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Graymills

POLYPROPYLENE

Air Operated Double Diaphragm Pumps 3/8” Model

Operations and Maintenance Instructions

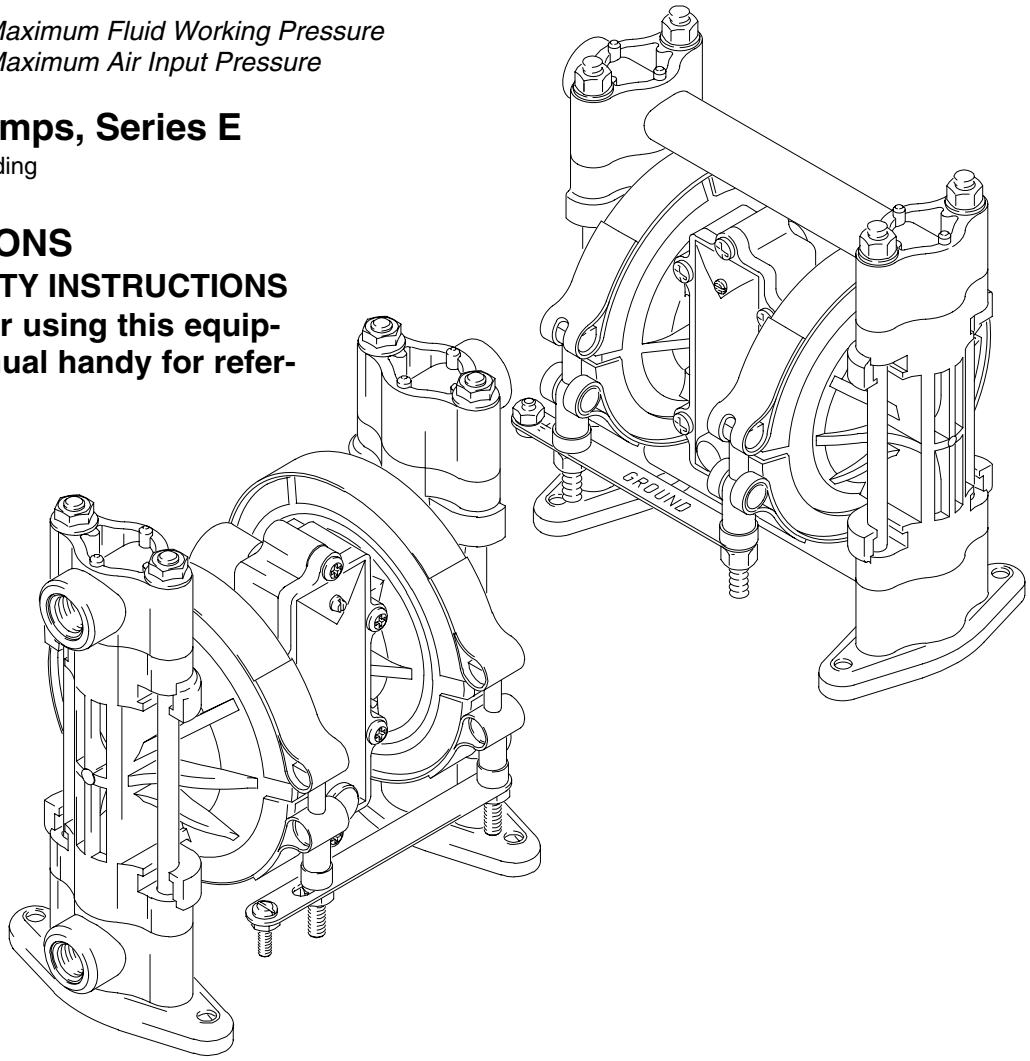
100 psi (0.7 MPa, 7 bar) Maximum Fluid Working Pressure
100 psi (0.7 MPa, 7 bar) Maximum Air Input Pressure

Polypropylene Pumps, Series E

US and Foreign Patents Pending

WARNING/CAUTIONS

Read all these SAFETY INSTRUCTIONS BEFORE installing or using this equipment. Keep this manual handy for reference/training.



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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.

Safety Alert Symbol

⚠ SAFETY ALERT

The safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

HAZARDOUS FLUIDS

Improper handling of hazardous fluids or inhaling toxic vapors can cause extremely serious injury or death from splashing in the eyes, ingestion, or bodily contamination. Observe all the following precautions when you handle hazardous or potentially hazardous fluids.

- Know what fluid you are pumping and its specific hazards. Take precautions to avoid a toxic fluid spill.
- Always wear appropriate clothing and equipment, such as eye protection and breathing apparatus, to protect yourself.
- Store hazardous fluid in an appropriate, approved container. Dispose of it according to all Local, State, and Federal guidelines for hazardous fluids.
- Secure the fluid outlet hose tightly into the receiving container to prevent it from coming loose and improperly draining the fluid.
- Pipe and dispose of the exhaust air safely, away from people, animals, and food handling areas. If the diaphragm fails, the fluid is exhausted along with the air. See **Air Exhaust Ventilation** on page 10.
- Use static wire hoses when pumping flammables.
- Keep containers closed when not in use.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

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

- This equipment is for professional use only. Observe all warnings. Read and understand all instruction manuals, warning labels, and tags before you operate this equipment. If you are not sure, or if you have questions about installation or operation, call Graymills Corporation.
- Never alter or modify any part of this equipment; doing so could cause it to malfunction.
- Check all equipment regularly and repair or replace worn or damaged parts immediately.
- Never exceed the recommended working pressure or the maximum air inlet pressure stated on your pump or in the **Technical Data** on page 4.
- Do not exceed the maximum working pressure of the lowest rated component in your system. This equipment has a **100 psi (0.7 MPa, 7 bar) maximum working pressure at 100 psi (0.7 MPa, 7 bar,) maximum incoming air pressure.**
- Be sure that all fluids and solvents used are chemically compatible with the wetted parts shown in the **Technical Data** on page 4. Always read the manufacturer's literature before you use fluid or solvent in the pump.
- Never move or lift a pump under pressure. If dropped, the fluid section may rupture. Always follow the **Pressure Relief Procedure** on page 11 before you move or lift the pump.

FIRE AND EXPLOSION HAZARD

Static electricity is created by the flow of fluid through the pump and hose. If the equipment is not properly grounded, sparking may occur. Sparks can ignite fumes from solvents and the fluid being pumped, dust particles, and other flammable substances, whether you are pumping indoors or outdoors, and can cause a fire or explosion and serious injury and property damage.

- To reduce the risk of static sparking, ground the pump and all other equipment used or located in the work area. Check your local electrical code for detailed grounding instructions for your area and type of equipment. See **Grounding** on page 6.
- If you experience any static sparking or even a slight shock while using this equipment, **stop pumping immediately.** Check the entire system for proper grounding. Do not use the system again until you have identified and corrected the problem.
- Pipe and dispose of the exhaust air safely, away from all sources of ignition. If the diaphragm fails, the fluid is exhausted along with the air. See **Air Exhaust Ventilation** on page 10.
- Do not smoke in the work area. Do not operate the equipment near a source of ignition or an open flame, such as a pilot light.

⚠ SAFETY PRECAUTIONS

CAUTION

- Verify the chemical compatibility of the pump wetted parts and the substance being pumped, flushed or recirculated. Chemical compatibility may change with temperature and concentration of the chemical(s) within the substance being pumped, flushed or recirculated.
- The pump should not be used for the structural support of the piping system. Be certain system components are properly supported to prevent stress on the pump parts.
- Do not allow pump to operate dry for long periods of time; this may cause unnecessary wear or damage to the pump.
- Maximum temperature limits are based upon mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperatures. Consult Graymills for chemical compatibility and temperature limits.

United States Government safety standards have been adopted under the Occupational Safety and Health Act. You should consult these standards—particularly the General Standards, Part 1910, and the Construction Standards, Part 1926.

Technical Data For Pumps with Teflon® Diaphragms

Maximum fluid working pressure . . . . . 100 psi (0.7 MPa, 7 bar)
Air pressure operating range . . . . 20 to 100 psi (0.14 to 0.7 MPa, ... 1.4 to 7 bar)
Maximum air consumption . . . . . 5.5 scfm (see chart)
Maximum free flow delivery . . . . . 6.5 gpm (24.6 lpm)
Maximum pump speed . . . . . 330 cpm
Maximum suction lift . . . . . 7 ft (2.1 m) dry, 12 ft (3.7 m) wet
Maximum size pumpable solids . . . . . 1/16 in. (1.6 mm)
Sound power level,
at full flow at 100 psi (0.7 MPa, 7 bar) . . . . . 85 dBa
Sound power level,
at 70 psi (0.48 MPa, 4.8 bar) and 1 gpm (3.8 lpm) . . . 78 dBa
Operating temperature range . . . . . 40 to 150° F (4.4 to 65.5° C)
Air inlet size . . . . . 1/4 npt(f)
Fluid inlet and outlet size . . . . . 3/8" npt(f)
Wetted parts vary by models . . . . . See pages 28 and 30
Non-wetted external parts . . polyester (labels) glass–filled polypropylene with conductive SST fibers
Weight (approximate) . . . . . 4.75 lb (2.2 kg)

Sound power level measured per ISO standard 9614–2.

Viton®, Teflon®, and Hytrel® are registered trademarks of the DuPont Co.

Loctite® is a registered trademark of the Loctite Corporation.

Santoprene® is a registered trademark of the Monsanto Company.

Technical Data For Pumps with Hytrel® Diaphragms

Maximum fluid working pressure . . . . 100 psi (0.7 MPa, 7 bar)
Air pressure operating range . . . . 20 to 100 psi(0.14 to 0.7 MPa, ... 1.4 to 7 bar)
Maximum air consumption . . . . . 5.5 SCFM (see chart)
Maximum free flow delivery . . . . . 7 gpm (26.5 lpm)
Maximum pump speed . . . . . 330 cpm
Maximum suction lift . . . . . 12 ft (3.7 m) dry; 21 ft (6.4 m) wet
Maximum size pumpable solids . . . . . .1/16 in. (1.6 mm)
Sound power level,
at full flow at 100 psi (0.7 MPa, 7 bar) . . . . . 85 dBa
Sound power level,
at 70 psi (0.48 MPa, 4.8 bar) and 1 gpm (3.8 lpm) . . 78 dBa
Operating temperature range. 40 to 150° F (4.4 to 65.5° C)
Air inlet size . . . . . 1/4 npt(f)
Fluid inlet and outlet size. . . . . .3/8 npt(f)
Wetted Parts vary by model. . . . . See pages 27 and NO TAG.
Non-wetted external parts . . polyester (labels) glass–filled polypropylene with conductive SST fibers
Weight (approximate) . . . . . 4.75 lb (2.2 kg)

Sound power level measured per ISO standard 9614–2.

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Loctite® is a registered trademark of the Loctite Corporation.

Santoprene® is a registered trademark of the Monsanto Company.

Installation

General Information

- The Typical Installations in Fig. 5 to Fig. 7 are only guides for selecting and installing system components. Contact your Graymills distributor for assistance in planning a system to suit your needs.

- Always use Genuine Graymills Parts and Accessories, available from your Graymills distributor. If you supply your own accessories, be sure they are adequately sized and pressure rated for your system.

- Use a compatible, liquid thread sealant or Teflon® tape on all male threads. Tighten all connections firmly to avoid air or fluid leaks. ***Do not over-tighten plastic threads.***

- Reference numbers and letters in parentheses refer to the callouts in the Figures and lists on pages 27 to 28.

⚠ WARNING

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.

1. Read **HAZARDOUS FLUIDS** on page 2.
2. 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.

⚠ CAUTION

Safe Operating Temperature
Minimum: 40° F (4.4° C); Maximum: 150° F (66° C).

Operating outside these temperature limits will adversely affect the strength of the pump housing. Certain chemicals may further reduce the operating temperature range. Consult engineering guides for chemical compatibilities and temperature limits, or contact your Graymills distributor.

Tightening Threaded Fasteners Before First Use

After unpacking the pump, and before using it for the first time, check and retorque all external fasteners. See the **Service** section for torque specifications. After the first day of operation, retorque the fasteners again. Although the recommended frequency for retorquing fasteners varies with pump usage, a general guideline is to retorque fasteners every two months.

Mountings

- Be sure the mounting can support the weight of the pump, hoses, and accessories, as well as the stress caused during operation.

- The pump can be used in a variety of installations, some of which are shown in Fig. 5 to Fig. 7.

- For all other mountings, be sure the pump is adequately secured.

Dual Manifolds

Dual manifold kits are available to enable you to pump two fluids simultaneously, or to mix two fluids in the pump.

Installation

Grounding

⚠ WARNING

FIRE AND EXPLOSION HAZARD
This pump must be grounded. Before operating the pump, ground the system as explained at right. Also read the section **FIRE AND EXPLOSION HAZARD** on page 3.

The polypropylene pump is ***not*** conductive.

When pumping conductive flammable fluids, ***always*** ground the entire fluid system by making sure the fluid system has an electrical path to a true earth ground (see Fig. 5 through Fig. 7). ***Never*** use a polypropylene pump with non-conductive flammable fluids as specified by your local fire protection code.

US Code (NFPA 77 Static Electricity) recommends a conductivity greater than 50 x 10^{-12} Siemans/meter (mhos/meter) over your operating temperature range to reduce the hazard of fire. Consult your fluid supplier to determine the conductivity or resistivity of your fluid. The resistivity must be less than 2 x 10^{12} ohm-centimeters.

To reduce the risk of static sparking, ground the pump and all other equipment used or located in the pumping area. Check your local electrical code for detailed grounding instructions for your area and type of equipment.

Ground all of this equipment:

- *Pump*: Attach a ground wire (Y) to the grounding strip (112) with the screw (28), lockwasher (29) and nut (27), as shown in Fig. 1. Connect the clamp end of the ground wire to a true earth ground.

NOTE: When pumping conductive flammable fluids with a polypropylene pump, ***always*** ground the fluid system. See the **WARNING** at left. Fig. 5 through Fig. 7 show recommended methods of grounding flammable fluid containers during filling.

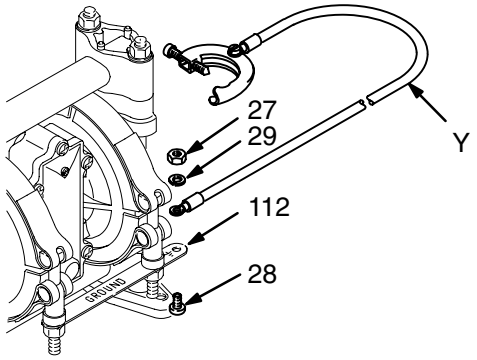

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Fig. 1

- *Air and fluid hoses*: Use only electrically conductive hoses.
- *Air compressor*: Follow the manufacturer's recommendations.
- *Solvent pails used when flushing*: Follow your local code. Use only metal pails, which are conductive. Do not place the pail on a non-conductive surface, such as paper or cardboard, which interrupts the grounding continuity.
- *Fluid supply container:* Follow your local code.

Installation

Air Line

⚠ WARNING

A bleed-type master air valve (B) is required in your system to relieve air trapped between this valve and the pump. See Fig. 5 to Fig. 7. Trapped air can cause the pump to cycle unexpectedly, which could result in serious injury, including splashing in the eyes or on the skin, injury from moving parts, or contamination from hazardous fluids.

⚠ CAUTION

The pump exhaust air may contain contaminants. Ventilate to a remote area if the contaminants could affect your fluid supply. See **Air Exhaust Ventilation** on page 10.

1. Install the air line accessories as shown in Fig. 5 to Fig. 7. Mount these accessories on the wall or on a bracket. Be sure the air line supplying the accessories is grounded.

   a. The fluid pressure can be controlled in either of two ways. To control it on the air side, install an air regulator (H). To control it on the fluid side, install a fluid regulator (M) near the pump fluid outlet (see Fig. 5).

   b. Locate one bleed-type master air valve (B) close to the pump and use it to relieve trapped air. See the **WARNING** above. Locate the other master air valve (E) upstream from all air line accessories and use it to isolate them during cleaning and repair.

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

2. Install an electrically conductive, flexible air hose (C) between the accessories and the 1/4 npt(f) pump air inlet (see Fig. 2). Use a minimum 1/4" (6.3 mm) ID air hose. Screw an air line quick disconnect coupler (D) onto the end of the air hose (C), and screw the mating fitting into the pump air inlet snugly. Do not connect the coupler (D) to the fitting yet.

Fluid Suction Line

- The pump fluid inlet is 3/8 npt(f). See Fig. 2. Screw the fluid fitting into the pump inlet snugly. Use a compatible liquid thread sealant or Teflon® tape on connections to prevent air from getting into material line.

- At inlet fluid pressures greater than 15 psi (0.1 MPa,1 bar), diaphragm life will be shortened.

- See the **Technical Data** on page 4 for maximum suction lift and flow rate loss at various lift distances.

Fluid Outlet Line

⚠ WARNING

A fluid drain valve (J) is required in your system to relieve pressure in the hose if it is plugged. See Fig. 5 to Fig. 7. The drain valve reduces the risk of serious injury, including splashing in the eyes or on the skin, or contamination from hazardous fluids when relieving pressure. Install the valve close to the pump fluid outlet.

- Use electrically conductive fluid hoses (N). The pump fluid outlet is 3/8 npt(f). See Fig. 2. Screw the fluid fitting into the pump outlet snugly.

- Install a fluid regulator (M) at the pump fluid outlet to control fluid pressure, if desired (see Fig. 6). See **Air Line,** step 1a, for another method of controlling pressure.

- Install a fluid drain valve (J) near the fluid outlet. See the **WARNING** above.

Installation

Changing the Orientation of the Fluid Inlet and Outlet Ports

The pump is shipped with the fluid inlet and outlet ports facing the same direction. See Fig. 2. If desired, the direction of one or both ports can be changed. Remove the manifold(s) from the pump as explained in steps 1, 2, and 4 on page 21. Reattach with the port facing the desired direction. ***Do not over-torque.***

1. Apply thread lube, and torque to 50 to 60 in-lb (5.6 to 6.8 N-m). Do not over-torque.
2. 1/4 npt(f) air inlet
3. 3/8 npt(f) fluid inlet
4. 3/8 npt(f) fluid outlet
5. 3/8 npt(f) air exhaust port

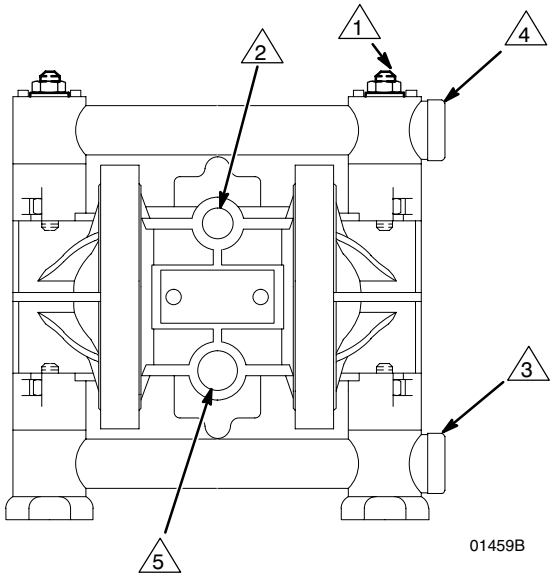

Fig. 2

Pump Shown

1. Apply thread lube, and torque to 50 to 60 in-lb (5.6 to 6.8 N-m). Do not over-torque.
2. 1/4 npt(f) air inlet
3. 3/8 npt(f) fluid inlet
4. 3/8 npt(f) fluid outlet
5. 3/8 npt(f) air exhaust port

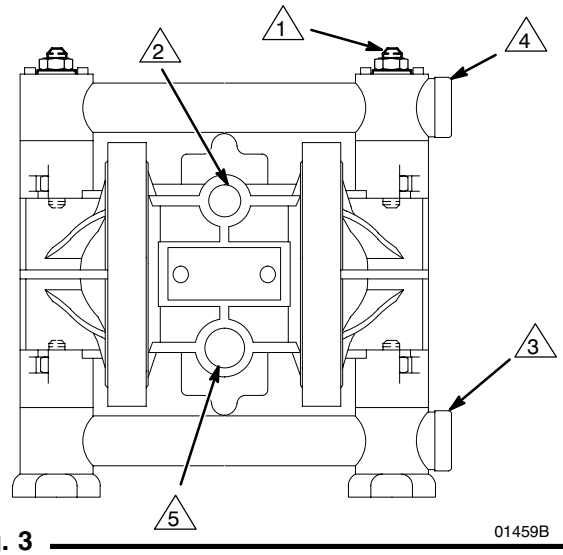

Fig. 3

Fluid Pressure Relief Valve

⚠ CAUTION

Some systems may require installation of a pressure relief valve at the pump outlet to prevent overpressurization and rupture of the pump or hose. See Fig. 4.

Thermal expansion of fluid in the outlet line can cause overpressurization. This can occur when using long fluid lines exposed to sunlight or ambient heat, or when pumping from a cool to a warm area (for example, from an underground tank).

Overpressurization can also occur if the Husky pump is being used to feed fluid to a piston pump, and the intake valve of the piston pump does not close, causing fluid to back up in the outlet line.

KEY

A 3/8 npt(f) fluid inlet port
B 3/8 npt(f) fluid outlet port
C Pressure relief valve
Part No. 110134 (aluminum)
Part No. 112119 (stainless steel)

1. Install valve between fluid inlet and outlet ports.
2. Connect fluid inlet line here. Use a compatible liquid thread sealant or Teflon® tape on connection to prevent air from getting into the material line.
3. Connect fluid outlet line here.

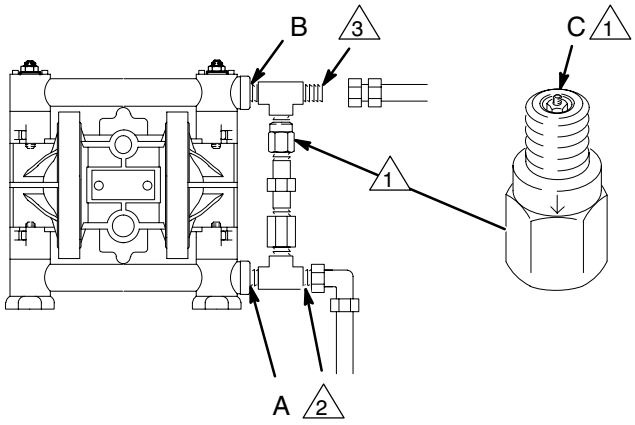

Fig. 4

Installation

BUNG-MOUNT TRANSFER INSTALLATION

KEY

- A 3/8” Diaphragm Pump
- B Bleed-Type Master Air Valve (required for pump)
- C Air Supply Line
- D Air Line Quick Disconnect
- E Master Air Valve (for accessories)
- F Air Line Filter
- H Pump Air Regulator
- J Fluid Drain Valve (required)
- L Fluid Suction Line
- M Fluid Inlet Filter
- N Fluid Supply Hose
- Y Ground Wire (required; see page 6 for installation instructions)

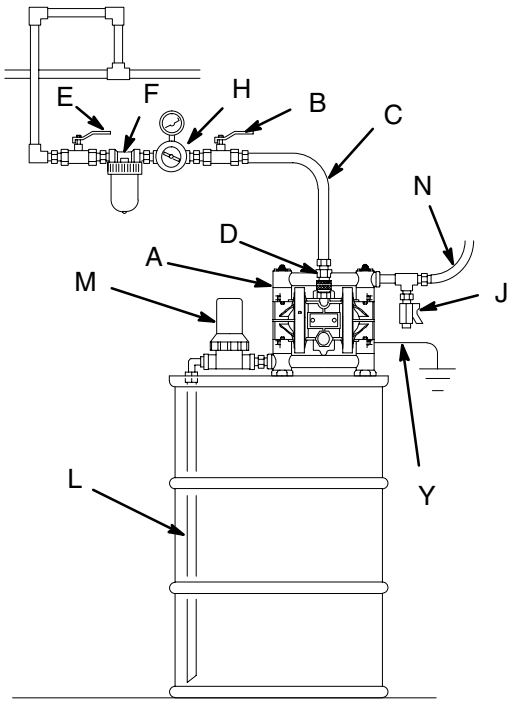

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Fig. 5

WALL-MOUNT TRANSFER INSTALLATION

KEY

- A 3/8” Diaphragm Pump
- B Bleed-Type Master Air Valve (required for pump)
- C Air Supply Line
- D Air Line Quick Disconnect
- E Master Air Valve (for accessories)
- F Air Line Filter
- H Pump Air Regulator
- J Fluid Drain Valve (required)
- L Fluid Suction Line
- N Fluid Supply Hose
- S Wall Bracket
- T Bung Adapter
- Y Ground Wire (required; see page 6 for installation instructions)

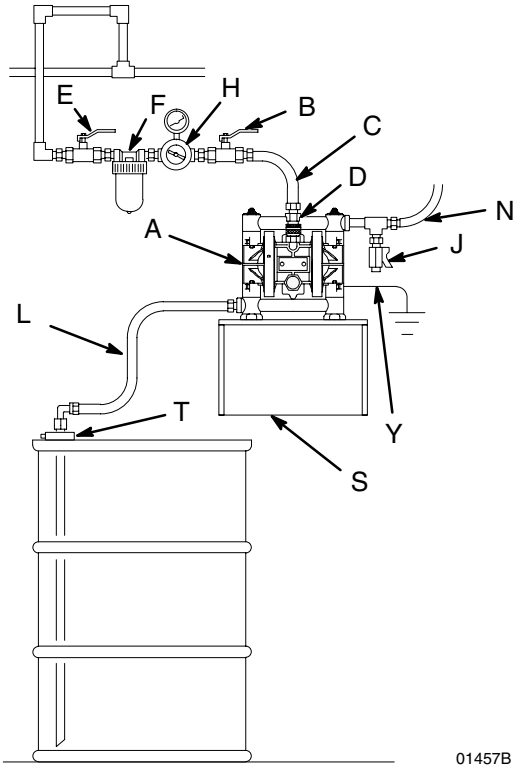

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Fig. 6

WALL-MOUNT SPLIT MANIFOLD TRANSFER INSTALLATION

KEY

- A 3/8” Diaphragm Pump
- B Bleed-Type Master Air Valve (required for pump)
- C Air Supply Line
- D Air Line Quick Disconnect
- E Master Air Valve (for accessories)
- F Air Line Filter
- H Pump Air Regulator
- J Fluid Drain Valve (required)
- L Fluid Suction Line
- N Fluid Supply Hose
- S Wall Bracket
- T Bung Adapter
- Y Ground Wire (required; see page 6 for installation instructions)

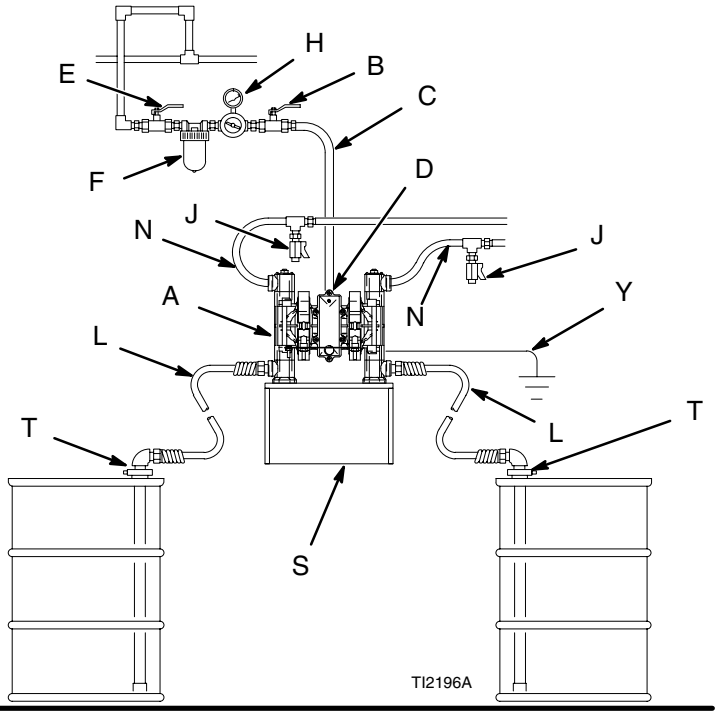

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Fig. 7

Installation

Air Exhaust Ventilation

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Be sure to read **FIRE OR EXPLOSION HAZARD** and **TOXIC FLUID HAZARD** on page 2, before operating this pump.

Be sure the system is properly ventilated for your type of installation. You must vent the exhaust to a safe place, away from people, animals, food handling areas, and all sources of ignition when pumping flammable or hazardous fluids.

Diaphragm failure will cause the fluid being pumped to exhaust with the air. Place an appropriate container at the end of the air exhaust line to catch the fluid. See Fig. 8.

The air exhaust port is 3/8 npt(f). Do not restrict the air exhaust port. Excessive exhaust restriction can cause erratic pump operation.

To exhaust to a remote location:

1. Remove the muffler (11) from the pump air exhaust port.

⚠ WARNING

PRESSURIZED EQUIPMENT HAZARD
To reduce the risk of serious eye injury from ice particles, *never* operate the pump with the air exhaust port open. Ice may form during pump operation, and ice particles will be ejected from the port along with the exhaust air. If the muffler (11) is removed, *always* connect an air exhaust hose to the exhaust port.

2. Install an electrically conductive air exhaust hose (X) and connect the muffler to the other end of the hose. The minimum size for the air exhaust hose is 3/8 in. (10 mm) ID. If a hose longer than 15 ft (4.57 m) is required, use a larger diameter hose. Avoid sharp bends or kinks in the hose.

3. Place a container (Z) at the end of the air exhaust line to catch fluid in case a diaphragm ruptures. If the fluid is flammable, ground the container. See Fig. 8.

VENTING EXHAUST AIR (Submerged Installation Shown)
See Fig. 4 for accessories

In a submerged installation (as shown), all wetted and non-wetted pump parts must be compatible with the fluid being pumped.

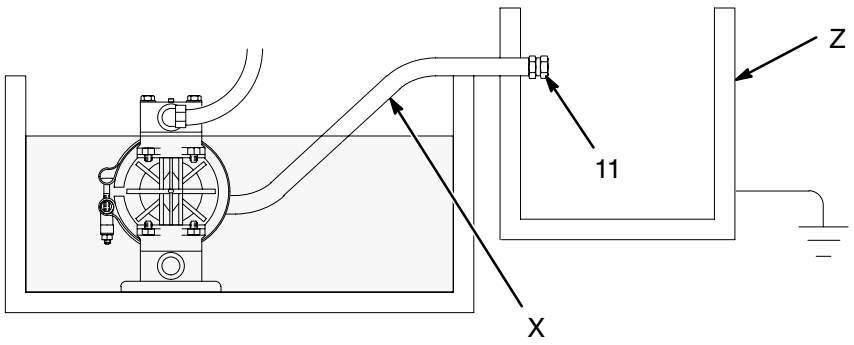


Fig. 8

Operation

Pressure Relief Procedure

PRESSURIZED EQUIPMENT HAZARD

The system pressure must be manually relieved to prevent the system from starting or spraying accidentally. To reduce the risk of an injury from accidental spray from the gun, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you

- Are instructed to relieve the pressure
- Stop spraying
- Check or service any of the system equipment
- Install or clean the spray tips

1. Shut off the air to the pump.
2. Open the dispensing valve, if used.
3. Open the fluid drain valve to relieve all fluid pressure, having a container ready to catch the drainage.

Flush the Pump Before First Use

The pump was tested in water. If the water could contaminate the fluid you are pumping, flush the pump thoroughly with a compatible solvent. Follow the steps under **Starting and Adjusting the Pump.**

Starting and Adjusting the Pump

WARNING

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. Do not lift a pump under pressure. If dropped, the fluid section may rupture. Always follow the **Pressure Relief Procedure** above before lifting the pump.

1. Be sure the pump is properly grounded. Read **FIRE OR EXPLOSION HAZARD** on page 3.
2. Check all fittings to be sure they are tight. Be sure to use a compatible liquid thread sealant or Teflon® tape on all male threads. Tighten the fluid inlet and outlet fittings snugly. Do not overtighten the fittings into the pump.
3. Place the suction tube (if used) in the fluid to be pumped.
4. Place the end of the fluid hose (N) into an appropriate container. Close the fluid drain valve (J).
5. With the pump air regulator (H) closed, open all bleed-type master air valves (B, E).
6. If the fluid hose has a dispensing device, hold it open while continuing with the following step. Slowly open the air regulator (H) until the pump starts to cycle. Allow the pump to cycle slowly until all air is pushed out of the lines and the pump is primed.

   If you are flushing, run the pump long enough to thoroughly clean the pump and hoses. Close the air regulator. Remove the suction tube from the solvent and place it in the fluid to be pumped.

Pump Shutdown

WARNING

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

At the end of the work shift, **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 11.

1. **Relieve the pressure** before checking or servicing the equipment.

2. Check all possible problems and causes before disassembling the pump.

PROBLEM	CAUSE	SOLUTION
The pump will not cycle, or cycles once and stops.	The air valve is stuck or dirty.	Turn the reset shaft (21). Disassemble and clean the air valve. See pages 18, 19. Use filtered air.
	The detent link (22) is worn or broken.	Replace the detent link (22) and ball (8). See pages 18, 19.
	The springs (3, 6) and/or valve cup (5) and plate (13) are broken or damaged.	Replace these parts. See pages 18, 19.
The pump cycles at stall or fails to hold pressure at stall.	The check valves or o-rings (108) are leaking.	Replace these parts. See page 21.
	The check balls (301) or seat (201) are worn.	Replace these parts. See page 21.
	The check ball (301) is wedged in the seat (201).	Replace the ball. See page 21.
There is excessive air leakage from the exhaust port.	The air valve cup (5) or plate (13) is worn.	Replace these parts. See pages 18, 19.
	The shaft seals (30}) are worn.	Replace the seals. See page 23.
The pump operates erratically.	The suction line is clogged.	Inspect; clear the line.
	The check valve balls (301) are sticking or leaking.	Clean or replace the balls. See page 21.
	The diaphragm (401) is ruptured.	Replace the diaphragm. See page 23.

Troubleshooting

PROBLEM	CAUSE	SOLUTION
There are air bubbles in the fluid.	The suction line is loose, or there is a lack of thread sealant.	Tighten the suction line. Use a compatible liquid thread sealant or Teflon tape on connections.
	The diaphragm (401) is ruptured.	Replace the diaphragm. See page 23.
	The manifolds (102) are loose or the o-rings (108) are damaged.	Tighten the manifold bolts (104) or nuts (106); replace the o-rings (108). See page 21.
	The outer diaphragm plates (103) are loose.	Tighten the plates. See page 23.
There is fluid in the exhaust air.	The diaphragm (401*) is ruptured.	Replace the diaphragm. See page 23.
	The outer diaphragm plates (103) are loose.	Tighten the plates. See page 23.
The pump exhausts air at stall.	The air valve cup (5) or plate (13) is worn.	Replace these parts. See pages 18, 19.
	The shaft seals (30}) are worn.	Replace the seals. See page 23.
The pump exhausts air from the clamps.	The clamps (111) are loose.	Tighten the clamp nuts (113). See page 14.
The pump exhausts air near the air valve.	The air valve screws (15) are loose.	Tighten the screws. See page 16.
	The air valve o-ring (19) is damaged.	Inspect; replace the o-ring. See pages 18, 19.
The pump leaks fluid from the check valves.	The o-rings (108) are worn or damaged.	Inspect; replace the o-rings. See page 21.

Maintenance

Lubrication

The air valve is designed to operate unlubricated, however if lubrication is desired, every 500 hours of operation (or monthly) remove the hose from the pump air inlet and add two drops of machine oil to the air inlet.

⚠ CAUTION

Do not over-lubricate the pump. Oil is exhausted through the muffler, which could contaminate your fluid supply or other equipment. Excessive lubrication can also cause the pump to malfunction.

Flushing and Storage

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 11.

Flush the pump when necessary to prevent the fluid you are pumping from drying or freezing in the pump and damaging it. Use a compatible solvent.

Before storing the pump, always flush the pump and **relieve the pressure.**

Tightening Threaded Connections

Before each use, check all hoses for wear or damage, and replace as necessary. Check to be sure all threaded connections are tight and leak-free.

The recommended frequency for retorquing of fasteners varies with pump usage; a general guideline is to retorque every two months.

Tightening the Clamps

When tightening the clamps (111), apply thread lubricant to the bolts and ***be sure*** to torque the nuts (113) to 50 to 60 in-lb (5.6 to 6.8 N-m). See Fig. 9.

△1 Apply thread lube and torque nuts to 50 to 60 In-lb (5.6 to 6.8 N.m)

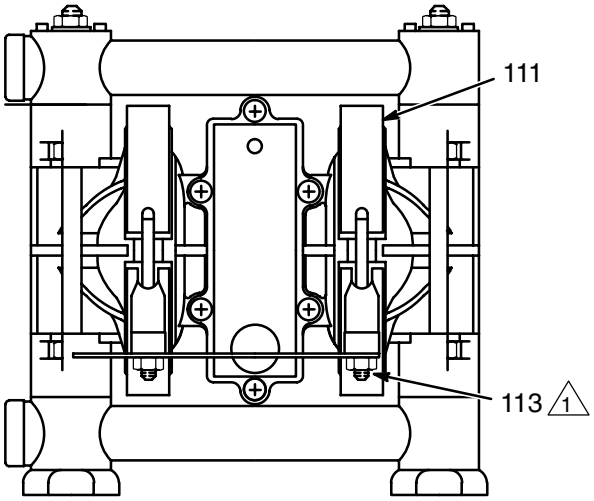


Fig. 9

Preventive Maintenance Schedule

Establish a preventive maintenance schedule, based on the pump's service history. This is especially important for prevention of spills or leakage due to diaphragm failure.

Notes

Service

Replacing the Air Valve

Tools Required

- Torque wrench
- Phillips screwdriver
- O-ring pick

NOTE: Order Kit #784-90865
Parts included in the kit are marked with a dagger, for example (2†). A tube of general purpose grease (26†) is supplied in the kit. Install the kit as follows.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 11.

1. **Relieve the pressure.**

2. Unscrew the six mounting screws (15) and remove the air valve (A) from the pump. See Fig. 10.

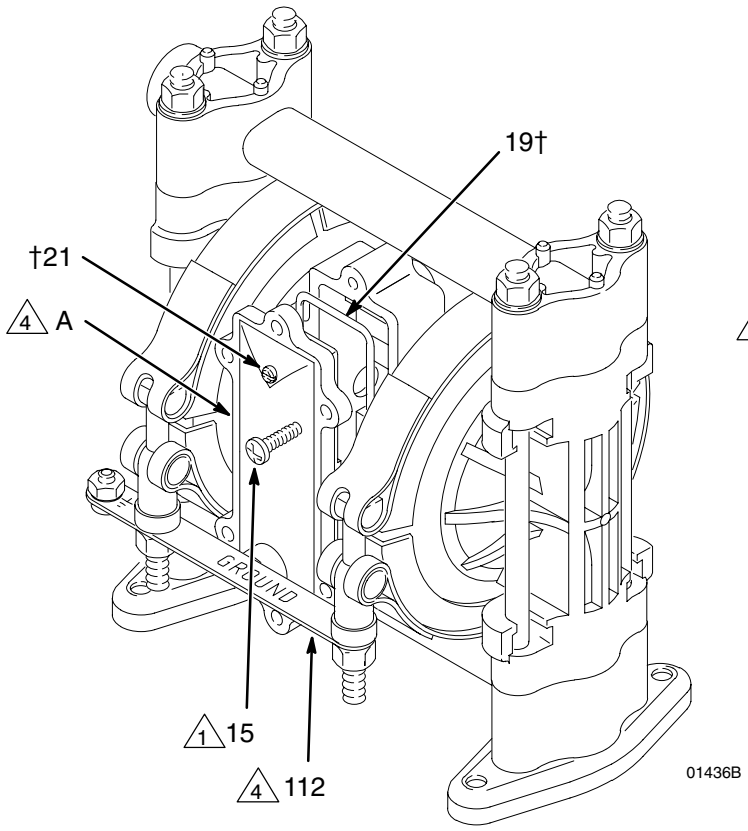
3. Refer to the Valve Plate Detail in Fig. 10. Remove the two screws (10) holding the valve plate (13) to the pump. Use an o-ring pick to remove the valve plate, seal (12), and bearing (9).

4. Apply grease (26†) to the bearing (9†). Install the bearing and the seal (12) in the pump housing (1). Install the valve plate (13) and secure with the two screws (10†), as shown. Torque the screws to 5 to 7 in-lb (0.6 to 0.8 N-m).

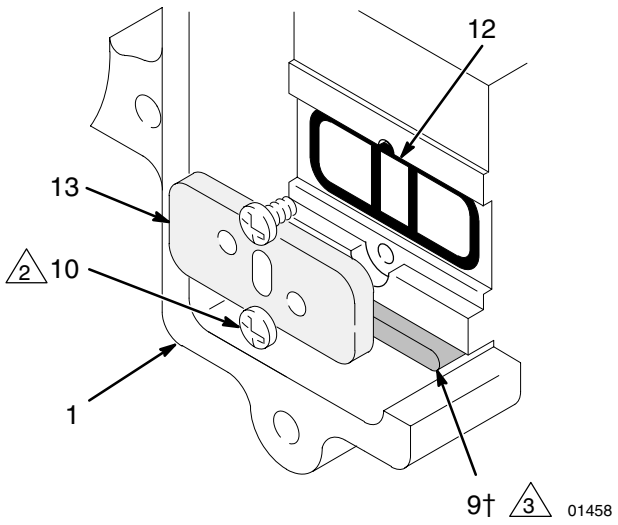
5. Make certain the o-ring (19†) is in place on the air valve cover (2†).

6. Apply grease (26†) where shown in Fig. 10.

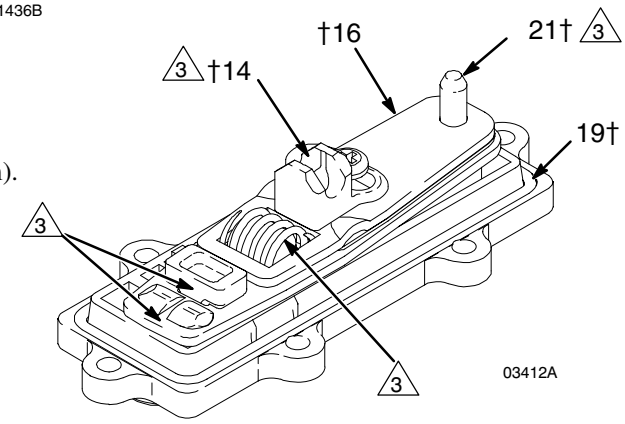
7. Align the new air valve assembly so the reset shaft (21†) is at the top. Install the valve on the pump, making sure the valve saddle (14†) engages the recessed area on the diaphragm shaft (23). Install the six screws (15) and torque oppositely and evenly, to 8 to 14 in-lb (0.9 to 1.6 N-m).



VALVE PLATE DETAIL



GREASE APPLICATION



1 Torque oppositely and evenly to 8 to 14 in-lb (0.9 to 1.6 N-m).

2 Torque to 5 to 7 in-lb (0.6 to 0.8 N-m).

3 Apply grease (26†).

Fig. 10

Service

Repairing the Air Valve

Tools Required

- Torque wrench
- Phillips screwdriver
- O-ring pick
- Rubber mallet

Disassembly

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 11.

1. **Relieve the pressure.**
2. Remove the air valve from the pump (see page 16).
3. Remove the screw (15) and shift saddle (14). See Fig. 11.
4. Disassemble the link assembly, consisting of the actuator link (16), spacer (17), detent link (22), spring (3), stop (4), and valve cup (5).
5. Remove the detent ball (8) and spring (6). The detent collar (7) is a press-fit and should not need removal; if it does require replacement, you should also replace the cover (2).
6. Remove the reset shaft (21), o-ring (20) and washer (18).
7. Clean all parts and inspect for wear or damage. Replace as needed. See **Reassembly,** page 19.

NOTE: ALL PARTS SHOWN ARE INCLUDED IN AIR VALVE KIT ——— #784-90865

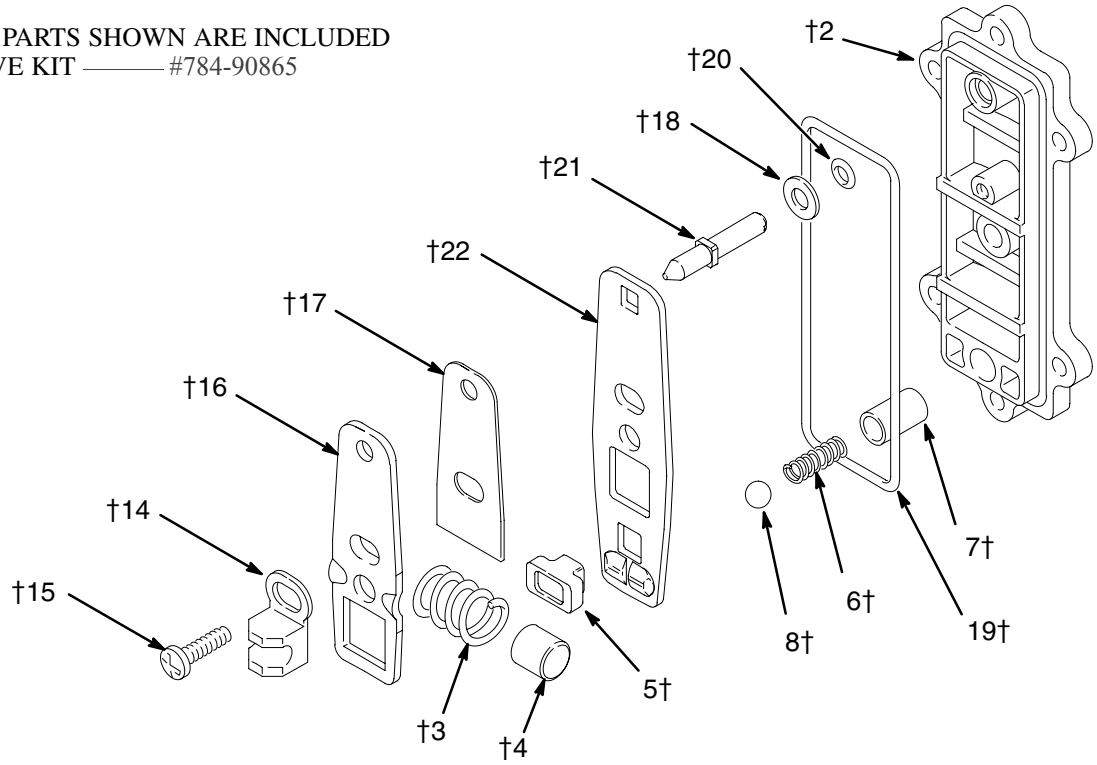


Fig. 11

Reassembly

1. *If the detent collar (7) was removed,* carefully install a new collar in a new cover (2), using a rubber mallet. See Fig. 12.

2. Grease the spring (6) and place it in the collar (7). Grease the ball (8) and set it on the spring.

3. Grease the o-ring (20) and install it in the hole (H) in the cover (2). See Fig. 12. Slide the washer (18) onto the blunt end of the reset shaft (21). Insert the shaft through the cover (2) until it seats.

4. Grease the spring (3). Place the link stop (4) inside the spring.

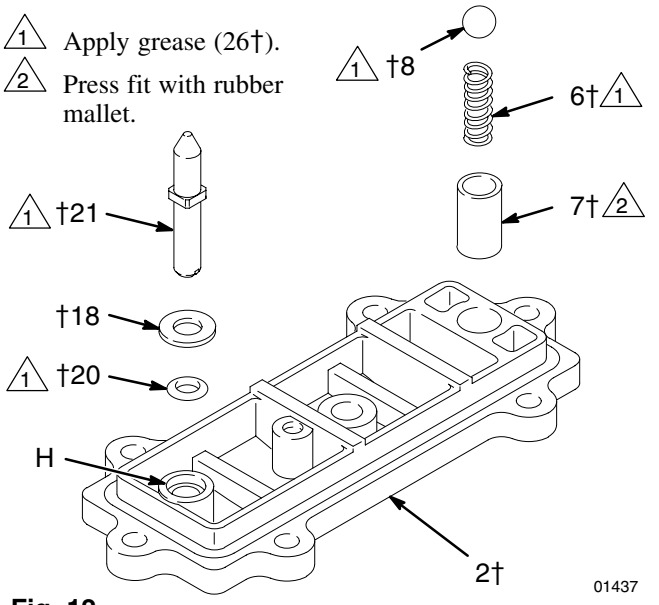


Fig. 12

5. Grease the detent link (22) and link spacer (17). Assemble the detent link, link spacer, and actuator link (16) as shown in Fig. 13. The raised bumps on the links (22 and 16) must face up.

6. Squeeze the spring (3) and install it and the stop (4) in the link assembly. The spring tension will hold all these parts together. Grease the valve cup (5) and install it in the link assembly as shown.

7. Install the link assembly on the cover (2) so the pointed end of the reset shaft (21) fits through the holes in the links and the square part of the shaft engages the square hole. Make certain the bumps on the detent link (22) engage the ball (8).

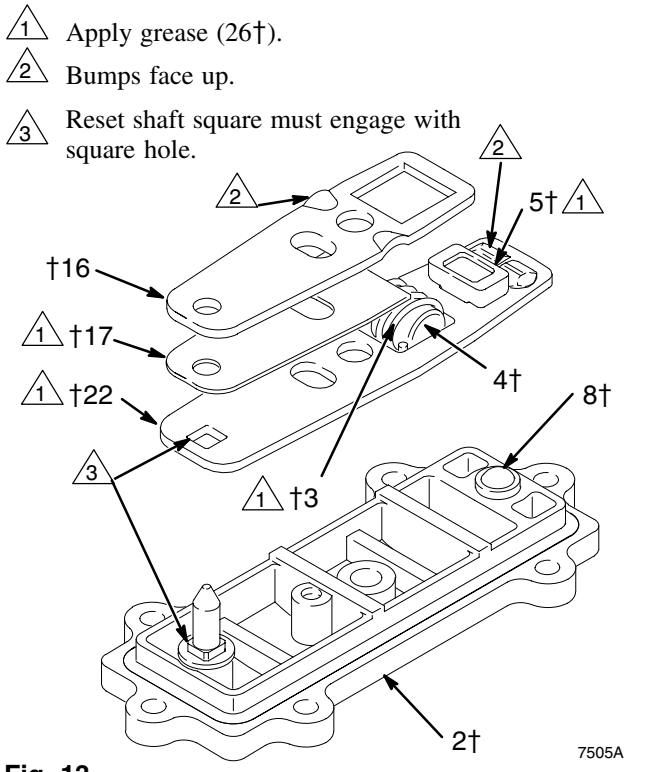


Fig. 13

8. Grease the inside surfaces of the shift saddle (14) and install it as shown in Fig. 14. Hold the link assembly firmly in place and install the screw (15). Torque to 7 to 9 in-lb (0.8 to 1.0 N-m). Install the o-ring (19) on the cover (2).

9. Reinstall the air valve as explained on page 16.

△1 Apply grease (26†).

△2 Torque to 7 to 9 in-lb (0.8 to 1.0 N-m).

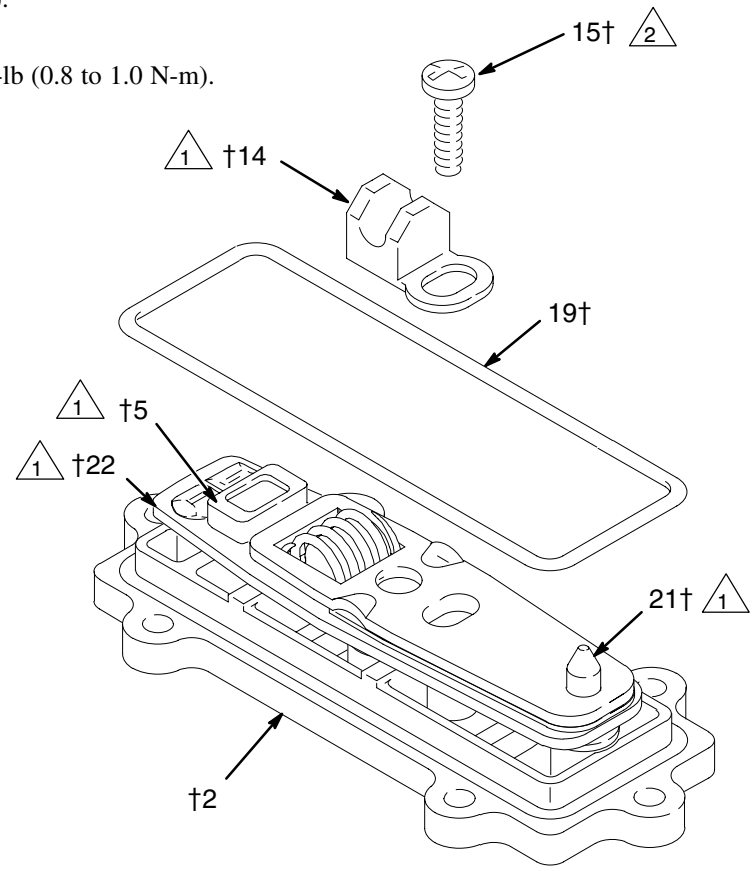


Fig. 14

⚠ CAUTION

Do not over-torque the manifold bolts (104). Doing so may cause the nuts (106) to spin in the housings, damaging the cover (101).

Service

Ball Check Valves

Tools Required

- Torque wrench
- 1/2” (13 mm) socket wrench
- O-ring pick

NOTE: A Fluid Section Repair Kit is available. See page 25 for the correct kit. Parts included in the kit are marked with an asterisk, for example (301*). Use all the parts in the kit for the best results. Always replace the o-rings (108) with new ones whenever the old ones are removed.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 11.

1. **Relieve the pressure.** Disconnect all hoses. Remove the pump from its mounting.

2. Using a 1/2” socket wrench, remove the nuts (106) holding the top manifold (102) to the covers (101). Lift the manifold off the pump. See Fig. 15.

3. Remove the outer o-ring (108), ball guide (202), ball (301), seat (201), and inner o-ring (108) from each of the covers.

4. Turn the pump over. Pull the tie rods (104) out of the pump, leaving the four nuts (106) on the rods. Remove the feet (107) and lower manifold (102).

5. Remove the outer o-ring (108), seat (201), ball (301), ball guide (202), and inner o-ring (108) from each of the covers (101).

6. Clean all parts and inspect for wear or damage. Replace parts as needed.

7. Reassemble the intake ball checks in the bottom of the pump, following all notes in Fig. 15. Be sure the ball checks are assembled **exactly** as shown.

8. Set the lower manifold (102) and feet (107) in place on the bottom of the pump.

9. Insert the long threads of each rod (104) through the feet and lower manifold. Push the rods up through the covers (101) until the nut (106) on the end of the rods bottoms on the foot. Make sure the rods are pushed all the way through. Turn the pump upright (the rods are a slight interference fit and will hold the pump parts securely in place).

10. Reassemble the outlet ball checks in the top of the pump, following all notes in Fig. 15. Be sure the ball checks are assembled **exactly** as shown. To avoid leaks, run your finger over the o-rings (108) to ensure that they are properly seated.

11. Install the top manifold (102) and four nuts (106). Torque to 50 to 60 in-lb (5.6 to 6.8 N-m). ***Do not over-torque.***

Service

1 Apply thread lubricant.

2 Flat side faces ball.

3 Beveled end up.

4 Torque to 50 to 60 in-lb (5.6 to 6.8 N-m).

5 Do not over-torque.

6 Long threads at top.

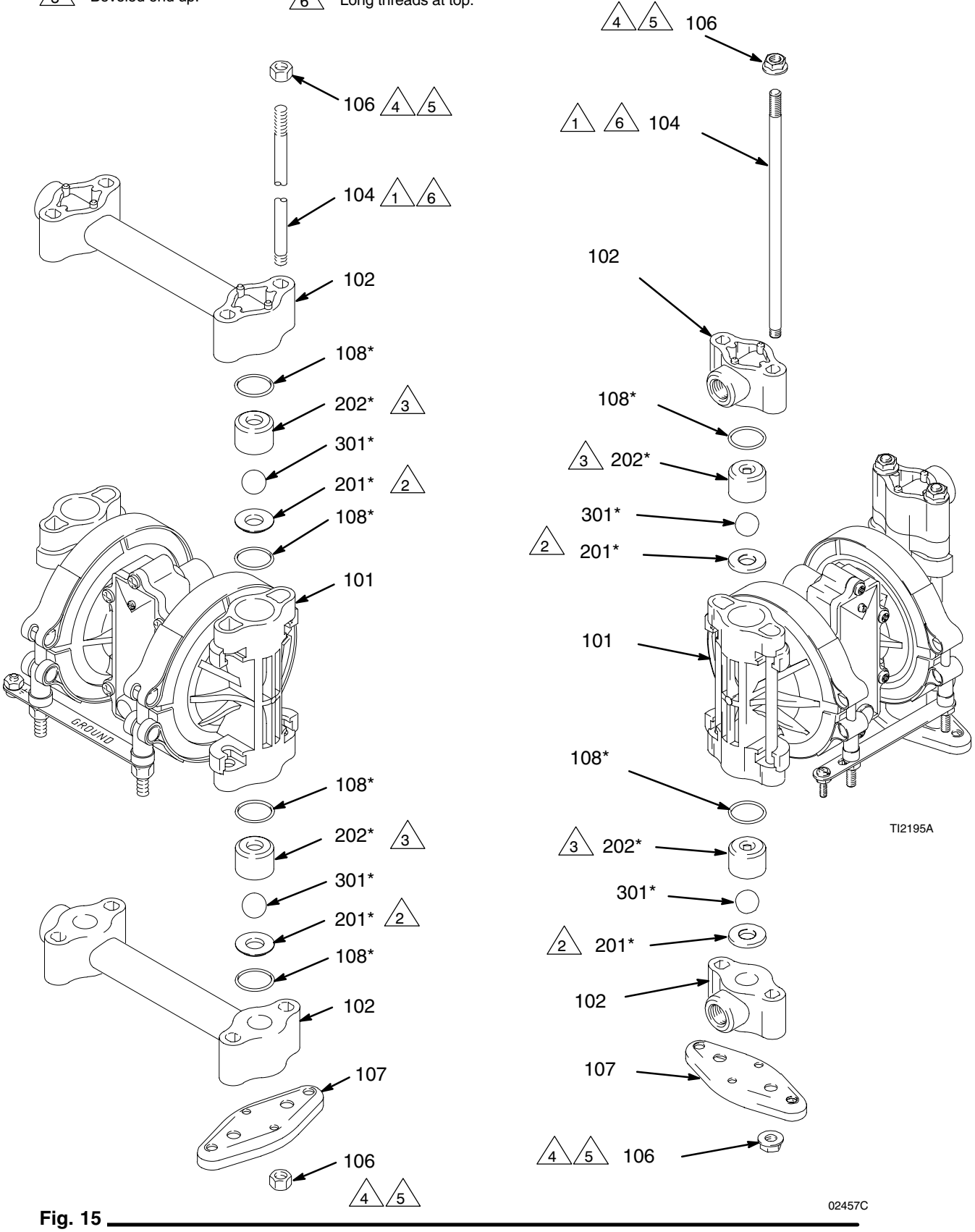


Fig. 15

Service

Diaphragm Repair

Tools Required

- Torque wrench
- One 7/16” (11 mm) and two 1/2” (13 mm) socket wrenches
- Phillips screwdriver
- O-ring pick
- 13/32” EZY-OUT bearing extractor
- Rubber mallet
- Vise with soft jaws

Disassembly

NOTE: A Fluid Section Repair Kit is available. See page 27 for the correct kit. Parts included in the kit are marked with an asterisk, for example (401*). Use all the parts in the kit for the best results.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 11.

1. **Relieve the pressure.** Disconnect all hoses.

2. Remove the air valve from the pump (see page 16).

3. Remove the manifolds (102) and disassemble the ball check valves as explained on page 21. Always replace the o-rings (108) with new ones.

4. Using a 7/16” socket wrench, remove the clamp nuts (113) and the grounding strip (112). Loosen the clamps (111) and slip them over the housing (1). Pull the covers (101) off the pump, then remove the clamps from the housing. See the Detail in Fig. 16.

5. Using a 1/2” socket wrench on both outer diaphragm plates (103), unscrew one plate from the diaphragm shaft (23). Remove one diaphragm (401), inner diaphragm plate (118), and o-ring (404). Pull the opposite diaphragm assembly and the diaphragm shaft out of the pump housing (1). See Fig. 16. Clamp the shaft in a vise with soft jaws and unscrew the outer plate (103), then disassemble the remaining diaphragm assembly.

6. Inspect the diaphragm shaft (23‡) for wear or scratches. If it is damaged, check the bearings (31‡) also. Replace parts as needed. To remove the bearings, place a 13/32 EZY-OUT in a vise. Position the pump housing (1) over the EZY-OUT (see Fig. 16). Turn the housing in the direction shown by the arrows to remove the bearing.

7. Hook the shaft seals (30‡) with an o-ring pick and pull them out of the housing (1).

8. Clean all parts and inspect for wear or damage. Replace parts as needed.

Reassembly

1. Install the shaft seals (30‡) in the housing (1). Using a rubber mallet, carefully drive the bearings (31‡) flush into the housing so the holes face out. See Fig. 16.

2. Grease the diaphragm shaft (23‡) and slide it into the housing (1). Install the o-rings (404*) in the grooves of the housing.

3. Assemble the inner diaphragm plates (118), diaphragms (401*), and outer diaphragm plates (103) as shown in Fig. 16. Apply medium-strength (blue) Loctite® or equivalent to the threads of the fluid-side plates (103), and torque the plates to 75 to 85 in-lb (8.5 to 9.6 N-m) at 100 rpm maximum using a 1/2-in. socket wrench. ***Do not over-torque.*** These parts ***must*** be assembled correctly.

⚠ CAUTION

Do not over-torque the outer diaphragm plates (103). Doing so will damage the hex heads.

4. When installing the covers (101), slip the clamps (111) over the housing (1) before positioning the covers. See the Detail in Fig. 16. Engage the notches in the covers with the locator tabs on the housing, then position the clamps over both parts. The clamp bolts should be on the air valve side of the housing, and pointing down toward the bottom of the pump. Install the grounding strip on the bolts. Apply thread lubricant to the bolts, then install the clamp nuts (113). Using a 7/16" socket wrench, torque the nuts to 50 to 60 in-lb (5.6 to 6.8 N-m).

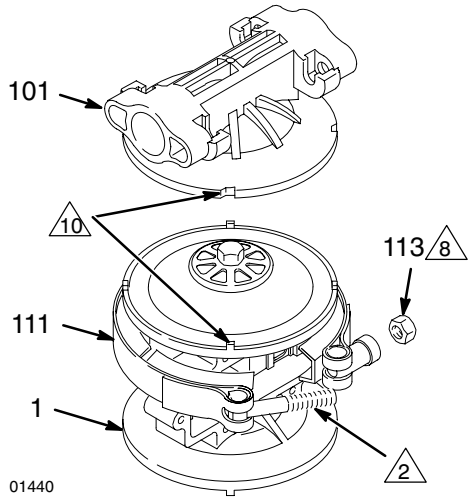
5. Reassemble the ball check valves and manifolds as explained on page 21. Always install new o-rings (108*), and make sure they are properly seated.

6. Reinstall the air valve, using the six mounting screws (15). See Fig. 10.

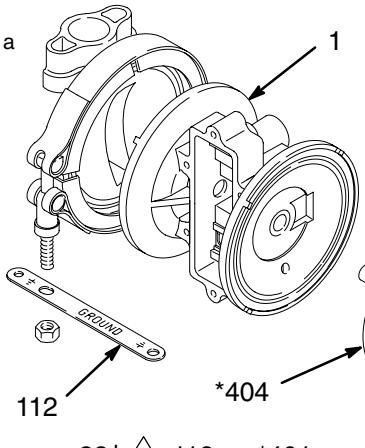
Notes

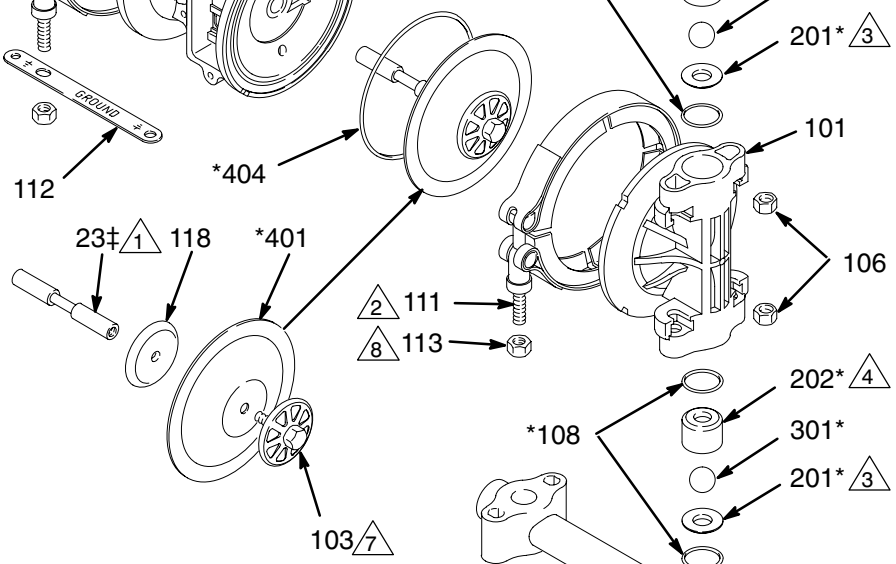
Service

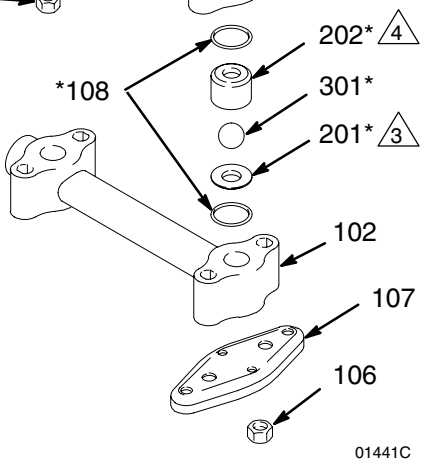
1. Grease shaft.
2. Apply thread lubricant.
3. Flat side faces ball.
4. Beveled end up.
6. Round side must face toward diaphragm.
7. Apply medium-strength (blue) Loctite® or equivalent. Torque to 75 to 85 in-lb (8.5 to 9.6 N-m) at 100 rpm maximum using a 1/2-in. socket wrench.
8. Torque to 50 to 60 in-lb (5.6 to 6.8 N-m).
9. Do not over-torque.
10. Notches must engage tabs.

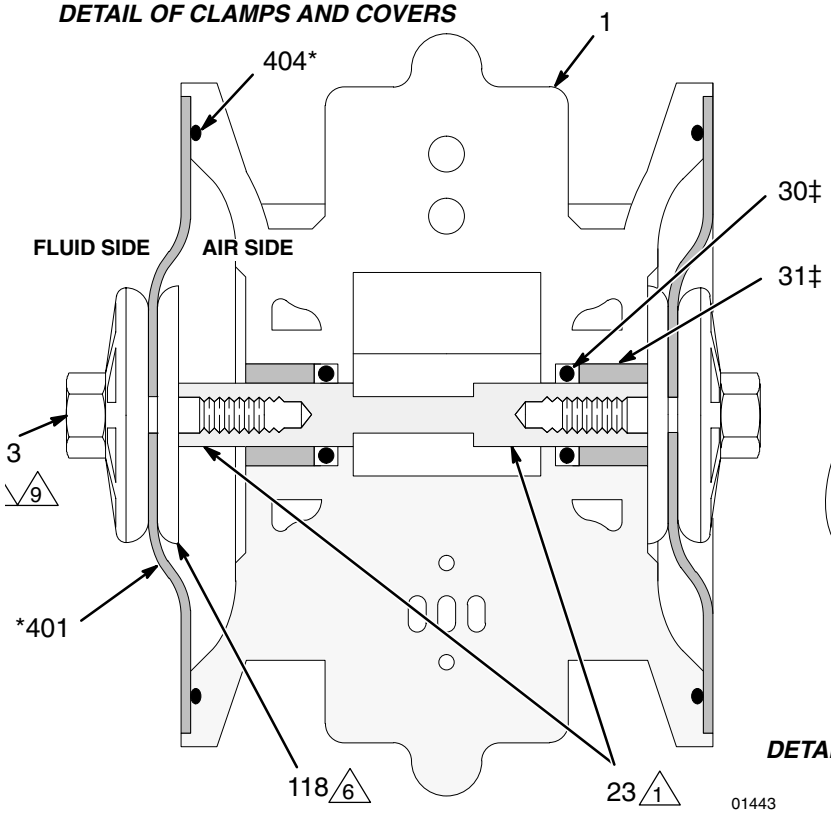


DETAIL OF CLAMPS AND COVERS

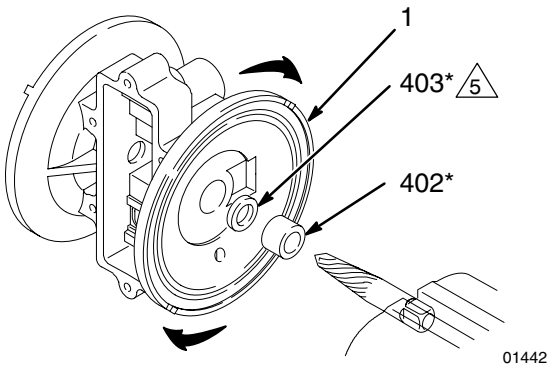








CUTAWAY VIEW OF DIAPHRAGM ASSEMBLIES IN PUMP HOUSING



13/32 IN. EZY-OUT

DETAIL OF BEARING REMOVAL USING EZY-OUT

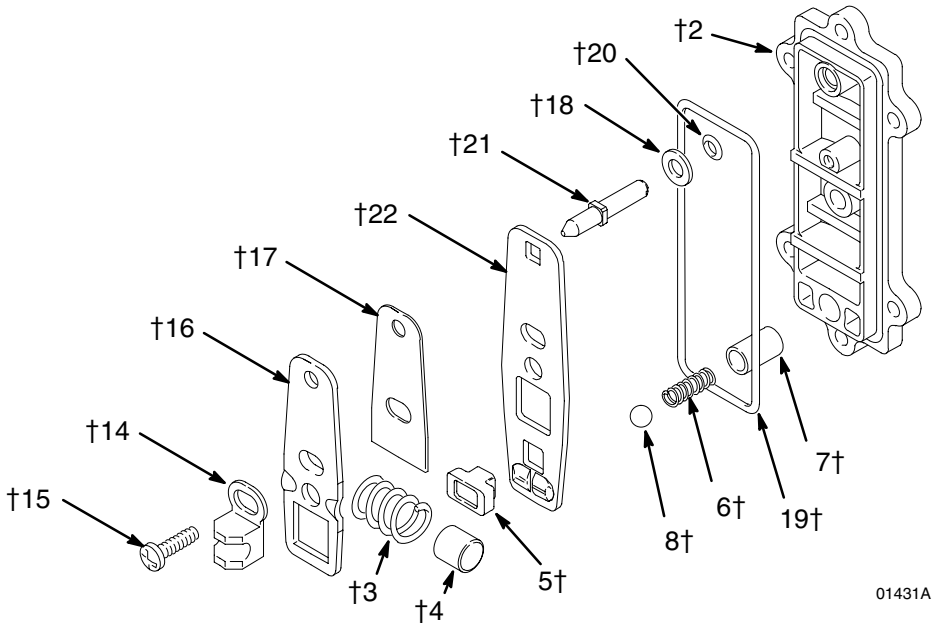
Parts

Air Motor Parts List (Matrix Column 2)

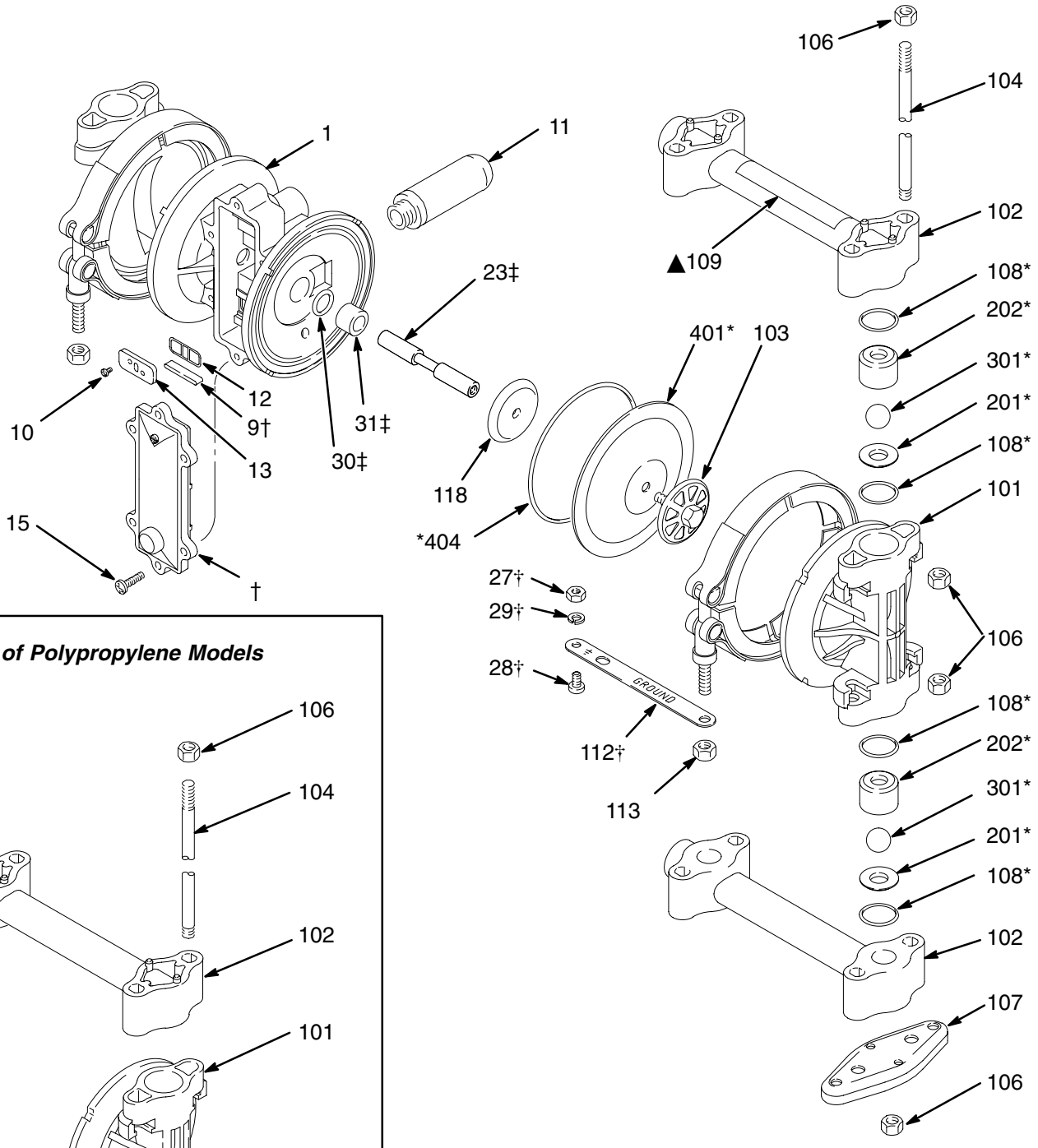
Digit	Ref. No.	Part No.	Description	Qty
3	1		HOUSING, center; polypropylene; see page 28	1
	2†		COVER, air valve; polypropylene	1
	3†		SPRING, compression; sst	1
	4†		STOP, link;	1
	5†		CUP, valve;	1
	6†		SPRING, compression; sst	1
	7†		COLLAR, detent; sst	1
	8†		BALL, detent; carbide	1
	9†		BEARING, link; see page 28	1
	10		SCREW, thread-forming; 1/4–20; 0.375 in. (9.5 mm) long; see page 28	2
	11		MUFFLER; see page 28	1
	12		SEAL, plate, valve; buna-N; see page 28	1
	13		PLATE, valve; sst; see page 28	1
	14†		SADDLE, shift;	1
	15†		SCREW, thread-forming; 10–14 size; 0.75 in. (19 mm) long; see below and page 28	7
	16†		LINK, actuator; sst	1
	17†		SPACER, link;	1
	18†		WASHER, plain; sst	1
	19†		O-RING; buna-N	1
	20†		O-RING; buna-N	1
	21†		SHAFT, reset; sst	1
	22†		LINK, detent; sst	1
	23‡		SHAFT, diaphragm; sst; see page 28	1
	26†		GREASE, general purpose; 0.375 oz. (10.5 g); not shown	1
	27		NUT, hex; 10–24; see page 28	1
	28		SCREW; 10–24; 0.75 in. (19 mm) long; see page 28	1
	29		LOCKWASHER, int. tooth; no. 10; see page 28	1
	30‡		PACKING, u-cup; Viton®	2
	31‡		BEARING;	2

† *These parts are included in #784-90865 ~~Air Valve~~ Kit may be purchased separately. The kit includes only one screw (15), shown below, and a tube of grease (26).*

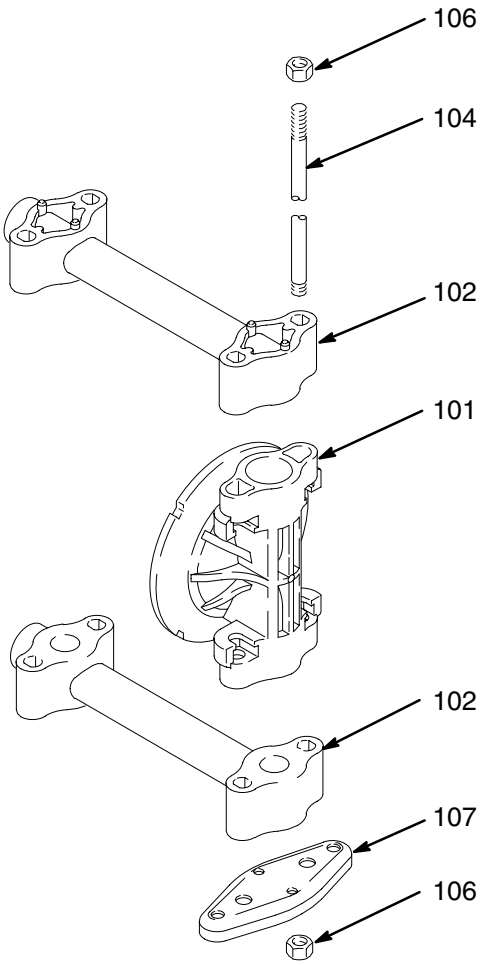
‡ *These parts are included in #784-90922 Diaphr~~agm Shaf~~t Kit which may be purchased separately.*



Parts



Detail of Polypropylene Models



* *Included in Pump Repair Kit, which may be purchased separately.*

† *Included in Air Valve Kit ~~#784-90~~865 which may be purchased separately. See parts list on page 27.*

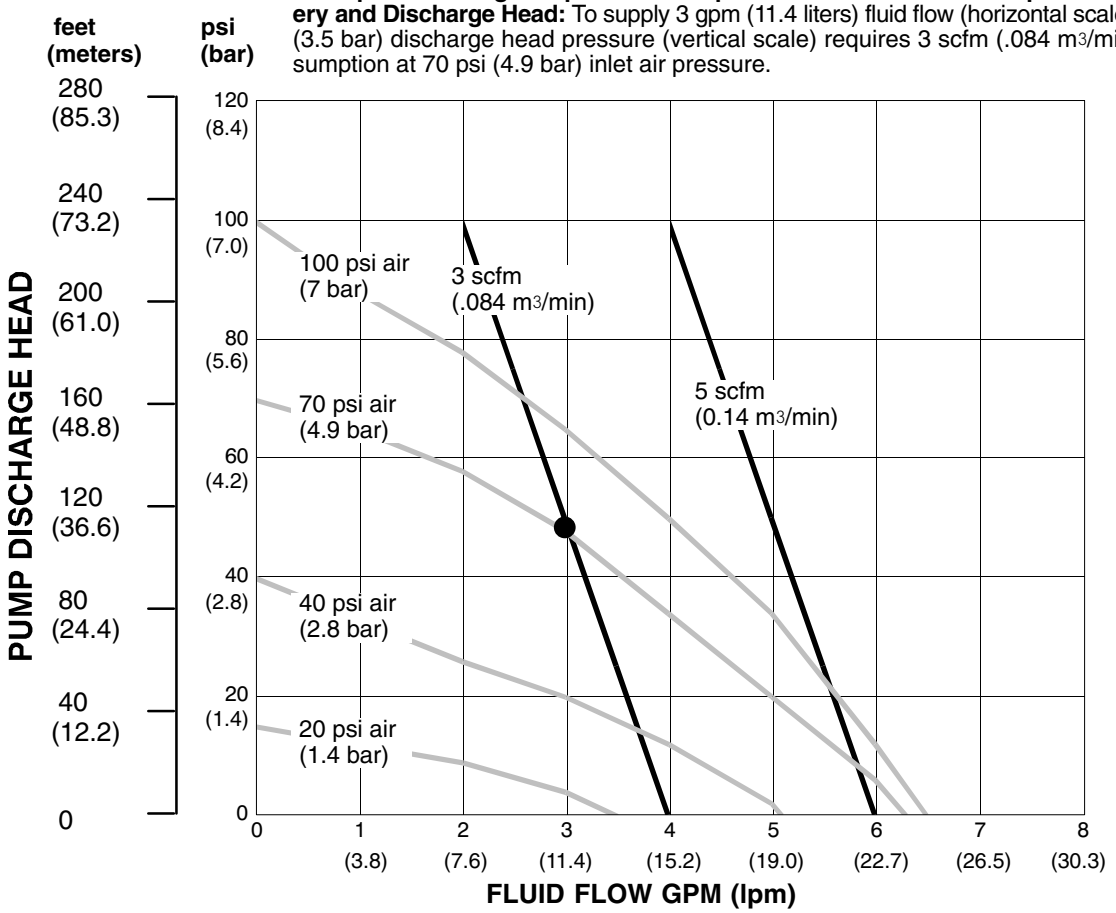
▲ *Replacement Danger and Warning labels, tags and cards are available at no cost.*

‡ *Included in Diaphragm Shaft Kit ~~#784-90~~922, which may be purchased separately.*

† *Not supplied with Polypropylene pump.*

Performance Chart – pumps with Teflon Diaphragms

Example of Finding Pump Air Consumption and Air Pressure at a Specific Fluid Delivery and Discharge Head: To supply 3 gpm (11.4 liters) fluid flow (horizontal scale) at 50 psi (3.5 bar) discharge head pressure (vertical scale) requires 3 scfm (.084 m3/min) air consumption at 70 psi (4.9 bar) inlet air pressure.

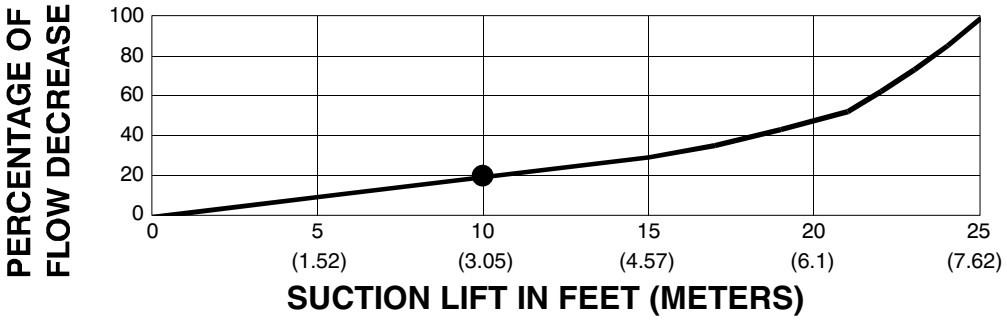


TEST CONDITIONS
Pump tested in water with inlet submerged.

KEY
FLUID PRESSURE AND FLOW
SCFM AIR CONSUMPTION

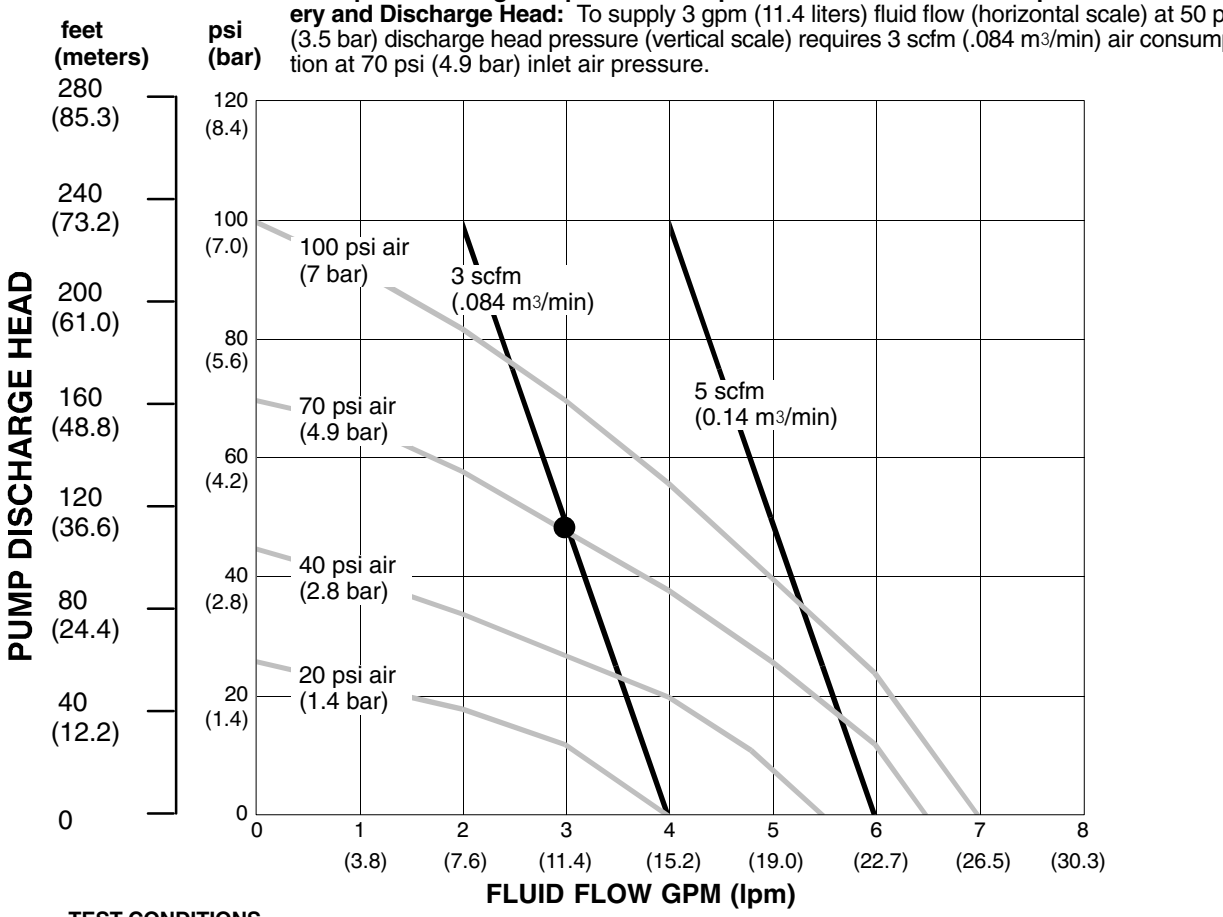
PUMPING RATE DECREASE AT DIFFERENT SUCTION LIFTS

EXAMPLE: At a suction lift of 10 ft (3.05 m), the pump flow rate will be decreased by 20 percent.



Performance Charts – pumps with Hytrel Diaphragms

Example of Finding Pump Air Consumption and Air Pressure at a Specific Fluid Delivery and Discharge Head: To supply 3 gpm (11.4 liters) fluid flow (horizontal scale) at 50 psi (3.5 bar) discharge head pressure (vertical scale) requires 3 scfm (.084 m3/min) air consumption at 70 psi (4.9 bar) inlet air pressure.

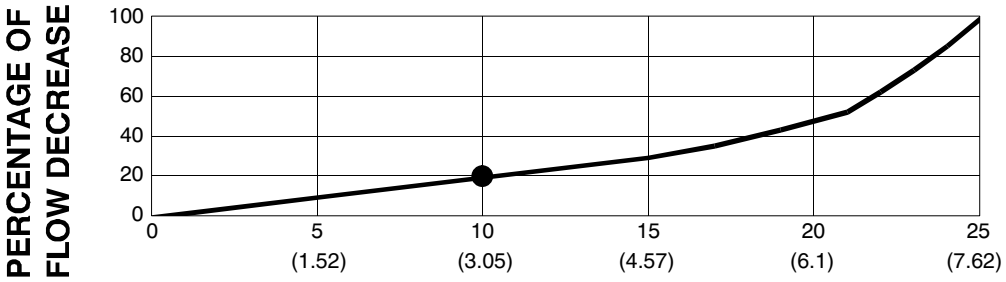


TEST CONDITIONS
Pump tested in water with inlet submerged.

KEY
FLUID PRESSURE AND FLOW
SCFM AIR CONSUMPTION

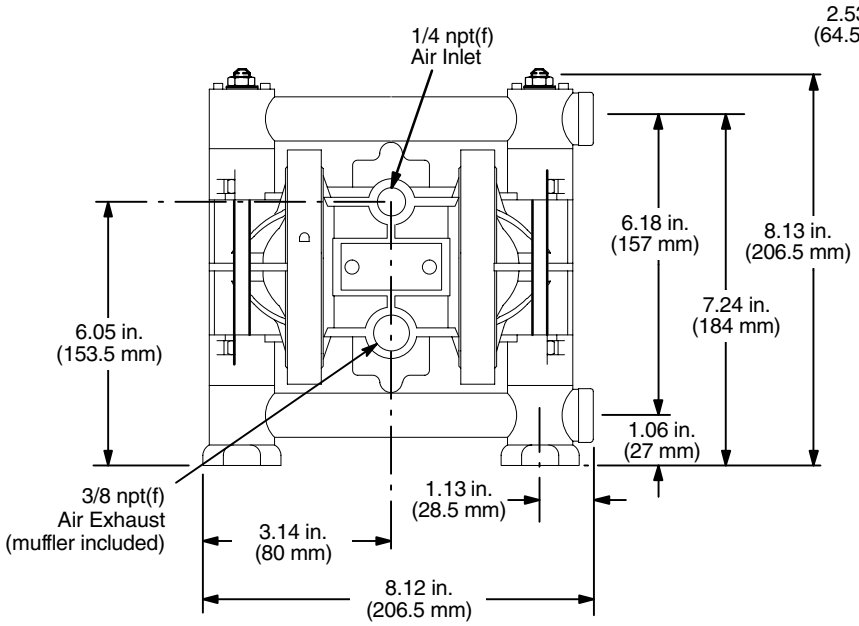
PUMPING RATE DECREASE AT DIFFERENT SUCTION LIFTS

EXAMPLE: At a suction lift of 10 ft (3.05 m), the pump flow rate will be decreased by 20 percent.

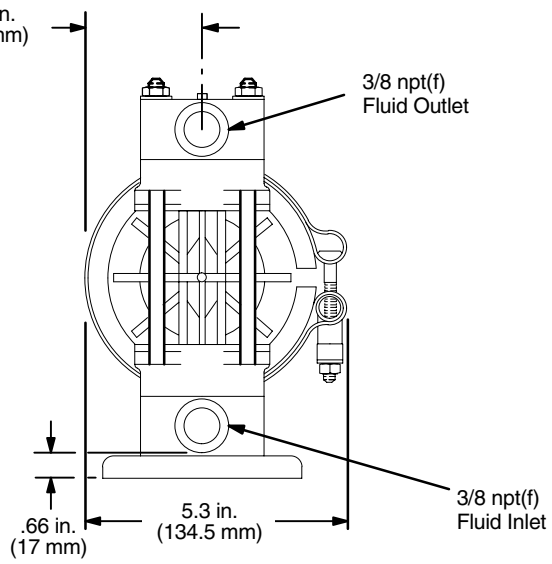


Dimensions

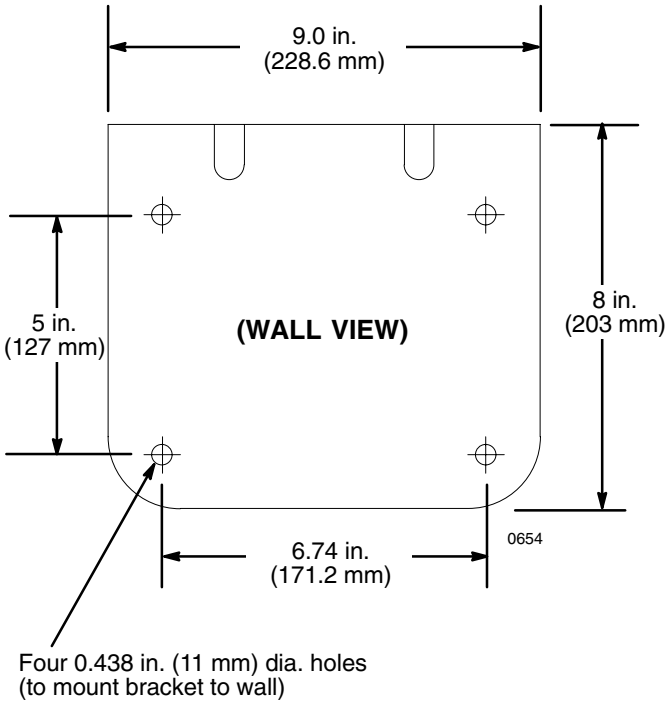
FRONT VIEW



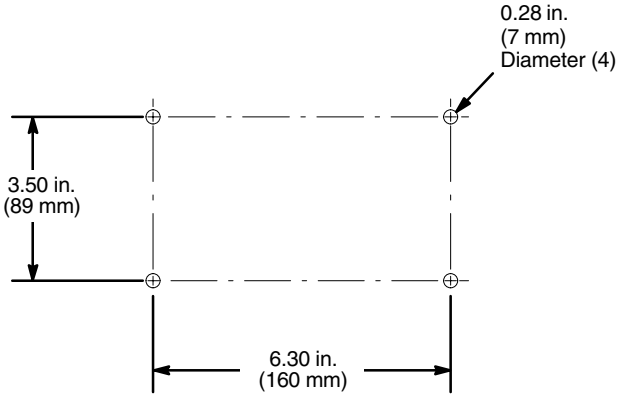
SIDE VIEW



WALL BRACKET 224-835



PUMP MOUNTING HOLE PATTERN



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WARRANTY

Graymills Corporation warrants that the equipment manufactured and delivered, when properly installed and maintained , shall be free from defects in workmanship and will function as quoted in the published specification. **Graymills** does not warrant process performance, nor assume any liability for equipment selection, adaptation, or installation.

Warranty does not apply to damages or defects caused by shipping, operator carelessness, mis–use, improper application or installation, abnormal use, use of add–on parts or equipment which damages or impairs the proper function of the unit and modifications made to the unit. Warranty does not apply to expendable parts needing replacement periodically due to normal wear and tear.

A new Warranty period shall not be established for repaired or replaced materials or products. Such items shall remain under Warranty for only the remainder of the Warranty period of the original materials or product.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY. **GRAYMILLS CORPORATION** MAKES NO OTHER WARRANTY OF ANY KIND EXPRESS OR IMPLIED. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE A FORESTATED OBLIGATION ARE HEREBY DISCLAIMED BY **GRAYMILLS CORPORATION** AND EXCLUDED FROM THIS SALE. **Graymills** warranty obligations and Buyer remedies (except to title) are solely and exclusively stated herein. In no case will **Graymills** be liable for consequential damages, loss of production, or any other loss incurred due to interruption of service.

Graymills' obligation under this Warranty shall be limited to:

a) Repairing or replacing (at **Graymills** sole discretion) any non–conforming or defective component within one year from the date of shipment from **Graymills**.

b) Repairing or replacing (at **Graymills** sole discretion), components supplied by, but not manufactured by **Graymills**, to the extent of the warranty given by the original manufacturer.

Buyer must give **Graymills** prompt notice of any defect or failure.

If you believe that you have a Warranty claim, contact **Graymills** at (773)248–6825. Any return material must have an RMA number on the outside of the package and must be shipped prepaid or shipment will be refused. **Graymills** will promptly examine the material and determine if it is defective and within the Warranty period.

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