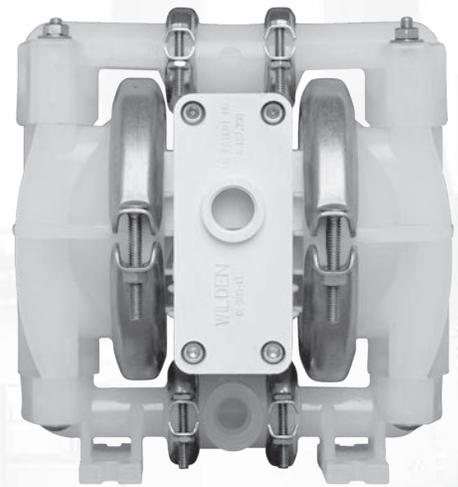


WILDEN®

Part of Pump Solutions Group

A **DOVER** COMPANY

P1
Original™ Series
PLASTIC Pumps



Where Innovation Flows

www.wilden-pumps.com

PROFLO®
PROGRESSIVE PUMP TECHNOLOGY



WIL-10140-E-08
REPLACES WIL-10140-E-07

TABLE OF CONTENTS

SECTION 1 CAUTIONS—READ FIRST! 1

SECTION 2 WILDEN PUMP DESIGNATION SYSTEM 2

SECTION 3 HOW IT WORKS—PUMP & AIR DISTRIBUTION SYSTEM 3

SECTION 4 DIMENSIONAL DRAWINGS 4

SECTION 5 PERFORMANCE

- A. P1 Plastic - Rubber-Fitted 5
 - P1 Plastic -TPE-Fitted..... 5
 - P1 Plastic - PTFE-Fitted 6
- B. Suction Lift Curves 6

SECTION 6 SUGGESTED INSTALLATION, OPERATION & TROUBLESHOOTING 7



CAUTIONS — READ FIRST!

TEMPERATURE LIMITS:

Polypropylene	0°C to 79°C	32°F to 175°F
PVDF	-12°C to 107°C	10°F to 225°F
PTFE PFA	-28.9°C to 148.9°C	-20°F to 300°F
Neoprene	-17.8°C to 93.3°C	0°F to 200°F
Buna-N	-12.2°C to 82.2°C	10°F to 180°F
EPDM	-51.1°C to 137.8°C	-60°F to 280°F
Viton®	-40°C to 176.7°C	-40°F to 350°F
Wil-Flex™	-40°C to 107.2°C	-40°F to 225°F
Polyurethane	12.2°C to 65.6°C	10°F to 150°F
Saniflex™	-28.9°C to 104.4°C	-20°F to 220°F
PTFE	4.4°C to 104.4°C	40°F to 220°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: Plastic series pumps are made of virgin plastic and are not UV stabilized. Direct sunlight for prolonged periods can cause deterioration of plastics.



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 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: Only explosion proof (NEMA 7) solenoid valves should be used in areas where explosion proof equipment is required.



NOTE: Non lube-free pumps must be lubricated. Wilden suggests an arctic 5 weight oil (ISO grade 15). Do not over-lubricate air supply. Over-lubrication will reduce pump performance.



NOTE: P1 Plastic PTFE-fitted pumps come standard from the factory with expanded PTFE gaskets. (See Gasket Kit Installation in Section 8E.)



CAUTION: Do not over-tighten the air valve bolts. Too much torque on the air valve bolts may damage the air valve muffler plate. Do not exceed 3.3 N•m (29 in-lbs).

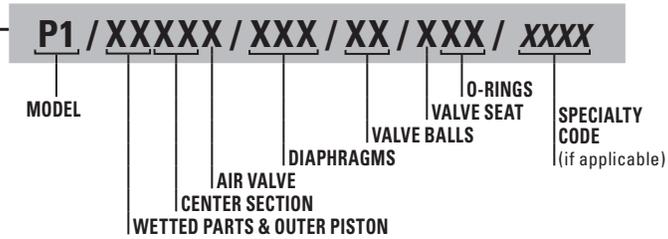


WILDEN PUMP DESIGNATION SYSTEM

**P1 ORIGINAL™
PLASTIC**

13 mm (1/2") Pump
Maximum Flow Rate:
56.8 lpm (15.0 gpm)

LEGEND



MATERIAL CODES

WETTED PARTS & OUTER PISTON

- KK = PVDF / PVDF
- KZ = PVDF / NO PISTON
- PP = POLYPROPYLENE / POLYPROPYLENE
- TT = PFA / PFA
- TZ = PTFE / NO PISTON

CENTER SECTION

- LL = ACETAL
- PP = POLYPROPYLENE

AIR VALVE

- P = POLYPROPYLENE

DIAPHRAGMS

- BNS = BUNA-N (Red Dot)
- FSS = SANIFLEX™ [Hytrel® (Cream)]
- PUS = POLYURETHANE (Clear)
- THU = PTFE W/HIGH-TEMP BUNA-N BACK-UP
- TEU = PTFE W/EPDM BACK-UP (White)
- TNU = PTFE W/NEOPRENE BACK-UP (White)
- TNL = PTFE W/NEOPRENE BACK-UP O-RING, IPD (White)
- VTS = VITON® (White Dot)
- WFS = WIL-FLEX™ [Santoprene® (Orange Dot)]

VALVE BALL

- BN = BUNA-N (Red Dot)
- FS = SANIFLEX™ [Hytrel® (Cream)]
- PU = POLYURETHANE (Brown)
- TF = PTFE (White)
- VT = VITON® (White Dot)
- WF = WIL-FLEX™ [Santoprene® (OrangeDot)]

VALVE SEAT

- K = PVDF
- P = POLYPROPYLENE

VALVE SEAT O-RING

- BN = BUNA-N
- FS = SANIFLEX™ [Hytrel® (Cream)]
- PU = POLYURETHANE (Brown)
- TV = PTFE ENCAP. VITON®
- WF = WIL-FLEX™ [Santoprene®]

SPECIALTY CODES

- | | | |
|---|--|--|
| 0100 Wil-Gard II™ 110V | 0525 Ultrapure II, female connections, PFA coated hardware, Wil-Gard II™ sensor wires ONLY | 0603 PFA coated hardware, Wil-Gard II™ 110V |
| 0102 Wil-Gard II™ sensor wires ONLY | 0530 Ultrapure II, Wil-Gard II™ 110V, female connections | 0608 PFA coated hardware, Wil-Gard II™ 220V |
| 0103 Wil-Gard II™ 220V | 0531 Ultrapure II, female connections, Wil-Gard II™ sensor wires ONLY | 0612 Ultrapure, PFA coated hardware, male connections |
| 0206 PFA coated hardware, Wil-Gard II™ sensor wires ONLY | 0532 Ultrapure II, PFA coated hardware, Wil-Gard II™ 110V, male bondable connections | 0618 Ultrapure, PFA coated hardware, Wil-Gard II™ 110V, male connections |
| 0502 PFA coated hardware | 0533 Ultrapure II, PFA coated hardware, Wil-Gard II™ 220V, male bondable connections | 0622 Ultrapure, male connections |
| 0520 Ultrapure II, female connections | 0560 Split manifold | 0623 Ultrapure, adapter block, no muffler, male connections |
| 0521 Ultrapure II, PFA coated hardware, female connections | 0561 Split manifold, PFA coated hardware | 0624 Ultrapure, Wil-Gard II™ 110V, male connections |
| 0522 Ultrapure II, male bondable connections | 0563 Split manifold, discharge only | 0660 Split manifold, Wil-Gard II™ 110V |
| 0523 Ultrapure II, PFA coated hardware, male bondable connections | 0564 Split manifold, Inlet ONLY | 0661 Split manifold, PFA coated hardware, Wil-Gard II™ 110V |
| 0524 Ultrapure II, Wil-Gard II™ 110V, male bondable connections | | |

NOTE: MOST ELASTOMERIC MATERIALS USE COLORED DOTS FOR IDENTIFICATION.

Viton® is registered trademarks of DuPont Dow Elastomers.

HOW IT WORKS—PUMP

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.

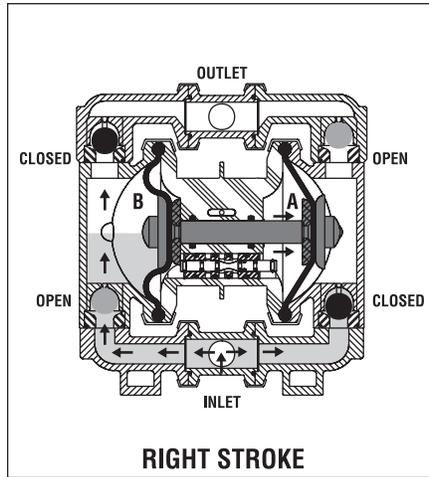


FIGURE 1 The air valve directs pressurized air to the back side of diaphragm A. The compressed air is applied directly to the liquid column separated by elastomeric diaphragms. The diaphragm acts as a separation membrane between the compressed air and liquid, balancing the load and removing mechanical 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).

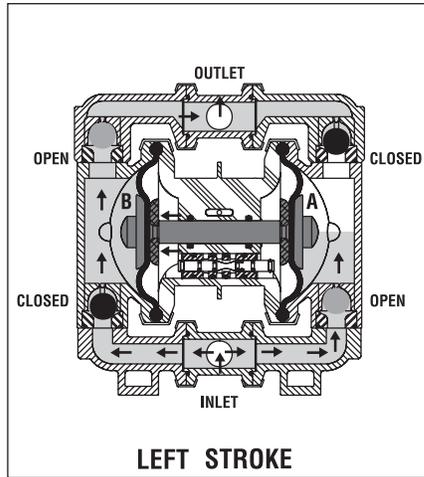


FIGURE 2 When the pressurized diaphragm, diaphragm A, reaches the limit of its discharge stroke, the air valve redirects pressurized air to the back side of diaphragm B. The pressurized air forces diaphragm B away from the center block while pulling diaphragm A to the center block. Diaphragm B is now 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.

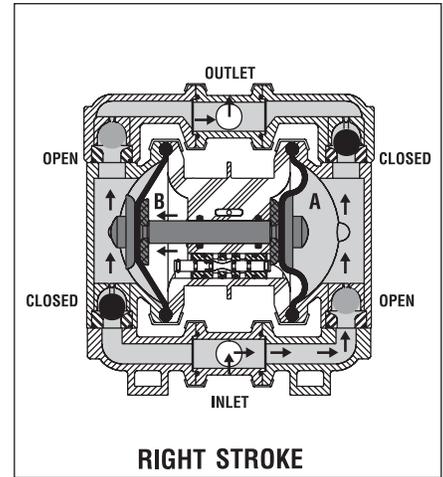


FIGURE 3 At completion of the stroke, the air valve again redirects air to the back side of diaphragm A, which starts diaphragm B on its exhaust stroke. As the pump reaches its original starting point, each diaphragm has gone through one exhaust and one discharge stroke. This constitutes one complete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

HOW IT WORKS—AIR DISTRIBUTION SYSTEM

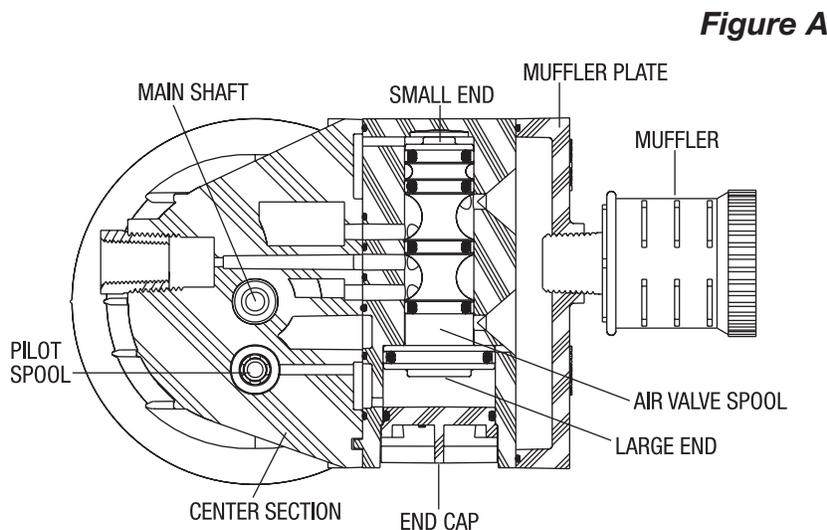


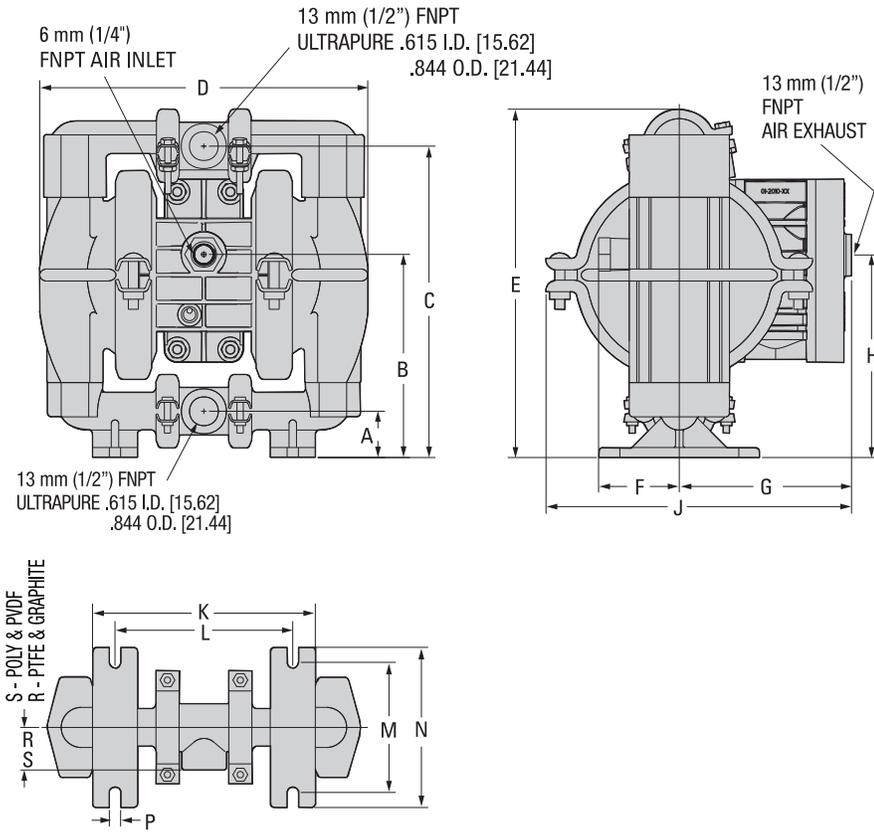
Figure A

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.

DIMENSIONAL DRAWINGS

DIMENSIONS

ITEM	METRIC (mm)	STANDARD (inch)
A	31	1.2
B	130	5.1
C	196	7.7
D	208	8.2
E	218	8.6
F	56	2.2
G	114	4.5
H	127	5.0
J	203	8.0
K	145	5.7
L	114	4.5
M	84	3.3
N	102	4.0
P	8	0.3
R	20	0.8
S	28	1.1



**P1 PLASTIC
PTFE-FITTED**

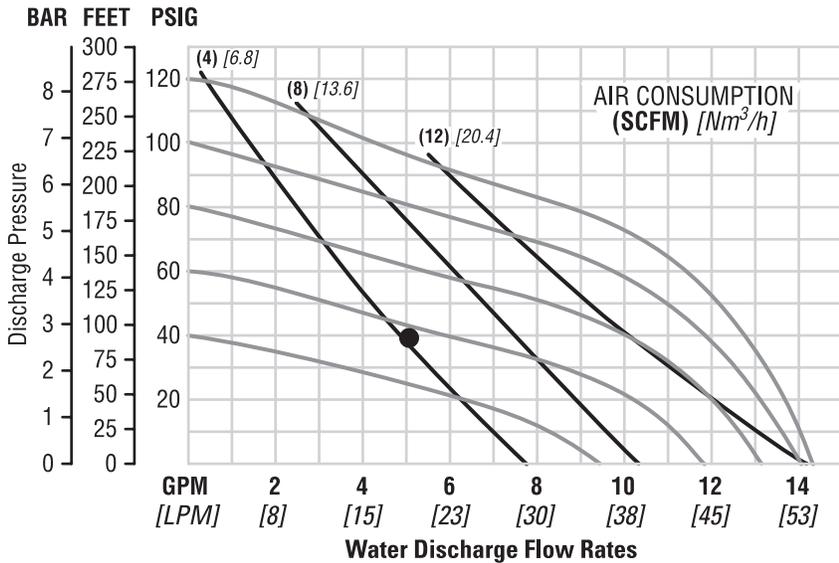
Height.....218 mm (8.6")
 Width.....208 mm (8.2")
 Depth203 mm (8.0")
 Est. Ship Weight..... Polypropylene 4 kg (9 lbs)
 PVDF 5 kg (11 lbs)
 PTFE PFA 6 kg (12 lbs)
 Air Inlet..... 6 mm (1/4")
 Inlet..... 13 mm (1/2")
 Outlet 13 mm (1/2")
 Suction Lift5.18 m Dry (17')
 9.8 m Wet (32')

Displacement per
 Stroke0.10 l (0.027 gal.)¹
 Max. Flow Rate.....53.4 lpm (14.1 gpm)
 Max. Size Solids 1.6 mm (1/16")

¹Displacement 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 2.8 bar (40 psig) requires 3.9 bar (56 psig) and 6.93 Nm³/h (4.1 scfm) air consumption. (See dot on chart.)

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



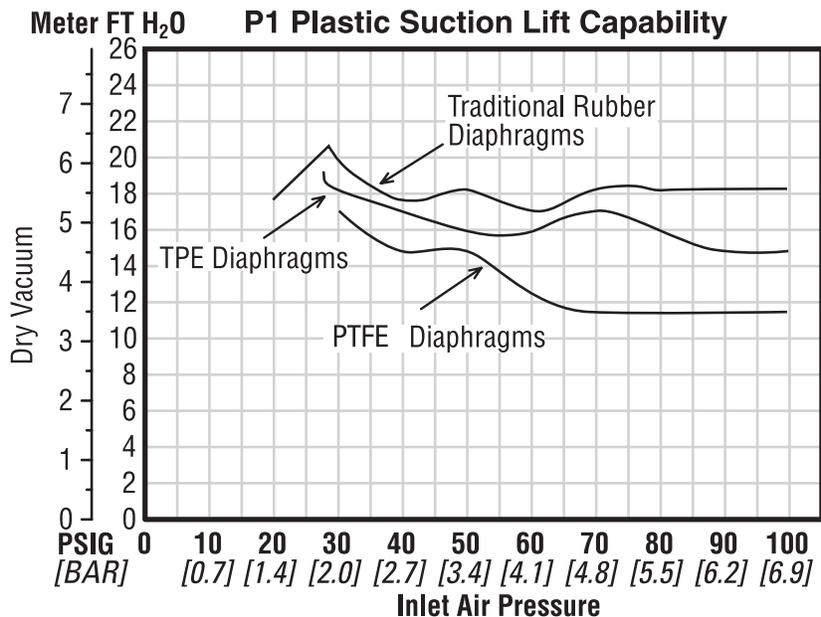
Flow rates indicated on chart were determined by pumping water.

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 5B SUCTION LIFT CURVE

**P1 PLASTIC
SUCTION LIFT CAPABILITY**

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.



The Pro-Flo® model P1 has a 13 mm (1/2") inlet and 13 mm (1/2") outlet and is designed for flows to 56.8 lpm (15 gpm). The **P1 Plastic** pump is manufactured with wetted parts of pure, unpigmented PVDF, PTFE PFA or polypropylene. The **P1 Plastic** is constructed with a polypropylene center section. A variety of diaphragms and o-rings are available to satisfy temperature, chemical compatibility, abrasion and flex concerns.

The suction pipe size should be at least 13 mm (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 (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 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 five 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 5µ micron air filter, needle valve and regulator. The use of an air filter before the pump will insure that the majority of any pipeline contaminants will be eliminated.

SOLENOID OPERATION: When operation is controlled by a solenoid valve in the air line, three-way valves should be used, thus allowing trapped air to bleed off and improving pump performance. Pumping volume can be set by counting the number of strokes per minute and multiplying by displacement per stroke.

Sound levels are reduced below OSHA specifications using the standard Wilden muffler element. Other mufflers can be used but 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 stresses 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.

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.

For **P1 Plastic** models, a non-raised surfaced-flange adapter should be utilized when mating to the pump's inlet and discharge manifolds for proper sealing.

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 for a 1/8" NPT fitting.

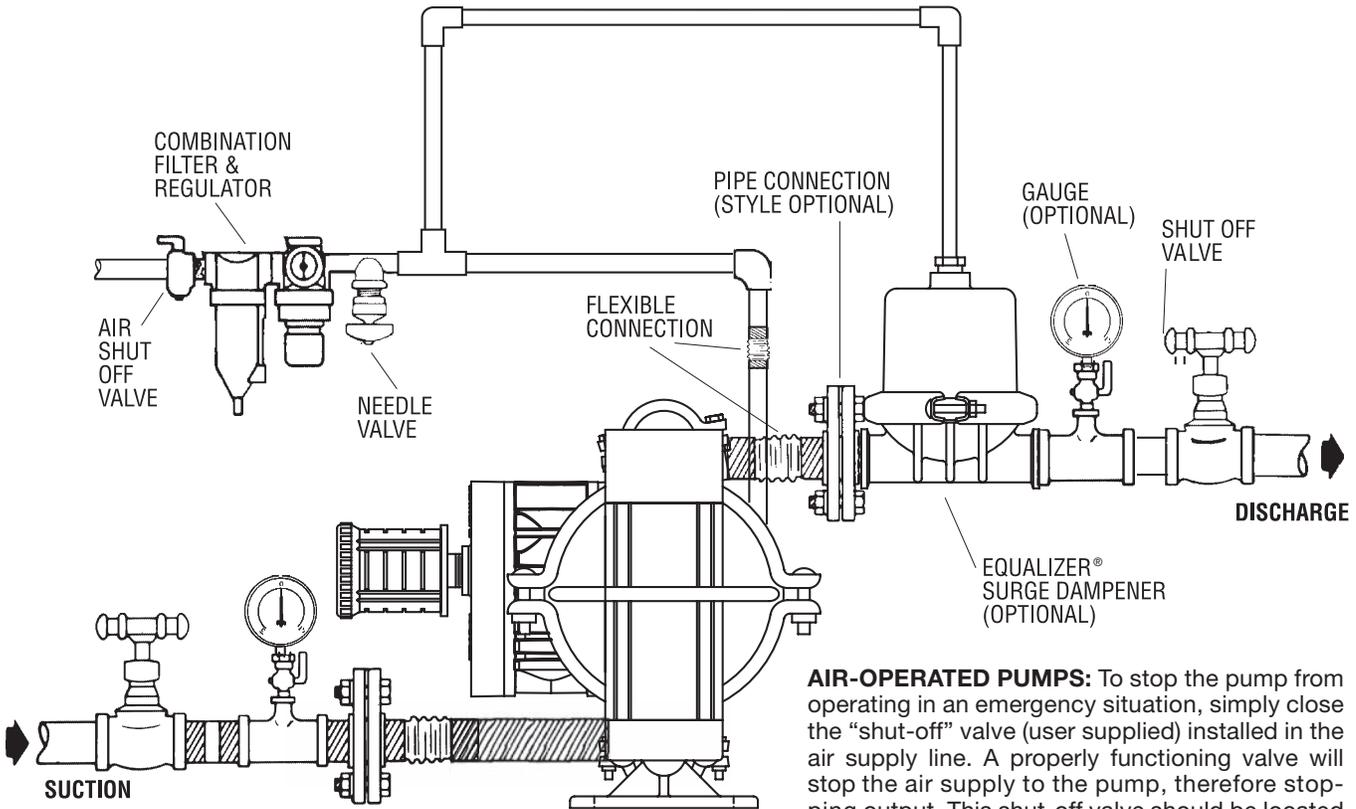
If the pump is to be used in a self-priming application, be sure that all connections are airtight and that the suction lift is within the model's ability. Note: Materials of construction and elastomer material have an effect on suction lift parameters. Please consult Wilden distributors for specifics.

Pumps in service with a positive suction head are most efficient when inlet pressure is limited to 0.5–0.7 bar (7–10 psig). Premature diaphragm failure may occur if positive suction is 10 psig and higher.

THE MODEL P1 PLASTIC WILL PASS 1.6 MM (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.

SUGGESTED OPERATION & MAINTENANCE

OPERATION: Pump discharge rate can be controlled by limiting the volume and/or pressure of the air supply to the pump (preferred method). An air regulator is used to regulate air pressure. A needle valve is used to regulate 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.