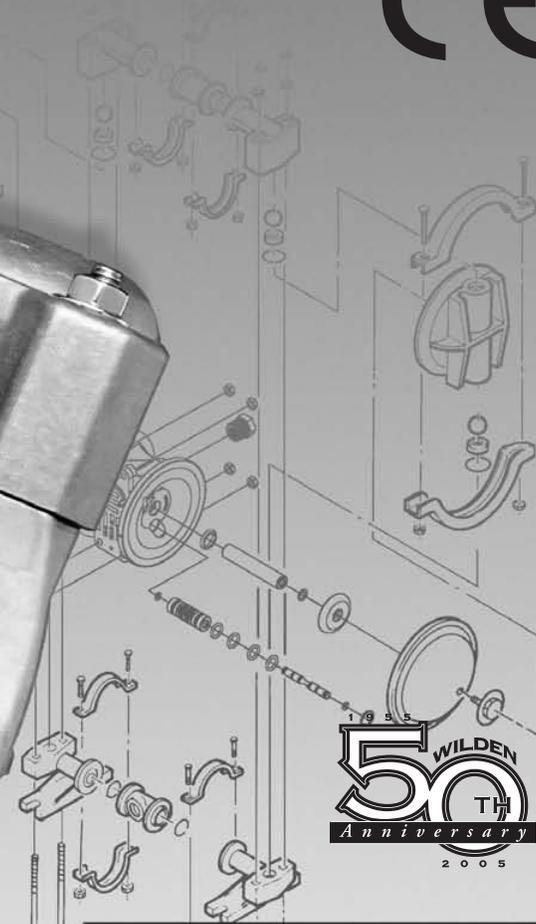
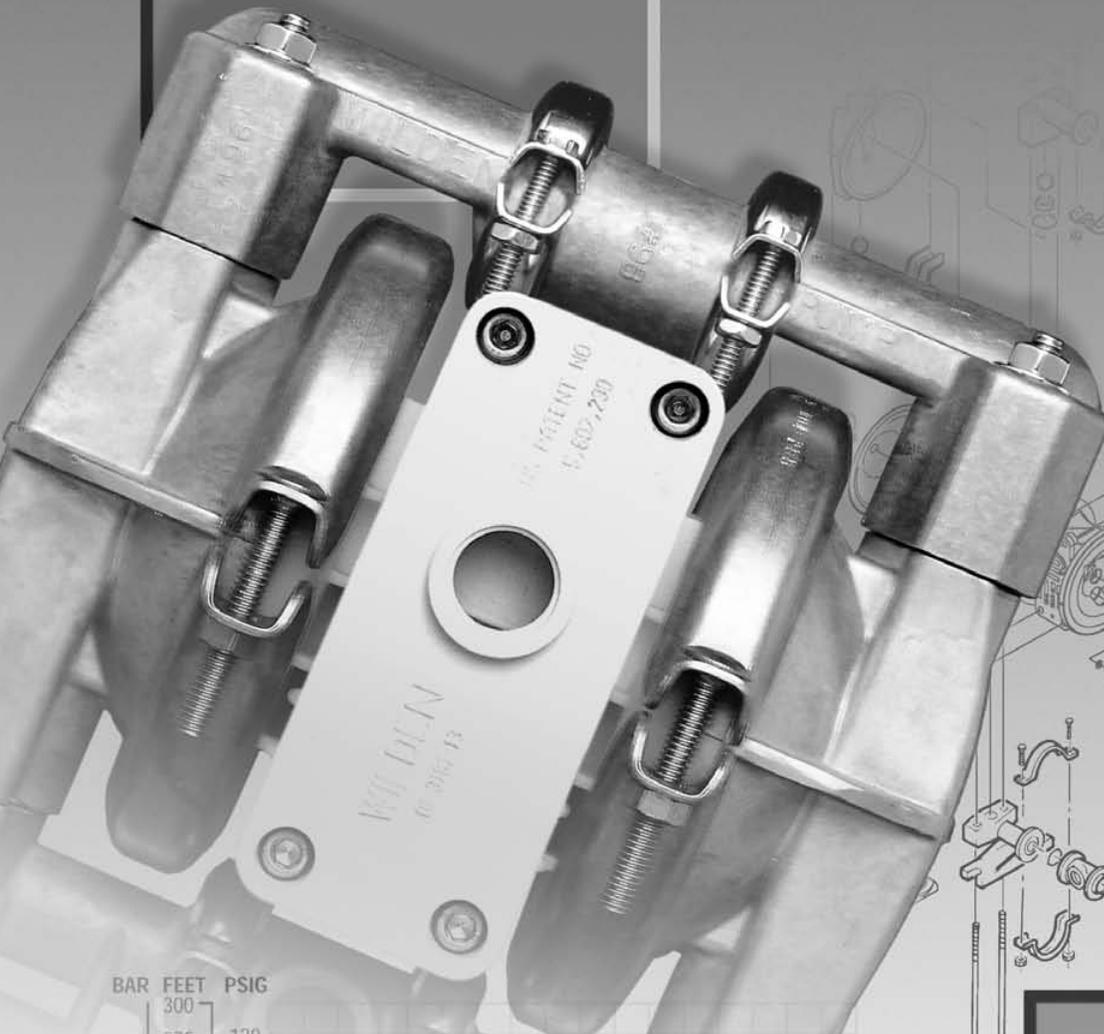


**BIOPHARM™**

**P1**

# Engineering Operation & Maintenance



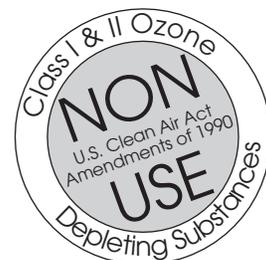
**PROFLO®**  
PROGRESSIVE PUMP TECHNOLOGY

## Metal Pumps

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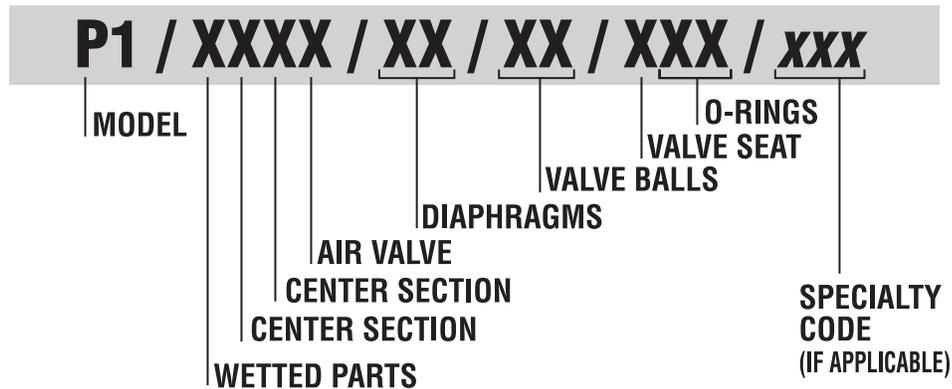
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## SECTION 1

# WILDEN PUMP DESIGNATION SYSTEM



In the case where a center section is used instead of a center block and air chambers, the designation will be as follows: Acetal = LL

## MODEL P1 METAL MATERIAL CODES

### WETTED PARTS

- H = ALLOY C
- S = STAINLESS STEEL

### CENTER SECTION

- LL = ACETAL
- PP = POLYPROPYLENE

### AIR VALVE

- L = ACETAL
- P = POLYPROPYLENE

### DIAPHRAGMS

- TS = PTFE W/SANIFLEX™  
BACKUP (White)

### VALVE BALL

- TF = PTFE (White)

### VALVE SEAT

- H = ALLOY C
- S = STAINLESS STEEL

### VALVE SEAT O-RING

- TF = PTFE (White)

### SPECIALTY CODE (AVAILABILITY VARIES BY MODEL.)

- 900 BioPharm
- 901 BioPharm, BSP
- 902 BioPharm, DIN
- 903 BioPharm, FDA (Tri-Clover® flanges & wing nuts)
- 904 BioPharm, USDA (Food Master)
- 905 BioPharm, 3A (CIP), Wil-Gard 110V
- 906 BioPharm, 3A (CIP), Wil-Gard 220V
- 907 BioPharm, LSH, side ported
- 908 BioPharm, FDA, Accu-Flo, 24V DC coil
- 909 BioPharm, FDA, Accu-Flo, 24V DC x-proof coil
- 910 BioPharm, FDA, Accu-Flo, 24V AC / 12V DC coil
- 911 BioPharm, FDA, Accu-Flo, 24V AC / 12V DC x-proof coil
- 912 BioPharm, FDA, Accu-Flo, 110V AC coil
- 913 BioPharm, FDA, Accu-Flo, 110V AC x-proof coil
- 914 BioPharm, Accu-Flo, 24V DC coil
- 915 BioPharm, Accu-Flo, 24V DC x-proof coil
- 916 BioPharm, Accu-Flo, 24V AC / 12V DC coil
- 917 BioPharm, Accu-Flo, 24V AC / 12V DC x-proof coil
- 918 BioPharm, Accu-Flo, 110V AC coil
- 919 BioPharm, Accu-Flo, 110V AC x-proof coil

**NOTE: MOST ELASTOMERIC MATERIALS USE COLORED DOTS FOR IDENTIFICATION.**

## SECTION 2

# THE WILDEN PUMP — HOW IT WORKS

The Wilden diaphragm pump is an air-operated, positive displacement, self-priming pump. These drawings show the flow pattern through the pump upon its initial stroke. It is assumed the pump has no fluid in it prior to its initial stroke.

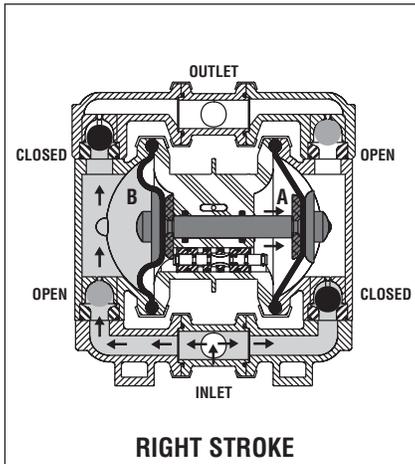


FIGURE 1 The air valve directs pressurized air to the back side of diaphragm A. The compressed air is applied directly to the liquid column separated by elastomeric diaphragms. The diaphragm acts as a separation membrane between the compressed air and liquid, balancing the load and removing mechanical stress from the diaphragm. The compressed air moves the diaphragm away from the center block of the pump. The opposite diaphragm is pulled in by the shaft connected to the pressurized diaphragm. Diaphragm B is on its suction stroke; air behind the diaphragm has been forced out to the atmosphere through the exhaust port of the pump. The movement of diaphragm B toward the center block of the pump creates a vacuum within chamber B. Atmospheric pressure forces fluid into the inlet manifold forcing the inlet valve ball off its seat. Liquid is free to move past the inlet valve ball and fill the liquid chamber (see shaded area).

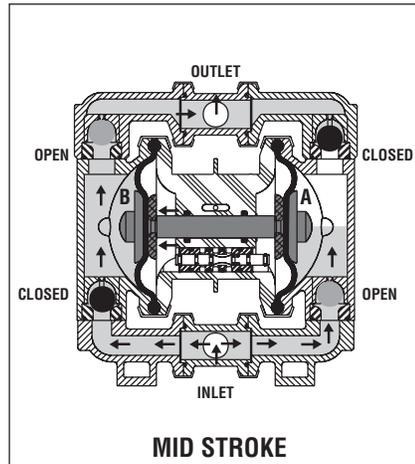


FIGURE 2 When the pressurized diaphragm, diaphragm A, reaches the limit of its discharge stroke, the air valve redirects pressurized air to the back side of diaphragm B. The pressurized air forces diaphragm B away from the center block while pulling diaphragm A to the center block. Diaphragm B is now on its discharge stroke. Diaphragm B forces the inlet valve ball onto its seat due to the hydraulic forces developed in the liquid chamber and manifold of the pump. These same hydraulic forces lift the discharge valve ball off its seat, while the opposite discharge valve ball is forced onto its seat, forcing fluid to flow through the pump discharge. The movement of diaphragm A toward the center block of the pump creates a vacuum within liquid chamber A. Atmospheric pressure forces fluid into the inlet manifold of the pump. The inlet valve ball is forced off its seat allowing the fluid being pumped to fill the liquid chamber.

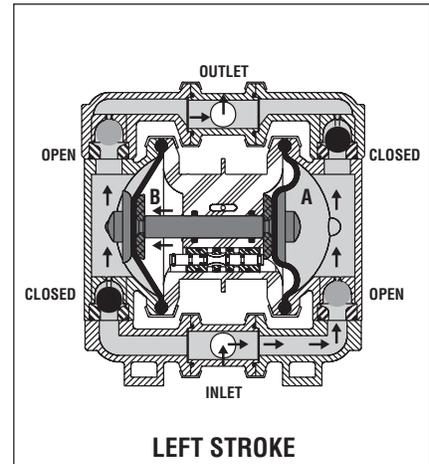
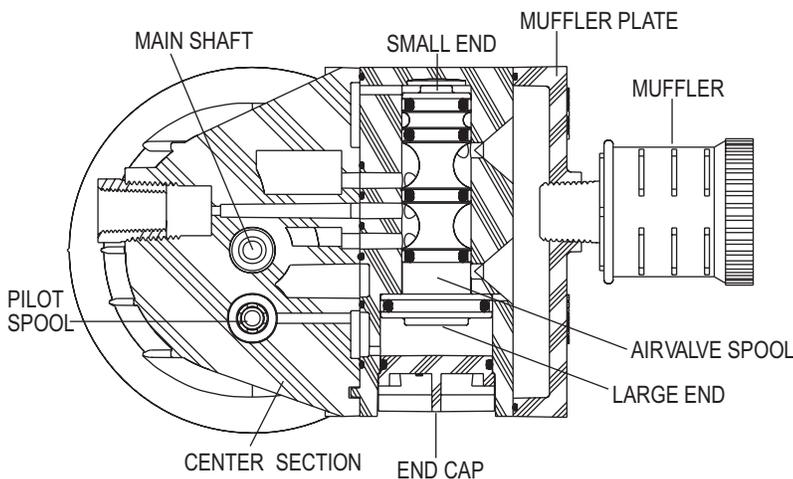


FIGURE 3 At completion of the stroke, the air valve again redirects air to the back side of diaphragm A, which starts diaphragm B on its exhaust stroke. As the pump reaches its original starting point, each diaphragm has gone through one exhaust and one discharge stroke. This constitutes one complete pumping cycle. The pump may take several cycles to completely prime depending on the conditions of the application.

## PRO-FLO™ AIR DISTRIBUTION SYSTEM OPERATION — HOW IT WORKS

Figure A



The Pro-Flo® patented air distribution system incorporates three moving parts: the air valve spool, the pilot spool, and the main shaft/diaphragm assembly. The heart of the system is the air valve spool and air valve. As shown in Figure A, this valve design incorporates an unbalanced spool. The smaller end of the spool is pressurized continuously, while the large end is alternately pressurized then exhausted to move the spool. The spool directs pressurized air to one air chamber while exhausting the other. The air causes the main shaft/diaphragm assembly to shift to one side — discharging liquid on that side and pulling liquid in on the other side. When the shaft reaches the end of its stroke, the inner piston actuates the pilot spool, which pressurizes and exhausts the large end of the air valve spool. The repositioning of the air valve spool routes the air to the other air chamber.

## SECTION 3

# WILDEN MODEL P1 METAL CAUTIONS – READ FIRST!

---



### TEMPERATURE LIMITS:

Nylon	-17.8°C to 93.3°C	0°F to 200°F
Saniflex™	-28.9°C to 104.4°C	-20°F to 220°F
PTFE	4.4°C to 148.9°C	40°F to 300°F*



**CAUTION:** When choosing pump materials, be sure to check the temperature limits for all wetted components. Example: Viton® has a maximum limit of 176.7°C (350°F) but polypropylene has a maximum limit of only 79°C (175°F).



**CAUTION:** Maximum temperature limits are based upon mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperatures. Consult engineering guide for chemical compatibility and temperature limits.



**CAUTION:** Always wear safety glasses when operating pump. If diaphragm rupture occurs, material being pumped may be forced out air exhaust.



**WARNING:** Prevention of static sparking — If static sparking occurs, fire or explosion could result. Pump, valves, and containers must be properly grounded when handling flammable fluids and whenever discharge of static electricity is a hazard.



**CAUTION:** Do not exceed 8.6 bar (125 psig) air supply pressure.



**CAUTION:** Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from pump. Disconnect all intake, discharge and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container.



**CAUTION:** Blow out air line for 10 to 20 seconds before attaching to pump to make sure all pipe line debris is clear. Use an in-line air filter. **A 5μ (micron) air filter is recommended.**



**NOTE:** Tighten clamp bands and retainers prior to installation. Fittings may loosen during transportation.



**NOTE:** When installing PTFE diaphragms, it is important to tighten outer pistons simultaneously (turning in opposite directions) to ensure tight fit.



**NOTE:** Before starting disassembly, mark a line from each liquid chamber to its corresponding air chamber. This line will assist in proper alignment during reassembly.



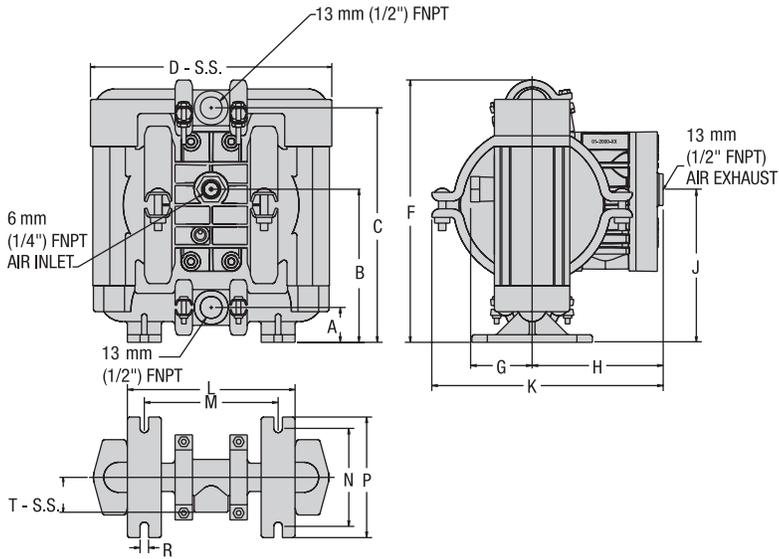
**CAUTION:** Verify the chemical compatibility of the process and cleaning fluid to the pump's component materials in the Chemical Resistance Guide (see E4).



**CAUTION:** Do not over-tighten the air inlet reducer bushing. Too much torque on the reducer bushing may damage the air valve muffler plate. Do not exceed 29 in.-lbs. [3.3 N•m].

## SECTION 4A

# DIMENSIONAL DRAWING WILDEN MODEL P1 METAL

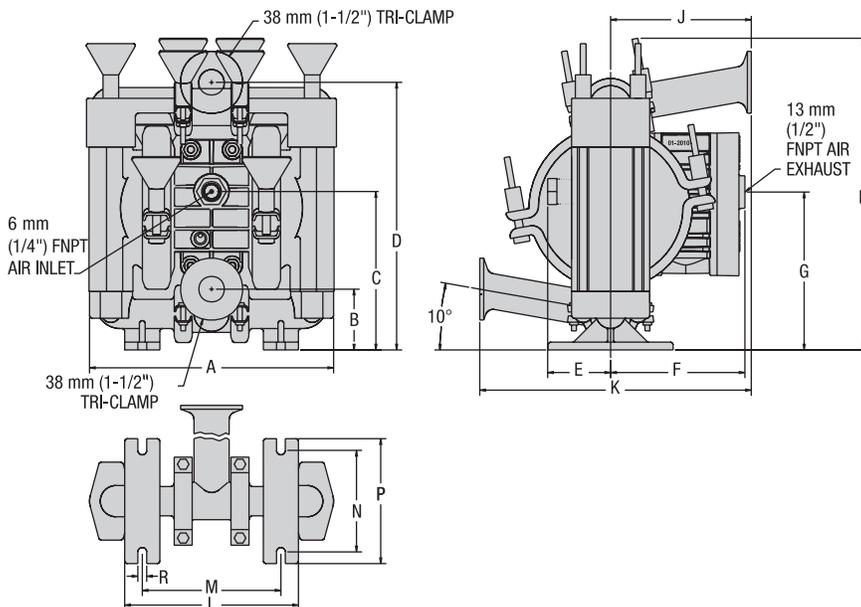


DIMENSIONS – P1 METAL		
ITEM	METRIC (mm)	STANDARD (inch)
A	29	1.1
B	129	5.1
C	199	7.8
D	203	8.0
F	222	8.8
G	56	2.2
H	115	4.5
J	129	5.1
K	205	8.1
L	140	5.5
M	112	4.4
N	83	3.3
P	102	4.0
R	7	0.3
T	30	1.2

BSP threads available.

## SECTION 4B

# DIMENSIONAL DRAWING WILDEN MODEL P1 METAL BIOPHARM



DIMENSIONS – P1 BIOPHARM METAL		
ITEM	METRIC (mm)	STANDARD (inch)
A	204	8.03
B	48	1.93
C	132	5.18
D	221	8.68
E	53	2.09
F	115	4.53
G	125	4.90
H	258	10.15
J	116	4.56
K	229	9.03
L	143	5.62
M	114	4.46
N	83	3.25
P	102	4.0
R	7	0.28

## SECTION 5A

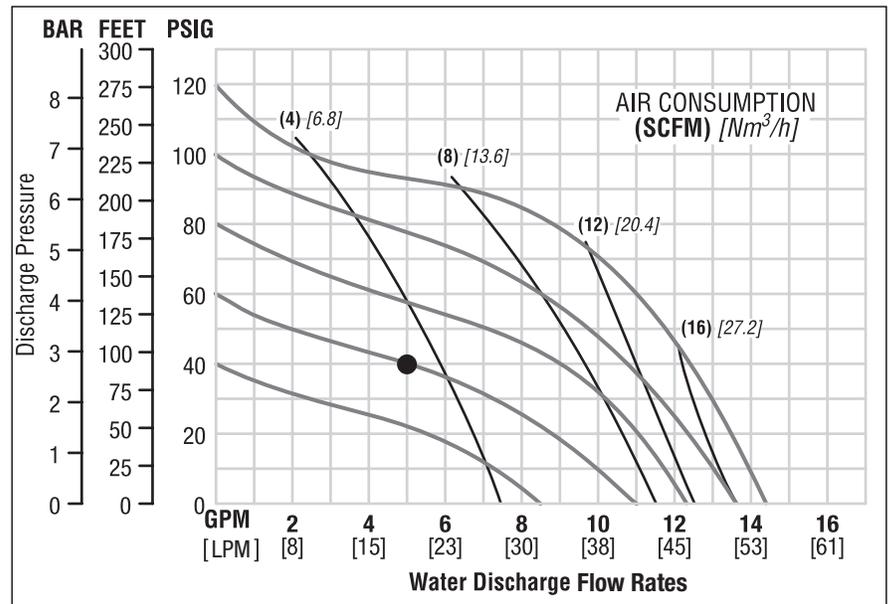
# PERFORMANCE CURVES MODEL P1 METAL TEFLON®-FITTED

Height .....222 mm (8.8")  
 Width .....203 mm (8.0")  
 Depth .....205 mm (8.1")  
 Ship Weight.....Alloy C 10 kg (22 lbs.)  
                   Stainless Steel 9.2 kg (20 lbs.)  
 Air Inlet.....6 mm (¼")  
 Inlet .....13 mm (½")  
 Outlet.....13 mm (½")  
 Suction Lift.....4.88 m Dry (16')  
                   9.45 m Wet (31')

Displacement per  
 Stroke ..... .09 l (0.025 gal.)<sup>1</sup>  
 Max. Flow Rate .....54 lpm (14.4 gpm)  
 Max. Size Solids .....1.59 mm (⅙")  
<sup>1</sup>Displacement per stroke was calculated at 4.8 bar (70 psig) air inlet pressure against a 2 Bar (30 psig) head pressure.

**Example:** To pump 18.9 lpm (5 gpm) against a discharge pressure head of 2.7 bar (40 psig) requires 4 bar (60 psig) and 5.92 Nm<sup>3</sup>/h (3.5 scfm) air consumption. (See dot on chart.)

**Caution:** Do not exceed 8.6 bar (125 psig) air supply pressure.

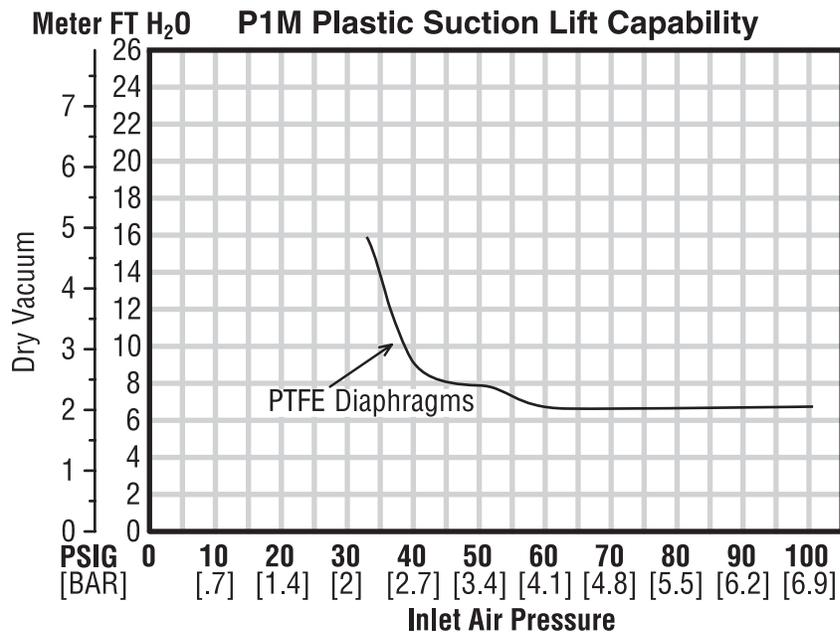


Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.

## SECTION 6

# SUCTION LIFT CURVE



These vacuum numbers will double when a small amount of back pressure is placed on the discharge.

Suction lift curves are calibrated for pumps operating at 305 m (1,000') above sea level. This chart is meant to be a guide only. There are many variables which can affect your pump's operating characteristics. The number of intake and

discharge elbows, viscosity of pumping fluid, elevation (atmospheric pressure) and pipe friction loss all affect the amount of suction lift your pump will attain.

# SECTION 7A

## INSTALLATION

---

The P1 Pro-Flo® model has a 13 mm ( $\frac{1}{2}$ " ) inlet and 13 mm ( $\frac{1}{2}$ " ) outlet and is designed for flows to 54 lpm (14.4 gpm). Refer to Section 5 for performance characteristics. The **P1 Metal** pump is manufactured with wetted parts of 316 Stainless Steel and Alloy C. The **P1** is available with a polypropylene or Acetal center section. A variety of diaphragms, valve balls, valve seats and o-rings are available to satisfy temperature, chemical compatibility, abrasion and flex concerns.

The suction pipe size should be at least 13 mm ( $\frac{1}{2}$ " ) diameter or larger if highly viscous material is being pumped. The suction hose must be non-collapsible, reinforced type as the P1 is capable of pulling a high vacuum. Discharge piping should be at least 13 mm ( $\frac{1}{2}$ " ); larger diameter can be used to reduce friction losses. It is critical that all fittings and connections are airtight or a reduction or loss of pump suction capability will result.

**INSTALLATION:** Months of careful planning, study, and selection efforts can result in unsatisfactory pump performance if installation details are left to chance.

Premature failure and long term dissatisfaction can be avoided if reasonable care is exercised throughout the installation process.

**LOCATION:** Noise, safety, and other logistical factors usually dictate where equipment will be situated on the production floor. Multiple installations with conflicting requirements can result in congestion of utility areas, leaving few choices for additional pumps.

Within the framework of these and other existing conditions, every pump should be located in such a way that key factors are balanced against each other to maximum advantage.

**ACCESS:** First of all, the location should be accessible. If it's easy to reach the pump, maintenance personnel will have an easier time carrying out routine inspections and adjustments. Should major repairs become necessary, ease of access can play a key role in speeding the repair process and reducing total downtime.

**AIR SUPPLY:** Every pump location should have an air line large enough to supply the volume of air necessary to achieve the desired pumping rate (see Section 5). Use air pressure up to a maximum of 8.6 bar (125 psig) depending on pumping requirements.

For best results, the pumps should use a 5 $\mu$  (micron) air filter, needle valve and regulator. The use of an air filter before the pump will ensure that the majority of any pipeline contaminants will be eliminated.

When operation is controlled by a solenoid valve in the air line, three-way valves should be used. This valve allows air trapped between the valve and the pump to bleed off which improves pump performance. Pumping volume can be determined by counting the number of strokes per minute and then multiplying the figure by the displacement per stroke.

**MUFFLER:** Sound levels are reduced below OSHA specifications using the standard Wilden muffler. Other mufflers can be used to further reduce sound levels, but they usually reduce pump performance.

**ELEVATION:** Selecting a site that is well within the pump's dynamic lift capability will assure that loss-of-prime troubles will be eliminated. In addition, pump efficiency can be adversely affected if proper attention is not given to site location.

**PIPING:** Final determination of the pump site should not be made until the piping problems of each possible location have been evaluated. The impact of current and future installations should be considered ahead of time to make sure that inadvertent restrictions are not created for any remaining sites.

The best choice possible will be a site involving the shortest and straightest hook-up of suction and discharge piping. Unnecessary elbows, bends, and fittings should be avoided. Pipe sizes should be selected so as to keep friction losses within practical limits. All piping should be supported independently of the pump. In addition, the piping should be aligned so as to avoid placing stress on the pump fittings.

Flexible hose can be installed to aid in absorbing the forces created by the natural reciprocating action of the pump. If the pump is to be bolted down to a solid location, a mounting pad placed between the pump and the foundation will assist in minimizing pump vibration. Flexible connections between the pump and rigid piping will also assist in minimizing pump vibration. If quick-closing valves are installed at any point in the discharge system, or if pulsation within a system becomes a problem, a surge suppressor should be installed to protect the pump, piping and gauges from surges and water hammer.

If the pump is to be used in a self-priming application, be sure that all connections are airtight and that the suction lift is within the model's ability. Note: Materials of construction and elastomer material have an effect on suction lift parameters. Please refer to Section 6 for specifics.

**The P1 can be installed in submersible applications** only when both the wetted and non-wetted portions are compatible with the material being pumped. If the pump is to be used in a submersible application, a hose should be attached to the pump's air and pilot spool exhaust ports and piped above the liquid level. The exhaust area for the pilot spool is designed to be tapped with a  $\frac{1}{8}$ " NPT fitting.

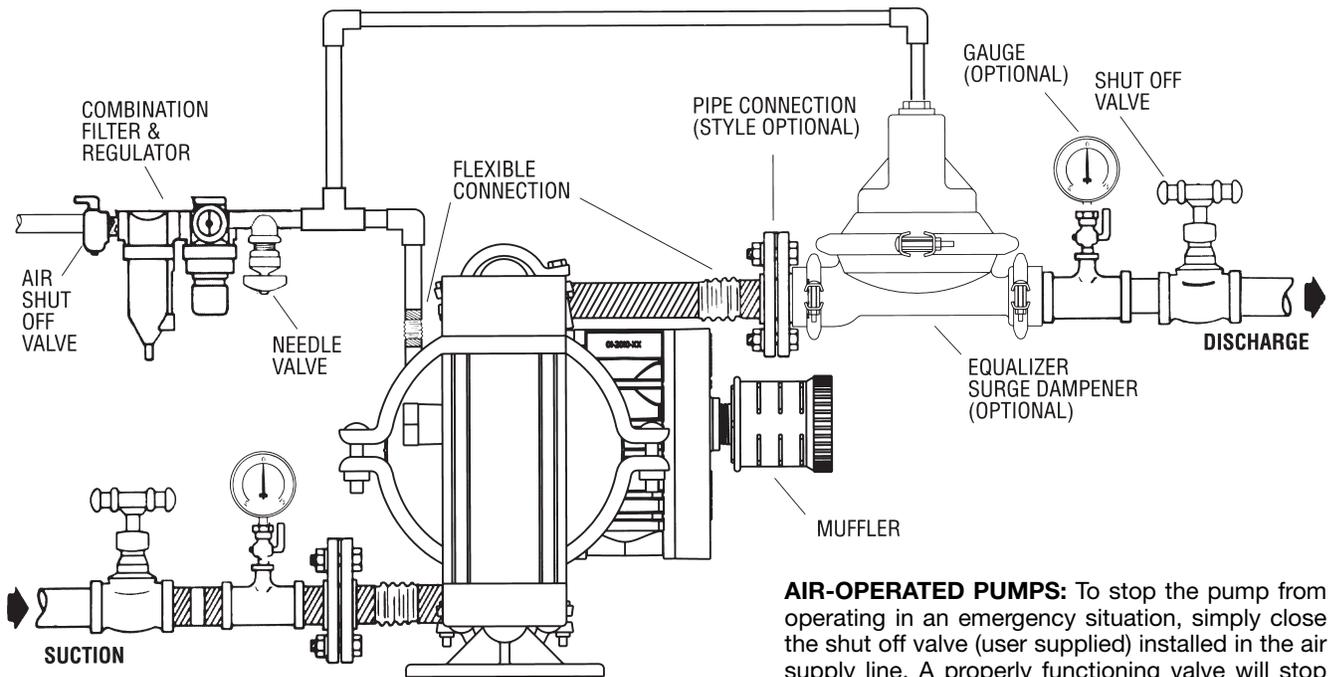
When pumps are installed in applications involving flooded suction or suction head pressures, a gate valve should be installed in the suction line to permit closing of the line for pump service.

Pumps in service with a positive suction head are most efficient when inlet pressure is limited to 7–10 psig (.5–.7 bar). Premature diaphragm failure may occur if positive suction is .7 bar (10 psig) and higher.

**THE MODEL P1 WILL PASS 1.6 MM ( $\frac{1}{16}$ " ) SOLIDS. WHENEVER THE POSSIBILITY EXISTS THAT LARGER SOLID OBJECTS MAY BE SUCKED INTO THE PUMP, A STRAINER SHOULD BE USED ON THE SUCTION LINE.**

**CAUTION: DO NOT EXCEED 8.6 BAR (125 PSIG) AIR SUPPLY PRESSURE.**

# SUGGESTED INSTALLATION



**AIR-OPERATED PUMPS:** To stop the pump from operating in an emergency situation, simply close the shut off valve (user supplied) installed in the air supply line. A properly functioning valve will stop the air supply to the pump, therefore stopping output. This shut off valve should be located far enough away from the pumping equipment such that it can be reached safely in an emergency situation.

**NOTE:** In the event of a power failure, the shutoff valve should be closed, if the restarting of the pump is not desirable once power is regained.

## SECTION 7B

# SUGGESTED OPERATION AND MAINTENANCE INSTRUCTIONS

**OPERATION:** Pump discharge rate can be controlled by limiting the volume and/or pressure of the air supply to the pump (preferred method). A regulator is used to regulate air pressure. A needle valve is used to regulate air volume. Pump discharge rate can also be controlled by throttling the pump discharge by partially closing a valve in the discharge line of the pump. This action increases friction loss which reduces flow rate. This is useful when the need exists to control the pump from a remote location. When the pump discharge pressure equals or exceeds the air supply pressure, the pump will stop; no bypass or pressure relief valve is needed, and pump damage will not occur. The pump has reached a “deadhead” situation and can be restarted by reducing the fluid discharge pressure or increasing the air inlet pressure. The Wilden P1 pump runs solely on compressed air and does not generate heat, therefore your process fluid temperature will not be affected.

**RECORDS:** When service is required, a record should be made of all necessary repairs and replacements. Over a period of time, such records can become a valuable tool for predicting and preventing future maintenance problems and unscheduled downtime. In addition, accurate records make it possible to identify pumps that are poorly suited to their applications.

**MAINTENANCE AND INSPECTIONS:** Since each application is unique, maintenance schedules may be different for every pump. Frequency of use, line pressure, viscosity and abrasiveness of process fluid all affect the parts life of a Wilden pump. Periodic inspections have been found to offer the best means for preventing unscheduled pump downtime. Personnel familiar with the pump’s construction and service should be informed of any abnormalities that are detected during operation.

# **SECTION 7C**

## **TROUBLESHOOTING**

---

### ***Pump will not run or runs slowly.***

1. Ensure that the air inlet pressure is at least .35 bar (5 psig) above startup pressure and that the differential pressure (the difference between air inlet and liquid discharge pressures) is not less than .7 bar (10 psig).
2. Check air inlet filter for debris (see recommended installation).
3. Check for extreme air leakage (blow by) which would indicate worn seals/bores in the air valve, pilot spool, main shaft.
4. Disassemble pump and check for obstructions in the air passageways or objects which would obstruct the movement of internal parts.
5. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. Also, as the check valve balls wear out, they become smaller and can become stuck in the seats. In this case, replace balls and seats.
6. Check for broken inner piston which will cause the air valve spool to be unable to shift.
7. Remove plug from pilot spool exhaust.

### ***Pump runs but little or no product flows.***

1. Check for pump cavitation; slow pump speed down to allow thick material to flow into liquid chambers.
2. Verify that vacuum required to lift liquid is not greater than the vapor pressure of the material being pumped (cavitation).

3. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. Also, as the check valve balls wear out, they become smaller and can become stuck in the seats. In this case, replace balls and seats.

### ***Pump air valve freezes.***

1. Check for excessive moisture in compressed air. Either install a dryer or hot air generator for compressed air. Alternatively, a coalescing filter may be used to remove the water from the compressed air in some applications.

### ***Air bubbles in pump discharge.***

1. Check for ruptured diaphragm.
2. Check tightness of outer pistons (refer to Section 8C).
3. Check tightness of clamp bands and integrity of o-rings and seals, especially at intake manifold.
4. Ensure pipe connections are airtight.

### ***Product comes out air exhaust.***

1. Check for diaphragm rupture.
2. Check tightness of outer pistons to shaft.

## SECTION 8A

# MODEL P1 METAL DIRECTIONS FOR DISASSEMBLY/REASSEMBLY

**CAUTION:** Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump. Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Be aware of any hazardous effects of contact with your process fluid.

The Wilden model P1 has a 13 mm ( $\frac{1}{2}$ " ) inlet and outlet and is designed for flows up to 54 lpm (14.4 gpm). The single-piece center section, consisting of center block and air chambers, is molded of acetal or polypropylene. All fasteners and hardware are stainless steel and the air valve is manufactured of high-tech engineered plastic. All o-rings used in the pump are of a special material and shore hardness which should only be replaced with factory-supplied parts.

### TOOLS REQUIRED:

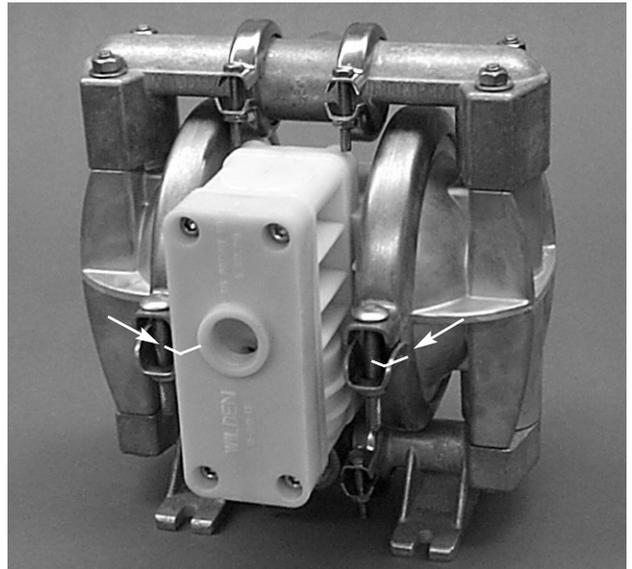
$\frac{3}{8}$ " Box Wrench

$\frac{7}{16}$ " Wrench

Adjustable Wrench

Vise equipped with soft jaws (such as plywood, plastic or other suitable material)

**NOTE:** The model used for these instructions incorporates rubber diaphragms, balls, and seats. Models with Teflon® diaphragms, balls and seats are the same except where noted.

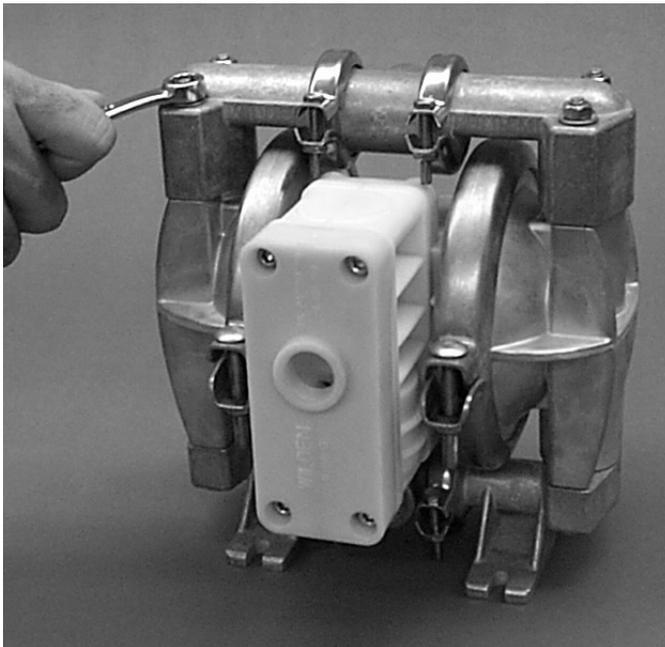


### DISASSEMBLY:

Figure 1

#### Step 1.

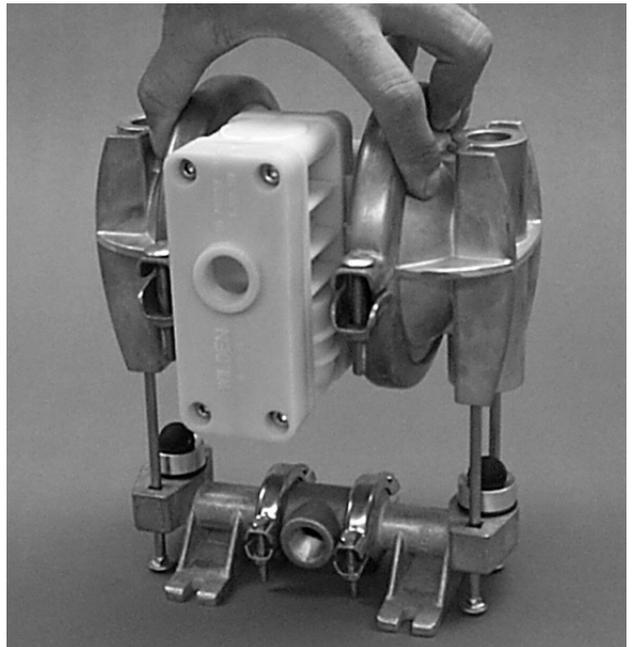
Before starting disassembly, mark a line from each liquid chamber to its corresponding air chamber. This line will assist in proper alignment during reassembly. (Figure 1)



#### Step 2.

Figure 2

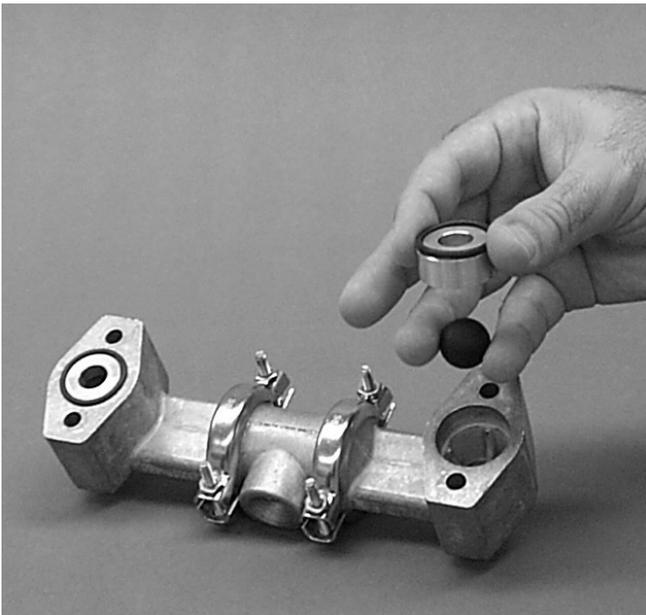
Utilizing the  $\frac{3}{8}$ " box wrench, start by removing the four long carriage bolts that hold the top and bottom manifolds to the center section. (Figure 2)



#### Step 3.

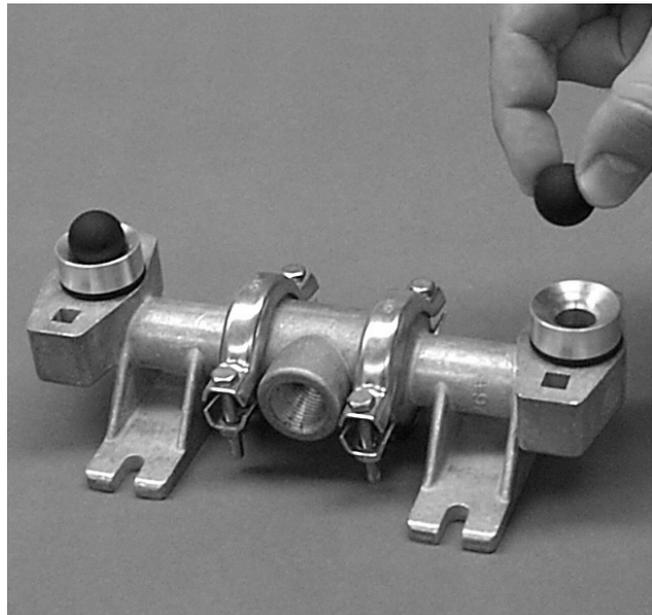
Figure 3

Remove the top manifold and lift the center section off the inlet manifold. (Figure 3)



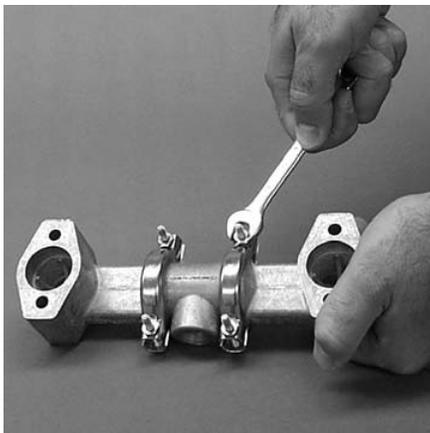
**Step 4.** *Figure 4*

Remove the discharge valve balls, seats and o-rings from the discharge manifold and inspect for nicks, gouges, chemical attack or abrasive wear. Replace worn parts with genuine Wilden parts for reliable performance. PTFE o-rings should be replaced when reassembled. (Figure 4)



**Step 5.** *Figure 5*

Inspect the ball retainer, retainer o-ring, and valve ball from intake manifold. Check for nicks, gouges, chemical attack or abrasive wear. Replace worn parts with genuine Wilden parts for reliable performance. PTFE o-rings should be replaced when reassembled. (Figure 5)



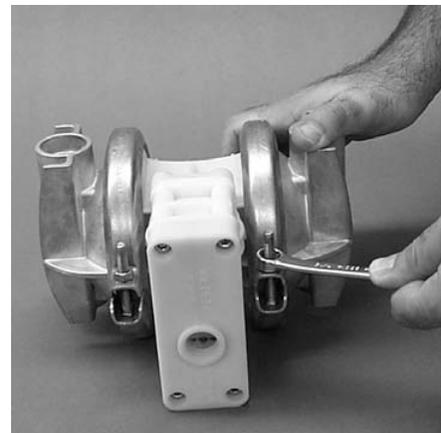
**Step 6.** *Figure 6*

Normally the inlet and discharge manifold should not be disassembled during regular pump maintenance. Should this be necessary, completely remove and disassemble manifold clamp bands utilizing a  $\frac{3}{8}$ " wrench. (Figure 6)



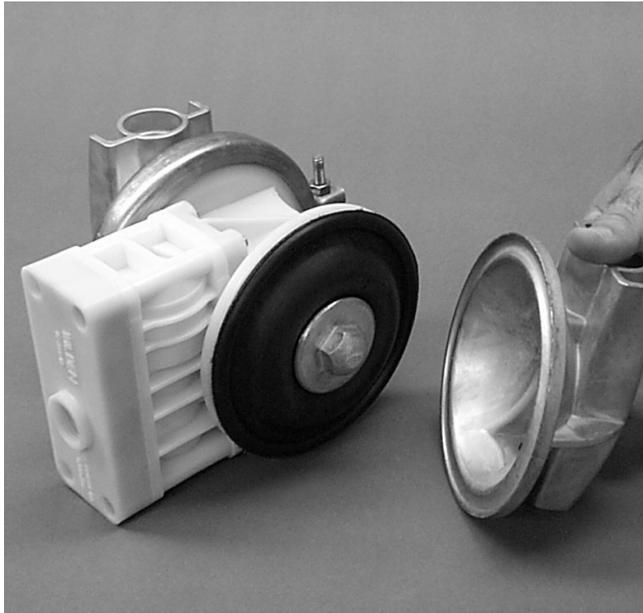
**Step 7.** *Figure 7*

Inspect o-rings for wear or damage and replace if necessary. PTFE o-rings should be replaced when reassembled. (Figure 7)



**Step 8.** *Figure 8*

Use a  $\frac{3}{8}$ " wrench to remove one set of clamp bands that secure one liquid chamber to the one-piece center section. (Figure 8)



**Step 9.** *Figure 9*

Lift the liquid chamber away from the center section to expose the diaphragm and outer piston. (Figure 9)



**Step 10.** *Figure 10*

Using an adjustable wrench, or by rotating the diaphragm by hand, remove the diaphragm assembly from the center section. (Figure 10)



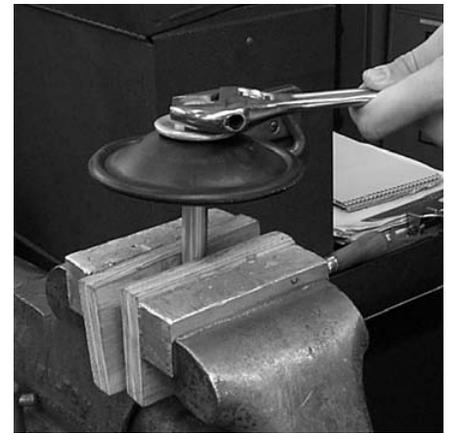
**Step 11A.** *Figure 11A*

**NOTE:** Due to varying torque values, one of the following two situations may occur: 1) The outer piston, diaphragm and inner piston remain attached to the shaft and the entire assembly can be removed from the center section. (Figure 11A)



**Step 11B.** *Figure 11B*

2) The outer piston, diaphragm, inner piston, and disc spring separate from the shaft which remains connected to the opposite side diaphragm assembly (Figure 11B). PTFE-fitted pumps come standard with back-up diaphragms (not shown).



**Step 12.** *Figure 12*

To remove the diaphragm assembly from the shaft, secure shaft with soft jaws (a vise fitted with plywood or other suitable material) to ensure shaft is not nicked, scratched, or gouged. Using an adjustable wrench, remove diaphragm assembly from shaft. Inspect all parts for wear and replace with genuine Wilden parts if necessary. (Figure 12)

## SECTION 8B

# PRO-FLO® AIR VALVE/CENTER SECTION DISASSEMBLY, CLEANING, INSPECTION

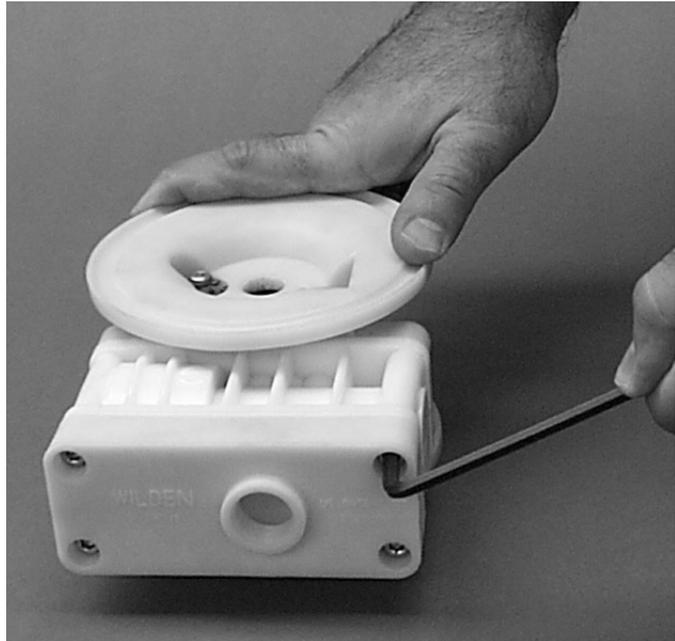
### AIR VALVE DISASSEMBLY:

**CAUTION:** Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump. Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Be aware of hazardous effects of contact with your process fluid.

The Wilden Metal P1 utilizes a revolutionary Pro-Flo® air distribution system. A 13 mm (½") air inlet connects the air supply to the center section. Proprietary composite seals reduce the coefficient of friction and allow the P1 to run lube-free. Constructed of Acetal or Polypropylene, the Pro-Flo® air distribution system is designed to perform in on/off, non-freezing, non-stalling, tough duty applications.

### TOOLS REQUIRED:

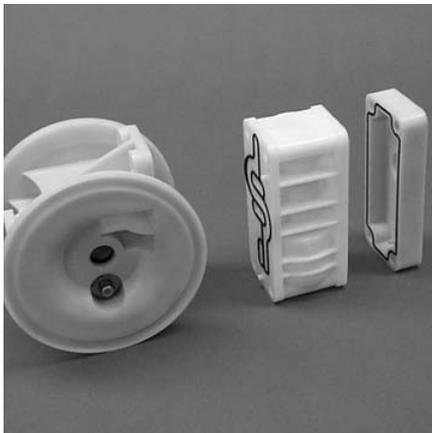
⅜" Hex Head Wrench  
½" Hex Head Wrench  
Snap Ring Pliers  
O-Ring Pick



**Step 1.**

*Figure 1*

Loosen the air valve bolts utilizing a ⅜" hex head wrench. (Figure 1)



**Step 2.**

*Figure 2*

Remove muffer plate and air valve bolts from air valve assembly (Figure 2) exposing muffer gasket for inspection. Replace if necessary.



**Step 3.**

*Figure 3*

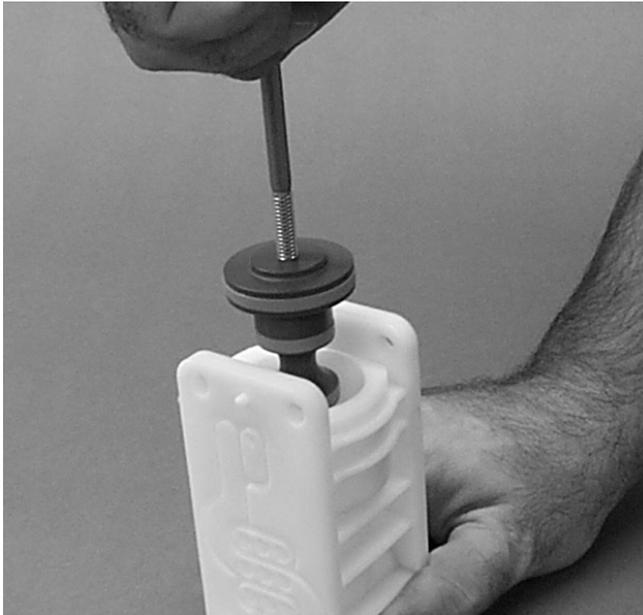
Lift away air valve assembly and remove air valve gasket for inspection (Figure 3). Replace if necessary.



**Step 4.**

*Figure 4*

Remove air valve end cap to expose air valve spool by simply lifting up on end cap once air valve bolts are removed. (Figure 4)



**Step 5.** *Figure 5*

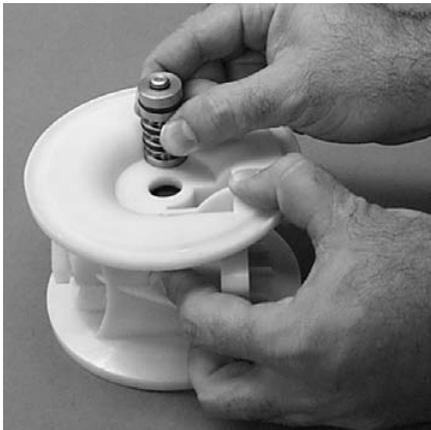
Remove air valve spool from air valve body by threading one air valve bolt into the end of the spool and gently sliding the spool out of the air valve body (*Figure 5*). Inspect seals for signs of wear and replace entire assembly if necessary. Use caution when handling air valve spool to prevent damaging seals.

**NOTE:** Seals should not be removed from assembly.  
Seals are not sold separately.



**Step 6.** *Figure 6*

Remove pilot spool retaining snap ring on both sides of center section with snap ring pliers (*Figure 6*).



**Step 7.** *Figure 7*

Remove pilot spool sleeve from center section (*Figure 7*).



**Step 8.** *Figure 8*

With o-ring pick, gently remove the o-ring from the opposite side of the "center hole" cut on the spool. Gently remove the pilot spool from sleeve and inspect for nicks or gouges and other signs of wear. Replace pilot sleeve assembly or outer sleeve o-rings if necessary. During re-assembly never insert the pilot spool into the sleeve with the "center cut" side first, this end incorporates the urethane o-ring and will be damaged as it slides over the ports cut in the sleeve.

**NOTE:** Seals should not be removed from pilot spool.  
Seals are not sold separately.



**Step 9.** *Figure 9*

Check center section Glyd™ rings for signs of wear. If necessary, remove Glyd™ rings with o-ring pick and replace. (*Figure 9*)

## SECTION 8C

# REASSEMBLY HINTS & TIPS

---

### ASSEMBLY:

Upon performing applicable maintenance to the air distribution system, the pump can now be reassembled. Please refer to the disassembly instructions for photos and parts placement. To reassemble the pump, follow the disassembly instructions in reverse order. The air distribution system needs to be assembled first, then the diaphragms and finally the wetted path. Please find the applicable torque specifications on this page. The following tips will assist in the assembly process.

- Clean the inside of the center section shaft bore to ensure no damage is done to new seals.
- Stainless bolts should be lubed to reduce the possibility of seizing during tightening.
- Level the water chamber side of the intake/discharge manifold to ensure a proper sealing surface. This is most easily accomplished by placing them on a flat surface prior to tightening their clamp bands to the desired torque (see this page for torque specs).
- Be sure to tighten outer pistons simultaneously on PTFE-fitted pumps to ensure proper torque values.
- Ensure proper mating of liquid chambers to manifolds prior to tightening vertical bolts. Overhang should be equal on both sides.
- Apply a small amount of Loctite 242 to the shaft interval threads before the diaphragm assembly.
- Concave side of disc spring in diaphragm assembly faces **toward** shaft.

### MAXIMUM TORQUE SPECIFICATIONS

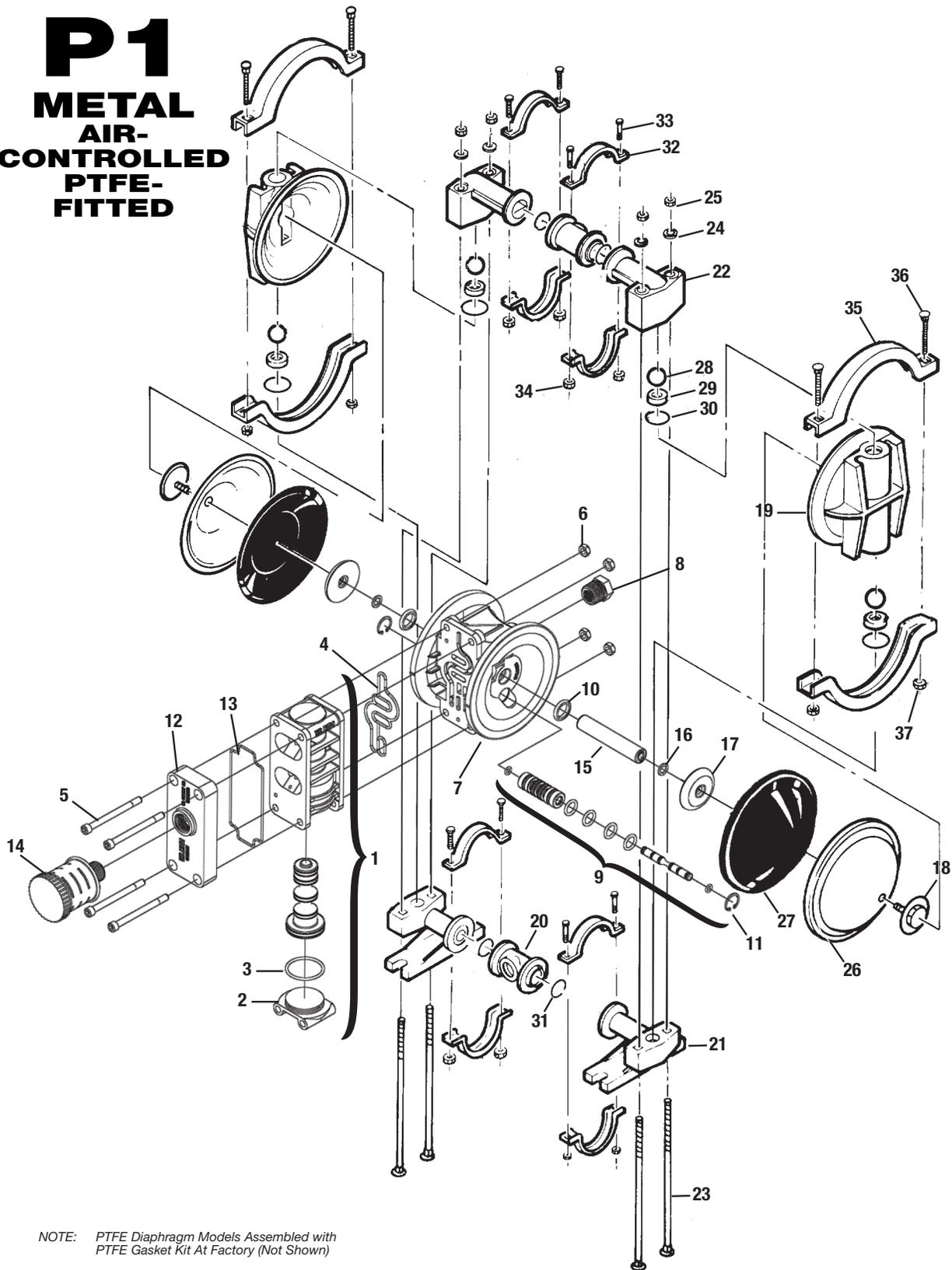
Description of Part	Metal Pumps
Air Valve, Pro-Flo®	2.8 N•m [25 in.-lbs.]
Outer Piston	10.2 N•m [90 in.-lbs.]
Small Clamp Band	1.7 N•m [15 in.-lbs.]
Large Clamp Band (Teflon®-Fitted)	9.6 N•m [85 in.-lbs.]
Vertical Bolts	14.1 N•m [125 in.-lbs.]
Air Inlet, Reducer Bushing	13.6 N•m [10 ft.-lbs.]



# SECTION 9A

# EXPLODED VIEW/PARTS LISTING

## P1 METAL AIR- CONTROLLED PTFE- FITTED



NOTE: PTFE Diaphragm Models Assembled with PTFE Gasket Kit At Factory (Not Shown)

## MODEL P1 METAL PTFE-FITTED

Item	Part Description	Qty. Per Pump	P1/	P1/	P1/	P1/	P1/	P1/
			SPPP/900	HPPP/900	SPPP/903	SLLL/900	HLLL/900	SLLL/903
			P/N	P/N	P/N	P/N	P/N	P/N
<b>1</b>	<b>Pro-Flo® Air Valve Assembly<sup>1</sup></b>	<b>1</b>	<b>01-2010-20</b>	<b>01-2010-20</b>	<b>01-2010-20</b>	<b>01-2010-13</b>	<b>01-2010-13</b>	<b>01-2010-13</b>
2	End Cap	1	01-2332-20	01-2332-20	01-2332-20	01-2332-13	01-2332-13	01-2332-13
3	O-Ring, End Cap	1	01-2395-52	01-2395-52	01-2395-52	01-2395-52	01-2395-52	01-2395-52
4	Gasket, Air Valve	1	01-2615-52	01-2615-52	01-2615-52	01-2615-52	01-2615-52	01-2615-52
5	Screw, HSHC, Air Valve ¼-20	4	01-6001-03	01-6001-03	01-6001-03	01-6001-03	01-6001-03	01-6001-03
6	Nut, Hex, ¼"-20	4	04-6400-03	04-6400-03	04-6400-03	04-6400-03	04-6400-03	04-6400-03
7	Center Section Assembly	1	01-3140-20	01-3140-20	01-3140-20	01-3140-13	01-3140-13	01-3140-13
8	Bushing, Reducer	1	01-6950-20	01-6950-20	01-6950-20	01-6950-20	01-6950-20	01-6950-20
9	Removable Pilot Sleeve Assembly	1	01-3880-99	01-3880-99	01-3880-99	01-3880-99	01-3880-99	01-3880-99
<b>10</b>	<b>Glyd™ Ring II</b>	<b>2</b>	<b>01-3220-55</b>	<b>01-3220-55</b>	<b>01-3220-55</b>	<b>01-3220-55</b>	<b>01-3220-55</b>	<b>01-3220-55</b>
11	Retaining Ring	2	00-2650-03	00-2650-03	00-2650-03	00-2650-03	00-2650-03	00-2650-03
12	Muffler Plate	1	01-3181-20	01-3181-20	01-3181-20	01-3181-20	01-3181-20	01-3181-20
13	Gasket, Muffler Plate	1	01-3505-52	01-3505-52	01-3505-52	01-3505-52	01-3505-52	01-3505-52
14	Muffler	1	02-3510-99	02-3510-99	01-3510-99	02-3510-99	02-3510-99	01-3510-99
15	Shaft, Pro-Flo®	1	01-3810-03	01-3810-03	01-3810-03	01-3810-03	01-3810-03	01-3810-03
16	Disc Spring (Belleville Washer)	2	01-6802-08	01-6802-08	01-6802-08	01-6802-08	01-6802-08	01-6802-08
17	Inner Piston	2	01-3711-08	01-3711-08	01-3711-08	01-3711-08	01-3711-08	01-3711-08
18	Outer Piston	2	01-4570-03	01-4570-04	01-4570-03	01-4570-03	01-4570-04	01-4570-03
19	Liquid Chamber	2	01-5000-03	01-5000-04	01-5000-03	01-5000-03	01-5000-04	01-5000-03
20	Manifold Tee Section	2	01-5160-03	01-5160-04	01-5160-03-70	01-5160-03	01-5160-04	01-5160-03-70
21	Inlet Manifold Elbow	2	01-5220-03	01-5220-04	01-5220-03	01-5220-03	01-5220-04	01-5220-03
22	Discharge Manifold Elbow	2	01-5230-03	01-5230-04	01-5230-03	01-5230-03	01-5230-04	01-5230-03
23	Screw, SHCS (Chamber Bolt)	4	01-6080-03	01-6080-03	01-6080-03	01-6080-03	01-6080-03	01-6080-03
24	Vertical Bolt Washer	4	01-6730-03	01-6730-03	01-6730-03	01-6730-03	01-6730-03	01-6730-03
25	Vertical Bolt Nut	4	04-6400-03	04-6400-03	04-6650-03-70	04-6400-03	04-6400-03	04-6650-03-70
<b>26</b>	<b>PTFE Primary Diaphragm</b>	<b>2</b>	<b>01-1010-55</b>	<b>01-1010-55</b>	<b>01-1010-55</b>	<b>01-1010-55</b>	<b>01-1010-55</b>	<b>01-1010-55</b>
<b>27</b>	<b>Backup Diaphragm</b>	<b>2</b>	<b>01-1060-56</b>	<b>01-1060-56</b>	<b>01-1060-56</b>	<b>01-1060-56</b>	<b>01-1060-56</b>	<b>01-1060-56</b>
<b>28</b>	<b>Valve Ball</b>	<b>4</b>	<b>01-1080-55</b>	<b>01-1080-55</b>	<b>01-1080-55</b>	<b>01-1080-55</b>	<b>01-1080-55</b>	<b>01-1080-55</b>
<b>29</b>	<b>Valve Seat</b>	<b>4</b>	<b>01-1120-03</b>	<b>01-1120-04</b>	<b>01-1120-03</b>	<b>01-1120-03</b>	<b>01-1120-04</b>	<b>01-1120-03</b>
<b>30</b>	<b>Valve Seat O-Ring</b>	<b>4</b>	<b>01-1200-55</b>	<b>01-1200-55</b>	<b>01-1200-55</b>	<b>01-1200-55</b>	<b>01-1200-55</b>	<b>01-1200-55</b>
<b>31</b>	<b>Manifold O-Ring</b>	<b>4</b>	<b>01-1300-55</b>	<b>01-1300-55</b>	<b>01-1300-55</b>	<b>01-1300-55</b>	<b>01-1300-55</b>	<b>01-1300-55</b>
32	Small Clamp Band Assy.	4	01-7100-03	01-7100-03	01-7100-03	01-7100-03	01-7100-03	01-7100-03
33	Small Clamp Band Bolt	8	01-6101-03	01-6101-03	01-6101-03	01-6101-03	01-6101-03	01-6101-03
34	Small Clamp Band Nut	8	01-6400-03	01-6400-03	01-6400-03	01-6400-03	01-6400-03	01-6400-03
35	Large Clamp Band Assy.	2	01-7300-03	01-7300-03	01-7300-03	01-7300-03	01-7300-03	01-7300-03
36	Large Clamp Band Bolt	4	01-6070-03	01-6070-03	01-6070-03	01-6070-03	01-6070-03	01-6070-03
37	Large Clamp Band Nut	4	04-6400-03	04-6400-03	04-6650-03-70	04-6400-03	04-6400-03	04-6650-03-70

<sup>1</sup>Air Valve Assembly includes items 2 and 3.

All boldface items are primary wear parts.

## SECTION 9B

# MATERIAL CODE DESIGNATIONS

Material Code	Material Description	Material Code	Material Description
01	Aluminum	51	Neoprene
02	Cast Iron	52	Buna-N / Nitrile
03	Stainless Steel	53	Viton® / FKM
04	Alloy C	54	Nordel® / EPDM
05	PTFE coated	55	PTFE
06	Electroless, nickel plated	56	Saniflex™ / Hytrel
07	Brass	57	FDA Wil-Flex™
08	Alloy Steel	58	Wil-Flex™
09	Mild steel, chrome plated	59	PTFE encapsulated silicone
10	Stainless steel, polished	60	PTFE encapsulated Viton®
11	Aluminum, anodized	61	Buna-N high temp.
12	Cardboard	62	Polyurethane - ether
13	Acetal	63	50/50 Wil-Flex™
14	Plexiglass®	64	PTFE/Neoprene laminate
16	Acetal, carbon filled	65	Isoplast®
17	Polyvinyl Chloride (PVC)	66	Delrin® AF
20	Polypropylene	67	R.T.P.
21	Kynar®/PVDF	68	FDA Viton®
22	PTFE/PFA	69	FDA Buna-N
23	Nylon	70	Isoplast®, SS filled
24	Phenolic	71	Verton®
26	Polyethylene	72	PTFE/EPDM laminate
28	Nylon, graphite filled	73	HALAR® coated aluminum
29	Nylon, clear	74	FDA EPDM
30	Cellulose fiber	75	Polyetheretherketone (PEEK), carbon filled
31	Armstrong N8090	76	Polyetherimide (PEI)
32	UHMW Polyethylene	77	Polyphenylene sulfide (PPS), glass filled
33	Chemraz®	78	Vinyl ester, glass filled
34	Fluoro-Seal™	79	G-10 fiberglass
37	Turcite®	81	EPDM/PTFE laminate
48	Expanded PTFE	82	Viton/PTFE laminate
49	Polyurethane	99	Multiple materials/Assemblies
50	Polyurethane - ester		





## WARRANTY

Each and every product manufactured by Wilden Pump and Engineering, LLC is built to meet the highest standards of quality. Every pump is functionally tested to insure integrity of operation.

Wilden Pump and Engineering, LLC warrants that pumps, accessories and parts manufactured or supplied by it to be free from defects in material and workmanship for a period of five (5) years from date of installation or six (6) years from date of manufacture, whichever comes first. Failure due to normal wear, misapplication, or abuse is, of course, excluded from this warranty.

Since the use of Wilden pumps and parts is beyond our control, we cannot guarantee the suitability of any pump or part for a particular application and Wilden Pump and Engineering, LLC shall not be liable for any consequential damage or expense arising from the use or misuse of its products on any application. Responsibility is limited solely to replacement or repair of defective Wilden pumps and parts.

All decisions as to the cause of failure are the sole determination of Wilden Pump and Engineering, LLC.

Prior approval must be obtained from Wilden for return of any items for warranty consideration and must be accompanied by the appropriate MSDS for the product(s) involved. A Return Goods Tag, obtained from an authorized Wilden distributor, must be included with the items which must be shipped freight prepaid.

The foregoing warranty is exclusive and in lieu of all other warranties expressed or implied (whether written or oral) including all implied warranties of merchantability and fitness for any particular purpose. No distributor or other person is authorized to assume any liability or obligation for Wilden Pump and Engineering, LLC other than expressly provided herein.

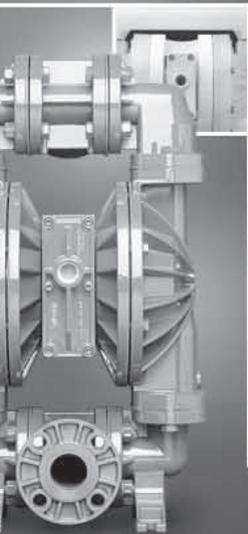
### PLEASE PRINT OR TYPE AND FAX TO WILDEN

PUMP INFORMATION			
Item # _____		Serial # _____	
Company Where Purchased _____			
YOUR INFORMATION			
Company Name _____			
Industry _____			
Name _____		Title _____	
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Telephone _____	Fax _____	E-mail _____	Web Address _____
Number of pumps in facility? _____		Number of Wilden pumps? _____	
Types of pumps in facility (check all that apply): <input type="checkbox"/> Diaphragm <input type="checkbox"/> Centrifugal <input type="checkbox"/> Gear <input type="checkbox"/> Submersible <input type="checkbox"/> Lobe			
<input type="checkbox"/> Other _____			
Media being pumped? _____			
How did you hear of Wilden Pump? <input type="checkbox"/> Trade Journal <input type="checkbox"/> Trade Show <input type="checkbox"/> Internet/E-mail <input type="checkbox"/> Distributor			
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## SANIFLO™ SANITARY PUMP TECHNOLOGY

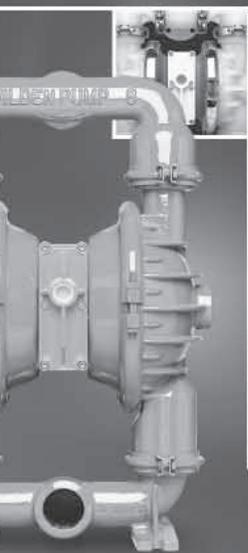
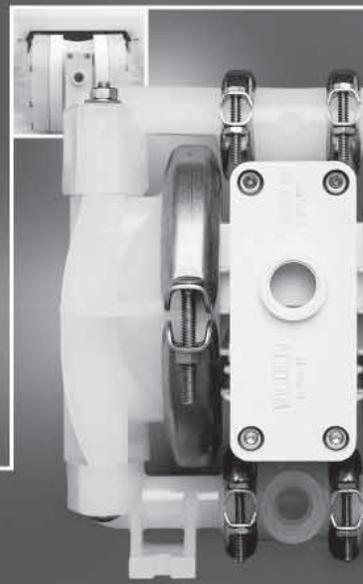
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