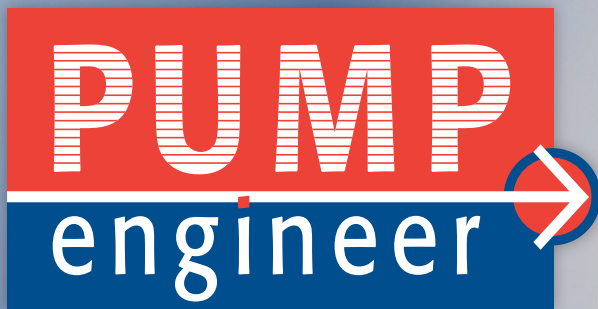


The global magazine for pump users and suppliers



COVER STORY:

Crane ChemPharma &
Energy, DEPA® Air Operated
Double Diaphragm Pumps:

Making the Right Selection
for Chemical Applications

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DEPA® Air Operated Double

Making the Right Selection

Crane ChemPharma & Energy, DEPA® is widely recognized as an industry leader in pump applications and pump technology. Today the company designs and manufactures a wide range of highly engineered products, including peristaltic and air operated diaphragm pumps, which are sought after around the world.

By Christian Gunske, Crane ChemPharma & Energy, a business of Crane Co.

The Air Operated Double Diaphragm (AODD) Pump is an incredibly flexible and versatile solution for nearly any application. Its structural makeup allows for operability even when running dry. It is the only positive displacement pump that can run against a closed valve, not just for short periods like rotodynamic pumps, but for extended periods, as well. The most impressive aspect of the DEPA® AODD pump is its usability across numerous processes.

Its versatility across a wide range of applications makes the AODD pump a preferred solution in the industry. However, selecting the right pump for the right application is challenging. In order to ensure quality and safety, operators must obtain and understand the technical requirements across the following three areas and provide this information to the manufacturer:

- Performance
- Liquid Properties
- Operating Environment



The Next Generation DEPA® Cast Stainless Steel Pump Family (Series M, Type DHxx-SA, SS), Size 15-80.



Pump Performance

Pump performance depends largely on the liquid flow rate (displacement), discharge pressure, and suction height. Performance can be represented as a function of flow rate, head, and air consumption, as seen in Figure 1. The initial pump size selection starts with identifying the chart that will cover the required flow rate. In Figure 1 a 1.5 inch (DN40) pump was selected and based on the chart, it is evident that the pump air inlet pressure needs to be 5,5 bar, and the resulting air consumption is 35 m³/h.

- Increased safety through optimized pump design
- Minimized leakage potential
- Faster and safer maintenance

Diaphragm Pumps:

for Chemical Applications



should therefore be completed so that the chemical compatibility of the wetted housing materials, as well as the effect the liquid will have on the lifetime of the parts, can be considered. Liquid properties provide valuable information on the density and viscosity of the liquid, which may impact the operating point of the pump.



- Density** - Different liquids have different densities or volumetric mass density (mass divided by volume – kg/m^3). Densities (ρ) are also determined by temperature. Water at 200°C , for example, has a density of $997 \text{ kg}/\text{m}^3$ whereas water at 950°C has a density of $960 \text{ kg}/\text{m}^3$. The heavier the liquid, the more air inlet pressure is needed to pump the liquid and, therefore, must be considered when sizing the pump.
- Viscosity** - Viscosity (η) in liquids is often referred to as the thickness of the liquid. In the example of comparing yogurt with water, oil has a higher viscosity. If we factor in temperature, we will see that with increased temperature, the liquid becomes less thick (decreasing viscosity). However, as AODD pumps run at a maximum pressure of 8.6 bar, the pressure impact on the viscosity of the liquid can be ignored. Furthermore, viscosity is either dynamic or kinematic. The dynamic viscosity (typically used for the correct sizing of the pump) describes the resistance of the liquid to shearing flows. Kinematic viscosity is the resistive flow of a fluid under the influence of gravity.

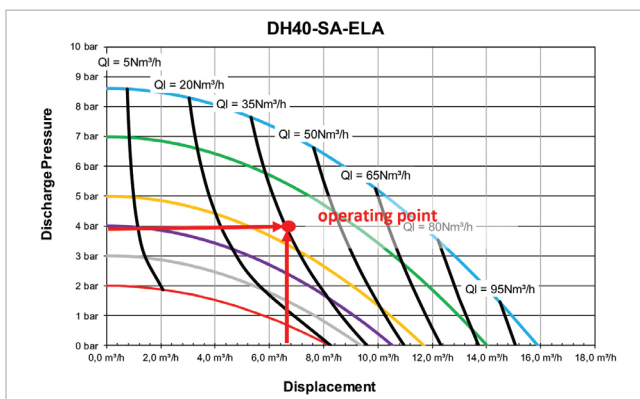


Figure 1: Performance chart of 1.5 inch (DN40) AODD pump. These charts are provided per pump size.

Liquid Properties

Having a good understanding of what liquids will actually be flowing through the pump is important in the pump selection process. A comprehensive analysis of the liquid properties present in the process

Operating environment

As with any product, the pump needs to fit the application's operating environment within a safety and regulatory framework. Such considerations include:

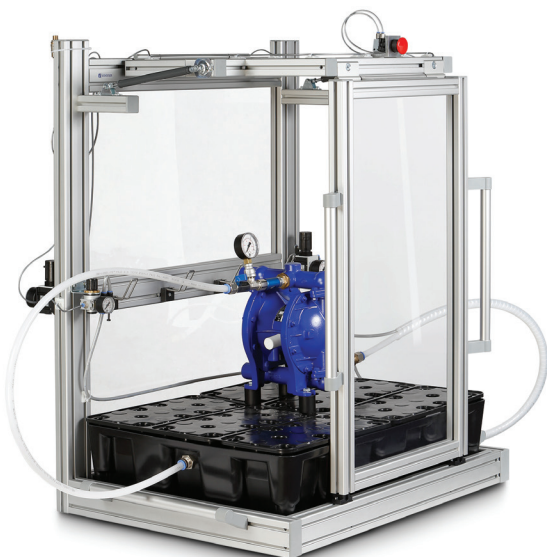
- Chemical Liquid Safety Consideration** – Operators are provided with a list of pertinent information about the liquid through the chemical data sheet (International Labour Organization (ILO), 2018).



This sheet lists the name of the chemical; fire and explosion hazards; acute health hazards; as well as physical and chemical properties. All of this information is important, as it can impact the pump's wetted housing material, and wear and tear part selection.

- **Hygienic Requirements** – Within the food and beverage, pharmaceutical, and cosmetic industries, different requirements are communicated that focus on different elements of the pump. The cleanability of the pump, the impact of abrasion on wear and tear parts in combination with the color of those parts, and the chemical composition of the materials used within the diaphragm pump all have specific hygienic properties that need to be considered. Through a variety of national, supranational, commercial and governmental bodies, hygienic regulations ensure health and safety for its citizens. With a focus on the European and American regulations, which are being adopted globally, regulations and considerations may need to be followed when selecting AODD pumps; this includes but is not limited to:

- Directives from the EHEDG (European Hygienic Engineering & Design Group) which actively supports the handling, preparation processing and packaging of food to ensure it is done hygienically. It also ensures that the process is done using hygienic machinery and in hygienic premises, according to the food hygiene directive, the machinery directive, and the food contact materials directive.
- Directives from its counterpart in the United States of America (3-A Sanitary Standards, Inc.) which has the same mission and goal for food and hygienic standards.
- Strict legal regulations (i.e. EC 1935/2004) surrounding the contact of food with certain materials and articles during its production, processing, storage, preparation and serving, before its eventual consumption. Such materials and articles are called Food Contact Materials (FCM) and are either



DEPA® Innovation

The only AOD pumps with ATEX zone 0 compliant certification worldwide

Designed and manufactured for over 50 years in Düsseldorf, Germany, Crane's DEPA® Air-Operated Double Diaphragm (AODD) pumps have earned the industry's recognition for premium quality and



innovative design. DEPA® products conform to ATEX requirements for use in potentially explosive and hazardous applications. They are the only AOD pumps with ATEX zone 0 compliant certification worldwide. DEPA® Air Operated Diaphragm Pumps provide reliability, efficiency and transfer control for all liquid and sheer sensitive materials. They can handle viscous and abrasive products and often work in the toughest conditions and most demanding applications. The material certifications meet hygienic standards, both for food and pharmaceutical, offering compliance with FDA, EHEDG, and 3A sanitary specifications. DEPA® pumps are self-priming and can run dry without damage. DEPA®'s compact and modular design requires fewer components, resulting in lower maintenance and shorter downtime. A wide range of applications can be accommodated by combining the housing and elastomer materials.

intended to come into contact with food, directly or indirectly, are already in contact with food, or can reasonably be brought into contact with food or transfer their constituents to food under normal or foreseeable use. Such government regulations stipulate that materials and objects must be manufactured in such a way that under normal and foreseeable conditions, their physical components are only transferred to foods in quantities which do not endanger the health of the consumer.

- Certifications surrounding the direct contact with food. For example, in accordance with EC 1935/2004, the BfR (Bundesinstitut für Risikobewertung) in Germany conducts testing and provides certification

on these materials. In France, the Association Nationale des Industries Alimentaires (ANIA) conducts such testing and has set even more stringent standards compared to the BfR regarding chemical components that are exposed to food. The main difference is the focus on whether the material is free from bisphenol-A and phthalates. In the United States of America, this is governed through the Food and Drug Administration (FDA) and described in Title 21, Subpart C, Section 177.2600 (Rubber articles intended for repeated use) and Title 21, Subpart B, Section 177.1550 (Perfluorocarbon resins).

- **Explosive Environment (ATEX)** - Hydrochloric acid is not an explosive liquid, however it should be considered so during pump selection, as the environmental conditions might necessitate the AODD pump to operate in an explosive environment. The definition of an explosion is the rapid increase in volume and release of energy in an extreme manner, usually with the generation of high temperatures and the release of gases (so-called exothermic reaction).

Flammable substances in a plant may include:

- Liquid in the AODD pump or the device
- Dust in the area surrounding the AODD pump
- Explosive products in the area surrounding the AODD pump

Oxygen (air) sources include:

- Initial start of pump (dry running of the AODD pump)
- Dust in area surrounding the AODD pump
- Exhaust air of pump
- Through a diaphragm leakage, the product comes into contact with compressed air

Ignition Sources include:

- Mechanically generated sparks
- Hot surfaces
- Electrostatic discharges

In order to prevent accidents / explosions, standards which regulate and enhance the safety for work in “explosion endangered areas” will be applied. The corresponding standards for Europe are what are known as the ATEX directives. ATEX is a European law for safety and environmental work situations. It is applicable in every location where explosions may occur (i.e. explosion endangered environments of gases and dusts). Devices for which ATEX is applied use the symbol together with the appropriate declaration.

External Certification of AODD pumps

AODD pumps can be certified by a wide range of external governmental and non-governmental bodies to perform duties within specific industries. For example,

within the marine industry these kinds of certifications can be issued by Bureau Veritas, the American Bureau of Shipping and similar companies.

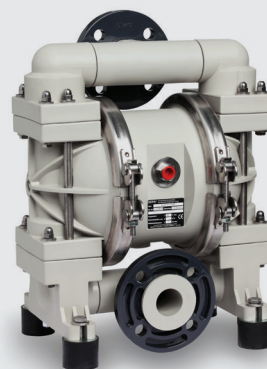
Final Thoughts

There are a lot of factors an operator must consider when making pump selections. Taking the time to fully understand and analyze the performance requirements, liquid properties of the in-process fluids and the characteristics of the operating environment can clarify the process for operators and should be at the forefront of any pump selection decision. Once that data is collected, the manufacturer will be able to provide the most suitable equipment based on the requirements.



Series M Typical Applications

- Automotive
- Chemical
- Ceramic and Porcelain
- Mining, Construction
- Paint and Varnish
- Wastewater
- Plant and Mechanical Engineering



Series P Typical Applications

- Chemical
- Galvanic and Coating
- Paint and Varnish
- Pulp and Paper
- Pharmaceutical
- Plant and Mechanical Engineering
- Power Stations and Waste Disposal Technology



Series L Typical Applications

- Beverage
- Biotechnology
- Chemical
- Cosmetic
- Dairies
- Food
- Medical Applications
- Pharmaceutical

