

CARBON STEEL

# Check-Mate<sup>®</sup> 450 Pumps

308017ZAA

WITH PRIMING PISTON, AND SEVERE-DUTY ROD AND CYLINDER

EN

**For use with non-heated bulk supply of medium to high viscosity sealant and adhesive materials. For professional use only.**

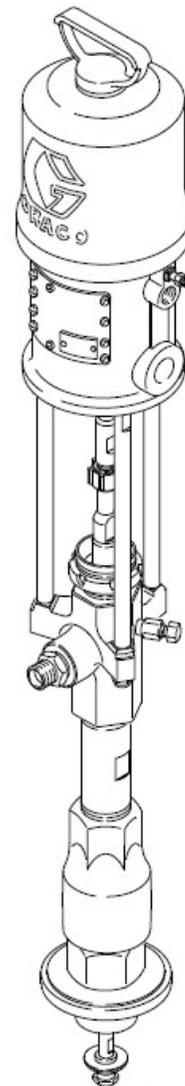
**Not approved for use in European explosive atmosphere locations.**

See page 2 for model information, including maximum working pressure.



### Important Safety Instructions

Read all warnings and instructions in this manual before using the equipment.  
Save these instructions.



Model 222768 Shown

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# Models

Model No.	Description	Maximum Air Working Pressure			Maximum Fluid Working Pressure		
		MPa	bar	psi	MPa	bar	psi
222768	20:1 ratio President® Pump, Series A (UHMWPE/PTFE Packed)	1.2	12	180	25	248	3600
237207	20:1 ratio stubby President® Pump, Series A (UHMWPE/PTFE Packed)	1.2	12	180	25	248	3600
246933	20:1 ratio President® Pump, Series A (Tuffstack Throat Packed)	1.2	12	180	25	248	3600
222769	34:1 ratio Senator® Pump, Series A (UHMWPE/PTFE Packed)	0.8	8	120	28	281	4080
224660	34:1 ratio Quiet Senator® Pump, Series A (UHMWPE/PTFE Packed)	0.8	8	120	28	281	4080
237492	34:1 ratio stubby Senator® Pump, Series A (UHMWPE/PTFE Packed)	0.8	8	120	28	281	4080
237780	34:1 ratio stubby Quiet Senator® Pump, Series A (UHMWPE/PTFE Packed)	0.8	8	120	28	281	4080
222778	55:1 ratio Bulldog® Pump, Series A (UHMWPE/PTFE Packed)	0.6	6.2	90	34	341	4950
222813	55:1 ratio Quiet Bulldog® Pump, Series A (UHMWPE/PTFE Packed)	0.6	6.2	90	34	341	4950
237208	55:1 ratio stubby Bulldog® Pump, Series A (UHMWPE/PTFE Packed)	0.6	6.2	90	34	341	4950
237779	55:1 ratio stubby Quiet Bulldog® Pump, Series A (UHMWPE/PTFE Packed)	0.6	6.2	90	34	341	4950

# Warnings

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

 <h2 style="margin: 0;">WARNING</h2>	
 	<p><b>EQUIPMENT MISUSE HAZARD</b></p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> <li>• Do not operate the unit when fatigued or under the influence of drugs or alcohol.</li> <li>• Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See in all equipment manuals.</li> <li>• Use fluids and solvents that are compatible with equipment wetted parts. See in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer.</li> <li>• Do not leave the work area while equipment is energized or under pressure.</li> <li>• Turn off all equipment and follow the <b>Pressure Relief Procedure</b> when equipment is not in use.</li> <li>• Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.</li> <li>• Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.</li> <li>• Make sure all equipment is rated and approved for the environment in which you are using it.</li> <li>• Use equipment only for its intended purpose. Call your distributor for information.</li> <li>• Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.</li> <li>• Do not kink or over bend hoses or use hoses to pull equipment.</li> <li>• Keep children and animals away from work area.</li> <li>• Comply with all applicable safety regulations.</li> </ul>
    	<p><b>SKIN INJECTION HAZARD</b></p> <p>High-pressure fluid from gun, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. <b>Get immediate surgical treatment.</b></p> <ul style="list-style-type: none"> <li>• Do not spray without tip guard and trigger guard installed.</li> <li>• Engage trigger lock when not spraying.</li> <li>• Do not point gun at anyone or at any part of the body.</li> <li>• Do not put your hand over the spray tip.</li> <li>• Do not stop or deflect leaks with your hand, body, glove, or rag.</li> <li>• Follow the <b>Pressure Relief Procedure</b> when you stop spraying and before cleaning, checking, or servicing equipment.</li> <li>• Tighten all fluid connections before operating the equipment.</li> <li>• Check hoses and couplings daily. Replace worn or damaged parts immediately.</li> </ul>

# **WARNING**

  	<p><b>MOVING PARTS HAZARD</b></p> <p>Moving parts, such as the priming piston, can pinch, cut or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> <li>• Keep clear of moving parts.</li> <li>• Keep hands and fingers away from the priming piston during operation and whenever the pump is charged with air.</li> <li>• Do not operate equipment with protective guards or covers removed.</li> <li>• Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the <b>Pressure Relief Procedure</b> and disconnect all power sources.</li> </ul>
   	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Flammable fumes, such as solvent and paint fumes, in <b>work area</b> can ignite or explode. Paint or solvent flowing through the equipment can cause static sparking. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well-ventilated area.</li> <li>• Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static sparking).</li> <li>• Ground all equipment in the work area. See <b>Grounding</b> instructions.</li> <li>• Never spray or flush solvent at high pressure.</li> <li>• Keep work area free of debris, including solvent, rags and gasoline.</li> <li>• Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.</li> <li>• Use only grounded hoses.</li> <li>• Hold gun firmly to side of grounded pail when triggering into pail. Do not use pail liners unless they are anti-static or conductive.</li> <li>• <b>Stop operation immediately</b> if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.</li> <li>• Keep a working fire extinguisher in the work area.</li> </ul>
	<p><b>TOXIC FLUID OR FUMES HAZARD</b></p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> <li>• Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using.</li> <li>• Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.</li> </ul>
	<p><b>PERSONAL PROTECTIVE EQUIPMENT</b></p> <p>Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. Protective equipment includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Protective eyewear, and hearing protection.</li> <li>• Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.</li> </ul>

# Installation

## System Accessories



A red-handled main air bleed valve (V), pump air bleed valve (G), and fluid drain valve (L) are required. These accessories help reduce the risk of serious injury, including fluid injection and splashing of fluid in the eyes or on the skin, and injury from moving parts if you are adjusting or repairing the pump.

The ram will hold pressure if the ram director valve (U) is in the horizontal (neutral) position. To relieve air pressure in the ram, close the red-handled bleed valve (V) and move the director valve (U) to DOWN. The ram will slowly drop.

The pump air bleed valve (G) relieves air trapped between it 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 (L) assists in relieving fluid pressure in the displacement pump, hose, and gun. Triggering the gun to relieve pressure may not be sufficient.

## Air Line

Install the following accessories as shown in FIG. 1, using adapters as necessary:

- **A red-handled main air bleed valve (V)** is required in your system to shut off the air supply to and relieve air pressure in the pump and ram. When closed, the valve will bleed off all air in the ram and pump, and the ram will slowly drop. Be sure the valve is easily accessible from the pump, and is located upstream from the air manifold (D). Order Part No. 113269 for Monark and President Pumps, or 113218 for Senator and Bulldog Pumps.
- **The pump air bleed valve (G)** is required in your system to relieve air trapped between it and the air motor when the valve is closed. Be sure the valve is easily accessible from the pump, and is located **downstream** from the air regulator (H).
- **The pump air regulator (H)** 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 pump air bleed valve (G).
- **An air line lubricator (F)** provides automatic air motor lubrication.
- **A pump runaway valve (E)** 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.
- **An air manifold (D)** has a swivel air inlet. It has ports for connecting lines to air accessories, such as the **ram air regulator (T)**, which controls the air pressure to the ram.
- **The air pressure relief valve (Q)** limits the air pressure to the ram to 10 bar (150 psi).
- **The ram director valve (U)** controls the raising and lowering of the ram.
- **An air line filter (J)** removes harmful dirt and moisture from the compressed air supply. Also, install a **drain valve (W)** at the bottom of each air line drop, to drain off moisture.
- **A bleed-type air valve (K)** isolates the air line accessories for servicing. Locate upstream from all other air line accessories.

## Fluid Line

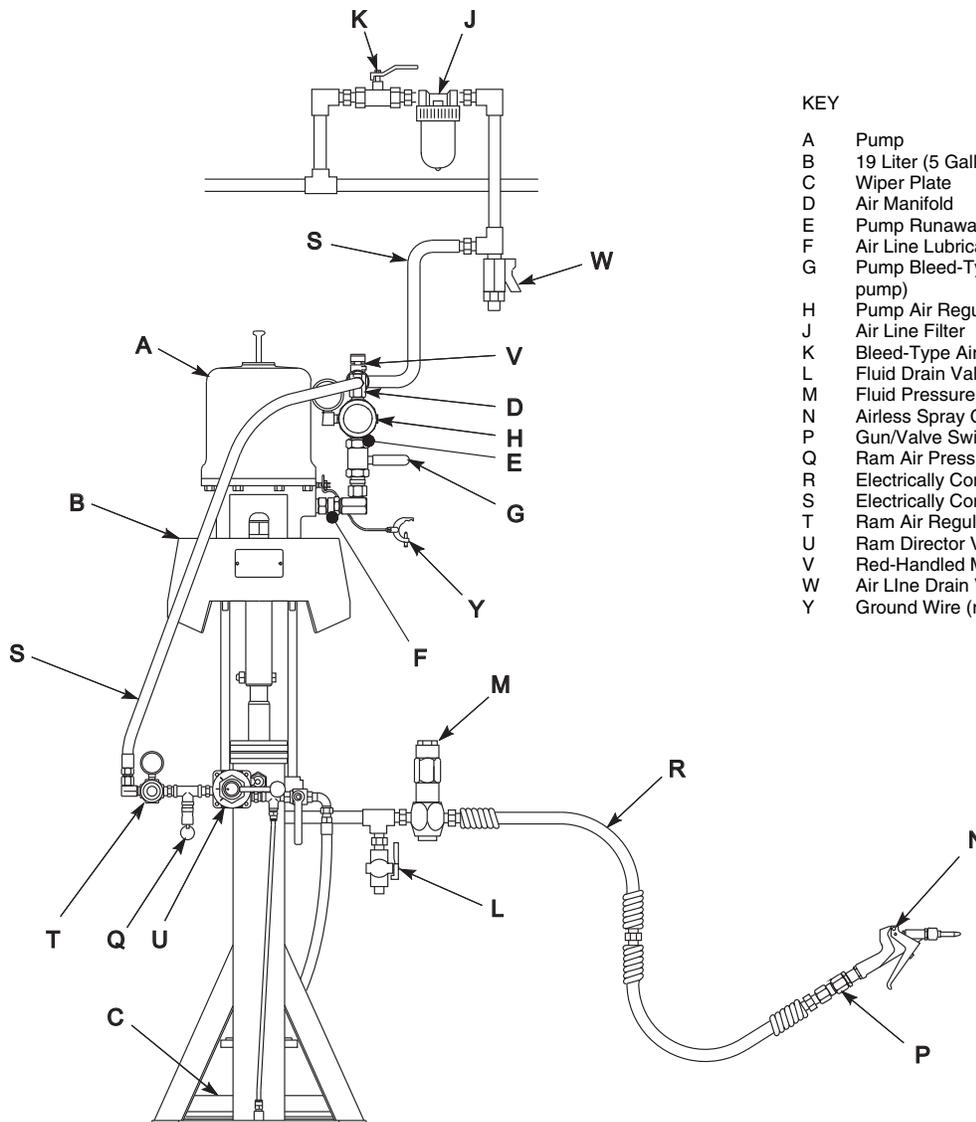
Install the following accessories in the positions shown in FIG. 1, using adapters as necessary:

- Install a **fluid drain valve (L)** in a tee near the pump fluid outlet. The drain valve is required in your system to relieve fluid pressure in the displacement pump, hose and gun/valve. Install with the drain valve pointing down, but so the handle points up when the valve is open. Order Part No. 210658 (3/8 npt).
- A **fluid regulator (M)** controls fluid pressure to the gun/valve, and dampens pressure surges.

- A **gun or dispense valve (N)** dispenses the fluid. The gun shown in FIG. 1 is a high pressure dispensing gun for highly viscous fluids.
- A **gun/valve swivel (P)** allows freer gun/valve movement.

## Air and Fluid Hoses

Be sure all air hoses (S) and fluid hoses (R) are properly sized and pressure-rated for your system. Use only electrically conductive hoses. Fluid hoses must have spring guards on both ends.



### KEY

- A Pump
- B 19 Liter (5 Gallon) Air-Powered Ram
- C Wiper Plate
- D Air Manifold
- E Pump Runaway Valve (location shown)
- F Air Line Lubricator (location shown)
- G Pump Bleed-Type Air Valve (required, for pump)
- H Pump Air Regulator
- J Air Line Filter
- K Bleed-Type Air Valve (for accessories)
- L Fluid Drain Valve (required)
- M Fluid Pressure Regulator
- N Airless Spray Gun or Dispensing Valve
- P Gun/Valve Swivel
- Q Ram Air Pressure Relief Valve
- R Electrically Conductive Fluid Supply Hose
- S Electrically Conductive Air Supply Hose
- T Ram Air Regulator
- U Ram Director Valve
- V Red-Handled Main Air Bleed Valve
- W Air Line Drain Valve
- Y Ground Wire (required)

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**FIG. 1: Typical Installation**

**NOTE:** FIG. 1 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.

## Mounting Accessories

Mount the pump (A) to suit the type of installation planned. Refer to **Dimensions** (page 40) and **Mounting Hole Layout** (page 41).

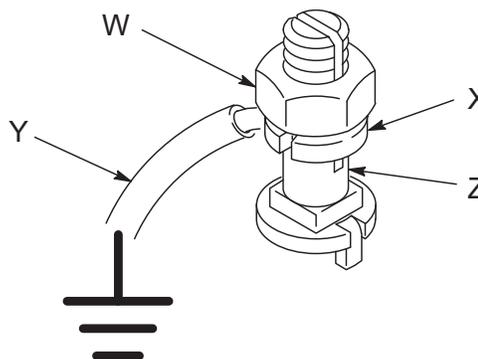
If you are mounting the pump on a ram (B), refer to the manual supplied with the ram for installation and operation instructions. The ram shown in FIG. 1 is a 19 liter (5 gal.) pail ram, used with a wiper plate (C). The ram shown includes an air regulator (T). It also requires an air supply hose (S) and an air manifold (D), which divides the main air supply into separate lines for the pump and the ram.

By using Pump Mounting Kit 222776, you can also mount the pump on Floor Stand 222780, 200 liter (55 gal.) Ram 207279, or Inductor 222635.

## Grounding



*Pump:* use a ground wire and clamp. See FIG. 2. Loosen the grounding lug locknut (W) and washer (X). Insert one end of a 1.5 mm<sup>2</sup> (12 ga) 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 No. 237569 Ground Wire and Clamp.



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**FIG. 2**

*Air and fluid hoses:* use only electrically conductive hoses.

*Air compressor:* follow manufacturer's recommendations.

*Spray gun/dispense valve:* ground through connection to a properly grounded fluid hose and pump.

*Fluid supply container:* follow your local code.

*Object being sprayed:* follow your local code.

*All solvent pails used when flushing:* follow 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.

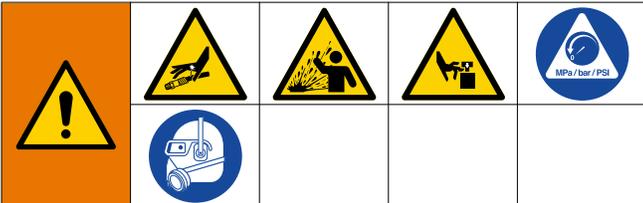
*To maintain grounding continuity when flushing or relieving pressure,* always hold a metal part of the gun/valve firmly to the side of a grounded metal pail, then trigger the gun/valve.

# Operation

## Pressure Relief Procedure



Follow the Pressure Relief Procedure whenever you see this symbol.



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

1. Lock the gun/valve trigger safety.
2. Close the pump's bleed-type air valve (G, required in your system).
3. Shut off the red-handled main air bleed valve (V, required in your system). If the pump is mounted on a ram, set the ram director valve (U) to DOWN. The ram will slowly drop.
4. Unlock the gun/valve trigger safety.
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. Lock the gun/valve trigger safety.
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.*

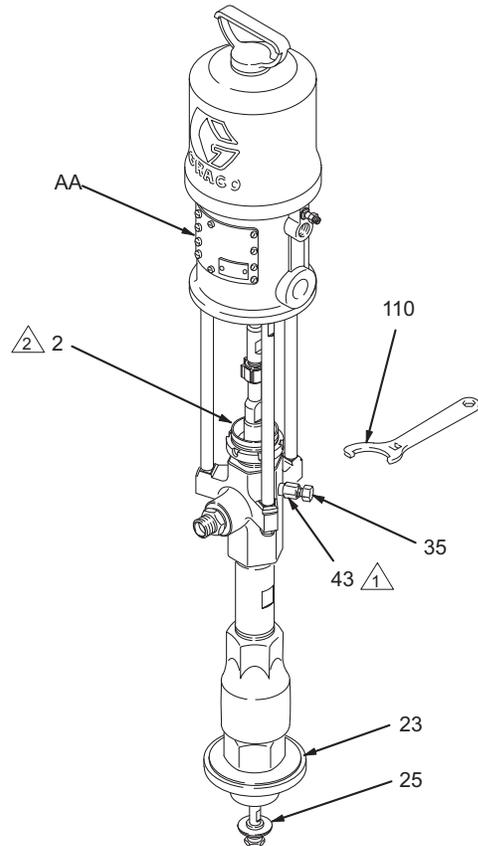
## Packing Nut/Wet-Cup



Before starting, fill the packing nut (2) 1/3 full with Graco Throat Seal Liquid (TSL) or compatible solvent. See FIG. 3.

The packing nut is torqued at the factory and is ready for operation. If it becomes loose and there is leaking from the throat packings, relieve pressure, then torque the nut to 45-53 N•m (33-39 ft-lb) using the supplied wrench (110). Do this whenever necessary. Do not overtighten the packing nut.

- 1 Bleed hole must face down.
- 2 Torque to 45–53 N•m (33–39 ft-lb).



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FIG. 3

## Fluid Line Accessories

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. See **Flushing**, page 10.

## Starting and Adjusting the Pump



See FIG. 3. The priming piston (25) and the air motor piston (located behind the air motor plates, AA) move during operation.

Keep hands and fingers away from the priming piston (25) during operation and whenever the pump is charged with air. The priming piston extends beyond the intake cylinder (23) to pull material into the pump and can amputate a hand or finger caught between it and the intake cylinder. Before checking, clearing, or cleaning the priming piston follow the **Pressure Relief Procedure** on page 8.

Never operate the pump with the air motor plates (AA) removed.

1. Do not install the spray tip yet.
2. Supply fluid to the pump, per the requirements of your system.
3. See FIG. 1. Close the pump air regulator (H).
4. Open the red-handled main air bleed valve (V) and the pump's bleed-type air valve (G).
5. Hold a metal part of the gun/valve (N) firmly to the side of a grounded metal pail and hold the trigger open.
6. Slowly open the air regulator (H) until the pump starts.

7. Cycle the pump slowly until all air is pushed out and the pump and hoses are fully primed.
8. Release the gun/valve trigger and lock the trigger safety. The pump should stall against pressure.



To reduce the risk of fluid injection, **do not** use your hand or fingers to cover the bleed hole on the underside of the bleeder valve body (43) when priming the pump. Use a crescent wrench to open and close the bleeder plug (35). Keep your hands away from the bleed hole.

9. If the pump fails to prime properly, open the bleeder valve plug (35) slightly. Use the bleed hole on the underside of the valve body (43) as a priming valve until the fluid appears at the hole. See FIG. 3. Close the plug (35).

**NOTE:** When changing fluid containers with the hose and gun/valve already primed, open the bleeder valve plug (35) to help prime the pump and vent air before it enters the hose. Close the plug when all air is eliminated.

### NOTICE

Do not allow the pump to run dry. It will quickly accelerate to a high speed, causing damage. If your pump is running too fast, stop it immediately and check the fluid supply. If the container is empty and air has been pumped into the lines, refill the container and prime the pump and the lines, or flush and leave it filled with a compatible solvent. Eliminate all air from the fluid system.

10. With the pump and lines primed, and with adequate air pressure and volume supplied, the pump will start and stop as you open and close the gun/valve. In a circulating system, the pump will speed up or slow down on demand, until the air supply is shut off.
11. Follow the **Pressure Relief Procedure**, page 8. Install the spray tip in the gun.

				
<p><b>COMPONENT RUPTURE HAZARD</b></p> <p>To reduce the risk of overpressurizing your system, which could cause component rupture and serious injury, never exceed the Maximum Incoming Air Pressure to the pump (see the on page 29).</p>				

- Use the air regulator (H) 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 tip/nozzle and pump wear.

## Shutdown and Care of the Pump

				
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For overnight shutdown, stop the pump at the bottom of the stroke to prevent fluid from drying on the exposed displacement rod and damaging the throat packings. Relieve the pressure.

Always flush the pump before the fluid dries on the displacement rod. Refer to **Flushing**.

## Flushing

				
<p>To avoid fire and explosion, always ground equipment and waste container. To avoid static sparking and injury from splashing, always flush at the lowest possible pressure.</p>				

Flush with a fluid that is compatible with the fluid you are pumping and with the wetted parts in your system. Check with your fluid manufacturer or supplier for recommended flushing fluids and flushing frequency. Always flush the pump before fluid dries on the displacement rod.

<b>NOTICE</b>
<p>Never leave water or water-base fluid in the pump overnight. If you are pumping water-base fluid, flush with water first, then with a rust inhibitor such as mineral spirits. Relieve the pressure, but leave the rust inhibitor in the pump to protect the parts from corrosion.</p>

- Relieve the pressure. Follow the **Pressure Relief Procedure**, page 8.
- Remove the spray tip/nozzle from the gun/valve.
- Hold a metal part of the gun/valve firmly to the side of a grounded metal pail.
- Start the pump. Always use the lowest possible fluid pressure when flushing.
- Trigger the gun/valve.
- Flush the system until clear solvent flows from the gun/valve.
- Relieve the pressure. Follow the **Pressure Relief Procedure**, page 8.

# Troubleshooting



1. Follow the **Pressure Relief Procedure**, page 8.
2. Check all possible problems and causes before disassembling the pump.

PROBLEM	CAUSE	SOLUTION
Pump fails to operate.	Restricted line or inadequate air supply; closed or clogged valves.	Clear; increase the air supply. Check that all valves are open.
	Obstructed fluid hose or gun/valve; fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	Fluid dried on the displacement rod.	Clean; always stop the pump at the bottom of its stroke; keep the wet-cup 1/3 filled with a compatible solvent.
	Dirty, worn, or damaged motor parts.	Clean or repair; see the separate motor manual.
Pump operates, but output is low on both strokes.	Restricted line or inadequate air supply; closed or clogged valves.	Clear; increase the air supply. Check that all valves are open.
	Obstructed fluid hose or gun/valve; fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	Bleeder valve is open.	Close the valve.
	Air is leaking into the supply container.	Check the ram plate seal.
	Fluid is too heavy for pump priming.	Use the bleeder valve (see <b>Starting and Adjusting the Pump</b> , page 9) or use a ram.
	Held open or worn intake valve or seals.	Clear the valve; replace the seals.
Pump operates, but output is low on downstroke.	Worn packings in the displacement pump.	Replace the packings.
	Fluid too heavy for pump priming.	Use the bleeder valve (see <b>Starting and Adjusting the Pump</b> , page 9) or use a ram.
Pump operates, but output is low on upstroke.	Held open or worn intake valve or seals.	Clear the valve; replace the seals.
	Held open or worn piston valve or seals.	Clear the valve; replace the seals.
Erratic or accelerated pump speed.	Held open or worn piston valve or seals.	Clear the valve; replace the seals.
	Held open or worn priming piston.	Clear; service.
	Exhausted fluid supply.	Refill and prime.
	Fluid is too heavy for pump priming.	Use the bleeder valve (see <b>Starting and Adjusting the Pump</b> , page 9) or use a ram.
	Worn packings in the displacement pump.	Replace the packings.

\* To determine if the fluid hose or gun is obstructed, follow the **Pressure Relief Procedure**, page 8. 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. If the pump starts when the air is turned on, the obstruction is in the fluid hose or gun.

# Service

## Required Tools

- Torque wrench
- Bench vise, with soft jaws
- Rubber mallet
- Hammer
- O-ring pick
- 13 mm (1/2 in.) dia. brass rod
- Set of socket wrenches
- Set of adjustable wrenches
- Pipe wrench
- Packing nut wrench (110, supplied)
- Thread lubricant
- Thread sealant
- 1-1/4 in. crow foot wrench

## Disconnect the Pump



1. Flush the pump, if possible. Stop the pump at the bottom of its stroke.
2. Relieve the pressure.
3. Disconnect the air hose. Hold the fluid outlet fitting (8) with a wrench to keep it from being loosened while you disconnect the fluid hose.
4. Remove the pump from its mounting. Disconnect the displacement pump (107) from the motor (101) as follows. Be sure to note the relative position of the pump's fluid outlet (8) to the motor air inlet (CC).
5. Using an adjustable wrench (or a hammer and rod), unscrew the coupling nut (104) from the connecting rod (103) or air motor shaft. Do not lose or drop the coupling collars (105). See FIG. 4.
6. Hold the tie rod flats with a wrench to keep the rods from turning. Use the wrench (110) provided with the pump to unscrew the nuts (106) from the tie rods (102). Carefully remove the displacement pump (107) from the motor (101).
7. Refer to **Maintenance**, page 14, to service the displacement pump. To service the air motor, refer to the separate motor manual, supplied.

## Reconnect the Pump

1. Make sure the coupling nut (104) and the coupling collars (105) are in place on the displacement rod (1). See FIG. 4.
2. Orient the pump's fluid outlet (8) to the air inlet (CC) as was noted in step 4 under Disconnecting the Displacement Pump. Position the displacement pump (107) on the tie rods (102).

**NOTE:** Refer to FIG. 4 and the Torque Chart for proper torque values for your pump.

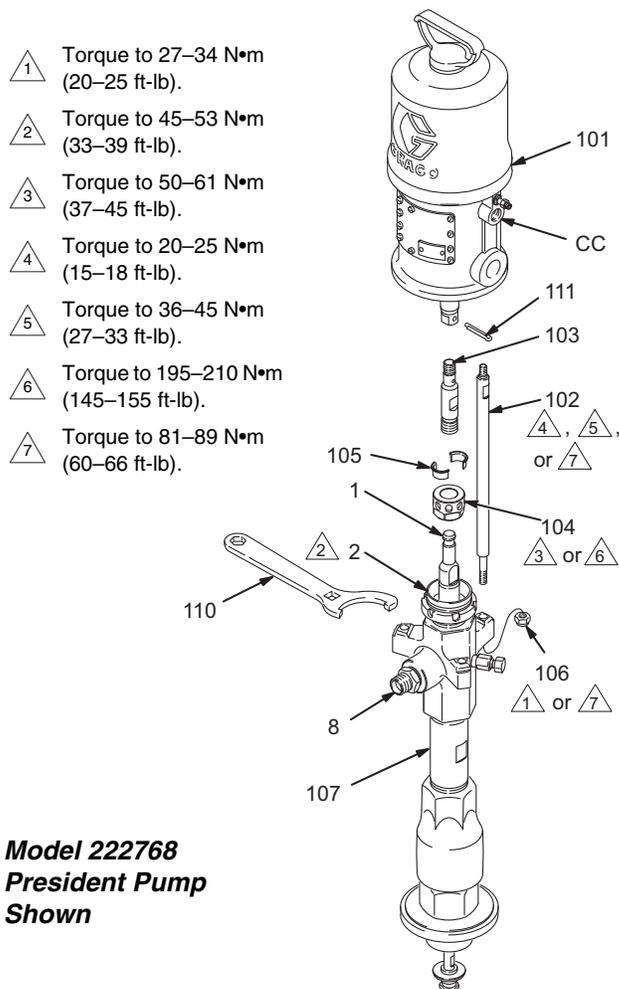
3. If you removed the tie rods (102) from the air motor (101), reinstall them using an 11 mm wrench. Torque as specified.
4. Screw the nuts (106) onto the tie rods (102) and torque as specified.
5. Screw the coupling nut (104) onto the connecting rod (103) or air motor shaft loosely. Hold the connecting rod flats with a wrench to keep it from turning. Using an adjustable wrench, torque the coupling nut.
6. Using a torque wrench in the square hole of the supplied wrench (110), torque the packing nut (2).
7. Mount the pump and reconnect all hoses. Reconnect the ground wire if it was disconnected. Fill the wet-cup (2) 1/3 full of Graco Throat Seal Liquid or compatible solvent.
8. Turn on the air supply. Run the pump slowly to ensure proper operation.



9. Before returning the pump to production, relieve the pressure and retorque the packing nut (2).

**PUMP TORQUE CHART (Refer to FIG. 4)**

Pump Model	Tie Rod (102)	Tie Rod Nut (106)	Coupling Nut (104)	Packing Nut (2)
222768, 237207, 246933	△ 4	△ 1	△ 3	△ 2
222769, 222770, 222778, 222813, 224660, 235626	△ 5	△ 1	△ 3	△ 2
237208, 237492, 237779, 237780	△ 7	△ 7	△ 6	△ 2



**FIG. 4**

0424B

# Maintenance

## Disassemble and Inspect the Pump

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

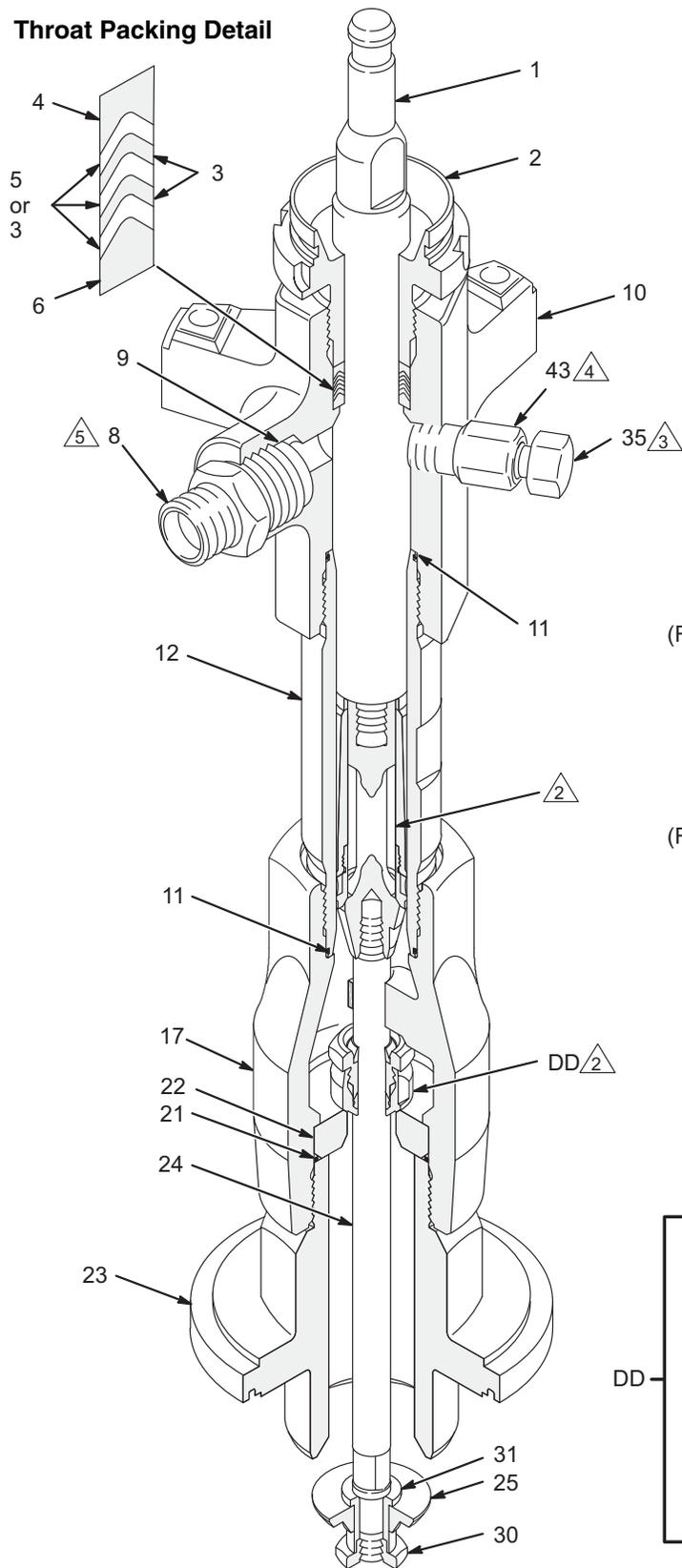
**NOTE:** Repair Kit 222773 is available for Displacement Pumps 222790, 237206, 237450 and 246932. The kit includes piston and intake seals and cylinder o-rings. For the best results, use all the new parts in the kit. Kit parts are marked with one asterisk \*.

Repair Kits 222774 (UHMWPE/PTFE), 222775 (PTFE), 237916 (UHMWPE/leather), and 234422 (UHMWPE/Tuffstack) are available to replace the throat packings. For the best results, use all the new parts in the kit. Kit parts are marked with a †, for example (3†).

Repair Kit 222793 is available to service the intake valve of Displacement Pumps 222790, 237206, 237450 and 246932. Kit 25Y247 also is available for the same Displacement Pumps, which includes the intake seals plus the cylinder o-rings (ref. 11). For the best results, use all the new parts in the kit. Kit 222793 parts are marked with a ‡. Kit 25Y247 parts are marked with a ★.

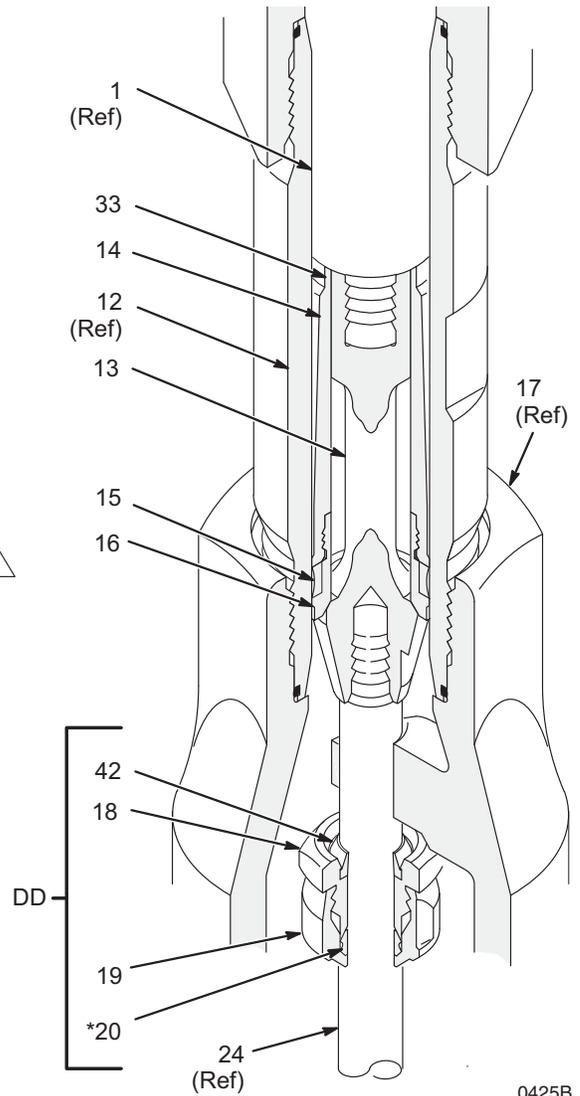
1. Remove the displacement pump from the air motor. (See **Disconnect the Pump**, page 12.) Place the pump in a vise, with the jaws on the outlet housing (10).
2. Hold the flats of the priming piston rod (24) with a 12 mm wrench. Using a 22 mm wrench, unscrew the priming piston nut (30). Slide the priming piston (25) and piston guide (31) off the rod. Inspect the surfaces of the guide (31) and piston (25) for scoring, wear, or other damage.
3. Loosen the packing nut (2) using the wrench (110) supplied, or a hammer and brass rod. Remove the intake cylinder (23), using an adjustable wrench.
4. Unscrew the intake valve housing (17) from the cylinder (12), using an adjustable wrench. Pull the housing off the pump. The intake check valve assembly (DD) should slide down the priming piston rod (24) as you remove the housing; if it does not slide easily, firmly tap on the top of the housing (17) with a rubber mallet to loosen.
5. Use an o-ring pick to remove the seal (21) from the intake valve housing (17). Discard the seal; use a new one for reassembly. Pull the intake valve seat (22) out the bottom of the housing (17). If the seat is difficult to remove, insert a brass rod through the top of the housing and drive the seat out with a hammer. Take care not to drop the check valve assembly (DD) as it comes free, and set it aside for later.
6. Push the displacement rod (1) down as far as possible, then pull it and the priming piston rod (24) out of the outlet housing (10) and cylinder (12).
7. Remove the packing nut (2), throat packings (5 and/or 3) and glands (4 and 6) from the outlet housing (10). Some models include a fluid outlet nipple (8) and o-ring (9). Do not remove these parts from the housing unless they need replacement.
8. Unscrew the bleeder valve plug (35) completely from the valve body (43). Clean the valve threads and the bleed hole. It is not necessary to remove the valve body from the pump outlet housing (10).
9. Use a 400 mm adjustable wrench on the flats of the pump cylinder (12) and unscrew the cylinder from the outlet housing (10). Remove the o-rings (11). Inspect the inside surface of the cylinder for wear, scoring or other damage by holding it up to the light at an angle or running a finger over the surface.
10. Inspect the outer surfaces of the displacement rod (1) and priming piston rod (24) for wear, scoring or other damage by holding them up to the light at an angle or running a finger over the surface.
11. Use a vise with soft jaws to hold the displacement rod (1) by its flats. Place a 19 mm wrench on the flats of the piston and unscrew the piston (13) and priming piston rod (24) from the displacement rod (1). Remove the spacer (33). Disassemble the piston guide (14) from the piston (13).
12. It is not necessary to remove the priming piston rod (24) from the piston (13) unless your inspection reveals scoring, wear, or other damage to either part. To disassemble, place the piston flats in a vise and unscrew the rod, using a 12 mm wrench on the flats.

**Throat Packing Detail**



- △1 Lips of v-packings must face down.
- △2 See Detail at right.
- △3 Valve Plug (remove and clean).
- △4 Valve Body (do not remove).
- △5 Remove only if damaged.

**Detail of Piston and Intake Check Valve**



0425B

**FIG. 5**

13. Place the flats of the piston seat (16) in a vise. Using a 13 mm (1/2 in.) dia. brass rod (EE), unscrew the piston guide (14) from the piston seat (16). See FIG. 6. Remove the piston seal (15); always replace with a new one. Inspect the mating surfaces of the piston (13) and piston seat (16) for nicks, scoring or wear.

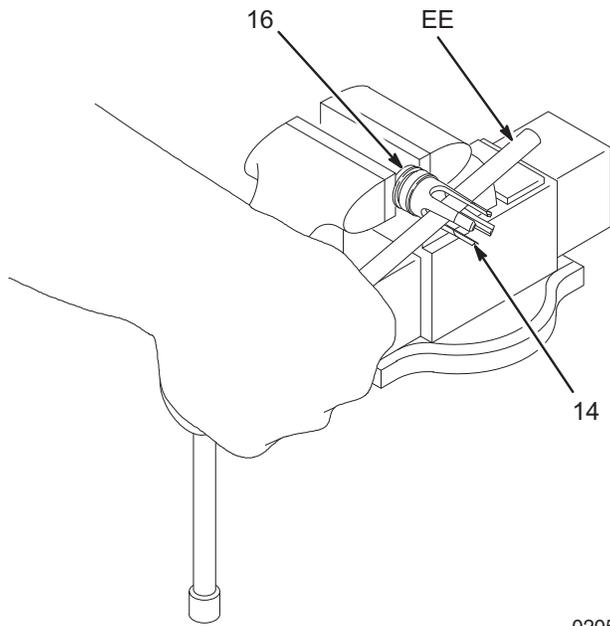


FIG. 6

14. To disassemble the intake check valve (DD), place the nut (18) in a vise and unscrew the intake valve body (19), using a 28 mm wrench. See FIG. 7. Remove the seals (42, 20) from the nut and from the valve body; always replace them with new ones. Inspect the mating surfaces of the intake valve body (19) and seat (22) for wear, scoring, or other damage.

**NOTE:** The seal (42) is press-fit in the nut (18) and may require cutting to ease removal.

15. Inspect all parts for damage and clean with a compatible solvent. To reassemble, refer to **Reassemble the Pump**, page 17.

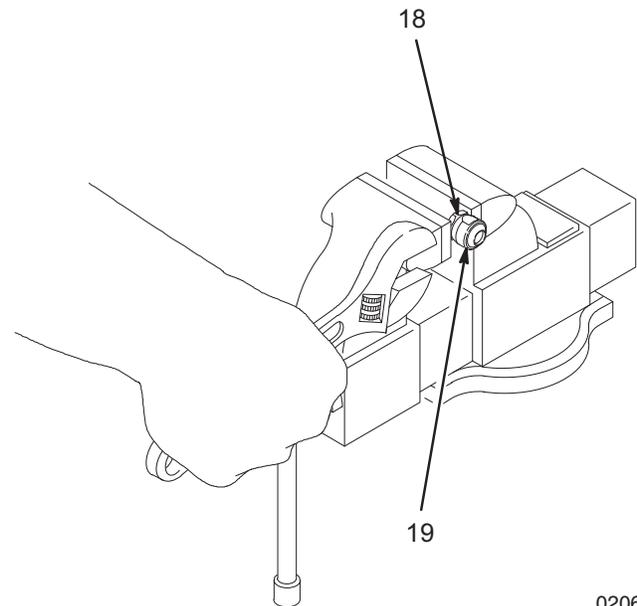


FIG. 7

## Reassemble the Pump

**NOTE:** Refer to FIG. 8.

1. Place a 13 mm (1/2 in.) diameter brass rod lengthwise in a vise. Install a new piston seal (15\*) on the piston seat. Apply thread sealant to the threads of the piston seat. Place the piston guide (14) securely on the brass rod. Using a 32 mm crow's-foot, screw the piston seat (16) into the piston guide. Torque to 27-34 N•m (20-25 ft-lb).
2. If it was necessary to remove the priming piston rod (24) from the piston (13), apply thread sealant to the threads of the rod. Place the flats of the piston (13) in a vise. Hold the flats of the rod with a 12 mm wrench, and screw the rod into the piston. Torque to 45-53 N•m (33-39 ft-lb).
3. Use a vise with soft jaws to hold the displacement rod (1) by its flats. Install the spacer (33, see the following note) on the rod. Install the assembled piston guide/seat on the piston (13). Apply thread sealant to the threads of the displacement rod, and screw the piston assembly onto the rod, using a 19 mm wrench on the flats of the piston. Torque to 120-130 N•m (88-95 ft-lb). There will be a small gap between the top of the piston (13) and the shoulder of the rod (1).

**NOTE:** The piston spacer (33) is not required when pumping fluids with a viscosity greater than 1 million centipoise.

4. Lubricate the threads of the bleeder valve plug (35). The plug has two sets of threads. Be sure to screw the plug completely into the valve body (43). Torque the plug to 30-38 N•m (22-28 ft-lb).

**NOTE:** Some models include an outlet nipple (8) and o-ring (9\*). It is not ordinarily necessary to remove these parts. However, if they were replaced because of damage, lubricate the o-ring and place it on the nipple. Screw the nipple into the outlet housing (10). Torque to 70-75 N•m (51-55 ft-lb).

5. Lubricate the o-rings (11\*) and install them on the cylinder (12). Apply thread lubricant to the top threads of the cylinder. Using a 400 mm wrench on the flats of the cylinder, screw it into the outlet housing (10). Torque to 325-354 N•m (240-260 ft-lb).

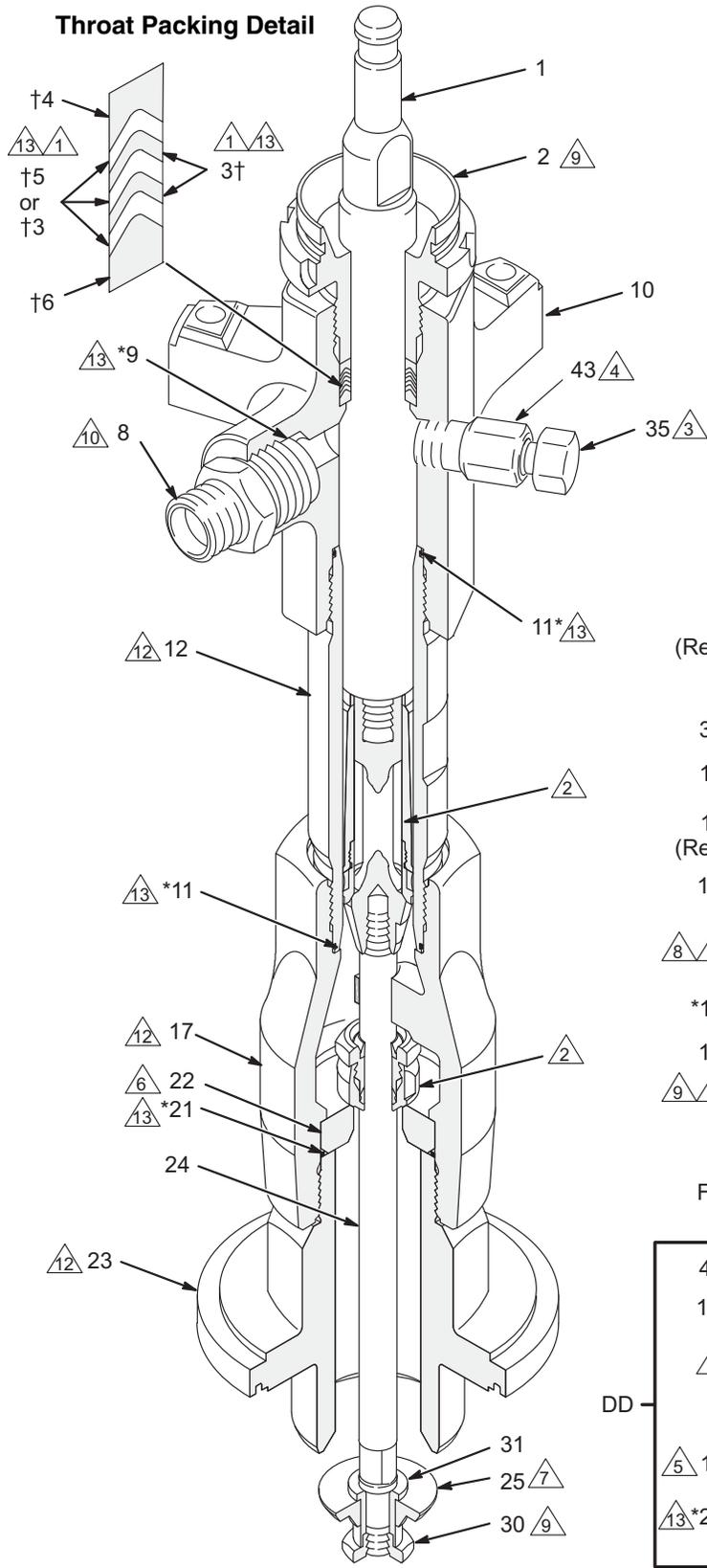
6. Lubricate the throat packings and glands, and install them in the outlet housing (10) one at a time in the following order, **with the lips of the v-packings facing down:** the male gland (6†), v-packings, and the female gland (4†). Apply thread lubricant to the packing nut (2) and install the nut loosely in the outlet housing.

**NOTE:** Refer to **Throat Packing Kits** (page 28) for the correct throat packing configuration for your pump.

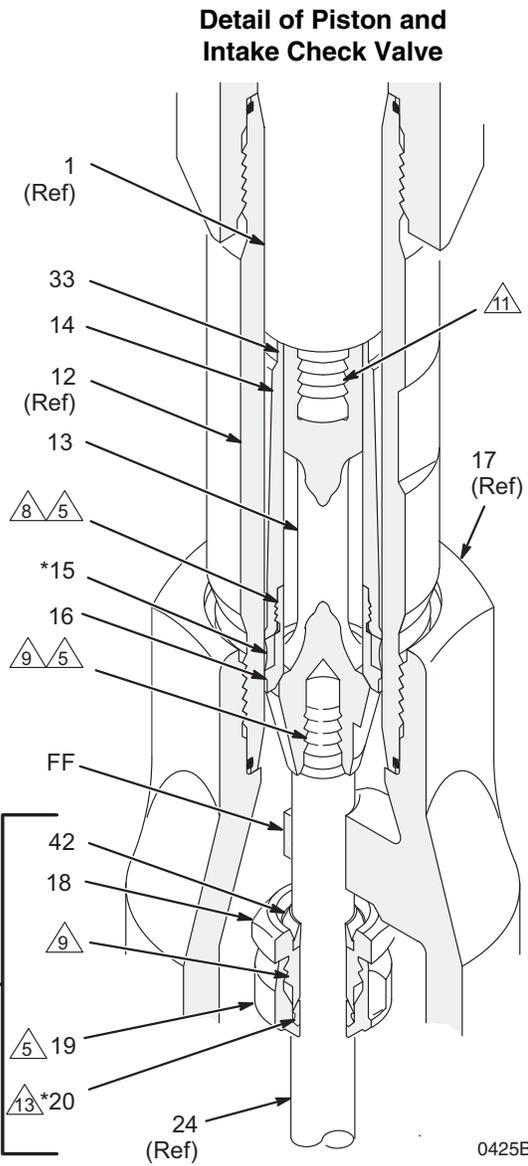
7. Carefully insert the displacement rod (1) into the bottom of the cylinder (12). Push the rod up into the cylinder and through the outlet housing (10), until it protrudes from the packing nut (2). Be careful not to damage the piston seal (15\*) while performing this step.
8. Apply thread lubricant to the bottom threads of the cylinder (12). Be sure the o-ring (11\*) is in place on the cylinder. Guide the intake valve housing (17) up onto the priming piston rod (24) and screw it onto the cylinder, using an adjustable wrench. Torque to 325-354 N•m (240-260 ft-lb).
9. With the beveled side facing up, press the seal (42) into the recess of the intake packing nut (18) until it snaps into place. The nose of the seal should be flush with or slightly recessed into the face of the packing nut.
10. Apply sealant to the threads of the intake packing nut (18). With the threads facing down toward the pump intake, slide the nut up onto the priming piston rod (24) until it clears the flats of the rod.
11. Lubricate a new intake valve seal (20\*) and slide it onto the rod, being careful not to damage the seal when passing over the flats of the rod. Slide the seal up until it reaches the packing nut (18). Apply sealant to the female threads of the intake valve body (19), and slide it onto the rod until it reaches the nut (18).
12. Place a 26 mm wrench on the flats of the packing nut (18) and a 28 mm wrench on the flats of the valve body (19). Screw the nut into the body, making certain they remain in position above the flats of the rod (24). Torque to 45-53 N•m (33-39 ft-lb). Slide the assembled intake check valve up the priming piston rod until it reaches the stop (FF); this may be difficult due to high friction between the seal and rod.

## Maintenance

13. Position the intake valve seat (22) so its large beveled side faces down toward the pump intake. Slide the seat (22) onto the priming piston rod (24) and into the intake valve housing (17) until it seats on the lower lip of the housing. Lubricate a new seal (21\*) and push it up into the gap around the bottom outer edge of the seat (22).
14. Apply thread lubricant to the threads of the intake cylinder (23) and screw the cylinder into the intake valve housing (17), using an adjustable wrench. Torque to 325-354 N•m (240-260 ft-lb).
15. Slide the priming piston guide (31) onto the rod (24) until it stops. Then install the priming piston (25) with the flat side of the priming piston (25) facing up toward the pump. Apply thread sealant to the threads of the priming piston rod (24). Hold the rod steady with a 12 mm wrench on the flats, and screw the priming piston nut (30) onto the rod with a 22 mm wrench. Torque to 45-53 N•m (33-39 ft-lb).
16. Reconnect the displacement pump to the air motor. See **Reconnect the Pump**, page 13.
17. Allow two hours for the thread sealant to cure before returning the pump to service.



- ▲1 Lips of v-packings must face down.
- ▲2 See Detail at right.
- ▲3 Lubricate threads and screw completely into body (43). Torque to 30–38 N•m (22–28 ft-lb).
- ▲4 Valve Body (bleed hole must face down).
- ▲5 Apply thread sealant.
- ▲6 Large bevel must face down.
- ▲7 Flat side must face up.
- ▲8 Torque to 27–34 N•m (20–25 ft-lb).
- ▲9 Torque to 45–53 N•m (33–39 ft-lb).
- ▲10 Torque to 70–75 N•m (51–55 ft-lb).
- ▲11 Torque to 120–130 N•m (88–95 ft-lb).
- ▲12 Torque to 325–354 N•m (240–260 ft-lb).
- ▲13 Lubricate.



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FIG. 8

# Parts

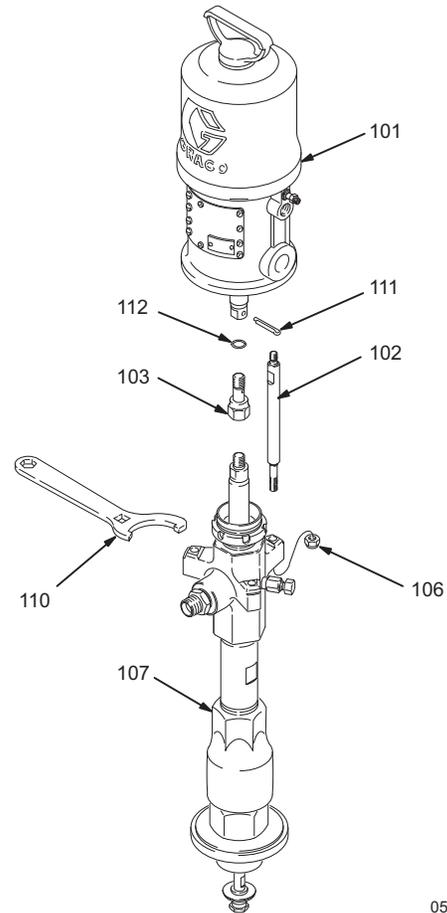
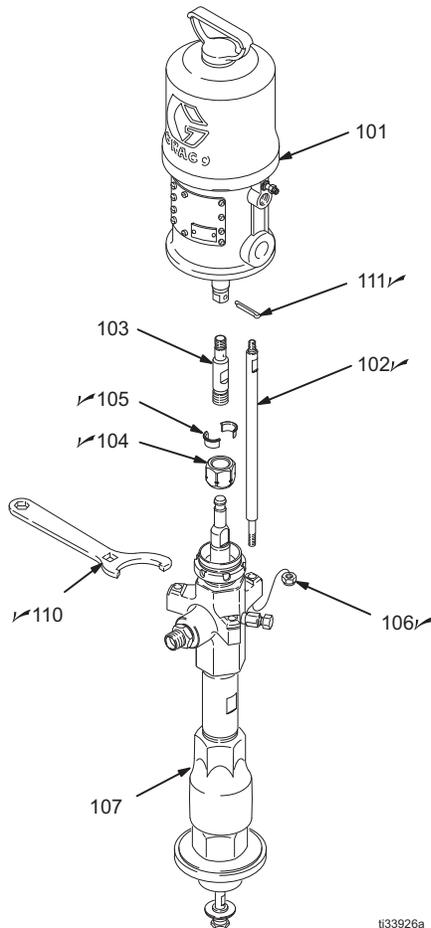
## Model 222768, Series A 20:1 Ratio President Pump (UHMWPE and PTFE Packed)

Ref.	Part	Description	Qty.
101	222772	AIR MOTOR, President See MM 306982 for parts	1
102✓	24B190	KIT, tie rod	3
103	184091	ROD, adapter	1
104✓	17F000	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
110✓	184119	WRENCH, packing nut	1
111✓	101946	PIN, cotter	1

## Model 237207, Series A 20:1 Ratio Stubby President Pump (UHMWPE and PTFE Packed)

Ref.	Part	Description	Qty.
101	222772	AIR MOTOR, President See MM 306982 for parts	1
102	24B191	KIT, tie rod	3
103	237251	ROD, adapter	1
106	109209	NUT, hex, self-locking; M10 x 1.5	3
107	237206	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
110	184119	WRENCH, packing nut	1
111	101946	PIN, cotter	1
112	156082	O-RING; buna-N	1

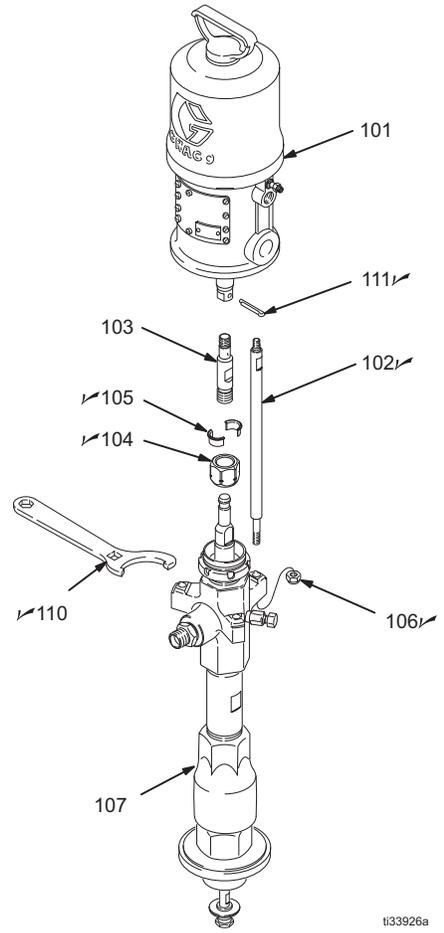
✓ Part included in Connection Kit 236070.



**Model 246933, Series A  
20:1 Ratio President Pump  
(Tuffstack Throat Packed)**

Ref.	Part	Description	Qty.
101	222772	AIR MOTOR, President See MM 306982 for parts	1
102✓	24B190	KIT, tie rod	3
103	184091	ROD, adapter	1
104✓	17F000	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	246932	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
110✓	184119	WRENCH, packing nut	1
111✓	101946	PIN, cotter	1

✓ Part included in Connection Kit 236070.



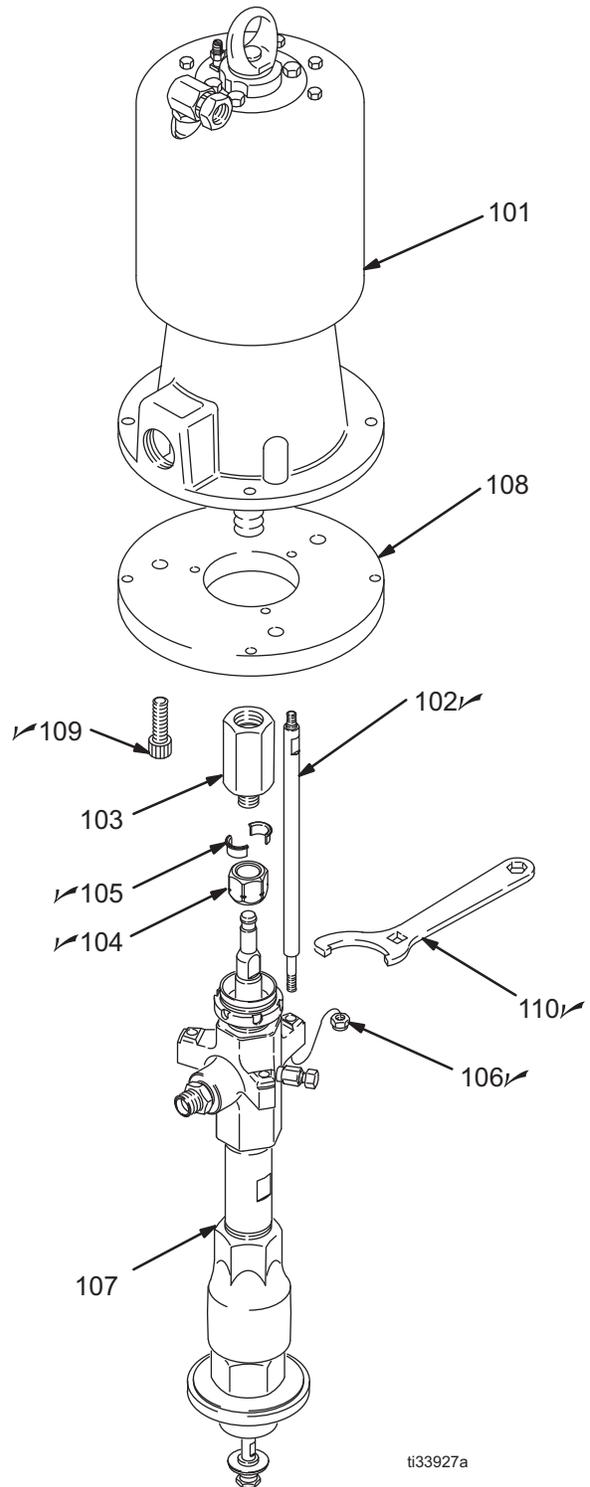
t33926a

**Model 222769, Series A**  
**34:1 Ratio Senator Pump (shown)**  
**(UHMWPE and PTFE Packed)**

**Model 224660, Series A**  
**34:1 Ratio Quiet Senator Pump**  
**(UHMWPE and PTFE Packed)**

Ref.	Part	Description	Qty.
101	217540	AIR MOTOR, Senator, standard <i>Used on Model 222769;</i> See MM 307592 for parts	1
	220571	AIR MOTOR, Senator, quiet <i>Used on Model 224660;</i> See MM 307592 for parts	1
102✓	24B190	KIT, tie rod	3
103	184127	ROD, adapter	1
104✓	17F000	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
108	184094	PLATE, adapter	1
119✓	109211	SCREW, cap, socket hd; 5/8-11 unc-2a x 2" (51 mm)	3
110✓	184119	WRENCH, packing nut	1

✓ Part included in Connection Kit 236070.



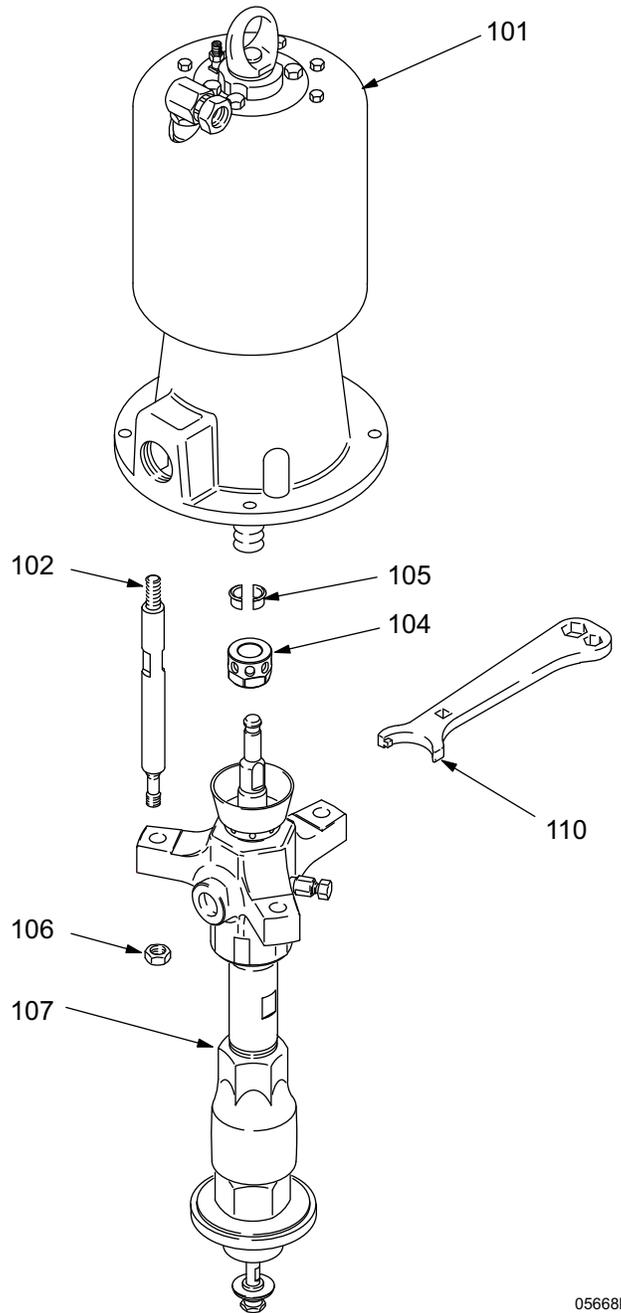
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**Model 237492, Series A**  
**34:1 Ratio Stubby Senator Pump (shown)**  
**(UHMWPE and PTFE Packed)**

**Model 237780, Series A**  
**34:1 Ratio Stubby Quiet Senator Pump**  
**(UHMWPE and PTFE Packed)**

Ref.	Part	Description	Qty.
101	217540	AIR MOTOR, Senator, standard <i>Used on Model 237492;</i> See MM 307592 for parts	1
	220571	AIR MOTOR, Senator, quiet <i>Used on Model 237780;</i> See MM 307592 for parts	1
102	190000	ROD, tie; 224 mm (8.82") shoulder to shoulder	3
104	186925	NUT, coupling	1
105	184129	COLLAR, coupling	2
106	106166	NUT, hex, self-locking; M16 x 2.0	3
107	237450	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
110	112887	WRENCH, packing nut	1

✓ Part included in Connection Kit 235417.



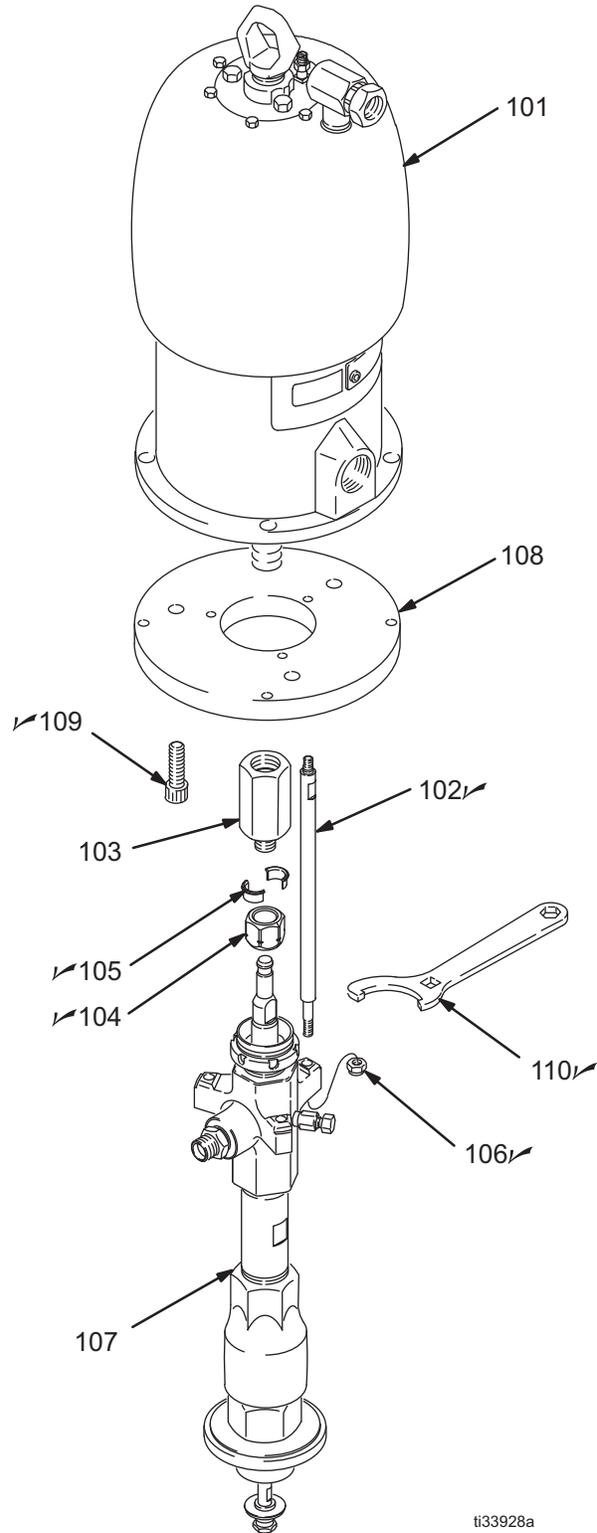
05668B

**Model 222778, Series A  
55:1 Ratio Bulldog Pump (shown)  
(UHMWPE and PTFE Packed)**

**Model 222813, Series A  
55:1 Ratio Quiet Bulldog Pump  
(UHMWPE and PTFE Packed)**

Ref.	Part	Description	Qty.
101	208356	AIR MOTOR, Bulldog, standard <i>Used on Model 222778; See MM 307049 for parts</i>	1
	215255	AIR MOTOR, Bulldog, quiet <i>Used on Model 222813; See MM 307304 for parts</i>	1
102 ✓	24B190	KIT, tie rod	3
103	184127	ROD, adapter	1
104 ✓	17F000	NUT, coupling	1
105 ✓	184128	COLLAR, coupling	2
106 ✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
108	184094	PLATE, adapter	1
109 ✓	109211	SCREW, cap, socket hd; 5/8-11 unc-2a x 2" (51 mm)	3
110 ✓	184119	WRENCH, packing nut	1

✓ Part included in Connection Kit 236070.

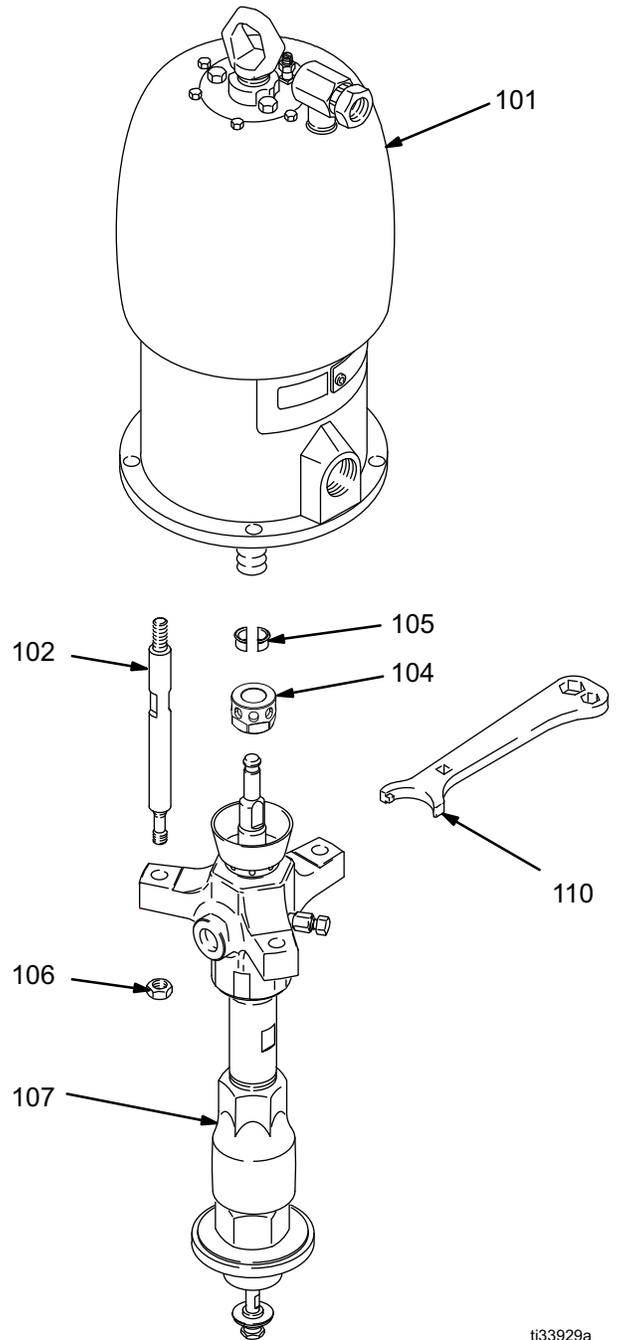


**Model 237208, Series A**  
**55:1 Ratio Stubby Bulldog Pump (shown)**  
**(UHMWPE and PTFE Packed)**

**Model 237779, Series A**  
**55:1 Ratio Stubby Quiet Bulldog Pump**  
**(UHMWPE and PTFE Packed)**

Ref.	Part	Description	Qty.
101	208356	AIR MOTOR, Bulldog, standard <i>Used on Model 237208;</i> See MM 307049 for parts	1
	215255	AIR MOTOR, Bulldog, quiet <i>Used on Model 237779;</i> See MM 307304 for parts	1
102	190000	ROD, tie; 224 mm (8.82") shoulder to shoulder	3
104	186925	NUT, coupling	1
105	184129	COLLAR, coupling	2
106	106166	NUT, hex, self-locking; M16 x 2.0	3
107	237450	PUMP, displacement (see <b>Displacement Pump</b> , page 26)	1
110	112887	WRENCH, packing nut	1

✓ Part included in Connection Kit 235417.



ti33929a

## Displacement Pump

NOTE: See Throat Packing Kits, page 28, for replacement throat packings.

**Model 222790, Series B Displacement Pump, UHMWPE and PTFE Packings**

**Model 235540, Series A Displacement Pump, PTFE Packings**

**Model 237206, Series A Displacement Pump, UHMWPE and PTFE Packings, Stubby Pump**

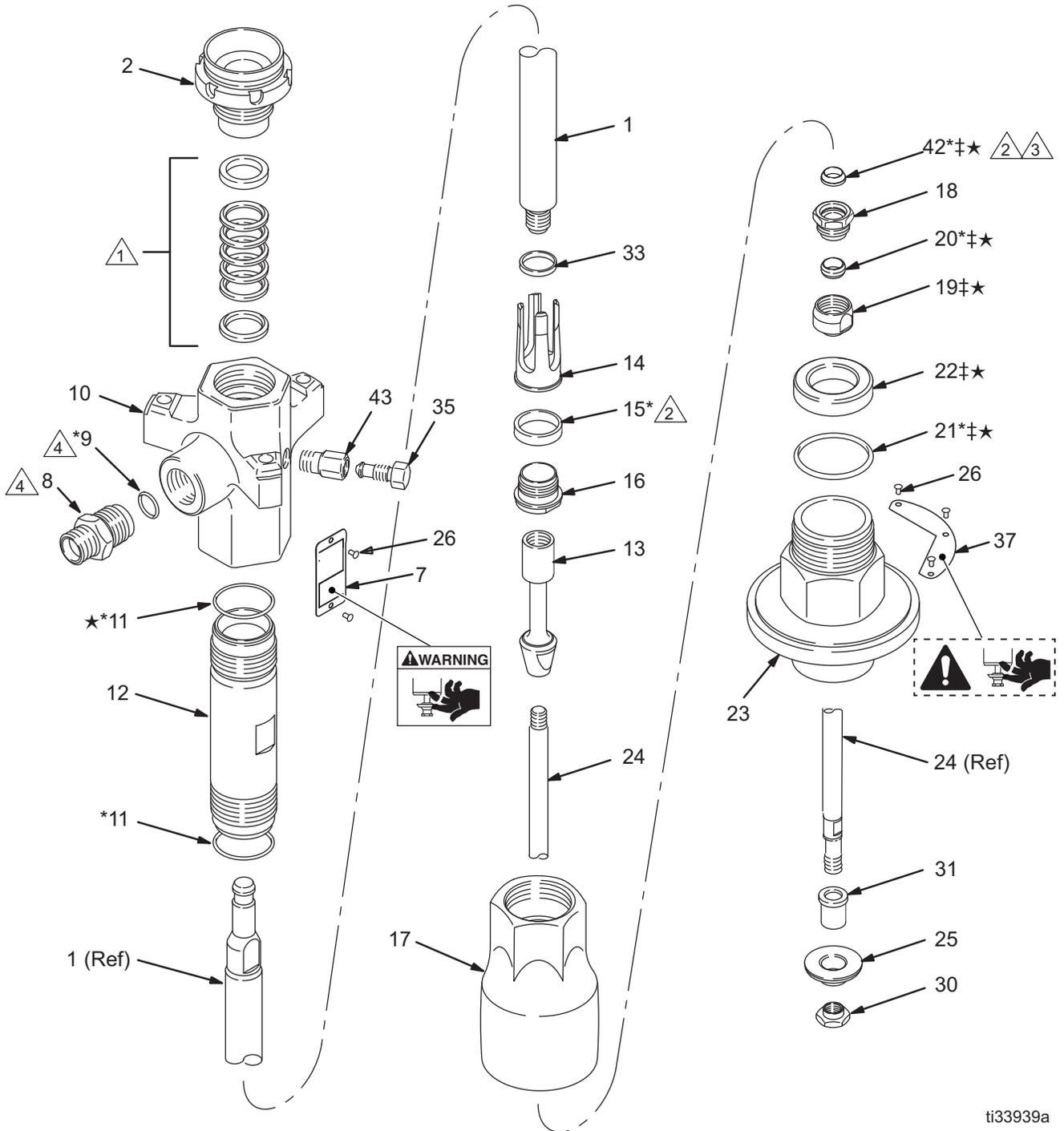
**Model 237450, Series A Displacement Pump, UHMWPE and PTFE Packings, Stubby Pump**

**Model 246932, Series A Displacement Pump, Tuffstack throat, UHMWPE and PTFE Packings**

Ref.	Part	Description	Qty.	Ref.	Part	Description	Qty.
1	184041	ROD, displacement; sst; 328.25 mm (12.92 in.) long; used on Models 222790 & 235540	1	17	184044	HOUSING, intake valve; ductile iron	1
	190159	ROD, displacement; sst; 252.45 mm (9.94 in.) long; used on Model 237206	1	18	184493	NUT, packing, intake valve; carbon steel	1
	190172	ROD, displacement; sst; 328.25 mm (12.92 in.) long; used on Model 237450	1	19‡★	184616	VALVE BODY, intake; alloy steel	1
2	184039	NUT, packing; carbon steel; used on Models 222790, 235540, and 237206	1	20*‡★	184049	SEAL, intake valve; PTFE	1
	236577	NUT, packing; carbon steel; used on Model 237450	1	21*‡★	187860	SEAL; acetal	1
7▲	184090	LABEL, warning	1	22‡★	184617	SEAT, intake valve; alloy steel	1
8	184037	NIPPLE, outlet; M30 x 1.5(m); 3/4 npt(m); carbon steel; used on Models 222790, 235540, and 237206 only	1	23	187859	CYLINDER, intake; ductile iron	1
9*	110135	O-RING; PTFE; used on Models 222790, 235540, and 237206 only	1	24	187858	ROD, priming piston; sst	1
10	184038	HOUSING, outlet; ductile iron; used on Models 222790, 235540, and 237206	1	25	184051	PISTON, priming; carbon steel	1
	189389	HOUSING, outlet; ductile iron; used on Model 237450	1	30	184121	NUT, priming piston; alloy steel	1
11*★	109205	O-RING; PTFE	2	31	184122	GUIDE, priming piston; alloy steel	1
12	184040	CYLINDER, pump; sst	1	33	184124	SPACER, piston; sst	1
13	184042	PISTON; alloy steel	1	35	190128	PLUG, bleeder valve	1
14	184043	GUIDE, piston; alloy steel	1	37▲	184151	LABEL, warning	1
15*	184053	SEAL, piston; UHMWPE; used on Models 222790, 237450, and 237206	1	39▲	172479	TAG, warning (not shown)	1
	188257	SEAL, piston; PTFE; used on Model 235540; (not included in Repair Kit 222773)	1	42*‡★	184469	SEAL, intake valve; UHMWPE; used on Models 222790, 237450, and 237206	1
16	184052	SEAT, piston; alloy steel	1	189217	SEAL, intake valve; PTFE; used on Model 235540; (not included in Repair Kits 222773 and 222793)	1	
				43	165702	BODY, bleeder valve	1
				*	<i>Part included in Seal Repair Kit 222773 (purchased separately).</i>		
				★	<i>Part included in Displacement Pump Seal Kit 25A247 (purchased separately).</i>		
				‡	<i>Part included in Intake Seat Repair Kit 222793 (purchased separately).</i>		
				▲	<i>Replacement Danger and Warning labels, tags and cards are available at no cost.</i>		

**Model 222790 Shown**

- △1 Refer to **Throat Packing Kits**, page 28, for available throat packing kits.
- △2 Seal Repair Kit 222773 does not include Piston Seal 188257 or Intake Valve Seal 189217 used on pump 235540.
- △3 Intake Seat Repair Kit 222793 does not include Intake Valve Seal 189217 used on pump 235540.
- △4 Used on Models 222790, 235540, and 237206 only.



ti33939a

# Accessories

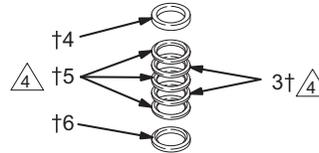
## Throat Packing Kits

### UHMWPE and PTFE Throat Packing Repair Kit 222774

for Displacement Pumps 222790, 237206, and 237450

Ref.	Part	Description	Qty.
3†	109302	V-PACKING; PTFE	2
4†	184172	GLAND, female; sst	1
5†	109252	V-PACKING; UHMWPE	3
6†	184222	GLAND, male; sst	1

 Lips of v-packings must face down.



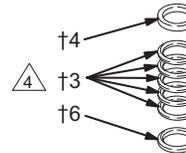
† *These parts are included in Throat Packing Repair Kit 222774, which may be purchased separately.*

### PTFE Throat Packing Repair Kit 222775

for Displacement Pump 235540

Ref.	Part	Description	Qty.
3†	109302	V-PACKING; PTFE	5
4†	184172	GLAND, female; sst	1
6†	184222	GLAND, male; sst	1

 Lips of v-packings must face down.



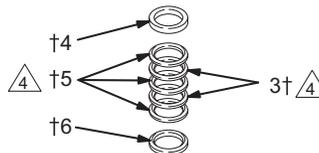
† *These parts are included in Throat Packing Repair Kit 222775, which may be purchased separately.*

### UHMWPE and Leather Throat Packing Conversion Kit 237916

for use with all Displacement Pumps

Ref.	Part	Description	Qty.
3†	184302	V-PACKING; leather	2
4†	184172	GLAND, female; sst	1
5†	109252	V-PACKING; UHMWPE	3
6†	184222	GLAND, male; sst	1

 Lips of v-packings must face down.



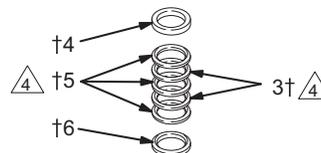
† *These parts are included in Throat Packing Repair Kit 237916, which may be purchased separately.*

### Tuffstack and UHMWPE Throat Packing Conversion Kit 234422

for Displacement Pump 246932

Ref.	Part	Description	Qty.
3†	109327	V-PACKING; Tuffstack	2
4†	184172	GLAND, female; sst	1
5†	109252	V-PACKING; UHMWPE	3
6†	184222	GLAND, male; sst	1

 Lips of v-packings must face down.



† *These parts are included in Throat Packing Repair Kit 234422, which may be purchased separately.*



# Technical Specifications

				
<p>Be sure that all fluids and solvents used are chemically compatible with the wetted parts listed below. Always read the manufacturer's literature before using fluid or solvent in this pump.</p>				

## President Pumps

Category	Data
Ratio	20:1
Maximum fluid working pressure	25 MPa, 248 bar (3600 psi)
Maximum air input pressure	1.2 MPa, 12 bar (180 psi)
Pump cycles per 3.8 liters (1 gal.)	48
Fluid flow at 60 cycles/min	4.5 liters/min (1.2 gpm)
Air motor effective diameter	108 mm (4.25")
Stroke length	102 mm (4")
Displacement pump effective area	4.5 cm <sup>2</sup> (0.697 in. <sup>2</sup> )
Maximum pump operating temperature	82°C (180°F)
Weight	22.7 kg (50 lb)
Wetted parts	Carbon Steel; E52100, 41L40, and 4140 Alloy Steel; 304, 316 and 17-4 PH Grades of Stainless Steel; Ductile Iron; Zinc and Nickel Plating; PTFE; Acetal; Ultra-High Molecular Weight Polyethylene (not used on Displacement Pump 235540)

### Sound Pressure Levels (dBa) (measured at 1 meter from unit)

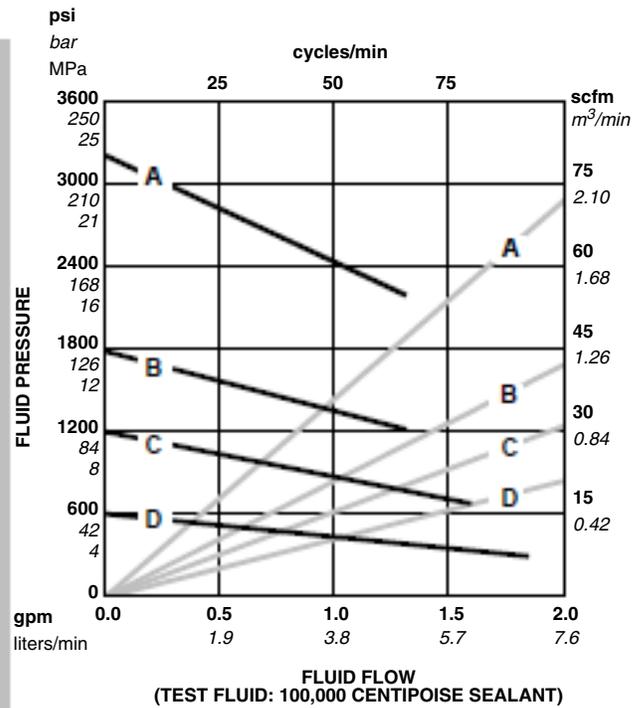
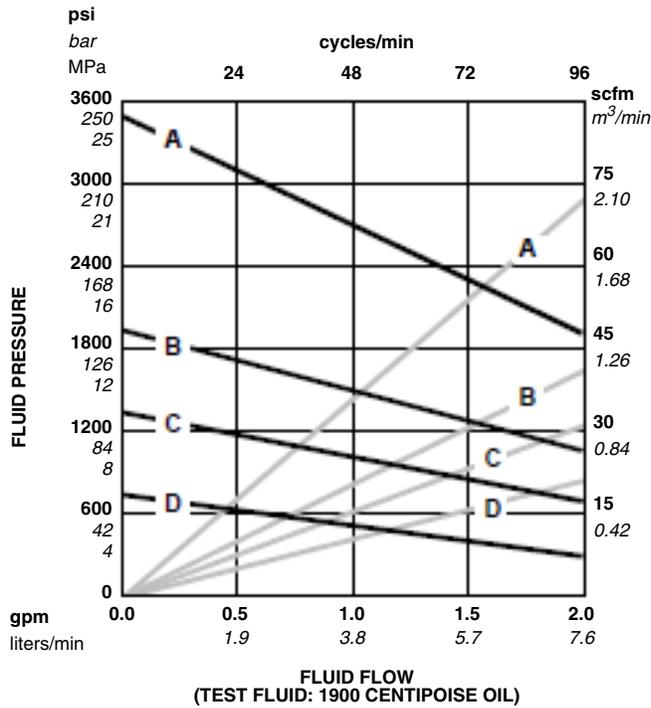
Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
President	73.6 dB(A)	78.3 dB(A)	80.9 dB(A)

### Sound Power Levels (dBa) (tested in accordance with ISO 9614-2)

Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
President	87.4 dB(A)	92.1 dB(A)	94.6 dB(A)

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

- A 1.2 MPa, 12 bar (180 psi) Air Pressure
- B 0.7 MPa, 7 bar (100 psi) Air Pressure
- C 0.49 MPa, 4.9 bar (70 psi) Air Pressure
- D 0.28 MPa, 2.8 bar (40 psi) Air Pressure



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

## Senator Pumps

Category	Data
Ratio	34:1
Maximum fluid working pressure	28 MPa, 281 bar (4080 psi)
Maximum air input pressure	0.8 MPa, 8 bar (120 psi)
Pump cycles per 3.8 liters (1 gal.)	38
Fluid flow at 60 cycles/min	6 liters/min (1.6 gpm)
Air motor effective diameter	146 mm (5.75")
Stroke length	120 mm (4.7")
Displacement pump effective area	4.5 cm <sup>2</sup> (0.697 in. <sup>2</sup> )
Maximum pump operating temperature	82°C (180°F)
Weight	45.5 kg (100 lb)
Wetted parts	Carbon Steel; E52100, 41L40, and 4140 Alloy Steel; 304, 316 and 17-4 PH Grades of Stainless Steel; Ductile Iron; Zinc and Nickel Plating; PTFE; Acetal; Ultra-High Molecular Weight Polyethylene (not used on Displacement Pump 235540)

### Sound Pressure Levels (dBa) (measured at 1 meter from unit)

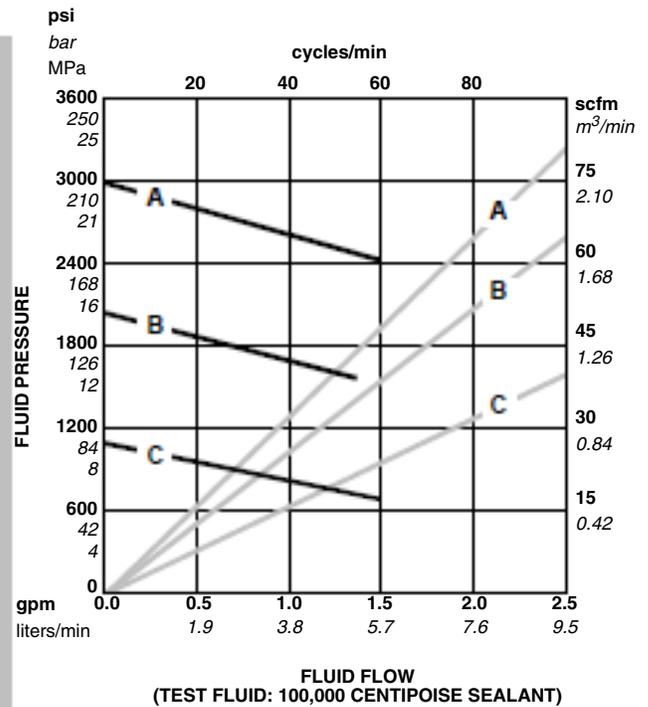
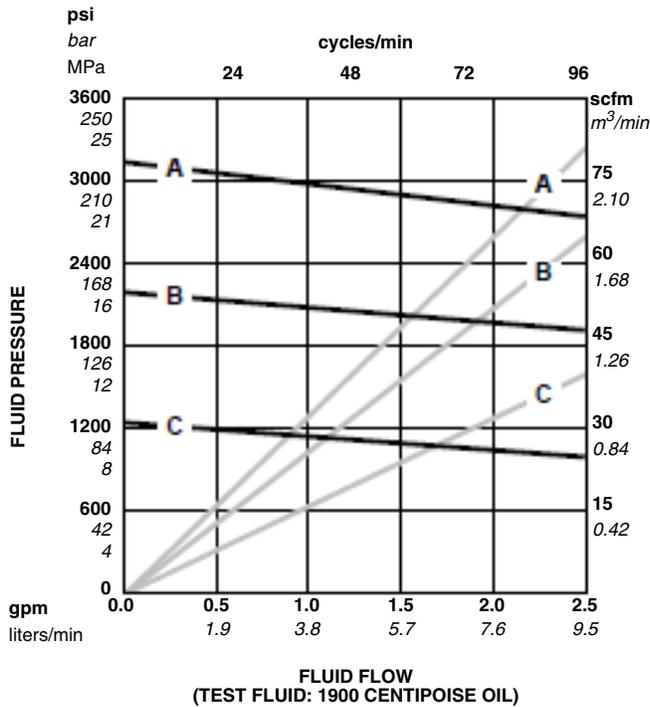
Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Senator	84.3 dB(A)	87.8 dB(A)	91.2 dB(A)

### Sound Power Levels (dBa) (tested in accordance with ISO 9614-2)

Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Senator	91.6 dB(A)	94.6 dB(A)	97.3 dB(A)

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

- A 0.7 MPa, 7 bar (100 psi) Air Pressure
- B 0.49 MPa, 4.9 bar (70 psi) Air Pressure
- C 0.28 MPa, 2.8 bar (40 psi) Air Pressure



**To find Fluid Outlet Pressure (MPa/bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (MPa/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 (m<sup>3</sup>/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (MPa/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.

## Quiet Senator Pumps

Category	Data
Ratio	34:1
Maximum fluid working pressure	28 MPa, 281 bar (4080 psi)
Maximum air input pressure	0.8 MPa, 8 bar (120 psi)
Pump cycles per 3.8 liters (1 gal.)	38
Fluid flow at 60 cycles/min	6 liters/min (1.6 gpm)
Air motor effective diameter	146 mm (5.75")
Stroke length	120 mm (4.7")
Displacement pump effective area	4.5 cm <sup>2</sup> (0.697 in. <sup>2</sup> )
Maximum pump operating temperature	82°C (180°F)
Weight	45.5 kg (100 lb)
Wetted parts	Carbon Steel; E52100, 41L40, and 4140 Alloy Steel; 304, 316 and 17-4 PH Grades of Stainless Steel; Ductile Iron; Zinc and Nickel Plating; PTFE; Acetal; Ultra-High Molecular Weight Polyethylene (not used on Displacement Pump 235540)

### Sound Pressure Levels (dBa) (measured at 1 meter from unit)

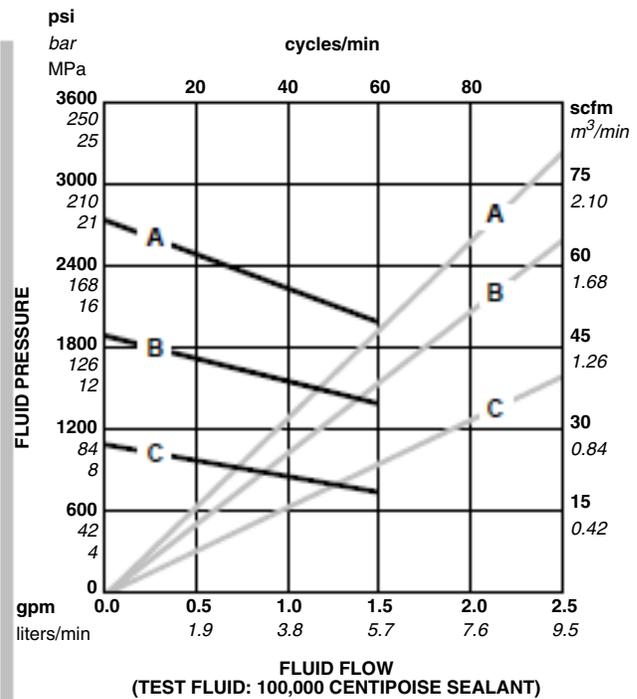
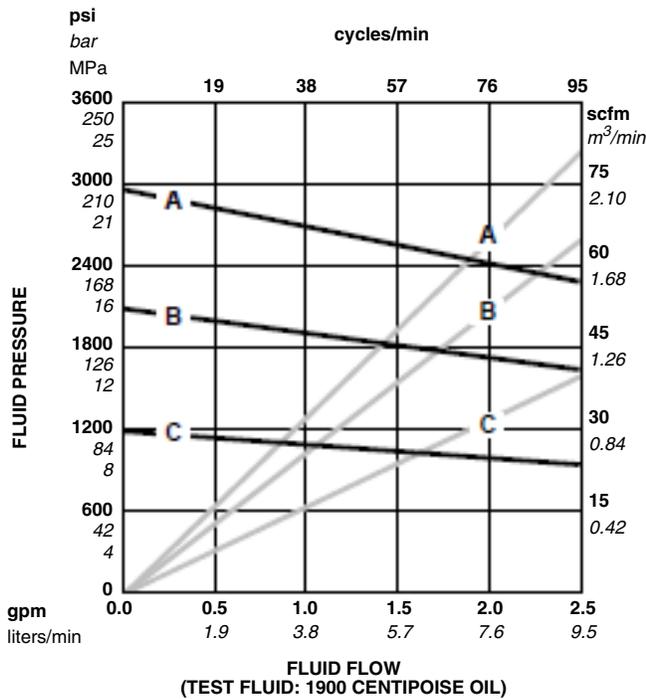
Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Quiet Senator	83.4 dB(A)	84.3 dB(A)	88.5 dB(A)

### Sound Power Levels (dBa) (tested in accordance with ISO 9614-2)

Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Quiet Senator	89.8 dB(A)	91.8 dB(A)	94.4 dB(A)

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

- A 0.7 MPa, 7 bar (100 psi) Air Pressure
- B 0.49 MPa, 4.9 bar (70 psi) Air Pressure
- C 0.28 MPa, 2.8 bar (40 psi) Air Pressure



**To find Fluid Outlet Pressure (MPa/bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (MPa/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 (m<sup>3</sup>/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (MPa/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.

## Bulldog Pumps

Category	Data
Ratio	55:1
Maximum fluid working pressure	34 MPa, 341 bar (4950 psi)
Maximum air input pressure	0.6 MPa, 6.2 bar (90 psi)
Pump cycles per 3.8 liters (1 gal.)	40
Fluid flow at 60 cycles/min	5.7 liters/min (1.5 gpm)
Air motor effective diameter	146 mm (5.75")
Stroke length	120 mm (4.7")
Displacement pump effective area	4.5 cm <sup>2</sup> (0.697 in. <sup>2</sup> )
Maximum pump operating temperature	82°C (180°F)
Weight	45.5 kg (100 lb)
Wetted parts	Carbon Steel; E52100, 41L40, and 4140 Alloy Steel; 304, 316 and 17-4 PH Grades of Stainless Steel; Ductile Iron; Zinc and Nickel Plating; PTFE; Acetal; Ultra-High Molecular Weight Polyethylene (not used on Displacement Pump 235540)

### Sound Pressure Levels (dBa) (measured at 1 meter from unit)

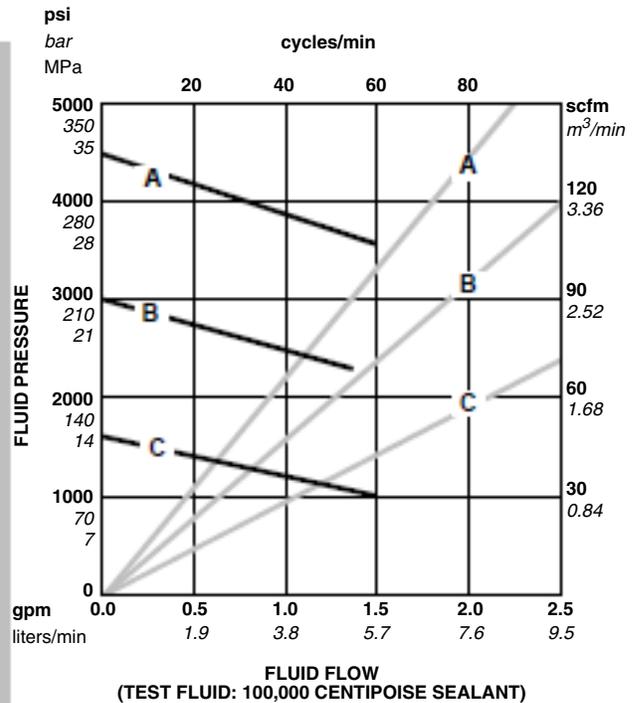
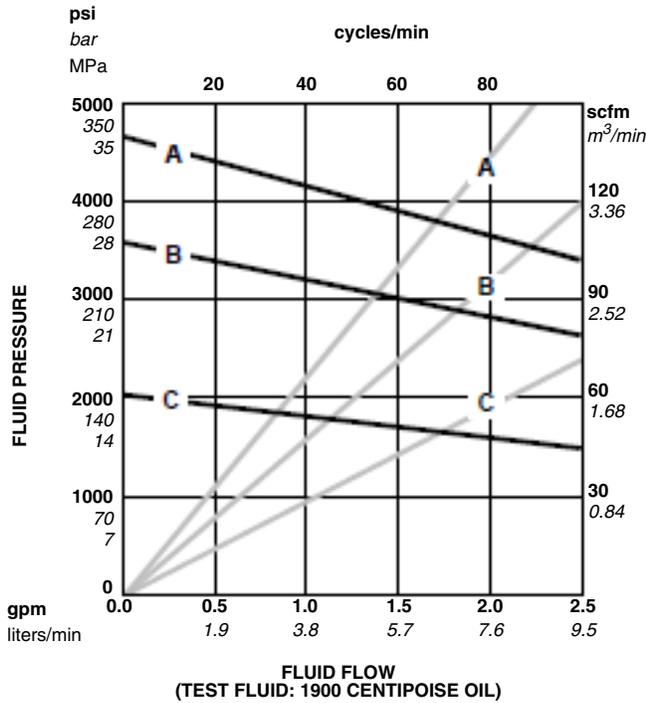
Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Bulldog	82.4 dB(A)	87.3 dB(A)	88.5 dB(A)

### Sound Power Levels (dBa) (tested in accordance with ISO 9614-2)

Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Bulldog	91.6 dB(A)	95.9 dB(A)	97.4 dB(A)

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

- A 0.6 MPa, 6.2 bar (90 psi) Air Pressure
- B 0.49 MPa, 4.9 bar (70 psi) Air Pressure
- C 0.28 MPa, 2.8 bar (40 psi) Air Pressure



**To find Fluid Outlet Pressure (MPa/bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (MPa/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 (m<sup>3</sup>/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (MPa/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.

## Quiet Bulldog Pumps

Category	Data
Ratio	55:1
Maximum fluid working pressure	34 MPa, 341 bar (4950 psi)
Maximum air input pressure	0.6 MPa, 6.2 bar (90 psi)
Pump cycles per 3.8 liters (1 gal.)	40
Fluid flow at 60 cycles/min	5.7 liters/min (1.5 gpm)
Air motor effective diameter	146 mm (5.75")
Stroke length	120 mm (4.7")
Displacement pump effective area	4.5 cm <sup>2</sup> (0.697 in. <sup>2</sup> )
Maximum pump operating temperature	82°C (180°F)
Weight	45.5 kg (100 lb)
Wetted parts	Carbon Steel; E52100, 41L40, and 4140 Alloy Steel; 304, 316 and 17-4 PH Grades of Stainless Steel; Ductile Iron; Zinc and Nickel Plating; PTFE; Acetal; Ultra-High Molecular Weight Polyethylene (not used on Displacement Pump 235540)

### Sound Pressure Levels (dBa) (measured at 1 meter from unit)

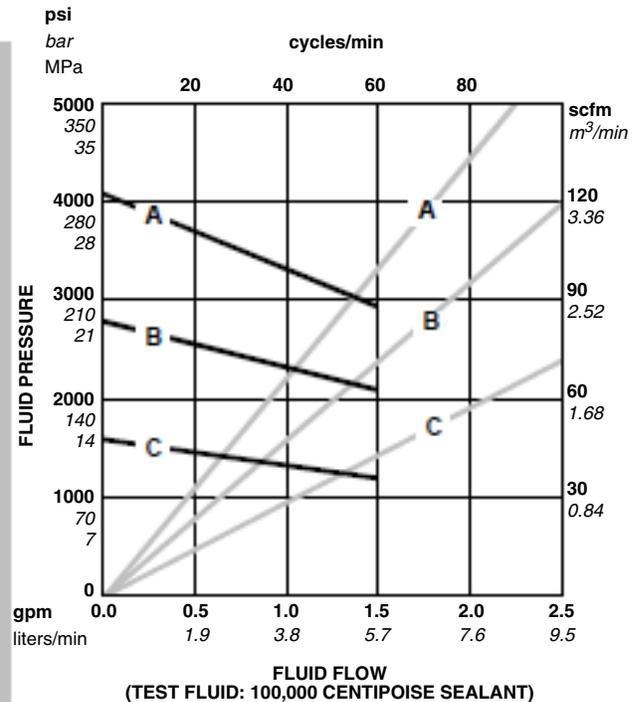
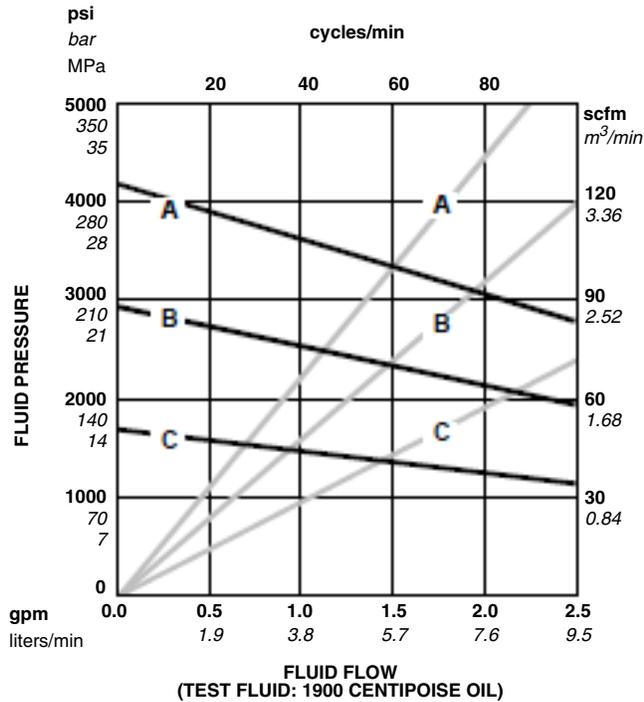
Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Quiet Bulldog	81.5 dB(A)	83.6 dB(A)	85.6 dB(A)

### Sound Power Levels (dBa) (tested in accordance with ISO 9614-2)

Air Motor	Input Air Pressures at 15 cycles per minute		
	40 psi (0.28 MPa, 2.8 bar)	70 psi (0.48 MPa, 4.8 bar)	100 psi (0.7 MPa, 7 bar)
Quiet Bulldog	90.2 dB(A)	93.5 dB(A)	94.9 dB(A)

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

- A 0.6 MPa, 6.2 bar (90 psi) Air Pressure
- B 0.49 MPa, 4.9 bar (70 psi) Air Pressure
- C 0.28 MPa, 2.8 bar (40 psi) Air Pressure



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

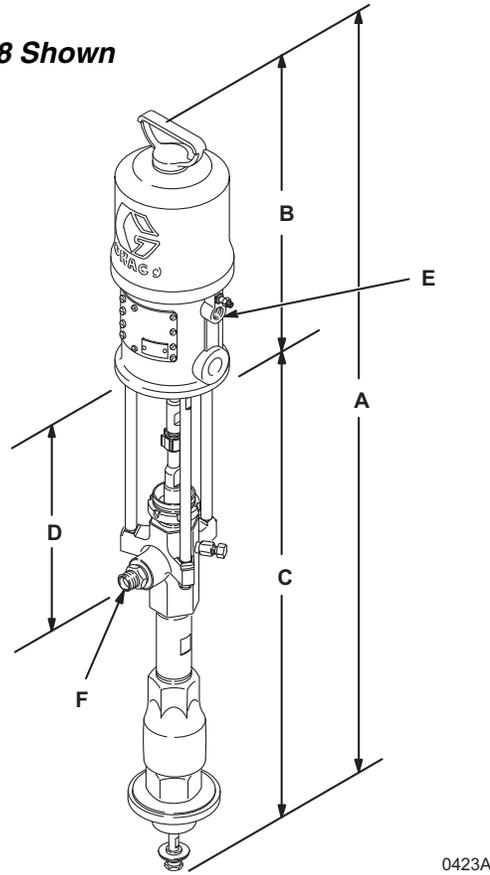
1. Locate desired flow along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve (black). Follow left to scale to read fluid outlet pressure.

To find Pump Air Consumption (m<sup>3</sup>/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (MPa/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.

# Dimensions

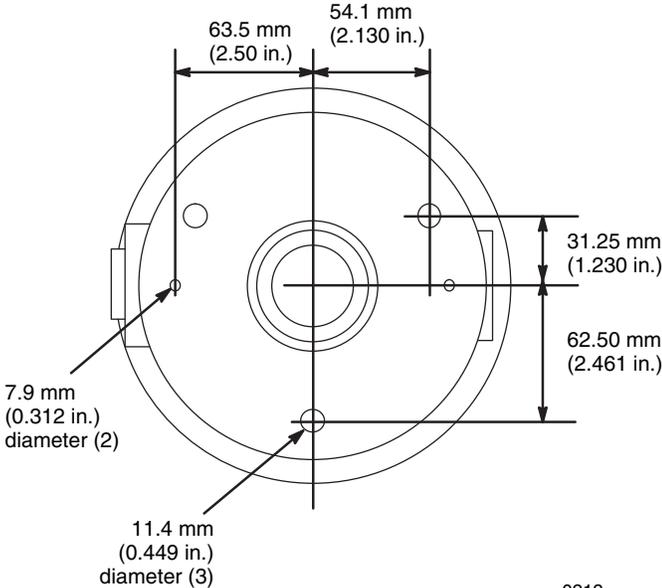
**Model 222768 Shown**



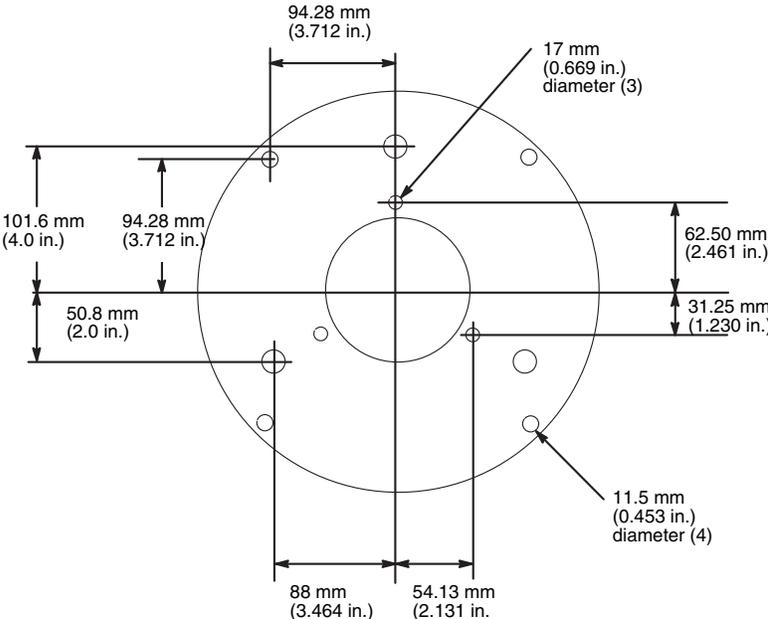
Pump Model	A	B	C	D	E (air inlet)	F (fluid outlet)
<b>222768, 246932</b>	1251 mm (49.25 in.)	418 mm (16.45 in.)	832 mm (32.75 in.)	328 mm (12.9 in.)	1/2 npt(f)	3/4 npt(m)
<b>237207</b>	1119 mm (44.07 in.)	418 mm (16.45 in.)	700 mm (27.57 in.)	196 mm (7.7 in.)	1/2 npt(f)	3/4 npt(m)
<b>222769, 224660</b>	1400 mm (55.1 in.)	570 mm (22.4 in.)	830 mm (32.7 in.)	322 mm (12.7 in.)	3/4 npsm(f)	3/4 npt(m)
<b>237492</b>	1329 mm (52.32 in.)	570 mm (22.4 in.)	759 mm (29.88 in.)	251 mm (9.9 in.)	3/4 npsm(f)	3/4 npt(f)
<b>237780</b>	1329 mm (52.32 in.)	570 mm (22.4 in.)	759 mm (29.88 in.)	251 mm (9.9 in.)	3/4 npsm(f)	3/4 npt(f)
<b>222778, 222813</b>	1400 mm (55.1 in.)	570 mm (22.4 in.)	830 mm (32.7 in.)	322 mm (12.7 in.)	3/4 npsm(f)	3/4 npt(m)
<b>237208</b>	1329 mm (52.32 in.)	570 mm (22.4 in.)	759 mm (29.88 in.)	251 mm (9.9 in.)	3/4 npsm(f)	3/4 npt(f)
<b>237779</b>	1329 mm (52.32 in.)	570 mm (22.4 in.)	759 mm (29.88 in.)	251 mm (9.9 in.)	3/4 npsm(f)	3/4 npt(f)

# Mounting Hole Layout

## PRESIDENT PUMPS



## SENATOR AND BULLDOG PUMPS



# Graco Standard Warranty

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

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

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

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

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

**GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO.** These items sold, but not manufactured by Graco (such as electric motors, 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.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

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

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

**Phone: 612-623-6921 or Toll Free: 1-800-328-0211 Fax: 612-378-3505**

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Original instructions. This manual contains English. MM 308017

**Graco Headquarters:** Minneapolis

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

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