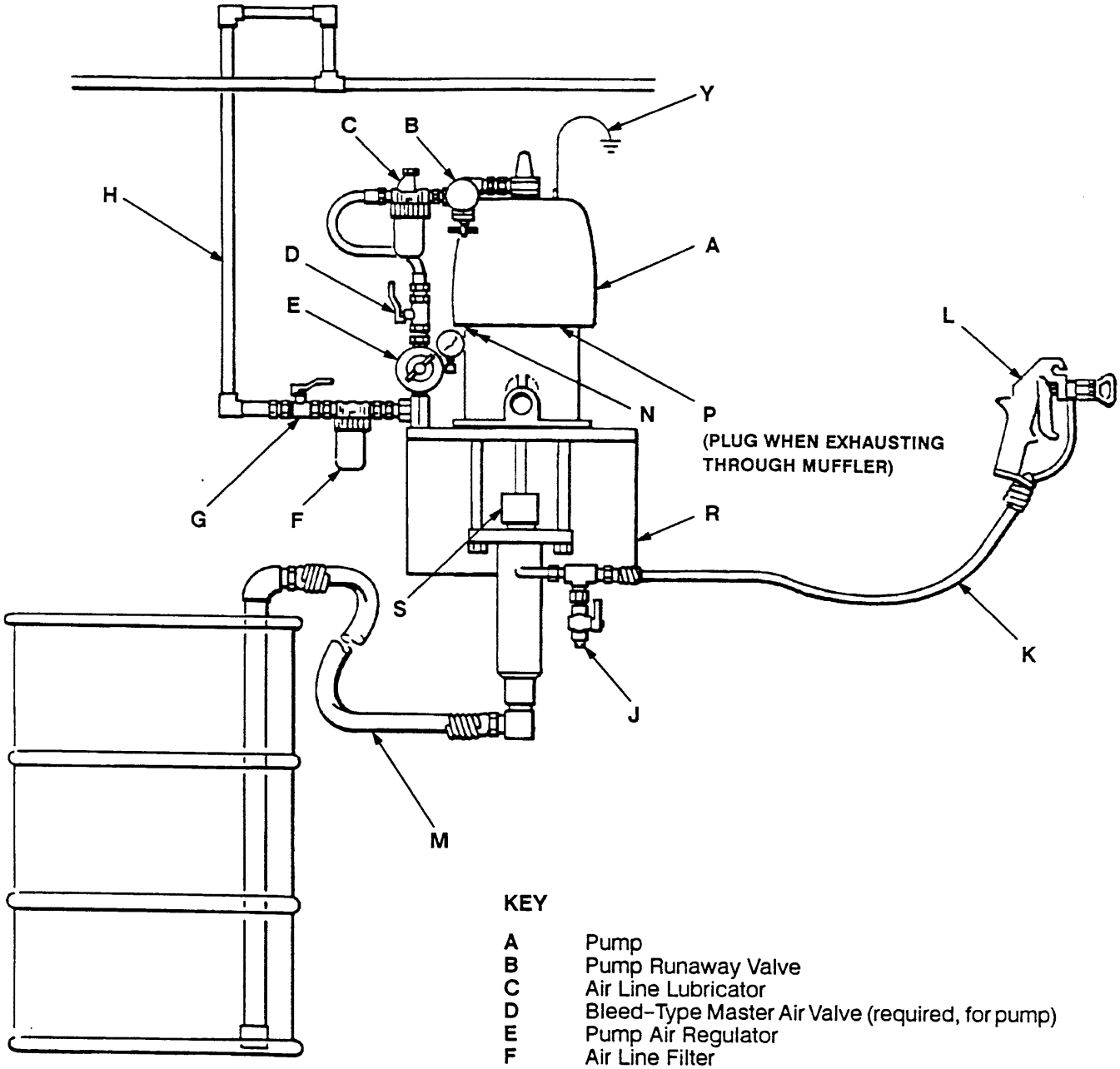
MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers or other body parts. The air motor piston (located behind the air motor shield) moves when air is supplied to the motor. Therefore, NEVER operate the pump with the air motor shield removed. KEEP CLEAR of moving parts when starting or operating the pump. Before servicing the pump, follow the **Pressure Relief Procedure** on page 2 to prevent the pump from starting accidentally.

IMPORTANT

United States Government safety standards have been adopted under the Occupational Safety and Health Act. These standards - particularly the General Standards, Part 1910, and the Construction Standards, Part 1926 - should be consulted.

TYPICAL INSTALLATION



KEY

A	Pump
B	Pump Runaway Valve
C	Air Line Lubricator
D	Bleed-Type Master Air Valve (required, for pump)
E	Pump Air Regulator
F	Air Line Filter
G	Bleed-Type Master Air Valve (for accessories)
H	Air Supply Hose
J	Fluid Drain Valve (required)
K	Fluid Supply Hose
L	Spray Gun
M	Fluid Suction Hose
N	Exhaust Port for Muffler (1-1/4" npt)
P	16 Exhaust Holes
R	Wall Bracket
S	Packing Nut/Wet-Cup
Y	Ground Wire (required)

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

See pages 16 and 17 for accessories available from Graco. If you supply your own accessories, be sure they are adequately sized and pressure-rated to meet the system's requirements.

The Typical Installation shown on page 4 is only a guide for selecting and installing system components and accessories. Contact your Graco representative or Graco Technical Assistance (see back page) for assistance in designing a system to suit your particular needs.

SYSTEM ACCESSORIES

Refer to the Typical Installation drawing on page 4.

WARNING

Two accessories are required in your system: a bleed-type master air valve (D) and a fluid drain valve (J). These accessories help reduce the risk of serious bodily 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.

The fluid drain valve assists in relieving fluid pressure in the displacement pump, hose, and gun. Triggering the gun to relieve pressure may not be sufficient.

Mounting Accessories

Mount the pump (A) to suit the type of installation planned. The pump dimensions and mounting hole layout are shown on page 18. Use 3/8 in. bolts, lockwashers and nuts to attach the pump firmly to the mounting.

Air and Fluid Hoses

Be sure all air and fluid hoses are properly sized and pressure-rated for your system. Use only grounded air and fluid hoses. Fluid hoses must have spring guards on both ends.

Connect a grounded fluid hose (K) to the pump's fluid outlet, using a suitable adapter.

Connect a fluid suction hose and tube (M) to the pump's fluid intake.

Use a grounded 3/4 in. I.D. (minimum) air hose (H) to supply air to the pump.

Air Line Accessories

Install the following accessories in the order shown in the Typical Installation, using adapters as necessary:

A pump runaway valve (B) senses when the pump is running too fast and automatically shuts off the air to the motor. A pump which runs too fast can be seriously damaged. Install closest to the pump air inlet.

An air line lubricator (C) provides automatic air motor lubrication.

A bleed-type master air valve (D) is required in your system to relieve air trapped between it and the air motor when the valve is closed (see the **WARNING** at left). Be sure the bleed valve is easily accessible from the pump, and is located **downstream** from the air regulator.

An air regulator (E) controls pump speed and outlet pressure by adjusting the air pressure to the pump. Locate the regulator close to the pump, but **upstream** from the bleed-type master air valve.

An air line filter (F) removes harmful dirt and moisture from the compressed air supply.

A second bleed-type air valve (G) isolates the air line accessories for servicing. Locate upstream from all other air line accessories.

Fluid Line Accessories

Install the following accessories in the positions shown in the Typical Installation, using adapters as necessary:

A fluid drain valve (J) is required in your system to relieve fluid pressure in the hose and gun (see the **WARNING** at left). Install the drain valve pointing down, but so the handle points up when opened.

A spray gun (L) dispenses the fluid. The gun shown in the Typical Installation is an airless spray gun.

Air Motor Exhaust

To route the air motor exhaust outside, remove the exhaust port plug and connect the hose to the 1-1/4 npt(f) exhaust port (N). Plug the 16 exhaust holes in the base of the motor with 1/4 in. size x 1/2 in. long self-tapping screws.

GROUNDING

WARNING

Before operating the pump, ground the system as explained under **FIRE OR EXPLOSION HAZARD** and **Grounding** on page 3.

WARNING

Pressure Relief Procedure
To reduce the risk of serious bodily injury, including fluid injection, splashing in the eyes or on the skin, or injury from moving parts, always follow this procedure whenever you shut off the pump, when checking or servicing any part of the spray/dispensing system, when installing, cleaning or changing spray tips/nozzles, and whenever you stop spraying/dispensing.

1. Engage the spray gun/dispensing valve safety latch.
2. Shut off the air to the pump.
3. Close the bleed-type master air valve (required in your system).
4. Disengage the gun/valve safety latch.
5. Hold a metal part of the gun/valve firmly to the side of a grounded metal pail, and trigger the gun/valve to relieve pressure.
6. Engage the gun/valve safety latch.
7. Open the drain valve (required in your system), having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip/nozzle 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. Now clear the tip/nozzle or hose.

WARNING

Moving parts can pinch or amputate your fingers or other body parts. When air is supplied to the motor, the air motor piston (located behind the air motor shield) moves. Therefore, NEVER operate the pump with the air motor shield removed.

Flush the Pump Before Using
The pump is tested with lightweight motor oil, which is left in to protect the pump parts. If the fluid you are pumping may be contaminated by the oil, flush out the oil with a compatible solvent before using the pump. If the pump is being used to supply a circulating system, allow the solvent to circulate until the pump is thoroughly flushed.

WARNING

For your safety, read the warning section, **FIRE OR EXPLOSION HAZARD** on page 3 before flushing, and follow all the recommendations given there.

Starting and Adjusting the Pump
See the **TYPICAL INSTALLATION** on page 4. Be sure the air regulator (E) and bleed-type master air valve (D) are closed. *DO NOT INSTALL THE SPRAY TIP YET!*

Connect a suction hose (M) to the pump's fluid inlet. Hold a metal part of the spray gun (L) firmly to the side of a grounded metal pail and hold the trigger open. Then open the pump's bleed-type master air valve (D). Now slowly open the air regulator until the pump starts, about 20 psi (1.4 bar).

Cycle the pump slowly until all the air is pushed out, and fluid is flowing from the gun in a steady stream. Release the spray gun trigger and engage the safety latch. The pump should stall against pressure when the trigger is released.

Follow the **Pressure Relief Procedure Warning** at left, then install the spray tip in the gun.

In a direct supply system, with the pump and lines primed and with adequate air pressure and volume supplied, the pump will start and stop as the spray gun is opened and closed. In a circulating system, the pump will run continuously and will speed up or slow down as supply demands until the air supply is shut off.

Use an adequately sized air regulator (E) to control the pump speed and the fluid pressure. See ACCESSORIES on page 16. Always use the lowest air pressure necessary to get the desired results. Higher pressures waste fluid and cause premature wear of the pump packings and spray tip.

Keep the packing nut/wet-cup (S) half filled with Graco Throat Seal Liquid (TSL) or compatible solvent, to help prolong the packing life. Adjust the packing nut weekly with the wrench (supplied) so it is just tight enough to prevent leakage; do not overtighten. Always follow the **Pressure Relief Procedure Warning** at left before adjusting the packing nut.

Never allow the pump to run dry of the fluid being pumped. A dry pump will quickly accelerate to a high speed, possibly damaging itself. A pump runaway valve (B), which shuts off the air supply to the pump if the pump accelerates beyond the pre-set speed, is available. See the Typical Installation on page 4 and **ACCESSORIES** on page 16. 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.

Shutdown and Care of the Pump
For overnight shutdown, follow the **Pressure Relief Procedure Warning** at left. Always stop the pump at the bottom of the stroke to prevent the fluid from drying on the exposed displacement rod and damaging the throat packings.

Always flush the pump before the fluid dries on the displacement rod. Follow the **Pressure Relief Procedure Warning** at left after flushing.

NOTES:

TROUBLESHOOTING CHART

NOTE: CHECK ALL POSSIBLE PROBLEMS AND SOLUTIONS BEFORE DISASSEMBLING PUMP.

PROBLEM	CAUSE	SOLUTION
Pump fails to operate	Restricted line or inadequate air supply	Clear; increase air supply.
	Obstructed fluid hose, gun, or dispensing valve	Open, clear.*
	Exhausted fluid supply	Refill; purge all air from pump and fluid lines.
	Fluid dried on displacement rod	Clean; always stop pump at bottom of stroke; keep wet-cup 1/2 filled with compatible solvent.
	Damaged air motor	Service air motor (see 307-049 or 307-304).
Pump operates but output low on both strokes	Restricted line or inadequate air supply	Clear; increase air supply.
	Obstructed fluid hose, gun, or dispensing valve	Open, clear.*
	Exhausted fluid supply	Refill; purge all air from pump and fluid lines.
	Air in displacement pump and hose	Reprime.
	Check valves need adjustment	Adjust (see page 10).
	Packing nut too tight or too loose	Adjust (see page 6).
	Worn throat packings	Replace (see page 10).
Pump operates but output low on down stroke	Held open or worn intake valve	Clear; service. See page 10.
Pump operates but output low on up stroke	Held open or worn fluid piston valve or packings	Clear; service. See page 10.
Erratic or accelerated operation	Exhausted fluid supply	Refill; purge all air from pump and fluid lines.
	Packing nut too tight	Adjust (see page 6).
	Check valves need adjustment	Adjust (see page 10).
	Held open or worn intake valve	Clear; service. See page 10.
	Held open or worn fluid piston valve or packings	Clear; service. See page 10.

* To determine if the fluid hose or gun/valve is obstructed, follow the **Pressure Relief Procedure Warning** below. Disconnect the fluid hose and place a container at the pump fluid outlet to catch any fluid. Turn on the air just enough to start the pump (about 20-40 psi [1.4-2.8 bar]). If the pump starts when the air is turned on, the obstruction is in the fluid hose or gun/valve.

WARNING

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing in the eyes or on the skin, or injury from moving parts, always follow this procedure whenever you shut off the pump, when checking or servicing any part of the spray/dispensing system, when installing, cleaning or changing spray tips/nozzles, and whenever you stop spraying/dispensing.

1. Engage the spray gun/dispensing valve safety latch.
2. Shut off the air to the pump.
3. Close the bleed-type master air valve (required in your system).
4. Disengage the gun/valve safety latch.
5. Hold a metal part of the gun/valve firmly to the side of a grounded metal pail, and trigger the gun/valve to relieve pressure.
6. Engage the gun/valve safety latch.
7. Open the drain valve (required in your system), having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray/dispense again.

If you suspect that the spray tip/nozzle 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. Now clear the tip/nozzle or hose.

DISCONNECTING THE DISPLACEMENT PUMP

1. Flush the pump if possible. Stop the pump at the bottom of its stroke. Follow the **Pressure Relief Procedure Warning** on page 8.
2. Disconnect the air and fluid hoses. Remove the pump from its mounting. Note the relative position of the pump's fluid outlet to the air motor's air inlet.
3. Remove the upper cotter pin (107) and unscrew the coupling nut (104) from the air motor (101). Unscrew the tie rod locknuts (108) from the tie rods (114). Carefully pull the displacement pump (109) away from the motor.
4. Loosen the packing nut (1). Loosen the jam nut (112). Remove the lower cotter pin (107) from the displacement rod (11). Unscrew the connecting rod (113) from the displacement rod (11) and from the coupling (105). See Fig 2.
5. Refer to page 10 for displacement pump service instructions.
6. Refer to the air motor instruction manual supplied with your pump for air motor service instructions (307-049 for Standard Bulldog Motors, and 307-304 for Quiet Bulldog Motors).

RECONNECTING THE DISPLACEMENT PUMP

1. Inspect the o-ring (106) on the connecting rod (113) and replace if necessary. Lubricate the threads of the connecting rod (113). Insert the coupling (105) in the coupling nut (104) and screw the coupling onto the connecting rod (113) so the holes in the coupling ailgn with the top holes in the rod.
2. Screw the connecting rod (113) into the displacement rod (11) until the holes in both parts are aligned. Install the lower cotter pin (107). Tighten the jam nut (112) down against the displacement rod (11). See Fig 2.
3. Orient the pump's fluid outlet to the air motor's air inlet as was noted in step 2 under **Disconnecting the Displacement Pump.** Position the displacement pump (109) on the tie rods (114).
4. Screw the locknuts (108) onto the tie rods (114) loosely. Screw the coupling nut (104) onto the air motor (101). Install the upper cotter pin (107).
5. Mount the pump and reconnect all hoses. Reconnect the ground wire if it was disconnected during repair.
6. Tighten the tie rod locknuts (108) evenly, and torque to 40-50 ft-lb (54-68 N.m).
7. Tighten the packing nut/wet-cup (1) with the wrench (103) supplied, so it is just snug - no tighter. Fill the wet-cup half full with Graco Throat Seal Liquid or compatible solvent. Start the pump and run it slowly, at about 20 psi (1.4 bar) air pressure, to check that it is operating properly.

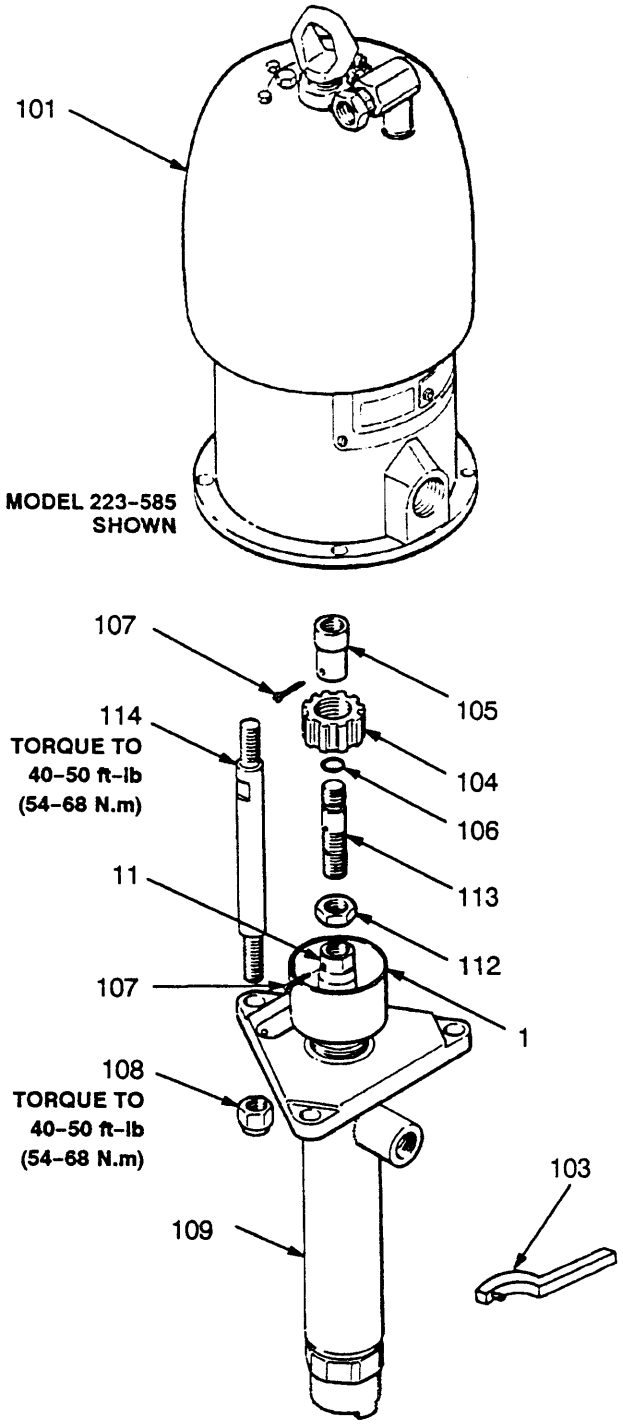


Fig 2

DISPLACEMENT PUMP SERVICE

WARNING

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing in the eyes or on the skin, or injury from moving parts, always follow this procedure whenever you shut off the pump, when checking or servicing any part of the spray/dispensing system, when installing, cleaning or changing spray tips/nozzles, and whenever you stop spraying/dispensing.

1. Engage the gun/valve safety latch.
2. Shut off the air to the pump.
3. Close the bleed-type master air valve (required in your system).
4. Disengage the gun/valve safety latch.
5. Hold a metal part of the gun/valve firmly to the side of a grounded metal pail, and trigger the gun/valve to relieve pressure.
6. Engage the gun/valve safety latch.
7. Open the drain valve (required in your system), having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip/nozzle or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, VERY SLOWLY loosen the retaining nut or hose end coupling and relieve pressure gradually, then loosen completely. Now clear the tip/nozzle or hose.

Disassembly

NOTES: Packing Repair Kit 224-098 is available. The kit includes two preassembled packing stacks. Do not disassemble the stacks or interchange parts between them. For the best results, use all the new parts in the kit, even if the old ones look good. Parts included in the repair kit are marked with an asterisk, for example (6*).

1. Disconnect the displacement pump from the motor as explained on page 9.
2. Screw the intake valve housing (3) out of the pump outlet housing (4). Note which set of holes the ball stop pin (14) is in. Remove the pin, ball guide (10), ball (8), and o-ring (7) from the intake valve housing (3). See Fig. 3. Check that the ball seat of the intake valve housing is not chipped or nicked.
3. Unscrew the wet-cup/packing nut (1) and push the displacement rod (11) down and out of the outlet housing (4).
4. Place the flats of the piston (2) in a vise. Using a wrench on the flats of the displacement rod (11), screw the rod off the piston.
5. Remove the ball (6), retainer (13), and gland/packing stack (21) from the piston. Check that the ball seat of the piston is not chipped or nicked.
6. Remove the gland/packing stack (21) from the throat.
7. Clean all parts thoroughly, and check for wear, scratches or other damage. Scoring or irregular surfaces on the displacement rod (11) or polished inner wall of the sleeve (15) can cause premature packing wear and leaking. Check these parts by rubbing a finger on the surfaces or by holding the parts up to the light at an angle. If either is worn or scratched, replace it.

NOTE: If the sleeve (15) needs replacement and is hard to remove, contact your nearest Graco Factory Branch or Graco Technical Service (see back page).

Reassembly

1. Lubricate the throat gland/packing stack (21*). Install the stack in the throat of the pump outlet housing (4). DO NOT disassemble the stack. *Be sure the lips of the v-packings face down in the throat.* See Fig. 4. Loosely install the packing nut/wet-cup (1).
2. Reinstall the sleeve (15) if it was removed, making sure to replace the gasket (12*). *Be sure the tapered end of the sleeve faces down, toward the pump intake.*
3. Lubricate the other packing stack (21*) and install it on the piston (2). DO NOT disassemble the stack. *Be sure the lips of the v-packings face up on the piston.* See Fig. 5. Install the retainer (13*) and ball (6*).
4. Screw the piston (2) into the displacement rod (11). Torque to 150-175 ft-lb (203-237 N.m). See Fig. 3.

NOTE: DO NOT use thread sealant on the piston.

5. Lubricate the displacement rod (11), and insert it in the bottom of the outlet housing (4). Carefully push it up through the throat packings.
6. Install the ball (8*), ball guide (10), and ball stop pin (14) in the intake valve housing (3). Be sure the pin is in the desired set of holes, as was noted in step 2 under **Disassembly.** (To change the pin location, see **Check Valve Adjustment,** below.) Install the o-ring (7*) on the intake valve housing (3). Apply thread lubricant and screw the assembly into the outlet housing (4). Torque to 90-100 ft-lb (122-136 N.m).
7. Reconnect the displacement pump to the motor as explained on page 9.

Check Valve Adjustment

The intake check valve is set for high flow rates or high viscosity fluids. To set the valve for lighter viscosity fluids or a lower flow rate, to minimize surging at pump stroke changeover, move the ball stop pin (14) to the lower set of holes, decreasing the check ball travel. The piston check valve in this pump is not adjustable.

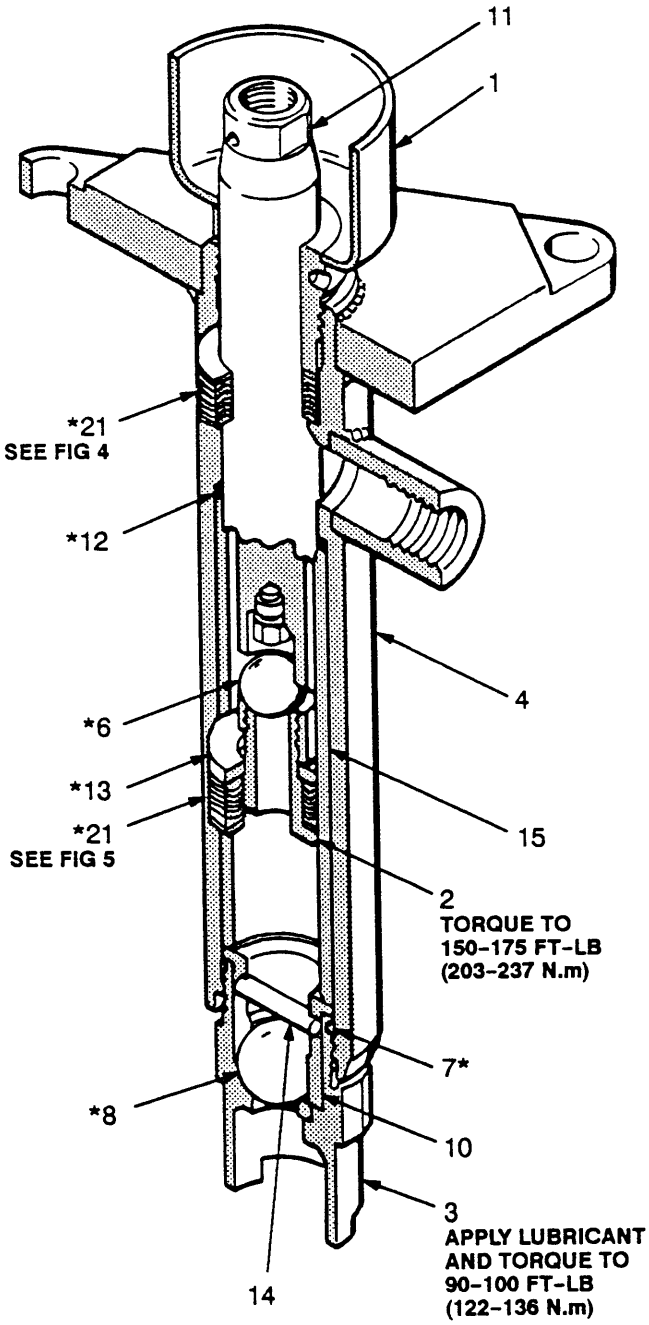


Fig. 3

DETAIL OF THROAT GLAND/PACKING STACK.
DO NOT DISASSEMBLE STACK WHEN INSTALLING IN PUMP.

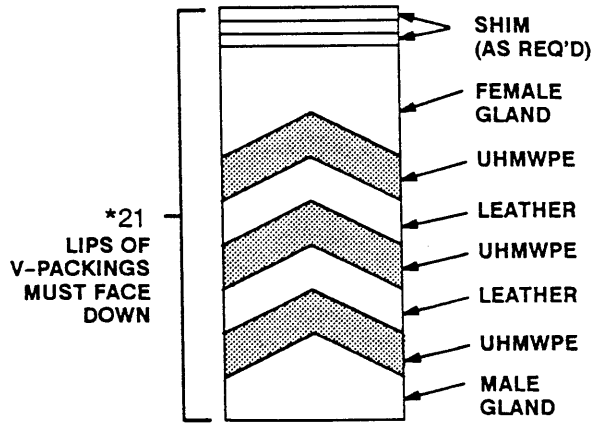


Fig. 4

DETAIL OF PISTON GLAND/PACKING STACK.
DO NOT DISASSEMBLE STACK WHEN INSTALLING IN PUMP.

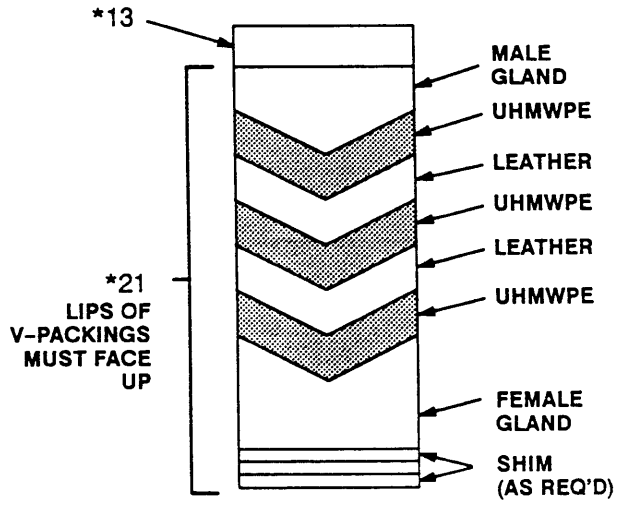


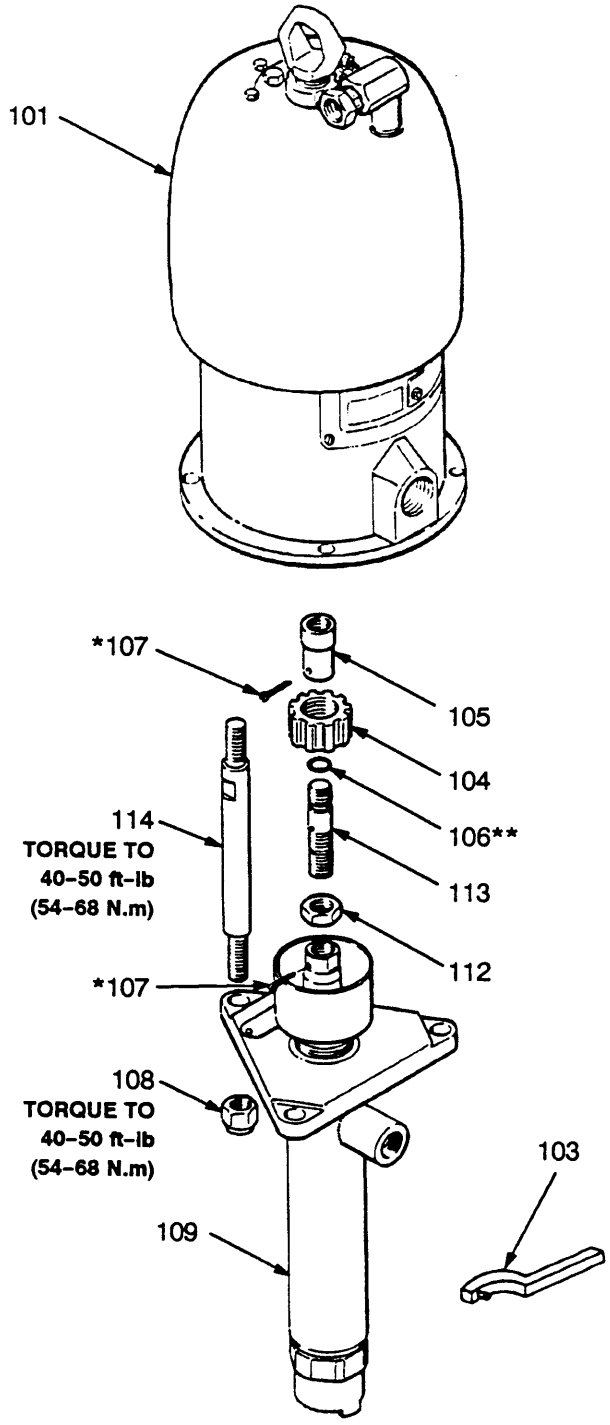
Fig 5

NOTES:

PARTS DRAWING AND PARTS LIST

Model 223-585, Series A
30:1 Ratio Bulldog Pump, with Standard Air Motor
Includes items 101-117

Model 224-386, Series A
30:1 Ratio Bulldog Pump, with Quiet Air Motor
Includes items 101-117



MODEL 223-585 SHOWN

REF NO.	PART NO.	DESCRIPTION	QTY
101	208-356	BULLDOG AIR MOTOR, standard Used on Model 223-585 (shown) See 307-049 for parts	1
	215-255	BULLDOG AIR MOTOR, quiet Used on Model 224-386 See 307-304 for parts	1
103	102-176	WRENCH	1
104	168-210	NUT, coupling	1
105	168-211	COUPLING	1
106	158-674**	SEAL, o-ring; nitrile rubber	1
107	100-103*	PIN, cotter; 0.12" (3.2 mm) x 1.5" (38 mm)	2
108	101-712	NUT, lock; 5/8-11	3
109	223-577	DISPLACEMENT PUMP ASSY See pages 14 and 15 for parts	1
112	101-936	NUT, jam; 3/4-10	1
113	168-212	ROD, connecting	1
114	167-911	ROD, tie; 7" (178 mm), shoulder-to-shoulder	3
117	172-447***	LABEL, warning (not shown)	1

* *Included in Repair Kit 224-098 (see page 15).*

** *Recommended "tool box" spare parts. Keep on hand to reduce downtime.*

*** *Extra warning tags and labels available at no extra charge.*

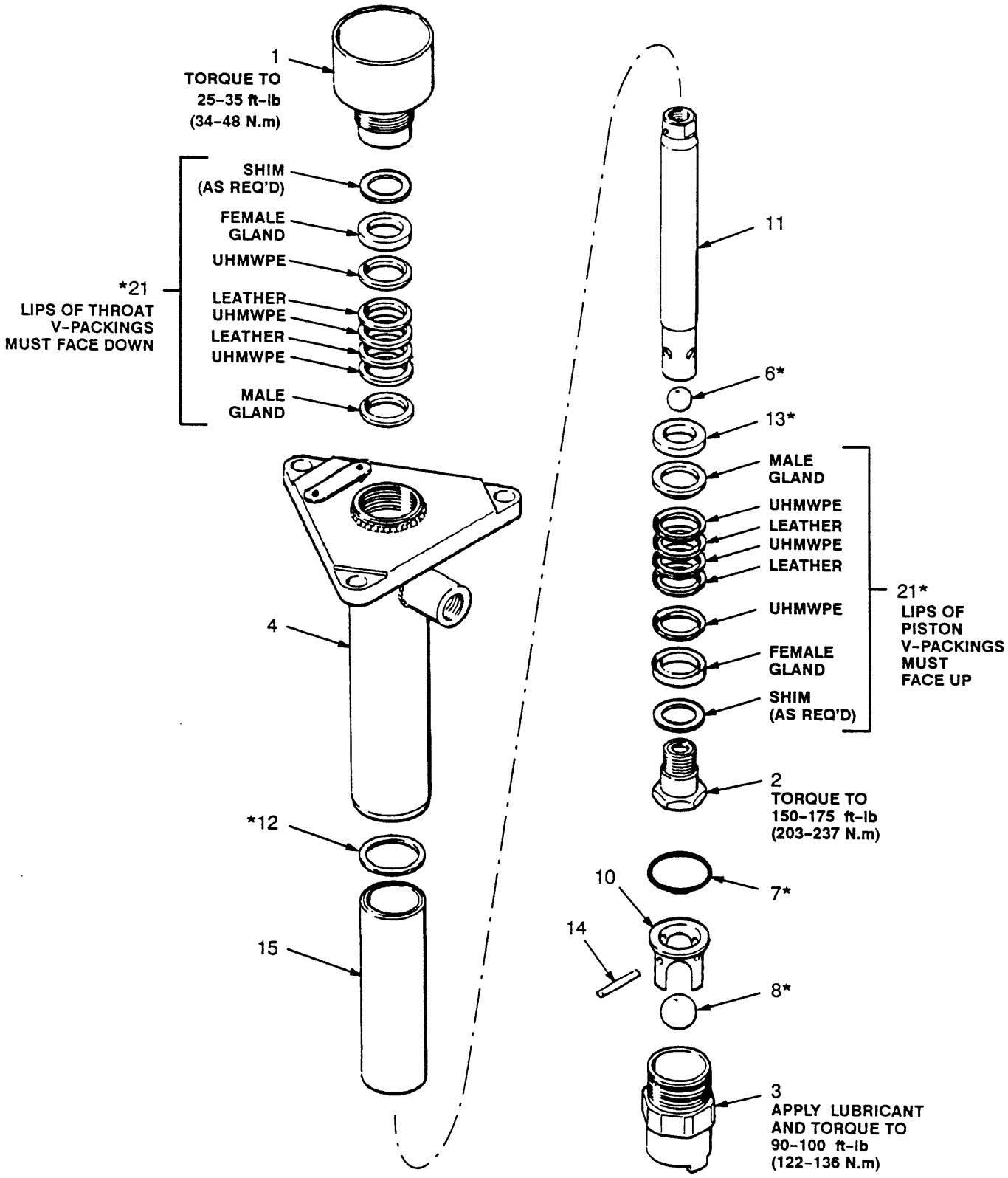
306 and 307 numbers in descriptions refer to separate instruction manuals, supplied.

HOW TO ORDER PARTS

1. To be sure you receive the correct replacement parts, kits or accessories, always give all of the information requested in the chart below.
2. Check the parts list to identify the correct part number; do not use the ref. no. when ordering.
3. Order all parts from your nearest Graco distributor.

6 digit Part Number	Qty	Part Description

Model 223-577, Series A
Includes items 1-21



Model 223-577, Series A
Includes items 1-21

REF NO.	PART NO.	DESCRIPTION	QTY
1	223-579	PACKING NUT/WET-CUP; stainless steel	1
2	223-562	PISTON; stainless steel with tungsten carbide seat	1
3	223-563	HOUSING, intake valve; stainless steel with tungsten carbide seat	1
4	223-578	HOUSING, outlet; stainless steel	1
6	109-217*	BALL, piston; stainless steel; 7/8" dia.	1
7	166-073*	O-RING; PTFE	1
8	109-219*	BALL, intake; stainless steel; 1-1/4" dia	1
10	186-158	GUIDE, ball; stainless steel	1
11	178-899	ROD, displacement; stainless steel	1
12	164-652*	GASKET; PTFE	1
13	186-153*	RETAINER, piston seal; stainless steel	1
14	186-152	PIN, ball stop, intake valve; stainless steel	1
15	178-900	SLEEVE; stainless steel	1
16	172-479***	TAG, warning (not shown)	1
21	223-657*	GLAND/PACKING STACK	2

* *Supplied in repair kit 224-098.*

*** *Extra warnings and tags are supplied at no charge.*

224-098 PACKING REPAIR KIT

Standard UHMWPE and leather packings.
(Must be purchased separately.) Includes:

Ref. No.	Qty
6	1
7	1
8	1
12	1
13	1
21	2

Kit also includes a cotter pin (100-103) to connect the displacement rod to the motor (see page 13).

HOW TO ORDER PARTS

1. To be sure you receive the correct replacement parts, kits or accessories, always give all of the information requested in the chart below.
2. Check the parts list to identify the correct part number; do not use the ref. no. when ordering.
3. Order all parts from your nearest Graco distributor.

6 digit Part Number	Qty	Part Description

SERVICE INFORMATION

Listed below by the assembly changed are OLD, NEW, and DELETED parts.

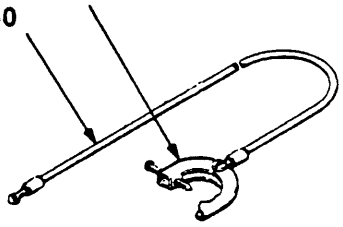
Assembly Changed	Status	Ref No.	Part No.	Name
223-585 & 224-386 Pumps	DELETED	110	180-180	Elbow
223-577 Displ. Pump	OLD		103-869	Intake Ball
	NEW	8	109-219	Intake Ball

INTERCHANGEABILITY NOTE: NEW parts replace the OLD parts listed directly above them.

USE GENUINE GRACO PARTS AND ACCESSORIES

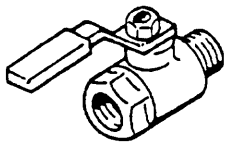
Must be purchased separately.

GROUNDING CLAMP 103-538
GROUND WIRE 208-950
(Required)
25 ft (7.6 m) long,
12 gauge (1.5 mm²)

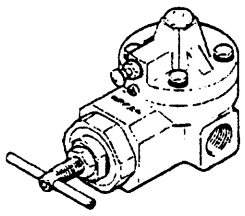


BLEED-TYPE MASTER AIR VALVE (Required)
300 psi (21 bar) MAXIMUM WORKING PRESSURE
107-141 3/4 npt(m) inlet x 3/4 npt(f) outlet

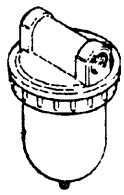
Relieves air trapped in the air line between the pump air inlet and this valve when closed.



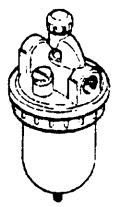
PUMP RUNAWAY VALVE 215-362
180 psi (12 bar) MAXIMUM WORKING PRESSURE
Shuts off air supply to the pump if the pump accelerates beyond the pre-adjusted setting due to an empty supply container, interrupted fluid supply to the pump, or excessive cavitation. 3/4 npt(f) inlet and outlet.



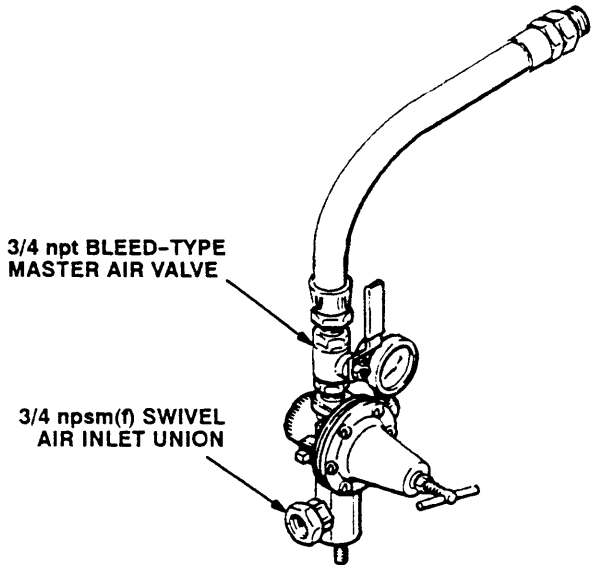
AIR LINE FILTER
250 psi (17.5 bar) MAXIMUM WORKING PRESSURE
106-150 3/4 npt(f) inlet and outlet



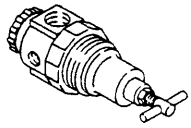
AIR LINE LUBRICATOR
250 psi (17.5 bar) MAXIMUM WORKING PRESSURE
214-849 16 oz (0.48 liter) bowl capacity.
3/4 npt(f) inlet and outlet



AIR PRESSURE REGULATOR KIT 205-712
300 psi (21 bar) MAXIMUM WORKING PRESSURE
0-9 bar (0-125 psi) REGULATED PRESSURE RANGE
Includes air regulator, gauge, bleed-type master air valve, hose and swivel inlet.



AIR REGULATOR
300 psi (21 bar) MAXIMUM WORKING PRESSURE
207-755 0-125 psi (0-9 bar) Regulated Pressure Range; 3/4 npt(f) inlet and outlet. Also order Air Pressure Gauge 101-180.



GROUNDED 3/4 in. (19 mm) BUNA-N AIR HOSE
175 psi (12 bar) MAXIMUM WORKING PRESSURE

Part No.	ID	Length	Thd. Size
208-610	3/4" (19 mm)	6 ft (1.8 m)	3/4 npt(m)
205-548	3/4" (19 mm)	15 ft (4.5 m)	3/4 npt(m)
208-611	3/4" (19 mm)	25 ft (7.6 m)	3/4 npt(m)
208-612	3/4" (19 mm)	50 ft (15 m)	3/4 npt(m)

GROUNDED NYLON FLUID HOSE
5000 psi (350 bar) MAXIMUM WORKING PRESSURE

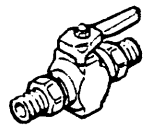
Part No.	ID	Length	Thd. Size
214-914	1/4" (6.3 mm)	25 ft (7.6 m)	1/4 npsm(f) swivel
214-915	1/4" (6.3 mm)	50 ft (15.2 m)	1/4 npsm(f) swivel
215-244	3/8" (9.5 mm)	25 ft (7.6 m)	3/8 npt(m)
215-245	3/8" (9.5 mm)	50 ft (15.2 m)	3/8 npt(m)
215-246	3/8" (9.5 mm)	100 ft (30.4 m)	3/8 npt(m)

USE GENUINE GRACO PARTS AND ACCESSORIES

Must be purchased separately.

FLUID DRAIN VALVE (Required)
5000 psi (350 bar) MAXIMUM WORKING PRESSURE
Open to relieve fluid pressure in hose and gun/valve.

210-657 1/4 npt (mbe)
210-658 3/8 npt (mbe)
210-659 1/4 npt x 3/8 npt (mbe)



WALL BRACKET 206-221
For mounting the Bulldog Pump to a wall.

SUCTION HOSE 214-961
500 psi (35 bar) MAXIMUM WORKING PRESSURE
For petroleum base solvent flushing and water base fluids. 6 ft (1.8 m) long, coupled 3/4 npt (mbe), nylon. Spring guard both ends.

55 GAL. (200 LITER) SUCTION TUBE 206-266
Use with Suction Hose 214-961 to draw fluid from a 55 gal. (200 liter) drum.

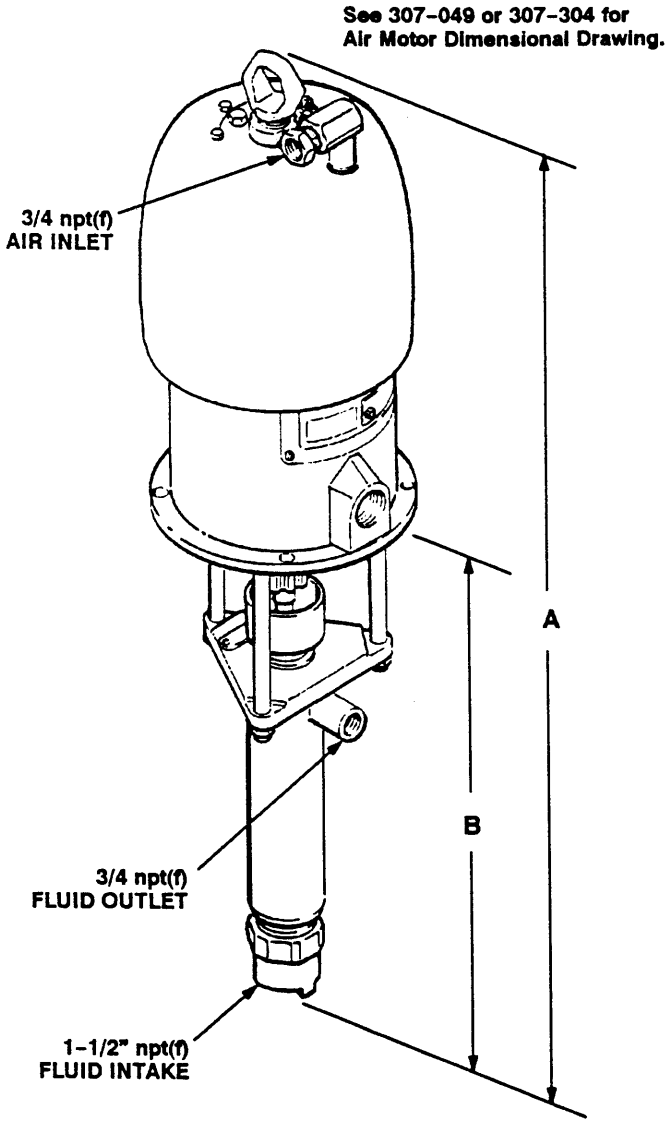
DRUM COVER AND AGITATOR 207-199
Fits a 55 gal. (200 liter) drum.

GRACO THROAT SEAL LIQUID
Non-evaporating solvent for wet-cup.

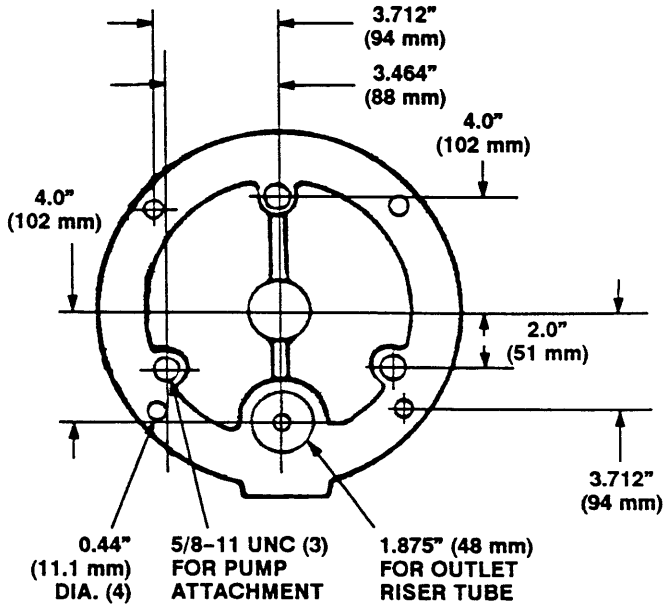
206-995 1 quart (0.95 liter)
206-996 1 gallon (3.8 liter)

DIMENSIONAL DRAWING

Model 223-585 Shown



MOUNTING HOLE LAYOUT



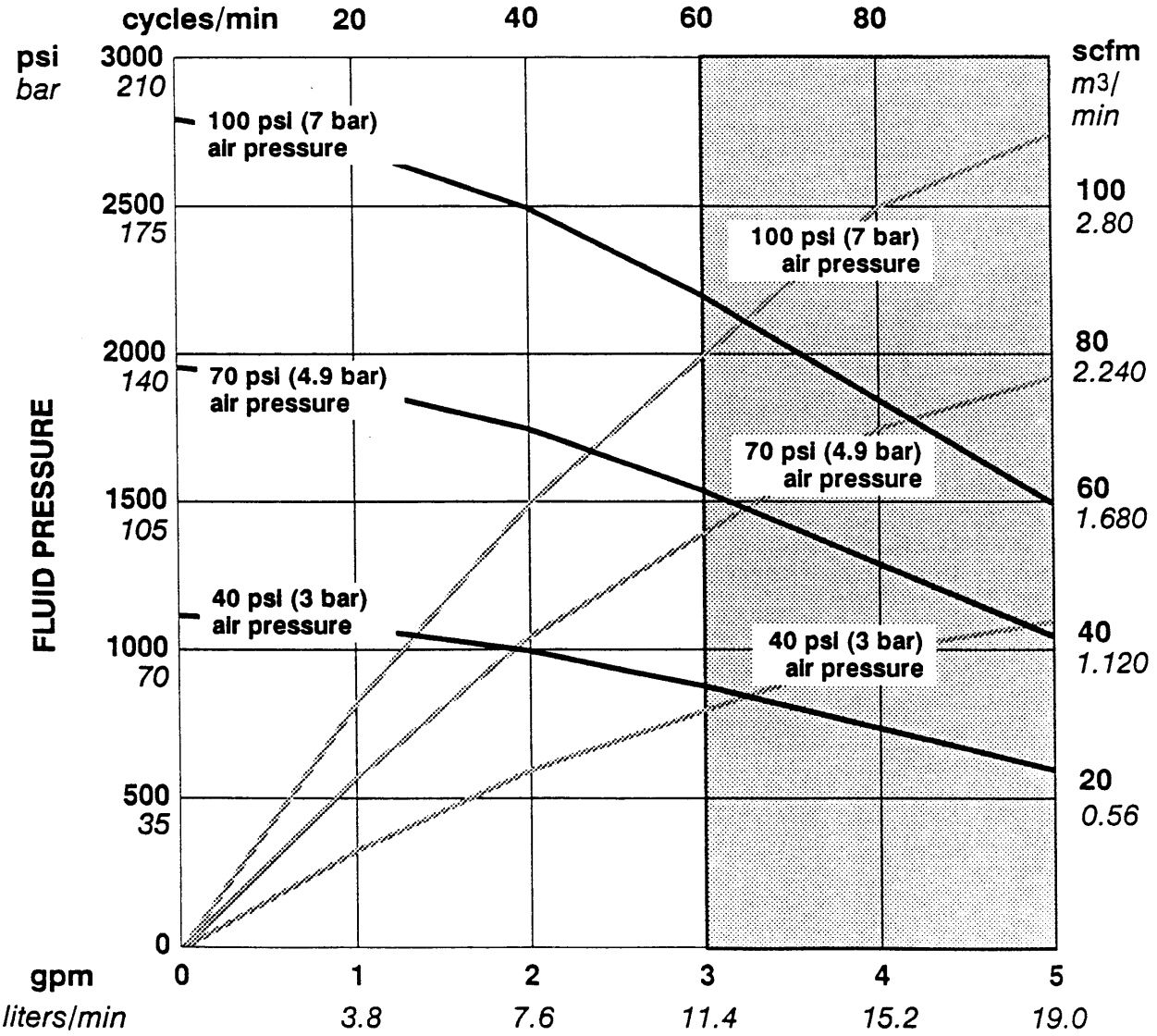
Pump Model	A	B
223-585	43.34 in. (1101 mm)	22.09 in. (561 mm)
224-386	43.59 in. (1107 mm)	22.09 in. (561 mm)

TECHNICAL AND PERFORMANCE DATA

Maximum fluid working pressure	3000 psi (210 bar)
Air input pressure operating range	40-100 psi (2.8-7 bar)
Ratio	30:1
Pump cycles per 1 gallon (3.8 liters)	20
Maximum recommended pump speed for continuous operation	60 cycles per min
Maximum flow	3 gpm (11.34 liter/min)
Air consumption	approx. 34 scfm (0.95 m³/min) at 1 gpm (3.8 liters/min) at 100 psi (7 bar) air pressure
Air inlet	3/4 npt(f)
Fluid outlet	3/4 npt(f)
Weight	approx. 75 lb (34 kg)
Wetted parts	304, 316, 329 and 17-4 PH Grades of Stainless Steel, Tungsten Carbide, Chrome Plating, PTFE, Leather, Ultra-High Molecular Weight Polyethylene

KEY: Fluid Outlet Pressure - Black Curves
Air Consumption - Gray Curves

NOTE: Pump may be operated continuously to shaded area.



FLUID FLOW (TEST FLUID: NO. 10 WEIGHT OIL)

To find Fluid Outlet Pressure (bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (bar/psi):

1. Locate desired flow along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve (black). Follow left to scale to read fluid outlet pressure.

To find Pump Air Consumption (m³/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (bar/psi):

1. Locate desired flow along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve (gray). Follow right to scale to read air consumption.

THE GRACO WARRANTY AND DISCLAIMERS

WARRANTY

Graco warrants all equipment manufactured by it 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. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment proven 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, 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 with Graco equipment of 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 claim. 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.

DISCLAIMERS AND LIMITATIONS

THE TERMS OF THIS WARRANTY CONSTITUTE PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND ARE IN LIEU OF ANY OTHER WARRANTIES (EXPRESS OR IMPLIED), INCLUDING WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY NON-CONTRACTUAL LIABILITIES, INCLUDING PRODUCT LIABILITIES, BASED ON NEGLIGENCE OR STRICT LIABILITY. EVERY FORM OF LIABILITY FOR DIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS IS EXPRESSLY EXCLUDED AND DENIED. IN NO CASE SHALL GRACO'S LIABILITY EXCEED THE AMOUNT OF THE PURCHASE PRICE. ANY ACTION FOR BREACH OF WARRANTY MUST BE BROUGHT WITHIN TWO (2) YEARS OF THE DATE OF SALE.

EQUIPMENT NOT COVERED BY GRACO WARRANTY

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO ACCESSORIES, EQUIPMENT, MATERIALS, OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motor, switches, hose, etc.) are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

IMPORTANT PHONE NUMBERS

TO PLACE AN ORDER, contact your Graco distributor, or call this number to identify the distributor closest to you:
1-800-328-0211 Toll Free

FOR TECHNICAL ASSISTANCE, service repair information or assistance regarding the application of Graco equipment: **1-800-543-0339 Toll Free**

Factory Branches: Atlanta, Chicago, Dallas, Detroit, Los Angeles, West Caldwell (N.J.)
Subsidiary and Affiliate Companies: Canada; England; Switzerland; France; Germany; Hong Kong; Japan; Korea

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