Tip of the month/No. 1

Dry backing pumps

Question:
In my turbo pumping station, I use a diaphragm pump as a backing pump. I would like an alternative dry backing pump with a higher pumping speed and improved base pressure, as I would like to reach an even lower pressure in the high vacuum and regenerate my cryo pump more quickly. What would you recommend? Is there anything that stands out, and is there anything I should consider before buying a replacement?

Answer:
We would recommend our ACP series for a dry pump with a higher pumping speed and improved base pressure when compared to the diaphragm pumps.

Background:
An ACP pump functions on the principle of a multi-stage Roots pump. Due to its design, this type of pump has no seals in the pumping module. The absence of seals in the pumping module that are prone to deteriorating leads to steady performance parameters during operation and makes the vacuum generated by the pump extremely clean and free from particles. By minimizing wearing parts, the pump will reach extremely long maintenance intervals of up to four years or 22,000 operating hours under all operational conditions. This air-cooled type of pump comes in three models, with a pumping speed of up to 37 m³/h. That is four times higher in comparison with our largest diaphragm pump. And the ACP pump's base pressure is at least 10 times better than the lowest value on our best diaphragm pump. For pumping traces of corrosive media, choose the version with an inert gas purge. ACPs with gas ballasts are available for use with condensable media.

You should consider the following points:

1. If a vacuum pump transports corrosive media, the pump may contain residue from this media when shut down. This is particularly the case during a power failure or an emergency shut down. Back diffusion of gases like air or atmospheric moisture from the exhaust back into the non-operating pump. For example, acids formed from air moisture and halogens can corrode the pump material. To avoid such processes, all ACP pumps are equipped with an anti-suckback valve on the pump outlet.

   In high vacuum applications, the gas throughput is very small. Therefore pressure, which could press open the valve at the outlet from within, cannot build up inside the pump. The gas composition in the

vacuum chamber and the fore-vacuum line during long pump cycles under high vacuum is dominated by light gases, such as hydrogen. If these gases are not driven out of the backing pump, they can diffuse back into it due to open gaps between rotors and stators in the ACP pumps, and because of the constant compression ratio of the turbo pump in use, they can also lead to a rise in the total pressure under high vacuum. So if you use gas ballast to at least intermittently drive out the light gas with a carrier gas flow, it will have a positive effect on the base pressure of your system.

Even if the use of gas ballast sees the total pressure in the fore-vacuum line rise to around 0.1 mbar, the total pressure on the high vacuum side will fall due to a reduction in the partial pressure of light gases in the fore-vacuum line.

The combination of a HiPace turbopump and an ACP backing pump can easily generate a base pressure in baked vacuum systems that is distinctly less than 10^{-10} mbar (=10^{-8} Pa).

2. You write in your question that you would like to regenerate a cryo pump. During regeneration of cryo pumps, significant quantities of water vapor gather within a short period of time. To avoid condensation from water vapor inside the pump, it should be warmed up. The use of gas ballast heats the pump due to the additional heat of compression. Before regeneration of the cryo pump, you should activate the gas ballast in an ACP pump for at least thirty minutes. After regeneration, the gas ballast should continue to run for at least thirty minutes.

Both suggestions involve the use of gas ballast. For the gas ballast to be controllable and/or remote controlled beyond the options of the inbuilt on/off valve, it is possible to screw an adapter flange into the pump stator in place of the standard valve. Accessories for specific applications can be connected to this adaptor at will.

When using corrosive media, you should introduce an inert gas, for example dry nitrogen, to use as a flushing medium.

To protect your system against venting through the gas ballast during a power failure, we recommend the use of an electromagnetic valve with instant reaction in the fore-vacuum line.

We would be happy to assist you in optimizing your vacuum solutions for specific applications – go ahead and ask us:

http://www.pfeiffer-vacuum.com/contact