œrlikon
leybold vacuum

Ultra-High Vacuum Technology

Sputter Ion Pumps
30 - 400 l/s

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Contents

Sputter ion pumps are gas binding pumps. The pumping effect is based chiefly on gettering processes.

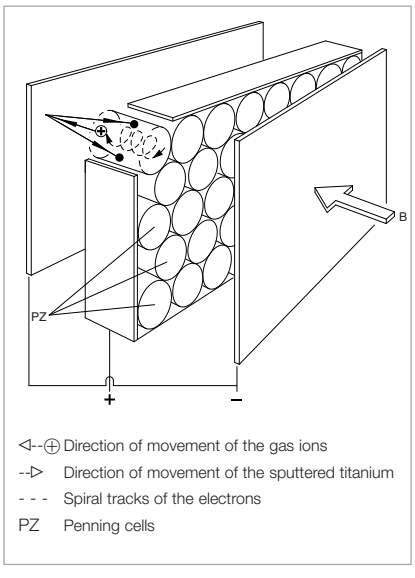
Operating Principle of Sputter Ion Pumps

Ions from a gas discharge impinge on the cathode of an electrode system within the pump housing thereby sputtering the cathode material (titanium, in conventional pumps). The titanium deposits on neighbouring surfaces act as a getter film binding reactive gas particles (nitrogen, oxygen, hydrogen, for example).

However, the energy of the ionised gas particles will not only cause sputtering of the cathode material but will also cause the impinging ions to penetrate deeply into the cathode material (ion implantation).

This sorption process "pumps" all kinds of ions, in particular also ions of gases which do not react with the titanium layer produced by sputtering, mostly noble gases.

The ions are generated by the following arrangement: located between two parallel cathode plates (see figure "Principle of the sputter ion pump") are densely packed cylindrical anodes made of stainless steel, the axes of which are at right angles with respect to the cathodes.



Operating principle of the sputter ion pump

The cathodes are at a negative potential of a few kV with reference to the anode.

The entire electrode arrangement is located in a homogeneous magnetic field which is produced by permanent magnets attached from the outside at the pump housing. The gas discharge which is produced by the high tension, contains both electrons and ions.

Under the influence of the magnetic field, the electrons move along long spiral tracks until they arrive at the anode cylinder of the corresponding cell. Owing to their high mass, the ions are practically not influenced on their way by the magnetic field. They fly along the short as possible path directly to the cathode. This arrangement is basically similar to that of a Penning sensor cell used to measure vacuum pressures.

In the case of diode pumps having the electrode configuration shown below (see Fig. "Electrode configuration of a diode sputter ion pump") the getter layers are created between the anode surfaces and between the sputtering areas on the cathode. Implantation of the ions is effected within the cathode surfaces.

However, as the cathode sputtering process progresses, already implanted chemically inert noble gases may be released again. This undesirable effect is termed "Memory Effect".

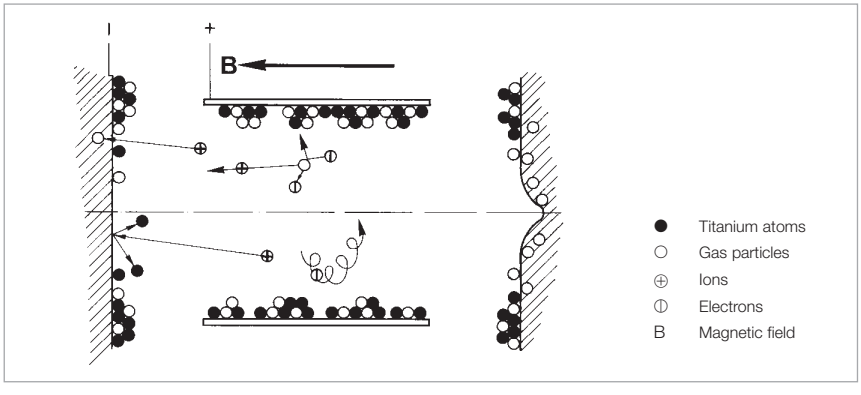
For air, nitrogen, carbon dioxide and water vapour, the pumping speed is practically the same. With reference to the pumping speed for air, the pumping speed of the sputter ion pumps for other gases is approximately:

- Hydrogen 150 to 200%
- Methane 100%
- Other lightweight hydrocarbons 80 to 120%
- Oxygen 80%
- Argon 30%
- Helium 28%

Sputter ion pumps allow, based on the discharge current, the measurement of the pressure within the vacuum chamber within a certain pressure range. In the case of diode pumps, this range extends down to a pressure range of approximately 10^{-11} mbar, in the case of triode pumps only down to 10^{-8} mbar.

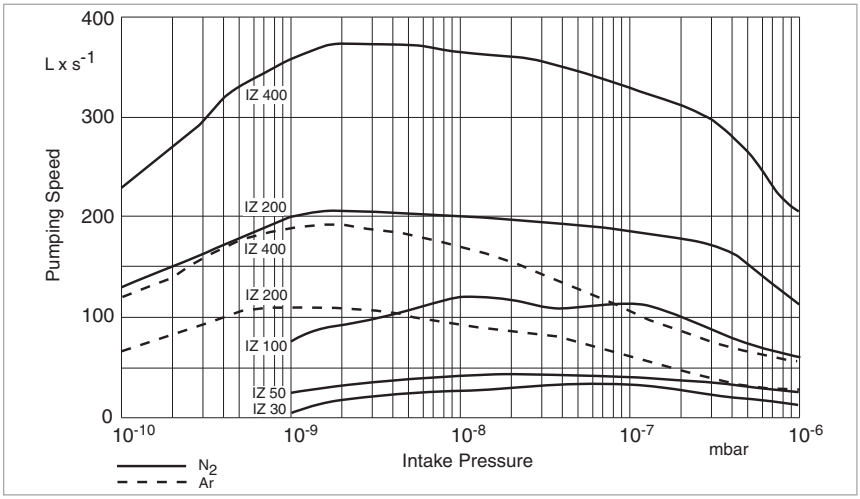
Characteristics of the IZ Series

- Diode pump, stabilised with noble gas (low memory effect) through the selection of suitable cathode materials
- Electrode system optimised for excellent pumping speeds in the UHV and XHV range
- Operation down to 10^{-12} mbar
- Integrated pressure readout through the IPC operating unit down to 1.3×10^{-11} mbar
- Integrated degassing system (IZ50 – IZ400)



Electrode configuration of a diode type sputter ion pump

Sputter Ion Pumps



Pumping speed curves for the IZ pumps

Typical Applications

- Mass spectrometry
- High energy physics
- Electron microscopy (AFM, STM, SEM)
- Surface analysis
- UHV evaporation (MBE)
- Nano technology

Technical Characteristics

- Generation of a high and ultra-high vacuum in to the XHV range which is entirely free of hydrocarbons
- No moving parts
- No operating noise
- Installation in any orientation
- Maintenance-free operation
- No additional cooling required

Advantages to the User

- Absolutely free of vibrations – important in connection with high sensitivity measurements
- Highly economic – low cost of ownership
- Direct pressure measurements are possible
- No protection measures against contamination in the event of a power failure are required
- Extremely long service life
- Very high pumping speed at UHV

Technical Data

Sputter Ion Pumps

		IZ30	IZ50	IZ100	IZ200	IZ400
High vacuum connection	DN	40 CF	63 CF	100 CF	160 CF	160 CF
Pumping speed for						
N_2 at 10^{-9} mbar	l/s	30	45	100	200	360
Ar at 10^{-9} mbar	l/s	10	15	48	105	190
Recommended operating pressure	mbar	< 8.0 x 10^{-5}	< 8.0 x 10^{-5}	< 5.0 x 10^{-5}	< 3.8 x 10^{-5}	< 3.0 x 10^{-5}
Ultimate pressure	mbar	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-12}	< 10^{-12}
Integrated heating system						
Heating voltage	V AC	–	220 - 240	220 - 240	220 - 240	220 - 240
Heating power	W	–	300	320	600	800
Degassing temperature						
with the internal heater	°C	–	250	250	250	250
max. degassing temperature	°C	350	350	350	350	350
Operating voltage	kV	+7.5	+7.5	+7.5	+7.5	+7.5
Ambient conditions						
Permissible temperature range	°C	0 to +40	0 to +40	0 to +40	0 to +40	0 to +40
max. humidity of the air	%	< 85	< 85	< 85	< 85	< 85
Dimensions (W x D x H)	mm	183 x 103 x 187	187 x 165 x 240	337 x 167 x 340	367 x 296 x 372	560 x 296 x 372
Weight, approx. (including integrated heating system)	kg	9.5	12	37	65	124

Ordering Information

Sputter Ion Pumps

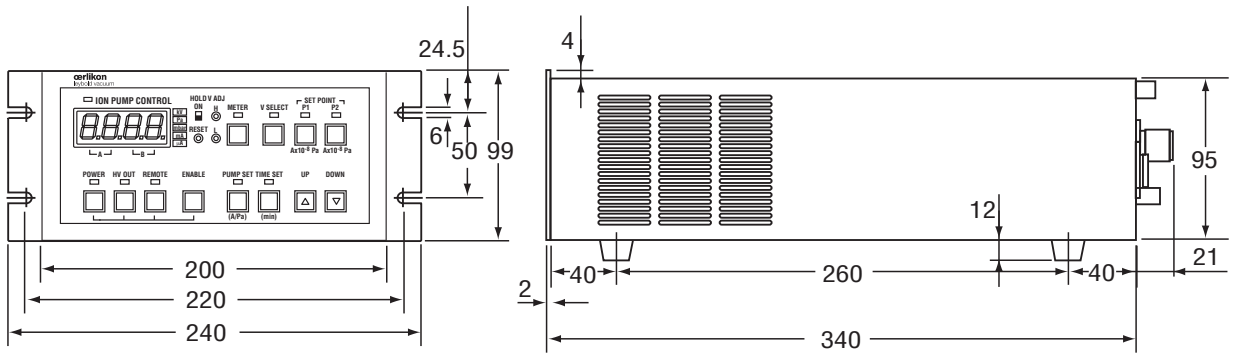
	IZ30	IZ50	IZ100	IZ200	IZ400
Sputter ion pump	**Part. No. 225 005**	**Part. No. 225 004**	**Part. No. 225 003**	**Part. No. 225 002**	**Part. No. 225 001**
Operating unit	**IPC**	**IPC**	**IPC**	**IPC**	**IPC**

Accessories

Operating Unit IPC

Technical Characteristics

- Integrated display for current, voltage and pressure
- Pressure readout individually adjustable to the specific type of pump
- Variable output voltage ranging from 1 to 7.5 kV
- RS 233 C interface
- 24 V interface (remote)
- Separate chart recorder output



Dimensional drawing for the operatng unit IPC

Technical Data — Operating Unit IPC

Weight, approx.	kg	4

Ordering Information — Operating Unit IPC

Operating Unit IPC	**Part No. 225 000**
Connecting cable (IZ pump-operating unit), temperature-resistant up to 150 °C	
5 m	**Part No. 225 020**
10 m	**Part No. 225 021**
15 m	**Part No. 225 022**
20 m	**Part No. 225 023**
other cables upon request	
Mains cable	
3 m (EU)	**Part No. 800102V0002**
3 m (US)	**Part No. 800102V1002**
HV pump connector for IZ pump	**Part No. 225 019**