

Selecting a Vaclon Pump

It is the function of the ions to maintain a fresh supply of "gettering" material. In this regard, the ion pump is self-regulating; it only sputters as much getter material as is needed at that particular pressure.

In this way, at low pressures cathode plates are not wasted and electric power is conserved.

Some of the noble gas atoms are pumped as a result of being ionized.

In this case, they are implanted (at least temporarily) in the cathodes by the force of the accelerating voltage. Others are pumped by burial in the sputtered titanium film (Figure 4). Generally, pumping noble gases does not pose a problem because they are present in such small quantities. When it is necessary to deal with considerable amounts of noble gases, a pump of the triode configuration should be used (Figure 5).

In the triode pump, the cathode is at negative potential and built with slits that permit grazing incidence sputtering. Thus, they tend not to be implanted to any appreciable extent and the un-sputtering of previously buried noble gases is largely eliminated. Instead, the gases either react with or are buried by the sputtered film on the walls of the pump body and on the anode.

Selecting Vaclon Plus Pumps

Ion pumps are commonly used to create Ultra High Vacuum (UHV), due to their cleanliness, ability to pump different gases, and maintenance- and vibration-free operation. Long operating life and ability to read pressure are other important features of ion pumps.

The Vaclon Plus family has been designed to enhance all of these characteristics, and thus offers the most advanced and valuable solution to any ion pumping requirement.

Cleanliness

To reach very low pressures (i.e. 10^{-11} mbar) in any system, both the chamber and pump outgassing must be minimized. If not cleaned properly, the ion pump itself can be a source of gas at UHV.

In order to ensure cleanliness, Vaclon Plus Pumps are factory processed at high temperature in ultraclean vacuum for a thorough outgassing of the body and all internal components.

The cleanliness of the ion pump element is even more critical, due to the continuous cathode bombardment. Any gas trapped on the surface or in the bulk of the cathode will eventually be released. All the Vaclon Plus pumping elements are vacuum-fired at over 800°C before being mounted inside the pump, in order to minimize outgassing, specifically of hydrogen deep in the cathode bulk.

Ion Pump Outgassing System

The ion pump outgassing system is a thermal process of the pump body, completely computer controlled and able to provide an automatic final test of the achieved pump specifications. The bake-out of the pump is done in a nitrogen-controlled atmosphere to protect the external pump body from oxidation. See Figure 6 for System outline.

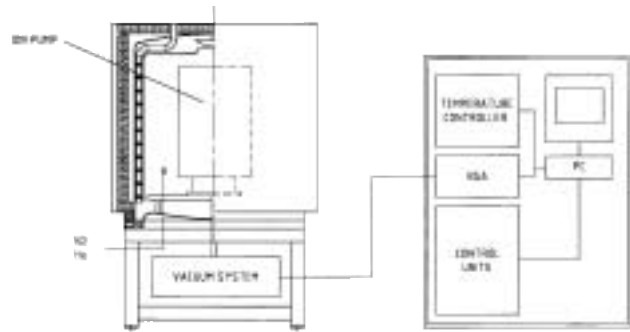


Figure 6 - System outline

The system is based on the principle of thermal outgassing the ion pump internal surfaces through the control of the their intrinsic outgassing. Therefore pressure, not time, is the driving factor of the overall process.

The bake-out time depends on the internal cleaning of the pump components and all the pumps will have, in this way, the same final outgassing rate and base pressure.

Figure 7 shows the working principle. The green curve represents the temperature and the yellow one the pressure read by the gauge located on the vacuum control system placed on the bottom of the outgassing station (see Fig. 6). The temperature is maintained at the set point level until the pressure does not change any more, which means the outgassing of the pump for the defined bake-out temperature is completed.

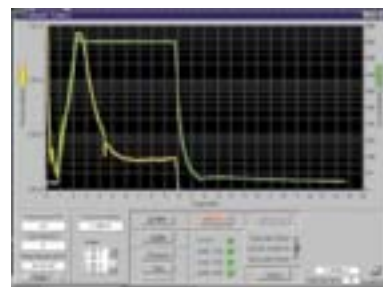


Figure 7 - Thermal process working principle

At the end of the thermal process, once room temperature is achieved, an RGA is performed. The gas analyser, placed on the vacuum system, provides the spectrum of the different gases degassed by the pump. If H_2 and the other peaks normally present in a well-baked vacuum system exceed the acceptance levels, the pump is baked again. Otherwise, it is pinched off and its base pressure monitored. The base pressure is evaluated through the ion current reading. The current decrease is computer monitored, and the pump is ready to be shipped only after the base current is reached. Figure 8 shows the result of the residual gas analysis performed at the end of the bake-out.

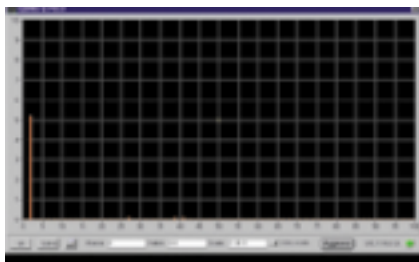


Figure 8 - Residual gas analysis

Pumping of Different Gases

In general, all ion pumps can pump all gases to some degree. To obtain the best performance and base pressure, different types of ion pumps have been developed with optimized performance in different pressure ranges and with different gases.

Varian's Vaclon *Plus* is a complete product family that offers the choice among three different elements: Diode, Noble Diode and StarCell®.

Whatever the application, there is a Vaclon *Plus* pump designed for it.

Long Operating Life

All Vaclon *Plus* pumps have rated lives in excess of many thousand of hours at a pressure of 1×10^{-6} mbar (50,000 hours for the Diode pump, and 80,000 hours for the StarCell®).

With many ion pumps, maintenance may be required well before the rated life, due to metallization of insulators or pumping element distortion.

All Vaclon *Plus* elements are designed to minimize cathode distortion (even after repetitive bake-outs and starting at high pressure), and the insulators are protected from sputtered titanium by using a double re-entrant design and a cap shield.

Pressure Reading

The ability to read pressures using an ion pump is due to the direct proportionality between pump current and operating pressure.

The reliability of pressure readings at very low pressure is limited by leakage current, and the leakage current from field emission is heavily dependent on the voltage applied to the pump.

The Dual controller, designed for use with any Vaclon *Plus* pump, provides the unique ability to adjust the voltage in accordance with the operating pressure. By doing this, the leakage current is minimized at low pressure, providing a reliable pressure reading down to the 10^{-10} mbar range.

Custom Design and Flexibility

All ion pumps can be mounted in any position, and do not need any isolation valve from the system in case of venting or power failure.

Vaclon *Plus* pumps are the most compact ion pumps in each speed range. The pumps can be configured with additional

flanges and can accommodate other pumping systems (like TSP), allowing the best use of available space.

New Feedthrough

The whole Ion Pump line is provided with an innovative feedthrough.

The improved feedthrough of the ion pump line is a major breakthrough. The greatest advantages of the ion pumps are listed here below:

- **Corrosion Free**

The design of the feedthrough will reduce drastically the corrosion that may occur when the pump is used in humid environments.

Our tests and experience have demonstrated that the corrosion starts and increases with the presence of humidity between feedthrough and connector. The high voltage during the pump operation ionizes the entrapped water vapor; the ions react with the brazing alloy and corrode it. The design of the feedthrough aims to solve these issues:

- On one hand the design structure of the feedthrough presents a negligible quantity of air.
- On the other hand, the brazing is done on the vacuum side so that the brazing alloy surface exposed to air is minimal.

- **High Voltage Cable Interlock**

The feedthrough has been designed for the "HV cable safety interlock" implementation. This feature avoids any electrical shock since the voltage is automatically cut off as soon as the cable is disconnected from the pump.

Our Ion Pump control units (MidiVac, Dual) and the HV cable are already able to support this safety feature when connected to an ion pump with the feedthrough.

- **Easy Connection**

The connection of the cable connector to the feedthrough requires simply inserting and pushing the connector. No use of retention screws is required.

- **Safety against Unintentional Extraction**

When the HV cable connector is inserted into the new patented feedthrough, it is firmly and mechanically secured to it. A latch on the cable prevents disconnection.

- **Compactness**

The feedthrough design allows a significant gain of space for the customer.