

# SERVICE & OPERATING MANUAL

## *SandPIPER II*<sup>®</sup>

### Model S05 Non-Metallic Design Level I



U.S. Patent #  
400,210  
5,996,627

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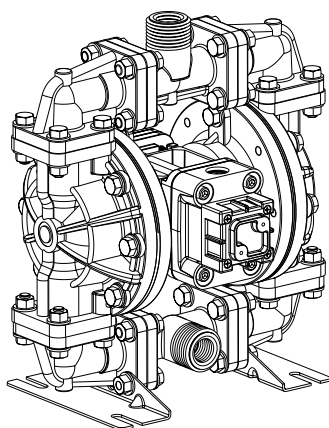


**WARREN  
RUPP®**

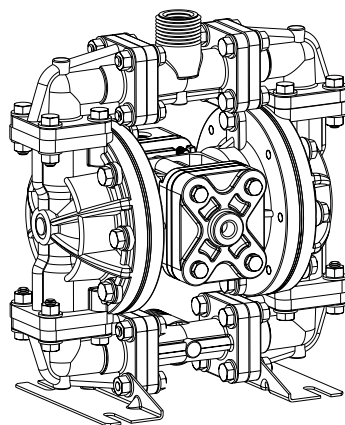
Quality System  
ISO9001 Certified

Environmental  
Management System  
ISO14001 Certified

**IDEX**  
IDEX CORPORATION



Air Exhaust Side View



Air Inlet Side View

CE

U.S. Patent #  
5,996,627  
Other U.S. Patents  
Applied for

**SandPIPER II®**

**S05 Non-Metallic  
Design Level I  
Ball Valve**

**Air-Powered  
Double-Diaphragm Pump**

ENGINEERING, PERFORMANCE  
& CONSTRUCTION DATA

|   |  |   |  |  |  |
|---|--|---|--|--|--|
| <b>INTAKE/DISCHARGE PIPE SIZE</b><br>½" NPT(Internal) or ½" BSPT<br>1" NPT(External) or 1" BSPT | <b>CAPACITY</b><br>0 to 14 gallons per minute<br>(0 to 52 liters per minute) | <b>AIR VALVE</b><br>No-lube, no-stall<br>design | <b>SOLIDS-HANDLING</b><br>Up to .125 in. (3mm) | <b>HEADS UP TO</b><br>100 psi or 231 ft. of water<br>(7 Kg/cm² or 70 meters) | <b>DISPLACEMENT/STROKE</b><br>.026 Gallon / .098 liter |
|---|--|---|--|--|--|

**⚠ CAUTION! Operating temperature limitations are as follows:**

| Materials  | Operating Temperatures      |                              |                                 |
|--|-----------------------------|------------------------------|---------------------------------|
|  | Maximum*                    | Minimum*                     | Optimum**                       |
| <b>Santoprene®</b> Injection molded thermoplastic elastomer with no fabric layer. Long mechanical flex life. Excellent abrasion resistance.  | 212°F<br>100°C              | -10°F<br>-23°C               | 50° to 212°F<br>10°C to 100°C   |
| <b>Virgin PTFE</b> Chemically inert, virtually impervious. Very few chemicals are known to react chemically with Virgin PTFE: molten alkali metals, turbulent liquid or gaseous fluorine and a few fluoro-chemicals such as chlorine trifluoride or oxygen difluoride which readily liberate free fluorine at elevated temperatures. | 212°F<br>100°C              | -35°F<br>-37°C               | 50°F to 212°F<br>10°C to 100°C  |
| <b>Polyurethane</b> High tensile material with excellent abrasion resistance. A general purpose material with excellent resistance to most oils.   | 210°F<br>99°C               | -40°F<br>-40°C               | -40°F to 210°F<br>-40°C to 99°C |
| <b>PVDF</b>  | 200°F<br>93°C               | 10°F<br>-13°C                |                                 |
| <b>Polypropylene</b>   | 150°F<br>65°C               | 40°F<br>5°C                  |                                 |
| <b>Nylon</b>   | 120°F<br>48°C               | 32°F<br>0°C                  |                                 |
| <b>Conductive Acetal</b>   | <b>180°F</b><br><b>82°C</b> | <b>-20°F</b><br><b>-28°C</b> |                                 |
| <b>Buna</b>  | 190°F<br>88°C               | -10°F<br>-23°C               | 0° to 140°F<br>10° to 60°C      |

For specific applications, always consult "Chemical Resistance Chart" Technical Bulletin

\*Definite reduction in service life.

\*\*Minimal reduction in service life at ends of range.

**SandPIPER II® pumps are designed to be powered only by compressed air.**

# Explanation of Pump Nomenclature

## S05 Non-Metallic - Design Level 1- Ball Valve

| MODEL           | Pump Brand | Pump Size | Check Valve Type | Design Level | Wetted Material | Diaphragm/Check Valve Materials | Check Valve Seat | Non-Wetted Material Options | Porting Options | Pump Style | Pump Options | Kit Options | Shipping Weight lbs. (kg) |
|-----------------|------------|-----------|------------------|--------------|-----------------|---------------------------------|------------------|-----------------------------|-----------------|------------|--------------|-------------|---------------------------|
| S05B1P1PPNS000. | S          | 05        | B                | 1            | P               | 1                               | P                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1P2PPNS000. | S          | 05        | B                | 1            | P               | 2                               | P                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1PUPPNS000. | S          | 05        | B                | 1            | P               | U                               | P                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1K1KPNS000. | S          | 05        | B                | 1            | K               | 1                               | K                | P                           | N               | S          | 0            | 00.         | 18 (9)                    |
| S05B1K2KPNS000. | S          | 05        | B                | 1            | K               | 2                               | K                | P                           | N               | S          | 0            | 00.         | 18 (9)                    |
| S05B1KUKPNS000. | S          | 05        | B                | 1            | K               | U                               | K                | P                           | N               | S          | 0            | 00.         | 18 (9)                    |
| S05B1N1NPNS000. | S          | 05        | B                | 1            | N               | 1                               | N                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1N2NPNS000. | S          | 05        | B                | 1            | N               | 2                               | N                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1NUNPNS000. | S          | 05        | B                | 1            | N               | U                               | N                | P                           | N               | S          | 0            | 00.         | 16 (8)                    |
| S05B1G1DXNS000. | S          | 05        | B                | 1            | G               | 1                               | D                | X                           | N               | S          | 0            | 00.         | 17 (8)                    |
| S05B1G2DXNS000. | S          | 05        | B                | 1            | G               | 2                               | D                | X                           | N               | S          | 0            | 00.         | 17 (8)                    |
| S05B1GUDXNS000. | S          | 05        | B                | 1            | G               | U                               | D                | X                           | N               | S          | 0            | 00.         | 17 (8)                    |
| S05B1P1PPBS000. | S          | 05        | B                | 1            | P               | 1                               | P                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1P2PPBS000. | S          | 05        | B                | 1            | P               | 2                               | P                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1PUPPBS000. | S          | 05        | B                | 1            | P               | U                               | P                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1K1KPBS000. | S          | 05        | B                | 1            | K               | 1                               | K                | P                           | B               | S          | 0            | 00.         | 18 (9)                    |
| S05B1K2KPBS000. | S          | 05        | B                | 1            | K               | 2                               | K                | P                           | B               | S          | 0            | 00.         | 18 (9)                    |
| S05B1KUKPBS000. | S          | 05        | B                | 1            | K               | U                               | K                | P                           | B               | S          | 0            | 00.         | 18 (9)                    |
| S05B1N1NPBS000. | S          | 05        | B                | 1            | N               | 1                               | N                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1N2NPBS000. | S          | 05        | B                | 1            | N               | 2                               | N                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1NUNPBS000. | S          | 05        | B                | 1            | N               | U                               | N                | P                           | B               | S          | 0            | 00.         | 16 (8)                    |
| S05B1G1AXBS000. | S          | 05        | B                | 1            | G               | 1                               | D                | X                           | B               | S          | 0            | 00.         | 17 (8)                    |
| S05B1G2DXBS000. | S          | 05        | B                | 1            | G               | 2                               | D                | X                           | B               | S          | 0            | 00.         | 17 (8)                    |
| S05B1GUDXBS000. | S          | 05        | B                | 1            | G               | U                               | D                | X                           | B               | S          | 0            | 00.         | 17 (8)                    |

**Pump Brand**  
S= SandPIPER II®

**Pump Size**  
05=½"

**Check Valve Type**  
B= Ball

**Design Level**  
1=Design Level

**Wetted Material**  
K= PVDF  
G= Conductive Acetal  
N= Nylon  
P= Polypropylene

**Diaphragm/Check Valve Materials**  
1= Santoprene/Santoprene  
2= Virgin PTFE-Santoprene Backup/Virgin PTFE  
B= Buna N  
U= Polyurethane/Polyurethane

**Check Valve Seat**  
D= Delrin

K= PVDF  
N= Nylon

P= Polypropylene

**Non-Wetted Material Options**  
P= Polypropylene  
1= Polypropylene with PTFE Coated Hardware  
C= Conductive Acetal

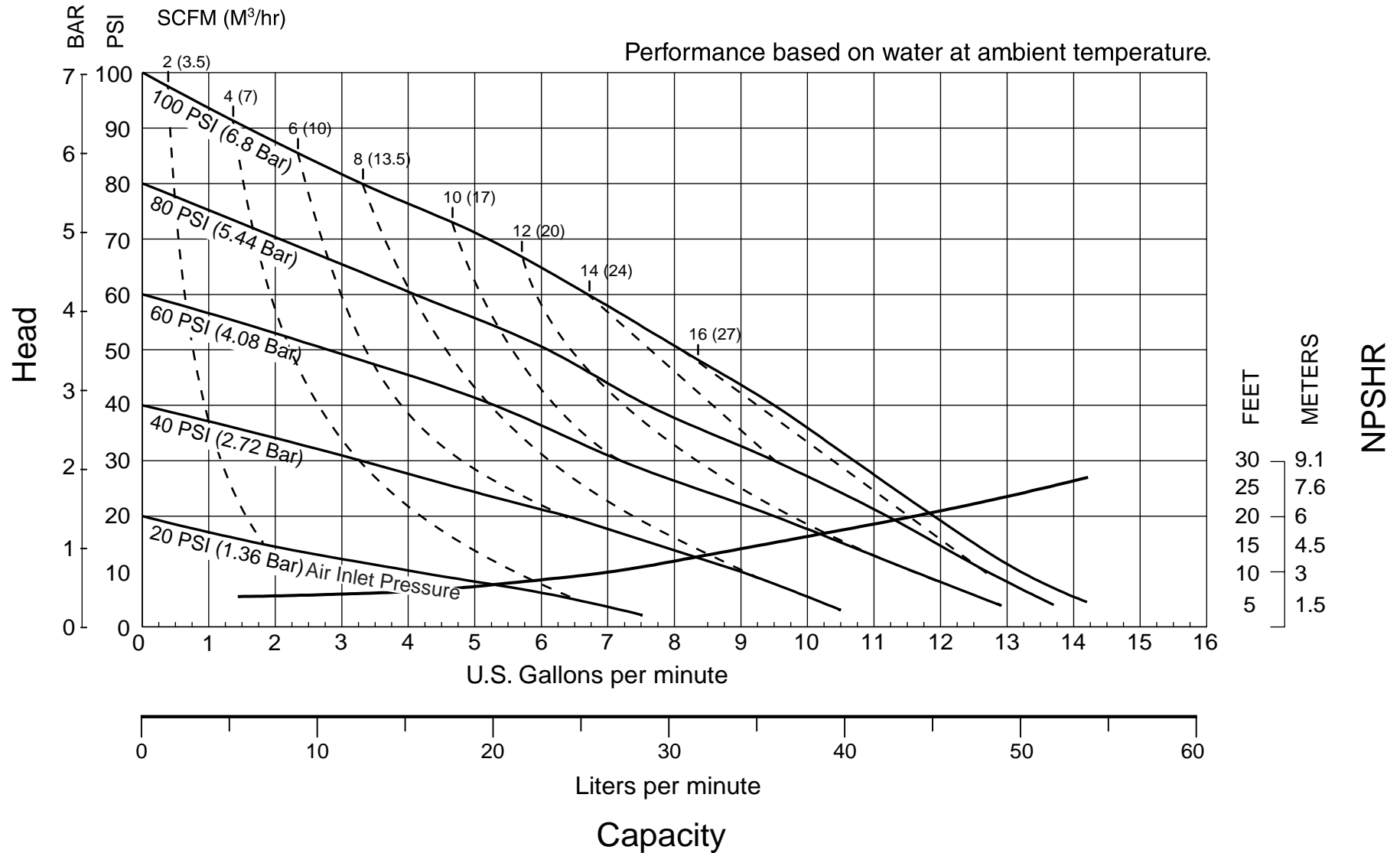
**Porting Options**  
N= NPT Threads  
B= BSPT Threads  
1= Dual Porting (NPT)  
2= Top Dual Porting (NPT)  
3= Bottom Dual Porting (NPT)  
4= Dual Porting (BSPT)  
5= Top Dual Porting (BSPT)  
6= Bottom Dual Porting (BSPT)

**Pump Style**  
S= Standard

**Pump Options**  
0= None  
1= 3M Muffler

**Kit Options**  
00.=None  
P0.=0-30VDC Pulse Output Kit  
P1.=Intrinsically-Safe 10-30VDC Pulse Output Kit  
P2.=110/120 or 220/240VAC Pulse Output Kit  
P3.=Intrinsically-Safe 110/120VAC Pulse Output Kit  
P4.=Intrinsically-Safe 220/240VAC Pulse Output Kit  
E0.=Solenoid Kit with 24VDC Coil  
E1.=Solenoid Kit with 24VDC Explosion-Proof Coil  
E2.=Solenoid Kit with 24VAC/12VDC Coil  
E3.=Solenoid Kit with 24VAC/12VDC Explosion-Proof Coil  
E4.=Solenoid Kit with 110VAC Coil  
E5.=Solenoid Kit with 110VAC Explosion-Proof Coil  
E6.=Solenoid Kit with 220VAC Coil  
E7.=Solenoid Kit with 220VAC Explosion-Proof Coil  
SP.=Stroke Indicator Pins

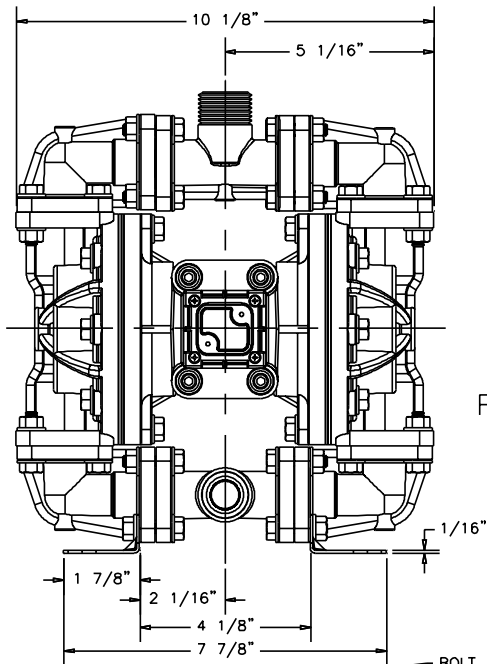
# Performance Curve, S05 Non-Metallic, Design Level 1



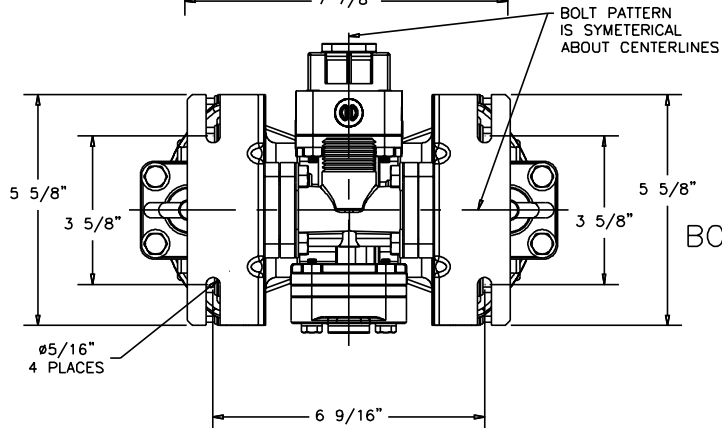
# Dimensions: S05 Non-Metallic

Dimensions in Inches

Dimensional tolerance:  $\pm 1/8"$

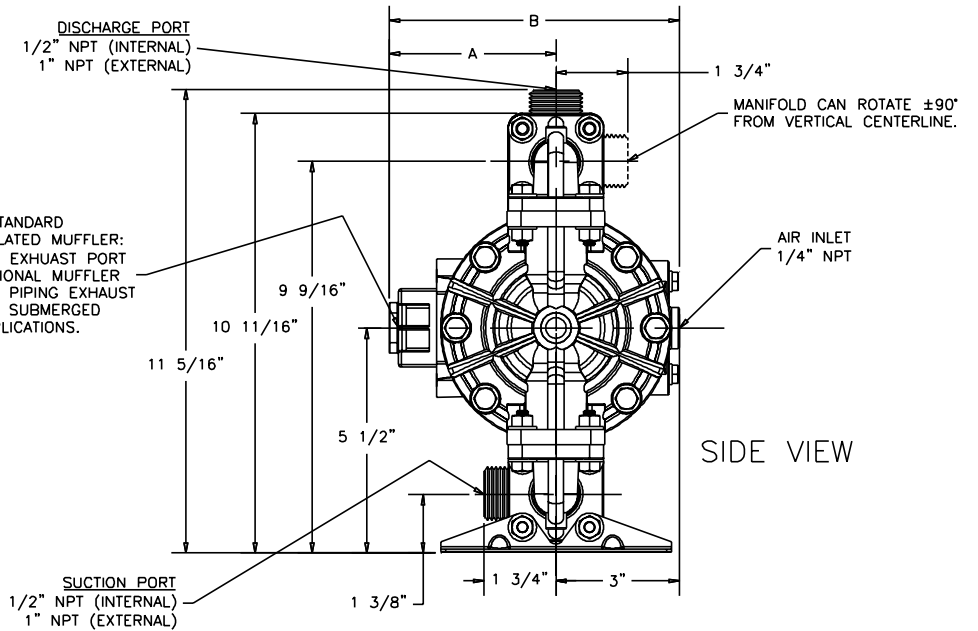


FRONT VIEW



BOTTOM VIEW

\* BOTH SUCTION AND DISCHARGE PORTS ARE AVAILABLE IN:  
1/2" BSPT (INTERNAL)  
1" BSPT (EXTERNAL)

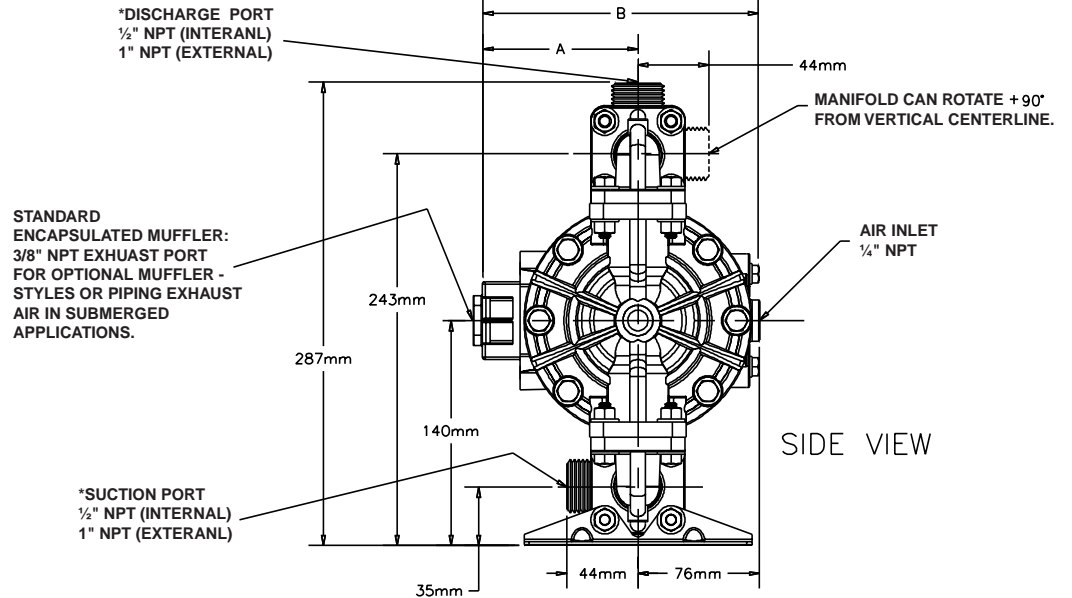
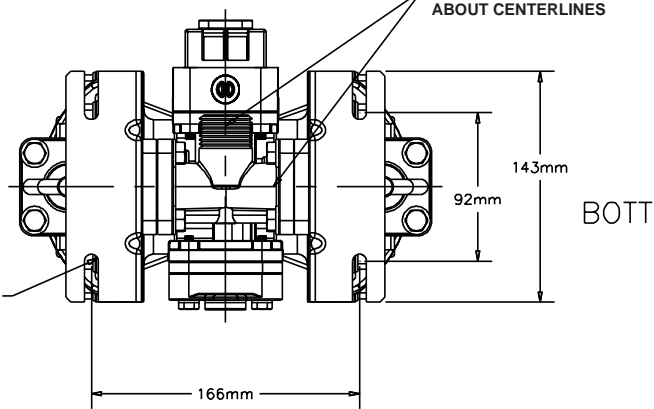
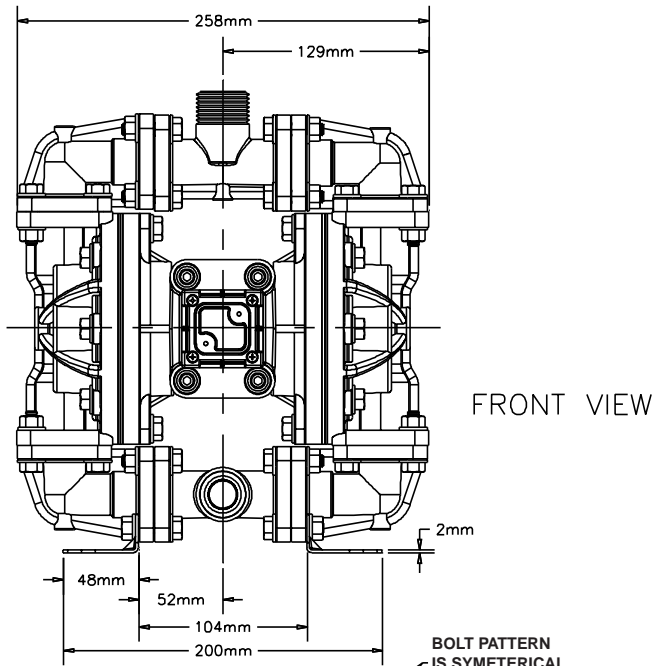


SIDE VIEW

| DIMENSION               | A        | B        |
|-------------------------|----------|----------|
| Standard Pump           | 4 1/16"  | 7 1/16"  |
| Pulse Output Kit        | 5 13/16" | 8 13/16" |
| Mesh Muffler            | 5 3/4"   | 8 3/4"   |
| Sound Dampening Muffler | 7"       | 9 15/16" |

# Metric Dimensions: S05 Non-Metallic

Dimensions in millimeters  
Dimensional tolerance:  $\pm 3\text{mm}$



\*BOTH SUCTION AND DISCHARGE PORTS ARE AVAILABLE IN  
1/2" BSPT TAPERED (INTERNAL)  
1" BSPT TAPERED (EXTERNAL)

| DIMENSION               | A     | B     |
|-------------------------|-------|-------|
| Standard Pump           | 103mm | 179mm |
| Pulse Output Kit        | 148mm | 224mm |
| Mesh Muffler            | 146mm | 222mm |
| Sound Dampening Muffler | 178mm | 252mm |

## PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by compressed air and is a 1:1 ratio design. The inner side of one diaphragm chamber is alternately pressurized while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod secured by plates to the centers of the diaphragms, to move in a reciprocating action. (As one diaphragm performs the discharge stroke the other diaphragm is pulled to perform the suction stroke in the opposite chamber.) Air pressure is applied over the entire inner surface of the diaphragm while liquid is discharged from the opposite side of the diaphragm. The diaphragm operates in a balanced condition during the discharge stroke which allows the pump to be operated at discharge heads over 200 feet (61 meters) of water.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device to maximize diaphragm life.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool

shifts to the opposite end of the valve body, the pressure to the chambers is reversed. The air distribution valve spool is moved by an internal pilot valve which alternately pressurizes one end of the air distribution valve spool while exhausting the other end. The pilot valve is shifted at each end of the diaphragm stroke when an actuator plunger is contacted by the diaphragm plate. This actuator plunger then pushes the end of the pilot valve spool into position to activate the air distribution valve.

The chambers are connected with manifolds with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

## INSTALLATION AND START-UP

Locate the pump as close to the product being pumped as possible. Keep the suction line length and number of fittings to a minimum. Do not reduce the suction line diameter.

For installations of rigid piping, short sections of flexible hose should be installed between the pump and the piping. The flexible hose reduces vibration and strain to the pumping system. A Warren Rupp DA05 Surge Dampener is recommended to further reduce pulsation in flow.

## AIR SUPPLY

Air supply pressure cannot exceed 100 psi (7 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air supply line

is solid piping, use a short length of flexible hose not less than ½" (13mm) in diameter between the pump and the piping to reduce strain to the piping. The weight of the air supply line, regulators and filters must be supported by some means other than the air inlet cap. Failure to provide support for the piping may result in damage to the pump. A pressure regulating valve should be installed to insure air supply pressure does not exceed recommended limits.

## AIR VALVE LUBRICATION

The air distribution valve and the pilot valve are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference or poor quality air supplies when lubrication of the compressed air supply is required. The pump air system will operate with properly lubricated compressed air supply. Proper lubrication requires the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of SAE 10 non-detergent oil for every 20 SCFM (9.4 liters/sec.) of air the pump consumes at the point of operation. Consult the pump's published Performance Curve to determine this.

## AIR LINE MOISTURE

Water in the compressed air supply can create problems such as icing or freezing of the exhaust air, causing the pump to cycle erratically or stop operating. Water in the air supply can be reduced by using a point-of-use air dryer to supplement the user's air drying

equipment. This device removes water from the compressed air supply and alleviates the icing or freezing problems.

## AIR INLET AND PRIMING

To start the pump, open the air valve approximately ½ to ¾ turn. After the pump primes, the air valve can be opened to increase air flow as desired. If opening the valve increases cycling rate, but does not increase the rate of flow, cavitation has occurred. The valve should be closed slightly to obtain the most efficient air flow to pump flow ratio.

## BETWEEN USES

When the pump is used for materials that tend to settle out or solidify when not in motion, the pump should be flushed after each use to prevent damage. (Product remaining in the pump between uses could dry out or settle out. This could cause problems with the diaphragms and check valves at restart.) In freezing temperatures the pump must be completely drained between uses in all cases.



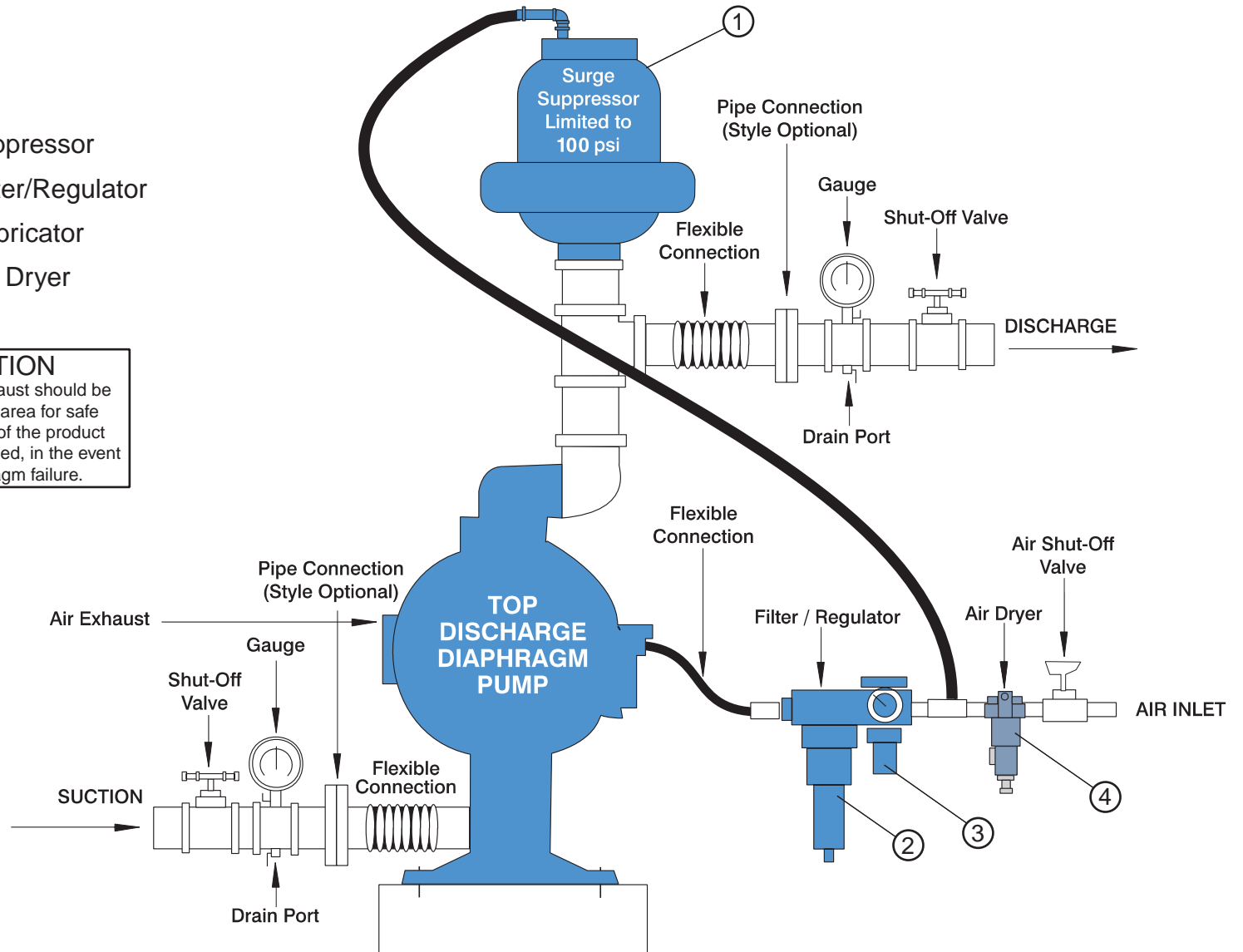
## INSTALLATION GUIDE Top Discharge Ball Valve Unit

Available from  
Warren Rupp

- ① DA05 Surge Suppressor
- ② 020-049-000 Filter/Regulator
- ③ 020-049-001 Lubricator
- ④ 020-046-008 Air Dryer



**CAUTION**  
The air exhaust should be piped to an area for safe disposition of the product being pumped, in the event of a diaphragm failure.



## TROUBLESHOOTING

### Possible Symptoms:

- Pump will not cycle.
- Pump cycles, but produces no flow.
- Pump cycles, but flow rate is unsatisfactory.
- Pump cycle seems unbalanced.
- Pump cycle seems to produce excessive vibration.

**What to Check:** Excessive suction lift in system.

**Corrective Action:** For lifts exceeding 20 feet (6 meters), filling the pumping chambers with liquid will prime the pump in most cases.

**What to Check:** Excessive flooded suction in system.

**Corrective Action:** For flooded conditions exceeding 10 feet (3 meters) of liquid, install a back pressure device.

**What to Check:** System head exceeds air supply pressure.

**Corrective Action:** Increase the inlet air pressure to the pump. Most diaphragm pumps are designed for 1:1 pressure ratio at zero flow.

**What to Check:** Air supply pressure or volume exceeds system head.

**Corrective Action:** Decrease inlet air pressure and volume to the pump as calculated on the published PERFORMANCE CURVE. Pump is cavitating the fluid by fast cycling.

**What to Check:** Undersized suction line.

**Corrective Action:** Meet or exceed pump connection recommendations shown on the DIMENSIONAL DRAWING.

**What to Check:** Restricted or undersized air line.

**Corrective Action:** Install a larger air line and connection. Refer to air inlet recommendations shown in your pump's SERVICE MANUAL.

**What to Check:** Check ESADS, the Externally Serviceable Air Distribution System of the pump.

**Corrective Action:** Disassemble and inspect the main air distribution valve, pilot valve and pilot valve actuators. Refer to the parts drawing and air valve section of the SERVICE MANUAL. Check for clogged discharge or closed valve before reassembly.

**What to Check:** Rigid pipe connections to pump.

**Corrective Action:** Install flexible connectors and a Warren Rupp surge dampener.

**What to Check:** Blocked air exhaust muffler.

**Corrective Action:** Remove muffler screen, clean or de-ice and reinstall. Refer to the Air Exhaust section of your pump SERVICE MANUAL.

**What to Check:** Pumped fluid in air exhaust muffler.

**Corrective Action:** Disassemble pump chambers. Inspect for diaphragm rupture or loose diaphragm plate assembly. Refer

to the Diaphragm Replacement section of your pump SERVICE MANUAL.

**What to Check:** Suction side air leakage or air in product.

**Corrective Action:** Visually inspect all suction side gaskets and pipe connections.

**What to Check:** Obstructed check valve.

**Corrective Action:** Disassemble the wet end of the pump and manually dislodge obstruction in the check valve pocket. Refer to the Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Worn or misaligned check valve or check valve seat.

**Corrective Action:** Inspect check valves and seats for wear and proper seating. Replace if necessary. Refer to Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Blocked suction line.

**Corrective Action:** Remove or flush obstruction. Check and clear all suction screens and strainers.

**What to Check:** Blocked discharge line.

**Corrective Action:** Check for obstruction or closed discharge line valves.

**What to Check:** Blocked pumping chamber.

**Corrective Action:** Disassemble and inspect the wetted chambers of the pump. Remove or flush any obstructions.

Refer to the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Entrained air or vapor lock in one or both pumping chambers.


**Corrective Action:** Purge chambers through tapped chamber vent plugs. PURGING THE CHAMBERS OF AIR CAN BE DANGEROUS! Contact the Warren Rupp Technical Services Department before performing this procedure. A model with top-ported discharge will reduce or eliminate problems with entrained air.

If your pump continues to perform below your expectations, contact your local Warren Rupp Distributor or factory Technical Services Group for a service evaluation.

## WARRANTY


Refer to the enclosed Warren Rupp Warranty Card.

# IMPORTANT SAFETY INFORMATION




**IMPORTANT**

Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.



**CAUTION**

Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Re-torque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.



**WARNING**

Before maintenance or repair, shut off the compressed air line, bleed the pressure, and disconnect the air line from the pump. The discharge line may be pressurized and must be bled of its pressure.




**WARNING**

In the event of diaphragm rupture, pumped material may enter the air end of the pump, and be discharged into the atmosphere. If pumping a product which is hazardous or toxic, the air exhaust must be piped to an appropriate area for safe disposition.




**WARNING**

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.




**WARNING**

This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.



**WARNING**

When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.



**WARNING**

Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the air supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.



**WARNING**

Airborne particles and loud noise hazards. Wear ear and eye protection.

## MATERIAL CODES

The Last 3 Digits of Part Number

|     |   |     |  |
|-----|---|-----|--|
| 000 | ..... Assembly, sub-assembly; and some purchased items                | 370 | ..... Butyl Rubber. Color coded: BROWN   |
| 010 | ..... Cast Iron   | 371 | ..... Phlithane (Tuftane)  |
| 012 | ..... Powered Metal   | 374 | ..... Carboxylated Nitrile   |
| 015 | ..... Ductile Iron  | 375 | ..... Fluorinated Nitrile  |
| 020 | ..... Ferritic Malleable Iron   | 378 | ..... High Density Polypropylene   |
| 025 | ..... Music Wire  | 405 | ..... Cellulose Fibre  |
| 080 | ..... Carbon Steel, AISI B-1112                                       | 408 | ..... Cork and Neoprene  |
| 100 | ..... Alloy 20  | 425 | ..... Compressed Fibre   |
| 110 | ..... Alloy Type 316 Stainless Steel                                  | 426 | ..... Blue Gard  |
| 111 | ..... Alloy Type 316 Stainless Steel (Electro Polished)               | 440 | ..... Vegetable Fibre  |
| 112 | ..... Alloy "C" (Hastelloy equivalent)                                | 465 | ..... Fibre  |
| 113 | ..... Alloy Type 316 Stainless Steel (Hand Polished)                  | 500 | ..... Delrin 500   |
| 114 | ..... 303 Stainless Steel   | 501 | ..... Delrin 570   |
| 115 | ..... 302/304 Stainless Steel   | 502 | ..... Conductive Acetal, ESD-800   |
| 117 | ..... 440-C Stainless Steel (Martensitic)                             | 503 | ..... Conductive Acetal, Glass-Filled  |
| 120 | ..... 416 Stainless Steel (Wrought Martensitic)                       | 505 | ..... Acrylic Resin Plastic  |
| 123 | ..... 410 Stainless Steel (Wrought Martensitic)                       | 506 | ..... Delrin 150   |
| 148 | ..... Hardcoat Anodized Aluminum                                      | 520 | ..... Injection Molded PVDF Natural color  |
| 149 | ..... 2024-T4 Aluminum  | 540 | ..... Nylon  |
| 150 | ..... 6061-T6 Aluminum  | 541 | ..... Nylon  |
| 151 | ..... 6063-T6 Aluminum  | 542 | ..... Nylon  |
| 152 | ..... 2024-T4 Aluminum (2023-T351)                                    | 544 | ..... Nylon Injection Molded   |
| 154 | ..... Almag 35 Aluminum   | 550 | ..... Polyethylene   |
| 155 | ..... 356-T6 Aluminum   | 551 | ..... Glass Filled Polypropylene   |
| 156 | ..... 356-T6 Aluminum   | 552 | ..... Unfilled Polypropylene   |
| 157 | ..... Die Cast Aluminum Alloy #380                                    | 553 | ..... Unfilled Polypropylene   |
| 158 | ..... Aluminum Alloy SR-319   | 555 | ..... Polyvinyl Chloride   |
| 159 | ..... Anodized Aluminum   | 556 | ..... Black Vinyl  |
| 162 | ..... Brass, Yellow, Screw Machine Stock                              | 570 | ..... Rulon II   |
| 165 | ..... Cast Bronze, 85-5-5   | 580 | ..... Ryton  |
| 166 | ..... Bronze, SAE 660   | 590 | ..... Valox  |
| 170 | ..... Bronze, Bearing Type, Oil Impregnated                           | 591 | ..... Nylatron G-S   |
| 175 | ..... Die Cast Zinc   | 592 | ..... Nylatron NSB   |
| 180 | ..... Copper Alloy  | 600 | ..... Virgin PTFE Tetrafluorocarbon (TFE)  |
| 305 | ..... Carbon Steel, Black Epoxy Coated                                | 601 | ..... Virgin PTFE (Bronze and moly filled)   |
| 306 | ..... Carbon Steel, Black Virgin PTFE Coated                          | 602 | ..... Filled Virgin PTFE   |
| 307 | ..... Aluminum, Black Epoxy Coated                                    | 603 | ..... Blue Gylon   |
| 308 | ..... Stainless Steel, Black Virgin PTFE Coated                       | 604 | ..... Virgin PTFE  |
| 309 | ..... Aluminum, Black Virgin PTFE Coated                              | 607 | ..... Envelon  |
| 310 | ..... Kynar Coated  | 606 | ..... Virgin PTFE  |
| 330 | ..... Zinc Plated Steel   | 610 | ..... Virgin PTFE Encapsulated Silicon   |
| 331 | ..... Chrome Plated Steel   | 611 | ..... Virgin PTFE Encapsulated Viton   |
| 332 | ..... Aluminum, Electroless Nickel Plated                             | 632 | ..... Neoprene/Hytrel  |
| 333 | ..... Carbon Steel, Electroless Nickel Plated                         | 633 | ..... Viton/Virgin PTFE  |
| 335 | ..... Galvanized Steel  | 634 | ..... EPDM/Virgin PTFE   |
| 336 | ..... Zinc Plated Yellow Brass  | 637 | ..... Virgin PTFE, Viton/Virgin PTFE   |
| 337 | ..... Silver Plated Steel   | 638 | ..... Virgin PTFE, Hytrel/Virgin PTFE  |
| 340 | ..... Nickel Plated   | 639 | ..... Buna-N/TFE   |
| 342 | ..... Filled Nylon  | 643 | ..... Santoprene®/EPDM   |
| 353 | ..... Geolast; Color: Black   | 644 | ..... Santoprene®/Virgin PTFE  |
| 354 | ..... Injection Molded #203-40 Santoprene - Duro 40D +/-5; Color: RED |     | Delrin, Viton and Hytrel are registered tradenames of E.I. DuPont.   |
| 355 | ..... Thermal Plastic   |     | Gylon is a registered tradename of Garlock, Inc.   |
| 356 | ..... Hytrel  |     | Nylatron is a registered tradename of Polymer Corp.  |
| 357 | ..... Injection Molded Polyurethane                                   |     | Santoprene is a registered tradename of Monsanto Corp.   |
| 358 | ..... Urethane Rubber (Some Applications) (Compression Mold)          |     | Rulon II is a registered tradename of Dixon Industries Corp.   |
| 359 | ..... Urethane Rubber   |     | Hastelloy-C is a registered tradename of Cabot Corp.   |
| 360 | ..... Buna-N Rubber. Color coded: RED                                 |     | Ryton is a registered tradename of Phillips Chemical Co.   |
| 361 | ..... Buna-N  |     | Valox is a registered tradename of General Electric Co.  |
| 363 | ..... Viton (Fluorel). Color coded: YELLOW                            |     | Warren Rupp, Ruppion, SandPIPER, SandPIPER II, PortaPump, Tranquilizer and SludgeMaster are registered tradenames of Warren Rupp, Inc. |
| 364 | ..... E.P.D.M. Rubber. Color coded: BLUE                              |     |  |
| 365 | ..... Neoprene Rubber. Color coded: GREEN                             |     |  |
| 366 | ..... Food Grade Nitrile  |     |  |
| 368 | ..... Food Grade EPDM   |     |  |

# Model S05 Non-Metallic Composite Repair Parts Drawing

## Available Service and Conversion Kits

| PART NO.    | DESCRIPTION  |
|-------------|--|
| 476-160-000 | <b>AIR END KIT</b><br>Seals, O-rings, Gaskets, Retaining Rings, Air Valve Spool and Pilot Valve Assembly.  |
| 476-161-000 | <b>AIR END KIT</b> for pumps equipped with Stroke Indicator (same components as above, except Spool Assembly with pins replaces Air Valve Spool) |
| 476-163-000 | <b>AIR END KIT</b> for standard Conductive Acetal pumps (same components as 475-160-000 above)   |
| 476-164-000 | <b>AIR END KIT</b> for Conductive Acetal pumps equipped with Stroke Indicator (same components as 475-161-000 above)                             |
| 476-165-354 | <b>WETTED END KIT</b><br>Santoprene Diaphragms, Nitrile Spacer Gaskets, Santoprene Check Balls and TFE Seals.                                    |
| 476-165-357 | <b>WETTED END KIT</b><br>Polyurethane Diaphragms, Nitrile Spacer Gaskets, Polyurethane Check Balls and TFE Seals.                                |
| 476-165-654 | <b>WETTED END KIT</b><br>Santoprene Diaphragms, TFE Overlay Diaphragm, TFE Check Balls and TFE Seals.  |

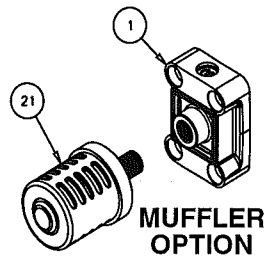
## PULSE OUTPUT KITS

(For use with 530-031-550 encapsulated muffler)

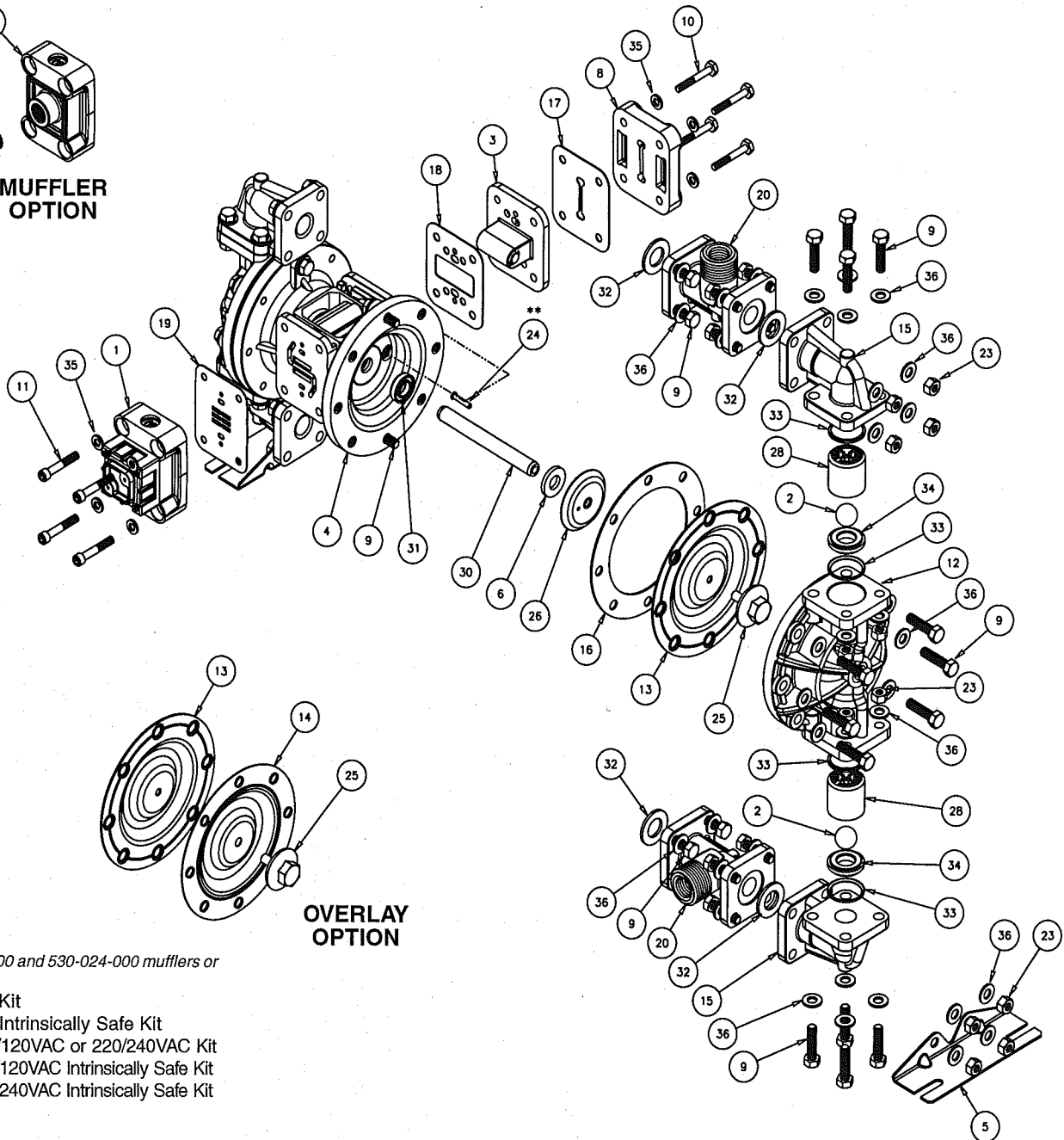
|             |                                   |
|-------------|-----------------------------------|
| 475-153-021 | DC Kit                            |
| 475-153-022 | DC Intrinsically Safe Kit         |
| 475-153-023 | 110/120VAC or 220/240VAC Kit      |
| 475-153-024 | 110/120VAC Intrinsically Safe Kit |
| 475-153-025 | 220/240VAC Intrinsically Safe Kit |

(For use with 530-023-000 and 530-024-000 mufflers or piped exhaust)

|             |                                   |
|-------------|-----------------------------------|
| 475-153-026 | DC Kit                            |
| 475-153-027 | DC Intrinsically Safe Kit         |
| 475-153-028 | 110/120VAC or 220/240VAC Kit      |
| 475-153-029 | 110/120VAC Intrinsically Safe Kit |
| 475-153-030 | 220/240VAC Intrinsically Safe Kit |



**MUFFLER OPTION**

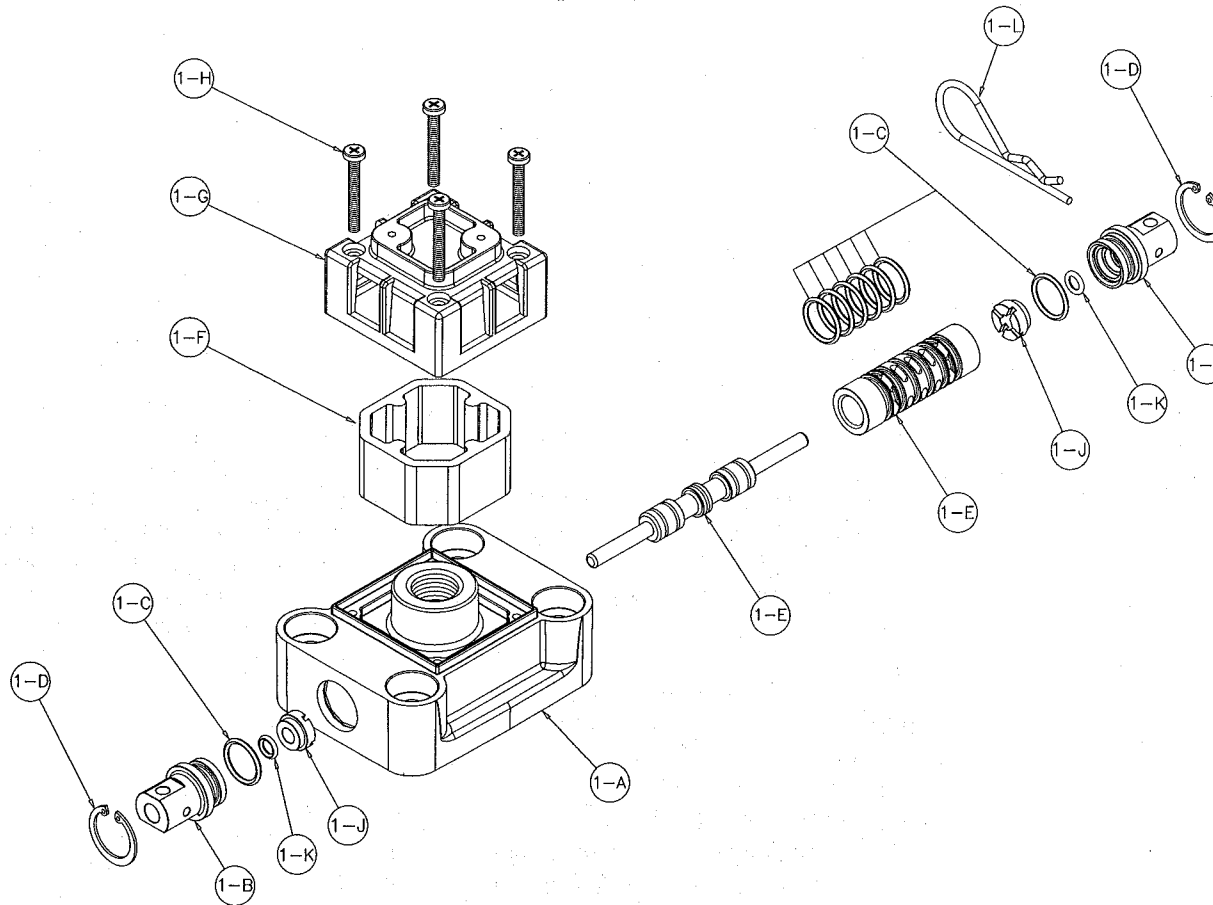


**OVERLAY OPTION**

# Composite Repair Parts List

| ITEM | PART NUMBER  | DESCRIPTION                                   | QTY | ITEM | PART NUMBER  | DESCRIPTION                                     | QTY |
|------|--------------|---|-----|------|--------------|---|-----|
| 1    | 031-115-000  | Air Valve Assembly                            | 1   | 15   | 312-106-502  | Elbow   | 4   |
|      | 031-115-001  | Air Valve Assembly (Conductive Acetal)        | 1   |      | 312-106-520  | Elbow   | 4   |
|      | 031-115-002  | Air Valve Assembly (w/Teflon Coated Hardware) | 1   |      | 312-106-542  | Elbow   | 4   |
|      | 031-116-000  | Air Valve Assembly                            | 1   |      | 312-106-552  | Elbow   | 4   |
|      | 031-116-001  | Air Valve Assembly (Conductive Acetal)        | 1   | 16   | 360-099-360  | Gasket, Spacer                                  | 2   |
|      | 031-116-002  | Air Valve Assembly (w/Teflon Coated Hardware) | 1   | 17   | 360-100-360  | Gasket, Air Inlet                               | 1   |
|      | 031-122-000  | Air Valve Assembly                            | 1   | 18   | 360-101-360  | Gasket, Pilot Valve                             | 1   |
|      | 031-122-001  | Air Valve Assembly (Conductive Acetal)        | 1   | 19   | 360-102-360  | Gasket, Air Valve                               | 1   |
|      | 031-123-000  | Air Valve Assembly                            | 1   | 20   | 518-138-502  | Manifold  | 2   |
|      | 031-123-001  | Air Valve Assembly (Conductive Acetal)        | 1   |      | 518-138-502E | Manifold (BSP)                                  | 2   |
| 2    | 050-027-354  | Ball, Check                                   | 4   |      | 518-138-520  | Manifold  | 2   |
|      | 050-027-357  | Ball, Check                                   | 4   |      | 518-138-520E | Manifold (BSP)                                  | 2   |
|      | 050-022-600  | Ball, Check                                   | 4   |      | 518-138-542  | Manifold  | 2   |
| 3    | 095-091-000  | Pilot Valve Assembly                          | 1   |      | 518-138-542E | Manifold (BSP)                                  | 2   |
|      | 095-091-001  | Pilot Valve Assembly                          | 1   |      | 518-138-552  | Manifold  | 2   |
| 4    | 114-023-157  | Intermediate Assembly                         | 1   |      | 518-138-552E | Manifold (BSP)                                  | 2   |
|      | 114-023-157S | Intermediate Assembly (Solenoid Option Only)  | 1   | 21   | 530-024-000  | Muffler   | 1   |
|      | 114-023-307  | Intermediate Assembly                         | 1   |      | 530-023-000  | Muffler (not shown)                             | 1   |
|      | 114-023-307S | Intermediate Assembly (Solenoid Option Only)  | 1   | 23   | 545-004-115  | Nut, Hex 5/16-18"                               | 24  |
|      | 114-023-309  | Intermediate Assembly                         | 1   |      | 545-004-308  | Nut, Hex 5/16-18"                               | 24  |
|      | 114-023-309S | Intermediate Assembly (Solenoid Option Only)  | 1   | 25   | 612-091-502  | Plate, Outer Diaphragm                          | 2   |
|      | 114-023-332  | Intermediate Assembly                         | 1   |      | 612-091-520  | Plate, Outer Diaphragm                          | 2   |
|      | 114-023-332S | Intermediate Assembly (Solenoid Option Only)  | 1   |      | 612-091-542  | Plate, Outer Diaphragm                          | 2   |
| 5    | 115-140-080  | Bracket, Mounting                             | 2   |      | 612-091-552  | Plate, Outer Diaphragm                          | 2   |
|      | 115-140-305  | Bracket, Mounting                             | 2   | 26   | 612-177-150  | Plate, Inner Diaphragm                          | 2   |
|      | 115-140-306  | Bracket, Mounting                             | 2   | 27   | 620-019-115  | Plunger, Actuator                               | 2   |
|      | 115-140-333  | Bracket, Mounting                             | 2   | 28   | 670-049-502  | Retainer, Ball →                                | 4   |
| 6    | 132-034-360  | Bumper, Diaphragm                             | 2   |      | 670-049-520  | Retainer, Ball                                  | 4   |
| 8    | 165-110-157  | Cap, Air Inlet                                | 1   |      | 670-049-542  | Retainer, Ball                                  | 4   |
|      | 165-110-307  | Cap, Air Inlet                                | 1   |      | 670-049-552  | Retainer, Ball                                  | 4   |
|      | 165-110-309  | Cap, Air Inlet                                | 1   | 30   | 685-056-120  | Rod, Diaphragm                                  | 1   |
|      | 165-110-332  | Cap, Air Inlet                                | 1   | 31   | 720-012-360  | Seal, Diaphragm Rod                             | 2   |
| 9    | 170-045-115  | Capscrew, Hex HD 5/16-18 X 1.25               | 48  | 32   | 720-045-600  | Seal, Manifold                                  | 4   |
|      | 170-045-308  | Capscrew, Hex HD 5/16-18 X 1.25               | 48  | 33   | 720-048-600  | Seal, Check Valve                               | 8   |
| 10   | 170-116-115  | Capscrew, Hex HD 1/4-20 X 1.62                | 4   | 34   | 722-080-506  | Seat, Check Valve                               | 4   |
|      | 170-116-308  | Capscrew, Hex HD 1/4-20 X 1.62                | 4   |      | 722-080-520  | Seat, Check Valve                               | 4   |
| 11   | 171-058-115  | Capscrew, Soc HD 1/4-20 X 1.50                | 4   |      | 722-080-542  | Seat, Check Valve                               | 4   |
|      | 171-058-308  | Capscrew, Soc HD 1/4-20 X 1.50                | 4   |      | 722-080-552  | Seat, Check Valve                               | 4   |
| 12   | 196-161-502  | Chamber, Outer                                | 2   |      | 722-093-552  | Seat, Check Valve (for Polyurethane Balls only) | 4   |
|      | 196-161-520  | Chamber, Outer                                | 2   | 35   | 901-037-115  | Washer, Flat 1/4"                               | 8   |
|      | 196-161-542  | Chamber, Outer                                | 2   |      | 901-037-308  | Washer, Flat 1/4"                               | 8   |
|      | 196-161-552  | Chamber, Outer                                | 2   | 36   | 901-038-115  | Washer, Flat 5/16"                              | 72  |
| 13   | 286-095-354  | Diaphragm                                     | 2   |      | 901-038-308  | Washer, Flat 5/16"                              | 72  |
|      | 286-095-357  | Diaphragm                                     | 2   | 52   | 920-025-000  | Ground Strap (Conductive Acetal Only)           | 1   |
| 14   | 286-096-600  | Diaphragm, Overlay                            | 2   |      |              |   |     |

# Air Distribution Valve Assembly Drawing With Stroke Indicator Option



## AIR VALVE ASSEMBLY W/STROKE INDICATOR OPTION PARTS LIST

| ITEM | PART NUMBER | DESCRIPTION                                 | QTY |
|------|-------------|---|-----|
| 1    | 031-116-000 | Main Air Valve Assembly                     | 1   |
| 1-A  | 095-086-551 | Body, Air Valve                             | 1   |
| 1-B  | 165-101-147 | Cap, End                                    | 2   |
| 1-C  | 560-101-360 | O-Ring                                      | 8   |
| 1-D  | 679-051-115 | Ring, Retaining                             | 2   |
| 1-E  | 031-134-000 | Sleeve & Spool Set<br>with pins and o-rings | 1   |
| 1-F  | 530-031-550 | Muffler                                     | 1   |
| 1-G  | 165-109-551 | Cap, Muffler                                | 1   |
| 1-H  | 710-011-115 | Screws, Self-Tapping                        | 4   |
| 1-J  | 132-030-552 | Bumper                                      | 2   |
| 1-K  | 560-029-360 | O-Ring                                      | 2   |
| 1-L  | 210-008-330 | Clip, Safety                                | 1   |

### For Conductive Acetal pumps:

|     |             |                         |   |
|-----|-------------|-------------------------|---|
| 1   | 031-116-001 | Main Air Valve Assembly | 1 |
| 1-A | 095-086-503 | Body, Main Air Valve    | 1 |
| 1-G | 165-109-503 | Cap, Muffler            | 1 |

(Includes all other items used on 031-116-000 above)

### For pumps with Teflon® coated hardware:

|     |             |                         |   |
|-----|-------------|-------------------------|---|
| 1   | 031-116-002 | Main Air Valve Assembly | 1 |
| 1-H | 710-011-308 | Screws, Self-Tapping    | 4 |

### For pumps with alternate Mesh or Sound Dampening mufflers or piped exhaust:

|   |             |                         |   |
|---|-------------|-------------------------|---|
| 1 | 031-123-000 | Main Air Valve Assembly | 1 |
|---|-------------|-------------------------|---|

(Includes all items used on 031-116-000 above minus items 1-F, 1-G and 1-H)

### For Conductive Acetal pumps with alternate Mesh or Sound Dampening mufflers or piped exhaust:

|     |             |                         |   |
|-----|-------------|-------------------------|---|
| 1   | 031-123-001 | Main Air Valve Assembly | 1 |
| 1-A | 095-086-503 | Body, Main Air Valve    | 1 |

(Includes all other items used on 031-123-000 above)

## AIR DISTRIBUTION VALVE SERVICING

To service the air valve first shut off the compressed air, bleed pressure from the pump, and disconnect the air supply line from the pump.

### STEP #1: See COMPOSITE REPAIR PARTS DRAWING.

Using a  $\frac{3}{16}$ " Allen wrench, remove the four hex socket capscrews (item 11) and four flat washers (item 36). Remove the air valve assembly from the pump.

Remove and inspect gasket (item 19) for cracks or damage. Replace gasket if needed.

### STEP #2: Disassembly of the air valve.

To access the internal air valve components first remove the two retaining rings (item 1-D) from each end of the air valve assembly using clip ring pliers.

Next remove the two end caps (item 1-B). Inspect the o-ring (item 1-C) for cuts or wear. Replace the o-rings if necessary.

Remove the spool (part of item 1-E) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and inspect for scratches or wear.

Inspect the inner diameter of the sleeve (part of item 1-E) for dirt, scratches, or other contaminants. Remove the sleeve if needed and replace with a new sleeve and spool set (item 1-E).

### STEP #3: Reassembly of the air valve.

Install one end cap (item 1-B) with an o-ring (item 1-C) into one end of the air valve body (item 1-A). Install one retaining ring (item 1-D) into the groove on the same end.

Remove the new sleeve and spool set (item 1-E) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-C) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body (item 1-A). align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Push the spool in until touches the end cap on the opposite end.

Install the remaining end cap with o-ring and retaining ring.

Fasten the air valve assembly (item 1) and gasket (item 19) to the pump.

Connect the compressed air line to the pump. The pump is now ready for operation.

## ⚠ IMPORTANT ⚠

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

## ⚠ WARNING ⚠

*Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.*

## ⚠ IMPORTANT ⚠

*This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.*

# Solenoid Shifted Air Valve Drawing

## SOLENOID SHIFTED AIR VALVE PARTS LIST

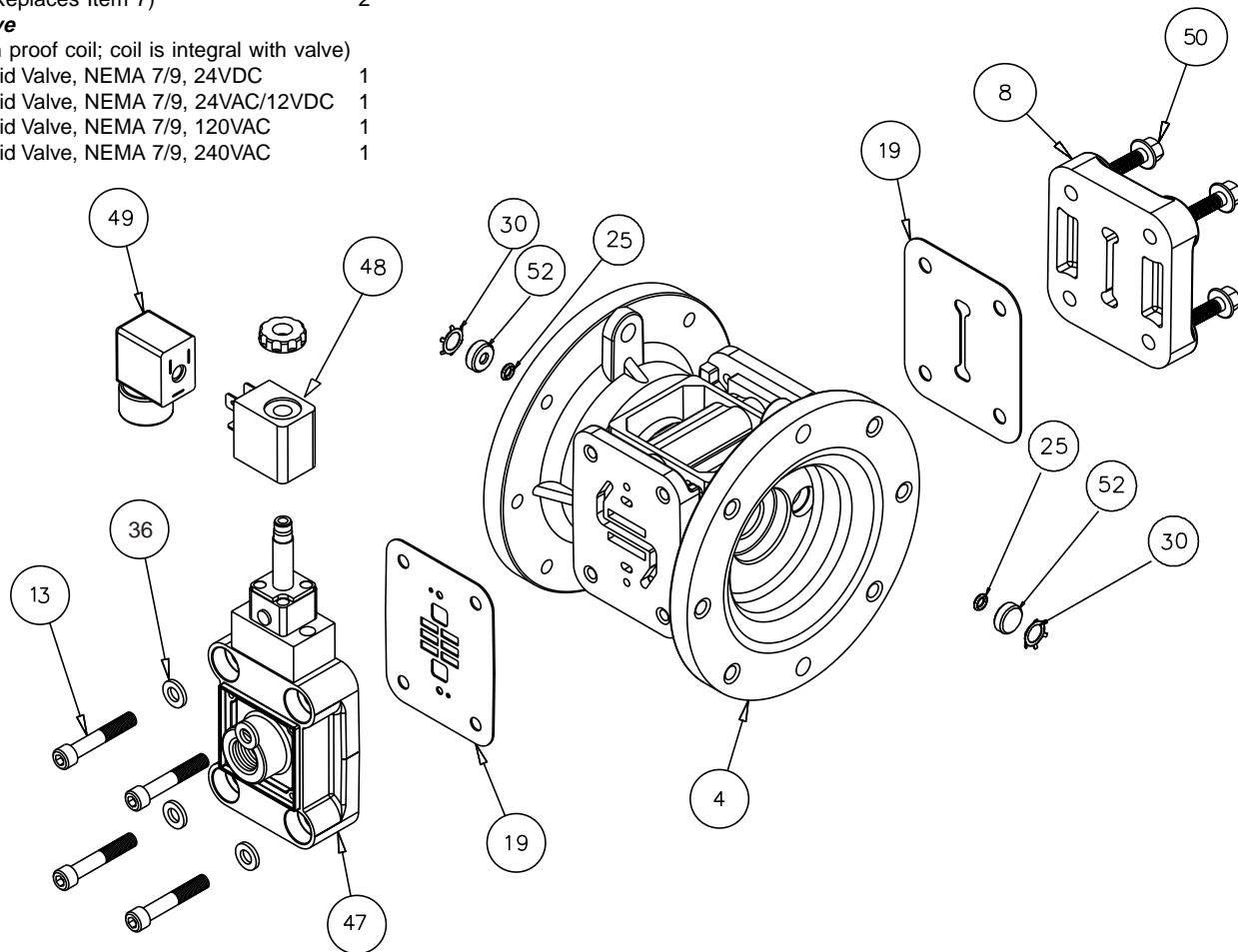
(Includes all items used on Composite Repair Parts List except as shown)

| ITEM | PART NUMBER | DESCRIPTION                   | QTY |
|------|-------------|-------------------------------|-----|
| 4    | 114-023-551 | Bracket, Intermediate         | 1   |
| 47   | 893-093-000 | Solenoid Valve, NEMA4         | 1   |
| 48   | 219-001-000 | Solenoid Coil, 24VDC          | 1   |
|      | 219-004-000 | Solenoid Coil, 24VAC/12VDC    | 1   |
|      | 219-002-000 | Solenoid Coil, 120VAC         | 1   |
|      | 219-003-000 | Solenoid Coil, 240VAC         | 1   |
| 49   | 241-001-000 | Connector, conduit            | 1   |
| 50   | 171-065-115 | Capscrew, Flanged ¼-20 x 1.00 | 4   |
| 52   | 618-050-150 | Plug (Replaces Item 7)        | 2   |

### For Explosion Proof Solenoid Valve

(Connector not required for explosion proof coil; coil is integral with valve)

|    |             |                                       |   |
|----|-------------|---------------------------------------|---|
| 47 | 893-094-001 | Solenoid Valve, NEMA 7/9, 24VDC       | 1 |
|    | 893-094-002 | Solenoid Valve, NEMA 7/9, 24VAC/12VDC | 1 |
|    | 893-094-003 | Solenoid Valve, NEMA 7/9, 120VAC      | 1 |
|    | 893-094-004 | Solenoid Valve, NEMA 7/9, 240VAC      | 1 |





## SOLENOID SHIFTED AIR DISTRIBUTION VALVE OPTION

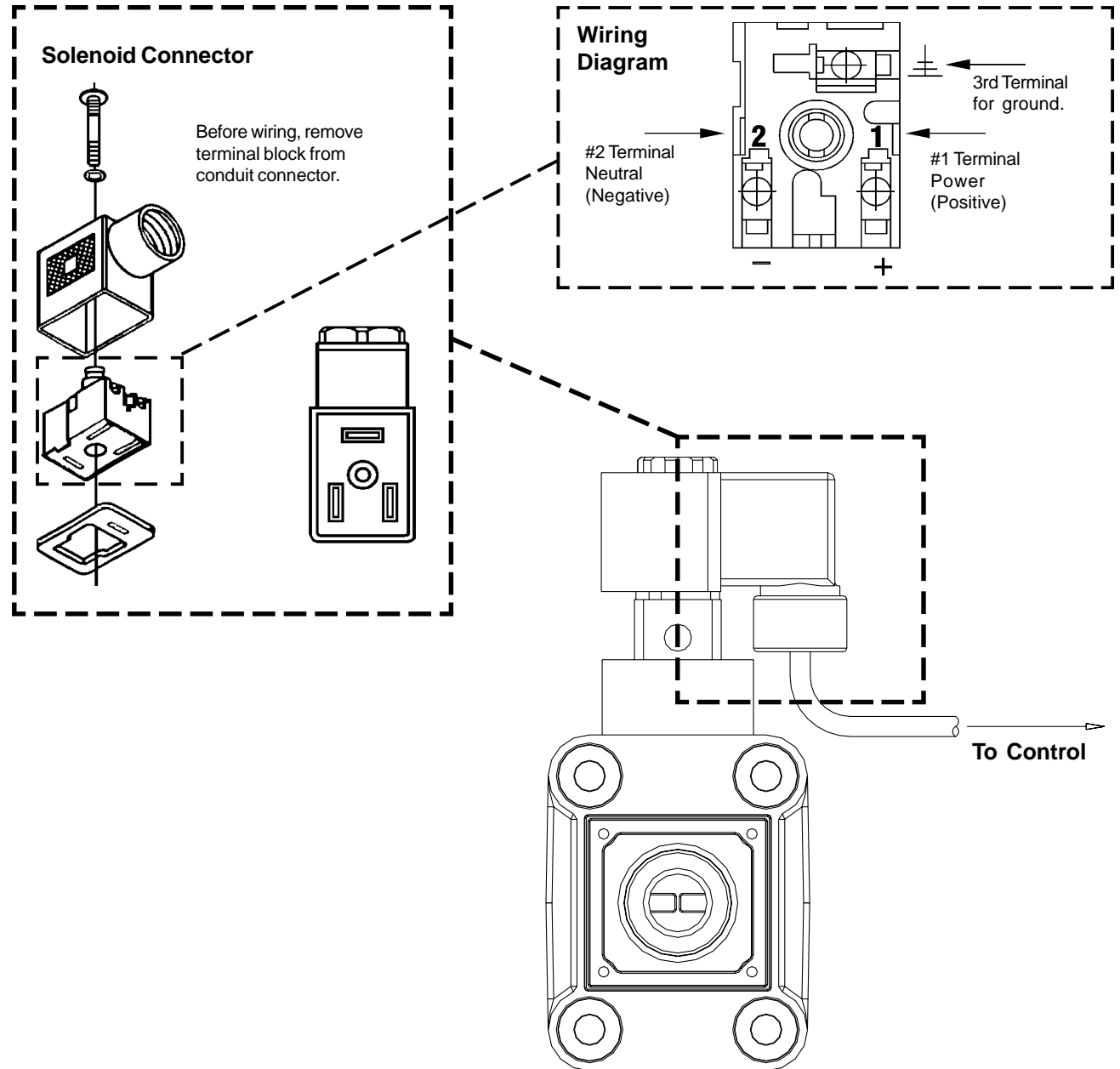
Warren Rupp's solenoid shifted, air distribution valve option utilizes electrical signals to precisely control your SandPIPER's speed. The solenoid coil is connected to the Warren Rupp Solenoid Rate Controller/Batch Control, or a customer - supplied control. Compressed air provides the pumping power, while electrical signals control pump speed (pumping rate).

### OPERATION

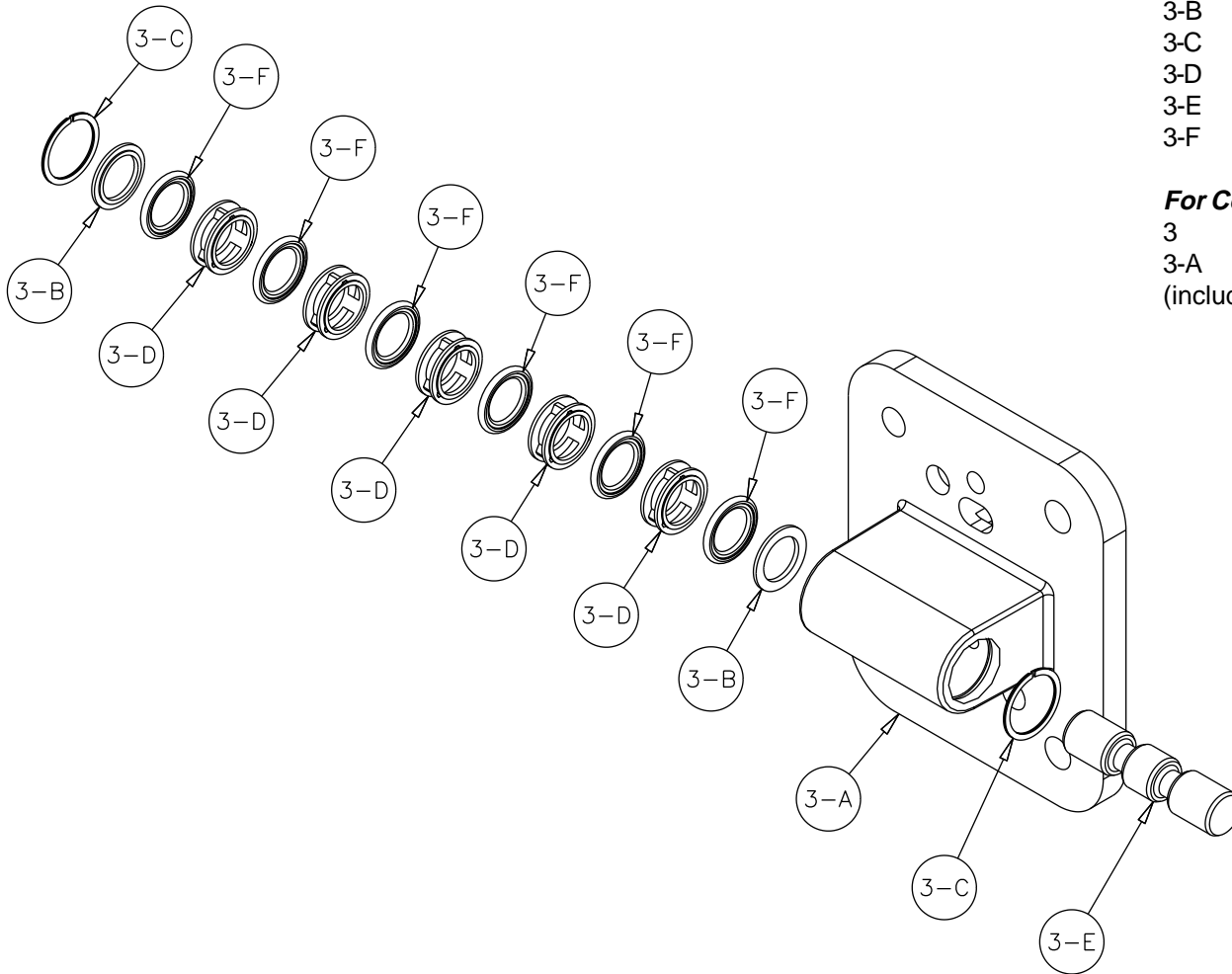
The Solenoid Shifted SandPIPER has a solenoid operated, air distribution valve in place of the standard SandPIPER's pilot operated, air distribution valve. Where a pilot valve is normally utilized to cycle the pump's air distribution valve, an electric solenoid is utilized. As the solenoid is powered, one of the pump's air chambers is pressurized while the other chamber is exhausted. When electric power is turned off, the solenoid shifts and the pressurized chamber is exhausted while the other chamber is pressurized. By alternately applying and removing power to the solenoid, the pump cycles much like a standard SandPIPER pump, with one exception. This option provides a way to precisely control and monitor pump speed.

### BEFORE INSTALLATION

Before wiring the solenoid, make certain it is compatible with your system voltage.



# Pilot Valve Assembly Drawing



## PILOT VALVE ASSEMBLY PARTS LIST

| ITEM | PART NUMBER | DESCRIPTION            | QTY |
|------|-------------|------------------------|-----|
| 3    | 095-091-000 | Pilot Valve Assembly   |     |
| 3-A  | 095-087-551 | Body, Pilot Valve      | 1   |
| 3-B  | 135-035-506 | Bushing, Pilot Valve   | 2   |
| 3-C  | 675-057-115 | Ring, Spiral Retaining | 2   |
| 3-D  | 770-065-175 | Spacer                 | 5   |
| 3-E  | 775-041-506 | Spool, Pilot Valve     | 1   |
| 3-F  | 917-003-374 | Wiper                  | 6   |

### For Conductive Acetal pumps:

|  |             |                      |   |
|--|-------------|----------------------|---|
| 3  | 095-091-001 | Pilot Valve Assembly | 1 |
| 3-A  | 095-087-503 | Body, Pilot Valve    | 1 |
| (includes all other items used on 095-091-000 Pilot Valve above) |             |                      |   |

## PILOT VALVE SERVICING

To service the pilot valve first shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump. Insert the safety clip (item 1-G from Air Distribution Valve assembly drawing) into the smaller unthreaded holes in the end cap (item 1-F from air distribution valve assembly drawing).

**Step #1:** See PUMP ASSEMBLY DRAWING.

Using a  $\frac{7}{16}$ " wrench or socket, remove the four capscrews (items 12). Remove the air inlet cap (item 8) and air inlet gasket (item 19). The pilot valve assembly (item 3) can now be removed for inspection or service.

**Step #2:** Disassembly of the pilot valve.

Remove the pilot valve spool (item 3-E). Wipe clean, and inspect for dirt, scratches or wear. Replace the spool if necessary.

Remove the two spiral retaining rings (items 3-C) from each end of the pilot valve body by inserting the tip of a small flat screw driver under the notch in the retaining ring. Lift and push the ring clockwise in a circular motion.

Remove the two pilot valve bushings (items 3-B), five spacers (items 3-D), and six spool wipers (items 3-F) by pushing gently from other end of the pilot valve body. Inspect the wipers and spacers for cuts and/or wear. Replace wipers and/or spacers as necessary.

**Step #3:** Re-assembly of the pilot valve.

First install a spiral retaining ring to one end of the pilot valve body. Spread the spiral and insert one end into the groove in the pilot valve body. Twist the ring in a clockwise motion until the full ring is snapped into the groove. Install one bushing making sure the step side faces toward the wiper. Apply a light coating of grease to the outside diameter of each wiper. Next, gently push in the wipers and spacers until they are against the installed retaining ring in the opposite end of the pilot valve body. Install the remaining bushing making sure the step side faces the wiper. Install the remaining spiral retaining ring using the same method described.

Apply a light coating of grease to the inner diameter of each wiper. Also apply a light coating of grease to the outer diameter of the pilot valve spool and gently push the spool through each wiper.

**Step #4:** Inspect the actuator plungers.

See PUMP ASSEMBLY DRAWING.

The actuator plungers (items 28) can be reached through the stem cavity of the pilot valve in the intermediate bracket (item 4). To service bushings, o-rings and retaining rings, see Intermediate Drawing.


Remove the plungers (items 28) from the bushings (item 7) in each end of the intermediate cavity. Apply a light coating of grease to each o-ring and re-install the plungers in to the bushings. Push the plungers in as far as they will go.

**Step #5:** Re-install the pilot valve assembly into the intermediate assembly.

Be careful to align the ends of the stem between the plungers when inserting the stem of the pilot valve into the cavity of the intermediate.

Re-install the gasket (item 19), air inlet cap (item 8) and capscrews (items 12).

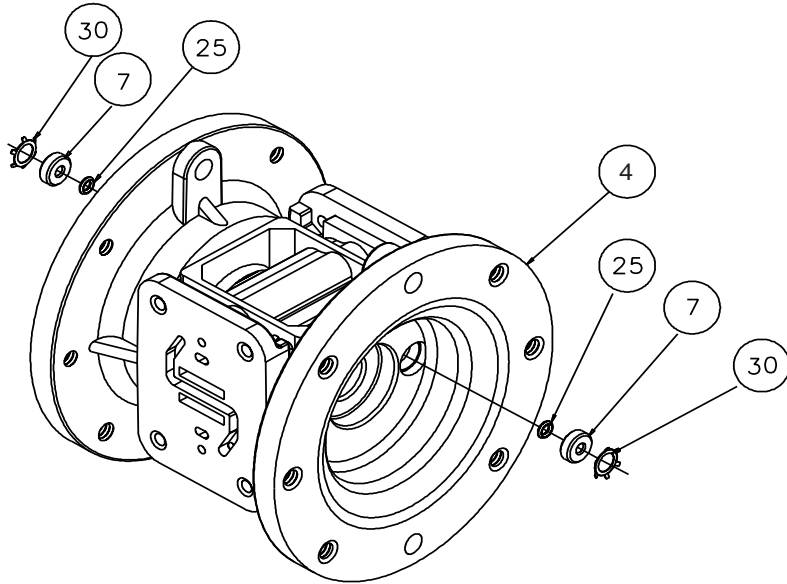
Connect the air supply to the pump. Remove the safety clip (item 1-G) from the end cap (item 1-F). The pump is now ready for operation.



**! IMPORTANT**

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

## Intermediate Assembly Drawing



### INTERMEDIATE REPAIR PARTS LIST

| ITEM | PART NUMBER | DESCRIPTION           | QTY |
|------|-------------|-----------------------|-----|
| 4    | 114-023-551 | Bracket, Intermediate | 1   |
| 7    | 135-036-506 | Bushing, Plunger      | 2   |
| 25   | 560-001-360 | O-Ring                | 2   |
| 30   | 675-042-115 | Ring, Retaining*      | 2   |

**\*NOTE:** It is recommended that when plunger components are serviced, new retaining rings be installed.


## Intermediate Assembly Servicing

### PLUNGER BUSHING, O-RING, AND RETAINING RING SERVICING

To service the plunger bushing components first remove the two retaining rings (items 30) using a small flat screwdriver. **\*Note:** It is recommended that new retaining rings be installed.

Next remove the two plunger bushings (items 7). Inspect the bushings for wear or scratches. Replace the bushings as necessary.

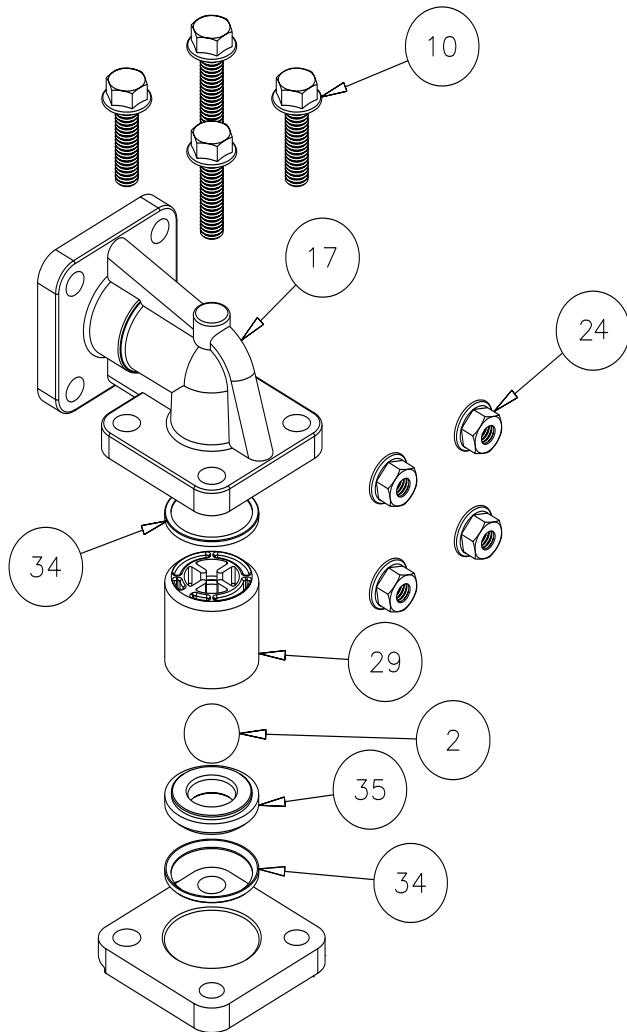
Inspect the two o-rings (25) for cuts and/or wear.



**! IMPORTANT**

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

# Modular Check Ball Valve Drawing



## MODULAR CHECK BALL VALVE SERVICING

Before servicing the check valves, first shut off the suction line and then the discharge line to the pump. Next, shut off the compressed air supply, bleed air pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining fluid from the pump. The pump can now be removed for service.

To access the modular check valve, remove the elbows (items 17 from pump composite repair parts drawing). Use a ½" wrench or socket to remove the fasteners. Once the elbows are removed, the modular check valves can be seen in the cavities of the outer chamber (items 14).

Next remove the check valve seal (item 34). Inspect the seal for cuts or pinched areas. Replace seal as needed.

Disassemble the component parts of each modular check valve. Inspect the check valve retainer (item 29) for cuts, abrasive wear, or embedded materials. Replace as needed.


Inspect the check balls (items 2) for wear, abrasion, or cuts on the spherical surface. The check valve seats (items 35) should be inspected for cuts, abrasive wear, or embedded material on the surfaces of both the external and internal chamfers. The spherical surface of the check balls must seat flush to the surface of the inner chamfer on the check valve seats for the pump to operate to peak efficiency. Replace any worn or damaged parts as necessary.

Remove the check valve seal (item 34). Inspect the seal for cuts or pinched areas. Replace seal as needed.

## RE-ASSEMBLE THE MODULAR CHECK VALVE

Place a check valve seal (item 34) into the cavity of the outer chamber (item 14). Make sure the chamfer side of the seal faces out. Insert the modular check valve into the outer chamber with the retainer facing up. Install a check valve seal (item 34). Make sure the chamfer side of the seals face the chamfer on the check valve seat or retainer.

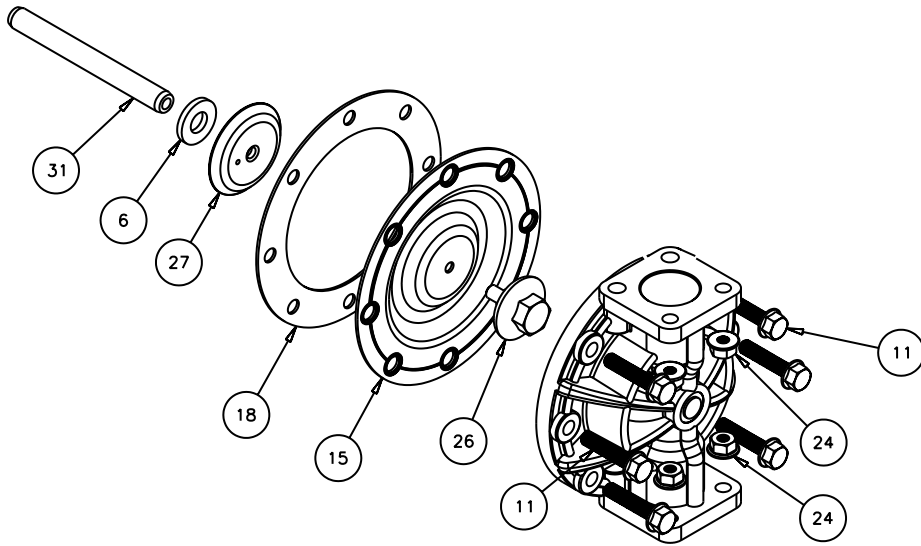
The pump can now be reassembled, reconnected and returned to operation.



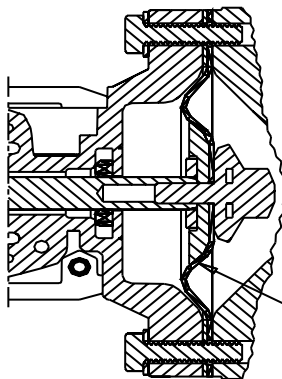
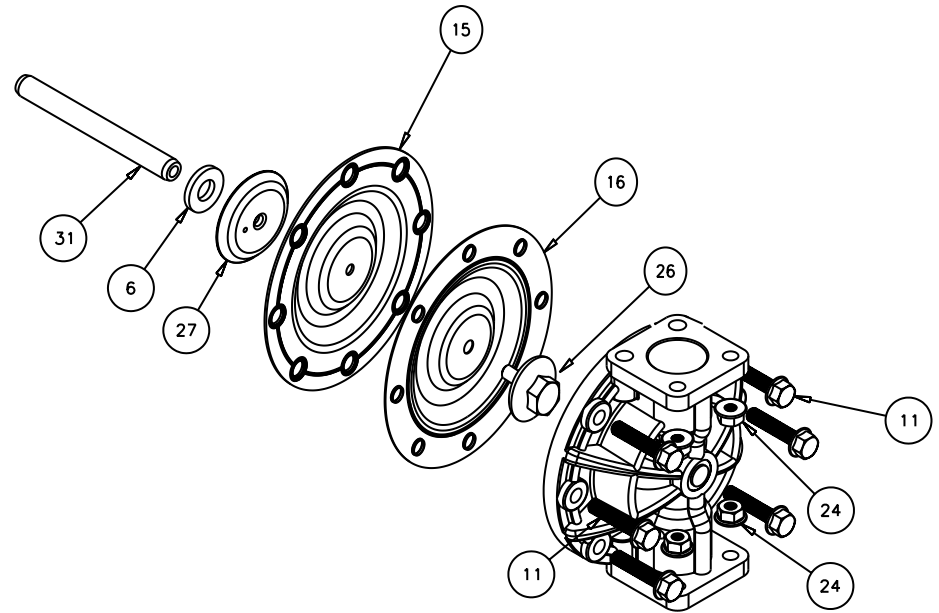
**⚠ IMPORTANT**

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

## Diaphragm Service Drawing, Non-Overlay



## Diaphragm Service Drawing, with Overlay



**Cross Section of Diaphragm**

THE DIAPHRAGMS FOR BOTH CONFIGURATIONS SHOWN ABOVE ARE TO BE INSTALLED WITH CONVOLUTIONS FACING TOWARDS CENTER OF PUMP

## DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining liquid from the pump.

**Step #1:** See the pump composite repair parts drawing, and the diaphragm servicing illustration.

Using a ½" wrench or socket, remove the 16 capscrews (item 10), and flanged nuts that fasten the elbows (items 17) to the outer chambers (items 14). Remove the elbows with the manifolds and spacers attached.

**Step #2:** Removing the outer chambers.

Using a ½" wrench or socket, remove the 16 capscrews (items 9 and 11), and flanged nuts that fasten the outer chambers, diaphragms, and intermediate (item 4) together.

**Step #3:** Removing the diaphragm assemblies.

Use a ¾" (19mm) wrench or six pointed socket to remove the diaphragm assemblies (outer plate, diaphragm, and inner plate) from the diaphragm rod (item 31) by turning counterclockwise.

Insert a 6-32 set screw into the smaller tapped hole in the inner diaphragm plate (item 27). Insert the protruding stud and the 6-32 fastener loosely into a vise. Use a ¾" wrench or socket to remove the outer diaphragm

plate (item 26) by turning counterclockwise. Inspect the diaphragm (item 15) for cuts, punctures, abrasive wear or chemical attack. Replace the diaphragms if necessary.

**Step #4:** Installing the diaphragms.

Push the threaded stud of the outer diaphragm plate through the center hole of the diaphragm. Thread the inner plate clockwise onto the stud. Insert the loose assembly with the above 6-32 fastener back into the vise. Use a torque wrench to tighten the diaphragm assembly together to 7.5 ft. Lbs. (10.17 Newton meters). Allow a minimum of 15 minutes to elapse after torquing, then re-torque the assembly to compensate for stress relaxation in the clamped assembly.

**Step #5:** Installing the diaphragm assemblies to the pump.

Make sure the bumper (item 6) is installed over the diaphragm rod.

Thread the stud of the one diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 31) until the inner diaphragm plate is flush to the end of the rod. Insert rod into pump.

Align the bolt holes in the diaphragm with the bolt pattern in the intermediate (item 4).

Fasten the outer chamber (item 14) to the pump, using the capscrews (items 9 and 11) and flanged nuts.

On the opposite side of the pump, pull the diaphragm rod out as far as possible. Make sure the bumper (item 6) is installed over the diaphragm rod.

Thread the stud of the remaining

diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 31) as far as possible and still allow for alignment of the bolt holes in the diaphragm with the bolt pattern in the inner chamber. Install diaphragms with convolutions facing towards center of pump. See sectional view on previous page.

Fasten the remaining outer chamber (item 14) to the pump, using the capscrews (items 9 and 11) and flanged nuts.

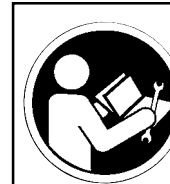
**Step #6:** Re-install the elbow/spacer/manifold assemblies to the pump, using the capscrews (item 10) and flanged nuts.

The pump is now ready to be re-installed, connected and returned to operation.

## OVERLAY DIAPHRAGM SERVICING

The overlay diaphragm (item 16) is designed to fit snugly over the exterior of the standard TPE diaphragm (item 15).

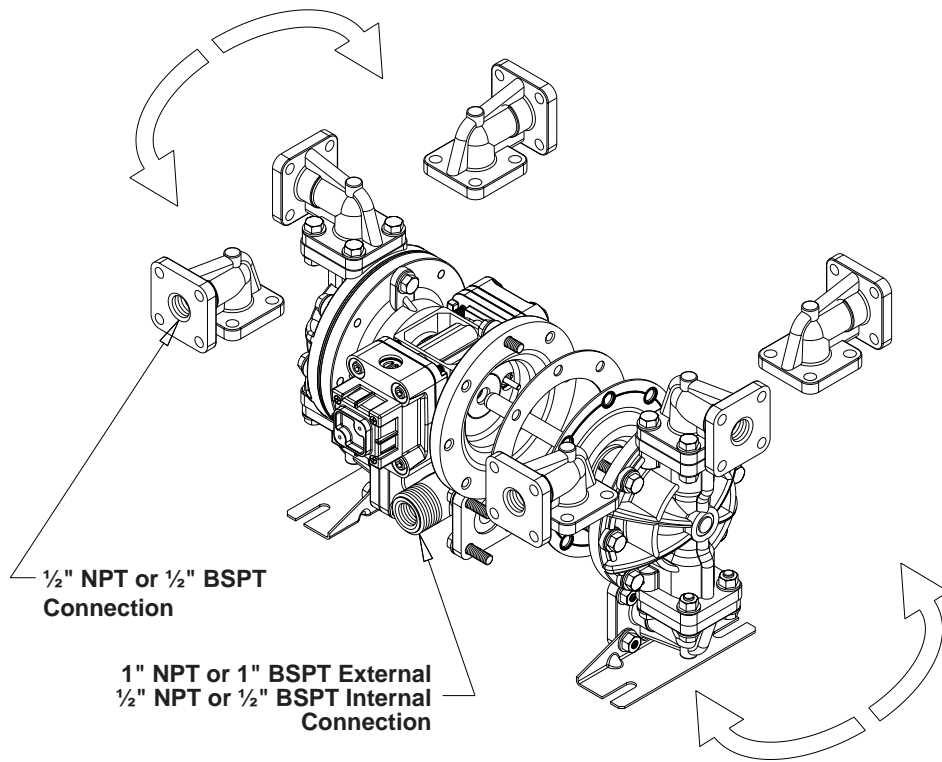
Follow the same procedures described for the standard diaphragm for removal and installation.



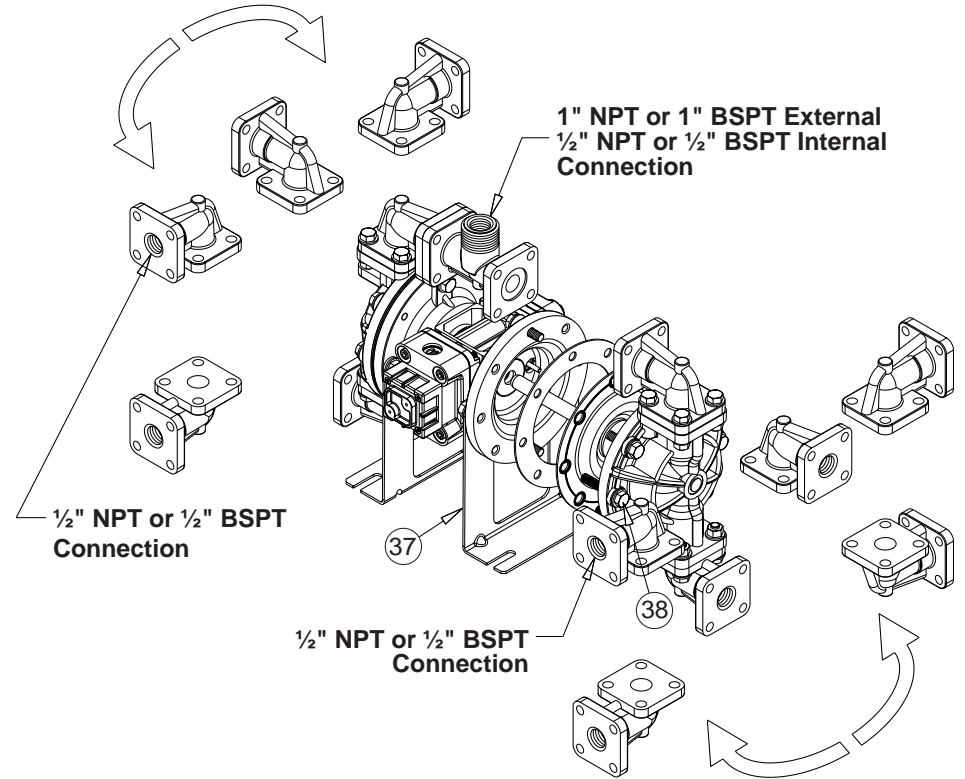
## ! IMPORTANT

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

# Dual Port Option Drawing



**Illustration for Single Port Suction  
with Dual Port Discharge**



**Illustration for Dual Port Suction and  
Single or Dual Port Discharge**



## DUAL PORTING OPTIONS

Several dual porting options are possible. The pump can be converted to a dual port arrangement on both the suction and the discharge ends. The porting can be configured to a single suction and a dual discharge. The porting can be changed to a dual suction and a single discharge.

The above changes are possible because the porting flange of the elbows (items 17) are designed to mate with ½" NPT or ½" BSPT (tapered) connection.

### Dual porting of both suction and discharge ends of the pump

Converting the pump from the standard single suction and discharge porting configuration to dual porting at each end is easy. Simply remove the manifold seals and manifolds (items 33 and 22 from pump assembly drawing) from the pump.

The discharge elbows and suction elbows can be rotated 90° increments (see arrows and optional positioning in the Dual Porting Drawing).

### Single porting of the suction and dual porting of the pump discharge


To convert the pump from the standard single suction and single discharge porting configuration to a dual discharge porting arrangement remove the only the discharge manifolds and manifold seals. Position the discharge elbows in the desired direction at 90° increments. (See arrows and optional positioning in the Dual Porting Drawing.)

### Dual porting of the suction and single porting of the pump discharge

To convert the pump from the standard single suction and single discharge porting configuration to a dual suction porting arrangement remove the only the suction (bottom) manifolds and manifold seals.

Position the suction elbows in the desired direction at 90° increments. (See arrows and optional positioning in the Dual Porting Drawing.)

**NOTE: See Repair Parts List on next page.**



**! IMPORTANT**

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

**SINGLE PORT SUCTION REPAIR PARTS LIST**

| ITEM | PART NO.     | DESCRIPTION                                  | QTY |
|------|--------------|--|-----|
| 17*  | 312-106-502E | Elbow, ½BSPT (replaces 312-106-502)          | 2   |
|      | 312-106-502N | Elbow, ½NPT (replaces 312-106-502)           | 2   |
|      | 312-106-520E | Elbow, ½BSPT (replaces 312-106-520)          | 2   |
|      | 312-106-520N | Elbow, ½NPT (replaces 312-106-520)           | 2   |
|      | 312-106-542E | Elbow, ½BSPT (replaces 312-106-542)          | 2   |
|      | 312-106-542N | Elbow, ½NPT (replaces 312-106-542)           | 2   |
|      | 312-106-552E | Elbow, ½BSPT (replaces 312-106-552)          | 2   |
|      | 312-106-552N | Elbow, ½NPT (replaces 312-106-552)           | 2   |
| 22*  | 518-138-502  | Manifold (installed in bottom position) NPT  | 1   |
|      | 518-138-502E | Manifold (installed in bottom position) BSPT | 1   |
|      | 518-138-520  | Manifold (installed in bottom position) NPT  | 1   |
|      | 518-138-520E | Manifold (installed in bottom position) BSPT | 1   |
|      | 518-138-542  | Manifold (installed in bottom position) NPT  | 1   |
|      | 518-138-542E | Manifold (installed in bottom position) BSPT | 1   |
|      | 518-138-552  | Manifold (installed in bottom position) NPT  | 1   |
|      | 518-138-552E | Manifold (installed in bottom position) BSPT | 1   |
| 24*  | 544-005-115  | Nut, Flanged 5/16-18                         | 28  |
|      | 544-064-308  | Nut, Flanged 5/16-18                         | 28  |

**SINGLE PORT DISCHARGE REPAIR PARTS LIST**

|     |              |   |   |
|-----|--------------|---|---|
| 11* | 171-064-115  | Capscrew, Flanged HD 5/16-18 X 1.50       | 4 |
|     | 171-064-308  | Capscrew, Flanged HD 5/16-18 X 1.50       | 4 |
| 17* | 312-106-502E | Elbow, ½BSPT (replaces 312-106-502)       | 2 |
|     | 312-106-502N | Elbow, ½NPT (replaces 312-106-502)        | 2 |
|     | 312-106-520E | Elbow, ½BSPT (replaces 312-106-520)       | 2 |
|     | 312-106-520N | Elbow, ½NPT (replaces 312-106-520)        | 2 |
|     | 312-106-542E | Elbow, ½BSPT (replaces 312-106-542)       | 2 |
|     | 312-106-542N | Elbow, ½NPT (replaces 312-106-542)        | 2 |
|     | 312-106-552E | Elbow, ½BSPT (replaces 312-106-552)       | 2 |
|     | 312-106-552N | Elbow, ½NPT (replaces 312-106-552)        | 2 |
| 22* | 518-138-502  | Manifold (installed in top position) NPT  | 1 |
|     | 518-138-502E | Manifold (installed in top position) BSPT | 1 |
|     | 518-138-520  | Manifold (installed in top position) NPT  | 1 |
|     | 518-138-520E | Manifold (installed in top position) BSPT | 1 |
|     | 518-138-542  | Manifold (installed in top position) NPT  | 1 |
|     | 518-138-542E | Manifold (installed in top position) BSPT | 1 |
|     | 518-138-552  | Manifold (installed in top position) NPT  | 1 |
|     | 518-138-552E | Manifold (installed in top position) BSPT | 1 |

| ITEM | PART NO.    | DESCRIPTION                                   | QTY |
|------|-------------|---|-----|
| 37   | 115-144-080 | Bracket, Free Standing (replaces 115-140-080) | 2   |
|      | 115-144-305 | Bracket, Free Standing (replaces 115-140-305) | 2   |
|      | 115-144-306 | Bracket, Free Standing (replaces 115-140-306) | 2   |
|      | 115-144-333 | Bracket, Free Standing (replaces 115-140-333) | 2   |
| 38   | 171-068-115 | Capscrew, Flanged 5/16-18 X 1.63              | 8   |
|      | 171-068-308 | Capscrew, Flanged 5/16-18 X 1.63              | 8   |

**DUAL PORT SUCTION AND DISCHARGE REPAIR PARTS LIST**

|     |              |   |    |
|-----|--------------|---|----|
| 11* | 171-064-115  | Capscrew, Flanged HD 5/16-18 X 1.50           | 4  |
|     | 171-064-308  | Capscrew, Flanged HD 5/16-18 X 1.50           | 4  |
| 17* | 312-106-502E | Elbow, ½BSPT (replaces 312-106-502)           | 4  |
|     | 312-106-502N | Elbow, ½NPT (replaces 312-106-502)            | 4  |
|     | 312-106-520E | Elbow, ½BSPT (replaces 312-106-520)           | 4  |
|     | 312-106-520N | Elbow, ½NPT (replaces 312-106-520)            | 4  |
|     | 312-106-542E | Elbow, ½BSPT (replaces 312-106-542)           | 4  |
|     | 312-106-542N | Elbow, ½NPT (replaces 312-106-542)            | 4  |
|     | 312-106-552E | Elbow, ½BSPT (replaces 312-106-552)           | 4  |
|     | 312-106-552N | Elbow, ½NPT (replaces 312-106-552)            | 4  |
| 22* | 518-138-502  | Manifold (none required)                      |    |
|     | 518-138-502E | Manifold (none required)                      |    |
|     | 518-138-520  | Manifold (none required)                      |    |
|     | 518-138-502E | Manifold (none required)                      |    |
|     | 518-138-542  | Manifold (none required)                      |    |
|     | 518-138-502E | Manifold (none required)                      |    |
|     | 518-138-552  | Manifold (none required)                      |    |
|     | 518-138-502E | Manifold (none required)                      |    |
| 24* | 544-005-115  | Nut, Flanged 5/16-18                          | 16 |
|     | 544-005-308  | Nut, Flanged 5/16-18                          | 16 |
| 37  | 115-144-080  | Bracket, Free Standing (replaces 115-140-080) | 2  |
|     | 115-144-305  | Bracket, Free Standing (replaces 115-140-305) | 2  |
|     | 115-144-306  | Bracket, Free Standing (replaces 115-140-306) | 2  |
|     | 115-144-333  | Bracket, Free Standing (replaces 115-140-333) | 2  |
| 38  | 171-068-115  | Capscrew, Flanged 5/16-18 X 1.63              | 8  |
|     | 171-068-308  | Capscrew, Flanged 5/16-18 X 1.63              | 8  |

\*Quantities change from Composite Repair Parts List.

## PUMPING HAZARDOUS LIQUIDS

When a diaphragm fails, the pumped liquid or fumes enter the air end of the pump. Fumes are exhausted into the surrounding environment. When pumping hazardous or toxic materials, the exhaust air must be piped to an appropriate area for safe disposal. See illustration #1 at right.

This pump can be submerged if the pump materials of construction are compatible with the liquid being pumped. The air exhaust must be piped above the liquid level. See illustration #2 at right. Piping used for the air exhaust must not be smaller than 1/2" (1.27 cm) diameter. Reducing the pipe size will restrict air flow and reduce pump performance. When the pumped product source is at a higher level than the pump (flooded suction condition), pipe the exhaust higher than the product source to prevent siphoning spills. See illustration #3 at right.

## CONVERTING THE PUMP FOR PIPING THE EXHAUST AIR

The following steps are necessary to convert the pump to pipe the exhaust air away from the pump.

Use a Phillips screwdriver to remove the six self-tapping screws (item 1-H).

Remove the muffler cap and muffler (items 1-G and 1-F). The 3/8" NPT molded threads in the air distribution valve body (item 1-A).

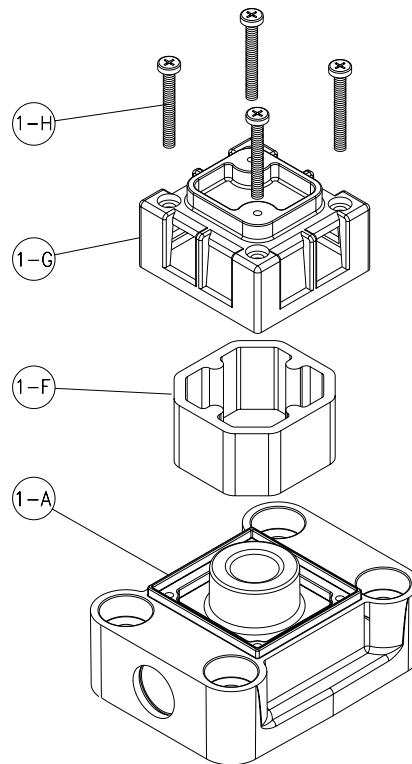
Piping or hose may now be installed.

## IMPORTANT INSTALLATION NOTE:

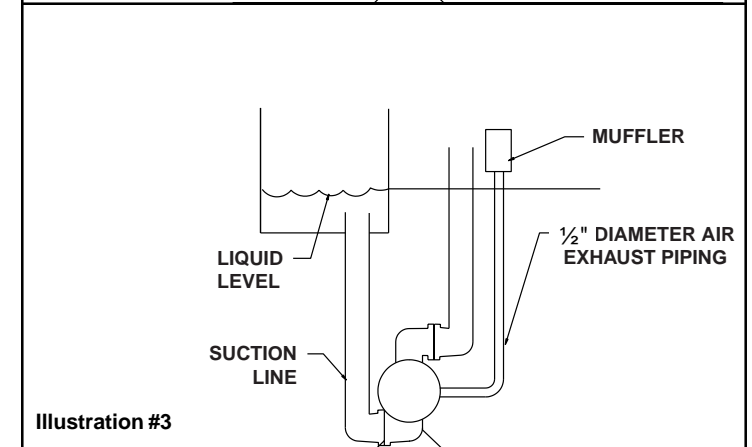
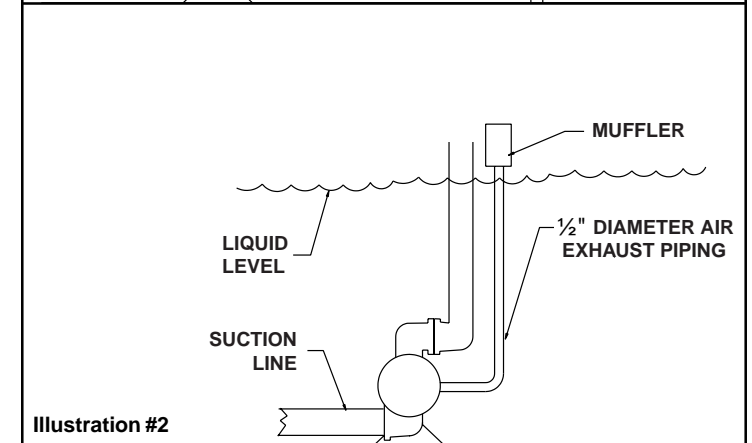
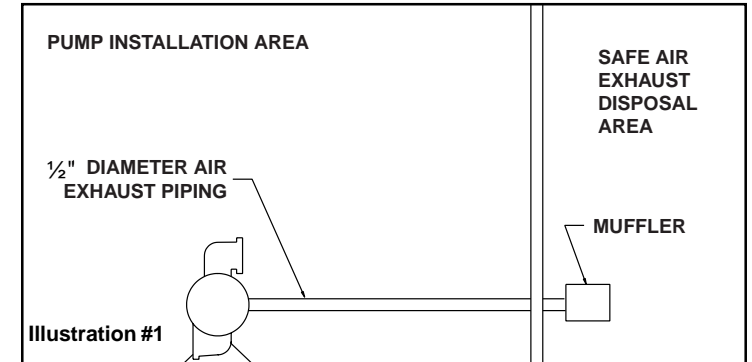
The manufacturer recommends installing a flexible hose or connection between the pump and any rigid plumbing. This reduces stresses on the molded plastic threads of the air exhaust port. Failure to do so may result in damage to the air distribution valve body.

Any piping or hose connected to the pump's air exhaust port must be physically supported. Failure to support these connections could also result in damage to the air distribution valve body.

## Exhaust Conversion Drawing



## CONVERTED EXHAUST ILLUSTRATION



# Pulse Output Kit Drawing

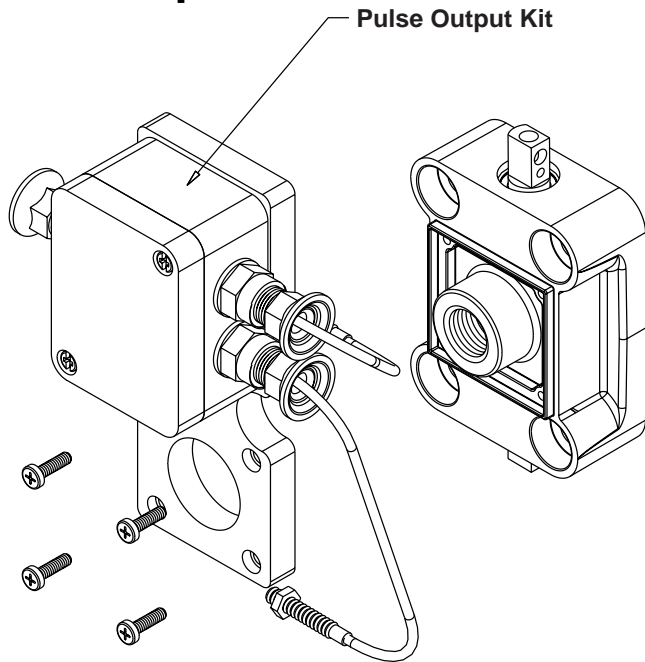
## PULSE OUTPUT KIT OPTION

This pump can be fitted with a Pulse Output Kit. This converts the mechanical strokes of the pump to an electrical signal which interfaces with the RuppTech™ Stroke Counter/ Batch Controller or user control devices such as a PLC.

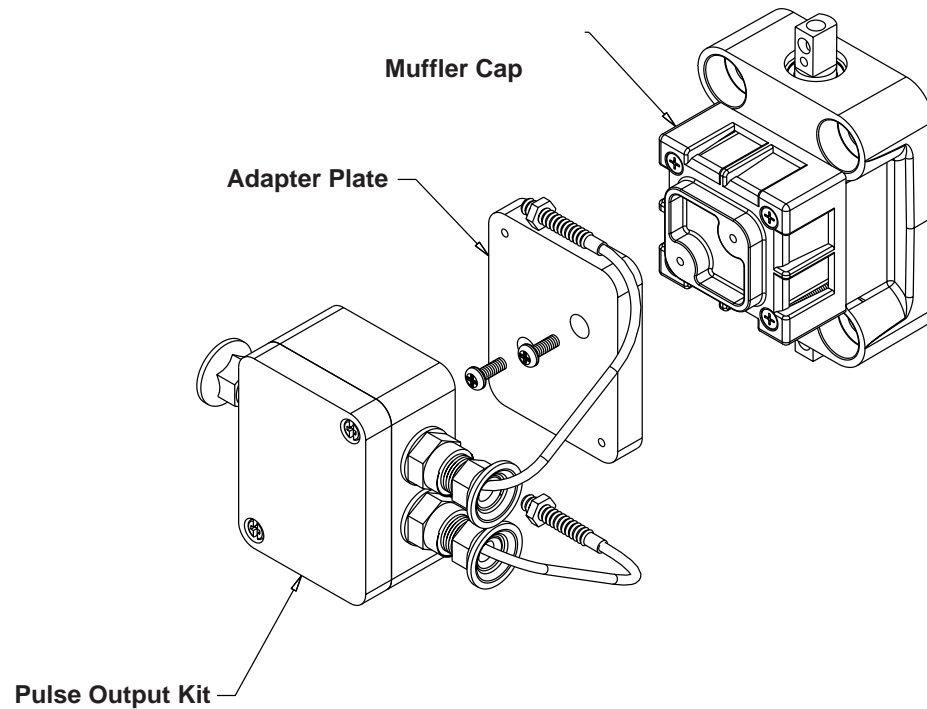
The Pulse Output Kits mount directly onto the Muffler Cap on the Air Distribution Valve Assembly or onto the Air Distribution Valve Assembly when the threaded exhaust port or an auxiliary muffler is being used.

See the individual kits listed on the Pump Repair Parts List for further information.

## Exhaust Port or Auxiliary Muffler Setup



## Integral Muffler Setup



# Grounding The Pump

*(for Conductive Acetal Pumps only)*

**NOTE:** Conductive Acetal Pumps are available with encapsulated muffler only.

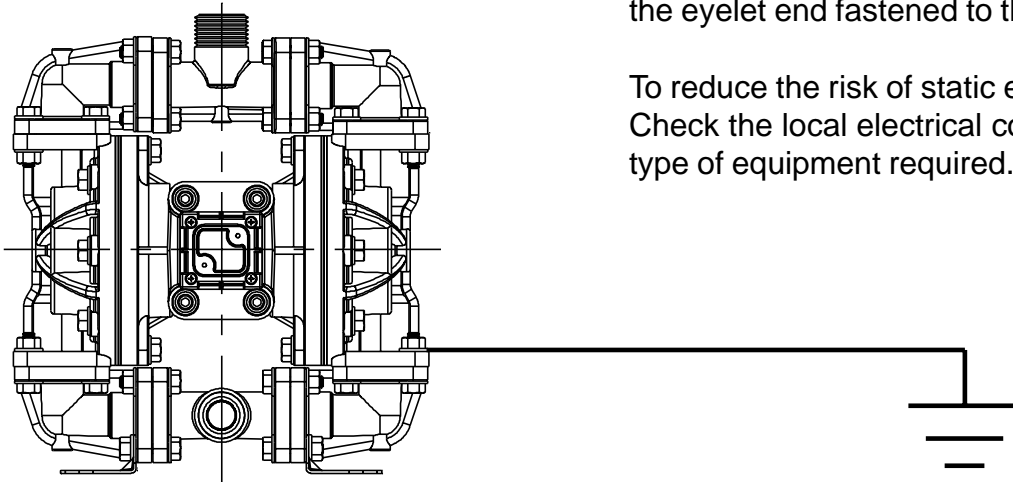
The eyelet end is fastened to the pump hardware.

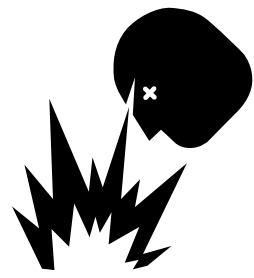
The clamp end is installed to a true earth ground.



This 8 foot long (244 centimeters) Ground Strap (Item 51) is shipped with the eyelet end fastened to the pump hardware.

To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required.



|   |  |
|---|--|
|  | <b>! WARNING</b>   |
|   | <i>Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.</i> |