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Backing vacuum for turbo pumps Vacuum for surface engineering, analytics, and industry

DURABLE, RELIABLE, AND ENERGY-EFFICIENT

vacuubrand

Technology for Vacuum Systems

High vacuum pumps, such as those used for many applications in physics, commonly need forevacuum backing pumps. Backing pumps (sometimes called roughing pumps) must fulfill specific demands in flow capacity and ultimate vacuum, and are commonly expected to provide continuous service over several years without interruption. With its specific focus on technologies for rough and fine vacuum generation, VACUUBRAND offers a broad selection of pumps that are well suited for backing service. State-of-the-art, oil-free diaphragm pumps can often replace outdated technologies.

COMMON APPLICATIONS

- as backing (roughing) vacuum for high- and ultra-high vacuum systems e.g. in electron microscopes, mass spectrometer, particle accelerators
- for gas transfer e.g., in cryostats (helium thermostats), gas targets
- to maintain process parameters in reactions in gas phase, coatings and gas discharges



Rotary vane pump RZ 9

Rotary vane pumps are used wherever an ultimate vacuum down to 10^{-3} mbar has to be attained, typically as a backing pump for high vacuum systems of oil diffusion pumps and traditional turbo pumps. Selection of the right pump depends upon the ultimate vacuum and pumping speed requirements of the respective application. Important criteria are pumping speed at low pressures, dimension, mass, and ease of maintenance.



Diaphragm pump
MV 2 NT VARIO

Diaphragm pumps run oil-free and therefore are the perfect backing-pump solution for wide-range turbomolecular pumps, featuring an integrated molecular drag stage, with forevacuum requirements in the mbar-range. Oil changes and waste-oil disposal are not required at all. Furthermore possible reactions of pumped media and pump oil are completely excluded. VARIO® diaphragm pumps with intuitive rpm-control feature integrated forevacuum measurement and continuous adaption of running speed for optimized forevacuum and maximum lifetime.



Diaphragm pump
MD 1 VARIO-SP

VARIO-SP™ diaphragm pumps are designed for OEM integration, combining extremely compact dimensions and high performance with an electronically controlled, brushless 24 V DC motor. Modified performance parameters, customized design according to specific installation requirements, options for external certification (e.g., according to CSA or UL standards), as well as adoption of customer-specific testing parameters, provide a high degree of flexibility for OEM design requirements.



Vacuum gauge
DCP 3000 + VSP 3000

Our sophisticated, state-of-the-art **vacuum gauges and controllers** for laboratory and industrial use satisfy the needs for chemical resistance and reliability under demanding conditions, without sacrificing ease of operation. VACUUBRAND offers a wide selection of electronic vacuum gauges, covering measuring ranges from atmosphere down to 5×10^{-9} mbar.



Solenoid valve
VV-B 6C

Our wide range of vacuum **valves and small flange components** support the convenient integration of equipment into both simple and highly complex vacuum systems. Standard flange dimensions according to DIN 28403 (ISO 2861-1) for all valves and components assure flexible use and compatibility.

PROCESS-RELATED SELECTION OF THE MOST APPROPRIATE BACKING PUMP

Applications without process gas-load

Determine the required backing vacuum in the forevacuum line from the compression ratio of the turbo pump and the intended vacuum in the system. Information on maximum compression ratio and maximum permissible backing pressure can be found in the technical data sheet of the turbo pump.

Use the compression ratio and maximum allowable backing pressure for the turbo pump to determine the appropriate backing pump. Use the lower of the two values to select the right backing pump.

Oil-sealed rotary vane pump

Single-stage for backing pressure > 0.5 mbar
Two-stage for backing pressure < 0.5 mbar

Oil-free diaphragm pump

Two-stage for backing pressure in the range of 5 to 30 mbar
Three-stage for backing pressure in the range of 2 to 5 mbar
Four-stage for backing pressure in the range of 0.5 to 2 mbar
If a leak-tight high vacuum system is operated at ultimate pressure with no significant gas load, match the ultimate vacuum of the diaphragm pump to the backing pressure required by the turbo pump. The required pumping capacity of the backing pump is driven only by the required pump down time.

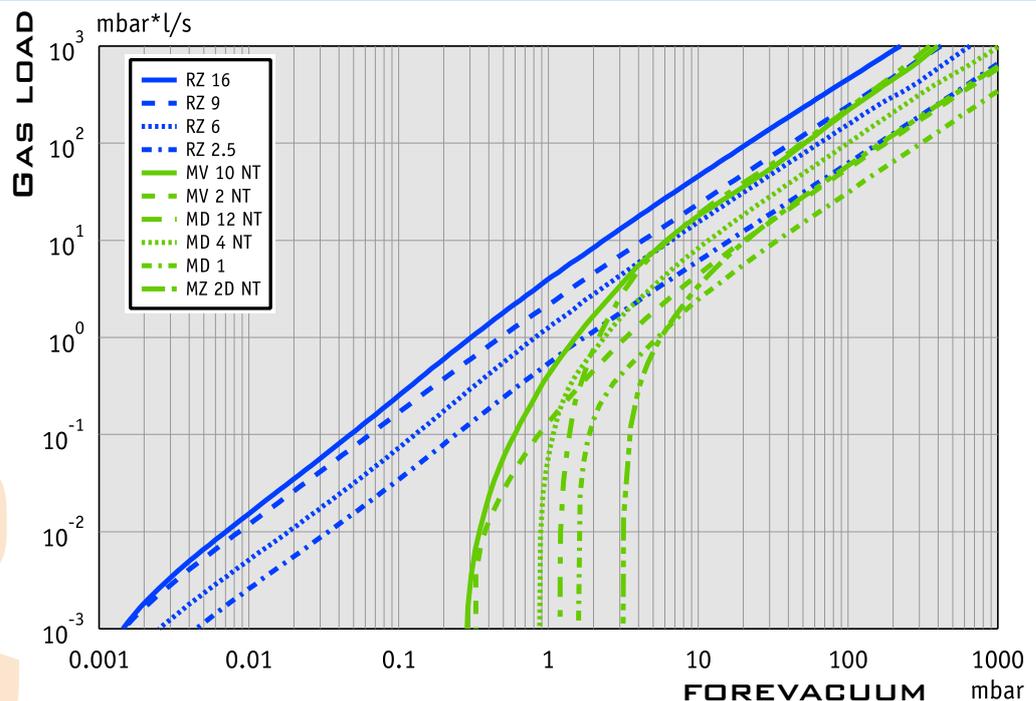
Applications with process gas-load

For systems with significant gas-load (e.g., through process-related gas intake or internal gas generation) or for fast pump-down requirements, a larger capacity backing pump is necessary.

The chart below shows transferable gas-load over achievable backing pressure for a selection of common VACUUBRAND backing-pumps.

Plot your process-related gas-load as a horizontal line in the chart (gas-load in mbar l/s). Now read out the corresponding estimated backing pressure by dropping a vertical line to the x-axis from the intersection of your horizontal line with curves for the most suitable pump options, based on the considerations described previously.

The ultimate vacuum specification of the selected pump should be less than 50% of the maximum specified backing pressure shown in your turbo pump data sheet.



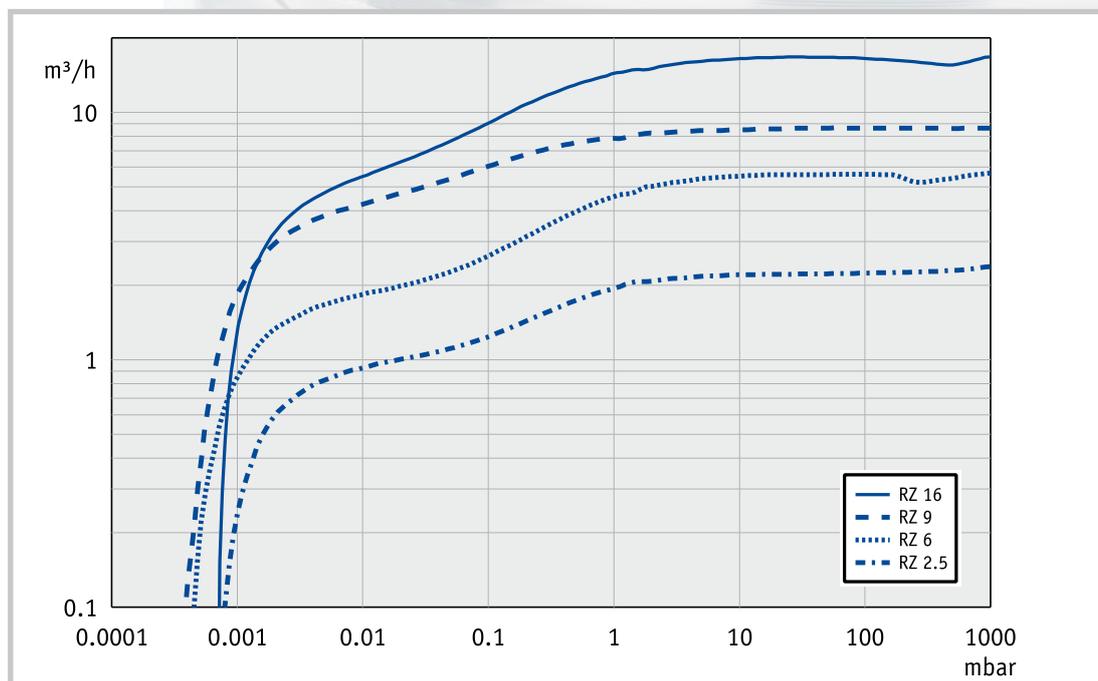
ROTARY VANE PUMPS

Rotary vane pumps are appropriate for process vacuum requirements between 10^{-1} and 10^{-3} mbar. VACUUBRAND rotary vane pumps provide excellent vacuum and pumping speed performance with compact designs. A comprehensive range of available accessories ensures the flexibility to address varying applications. The effective gas ballast device on these pumps, with large gas ballast flow, assures outstanding vapor tolerance for moisture and solvents. VACUUBRAND's progressive recirculated oil lubrication system in the RZ 2.5 and RZ 6 two-stage rotary vane pumps leads to significantly lower noise level, and a reduced number of wear parts simplifies maintenance. Continuous, passive oil circulation over all rotating parts and seals maximizes the lifetime of shaft seals.

APPLICATIONS

Rotary vane pumps are widely used for physical research as well as industrial production applications, including backing of turbo pumps, evacuation of load locks, various drying processes, deposition (e.g., CVD, ALD), filling processes for pure gases, and more. To select the right pump for each instrument, first consider your requirements for pumping speed and ultimate vacuum. In practice, selecting the right pump depends on achieving an effective pumping speed at the required process vacuum. Because of this, VACUUBRAND's nearly constant pumping speed over a wide pressure range is highly beneficial. When pumping condensable vapors, the highly efficient gas ballast flow of VACUUBRAND pumps ensures excellent vapor tolerance, and the reduced risk of condensation inside the pump helps extend service intervals. The VACUUBRAND design provides excellent ultimate vacuum performance, even with an open gas ballast continuously purging condensate. This ensures that demanding vacuum processes can be served, even as the open gas ballast protects the pump.

PUMPING SPEED CURVES FOR ROTARY VANE PUMPS



ROTARY VANE PUMPS



Rotary vane pump RZ 2.5



Rotary vane pump RZ 6



Rotary vane pump RZ 9



Rotary vane pump RZ 16

PERFORMANCE FEATURES

- excellent pumping speed performance, even near the ultimate vacuum
- high water vapor tolerance through efficient gas ballast design; good ultimate vacuum even with open gas ballast
- vacuum-tight shut-off
- long oil change intervals through large applicable oil volume
- easy maintenance with VACUUBRAND's distinctive telescope pump design

TECHNICAL DATA	max. pumping speed 50/60 Hz	ult. vacuum with open gas ballast	ult. vacuum without gas load
RZ 2.5	2.3/2.8 m ³ /h	1 x 10 ⁻² mbar	2 x 10 ⁻³ mbar
RZ 6	5.7/6.8 m ³ /h	1 x 10 ⁻² mbar	2 x 10 ⁻³ mbar
RZ 9	8.9/10.2 m ³ /h	1 x 10 ⁻² mbar	2 x 10 ⁻³ mbar
RZ 16	16.6/19.1 m ³ /h	1 x 10 ⁻² mbar	2 x 10 ⁻³ mbar

- for pumping of pure oxygen or strong oxidants corresponding pump versions with perfluoropolyether oil are available (upon request)

ORDERING INFORMATION RZ 2.5
230 V ~ 50-60 Hz CEE 698120

ORDERING INFORMATION RZ 6
230 V ~ 50-60 Hz CEE 698130

ORDERING INFORMATION RZ 9
230 V ~ 50-60 Hz CEE 698140

ORDERING INFORMATION RZ 16
230 V ~ 50-60 Hz CEE 698050

Other voltages are available. Call for details.

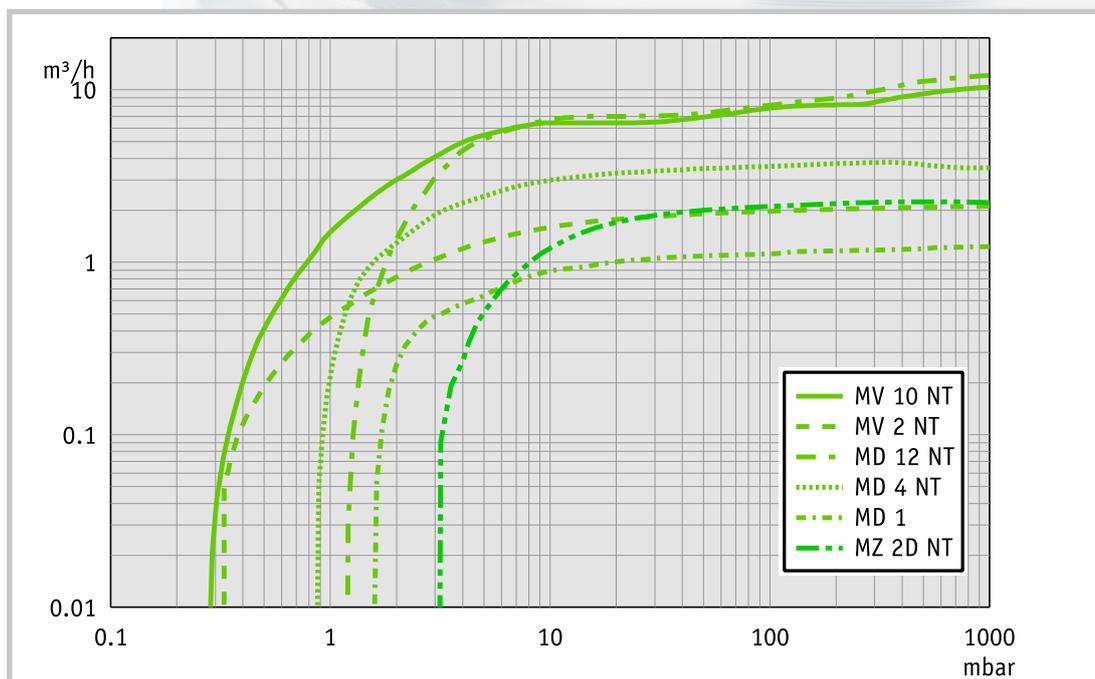
DIAPHRAGM PUMPS FOR BACKING OF WIDE-RANGE TURBOMOLECULAR PUMPS

Diaphragm pumps are totally oil-free vacuum pumps that can be used effectively in a wide range of evacuation and gas transfer applications, such as in physics laboratories, because vacuum performance ranges from atmospheric pressure down to 0.6 mbar (0.3 mbar for VARIO® diaphragm pumps). Since modern turbo pumps with integrated molecular drag stage (commonly called wide-range turbomolecular pumps), need foreline vacuum levels only in the mbar range, diaphragm pumps can be used as oil-free backing pumps. The dry diaphragm pumps eliminate oil back-diffusion, risk of oil back-flow, as well as the need for oil changes.

APPLICATIONS

Innovations in diaphragm pump technology, with optimized planar diaphragms design and electronically controlled drive systems, permit even more compact pump designs, further improved vacuum performance, and exceptionally long diaphragm lifetimes. Our long-run durability test for diaphragm pumps, with more than five years of non-stop operation and continuous vacuum measurement, has demonstrated diaphragm lifetimes of more than 40,000 hours of operation at ultimate vacuum levels better than original specification. Especially for speed controlled systems, maintenance intervals similar to those of turbomolecular pumps are therefore realistic, ensuring long, reliable service.

PUMPING SPEED CURVES FOR DIAPHRAGM PUMPS



DIAPHRAGM PUMPS WITH FIXED RPM



Diaphragm pump MD 1



Diaphragm pump MD 4 NT



Diaphragm pump MV 2 NT



Diaphragm pump MV 10 NT

PERFORMANCE FEATURES

- large selection of pump models with regard to ultimate vacuum and pumping speed performance
- high pumping speed performance close to ultimate vacuum specification
- maintenance-free drive system, service-friendly design; easy diaphragm and valve exchange
- exceptionally quiet operation and low vibration
- excellent durability for diaphragms and valves, with typical lifetimes of more than 10,000 hours of operation
- long-term performance stability through reliable planar-diaphragm design
- flexible in mounting position
- minimized leakage rates

TECHNICAL DATA	max. pumping speed 50/60 Hz	ult. vacuum
MZ 2D NT	2.3/2.5 m ³ /h	4 mbar
MD 12 NT	12.1/13.3 m ³ /h	2 mbar
MD 1	1.2/1.4 m ³ /h	1.5 mbar
MD 4 NT	3.8/4.3 m ³ /h	1 mbar
MV 10 NT	10.4/11.6 m ³ /h	0.5 mbar
MV 2 NT	2.2/2.4 m ³ /h	0.5 mbar

ORDERING INFORMATION	MZ 2D NT
230 V ~ 50-60 Hz CEE	732200
ORDERING INFORMATION	MD 12 NT
230 V ~ 50-60 Hz CEE	743000
ORDERING INFORMATION	MD 1
230 V ~ 50-60 Hz CEE	696080

ORDERING INFORMATION	MD 4 NT
230 V ~ 50-60 Hz CEE	736000
ORDERING INFORMATION	MV 10 NT
230 V ~ 50-60 Hz CEE	744000
ORDERING INFORMATION	MV 2 NT
230 V ~ 50-60 Hz CEE	738000

Other voltages are available. Call for details.

- For applications with hazardous gases and for contamination-free analytics, a diaphragm pump featuring excellent chemical resistance as well as reduced and specified leakage rate is available. All media-contacted parts are made from fluorinated compound materials or highly corrosion-resistant stainless steel.

TECHNICAL DATA	pumping speed 50/60 Hz	Leakage rate	ult. vacuum	ORDERING INFORMATION	MD 4CRL
MD 4CRL NT	3.4/3.8 m ³ /h	0.001 mbar l/s	1.5 mbar	230 V ~ 50-60 Hz	without power cable 736445

VARIO® DIAPHRAGM PUMPS - OIL-FREE BACKING PUMPS FOR OPTIMAL HIGH VACUUM SYSTEM PERFORMANCE

Through increased running speed during the pump-down process, compared to corresponding conventional diaphragm pump models, VARIO® diaphragm pumps reflect a unique combination of modern control electronics with high-performance mechanics. Significantly higher pumping speed rates are achieved. Furthermore the patent-protected automatic rpm-optimisation improves the ultimate vacuum performance, while noise-level, power consumption, and vibrations are reduced through low rpm operation. Additionally, the lifetime for diaphragms and valves is significantly extended.



PERFORMANCE FEATURES

- patented "Turbo Mode" automatically achieves optimal vacuum levels
- minimized pump down time due to enhanced pumping speed
- exceptionally long service intervals
- low vibration, nearly silent operation
- RS-232 interface for automatic fore-line monitoring
- integrated fore-line vacuum measurement and display

TECHNICAL DATA	max. pumping speed	ult. vacuum
MD 4 NT VARIO	5.7 m ³ /h	1 mbar
MV 2 NT VARIO	3.3 m ³ /h	0.3 mbar
MV 10 NT VARIO	12.0 m ³ /h	0.3 mbar

ORDERING INFORMATION	MD 4 NT VARIO
200-230 V ~ 50-60 Hz CEE	736300

ORDERING INFORMATION	MV 10 NT VARIO
200-230 V ~ 50-60 Hz CEE	744100

ORDERING INFORMATION	MV 2 NT VARIO
200-230 V ~ 50-60 Hz CEE	738100

Other voltages are available. Call for details.

VARIO-SP™ - VARIABLE SPEED DIAPHRAGM PUMPS FOR SYSTEM INTEGRATION

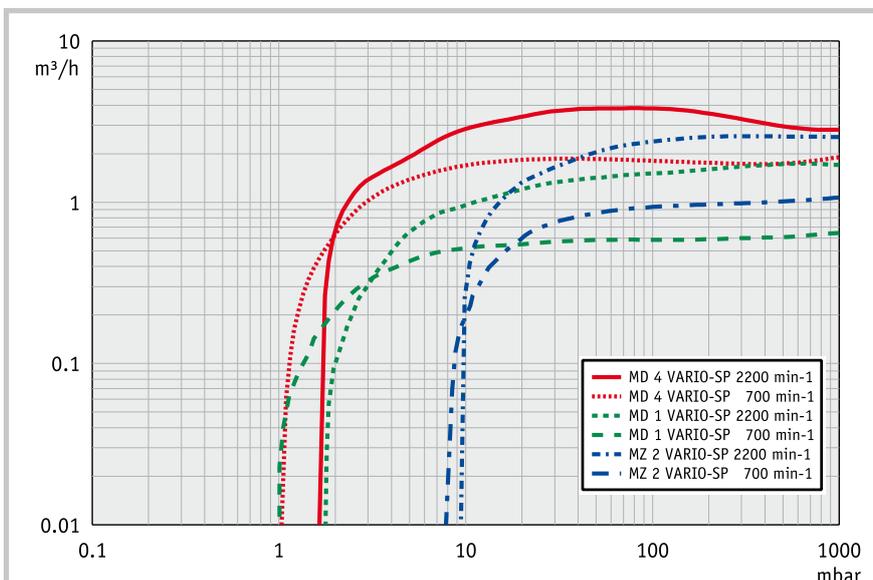
VARIO-SP™ diaphragm pumps deliver high performance in a compact package by using a brushless 24 V DC motor. These pumps are designed for integration into OEM equipment such as leak detectors, residual gas analyzers, or waste gas analyzers. The 24 V DC motor permits worldwide operation independent of local voltage differences.



PERFORMANCE FEATURES

- variable speed motor allows high speed pump down and low speed operation at system pressure
- planar diaphragm design ensures high pumping speeds are maintained to low pressure levels
- ability to operate pump at low speed maximizes service intervals
- consistent, reliable performance, even in continuous duty
- pump speed and operating point controlled by external PWM or 0-10 V analog signal

PUMPING SPEED CURVES FOR VARIO-SP™ PUMPS



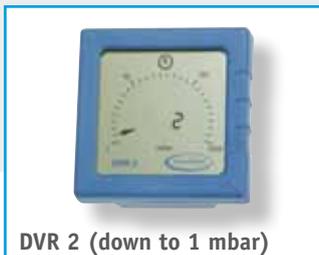
ORDERING INFORMATION MD 1 VARIO-SP
24 V= 696101

ORDERING INFORMATION MZ 2 VARIO-SP
24 V= 720000

ORDERING INFORMATION MD 4 VARIO-SP
24 V= 720100

VACUUM MEASUREMENT

Modern laboratory and industrial applications require vacuum gauges with excellent chemical resistance, reliability in demanding conditions, and ease of use. VACUUBRAND's wide range of electronic vacuum gauges is designed to measure from atmospheric pressure to 5×10^{-9} mbar.



- In the rough vacuum range (atmosphere pressure down to 0.1 mbar), VACUUBRAND offers gauges with capacitive sensors. These sensors, built around ceramic diaphragms, offer highly accurate measurements which are gas-independent. These gauges offer excellent chemical resistance and outstanding long-term stability. Our DVR 2 gauge provides the convenience of battery-powered portability. Our VSK 3000 gauge head, combined with the DCP 3000 gauge, offers an RS-232 interface and local data logging.
- VACUUBRAND offers the VSP 3000 gauge head for applications in the fine vacuum range. The VSP 3000 utilizes a Pirani-style vacuum sensor to measure pressures from 10 mbar down to 10^{-3} mbar. Pirani-style gauges measure the vacuum level based on the thermal conductivity of the gas. This measurement principle is inherently gas dependent and provides maximum accuracy in the range of 10 mbar to 10^{-2} mbar. The VSP 3000 features a thermal conductivity sensor encapsulated in ceramic. Compared to conventional Pirani gauges, VACUUBRAND provides a more durable, chemically resistant Pirani gauge through the use of engineering plastics and advanced ceramic materials, making the VSP 3000 an ideal solution for applications which require chemical resistance. No longer is rapid venting catastrophic for your Pirani sensor!
- The DCP 3000 vacuum gauge communicates with the VSP 3000 and VSK 3000 gauge heads through VACUUBRAND's proprietary digital BUS interface, VACUU-BUS®. The VACUU-BUS communication interface allows individual components to be automatically detected, identified, and monitored. The DCP 3000 accepts up to four VSK 3000 and four VSP 3000 sensors simultaneously. The DCP 3000 also has a data logging function which can record up to 32,000 data points using the gauge's internal memory. That data can later be downloaded to your computer using a serial connection (RS-232).
- For work in the high vacuum range, the DCP 3000 can be paired with an MPT 100 gauge head. The MPT 100 is a Pirani/Penning combination gauge which combines the Pirani style thermal conductivity measurement with a Penning style cold cathode measurement.

Vacuum Gauges	Measurement principle	Measuring range	ORDERING INFORMATION
DVR 2	Ceramic-diaphragm	1080 - 1 mbar (hPa), 810 - 1 torr	682902
Set DCP 3000 + VSK 3000	Ceramic-diaphragm	1080 - 0.1 mbar (hPa), 810 - 0.1 torr	683170
Set DCP 3000 + VSP 3000	Thermal conductivity (Pirani) chemically resistant plastics / ceramics	1×10^3 - 1×10^{-3} mbar (hPa), 7.5×10^2 - 1×10^{-3} torr	683190
Set DCP 3000 + MPT 100	Combined thermal conductivity (Pirani) / cold cathode (Penning)	1×10^3 - 5×10^{-9} mbar (hPa), 7.5×10^2 - 3.7×10^{-9} torr	683175

Further information at www.vacuubrand.com

VACUUM CONTROL

Many laboratory applications require vacuum control to ensure the reliability and repeatability of data. Vacuum is controlled by adjusting the pumping speed to match process conditions with the desired vacuum level. This can be accomplished in several ways, such as:

- switching the pump on and off with the VNC 2 controller
- opening and closing an in-line solenoid valve using the CVC 3000 or VNC 2 controllers
- continuously adjusting the pump motor speed to match the gas load using VARIO pumps with CVC 3000 controllers



- All VACUUBRAND controllers support a range of accessories such as water coolant valves, venting valves, or liquid level sensors. VACUUBRAND controllers and accessories communicate through our proprietary VACUU·BUS® digital interface. The VACUU·BUS® communication interface allows for individual components to be automatically detected, identified, and monitored by the vacuum controller. With the ability to connect multiple VACUU·BUS® components and the chemically resistant, IP 67 rated connections, a VACUUBRAND controller safely and accurately controls lab vacuum processes.
- Paired with a VARIO® diaphragm pump, the CVC 3000 vacuum controller automatically controls motor speed to match process requirements in real time. The VARIO® approach delivers maximum precision for optimal vacuum levels all while minimizing power consumption, noise, and vibration.
- For control in the fine vacuum range (1 mbar - 10⁻³ mbar), VACUUBRAND offers control packages that can be paired with rotary vane pumps. These control packages combine our CVC 3000 controller with an in-line solenoid valve and small flange connections. These packages include the VSP 3000 Pirani-style gauge head. The VSP 3000 features a thermal conductivity sensor encapsulated in ceramic to provide a more durable and chemically resistant Pirani gauge. With the VSP 3000, no longer is rapid venting catastrophic for the sensor. Packages are available with KF DN 16 connections for smaller rotary vane pumps or KF DN 25 connections for larger rotary vane pumps

Vacuum-Controller	Measurement principle	Measuring range	ORDERING INFORMATION
CVC 3000	Ceramic-diaphragm	1080 - 0.1 mbar (hPa), 810 - 0.1 torr	683160
VNC 2	Ceramic-diaphragm	1100 - 1 mbar (hPa), 825 - 1 torr	683070
Controller package 1 / KF DN 16	Pirani	1080 - 10 ⁻³ mbar	635983
Controller package 2 / KF DN 25	Pirani	1080 - 10 ⁻³ mbar	635982

VACUUM VALVES AND SMALL FLANGE COMPONENTS

VACUUBRAND offers a wide selection of accessory components, including vacuum valves, small flange components, and other connectors. These components conform to industry standard for sizing and are compatible with vacuum equipment offered by a wide range of manufacturers. VACUUBRAND's valves and components are manufactured in-house to ensure the highest in quality and reliability. All valves and small flange components are leak tested as part of our quality control process.



Stainless steel components



Vacuum valves VS



Centering rings for KF-components

VACUUBRAND's range of small flange components conforms to DIN 28 403 (ISO 2861-1). Our range of connectors is offered in KF DN 10, KF DN 16, KF DN 25, and KF DN 40 sizes. Our trapped O-ring centering rings allow for easy conversion of KF DN 20 to KF DN 25 and KF DN 32 to KF DN 40 without the need for additional transition components.

- compact, economical design
- high conductance
- helium leak tested to ensure components are leak tight
- minimal wear

VS vacuum valves: Compact, manually operated valves with high conductance. Position indicator shows if the valve is open or closed at a glance.

Stainless steel bellows valves: Compact, manually operated valves with low leak rates and high conductance.

Centering rings for KF components: VACUUBRAND offers a wide range of gasket materials such as Aluminum, Indium, NBR and FKM. For applications with ionizing radiation, metal KF seals are available.

Trapped O-ring centering rings: These seals provide a seamless seal against vacuum and can withstand slight overpressure in the system.

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Technical changes are subject to change without notice

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Technology for Vacuum Systems