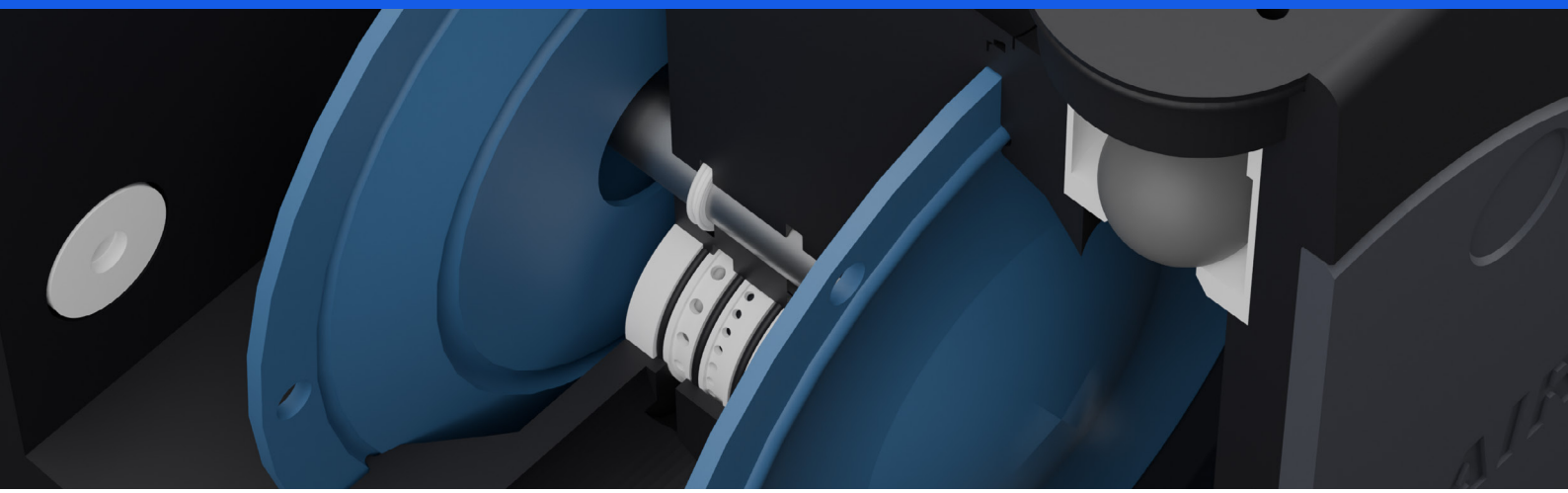
10 Essentials when selecting a double diaphragm pump



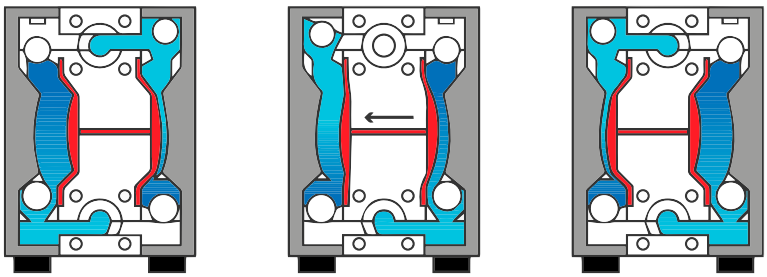
In nearly all factories, you will find at least a couple of air-operated double diaphragm pumps. They might not always be central to the process or highly visible, but they consistently perform their tasks day after day. With proper maintenance, the wearing parts can be replaced at regular intervals, allowing the pump to function seamlessly. But how do you truly optimize the performance of your double diaphragm pump? The key lies in selecting the right pump for your specific application and process parameters. This process might seem daunting, but it is actually quite manageable. By focusing on critical parameters such as fluid properties, flow rate, temperature, and pressure, you can make an informed decision and select the most suitable pump for your needs.

01 Fluid compatibility

The selection of the best pump begins with a determination of the fluid parameters you are pumping. Important factors to consider include the fluid's chemical corrosiveness, temperature, and specific gravity (SG). Additionally, the presence of solid-laden and abrasive particles is a crucial aspect to keep in mind.
Double diaphragm pumps offer a wide range of material options for the wetted parts, enabling them to handle a diverse array of fluids. This flexibility makes them one of the most versatile pumping principles available.

These pumps are capable of handling:

- Chemicals
- Slurries
- Syrups
- Gels
- Creams
- Food sauces & ingredients
- Paints
- Emulsions
- Ink
- Plasma with small bone fragments
- Fine and smaller solids
- High viscosity fluids
- Abrasive fluids
- High specific gravity fluids
- Thixotropic fluids



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02 Process parameters

The process parameters are also very important. What is the flow rate and the temperature of the medium in the process? Does the process line have a positive or negative suction head, and what are the conditions at the discharge and suction sides?

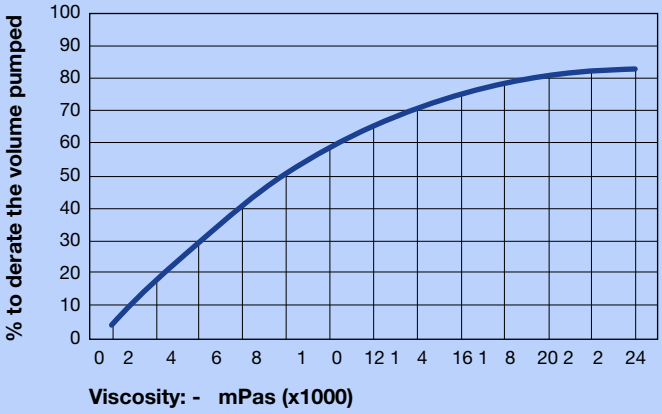
In cases of cavitation, the impellers of industrial pumps often develop holes, and the vibration caused can lead to the destruction of bearings, mechanical seals, shaft connections, or even the breaking of impeller screws.

Checkpoints for process parameters:

- Verify material compatibility: Ensure your fluid is compatible with the wetted materials of the pump.
- Verify maximum operational temperature: Confirm the maximum temperature tolerance of the wetted materials. Also, consider how your fluid may alter at higher or lower temperatures.
- Verify pressure conditions: Ensure the selected pump can accommodate the required pressure conditions for your process.

03 The influence of viscosity

The viscosity of your liquid must align with the pump specifications. Flow rates are typically standardized using water at 20°C. As viscosity increases, the actual flow rate decreases; refer to the diagram on the right for an estimation of this decrease percentage. Handling more viscous fluids absorbs a portion of the pump's maximum flow rating. Fluid viscosity is influenced by the working temperature. Generally, liquids are less viscous at higher temperatures compared to lower temperatures.



Correction curve to derate diaphragm pumps for viscosity to volume. Example : the pumped flow rate of a medium with 6000 mPas will decrease to 60% of the rated value.

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04 Agitation

Agitation plays a secondary role and has less influence on the deviation of the pump curve. It can be classified into three categories:

1. Fluids that maintain constant viscosity despite agitation at a constant temperature (e.g., mineral oil).

2. Fluids whose viscosity increases with agitation (e.g., clay slurry).

3. Fluids that decrease in viscosity as agitation increases (e.g., waxes).

05 Negative suction head

When the liquid level is positioned below the pump inlet, the pump experiences a negative suction head. This condition impacts the flow rate, causing it to decrease as depicted in the curve to the right.

06 Extending the pump's operating life

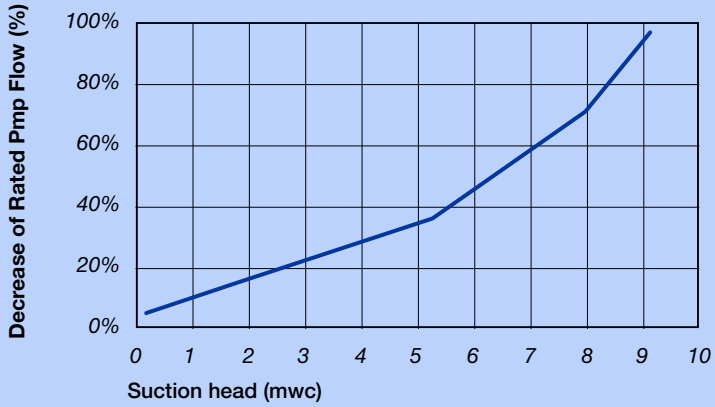
Once you have evaluated the fluid duties, system requirements, and fluid characteristics, the next crucial step is minimizing stress and optimizing the pump's operation to ensure efficient fluid movement within your process.

This entails ensuring that the pump:

- Operates within its specified operating window.
- Uses materials that are compatible with the fluid
- Is installed with appropriate suction and discharge pressures to facilitate optimal diaphragm movement.

Correctly interpreting the performance curve prevents overworking the pump and unnecessary stress, thereby extending its operational lifespan.

Decrease in flow rate as suction head lift rises



Example: 20% loss of rated pump flow at 3.5 m suction lift.

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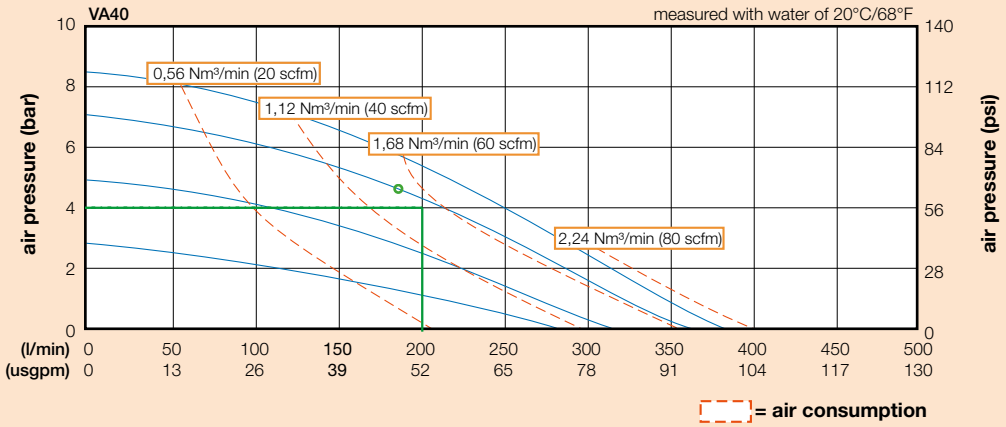
To find the working point of the curve you only need following data:
Once you have gathered this data, interpreting the pump curve becomes straightforward. Start by identifying the required discharge pressure on the vertical axis. Next, draw a horizontal line across to intersect with the desired flow rate (e.g., VA 40 at 4 bar, which is 200 l/min shown by a dotted red line). Trace back from this intersection to the beginning of the curve on the left (in this case, at 7 bar).

Air consumption is a critical factor. Again, locate the point corresponding to 200 l/min at 4 bar. Determine where this duty point falls between the two red dotted lines and draw an imaginary dotted line (purple) through this nearest duty point to a red dotted line. This method allows you to ascertain the air consumption, which in this example is 1.5 m³/min.



07 Maximizing safety

Double diaphragm pumps are ideal for handling hazardous liquids such as corrosive acids, lyes, poisonous compounds, and volatile fluids without issues. By carefully selecting materials with maximum chemical compatibility, these pumps eliminate the risk of corrosion. They also operate without mechanical seals, which prevents gradual abrasive wear on seal faces. For processes requiring maximum safety, there are double diaphragm pump models available manufactured from solid machined virgin ETFE or PTFE. Additional safety measures can be implemented, such as installing accessory components like a barrier chamber to prevent atmospheric escape in the event of a ruptured diaphragm. This chamber can be integrated with a barrier protection system that triggers an alert signal for immediate pump shutdown, enhancing operational safety.

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How do I safely use a double diaphragm pump in ATEX zones?
An explosion risk zone requires a pump which can operate without contributing to or triggering the potential of that risk; this can be heat/ignition or fuel from a leaked fluid. Double diaphragm pumps are a common choice in ATEX zones as they can operate safely without causing one of the key risks. However, a fluid moving round any pump can build up a static charge through friction against the inside of the pump casing. You must always ground the pump, any pump, and ensure your pump is from a conductive material to prevent a dangerous build-up of static charge.

08 Avoid damage

An air-operated double diaphragm pump is a highly reliable pump type, known for its ease of operation and maintenance. However, despite its simplicity, there are several factors that even this pump type can pose risks with.

09 The real multi-purpose pump, a pump for all occasions

Double diaphragm pumps are highly versatile and can be used effectively in various pumping processes, making them ideal for emergency situations as well. For smaller pumps with an inlet diameter of DN 25, they can be easily transported around the site either by hand or on a mobile trolley, allowing for use at multiple points as needed. For applications requiring higher flow rates, the pump can be conveniently mounted on a cart, ensuring portable use at various points throughout your process.

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10 Calculate your cost: which is the best deal for your process?

A comparison between AODD (Air Operated Double Diaphragm) and EODD (Electrically Operated Double Diaphragm) pumps is certainly worth calculating. Despite their higher initial purchase costs, electrically-driven pumps typically recoup their expenses within approximately one year. The total cost of any double diaphragm pump includes the purchase price, energy cost, wearing parts, operating cost, and servicing time. To estimate these costs, consider your operational hours, the cost per volume of compressed air, air usage as specified in the datasheet, and the required service kit intervals. With the new series of electrically-driven diaphragm pumps, air usage is not a factor to calculate. Instead, energy (electricity) costs must be taken into account.

AODD (Air Operated Double Diaphragm Pump)

An air-operated double diaphragm pump is a highly reliable pump type, known for its ease of operation and maintenance. However, despite its simplicity, there are several factors that even this pump type can pose risks with.

EODD (Electrically Operated Double Diaphragm Pump)

EODD pumps operate similarly to AODD pumps, with an air cushion between the diaphragms. However, they are driven by an electric motor instead of compressed air. At startup, a small internal compressor inflates the air cushion, allowing the center piston to reciprocate within the housing via a gearbox.

When comparing AODD and EODD pumps, consider factors such as the cost of air consumption, electricity rates, and the initial purchase cost of the pump to determine which option is more cost-effective for your application.

Application examples (based on water)

Comparison	AODD	**VA25 HE**	**VA25 HE**	**VA50 HE**
	EODD	**VA-E25**	**VA-E25**	**VA-E50**
Flow - pressure		45 l/min - 4,8 bar	100 l/min - 1 bar	350 l/min - 2 bar
Air consumption AODD (Nm³/min)		0,63	0,47	1,70
Air consumption AODD 8 hours working (Nm³)		302,40	225,60	816,00
Cost AODD in € / day * at 8 hours/day		6,05	4,51	16,32
Absorbed motor power EODD (kW)		0,80	1,00	2,80
Cost energy per day ** at 8 hours/day		1,04	1,30	3,63
Total savings per pump (€)		5,01	3,22	12,69
Total savings per pump (%)		83%	71%	78%

*€ 0.02 per Nm³ / **€ 0.162/kWh

Conclusion

A double diaphragm pump is renowned for its ease of use and safety across various applications. When selecting between an air-driven or electrically driven pump, it is essential to evaluate beyond just the initial purchase price. Consulting with a specialist is crucial to thoroughly understand the pros and cons tailored to your specific process conditions.

Once your pump is operational, and if you seek further tips, tricks, or personalized on-site advice for optimizing its performance in your application, where can you turn.

More than 60 years of experience in professional pumping applications make VERDER the pump manufacturer of choice for customers from many industries on all continents. The company brings with it the process understanding, the technological expertise and the market insight to develop pumping solutions which rank among the best of the world enabling our customers to progress.

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