APPLICATION NOTE

RV VACUUM PUMP MODE SWITCH USE

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Edwards' RV range of oil sealed rotary vane pumps feature a mode switch on the side of the pump body.

The mode switch is a unique feature of the Edwards Vacuum RV range of oil sealed rotary vane pumps. It is used to change the pump from high vacuum mode to high throughput mode allowing RV pumps to do double duty in a wide variety of applications where previously both single stage and two stage rotary vane pumps would have been required for reliable operation.

Figure 1 - Mode switch on an RV pump

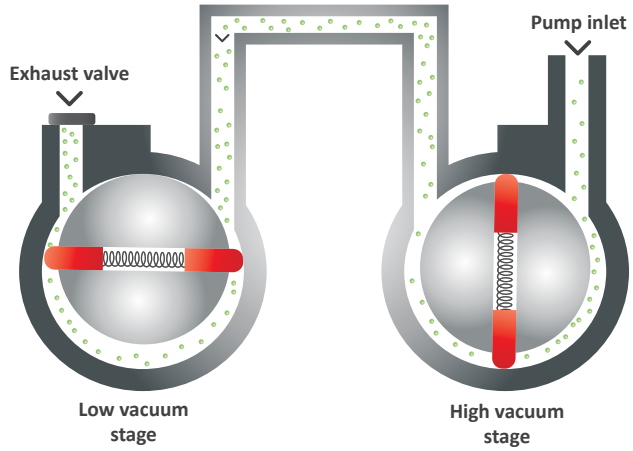

Figure 2 - Simplified diagram of two stage oil Sealed Rotary Vane Pump (OSRVP)

In a two stage oil sealed rotary vane pump, two pumping stages are used in series: first, the high vacuum stage which exhausts into the second low vacuum stage and ultimately exhausts to atmospheric pressure.

Vacuum pump oil is injected into the stages via an oil pump and an oil pressure regulator that is part of the pumping mechanism. The oil performs a number of duties, including lubricating, sealing and transferring heat away.

With the mode switch in high vacuum mode the oil is degassed in the interstage area before being allowed into the high vacuum stage at a controlled rate. This degassing allows best ultimate to be attained.

In high throughput mode, high oil flow is directed into the high vacuum stage to ensure good lubrication. In high throughput mode we are not concerned with the ultimate performance of the pump, just its ability to cope with large gas loads without the high vacuum stage being starved of lubrication.

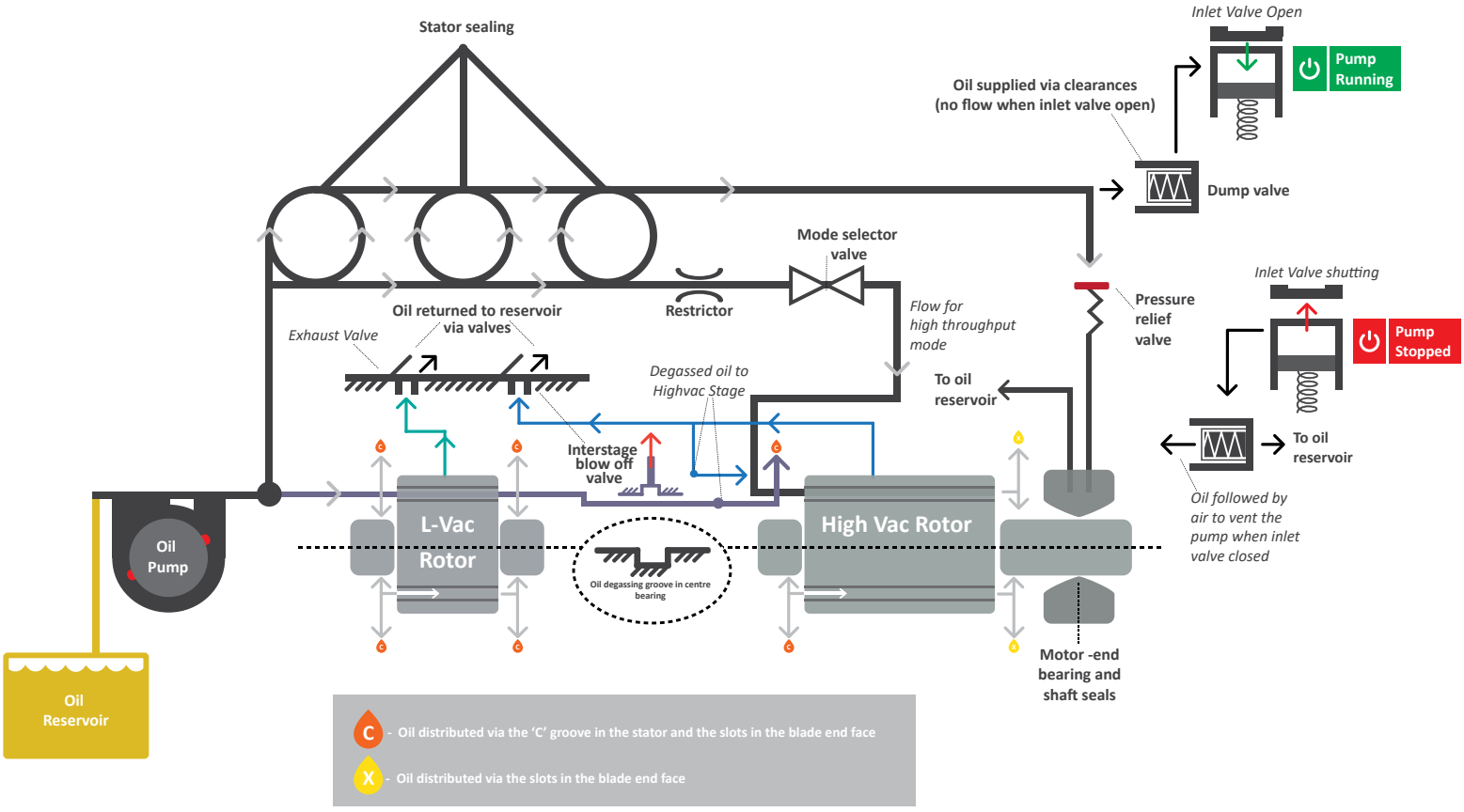

Figure 3- Diagram of the oil circuit

For applications where the pump spends a considerable amount of time at relatively high inlet pressures (high pressure in this case meaning greater than 75Torr/100mbar or about 1/10th of atmospheric pressure), the pump should be operated in high throughput mode.

With a conventional two stage pump operating during high pressure/high throughput operation like this, the amount of gas passing through the high vacuum stage can get so high that it carries out the oil normally inside it causing it to "run dry", meaning direct metal-to-metal contact between the moving and non-moving parts of the pump. This results in very rapid wear and damage.

The mode selector switch changes the oil distribution path inside the pump body to increase the flow of oil into the high vacuum stage. This keeps it lubricated and also helps the pump handle large amounts of condensable vapor which may otherwise condense inside the pump.

An alternative to a mode control switch is to have two dedicated pumps: a single stage pump for high throughput/pressure operation and a two stage pump for high vacuum use. The mode switch allows a single pump to do double duty in both high throughput and high vacuum operation without compromising performance in either mode.

Even though the mode selector switch looks like a variable control, it should be rotated either all the way out (high vacuum mode) or all the way in (high throughput mode).

It's absolutely okay to change the mode selector switch while the pump is running.

If the inlet pressure is being measured, one of the things that will be noticed is that the ultimate pressure the pump can achieve in high throughput mode is approximately one decade higher than in high vacuum mode; $2x10^{-2}$ Torr or $3x10^{-2}$ mbar.

Figure 4 - Closeup of inlet

While this higher ultimate pressure performance may suggest that the pump is not "working as well", high throughput mode is used when pumping on a continuous inlet gas load, so the pump will be at a significantly higher inlet pressure (by several orders of magnitude) due to the gas load.

In other words, the pressure at the inlet of the pump is governed by the amount of the gas being pumped and the pace with which the pump can remove it, rather than the ultimate pressure capability of the pump.

Moving the mode switch to high vacuum mode re-enables the pump's lowest pressure ultimate capabilities on-the-fly.

Recommended mode selector switch settings

Application	Mode selector switch setting
Distillation, rotary evaporation, freeze drying, gel drying, vacuum filtration, degassing, de-airation, pumping solvent vapor or any other condensable vapors	High throughput
Backing turbo or diffusion pumps	High vacuum
Pumping systems down from atmospheric pressure	More than 10 minutes of >75Torr/100mbar or repeat cycling on >100 liters: high throughput. All other high vacuum
Vacuum bagging or vacuum chucking and central vacuum applications	High throughput
Continuous pumping at <75Torr/100mbar	High vacuum
Mass spectrometry, scanning electron microscope, helium leak detector pumping	High vacuum

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