

Golden Rules for the use of Rotary Vane Vacuum Pumps in the Laboratory



Rule 1 **Always operate the vacuum pump with the Gas Ballast valve open!**

Gas ballasting prevents the accumulation of vapours in the pump oil. If you are pumping vapours and the gas ballast is closed, a cold trap with a supply of refrigerant must be used on the inlet to the pump. If you do not obey this simple rule, you may cause damage to your pump.

Rule 2 **Do not connect the vacuum pump to the process until it has reached its operating temperature!**

Rotary vane pumps will not pump to their maximum water vapour pumping rate until they are at their optimum operating temperature. The vapour tolerance of a rotary vane pump is highly dependent on its operating temperature. If a cold pump is connected to vacuum system, it is highly likely that heavy condensation will occur within the pump. It is strongly recommended that a simple shut off valve is inserted into the line before the pump. Before opening the shut off valve, the pump is run for 20 minutes with the gas ballast open to make sure it has reached its maximum operating temperature.

Rule 3 **Let the pump continue to operate with the gas ballast valve open after the process has finished.**

Even with the gas ballast open, and operating the pump within its vapour tolerance, some vapours may still dissolve in the oil. Alternatively, you may have exceeded the pumps maximum vapour load without knowing it. Any oil soluble vapours (mostly organic) dissolved in the oil will outgas uncontrollably from the oil. If however the pump continues to operate for 20 minutes after the process has finished, with the inlet shut off valve closed and the gas ballast open, dissolved gases and vapours can be virtually eliminated from the pump oil.

Rule 4 **Never restrict flow from the exhaust port of the pump!**

JAVAC Rotary Vane pumps are designed to exhaust to atmospheric pressure. Pressures higher than atmosphere may damage the pump which is designed for vacuum, not pressure service. We recommend the following rule for sizing exhaust discharge lines:

Inlet pipe cross section = exhaust pipe cross section

Rule 5 **Avoid Ingestion of Liquids and Solids!**

Rotary Vane vacuum pumps are designed to pump gases and vapours. Heavy ingestion of liquids or solids will damage the moving parts of the pump. An inlet condensate trap will act to knock out liquids and solids before they reach the pump.



Continued over page...

Golden Rules for the use of Rotary Vane Vacuum Pumps in the Laboratory



Rule 6 Operate Pumps with an Inlet Condenser or Cold Trap.

It is obvious that any products that do not reach the pump cannot cause a problem. This common place truth is all too often overlooked. Solvent vapours are most often pumped at pressures above 1mbar. The condensation of these vapours before they reach the pump offers two important benefits.

- Additional protection provided to the pump assists the lubrication of bearing surfaces during severe processes.
- The inlet condenser produces clean recovered solvent.

At pressures below 1mbar, the pump usually has to deal with high boiling point vapours, ie. vapours of high relative molecular weight. Even with gas ballasting, these vapours are usually not expelled from the pump. It is highly recommended for these, that they are condensed in a cold trap before they enter the pump. The pump should be operated with gas ballasting in addition to the cold trap. Typical cold traps are either low temperature refrigerated types or the more conventional liquid nitrogen based variety. In these situations some sludge and particulates tend to form in the oil regardless of all preventative measures. Adding to this tendency is the wide range of pumping applications a single pump will experience in a typical laboratory setting. It is recommended that general pump maintenance of oil changes and cleaning out the oil box be undertaken on a regular basis.

Rule 7 Regular Maintenance of Pumps

Maintenance materially affects the working life of a pump. Regular inspection of the oil level and condition is advisable. Javac pumps offer the advantage that they can operate with low oil levels. Nevertheless, when used in laboratories, the oil level should not drop too low, as contaminant concentrations increase at the same rate as the oil level drops. Oil change intervals cannot be determined by operating time. Several chemical compounds catalyse aging of the oil to a large degree. The precise determination of oil quality is normally too intricate to be of value, so oil changes should be made when the oil is discoloured (darkened), the viscosity is increased, sludge is formed or strong odours are noted. The pump should be cleaned at regular intervals to assist with the dissipation of heat and checking general pump condition.

Rule 8 Use Vacuum Lines that are as short and of as large a diameter as possible.

The lower the operating pressure, the more important it is to minimize resistance to flow in the vacuum lines. It is therefore advisable to dimension connecting pipe lines or tubing as short and as wide as possible. Vacuum lines of the same nominal width as the intake port of the vacuum pump are optimally suited. Dirty vacuum lines (particularly flexible tubing) produce considerable outgassing. As an example, an outgassing rate of 1.6×10^{-1} mol/hr in the vacuum line will cause a pump of 75L/min to be unable to go any lower than 1mbar in pressure.