SANDPIPER®
A WARREN RUPP PUMP BRAND
IDEX FLUID & METERING

SERVICE & OPERATING MANUAL
Original Instructions

CE

Ex See pages 21 & 22 for ATEX ratings

Model HDB1½ Type 7
Model HDB40 Type 7

Table of Contents

Warren Rupp, Inc. • A Unit of IDEX Corporation • 800 N. Main St., Mansfield, Ohio 44902 USA
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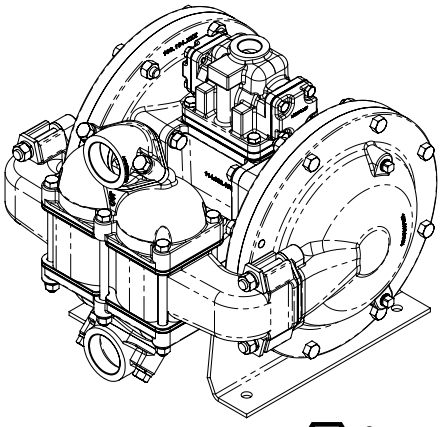
Quality System
ISO9001 Certified

Environmental
Management System
ISO14001 Certified



SANDPIPER®
A WARREN RUPP PUMP BRAND

HDB1½ Type 7
HDB40 Type 7

Heavy Duty Ball Valve
Air-Operated
Double Diaphragm Pump

ENGINEERING, PERFORMANCE
& CONSTRUCTION DATA

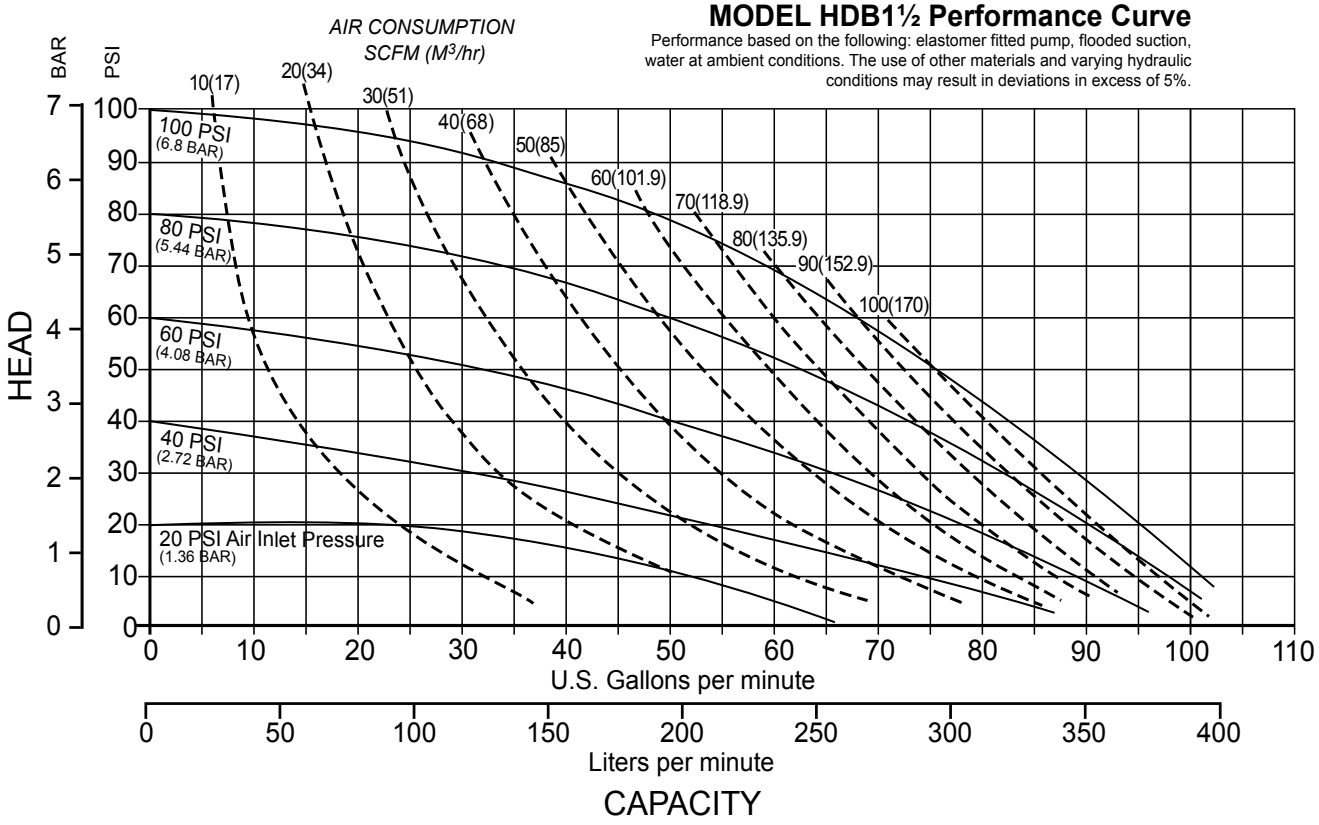
See page 21 & 22 for ATEX ratings

IDEX FLUID & METERING

INTAKE/DISCHARGE PIPE SIZE	CAPACITY	AIR VALVE	SOLIDS-HANDLING	HEADS UP TO	DISPLACEMENT/STROKE
HDB1½: 1½ NPT HDB40: 1½ BSP (Tapered)	0 to 105 gallons per minute (0 to 397 liters per minute)	No-lube, no-stall design	Up to ¼ in. *(6.3mm)*	125 psi or 289 ft. of water (8.8 Kg/cm² or 88 meters)	.37 Gallon / 1.29 liter

MODEL HDB1½ Performance Curve

Performance based on the following: elastomer fitted pump, flooded suction, water at ambient conditions. The use of other materials and varying hydraulic conditions may result in deviations in excess of 5%.



SANDPIPER® pumps are designed to be powered only by compressed air.

Explanation of Pump Nomenclature, HDB1 1/2 & HDB40

MATERIALS OF CONSTRUCTION

To order a pump or replacement parts, first enter the Model Number HDB15, or HDB40, followed by the Type Designation listed below in the far left column.

Type HDB1½ HDB40-A	Porting* Side	Porting* Bottom	Manifold	Outer Chamber	Inner Chamber	Outer Diaphragm Plate	Inner Diaphragm Plate	Intermediate Housing	Diaphragm Rod	Valve Seat	Hard-ware	Diaphragm	Ball Valve Material	Manifold Seat Gasket	Manifold Sealing Rings	Shipping Wt. (lbs)
SB7A.	X	X	356-T6AL	356-T6AL	380AL	380AL	380AL	356-T6AL	416SS	316SS	PS	B	B	CB	A	75
SC7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	V	T	CT	T	75
SI7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	I	I	CT	A	75
SN7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	N	N	CN	A	75
SV7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	V	V	CT	T	75
SGN7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	N/T	T	CT	T	75
SS7A.	X	X	356T6AL	356T6AL	380AL	380AL	380AL	356T6AL	416SS	316SS	PS	S	S	CT	A	75
SB7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	B	B	CB	A	102
SC7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	V	T	CT	T	102
SI7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	I	I	CT	A	102
SN7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	N	N	CN	A	102
SV7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	V	V	CT	T	102
SGN7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	N/T	T	CT	T	102
SS7CI.	X	X	CI	CI	380AL	CI	380AL	356T6AL	416SS	316SS	PS	S	S	CT	A	102
SB7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	B	B	CB	A	104
SC7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	V	T	CT	T	104
SI7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	I	I	CT	A	104
SN7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	N	N	CN	A	104
SV7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	V	V	CT	T	104
SGN7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	N/T	T	CT	T	104
SS7II.	X	X	CI	CI	CI	CI	CI	CI	416SS	316SS	PS	S	S	CT	A	104
SB7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	B	B	CB	A	107
SC7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	V	T	CT	T	107
SI7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	I	I	CT	A	107
SN7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	N	N	CN	A	107
SV7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	V	V	CT	T	107
SGN7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	N/T	T	CT	T	107
SGV7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	V/T	T	CT	T	107
SS7SS.	X	X	SS	SS	380AL	SS	380AL	356T6AL	416SS	316SS	PS	S	S	CT	A	107
SB7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	B	B	CB	A	107
SC7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	V	T	CT	T	107
SI7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	I	I	CT	A	107
SN7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	N	N	CN	A	107
SV7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	V	V	CT	T	107
SGI7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	I/T	T	CT	T	107
SGN7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	N/T	T	CT	T	107
SGV7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	V/T	T	CT	T	107
SS7SI.	X	X	SS	SS	CI	SS	CI	CI	416SS	316SS	PS	S	S	CT	A	107
SGN7HC.	X	X	Alloy C	Alloy C	CI	Alloy C	CI	CI	416SS	Alloy C	PS	N/T	T	CT	T	107

Meanings of Abbreviations:

A = Compressed Fibre
AL = Aluminum
B = Nitrile
CB = Conductive Nitrile
CI = Cast Iron
CN = Conductive Neoprene
CT = Conductive PTFE
DC = Die Cast
H/T = Hytrel® Backup/PTFE Overlay
I = EPDM
I/T = EPDM Backup/PTFE Overlay
N = Neoprene
N/T = Neoprene Backup/PTFE Overlay
PS = Plated Steel
S = Santoprene
SS = Stainless Steel
T = PTFE
V = FKM
Alloy C = Alloy C

*Note: For bottom ported option replace 1st character "S" with "D"

II 1 G c T5
II 3/1 G c T5
II 1 D c T100oC
I M1 c
I M2 c
Models equipped with Cast Iron, Stainless Steel, or Alloy C wetted parts, and Cast Iron midsection parts. See page 22 for ATEX Explanation of EC-Type Certificate.

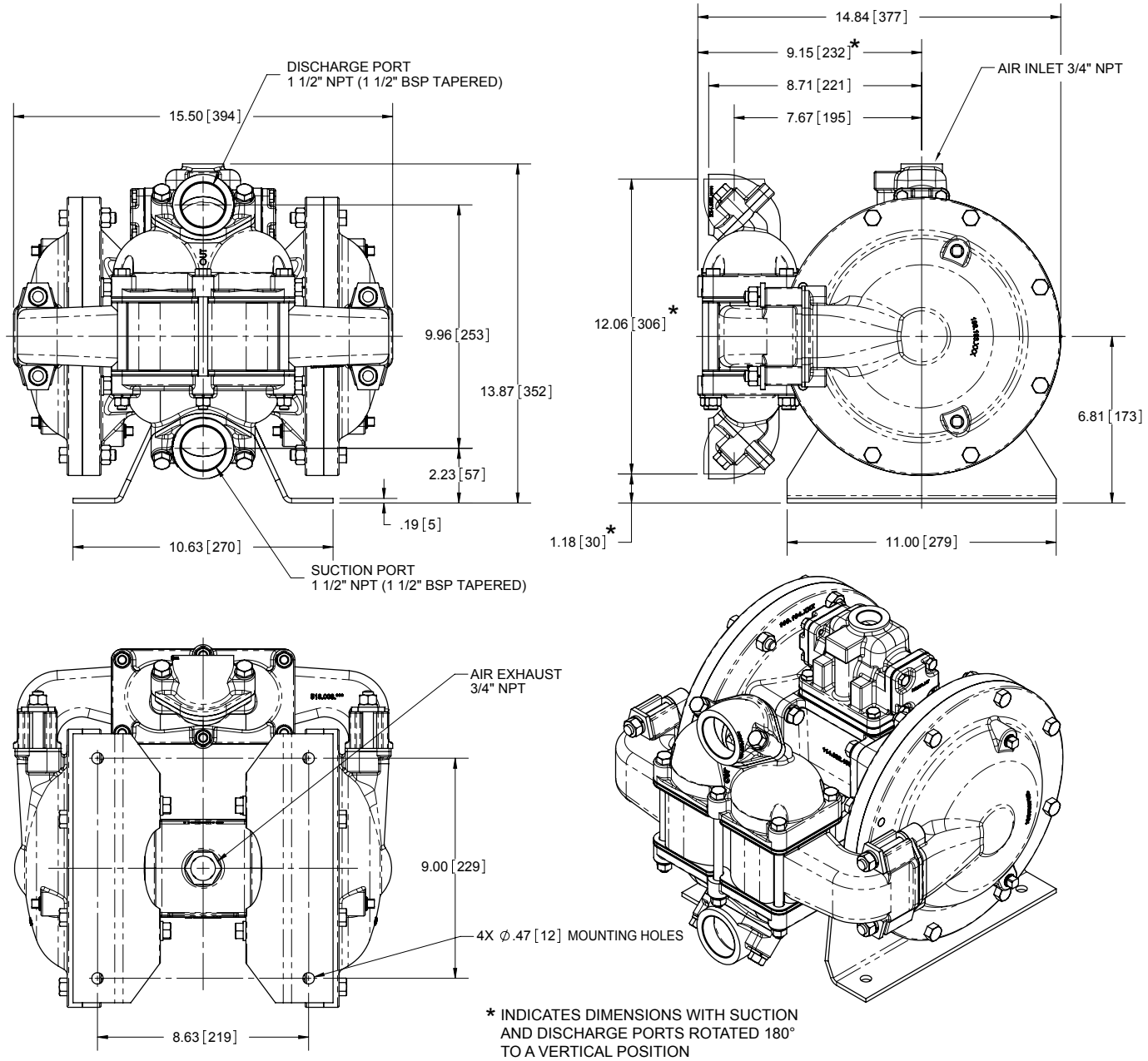
II 2 G c T5
II 3/2 G c T5
II 2 D c T100oC
All models, including pumps equipped with Aluminum wetted and midsection parts. See page 22 for ATEX Explanation of Type Examination Certificate.

Materials	*Maximum and Minimum Temperatures are the limits for which these materials can be operated. Temperatures coupled with pressure affect the longevity of diaphragm pump components. Maximum life should not be expected at the extreme limits of the temperature ranges.*	
	Operating Temperatures	
	Maximum	**Minimum**
Nitrile General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.	190°F 88°C	-10°F -23°C
EPDM Shows very good water and chemical resistance. Has poor resistance to oil and solvents, but is fair in ketones and alcohols.	280°F 138°C	-40°F -40°C
NEOPRENE All purpose. Resistant to vegetable oils. Generally not affected by moderate chemicals, fats, greases and many oils and solvents. Generally attacked by strong oxidizing acids, ketones, esters, nitro hydrocarbons and chlorinated aromatic hydrocarbons.	200°F 93°C	-10°F -23°C
HYTREL® Good on acids, bases, amines and glycols at room temperature.	220°F 104°C	-20°F -29°C
PTFE Chemically inert, virtually impervious. Very few chemicals are known to react chemically with 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.	220°F 104°C	-35°F -37°C
FKM (Fluorocarbon) shows good resistance to a wide range of oils and solvents; especially all aliphatic, aromatic and halogenated hydrocarbons, acids, animal and vegetable oils. Hot water or hot aqueous solutions (over 70°F) will attack FKM.	350°F 177°C	-40°F -40°C
Santoprene® Injection molded thermoplastic elastomer with no fabric layer. Long mechanical flex life. Excellent abrasion resistance.	275°F 135°C	-40°F -40°C
‡ **CF-8M Stainless Steel** equal to or exceeding ASTM specification A743 for corrosion resistant iron chromium, iron chromium nickel, and nickel based alloy castings for general applications. Commonly referred to as 316 Stainless Steel in the pump industry.		
ALLOY C CW-12MW equal to or exceeding ASTM A494 specification for nickel and nickel alloy castings.		

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

Dimensions: HDB1 1/2 & HDB40, Side Ported

Dimensions are ± .13" (3mm)
Figures in parenthesis = millimeters

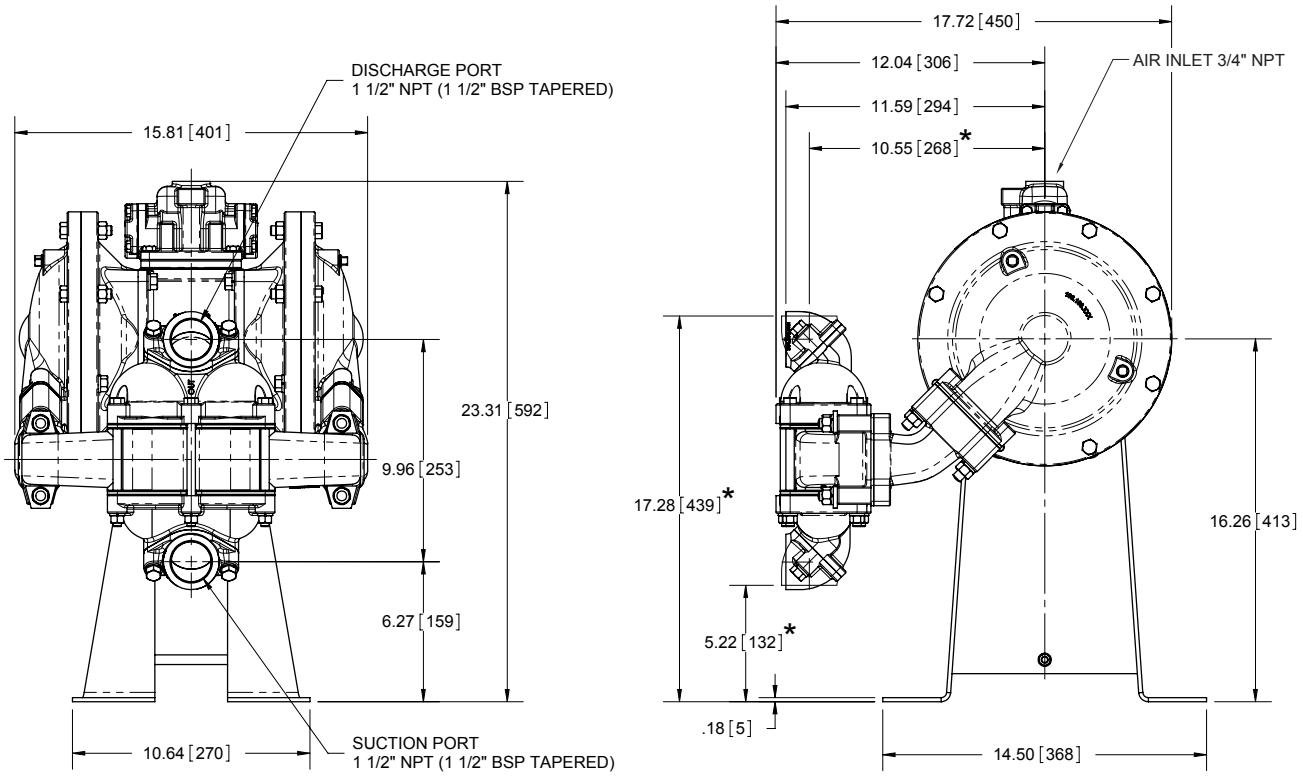


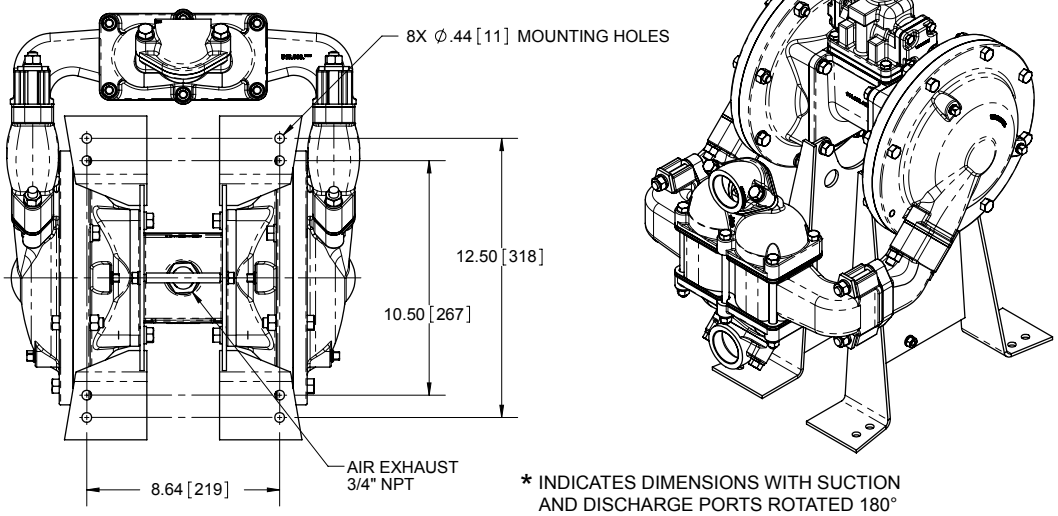
* INDICATES DIMENSIONS WITH SUCTION AND DISCHARGE PORTS ROTATED 180° TO A VERTICAL POSITION

Model HDB1½-A features 1½" NPT threaded connections.
Model HDB40-A features 1½" BSP Tapered connections.

Dimensions: HDB1 1/2 & HDB40, Down Ported

Dimensions are ± .13" (3mm)
Figures in parenthesis = millimeters





* INDICATES DIMENSIONS WITH SUCTION AND DISCHARGE PORTS ROTATED 180° TO A VERTICAL POSITION

Model HDB1½-A features 1½" NPT threaded connections.
Model HDB40-A features 1½" BSP Tapered connections.

PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by compressed air and is a 1:1 pressure ratio design. It alternately pressurizes the inner side of one diaphragm chamber, while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod, to move endwise. Air pressure is applied over the entire surface of the diaphragm, while liquid is discharged from the opposite side. The diaphragm operates under a balanced condition during the discharge stroke, which allows the unit to be operated at discharge heads over 200 feet (61 meters) of water head.

Since the diaphragms are connected by a common rod, secured by plates to the center of the diaphragms, one diaphragm performs the discharge stroke, while the other is pulled to perform the suction stroke in the opposite chamber.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Do not install on suction head in excess of 10 feet of liquid (3.048 meters). Consult factory if conditions exceed this recommendation.

Alternate pressuring and exhausting of the diaphragm chamber is performed by means of an externally mounted, pilot operated, four-way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet air 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 porting of chambers is reversed. The air distribution valve spool is moved by an internal pilot valve which alternately pressurizes one side of the air distribution valve spool, while exhausting the other side. The pilot valve is shifted at each end of the diaphragm stroke by the diaphragm plate coming in contact with the end of the pilot spool. This pushes it into position for shifting of the air distribution valve.

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

⚠ *WARNING* ⚠

HAZARD WARNING -POSSIBLE EXPLOSION HAZARD can result if 1,1,1-Trichloroethane, Methylene Chloride or other Halogenated Hydrocarbon solvents are used in pressurized fluid systems having Aluminum or Galvanized wetted parts. Death, serious bodily injury and/or property damage could result. Consult with the factory if you have questions concerning Halogenated Hydrocarbon solvents.

INSTALLATION & START-UP

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

For installations of rigid piping, short flexible sections of hose should be installed between pump and piping. This reduces vibration and strain to the piping system. A Warren Rupp Tranquilizer® surge suppressor is recommended to further reduce pulsation in flow. Tighten all gaskets prior to start-up.

This pump was tested at the factory prior to shipment and is ready for operation.

AIR SUPPLY

Air supply pressures cannot exceed 125 psi (8.61 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air line is solid piping, use a short length of flexible hose [not less than $^{3}/_{4}$" (19mm) in diameter] between pump and piping to eliminate strain to pipes.

AIR INLET & PRIMING

For start-up, open an air valve approximately $^{1}/_{2}$ to $^{3}/_{4}$ turn. After the unit primes, an air valve can be opened to increase flow as desired. If opening the valve increases cycling rate, but does not increase flow rate, cavitation has occurred, and the valve should be closed slightly.

For the most efficient use of compressed air and the longest diaphragm life, throttle the air inlet to the lowest cycling rate that does not reduce flow.

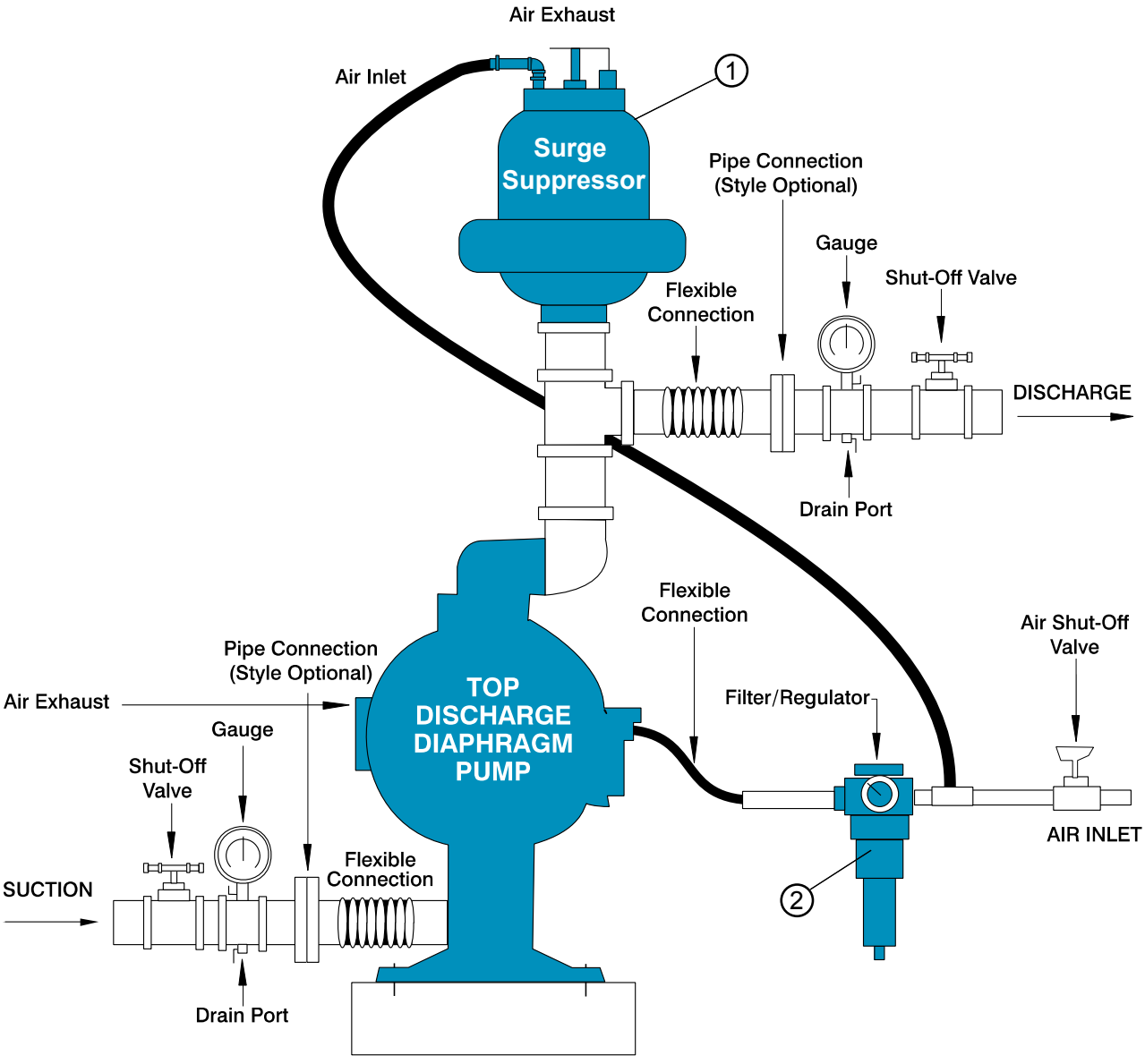
INSTALLATION GUIDE
Top Discharge Ball or Flap Valve Unit

Available from Warren Rupp

① Tranquilizer®/Surge Supressor

② Filter/Regulator

⚠ 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.



AIR EXHAUST

If a diaphragm fails, the pumped liquid or fumes can enter the air end of the pump, and be exhausted into the atmosphere. When pumping hazardous or toxic materials, pipe the exhaust to an appropriate area for safe disposition.

This pump can be submerged if materials of construction are compatible with the liquid. The air exhaust must be piped above the liquid level. Piping used for the air exhaust must not be smaller than 1" (2.54 cm). Reducing the pipe size will restrict air flow and reduce pump performance .When the product source is at a higher level than the pump (flooded suction), pipe the exhaust higher than the product source to prevent siphoning spills.

Freezing or icing-up of the air exhaust can occur under certain temperature and humidity conditions. Use of an air dryer unit should eliminate most icing problems.

BETWEEN USES

When used for materials that tend to settle out or transform to solid form, the pump should be completely 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 valves and diaphragms at re-start. In freezing temperatures, the pump must be drained between uses in all cases.

CHECK VALVE SERVICING

For best priming and most efficient pumping performance, it is important to maintain check valves and valve seats in good condition for proper sealing. Need for inspection or service of ball valves is usually indicated by poor priming, unstable cycling, reduced performance, or pump cycles but will not pump.

Inspection and service of check valves requires the removal of six bolts which provide access to all four ball valves and both, suction and discharge, valve seats. New ball check valves are $2^{1}/_{4}$" (5.715 cm) diameter and will require replacement when worn to approximately 2" (5.08 cm) diameter.

DIAPHRAGM SERVICING

Need for inspection, or service, of diaphragm is usually indicated when unit pumps from one chamber only and air is discharged out pump discharge port or when liquid being pumped is discharged through air exhaust port. To service diaphragms, remove the eight 7/16 bolts that secure the outer chamber to the inner chamber (items 11 & 15), as well as the nuts, lock washers and tapered washers (items 30,45 & 46) that secure the manifold to the chamber. To remove diaphragms, loosen diaphragm assembly (outer plate no. 36, diaphragm no. 18, inner plate no. 35) by turning out of the shaft using a wrench. A 1" (2.54 cm) square lug is provided on the outer plate (no. 36) for this purpose. Removal of opposite outer chamber will permit removal of second diaphragm assembly and shaft as a unit. To disassemble the diaphragm assemblies, clamp the inner diaphragm plate (no. 35) around the outer diameter between jaws of a vise to hold it while you turn the outer diaphragm plate (no. 36) loose using a wrench. Interior components consisting of shaft seals and sleeve bearings are now accessible for service if required.

REASSEMBLY

All procedures for reassembling the diaphragms are just in reverse of previous instructions for disassembly. The diaphragms are to be installed with their natural bulge outward or toward the outer diaphragm plate (no. 36). Make sure the inner plate is installed with the flat face against the diaphragm. If needed, the second diaphragm can be installed with the natural bulge toward the air side. The can aid in the assembling of the outer chamber.

After all components are in position in vise and hand tight, tighten with wrench to approximately 40 ft. lbs. (54.23 Newton meters) torque. After each diaphragm assembly has been made, thread one assembly into shaft (no. 40) (hold shaft near middle in vise having soft jaws to protect finish). Install this sub assembly into pump and secure by placing the outer chamber (no. 16) on the end with the diaphragm. This will hold the assembly in place while the opposite side is installed. Make sure the last diaphragm assembly is torqued to 30 ft. lbs. (40.67 Newton meters). This final torquing will lock the diaphragm assemblies together. Place remaining outer chamber on open end and secure.

A Note about Air Valve Lubrication

The SANDPIPER pump's pilot valve and main air valve assemblies 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 supplies. Proper lubrication of the compressed air supply would entail the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of 10 wt., non-detergent oil for every 20 SCFM of air the pump consumed at its point of operation. Consult the pump's published Performance Curve to determine this.

It is important to remember to inspect the sleeve and spool set routinely. It should move back and forth freely. This is most important when the air supply is lubricated. If a lubricator is used, oil accumulation will, over time, collect any debris from the compressed air. This can prevent the pump from operating properly.

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. This can be addressed by using a point of use air dryer to supplement a plant's air drying equipment. This device will remove excess water from the compressed air supply and alleviate the icing or freezing problem.

ESADS+Plus®: Externally Serviceable Air Distribution System

Please refer to the exploded view drawing and parts list in the Service Manual supplied with your pump. If you need replacement or additional copies, contact your local Warren Rupp Distributor, or the Warren Rupp factory Literature Department at the number shown below. To receive the correct manual, you must specify the MODEL and TYPE information found on the name plate of the pump.

Models with 1" suction/discharge or larger, and METAL center sections:

The main air valve sleeve and spool set is located in the valve body mounted on the pump with four hex head capscrews. The valve body assembly is removed from the pump by removing these four hex head capscrews.

With the valve body assembly off the pump, access to the sleeve and spool set is made by removing four hex head capscrews (each end) on the end caps of the valve body assembly. With the end caps removed, slide the spool back and forth in the sleeve. The spool is closely sized to the sleeve and must move freely to allow for proper pump operation. An accumulation of oil, dirt or other contaminants from the pump's air supply, or from a failed diaphragm, may prevent the spool from moving freely. This can cause the spool to stick in a position that prevents the pump from operating. If this is the case, the sleeve and spool set should be removed from the valve body for cleaning and further inspection.

Remove the spool from the sleeve. Using an arbor press or bench vise (with an improvised mandrel), press the sleeve from the valve body. Take care not to damage the sleeve. At this point, inspect the o-rings on the sleeve for nicks, tears or abrasions. Damage of this sort could happen during assembly or servicing. A sheared or cut o-ring can allow the pump's compressed air supply to leak or bypass within the air valve assembly, causing the pump to leak compressed air from the pump air exhaust or not cycle properly. This is most noticeable at pump dead head or high discharge pressure conditions. Replace any of these o-rings as required or set up a routine, preventive maintenance schedule to do so on a regular basis.

This practice should include cleaning the spool and sleeve components with a safety solvent or equivalent, inspecting for signs of wear or damage, and replacing worn components.

To re-install the sleeve and spool set, lightly lubricate the o-rings on the sleeve with an o-ring assembly lubricant or lightweight oil (such as 10 wt. air line lubricant). Re-install one end cap, gasket and bumper on the valve body. Using the arbor press or bench vise that was used in disassembly, carefully press the sleeve back into the valve body, without shearing the o-rings. You may have to clean the surfaces of the valve body where the end caps mount. Material may remain from the old gasket. Old material not cleaned from this area may cause air leakage after reassembly. Take care that the bumper stays in place allowing the sleeve to press in all the way. Re-install the spool, the opposite end cap, gasket and bumper on the valve body. After inspecting and cleaning the gasket surfaces on the valve body and intermediate, re-install the valve body on the pump using new gaskets. Tighten the four hex head capscrews evenly and in an alternating cross pattern.

PILOT VALVE

The pilot valve assembly is accessed by removing the main air distribution valve body from the pump and lifting the pilot valve body out of the intermediate housing.

Most problems with the pilot valve can be corrected by replacing the o-rings. Always grease the spool prior to inserting it into the sleeve. If the sleeve is removed from the body, reinsertion must be at the chamfered side. Grease the o-rings to slide the sleeve into the valve body. Securely insert the retaining ring around the sleeve. When reinserting the pilot valve, push both plungers (see #39 on drawing), located inside the intermediate bracket, out of the path of the pilot valve spool ends to avoid damage.

PILOT VALVE ACTUATOR

The bushings (no. 8) for the pilot valve actuators threaded into the intermediate bracket (no. 5) from the outside. The plunger (no. 39) may be removed for inspection or replacement from the inside by removing the air distribution valve body (no. 1) and the pilot valve body (no. 4) from the pump. The plungers (no. 39) should be visible as you look down into the intermediate from the top. Depending on their position, you may find it necessary to use a fine piece of wire to pull them out. There is an o-ring (no. 31) on the plunger.

Under some circumstances, it may become necessary to replace the threaded bushings (no. 8). The pump will need to be disassembled by removing the manifold assembly (no. 27), outer chamber (no. 16) and diaphragm (no. 18). Once the parts have been removed, the threaded bushing (no. 8) can be removed from the intermediate (no. 5).

TROUBLESHOOTING

PROBLEM: Pump cycles but will not pump. (Note: higher suction lifts require faster cycling speed for priming.)
POSSIBLE CAUSES:
A. Air leak in suction line.
B. Excessive suction lift.
C. Check valve not seating properly.
D. Leakage at joint of suction manifold or elbow flange.
E. Suction line or strainer plugged.
F. Diaphragm ruptured.

PROBLEM: Pump will not cycle. (Note: Always disconnect air supply to relieve air pressure before disassembling any portion of pump.)
POSSIBLE CAUSES:
A. Discharge hose or line plugged, or discharge head requirement greater than air supply pressure. (Disconnect discharge line to check.)
B. Spool in air distribution valve not shifting. (Remove end cap and check spool — must slide freely.)
C. Diaphragm ruptured. (Air will escape out discharge line in this case.)
D. Blockage in diaphragm chamber preventing movement. (Shut off air supply and reopen after pressure is relieved.)
E. Muffler clogged.

PROBLEM: Uneven discharge flow. (Indicates one chamber not operating properly.)
POSSIBLE CAUSES:
A. Check valve not sealing properly in one chamber.
B. Diaphragm failure in one chamber.
C. Air leak at suction manifold joint or elbow flange one side.
D. Muffler clogged.

For additional information, see the Warren Rupp Troubleshooting Guide.

WARRANTY:

This unit is guaranteed for a period of five years against defective material and workmanship.

RECOMMENDED WARREN RUPP ACCESSORIES TO MAXIMIZE PUMP PERFORMANCE:

- **Tranquilizer® Surge Suppressor: For nearly pulse-free flow.**
- **Warren Rupp Filter/Regulator: For modular installation and service convenience.**
- **Warren Rupp Speed Control: For manual or programmable process control. Manual adjustment or 4-20mA reception.**

For more detailed information on these accessories, contact your local Warren Rupp Factory-Authorized Distributor, or Warren Rupp corporate headquarters.

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. (See page 13)

⚠ 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.

RECYCLING

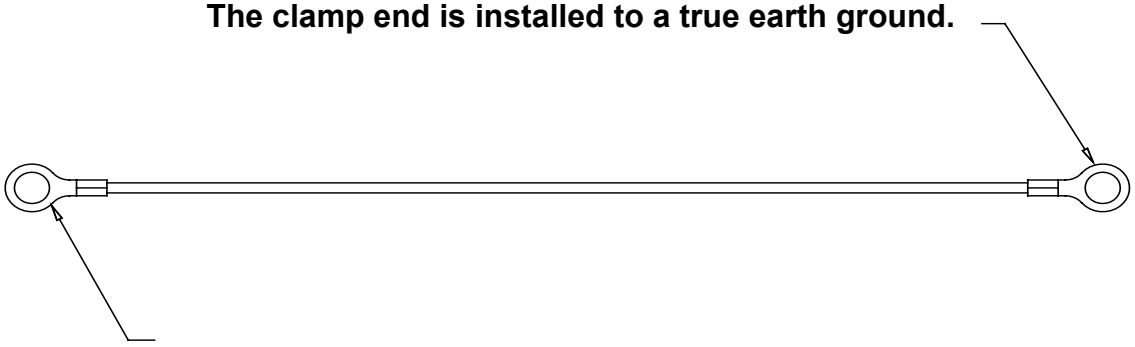
Many components of SANDPIPER® AODD pumps are made of recyclable materials (see chart on page 14 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.

Grounding The Pump

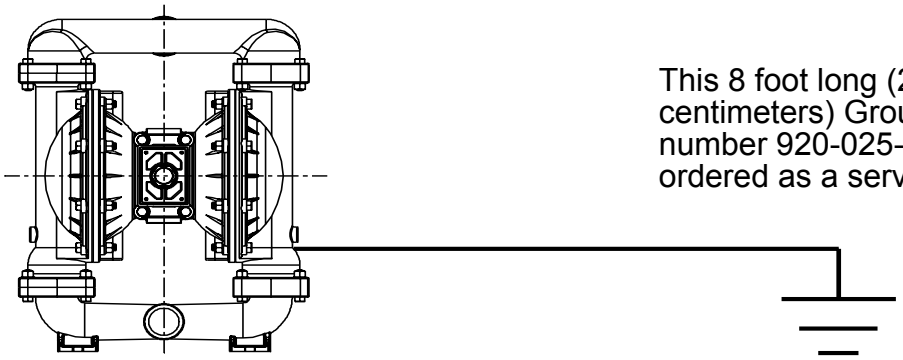
WARNING

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.

The clamp end is installed to a true earth ground.



The eyelet end is fastened to the pump hardware.



This 8 foot long (244 centimeters) Ground Strap, part number 920-025-000 can be ordered as a service item.

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, or in the absence of local codes, an industry or nationally recognized code having jurisdiction over specific installations.

MATERIAL CODES
THE LAST 3 DIGITS OF PART NUMBER

000	Assembly, sub-assembly; and some purchased items
010	Cast Iron
012	Powered Metal
015	Ductile Iron
020	Ferritic Malleable Iron
025	Music Wire
080	Carbon Steel, AISI B-1112
100	Alloy 20
110	Alloy Type 316 Stainless Steel
111	Alloy Type 316 Stainless Steel (Electro Polished)
112	Alloy C
113	Alloy Type 316 Stainless Steel (Hand Polished)
114	303 Stainless Steel
115	302/304 Stainless Steel
117	440-C Stainless Steel (Martensitic)
120	416 Stainless Steel (Wrought Martensitic)
123	410 Stainless Steel (Wrought Martensitic)
148	Hardcoat Anodized Aluminum
149	2024-T4 Aluminum
150	6061-T6 Aluminum
151	6063-T6 Aluminum
152	2024-T4 Aluminum (2023-T351)
154	Almag 35 Aluminum
155	356-T6 Aluminum
156	356-T6 Aluminum
157	Die Cast Aluminum Alloy #380
158	Aluminum Alloy SR-319
159	Anodized Aluminum
162	Brass, Yellow, Screw Machine Stock
165	Cast Bronze, 85-5-5-5
166	Bronze, SAE 660
170	Bronze, Bearing Type, Oil Impregnated
175	Die Cast Zinc
180	Copper Alloy
305	Carbon Steel, Black Epoxy Coated
306	Carbon Steel, Black PTFE Coated
307	Aluminum, Black Epoxy Coated
308	Stainless Steel, Black PTFE Coated
309	Aluminum, Black PTFE Coated
310	PVDF Coated
313	Aluminum, White Epoxy Coated
330	Zinc Plated Steel
331	Chrome Plated Steel
332	Aluminum, Electroless Nickel Plated
333	Carbon Steel, Electroless Nickel Plated
335	Galvanized Steel
336	Zinc Plated Yellow Brass
337	Silver Plated Steel
340	Nickel Plated
342	Filled Nylon
351	Food Grade Santoprene; Color: NATURAL
353	Geolast; Color: BLACK
354	Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED
355	Thermal Plastic
356	Hytrel; Color: BLUE
357	Injection Molded Polyurethane; Color: GREEN
358	Urethane Rubber; Color: NATURAL (Some Applications) (Compression Mold)
359	Urethane Rubber; Color: NATURAL
360	Nitrile Rubber; Color Coded: RED
361	Nitrile
363	FKM (Fluorocarbon). Color Coded: YELLOW
364	E.P.D.M. Rubber. Color Coded: BLUE
365	Neoprene Rubber; Color Coded: GREEN
366	Food Grade Nitrile; Color: WHITE
368	Food Grade EPDM; Color: GRAY
370	Butyl Rubber Color Coded: BROWN
371	Philthane (Tuftane)
374	Carboxylated Nitrile
375	Fluorinated Nitrile
378	High Density Polypropylene
379	Conductive Nitrile; Color Coded: RED & SILVER
384	Conductive Neoprene; Color Coded: GREEN & SILVER
405	Cellulose Fibre
408	Cork and Neoprene
425	Compressed Fibre
426	Blue Gard
440	Vegetable Fibre
465	Fibre
500	Delrin 500
501	Delrin 570
502	Conductive Acetal, ESD-800; Color: BLACK
503	Conductive Acetal, Glass-Filled Color: BLACK; Color Coded: YELLOW
505	Acrylic Resin Plastic
506	Delrin 150
520	Injection Molded PVDF; Color: NATURAL
521	Injection Molded Conductive PVDF; Color: BLACK; Color Coded: LIGHT GREEN
540	Nylon
541	Nylon
542	Nylon
544	Nylon Injection Molded
550	Polyethylene
551	Glass Filled Polypropylene; Color: BLACK
552	Unfilled Polypropylene; Color: NATURAL
555	Polyvinyl Chloride
556	Black Vinyl
557	Conductive Polypropylene; Color: BLACK; Color Coded: SILVER
558	Conductive HDPE; Color: BLACK Color Coded: SILVER
559	Conductive Polypropylene; Color: BLACK Color Coded: SILVER
570	Rulon II
580	Ryton
590	Valox
591	Nylatron G-S
592	Nylatron NSB
600	PTFE (virgin material) Tetrafluorocarbon (TFE)
601	PTFE (Bronze and moly filled)
602	Filled PTFE
603	Blue Gylon
604	PTFE
606	PTFE
607	Envelon
608	Conductive PTFE; Color: BLACK
610	PTFE Encapsulated Silicon
611	PTFE Encapsulated FKM
632	Neoprene/Hytrel
633	FKM/PTFE
634	EPDM/PTFE
635	Neoprene/PTFE
637	PTFE , FKM/PTFE
638	PTFE , Hytrel/PTFE
639	Nitrile/TFE
643	Santoprene®/EPDM
644	Santoprene®/PTFE
656	Santoprene Diaphragm and Check Balls/EPDM Seats
661	EPDM/Santoprene
666	FDA Nitrile Diaphragm, PTFE Overlay, Balls, and Seals
668	PTFE, FDA Santoprene/PTFE

Delrin is a registered tradename of E.I. DuPont.

Gylon is a registered tradename of Garlock, Inc.

Nylatron is a registered tradename of Polymer Corp.

Santoprene is a registered tradename of Exxon Mobil Corp.

Rulon II is a registered tradename of Dixion Industries Corp.

Ryton is a registered tradename of Phillips Chemical Co.

Valox is a registered tradename of General Electric Co.

PortaPump, Tranquilizer and SludgeMaster are registered tradenames of Warren Rupp, Inc.

Composite Repair Parts List

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL
1	031.019.156	Assembly, Main Air Valve (Aluminum Center)	1
	031.019.010	Assembly, Main Air Valve (Cast Iron Center)	1
1.1	**031.012.000**	**Sleeve and Spool Set**	**1**
1.2	095.043.156	Body, Air Valve (Aluminum Center)	1
	095.043.010	Body, Air Valve (Cast Iron Center)	1
1.3	**132.014.358**	**Bumper, Air Valve**	**2**
1.4	165.011.157	Cap, End (Aluminum Center)	2
	165.011.010	Cap, End (Cast Iron Center)	
1.5	170.032.330	Capscrew, Hex Hd, 1/4-20 X .75	8
1.6	**360.010.425**	**Gasket, End Cap**	**2**
1.7	**560.020.360**	**O-ring**	**6**
2	050.005.360W	Ball, Check	4
	050.005.363	Ball, Check	4
	050.005.364	Ball, Check	4
	050.005.365W	Ball, Check	4
	050.005.354	Ball, Check	4
	050.010.600	Ball, Check	4
3	070.006.170	Bearing	2
4	**095.073.000**	**Assembly, Pilot Valve**	**1**
4.1	**095.070.551**	**Body, Pilot Valve**	**1**
4.2	**560.023.360**	**O-ring**	**2**
4.3	**560.033.360**	**O-ring**	**4**
4.4	**675.037.080**	**Ring, Retaining**	**1**
4.5	**755.025.162**	**Sleeve**	**1**
4.6	**775.026.115**	**Spool, Pilot Valve**	**1**
5	114.002.156	Bracket, Intermediate	1
	114.002.010	Bracket, Intermediate	1
6	115.046.080	Bracket, Leg (Side Ported Only)	2
	115.057.080	Bracket, Leg (Down Ported Only)	2
7	**132.002.360**	**Bumper, Diaphragm Rod**	**2**
8	**135.016.162**	**Bushing, Threaded**	**2**
9	170.023.330	Capscrew, Hex Hd, 7/16-14 X 1.75	4
	170.035.330	Capscrew, Hex Hd, 7/16-14 X 1.50 (Stainless Units Only)	4
10	170.024.330	Capscrew, Hex Hd, 7/16-14 X 1.00	4
11	170.035.330	Capscrew, Hex Hd, 7/16-14 X 1.50	4
12	170.040.330	Capscrew, Hex Hd, 3/8-16 X 5.50	6
13	170.045.330	Capscrew, Hex Hd, 5/16-18 X 1.25	4
14	170.058.330	Capscrew, Hex Hd, 7/16-14 X 1.25	4
15	170.060.330	Capscrew, Hex Hd, 7/16-14 X 2.00	12
16	196.193.156	Chamber, Outer (Includes Plug-Item #38)	2
	196.193.010	Chamber, Outer (Includes Plug-Item #38)	2
	196.193.110	Chamber, Outer (Includes Plug-Item #38)	2
	196.193.112	Chamber, Outer (Includes Plug-Item #38)	2
17	196.194.156	Chamber, Inner (Includes Plug - Item #37)	2
	196.194.010	Chamber, Inner (Includes Plug - Item #37)	2
18	**286.005.360**	**Diaphragm**	**2**
	286.005.363	**Diaphragm**	**2**
	286.005.364	**Diaphragm**	**2**
	286.005.365	**Diaphragm**	**2**
	286.005.354	**Diaphragm**	**2**
	286.114.659	**Diaphragm, One-Piece Bonded PTFE Diaphragm**	**2**

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL
19	**286.020.604**	**Diaphragm, Overlay**	**2**
20	334.006.156	Flange, Discharge	1
	334.006.010	Flange, Discharge	1
	334.006.110	Flange, Discharge	1
	334.006.112	Flange, Discharge	1
21	334.007.156	Flange, Suction	1
	334.007.010	Flange, Suction	1
	334.007.110	Flange, Suction	1
	334.007.112	Flange, Suction	1
22	334.008.156	Flange, Threaded	2
	334.008.010	Flange, Threaded	2
	334.008.110	Flange, Threaded	2
	334.008.112	Flange, Threaded	2
	334.008.156E	Flange, Threaded (HDB40 Only) BSP Thread	2
	334.008.010E	Flange, Threaded (HDB40 Only) BSP Thread	2
	334.008.110E	Flange, Threaded (HDB40 Only) BSP Thread	2
	334.008.112E	Flange, Threaded (HDB40 Only) BSP Thread	2
23	**360.017.379**	**Gasket, Manifold / Seat**	**4**
	360.017.384	**Gasket, Manifold / Seat**	**4**
	360.017.608	**Gasket, Manifold / Seat**	**4**
24	**360.022.425**	**Gasket, Manifold (Side Ported Units)**	**2**
	360.022.425	**Gasket, Manifold (Down Ported Units)**	**4**
	360.022.600	**Gasket, Manifold (Side Ported Units)***	**2**
	360.022.600	**Gasket, Manifold (Down Ported Units)***	**4**
		*** PTFE and FKM Fitted Units Only**	
25	**360.041.379**	**Gasket, Pilot Valve**	**1**
26	**360.048.425**	**Gasket, Air Valve**	**1**
27	518.003.156	Manifold	1
	518.003.010	Manifold	1
	518.003.110	Manifold	1
	518.003.112	Manifold	1
28	530.036.000	Muffler	1
29	545.005.330	Nut, Hex, 3/8-16	6
30	545.007.330	Nut, Hex, 7/16-14 (Side Ported Units)	16
	545.007.330	Nut, Hex 7/16-14 (Down Ported Units)	20
31	560.001.360	O-Ring (Sold with Item 39)	2
32	**560.022.360**	**O-Ring**	**2**
33	**560.028.360**	**O-Ring**	**2**
	560.028.610	**O-Ring (PTFE and FKM Fitted Units Only)**	**2**
34	**570.009.360**	**Pad, Wear**	**2**
	570.009.363	**Pad, Wear**	**2**
	570.009.364	**Pad, Wear (Also used with Santoprene (354) Fitted Units)**	**2**
	570.009.365	**Pad, Wear**	**2**
35	612.052.157	Plate, Inner Diaphragm	2
	612.052.010	Plate, Inner Diaphragm	2
	612.219.150	Plate, Inner Diaphragm (Used with 286.114.654 One-Piece Bonded PTFE Diaphragm)	2
36	612.039.157	Plate, Outer Diaphragm Assy. (Not Used with 286.114.654)	2
	612.039.010	Plate, Outer Diaphragm Assy. (Not Used with 286.114.654)	2
	612.097.110	Plate, Outer Diaphragm Assy. (Not Used with 286.114.654)	2
	612.097.112	Plate, Outer Diaphragm Assy. (Not Used with 286.114.654)	2
37	618.003.330	Plug, Pipe 1/4	2
38	618.003.330	Plug, Pipe 1/4 (Aluminum and Cast iron Units)	4

	618.003.110	Plug, Pipe 1/4 (Stainless Units)	4
	618.003.112	Plug, Pipe 1/4 (Hastalloy Units)	4
39	**620.011.114**	**Plunger, Actuator**	**2**
40	**685.007.120**	**Rod, Diaphragm**	**1**
41	**720.004.360**	**Seal, U-Cup**	**2**
42	**722.010.110**	**Seat, Check Valve**	**2**
	722.010.110	**"Seat, Check Valve - Suction Side (PTFE and Santoprene Fitted Units)"**	**1**
	722.010.112	**Seat, Check Valve**	**2**
	722.010.112	**"Seat, Check Valve - Suction Side (PTFE and Santoprene Fitted Units)"**	**1**
	722.031.110	**"Seat, Check Valve - Discharge Side (PTFE and Santoprene Fitted Units)"**	**1**
	722.031.112	**"Seat, Check Valve - Discharge Side (PTFE and Santoprene Fitted Units)"**	**1**
43	807.017.330	Stud, Threaded (Side Port Units Only)	4
	807.017.330	Stud, Threaded (Down Port Units Only)	8
44	900.005.330	Washer, Lock 3/8	6
45	900.006.330	Washer, Lock 7/16 (Side Ported Units)	20
	900.006.330	Washer, Lock 7/16 (Down Ported Units)	24
46	905.001.330	Washer, Tapered	4
47	312.020.156	Elbow (Down Ported Units)	2
	312.020.110	Elbow (Down Ported Units, SST & C.I.)	2
	312.020.112	Elbow (Down Ported Units)	2
48	545.004.330	Nut, Hex 5/16-18 (Down Ported Units)	2
50	900.004.330	Washer, Lock 5/16 (Down Ported Units)	2
51	685.032.080	Rod, Connecting (Down Ported Units)	1

Repair Parts shown in **DARKER** type are more likely to need replacement after extended periods of normal use. These parts are readily available from most Warren Rupp Distributors.

Pump owners may prefer to maintain a limited inventory of these parts to reduce repair downtime.

Air End Repair Kit:

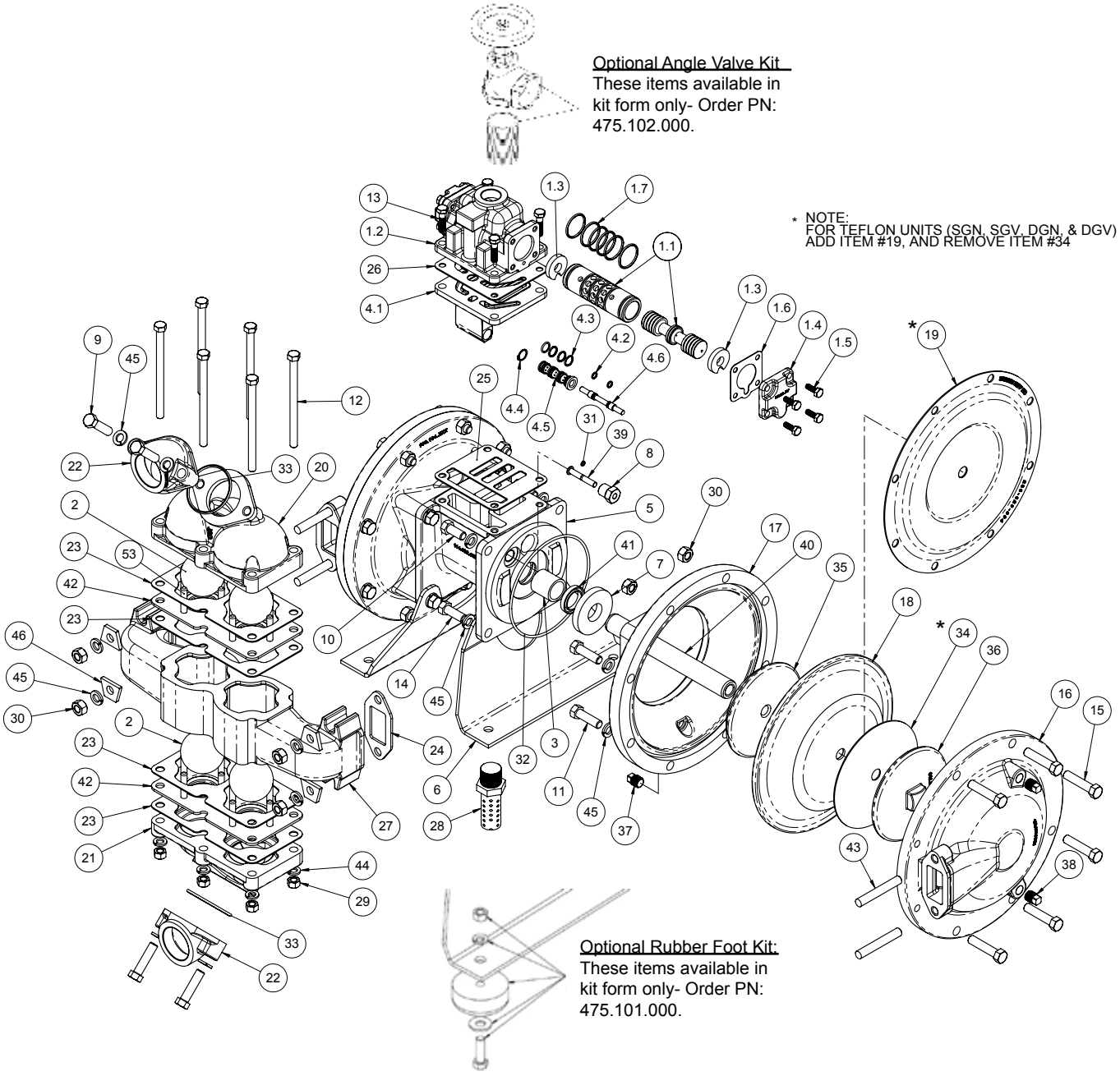
476.247.000 (contains items: 1.1, 1.3, 1.6, 1.7, 4, 8, 25, 26, 39, 41)

Wet End Repair Kit:

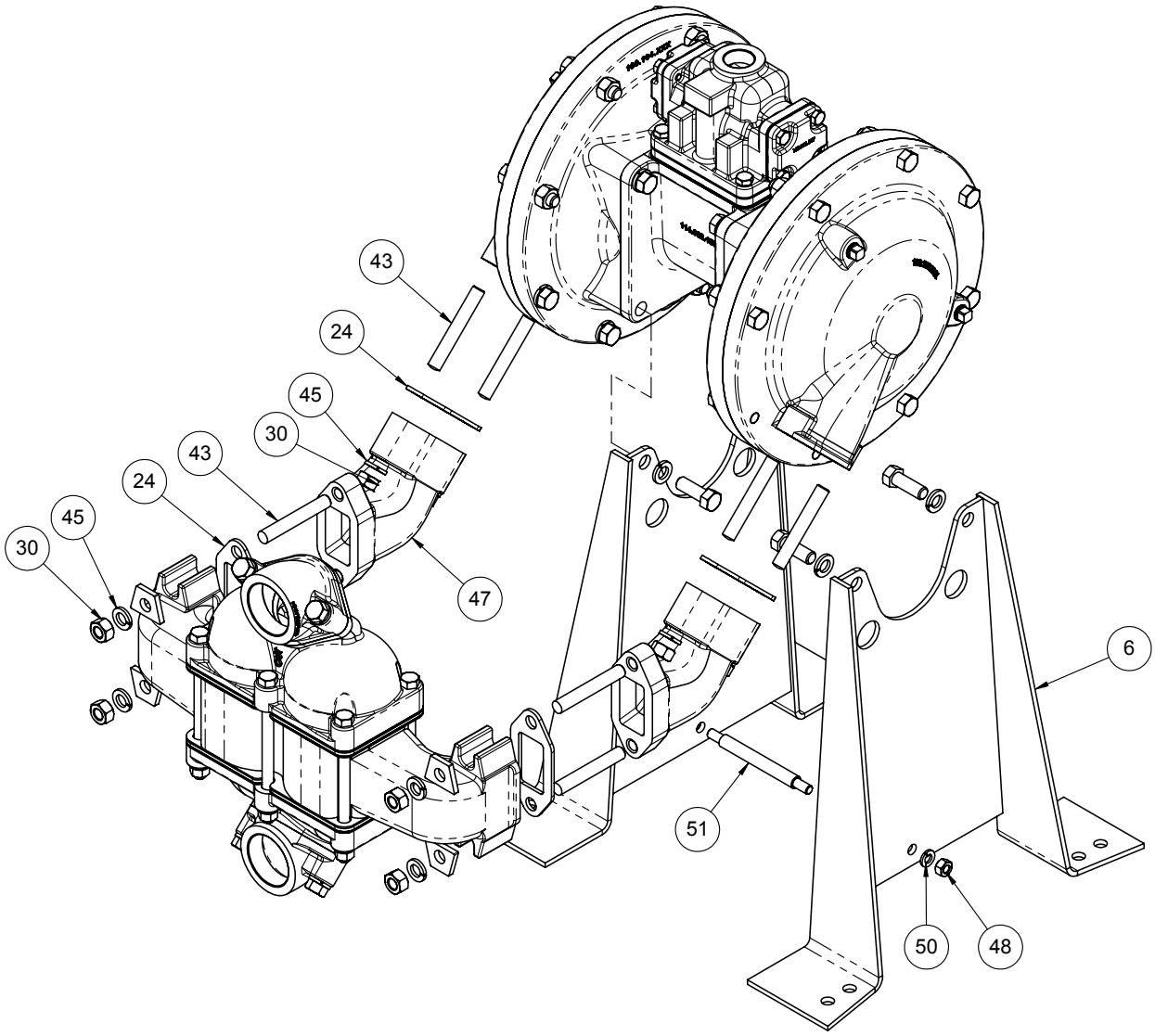
476.244.354 for Santoprene equipped pumps (Includes items: 2, 18, 23, 24, 33, 34)
476.244.360 for Nitrile equipped pumps (Includes items: 2, 18, 23, 24, 33, 34)
476.244.363 for FKM equipped pumps (Includes items: 2, 18, 23, 24, 33, 34)
476.244.364 for EPDM equipped pumps (Includes items: 2, 18, 23, 24, 33, 34)
476.244.365 for Neoprene equipped pumps (Includes items: 2, 18, 23, 24, 33, 34)
476.244.644 for Santoprene with PTFE check balls (Includes items: 2, 18, 23, 24, 33, 34)
476.036.659 for One-Piece Bonded PTFE Diaphragms (Includes items: 2, 18, 23, 24, 33, 35)
476.261.635 for PTFE Overlay Diaphragms and Neoprene backers (Includes items: 2, 18, 19, 23, 24, 33)

To convert a pump to One-Piece Bonded PTFE Diaphragms
order kit number: 475.255.000

Composite Repair Drawing-Side Ported



Composite Repair Drawing-Down Ported



Optional Down Ported Conversion Kits:

475.022.156 Down Ported Conversion Kit*
475.022.010 Down Ported Conversion Kit*
475.022.110 Down Ported Conversion Kit*
475.022.112 Down Ported Conversion Kit*

*Conversion Kit Includes the Following (items 6, 24, 30, 43, 45, 47, 48, 50, 51)

WARREN RUPP, INC.®

Declaration of Conformity

Manufacturer:
Warren Rupp, Inc.®, 800 N. Main Street, P.O. Box 1568,
Mansfield, Ohio, 44901-1568 USA
certifies that Air-Operated Double Diaphragm Pump Series: HDB, HDF, M Non-Metallic, S Non-Metallic, M Metallic, S Metallic, T Series, G Series, RS Series U Series, EH and SH High Pressure, W Series, SMA and SPA Submersibles, and Tranquilizer Surge Suppressors comply with the European Community Directive 2006/42/EC on Machinery, according to Annex VIII. This product has used Harmonized Standard EN 809, Pumps and Pump Units for Liquids - Common Safety Requirements, to verify conformance.

David Roseberry
Signature of authorized person

October 20, 2005
Date of issue

David Roseberry
Printed name of authorized person

Engineering Manager
Title

Revision Level: E

MAY 27, 2010
Date of revision

IDEX FLUID & METERING

CE

Declaration of Conformity
Declaration of Conformity

WARREN RUPP, INC.®

EC Declaration of Conformity

In accordance with ATEX Directive 94/9/EC,
Equipment intended for use in potentially explosive environments.

Manufacturer:
Warren Rupp, Inc.®
A Unit of IDEX Corportion
800 North Main Street
P.O. Box 1568
Mansfield, OH 44901-1568 USA

Applicable Standard:
EN13463-1: 2001,
EN13463-5: 2003

EN 60079-25: 2004
For pumps equipped with Pulse Output ATEX Option
KEMA Quality B.V. (0344)

AODD Pumps and Surge Suppressors
For Type Examination Designations, see page 2 (back)

AODD (Air-Operated Double Diaphragm) Pumps
EC Type Examination Certificate No. Pumps: KEMA 09ATEX0071 X

KEMA Quality B.V.
Utrechtseweg 310
6812 AR Arnhem, The Netherlands

SANDPIPER®
A WARREN RUPP, INC. BRAND

Tranquilizer®

DATE/APPROVAL/TITLE:
27 MAY 2010

David Roseberry, Engineering Manager

IDEX FLUID & METERING

WARREN RUPP, INC.®

EC Declaration of Conformity

ATEX Summary of Markings

Type	Marking			Listed In	Non-Conductive Fluids
Pump types, S1F, S15, S20, and S30 provided with the pulse output option		II 2 G Ex ia c IIC T5 II 3/2 G Ex ia c IIC T5 II 2 D Ex c iaD 20 IP67 T100ºC	KEMA 09ATEX0071 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X	No Yes Yes
Pump types, S1F, S15, S20, and S30 provided with the integral solenoid option		II 2 G EEx m c II T5 II 3/2 G EEx m c II T5 II 2 D c IP65 T100ºC	KEMA 09ATEX0071 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X	No Yes Yes
Pump types, HDB1½, HDB40, HDB2, HDB50, HDB3, HDF1, HDF25, HDF2, HDF3M, PB¼, S05, S1F, S15, S20, S30, SB1, SB25, ST1½, ST40, G15, G20, and G30, without the above listed options, no aluminum parts		II 1 G c T5 II 3/1 G c T5 II 1 D c T100ºC I M1 c I M2 c	KEMA 09ATEX0071 X KEMA 09ATEX0072 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0072 X	No Yes Yes No Yes
Pump types, DMF2, DMF3, HDB1½, HDB40, HDB2, HDB50, HDB3, HDF1, HDF25, HDF2, HDF3M, PB¼, S05, S1F, S15, S20, S30, SB1, SB25, SE½, ST1, ST25, ST1½, ST40, U1F, G05, G1F, G15, G20, and G30		II 2 G c T5 II 3/2 G c T5 II 2 D c T100ºC	KEMA 09ATEX0072 X CE	KEMA 09ATEX0072 X KEMA 09ATEX0072 X KEMA 09ATEX0072 X	No Yes Yes
Surge Suppressors all types		II 2 G T5 II 3/2 G T5 II 2 D T100ºC	KEMA 09ATEX0073 CE	KEMA 09ATEX0073 KEMA 09ATEX0073 KEMA 09ATEX0073	No Yes Yes

EC Type Certificate No. Pumps: KEMA 09ATEX0071 X
Type Certificate No. Pumps: KEMA 09ATEX0072 X
Type Certificate No. Suppressors: KEMA 09ATEX0073

IDEX FLUID & METERING