Instructions–Parts List

CARBON STEEL

Check–Mate ™ 450 Pumps

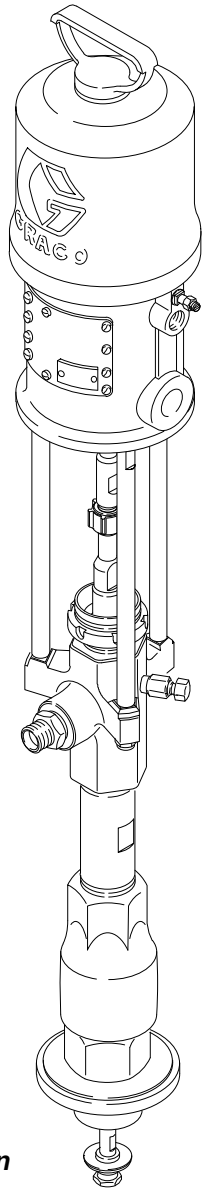
308017Y

EN

WITH PRIMING PISTON, AND SEVERE–DUTY ROD AND CYLINDER

U.S. Patent Nos. 5,147,188 and 5,154,532.

Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.



Model 222768 Shown

0423A

Table of Contents

PROVEN QUALITY. LEADING TECHNOLOGY.

List of Models

Model No.	Description	Maximum Air Working Pressure			Maximum Fluid Working Pressure		
		MPa	bar	psi	MPa	bar	psi
222770	10:1 ratio Monark® Pump, Series A (UHMWPE/PTFE Packed)	1.2	12	180	12	124	1800
235626	10:1 ratio Monark® Pump, Series A (PTFE Packed)	1.2	12	180	12	124	1800
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

Symbols

Warning Symbol

⚠ WARNING

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

Caution Symbol

⚠ CAUTION

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

⚠ WARNING

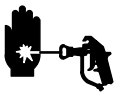
INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure stated on the equipment or in the **Technical Data** for your equipment. Do not exceed the maximum working pressure of the lowest rated component in your system.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Do not use hoses to pull equipment.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below –40°C (–40°F).
- Wear hearing protection when operating this equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ WARNING



SKIN INJECTION HAZARD

Spray from the spray gun/dispense valve, hose leaks or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid splashed in the eyes or on the skin can also cause serious injury.

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate surgical treatment.**
- Do not point the gun/valve at anyone or at any part of the body.
- Do not put your hand or fingers over the spray tip/nozzle.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Do not “blow back” fluid; this is not an air spray system.
- Always have the tip guard and the trigger guard on the spray gun when spraying.
- Check the gun diffuser operation weekly. Refer to the gun manual.
- Be sure the gun/valve trigger safety operates before spraying/dispensing.
- Lock the gun/valve trigger safety when you stop spraying/dispensing.
- Follow the **Pressure Relief Procedure** on page 9 whenever you: are instructed to relieve pressure; stop spraying/dispensing; clean, check, or service the equipment; and install or clean the spray tip/nozzle.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.
- Use only Graco approved hoses. Do not remove any spring guard that is used to help protect the hose from rupture caused by kinks or bends near the couplings.

MOVING PARTS HAZARD

Moving parts, such as the priming piston, can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Keep hands and fingers away from the priming piston during operation and whenever the pump is charged with air.
- Before servicing the equipment, follow the **Pressure Relief Procedure** on page 9 to prevent the equipment from starting unexpectedly.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment and the object being sprayed. Refer to **Grounding** on page 8.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop spraying/dispensing immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being sprayed/dispensed.
- Keep the spray/dispense area free of debris, including solvent, rags, and gasoline.
- Electrically disconnect all equipment in the spray/dispense area.
- Extinguish all open flames or pilot lights in the spray/dispense area.
- Do not smoke in the spray/dispense area.
- Do not turn on or off any light switch in the spray/dispense area while operating or if fumes are present.
- Do not operate a gasoline engine in the spray/dispense area.

TOXIC FLUID HAZARD

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Installation

General Information

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

NOTE: Always use Genuine Graco Parts and Accessories, available from your Graco distributor. Refer to the Product Data Sheet, Form No. 305546. If you supply your own accessories, be sure they are adequately sized and pressure-rated to meet the system's requirements.

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.

System Accessories

⚠ WARNING

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 red-handled main air bleed valve (V) shuts off and relieves the air to the pump and ram. Order Part No. 113269 for Monark and President Pumps, or 113218 for Senator and Bulldog Pumps. 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. Order Part No. 210658 (3/8 npt).

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 the pump and ram (see the **WARNING** at left). 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).
- **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 (see the **WARNING** at left). 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.

Installation

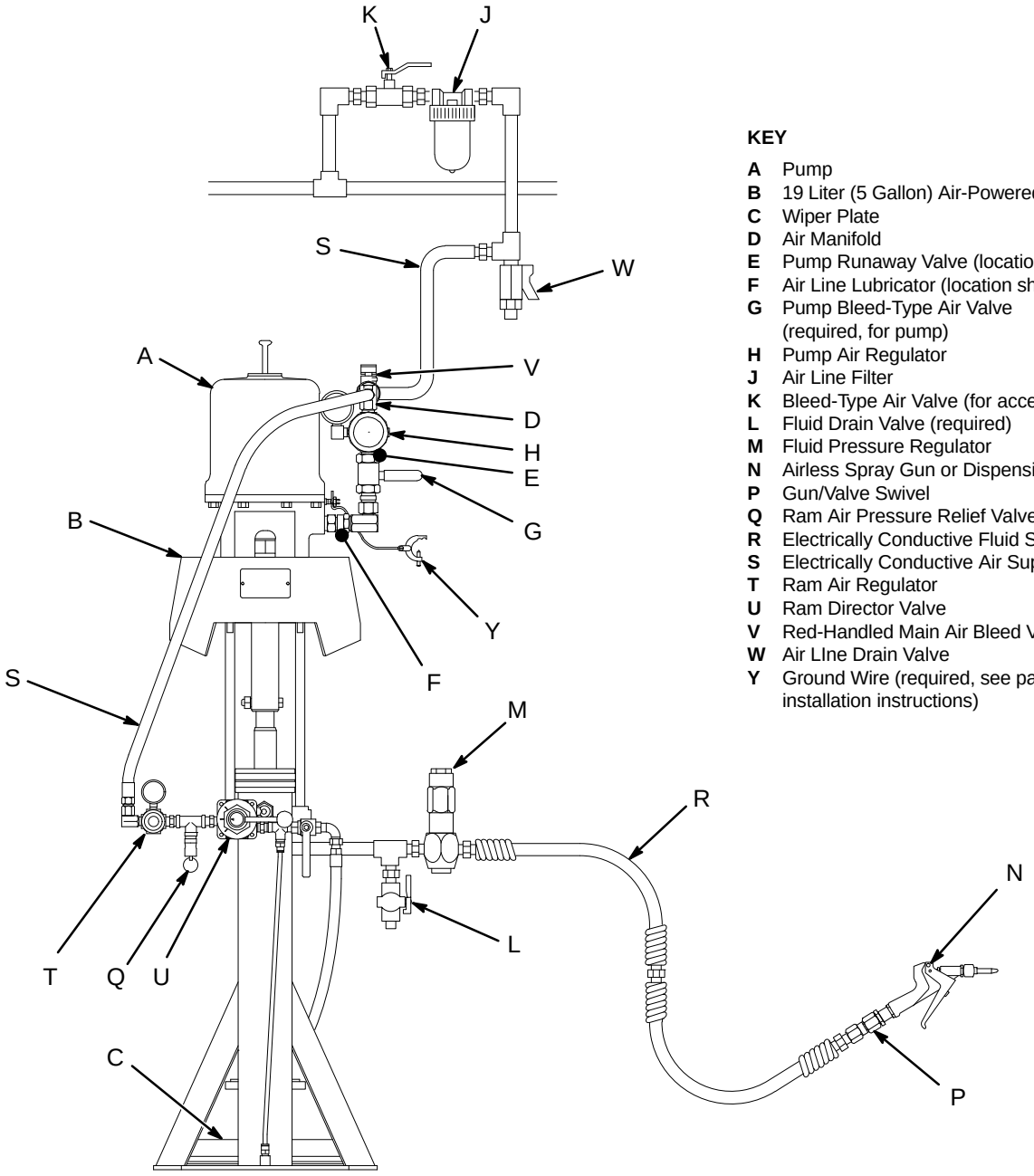
Fluid Line Accessories

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 (see the **WARNING** on page 6). Install with the drain valve pointing down, but so the handle points up when the valve is open.
- **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, see page 8 for installation instructions)

Fig. 1

Installation

Grounding

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Before operating the pump, ground the system as explained below. Also read the section **FIRE AND EXPLOSION HAZARD** on page 5.

1. *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^2 (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.

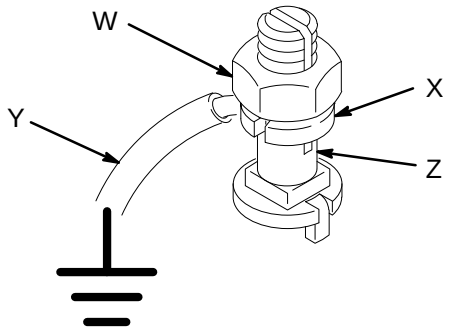


Fig. 2

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

3. *Air compressor:* follow manufacturer's recommendations.

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

5. *Fluid supply container:* follow your local code.

6. *Object being sprayed:* follow your local code.

7. *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.

8. *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.

Mounting Accessories

Mount the pump (A) to suit the type of installation planned. Pump dimensions and the mounting hole layout are shown on pages 46 and 47.

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.

Operation

Pressure Relief Procedure

⚠ WARNING

SKIN INJECTION HAZARD
The system pressure must be manually relieved to prevent the system from starting or dispensing accidentally. Fluid under high pressure can be injected through the skin and cause serious injury. To reduce the risk of an injury from injection, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- stop spraying/dispensing,
- check or service any of the system equipment,
- or install or clean the spray tip/nozzle.

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.

⚠ WARNING

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

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.

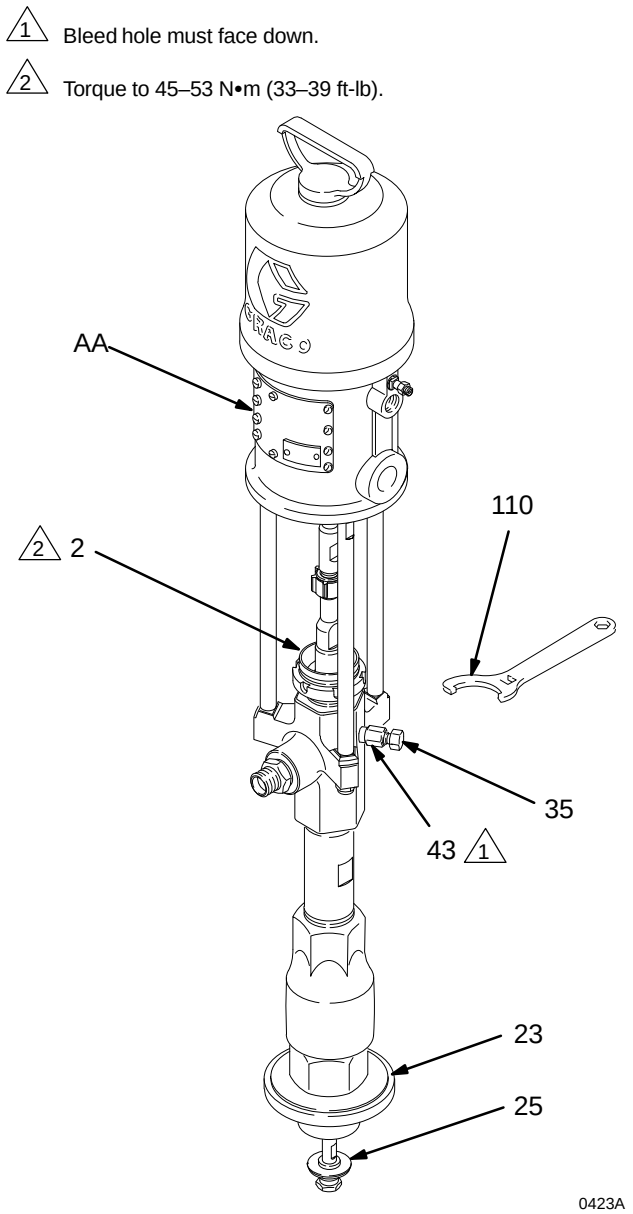


Fig. 3

Operation

Flush the Pump Before First Use

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** on page 11.

Starting and Adjusting the Pump

⚠ WARNING

MOVING PARTS HAZARD
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. Follow the **Pressure Relief Procedure** on page 9, before checking, clearing, or cleaning the priming piston.

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.

⚠ WARNING

SKIN INJECTION HAZARD
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.

⚠ CAUTION

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.

Operation

Starting and Adjusting the Pump (continued)

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.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

11. Relieve the pressure. Install the spray tip in the gun.

⚠ WARNING

COMPONENT RUPTURE HAZARD
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 **Technical Data** on pages 33–43).

12. 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

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

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** at right.

Flushing

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Before operating the pump, read the section **FIRE AND EXPLOSION HAZARD** on page 5. Be sure the entire system and flushing pails are properly grounded. Refer to **Grounding** on page 8.

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.

⚠ CAUTION

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.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

1. Relieve the pressure.
2. Remove the spray tip/nozzle from the gun/valve.
3. Hold a metal part of the gun/valve firmly to the side of a grounded *metal* pail.
4. Start the pump. Always use the lowest possible fluid pressure when flushing.
5. Trigger the gun/valve.
6. Flush the system until clear solvent flows from the gun/valve.
7. Relieve the pressure.

Troubleshooting

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

1. Relieve the pressure.
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 page 10); use a ram.
	Held open or worn intake valve or seals.	Clear the valve; replace the seals.
	Worn packings in the displacement pump.	Replace the packings.
Pump operates, but output is low on downstroke.	Fluid too heavy for pump priming.	Use the bleeder valve (see page 10); use a ram.
	Held open or worn intake valve or seals.	Clear the valve; replace the seals.
Pump operates, but output is low on upstroke.	Held open or worn piston valve or seals.	Clear the valve; replace the seals.

THE TROUBLESHOOTING CHART IS CONTINUED ON PAGE 13.

* To determine if the fluid hose or gun is obstructed, follow the **Pressure Relief Procedure** on page 9. 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.

Troubleshooting

PROBLEM	CAUSE	SOLUTION
Erratic or accelerated pump speed.	Exhausted fluid supply.	Refill and prime.
	Fluid is too heavy for pump priming.	Use the bleeder valve (see page 10); use a ram.
	Held open or worn piston valve or seals.	Clear the valve; replace the seals.
	Held open or worn priming piston.	Clear; service.
	Worn packings in the displacement pump.	Replace the packings.

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

Disconnecting the Displacement Pump

1. Flush the pump, if possible. Stop the pump at the bottom of its stroke.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

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 page 15 for displacement pump service. To service the air motor, refer to the separate motor manual, supplied.

Service

Reconnecting the Displacement 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.

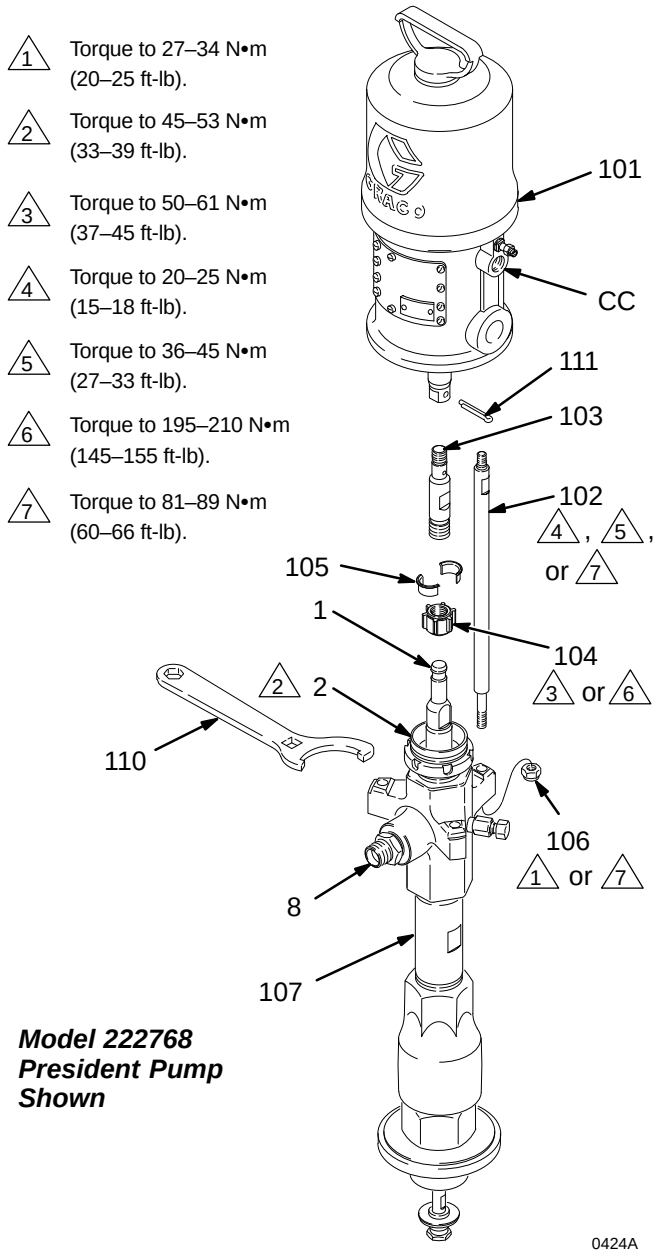
⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 9.

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



Model 222768 President Pump Shown

0424A

Fig. 4

Displacement Pump Service

Disassembly

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†). See page 32.

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 as explained on page 14. 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.

Service

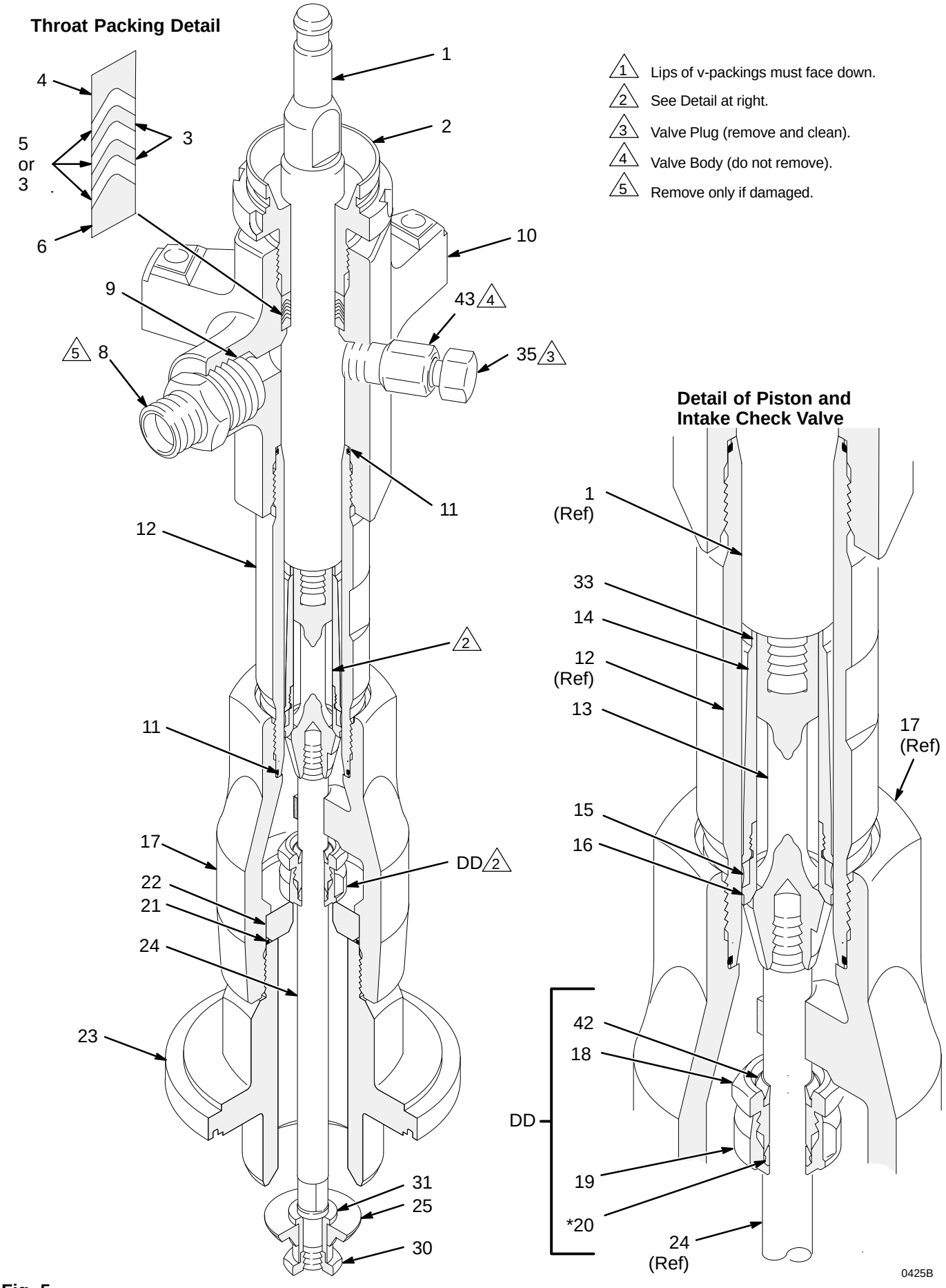


Fig. 5

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.

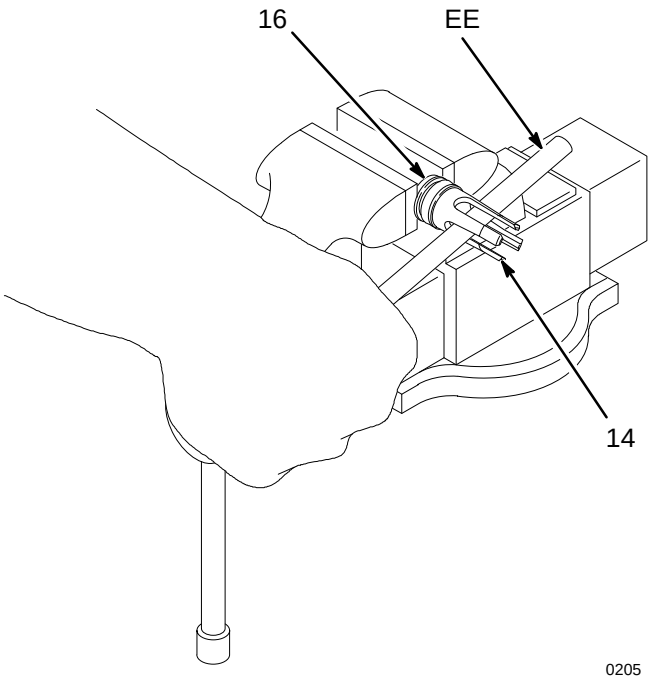


Fig. 6

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 page 19.

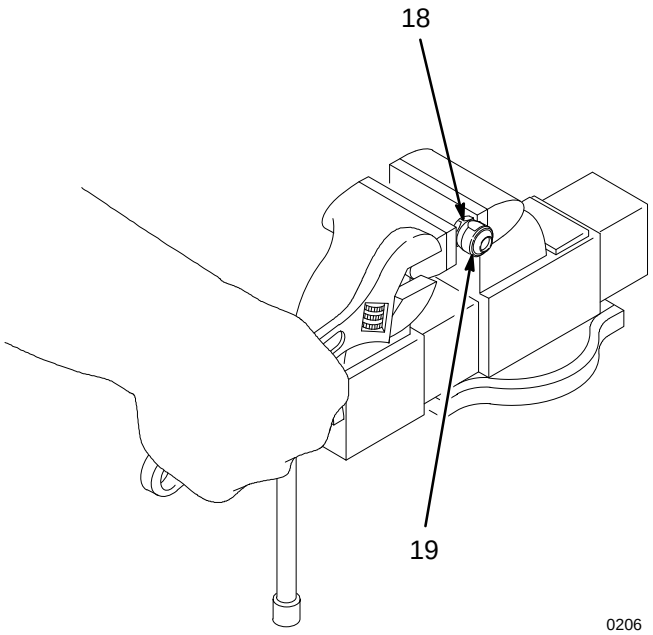


Fig. 7

Reassembly (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 (see the **NOTE** below), 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 page 32 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.

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).

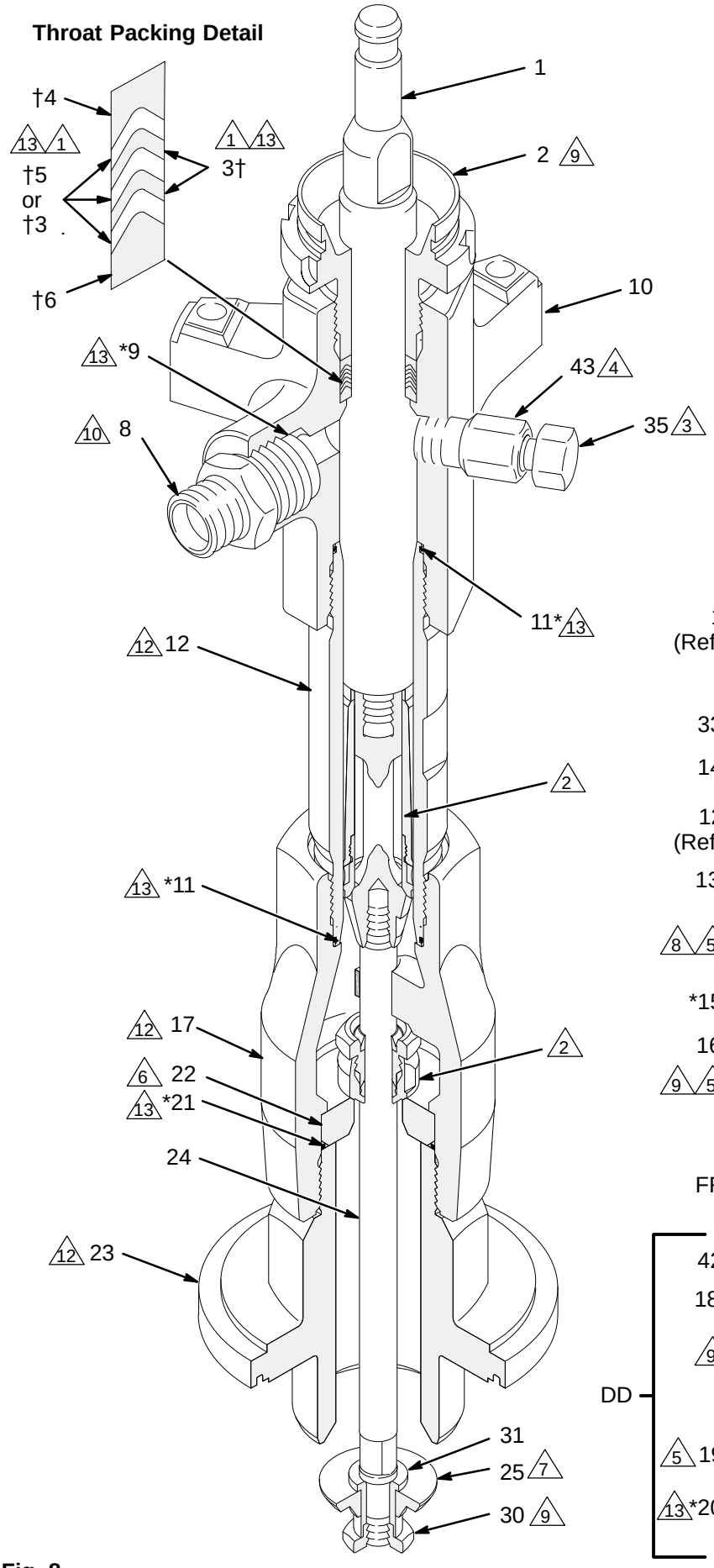
14. Apply thread lubricant to the threads of the intake cylinder (23) and screw the cylinder into the intake valve housing (17), using an adjustable wrench. Torque to 325–354 N.m (240–260 ft-lb).

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 as explained on page 15.

17. Allow 2 hours for the thread sealant to cure before returning the pump to service.

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.

Detail of Piston and Intake Check Valve

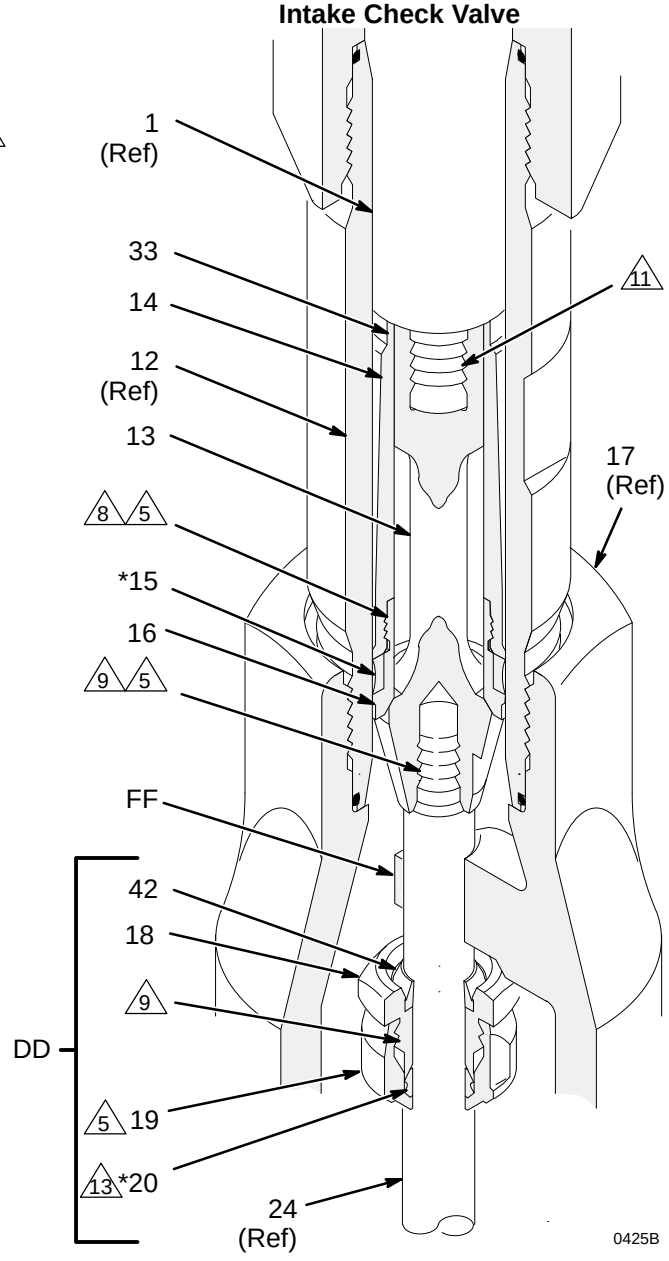


Fig. 8

Notes

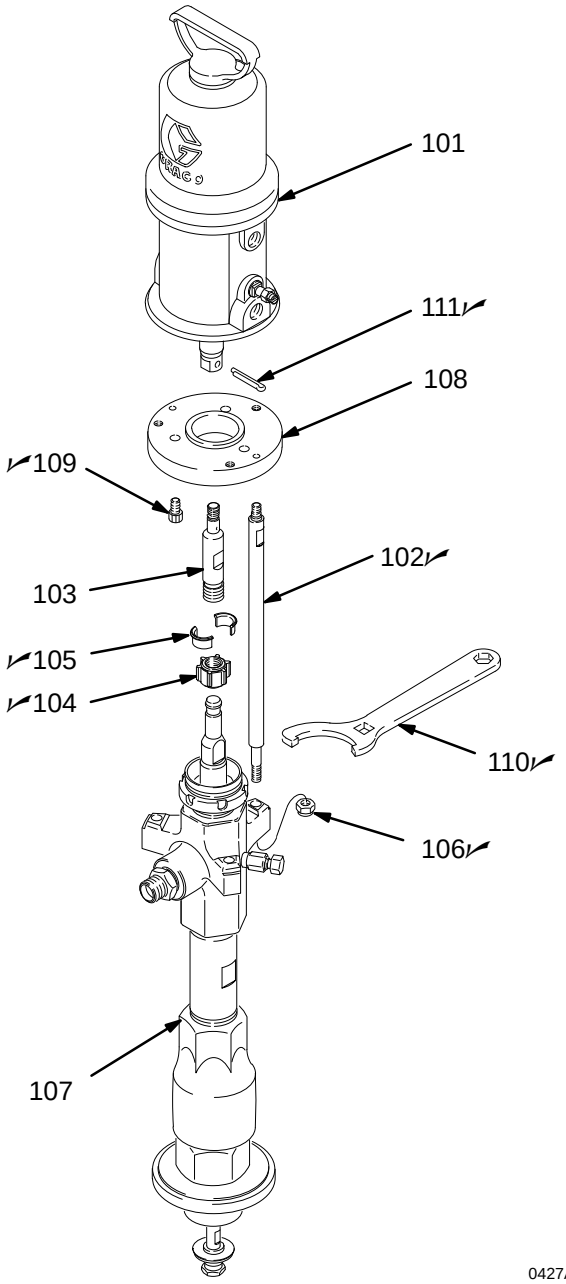
Parts

Model 222770, Series A
10:1 Ratio Monark Pump
(UHMWPE and PTFE Packed)

Model 235626, Series A
10:1 Ratio Monark Pump (PTFE Packed)

Ref. No.	Part No.	Description	Qty.
101	222791	AIR MOTOR, Monark	
		See 307043 for parts	1
102✓	24B190	KIT, tie rod	3
103	184092	ROD, adapter	1
104✓	184059	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement;	
		Used on Model 222770 only	
		See pages 30 & 31 for parts	1
	235540	PUMP, displacement;	
		Used on Model 235626 only	
		See pages 30 & 31 for parts	1
108	184077	PLATE, adapter	1
109✓	109212	SCREW, cap, socket hd;	
		3/8–16 unc–3a x 0.75” (19 mm)	3
110✓	184119	WRENCH, packing nut	1
111✓	101946	PIN, cotter	1

✓ *These parts are included in Connection Kit 236070.*



Parts

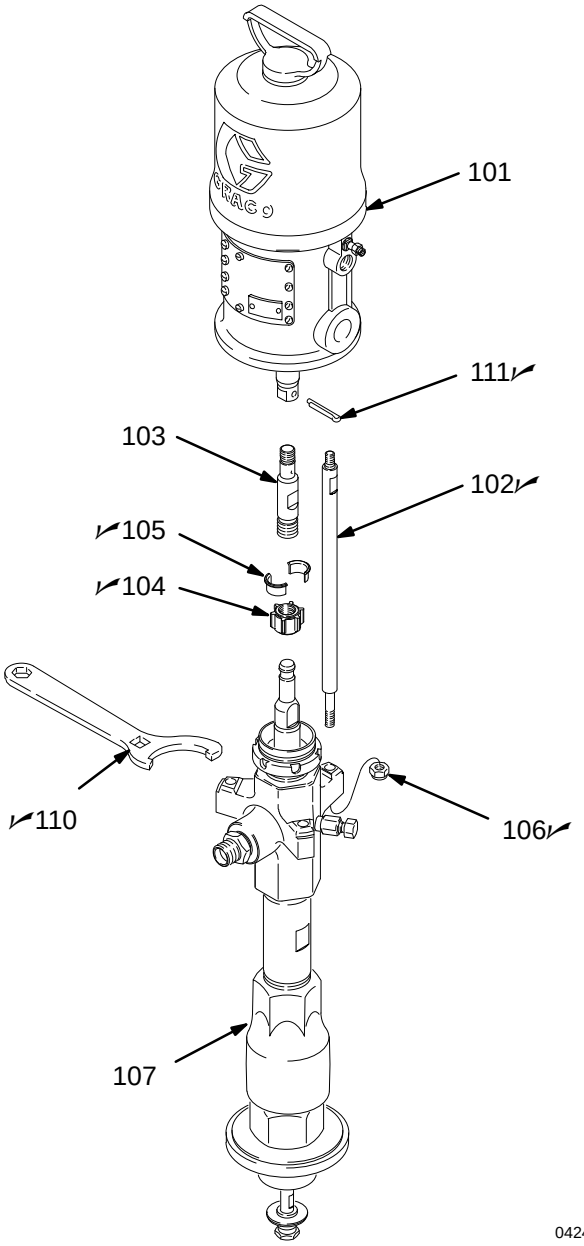
Model 222768, Series A
20:1 Ratio President Pump
(UHMWPE and PTFE Packed)

Ref. No.	Part No.	Description	Qty.
101	222772	AIR MOTOR, President See 306982 for parts	1
102✓	24B190	KIT, tie rod	3
103	184091	ROD, adapter	1
104✓	184059	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement See pages 30 & 31 for parts	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. No.	Part No.	Description	Qty.
101	222772	AIR MOTOR, President See 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 pages 30 & 31 for parts	1
110	184119	WRENCH, packing nut	1
111	101946	PIN, cotter	1
112	156082	O-RING; buna-N	1

✓ *These parts are included in Connection Kit 236070.*



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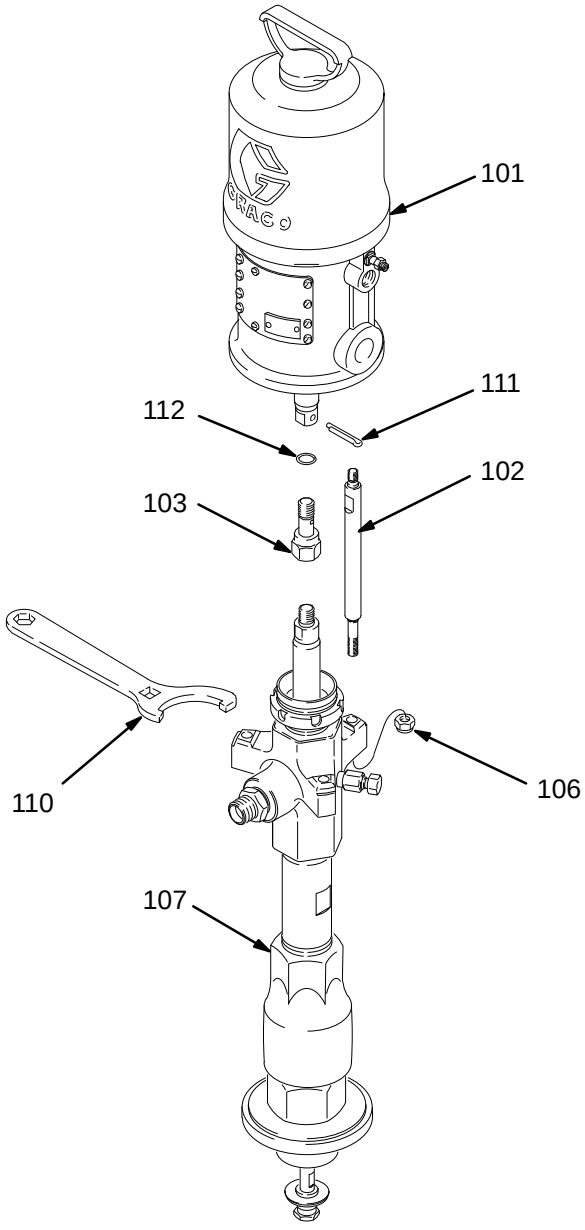

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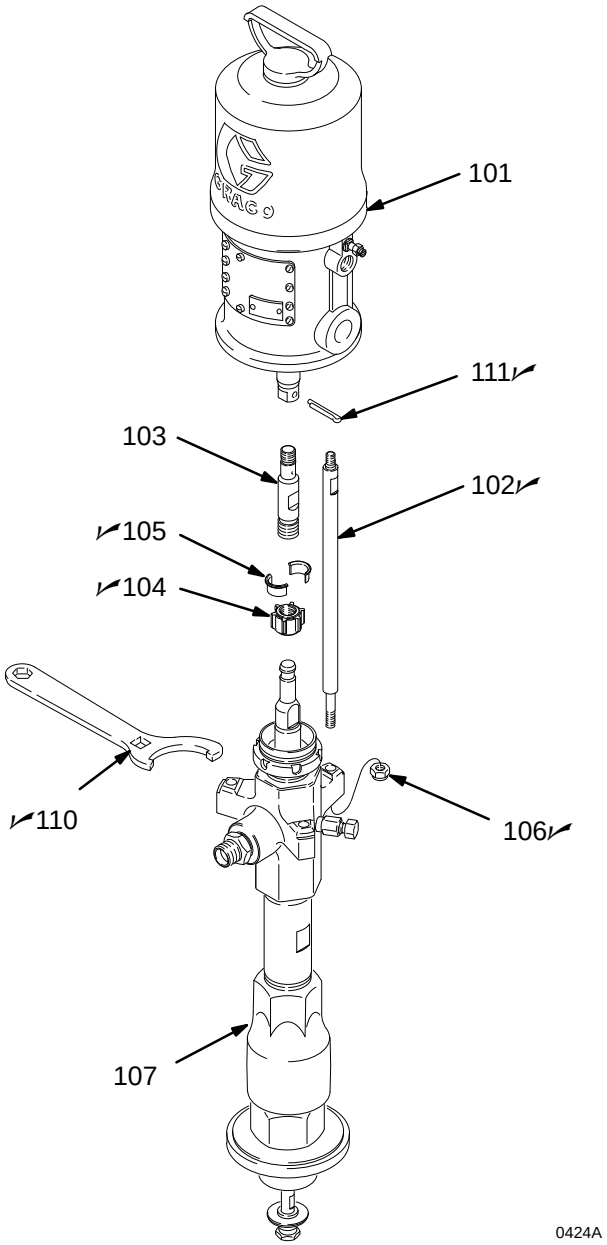
Parts

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

Ref. No.	Part No.	Description	Qty.
101	222772	AIR MOTOR, President See 306982 for parts	1
102✓	24B190	KIT, tie rod	3
103	184091	ROD, adapter	1
104✓	184059	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	246932	PUMP, displacement See pages 30 & 31 for parts	1
110✓	184119	WRENCH, packing nut	1
111✓	101946	PIN, cotter	1

✓ *These parts are included in Connection Kit 236070.*



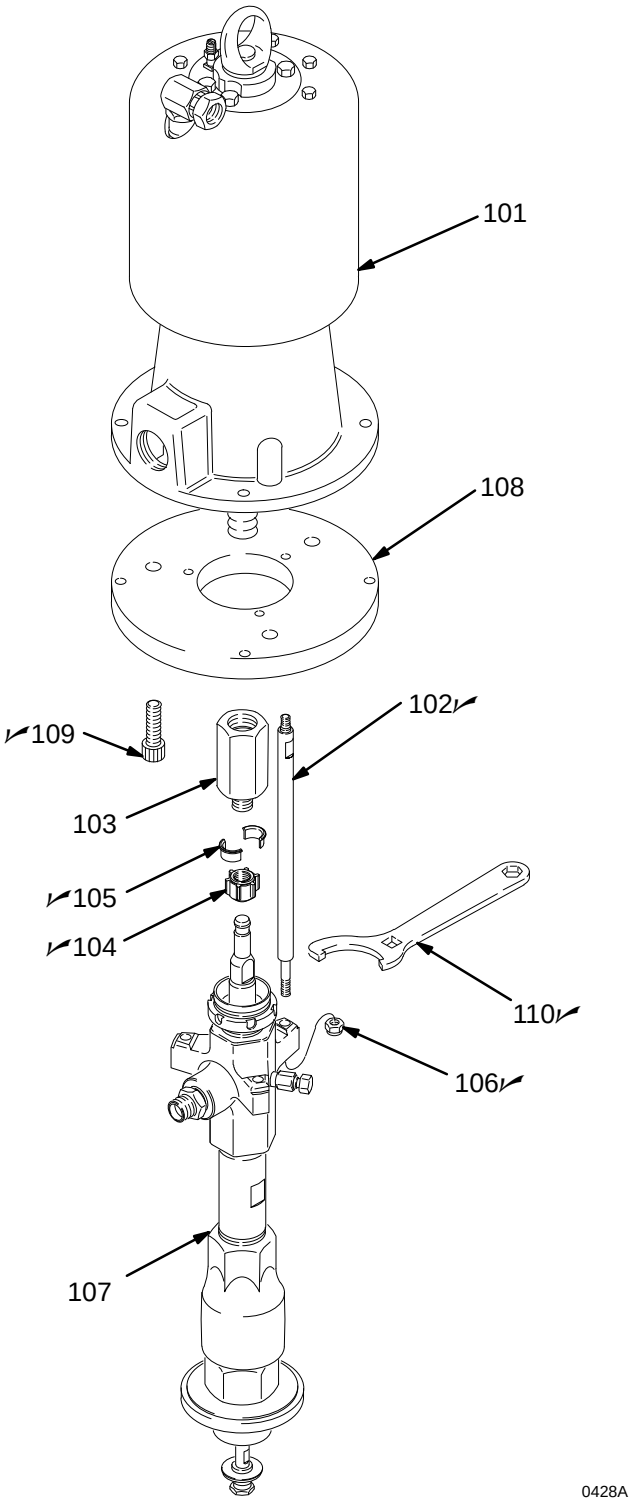
Parts

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. No.	Part No.	Description	Qty.
101	217540	AIR MOTOR, Senator, standard *Used on Model 222769;* See 307592 for parts	1
	220571	AIR MOTOR, Senator, quiet *Used on Model 224660;* See 307592 for parts	1
102✓	124B190	KIT, tie rod	3
103	184127	ROD, adapter	1
104✓	184059	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement See pages 30 & 31 for parts	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

✓ *These parts are included in Connection Kit 236070.*



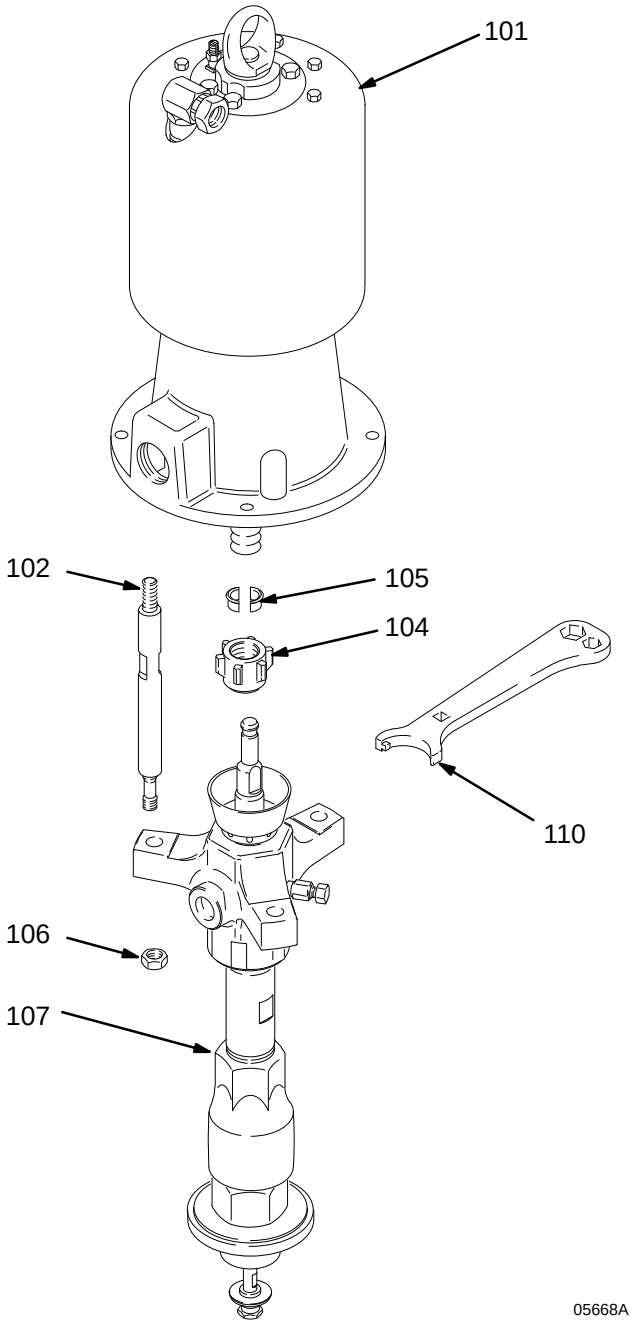
Parts

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. No.	Part No.	Description	Qty.
101	217540	AIR MOTOR, Senator, standard *Used on Model 237492;* See 307592 for parts	1
	220571	AIR MOTOR, Senator, quiet *Used on Model 237780;* See 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 pages 30 & 31 for parts	1
110✓	112887	WRENCH, packing nut	1

✓ *These parts are included in Connection Kit 235417.*



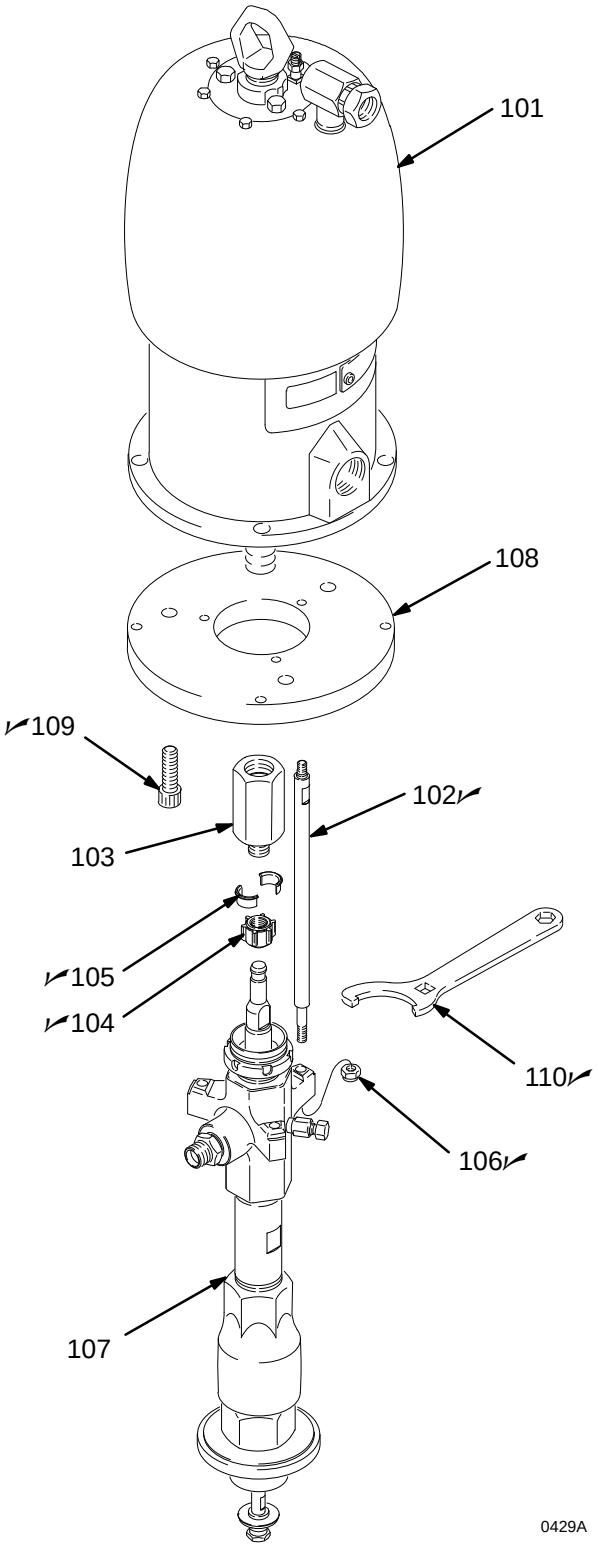
Parts

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. No.	Part No.	Description	Qty.
101	208356	AIR MOTOR, Bulldog, standard	
		Used on Model 222778	
		See 307049 for parts	1
	215255	AIR MOTOR, Bulldog, quiet	
		Used on Model 222813	
		See 307304 for parts	1
102✓	24B190	KIT, tie rod	3
103	184127	ROD, adapter	1
104✓	184059	NUT, coupling	1
105✓	184128	COLLAR, coupling	2
106✓	109209	NUT, hex, self-locking; M10 x 1.5	3
107	222790	PUMP, displacement	
		See pages 30 & 31 for parts	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

✓ *These parts are included in Connection Kit 236070.*



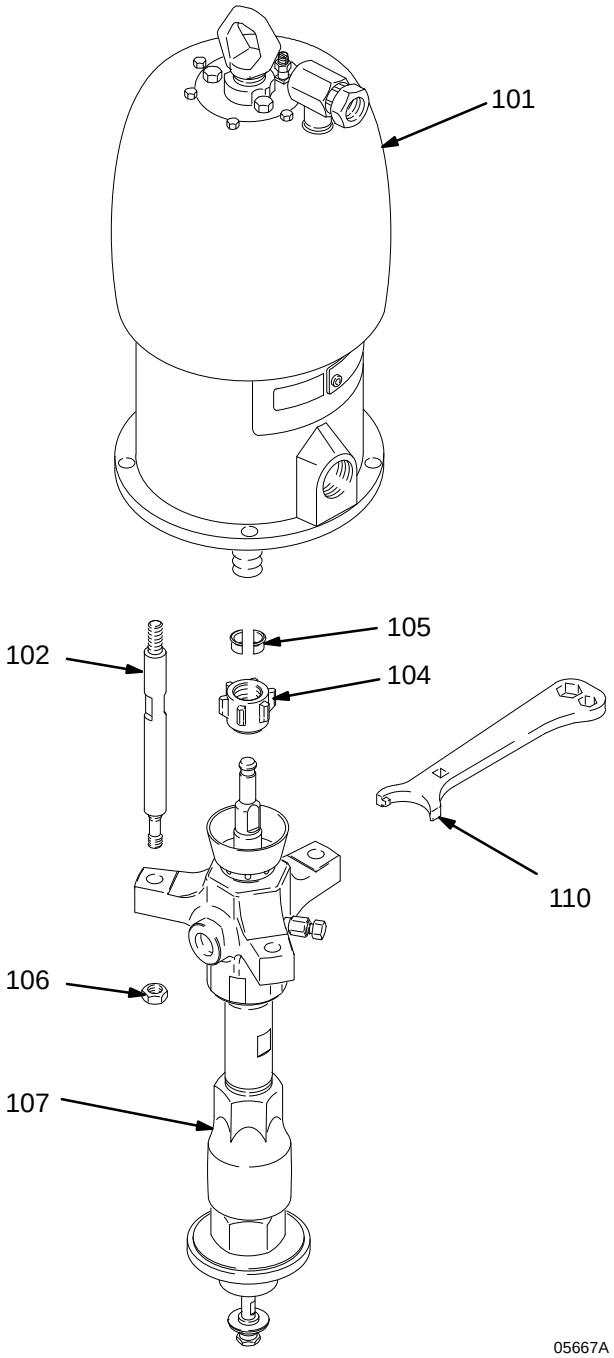
Parts

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. No.	Part No.	Description	Qty.
101	208356	AIR MOTOR, Bulldog, standard *Used on Model 237208* See 307049 for parts	1
	215255	AIR MOTOR, Bulldog, quiet *Used on Model 237779* See 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 pages 30 & 31 for parts	1
110✓	112887	WRENCH, packing nut	1

✓ *These parts are included in Connection Kit 235417.*



Displacement Pump Parts

NOTE: Refer to page 32 for the available throat packing kits.

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. No.	Part No.	Description	Qty.
1	184041	ROD, displacement; sst; 328.25 mm (12.92 in.) long; used on Models 222790 & 235540	1
	190159	ROD, displacement; sst; 252.45 mm (9.94 in.) long; used on Model 237206	1
	190172	ROD, displacement; sst; 328.25 mm (12.92 in.) long; used on Model 237450	1
2	184039	NUT, packing; carbon steel; used on Models 222790, 235540, and 237206	1
	236577	NUT, packing; carbon steel; used on Model 237450	1
7▲	184090	LABEL, warning	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
9*	110135	O-RING; PTFE; used on Models 222790, 235540, and 237206 only	1
10	184038	HOUSING, outlet; ductile iron; used on Models 222790, 235540, and 237206	1
	189389	HOUSING, outlet; ductile iron; used on Model 237450	1
11*★	109205	O-RING; PTFE	2
12	184040	CYLINDER, pump; sst	1
13	184042	PISTON; alloy steel	1
14	184043	GUIDE, piston; alloy steel	1
15*	184053	SEAL, piston; UHMWPE; used on Models 222790, 237450, and 237206	1
	188257	SEAL, piston; PTFE; used on Model 235540; (not included in Repair Kit 222773)	1
16	184052	SEAT, piston; alloy steel	1
17	184044	HOUSING, intake valve; ductile iron	1
18	184493	NUT, packing, intake valve; carbon steel	1
19‡★	184616	VALVE BODY, intake; alloy steel	1
20*‡★	184049	SEAL, intake valve; PTFE	1
21*‡★	187860	SEAL; acetal	1
22‡★	184617	SEAT, intake valve; alloy steel	1
23	187859	CYLINDER, intake; ductile iron	1
24	187858	ROD, priming piston; sst	1
25	184051	PISTON, priming; carbon steel	1
30	184121	NUT, priming piston; alloy steel	1
31	184122	GUIDE, priming piston; alloy steel	1
33	184124	SPACER, piston; sst	1
35	190128	PLUG, bleeder valve	1
37▲	184151	LABEL, warning	1
39▲	172479	TAG, instruction (not shown)	1
42*‡★	184469	SEAL, intake valve; UHMWPE; used on Models 222790, 237450, and 237206	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

* *These parts are included in Seal Repair Kit 222773, which may be purchased separately.*

★ *These parts are included in Displacement Pump Seal Kit 25A247, which may be purchased separately.*

‡ *These parts are included in Intake Seat Repair Kit 222793, which may be purchased separately.*

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

Displacement Pump Parts

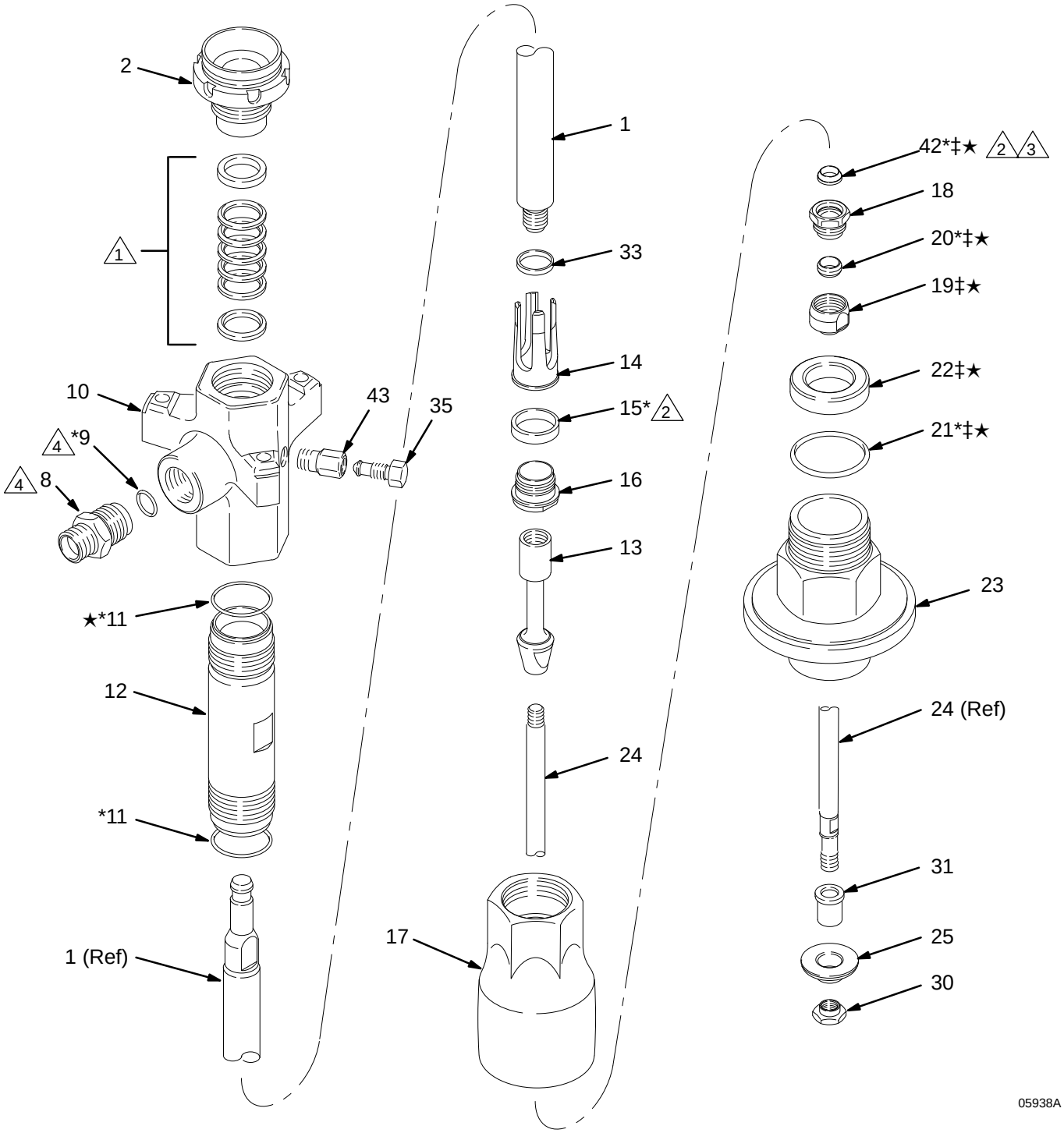
Model 222790 Shown

△1 Refer to page 32 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.



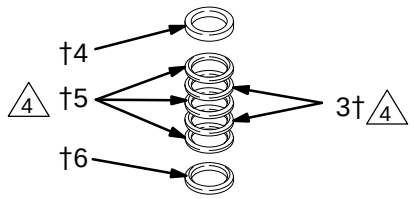
Throat Packing Kits

UHMWPE and PTFE Throat Packing Repair Kit 222774,
used on Displacement Pumps 222790, 237206, and 237450

Ref. No.	Part No.	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

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

△4 Lips of v-packings must face down.

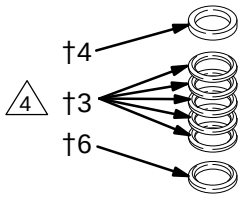


PTFE Throat Packing Repair Kit 222775,
used on Displacement Pump 235540

3†	109302	V-PACKING; PTFE	5
4†	184172	GLAND, female; sst	1
6†	184222	GLAND, male; sst	1

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

△4 Lips of v-packings must face down.

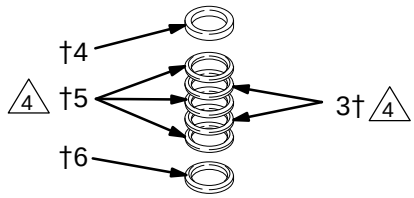


UHMWPE and Leather Throat Packing Conversion Kit 237916,
for use with all Displacement Pumps

Ref. No.	Part No.	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

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

△4 Lips of v-packings must face down.

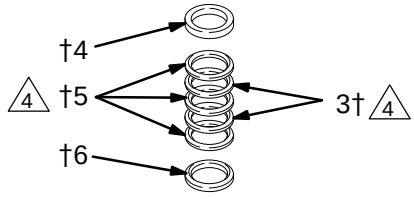


Tuffstack and UHMWPE Throat Packing Conversion Kit 234422,
used on Displacement Pump 246932

Ref. No.	Part No.	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

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

△4 Lips of v-packings must face down.



Technical Data (Monark Pumps)

⚠ WARNING

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.

Category	Data
Ratio	10:1
Maximum fluid working pressure	12 MPa, 124 bar (1800 psi)
Maximum air input pressure	1.2 MPa, 12 bar (180 psi)
Pump cycles per 3.8 liters (1 gal.)	60
Fluid flow at 60 cycles/min	3.8 liters/min (1.0 gpm)
Air motor effective diameter	76 mm (3")
Stroke length	76 mm (3")
Displacement pump effective area	4.5 cm^2 (0.697 $in.^2$)
Maximum pump operating temperature	82°C (180°F)
Weight	21 kg (45 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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**100 psi (0.7 MPa, 7 bar)**
Monark	62.6 dB(A)	62.5 dB(A)	63.9 dB(A)

Sound Power Levels (dBa)

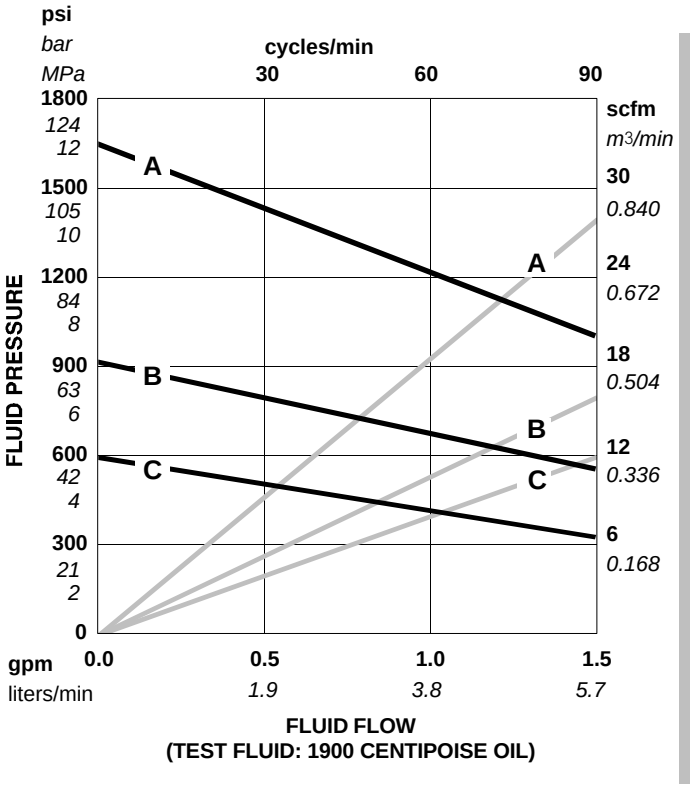
(tested in accordance with ISO 9614–2)

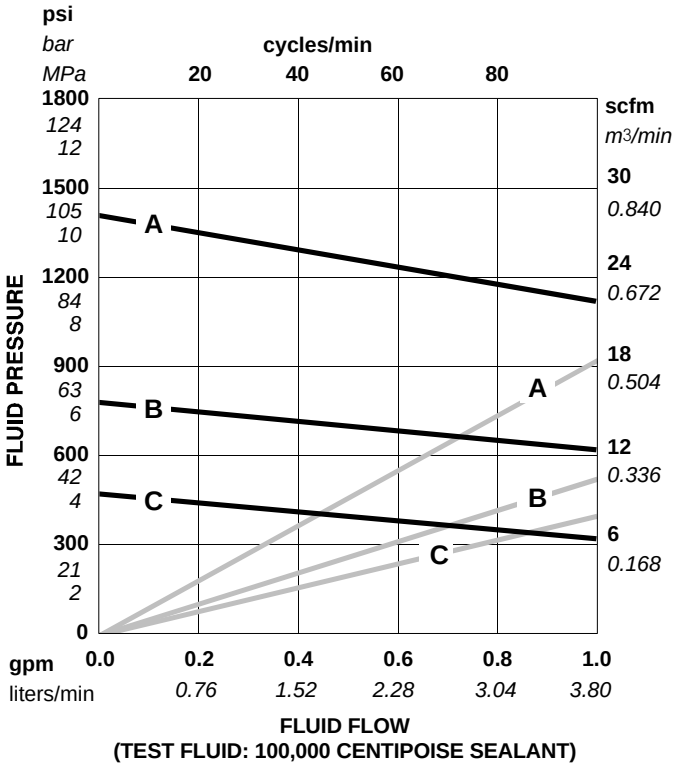
	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**100 psi (0.7 MPa, 7 bar)**
Monark	69.5 dB(A)	70.7 dB(A)	71.0 dB(A)

Technical Data (Monark Pumps)

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





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^3/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.

Technical Data (President Pumps)

⚠ WARNING

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.

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^2 (0.697 $in.^2$)
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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**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)

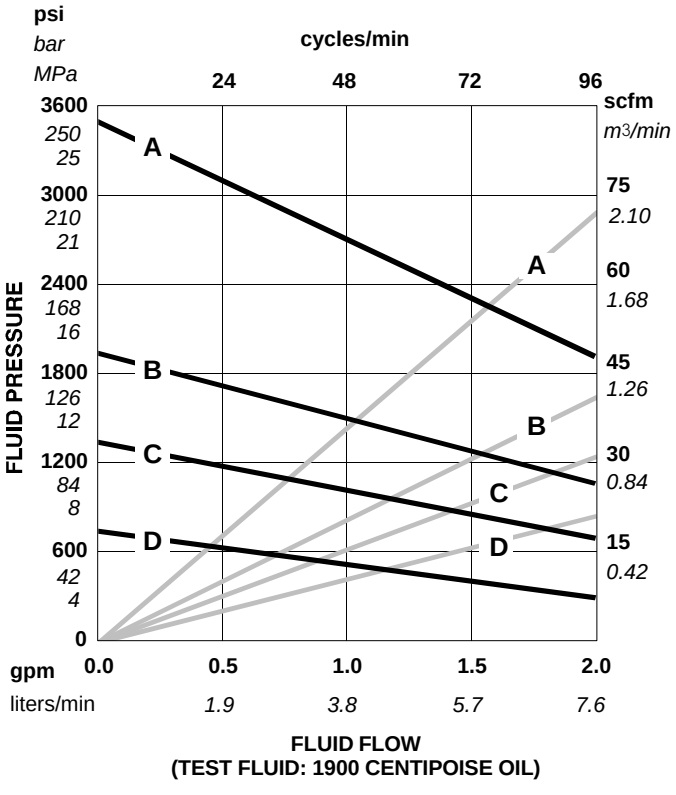
(tested in accordance with ISO 9614–2)

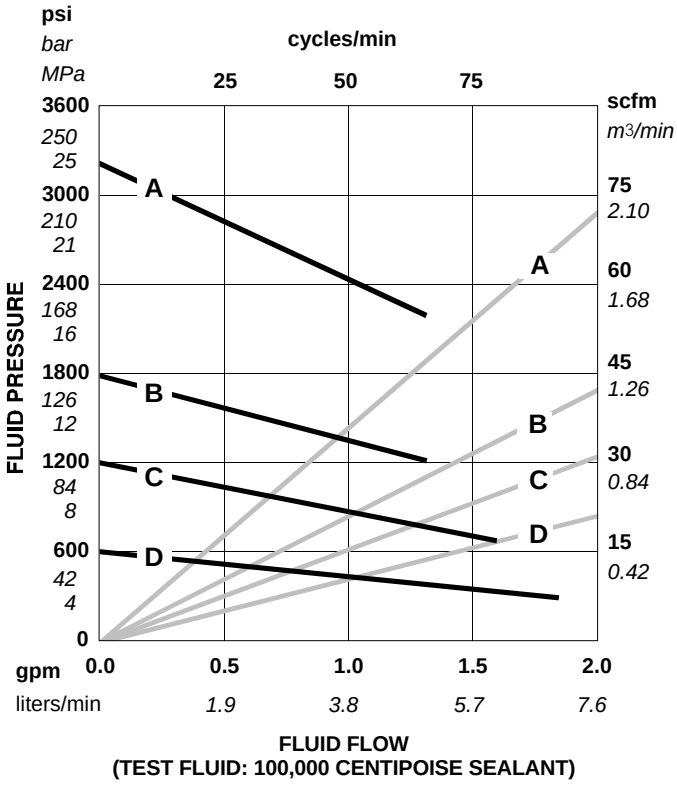
	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**100 psi (0.7 MPa, 7 bar)**
President	87.4 dB(A)	92.1 dB(A)	94.6 dB(A)

Technical Data (President Pumps)

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 (m^3/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.

Technical Data (Senator Pumps)

⚠ WARNING

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.

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^2 (0.697 $in.^2$)
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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**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)

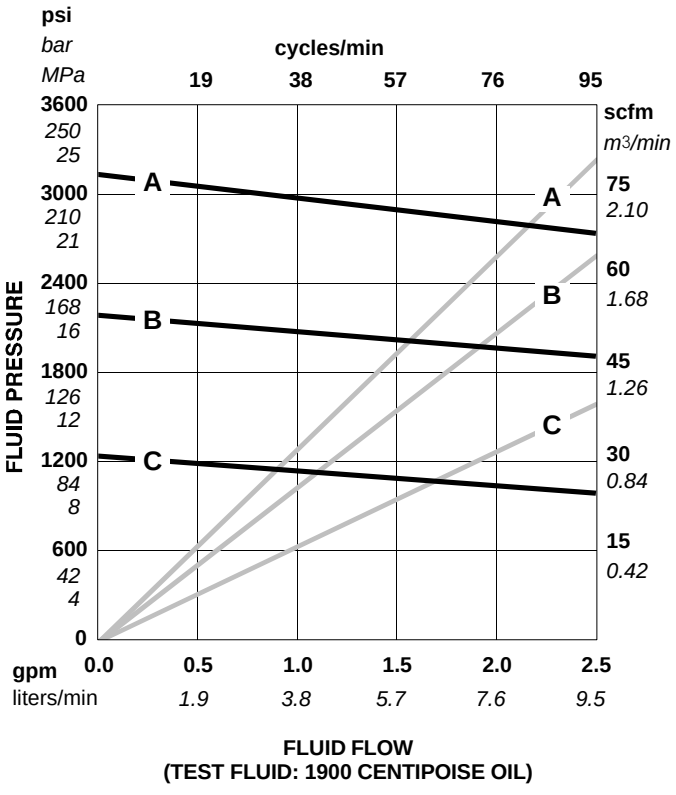
(tested in accordance with ISO 9614–2)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**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)

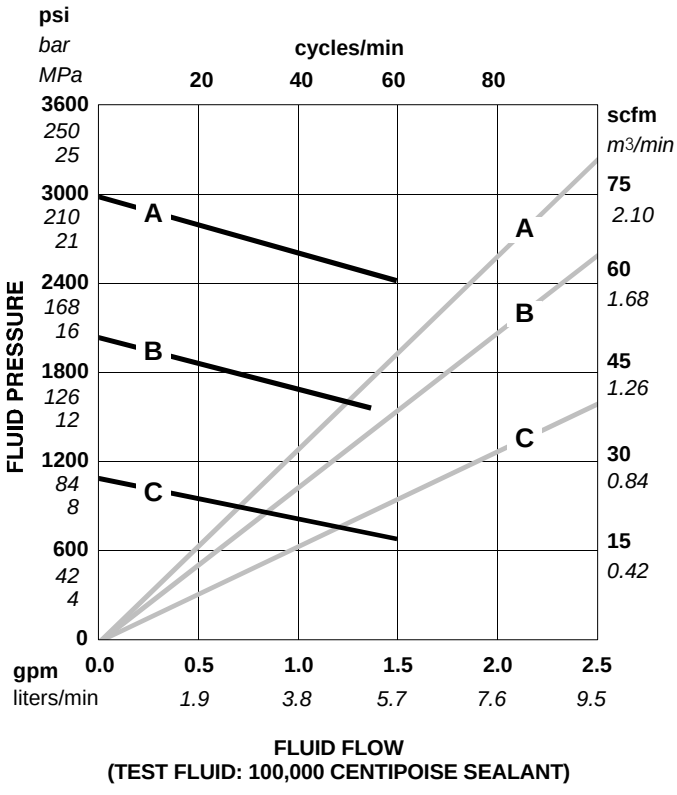
Technical Data (Senator Pumps)

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



FLUID FLOW
(TEST FLUID: 1900 CENTIPOISE OIL)



FLUID FLOW
(TEST FLUID: 100,000 CENTIPOISE SEALANT)

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^3/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.

Technical Data (Quiet Senator Pumps)

⚠ WARNING

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.

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^2 (0.697 $in.^2$)
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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**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)

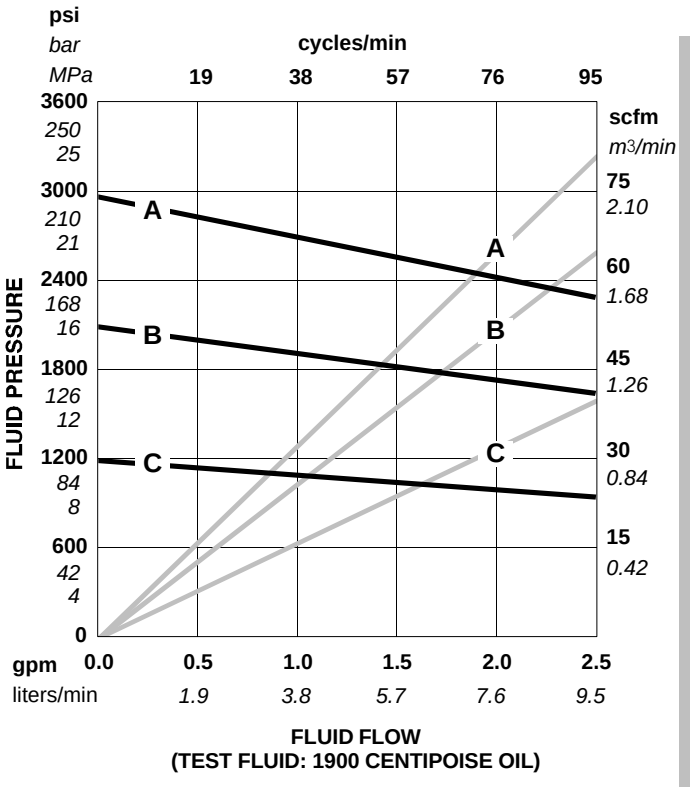
(tested in accordance with ISO 9614–2)

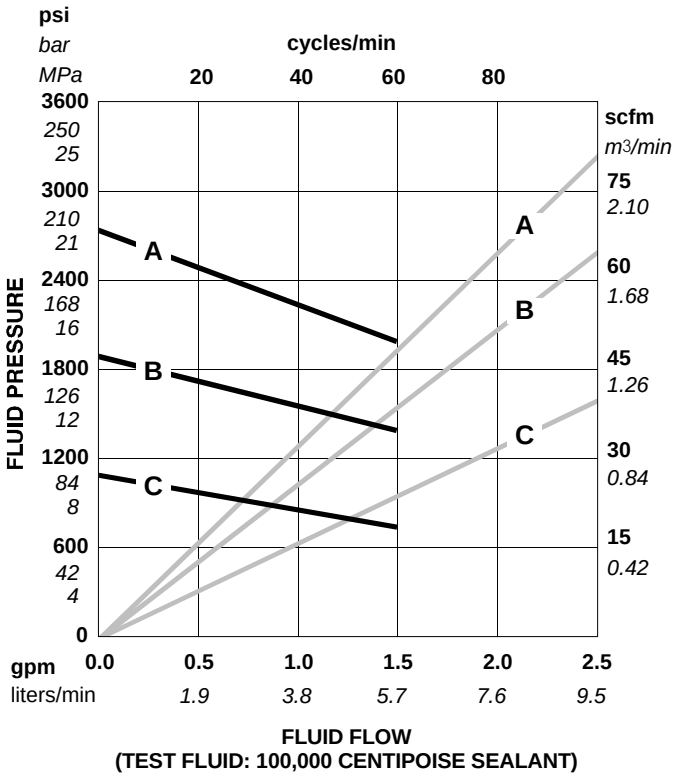
	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**100 psi (0.7 MPa, 7 bar)**
Quiet Senator	89.8 dB(A)	91.8 dB(A)	94.4 dB(A)

Technical Data (Quiet Senator Pumps)

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^3/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.

Technical Data (Bulldog Pumps)

⚠ WARNING

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.

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^2 (0.697 $in.^2$)
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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**90 psi (0.6 MPa, 6.2 bar)**
Bulldog	82.4 dB(A)	87.3 dB(A)	88.5 dB(A)

Sound Power Levels (dBa)

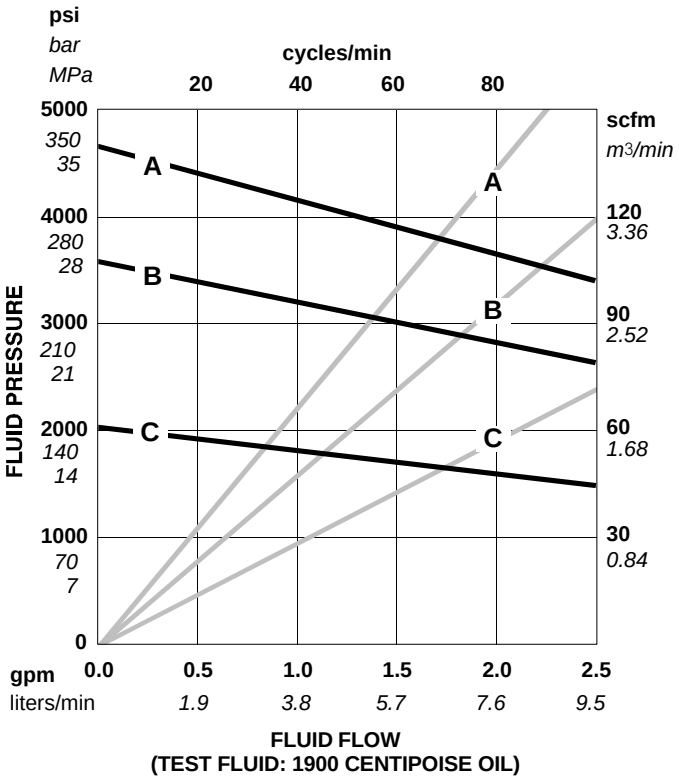
(tested in accordance with ISO 9614–2)

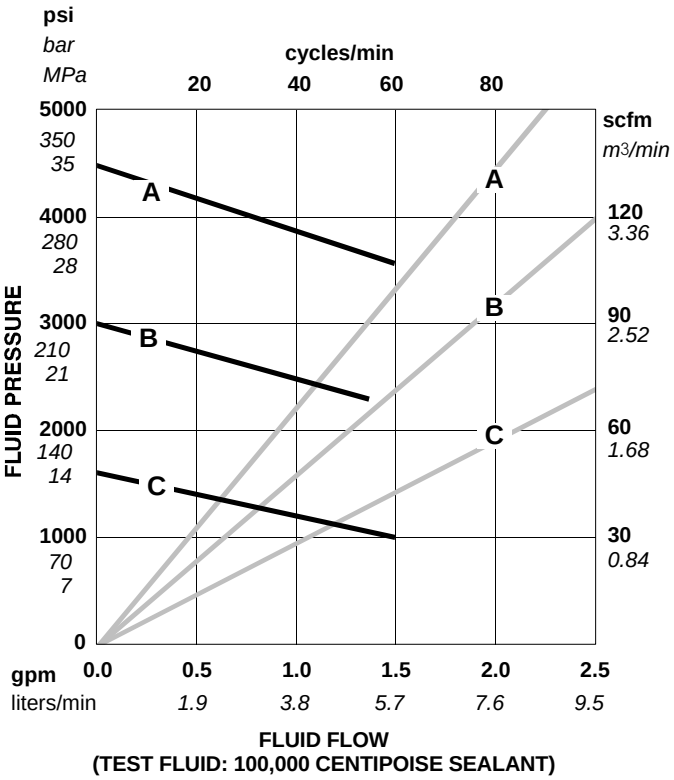
	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**90 psi (0.6 MPa, 6.2 bar)**
Bulldog	91.6 dB(A)	95.9 dB(A)	97.4 dB(A)

Technical Data (Bulldog Pumps)

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^3/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.

Technical Data (Quiet Bulldog Pumps)

⚠ WARNING

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.

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^2 (0.697 $in.^2$)
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)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**90 psi (0.6 MPa, 6.2 bar)**
Quiet Bulldog	81.5 dB(A)	83.6 dB(A)	85.6 dB(A)

Sound Power Levels (dBa)

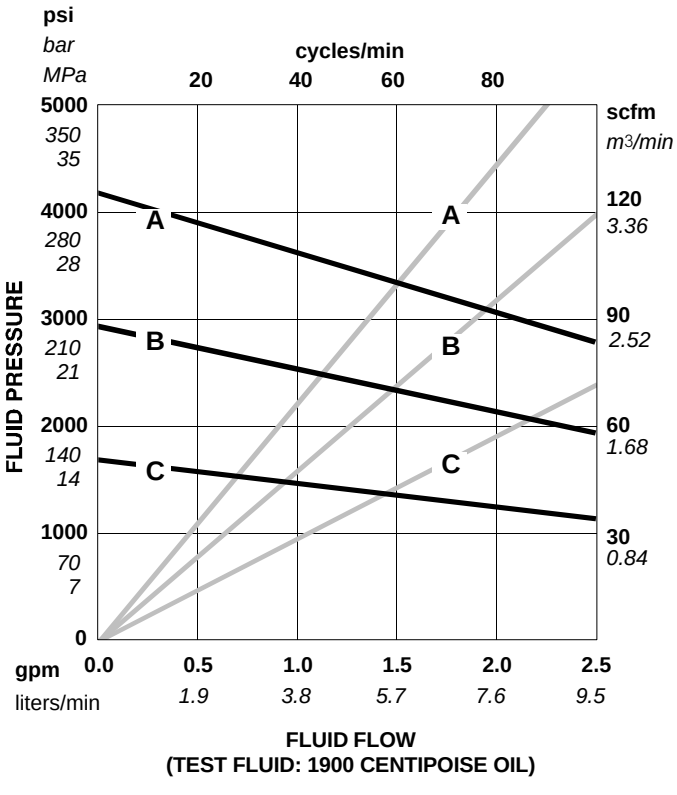
(tested in accordance with ISO 9614–2)

	Input Air Pressures at 15 cycles per minute		
Air Motor	**40 psi (0.28 MPa, 2.8 bar)**	**70 psi (0.48 MPa, 4.8 bar)**	**90 psi (0.6 MPa, 6.2 bar)**
Quiet Bulldog	90.2 dB(A)	93.5 dB(A)	94.9 dB(A)

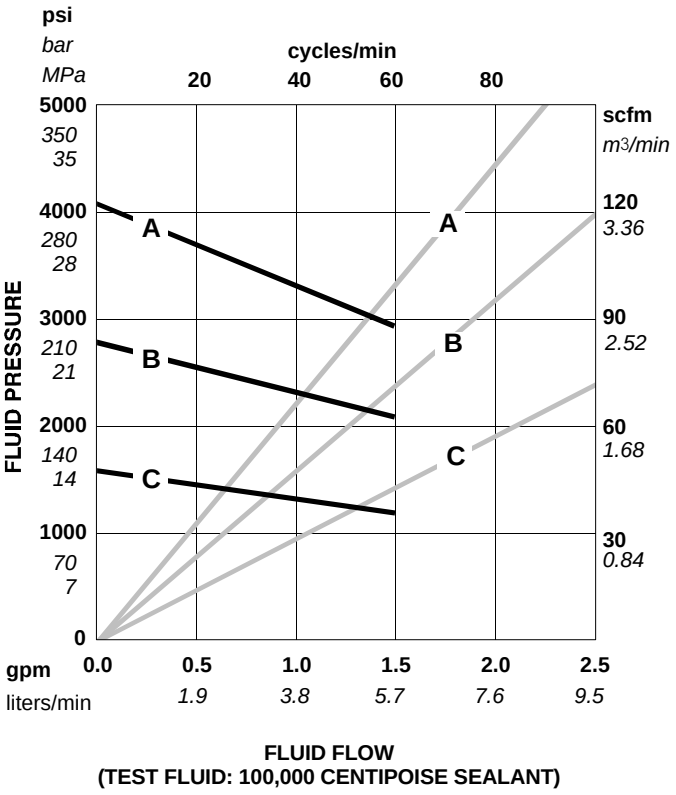
Technical Data (Quiet Bulldog Pumps)

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



FLUID FLOW
(TEST FLUID: 1900 CENTIPOISE OIL)



FLUID FLOW
(TEST FLUID: 100,000 CENTIPOISE SEALANT)

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.

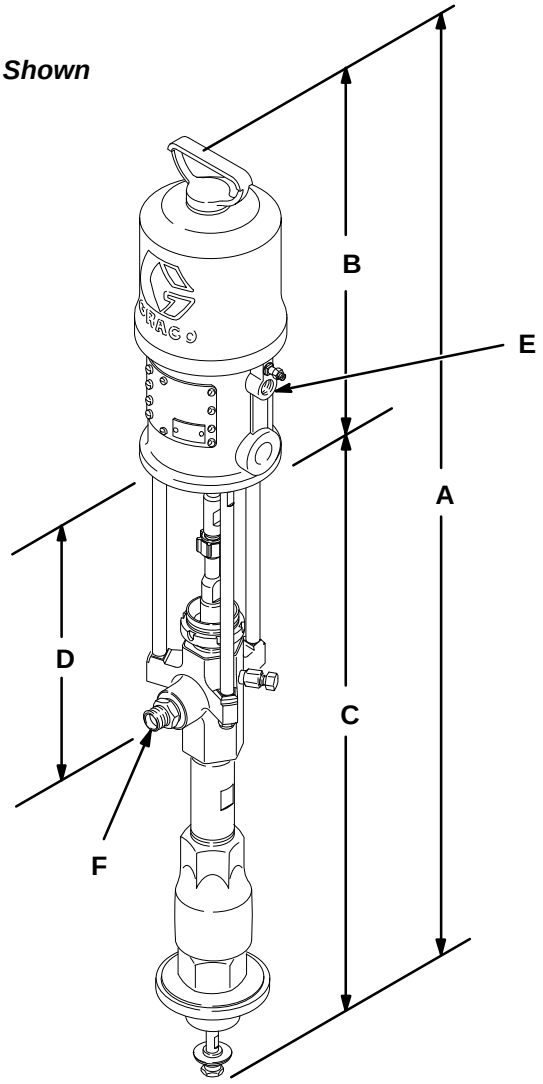
To find Pump Air Consumption (m^3/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (MPa/bar/psi):

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.

Notes

Dimensions

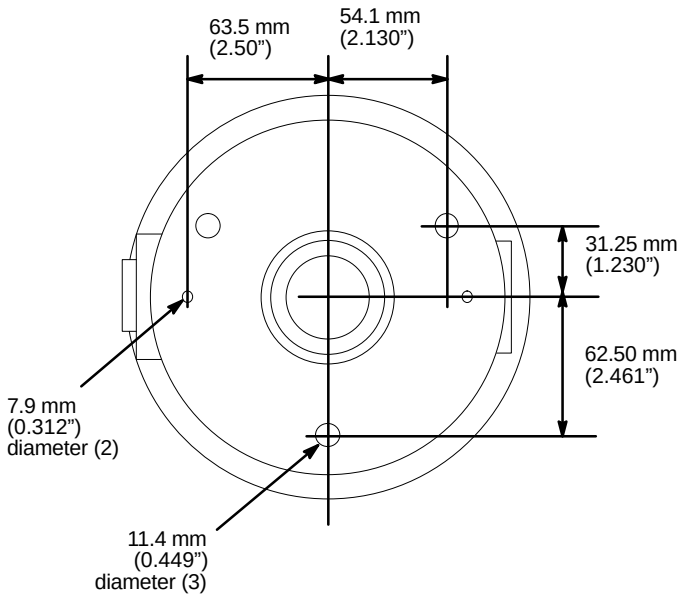
Model 222768 Shown



Pump Model	A	B	C	D	E (air inlet)	F (fluid outlet)
222770, 235626	1188 mm (46.25 in.)	365 mm (14.35 in.)	826 mm (32.5 in.)	328 mm (12.9 in.)	3/8 npt(f)	3/4 npt(m)
222768, 246932	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)
237207	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)
222769, 224660	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)
237492	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)
237780	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)
222778, 222813	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)
237208	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)
237779	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)

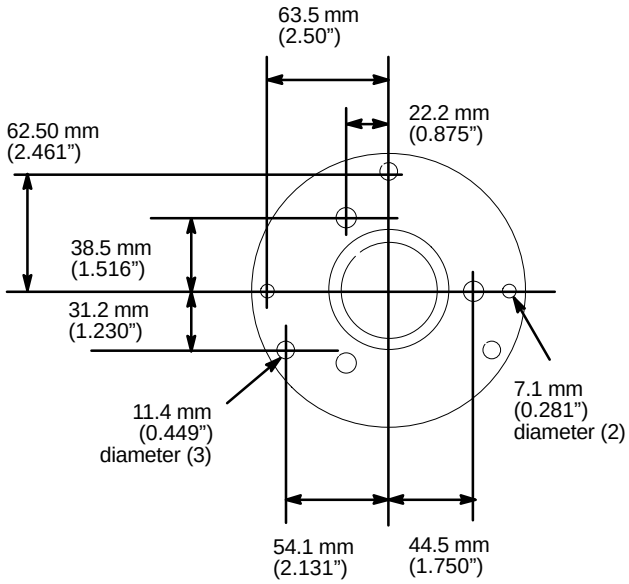
Mounting Hole Layout

PRESIDENT PUMPS



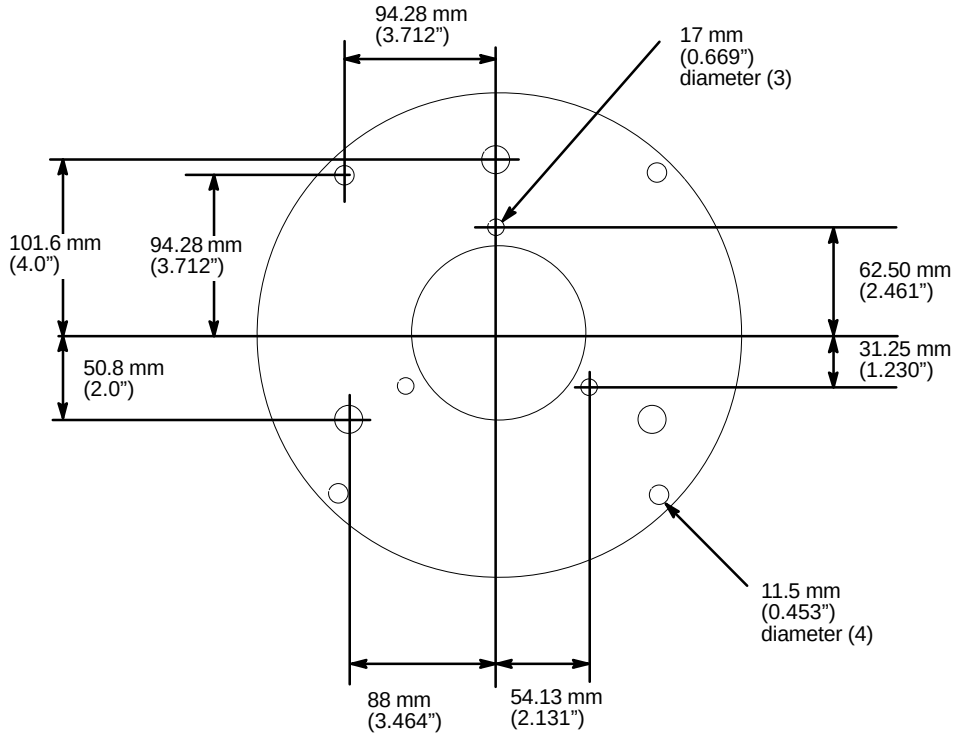
0213

MONARK PUMPS



0214

SENATOR AND BULLDOG PUMPS



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