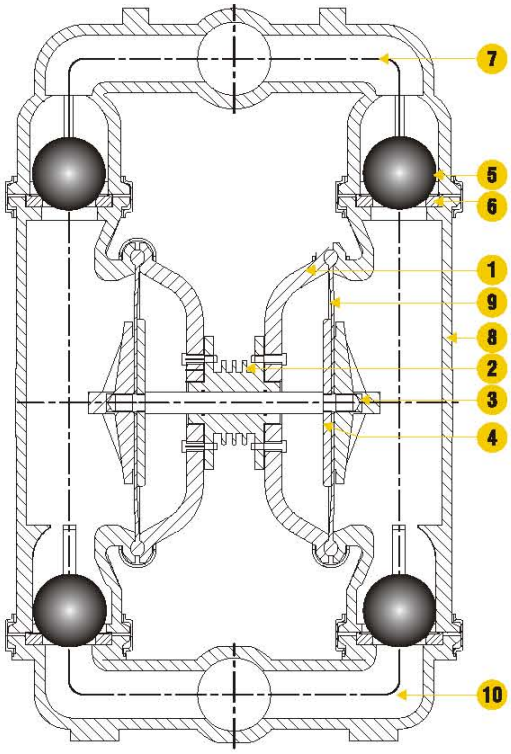
CONGRATULATIONS ON PURCHASING YOUR NEW PRICE AODD PUMP!

IMPORTANT: Please read all the installation and safety information carefully before you start your new pump.

THE PRICE PUMP
AIR OPERATED DIAPHRAGM PUMP



1. Air Chamber
The air chamber is the chamber that houses the air which powers the diaphragms.

2. Air Distribution System
The air distribution system is the heart of the pump. The air distribution system is the mechanism that shifts the pump in order to create suction and discharge strokes.

3. Lock Nut (Outer Diaphragm Piston)
The outer diaphragm pistons provide a means to connect the diaphragms to the reciprocating common shaft and to seal the liquid side from the air side of the diaphragm.

4. Holding plate (Inner Diaphragm Piston)
The inner piston is located on the air side of the pump and does not come into contact with the process fluid.

5. Check Valve Ball
PRICE air-operated pumps use suction and discharge check valves to produce directional flow of process fluid in the liquid chamber. The check valve balls seal and release on the check valve seats allowing for discharge and suction of process fluid to occur.

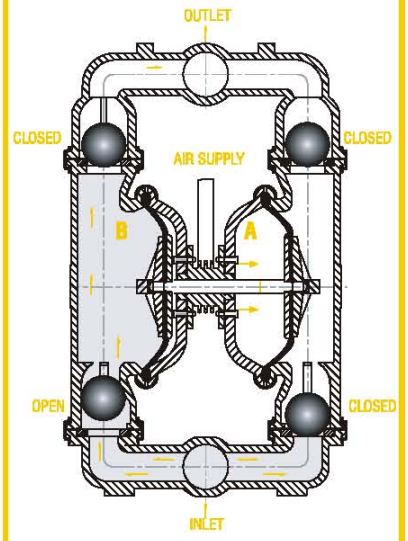
6. Check Valve Seat
The removable seats provide the ball valves a site to check.

7. Discharge Manifold
Process fluid exits the pump from the discharge port located on the discharge manifold at the top of the pump.

8. Liquid Chamber: The liquid chamber is filled with the process fluid during the suction stroke and is emptied during the discharge stroke. It is separated from the compressed air by the diaphragms.

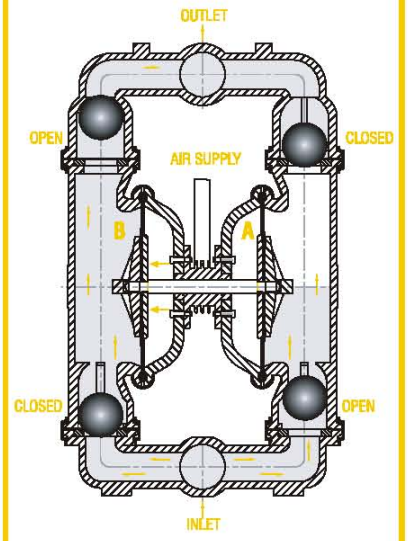
9. Diaphragm: The diaphragm membrane provides for separation of the process fluid and the compressed air power source. To perform adequately, diaphragms should be of sufficient thickness and of appropriate material to prevent degradation or permeation in specific process fluid applications. PRICE offers a variety of diaphragm materials for your specific application requirements.

10. Inlet Manifold: Process fluid enters the pump from the intake port located on the inlet manifold at the bottom of the pump.



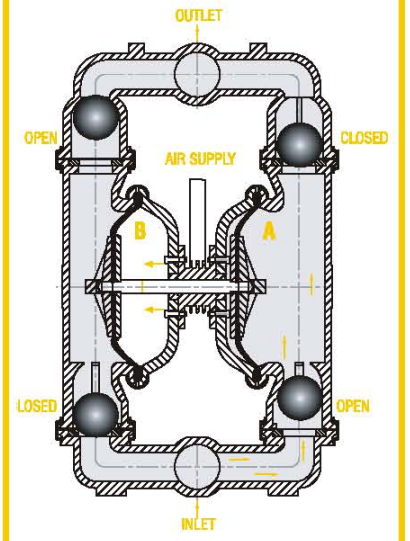
RIGHT STROKE (Fig 1)

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



MID STROKE (Fig 2)

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

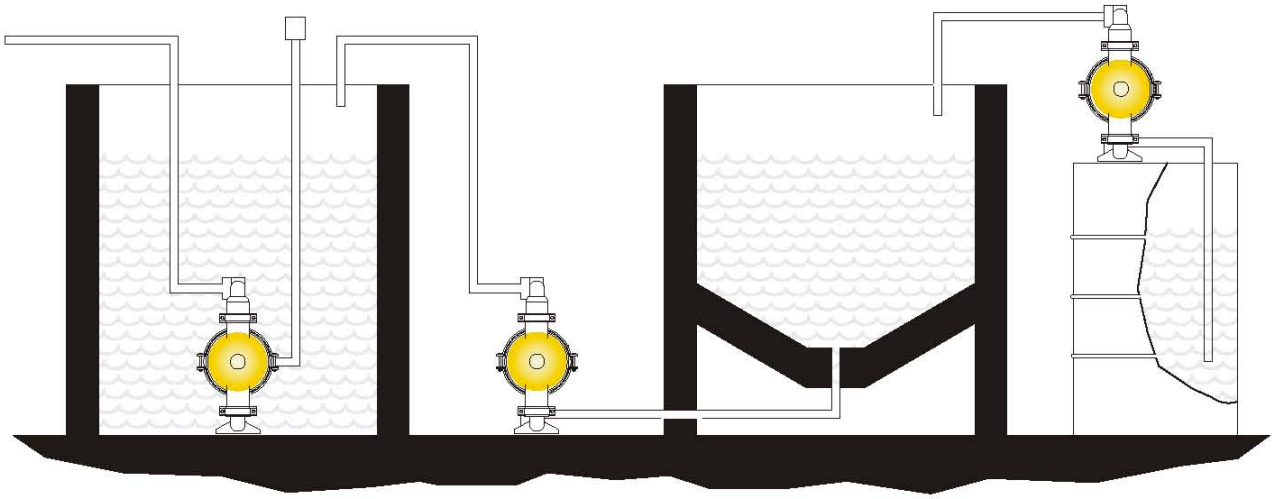


LEFT STROKE (Fig 3)

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

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

THE PRICE PUMP INSTALLATION VERSATILITY



SUBMERGED
PRICE Pumps are totally submersible. It is important that the air exhaust be ported above the level of the fluid, and that the materials of construction also be compatible with the fluid that the pump is submerged in.

POSITIVE SUCTION
Pump can draw from the bottom of the vessel. Preferred installation for viscous fluids. For emptying tanks it is important to limit the inlet fluid pressure to approximately 10 PSI (0.69 bar) for Teflon diaphragms and 15 PSI (1.03 bar) for rubber and sentoprene diaphragms.

SELF PRIMING
The suction capabilities of each pump may vary due to system design, product being pumped, and pump materials of construction. Please consult the factory with specific criteria.

THE PRICE PUMP APPLICATION VERSATILITY

- Automotive Industry
- Aviation
- Food and Beverage
- Ceramics
- Chemical Industry
- Latex
- Mining
- Construction Industry
- Electronics Industry
- Plating & Finishing
- Pulp Paper Packaging
- Refineries
- Road Tanker Trucks
- Shipbuilding
- Smelters, Foundries & Dye Casting
- Textile & Carpet
- Water and Sewage Treatment
- Utility
- Paints, Inks & Coatings
- Pharmaceutical Industry

THE PRICE PUMP SAFETY SUPPLEMENT

Supplement to Engineering, Operation and Maintenance Manual

ALWAYS FIRST READ THIS MANUAL BEFORE INSTALLATION, START-UP OR MAINTENANCE.

This safety manual applies to all PRICE pumps and comprises instructions for safe installation, use and maintenance of your pump.

In this manual you may be warned for remaining hazards. This kind of information is preceded by the following label.
CAUTION = Hazards or unsafe practices which could result in severe personal injury, death or in substantial product or property damage.

CAUTION
- Verify pump model received against purchase order or spec sheet.
- Retorque all bolts to specifications on torque table. Remove shipping plugs.
- Pumps that need to be submersed must have both wetted and non-wetted parts compatible with material being pumped.
- Submersed pumps must have a hose attached to pump's air exhaust and the exhaust air piped above liquid level. Pumps should be thoroughly flushed with water before installation.

CAUTION
- Blow out air line for 10 to 20 seconds before attaching to pump to make sure all pipe line debris is clear.
- Always wear safety glasses when operating pump. If diaphragm rupture occurs, material being pumped may be forced out air exhaust.

CAUTION: All suction and discharge piping/ hoses should be designed to withstand the pressure and temperature of the specific application.

CAUTION: Do not exceed 0.7 bar (100 psi) liquid inlet pressure to pump port; this creates potential for premature wear and parts failure.

CAUTION: Do not exceed 7.0 bar (100 psi) air supply pressure.
- A pressure relief valve set at 100 Psi shuld be made use of to avoid excess air inlet pressure.
- Due to the reciprocating action of the pump, lateral instabilities can occur during normal operation, thus footed pumps should be bolted to structural steelwork/concrete. Ensure the operating surface is level and flat.
- Most PRICE pumps can be used in submersible applications only when both wetted and non-wetted portions are com patible with the material being pumped. If the pump is to be used in a submersible application, a hose should be attached to the pump's air exhaust and the exhaust air piped above the liquid level.
- Each PRICE pump has a particular maximum solids capability. Whenever the possibility exists that larger solid objects may be sucked into the pump, a strainer should be used on the suction line to prevent damage to the pump and subsequent risk to the operator.

CAUTION: VENTILATION
Ensure proper ventilation of tanks/vessels that house liquid supply. Due to a pump's high vacuum ability, improper ventilation of these supply tanks can lead to implosion of tanks when fluid is completely evacuated.

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

CAUTION: TEMPERATURE HAZARDS
Material being pumped should be compatible with pump's materials of construction and stated temperature limits as stated in PRICE Chemical Resistance Guide.

CAUTION: HAZARDS GENERATED BY NOISE
Pump noise can exceed 75 dba under certain operating conditions, e.g. high air pressure supply and little or no discharge head. Extended periods of operation under such conditions can create a hazard to operators working in proximity of the pumps. Use proper hearing protection devices.

CAUTION: HAZARDOUS MATERIALS
a. Maintenance instructions manual must be followed to avoid diaphragm failure.
b. NOTICE: All fasteners should be checked to match the pump's given torque specifications.

CAUTION: CHEMICAL COMPATIBILITY
a. When specifying a pump for a particular application, pump wetted materials of construction and elastomer materials must be compatible with the process fluid. Please consult PRICE Chemical Resistance Guide or your local authorized PRICE distributor for more information.
b. Explosive reaction: Some materials such as halogenated hydrocarbon solvents should not be pumped with an aluminum construction pump due to a possible explosive reaction.
c. Certain materials' chemical compatibility with a particular pump construction, in particular plastic wetted parts, can change as material concentration and temperature vary. Please consult your local authorized PRICE distributor for more information.

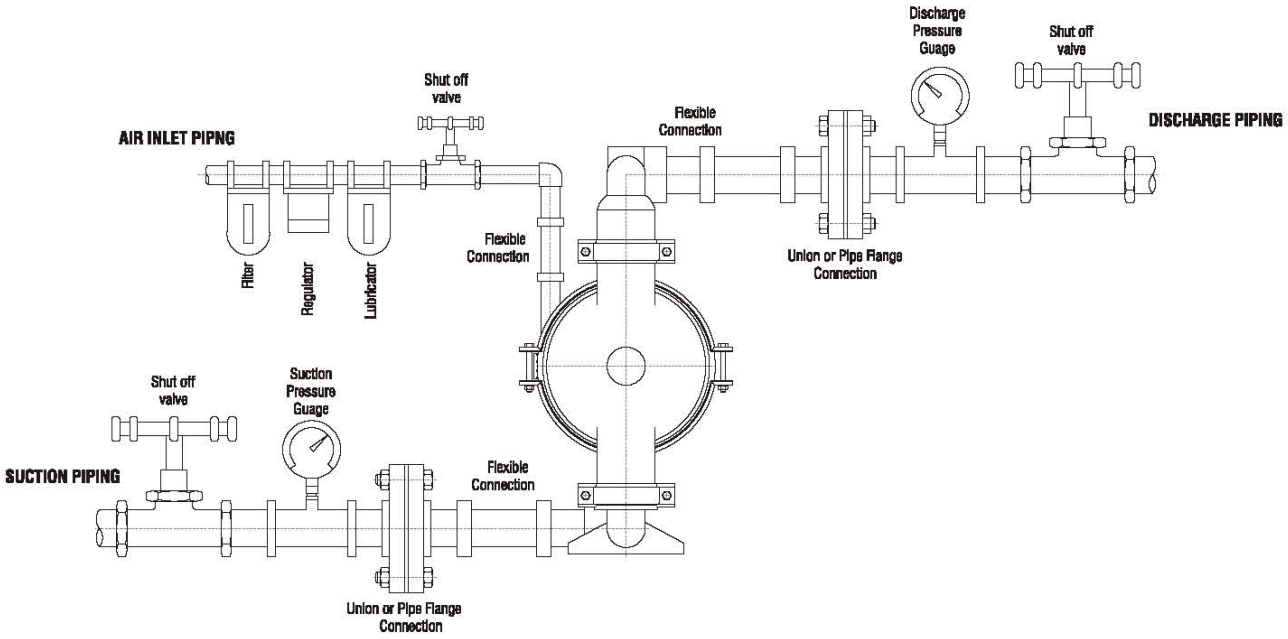
CAUTION: OPERATION
Ensure all operators are properly trained and employ safe operating and maintenance practices as outlined in this Safety Manual, the Pump User's Guide and Manual. In addition, all proper safety eyewear and ear protection should be used when necessary.

CAUTION: THERMAL EXPANSION
Some liquids present in piping may expand at elevated temperatures, resulting in pipe and/or pump damage and subsequent risk to operator.

CAUTION: ULTRAVIOLET HAZARDS
When the pump is subjected to sunlight (strong ultraviolet radiations) for a long period of time, the outer plastic components of the pump tend to become brittle in nature. This would reduce the pump's damage resistance.

TEMPERATURE LIMITS
Polypropylene: 0°C **to** 79°C (32°F to 175°F)
PVDF: –12°C **to** 107°C (10°F to 225°F)
Neoprene: –17.8°C **to** 93.3°C (0°F to 200°F)
Buna-N: –12.2°C **to** 82.2°C (10°F to 180°F)
Viton®: –40°C **to** 176.7°C (–40°F to 350°F)
Teflon® PTFE: 4.4°C **to** 104.4°C (40°F to 220°F)

THE PRICE PUMP
SUGGESTED INSTALLATION & MAINTENANCE



PRE-INSTALLATION CHECKLIST:
Cautions
- Verify pump model received against purchase order or spec sheet.
- Re-torque all bolts to specifications on torque table.
- Remove shipping plugs.
- Pumps that need to be submersed must have both wetted and non-wetted parts compatible with material being pumped.
- Submersed pumps must have a hose attached to pump's air exhaust and the exhaust air piped above liquid level.
- Pumps should be thoroughly flushed with water before installation.
- Do not exceed 7 bar (105 psi) air supply pressure.
- Blow out air line for 10 to 20 seconds before attaching to pump to make sure all pipe line debris is clear.

SUGGESTED INSTALLATION:
The suction pipe should be at least the diameter of the
pump's inlet manifold connection or larger if highly viscous material is being pumped. The suction hose must be noncollapsible, reinforced type as PRICE pumps are capable of pulling a high vacuum. Discharge piping should be at least the diameter of the pump's discharge manifold connection; larger piping can be used to reduce friction losses. It is critical that all fittings and connections are airtight or a reduction or loss of pump suction capability will result. The pump should not be used as a support mechanism for the piping system.PRICE suggests the use of flexible connections for inlet/outlet ports and air line (see diagrams). Due to the reciprocating action of the pump, lateral instabilities can occur during normal operation, thus footed pumps should be bolted to the ground and pads should be used. Ensure the operating surface is level and flat. Most PRICE pumps can be used in submersible applications only when both wetted and non-wetted portions are compatible with the material being pumped. If the pump is to be used in a submersible application, a hose should be attached to the pump's air exhaust and the exhaust air piped above the liquid level.

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

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

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

airtight and that the suction lift is within the pump's ability. Note: Materials of construction and elastomer material have an effect on suction lift parameters. Pumps in service with a positive suction head are most efficient when inlet pressure is limited to 0.5–0.7 bar (7–10psig). Premature diaphragm failure may occur if positive suction head is 0.8 bar (11 psig) and higher, particularly when using Teflon® and Thermoplastic diaphragms. All positive suction head applications should include a "check valve" at the pump liquid inlet to allow for the pump to be disconnected. Each PRICE pump has a specific maximum solids capability. Whenever the possibility exists that larger solid objects may be sucked into the pump, a strainer should be used on the suction line.

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump.

Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Wear safety glasses. When diaphragm failure occurs, material being pumped may be forced out the air exhaust.

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

BEFORE YOU DISASSEMBLE THE PUMP:

- Wear safety glasses
- Shut off main air supply
- Disconnect air hose from air valve to drain air pressure in hose
- Isolate pump using isolation valves to avoid product spillage from pipe
- Turn pump upside down to drain all liquid trapped by valve balls
- Mark a line from each liquid chamber to its corresponding air chamber to assist in proper alignment during reassembly

INSPECTION

Air Valve Piston/Spool and Casing

- Ensure piston/spool can move freely
- Clean out debris

Diaphragms

- Make sure no swelling, cracking, or other damage is apparent

Balls/Seats/O-rings

- Make sure no swelling, cracking, or other damage
is apparent
- Lubricate shaft if needed

MEAN TIME TO FAILURE

A Preventative Maintenance Schedule (PMS) should be set up for the following parts to ensure pump is serviced prior to part wear

- Diaphragms
- Valve Seats
- Valve Balls
- O-rings

SEAL REPLACEMENT

Proper seal installation is critical to pump performance when employing AODDPs in your application. Great care must be taken to ensure that seals are placed in the proper grooves and not damaged during installation. Incorrect seal location will render the pump inoperable. Damaged seals may cause decreased performance and shorter seal life.

TROUBLESHOOTING GUIDE

SYMPTOMS	POTENTIAL CAUSES
PUMP CYCLES ONCE AND STOPS	1. Incorrect o-ring Placement 2. Deadhead (system pressure meets or exceeds air supply pressure) 3. Air valve or center block gaskets installed incorrectly
PUMP WILL NOT OPERATE (STALL OR DEADHEAD)	1. Wrongly fitted piston block 2. lack of air (line size, PSI, CFM) 3. Centering of spool 4. Worn o-ring 5. Air porting in center block is plugged 6. Wrong type of lubrication (attack-on-rings) over lubrication 7. Debris in air valve 8. Clogged manifolds 9. Incorrect o-ring placement 10. Deadhead (system pressure meets or exceeds air supply pressure) 11. Closed discharge valve
PUMP CYCLES AND WILL NOT PRIME OR LOW FLOW	1. Cavitation on suction side 2. Valve ball(s) not seating properly or sticking 3. Valve ball(s) missing (pushed into pump/thermal expansion or missing) 4. Valve ball (s) /seat(s) damaged or attacked by product (swelling, shrinking, etc) 5. Vapor pressure 6. Clogged suction line
PUMP RUNNING SLUGGISH/STALLING	1. Over lubrication/under lubrication 2. Wrong type of lubrication 3. Icing 4. Clogged manifolds 5. Deadhead (system pressure meets or exceeds air supply pressure) 6. Cavitation on suction side 7. Lack of air (line size, PSI, CFM) 8. Worn o-rings 9. Vapor pressure 10. Incorrect pump size
PRODUCT LEAKING THROUGH EXHAUST OR AROUND CLAMP BANDS	1. Diaphragm failure-product leaking out exhaust 2. Diaphragm plate loose - product leaking out exhaust 3. Clamp bands loose-product leaking out clamp bands 4. Clamp bands stretched - product leaking out clamp bands 5. Teflon gasket tape ruined 6. Excessive positive suction pressure – product leaking around many or all clamp bands 7. Diaphragms stretched around center hole or bolt holes 8. Clamp bands not seated properly 9. Excessive air supply pressure
PREMATURE DIAPHRAGM FAILURE	1. Cavitation 2. Excessive flooded suction pressure 3. Misapplication (Chemical /Physical incompatibility) 4. Wrong type of lubrication (attack on air side) 5. Incorrect diaphragm plates 6. Incorrect shaft with corresponding elastomer 7. Start up at full air pressure 8. Excessive dry running at high air pressure
BREAKING AND BENDING SHAFTS	1. Build up of solids in water chamber 2. Loose diaphragm plates

RECOMMENDATIONS

1. Reinstall o-rings in correct position
2. Reinstall inner diaphragm plate correctly
3. Check system for pressure ratio to pump
4. Install gaskets with holes properly aligned with parts or valve and center block

1. Set lubricator on lowest possible setting.
• Clean out center section
2. Check:
• Air line size and length
• Compressor capacity (HP vs. cfm required)
• Other usage of air in plant
• Air requirement by pump
(pump capacity, product viscosity and specific gravity)
3. Disconnect and reconnect air
4. Replace o-rings
5. Clean porting in center block to allow proper air flow
6. Check compatibility of O-rings with lubrication (see operating manual)
7. Clean air valve/filter
• Check for scoring on spool and sleeve
8. Clean suction or discharge manifolds/piping
• Clean filter bags or screens
9. Reinstall o-rings in correct position (see operating manual for assistance)
10. Increase air supply pressure
11. Open discharge valve

1. Check suction condition (move pump closer to product)
2. Clean out around valve ball cage and valve seat area
• Replace valve ball and valve seat if worn or damaged
• Check Chemical Resistance Chart for compatibility and proper elastomer match
• Use heavier valve ball material
3. Worn valve ball or valve seat (replace)
• Thermal expansion in discharge pipe (add one way valve into piping)
• Worn fingers in valve ball cage (replace part)
4. Check Chemical Resistance Chart for compatibility and proper elastomer match
5. Consult factory for evaluation and recommendation.
6. Clean suction manifold or piping
• Install screen or bag filter

1. Set lubricator on lowest possible setting
1,2. Clean out entire center section of pump
2. lubrication recommended
4. Clean manifolds to allow proper air flow
5. Check system to locate deadhead (equilibrium)
• Increase air supply pressure
6. Check suction condition (move pump closer to product
7. Check:
• Air line size length
• Compressor capacity (HP vs cfm required)
• Other usage of air in plants
• Air requirement by pump
(pump capacity, product viscosity and specific gravity)
8. Replace o-rings
9,10. consult factory for evaluation and recommendation

1. Replace diaphragms (and back up diaphragm when using Teflon)
1,2. clean out entire center section of pump
2. Check diaphragms for damage and retighten diaphragm plates
3. Tighten clamp bands (check for stretching)
4. Replace clamp bands (apply grease to inside of clamp band to assist complete compression)
5. Replace Teflon gasket tape with Teflon diaphragms
6. Check excessive positive suction pressure
• Move pump closer to product
• Add accumulation tank or pulsation dampener as close to the pump as possible on suction side of pump
• Raise pump/place pump on top of tank to reduce inlet pressure
• Install flex hose on inlet and discharge as recommended installation
7. Check for excessive inlet pressure or air pressure
• Tighten bolts to recommended torque (See assembly/ disassembly instructions page)
8. Seat clamp bands with mallet
9. Check operating manual for recommendations

1. Enlarge pipe diameter on suction side of pump
1,2. Move pump closer to product
• Raise pump/place pump on top of tank to reduce inlet pressure
3. Add accumulation tank or pulsation dampener as close to the pump as possible
• Start pump slowly (add smart start)
3, 4. Consult Chemical Resistance Chart for compatibility with products, cleaners, temperature limitations and lubrication
5. Check for correct part
6. Check for correct installation
8. Start up pump slowly
9. Install control or automatic shutoff

1. Flush pump
• Start pump slow
3. Double check tightness of diaphragm plates when installing replacement diaphragms

THE PRICE PUMP
PUMP & ELASTOMER OPTIONS

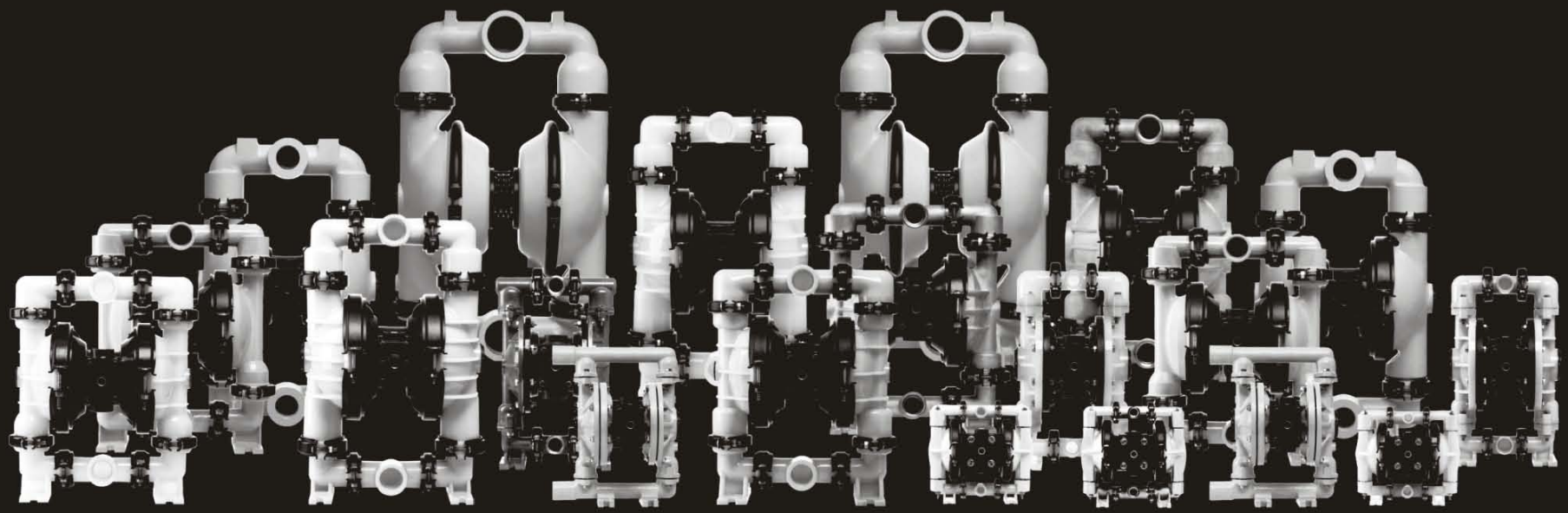
AVAILABLE MATERIALS OF CONSTRUCTION - PUMPS					
PUMP MODEL NO.	AOD 15	AOD 30	AOD 40	AOD 55	AOD 80
Polypropylene (PP)	✓	✓	✓	✓	✓
Polyvinylidene Fluoride (PVDF)	✓	✓	✓	✓	
Stainless Steel (SS)	✓	✓	✓	✓	✓
Aluminium (AL)		✓	✓	✓	✓
Cast Iron (CI)		✓	✓	✓	✓

AVAILABLE MATERIALS OF CONSTRUCTION - ELASTOMERS				
ELASTOMER OPTIONS	DIAPHRAGM	BALL VALVE	BALL SEAT	O-RINGS
Neoprene	✓	✓	✓	✓
Viton				✓
Nitrile (Buna-N)	✓	✓	✓	✓
Butyl	✓	✓	✓	
Teflon Ptfe	✓	✓		
Santoprene	✓			
Hypalon	✓	✓	✓	✓
Epdm (Nordel)	✓	✓	✓	
Polypropylene (PP)			✓	
Stainless Steel (SS)		✓	✓	
Aluminium (AL)			✓	
Polyvinylidene Fluoride (PVDF)			✓	
Cast Iron (CI)			✓	

Only Teflon ball valves available for our model # AOD 15.

TEMPERATURE LIMITS	
Polypropylene	0°C to 79°C (32°F to 175°F)
PVDF	–12°C to 107°C (10°F to 225°F)
Neoprene	–17.8°C to 93.3°C (0°F to 200°F)
Buna-N	–12.2°C to 82.2°C (10°F to 180°F)
Viton®	–40°C to 176.7°C (–40°F to 350°F)
Teflon® PTFE	4.4°C to 104.4°C (40°F to 220°F)

WETTED MATERIAL COMATIBILITY		
FLUID SOLUTIONS	NUMERIC pH LEVEL	WETTED PART MOC
Alkaline Caustic	14 13 12 11	Stainless Steel
Basic	10 9	Caste Iron
Neutral	8 7 6	Aluminium
Acid	5 4	Stainless Steel
	3 2 1 0	PP / PVDF



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