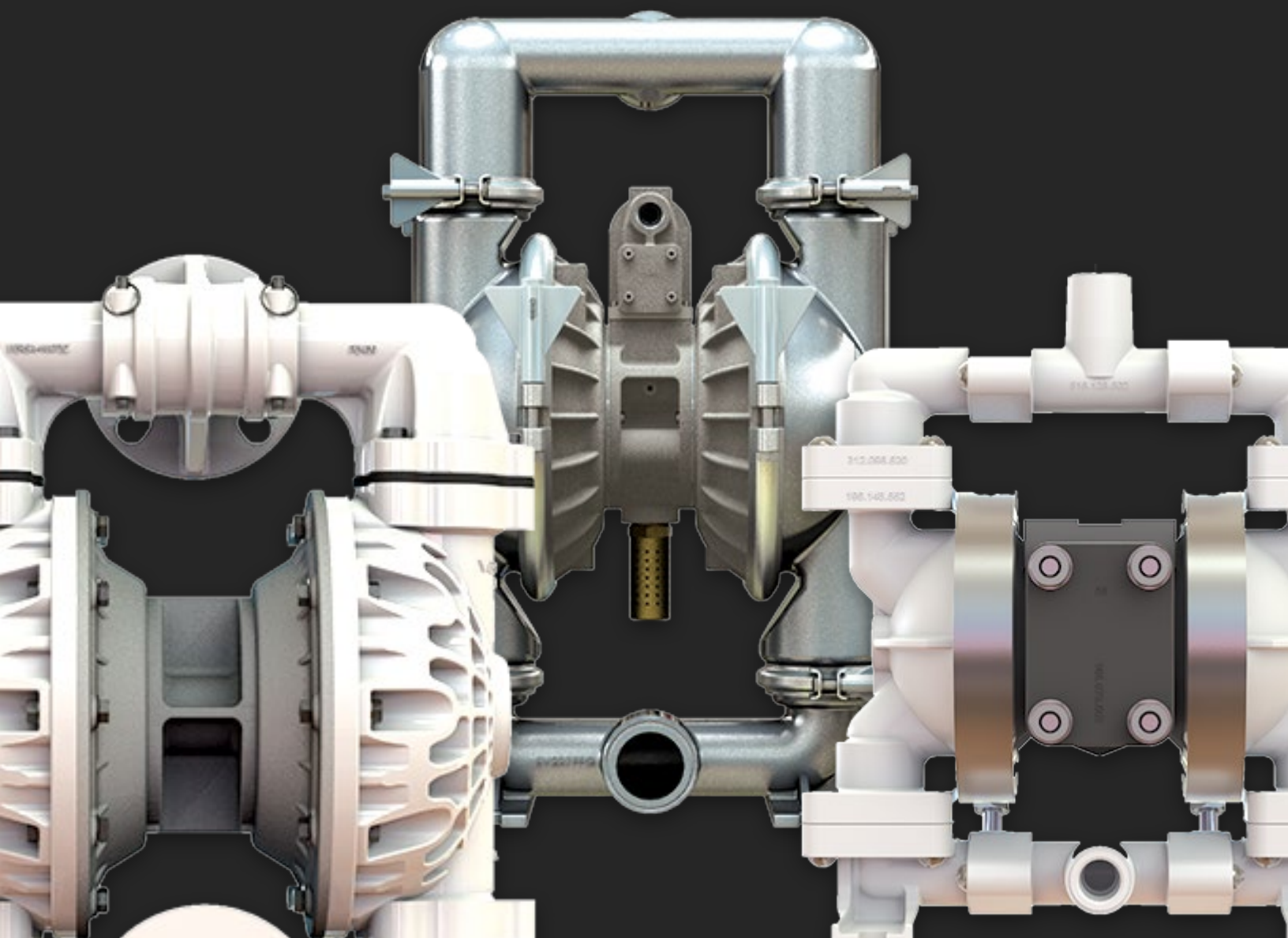




VERSAMATIC®
PUMPING MADE EASY

THE ULTIMATE GUIDE TO KEEPING AIR-OPERATED DOUBLE-DIAPHRAGM (AODD) PUMPS PERFORMING AT THEIR BEST



YOUR GUIDE TO OPTIMIZING AODD PUMP PERFORMANCE

Plant maintenance managers understand the importance of keeping systems and machinery running smoothly, and in turn, keeping production stoppage as low as possible.

If you're a plant manager, there are likely three things you think about every day in some form: performance, schedule and budget. All of these must come together to properly do your job.

When something happens, like equipment failure, it can have a ripple effect throughout the entire plant, potentially causing a process to shut down. Additionally, if a machine isn't performing at its best, it can slow down production. If production is slowed, the budget takes a hit. And — let's face it — you don't have time for drawn-out process issues, repairs or expensive repair parts.

Luckily, working with AODD pumps, you don't have much to worry about. AODD pumps are known for being reliable workhorses of industry capable of providing years of dependable, consistent service. Though an AODD pump is designed to be an incredibly versatile piece of equipment, there are ways to make them perform even better.

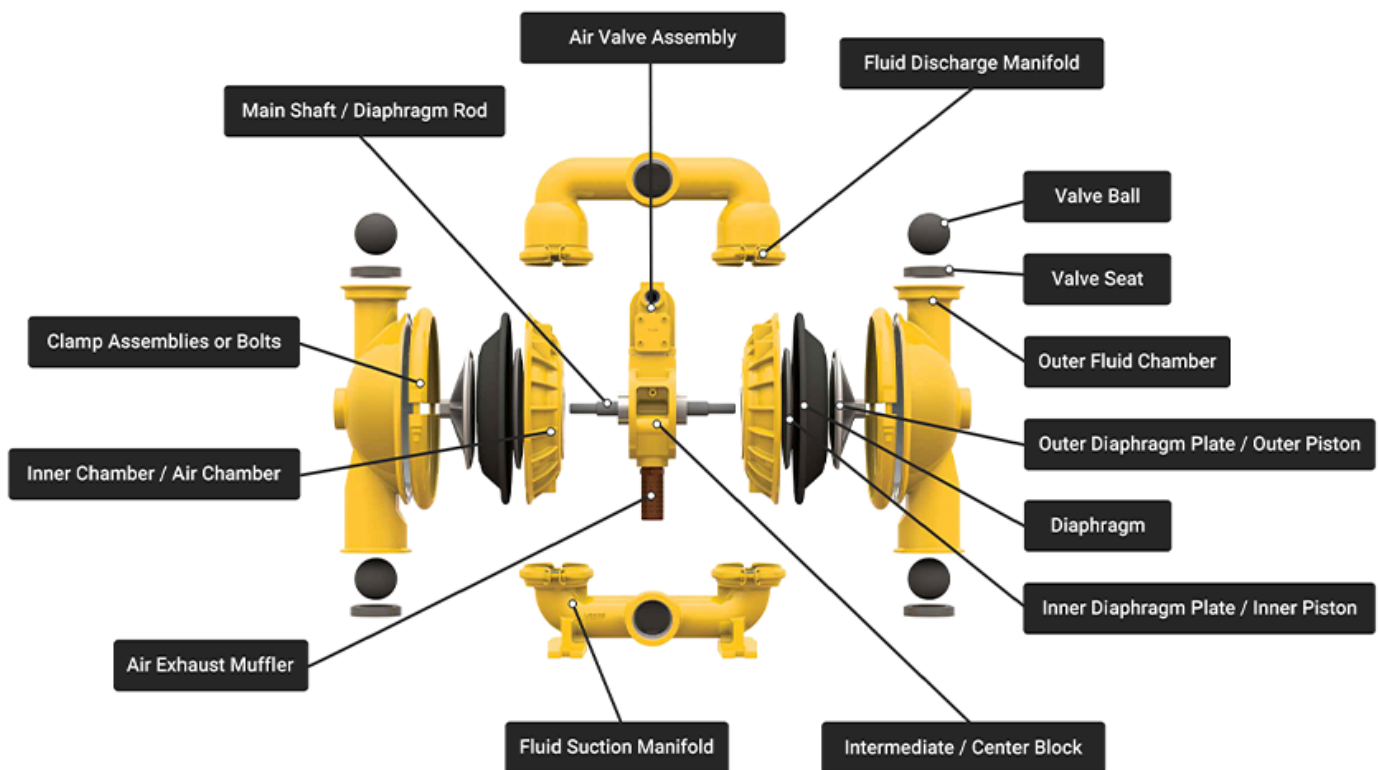
In this guide, you'll learn:

- The basic components of an AODD pump
- How AODD pumps works
- Ways to optimize AODD pump performance

BASIC COMPONENTS OF AN AODD PUMP

Before you increase reliability, it's best to know the basic components of an AODD pump. By understanding the basics, you can make a more educated decision, helping your AODD pump perform at its best in a specific application.

These are the basic components of an AODD pump:



[Read this blog](#) to find out more about each specific component.



HOW AODD PUMPS WORK

INSTALLATION VERSATILITY

All installations: Run-dry capable | No heat generation | No electricity required

SUCTION LIFT

- Self-priming
- High vacuum capable
- Max lift of 32' (9.8m)

SUBMERGED

- Capable of full submersion
- Screened inlet option

FLOODED SUCTION

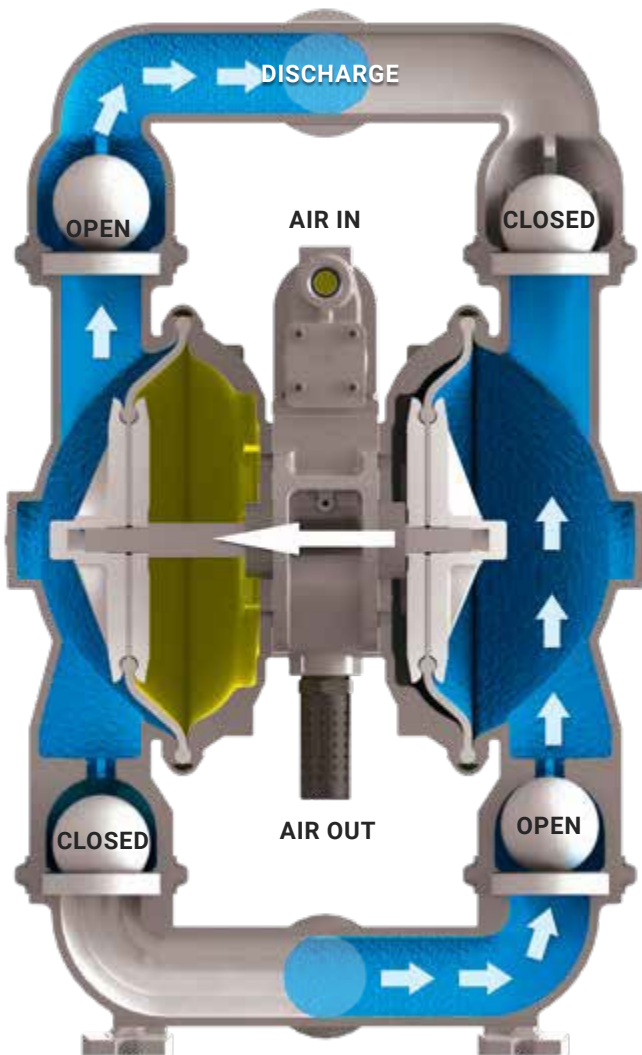
- Preferred for viscous fluids
- Most common application
- Screened inlet option



NOTE: Consult your distributor or owners manual for proper materials of construction and installation for your application.

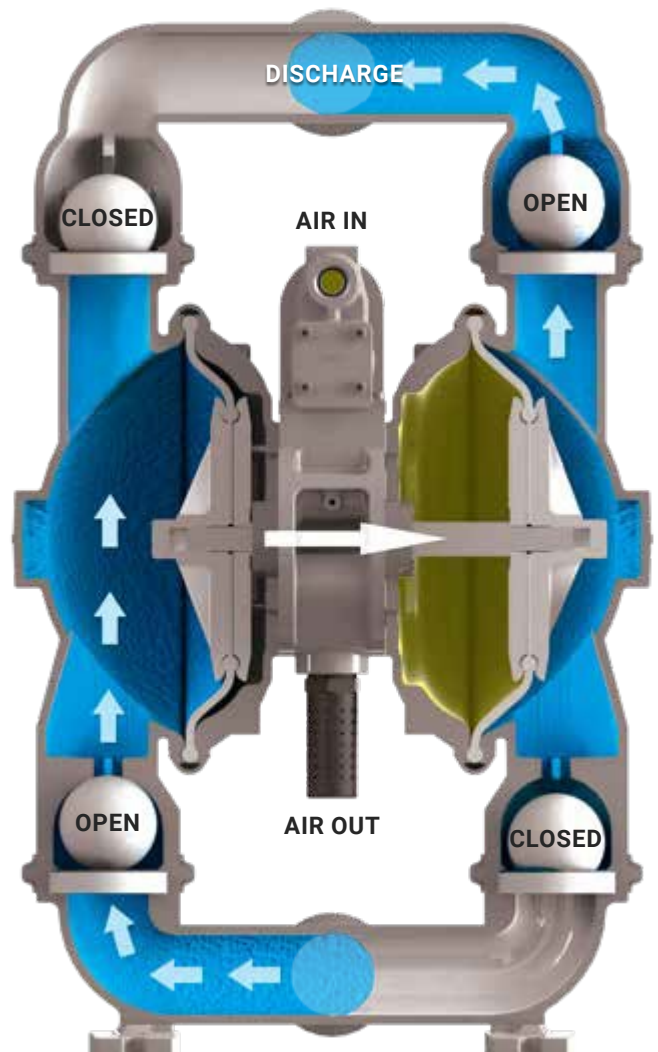
AODD PUMP OPERATION

= Compressed Air = Pumped Fluid



1: SUCTION CYCLE

Compressed air fills left inner chamber, causing the opposing diaphragm to create suction, lifting the lower valve ball, pulling in fluid at inlet. Simultaneously the left chamber is in "Discharge" cycle.



2: DISCHARGE CYCLE

Compressed air fills right inner chamber, causing upper valve ball to open and discharge fluid. Simultaneously, the left chamber is in "Suction" cycle.

10 ESSENTIAL TIPS FOR OPTIMIZING AODD PUMP PERFORMANCE

1. Understand where the pump needs to be installed within the system
2. Ensure compatibility between product and pump materials
3. Know your pump's operating point
4. Consider your power options
5. Utilize accessories to prolong life of pump
6. Purchase manufacturer's recommended replacement parts
7. Track the pump's performance
8. Check pump hardware
9. Conduct complete maintenance
10. Educate yourself

1. UNDERSTAND WHERE THE PUMP NEEDS TO BE INSTALLED WITHIN THE SYSTEM

A pump's location within the system is critical to its performance and longevity. This is because AODD pumps can be used in three main ways:

- **Suction lift:** AODD pumps are self-priming and can pull a suction lift up to 32' (9.8m). When installed in a suction lift application, the liquid level is below the center line of the pump. Ideally, the length of the suction pipe should be as short as possible. This will help with priming and reduce stress on the pump's diaphragms.
- **Submerged:** AODD pumps can be submerged in the fluid that is being pumped. Before submersion, however, you need to ensure that all pump materials are compatible with the fluid and that the pump's air exhaust is extended above the fluid level. You also want to make sure that a suction screen is used if solids are present in the fluid. This ensures that solids larger than the pump can handle (pass) don't enter the unit.
- **Flooded suction:** When installed in a flooded suction, the pump is located with the liquid level above the center line of the pump. Due to the liquid's pressure into the pump, it's important to place the pump as close to the fluid vessel as possible. This will reduce diaphragm stress and valve ball chatter. Controlling the fluid pressure coming into the suction side of the pump is important; ideally, it should be less than 10' (3 m) of pressure. If the inlet pressure is greater than 10' (3 m), you should consult the pump manufacturer.



2. ENSURE COMPATIBILITY BETWEEN PRODUCT AND PUMP MATERIALS

Selecting the right materials for an AODD pump is an essential step in achieving maximum performance and safety. Before choosing a pump's material, however, these fluid characteristics must be considered:

- Overall chemical compatibility
- Temperature
- Viscosity
- Abrasiveness
- Specific gravity

Understanding the diaphragm pump material selection process will help decrease downtime while increasing reliability, performance and profitability.

Chemical Compatibility

It is critical to make sure the fluid you're moving is chemically compatible with the pump materials. This includes elastomers, castings and possibly hardware if there are plans to submerge the pump. To do this, consult your AODD pump manufacturer's [chemical compatibility guide](#).

Temperature Range (Fluid Being Pumped)

AODD pumps can handle a wide range of temperatures: cold fluids (consult factory when pumping fluids below freezing) and fluids up to 220 degrees Fahrenheit (104 degrees Celsius) and beyond. When exceeding 220 degrees Fahrenheit (104 degrees Celsius), consult the factory for guidance.

Fluid Viscosity

The viscosity of fluid being pumped is important to understand, as it has a direct correlation to performance and material choice. For higher-viscosity (thicker) products, heavy valve balls like stainless steel or PTFE might be needed in order to rise and fall in the thick fluid. This allows the pump to operate as intended. Lighter materials, like Santoprene, might not work as well with thick products, as they have a tendency to float, affecting flow and pump performance.

Abrasive Fluids

If you're pumping abrasive material, you may consider choosing a harder casting and/or seat material. Both stainless steel and cast iron are great options for combating premature wear due to abrasives, while PVDF is best for plastic pumps in abrasive applications. If you're questioning the effectiveness of a specific material, consult the AODD pump manufacturer for assistance.

Specific Gravity

Knowing the Specific Gravity (SG) of the product you're pumping is a key component to understanding the pressures your pump may encounter. Water has a SG of 1. When pumping something that varies from this, it can affect the pump in a number of ways.

1. If the product is lighter than water (alcohols, acetone, etc.), it can cause issues on the suction side of the pump with priming. Some products can even change form (liquid to gas) under these circumstances, causing further issues.
2. If the product is heavier than water (bromine, iodine, etc.), it can also cause issues on the suction side with priming, but more commonly on the discharge of the pump, with an increase in head pressure. Essentially, it is taking more energy to move the product, which decreases the optimal output.

Materials Selection Guide

Diaphragm Material	Purchase Price	Flex Life	Abrasion Resistance	Chemical Resistance	Temp. Limitations	Temp. Max. Operating	Temp. Min. Operating
Nitrile	A	A-	B	C+	C	190°F/88°C	-10°F/-23°C
EPDM	B	B	B+	B+	B+	280°F/138°C	-40°F/-40°C
Hytrel®	B-	A	A+	B+	B	220°F/104°C	-20°F/-29°C
Neoprene	A+	A	B	D	C	200°F/93°C	-10°F/-23°C
PTFE	D	C-	F	A+	A	220°F/104°C	-35°F/-37°C
Santoprene®	A+	A+	A+	A	A+	275°F/135°C	-40°F/-40°C
FKM	F	D	C	A	A+	350°F/177°C	-40°F/-40°C

A+ = Best • F = Not Recommended

For reference only, consult distributor

Nordel® is a registered tradename of The Dow Chemical Company • Santoprene® is a registered tradename of Exxon Mobil Corp.
 Hytrel® is a registered tradename of E.I. DuPont • Kynar® is a registered tradename of Arkema

Materials

Material Profile:	Operating Temp:		Polypropylene: A thermoplastic polymer. Moderate tensile and flex strength. Resists strong acids and alkali. Attacked by chlorine, fuming nitric acid and other strong oxidizing agents.	180°F 82°C	32°F 0°C
	Max.	Min.			
EPDM: Very good water and chemical resistance. Has poor resistance to oils and solvents, but is fair in ketones and alcohols.	280°F 138°C	-40°F -40°C	PVDF: (Polyvinylidene Fluoride) A durable fluoroplastic with excellent chemical resistance. Excellent for UV applications. High tensile strength and impact resistance.	250°F 121°C	0°F -18°C
FKM: (Fluoroelastomers) 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
Hytrel®: Good on acids, bases, amines and glycols at room temperatures only.	220°F 104°C	-20°F -29°C	UHMW PE: A thermoplastic that is highly resistant to a broad range of chemicals. Exhibits outstanding abrasion and impact resistance, along with environmental stress-cracking resistance.	180°F 82°C	-35°F -37°C
Neoprene: All purpose. Resistance to vegetable oils. Generally not affected by moderate chemicals, fats, greases and many oils and solvents. Generally attacked by strong oxidizing acids, ketones, esters and nitro hydrocarbons and chlorinated aromatic hydrocarbons.	200°F 93°C	-10°F -23°C	Urethane: Shows good resistance to abrasives. Has poor resistance to most solvents and oils.	150°F 66°C	32°F 0°C
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	Virgin PTFE: (PFA/TFE) Chemically inert, virtually impervious. Very few chemicals are known to chemically react 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 temp.	220°F 104°C	-35°F -37°C
Nylon: 6/6 High strength and toughness over a wide temperature range. Moderate to good resistance to fuels, oils and chemicals.	180°F 82°C	32°F 0°C	<i>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.</i> Metals: Stainless Steel: Equal to or exceeding ASTM specification A743 CF-8M 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.		

3. KNOW YOUR PUMP'S OPERATING POINT

According to the [Hydraulic Institute](#), pumping systems account for over 40% of industrial energy use. When it comes to powering pumps, energy saved equals dollars saved.

AODD pump up-sizing is one strategy to reduce AODD pump energy consumption. When you increase the size of the pump for the same desired flow, it increases the pump's efficiency—ensuring the maximum volume of liquid is pumped per amount of compressed air consumed.

In other words, if a pump is running to the far right hand of the curve (i.e., the pump is running flat out) to produce the desired flow rate, going up one pump size can allow you to shift the performance point to the left on the curve. This means the pump will cycle less, reducing energy consumption and extending pump longevity while getting the same desired output.

Displacement per stroke is also important to note, as there's a direct correlation between pump longevity and efficiency. In many cases, choosing a pump with a greater displacement per stroke will reduce wear on the unit.

Using a larger unit can also reduce wear when pumping abrasive liquids, such as ceramic slip. By upsizing the AODD pump and running it more slowly, you reduce fluid velocity, which, in turn, reduces abrasive wear.

REMEMBER: Before fluid begins to flow through your pump, there is something you can do during installation that will make it even more efficient: make sure the fluid inlet and outlet piping/fittings are at least as large as the pump's connection size.

This means if you are installing a 2" pump, it should be connected to a 2" or larger piping. If the piping is smaller than the pump size, fluid suction will be restricted and negatively affect pump flow, efficiency and [diaphragm](#) life.

This step is crucial for long pump life and the most effective operation of the pump.

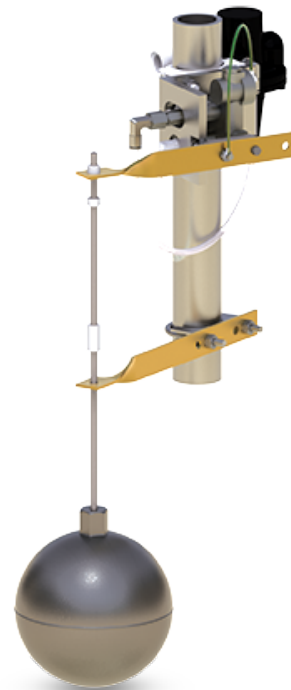


4. CONSIDER YOUR POWER OPTIONS

Perhaps nothing affects the pump's longevity more than air quality. An AODD pump's power source is compressed air. Just as dirty air can disrupt pump performance, air pressure can mean the difference between a pump working at full capacity and a pump that underperforms or won't operate at all.

Air pressure controls how fast an AODD pump operates and how much flow it produces. If the pump is receiving more pressure than it requires, the pump will cycle rapidly, leading to inefficient operation, additional pump wear and premature failure. By installing an air filter/regulator, you ensure the air is clean and pressure is appropriate. You want the fluid to have enough time to fully enter and exit each fluid chamber and the valve balls to seat properly. This will ensure each stroke is complete and leads to volumetric pump efficiency.

REMEMBER: Using air filter/regulators and liquid level controllers can save you money on energy use and improve diaphragm life. Most importantly, controlling air pressure can prevent premature failures, which could lead to lost product, costly cleanup and unplanned downtime.



5. UTILIZE ACCESSORIES TO PROLONG LIFE OF PUMP

These are sold by distributors and should be easy to find and install:

- **Flexible fluid connections** help reduce pipe stress that can cause leaking or, in extreme cases, damage pump components. Flex connections can also reduce fluid pulsation, protecting downstream equipment.
- **Liquid-filled pressure gauges** installed on the fluid inlet and discharge can act as windows to pump performance and offer helpful information to control the pump more effectively. They can also troubleshoot systems issues like blockages, restrictions or pressure fluctuations.
- **Inlet stabilizers** on the suction side of the pump can reduce incoming pressure spikes, commonly referred to as water hammer, that tend to be felt on the diaphragms during the suction stroke, reducing their life in some applications with positive suction pressure.
- **Surge suppressors** provide nearly pulse-free discharge flow for steadier pressure and less system vibration (vibration can cause damage to piping, valves and measuring equipment) and noise.
- **Liquid level controllers** provide a safe and cost-effective way to control AODD pumps (providing on/off/on functionality). Liquid level controllers are most notably used in water and chemical sump applications. Their mechanics are simple: a pneumatic float switch turns the air to the pump on and off as the liquid level rises and falls.

6. PURCHASE MANUFACTURER'S RECOMMENDED REPLACEMENT PARTS

If replacement parts are needed, they can be ordered through a manufacturer's distribution network. Purchasing genuine parts from the original equipment manufacturer reduces downtime and multiple maintenance sessions. Manufacturers make parts specifically to fit their own pumps, and using replacement parts from a different source will void your pump's warranty.

7. TRACK THE PUMP'S PERFORMANCE

Unfortunately, there's no telltale sign an AODD pump is about to fail. The flow and performance will be consistent until a repair is needed. Because every plant is unique and applications vary, there's no standard AODD pump maintenance schedule. The best way to estimate pump longevity is by getting to know your pump and tracking the mean time between failures.

REMEMBER: Research the performance of pumps in similar applications to get an idea of when your pump may need wet side or air side repairs. Additionally, track your pump over time to see when it typically needs service, then establish a preventive maintenance schedule.

8. CHECK PUMP HARDWARE

When installing a new AODD pump (or one that was repaired and placed on the shelf for later use), you should always check the tightness of the pump's hardware. This can prevent leaking and damaged seals. Pump hardware tends to loosen up over time due to temperature changes and vibration. Hardware torque specifications can be found in the operation manual. When installing bolted pumps, tighten the hardware in a cross-pattern to factory specifications.

REMEMBER: It's important that the pump isn't under pressure when tightening hardware. If a pump isn't properly tightened prior to seeing fluid pressure, it could leak and seals could be damaged. Pumps will often come with a tag to encourage retightening of hardware.

9. CONDUCT COMPLETE MAINTENANCE

If one individual AODD pump component fails, change all of the components. For example, if you're changing one seat, change all of the seats. Simple-to-install, cost-effective Air End and Wet End kits are commonly available to take the guesswork out of repair parts selection.

REMEMBER: If your plant uses pumps for critical applications, you may want to consider having spare pumps on hand. Swapping a spare pump out for a pump that needs repair takes just minutes—much less time than a pump being out of service while awaiting repair.

10. EDUCATE YOURSELF

The beauty of an AODD pump is in its simplicity. Still, it's critical to understand the technology in order to work with it best:

- Read pump manuals to make sure you understand the workings of your pump.
- Build a relationship with your pump manufacturer and/or distributor. Many offer technical assistance by phone, online or even in person.



ABOUT VERSAMATIC

For almost 40 years, Versamatic has been one of the largest and most trusted manufacturers of world-class, AODD pumps and replacement parts for a broad, global customer base. Count on the consistency, reliability and trouble-free operation of Versamatic's bolted metal, bolted plastic and clamped metal AODD pumps offered in a wide range of sizes and flow rates.

Versamatic's team of engineers and customer support specialists helps you throughout the process, from selecting the pump to purchasing and providing post-sales support. Trust Versamatic's experience to understand your specific needs, provide expert guidance and develop ideal solutions to keep your pumps working at the highest, most efficient level possible.

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Versamatic

800 North Main Street
Mansfield, OH 44902

419-526-7296

