Leybold

High Vacuum Pumps

TURBOVAC / TURBOVAC MAG
Turbomolecular Pumps

DIP / OB
Oil Diffusions Pumps

COOLVAC
Cryo Pumps

COOLPOWER
Cold Heads

COOLPAK
Compressor Units

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Catalog Part High Vacuum Pumps
Edition: Fall 2016

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High Vacuum Pumps

Accessories

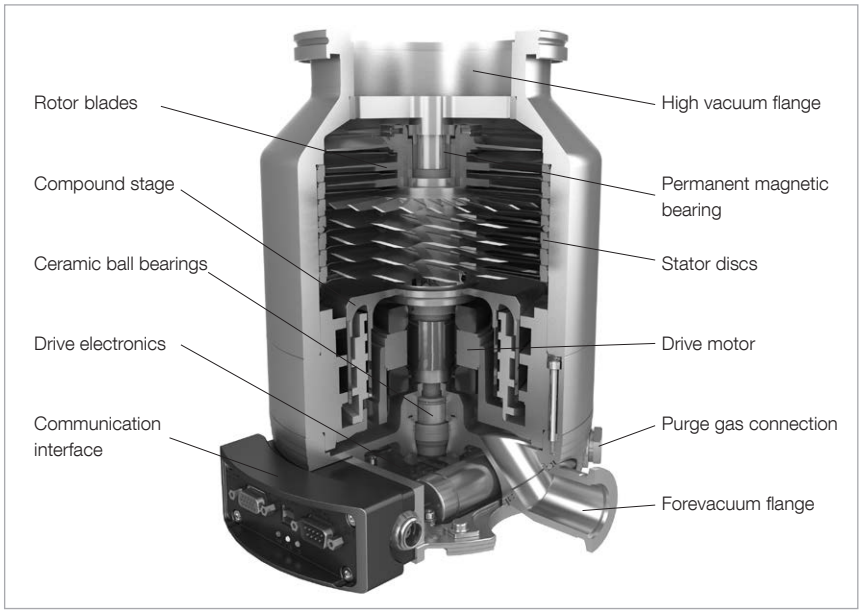
Cryo Pumps / Cryogenics

General to TURBOVAC Pumps

Turbomolecular vacuum pumps (TURBOVAC) are used in applications which require a clean high or ultrahigh vacuum like, for example, in research, development or in industrial fields like the semiconductor industry, analytical instrumentation or coating technology.

Principle of Operation

In principle, the turbomolecular pump is a turbine rapidly revolving in a housing where the rotor stages of the turbine are equipped with a number of rotor blades. Located between the rotating rotor blades are stationary stator disks with blades arranged in the opposite direction. By means of a momentum transfer from the rotating rotor blades to the gas molecules their initially non-directional thermal motion is changed in to a directional motion from the inlet flange of the pump in the axial direction towards the forevacuum flange. In the molecular flow range (i.e. at pressures below 10^{-3} mbar (0.75×10^{-3} Torr)) the mean free path of the gas molecules is larger then the spacing between the rotor and the stator blades (typically a few tenths of a millimetre). Correspondingly the molecules chiefly collide with the optically dense rotor blades, resulting in a highly efficient pumping action. In the laminar flow range (i.e. at pressures over 10^{-1} mbar (0.75×10^{-1} Torr)) the effect of the rotor is impaired by frequent collisions between molecules themselves. For this reason, a turbomolecular pump is not capable of pumping gases at atmospheric pressure.



Sectional drawing of a turbomolecular pump (TURBOVAC i)

Rotor Bearing

Leybold offers different rotor bearing systems. A purely classic mechanical type of rotor bearing (TURBOVAC) or a magnetic rotor bearing (TURBOVAC MAG) and also a hybrid bearing (TURBOVAC i / iX) where the bearing on the forevacuum side is a ceramic ball bearing lubricated for life and where the bearing on the high vacuum side is implemented by way of a non-wearing magnetic bearing. Typical for all these types of bearing is that they do not require any lubricating oil which under circumstances like standstill of the pump might diffuse back into the vacuum chamber due to the lack of any pumping action.

Drive Electronics/Control Unit

Driving and monitoring the turbomolecular pump requires an electronic frequency converter (inverter). The frequency converter delivers the driving voltage and the output frequency for the motor and also automatically monitors the system. Optimum running up of the pump rotor is attained by a steadily increasing voltage and frequency feed. After attaining the nominal speed, the start-up current is reduced in a controlled manner to the level necessary for normal operation.

The frequency converter and the motor of the TURBOVAC have been designed for a minimal drop of speed even at high intake pressures. This ensures the highest possible gas throughput also in the transition range from molecular to viscous flow

Depending on the given system and installation conditions, the control unit may be supplemented by a comprehensive range of optional accessories facilitating easy integration within existing installations.

Forevacuum Pump

Since turbomolecular pumps are not capable of compressing directly against atmospheric pressure their operation will always require a sufficiently rated forevacuum pump. For the classic rotor arrangement with rotor blades, generally two-stage rotary vane pumps (TRIVAC) will be suitable. In some cases also single-stage rotary vane vacuum pumps (SOGEVAC BI) or scroll vacuum pumps (SCROLLVAC).In the case of the wide range variant where the rotor is equipped with an additional compression stage (compound stage) also diaphragm vacuum pumps (DIVAC) may be used.

Characteristic Quantities

Pumping speed (volume flow rate)

The pumping speed “S” is the conveyed volume flow through the intake opening of the pump. It is dependent on the type of gas so that for this reason the nominal pumping speed, i.e. the maximum attainable pumping speed of the pump is commonly stated for air, respectively nitrogen. In the field of high vacuum engineering it is common to state the pumping speed in the unit of measurement [l/s]. The pumping speed is a nonlinear function of the inlet pressure $S = S(p_1)$

Gas throughput

Gas throughput “Q”, unit of measurement [mbar x l/s] is linked to the pumping speed through the inlet pressure.
$Q = Q(p_1) = p_1 \times S(p_1)$.

Compression

Compression “K” is defined as the ratio between the pressure on the forevacuum side of the turbomolecular pump and the pressure on the high vacuum side.
$K = K(p_{VV}) = p_{VV}/p_{HV}$.
Compression is dependent on the type of gas.

Ultimate pressure (base pressure)

The ultimate pressure “p_{ult}” of a turbomolecular pump which can be baked out is defined through the ratio between forevacuum pressure and compression ratio which is attained in a test chamber 48 hours after a 24-hour bake-out (degassing) of the measurement arrangement.
$p_{ult} = p_{FV}/K_0$.

The maximum attainable ultimate pressure depends among other things on the cleanness of the apparatus, the type of forevacuum pump used, the types of seals used for the high vacuum flange and the bake-out conditions.

TURBOVAC Product Line

The TURBOVAC pumps are turbomolecular pumps with mechanical rotor suspension which are used in the pressure range from 10^{-1} mbar (0.75×10^{-1} Torr) to 10^{-10} mbar (0.75×10^{-10} Torr) Pumping speeds for air vary from 35 l x s^{-1} (inlet flange diameter = 40 mm (1.57 in.)) to 1,150 l x s^{-1} (inlet flange diameter = 250 mm (9.84 in.)).
Besides a variant with extremely reliable ceramic ball bearings on the forevacuum and the high vacuum side, Leybold also offers a line of turbomolecular pumps equipped with hybrid bearings which on the forevacuum side are equipped with a ceramic ball bearing and on the high vacuum side with a permanent magnetic bearing (TURBOVAC i line).

Owing to their compact design and ease of operation, these pump lines are used in all high vacuum and ultrahigh vacuum fields of application. In particular, the TURBOVAC pumps are running very successfully in mass spectrometers, in CD, DVD and hard disk production units, in the manufacture of large area optical coatings, in non-corrosive semiconductor production processes and in laboratories as well as research institutes

The most important advantages of the TURBOVAC product line are:

- Oil-free pumps for the generation of clean high and ultra-high vacuum conditions
- Highest performance in any orientation
- Highest degree of operating reliability
- Easy to operate
- Compact design

TURBOVAC (T) 350 iX

TURBOVAC MAG Product Line

The TURBOVAC MAG pumps are turbomolecular pumps with magnetic rotor suspension which are used in the pressure range from 10^{-1} mbar (0.75×10^{-1} Torr) to 10^{-10} mbar (0.75×10^{-10} Torr). Pumping speeds for air vary from 300 l x s^{-1} (inlet flange diameter = 100 mm (3.94 in.)) to 3,200 l x s^{-1} (inlet flange diameter = 320 mm (12.6 in.)).
The TURBOVAC MAG pumps are mostly installed on semiconductor processing lines like etching, CVD, PVD and ion implantation, i.e. in applications where corrosive gases need to be pumped. Also electron beam microscopy is an important area of application for these pumps.

The most important advantages of the TURBOVAC MAG product line are:

- Hydrocarbon-free pumps for the generation of clean high and ultra-high vacuum conditions
- High performance in any orientation
- High degree of operating reliability
- Extremely low vibration
- Designed for pumping of corrosive gases
- Almost maintenance-free

TURBOVAC MAG 2200 iPL

Use of Turbomolecular Pumps in Analytical Instruments

All modern analytical methods for gas, liquid and plasma analysis – like for example GC-MS, LC-MS and ICP-MS – rely on mass spectrometers and for this reason require adequate high vacuum conditions. Also in electron microscopes and many surface analysis instruments the production of a high vacuum is essential. In over 90% of all high vacuum applications, the turbomolecular pump has been found to be ideal. Thanks to the hydrocarbon-free vacuum, most simple operation, compact design and almost maintenance-free operation it has in most cases displaced above all the diffusion pump.

On the basis of decades of experience and in cooperation with research facilities and the manufacturers of analytical instruments, Leybold has continually optimized its products.

TURBOVAC MAG W 600 iP

Through the TURBOVAC wide range series, a further improvement has been attained, making available to users in the area of analytical engineering highly flexible and reliable products.

Owing to the modular concept the user may adapt the vacuum system precisely to his requirements. The components can be integrated perfectly and thus find the most cost-effective system configuration. Through the introduction of the TURBOVAC multi inlet series, Leybold has, based on special customer requirements, achieved a major step ahead for analytical instruments.

Two or more analysis chambers can be pumped down simultaneously by a single multi-inlet pump. These pumps have been tailored for pumping speed and gas throughput in order to attain a higher detection sensitivity of analytical systems, for a smaller footprint and an increased sample throughput, for example. The benefits for the customers are the extreme compactness of the vacuum systems without sacrificing performance density, simple installation, stable vacuum connections and, compared to the use of discrete individual pumps, significantly lower investment costs for the entire system. The cartridge solution, moreover, allows for an innovative and cost-effective design of the customer's system and during servicing a simple replacement of the active unit without involved assembly work and leak searching.

Cartridge benefits, which convince

- Higher effective pumping speed
- No losses in conductance
- Compact vacuum system
- Easy pump replacement without having to disassemble the highly sensitive mass spectrometer chambers

The benefits for the customers are reflected by the efficiency of the analytical instruments:

- Increase in detection sensitivity
- Smaller analytical systems
- Increase in sample throughput
- Reduction of system costs
- Lower maintenance costs

In combination with backing pumps like the SOGEVAC, TRIVAC or SCROLLVAC, Leybold is able to offer the best vacuum system optimized for all major applications in the area of analytical instrumentation.

TURBOVAC i Multi Inlet

Use of Turbomolecular Pumps in the Area of Semiconductor Processes

In the semiconductor industry turbomolecular pumps are used on the following processes, among others:

- Etching
- Sputtering
- Ion implantation
- CVD
- Lithography.

In these applications pumping of aggressive gases is often required. This may necessitate the use of pumps equipped with a purge gas facility or a magnetic suspension in order to avoid damaged bearings. Especially during metal etching, deposits may occur in the forevacuum space of the turbomolecular pump. In order to prevent this the pumps must be heated to a certain temperature. Such temperature controlled variants are optionally available for the MAG 1500 C, MAG 2000 C, MAG 2800 and MAG 3200.

In contrast to turbomolecular pumps with mechanical bearings, magnetically levitated pumps provide the advantage that they prevent overheating of the bearings at high gas flows and effectively exclude any damage to the magnetic bearings by aggressive media.

In electron microscopes and in lithographic equipment, low vibration levels are
exceptionally important. For this reason magnetically levitated turbomolecular pumps should be used here. The recommended backing pumps are rotary vane pumps from the TRIVAC range, possibly fitted with the BCS system.

TURBOVAC MAG W 2000 CT

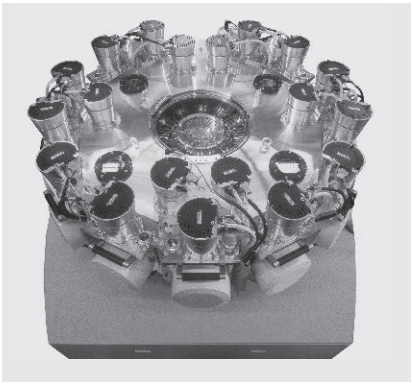
Use of Turbomolecular Pumps in the Area of Coating Systems

Coating of optical and magnetic storage media, optical components as well as architectural glass requires high vacuum conditions. This is the only way to ensure that the formed layers will be uniform and adhere to the substrate.

The way in which the vacuum is generated has a significant impact on the quality of the coating. By pumping the vacuum chamber down to pressures in the range of 10^{-6} mbar (0.75×10^{-6} Torr), interfering gas and water molecules are removed from the processing chamber. In the case of sputtering the coating process is run in the pressure range between 10^{-3} and 10^{-2} mbar (0.75×10^{-3} and 0.75×10^{-2} Torr), and in the case of evaporation coating, pressures below 10^{-4} mbar (0.75×10^{-4} Torr) are utilized.

The turbomolecular pump meets all requirements of the customers as to a hydrocarbon-free vacuum, very simple operation, compact design and almost maintenance-free operation in an almost ideal manner. The range of pumps from Leybold includes pumps with flange diameters ranging from 40 mm to 250 mm (1.57 in. to 9.84 in.) nominal width.

Thus the right pump is available for each application, be it coating of data memories (CD, DVD, hard discs), coating of tools and coating of precision lenses in the area of optical components, displays or architectural glass.

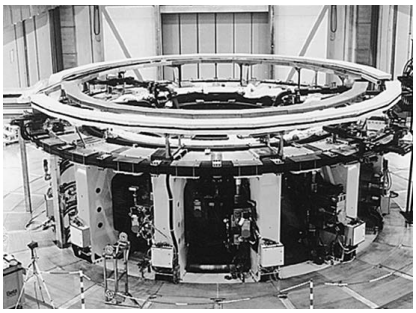


Entire high vacuum equipment of a CD/DVD coating system with TURBOVAC TW 250 S pumps

Use of turbomolecular pumps in research and development

In many applications in which new ideas shall be transformed into technical processes, vacuum technology is a basic requirement for being able to implement these processes at all.

In the field of research and development, all types of turbomolecular pumps from Leybold are being used. Since the application requirements differ widely, for example are being used. Since the application requirements differ widely, for example between university basic research, industrial development, in research and in large laboratories, the right component or the matching system can be put together from the comprehensive range of equipment being offered.



Nuclear fusion technology

Applications for TURBOVAC Pumps

Pumps	TURBOVAC 50	TURBOVAC 151, 361 (C)	TURBOVAC 600 C	TURBOVAC 1000 C	TURBOVAC 1100 C	TURBOVAC SL 80	TURBOVAC 90 i, (T) 250/350/450	TURBOVAC 90 iX, (T) 250/350/450 iX	TURBOVAC i Multi Inlet	MAG W 300/400/600/700 iP	MAG W 1300/1600/1700/2200 iP(L)	MAG W 300/400/600/700 P	MAG W 830/1300 C	MAG W 1500 CT	MAG W 2200 C	MAG W 2000 C/CT	MAG W 2800/3200 C/CT
Applications																	
Analytical Instruments																	
Leak detectors	■	■				■	■			■	■	■	■				
Mass spectrometers	■	■				■	■		■	■	■	■	■				
Gas chromatography (GC-MS)	■	■				■	■		■	■	■	■	■				
Liquid chromatography (LC-MS)	■	■				■	■		■	■	■	■	■				
Quadrupol time of flight (Q-TOF)							■		■	■	■	■	■				
Matrix assisted laser desorption time of flight (MALDI-TOF)	■						■		■	■	■	■	■				
Inductively coupled plasma mass spectrometry (ICP-MS)	■						■		■	■	■	■	■				
Electron beam microscopy	■					■	■	■		■	■	■	■				
Coating																	
Data storage / optical		■					■	■		■	■	■	■		■	■	■
Data storage / magnetic			■	■	■		■	■		■	■	■	■		■	■	■
Flat panel displays			■	■	■					■	■	■	■		■	■	■
Optical coating		■	■	■	■		■	■		■	■	■	■		■	■	■
Large area coating				■	■						■		■		■	■	■
Decorative coating				■	■		■				■		■		■	■	■
Metallization				■	■		■				■		■		■	■	■
Wear protection			■	■	■						■		■		■	■	■
Metallurgy				■	■						■		■		■	■	■
R & D (Research and Development)																	
Surface analysis				■		■	■			■	■	■	■	■	■	■	■
UHV / XHV systems		■	■	■	■	■	■	■		■	■	■	■			■	■
Particle accelerators		■		■	■					■	■	■	■		■	■	■
Fusion experiments			■	■	■					■	■	■	■	■	■	■	■
Space simulation			■	■	■					■	■	■	■	■	■	■	■
Semiconductor Processes																	
Load locks and transfer chambers	■	■	■	■	■	■	■	■		■	■	■	■				
Etch														■	■		■
PECVD										■	■	■	■	■	■	■	■
PVD							■			■	■	■	■	■	■	■	■
Ion implantation										■		■	■	■	■	■	■

Accessories for TURBOVAC Pumps

Pumps	TURBOVAC 50	TURBOVAC 151, 361 (C)	TURBOVAC 600 C	TURBOVAC 1000 C	TURBOVAC 1100 C	TURBOVAC SL 80	TURBOVAC 90 i, (T) 250/350/450 i	TURBOVAC 90 iX, (T) 250/350/450 iX	TURBOVAC i Multi Inlet	MAG W 300/400/600/700 iP	MAG W 1300/1600/1700/2200 iP(L)	MAG W 300/400/600/700 P	MAG W 830/1300 C	MAG W 1500 CT	MAG W 2200 C	MAG W 2000 C/CT	MAG W 2800/3200 C/CT
Applications																	
Integrated Frequency Converter							■	■	■	■	■						
External Frequency Converter						■											
External Frequency Converter and Power Supply	■	■	■	■	■							■	■	■	■	■	■
Power Supply						■	■	■	■	■							
Mounting Kit		■	■				■	■	■								
Inlet screen / Splinter guard						■	■	■	■	■	■	■	■	■	■	■	■
Vibration absorber	■	■	■	■	■	■	■	■	■	■		■					
Air cooling unit	■	■	■	■		■	■	■	■	■		■					
Water cooling kit	■					■	■	■	■	■		■					
Flange heaters for CF flanges	■	■	■	■		■	■	■	■	■		■					
Venting valve	■	■	■	■	■	■	■	■		■		■					
Purge gas valve						■	■	■	■	■	■	■					
Purge gas and venting valve		■	■	■	■	■					■		■	■	■	■	■
Power failure venting valve		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Electronic brake module										■		■					
Relais box							■	■	■								
Accessories for serial interfaces		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Control Software for TURBOVAC		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

General to TURBOVAC i / iX Pumps

Turbomolecular Pumps with Hybrid Rotor Suspension (mechanical/magnetic)

TURBOVAC i, iX / T i, T iX

The TURBOVAC i / iX series is a modular line of turbomolecular vacuum pumps. With the integrated drive electronics (frequency converter) it forms a single unit.
In the development of the TURBOVAC i / iX special emphasis was placed on the maximum attainable pump performance in consideration of its footprint. The specially developed rotor/stator design, upon request with an additional compression stage, guarantees excellent performance data as to pumping speed, gas throughput and compression especially also for light gases.
In all pumps of this line, the bearing consists of a non-wearing permanent magnetic bearing on the high vacuum side and an oil-free ceramic ball bearing which is lubricated for life on the forevacuum side. For this reason, the usually required standard maintenance involving an oil change is no longer necessary. The ceramic ball bearing is replaceable on-site, should this be required.
The pumps are equipped as standard with a venting and purge gas facility for directly connecting a venting valve, purge gas valve or purge gas throttle to the pump.

Owing to the many possible combinations (electronics, pump stage design, housing and the range of accessories) the TURBOVAC i / iX can be flexibly adapted to the specific application in each case.
For example, in comparison with the TURBOVAC i, the TURBOVAC iX is equipped with an integrated vacuum system control unit which drives accessory components like vacuum gauge, valves, fans and forevacuum pumps. Moreover, numerous optionally available communication interfaces facilitate easy integration within your installation.
The pump stage design (rotor, stator and Holweck stage) can be selected specifically in consideration of the respective process requirements and offers variants for highest possible gas throughput, pumping speed and/or compression in single or multi-chamber systems. Equally comprehensive is the range of housing and flange variants being offered where the vacuum connections can be adapted flexibly to the on-site installation conditions. The comprehensive range of accessories completes the TURBOVAC i / iX line thereby extending the fields of application for these pumps.

Advantages to the User

- High pumping performance from a compact size
- Cost-effective price-to-performance ratio
- Highly reliable, maintenance-free bearing concept without oil lubrication
- Owing to the overall modular concept, individually adaptable to the respective conditions and requirements
- Variety of housings and flange options
- Easy and easily adaptable installation, any mounting position
- Easy process integration due to the numerous interfacing options
- Flexible accessory options (power supply, cooling, heating, venting, installation etc.)

Overview of Variants

Electronics Variants

All pumps are equipped with integrated drive electronics with a 24 V/48 V power supply which controls the amount of drive power and which monitors all pump functions.

The individual requirements with regard to communication interfaces and the functional scope of the driving options for accessory components can be covered through a number of different electronics variants.

Left: TURBOVAC i with standard interface
Centre: **TURBOVAC i** with Anybus interface extension
Right: **TURBOVAC iX** with integrated vacuum system control unit and Anybus interface extension

Electronics Variants

TURBOVAC i (Standard)
Cost-effective solution equipped with basic functions and interfaces.

- Internal 24/48 V DC frequency converter
- Status LEDs
- Accessory connection for up to 2 controllable accessory components
- User-friendly interfaces (USB, RS 485, 15-pin digital I/O)

Standard interface USB, RS 485 and 15-pin digital I/O for TURBOVAC i

TURBOVAC i (Anybus interface extension)

Features like TURBOVAC I, additionally:

- User-friendly interfaces (USB, 15-pin digital I/O) and Anybus interface instead of the RS 485 for further interface options: RS 232, Profibus, Ethernet/IP (further interfaces upon request)

Anybus interface expansion for TURBOVAC i

TURBOVAC iX (Vacuum system control unit)
With integrated vacuum system control unit and Anybus interface extension.

Features like TURBOVAC i (Anybus interface extension), additionally:

- 3 outputs for controlling vacuum pump accessories
- 1 vacuum gauge head connection for powering and data recording of vacuum gauge heads and application of pressure data for pump system control
- Flexibly programmable software, for customising the configuration of the control connections

Integrated vacuum system control unit of the TURBOVAC iX

Performance Variants

TURBOVAC i, iX

The standard variant for UHV applications and compact pump system solutions. Owing to the additional Holweck compression stage it delivers a high pumping speed and a high compression especially for light gases, and due to its high forevacuum tolerance it is suited for operation in connection with diaphragm or scroll forevacuum pumps.

TURBOVAC T i, T iX

The “T” version with its classic rotor design without additional compression stage is suited for deployment under more stringent process conditions and high gas loads. Compared to the standard variant it stands for faster run-up times, increased gas throughput and an improved tolerance with regard to pumping of particle or dust containing media.

TURBOVAC i Multi-Inlet

The variant with a special rotor design and two or more inlets as an efficient and compact vacuum solution for multi-chamber systems. It allows for a high degree of system integration and convinces compared to systems with discreet turbomolecular pumps through its lower weight and smaller footprint as well as an increased reliability of the entire vacuum system through the reliance on fewer components compared to similar systems equipped with discrete turbomolecular pumps.

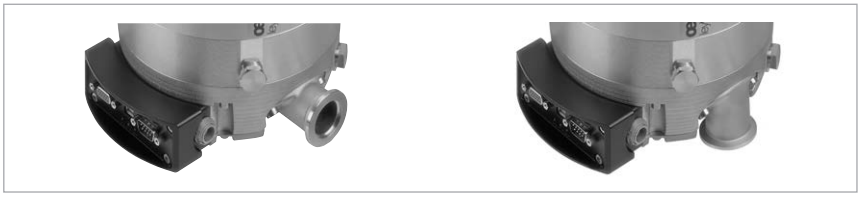
Housing and Flange Variants

The optimised rotor geometry has been specially adapted to the industrial standard sizes for maximum pump performance. Housings with ISO-K as well as CF flanges are available. Moreover, the standard housings with an additional inlet stage are available upon request.

Multiple inlet stages can be implemented through the **TURBOVAC Multi-Inlet**. Here in addition to the special cartridge solution which facilitates easy replacement in the field, also custom housing and chamber solutions are offered for utmost system integration.

Flexibility

The forevacuum connection on all pumps is rotatable thereby facilitating flexible installation within existing systems making optimum use of the available space. Moreover, the required amount of installation space may be reduced by a detachable cable connected interface module



Left: TURBOVAC i with radial forevacuum flange
Right: TURBOVAC i with axial forevacuum flange

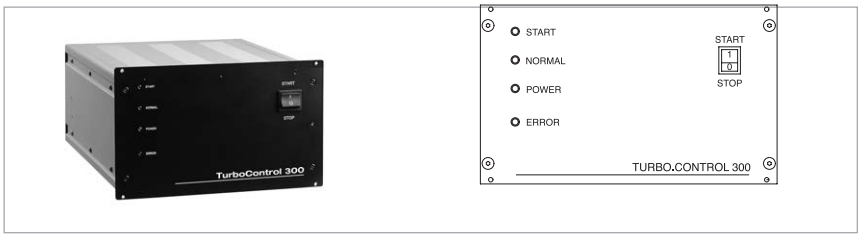
Accessories for TURBOVAC i, iX / T i, T iX

Power Supply TURBO.POWER integra

- Plug-and-play power supply for fitting underneath the pump, 100-240 V
  - for TURBOVAC (T) 350 i(X) and TURBOVAC (T) 450 i(X) only
- Including short connecting cable to the pump
- Also for benchtop placement (TURBOVAC 90/250/350/450) with optional extension cable (1, 3, 5 m (3.5, 10.5, 17.5 ft))
- Requires a country-specific mains cord (EU, US, UK …)

Pump control unit with Power Supply TURBO.CONTROL 300

- Control unit and power supply for rack installation
- With on/off switch for the turbo-molecular pump
- Status LEDs and status relays for monitoring the pump
- For remote control via interface
- Requires a connection cable to the pump (1, 3, 5 m (3.5, 10.5, 17.5 ft)) and country-specific mains cord (EU, US, UK ...)



Connecting cables to the pump with bare wire ends of for customer specific power supply units

Relay Box

The relay box allows you to control via the 24 V DC output on the TURBOVAC i a mains powered electric consumer, like a backing pump, for example. Mains power and consumer are connected using mains power cords, the control voltage is connected through an M 8 connector.

- incl. connection cable with a M 8 plug, 2 m (7.0 ft) long

DC Pump Plug

for adapting the supply voltage by the customer.

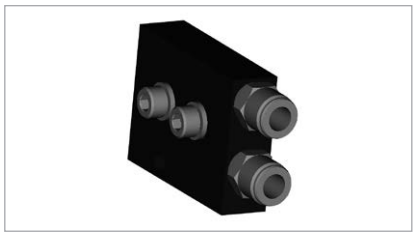
- 24/48 V DC-In plug TURBOVAC i

Radial air cooler
for lateral installation on the pump, including connection plug

- Flexible positioning

Axial air cooler
For installation underneath the pump, including connection plug

Water cooling
for flexible installation on the pump (required for degassing the turbomolecular pump)



Heating Collar
for degassing the pump

- Degassing temperature 100 °C (212 °F)
- Requires a country-specific mains cord (EU, US, UK …)
- With optional relay box and accessory cable, automatic control via the electronics of the TURBOVAC i / iX is possible

Accessory Valves

- Power supply 24 V DC
- G 1/8" inlet (inside thread) and discharge (outside thread) connection
- Including O-ring and connecting cable with M 8 plug for connection to the accessory input on the TURBOVAC i / iX

Purge Gas Valve (for connection to the purge gas connection on the turbomolecular pump)

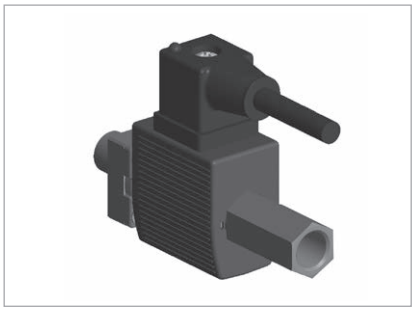
for controlling the admitted purge gas quantity

- The valve is closed when no power

Venting Valve (for connection the venting connection)

for venting the turbomolecular pump

- The valve is normally closed



Power Failure Venting Valve (for connection the venting connection)

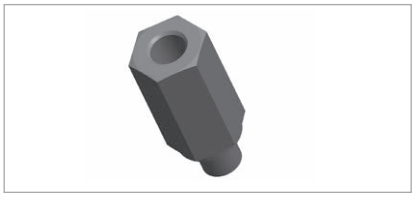
for venting the turbomolecular pump

- The valve is normally open

Purge Gas Throttle

for passively controlling the admitted purge gas quantity

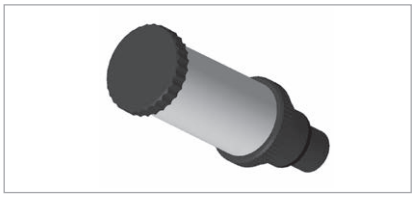
- G 1/8" inlet (inside thread) and discharge (outside thread) connection
- Purge gas throttle 24 sccm



Air Filter

for connection to the valves or throttles

- Prevents contamination and clogging of valves and throttles
- G1/8"



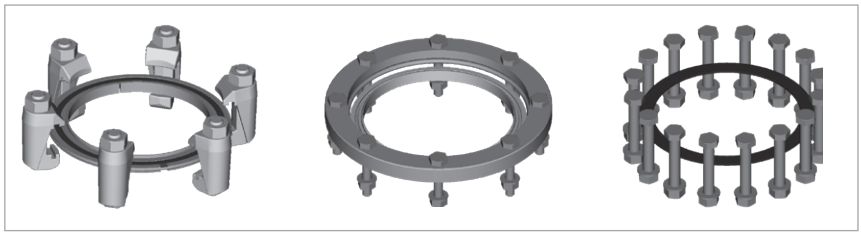
Y-Splitter

- Extends the M 8 accessory connection on the TURBOVAC i by a further connection for parallel driving of two accessory components.
  Here both accessory components are switched synchronously

Installation and Mounting Accessories

Mounting kit for safe mounting of the pump

The mounting kits include:
ISO-K kit (100 und 160):
centering rings and clamps
ISO-F kit (100 und 160):
collar flange, outside ring, bolts and nuts
CF kit (100 und 160):
2 copper gaskets, bolts, nuts and washers



Mounting kits (left ISO-KF, centre ISO-F, right CF)

Centering Rings with Splinter Guard (DN 100 and 160 ISO-K/F)

Centering Rings with Inlet Screens (DN 100 and 160 ISO-K/F)

Splinter Guards (DN 100 und 160 CF)

Inlet Screens (DN 100 und 160 CF)

for protecting the pump against ingesting parts.

Inlet screen, 3.2 mm (0.01 ft) mesh
Splinter guard, 0.8 mm (0.003 ft) mesh

Note:
For ISO-K/F, both inlet screen and splinter guard have been integrated in the centering ring.

Vibration Absorber (DN 100/160 ISO-K and 100/160 CF)

Prevents any possible vibration transfer from the pump to sensitive instrumentation or apparatus.

Software LEYASSIST *

Software for PC-based communication, control and monitoring of turbomolecular pumps via USB, RS 485 or RS 232 interface with automatic pump detection.

Functions

- Display of vacuum system status
- Trend configuration and report
- Configuring the accessory functions of the TURBOVAC i / iX
- Reading/writing of parameters
- Data logging
- Alarm/warning message logging
- Interface uses USB (with USB cable 2.0, Type A/B, 1.8 m (6.3 ft) long), RS 485 or RS 232 (with dongle)
  - Functions: reading/writing of parameters, control and data acquisition
- Automatic detection of connected Leybold pump type or instrument
- Different languages and with different user access levels are available

* included in delivery of TURBOVAC iX

Ordering Information

Software LEYASSIST for turbomolecular vacuum pumps	**Part. No. 230439V01**

Products

TURBOVAC
with Hybrid Rotor Suspension (mag/mech)

with integrated Frequency Converter
TURBOVAC 90 i, 250 i, (T) 350 i and (T) 450 i

TURBOVAC 90 i (left), 250 i (T), 350 i and (T) 450 i (right)

with integrated Frequency Converter and integrated Vacuum System Controller
TURBOVAC 90 iX, 250 iX, (T) 350 iX and (T) 450 iX

TURBOVAC 90 iX (left), 250 iX, (T) 350 iX and (T) 450 iX (right)

Typical Applications

- Analytical technologies / Research & Development
  - Mass spectrometers
  - Electron microscopes
  - Surface analysis
  - X-ray-analysis
  - Particle accelerators and synchrotons
  - Laboratory coating systems
  - MBE (Molecular Beam Epitaxy)
  - UHV systems
- Life Sciences
  - Proton therapy
  - Gamma sterilisation
  - Production of high quality implants
- Industrial and Coating applications
  - PVD- Physical Vapour deposition
  - Optical coatings
  - CD/DVD/Blu-Ray Disc production
  - Thin film technologies, photovoltaics
- Load locks, transfer chambers, handling systems
- Electron beam welders
- Insulation vacuum and leak detection

Technical Features

TURBOVAC i

- Integrated electronic drive unit with 24/48 V DC supply
- Best in class pumping speed and compression especially for light gases
- Vacuum port design flexibility
- Installation in any orientation
- Superior reliability due to innovative pump and bearing design
- The only maintenance free hybrid mechanical TMP
  - no need for oil changes
- On-site maintenance possibility (bearing exchange) to reduce service costs and time
- Widest range of interface options (USB ,RS 485 and 15 pin digital I/O as standard)
- Optimized size/performance ratio on 100 and 160 flanges

TURBOVAC iX

- Integrated vacuum system controller with flexible interfaces and several accessory ports for control of cooling units, valves, gauges, forevacuum pumps etc.
- Flexible accessory program options for easy plug & play
- Flexibility to match different process and application requirements

TURBOVAC T i, T iX

- Variant without Compound Stage
- increased gas throughput
- Increased tolerance against dust and particles
- Improved run-up time

Advantages to the User

TURBOVAC i

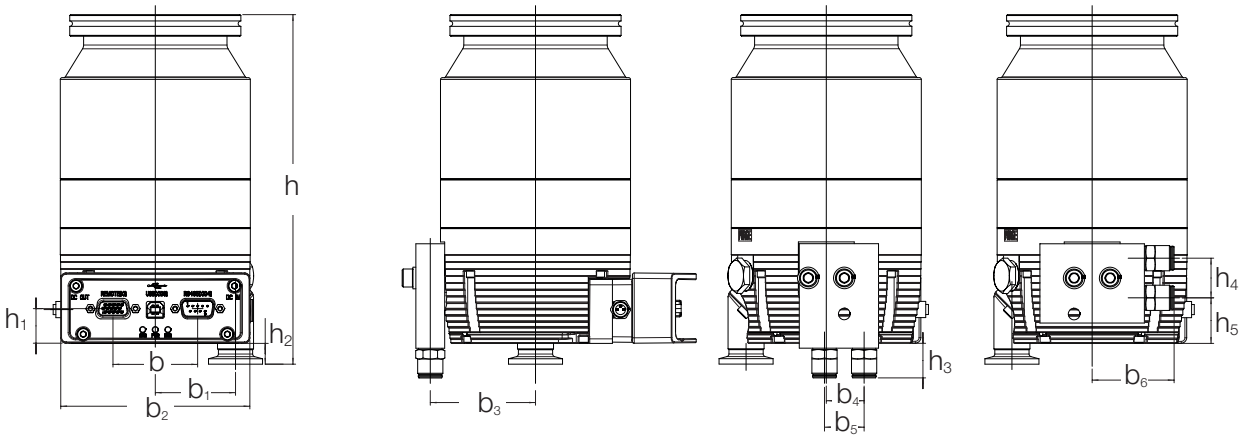
- Best performance and functionality for your money
- Maximum user flexibility for easy system integration, operation and control
- Highest productivity and system uptime at lowest CoO (Cost of Ownership)
- Improved pump-down time and target pressures
- Superior pumping performance for light gases
- Down-sizing of vacuum system in terms of costs and dimensions (use of small forevacuum pumps)

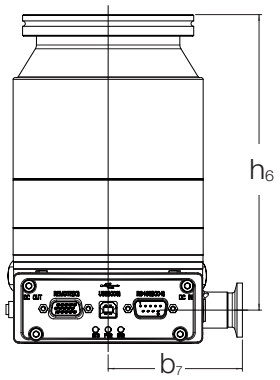
TURBOVAC iX

- Easy plug & play pump system control
- Avoid extra costs for separate pump system control units and cabling

TURBOVAC T i, T iX

- Suitable for demanding process applications and high throughput operation
- Fast cycle operation and pump down possible

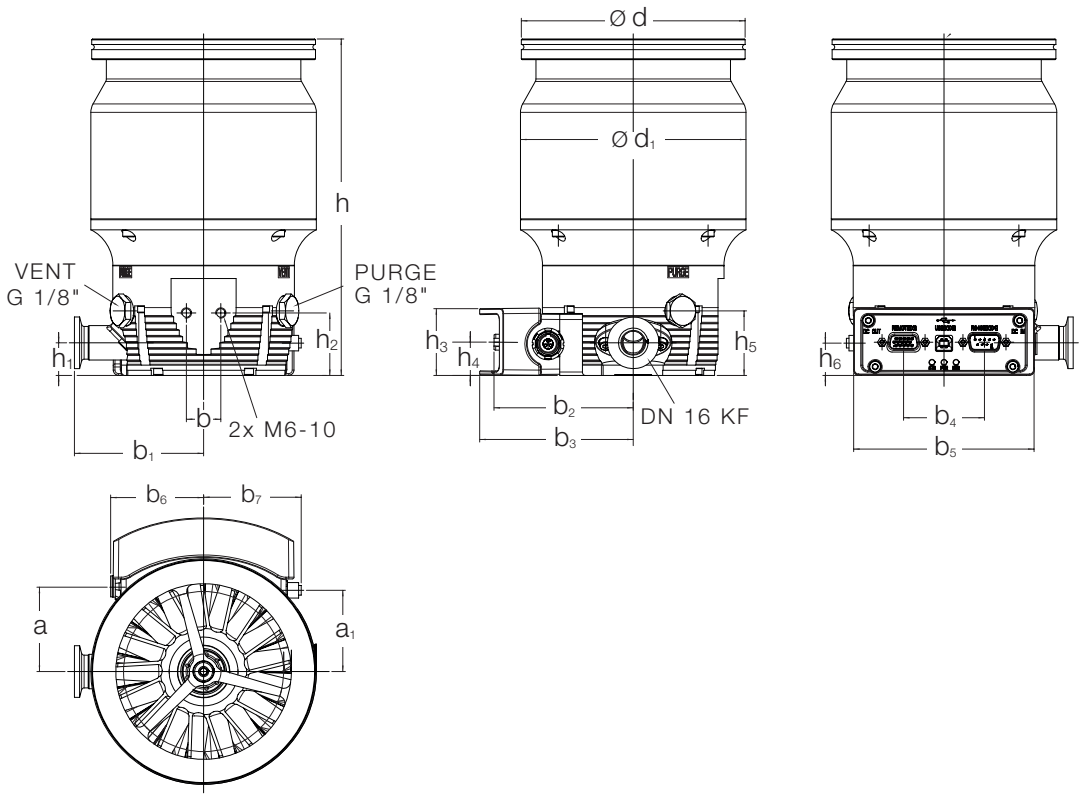




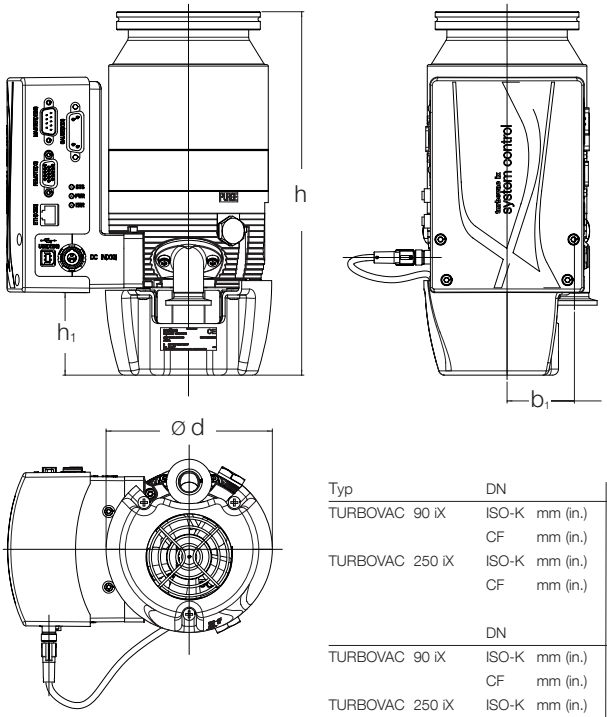
Typ	DN		a	a_1	b	b_1	b_2	b_3	b_4
TURBOVAC 90 i	ISO-K	mm (in.)	-	-	47 (1.85)	45 (1.77)	105 (4.13)	58 (2.28)	21 (0.83)
	CF	mm (in.)	-	-	47 (1.85)	45 (1.77)	105 (4.13)	58 (2.28)	21 (0.83)
TURBOVAC 250 i	ISO-K	mm (in.)	49 (1.93)	47 (1.85)	20 (0.79)	75 (2.95)	81 (3.19)	89 (3.50)	47 (1.85)
	CF	mm (in.)	49 (1.93)	-	20 (0.79)	75 (2.95)	81 (3.19)	89 (3.50)	47 (1.85)

	DN		b_5	b_6	b_7	d	d_1	h	h_1
TURBOVAC 90 i	ISO-K	mm (in.)	22 (0,87)	46 (1.81)	75 (2.95)	110 (4.33)	-	194 (7.64)	19 (0.75)
	CF	mm (in.)	22 (0,87)	46 (1.81)	75 (2.95)	110 (4.33)	-	194 (7.64)	19 (0.75)
TURBOVAC 250 i	ISO-K	mm (in.)	105 (4.13)	54 (2.13)	57 (2.24)	130 (5.12)	131 (5.16)	196 (7.32)	19 (0.75)
	CF	mm (in.)	105 (4.13)	54 (2.13)	52 (2.05)	151.5 (5.96)	131 (5.16)	205 (8.07)	19 (0.75)

	DN		h_2	h_3	h_4	h_5	h_6
TURBOVAC 90 i	ISO-K	mm (in.)	12 (0.47)	19 (0.75)	22 (0,87)	25 (0.98)	164 (6.46)
	CF	mm (in.)	12 (0.47)	19 (0.75)	22 (0,87)	25 (0.98)	164 (6.46)
TURBOVAC 250 i	ISO-K	mm (in.)	36 (1.41)	39 (1.54)	19 (0.75)	38 (1.50)	19 (0.75)
	CF	mm (in.)	36 (1.41)	39 (1.54)	19 (0.75)	38 (1.50)	19 (0.75)



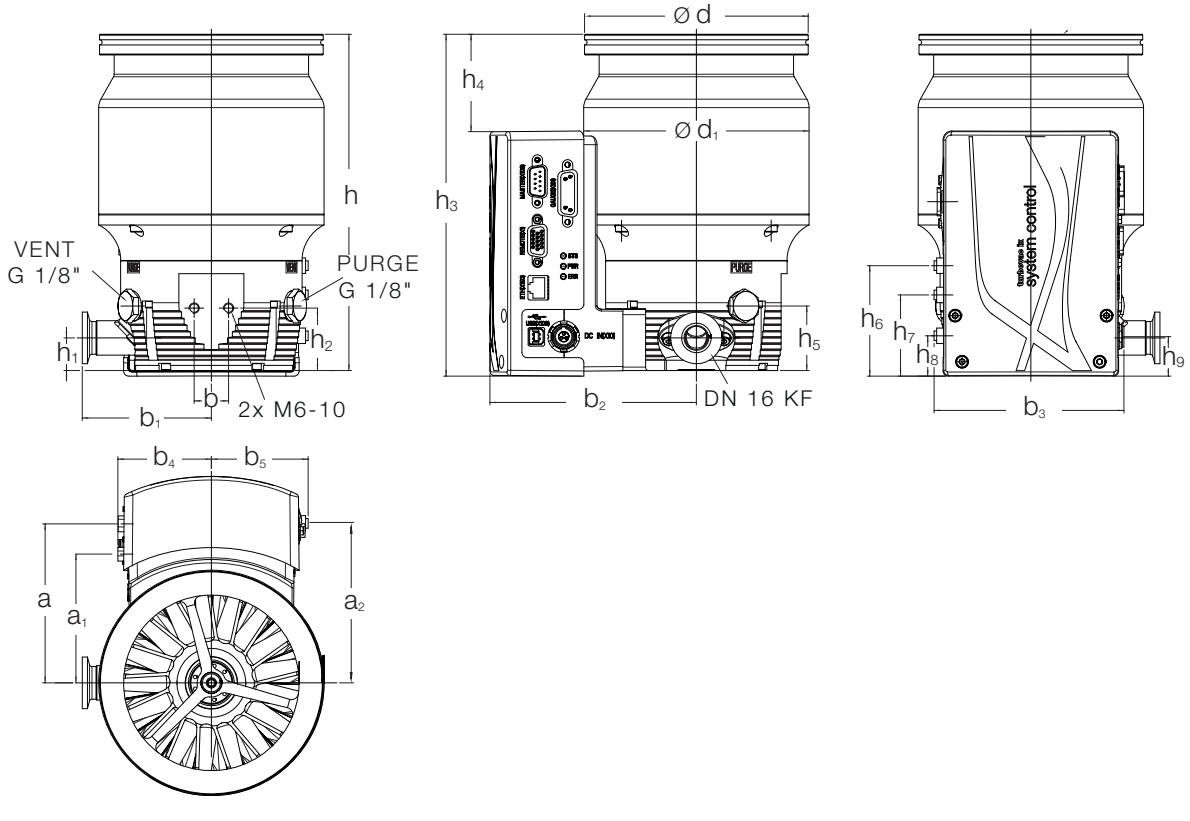
Dimensional drawing for the TURBOVAC pumps, 90 i top and 250 i bottom



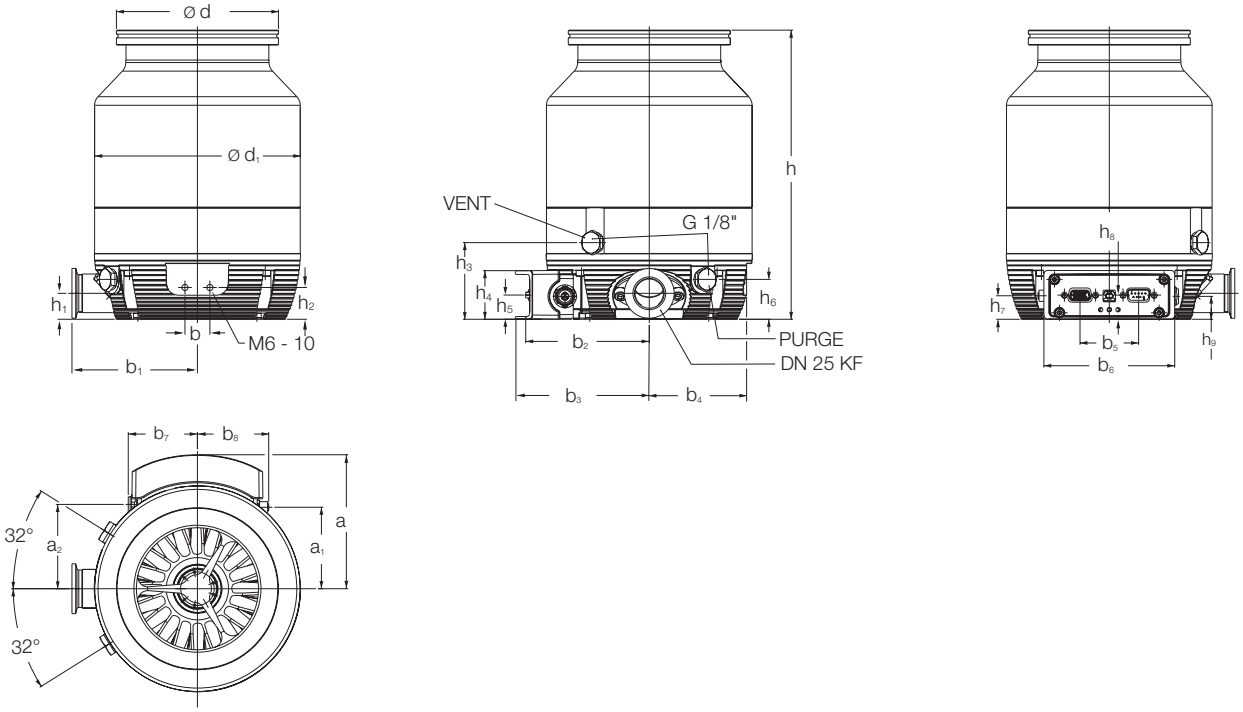
Typ	DN		a	a_1	a_2	b	b_1	b_2	b_3
TURBOVAC 90 iX	ISO-K	mm (in.)	-	-	-	-	45 (1.77)	-	-
	CF	mm (in.)	-	-	-	-	45 (1.77)	-	-
TURBOVAC 250 iX	ISO-K	mm (in.)	92 (3.62)	75 (295)	93 (3.66)	20 (0.79)	75 (2.95)	120 (4.72)	110 (4.33)
	CF	mm (in.)	92 (3.62)	75 (295)	93 (3.66)	20 (0.79)	75 (2.95)	120 (4.72)	110 (4.33)

	DN		d	d_1	h	h_1	h_2	h_3	h_4
TURBOVAC 90 iX	ISO-K	mm (in.)	110 (4.33)	-	240 (9.45)	55 (2.16)	-	-	-
	CF	mm (in.)	110 (4.33)	-	240 (9.45)	55 (2.16)	-	-	-
TURBOVAC 250 iX	ISO-K	mm (in.)	130 (5.12)	131 (5.16)	196 (7.72)	19 (0.75)	36 (1.42)	199 (7.83)	57 (2.24)
	CF	mm (in.)	151,5 (5.96)	131 (5.16)	205 (8.07)	19 (0.75)	36 (1.42)	208 (8.19)	66 (2.60)

	DN		h_5	h_6	h_7	h_8	h_9
TURBOVAC 90 iX	ISO-K	mm (in.)	-	-	-	-	-
	CF	mm (in.)	-	-	-	-	-
TURBOVAC 250 iX	ISO-K	mm (in.)	38 (1.50)	64 (2.52)	47 (1.85)	23 (0.91)	23 (0.91)
	CF	mm (in.)	38 (1.50)	64 (2.52)	47 (1.85)	23 (0.91)	23 (0.91)



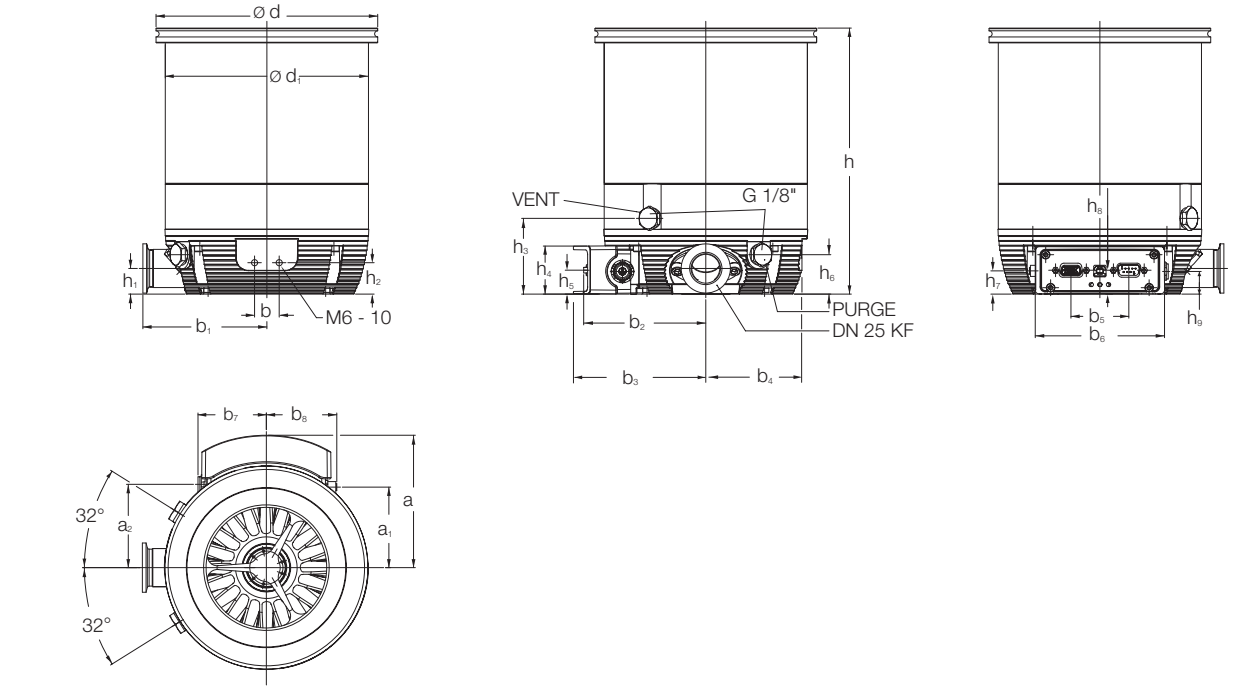
Dimensional drawing for the TURBOVAC pumps, 90 iX top and 250 iX bottom



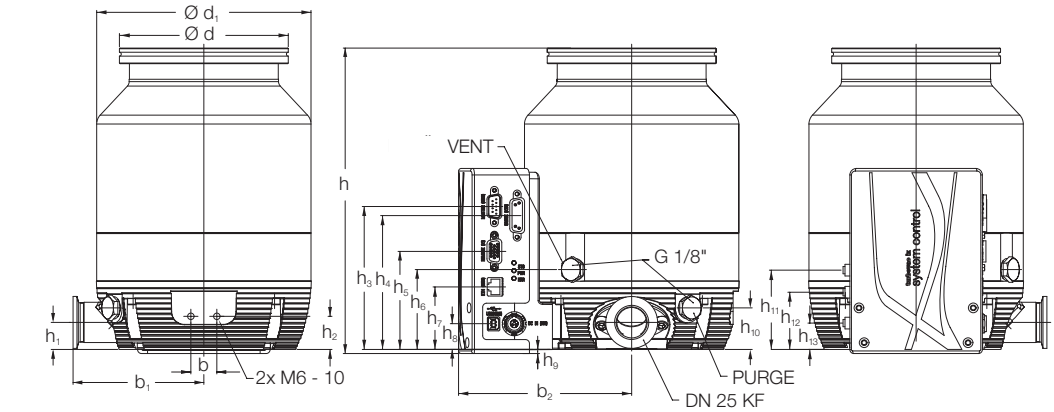
Type	DN		a	a_1	a_2	b	b_1	b_2	b_3	b_4
TURBOVAC (T) 350 i	ISO-K	mm (in.)	107.5 (4.23)	65.4 (2.57)	67.6 (2.66)	20 (0.79)	100.7 (3.96)	99.2 (3.91)	107.5 (4.23)	78.1 (3.07)
	CF	mm (in.)	107.5 (4.23)	65.4 (2.57)	67.6 (2.66)	20 (0.79)	100.7 (3.96)	99.2 (3.91)	107.5 (4.23	78.1 (3.07)
TURBOVAC (T) 450 i	ISO-K	mm (in.)	107.5 (4.23)	65.4 (2.57)	67.6 (2.66)	20 (0.79)	100.7 (3.96)	99.2 (3.91)	107.5 (4.23	78.1 (3.07)
	CF	mm (in.)	107.5 (4.23)	65.4 (2.57)	67.6 (2.66)	20 (0.79)	100.7 (3.96)	99.2 (3.91)	107.5 (4.23	78.1 (3.07)

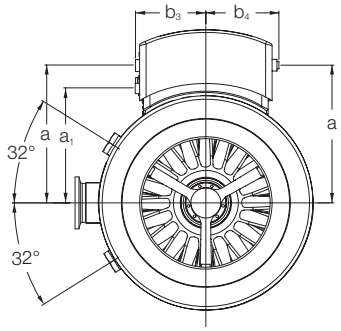
	DN		b_5	b_6	b_7	b_8	d	d_1	h	h_1
TURBOVAC (T) 350 i	ISO-K	mm (in.)	47 (1.85)	105 (4.13)	55.5 (2.19)	57.2 (2.25)	130 (5.12)	165 (6.5)	232 (9.13)	20.8 (0.82)
	CF	mm (in.)	47 (1.85)	105 (4.13)	55.5 (2.19)	57.2 (2.25)	180 (7.09)	165 (6.5)	245 (9.65)	20.8 (0.82)
TURBOVAC (T) 450 i	ISO-K	mm (in.)	47 (1.85)	105 (4.13)	55.5 (2.19)	57.2 (2.25)	130 (5.12)	165 (6.5)	216 (8.5)	20.8 (0.82)
	CF	mm (in.)	47 (1.85)	105 (4.13)	55.5 (2.19)	57.2 (2.25)	180 (7.09)	165 (6.5)	222 (8.74)	20.8 (0.82)

	DN		h_2	h_3	h_4	h_5	h_6	h_7	h_8	h_9
TURBOVAC (T) 350 i	ISO-K	mm (in.)	25.5 (1.0)	61.5 (2.42)	39 (1.54)	19.4 (0.76)	32 (1.26)	19 (0.75)	18.8 (0.74)	18.4 (0.72)
	CF	mm (in.)	25.5 (1.0)	61.5 (2.42)	39 (1.54)	19.4 (0.76)	32 (1.26)	19 (0.75)	18.8 (0.74)	18.4 (0.72)
TURBOVAC (T) 450 i	ISO-K	mm (in.)	25.5 (1.0)	61.5 (2.42)	39 (1.54)	19.4 (0.76)	32 (1.26)	19 (0.75)	18.8 (0.74)	18.4 (0.72)
	CF	mm (in.)	25.5 (1.0)	61.5 (2.42)	39 (1.54)	19.4 (0.76)	32 (1.26)	19 (0.75)	18.8 (0.74)	18.4 (0.72)



Dimensional drawing for the TURBOVAC (T) pumps, 350 i top and 450 i bottom

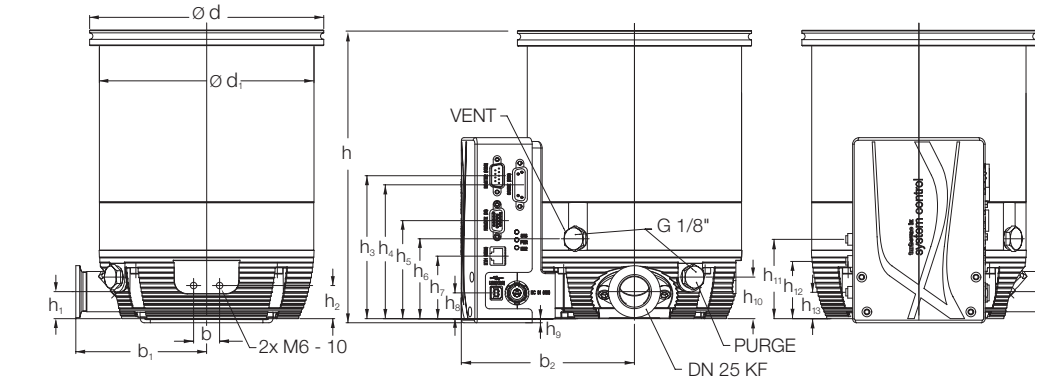


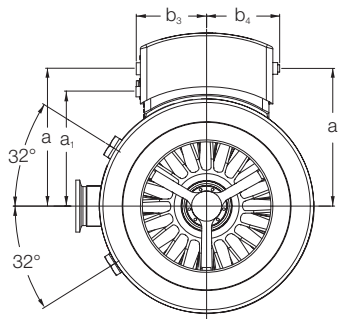


Type	DN		a	a_3	b	b_1	b_2	b_3	b_4
TURBOVAC (T) 350 iX	ISO-K	mm (in.)	111 (4.37)	78 (3.07)	20 (0.79)	101 (3.98)	138 (5.43)	54 (2.13)	56 (2.2)
	CF	mm (in.)	111 (4.37)	78 (3.07)	20 (0.79)	101 (3.98)	138 (5.43)	54 (2.13)	56 (2.2)
TURBOVAC (T) 450 iX	ISO-K	mm (in.)	111 (4.37)	78 (3.07)	20 (0.79)	101 (3.98)	138 (5.43)	54 (2.13)	56 (2.2)
	CF	mm (in.)	111 (4.37)	78 (3.07)	20 (0.79)	101 (3.98)	138 (5.43)	54 (2.13)	56 (2.2)

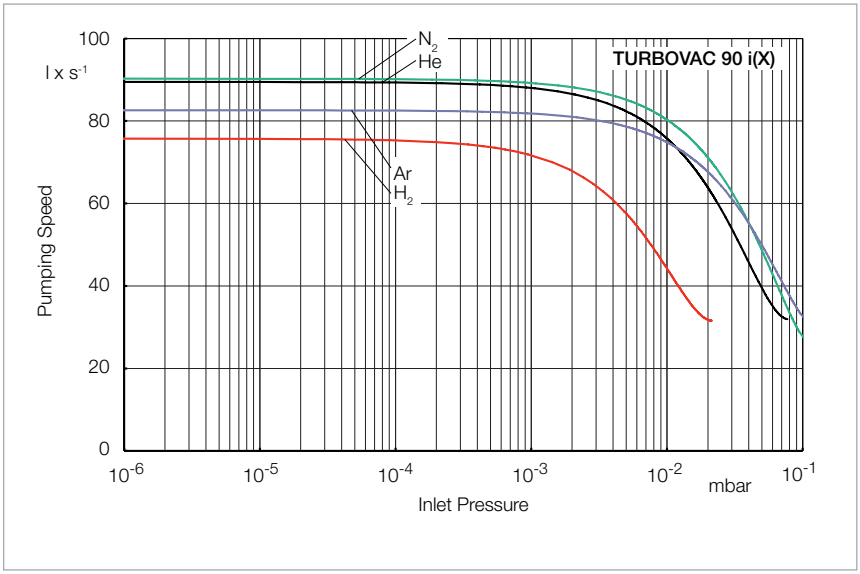
	DN		d	d_1	h	h_1	h_2	h_3	h_4	h_5
TURBOVAC (T) 350 iX	ISO-K	mm (in.)	130 (5.12)	165 (6.5)	235 (9.25)	21 (0.83)	26 (1.02)	110 (4.33)	103 (4.06)	76 (2.99)
	CF	mm (in.)	180 (7.09)	165 (6.5)	248 (9.76)	21 (0.83)	26 (1.02)	110 (4.33)	103 (4.06)	76 (2.99)
TURBOVAC (T) 450 iX	ISO-K	mm (in.)	130 (5.12)	165 (6.5)	219 (8.62)	21 (0.83)	26 (1.02)	110 (4.33)	103 (4.06)	76 (2.99)
	CF	mm (in.)	180 (7.09)	165 (6.5)	225 (8.86)	21 (0.83)	26 (1.02)	110 (4.33)	103 (4.06)	76 (2.99)

	DN		h_6	h_7	h_8	h_9	h_{10}	h_{11}	h_{12}	h_{13}
TURBOVAC (T) 350 iX	ISO-K	mm (in.)	62 (2.44)	48 (1.89)	20 (0.79)	3 (0.12)	32 (1.26)	64 (2.52)	47 (1.85)	23 (0.91)
	CF	mm (in.)	62 (2.44)	48 (1.89)	20 (0.79)	3 (0.12)	32 (1.26)	64 (2.52)	47 (1.85)	23 (0.91)
TURBOVAC (T) 450 iX	ISO-K	mm (in.)	62 (2.44)	48 (1.89)	20 (0.79)	3 (0.12)	32 (1.26)	64 (2.52)	47 (1.85)	23 (0.91)
	CF	mm (in.)	62 (2.44)	48 (1.89)	20 (0.79)	3 (0.12)	32 (1.26)	64 (2.52)	47 (1.85)	23 (0.91)

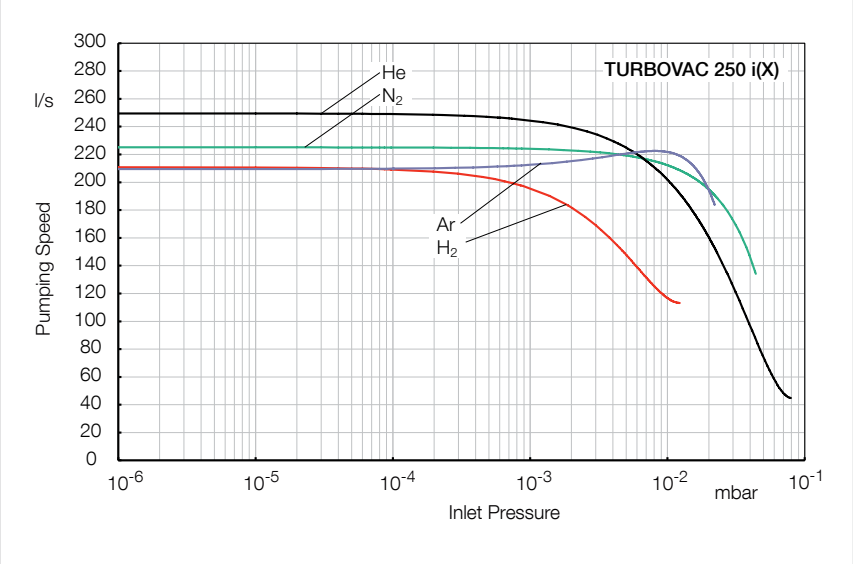




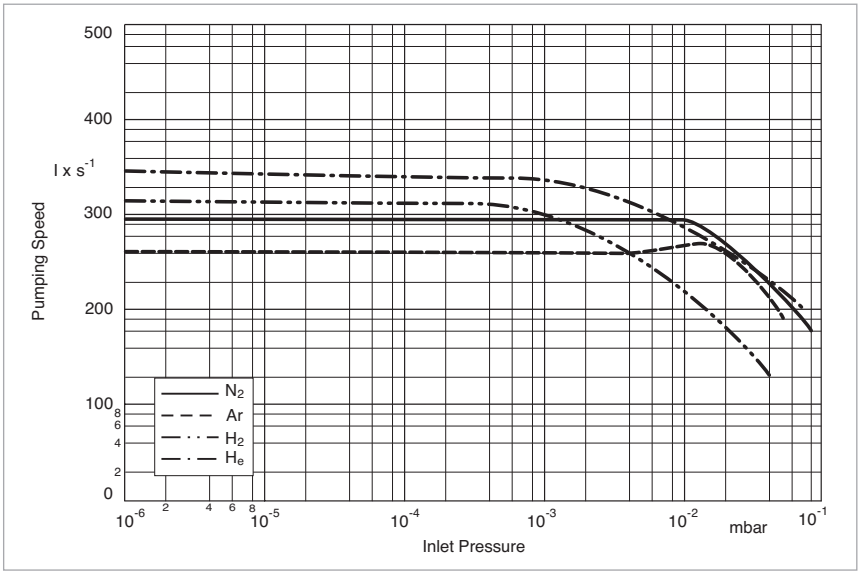
Dimensional drawing for the TURBOVAC (T) pumps, 350 iX top and 450 iX bottom



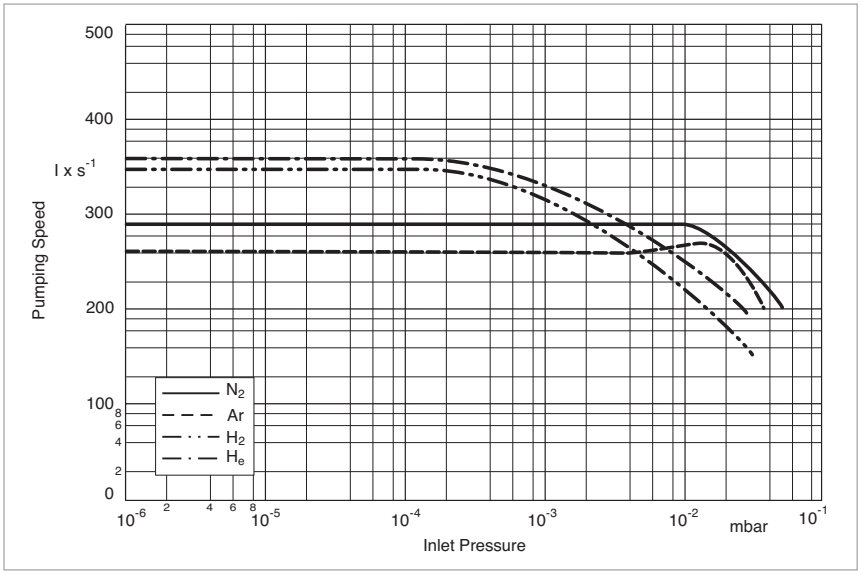
Pumping speed as a function of the inlet pressure for the TURBOVAC 90 i



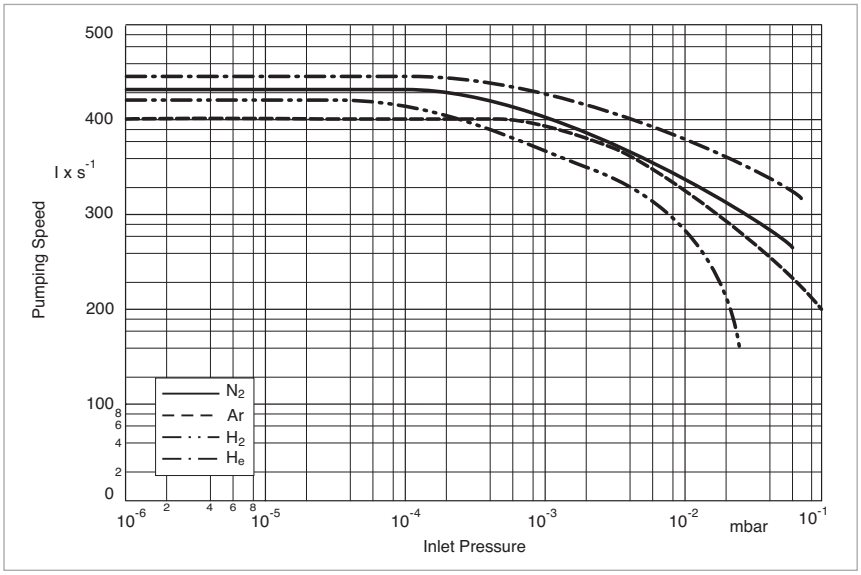
Pumping speed as a function of the inlet pressure for the TURBOVAC 250 i



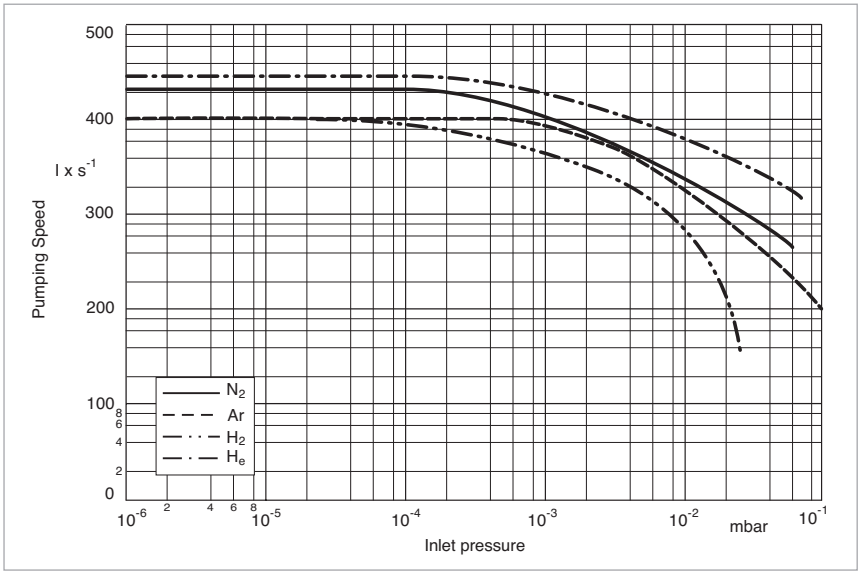
Pumping speed as a function of the inlet pressure for the TURBOVAC 350 i



Pumping speed as a function of the inlet pressure for the TURBOVAC T 350 i



Pumping speed as a function of the inlet pressure for the TURBOVAC 450 i



Pumping speed as a function of the inlet pressure for the TURBOVAC T 450 i

Technical Data

		TURBOVAC					
		90 i/iX	250 i/iX	350 i/iX	450 i/iX	T 350 i/iX	T 450 i/iX
High-vacuum connection	DN	63 ISO-K 63 CF	100 ISO-K 100 CF	100 ISO-K 100 CF	160 ISO-K 160 CF	100 ISO-K 100 CF	160 ISO-K 160 CF
Forevacuum connection	DN	16 ISO-KF	16 ISO-KF	25 ISO-KF	25 ISO-KF	25 ISO-KF	25 ISO-KF
Pumping speed							
N_2	l x s^{-1}	90	225	290	430	290	430
Ar	l x s^{-1}	83	210	260	400	260	400
He	l x s^{-1}	90	250	360	440	360	440
H_2	l x s^{-1}	78	210	350	420	320	400
Gas throughput							
N_2	mbar x l x s^{-1}	10	6	4.5	4.5	11.5	115
Ar	mbar x l x s^{-1}	3	3	2	2	6	6
He	mbar x l x s^{-1}	11	6	8	8	20	20
H_2	mbar x l x s^{-1}	11	>10	8	8	20	20
Compression ratio							
N_2		1×10^{11}	$1 \cdot 10^{11}$	1×10^{11}	1×10^{11}	1×10^{10}	1×10^{10}
Ar		1×10^{11}	$1 \cdot 10^{11}$	1×10^{11}	1×10^{11}	1×10^{11}	1×10^{11}
He		-	-	1×10^{8}	1×10^{8}	1×10^{6}	1×10^{6}
H_2		5×10^{7}	$2 \cdot 10^{7}$	1×10^{6}	1×10^{6}	1×10^{4}	1×10^{4}
Ultimate pressure with 2-stage oil-sealed rotary vane vacuum pump ISO-K / CF flange	mbar (Torr)	$< 8 \times 10^{-8}$ / $< 5 \times 10^{-10}$ ($< 6 \times 10^{-8}$ / $< 3.75 \times 10^{-10}$)					
Max. forevacuum pressure N_2	mbar (Torr)	14 (10.5)	14 (10.5)	10 (7.5)	10 (7.5)	0.5 (0.375)	0.5 (0.375)
Recommended forevacuum pumps							
TRIVAC		D 2,5 E / D 4 B	D 2,5 E / D 4 B	D 4 B	D 4 B	D 16 B	D 16 B
SCROLLVAC		SC 5 D	SC 5 D / 15 D	SC 5 D / 15 D	SC 5 D / 15 D	SC 15 D / 30 D	SC 15 D / 30 D
DIVAC		1.4 HV3	3.8 HV3	3.8 HV3	3.8 HV3	–	–
Operating speedl	min^{-1} (rpm)	72 000	72 000	60 000	60 000	60 000	60 000
Speed adjustment range	%	62 to 100	62 to 100	50 to 100	50 to 100	50 to 100	50 to 100
Run-up time, approx.	min	1.5	2	5.5	5.5	3.5	3.5
Ambient temperature							
during operation	°C	+5 to +45					
	(°F)	(+41 to +113)					
during storage	°C	-15 to -70					
	(°F)	(+5 to -94)					
Cooling							
standard		Convection					
optional		Air or water					
Cooling water connection		Plug connection for 6 x 1 hose					
alternatively		G 1/8" Screw-in thread					
Cooling water consumption	l/h	30 to 60	30 to 60	50 to 100	50 to 100	50 to 100	50 to 100
Permissible cooling water pressure	bar(g)	3 to 6					
Permissible cooling water temperature	°C	+15 to +35					
	(°F)	(+59 to +95)					
Noise level							
with convection cooling	db(A)	< 41	< 41	< 44	< 44	< 44	< 44
mwith radial cooler	db(A)	< 44	< 44	< 47	< 47	< 47	< 47
with axial cooler	db(A)	< 49	< 49	< 49	< 49	< 49	< 49

Additional Technical Data for the Frequency Converter (i Version)

		TURBOVAC					
		90 i	250 i	350 i	450 i	T 350 i	T 450 i
Technical Data for the integrated Drive Electronics							
Supply voltage	V DC	24/48 ±10%					
Max. current consumption	A	10 at 24 V DC					
Max. power consumption	W	240					
Power consumption at ultimate pressure	W	20					
Type of protection	IP	40					
Interfaces		RS 485, USB, 15-pin digital I/O					
Other interfaces		Upon request					
Accessory connection		1 pcs. M 8 connector, 24 V DC					
Weight ISO-K / CF	kg (lbs)	3.1 / 4.8 (6.8 / 10.6)	4 / 6,6 (8.8 / 14.5)	7.5 / 11.5 (16.5 / 25.4)	7.7 / 12.5 (17.0 / 27.6)	7.0 / 11.0 (15.4 / 14.3)	7.2 / 12.0 (15.9 / 26.5)

Additional Technical Data for the Frequency Converter (iX-Version)

		TURBOVAC					
		90 iX	250 iX	350 iX	450 iX	T 350 iX	T 450 iX
Technical Data for the integrated Drive Electronics and Vacuum System Controller							
Supply voltage	V DC	24/48 ±10%					
Max. current consumption	A	10 at 24 V DC					
Max. power consumption	W	240					
Power consumption at ultimate pressure	W	20					
Type of protection	IP	40					
Interfaces		USB+,15 pin Standard, Anybus (either RS 485, RS 232, Profibus, ...)					
Accessory connections		3 pcs. M 8 connector, 24 V DC					
Max. load for the 24 V DC output (cooler or valve supply)	V / W	24 / max. 12					
Gauge head connection		15-way Sub-D					
Weight ISO-K / CF	kg (lbs)	3.6 / 5.3 (7.9 / 11.7)	4,5 / 7,1 (9.9 / 15.6)	8.0 / 12.0 (17.6 / 26.5)	8.2 / 13.0 (18.1 / 28.7)	7.5 / 11.5 (16.5 / 25.4)	7.7 / 12.5 (17.0 / 27.6)

TURBOVAC
90 i, iX / 250 i, iX / (T) 350 i, iX / (T) 450 i, iX

TURBO.POWER integra
(TURBO.CONTROL 300)

Ordering Information

TURBOVAC

	Wide Range				Classic	
	90 i	250 i	350 i	450 i	T 350 i	T 450 i
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
TURBOVAC with integrated frequency converter, RS 485, USB+ and 15-Pin digital I/O interface						
DN 63 ISO-K	810031V1000	–	–	–	–	–
DN 63 CF	810041V1000	–	–	–	–	–
DN 100 ISO-K	–	820051V1000	830051V1000	–	830050V1000	–
DN 100 CF	–	820061V1000	830061V1000	–	830060V1000	–
DN 160 ISO-K	–	–	–	830071V1000	–	830070V1000
DN 160 CF	–	–	–	830081V1000	–	830080V1000
other interfaces	Upon request					

	Wide Range				Classic	
	90 iX	250 iX	350 iX	450 iX	T 350 iX	T 450 iX
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
TURBOVAC with integrated frequency converter, and vacuum system controller, RS 485, USB+ and 15-Pin digital I/O interface						
DN 63 ISO-K	810031V3300	–	–	–	–	–
DN 63 CF	810041V3300	–	–	–	–	–
DN 100 ISO-K	–	820051V3300	830051V3300	–	830050V3300	–
DN 100 CF	–	820061V3300	830061V3300	–	830060V3000	–
DN 160 ISO-K	–	–	–	830071V3300	–	830070V3300
DN 160 CF	–	–	–	830081V3300	–	830080V3300
other interfaces	Upon request					

Ordering Information

TURBOVAC (T)

90 i, iX / 250 i, iX / 350 i, iX / 450 i, iX

Mandatory Accessories P PS	Part No.
Power supply TURBO.POWER integra, including 0.3 (1.1 ft) long cable	800100V0003
Mains cable, 3 m (10.5 ft)	
EU plug	800102V0002
UK plug	800102V0003
US plug 5-15P, 115 V	800102V1002
Cable pump - TURBO.POWER integra	
1 m (3.5 ft)	800096V0100
3 m (10.5 ft)	800096V0300
5 m (17.5 ft)	800096V0500
Mounting kit TURBOVAC	
DN 63 ISO-K	800134V0010
DN 100 ISO-K	800134V0020
DN 160 ISO-K	800134V0030
DN 100 ISO-K to ISO-F	800134V0025
DN 160 ISO-K to ISO-F	800134V0035
DN 63 CF	800134V0011
DN 100 CF	800134V0021
DN 160 CF	800134V0031
Forevacuum pumps TRIVAC D 4 B and TRIVAC D 16 B see Catalog Part “Oil Sealed Vacuum Pumps”	
Forevacuum pumps SCROLLVAC SC 5 D, SCROLLVAC SC 15 D and DIVAC 3.8 HV3 see Catalog Part “Dry Compressing Vacuum Pumps”	

Accessories, optional P	Part No..
Power supply, cable, other accessories	
Power supply and control unit TURBO.CONTROL 300	800100V0001
Cable pump - TURBO.CONTROL 300	
1 m (3.5 ft)	800092V0100
3 m (10.5 ft)	800092V0300
5 m (17.5 ft	800092V0500
Extension cable - only in combination with connecting cable 1m (3.5 ft)	
10 m (35 ft)	800092V1000
20 m (70 ft)	800092V2000

Accessories, optional [P]	Part No.
24/48 V DCIn plug TURBOVAC	800090V0000
USB-Kabel 2.0, Typ A/B, 1.8 m (6.3 ft) long	800110V0108
Y cable M 8	800110V0020
Relaybox for forevacuum pump, 1-phase, 10 A	800110V0030
Start stop switch	800110V0021
Cooling	
Air cooler	
TURBOVAC 90 i(X)	
radial	800136V0007
axial	800136V0008
TURBOVAC 250 i(X)	
radial	800136V0009
axial	800136V0008
TURBOVAC 350/450 i(X)	
radial	800136V0005
axial	800136V0006
Water cooling TURBOVAC i(X), connection thread G 1/8”	800135V0005
Water cooling TURBOVAC i(X), connection thread G 1/4”	800135V0006
Venting and purge gas	
Venting valve, 24 V DC, G 1/8"	800120V0012
Power failure venting valve, 24 V DC, G 1/8"	800120V0022
Purge gas valve, 24 V DC, G 1/8", 24 sccm	800120V0013
Purge gas throttle, 24 sccm	800120V0014
Air filter, G 1/8"	800110V0022
Heating	
Flange heater (needs mains cable, see above)	
DN 63 CF, 230 V	800137V0003
DN 63 CF, 115 V	800137V0004
DN 100 CF, 230 V	800137V0005
DN 100 CF, 115 V	800137V0006
DN 160 CF, 230 V	800137V0007
DN 160 CF, 115 V	800137V0008
Installation	
Vibration absorber	
DN 100 ISO-K	800131V1100
DN 160 ISO-K	500073
DN 100 CF	500071
DN 160 CF	500072
Centering ring	
with fine inlet screen, 0.8 mm (0.03") mesh	
DN 63 ISO-K/F	800133V0012
DN 100 ISO-K/F	800133V0022
DN 160 ISO-K/F	800133V0032
with coarse inlet screen, 3.2 mm (0.13") mesh	
DN 63 ISO-K/F	800133V0011
DN 100 ISO-K/F	800133V0021
DN 160 ISO-K/F	800133V0031
Fine Inlet screen, 0.8 mm (0.03") mesh	
DN 63 CF	800132V0012
DN 100 CF	800132V0022
DN 160 CF	800132V0032
Coarse inlet screen, 3.2 mm (0.13") mesh	
DN 63 CF	800132V0011
DN 100 CF	800132V0021
DN 160 CF	800132V0031

Included in the Delivery of the Pump

High and forevacuum flanges are protective-capped

The flange mounting components and the inlet screen are not included in the delivery

Special Turbomolecular Pumps

TURBOVAC i Multi Inlet Cartridge

Precision is key when it comes to analytical instruments.

Outfitted with two or more inlets, the innovative turbopumps with integrated drive electronics provide extraordinary pumping performance and are adaptable to the system requirements of each instrument.

In combination with our support for the whole vacuum system design, it will result in the best possible level of pump system integration you have ever experienced.

The TURBOVAC 350-400 i Multi Inlet line has been especially developed to meet the requirements of analytical instruments and features an extremely high level of flexibility, allowing you to choose the number, height and position of the multiple vacuum ports. The result: a pump that is perfectly fitted to your specific performance needs and installation requirements.

Additionally, we offer the support and experience in vacuum system design which opens a wide range of possibilities, from the adaptation of the pump housing to your vacuum chamber through to the design of a custom-built housing/chamber that meets your particular needs. Your benefit: optimum system integration of the pump(s) into your instrument and a reduced time to market.

Your Advantage

- Perfect integration of the pump(s) within your instrumentation
- Cutting of system costs
- Smaller size of the analytical system
- Reduction in the number of individual vacuum components
- Choice between cartridge and custom pump housing

In order to simplify installation, operation and control, all TURBOVAC i variants feature an integrated electronic drive with 24/48 V DC supply and a detachable operator interface with USB, RS 485 and digital I/O connections.

Performance

- Industry-leading pumping speed especially for light gases (up to 60 % higher than existing products)
- Optimized rotor diameter to provide maximum pumping performance
- > 40 l/s pumping speed at Interstage port 2

Flexibility

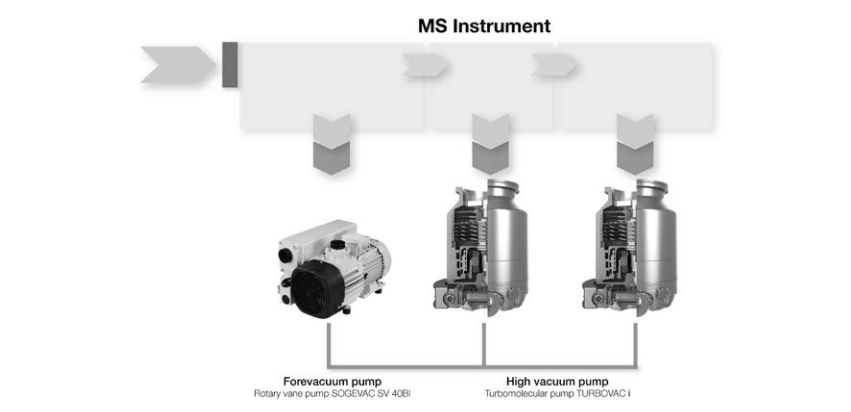
- Vacuum port design flexibility
  - Rotatable fore-vacuum port
  - Multiple interstage ports
  - High level of flexibility in terms of height and position of vacuum ports
- Unique cartridge solutions for optimized system integration with fast and simple field replacement
- Special pump housing solutions adapted to your instrument
- Complete vacuum system design including your vacuum chamber
- Variable rotor and Holweck design to adapt the performance to your application

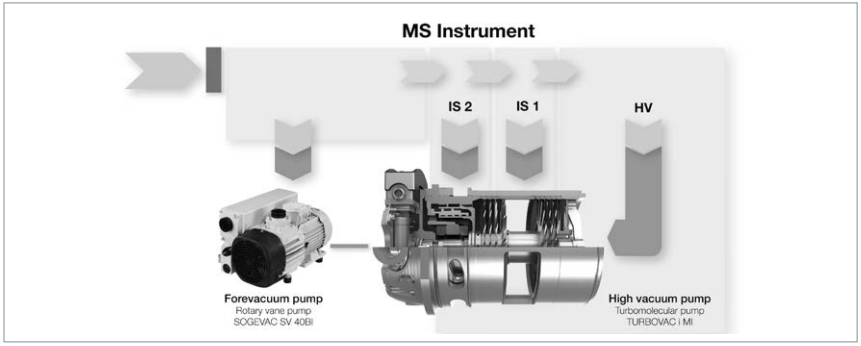
Installation, operation and control

- Integrated 24/48 V DC drive electronics to avoid expensive cabling
- Widest range of communication interfaces: USB, RS 485 and remote 15 pin digital I/O as standard options
- Highly efficient motor
- Thermal isolation by design for optimized cooling of bearing and improved pump lifetime
- Simply-supported shaft reduces vibration
- Maintenance free upper passive magnetic bearing
- Oil free, lifetime lubricated lower mechanical ceramic ball bearing, field-replaceable

Outstanding performance

Thanks to its variable rotor and drag stage design, our new Multi Inlet product line provides the highest performance for all mass spectrometer applications. With increased pumping speed levels especially for light gases which are up to 60% higher than those offered by other products currently on the market, it provides significant advantages for your instruments: lower pressures, improved detection sensitivity levels and higher sample throughput rates.





Superior reliability

The unique maintenance and oil free hybrid bearing system is characterized by its extreme reliability and durability – that's because we equipped it with an innovative lifetime lubrication system that never needs an oil change.
The simply-supported shaft system results in a low vibration pump design which reduces noise, mechanical stress and negative impact on vibration sensitive applications. Optimized cooling of the bearings is ensured through thermal isolation and the highly efficient motor. To protect the bearings from critical gases or particles, all pumps are equipped with a purge port. As a consequence, not only pump lifetime is increased significantly, but also system uptime as well as productivity. In combination with low costs of ownership, the operation of your vacuum system will be more efficient than ever.

Advantages to the User

- High gas throughput
- High effective pumping speed
- High efficiency for analytical instruments
- High detection sensitivity
- High sample throughput
- Free of hydrocarbons
- Hybrid bearing suspension for low vibration levels
- Space and weight saving
- Low component count
- Favourable price-to-performance ratio
- Installation and user friendly
- Practically maintenance free

Typical Applications

For example

- LC-MS (linking of a liquid chromatograph to a mass spectrometer)
- GC/MS (linking of a gas chromatograph to a mass spectrometer)
- TOF-MS (time-of-flight mass spectrometer)
- ICP-MS (inductively coupled plasma mass spectrometry)
- Helium leak detectors

Technical Features

- Dual Inlet (pumping down of two analysis chambers)
- Triple inlet (pumping down of three analysis chambers)
- High effective pumping speed

HV stage	up to 400 l/s
Interstage IS 1	up to 300 l/s
Interstage IS 2	up to 50 l/s

- Cartridge solutions (without pump housing) are available
- Compact vacuum system

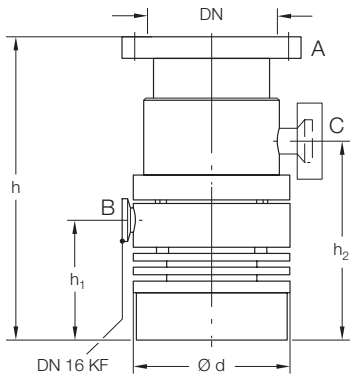
Customized versions are available upon request

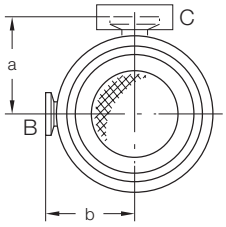
Mechanical Rotor Suspension without Compound Stage

TURBOVAC 50

Typical Applications

- Leak detectors
- Mass spectrometers
- Electron beam microscopy
- TV tube manufacturing
- Load locks and transfer chambers
- High vacuum chambers





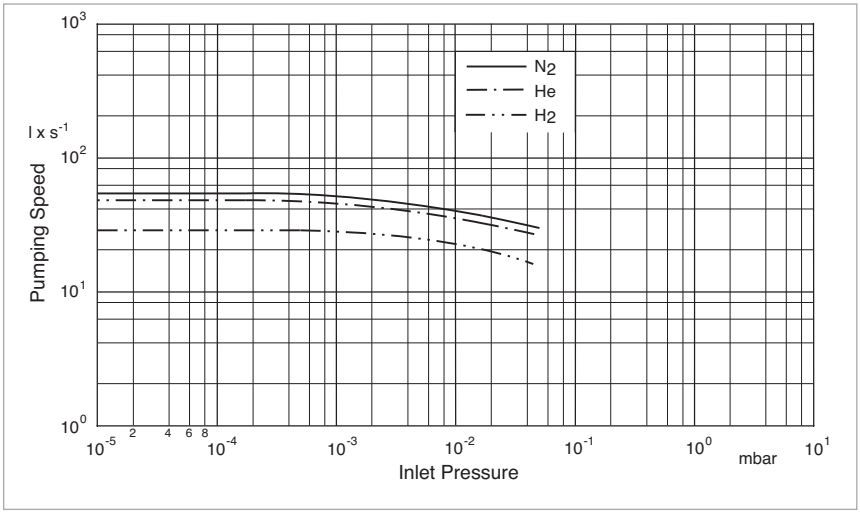
Top view

DN		a	b	d	h	h_1	h_2
40 ISO-KF	mm	54.5	55	93	166	71.5	119
	in.	2.15	2.17	3.66	6.54	2.81	4.69
63 ISO-K	mm	54.5	55	93	157.5	71.5	119
	in.	2.15	2.17	3.66	6.20	2.81	4.69

Dimensional drawing for the TURBOVAC 50

Technical Features

- Small footprint
- Installation in any orientation
- Cooling by convection is sufficient for most applications
- Air and water cooling can be added easily
- Oil-free pump for generating clean high and ultra-high vacuum conditions



Pumping speed as a function of the inlet pressure (TURBOVAC 50 with flange DN 63 ISO-K)

Advantages to the User

- Space-saving
- Easy to integrate into complex vacuum systems
- Low operating costs
- Highly reliable operation also in processes loaded with particles

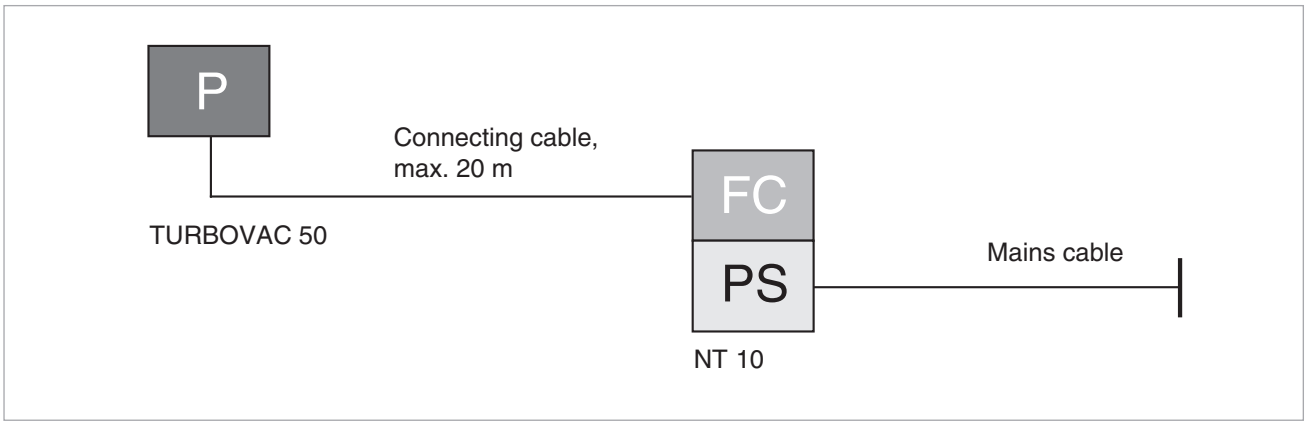
Technical Data — TURBOVAC 50

Connection			
Inlet	DN	40 ISO-KF • 40 CF	63 ISO-K • 63 ICF
Outlet	DN	16 ISO-KF	16 ISO-KF
Pumping speed			
N_2	l x s^{-1}	33	55
Ar	l x s^{-1}	30	50
He	l x s^{-1}	36	48
H_2	l x s^{-1}	28	30
Gas throughput			
N_2	mbar · l x s^{-1}	0.90	1.00
Ar	mbar · l x s^{-1}	0.70	0.80
He	mbar · l x s^{-1}	0.30	0.40
H_2	mbar · l x s^{-1}	0.25	0.30
Compression ratio			
N_2		2×10^6	2×10^6
Ar		2×10^6	2×10^6
He		5×10^2	5×10^2
H_2		2×10^2	2×10^2
Ultimate pressure	mbar (Torr)	< 5×10^{-8} (< 3.8×10^{-8})	< 5×10^{-8} (< 3.8×10^{-8})
Max. foreline pressure for N_2	mbar (Torr)	1×10^{-1} (7.5×10^{-2})	1×10^{-1} (7.5×10^{-2})
Recommended forevacuum pump		TRIVAC D 2,5 E	TRIVAC D 2,5 E
Nominal rotation speed	min^{-1} (rpm)	72 000	72 000
Run-up time, approx.	min	2	2
Max. power consumption	W	45	45
Power consumption at ultimate pressure	W	15	15
Admissible ambient temperature	°C (°F)	+10 to +55 (+50 to +131)	+10 to +55 (+50 to +131)
Cooling			
standard		Convection	Convection
optional		Air / Water	Air / Water
Cooling water connection		10 mm hose nozzle	10 mm hose nozzle
Cooling water consumption	l x h^{-1}	15 to 25	15 to 25
Permissible cooling water pressure	bar	3 to 7	3 to 7
Permissible cooling water temperature	°C (°F)	+10 to +35 (+50 to +95)	+10 to +35 (+50 to +95)
Weight	kg (lbs)	2.0 (4.4)	2.0 (4.4)

Technical Data — TURBOTRONIK NT 10

Mains connection	50/60 Hz	100-120 or 200-240 V
Max. power consumption	W	45
Max. output voltage	V	3 x 150
Max. output current	A	6
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +40 (+32 to +104)
Dimensions (W x H x D)	mm (in.)	106 x 128 x 233 (4.17 x 5.04 x 9.17)
Weight, approx.	kg (lbs)	1.5 (3.3)

TURBOVAC 50 without Compound Stage P	Part No.	
DN 40 ISO-KF, convection	854 00	
DN 40 CF, convection	853 99	
DN 63 ISO-K, convection	854 01	
DN 63 CF, convection	854 02	
Mandatory Accessories FC PS		
Electronic frequency converter TURBOTRONIK NT 10		
with EURO plug, 180-240 V	859 00	
with US plug, 90-140 V	859 01	
Connecting cable converter – TURBOVAC		
1.0 m (3.5 ft)	200 11 609	
3.0 m (10.5 ft)	121 08	
5.0 m (17.5 ft)	121 09	
10.0 m (35.0 ft)	161 10	
20.0 m (70.0 ft)	800150V2000	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	140 000	
110-120 V, 200-240 V, 50/60 Hz; without plug, world version	140 001	
110-120 V, 50/60 Hz; NEMA plug, US version	140 002	
100 V, 50/60 Hz; NEMA plug, Japan version	140 003	
For further types, see Catalog Part “Oil sealed Vacuum Pumps”		



Ordering Information

TURBOVAC 50

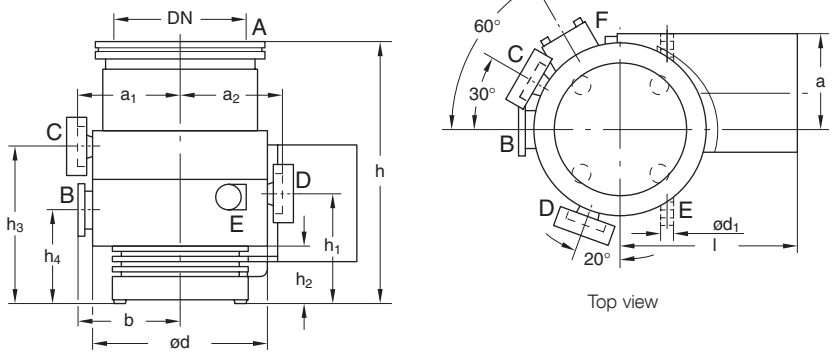
Accessories, optional	Part No.
Air cooling unit 230 V AC 100 - 115 V AC	 **854 05** **800152V0015**
Water cooling kit (hose nozzles ∅ 10 mm (0.4 in.)	**800135V0003**
Vibration absorber DN 63 ISO-K	 **800131V0063**
Solenoid venting valve, normally closed 24 V DC, DN 16 ISO-KF	 **800120V0011**
Power failure venting valve, normally open 24 V DC, DN 16 ISO-KF	 **800120V0021**
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	**ISO-K**
Inlet screen, centering ring with FPM O-ring, clamping ring	**ISO-KF**
Centering ring with O-ring, clamping ring	**Foreline Flange**
Included in the Delivery of the Frequency Converter FC PS	
Mains cable	

Mechanical Rotor Suspension without Compound Stage

TURBOVAC 151, 151 C ClassicLine

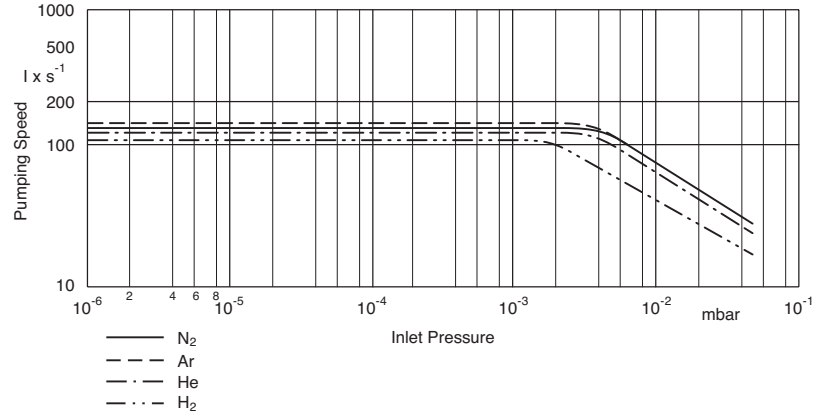
Turbomolecular pumps without a purge gas facility are only suited for pumping of air or inert gases.
They are not suited for pumping of aggressive or reactive gases.

TURBOVAC pumps with a “C” in the type designation are equipped with a purge gas facility.
The purge gas protects the bearing area and the motor of the TURBOVAC.



DN		151 h	151 C h	151 C h_1	h_2	h_3	h_4	a	a_1	a_2	b	d	d_1	l
100 ISO-K	mm	207	207	88	47	126	73	76	79	78	76	132	10	136
	in.	8.14	8.14	3.46	1.85	4.96	2.87	2.99	3.11	3.07	2.99	5.20	0.39	5.35
100 CF	mm	224	–	–	47	126	73	76	79	78	76	132	10	136
	in.	8.82	–	–	1.85	4.96	2.87	2.99	3.11	3.07	2.99	5.20	0.39	5.35

Dimensional drawing for the TURBOVAC 151 and 151 C



Pumping speed as a function of the inlet pressure (TURBOVAC 151 with flange DN 100)

Typical Applications

- Leak detectors
- Mass spectrometers
- Optical coating
- R & D
  - UHV systems
  - Particle accelerators
- Load locks and transfer chambers

Technical Features

- Small footprint
- Operation in any orientation
- Oil-free pump for generating clean high and ultra-high vacuum conditions
- Bearing temperature measurement through the TURBO.DRIVE TD 20 *classic*

Advantages to the User

- Space-saving
- Easy to integrate into complex vacuum systems
- Low operating costs
- Highly reliable operation also in processes loaded with particles

Technical Data — TURBOVAC 151 (C)

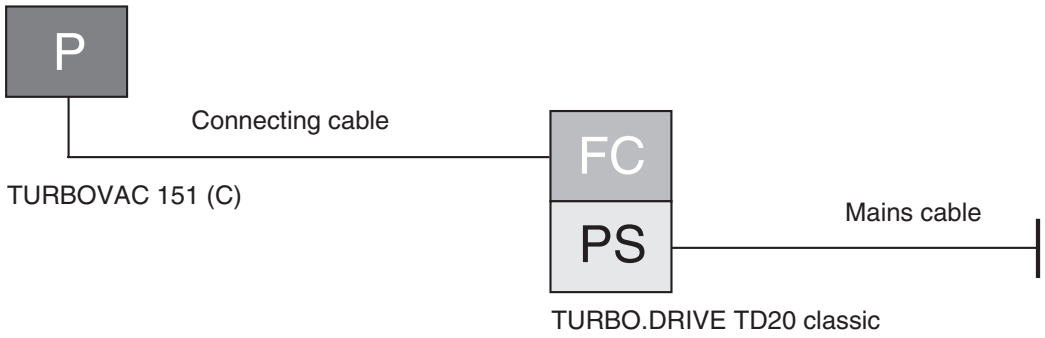
Connection			
Inlet	DN	100 ISO-K	100 CF
Outlet	DN	25 ISO-KF	25 ISO-KF
Pumping speed			
N_2	l x s^{-1}	145	145
Ar	l x s^{-1}	150	150
He	l x s^{-1}	135	135
H_2	l x s^{-1}	115	115
Gas throughput			
N_2	mbar · l x s^{-1}	1.5	1.5
Ar	mbar · l x s^{-1}	1.3	1.3
He	mbar · l x s^{-1}	1.5	1.5
H_2	mbar · l x s^{-1}	1.0	1.0
Compression ratio			
N_2		1×10^9	1×10^9
Ar		1×10^9	1×10^9
He		2×10^4	2×10^4
H_2		8×10^2	8×10^2
Ultimate pressure	mbar (Torr)	< 1×10^{-10} (< 7.5×10^{-11})	< 1×10^{-10} (< 7.5×10^{-11})
Max. foreline pressure for N_2	mbar (Torr)	5×10^{-1} (3.8×10^{-1})	5×10^{-1} (3.8×10^{-1})
Recommended forevacuum pump		from TRIVAC D 4 B to D 16 B	from TRIVAC D 4 B to D 16 B
Nominal rotation speed	min^{-1} (rpm)	50 000	50 000
Run-up time, approx.	min	2	2
Max. power consumption	W	300	300
Power consumption at ultimate pressure	W	70	70
Admissible ambient temperature	°C (°F)	10 to 55 (50 to 131)	10 to 55 (50 to 131)
Cooling			
standard		Water	Water
optional		Air	Air
Cooling water connection		10 mm hose nozzle	10 mm hose nozzle
Cooling water consumption	l x h^{-1}	15 to 35	15 to 35
Permissible cooling water pressure	bar	3 to 7	3 to 7
Permissible cooling water temperature	°C (°F)	10 to 25 (50 to 77)	10 to 25 (50 to 77)
Weight	kg (lbs)	8 (17)	8 (17)

Technical Data — TURBO.DRIVE TD 20 *classic*

Mains connection	50/60 Hz	100 to 240 V (+15 % / -10 %)
Max. power consumption	W	500
Max. output voltage	V	3 x 47
Max. output current	A	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	kg (lbs)	4.0 (8.8)

TURBOVAC 151 (C) without Compound Stage P	Part No.	
DN 100 ISO-K, water-cooled	**856 31**	
DN 100 ISO-K, water-cooled (C version)	**856 35**	
DN 100 CF, water-cooled	**856 32**	
DN 100 CF, water-cooled (C version)	**103 41**	
Mandatory Accessories FC PS		
TURBO.DRIVE TD 20 *classic*		
without interface	**800075V0001**	
with RS 232 C interface	**800075V0002**	
with RS 485 C interface	**800075V0004**	
with Profibus	**800075V0003**	
with 25-pol I/O	**800075V0005**	
Connecting cable TURBOVAC - frequency converter		
3 m (10.5 ft)	**857 65**	
5 m (17.5 ft)	**857 66**	
10 m (35.0 ft)	**857 67**	
20 m (70.0 ft)	**857 68**	
50 m (175.0 ft)	**800152V0008**	
60 m (210.0 ft)	**800152V0007**	
80 m (280.0 ft)	**800152V0080**	
140 m (490.0 ft)	**800152V0140**	
Mains cable		
3 m (10.5 ft)		
EURO plug	**800102V0002**	
UK plug	**800102V0003**	
US plug 5-15 P	**800102V1002**	
2 m (7.5 ft)		
US plug 115 V AC	**992 76 513**	
Forevacuum pump		
TRIVAC D 4 B		
1 phase motor; 230 V, 50 Hz	**112 45**	
1 phase dual voltage motor; 100-120 V / 200-240 V; 50/60 Hz	**140 081** [1]	
TRIVAC D 8 B		
1 phase motor; 230 V, 50 Hz	**112 55**	
1 phase dual voltage motor; 100-220 V / 200-240 V; 50/60 Hz	**140 082** [1]	
TRIVAC D 16 B		
1 phase motor; 230 V, 50 Hz	**112 65**	
1 phase motor; 230 V, 50/60 Hz	**113 25**	
3 phase motor; 200-240 V/380-400 V, 50 Hz / 200-240 V/380-480 V, 60 Hz	**112 66**	
SCROLLVAC SC 30 D		
1 phase motor; 200-230 V, 50/60 Hz	**133 002**	
1 phase motor; 100-115 V, 50/60 Hz	**133 102**	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V 60 Hz	**133 004**	
For further types, see Catalog Parts “Oil Sealed Vacuum Pumps” and “Dry Compressing Vacuum Pumps”		

[1] The mains cord (Part No. 200 81 091) must be ordered additionally



Ordering Information

TURBOVAC 151 (C)

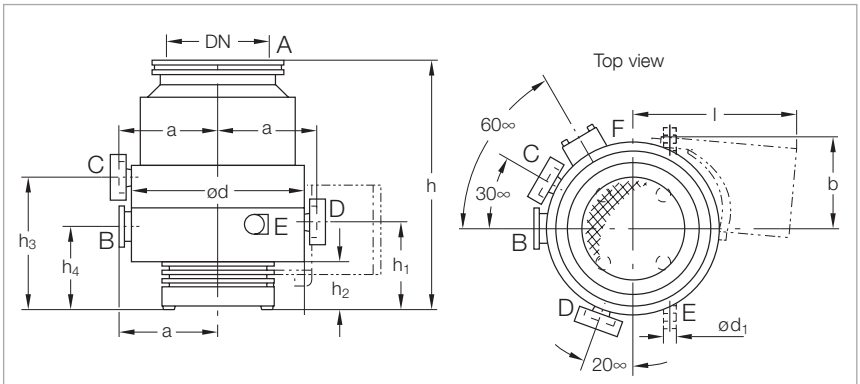
Accessories, optional	Part No.
Air cooling unit	
230 V AC	855 31
100 - 115 V AC	800152V0016
Flange heater	
DN 100 CF, 230 V, 50 Hz	854 27
DN 100 CF, 115 V, 60 Hz	854 28
Vibration absorber	
DN 100 ISO-K	800131V0100
DN 100 CF	500 071
Solenoid venting valve, with gas admission filter, normally closed	
24 V DC, DN 16 ISO-KF	800120V0011
Power failure venting valve, with gas admission filter, normally open	
24 V DC, DN 16 ISO-KF	800120V0021
Purge gas and venting valve	
gas flow at 1 bar 0.4 mbar x l x s^{-1} (24 sccm),	
pump connection DN 10 ISO-KF / gas connection G 1/4"	
230 V AC	800152V0014
100 - 115 V AC	800152V0041
24 V DC	800152V0013
Gas filter to G 1/4" for purge gas and venting valve	800110V0012
Replacement filter (for gas filter to G 1/4" for purge gas and venting valve)	E 200 18 515
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	ISO-K
Inlet screen	CF
Centering ring with O-ring, clamping ring	Foreline Flange
Pivoted threaded fittings to replace the included hose nipples	Water Cooling

Mechanical Rotor Suspension without Compound Stage

TURBOVAC 361, 361 C ClassicLine

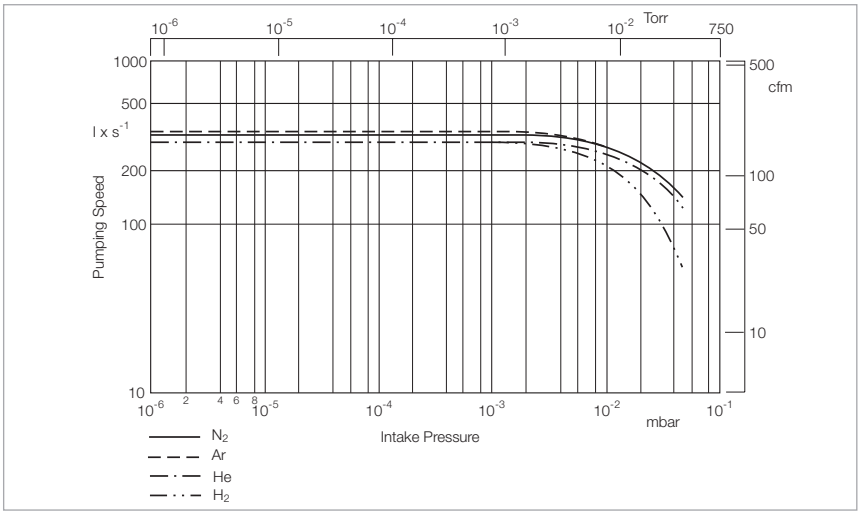
Turbomolecular pumps without a purge gas facility are only suited for pumping of air or inert gases.
They are not suited for pumping of aggressive or reactive gases.

TURBOVAC pumps with a “C” in the type designation are equipped with a purge gas facility.
The purge gas protects the bearing area and the motor of the TURBOVAC.



DN		361 h	361 C h	361 C h_1	h_2	h_3	h_4	a	b	d_1	l
100 ISO-K	mm	254	254	88	47	135	77	98	94	10	166
	in.	10	10	3.46	1.85	5.31	3.03	3.86	3.70	0.39	6.54
100 CF	mm	268	–	–	47	135	77	98	94	10	166
	in.	10.55	–	–	1.85	5.31	3.03	3.86	3.70	0.39	6.54
160 ISO-K	mm	227	227	88	47	135	77	98	94	10	166
	in.	8.94	8.94	3.46	1.85	5.31	3.03	3.86	3.70	0.39	6.54
160 CF	mm	226	–	–	47	135	77	98	94	10	166
	in.	8.90	–	–	1.85	5.31	3.03	3.86	3.70	0.39	6.54

Dimensional drawing for the TURBOVAC 361 and 361 C



Pumping speed as a function of the inlet pressure (TURBOVAC 361 with flange DN 100)

Typical Applications

- Leak detectors
- Mass spectrometers
- Data storage
- Optical coating
- R & D
  - UHV systems
  - Particle accelerators
- Load locks and transfer chambers

Technical Features

- Small footprint
- Installation in any orientation
- Oil-free pump for generating clean high and ultra-high vacuum conditions
- Bearing temperature measurement through the TURBO.DRIVE TD 20 *classic*

Advantages to the User

- Space-saving
- Easy to integrate into complex vacuum systems
- Low operating costs
- Highly reliable operation also in processes loaded with particles

Technical Data

TURBOVAC 361 (C)

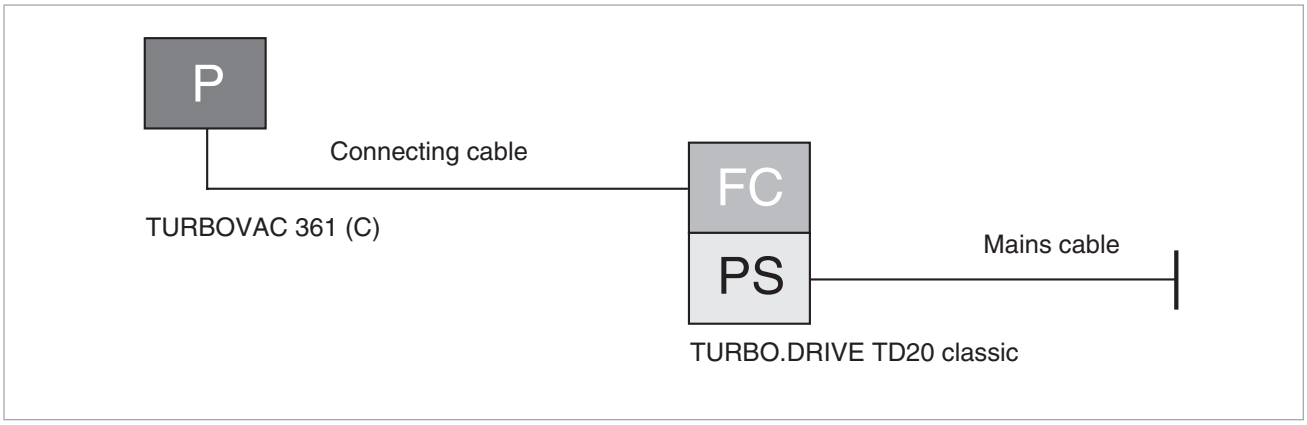
Connection			
Inlet	DN	100 ISO-K • 100 CF	160 ISO-K • 160 CF
Outlet	DN	25 ISO-KF	25 ISO-KF
Pumping speed			
N_2	l x s^{-1}	345	400
Ar	l x s^{-1}	350	410
He	l x s^{-1}	340	380
H_2	l x s^{-1}	340	370
Gas throughput			
N_2	mbar · l x s^{-1}	3.0	3.0
Ar	mbar · l x s^{-1}	2.5	2.5
He	mbar · l x s^{-1}	3.0	3.0
H_2	mbar · l x s^{-1}	2.0	2.0
Compression ratio			
N_2		1 x 10^9	1 x 10^9
Ar		1 x 10^9	1 x 10^9
He		6 x 10^4	6 x 10^4
H_2		3 x 10^3	3 x 10^3
Ultimate pressure	mbar (Torr)	< 1 x 10^{-10} (< 7.5 x 10^{-11})	< 1 x 10^{-10} (< 7.5 x 10^{-11})
Max. foreline pressure for N_2	mbar (Torr)	5 x 10^{-1} (4 x 10^{-1})	5 x 10^{-1} (3.8 x 10^{-1})
Recommended forevacuum pump		from TRIVAC D 16 B to D 25 B	from TRIVAC D 16 B to D 25 B
Nominal rotation speed	min^{-1} (rpm)	45 000	45 000
Run-up time, approx.	min	2	2
Max. power consumption	W	300	300
Power consumption at ultimate pressure	W	70	70
Admissible ambient temperature	°C (°F)	10 to 55 (50 to 131)	10 to 55 (50 to 131)
Cooling			
standard		Water	Water
optional		Air	Air
Cooling water connection		10 mm hose nozzle	10 mm hose nozzle
Cooling water consumption	l x h^{-1}	15 to 35	15 to 35
Permissible cooling water pressure	bar	3 to 7	3 to 7
Permissible cooling water temperature	°C (°F)	10 to 25 (50 to 77)	10 to 25 (50 to 77)
Weight	kg (lbs)	12 (26)	12 (26)

Technical Data

TURBO.DRIVE TD 20 *classic*

Mains connection	50/60 Hz	100 to 240 V (+15 % / -10 %)
Max. power consumption	W	500
Max. output voltage	V	3 x 47
Max. output current	A	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	kg (lbs)	4.0 (8.8)

TURBOVAC 361 (C) without Compound Stage P	Part No.	
DN 100 ISO-K, water-cooled	**856 70**	
DN 100 ISO-K, water-cooled (C version)	**856 75**	
DN 100 CF, water-cooled	**856 71**	
DN 100 CF, water-cooled (C version)	**112 09**	
DN 160 ISO-K, water-cooled	**856 72**	
DN 160 ISO-K, water-cooled (C version)	**856 77**	
DN 160 CF, water-cooled	**856 73**	
Mandatory Accessories FC PS		
TURBO.DRIVE TD 20 *classic*		
without interface	**800075V0001**	
with RS 232 C interface	**800075V0002**	
with RS 485 C interface	**800075V0004**	
with Profibus	**800075V0003**	
with 25-pol I/O	**800075V0005**	
Connecting cable TURBOVAC - frequency converter		
3 m (10.5 ft)	**857 65**	
5 m (17.5 ft)	**857 66**	
10 m (35.0 ft)	**857 67**	
20 m (70.0 ft)	**857 68**	
50 m (175.0 ft)	**800152V0008**	
60 m (210.0 ft)	**800152V0007**	
80 m (280.0 ft)	**800152V0080**	
140 m (490.0 ft)	**800152V0140**	
Mains cable		
3 m (10.5 ft)		
EURO plug	**800102V0002**	
UK plug	**800102V0003**	
US plug 5-15 P	**800102V1002**	
2 m (7.5 ft)		
US plug 115 V AC	**992 76 513**	
Forevacuum pump		
TRIVAC D 16 B		
1 phase motor; 230 V, 50 Hz	**112 65**	
1 phase motor; 230 V, 50/60 Hz	**113 25**	
3 phase motor; 200-240 V/380-400 V, 50 Hz / 200-240 V/380-480 V, 60 Hz	**112 66**	
TRIVAC D 25 B		
1 phase motor; 230 V, 50 Hz	**112 75**	
1 phase motor; 230 V, 50/60 Hz	**113 35**	
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	**112 76**	
SCROLLVAC SC 30 D		
1 phase motor; 200-230 V, 50/60 Hz	**133 002**	
1 phase motor; 100-115 V, 50/60 Hz	**133 102**	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V, 60 Hz	**133 004**	
For further types, see Catalog Parts “Oil Sealed Vacuum Pumps” and “Dry Compressing Vacuum Pumps”		



Ordering Information

TURBOVAC 361 (C)

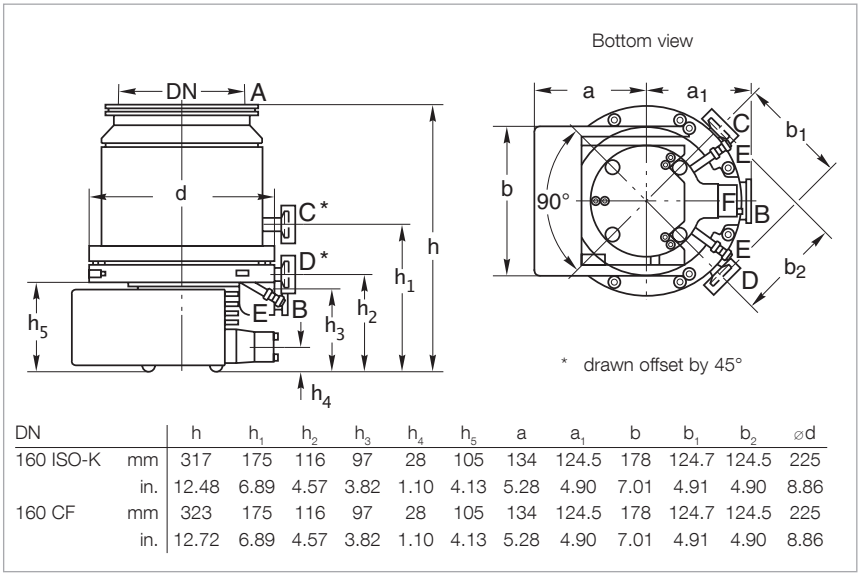
Accessories, optional	Part No.
Air cooling unit	
230 V AC	855 31
100 - 115 V AC	800152V0016
Flange heater	
DN 100 CF, 230 V, 50 Hz	854 27
DN 100 CF, 115 V, 60 Hz	854 28
DN 160 CF, 230 V, 50 Hz	854 37
DN 100 CF, 115 V, 60 Hz	854 38
Vibration absorber	
DN 100 ISO-K	800131V0100
DN 100 CF	500 071
DN 160 ISO-K	500 073
DN 160 CF	500 072
Solenoid venting valve, with gas admission filter, normally closed	
24 V DC, DN 16 ISO-KF	800120V0011
Power failure venting valve, with gas admission filter, normally open	
24 V DC, DN 16 ISO-KF	800120V0021
Purge gas and venting valve	
gas flow at 1 bar 0.4 mbar x l x s^{-1} (24 sccm),	
pump connection DN 10 ISO-KF / gas connection G 1/4"	
230 V AC	800152V0014
100 - 115 V AC	800152V0042
24 V DC	800152V0013
Gas filter to G 1/4" for purge gas and venting valve	800110V0012
Replacement filter	E 200 18 515
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	ISO-K
Inlet screen	CF
Centering ring with O-ring, clamping ring	Foreline Flange
Pivoted threaded fittings to replace the included hose nipples	Water Cooling

Mechanical Rotor Suspension without Compound Stage

TURBOVAC 600 C ClassicLine

Typical Applications

- Load locks and transfer chambers
- Optical coating
- Flat panel displays
- R & D

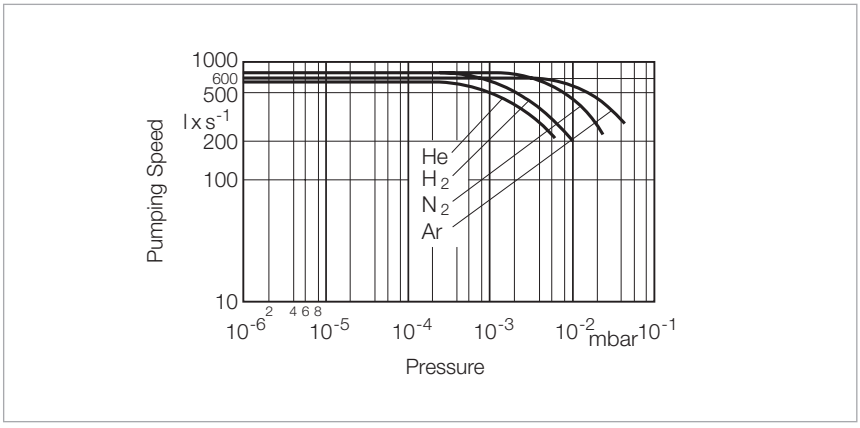


DN		h	h_1	h_2	h_3	h_4	h_5	a	a_1	b	b_1	b_2	⌀d
160 ISO-K	mm	317	175	116	97	28	105	134	124.5	178	124.7	124.5	225
	in.	12.48	6.89	4.57	3.82	1.10	4.13	5.28	4.90	7.01	4.91	4.90	8.86
160 CF	mm	323	175	116	97	28	105	134	124.5	178	124.7	124.5	225
	in.	12.72	6.89	4.57	3.82	1.10	4.13	5.28	4.90	7.01	4.91	4.90	8.86

Dimensional drawing for the TURBOVAC 600 C

Technical Features

- Small footprint
- Installation in any orientation
- Oil-free pump for generating clean high and ultra-high vacuum conditions
- Bearing temperature measurement through the TURBO.DRIVE TD 20 *classic*
- Seal gas connection
- Venting connection



Pumping speed for different gases as a function of intake pressure
(TURBOVAC 600 C with flange DN 160 ISO-K)

Advantages to the User

- Installation in any orientation
- Highly reliable due to hybrid ceramic ball bearings

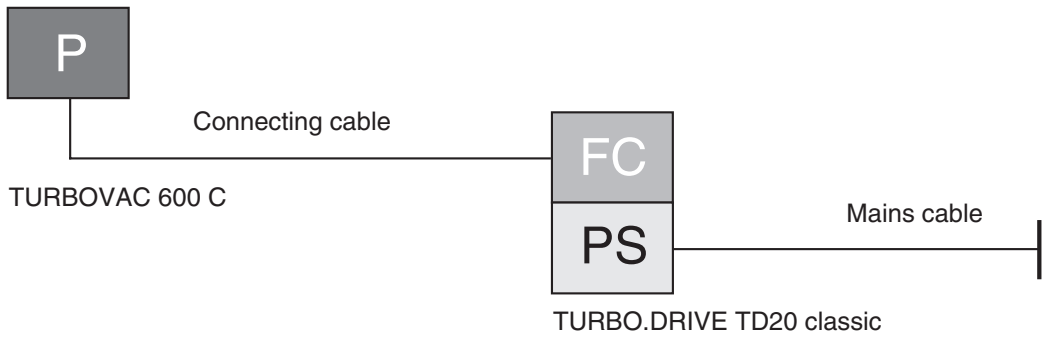
Technical Data — TURBOVAC 600 C

Connection		
Inlet	DN	160 ISO-K • 160 CF
Outlet	DN	40 ISO-KF
Pumping speed		
N_2	l x s^{-1}	560
Ar	l x s^{-1}	550
He	l x s^{-1}	600
H_2	l x s^{-1}	570
Gas throughput		
N_2	mbar · l x s^{-1}	4.0
Ar	mbar · l x s^{-1}	4.0
He	mbar · l x s^{-1}	5.5
H_2	mbar · l x s^{-1}	4.0
Compression ratio		
N_2		> 10^9
Ar		> 10^9
He		2.0 x 10^4
H_2		1.1 x 10^3
Ultimate pressure	mbar (Torr)	< 1.0 x 10^{-10} (< 7.5 x 10^{-11})
Max. foreline pressure for N_2	mbar (Torr)	1.0 x 10^{-1} (7.5 x 10^{-2})
Recommended forevacuum pump		TRIVAC D 25 B / D 40 B
Nominal rotation speed	min^{-1} (rpm)	36 000
Run-up time, approx.	min	3
Max. power consumption	W	400
Power consumption at ultimate pressure	W	90
Admissible ambient temperature	°C (°F)	10 to 55 (50 to 131)
Cooling		
standard		Water
optional		Air
Cooling water connection		10 mm hose nozzle
Cooling water consumption	l x h^{-1}	20 to 80
Permissible cooling water pressure	bar	3 to 7
Permissible cooling water temperature	°C (°F)	10 to 30 (50 to 86)
Weight	kg (lbs)	17.0 (37.5)

Technical Data — TURBO.DRIVE TD 20 *classic*

Mains connection	50/60 Hz	100 to 240 V (+15 % / -10 %)
Max. power consumption	W	500
Max. output voltage	V	3 x 47
Max. output current	A	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	kg (lbs)	4.0 (8.8)

TURBOVAC 600 C without Compound Stage	P	Part No.	
DN 160 ISO-K, water-cooled		800150V0015	
DN 160 CF, water-cooled		800150V0017	
	FC PS		
TURBO.DRIVE TD 20 *classic*			
without interface		800075V0001	
with RS 232 C interface		800075V0002	
with RS 485 C interface		800075V0004	
with Profibus		800075V0003	
with 25-pol I/O		800075V0005	
Connecting cable TURBOVAC - frequency converter			
3 m (10.5 ft)		857 65	
5 m (17.5 ft)		857 66	
10 m (35.0 ft)		857 67	
20 m (70.0 ft)		857 68	
50 m (175.0 ft)		800152V0008	
60 m (210.0 ft)		800152V0007	
80 m (280.0 ft)		800152V0080	
140 m (490.0 ft)		800152V0140	
Mains cable			
3 m (10.5 ft)			
EURO plug		800102V0002	
UK plug		800102V0003	
US plug 5-15 P		800102V1002	
2 m (7.5 ft)			
US plug 115 V AC		992 76 513	
Forevacuum pump			
TRIVAC D 25 B			
1 phase motor; 230 V, 50 Hz		112 75	
1 phase motor; 230 V, 50/60 Hz		113 35	
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz;		112 76	
TRIVAC D 40 B			
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz		112 86	
3 phase motor; 200/346 V, 50 Hz / 208/360 V, 60 Hz		113 47	
SCROLLVAC SC 30 D			
1 phase motor; 200-230 V, 50/60 Hz		133 002	
1 phase motor; 100-115 V, 50/60 Hz		133 102	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V, 60 Hz		133 004	
For further types, see Catalog Parts “Oil Sealed Vacuum Pumps” and “Dry Compressing Vacuum Pumps”			



Ordering Information

TURBOVAC 600 C

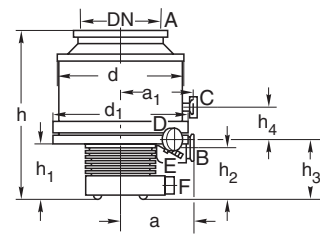
Accessories, optional	Part No.
Air cooling unit	
230 V AC	**855 41**
100 - 115 V AC	**800152V0017**
Flange heater	
DN 160 CF, 230 V, 50 Hz	**854 37**
DN 100 CF, 115 V, 60 Hz	**854 38**
Vibration absorber	
DN 160 ISO-K	**500 073**
DN 160 CF	**500 072**
Solenoid venting valve, with gas admission filter, normally closed	
24 V DC, DN 16 ISO-KF	**800120V0011**
Power failure venting valve, with gas admission filter, normally open	
24 V DC, DN 16 ISO-KF	**800120V0021**
Purge gas and venting valve	
gas flow at 1 bar 0.6 mbar x l x s^{-1} (36 sccm),	
pump connection DN 10 ISO-KF / gas connection G 1/4"	
230 V AC	**800152V0040**
100 - 115 V AC	**800152V0043**
24 V DC	**800152V0012**
Gas filter to G 1/4" for purge gas and venting valve	**800110V0012**
Replacement filter	**E 200 18 515**
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	**ISO-K**
Inlet screen	**CF**
Centering ring with O-ring, clamping ring	**Foreline Flange**
Pivoted threaded fittings to replace the included hose nipples	**Water Cooling**

Mechanical Rotor Suspension without Compound Stage

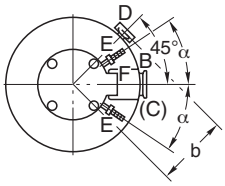
TURBOVAC 1000 C ClassicLine

Typical Applications

- Research systems



Bottom view



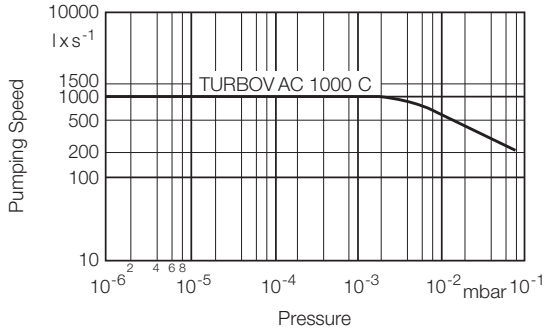
[1] DN 40 ISO-KF, cast base flange
[2] DN 63 ISO-K, screwed in

DN		h	h_1	h_2	h_3	h_4	a	a_1	b	∅d	∅d_1
160 ISO-K/40 ISO-KF [1]	mm	338	111	102	123	62	140	133	141	241	258
	in.	13.31	4.37	4.02	4.84	2.44	5.51	5.24	5.55	9.49	10.16
160 ISO-K/63 ISO-K [2]	mm	341	111	94	123	62	153	133	152	241	258
	in.	13.43	4.37	3.7	4.84	2.44	6.02	5.24	5.98	9.49	10.16
160 CF/40 ISO-KF [1]	mm	348	108	99	121	83	140	133	141	241	258
	in.	13.70	4.25	3.90	4.76	3.27	5.51	5.24	5.55	9.49	10.16
200 ISO-K/40 ISO-KF [1]	mm	351	111	102	123	62	140	133	141	241	258
	in.	13.82	4.37	4.02	4.84	2.44	5.51	5.24	5.55	9.49	10.16
200 CF/40 ISO-KF [1]	mm	336	108	99	121	83	140	133	141	241	258
	in.	13.23	4.25	3.90	4.76	3.27	5.51	5.24	5.55	9.49	10.16
250 ISO-K/40 ISO-KF [1]	mm	307	108	99	121	83	140	133	141	241	258
	in.	12.09	4.25	3.90	4.76	3.27	5.51	5.24	5.55	9.49	10.16
250 ISO-K/63 ISO-K ISO-KF [2]	mm	310	111	94	121	91	153	133	141	241	258
	in.	12.20	4.37	3.70	4.76	3.58	6.02	5.24	5.55	9.49	10.16

Dimensional drawing for the TURBOVAC 1000 C

Technical Features

- Robust rotor design
- Installation in any orientation
- Highest pumping speed and highest throughput
- Bearing temperature measurement through the TURBO.DRIVE TD 20 *classic*
- Seal gas connection
- Venting connection



Pumping speed for air as a function of intake pressure (TURBOVAC 1000 C with DN 250 flange)

Advantages to the User

- Installation in any orientation
- Highly reliable due to hybrid ceramic ball bearings
- Standard model: water cooling
- Purge gas facility

Technical Data

TURBOVAC 1000 C

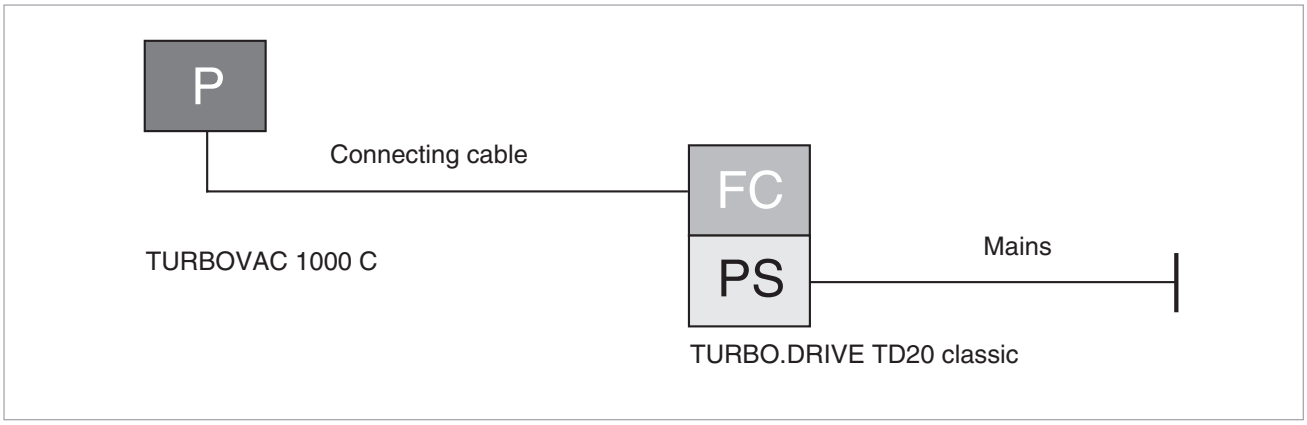
Connection				
Inlet	**DN**	160 ISO-K • 160 CF	200 ISO-K • 200 CF	250 ISO-K
Outlet	**DN**	40 ISO-KF • 63 ISO-K	40 ISO-KF	40 ISO-KF • 63 ISO-K
Pumping speed				
N_2	**l x s^{-1}**	850	1100	1150
Ar	**l x s^{-1}**	810	1050	1100
He	**l x s^{-1}**	880	975	1000
H_2	**l x s^{-1}**	900	970	1000
Gas throughput				
N_2	**mbar · l x s^{-1}**	6.5	6.5	6.5
Ar	**mbar · l x s^{-1}**	4.0	4.0	4.0
He	**mbar · l x s^{-1}**	7.0	7.0	7.0
H_2	**mbar · l x s^{-1}**	8.0	8.0	8.0
Compression ratio				
N_2		> 1 x 10^9	> 1 x 10^9	> 1 x 10^9
Ar		> 1 x 10^9	> 1 x 10^9	> 1 x 10^9
He		5 x 10^4	5 x 10^4	5 x 10^4
H_2		1 x 10^4	1 x 10^4	1 x 10^4
Ultimate pressure	**mbar (Torr)**	< 1 x 10^{-10} (< 7.5 x 10^{-11})	< 1 x 10^{-10} (< 7.5 x 10^{-11})	< 1 x 10^{-10} (< 7.5 x 10^{-11})
Max. foreline pressure for N_2	**mbar (Torr)**	5 x 10^{-2} (3.8 x 10^{-2})	5 x 10^{-2} (3.8 x 10^{-2})	5 x 10^{-2} (3.8 x 10^{-2})
Recommended forevacuum pump				
for standard operation		TRIVAC D 25 B / D 40 B	TRIVAC D 25 B / D 40 B	TRIVAC D 25 B / D 40 B
for purge gas operation		TRIVAC D 40 B / D 65 B	TRIVAC D 40 B / D 65 B	TRIVAC D 40 B / D 65 B
Nominal rotation speed	**min^{-1} (rpm)**	36 000	36 000	36 000
Run-up time, approx.	**min**	9	9	9
Max. power consumption	**W**	300	300	300
Power consumption at ultimate pressure	**W**	200	200	200
Admissible ambient temperature	**°C (°F)**	10 to 55 (50 to 131)	10 to 55 (50 to 131)	10 to 55 (50 to 131)
Cooling				
standard		Water	Water	Water
optional		Air	Air	Air
Cooling water connection		10 mm hose nozzle	10 mm hose nozzle	10 mm hose nozzle
Cooling water consumption	**l x h^{-1}**	20 to 80	20 to 80	20 to 80
Permissible cooling water pressure	**bar**	3 to 7	3 to 7	3 to 7
Permissible cooling water temperature	**°C (°F)**	10 to 30 (50 to 86)	10 to 30 (50 to 86)	10 to 30 (50 to 86)
Weight	**kg (lbs)**	25.0 (55.1)	25.0 (55.1)	25 (55.1)

Technical Data

TURBO.DRIVE TD 20 *classic*

Mains connection	**50/60 Hz**	100 to 240 V (+15 % / -10 %)
Max. power consumption	**W**	500
Max. output voltage	**V**	3 x 47
Max. output current	**A**	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	**IP**	20
Admissible ambient temperature	**°C (°F)**	0 to +45 (+32 to +113)
Dimensions (W x H x D)	**mm (in.)**	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	**kg (lbs)**	4.0 (8.8)

TURBOVAC 1000 C without Compound Stage P	Part No.	
DN 160 ISO-K / DN 40 ISO-KF, water-cooled	855 35	
DN 160 ISO-K / DN 63 ISO-K, water-cooled	855 38	
DN 160 CF / DN 40 ISO-KF, water-cooled	854 91	
DN 200 ISO-K / DN 40 ISO-KF, water-cooled	153 00	
DN 200 CF / DN 40 ISO-KF, water-cooled	117 64	
DN 250 ISO-K / DN 40 ISO-KF, water-cooled	855 36	
DN 250 ISO-K / DN 63 ISO-K, water-cooled	855 39	
Mandatory Accessories FC PS		
TURBO.DRIVE TD 20 *classic*		
without interface	800075V0001	
with RS 232 C interface	800075V0002	
with RS 485 C interface	800075V0004	
with Profibus	800075V0003	
with 25-pol I/O	800075V0005	
Connecting cable TURBOVAC - frequency converter		
3 m (10.5 ft)	857 65	
5 m (17.5 ft)	857 66	
10 m (35.0 ft)	857 67	
20 m (70.0 ft)	857 68	
50 m (175.0 ft)	800152V0008	
60 m (210.0 ft)	800152V0007	
80 m (280.0 ft)	800152V0080	
140 m (490.0 ft)	800152V0140	
Mains cable		
3 m (10.5 ft)		
EURO plug	800102V0002	
UK plug	800102V0003	
US plug 5-15 P	800102V1002	
2 m (7.5 ft)		
US plug 115 V AC	992 76 513	
Forevacuum pump		
TRIVAC D 25 B		
1 phase motor; 230 V, 50 Hz	112 75	
1 phase motor; 230 V, 50/60 Hz	113 35	
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	112 76	
TRIVAC D 40 B		
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	112 86	
3 phase motor; 200/346 V, 50 Hz / 208/360 V, 60 Hz	113 47	
TRIVAC D 65 B		
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	112 96	
3 phase motor; 230/346 V, 50 Hz / 208/360 V, 60 Hz	113 57	
SCROLLVAC SC 30 D		
1 phase motor; 200-230 V, 50/60 Hz	133 002	
1 phase motor; 100-115 V, 50/60 Hz	133 102	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V, 60 Hz	133 004	
For further types, see Catalog Parts “Oil Sealed Vacuum Pumps” and “Dry Compressing Vacuum Pumps”		



Ordering Information

TURBOVAC 1000 C

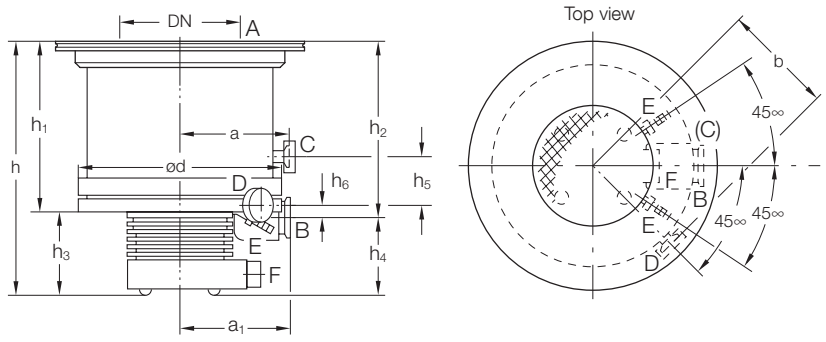
Accessories, optional	Part No.
Air cooling unit	
230 V AC	855 41
100 - 115 V AC	800152V0017
Flange heater	
DN 160 CF, 230 V, 50 Hz	854 37
DN 100 CF, 115 V, 60 Hz	854 38
Vibration absorber	
DN 160 ISO-K	500 073
DN 160 CF	500 072
Solenoid venting valve, with gas admission filter, normally closed	
24 V DC, DN 16 ISO-KF	800120V0011
Power failure venting valve, with gas admission filter, normally open	
24 V DC, DN 16 ISO-KF	800120V0021
Purge gas and venting valve	
gas flow at 1 bar 0.6 mbar x l x s^{-1} (36 sccm),	
pump connection DN 10 ISO-KF / gas connection G 1/4"	
230 V AC	800152V0040
100-115 V AC	800152V0043
24 V DC	800152V0012
Gas filter to G 1/4" for purge gas and venting valve	800110V0012
Replacement filter	E 200 18 515
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	ISO-K
Inlet screen	CF
Centering ring with O-ring, clamping ring	Foreline Flange
Pivoted threaded fittings to replace the included hose nipples	Water Cooling

Mechanical Rotor Suspension without Compound Stage

TURBOVAC 1100 C ClassicLine

Typical Applications

- Data storage
- Flat panel displays
- Optical coating
- Large area coating
- Load locks and transfer chambers

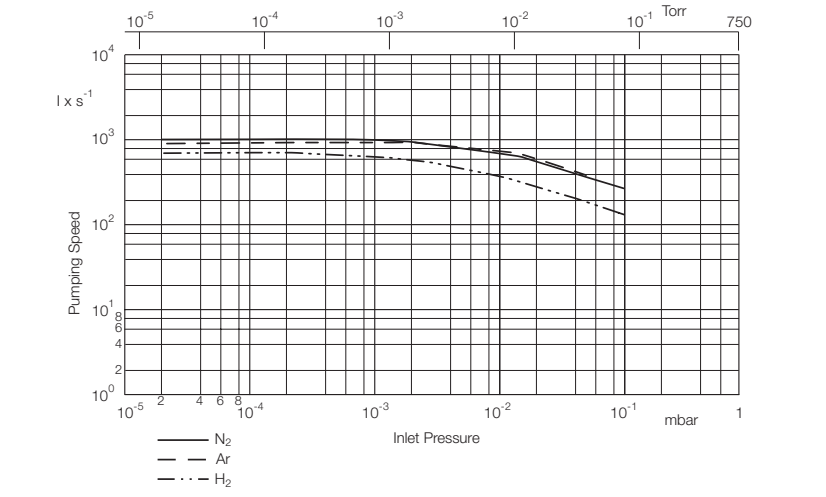


DN		h	h_1	h_2	h_3	h_4	h_5	h_6	a	a_1	b	d
160 ISO-K	mm	341	230	247	111	94	63	28.5	133	153	141	258
	in.	13.43	9.06	9.72	4.37	3.70	2.48	1.12	5.24	6.02	5.55	10.16
200 ISO-K	mm	325	214	231	111	94	63	28.5	133	153	141	258
	in.	12.80	8.43	9.09	4.37	3.70	2.48	1.12	5.24	6.02	5.55	10.16
250 ISO-K	mm	310	200	217	111	94	63	28.5	133	153	141	258
	in.	12.20	7.87	8.54	4.37	3.70	2.48	1.12	5.24	6.02	5.55	10.16

Dimensional drawing for the TURBOVAC 1100 C

Technical Features

- Robust rotor design
- Installation in any orientation
- Highest pumping speed and highest throughput
- Bearing temperature measurement through the TURBO.DRIVE TD 20 *classic*
- Oil-free pump for generating clean high and ultra-high vacuum conditions
- Seal gas connection
- Venting connection



Pumping speed as a function of the inlet pressure (TURBOVAC 1100 C with flange DN 250)

Advantages to the User

- Space-saving
- Easy to integrate into complex vacuum systems
- High productivity
- Low operating costs
- Highly reliable operation also in processes loaded with particles

Technical Data

TURBOVAC 1100 C

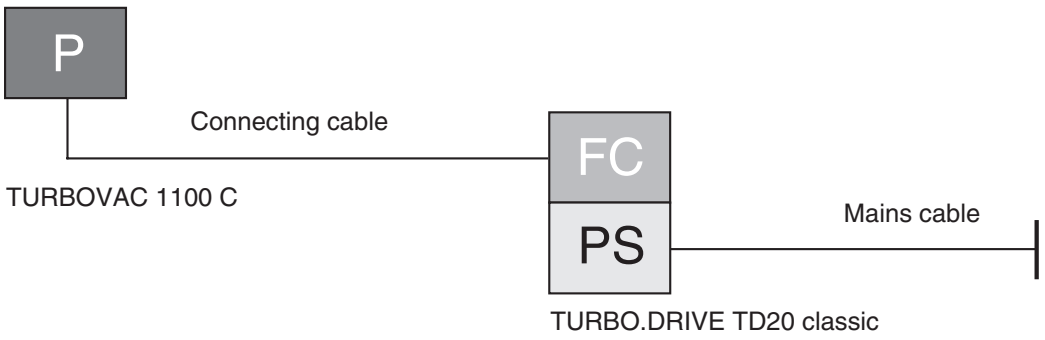
Connection				
Inlet	DN	160 ISO-K	200 ISO-K	250 ISO-K
Outlet	DN	63 ISO-K	63 ISO-K	63 ISO-K
Pumping speed				
N_2	l x s^{-1}	710	830	1050
Ar	l x s^{-1}	660	760	980
He	l x s^{-1}	650	750	850
H_2	l x s^{-1}	520	600	630
Gas throughput				
N_2	mbar · l x s^{-1}	6.5	6.5	6.5
Ar	mbar · l x s^{-1}	6.5	6.5	6.5
He	mbar · l x s^{-1}	8.0	8.0	8.0
H_2	mbar · l x s^{-1}	9.0	9.0	9.0
Compression ratio				
N_2		> 1 x 10^7	> 1 x 10^7	> 1 x 10^7
Ar		> 1 x 10^7	> 1 x 10^7	> 1 x 10^7
He		3 x 10^4	3 x 10^4	3 x 10^4
H_2		1 x 10^3	1 x 10^3	1 x 10^3
Ultimate pressure	mbar (Torr)	< 3.0 x 10^{-10} (< 2.3 x 10^{-10})	< 3.0 x 10^{-10} (< 2.3 x 10^{-10})	< 3.0 x 10^{-10} (< 2.3 x 10^{-10})
Max. foreline pressure for N_2	mbar (Torr)	< 1.0 x 10^{-1} (< 7.5 x 10^{-2})	< 1.0 x 10^{-1} (< 7.5 x 10^{-2})	< 1.0 x 10^{-1} (< 7.5 x 10^{-2})
Recommended forevacuum pump		TRIVAC D 65 B / SCROLLVAC SC 15/30 D	TRIVAC D 65 B / SCROLLVAC SC 15/30 D	TRIVAC D 65 B / SCROLLVAC SC 15/30 D
Nominal rotation speed	min^{-1} (rpm)	30 000	30 000	30 000
Run-up time, approx.	min	9	9	9
Max. power consumption	W	400	400	400
Power consumption at ultimate pressure	W	300	300	300
Admissible ambient temperature	°C (°F)	10 to 55 (50 to 131)	10 to 55 (50 to 131)	10 to 55 (50 to 131)
Cooling				
standard		Water	Water	Water
optional		Air	Air	Air
Cooling water connection		10 mm hose nozzle	10 mm hose nozzle	10 mm hose nozzle
Cooling water consumption	l x h^{-1}	24 to 60	24 to 60	24 to 60
Permissible cooling water pressure	bar	3 to 7	3 to 7	3 to 7
Permissible cooling water temperature	°C (°F)	10 to 30 (50 to 86)	10 to 30 (50 to 86)	10 to 30 (50 to 86)
Weight	kg (lbs)	22 (48)	22 (48)	22 (48)

Technical Data

TURBO.DRIVE TD 20 *classic*

Mains connection	50/60 Hz	100 to 240 V (+15 % / -10 %)
Max. power consumption	W	500
Max. output voltage	V	3 x 47
Max. output current	A	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	kg (lbs)	4.0 (8.8)

TURBOVAC 1100 C without Compound Stage P	Part No.	
DN 160 ISO-K / DN 63 ISO-K, water-cooled	800150V0030	
DN 200 ISO-K / DN 63 ISO-K, water-cooled	800150V0031	
DN 250 ISO-K / DN 63 ISO-K, water-cooled	800150V0032	
Mandatory Accessories FC PS		
TURBO.DRIVE TD 20 *classic*		
without interface	800075V0001	
with RS 232 C interface	800075V0002	
with RS 485 C interface	800075V0004	
with Profibus	800075V0003	
with 25-pol I/O	800075V0005	
Connecting cable TURBOVAC - frequency converter		
3 m (10.5 ft)	857 65	
5 m (17.5 ft)	857 66	
10 m (35.0 ft)	857 67	
20 m (70.0 ft)	857 68	
50 m (175.0 ft)	800152V0008	
60 m (210.0 ft)	800152V0007	
80 m (280.0 ft)	800152V0080	
140 m (490.0 ft)	800152V0140	
Mains cable		
3 m (10.5 ft)		
EURO plug	800102V0002	
UK plug	800102V0003	
US plug 5-15 P	800102V1002	
2 m (7.5 ft)		
US plug 115 V AC	992 76 513	
Forevacuum pump		
TRIVAC D 65 B		
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	112 96	
3 phase motor; 230/346 V, 50 Hz / 208/360 V, 60 Hz	113 57	
SCROLLVAC SC 30 D		
1 phase motor; 200-230 V, 50/60 Hz	133 002	
1 phase motor; 100-115 V, 50/60 Hz	133 102	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V, 60 Hz	133 004	
For further types, see Catalog Parts “Oil Sealed Vacuum Pumps” and “Dry Compressing Vacuum Pumps”		



Ordering Information

TURBOVAC 1100 C

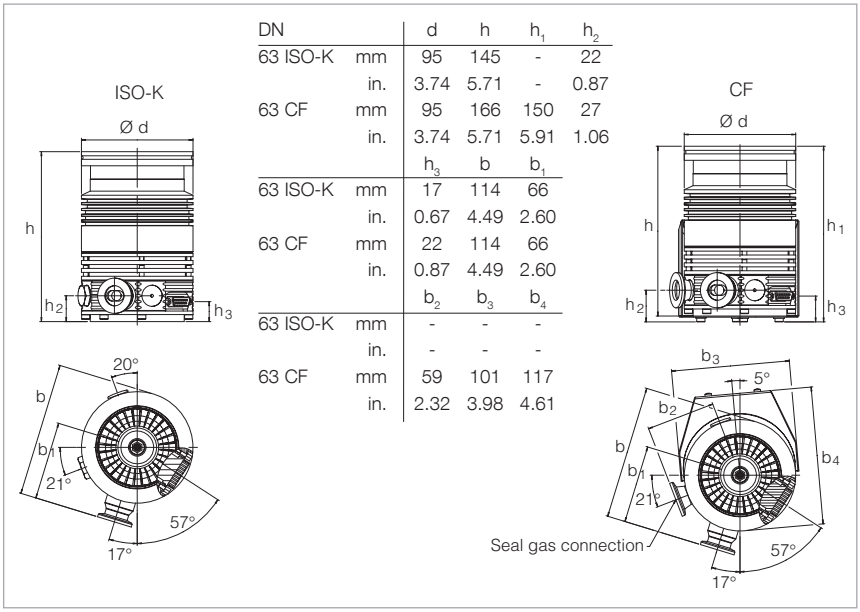
Accessories, optional	Part No.
Vibration absorber DN 160 ISO-K	**500 073**
Solenoid venting valve, with gas admission filter, normally closed 24 V DC, DN 16 ISO-KF	**800120V0011**
Power failure venting valve, with gas admission filter, normally open 24 V DC, DN 16 ISO-KF	**800120V0021**
Purge gas and venting valve gas flow at 1 bar 0.6 mbar x l x s^{-1} (36 sccm), pump connection DN 10 ISO-KF / gas connection G 1/4" 230 V AC 100-115 V AC 24 V DC	 **800152V0040** **800152V0043** **800152V0012**
Gas filter to G 1/4" for purge gas and venting valve	**800110V0012**
Replacement filter	**E 200 18 515**
Included in the Delivery of the Pump P	
Inlet screen, centering ring with FPM sealing ring, outer ring	**ISO-K**
Inlet screen	**CF**
Centering ring with O-ring, clamping ring	**Foreline Flange**
Pivoted threaded fittings to replace the included hose nipples	**Water Cooling**

Mechanical Rotor Suspension with Frequency Converter for Attaching or Separate with or without Compound Stage

TURBOVAC SL 80 / L 80 H / SL 80 C

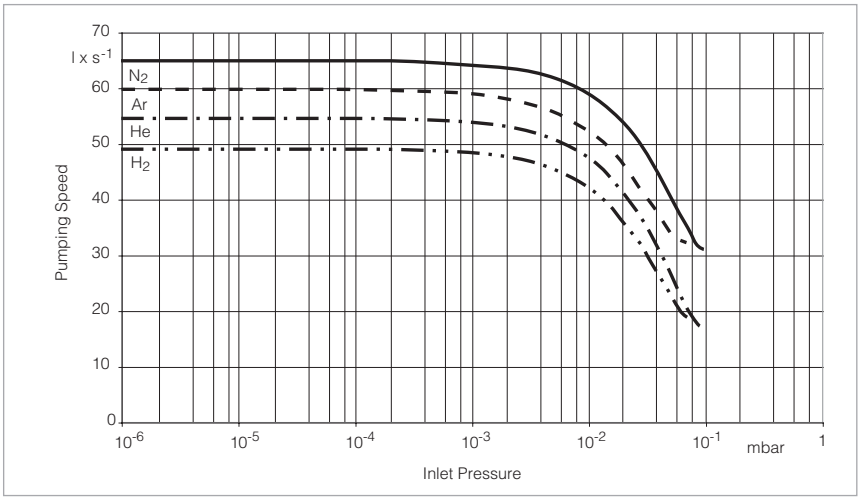
Typical Applications

- Helium leak detectors
- Mass spectrometers (gas chromatography GC-MS), liquid chromatography (LC-MS), residual gas analysis, mobile analytical systems, etc.)
- Electron beam microscopy
- XHV-/UHV systems
- Transfer chambers



DN		d	h	h_1	h_2
63 ISO-K	mm	95	145	-	22
	in.	3.74	5.71	-	0.87
63 CF	mm	95	166	150	27
	in.	3.74	5.71	5.91	1.06
		h_3	b	b_1	
63 ISO-K	mm	17	114	66	
	in.	0.67	4.49	2.60	
63 CF	mm	22	114	66	
	in.	0.87	4.49	2.60	
		b_2	b_3	b_4	
63 ISO-K	mm	-	-	-	
	in.	-	-	-	
63 CF	mm	59	101	117	
	in.	2.32	3.98	4.61	

Dimensional drawing for the TURBOVAC SL 80: attachment examples



Pumping speed as a function of the inlet pressure

Technical Features

- Oil-free pump
- High pressure foreline tolerance
- Excellent resistance to vibration due to proven mechanical bearings
- Efficient convection cooling due to a large number of cooling fins
- Purge gas/venting connection
- Installation in any orientation
- Flexible attachment of the frequency converter to the pump
- Small footprint
- Delayed venting through the frequency converter TURBO.DRIVE TD 400 (optional)
- Selection of interfaces, USB, RS 232 C, RS 485 C, Profibus

Advantages to the User

- Easy to integrate into complex vacuum systems
- Space-saving
- Prepared for pumping of slightly corrosive gases owing to the seal gas connection
- High reliability, MTTF over 200,000 hours
- Matching accessories (fan, water cooling, seal gas/venting valves, power failure venting valves, flange heaters, different cable lengths etc.)
- High reliability due to self-monitoring

Technical Data

TURBOVAC

		SL 80			SL 80 H		SL 80 C
Connection							
Inlet	DN	40 ISO-KF	63 ISO-K	63 CF	63 ISO-K	63 CF	63 ISO-K
Outlet	DN	16 ISO-KF			16 ISO-KF		16 ISO-KF
Pumping speed							
N_2	l x s^{-1}	40	65	65	65		70
Ar	l x s^{-1}	34	60	60	60		65
He	l x s^{-1}	44	55	55	55		50
H_2	l x s^{-1}	40	49	49	49		45
Gas throughput							
N_2	mbar · l x s^{-1}	2.0			0.9		3.5
Ar	mbar · l x s^{-1}	1.6			0.8		3.5
He	mbar · l x s^{-1}	1.2			1.5		2.0
H_2	mbar · l x s^{-1}	0.5			0.6		1.0
Compression ratio							
N_2		> 1 x 10^{11}			> 1 x 10^{11}		2 x 10^6
Ar		> 1 x 10^{11}			> 1 x 10^{11}		2 x 10^6
He		2 x 10^6			6 x 10^6		6 x 10^2
H_2		4 x 10^4			8 x 10^4		2 x 10^2
Ultimate pressure	mbar	< 2 x 10^{-10}			< 2 x 10^{-10}		< 5 x 10^{-8}
	Torr)	(< 1.5 x 10^{-10})			(< 1.5 x 10^{-10})		(< 4.0 x 10^{-8})
Max. foreline pressure for N_2	mbar (Torr)	16 (12)			16 (12)		0.35 (0.26)
Recommended forevacuum pump		TRIVAC D 2,5 E / D 4 B SCROLLVAC SC 5 D / 15 D DIVAC 1.4 HV3			TRIVAC D 2,5 E / D 4 B SCROLLVAC SC 5 D / 15 D DIVAC 1.4 HV3		TRIVAC D 2,5 E / D 4 B SCROLLVAC SC 5 D / 15 D –
Nominal rotation speed	min^{-1} (rpm)	72 000			72 000		72 000
Run-up time, approx.	min	1.5			1.5		1.5
Max. power consumption	W	120			120		120
Power consumption at ultimate pressure	W	17			17		17
Admissible ambient temperature	°C (°F)	+15 to +45 (+50 to +113)			+15 to +45 (+50 to +113)		+15 to +45 (+50 to +113)
Cooling							
standard		Convection			Convection		Convection
optional		Water / Air			Water / Air		Water / Air
Cooling water connection		G 1/8", inside thread / 8 mm hose nozzle			G 1/8", inside thread / 8 mm hose nozzle		G 1/8", inside thread / 8 mm hose nozzle
Cooling water consumption	l x h^{-1}	15 to 60			15 to 60		15 to 60
Permissible cooling water pressure	bar	2 to 7			2 to 7		2 to 7
Permissible cooling water temperature	°C (°F)	10 to 40 (50 to 104)			10 to 40 (50 to 104)		10 to 40 (50 to 104)
Weight, approx.	kg	1.8	1.9)	3.1	1.9	3.1	1.9
	(lbs)	(3.97)	(4.19)	(6.84)	(4.19)	(6.84)	(4.19)

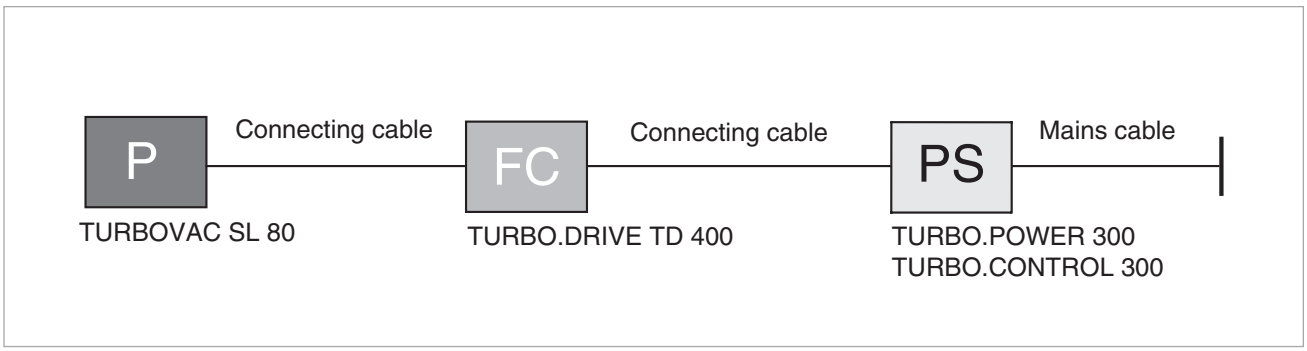
Technical Data

TURBO.DRIVE TD 400

Mains connection	V DC	24
Max. current consumption	A	8
Max. power consumption	W	190
Max. output voltage	V	3 x 24
Interface		USB, RS 232 C, RS 485 C or Profibus
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	+5 to +45 (+41 to +113)
Dimensions (W x H x D)	mm (in.)	100 x 90 x 100 (3.9 x 3.5 x 3.9)
Weight, approx.	kg (lbs)	0.7 (1.6)

TURBOVAC SL 80 P	Part No.	
with compound stage		
DN 40 ISO-KF	800002V3004	
DN 63 ISO-K / DN 16 ISO-KF	800002V3001	
DN 63 ISO-K / DN 16 ISO-KF (SL 80 H)	800002V3005	
DN 63 CF / DN 16 ISO-KF	800002V3002	
DN 63 CF / DN 16 ISO-KF (SL 80 H)	800002V3006	
without compound stage		
DN 63 ISO-K / DN 16 ISO-KF (SL 80 C)	800002V3008	
Mandatory Accessories P FC PS		
Electronic frequency converter TURBO.DRIVE TD 400		
with USB interface	800073V0008	
with RS 232 C interface	800073V0002	
with RS 485 C interface	800073V0003	
with Profibus	800073V0004	
Connecting cable pump - frequency converter		
0.2 m (0.7 ft)	800152V0021	
0.3 m (1.1 ft)	800152V0023	
0.4 m (1.4 ft)	800152V0022	
0.5 m (1.75 ft)	800152V0050	
1.0 m (3.5 ft)	152 47	
2.5 m (8.75 ft)	864 49	
3.0 m (10.5 ft)	864 40	
5,0 m (17.5 ft)	864 50	
10.0 m (35.0 ft)	800080V1000	
Power supply and control unit TURBO.CONTROL 300	800100V0001	
24 V connecting cable power supply - TURBO.CONTROL 300		
1 m (3.5 ft)	800091V0100	
3 m (10.5 ft)	800091V0300	
5 m (17.5 ft)	800091V0500	
10 m (35.0 ft)	800091V1000	
20 m (70.0 ft)	800091V2000	
Power supply TURBO.POWER 300	800100V0002	
24 V connecting cable power supply - TURBO.POWER 300		
1 m (3.5 ft)	800094V0100	
3 m (10.5 ft)	800094V0300	
5 m (17.5 ft)	800094V0500	
10 m (35.0 ft)	800094V1000	
20 m (70.0 ft)	800094V2000	
Mains cable 3 m (10.5 ft) - TURBO.CONTROL 300 / TURBO.POWER 300		
with EURO plug	800102V0002	
with UK plug	800102V0003	
with US plug 5-15 P	800102V1002	
with US plug 115 V AC, 2 m (7.5 ft)	992 76 513	
START/STOP switch for manual operation of the turbomolecular pump	152 48	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	140 000	
110-120 V / 220-240 V, 50/60 Hz, without plug, (world version)	140 001	
TRIVAC D 4 B		
1 phase EURO motor; 230 V, 50 Hz	112 45	
1 phase dual voltage motor; 100-120 V / 200-240 V; 50/60 Hz	140 081 [1]	
DIVAC 1.4 HV3		
90-230 V, 50/60 Hz	127 90 V	
SCROLLVAC SC 5 D		
1 phase motor; 200-230 V, 50/60 Hz	133 000	
1 phase motor; 100-115 V, 50/60 Hz	133 100	
SCROLLVAC SC 15 D		
1 phase motor; 200-230 V, 50/60 Hz	133 001	
1 phase motor; 100-115 V, 50/60 Hz	133 101	
3 phase motor; 380-415 V, 50 Hz / 200-230 V, 460 V, 60 Hz	133 003	
For further types, see Catalog Parts "Oil Sealed Vacuum Pumps" and "Dry Compressing Vacuum Pumps"		

[1] The mains cord (Part No. 200 81 091) must be ordered additionally



Ordering Information

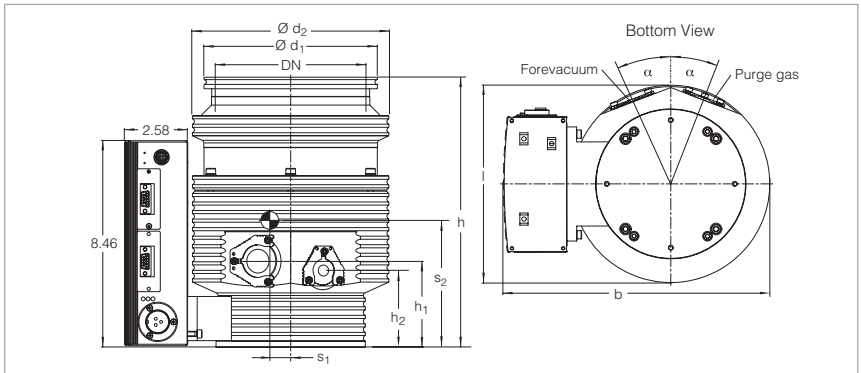
TURBOVAC

SL 80 / SL 80 H / SL 80 C

Accessories, optional (P FC PS)	Part No.
Mounting kit TD 400 for SL 80, incl. 0.2 m (0.7 ft.) long connecting cable pump - frequency converter	
for installing the frequency converter beside the pump	800110V0005
for installing the frequency converter beneath the pump (not for 800073V0007)	800110V0008
Water cooling unit with 2x G 1/8" connections, including 2 hose nozzles G 1/8" 8 mm (0.3 in.) OD, 2 gaskets (copper) 10 x 14 x 1 mm (0.4 x 0.6 x 0.04 in.) and hose clamps	800135V0001
Air cooling unit	800136V0001
Flange heater	
DN 63 CF, 230 V, 50 Hz	854 04
DN 63 CF, 115 V, 60 Hz	854 07
Inlet screen	
DN 40 ISO-KF	E 200 17 169
DN 63 ISO-K (coarse)	E 200 17 170
DN 63 CF (coarse)	E 200 17 171
Fine filter with centering ring	
DN 63 ISO-K	887 20
Vibration absorber	
DN 63 ISO-K	800131V0063
DN 63 CF	500 070
Pump connection adapter DN 10 ISO-KF / pump connection M 8 (incl. O-ring, filter and clamping ring)	800110V0011
Purge gas and venting valve	
gas flow at 1 bar 0.4 mbar x l x s^{-1} (24 sccm), pump connection DN 10 ISO-KF / gas connection G 1/4"	
230 V AC	800152V0014
100 - 115 V AC	800152V0042
24 V DC	800152V0013
Gas filter to G 1/4" for purge gas and venting valve	800110V0012
Replacement filter	E 200 18 515
Power failure venting valve, normally open	
24 V DC, DN 16 ISO-KF	800120V0021
Power failure venting valve, normally open	
24 V DC, DN 10 ISO-KF	174 46
230 V AC / 50/60 Hz, DN 10 ISO-KF	174 26
Hat rail adaptor as mounting aid	800110V0003
Fin type cooler	800110V0001

MAG INTEGRA - Magnetic Rotor Suspension with integrated Frequency Converter, with Compound Stage

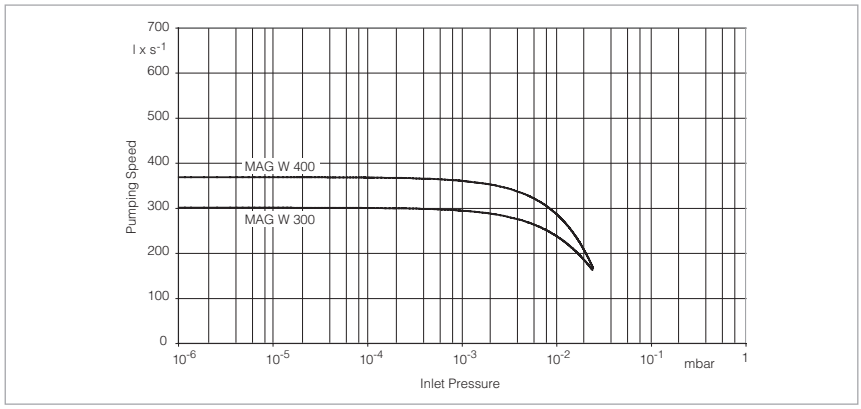
TURBOVAC MAG W 300/400 iP



		DN	⌀ d_1	⌀ d_2	h	h_1	h_2	l	b	b*	α	s_1	s_2
MAG W 300 iP	mm	100 ISO-K	130.0	155.0	250.0	77.7	70.0	156.0	250.0	233.0	16°	19.0	103.0
	in.		5.12	6.10	9.84	3.06	2.76	6.14	9.84	9.17	16°	0.75	4.06
	mm	100 CF	151.5	155.0	264.3	77.7	70.0	156.0	250.0	233.0	16°	15.0	129.0
	in.		5.96	6.10	10.41	3.06	2.76	6.14	9.84	9.17	16°	0.59	5.08
MAG W 400 iP	mm	160 ISO-K	180.0	155.0	241.0	77.7	70.0	168.5	262.5	245.5	16°	19.0	106.0
	in.		7.09	6.10	9.49	3.06	2.76	6.63	10.33	9.67	16°	0.75	4.17
	mm	160 CF	202.5	155.0	234.7	77.7	70.0	181.2	273.7	256.7	16°	14.0	129.0
	in.		7.97	6.10	9.24	3.06	2.76	9.13	10.78	10.11	16°	0.55	5.08

b* = width with plug of the DRIVE/BEARING cable connected instead of MAG.DRIVE iS

Dimensional drawing for the TURBOVAC MAG W 300/400 iP



Pumping speed for N_2 of the TURBOVAC MAG W 300/400 iP as a function of the inlet pressure

Typical Applications

- Gas analysis systems
- Particle accelerators
- Electron microscopes
- Research
- Coating systems

Technical Features

- Installation in any orientation
- DN 100 or 160 ISO-K and/or CF high vacuum connection
- DN 16 ISO-KF with clamped fore vacuum connection
- Purge gas/venting connection DN 16 ISO-KF with clamped connection (purge/vent)
- Water or air cooling optional
- 2 slots for industrial communications modules
  - Standard 9 pin 24 V SPS PLC-IO in Control Slot
  - RS 232 C in Service Slot
  - further interfaces can be fitted: Profibus, RS 485 C, DeviceNet, EtherNet IP, EtherCat

Advantages to the User

- Highest pumping speed from the smallest possible size
- New standard regarding maintenance-free systems
- Suitability for vibration sensitive applications in the area of analytical engineering, thin-film technology, electron microscopes, research, development among others
- Flexibility due to the modular concept; the converter is optionally also available by way of a bench top unit

Technical Data

TURBOVAC MAG

		W 300 iP		W 400 iP	
Inlet flange	DN	100 ISO-K	100 CF	160 ISO-K	160 CF
Pumping speed					
N_2	l x s^{-1}	300	300	365	365
Ar	l x s^{-1}	260	260	330	330
He	l x s^{-1}	260	260	280	280
H_2	l x s^{-1}	190	190	200	200
Operating speed	min^{-1}	58 800	58 800	58 800	58 800
Compression ratio					
N_2		1.0×10^{10}	1.0×10^{10}	1.0×10^{10}	1.0×10^{10}
H_2		3.2×10^{3}	3.2×10^{3}	3.2×10^{3}	3.2×10^{3}
He		9.2×10^{4}	9.2×10^{4}	9.2×10^{4}	9.2×10^{4}
Ultimate pressure	mbar (Torr)	$< 10^{-8}$ ($< 0.75 \times 10^{-8}$)	$< 10^{-10}$ ($< 0.75 \times 10^{-10}$)	$< 10^{-8}$ ($< 0.75 \times 10^{-8}$)	$< 10^{-10}$ ($< 0.75 \times 10^{-10}$)
Max. degassing temperature	°C (°F)	–	80 (176)	–	80 (176)
Max. foreline pressure for N_2	mbar (Torr)	8 (6)	8 (6)	8 (6)	8 (6)
Recommended backing pump		TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B
Run-up time	min	< 5	< 5	< 5	< 5
Foreline flange (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Purge / vent port (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Water cooling connection (optional)	G	1/8"	1/8"	1/8"	1/8"
Weight, approx.	kg (lbs)	12 (26)	12 (26)	12 (26)	12 (26)

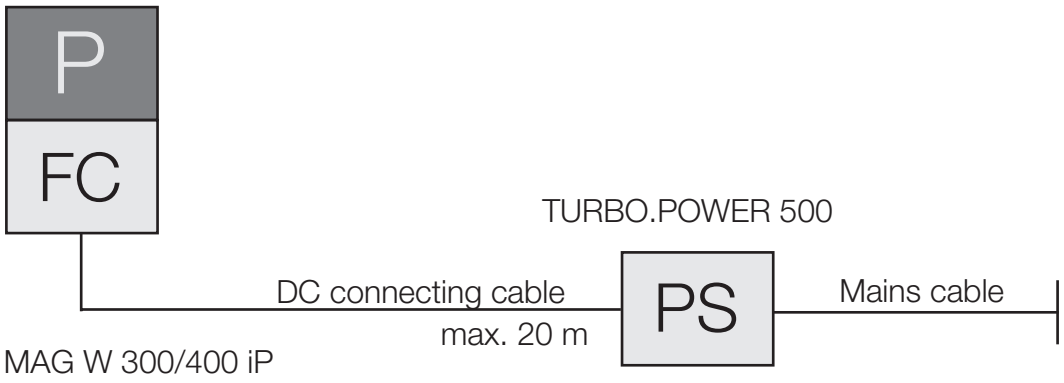
Technical Data

Integrated Frequency Converter TURBO.DRIVE iS

Power supply	V	48	48	48	48
Ripple	%	< 2	< 2	< 2	< 2
Power consumption					
maximum	W	400	400	400	400
at ultimate pressure	W	259	259	259	259
DC current consumption, max.	A	7.5 to 9.3	7.5 to 9.3	7.5 to 9.3	7.5 to 9.3
DC power supply voltage range	V	43 to 53	43 to 53	43 to 53	43 to 53
Length of the DC connection cable, max.					
at 3 x 1.5 mm^2	m (ft)	5 (17.5)	5 (17.5)	5 (17.5)	5 (17.5)
at 3 x 2.5 mm^2	m (ft)	20 (70.0)	20 (70.0)	20 (70.0)	20 (70.0)
Contact rating for the relays, max.		32 V; 0,5 A	32 V; 0,5 A	32 V; 0,5 A	32 V; 0,5 A
Permissible ambient temperature					
during operation	°C	+10 to +40	+10 to +40	+10 to +40	+10 to +40
	(°F)	(+50 to +104)	(+50 to +104)	(+50 to +104)	(+50 to +104)
during storage	°C	0 to +60	0 to +60	0 to +60	0 to +60
	(°F)	(0 to +140)	(0 to +140)	(0 to +140)	(0 to +140)
Relative humidity of the air, non-condensing	%	5 to 85	5 to 85	5 to 85	5 to 85
Protection class	IP	30	30	30	30
Overvoltage category		II	II	II	II
Pollution category		2	2	2	2

	Part No.	
TURBOVAC MAG W 300 iP P FC **with Integrated Frequency Converter and Seal Gas Connection**		
DN 100 ISO-K	**410300V0505**	
DN 100 CF	**410300V0506**	
TURBOVAC MAG W 400 iP P FC **with Integrated Frequency Converter and Seal Gas Connection**		
DN 160 ISO-K	**410400V0505**	
DN 160 CF	**410400V0506**	
Mandatory Accessories P FC		
Power supply TURBO.POWER 500	**410300V0221**	
DC cable frequency converter - power supply		
1 m (3.5 ft)	**410300V2001**	
3 m (10.5 ft)	**410300V2003**	
5 m (17.5 ft)	**410300V2005**	
10 m (35.0 ft)	**410300V2010**	
20 m (70.0 ft)	**410300V2020**	
Mains cable, 3 m (10.5 ft)		
with EURO plug	**800102V0002**	
with US plug 5-15 P	**800102V1002**	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	**140 000**	
110-120 V, 50/60 Hz; NEMA plug, US version	**140 002**	
TRIVAC D 8 B		
1 phase motor; 230 V, 50/60 Hz	**112 55**	
3 phase motor; 230/400 V, 50 Hz; 250/440 V, 60 Hz	**112 56**	

With integrated Frequency Converter

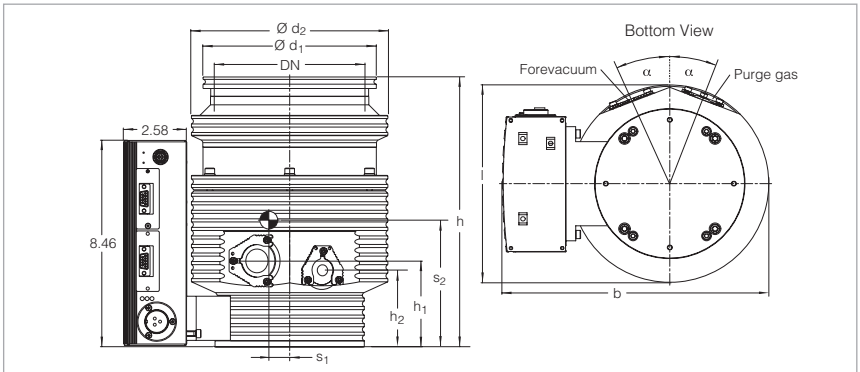


Ordering Information **TURBOVAC MAG W 300/400 iP**

Accessories, optional P	Part No.
Inlet screen	
DN 100 ISO-K	
coarse (3.2 x 3.2 mm (0.13 x 0.13 in.))	800132V0101
fine (1.6 x 1.6 mm (0.06 x 0.06 in.))	800132V0102
DN 100 CF	
coarse (3.2 x 3.2 mm (0.13 x 0.13 in.))	200 91 514
fine (1.6 x 1.6 mm (0.06 x 0.06 in.))	E 200 17 195
DN 160 ISO-K	E 200 00 307
DN 160 CF	E 200 17 247
Flange heater	
100 CF, 230 V, 50 Hz	854 27
100 CF, 115 V, 60 Hz	854 28
160 CF, 230 V, 50 Hz	854 37
160 CF, 115 V, 60 Hz	854 38
Water cooling unit	410300V0101
Air cooling unit	410300V0102
START/STOP switch for manual operation of the turbomolecular pump	152 48
DC plug	800 001 694
Solenoid venting valve, normally closed	
24 V DC, DN 16 ISO-KF	800120V0011
Power failure venting valve, normally open	800120V0021
Included in the Delivery of the Pump P	
Flanges for forevacuum, venting and purge gas are blank-flanged	
Centering ring with FPM sealing ring and a clamping yoke	

MAG INTEGRA - Magnetic Rotor Suspension with integrated Frequency Converter, with Compound Stage

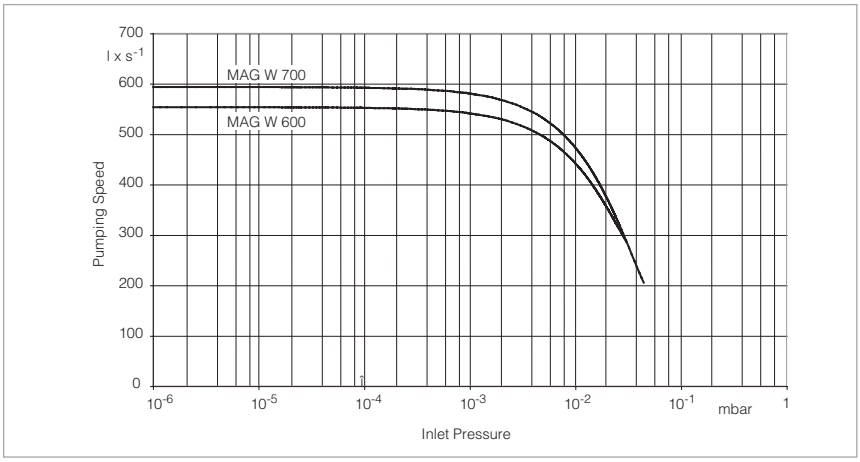
TURBOVAC MAG W 600/700 iP



		DN	⌀ d_1	⌀ d_2	h	h_1	h_2	l	b	b*	α	s_1	s_2
MAG W 600 iP	mm	160 ISO-K	180.0	204.0	281.5	90	80	204.0	274.5	257.5	21°	13.0	121.0
	in.		7.09	8.03	11.08	3.54	3.15	8.03	10.81	10.14	21°	0.51	4.76
	mm	160 CF	202.5	204.0	294.0	90	80	204.0	274.5	257.5	21°	10.0	150.0
	in.		7.97	8.03	11.57	3.54	3.15	8.03	10.81	10.14	16°	0.39	5.91
MAG W 700 iP	mm	200 ISO-K	240.0	204.0	280.5	90	80	240.0	292.5	275.5	21°	13.0	130.0
	in.		9.45	8.03	11.04	3.54	3.15	9.45	11.52	10.85	21°	0.51	5.12
	mm	200 CF	253.0	204.0	275.0	90	80	253.0	299.0	282.0	21°	9.0	156.0
	in.		9.96	8.03	10.83	3.54	3.15	9.96	11.77	11.10	21°	0.35	6.14

b* = width with plug of the DRIVE/BEARING cable connected instead of MAG.DRIVE iS

Dimensional drawing for the TURBOVAC MAG W 600/700 iP



Pumping speed for N_2 of the TURBOVAC MAG W 600/700 iP as a function of the inlet pressure

Typical Applications

- Gas analysis systems
- Particle accelerators
- Electron microscopes
- Research
- Coating systems

Technical Features

- Installation in any orientation
- DN 160 or 200 ISO-K and/or CF high vacuum connection
- DN 25 ISO-KF with clamped fore-vacuum connection
- Purge gas/venting connection DN 16 ISO-KF with clamped connection (purge/vent)
- Water or air cooling optional
- 2 slots for industrial communications modules
  - Standard 9 pin 24 V SPS PLC-IO in Control Slot
  - RS 232 C in Service Slot
  - further interfaces can be fitted: Profibus, RS 485 C, DeviceNet, EtherNet IP, EtherCat

Advantages to the User

- Highest pumping speed from the smallest possible size
- New standard regarding maintenance-free systems
- Suitability for vibration sensitive applications in the area of analytical engineering, thin-film technology, electron microscopes, research, development among others
- Flexibility due to the modular concept; the converter is optionally also available by way of a bench top unit

Technical Data

TURBOVAC MAG

		W 600 iP		W 700 iP	
Inlet flange	DN	160 ISO-K	160 CF	200 ISO-K	200 CF
Pumping speed					
N_2	l x s^{-1}	550	550	590	590
Ar	l x s^{-1}	520	520	540	540
He	l x s^{-1}	570	570	600	600
H_2	l x s^{-1}	410	410	430	430
Operating speed	min^{-1}	48 000	48 000	48 000	48 000
Compression ratio					
N_2		1.6×10^{10}	1.6×10^{10}	1.6×10^{10}	1.6×10^{10}
H_2		3.4×10^{4}	3.4×10^{4}	3.4×10^{4}	3.4×10^{4}
He		1.7×10^{6}	1.7×10^{6}	1.7×10^{6}	1.7×10^{6}
Ultimate pressure	mbar	$< 10^{-8}$	$< 10^{-10}$	$< 10^{-8}$	$< 10^{-10}$
	(Torr)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)
Max. degassing temperature	°C (°F)	–	80 (176)	–	80 (176)
Max. foreline pressure for N_2	mbar (Torr)	6.0 (4.5)	6.0 (4.5)	6.0 (4.5)	6.0 (4.5)
Recommended backing pump		TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B
Run-up time	min	< 6	< 6	< 6	< 6
Foreline flange (clamped)	DN	25 ISO-KF	25 ISO-KF	25 ISO-KF	25 ISO-KF
Purge / vent port (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Water cooling connection (optional)	G	1/8"	1/8"	1/8"	1/8"
Weight, approx.	kg (lbs)	17 (37.5)	17 (37.5)	17 (37.5)	17 (37.5)

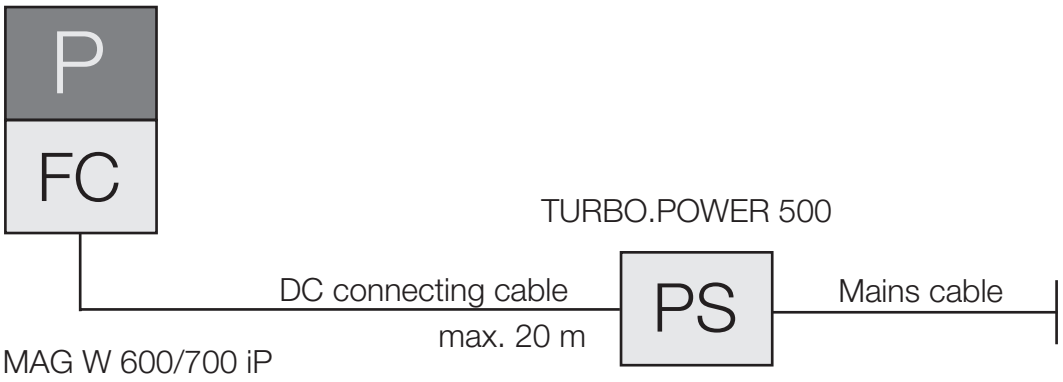
Technical Data

Integrated Frequency Converter TURBO.DRIVE iS

Power supply	V	48	48	48	48
Ripple	%	< 2	< 2	< 2	< 2
Power consumption					
maximum	W	400	400	400	400
at ultimate pressure	W	259	259	259	259
DC current consumption, max.	A	7.5 to 9.3	7.5 to 9.3	7.5 to 9.3	7.5 to 9.3
DC power supply voltage range	V	43 to 53	43 to 53	43 to 53	43 to 53
Length of the DC connection cable, max.					
at 3 x 1.5 mm^2	m (ft)	5 (17.5)	5 (17.5)	5 (17.5)	5 (17.5)
at 3 x 2.5 mm^2	m (ft)	20 (70.0)	20 (70.0)	20 (70.0)	20 (70.0)
Contact rating for the relays, max.		32 V; 0,5 A	32 V; 0,5 A	32 V; 0,5 A	32 V; 0,5 A
Permissible ambient temperature					
during operation	°C	+10 to +40	+10 to +40	+10 to +40	+10 to +40
	(°F)	(+50 to +104)	(+50 to +104)	(+50 to +104)	(+50 to +104)
during storage	°C	0 to +60	0 to +60	0 to +60	0 to +60
	(°F)	(0 to +140)	(0 to +140)	(0 to +140)	(0 to +140)
Relative humidity of the air, non-condensing	%	5 to 85	5 to 85	5 to 85	5 to 85
Protection class	IP	30	30	30	30
Overvoltage category		II	II	II	II
Pollution category		2	2	2	2

	Part No.	
TURBOVAC MAG W 600 iP P FC **with Integrated Frequency Converter and Seal Gas Connection**		
DN 160 ISO-K	**410600V0505**	
DN 160 CF	**410600V0506**	
TURBOVAC MAG W 700 iP P FC **with Integrated Frequency Converter and Seal Gas Connection**		
DN 200 ISO-K	**410700V0505**	
DN 200 CF	**410700V0506**	
Mandatory Accessories P FC		
Power supply TURBO.POWER 500	**410300V0221**	
DC cable frequency converter - power supply		
1 m (3.5 ft)	**410300V2001**	
3 m (10.5 ft)	**410300V2003**	
5 m (17.5 ft)	**410300V2005**	
10 m (35.0 ft)	**410300V2010**	
20 m (70.0 ft)	**410300V2020**	
Mains cable, 3 m (10.5 ft)		
with EURO plug	**800102V0002**	
with US plug 5-15 P	**800102V1002**	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	**140 000**	
110-120 V, 50/60 Hz; NEMA plug, US version	**140 002**	
TRIVAC D 8 B		
1 phase motor; 230 V, 50/60 Hz	**112 55**	
3 phase motor; 230/400 V, 50 Hz; 250/440 V, 60 Hz	**112 56**	

With integrated Frequency Converter

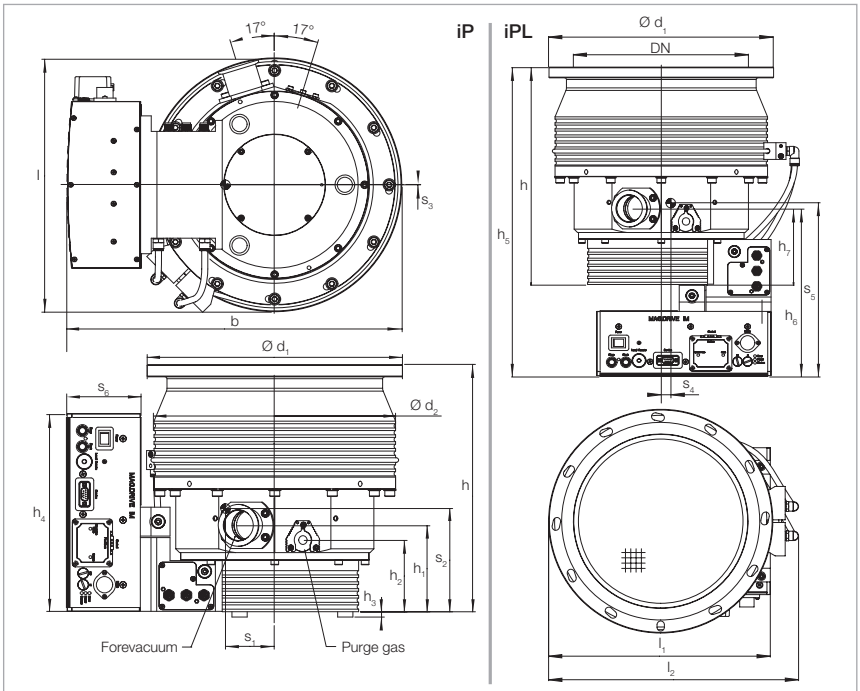


Ordering Information **TURBOVAC MAG W 600/700 iP**

Accessories, optional P	Part No.
Inlet screen	
DN 160 ISO-K	**E 200 00 307**
DN 160 CF	**E 200 17 247**
DN 200 ISO-K	**200 91 639**
DN 200 CF	**400 001 515**
Flange heater	
160 CF, 230 V, 50 Hz	**854 37**
160 CF, 115 V, 60 Hz	**854 38**
Water cooling unit	**410600V0101**
Air cooling unit	**410600V0102**
START/STOP switch for manual operation of the turbomolecular pump	**152 48**
DC plug	**800 001 694**
Solenoid venting valve, normally closed	
24 V DC, DN 16 ISO-KF	**800120V0011**
Power failure venting valve, normally open	**800120V0021**
Included in the Delivery of the Pump P	
Flanges for forevacuum, venting and purge gas are blank-flanged	
Centering ring with FPM sealing ring and a clamping yoke	

MAG INTEGRA - Magnetic Rotor Suspension with integrated Frequency Converter, with Compound Stage

TURBOVAC MAG W 1300 iP(L) to 2200 iP(L)



Type	DN		b	d_1	d_2	h	h_1	h_2	h_3	h_4	h_5	h_6
MAG W 1300	200 ISO-F	mm	420 [1]	285	285	305	114	94	7	260	442	251
		in.	16.54 [1]	11.22	11.22	12.01	4.49	3.70	0.38	10.24	17.40	9.88
	200 CF	mm	416	254	285	335	114	94	7	260	472	251
		in.	16.38	10.00	11.22	13.19	4.49	3.70	0.38	10.24	18.58	9.88
MAG W 1600/1700	250 ISO-F	mm	442	335	317	325	114	94	7	260	463	251
		in.	17.40	13.19	12.48	12.80	4.49	3.70	0.38	10.24	18.23	9.88
	250 CF	mm	432	305	317	330	114	94	7	260	467	251
		in.	17.01	12.01	12.48	12.99	4.49	3.70	0.38	10.24	18.39	9.88
MAG W 2200	250 ISO-F	mm	450	335	349	355	114	94	7	260	492	251
		in.	17.18	13.19	13.74	13.19	4.49	3.70	0.38	10.24	19.37	9.88
	250 CF	mm	446	305	349	372	114	94	7	260	506	251
		in.	17.56	12.01	13.74	14.65	4.49	3.70	0.38	10.24	19.92	9.88

			h_7	l	l_1	l_2	s_1	s_2	s_3	s_4	s_5	s_6
MAG W 1300	200 ISO-F	mm	114	311 [1]	311 [1]	332 [1]	42	140	0	15	241	98
		in.	4.49	12.24 [1]	12.24 [1]	13.07 [1]	1.65	5.51	0	0.59	9.49	3.86
	200 CF	mm	114	307	307	–	32	164	0	–	–	98
		in.	4.49	12.09	12.09	–	1.26	6.46	0	–	–	3.86
MAG W 1600/1700	250 ISO-F	mm	114	335	331	374	39	154	0	14	259	98
		in.	4.49	13.19	12.24	14.72	1.54	6.06	0	0.55	10.20	3.86
	250 CF	mm	114	335	322	–	29	173	0	9	285	98
		in.	4.49	13.19	12.68	–	1.14	6.81	0	0.35	11.22	3.86
MAG W 2200	250 ISO-F	mm	114	343	340	392	34	165	0	12	272	98
		in.	4.49	13.50	13.39	15.43	1.34	6.50	0	0.47	10.71	3.86
	250 CF	mm	114	339	340	–	26	187	0	8	302	98
		in.	4.49	13.35	13.39	–	1.02	7.36	0	0.32	11.89	3.86

[1] 4 mm (o.16 in.) for cooling coil

Dimensional drawing for the MAG INTEGRA, dimensions in mm

Typical Applications

- PVD coatings systems
- Coating of architectural glass
- Optical coatings
- LC displays
- Flat panels
- Research
- Analytical systems

Technical Features

- Installation in any orientation
- DN 200 and/or 250 in ISO-F and/or CF high vacuum connection
- DN 40 KF forevacuum connection
- Purge gas/venting connection DN 16 KF with clamped connection (purge/vent)
- Water cooling
- Protection class IP 54
- 2 slots for industrial communications modules
  - Standard ProfiBus
  - RS 232 C in Service Slot
  - further interfaces can be fitted: RS 485 C, 9 pin 24 V PLC, DeviceNet, EtherNet IP, EtherCat

Advantages to the User

- Highest pumping speed and gas throughput from a very small size
- Rugged and reliable operation in industrial applications
- Sets new benchmarks for maintenance-free systems
- Suited for vibration sensitive applications in the areas of analytical, thin-film, electron microscopy, research and development among others.
- Flexibility through the modular concept; the converter is either attached to the side or under the pump

Technical Data

TURBOVAC MAG W

		1300 iP(L)	1600 iP(L) Booster	1700 iP(L)	2200 iP(L)
Inlet flange	DN	200 ISO-F 200 CF	250 ISO-F	250 ISO-F 250 CF	250 ISO-F 250 CF
Pumping speed					
N_2	l x s^{-1}	1100	1600	1610	2100
Ar	l x s^{-1}	1050	1470	1480	1900
He	l x s^{-1}	1220	1770	1710	2050
H_2	l x s^{-1}	1130	1570	1660	1750
Operating speed	min^{-1}	37 800	33 000	33 000	30 600
standby speed adjustable from	min^{-1}	13 800 (230 Hz)	13 800 (230 Hz)	13 800 (230 Hz)	13 800 (230 Hz)
to nominal speed					
Max. compression ratio					
N_2		> 10^8	> 10^7	> 10^8	> 10^8
Ar		> 10^8	> 10^7	> 10^8	> 10^8
He at 1 sccm		2.0 x 10^5	6.0 x 10^4	2.0 x 10^5	5.0 x 10^4
H_2 at 1 sccm		8.0 x 10^3	1.0 x 10^3	4.0 x 10^3	5.0 x 10^3
Max. gas throughput					
N_2 briefly, e.g. during pumpdown	mbar x l x s^{-1}	30	60	30	30
N_2 in continuous operation	mbar x l x s^{-1}	20	30	20	17
Ar briefly, e.g. during pumpdown	mbar x l x s^{-1}	20	30	20	20
Ar in continuous operation	mbar x l x s^{-1}	15	20	15	12
Ultimate pressure					
ISO-F flange	mbar (Torr)	< 10^{-8} (< 7.5 x 10^{-9})	< 10^{-8} (< 7.5 x 10^{-9})	< 10^{-8} (< 7.5 x 10^{-9})	< 10^{-8} (< 7.5 x 10^{-9})
CF flange	mbar (Torr)	< 10^{-10} (< 7.5 x 10^{-11})	–	< 10^{-10} (< 7.5 x 10^{-11})	< 10^{-10} (< 7.5 x 10^{-11})
Max. degassing temperature	°C (°F)	80 (176)	80 (176)	80 (176)	80 (176)
Max. foreline pressure					
N_2	mbar (Torr)	4.0 (3.00)	1.0 (0.75)	4.0 (3.00)	2.5 (1.9)
Ar	mbar (Torr)	0.6 (0.45)	1.0 (0.75)	0.6 (0.45)	2.5 (1.9)
Recommended backing pump		TRIVAC B or dry compressing pumps			
Run-up time	min	< 5	< 7	< 7	< 10
Foreline flange	DN	40 KF	40 KF	40 KF	40 KF
Purge / vent port (clamped)	DN	16 KF	16 KF	16 KF	16 KF
Water cooling connection	G	1/8"	1/8"	1/8"	1/8"
Weight, approx.	kg (lbs)	40 (88)	45 (99)	45 (99)	50 (110)
Noise level acc. ISO 3744	dB(A)	< 41	< 41	< 41	< 41
Vibration level at high vacuum flange at max. speed	µm	0.01	0.01	0.01	0.01

Technical Data

Integrated Frequency Converter

MAG.DRIVE iM

Power supply	V	200 - 240 ±10%
Mains frequency	Hz	50 / 60
Power consumption		
maximum	W	750
at ultimate pressure	W	150
Contact rating for the relays, max.		32 V, 0.5 A
Permissible ambient temperature		
during operation	°C (°F)	+10 to +45 (+50 to +113)
during storage	°C (°F)	-10 to +60 (+14 to +140)
Relative humidity of the air, non-condensing	%	5 to 85
Protection class	IP	54
Overvoltage category		II
Pollution category		2

Ordering Information

TURBOVAC MAG
W 1300/1600/1700/2200 iP(L)

TURBOVAC MAG W 1300 P FC PS with Integrated Frequency Converter and Purge Gas Connection	Part No.	
MAG W 1300 iP, DN 200 ISO-F, Profibus	411300V0504	
MAG W 1300 iP, DN 200 ISO-F, 24 V SPS interface	411300V0514	
MAG W 1300 iP, DN 200 CF, Profibus	411300V0506	
MAG W 1300 iP, DN 200 CF, 24 V SPS interface	411300V0516	
MAG W 1300 iPL, DN 200 ISO-F, Profibus	411300V0704	
MAG W 1300 iPL, DN 200 ISO-F, 24 V SPS interface	411300V0714	
MAG W 1300 iPL, DN 200 CF, Profibus	411300V0706	
MAG W 1300 iPL, DN 200 CF 24 V SPS interface	411300V0716	
TURBOVAC MAG W 1600 Booster P FC PS with Integrated Frequency Converter and Purge Gas Connection		
MAG W 1600 iP Booster, DN 250 ISO-F, Profibus	411600V0504	
MAG W 1600 iP Booster, DN 250 ISO-F, 24 V SPS interface	411600V0514	
MAG W 1600 iPL Booster, DN 250 ISO-F, Profibus	411600V0704	
MAG W 1600 iPL Booster, DN 250 ISO-F, 24 V SPS interface	411600V0714	
TURBOVAC MAG W 1700 P FC PS with Integrated Frequency Converter and Purge Gas Connection		
MAG W 1700 iP, DN 250 ISO-F, Profibus	411700V0504	
MAG W 1700 iP, DN 250 ISO-F, 24 V SPS interface	411700V0514	
MAG W 1700 iP, DN 250 CF, Profibus	411700V0506	
MAG W 1700 iP, DN 250 CF, 24 V SPS interface	411700V0516	
MAG W 1700 iPL, DN 250 ISO-F, Profibus	411700V0704	
MAG W 1700 iPL, DN 250 ISO-F, 24 V SPS interface	411700V0714	
MAG W 1700 iPL, DN 250 CF, Profibus	411700V0706	
MAG W 1700 iPL, DN 250 CF, 24 V SPS interface	411700V0716	
TURBOVAC MAG W 2200 P FC PS with Integrated Frequency Converter and Purge Gas Connection		
MAG W 2200 iP, DN 250 ISO-F, Profibus	412200V0504	
MAG W 2200 iP, DN 250 ISO-F, 24 V SPS interface	412200V0514	
MAG W 2200 iP, DN 250 CF, Profibus	412200V0506	
MAG W 2200 iP, DN 250 CF, 24 V SPS interface	412200V0516	
MAG W 2200 iPL, DN 250 ISO-F, Profibus	412200V0704	
MAG W 2200 iPL, DN 250 ISO-F, 24 V SPS interface	412200V0714	
MAG W 2200 iPL, DN 250 CF, Profibus	412200V0706	
MAG W 2200 iPL, DN 250 CF, 24 V SPS interface	412200V0716	
Other interfaces upon request		

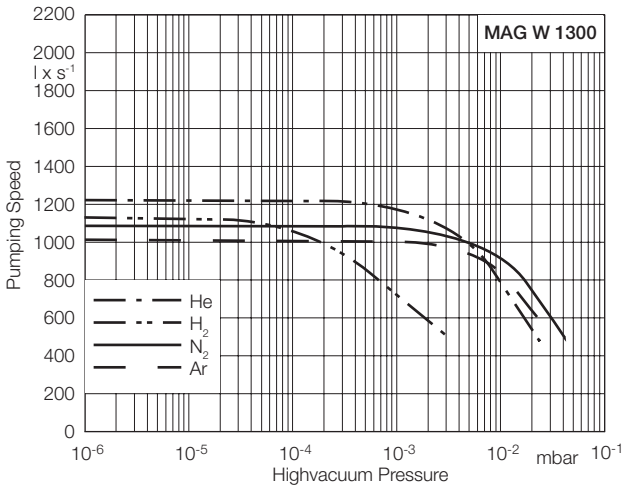
With integrated Frequency Converter and Power Supply

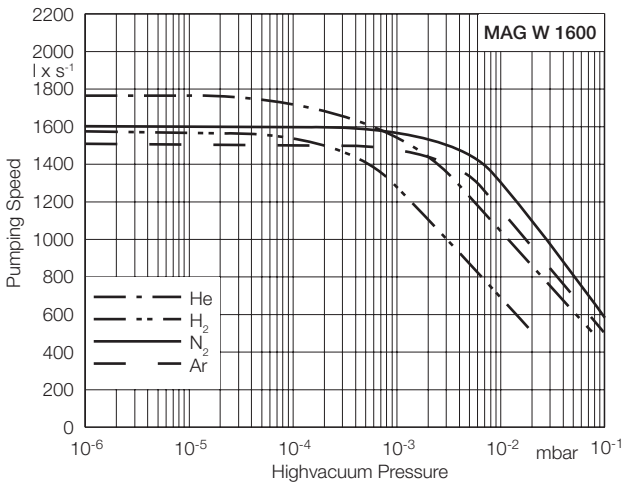
MAG W 1300 iP(L),
MAG W 1600 iP(L) Booster,
MAG W 1700 iP(L),
MAG W 2200 iP(L)

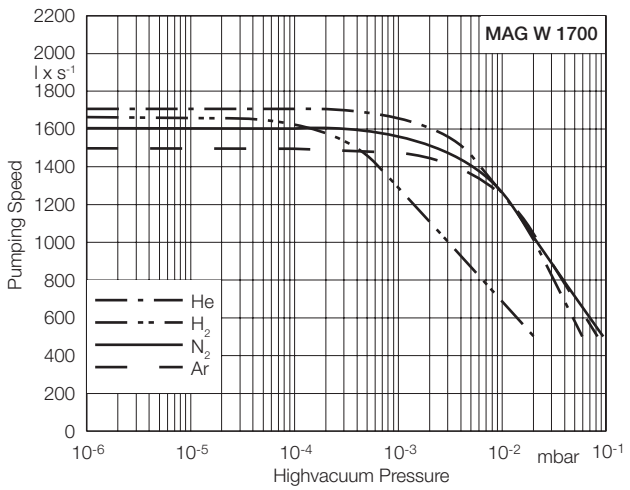
Ordering Information

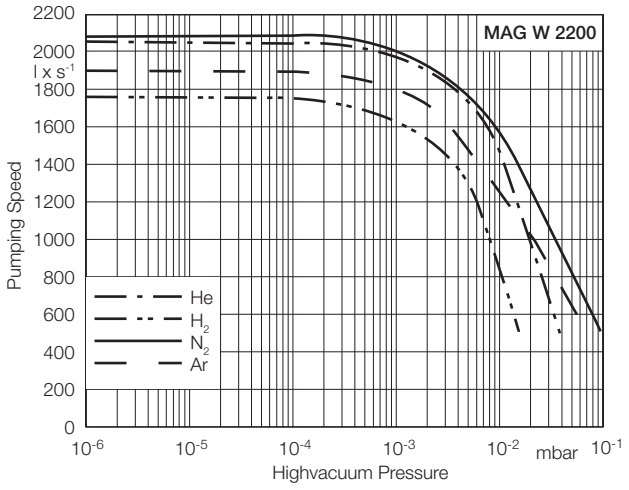
TURBOVAC MAG
W 1300/1600/1700/2200 iP(L)

Mandatory Accessories P	Part No.
Set of bolts, nuts and washers for ISO-F flange (12 each)	
Bolts M 10 x 50	**400153V0012**
Bolts M 10 x 35	**400153V0010**
Centering with O-ring	
Al/FPM	
DN 200	**268 44**
DN 250	**268 45**
Stainless steel/FPM	
DN 200	**887 02**
DN 250	**887 08**
Set of bolts, nuts and washers for CF flange (8 each)	
Bolts M 8 x 40	**400153V0016**
(For DN 200, 3 sets are required; for DN 250, 4 sets)	
Copper gasket rings for CF flange	
DN 200 (Set of 10 pieces)	**839 47**
DN 250 (Set of 5 pieces)	**839 48**
Set of hex. bolts with nuts, bolts and washers for CF flange	
DN 200	**839 07**
DN 250 (2 sets required)	**839 07**
Accessories, optional P FC PS	
Mains cable, 2.5 m (8.75 ft)	
with EURO plug	**411310V03**
with US plug	**411320V03**
Seal Kit DN 250 Metal	**200 07 901**
Seal kit, metal, for other flanges	**upon request**
Purge gas and venting valve 24 V DC	
0.6 mbar·l/s at 1.5 to 6 bar	**121 33**
0.6 mbar·l/s at 1 to 1.5 bar	**800152V0010**
Cable set (2 pieces) for connection to the pump	**411300V01**
Cooling water valve kit	**411300V02**
Spare Parts	
Inlet screen	
DN 200 ISO-F and DN 200 CF	**E 200 04 558**
DN 250 ISO-F and DN 250 CF	**E 200 04 557**
Included in the Delivery of the Pump P	
Flanges for forevacuum, venting and purge gas are blank-flanged	
Converter-side mains plug (IP 54)	
Inlet screen	







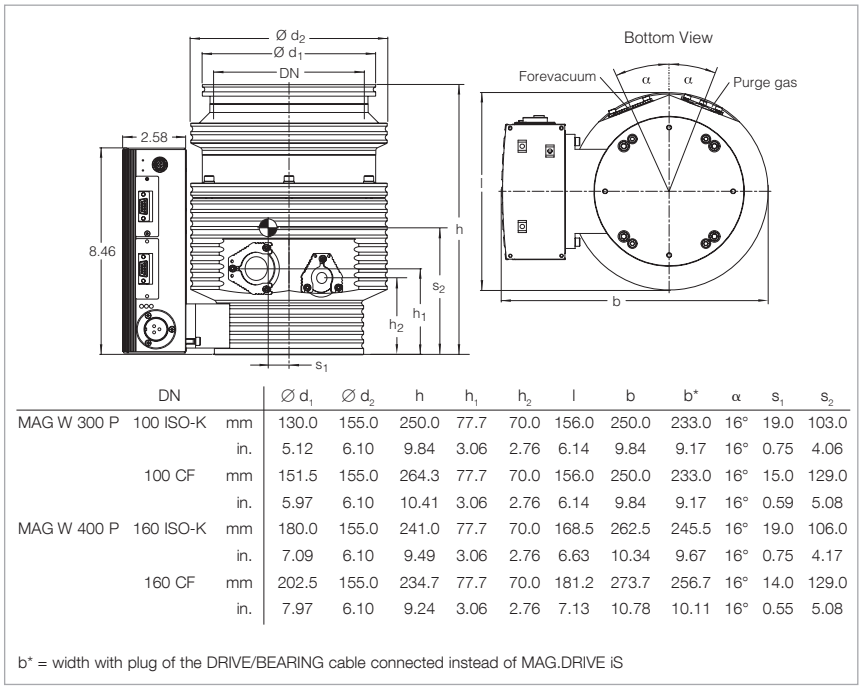


Pumping speed curves of the MAG W 1300, W 1600, W 1700 and W 2200

Notes

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

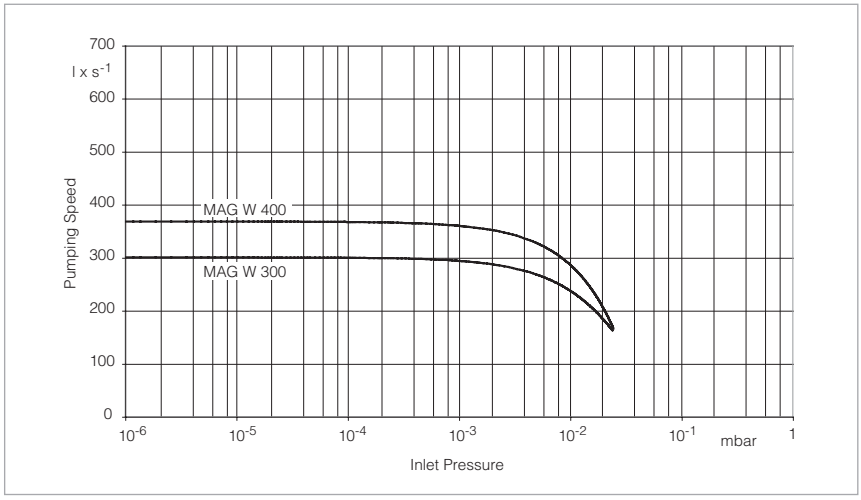
TURBOVAC MAG W 300/400 P



	DN		Ø d_1	Ø d_2	h	h_1	h_2	l	b	b*	α	s_1	s_2
MAG W 300 P	100 ISO-K	mm	130.0	155.0	250.0	77.7	70.0	156.0	250.0	233.0	16°	19.0	103.0
		in.	5.12	6.10	9.84	3.06	2.76	6.14	9.84	9.17	16°	0.75	4.06
	100 CF	mm	151.5	155.0	264.3	77.7	70.0	156.0	250.0	233.0	16°	15.0	129.0
		in.	5.97	6.10	10.41	3.06	2.76	6.14	9.84	9.17	16°	0.59	5.08
MAG W 400 P	160 ISO-K	mm	180.0	155.0	241.0	77.7	70.0	168.5	262.5	245.5	16°	19.0	106.0
		in.	7.09	6.10	9.49	3.06	2.76	6.63	10.34	9.67	16°	0.75	4.17
	160 CF	mm	202.5	155.0	234.7	77.7	70.0	181.2	273.7	256.7	16°	14.0	129.0
		in.	7.97	6.10	9.24	3.06	2.76	7.13	10.78	10.11	16°	0.55	5.08

b* = width with plug of the DRIVE/BEARING cable connected instead of MAG.DRIVE iS

Dimensional drawing for the TURBOVAC MAG W 300/400 P



Pumping speed for N_2 of the TURBOVAC MAG W 300/400 P as a function of the inlet pressure

Typical Applications

- Gas analysis systems
- Particle accelerators
- Electron microscopes
- Research
- Coating systems

Technical Features

- Installation in any orientation
- DN 100 or 160 ISO-K and/or CF high vacuum connection
- DN 16 ISO-KF with clamped forevacuum connection
- Purge gas/venting connection DN 16 ISO-KF with clamped connection (purge/vent)
- Water or air cooling optional

Advantages to the User

- Highest pumping speed from the smallest possible size
- New standard regarding maintenance-free systems
- Suitability for vibration sensitive applications in the area of analytical engineering, thin-film technology, electron microscopes, research, development among others
- Flexibility due to the modular concept; alternatively the pump is available also with an integrated frequency converter

Technical Data

TURBOVAC MAG

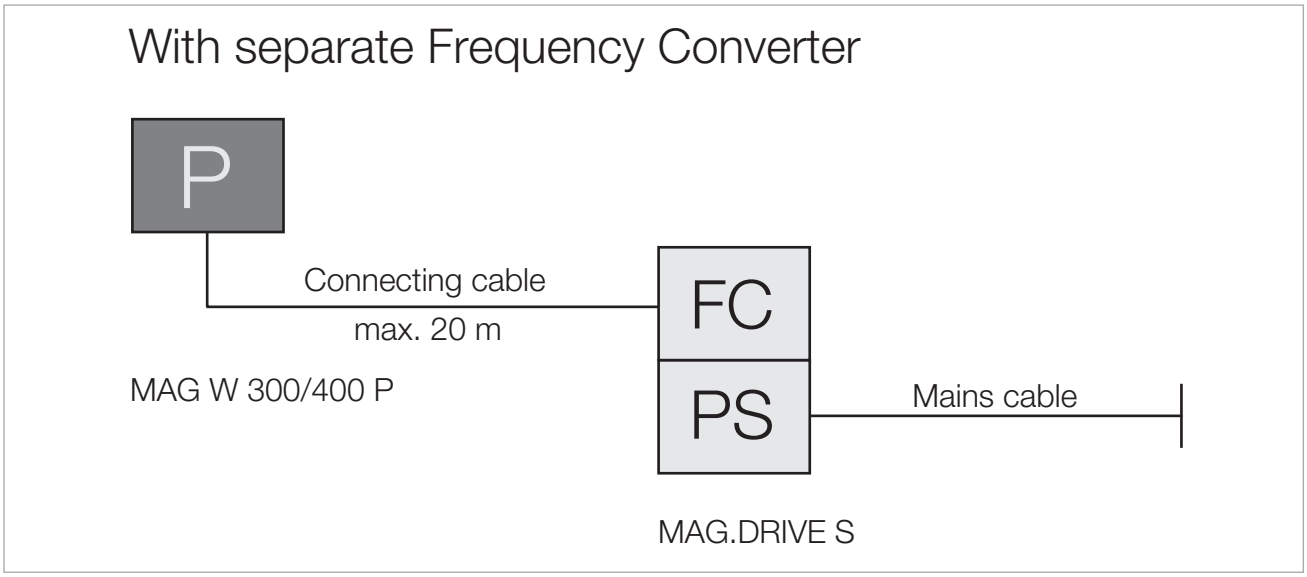
		W 300 P		W 400 P	
Inlet flange	DN	100 ISO-K	100 CF	160 ISO-K	160 CF
Pumping speed					
N_2	l x s^{-1}	300	300	365	365
Ar	l x s^{-1}	260	260	330	330
He	l x s^{-1}	260	260	280	280
H_2	l x s^{-1}	190	190	200	200
Operating speed	min^{-1}	58 800	58 800	58 800	58 800
Compression ratio					
N_2		1.0×10^{10}	1.0×10^{10}	1.0×10^{10}	1.0×10^{10}
H_2		3.2×10^{3}	3.2×10^{3}	3.2×10^{3}	3.2×10^{3}
He		9.2×10^{4}	9.2×10^{4}	9.2×10^{4}	9.2×10^{4}
Ultimate pressure	mbar	$< 10^{-8}$	$< 10^{-10}$	$< 10^{-8}$	$< 10^{-10}$
	(Torr)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)
Max. degassing temperature	°C (°F)	–	80 (176)	–	80 (176)
Max. foreline pressure for N_2	mbar (Torr)	8 (6)	8 (6)	8 (6)	8 (6)
Recommended backing pump		TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B
Run-up time	min	< 5	< 5	< 5	< 5
Foreline flange (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Purge / vent port (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Water cooling connection (optional)	G	1/8"	1/8"	1/8"	1/8"
Weight, approx.	kg (lbs)	12 (26)	12 (26)	12 (26)	12 (26)

Technical Data

MAG.DRIVE S

Voltage range	V	100 - 240, ±10 %
Nominal frequency	Hz	50 / 60
Power consumption		
stand-by	W	100
maximum	W	400
Max. motor voltage	V	48
Max. pump current	A	6
Fuses F1, F2 5 x 20 mm		10 A fast blow high breaking capacity 250 V
System fuse		L or G characteristic
Max. frequency	Hz	0 to 2000
Load capability, relay output X1	V / A	32 / 0,5
Temperature		
during operation	°C (°F)	0 to +45 (+32 to +113)
during storage	°C (°F)	-10 to +60 (+14 to +140)
Relative humidity of the air	%	95 (non-condensing)

	Part No.	
TURBOVAC MAG W 300 P [P] **with separate Frequency Converter and Compound Stage**		
DN 100 ISO-K	**410300V0005**	
DN 100 CF	**410300V0006**	
TURBOVAC MAG W 400 P [P] **with separate Frequency Converter and Compound Stage**		
DN 160 ISO-K	**410400V0005**	
DN 160 CF	**410400V0006**	
Mandatory Accessories [P] [FC]		
Electronic frequency converter		
MAG.DRIVE S with display	**410300V0212**	
Connecting cable DRIVE/BEARING		
(connection between pump and MAG.DRIVE S)		
3.0 m (10.5 ft)	**410300V4003**	
5.0 m (17.5 ft)	**410300V4005**	
10.0 m (35.0 ft)	**410300V4010**	
20.0 m (70.0 ft)	**410300V4020**	
Mains cable		
3.0 m (10.5 ft)		
EURO plug	**800102V0002**	
US plug 5-15 P	**800102V1002**	
2.0 m (7.5 ft)		
US plug 115 V AC	**992 76 513**	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	**140 000**	
110-120 V, 50/60 Hz; NEMA plug, US version	**140 002**	
TRIVAC D 8 B		
1 phase motor; 230 V, 50/60 Hz	**112 55**	
3 phase motor; 230/400 V, 50 Hz; 250/440 V, 60 Hz	**112 56**	



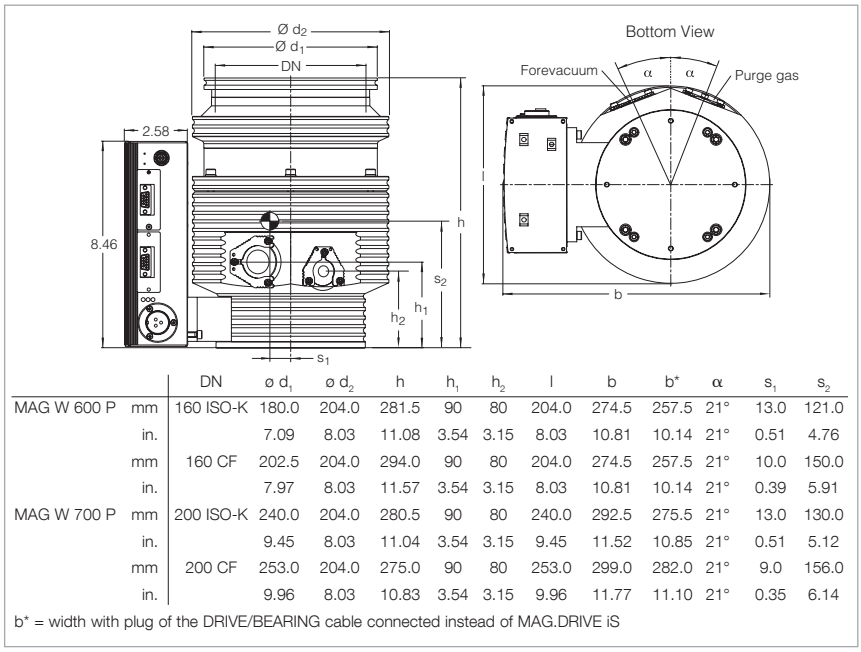
Ordering Information

TURBOVAC MAG W 300/400 P

Accessories, optional P	Part No.
Inlet screen	
DN 100 ISO-K	
coarse (3.2 x 3.2 mm (0.13 x 0.13 in.)	800132V0101
fine (1.6 x 1.6 mm (0.06 x 0.06 in.))	800132V0102
DN 100 CF	
coarse (3.2 x 3.2 mm (0.13 x 0.13 in.))	200 91 514
fine (1.6 x 1.6 mm (0.06 x 0.06 in.))	E 200 17 195
DN 160 ISO-K	E 200 00 307
DN 160 CF	E 200 17 247
Flange heater	
100 CF, 230 V, 50 Hz	854 27
100 CF, 115 V, 60 Hz	854 28
160 CF, 230 V, 50 Hz	854 37
160 CF, 115 V, 60 Hz	854 38
Water cooling unit	410300V0101
Air cooling unit	410300V0102
Solenoid venting valve, normally closed	
24 V DC, DN 16 ISO-KF	800120V0011
Power failure venting valve, normally open	800120V0021
Included in the Delivery of the Pump P	
Flanges for forevacuum, venting and purge gas are blank-flanged	
Centering ring with FPM sealing ring and a clamping yoke	

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

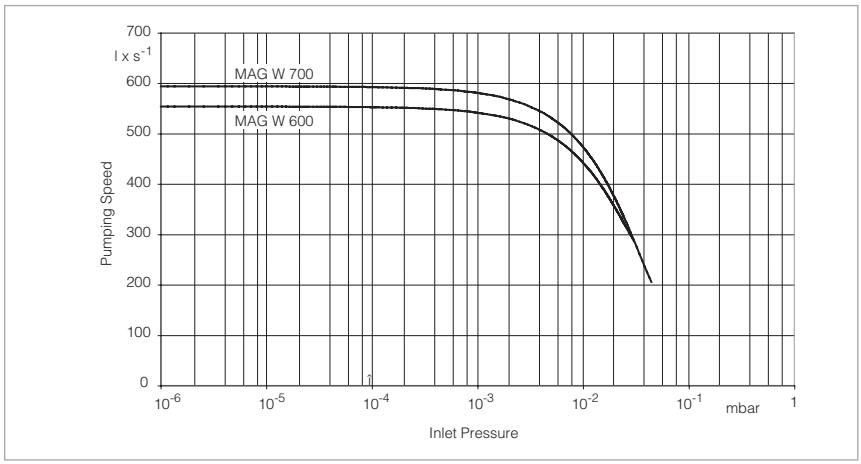
TURBOVAC MAG W 600/700 P



		DN	ø d_1	ø d_2	h	h_1	h_2	l	b	b*	α	s_1	s_2
MAG W 600 P	mm	160 ISO-K	180.0	204.0	281.5	90	80	204.0	274.5	257.5	21°	13.0	121.0
	in.		7.09	8.03	11.08	3.54	3.15	8.03	10.81	10.14	21°	0.51	4.76
	mm	160 CF	202.5	204.0	294.0	90	80	204.0	274.5	257.5	21°	10.0	150.0
	in.		7.97	8.03	11.57	3.54	3.15	8.03	10.81	10.14	21°	0.39	5.91
MAG W 700 P	mm	200 ISO-K	240.0	204.0	280.5	90	80	240.0	292.5	275.5	21°	13.0	130.0
	in.		9.45	8.03	11.04	3.54	3.15	9.45	11.52	10.85	21°	0.51	5.12
	mm	200 CF	253.0	204.0	275.0	90	80	253.0	299.0	282.0	21°	9.0	156.0
	in.		9.96	8.03	10.83	3.54	3.15	9.96	11.77	11.10	21°	0.35	6.14

b* = width with plug of the DRIVE/BEARING cable connected instead of MAG.DRIVE iS

Dimensional drawing for the TURBOVAC MAG W 600/700 P



Pumping speed for N_2 of the TURBOVAC MAG W 600/700 P as a function of the inlet pressure

Typical Applications

- Gas analysis systems
- Particle accelerators
- Electron microscopes
- Research
- Coating systems

Technical Features

- Installation in any orientation
- DN 160 or 200 ISO-K and/or CF high vacuum connection
- DN 25 ISO-KF with clamped forevacuum connection
- Purge gas/venting connection DN 16 ISO-KF with clamped connection (purge/vent)
- Water or air cooling optional

Advantages to the User

- Highest pumping speed from the smallest possible size
- New standard regarding maintenance-free systems
- Suitability for vibration sensitive applications in the area of analytical engineering, thin-film technology, electron microscopes, research, development among others
- Flexibility due to the modular concept; alternatively the pump is available also with an integrated frequency converter

Technical Data

TURBOVAC MAG

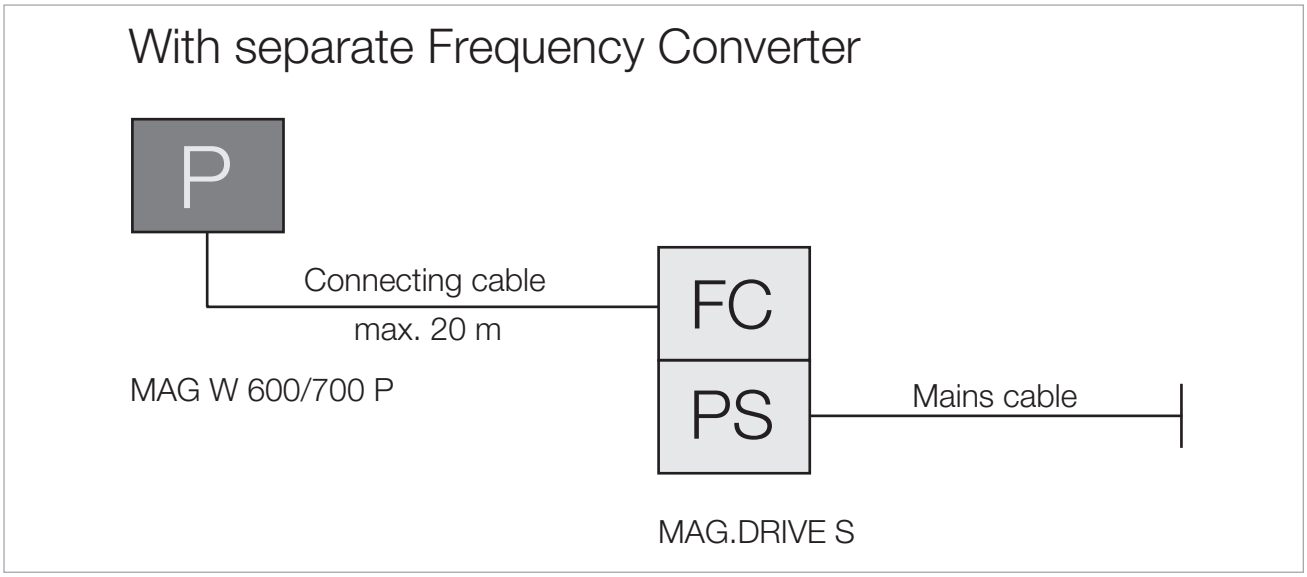
		W 600 P		W 700 P	
Inlet flange	DN	160 ISO-K	160 CF	200 ISO-K	200 CF
Pumping speed					
N_2	l x s^{-1}	550	550	590	590
Ar	l x s^{-1}	520	520	540	540
He	l x s^{-1}	570	570	600	600
H_2	l x s^{-1}	410	410	430	430
Operating speed	min^{-1}	48 000	48 000	48 000	48 000
Compression ratio					
N_2		1.6×10^{10}	1.6×10^{10}	1.6×10^{10}	1.6×10^{10}
H_2		3.4×10^{4}	3.4×10^{4}	3.4×10^{4}	3.4×10^{4}
He		1.7×10^{6}	1.7×10^{6}	1.7×10^{6}	1.7×10^{6}
Ultimate pressure	mbar	$< 10^{-8}$	$< 10^{-10}$	$< 10^{-8}$	$< 10^{-10}$
	(Torr)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)	($< 0.75 \times 10^{-8}$)	($< 0.75 \times 10^{-10}$)
Max. degassing temperature	°C (°F)	–	80 (176)	–	80 (176)
Max. foreline pressure for N_2	mbar (Torr)	6.0 (4.5)	6.0 (4.5)	6.0 (4.5)	6.0 (4.5)
Recommended backing pump		TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B	TRIVAC D 2,5 E TRIVAC D 8 B
Run-up time	min	< 6	< 6	< 6	< 6
Foreline flange (clamped)	DN	25 ISO-KF	25 ISO-KF	25 ISO-KF	25 ISO-KF
Purge / vent port (clamped)	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Water cooling connection (optional)	G	1/8"	1/8"	1/8"	1/8"
Weight, approx.	kg (lbs)	17 (37.5)	17 (37.5)	17 (37.5)	17 (37.5)

Technical Data

MAG.DRIVE S

Voltage range	V	100 - 240, ±10 %
Nominal frequency	Hz	50 / 60
Power consumption		
stand-by	W	100
maximum	W	400
Max. motor voltage	V	48
Max. pump current	A	6
Fuses F1, F2 5 x 20 mm		10 A fast blow high breaking capacity 250 V
System fuse		L or G characteristic
Max. frequency	Hz	0 to 2000
Load capability, relay output X1	V / A	32 / 0,5
Temperature		
during operation	°C (°F)	0 to +45 (+32 to +113)
during storage	°C (°F)	-10 to +60 (+14 to +140)
Relative humidity of the air	%	95 (non-condensing)

	Part No.	
TURBOVAC MAG W 600 P P **with separate Frequency Converter and Compound Stage**		
DN 160 ISO-K	**410600V0005**	
DN 160 CF	**410600V0006**	
TURBOVAC MAG W 700 P P **with separate Frequency Converter and Compound Stage**		
DN 200 ISO-K	**410700V0005**	
DN 200 CF	**410700V0006**	
Mandatory Accessories P FC		
Electronic frequency converter MAG.DRIVE S with display	**410300V0212**	
Connecting cable DRIVE/BEARING (connection between pump and MAG.DRIVE S)		
3.0 m (10.5 ft)	**410300V4003**	
5.0 m (17.5 ft)	**410300V4005**	
10.0 m (35.0 ft)	**410300V4010**	
20.0 m (70.0 ft)	**410300V4020**	
Mains cable		
3.0 m (10.5 ft)		
EURO plug	**800102V0002**	
US plug 5-15 P	**800102V1002**	
2.0 m (7.5 ft)		
US plug 115 V AC	**992 76 513**	
Forevacuum pump		
TRIVAC D 2,5 E		
220-240 V, 50 Hz; 230 V, 60 Hz; Schuko plug, EURO version	**140 000**	
110-120 V, 50/60 Hz; NEMA plug, US version	**140 002**	
TRIVAC D 8 B		
1 phase motor; 230 V, 50/60 Hz	**112 55**	
3 phase motor; 230/400 V, 50 Hz; 250/440 V, 60 Hz	**112 56**	



Ordering Information

TURBOVAC MAG W 600/700 P

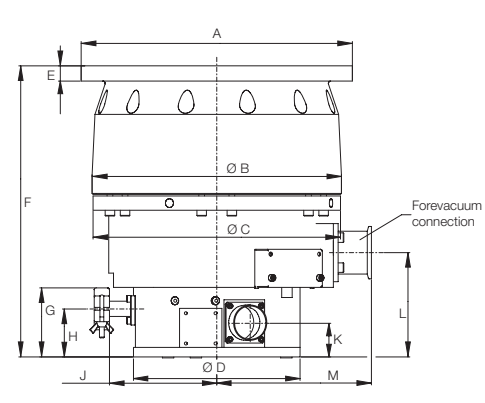
Accessories, optional	P	Part No.
Inlet screen		
DN 160 ISO-K		**E 200 00 307**
DN 160 CF		**E 200 17 247**
DN 200 ISO-K		**200 91 639**
DN 200 CF		**400 001 515**
Flange heater		
160 CF, 230 V, 50 Hz		**854 37**
160 CF, 115 V, 60 Hz		**854 38**
Water cooling unit		**410600V0101**
Air cooling unit		**410600V0102**
Solenoid venting valve, normally closed		
24 V DC, DN 16 ISO-KF		**800120V0011**
Power failure venting valve, normally open		**800120V0021**
Included in the Delivery of the Pump	P	
Flanges for forevacuum, venting and purge gas are blank-flanged		
Centering ring with FPM sealing ring and a clamping yoke		

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

TURBOVAC MAG W 830/1300 C

Typical Applications

- Semiconductor processes, like PVD and ion implantation
- Transfer chambers
- Particle accelerators
- Research
- Coating systems



	Forevacuum flange	Inlet flange		A	B	C	D	E
MAG W 830 C	DN 40 ISO-KF	160 ISO-F	mm	225	262	260	175	16
	DN 40 ISO-KF	160 ISO-F	in.	8.86	10.31	10.24	6.89	0.63
MAG W 1300 C	DN 40 ISO-KF / DN 25 ISO-KF	200 ISO-F	mm	285	262	260	175	16
	DN 40 ISO-KF / DN 25 ISO-KF	250 ISO-F	in.	11.22	10.31	10.24	6.89	0.63
MAG W 1300 C	DN 40 ISO-KF	250 ISO-F	mm	335	262	260	175	16
	DN 40 ISO-KF	250 ISO-F	in.	13.19	10.31	10.24	6.89	0.63

		F	G	H	J	K	L	M	N
MAG W 830 C	mm	353	72	50	113	35	109.5	163	243
	in.	13.9	2.83	1.97	4.45	1.38	4.31	6.42	9.57
MAG W 1300 C	mm	306	72	50	113	35	109.5	163	243
	in.	12.05	2.83	1.97	4.45	1.38	4.31	6.42	9.57
MAG W 1300 C	mm	306	72	50	113	35	109.5	163	243
MAG W 1300 C	in.	12.05	2.83	1.97	4.45	1.38	4.31	6.42	9.57

		O	P	Q	R	S	T
MAG W 830 C	mm	103	114.7	98	8.3	85	31
	in.	4.06	4.52	3.86	0.33	3.35	1.22
MAG W 1300 C	mm	103	114.7	98	8.3	85	31
	in.	4.06	4.52	3.86	0.33	3.35	1.22
MAG W 1300 C	mm	103	114.7	98	8.3	85	31
	in.	4.06	4.52	3.86	0.33	3.35	1.22

Dimensional drawing for the TURBOVAC MAG W 830/1300 C

Technical Features

- Active 5-axis magnetic bearing system
- Digital monitoring of the bearing system
- Low noise and vibration levels
- Installation in any orientation
- Advanced rotor design for high throughput
- Purge gas connection
- Intelligent power control system

Advantages to the User

- Maintenance-free
- High throughput for all process gases
- High pumping speed at low pressure
- High foreline pressure tolerance: up to 2 mbar (1.5 Torr)
- Lowest weight and size in its class
- Application specific design

Technical Data

TURBOVAC MAG

		W 830	W 830 C	W 1300	W 1300 C	
Inlet flange	DN	160 CF	160 ISO-F	200 CF	200 ISO-F	250 ISO-F
Pumping speed according to PNEUROP						
N_2	l x s^{-1}	900	700	1170	1100	1220
Ar	l x s^{-1}	750	650	1100	1050	1180
He	l x s^{-1}	900	500	1150	1100	1200
H_2	l x s^{-1}	740	350	920	920	1020
Operating speed	min^{-1}	36 000	24 000	36 000	36 000	36 000
Compression ratio						
N_2		1.5 x 10^8	> 5 x 10^7	1.5 x 10^8	> 10^8	> 10^8
Ultimate pressure according to DIN 28 400						
	mbar	< 1 x 10^{-10}	< 10^{-8}	< 1 x 10^{-10}	< 10^{-8}	< 10^{-8}
	(Torr)	(< 0.75 x 10^{-10})	(< 0.75 x 10^{-8})	(< 0.75 x 10^{-10})	(< 0.75 x 10^{-8})	(< 0.75 x 10^{-8})
Max. foreline pressure for N_2						
with convection cooling	mbar (Torr)	0.2 (0.15)	–	0.2 (0.15)	–	–
with water cooling	mbar (Torr)	2.0 (1.5)	2.0 (1.5)	2.0 (1.5)	2.0 (1.5)	2.0 (1.5)
Recommended backing pump						
Rotary vane pump		TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS
or dry compressing pump offering a pumping speed of 100 m^3/h						
Run-up time	min	< 6	< 4	< 6	< 6	< 6
Foreline flange	DN	40 ISO-KF	40 ISO-KF	40 ISO-KF	40 ISO-KF	40 ISO-KF
Purge and vent port	DN	10 ISO-KF/ 16 ISO-KF	10 ISO-KF/ 16 ISO-KF	10 ISO-KF/ 16 ISO-KF	10 ISO-KF/ 16 ISO-KF	10 ISO-KF/ 16 ISO-KF
Cooling water connection (OD of tube)	mm (in.)	1/4"	1/4"	1/4"	6	6
Weight, approx.	kg (lbs)	35 (77.3)	32 (70.6)	35 (77.3)	32 (70.6)	32 (70.6)

Technical Data

MAG.DRIVE digital

Mains connection, 50/60 Hz	V	200 - 240, +10 %/-15 %
Current for connected consumers max.	A	20
Max. motor voltage	V	60
Nominal frequency	Hz	50/60
Permissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx.	kg (lbs)	10 (22)

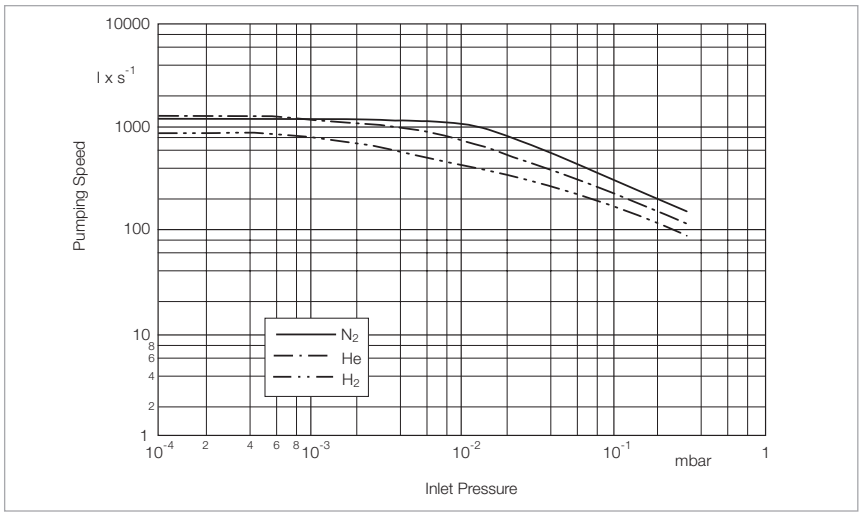
Ordering Information

TURBOVAC MAG
W 830 (C) / W 1300 (C)

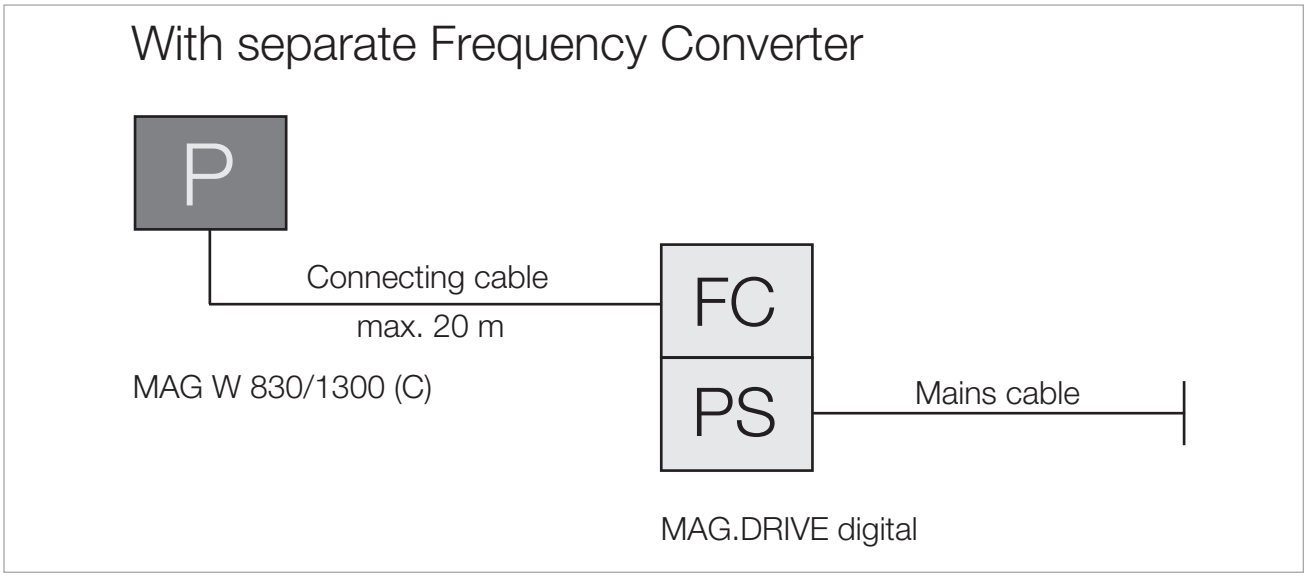
TURBOVAC MAG W 830 (C) with separate Frequency Converter and Compound Stage P	**Part No.**	
DN 160 CF (MAG W 830)	**400100V0041**	
DN 160 ISO-F (MAG W 830 C)	**400100V0005**	
TURBOVAC MAG W 1300 (C) with separate Frequency Converter and Compound Stage P		
DN 200 CF (MAG W 1300)	**400110V0051**	
DN 200 ISO-F (MAG W 1300 C)	**400110V0011**	
DN 250 ISO-F (MAG W 1300 C)	**400110V0021**	
Mandatory Accessories P FC		
Electronic frequency converter [1]		
MAG.DRIVE digital	**400035V0011**	
MAG.DRIVE digital, Profibus	**400035V0013**	
MAG.DRIVE digital, RS 232 C interface	**400035V0014**	
Plug-in control	**121 36**	
Connecting cable converter – pump [2]		
1.5 m (5.25 ft) DRIVE/BEARING	**400036V0001**	
3.0 m (10.5 ft) DRIVE/BEARING	**400036V0008**	
5.0 m (17.5 ft) DRIVE/BEARING	**400036V0004**	
10.0 m (35.0 ft) DRIVE/BEARING	**400036V0002**	
20.0 m (70.0 ft) DRIVE/BEARING	**400036V0003**	
Forevacuum pump		
TRIVAC D 65 B		
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	**113 98**	
3 phase motor; 208-23/460 V, 60 Hz / 200-220/380 V, 60 Hz	**913 98-2**	
For further types, see Catalog Part “Oil Sealed Vacuum Pumps”		

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

[2] Further connecting cables can be found under MAG.DRIVE digital in the chapter “Turbomolecular Pumps with Magnetic Rotor Suspension”, para. “Electronic Frequency Converters”



Pumping speed of the TURBOVAC MAG W 1300 C (DN 250) as a function of the inlet pressure



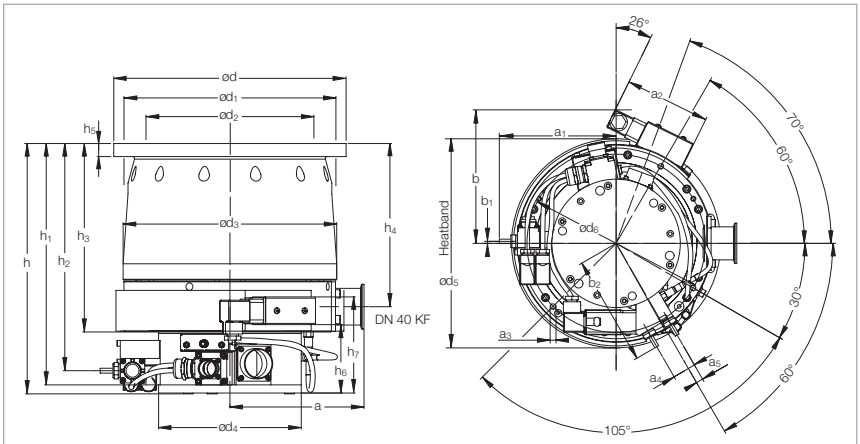
Ordering Information

TURBOVAC MAG
W 830 (C) / W 1300 (C)

Accessories, optional	P	Part No.
Purge gas and venting valve		121 33
Connecting cable for optional purge gas valve (pump/converter)		
1.5 m (5.25 ft)		400038V0007
3.0 m (10.5 ft)		400038V0006
10.0 m (35.0 ft)		400038V0002
20.0 m (70.0 ft)		400038V0009
Included in the Delivery of the Pump	P	
Inlet screen		
DN 160 ISO-F		E 200 00 307
DN 160 CF		E 200 17 247
DN 200 ISO-F		200 91 470
DN 200 CF		E 200 17 248
DN 250 ISO-F		200 91 471

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

TURBOVAC MAG W 1500 CT



Bottom view

		a	a_1	a_2	a_3	a_4	a_5	b	b_1	b_2	d	d_1	d_2
200 ISO-F	mm	164.5	159	116.5	M8 x 15	32	9	182	3	150	285	260	213
	in.	6.48	6.26	4.59	M8 x 0.6	1.26	0.35	7.17	0.12	5.91	11.22	10.24	8.39
250 ISO-F	mm	164.5	159	116.5	M8 x 15	32	9	182	3	150	335	310	261
	in.	6.48	6.26	4.59	M8 x 0.6	1.26	0.35	7.17	0.12	5.91	11.22	12.20	10.28

		d_3	d_4	d_5	d_6	h	h_1	h_2	h_3	h_4	h_5	h_6	h_7
200 ISO-F	mm	262	175	285	243	307	296	279	231	200	16	84	118
	in.	10.31	6.89	11.22	9.57	12.09	11.65	10.98	9.09	7.87	0.63	3.31	4.65
250 ISO-F	mm	262	175	285	243	307	296	279	231	200	16	84	118
	in.	10.31	6.89	11.22	9.57	12.09	11.65	10.98	9.09	7.87	0.63	3.31	4.65

Dimensional drawing for the TURBOVAC MAG W 1500 CT

Typical Applications

- All major semiconductor processes such as Etch, CVD, PVD and Ion Implantation

Technical Features

- Active 5-axis magnetic bearing system
- Bearing and temperature system are controlled digitally
- Corrosion resistant
- Low noise and vibration levels
- Installation in any orientation
- Advanced rotor design for high pump speeds and forevacuum pressures
- Integrated purge gas system
- Integrated temperature management system (TMS)
- Intelligent power control system

Advantages to the User

- Maintenance-free
- High throughput for all process gases
- High pumping speed at low pressure
- High foreline pressure tolerance: up to 2.6 mbar (1.95 Torr)
- High resistance against corrosive gases
- Robust against particles and deposits
- Temperature control up to 90 °C (194 °F) to avoid condensation
- Lowest weight and size in its class
- Application specific design

Technical Data

TURBOVAC MAG W 1500 CT

Inlet flange	DN	200 ISO-F	250 ISO-F	200 CF
Pumping speed according to PNEUROP				
N_2	l x s^{-1}	1100	1220	1100
Ar	l x s^{-1}	1050	1180	1050
He	l x s^{-1}	1100	1200	1100
H_2	l x s^{-1}	920	1020	920
Operating speed	min^{-1}	36 000	36 000	36 000
Compression ratio				
N_2		> 10^8	> 10^8	> 10^8
Ultimate pressure according to DIN 28 400	mbar (Torr)	< 10^{-8} (< 0.75 x 10^{-8})	< 10^{-8} (< 0.75 x 10^{-8})	< 10^{-10} (< 0.75 10^{-10})
Max. foreline pressure for N_2	mbar (Torr)	2.6 (1.95)	2.6 (1.95)	2.6 (1.95)
Recommended backing pump Rotary vane pump or dry compressing pump offering a pumping speed of 100 m^3/h		TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS
Run-up time at 95% of nominal speed	min	< 6	< 6	< 6
Foreline flange	DN	40 ISO-KF	40 ISO-KF	40 ISO-KF
Purge and vent port	VCR	1/4"	1/4"	1/4"
Cooling water connection (OD of tube)	mm (in.)	6.4 (0.25)	6.4 (0.25)	6.4 (0.25)
Weight, approx.	kg (lbs)	32 (70.6)	32 (70.6)	32 (70.6)

Technical Data

MAG.DRIVE digital

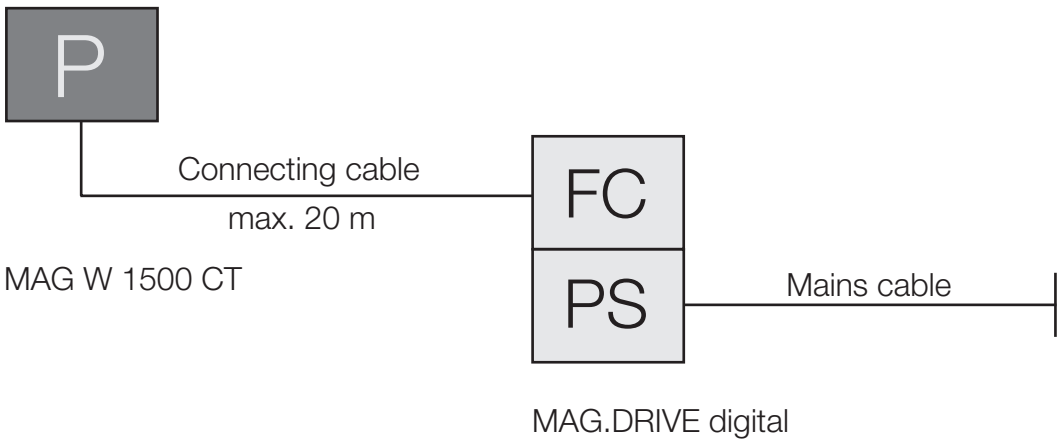
Mains connection, 50/60 Hz	V	200 - 240, +10 %/-15 %
Current for connected consumers max.	A	20
Max. motor voltage	V	60
Nominal frequency	Hz	50/60
Permissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx.	kg (lbs)	10 (22)

TURBOVAC MAG W 1500 CT with separate Frequency Converter and Compound Stage	P	Part No.	
DN 200 ISO-F DN 250 ISO-F DN 200 CF		400026V0002 400027V0002 400030V0002	
Mandatory Accessories	P FC		
Electronic frequency converter [1] MAG.DRIVE digital MAG.DRIVE digital, Profibus MAG.DRIVE digital, RS 232 C interface		 400035V0011 400035V0013 400035V0014	
Connecting cable converter – pump [2] 1.5 m (5.25 ft) DRIVE/BEARING 1.5 m (5.25 ft) TMS 3.0 m (10.5 ft) DRIVE/BEARING 3.0 m (10.5 ft) TMS 5.0 m (17.5 ft) DRIVE/BEARING 5.0 m (17.5 ft) TMS 10.0 m (35.0 ft) DRIVE/BEARING 10.0 m (35.0 ft) TMS 20.0 m (70.0 ft) DRIVE/BEARING 20.0 m (70.0 ft) TMS		 400036V0001 400037V0001 400036V0008 400037V0008 400036V0004 400037V0004 400036V0002 400037V0002 400036V0003 400037V0003	
Plug-in control		121 36	
Forevacuum pump TRIVAC D 65 B 3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz 3 phase motor; 208-23/460 V, 60 Hz / 200-220/380 V, 60 Hz		 113 98 913 98-2	
For further types, see Catalog Part “Oil Sealed Vacuum Pumps”			

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

[2] Further connecting cables can be found under MAG.DRIVE digital in the chapter “Turbomolecular Pumps with Magnetic Rotor Suspension”, para. “Electronic Frequency Converters”

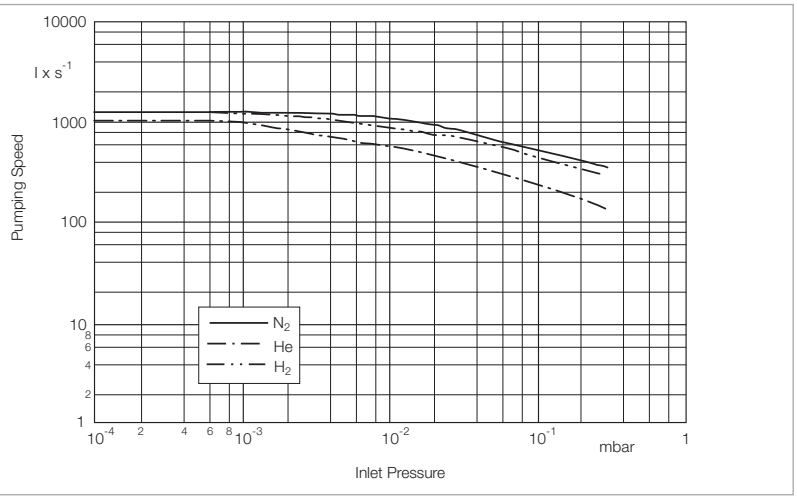
With separate Frequency Converter



Ordering Information

TURBOVAC MAG W 1500 CT

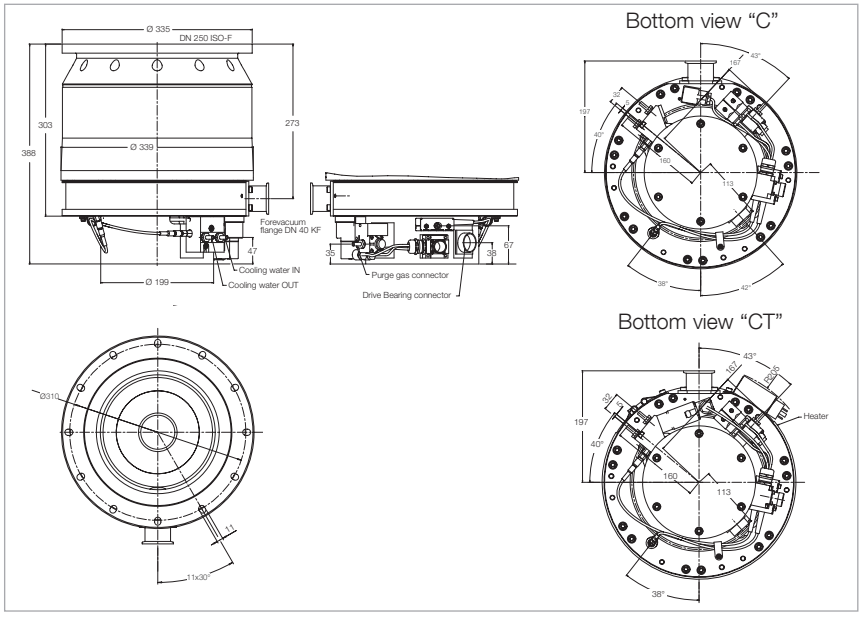
Accessories, optional	P	Part No.
Seal kit DN 250 metal		**200 07 901**
Included in the Delivery of the Pump	P	
Inlet screen DN 200 ISO-F DN 250 ISO-F DN 250 CF		**200 91 470** **200 91 471** **200 91 638**
Integrated purge gas system VRC nut 1/4"		
Integrated temperature management system		
Cooling water connection Swagelock 1/4" tube		
Included in the Delivery of the Frequency Converter	FC	
Mains cord, 3 m (10.5 ft.) long, approx. with EURO or US plug		



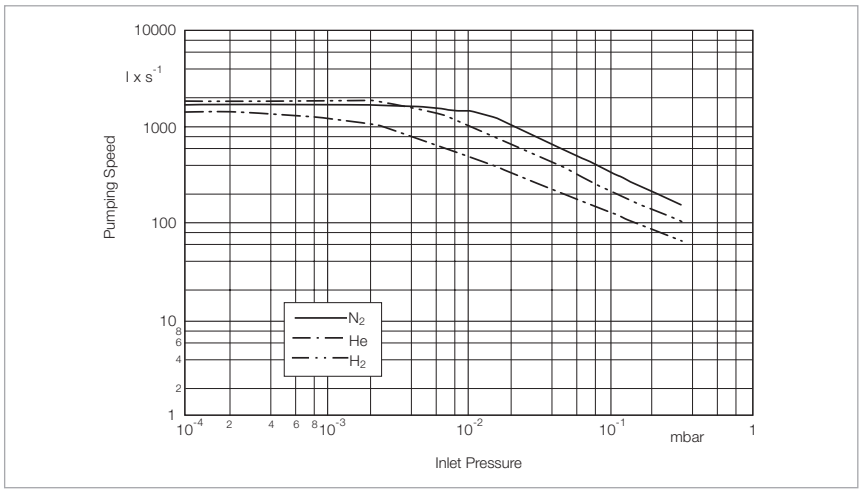
Pumping speed of the TURBOVAC MAG W 1500 CT (DN 250) as a function of the inlet pressure

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter with Compound Stage

TURBOVAC MAG W 2000 C/CT



Dimensional drawing for the TURBOVAC MAG W 2000 C/CT



Pumping speed of the TURBOVAC MAG W 2000 CT (DN 250) as a function of the inlet pressure

Typical Applications

- All major semiconductor processes such as Etch, CVD, PVD and Ion Implantation

Technical Features

- Active 5-axis magnetic bearing system
- Patented KEPLA-COAT® for rotor and stator to prevent corrosion
- Low noise and vibration levels
- Installation in any orientation
- Advanced rotor design for high pump speeds and forevacuum pressures
- Integrated purge gas system
- CT versions: Integrated temperature management system (TMS)

Advantages to the User

- Maintenance-free
- High throughput for all etch gases
- High pumping speed at low pressure
- High foreline pressure tolerance: up to 5.3 mbar (4 Torr)
- High resistance against corrosive gases
- Robust against particles and deposits
- Temperature management system (TMS) to avoid condensation
- Application specific design

Technical Data

		TURBOVAC MAG	
		W 2000 C	W 2000 CT
Inlet flange	DN	250 ISO-F	250 ISO-F
Pumping speed according to PNEUROP			
N_2	l x s^{-1}	1760	1760
Ar	l x s^{-1}	1650	1650
He	l x s^{-1}	1800	1800
H_2	l x s^{-1}	1500	1500
Operating speed	min^{-1}	28 800	28 800
Compression ratio N_2		> 10^8	> 10^8
Ultimate pressure according to DIN 28 400	mbar (Torr)	< 10^{-8} (< 0.75 x 10^{-8})	< 10^{-8} (< 0.75 x 10^{-8})
Max. foreline pressure for N_2	mbar (Torr)	3.5 (2.63)	3.5 (2.63)
Recommended backing pump Rotary vane pump or dry compressing pump offering a pumping speed of 100 m^3/h		TRIVAC D 65 BCS	TRIVAC D 65 BCS
Run-up time	min	< 8	< 8
Foreline flange	DN	40 ISO-KF	40 ISO-KF
Purge and vent port	VCR	1/4"	1/4"
Cooling water connection (OD of tube)	mm (in.)	6.4 (0.25)	6.4 (0.25)
Weight, approx.	kg (lbs)	68 (150)	68 (150)

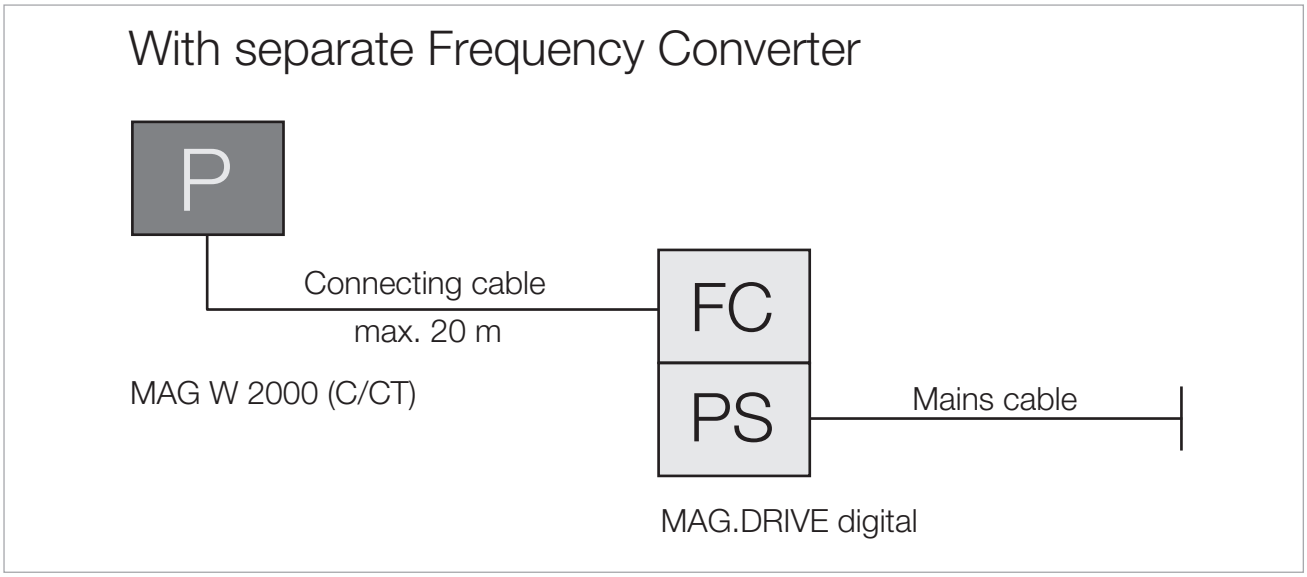
Technical Data

		MAG.DRIVE digital
Mains connection, 50/60 Hz	V	200 - 240, +10 %/-15 %
Current for connected consumers max.	A	20
Max. motor voltage	V	60
Nominal frequency	Hz	50/60
Permissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx.	kg (lbs)	10 (22)

TURBOVAC MAG W 2000 C/CT with separate Frequency Converter and Compound Stage P	Part No.	
DN 250 ISO-F (MAG W 2000 C) DN 250 ISO-F (MAG W 2000 CT)	400047V0001 400047V0002	
Mandatory Accessories P FC		
Electronic frequency converter [1] MAG.DRIVE digital MAG.DRIVE digital, Profibus MAG.DRIVE digital, RS 232 C interface	 400035V0011 400035V0013 400035V0014	
Connecting cable converter – pump [2] 1.5 m (5.25 ft) DRIVE/BEARING 1.5 m (5.25 ft) TMS 3.0 m (10.5 ft) DRIVE/BEARING 3.0 m (10.5 ft) TMS 5.0 m (17.5 ft) DRIVE/BEARING 5.0 m (17.5 ft) TMS 10.0 m (35.0 ft) DRIVE/BEARING 10.0 m (35.0 ft) TMS 20.0 m (70.0 ft) DRIVE/BEARING 20.0 m (70.0 ft) TMS	 400036V0001 400037V0001 400036V0008 400037V0008 400036V0004 400037V0004 400036V0002 400037V0002 400036V0003 400037V0003	
Plug-in control	121 36	
Forevacuum pump TRIVAC D 65 B 3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz 3 phase motor; 208-23/460 V, 60 Hz / 200-220/380 V, 60 Hz	 113 98 913 98-2	
For further types, see Catalog Part “Oil Sealed Vacuum Pumps”		

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

[2] Further connecting cables can be found under MAG.DRIVE digital in the chapter “Turbomolecular Pumps with Magnetic Rotor Suspension”, para. “Electronic Frequency Converters”



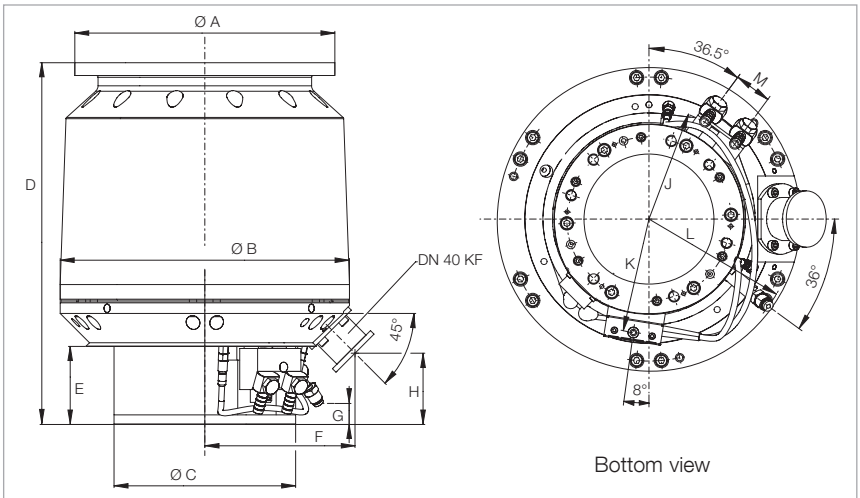
Ordering Information

TURBOVAC MAG W 2000 C/CT

Included in the Delivery of the Pump P	Part No.
Inlet screen DN 250 ISO-F	**200 91 471**
Integrated purge gas system VRC nut 1/4"	
Integrated temperature management system (only CT version)	
Cooling water connection Swagelock 1/4" tube	
Included in the Delivery of the Frequency Converter FC	
Mains cord, 3 m (10.5 ft.) long, approx. with EURO or US plug	

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

TURBOVAC MAG W 2200 C/CT



		A	B	C	D	E	F	G	H	J	K	L	M
200 ISO-F	mm	285	317	199	396	85.5	164.6	23	78	117	120	155	39
	in.	11.22	12.48	7.83	15.59	3.37	6.48	0.91	3.07	4.61	4.72	6.10	1.54
250 ISO-F	mm	335	317	199	371	85.5	164.6	23	78	117	120	155	39
	in.	13.19	12.48	7.83	14.61	3.37	6.48	0.91	3.07	4.61	4.72	6.10	1.54
250 CF	mm	305	317	199	401	85.5	164.6	23	78	117	120	155	39
	in.	12.01	12.48	7.83	15.79	3.37	6.48	0.91	3.07	4.61	4.72	6.10	1.54

Dimensional drawing for the TURBOVAC MAG W 2200 C

Typical Applications

- All major semiconductor processes such as Etch, CVD, PVD and Ion Implantation
- Coating systems

Versions with CF high vacuum connection

- Particle accelerators
- Research

Technical Features

- Active 5-axis magnetic bearing system
- Digital monitoring of the bearing system
- Low noise and vibration levels
- Installation in any orientation
- Advanced rotor design for high pump speeds and forevacuum pressures
- Purge gas connection
- Intelligent power control system
- Integrated temperature management System (TMS) (“CT” version only)

Advantages to the User

- Maintenance-free
- High throughput for all process gases
- High pumping speed at low pressure
- High foreline pressure tolerance: up to 2 mbar (1.5 Torr)
- Lowest weight and size in its class
- Application specific design

Technical Data

		TURBOVAC MAG		
		W 2200 C/CT		W 2200
Inlet flange	DN	200 ISO-F	250 ISO-F	250 CF
Pumping speed according to PNEUROP				
N_2	l x s^{-1}	1600	2000	1800
Ar	l x s^{-1}	1450	1900	1700
He	l x s^{-1}	1780	1980	1980
H_2	l x s^{-1}	1720	1930	1930
Operating speed	min^{-1}	29 400	29 400	29 400
Compression ratio				
N_2		> 1 x 10^8	> 1 x 10^8	1 x 10^8
Ultimate pressure according to DIN 28 400	mbar (Torr)	< 10^{-8} (< 0.75 x 10^{-8})	< 10^{-8} (< 0.75 x 10^{-8})	< 1 x 10^{-10} (< 0.75 x 10^{-10})
Max. foreline pressure for N_2				
with convection cooling	mbar (Torr)	–	–	0.1 (0.075)
with water cooling	mbar (Torr)	2 (1.5)	2 (1.5)	1 (0.75)
Recommended backing pump				
Rotary vane pump		TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS
or dry compressing pump				
offering a pumping speed of 100 m^3/h				
Run-up time				
at 95% of nominal speed	min	< 8	< 8	< 8
Foreline flange	DN	40 ISO-KF	40 ISO-KF	40 ISO-KF
Purge and vent port		1/4" VCR	1/4" VCR	DN 10/16
Cooling water connection				
(OD of tube)		1/2"	1/2"	Swagelok tube 1/4"
Weight, approx.	kg (lbs)	48 (106)	48 (106)	60 (132)

Technical Data

		MAG.DRIVE digital
Mains connection, 50/60 Hz	V	200 - 240, +10 %/-15 %
Current for connected consumers		
max.	A	20
Max. motor voltage	V	60
Nominal frequency	Hz	50/60
Permissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx.	kg (lbs)	10 (22)

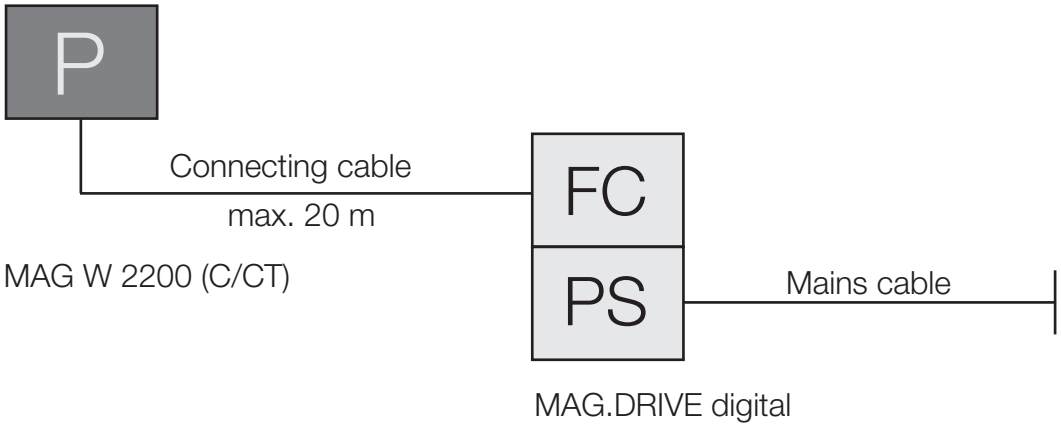
TURBOVAC MAG W 2200 C/CT with separate Frequency Converter and Compound Stage P	Part No.	
DN 200 ISO-F (MAG W 2200 C)	400081V0011	
DN 250 ISO-F (MAG W 2200 C)	400081V0021	
DN 250 CF (MAG W 2200)	400081V0061	
DN 200 ISO-F (MAG W 2200 CT)	400081V0013	
DN 250 ISO-F (MAG W 2200 CT)	400081V0023	
Mandatory Accessories P FC		
Electronic frequency converter [1]		
MAG.DRIVE digital	400035V0011	
MAG.DRIVE digital, Profibus	400035V0013	
MAG.DRIVE digital, RS 232 C interface	400035V0014	
Connecting cable converter – pump [2]		
1.5 m (5.25 ft) DRIVE/BEARING	400036V0001	
1.5 m (5.25 ft) TMS [3]	400037V0001	
3.0 m (10.5 ft) DRIVE/BEARING	400036V0008	
3.0 m (10.5 ft) TMS [3]	400037V0008	
5.0 m (17.5 ft) DRIVE/BEARING	400036V0004	
5.0 m (17.5 ft) TMS [3]	400037V0004	
10.0 m (35.0 ft) DRIVE/BEARING	400036V0002	
10.0 m (35.0 ft) TMS [3]	400037V0002	
20.0 m (70.0 ft) DRIVE/BEARING	400036V0003	
20.0 m (70.0 ft) TMS [3]	400037V0003	
Plug-in control	121 36	
Forevacuum pump		
TRIVAC D 65 B		
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz	113 98	
3 phase motor; 208-23/460 V, 60 Hz / 200-220/380 V, 60 Hz	913 98-2	
For further types, see Catalog Part “Oil Sealed Vacuum Pumps”		

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

[2] Further connecting cables can be found under MAG.DRIVE digital in the chapter “Turbomolecular Pumps with Magnetic Rotor Suspension”, para. “Electronic Frequency Converters”

[3] TMS connecting cables are only needed for the “CT” version of the TURBOVAC MAG W 2200

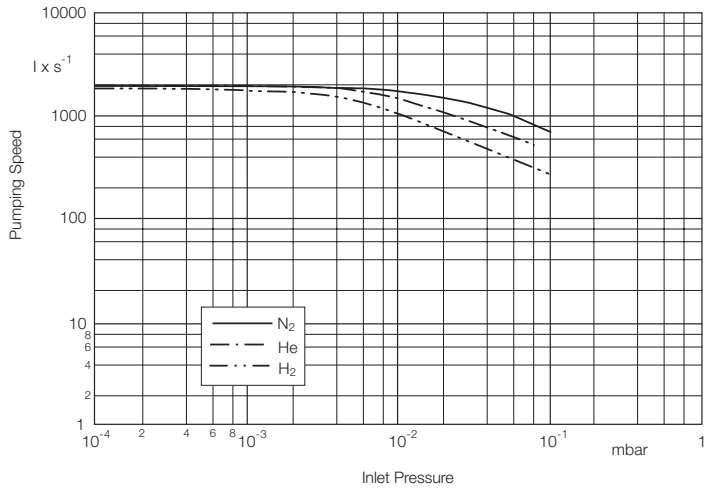
With separate Frequency Converter



Ordering Information

TURBOVAC MAG W 2200 C/CT

Accessories, optional	P	Part No.
Purge gas and venting valve		**121 33**
Connection cable for optional seal gas valve (pump/converter)		
1.5 m (5.25 ft)		**400038V0007**
3.0 m (10.5 ft)		**400038V0006**
10.0 m (35.0 ft)		**400038V0002**
20.0 m (70.0 ft)		**400038V0009**
Seal kit		
DN 250 metal		**200 07 901**
Included in the Delivery of the Pump	P	
Inlet screen		
DN 200 ISO-F		**E 400 000 096**
DN 250 ISO-F		**E 400 000 100**
DN 250 CF		**E 200 15 157**
Included in the Delivery of the Frequency Converter	FC	
Mains cord, 3 m (10.5 ft.) long, approx. with EURO or US plug		

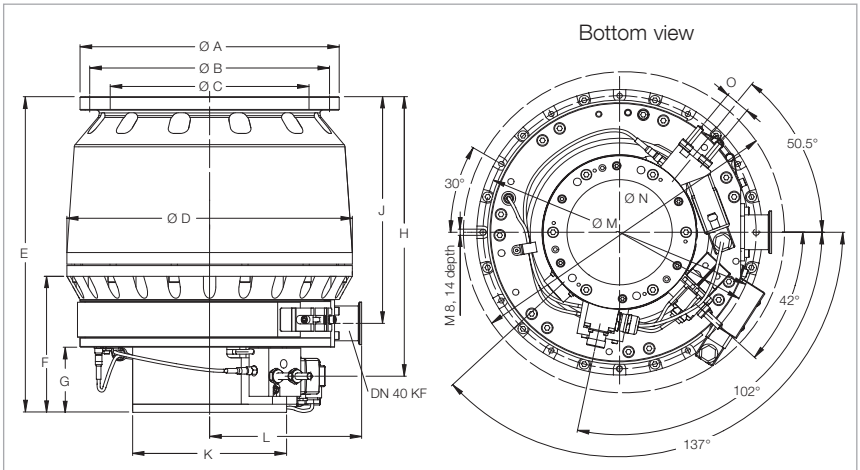


Pumping speed of the TURBOVAC MAG W 2200 C (DN 250) as a function of the inlet pressure

MAG DIGITAL - Magnetic Rotor Suspension with separate Frequency Converter, with Compound Stage

TURBOVAC MAG W 2800/3200 C/CT

TURBOVAC MAG W 2800 CT (left) and TURBOVAC MAG W 3200 CT (right)



		A	B	C	D	E	F	G	H	J
250 ISO-F	mm	335	310	261	293	408	176	89	361	293
	in.	13.19	12.2	10.28	11.54	16.06	6.93	3.50	14.21	11.54
250 CF	mm	305	284	268	307	422	176	89	391	248
	in.	12.01	11.18	10.55	12.09	16.61	6.93	3.50	15.39	9.76
320 ISO-F	mm	425	395	318	248	363	176	89	316	248
	in.	16.73	15.55	12.52	9.76	14.29	6.93	3.50	12.44	9.76

		K	L	M	N	O
250 ISO-F	mm	199	196.5	353	415	32
	in.	7.83	7.74	13.9	16.34	1.26
250 CF	mm	199	196.5	353	415	32
	in.	7.83	7.74	13.9	16.34	1.26
320 ISO-F	mm	199	196.5	353	415	32
	in.	7.83	7.74	13.9	16.34	1.26

Dimensional drawing for the TURBOVAC MAG W 2800/3200 C/CT

Typical Applications

- All major semiconductor processes such as Etch, CVD, PVD and Ion Implantation

Versions with CF high vacuum connection

- Particle accelerators
- Research

Technical Features

- Active 5-axis magnetic bearing system
- Bearing and temperature system are controlled digitally
- Corrosion resistant
- Low noise and vibration levels
- Installation in any orientation
- Advanced rotor design for high pump speeds and forevacuum pressures
- Integrated purge gas system
- CT versions: Integrated temperature management system (TMS)
- Intelligent power control system

Advantages to the User

- Maintenance-free
- High throughput for all process gases
- High pumping speed at low pressure
- High foreline pressure tolerance: up to 2 mbar (1.5 Torr)
- High resistance against corrosive gases
- Robust against particles and deposits
- Temperature control up to 90 °C (194 °F) to avoid condensation
- Lowest weight and size in its class
- Application specific design

Technical Data

TURBOVAC MAG

	W 2800 C	W 2800 CT	W 2800	W 3200 CT
Inlet flange DN	250 ISO-F	250 ISO-F	250 CF	320 ISO-F
Pumping speed according to PNEUROP				
N_2 l x s^{-1}	2650	2650	2650	3200
Ar l x s^{-1}	2450	2450	2450	3000
He l x s^{-1}	2650	2650	2650	3000
H_2 l x s^{-1}	2100	2100	2100	2250
Operating speed min^{-1}	28 800	28 800	28 800	28 800
Compression ratio				
N_2	1 x 10^8	1 x 10^8	1 x 10^9	1 x 10^8
Ultimate pressure according to DIN 28 400				
mbar	< 10^{-8}	< 10^{-8}	< 1 x 10^{-10}	< 10^{-8}
(Torr)	(< 0.75 x 10^{-8})	(< 0.75 x 10^{-8})	(< 0.75 x 10^{-10})	(< 0.75 x 10^{-8})
Max. foreline pressure for N_2				
with convection cooling mbar (Torr)	–	–	0.3 (0.23)	–
with water cooling mbar (Torr)	2.0 (1.5)	2.0 (1.5)	3.0 (2.3)	2.0 (1.5)
Recommended backing pump Rotary vane pump or dry compressing pump offering a pumping speed of 100 m^3/h	TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS	TRIVAC D 65 BCS
Run-up time min	< 10	< 10	< 10	< 10
Foreline flange DN	40 ISO-KF	40 ISO-KF	40 ISO-KF	40 ISO-KF
Purge / vent port	1/4" VCR	1/4" VCR	DN 10/16	1/4" VCR
Cooling water connection Swagelok tube	1/4"	1/4"	1/4"	1/4"
Weight, approx. kg (lbs)	64 (141.3)	64 (141.3)	75 (165.6)	65 (143.5)

Technical Data

MAG.DRIVE digital

Mains connection, 50/60 Hz V	200 - 240, +10 %/-15 %
Current for connected consumers, max. A	20
Max. motor voltage V	60
Nominal frequency Hz	50/60
Permissible ambient temperature °C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D) mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx. kg (lbs)	10 (22)

Ordering Information

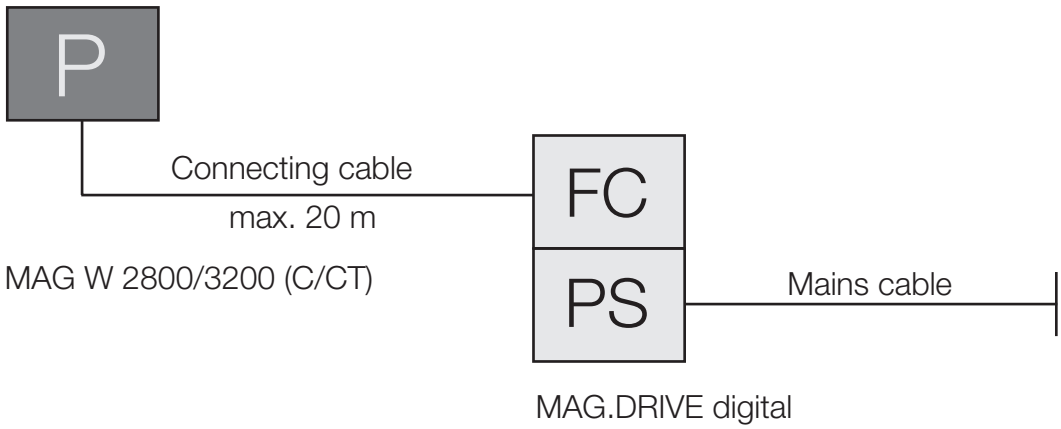
TURBOVAC MAG W 2800 / 3200 C/CT

TURBOVAC MAG W 2800 (C/CT) with separate Frequency Converter and Compound Stage	P	Part No.	
DN 250 CF (MAG W 2800)		400006V0071	
DN 250 ISO-F (MAG W 2800 C)		400000V0001	
DN 250 ISO-F (MAG W 2800 CT)		400000V0002	
TURBOVAC MAG W 3200 (C/CT) with separate Frequency Converter and Compound Stage	**P**		
DN 320 ISO-F (MAG W 3200)		400003V0003	
DN 320 ISO-F (MAG W 3200 C)		400003V0001	
DN 320 ISO-F (MAG W 3200 CT)		400003V0002	
Mandatory Accessories	**P FC**		
Electronic frequency converter [1]			
MAG.DRIVE digital		400035V0011	
MAG.DRIVE digital, Profibus		400035V0013	
MAG.DRIVE digital, RS 232 C interface		400035V0014	
Plug-in control		121 36	
Connecting cable converter – pump [2]			
1.5 m (5.25 ft) DRIVE/BEARING		400036V0001	
1.5 m (5.25 ft) TMS		400037V0001	
3.0 m (10.5 ft) DRIVE/BEARING		400036V0008	
3.0 m (10.5 ft) TMS		400037V0008	
5.0 m (17.5 ft) DRIVE/BEARING		400036V0004	
5.0 m (17.5 ft) TMS		400037V0004	
10.0 m (35.0 ft) DRIVE/BEARING		400036V0002	
10.0 m (35.0 ft) TMS		400037V0002	
20.0 m (70.0 ft) DRIVE/BEARING		400036V0003	
20.0 m (70.0 ft) TMS		400037V0003	
Forevacuum pump			
TRIVAC D 65 B			
3 phase motor; 230/400 V, 50 Hz / 250/440 V, 60 Hz		112 96	
3 phase motor; 208-23/460 V, 60 Hz / 200-220/380 V, 60 Hz		912 96-2	
For further types, see Catalog Part “Oil Sealed Vacuum Pumps”			

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

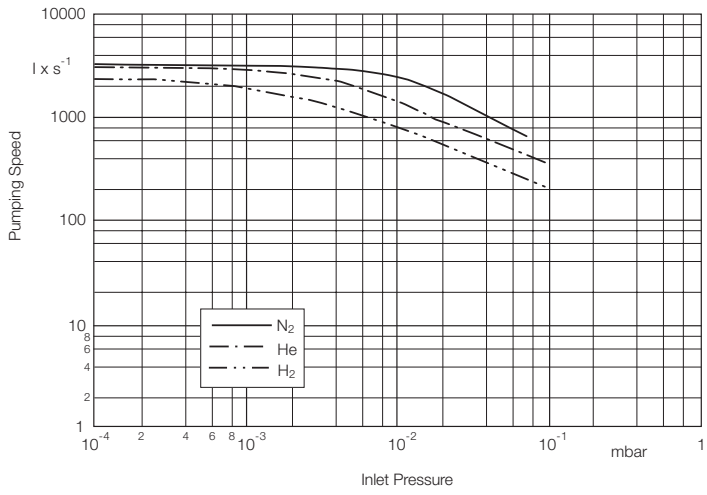
[2] Further connecting cables can be found under MAG.DRIVE digital in the chapter “Turbomolecular Pumps with Magnetic Rotor Suspension”, para. “Electronic Frequency Converters”

With separate Frequency Converter



Ordering Information

Accessories, optional P	TURBOVAC MAG W 2800 C/CT / 3200 CT Part No.
Purge gas and venting valve	121 33
Seal kit DN 250 metal	 200 07 901
Included in the Delivery of the Pump P	
Inlet screen DN 250 ISO-F DN 250 CF DN 320 ISO-F	 E 400 000 100 200 15 157 E 400 000 134
Included in the Delivery of the Frequency Converter FC	
Mains cord, 3 m (10.5 ft.) long, approx. with EURO or US plug	



Pumping speed of the TURBOVAC MAG W 3200 C (DN 320) as a function of the inlet pressure

Accessories

Electronic Frequency Converters for Pumps with Mechanical Rotor Suspension

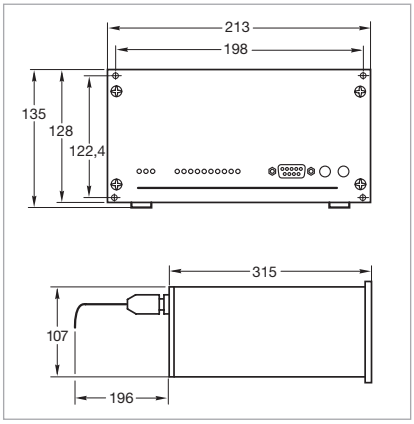
TURBO.DRIVE TD 20 *classic*

Technical Features

- For operating the TURBOVAC 151 (C), 361 (C), 600 C, 1000 C and 1100 C turbomolecular pump
- Front panel with LED
  - Status, Power, Error, pump run-up, pumping power
- Wide voltage range mains input
- Current interfaces like Profibus, DeviceNet, Ethernet/IP, RS 232 C, RS 485 C and 25-way terminal strip, available as options

Advantages to the User

- Easy integration within a vacuum system owing to the large variety of different modern interfaces as well as for modernising older systems
- Start/stop function through keys on the front panel
- Remote control and process control through analog and PLC compatible inputs and outputs
- Compatible to frequency converter NT 20, NT 151/361 and NT 361



Dimensional drawing for the electronic frequency converter TURBO.DRIVE TD 20 *classic*

Technical Data

TURBO.DRIVE TD 20 classic

Mains connection	50/60 Hz	100 to 240 V (+15 % / -10 %)
Max. power consumption	W	500
Max. output voltage	V	3 x 47
Max. output current	A	5
Interface		Without, RS 232 C, RS 485 C, Profibus or 25-way terminal strip
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	213 x 128 x 315 (8.39 x 5.04 x 12.40)
Weight, approx.	kg (lbs)	4.0 (8.8)

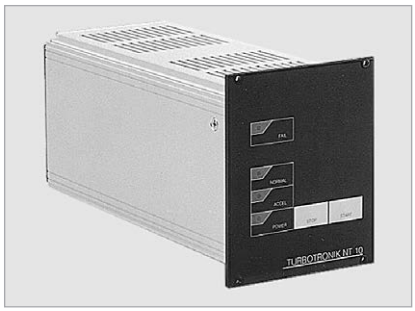
Ordering Information

TURBO.DRIVE TD 20 classic

	Part No.
TURBO.DRIVE TD 20 classic	
without interface	**800075V0001**
with RS 232 C interface	**800075V0002**
with RS 485 C interface	**800075V0004**
with Profibus	**800075V0003**
with 25-pol I/O	**800075V0005**
Mains cable	
3 m (10.5 ft)	
EURO plug	**800102V0002**
UK plug	**800102V0003**
US plug 5-15 P	**800102V1002**
2 m (7.5 ft)	
US plug 115 V AC	**992 76 513**
Connecting cable TURBOVAC - frequency converter	
3 m (10.5 ft)	**857 65**
5 m (17.5 ft)	**857 66**
10 m (35.0 ft)	**857 67**
20 m (70.0 ft)	**857 68**
50 m (175.0 ft)	**800152V0008**
60 m (210.0 ft)	**800152V0007**
80 m (280.0 ft)	**800152V0080**
140 m (490.0 ft)	**800152V0140**
19" rack mounting frame 3 HU	**161 00**
Pump adapter cable	**800 000 006**
Adapter cable, 0.2 m (0.7 ft) long 25-way PLC interface to 2x Phoenix plugs (required when a NT 20 with connected PLC interface needs to be replaced)	**800152V0020**
PC software TURBO.DRIVE Server [1]	**800110V0102** (see Chapter "Accessories" at the end of the section)

[1] Software supports only RS 232 C, RS 485 C and Profibus

TURBOTRONIK NT 10



Technical Features

- For operating the TURBOVAC 50 turbomolecular pump
- Bench top unit
- Also for rack mounting (1/4 19", 3 HU)
- Controls and indicators on the front panel
- Inputs for remote control and process controller
- Freely assignable relays (e.g. to control the backing pumps)

Technical Data — TURBOTRONIK NT 10

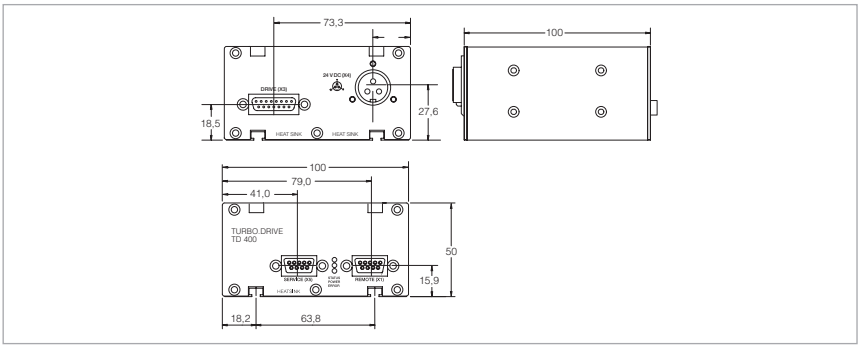
Mains connection	50/60 Hz	100-120 or 200-240 V
Max. power consumption	W	45
Max. output voltage	V	3 x 150
Max. output current	A	6
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +40 (+32 to +104)
Dimensions (W x H x D)	mm (in.)	106 x 128 x 233 (4.17 x 5.04 x 9.17)
Weight, approx.	kg (lbs)	1.5 (3.3)

Ordering Information — TURBOTRONIK NT 10

	Part No.
100 - 120 V (with US plug)	**859 01**
200 - 240 V (with EURO plug)	**859 00**
Connecting cable pump - converter	
1 m (3.5 ft)	**200 11 609**
3 m (10.5 ft)	**121 08**
5 m (17.5 ft)	**121 09**
10 m (35.0 ft)	**161 10**
15 m (52.5 ft)	**119 90**
20 m (70.0 ft)	**800150V2000**

TURBO.DRIVE TD 400 (TD 400) for TURBOVAC SL 80

TURBO.DRIVE TD 400 (Front side)



Dimensional drawing for the TURBO.DRIVE TD 400

Technical Features

- Small footprint
- USB, RS 232 C, RS 485 C, Profibus or Ethernet/IP interface
- Configurations:
  - as a separate frequency converter
  - integrated within the turbomolecular pump
- Remote control via remote interface
- Flexible mounting options
- Cost-effective supply of 24 V DC

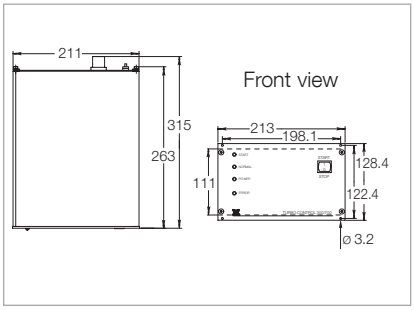
Technical Data — TURBO.DRIVE TD 400

Mains connection	V DC	24
Max. current consumption	A	8
Max. power consumption	W	190
Max. output voltage	V	3 x 24
Interface		USB, RS 232 C, RS 485 C or Profibus
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	+5 to +45 (+41 to +113)
Dimensions (W x H x D)	mm (in.)	100 x 90 x 100 (3.9 x 3.5 x 3.9)
Weight, approx.	kg (lbs)	0.7 (1.6)

Ordering Information — TURBO.DRIVE TD 400

	Part No.
TURBO.DRIVE TD 400	
with USB interface	**800073V0008**
with RS 232 C interface	**800073V0002**
with RS 485 C interface	**800073V0003**
with Profibus	**800073V0004**
Connecting cable TD 400 - Pump	
0.2 m (0.70 ft)	**800152V0021**
0.3 m (1.15 ft)	**800152V0023**
0.4 m (1.40 ft)	**800152V0022**
0.5 m (1.75 ft)	**800152V0050**
1.0 m (3.50 ft)	**P152 47**
2.5 m (8.75 ft)	**864 49**
3.0 m (10.5 ft)	**864 40**
5.0 m (17.5 ft)	**864 50**
START/STOP switch (for manual operation)	**152 48**
Hat rail adaptor as mounting aid	**800110V0003**
Accessories for RS 232 C and RS 485 C interfaces	(see Chapter “Accessories” at the end of the section)

TURBO.CONTROL 300
Power Supply Unit for TURBO.DRIVE TD 400



Dimensional drawing for the power supply TURBO.CONTROL 300

Technical Features

- Cost-effective supply of 24 V DC power for SL 80 and TURBO.DRIVE TD 400
- Plug & play
- Bench top unit or for cabinet mounting
- Mains switch
- START/STOP switch for the turbo-molecular pump
- Remote control via remote interface
- Status indicating LEDs and status relays

Technical Data

Power Supply
TURBO.CONTROL 300

Mains connection	50/60 Hz	85-264 V
Max. power consumption	W	300
Max. output voltage	V DC	24
Max. current consumption	A	8.4
Protection rating	IP	20
Admissible ambient temperature	°C (°F)	0 to +40 (+32 to +104)
Dimensions (W x H x D)	mm (in.)	213 x 129 x 320 (8.4 x 5.1 x 12.6)
Weight, approx.	kg (lbs)	1.5 (3.3)

Ordering Information

Power Supply
TURBO.CONTROL 300

	Part No.
Power supply TURBO.CONTROL 300	**800100V0001**
DC cable frequency converter - power supply	24 V DC control cable
1 m (3.5 ft)	**800091V0100**
3 m (10.5 ft)	**800091V0300**
5 m (17.5 ft)	**800091V0500**
10 m (35.0 ft)	**800091V1000**
20 m (70.0 ft)	**800091V2000**
Mains cable	
3 m (10.5 ft)	
with EURO plug	**800102V0002**
with UK plug	**800102V0003**
with US plug 5-15 P	**800102V1002**
2 m (7.5 ft)	
US plug 115 V AC	**992 76 513**

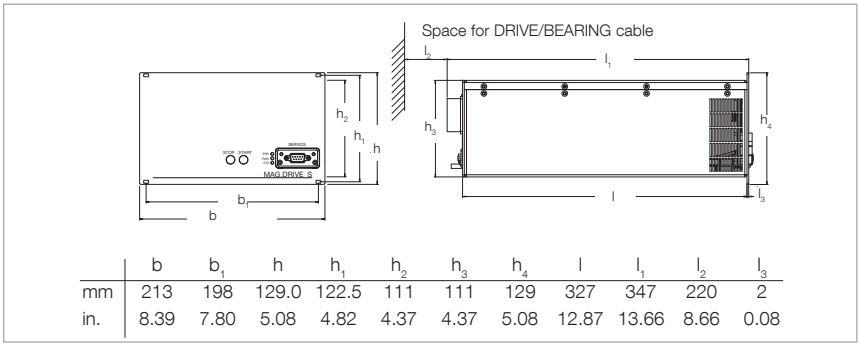
Electronic Frequency Converters for Pumps with Magnetic Rotor Suspension

MAG.DRIVE S

MAG.DRIVE S with display

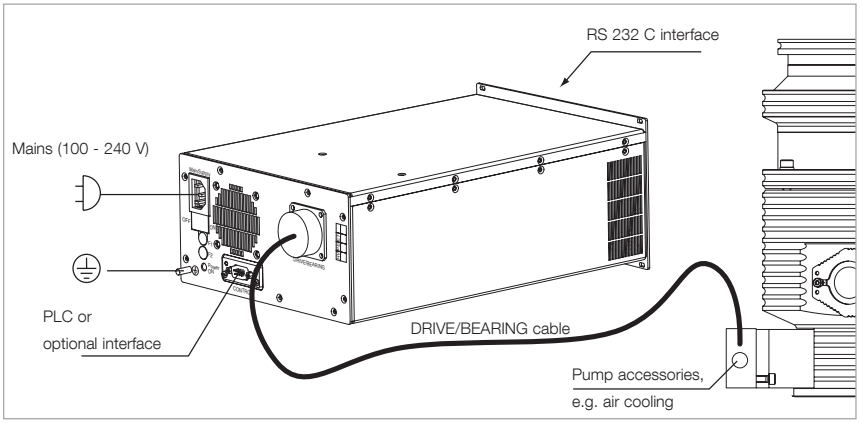
Advantages to the User

- Operation of turbomolecular pumps with magnetically levitated rotors:
  MAG W 300/400 P and
  MAG W 600/700 P
- Easy operation through the controls
- Communication to host computer of the customer via serial interface and conventional interface possible
- Setting of speed and other functions
- Warning in case the pump is running out of specification
- Storing of all parameters in the pump's memory
- Small size and low weight
- Integrated fan
- 2 slots for industrial communications modules
  - rear side:
    Standard 9 pin 24 V SPS
    PLC-IO in Control Slot
  - front side:
    RS 232 C in Service Slot
  - further interfaces can be fitted:
    Ethernet, Profibus, DeviceNet,
    RS 485 C



	b	b_1	h	h_1	h_2	h_3	h_4	l	l_1	l_2	l_3
mm	213	198	129.0	122.5	111	111	129	327	347	220	2
in.	8.39	7.80	5.08	4.82	4.37	4.37	5.08	12.87	13.66	8.66	0.08

Dimensional drawing for the MAG.DRIVE S



Overview connection lines

Technical Data

MAG.DRIVE S

Voltage range	V	100 - 240, ± 10%
Nominal frequency	Hz	50 / 60
Power consumption		
stand-by	W	100
maximum	W	400
Max. motor voltage	V	48
Max. pump current	A	6
Fuses F1, F2 5 x 20 mm		10 A fast blow high breaking capacity 250 V
System fuse		L or G characteristic
Max. frequency	Hz	0 to 2000
Load capability, relay output X1	V / A	32 / 0,5
Temperature		
during operation	°C (°F)	0 to +45 (+32 to +113)
during storage	°C (°F)	-10 to +60 (+14 to +140)
Relative humidity of the air	%	95 (non-condensing)
Weight, approx.	kg (lbs)	65 (14.35)

Ordering Information

MAG.DRIVE S

	Part No.
Electronic frequency converter MAG.DRIVE S with display	**410300V0212**
Connecting cable DRIVE/BEARING (connection between pump and MAG.DRIVE S)	
3.0 m (10.5 ft)	**410300V4003**
5.0 m (17.5 ft)	**410300V4005**
10.0 m (35.0 ft) [1]	**410300V4010**
20.0 m (70.0 ft) [1]	**410300V4020**
Mains cable	
3.0 m (10.5 ft)	
EURO plug	**800102V0002**
US plug 5-15 P	**800102V1002**
2.0 m (7.5 ft)	
US plug 115 V AC	**992 76 513**

[1] Suited for operating the MAG W 300/400 only

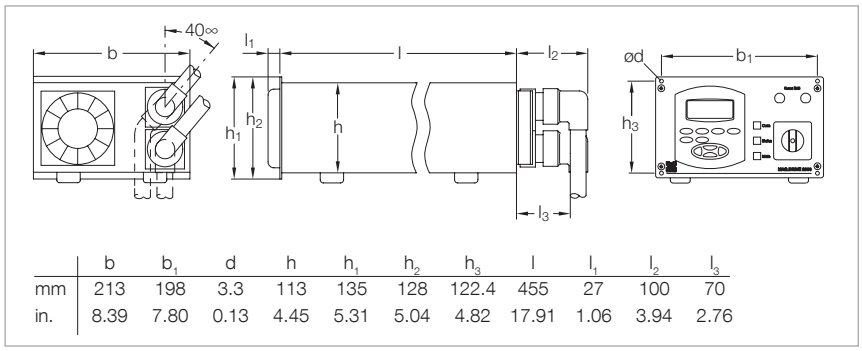
MAG.DRIVE digital

MAG.DRIVE digital without plug-in control

MAG.DRIVE digital with plug-in control

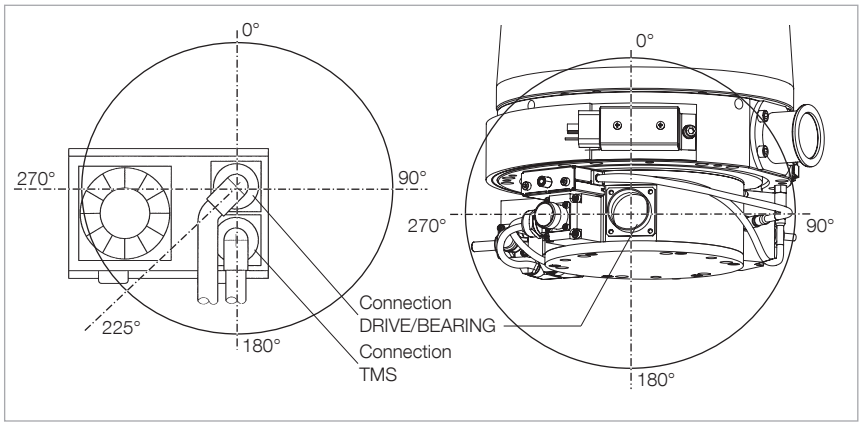
Advantages to the User

- Operation of turbomolecular pumps with magnetically levitated rotors:
  MAG W 830/1300 C,
  MAG (W) 1500 CT,
  MAG W 2000 C/CT,
  MAG W 2200 C/CT and
  MAG W 2800/3200 C/CT
- Easy operation through the controls or the use of plug-in control unit
- Communication to host computer of the customer via serial interface and conventional interface possible
- Setting of speed, temperature of the basic flange and other functions
- Warning in case the pump is running out of specification
- Storing of all parameters in the pump's memory
- Plug-in control
- Small size and low weight
- Integrated fan
- Integrated temperature management system (TMS)



	b	b_1	d	h	h_1	h_2	h_3	l	l_1	l_2	l_3
mm	213	198	3.3	113	135	128	122.4	455	27	100	70
in.	8.39	7.80	0.13	4.45	5.31	5.04	4.82	17.91	1.06	3.94	2.76

Dimensional drawing for the MAG.DRIVE digital



Overview connection lines

Technical Data

MAG.DRIVE digital

Mains connection, 50/60 Hz	V	200 - 240, +10%/-15%
Current for connected consumers, max.	A	20
Max. motor voltage	V	60
Nominal frequency	Hz	50/60
Permissible ambient temperature	°C (°F)	0 to +45 (+32 to +113)
Dimensions (W x H x D)	mm (in.)	483 x 213 x 1/2 19" (19.02 x 8.39 x 1/2 19")
Weight, approx.	kg (lbs)	10 (22)

Ordering Information

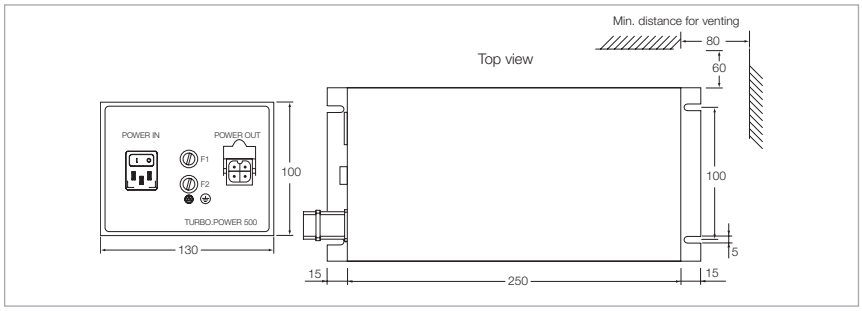
MAG.DRIVE digital

				Part No.
Electronic frequency converter [1]				
MAG.DRIVE digital				**400035V0011**
with Profibus interface				**400035V0013**
with RS 232 C interface				**400035V0014**
Plug-in control				**121 36**
Connection line leading to the DRIVE/BEARING of the TURBOVAC MAG ... C/CT				
	Cable outlet frequency converter	Cable outlet pump		
	DRIVE/BEARING	DRIVE/BEARING	PK	
1.5 m (5.25 ft)	bended 225°	straight	straight	**400036V0001**
1.5 m (5.25 ft)	bended 40°	bended 180°	straight	**400036V0025**
3.0 m (10.5 ft)	straight	bended 180°	straight	**400036V0006**
3.0 m (10.5 ft)	bended 225°	straight	straight	**400036V0008**
3.0 m (10.5 ft)	straight	bended 270°	straight	**400036V0009**
5.0 m (17.5 ft)	bended 225°	straight	straight	**400036V0004**
5.0 m (17.5 ft)	straight	straight	straight	**400036V0010**
8.0 m (28.0 ft)	bended 225°	straight	straight	**400036V0005**
10.0 m (35.0 ft)	bended 225°	straight	straight	**400036V0002**
20.0 m (70.0 ft)	bended 225°	straight	straight	**400036V0003**
23.0 m (80.5 ft)	bended 225°	straight	straight	**400036V0012**
30.0 m (105 ft)	bended 225°	straight	straight	**400036V0011**
TMS (only for CT versions)				
	Cable outlet frequency converter	Cable outlet pump		
	TMS	TMS	Heater	
1.5 m (5.25 ft)	bended 225°	straight	bended 180°	**400037V0001**
1.5 m (5.25 ft)	bended 40°	straight	bended 180°	**400037V0025**
3.0 m (10.5 ft)	bended 225°	straight	bended 180°	**400037V0008**
5.0 m (17.5 ft)	bended 225°	straight	bended 180°	**400037V0004**
8.0 m (28.0 ft)	bended 225°	straight	bended 180°	**400037V0005**
10.0 m (35.0 ft)	bended 225°	straight	bended 180°	**400037V0002**
20.0 m (70.0 ft)	bended 225°	straight	bended 180°	**400037V0003**
Purge / Vent (only for optional purge vent valve Part No. 121 33)				
	Cable outlet frequency converter	Cable outlet pump		
	TMS	Purge	Vent	
1.5 m (5.25 ft)	straight	bended	bended	**400038V0007**
3.0 m (10.5 ft)	bended 225°	bended	bended	**400038V0006**
10.0 m (35.0 ft)	bended 225°	bended	bended	**400038V0002**
20.0 m (70.0 ft)	straight	bended	bended	**400038V0009**
Connector for hardware interface				**upon request**
19" installation frame				**161 00**

[1] Included are 2 mains cords. One with EURO plug and one with US plug (220 V AC). Replacement mains cord are Part Numbers 180 097 or 180 096 respectively

Power Supply TURBO.POWER 500

for TURBOVAC MAG W 300/400/600/700 iP



Dimensional drawing for the power supply TURBO.POWER 500

Technical Features

- For supplying 48 V DC power to the MAG W 300/400/600/700 iP
- Bench top unit or for cabinet mounting

Technical Data

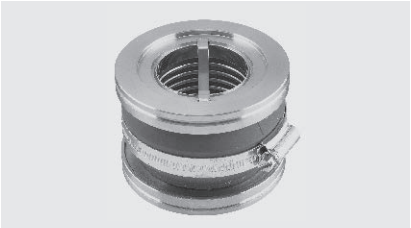
		Power Supply TURBO.POWER 500
Power supply (POWER IN)	V	100 - 240, ± 10%
Nominal frequency	Hz	50 / 60
Power consumption		
maximum	VA	650
at ultimate pressure operation of the pump	VA	450
DC voltage range		
POWER OUT	V DC	48
max.	A	10
Length of the DC connection cable, max.		
at 3 x 1.5 mm²	m (ft)	5 (17.5)
at 3 x 2.5 mm²	m (ft)	20 (70.0)
Ambient temperature		
during operation	°C (°F)	+10 to +40 (+50 to +104)
during storage	°C (°F)	-10 to -70 (+14 to -94)
Relative humidity of the air	%	5 to 85 (non-condensing)
Protection class	IP	30
Overvoltage category		II
Pollution category		2
Weight, approx.	kg (lbs)	4.0 (8.8)

Ordering Information

	Power Supply TURBO.POWER 500 Part No.
Power supply TURBO.POWER 500	**410300V0221**
DC cable (connection between TURBO.POWER 500 and MAG.DRIVE iS)	
1.0 m (3.5 ft)	**410300V2001**
3.0 m (10.5 ft)	**410300V2003**
5.0 m (17.5 ft)	**410300V2005**
10.0 m (35.0 ft)	**410300V2010**
20.0 m (70.0 ft)	**410300V2020**
Mains cable	
3.0 m (10.5 ft)	
EURO plug	**800102V0002**
US plug 5-15 P	**800102V1002**
2.0 m (7.5 ft)	
US plug 115 V AC	**992 76 513**

Vibration Absorber

Vibration absorbers are used to inhibit the propagation of vibrations from the turbomolecular pump to highly sensitive instruments like electron beam microscopes, micro-balances or analytical instruments.



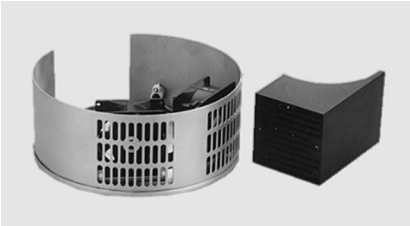
Ordering Information

Vibration Absorber

	Part No.
Vibration absorber	
DN 63 ISO-K 66 mm (2.60 in.) long	**800131V0063**
DN 63 CF 81 mm (3.19 in.) long	**500 070**
DN 100 ISO-K 84 mm (3.31 in.) long	**800131V0100**
DN 100 CF 100 mm (4.09 in.) long	**500 071**
DN 160 ISO-K 84 mm (3.31 in.) long	**500 073**
DN 160 CF 104 mm (4.09 in.) long	**500 072**

Air Cooling Unit for TURBOVAC ClassicLine Pumps

For the purpose of retrofitting the TURBOVAC 50, 151, 361 and 600 pumps for air cooling, an air cooling unit is available by way of a retrofit kit. This kit can be easily fitted to the respective pump using the fitting components included with the accessories.



Technical Data

Air Cooling Unit

Rated power consumption of the air cooling unit when connected to	
TURBOVAC 50, 151 (C)/361 (C) W	10.5
TURBOVAC 600 C, 1000 C W	21.0

Ordering Information

Air Cooling Unit

	Part No.	Part No.
Air cooling unit for	230 V	100-115 V
TURBOVAC 50	**854 05**	**800152V0015**
TURBOVAC 1 51 (C)/361 (C)	**855 31**	**800152V0016**
TURBOVAC 600 C, 1000 C	**855 41**	**800152V0017**

Air Cooling Unit for TURBOVAC SL Pump

For fitting to the turbomolecular pump SL 80

Air cooling units for the pump SL 80

Technical Data		Air Cooling Unit
Power supply voltage	V DC	24
Current rating	mA	39
Power	W	0.9
Operating temperature	°C (°F)	+10 to +40 (+50 to +104)
Protection class	IP	20
Weight, approx.	kg (lbs)	0.23 (0.51)
Volume flow	m^3/h	20

Ordering Information	Air Cooling Unit
	Part No.
Air cooling unit for TURBOVAC SL 80	**800136V0001**

Flange Heater for CF High Vacuum Flanges

Most TURBOVAC pumps can be baked out in order to improve the ultimate pressure attained in the UHV range. Degassing of the turbomolecular pump will only be useful when simultaneously baking out the vacuum chamber.

Technical Data		Flange Heater
Rated power consumption of the flange heater		
DN 63 CF, DN 100 CF	W	100
DN 160 CF	W	150

Ordering Information	Flange Heater	
	Part No.	**Part No.**
Flange heater	230 V	115 V
DN 63 CF	**854 04**	**854 07**
DN 100 CF	**854 27**	**854 28**
DN 160 CF	**854 37**	**854 38**

Fine Filter

A fine filter integrated in the centering ring protects the pump against particles and dust on the high vacuum side.

Ordering Information — Fine Filter

	Part No.
Connection flange of the fine filter	
DN 40 ISO-KF	883 98
DN 63 ISO-K	887 20
DN 100 ISO-K	887 21

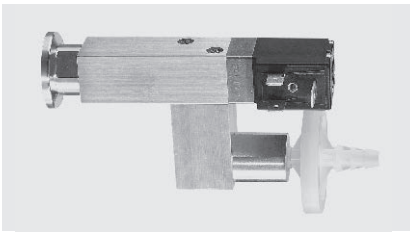
Securing Collar for Octal Socket Plugs for ClassicLine Pumps TURBOVAC 151 (C), 361 (C), 600 C, 1000 C and 1100 C

The securing collar serves the purpose of securing the plug on the ClassicLine pumps TURBOVAC 151 (C), 361 (C), 600 C, 1000 C and 1100 C against being disconnected inadvertently.

Ordering Information — Securing Collar for Octal Socket Plugs

	Part No.
Securing collar for octal socket plugs	800001830

Solenoid Venting Valve



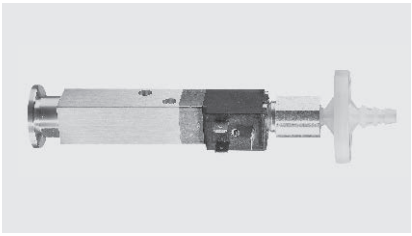
Technical Data — Venting Valve

Drive voltage	V DC	24
Power consumption	W	4
Connecting flange	DN	16 ISO-KF
Weight, approx.	kg (lbs)	0.3 (0.66)

Ordering Information — Venting Valve

	Part No.
Solenoid venting valve, normally closed	800120V0011

Power Failure Venting Valve



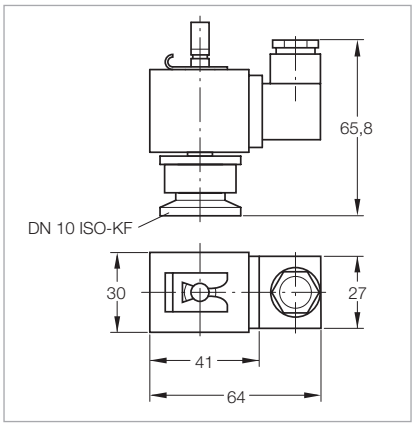
Technical Data — Power Failure Venting Valve

Drive voltage	V DC	24
Power consumption	W	4
Connecting flange	DN	16 ISO-KF
Weight, approx.	kg (lbs)	0.3 (0.66)

Ordering Information — Power Failure Venting Valve

	Part No.
Power failure venting valve, normally open	800120V0021

Power Failure Venting Valve, Electromagnetically Actuated



Dimensional drawing for the electromagnetically astuated power failure venting valve

Technical Data — Power Failure Venting Valve

Technical data	See Catalog “Valves”, para. “Special Valves”

Ordering Information — Power Failure Venting Valve

	Part No.
Power failure venting valve DN 10 ISO-KF, electromagnetically actuated	
24 V DC	**174 46**
230 V AC / 50/60 Hz	**174 26**

Purge Gas and Venting Valve

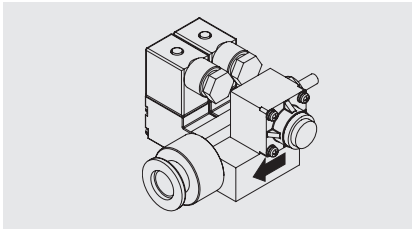
Technical Data — Purge Gas and Venting Valve

Connecting flange	DN	10 ISO-KF
Weight, approx.	kg (lbs)	0.7 (1.55)

Ordering Information — Purge Gas and Venting Valve

	Part No.
Purge gas and venting valve, 230 V	
0.2 mbar x l x s^{-1} (12 sccm)	**855 19**
0.4 mbar x l x s^{-1} (24 sccm)	**855 29**

Purge Gas and Venting Valve



Technical Data — Purge Gas and Venting Valve

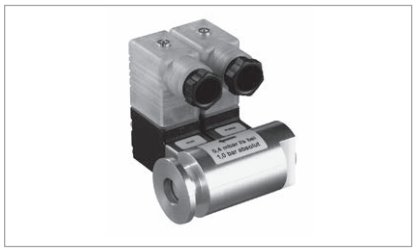
Connecting flange		
Inlet		1/4" tube
Outlet		pump specific or DN 16 ISO-KF
Purge gas pressure, abs.	bar	1.5 to 6,0
Weight, approx.	kg (lbs)	0.5 (1.1)

Ordering Information — Purge Gas and Venting Valve

	Part No.
Purge gas and venting valve, 24 V DC	
0.6 mbar x l x s^{-1}	**121 33**

Further 0.6 mbar x l x s^{-1} valves upon request

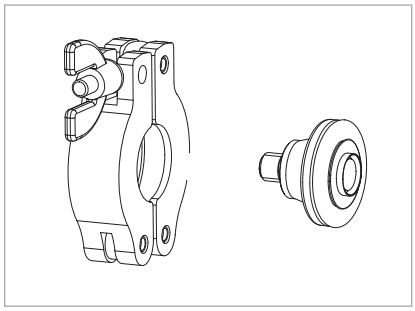
Purge Gas and Venting Valve for ClassicLine and SL Pumps



Technical Data		Purge Gas and Venting Valve
Connecting flange		
Pump side	DN	10 ISO-KF
Gas connection	G	1/4"
Seal gas pressure, abs.	bar	1
Weight, approx.	kg (lbs)	0.3 (0.66)

Ordering Information	Purge Gas and Venting Valve
	Part No.
Purge gas and venting valve at 1 bar	
0.2 mbar x l x s^{-1} (12 sccm), 24 V DC	**113 50**
0.2 mbar x l x s^{-1} (12 sccm), 110 - 115 V AC	**800152V0041**
0.2 mbar x l x s^{-1} (12 sccm), 230 V AC	**800152V0019**
0.4 mbar x l x s^{-1} (24 sccm), 24 V DC	**800152V0013**
0.4 mbar x l x s^{-1} (24 sccm), 110 - 115 V AC	**800152V0042**
0.4 mbar x l x s^{-1} (24 sccm), 230 V AC	**800152V0014**
0.6 mbar x l x s^{-1} (36 sccm), 24 V DC	**800152V0012**
0.6 mbar x l x s^{-1} (36 sccm), 110 - 115 V AC	**800152V0043**
0.6 mbar x l x s^{-1} (36 sccm), 230 V AC	**800152V0040**

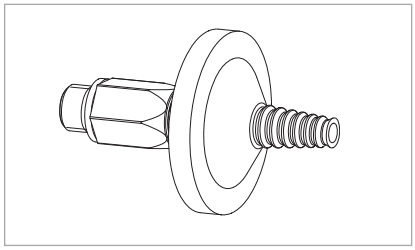
Adapter Set for Seal Gas and Venting Valve for the SL pumps



Technical Data	Adapter Set
Pump flange adapter	M8 / DN 10 ISO-KF
incl. adapter centering ring	
with sinter filter insert and clamping ring	DN 10 / DN 16 ISO-KF

Ordering Information	Adapter Set
	Part No.
Adapter set for	
purge gas and venting valve	**800110V0011**

Gas Filter to G 1/4" for Purge Gas and Venting Valve



Technical Data	Gas Filter
Gasfilter	
including fitting G 1/4" and 2 gaskets	

Ordering Information	Gas Filter
	Part No.
Gas filter to G 1/4"	
for seal gas and venting valve	**800110V0012**
Replacement filter for gas filter to G 1/4"	**E 200 18 515**
for seal gas and venting valve	

Accessories for Serial Interfaces RS 232 C and RS 485 C

Through these accessories many control, monitoring and information capabilities can be implemented in connection with the electronic frequency converters and turbomolecular pumps.

All turbomolecular pumps or electronic frequency converters are supported.

PC Software LEYASSIST

Software for PC-based communication, control and monitoring of turbomolecular pumps via USB, RS 485 or RS 232 interface with automatic pump detection.

Functions

- Display of vacuum system status
- Configuring the accessory functions of the TURBOVAC i / iX
- Reading/writing of parameters
- Data logging
- Alarm/warning message logging

Ordering Information **PC Software LEYASSIST**

	Part No.
PC software LEYASSIST	**230439V01**

Interface Adaptor for Frequency Converter with RS 232 C/RS 485 C Interface

Ordering Information **Interface Adaptor RS 232 C/RS 485 C**

	Part No.
Adaptor RS 232 C/RS 485 C mains connection 230 V, 50 Hz, EURO plug	**800110V0101**
Adaptor USB/RS 232 C for connection of RS 232 C to USB (PC), including CD with drivers and manual	**800110V0103**

Services for Mechanically Suspended Turbomolecular Pumps

Complete Refurbishing at the Service Centre

Complete refurbishing at the service centre includes the following:
Complete disassembly, cleaning, replacement of all wearing parts, mounting, electrical safety test, final test including vibration measurement

Complete Refurbishing with Decontamination at the Service Centre

Complete refurbishing with decontamination at the service centre includes the following:
Complete disassembly, cleaning and decontamination, replacement of all wearing parts, mounting, electrical safety test, final test including vibration measurement

Ordering Information	Complete Refurbishing at the Service Centre	Complete Refurbishing with Decontamination at the Service Centre
	Part No.	Part No.
For pump		
TURBOVAC 35 / 50D	**AS 2165**	**AS 2165 D**
TURBOVAC 50	**AS 2133**	**AS 2133 D**
TURBOVAC SL 80	**LAS 2368**	**LAS 2368 D**
TURBOVAC TW 70 H	**AS 2368**	**AS 2368 D**
TURBOVAC 151	**AS 2134**	**AS 2134 D**
TURBOVAC TW 250 S	**AS 2168**	**AS 2168 D**
TURBOVAC SL 300	**LAS 2369**	**LAS 2369 D**
TURBOVAC TW 300	**AS 2369**	**AS 2369 D**
TURBOVAC 361	**AS 2135**	**AS 2135 D**
TURBOVAC 600 / 1000	**AS 2136**	**AS 2136 D**
TURBOVAC TW 701 / 690	**AS 2330**	**AS 2330 D**
TURBOVAC 1100	**AS 2137**	**AS 2137 D**

Services for Magnetically Levitated Turbomolecular Pumps

Complete Refurbishing at the Service Centre

Complete refurbishing at the service centre includes the following:
Complete disassembly, cleaning, replacement of all wearing parts, mounting, electrical safety test, final test including vibration measurement

Complete Refurbishing with Decontamination at the Service Centre

Complete refurbishing with decontamination at the service centre includes the following:
Complete disassembly, cleaning and decontamination, replacement of all wearing parts, mounting, electrical safety test, final test including vibration measurement

Ordering Information	Complete Refurbishing at the Service Centre	Complete Refurbishing with Decontamination at the Service Centre
	Part No.	**Part No.**
For pump		
TURBOVAC 340 M	**AS 2141**	**AS 2141 D**
TURBOVAC 340 MC/MCT	**AS 2142** [1]	**AS 2142 D** [1]
TURBOVAC MAG 400 C/CT	**AS 2143** [1]	**AS 2143 D** [1]
MAG (W) 1600 / 2000	**AS 2164** [1]	**AS 2164 D** [1]
MAG (W) 830 / 1300 / 1500	**AS 2370** [1]	**AS 2370 D** [1]
MAG 900 / 1000 / 1200	**AS 2160** [1]	**AS 2160 D** [1]
MAG 2200	**AS 2200** [1]	**AS 2200 D** [1]
MAG 2800 / 3200	**AS 2800** [1]	**AS 2800 D** [1]

Notes

The listed services include the costs for material and working hours for standard pumps. Services for pump variants upon request.
If additional spare parts are needed for repairs, then these are invoiced separately according to a cost estimate.

[1] Including rotor replacement

Applications and Accessories for Oil Diffusion Pumps

Pumps	DIP 3000	DIP 8000	DIP 12000	DIP 20000	DIP 30000	DIP 50000	LEYBOJET 630	OB 6000	OB 12000	OB 18000
Application										
Vacuum coating (e.g. Sputtering)	■	■	■	■	■	■	■	■	■	■
Research and development	■	■	■	■	■	■	■	■	■	■
Metallurgy/furnaces	■	■	■	■	■	■	■	■	■	■
Mechanical engineering	■	■	■	■	■	■	■	■	■	■
Sputtering process							■	■	■	■
Secondary metallurgy (e.g. VIM, VID)								■	■	■
High vacuum furnaces								■	■	■

Accessories	Page										
Astrotorus baffle	450	■	■	■	■	■	■	■			
Over-temperature protection switch	452	■	■	■	■	■	■	■			
Contact thermometer	452	■	■	■	■	■	■	■			
Resistance thermometer Pt100	452	■	■	■	■	■	■	■			
Monitoring instruments	453	■	■	■	■	■	■	■	■	■	■
Power controller	454				■	■	■	■	■	■	■
Adsorption trap	456	For generating an oil-free vacuum with oil sealed backing pumps									

Oil for Diffusion Pumps for different fields of application

Application	Vacuum coating	Research and development	Metallurgy/furnaces	Mechanical engineering	Sputter processes
LEYBONOL Oils					
LVO 500	■	■	■	■	■
LVO 510	●	●	●	●	●
LVO 520	●	●			
LVO 530	●	●			
LVO 540 [1)]	■	■	■	■	■

■ = Standard
● = Possible

[1)] Only for OB pumps

The table only lists general applications. Your specific requirements might be subject to deeper analysis. For further questions, please contact our technical Sales support.

For information on oil specifications please refer to Catalog Part "Oils / Greases / Lubricants LEYBONOL®".

Oil for Diffusion Pumps for different pump types

Pumps	DIP 3000	DIP 8000	DIP 12000	DIP 20000	DIP 30000	DIP 50000	LEYBOJET 630	OB 6000	OB 12000	OB 18000
LEYBONOL Oils										
LVO 500	■	■	■	■	■	■	■			
LVO 510	●	●	●	●	●	●	●			
LVO 520	●	●	●	●	●	●	●			
LVO 530	●	●	●	●	●	●	●			
LVO 540								■	■	■

■ = Standard
● = Possible

Note
All oils may be used.
The pumps are supplied as standard without oil.

The table only lists general applications. Your specific requirements might be subject to deeper analysis. For further questions, please contact our technical Sales support.

For information on oil specifications please refer to Catalog Part "Oils / Greases / Lubricants LEYBONOL®".

Operating Principle of Fluid Entrainment Vacuum Pumps

The main components of diffusion pumps, the operation of which relies on vapor-phase pump fluids are:

- Cooled pump body with intake and exhaust ports
- System of nozzles
- Pump boiler

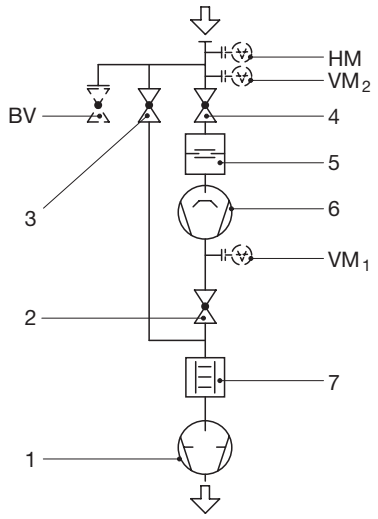
In the case of diffusion pumps a pump fluid contained in a boiler is heated to such an extent that it is vaporized. The vapor is then forced through nozzles within the pump. The nozzles are generally designed in such a way, that they accelerate the vapor to a speed exceeding the speed of sound (Laval nozzles), thus creating a high speed vapor jet. The vapor is then deflected by the nozzles at a specific angle onto the pump body. The pump body is cooled, so that the vaporized pump fluid condenses and is returned back to the boiler as a liquid. The pumping action of diffusion pumps and fluid entrainment pumps in general is based on the transporting capacity of the vapor jet.

The gas which is to be pumped is compressed sufficiently at the fore-vacuum port so that it can be pumped out by a backing pump.

Oil Diffusion Pumps

Compared to other fluid entrainment pumps the density of the vapor in the boiler and in the vapor jet is fairly low so that the gas molecules may almost completely diffuse into the vapor jet. Thus most of the molecules which enter the vapor jet are also pumped out.

For this reason, the pumping speed of diffusion pumps is extremely high with respect to the intake area and constant – starting at an inlet pressure of approx. 10^{-3} mbar (0.75 x 10^{-3} Torr) down to very low pressures – as within the pressure range the vapor jet is not influenced in any way by the pressure within the vacuum vessel.



1	Two-stage rotary vane vacuum pump
2	Forevacuum valve
3	Rough vacuum valve
4	High vacuum valve
5	Baffle
6	Oil diffusion pump
7	Adsorption trap
HM	High vacuum gauge
VM_1	Forevacuum gauge/diffusion pump
VM_2	Forevacuum gauge/roughing line
BV	Venting valve

Diagram of a pump system with diffusion pump

Operating Oil Diffusion Pumps

Forevacuum

In all cases diffusion pumps require a sufficiently sized backing pump (see Technical Data). The size and type of forevacuum pump depends on the operating conditions and the quantities of gas which are to be pumped.

1. Continuous operation at operating pressures above 10^{-4} mbar (0.75 x 10^{-4} Torr) – large quantities of gas.
2. Continuous operation at operating pressures below 10^{-4} mbar (0.75 x 10^{-4} Torr) – smaller quantities of gas.

In applications which rely on diffusion pumps, the vacuum chamber must be connected via a valve **(3)** and a roughing line directly to the backing pump. This is done so that the vacuum chamber may be pre-evacuated by the backing pump down to a pressure where the diffusion pump can take over. Until the high vacuum valve **(4)** opens, both diffusion pump and pump fluid are preserved. Before venting the vacuum chamber the forevacuum valve **(2)** and the high vacuum valve **(4)** must be closed, whereby the diffusion pump remains in the ready status.

Pumping Speed

The pumping speed of any pump is equivalent to the volume throughput through the intake opening of a pump. In the case of diffusion pumps the pumping speed for lighter gases is higher compared to heavier gases.

Backstreaming of the Pump Fluid

Undesirable backstreaming of molecules from the pump fluid is caused by the effect that some molecules are able to leave the vapor jet and thus do not arrive at the cooled pump body. Because of collisions between each other and due to reflection at the pump body, these molecules are then able to move in the direction of the vacuum chamber.

For DIP pumps the backstreaming effect amounts only to a few µg per cm^2 of intake area per minute. Backstreaming may be almost completely suppressed by including a cold cap baffle or an additional Astrotorus baffle.

Backstreaming of Oil in the Case of Diffusion Pumps

- Pump without baffle
  approx. 1 x 10^{-2} mg x cm^{-2} x min^{-1}
- Pump with cold cap baffle
  approx. 1 x 10^{-3} mg x cm^{-2} x min^{-1}
- Pump with Astrotorus baffle
  (T = 10 °C (50 °F))
  approx. 1 x 10^{-5} mg x cm^{-2} x min^{-1}

The values stated have been measured at an intake pressure of < 1 x 10^{-4} mbar and apply to LEYBONOL LVO 500.

Attainable Ultimate Pressure

The attainable ultimate pressure for a particular vacuum system depends not only on the type and pumping speed rating of the diffusion pump, but also on the vapor pressure of the pump fluid, shape and temperature of the baffle, leaks at connecting flanges or welded joints and the condition of the surfaces within the vacuum chamber.

When excluding all effects which contribute to an increase in pressure within the vacuum chamber due to leaks and contamination of the vacuum chamber walls, it will be possible to attain the ultimate pressures stated in the table "Attainable Ultimate Pressures with Oil Diffusion Pumps (DIP)" given in chapter "General".

In practice the following combination has been found to work very well when needing a low vacuum free of oil vapors.

- Water-cooled cold cap baffle as a integral part of the diffusion pump together with a water-cooled Astrotorus baffle which may be installed as an additional component on the high vacuum flange of the diffusion pump.

Sealing Methods

For ultimate pressures down to 10^{-8} mbar (0.75×10^{-8} Torr) bakeout temperatures of up to 150 °C (302 °F) are sufficient. FPM [FKM (= Fluor caoutchouc), temperature resistant up to 150 °C (302 °F)] sealing rings or ultra sealing rings made of aluminum must be used.

In order to prevent pressure variations, ultra sealing rings must be used in the connections, between diffusion pump and baffle.

Ultimate pressures below 10^{-8} mbar (0.75×10^{-8} Torr) require bakeout temperatures up to 400 °C (752 °F). However, it is only necessary to bake out the vacuum chamber to 400 °C (752 °F) and to maintain a temperature gradient across the baffle or the cold trap so that a temperature of 150 °C (302 °F) is not exceeded at the intake flange of the pump.

In this way, it is still acceptable to use FPM (FKM) sealing rings or ultra sealing rings made of aluminium.

Cooling

The cooling water temperature should not exceed 25 °C (77 °F) at the intake and 30 °C (86 °F) at the discharge, otherwise sufficient condensation of the pump fluid cannot be ensured. When connecting the cooling system of the pump and the baffle in series, the cooling water must always be made to flow through the baffle first and then through the diffusion pump, because the attainable ultimate pressure in the vacuum chamber depends strongly on the condensation temperature of the pump fluid in the baffle.

Attainable Ultimate Pressures with Oil Diffusion Pumps

Attainable Ultimate Pressure [1]		LEYBONOL LVO 500
Without baffle	mbar (Torr)	1.5×10^{-6} (1.1×10^{-6})
With cold cap baffle	mbar (Torr)	5.0×10^{-7} (3.8×10^{-7})
With Astrotorus baffle	mbar (Torr)	1.5×10^{-7} (1.1×10^{-7})

[1] Attained in consideration of the notes given under "Sealing Methods" in the chapter "General" para. "Oil Diffusion Pumps" and after degassing the connected vacuum chamber for several hours at 200 °C (392 °F)

DIP Pumps Water-Cooled

DIP 12 000

DIP 30 000 with Power Controller

The DIP range of pumps was developed for operation in industrial systems. Excellent vacuum performance data combined with the inherent ruggedness of this kind of pump, make our diffusion pumps a reliable component in high and medium vacuum applications.

Advantages to the User

- High pumping speeds in the fine and high vacuum ranges
- Low attainable ultimate pressure
- Integrated, water-cooled cold cap baffle guarantees low oil backstreaming rates into the vacuum chamber
- Low oil losses (even at high gas throughputs) by integrated water-cooled forevacuum baffle
- High forevacuum resistance even at reduced heating power
- The heating cartridges are accessible from the outside via heating inserts which are built into the boiler. This ensures a quick exchange of single heating cartridges (even when the pump is hot)
- A separate automatic circuit breaker for each heating cartridge ensures a high level of electrical safety
- A standard built-in thermostat acts as an thermal overload switch and ensures that the heating cartridges can not overheat
- All pumps are prepared for installation with an over-temperature switch (optional) for checking the cooling water circuit, and a contact thermometer (optional) to monitor the operating temperature of the diffusion pump
- Indication of the oil level by sight-glass permits simple checking of the current oil level
- All DIP pumps are delivered with their inside chamber cleaned in such a manner that it is free of oil. The inside is evacuated. In the condition as delivered, the pumps may be also operated with silicone oil
- Utilisation of the DIP power controller cuts power consumption by up to 30% without impairing pump performance (option)

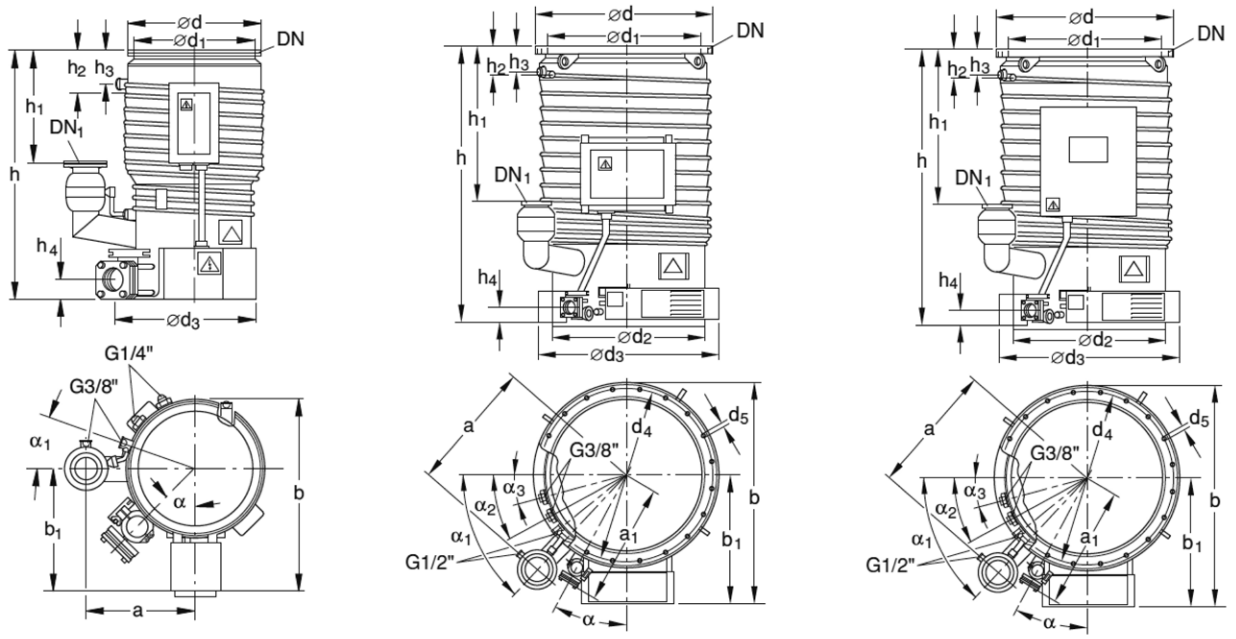
Typical Applications

The diffusion pumps from the DIP range are used in coating systems, vacuum melting and drying systems as well as in vacuum furnaces in the area of metallurgy.

Supplied Equipment

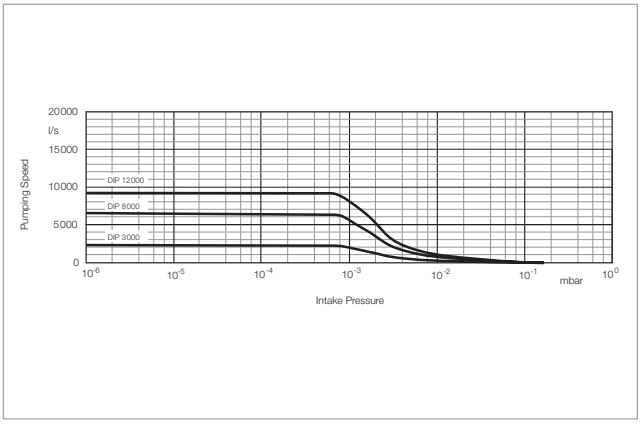
The DIP pumps are supplied ready for connection but without the filling of pump fluid.

The inside of the pump is cleaned before delivery to such an extent that it is free of oil. The inside is evacuated. High and forevacuum flanges are equipped with gaskets and centering rings having shipping flanges and complete with clamping components.

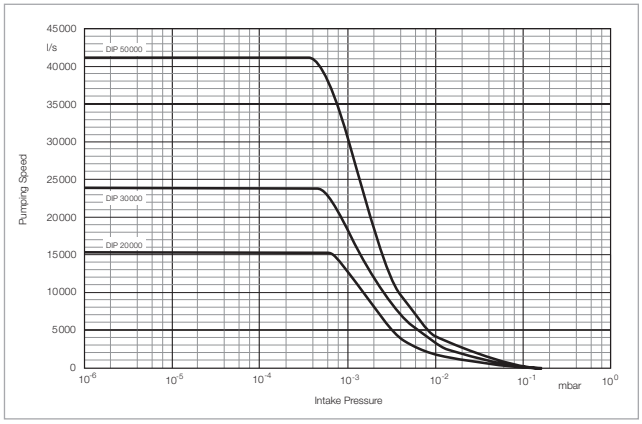


DIP	3 000	8 000	12 000	20 000	30 000	50 000
DN	250 ISO-K	400 ISO-K	500 ISO-K	630 ISO-F	800 ISO-F	1000 ISO-F
DN_1	63 ISO-K	63 ISO-K	100 ISO-K	100 ISO-K	160 ISO-K	160 ISO-K
a	240 (9.45)	350 (13.78)	420 (16.54)	540 (21.26)	600 (23.62)	800 (31.5)
a_1	250.5 (9.86)	375.5 (14.78)	432 (17)	496 (19.53)	536 (21.10)	636 (25.04)
b	443 (17.44)	643 (25.31)	775 (30.51)	980 (38.58)	1150 (45.28)	1350 (53.15)
b_1	276 (10.87)	373 (14.69)	460 (18.11)	600 (23.62)	690 (27.17)	790 (31.10)
d	290 (11.42)	450 (17.72)	550 (21.65)	750 (29.53)	920 (36.22)	1120 (44.09)
d_1	261 (10.28)	400 (15.75)	50119.72)	651 (25.63)	800 (31.5)	1000 (39.37)
d_2	–	405 (15.94)	506 (19.92)	636 (25.04)	716 (28.19)	916 (36.06)
d_3	278 (10.94)	530 (20.87)	630 (24.80)	760 (29.92)	840 (33.07)	1040 (40.94)
d_4	–	–	–	720 (28.35)	890 (35.04)	1090 (42.91)
d_5	–	–	–	14 (0.55)	14 (0.55)	14 (0.55)
Quantity of holes	–	–	–	20	24	32
h	560 (22.05)	785 (30.91)	940 (37)	1130 (44.49)	1450 (57.09)	1880 (74.02)
h_1	250 (9.84)	400 (15.75)	470 18.5)	620 (24.41)	870 (34.25)	1275 (50.2)
h_2	68 (2.68)	88 (3.46)	92 (3.62)	97 (3.82)	102 (4.02)	102 (4.02)
h_3	75 (2.95)	102 (4.02)	106 (4.17)	110 (4.33)	116 (4.57)	116 (4.57)
α	45 °	30 °	30 °	30 °	20 °	25 °
α_1	20 °	45 °	45 °	45 °	45 °	45 °
α_2	–	30 °	30 °	30 °	30 °	25 °
α_3	–	15 °	15 °	15 °	15 °	15 °

Dimensional drawing for the DIP 3000 [left], DIP 8000 and DIP 12000 [middle], DIP 20 000 to DIP 50 000 [right]; dimensions in brackets ( ) are in inch



Pumping speed characteristics of the DIP 3000 to 12000 pumps as a function of intake pressure



Pumping speed characteristics of the DIP 20000 to 50000 pumps as a function of intake pressure

Technical Data

	DIP 3 000	DIP 8 000	DIP 12 000
High vacuum / forevacuum connection DN	250 ISO-K / 63 ISO-K	400 ISO-K / 63 ISO-K	500 ISO-K / 100 ISO-K
Pumping speed for air [1] below 1 x 10^{-4} mbar l x s^{-1}	3 000	8 000	12 000
Operating range mbar (Torr)	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})
Ultimate total pressure [1] mbar (Torr)	< 5.0 x 10^{-7} (3.75 x 10^{-7})	< 5.0 x 10^{-7} (3.75 x 10^{-7})	< 5.0 x 10^{-7} (3.75 x 10^{-7})
Max. permissible forevacuum pressure mbar (Torr)	6.0 x 10^{-2} (4.5 x 10^{-2})	6.0 x 10^{-2} (4.5 x 10^{-2})	6.0 x 10^{-2} (4.5 x 10^{-2})
Pump fluid filling, min. / max. l (qts)	1.0 / 1.4 (1.1 / 1.5)	1.7 / 3.4 (1.8 / 3.6)	2.4 / 5.3 (2.5 / 5.6)
Mains connection			
Standard EURO, 50/60 Hz V	230 ~ 1 Ph	400 ~ 3 Ph Y	400 ~ 3 Ph Y
Standard Americas, 50/60 Hz V	230 ~ 1 Ph	460 ~ 3 Ph Y	460 ~ 3 Ph Y
Special, 50/60 Hz V	–	230 ~ 3 Ph Δ	230 ~ 3 Ph Δ
Heating power kW	2.4	4.8	7.2
Number of heating cartridges	2	6	9
Heating up time min	< 25	< 25	< 25
Cooling water (minimum)			
for pump [2] l x h^{-1} (gal/min)	160 (0.7)	290 (1.28)	500 (2.2)
for cold cap baffle l x h^{-1} (gal/min)	20 (0.09)	30 (0.13)	50 (0.22)
max. supply pressure bar (psig)	6 (87)	6 (87)	6 (87)
Number of cooling circuits (including cold cap baffle)	2	2	2
Cooling water connection			
for pump G (BPS)	3/8"	1/2"	1/2"
for cold cap baffle G (BPS)	1/4"	3/8"	3/8"
Weight, approx. kg (lbs)	29 (64)	70 (154)	102 (225)
Recommended backing pump [3]			
at operating pressures > 10^{-4} mbar (> 0.75 x 10^{-4} Torr)	TRIVAC D 65 B + W 251	SV 300 + W 251	SV 300 + W 501
at operating pressures < 10^{-4} mbar (< 0.75 x 10^{-4} Torr)	–	TRIVAC D 65 B + W 251	TRIVAC D 65 B + W 251

Ordering Information

	DIP 3 000	DIP 8 000	DIP 12 000
	Part No.	**Part No.**	**Part No.**
Oil diffusion pump			
Standard EURO	**222 10**	**222 20**	**222 25**
Standard Americas	**222 10**	**500 670**	**500 591**
Special	**–**	**500 649**	**22225V003**
Astrotorus baffle	**227 50**	**227 60**	**227 65**
Water flow monitor	**500006623**	**500006623**	**500006623**
Over-temperature protection switch	**122 84**	**122 84**	**122 84**
Contact thermometer	**218 81**	**218 81**	**218 81**
Resistance thermometer Pt100 sensor	**200 02 958**	**200 02 958**	**200 02 958**
Pump fluid [4]	see Catalog Part "Oils / Greases / Lubricants LEYBONOL"		

[1] Measured to DIN 28 427 with **LEYBONOL LVO 500** as the pump fluid

[2] The required quantity of cooling water refers to ΔT = 10 °C (50 °F). The discharge temperature should not exceed 30 °C (86 °F)

[3] Single- or two-stage rotary vane vacuum pump (TRIVAC; SOGEVAC) from our range of forevacuum pumps jointly with Roots vacuum pumps (RUVAC) in pump systems

[4] Oil must be purchased separately

Technical Data

	DIP 20 000	DIP 30 000	DIP 50 000
High vacuum / forevacuum connection DN	630 ISO-F / 100 ISO-K	800 ISO-F / 160 ISO-K	1000 ISO-F / 160 ISO-K
Pumping speed for air [1] below 1 x 10^{-4} mbar l x s^{-1}	20 000	30 000	50 000
Operating range mbar (Torr)	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})	< 10^{-2} to 10^{-7} (0.75 x 10^{-2} to 0.75 x 10^{-7})
Ultimate total pressure [1] mbar (Torr)	< 5.0 x 10^{-7} (3.75 x 10^{-7})	< 5.0 x 10^{-7} (3.75 x 10^{-7})	< 5.0 x 10^{-7} (3.75 x 10^{-7})
Max. permissible forevacuum pressure mbar (Torr)	6.0 x 10^{-2} (4.5 x 10^{-2})	6.0 x 10^{-2} (4.5 x 10^{-2})	6.0 x 10^{-2} (4.5 x 10^{-2})
Pump fluid filling, min. / max. l (qts)	6.0 / 9.0 (6.3 / 9.5)	7.0 / 15.0 (7.4 / 15.9)	12.0 / 25.0 (12.7 / 26.4)
Mains connection			
Standard EURO, 50/60 Hz V	400 ~ 3 Ph Y	400 ~ 3 Ph Y	400 ~ 3 Ph Y
Standard Americas, 50/60 Hz V	460 ~ 3 Ph Y	460 ~ 3 Ph Y	460 ~ 3 Ph Y
Special, 50/60 Hz V	230 ~ 3 Ph Δ	230 ~ 3 Ph Δ	230 ~ 3 Ph Δ
Reduced power consumption through power controller (saves up 30%) kW	8.4	12.6	16.8
Heating power kW	12	18	24
Number of heating cartridges	12	18	24
Heating up time min	< 25	< 30	< 30
Cooling water (minimum)			
for pump [2] l x h^{-1} (gal/min)	600 (2.6)	900 (4.0)	1500 (6.6)
for cold cap baffle l x h^{-1} (gal/min)	60 (0.26)	80 (0.35)	150 (0.66)
max. supply pressure bar (psig)	6 (87)	6 (87)	6 (87)
Number of cooling circuits (including cold cap baffle)	2	3	3
Cooling water connection			
for pump G (BPS)	1/2"	1/2"	1/2"
for cold cap baffle G (BPS)	3/8"	3/8"	3/8"
Weight, approx. kg (lbs)	172 (379)	296 (653)	560 (1235)
Recommended backing pump [3]			
at operating pressures > 10^{-4} mbar (> 0.75 x 10^{-4} Torr)	SV 200 + W 501	SV 300 + W 1001	SV 630 B + W 2001
at operating pressures < 10^{-4} mbar (< 0.75 x 10^{-4} Torr)	TRIVAC D 65 B + W 251	SV 300 + W 251	SV 300 + W 501

Ordering Information

	DIP 20 000 Part No.	DIP 30 000 Part No.	DIP 50 000 Part No.
Oil diffusion pump			
Standard EURO with control unit	**222 30V001**	**222 35V001**	**222 40V001**
Standard Americas with control unit	**222 30V002**	**222 35V002**	**222 40V002**
Standard EURO	**222 30**	**222 35**	**222 40**
Standard Americas	**500 882**	**500 665**	**500 728**
Special	**22230V004**	**22235V006**	**500 654**
Retrofit kit energy control unit	**503 647V001**	**503 648V001**	**503 648V001**
Retrofit kit energy control unit US	**503 647V002**	**503 648V002**	**503 648V002**
Astrotorus baffle	**227 70**	**227 75**	**227 80**
Water flow monitor	**500006623**	**500006623**	**500006623**
Over-temperature protection switch	**122 84**	**122 84**	**122 84**
Contact thermometer	**218 81**	**218 81**	**218 81**
Resistance thermometer Pt100 sensor	**200 02 958**	**200 02 958**	**200 02 958**
Pump fluid [4]	see Catalog Part "Oils / Greases / Lubricants LEYBONOL"		

[1] Measured to DIN 28 427 with **LEYBONOL LVO 500** as the pump fluid

[2] The required quantity of cooling water refers to ΔT = 10 °C (50 °F). The discharge temperature should not exceed 30 °C (86 °F)

[3] Single- or two-stage rotary vane vacuum pump (TRIVAC; SOGEVAC) from our range of forevacuum pumps jointly with Roots vacuum pumps (RUVAC) in pump systems

[4] Oil must be purchased separately

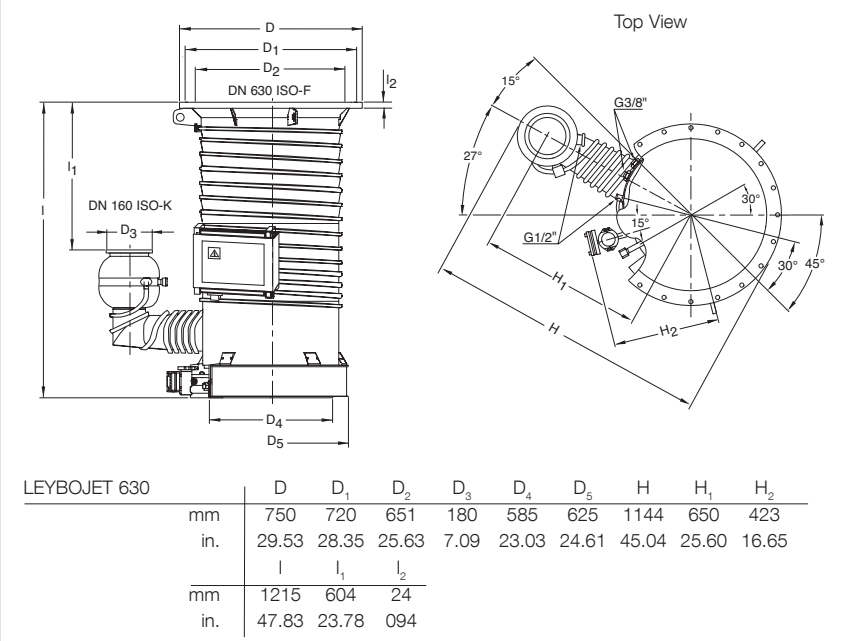
LEYBOJET 630
Water-Cooled

LEYBOJET 630

The oil diffusion pumps from Leybold are well proven in industrial high vacuum applications.

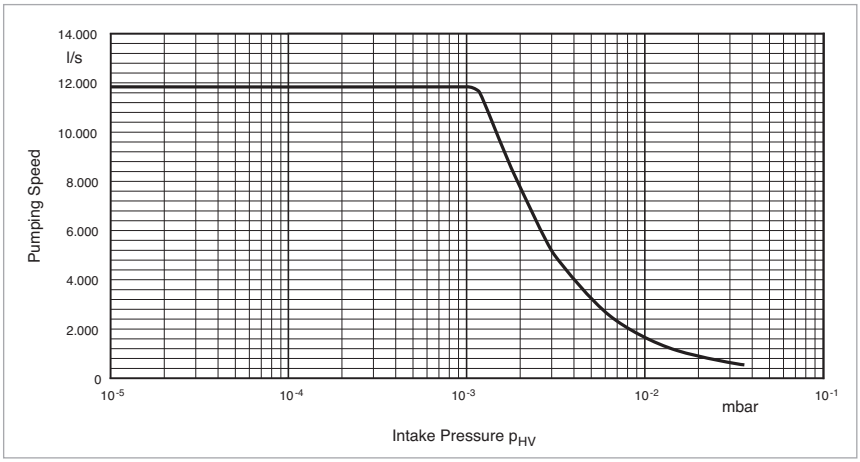
They excel through their excellent vacuum performance data and owing to their rugged design are a reliable component in many medium and high vacuum systems.

The water-cooled LEYBOJET 630 was developed especially with the medium vacuum in mind.



LEYBOJET 630		D	D_1	D_2	D_3	D_4	D_5	H	H_1	H_2
	mm	750	720	651	180	585	625	1144	650	423
	in.	29.53	28.35	25.63	7.09	23.03	24.61	45.04	25.60	16.65
		l	l_1	l_2						
	mm	1215	604	24						
	in.	47.83	23.78	094						

Dimensional drawing for the LEYBOJET 630



Pumping speed curve of the LEYBOJET 630 as a function of the intake pressure

Advantages for the User

- High and stable pumping speed well into medium vacuum range
- Low ultimate pressure
- Low oil backstreaming due to integrated water-cooled cold cap baffle
- High forevacuum tolerance
- Each heating cartridge is protected by a separate circuit breaker
- In maintaining the well proven heating system - heating insert with thermally conducting panels and heating cartridges - the LEYBOJET 630 is now equipped with an additional ejector nozzle for the purpose of obtaining a stable pumping speed well into the medium vacuum range

Typical Applications

The principal areas of application of the LEYBOJET 630 are modern sputtering processes as well as vacuum melting and drying plants.

Supplied Equipment

The LEYBOJET 630 are supplied ready for connection but without the filling of pump fluid.

The inside of the pump is cleaned before delivery to such an extent that it is free of oil. The inside is evacuated. High and forevacuum flanges are equipped with gaskets, centering rings, shipping flanges, and clamping components.

Technical Data

LEYBOJET 630

High vacuum connection	DN	630 ISO-F
Forevacuum connection	DN	160 ISO-K
Pumping speed for air [1]		
at 1 x 10^{-2} mbar	l x s^{-1}	1 700
at 1 x 10^{-3} mbar	l x s^{-1}	12 000
< 1 x 10^{-4} mbar	l x s^{-1}	12 000
Operating range	mbar (Torr)	< 10^{-2} (< 0.75 x 10^{-2})
Ultimate total pressure [1]	mbar (Torr)	< 5 x 10^{-7} (< 3.75 x 10^{-7})
Max. permissible forevacuum pressure	mbar (Torr)	6 x 10^{-1} (4.5 x 10^{-1})
Pump fluid filling, min. / max.	l (qts)	5.0 / 8.0 (5.3 / 8.5)
Mains connection 50/60 Hz	V	400, 3 Ph
Heating power	kW	10.8
Number of heating cartridges		9
Heating up time	min	< 30
Cooling water		
min. throughput [2]	l x h^{-1} (gal/min)	500 (2.2)
connection	G	1/2"
Number of cooling circuits (including cold cap baffle)		2
Cooling water connection		
for pump	G (BPS)	1/2"
for cold cap baffle	G (BPS)	3/8"
Weight, approx.	kg (lbs)	145 (320)
Recommended backing pump [3]		
at operating pressures > 10^{-4} mbar (> 0.75 x 10^{-4} Torr)		SV 200 + W 501
at operating pressures < 10^{-4} mbar (< 0.75 x 10^{-4} Torr)		TRIVAC D 65 B + W 251

Ordering Information

LEYBOJET 630

	Part No.
Oil diffusion pump LEYBOJET 630	**502 180**
Astrotorus baffle	**227 70**
Water flow monitor	**500006623**
Over-temperature protection switch	**122 84**
Contact thermometer	**218 81**
Resistance thermometer Pt100 sensor	**200 02 958**
Pump fluid [4]	see Catalog Part “Oils / Greases / Lubricants LEYBONOL”

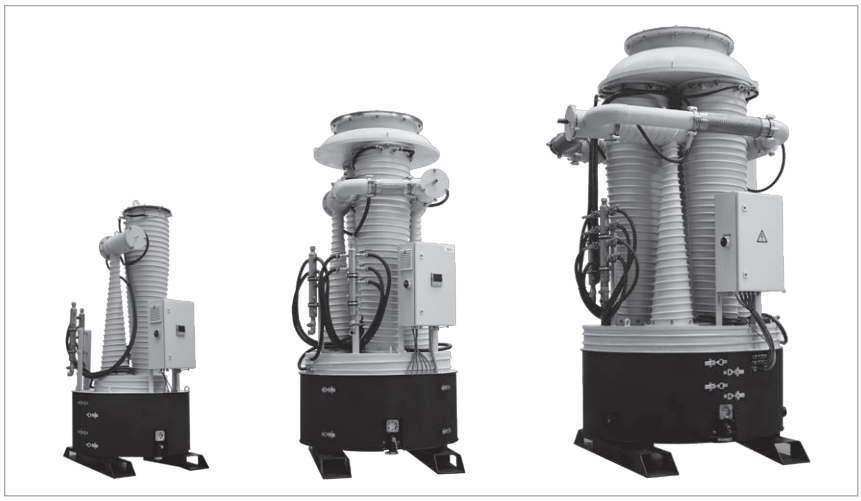
[1] Measured to DIN 28 427 with **LEYBONOL LVO 500** as the pump fluid

[2] The required quantity of cooling water refers to ΔT = 10 °C (50 °F). The discharge temperature should not exceed 30 °C (86 °F)

[3] Single- or two-stage rotary vane vacuum pump (TRIVAC; SOGEVAC) from our range of forevacuum pumps jointly with Roots vacuum pumps (RUVAC) in pump systems

[4] Oil must be purchased separately

Oil Booster OB 6000 to OB 18000



Oil Booster OB 6000 (left), OB 12000 (middle) and OB 18000 (right)

The design of the oil booster pumps from Leybold is well proven in industrial high vacuum applications. They excel above all through excellent vacuum performance data and are, owing to their rugged design a reliable component in many medium and high vacuum units.

The water cooled oil booster pump was developed in particular for applications in the rough and medium vacuum range. The pumps from the OB line from Leybold deliver when properly deployed, a maximum pumping speed at high gas throughputs.

Advantages for the User

- Very high pumping speed from a small sized pump
- Pump sizes 6000, 12,000 and 18,000 m^3 per hour
- Simple to operate
- Rugged and long life
- Selectable flange connections (OB 12,000 and 18,000 only)
- Small manageable amount of spare parts
- Pump components (e.g. heating elements, diffusion corpus, jet corpus) are similar for all OB sizes and can be exchanged easily
- Modern electronic pump monitoring (PLC controlled)
- High efficiency due to direct heating
- Optimized heating design for long oil change intervals

Typical Applications

- Vacuum Induction Melting (VIM) or Vacuum Induction Degassing (VID) of special alloys are utmost important process steps in the metallurgy.
- Depending on the required steel-quality, the required process pressure in such applications is particularly low.
- Secondary metallurgy processes are becoming more popular thanks to the greater demand for better steels e.g. in the automotive, construction and rail markets.

Supplied Equipment

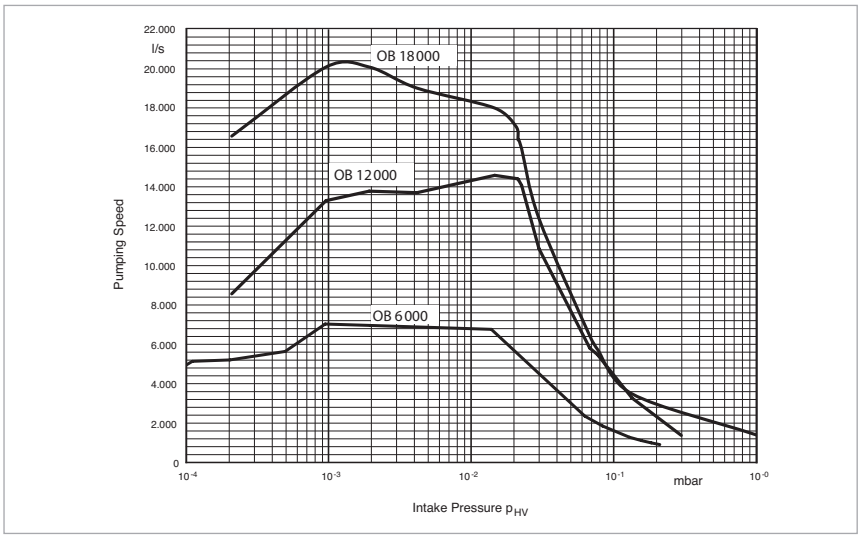
The OB pumps are plug-and-play but are delivered without pump fluid.
The pump chamber is free of oil and has been cleaned.
The inside volume is evacuated. The high vacuum and forevacuum flanges are equipped with sealing and centering rings as well as shipping flanges.
Moreover, the electric circuit breaker box and the cooling water manifold have been installed for immediate connection.
The included Pt100 temperature sensor ensures safe oil temperature monitoring.
The installed overtemperature protection switch monitors and ensures safe operation of the pump.

Technical Data

		Oil Booster OB 6000	Oil Booster OB 12000	Oil Booster OB 18000
Pumping speed for air below 1.0 x 10^{-3} mbar (7.5 x 10^{-3} Torr)	mbar x l x s^{-1}	6.000	12.000	18.000
High vacuum connection				
standard	DN	400 ISO-K	630 ISO-F	630 ISO-F
optional	DN	400 ISO-K / ASA 16 / ASA 18	500 ISO-K / 800 ISO-F / ASA 16 / ASA 20	800 ISO-F / 1000 ISO-F / ASA 32 / ASA 35
Fore vacuum connection (standard)	DN	160 ISO-K	160 ISO-K	160 ISO-K
Operating range	mbar (Torr)	1 to 10^{-6} (0.75 to 10^{-6})	1 to 10^{-6} (0.75 to 10^{-6})	1 to 10^{-6} (0.75 to 10^{-6})
Ultimate total pressure	mbar (Torr)	5 x 10^{6} (< 3.75 x 10^{-6})	5 x 10^{6} (< 3.75 x 10^{-6})	5 x 10^{6} (< 3.75 x 10^{-6})
Pump fluid filling	l (qts)	45 (47.6)	60 (63.4)	90 (95.1)
Mains connection				
Standard EURO, 50/60 Hz	V	400 ~ 3 Ph Y	400 ~ 3 Ph Y	400 ~ 3 Ph Y
Standard Americas, 50/60 Hz	V	460 ~ 3 Ph Y	460 ~ 3 Ph Y	460 ~ 3 Ph Y
Special, 50/60 Hz	V	230 ~ 3 Ph Δ	230 ~ 3 Ph Δ	230 ~ 3 Ph Δ
Weight	kg (lbs)	450 (992)	850 (1874)	1400 (3086)
Cooling water				
consumption	l x h^{-1} (gal/min)	700 (3.1)	800 (3.5)	1360 (6.0)
connection	G	1"	1"	1"

Ordering Information

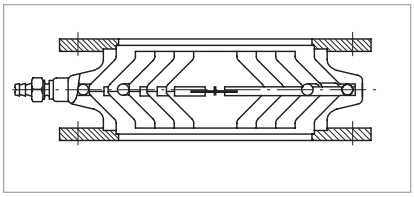
	Oil Booster OB 6000	Oil Booster OB 12000	Oil Booster OB 18000
	Part No.	**Part No.**	**Part No.**
Oil diffusion pump			
Standard EURO	**503750V001**	**503654V001**	**503508V001**
Standard US	**503750V005**	**503654V005**	**503508V005**
with control unit			
EURO version	**503750V002**	**503654V002**	**503508V002**
US version	**503750V006**	**503654V006**	**503508V006**
with control unit and waterflow/ -temperature monitoring			
EURO version (380 V)	**503750V003**	**503654V003**	**503508V003**
US version (460 V)	**503750V004**	**503654V004**	**503508V004**
Pump fluid	see Catalog Part “Oils / Greases / Lubricants LEYBONOL”		



Pumping speed curves of the Oil Booster OB 6000 to OB 18000 as a function of the intake pressure

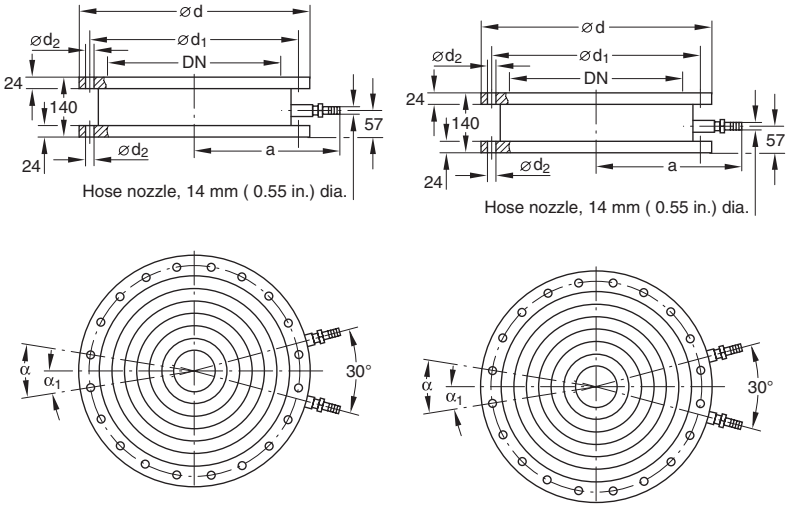
Accessories for Oil Diffusion Pumps

Astrotorus Baffles



Section through an astrotorus baffle

The cooling inserts of the astrotorus baffles are made of copper, whereas the housing and the connection flange are made of standard steel.



DN		a	b	⌀ d	⌀ d_1	⌀ d_2
250 ISO-K	mm	265	30	416	290	–
	in.	10.4	0.18	16.4	11.4	–
400 ISO-K	mm	362	120	512	450	–
	in.	14.25	4.72	20.2	17.7	–
500 ISO-K	mm	412	120	612	550	–
	in.	16.22	4.72	24.1	21.7	–
630 ISO-F	mm	440	–	750	720	14
	in.	17.32	–	29.53	28.35	0.55
800 ISO-F	mm	546	–	920	890	14
	in.	21.5	–	36.22	35.04	0.55
1000 ISO-F	mm	599	–	1120	1090	14
	in.	23.58	–	44.09	42.91	0.55

DN		Quantity	h	h_1	α	α_1
250 ISO-K	mm	–	195	97	–	–
	in.		7.68	3.82	–	–
400 ISO-K	mm	–	193	96	–	–
	in.		7.6	3.78	–	–
500 ISO-K	mm	–	193	96	–	–
	in.		7.6	3.78	–	–
630 ISO-F	mm	20	140	–	18 °	9 °
	in.	20	5.5	–	18 °	9 °
800 ISO-F	mm	24	140	–	15 °	7,5 °
	in.	24	5.5	–	15 °	7,5 °
1000 ISO-F	mm	32	140	–	11.25 °	5.625 °
	in.	32	5.5	–	11.25 °	5.625 °

Dimensional drawing for the astrotorus baffle ISO-K (left) and ISO-F (right)

Technical Data

Astrotorus Baffles

Connection to pump	DIP	3 000	8 000	12 000
HV connection flanges	DN	250 ISO-K	400 ISO-K	500 ISO-K
Throttling of the pumping speed, approx.	%	30	30	30
Conductance	l x s^{-1}	3 000	9 000	12 000
Weight	kg (lbs)	25.0 (55.2)	30.0 (66.2)	65.0 (143.5)

Ordering Information

Astrotorus Baffles

	Part No.	Part No.	Part No.
Astrotorus baffle			
250 ISO-K	**227 50**	–	–
400 ISO-K	–	**227 60**	–
500 ISO-K	–	–	**227 65**

Technical Data

Astrotorus Baffles

Connection to pump	DIP	20 000	30 000	50 000
HV connection flanges	DN	630 ISO-F	800 ISO-F	1000 ISO-F
Throttling of the pumping speed, approx.	%	30	30	30
Conductance	l x s^{-1}	18 000	28 000	50 000
Weight	kg (lbs)	120.0 (264.9)	170.0 (375.3)	190.0 (419.4)

Ordering Information

Astrotorus Baffles

	Part No.	Part No.	Part No.
Astrotorus baffle			
630 ISO-F	**227 70**	–	–
800 ISO-F	–	**227 75**	–
1000 ISO-F	–	–	**227 80**

For matching valves, please ask us for a quotation.

Temperature dependant Switching Components for Automatic Pump System Control

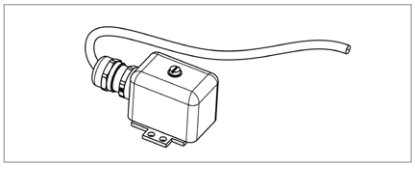
The operational status of the diffusion pump depends on the temperature of the pump fluid in the pump boiler. Through temperature dependent switching components which are inserted into the pump boiler it is possible to monitor the operational status of the diffusion pump and signal its status to a process controller.

For this, the diffusion pump requires two thresholds. Depending on the type of pump, the upper threshold should be between 180 and 200 °C (356 and 392 °F) and the lower threshold between 90 and 100 °C (194 and 212 °F).

The upper threshold indicates that the diffusion pump is ready for operation and thus actuates certain devices, for example opening of the high vacuum valve ahead of the diffusion pump.

The lower threshold indicates that the diffusion pump has cooled down to such an extent that the backing pump and the cooling water supply may be switched off.

Over-temperature protection switches are used to monitor the temperature of the cooling water in the cooling water circuit of the diffusion pumps. When the temperature rises to unacceptably high levels (for example when the cooling water supply fails) the heater in the diffusion pump is switched off (correct electrical connection to the main supply is required). The use of over-temperature protection switches avoids unnecessary alarms that may be triggered by contaminated water when only a water flow monitor is used. The over-temperature protection switch is screwed on to a contact plate which is soldered to the cooling pipe on the pump's body.

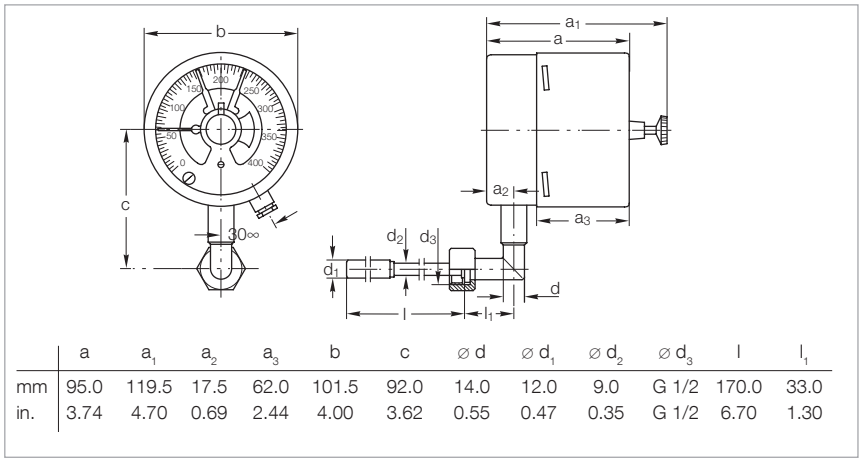


Over-temperature protection switch

Max. switching current: 5 A (230 V, 50/60 Hz).

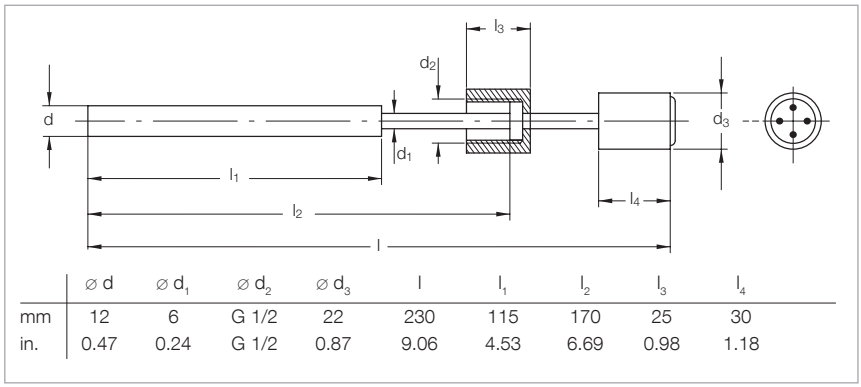
Contact thermometer with a range from 0 to 400 °C (32 to 752 °F). Through a trailing pointer two switching thresholds may be set up independently. The current oil temperature and the thresholds which have been set up can be read off at the location of the diffusion pump. The contacting thermometer is not suited for remote signaling of temperatures.

Resistance thermometer Pt100 sensor. The measurement range of this sensor depends on the temperature display unit used by the customer where also the required thresholds are set up. The Pt100 sensor is ideal for remote signaling of temperatures.



	a	a_1	a_2	a_3	b	c	⌀ d	⌀ d_1	⌀ d_2	⌀ d_3	l	l_1
mm	95.0	119.5	17.5	62.0	101.5	92.0	14.0	12.0	9.0	G 1/2	170.0	33.0
in.	3.74	4.70	0.69	2.44	4.00	3.62	0.55	0.47	0.35	G 1/2	6.70	1.30

Dimensional drawing for the contact thermometer



	⌀ d	⌀ d_1	⌀ d_2	⌀ d_3	l	l_1	l_2	l_3	l_4
mm	12	6	G 1/2	22	230	115	170	25	30
in.	0.47	0.24	G 1/2	0.87	9.06	4.53	6.69	0.98	1.18

Dimensional drawing for the resistance thermometer Pt100 sensor

Ordering Information

Monitoring Instruments

	Part No.
Over-temperature protection switch	**122 84**
Contact thermometer **(Measurement range 0 to +400 °C (+32 to +752 °F), Rating at 220 V AC: 250 mA [resistive load], Weight: 1.7 kg (3.7 lbs))**	**218 81**
Resistance thermometer Pt100 sensor	**200 02 958**

Monitoring Instruments

Protection against Overheating

Water flow monitors are installed in the cooling water return section of the diffusion pump. When the cooling water throughput drops below a certain level, either the heater in the diffusion pump is switched off or a warning light or signal is triggered, depending of the type of circuit.

Measurement range: 1 to 40 l · h^{-1} (0.06 to 2.52 gal/min)

The water throughput may be set within the limits stated with a high degree of reproducibility.

Water flow monitors may be installed in any orientation.
Max. switching capacity:
100 VA (230 V, 50/60 Hz).

Protection against Power Failure

A SECUVAC valve (see Product Section “Vacuum Valves”) must be installed in the forevacuum line in order to prevent damage to the diffusion pump or the pump fluid in the event of a power failure affecting backing pumps which are not equipped with an automatic isolation valve. Rotary vane vacuum pumps from the TRIVAC B series are equipped with an automatic safety valve (intake isolation valve) as standard.

Protection against Pressure Increases in the Forevacuum Line

For protection against a pressure increase in the forevacuum line which is not caused by a power failure you may use our vacuum gauges which offer an adjustable switching threshold (see Product Section “Vacuum measuring - controlling”).

Ordering Information

Water Flow Monitor

	Part No.
Water flow monitor	**500006623**

Power Controller

Power controller with integrated USB interface

Ethernet interface for PLC data integration

When it comes to the aspect of economic and efficient operation of diffusion pumps, power consumption plays an important role.
Through our DIP power controller, you may now drastically cut your power consumption - and this without impairing pump performance in any way!

Leybold Solutions provides an unique energy control unit with less thermal loss to control the heating power to save energy significantly!

Advantages to the User

- Energy saving up to 30% (low costs and ROI in less than three years)
- Further potential savings through temperature decrease in standby-mode
- High quality regulation with customized software
- Increased operation safety and comfort
- Improved service life for oil and heating cartridges
- Easy and exact to operate via PLC or manual directly at the pump
- Uncomplicated integration of generated data into your own process control or export data via USB port
- Strategically process analysis and optimization by interpretation of energy control unit data

Technical Data

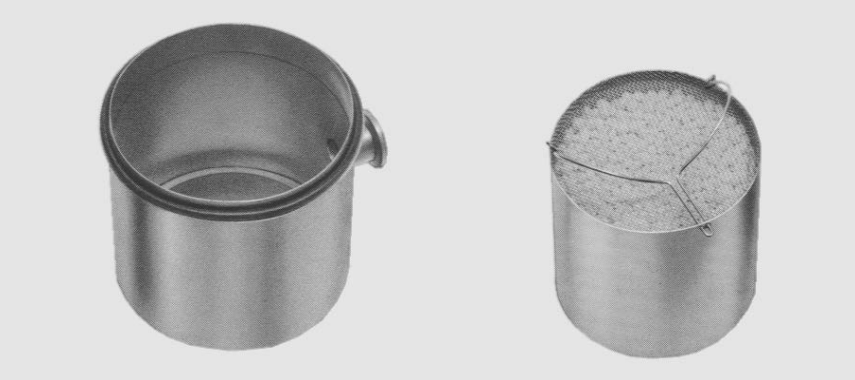
		Power Controller for DIP 20 000	Power Controller for DIP 30 000	Power Controller for DIP 50 000
Pumping speed for air below 1 x 10^{-4} mbar	l x s^{-1}	20 000	30 000	50 000
Installed heating power	kW	12	18	24
Number of heating cartridges		2	6	9
Heating up time	min	< 25	< 30	< 30
Cooling water (minimum)				
for the pump	l x h^{-1}	600	900	1500
for the cold cap baffle	l x h^{-1}	80	80	150

Ordering Information

	Power Controller for DIP 20 000 Part No.	Power Controller for DIP 30 000 Part No.	Power Controller for DIP 50 000 Part No.
Oil diffusion pump with power controller			
DIP 20 000	**22230V001**	–	–
DIP 30 000	–	**22235V001**	–
DIP 50 000	–	–	**22240V001**
Retrofit kit (DIP power controller)			
DIP 20 000	**503647V001**	–	–
DIP 30 000	–	**503648V001**	–
DIP 50 000	–	–	**503649V001**
Full-service retrofit kit [1]			
DIP 20 000	**AS8100F**	–	–
DIP 30 000	–	**AS8101F**	–
DIP 50 000	–	–	**AS8102F**
Mineral oil LVO 500			
1 l	**L50001**	**L50001**	**L50001**
5 l	**L50005**	**L50005**	**L50005**
20 l	**L50020**	**L50020**	**L50020**
Mineral oil LVO 510			
1 l	**L51001**	**L51001**	**L51001**
5 l	**L51005**	**L51005**	**L51005**
Silicone oil LVO 520			
1 l	**L52001**	**L52001**	**L52001**
5 l	**L52005**	**L52005**	**L52005**
Silicone oil LVO 530			
1 l	**L53001**	**L53001**	**L53001**

[1] Delivery, installation, commissioning and instruction of the staff is included

Adsorption Traps with Aluminium Oxide Insert



Adsorption trap (left) and insert (right)

Adsorption traps are installed in all those cases where an oil-free vacuum is to be produced with oil-sealed vacuum pumps.

Advantages to the User

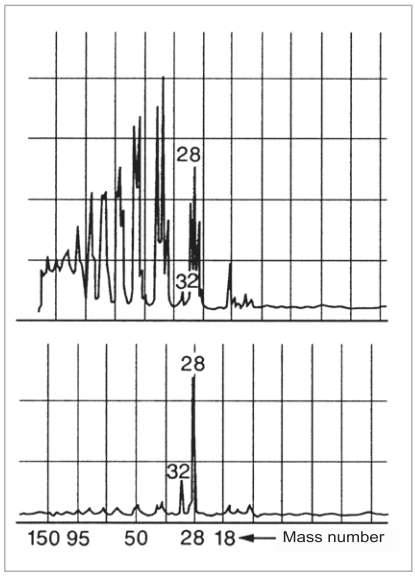
- Backstreaming of oil is reduced by 99%
- Long service life
- High conductance
- Filling can be easily exchanged
- Improvement in the ultimate pressure attained by backing pumps by one order of magnitude
- Stainless steel housing and insert
- NBR gasket

Typical Applications

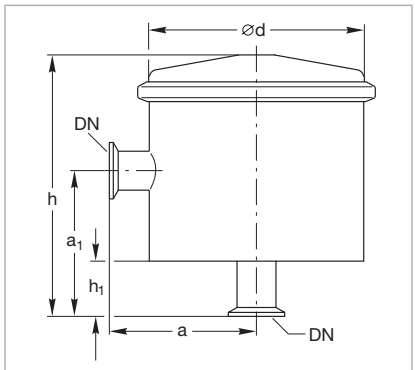
- Product of an oil-free vacuum

Supplied Equipment

- Complete with insert
- Without adsorbent



Residual gas spectrum; top ahead of a rotary vacuum pump, bottom ahead of a rotary vacuum pump with adsorption trap



DN		a	a_1	Ø d	h	h_1
16 ISO-KF	mm	82	82	135	147	32
	in.	3.23	3.23	5.31	5.79	1.25
25 ISO-KF	mm	102	102	175	155	33
	in.	4.02	4.02	6.89	6.10	1.26
40 ISO-KF	mm	132	65	235	160	20
	in.	5.19	2.56	9.25	6.3	0.79

Dimensional drawing for the adsorption traps

Technical Data

		Adsorption Traps		
		16 ISO-KF	25 ISO-KF	40 ISO-KF
Conductance at 10^{-2} mbar (Torr)	l x s^{-1}	4.0	6.0	12.0
Service live with Al oxide	Months	3	3	3
Al oxide filling	l (qts)	0.5 (0.53)	1.0 (1.06)	2.0 (2.1)
Weight, approx.	kg (lbs)	1.3 (2.9)	1.3 (2.9)	4.0 (8.8)

Ordering Information

	Adsorption Traps		
	16 ISO-KF	25 ISO-KF	40 ISO-KF
	Part No.	Part No.	Part No.
Adsorption trap	**854 14**	**854 15**	**854 16**
Activated aluminum oxide in tin 1.6 l (approx. 1.2 kg (2.65 lbs))	**854 10**	**854 10**	**854 10**

Applications and Accessories, Cryo Pumps

Cryo pumps	COOLVAC 1500 iCL	COOLVAC 2000 iCL	COOLVAC 3000 iCL	COOLVAC 5000 iCL	COOLVAC 10000 iCL	COOLVAC 18000 iCL	COOLVAC 30000 iCL	COOLVAC 60000 iCL	COOLVAC 30000 LN_2	COOLVAC 60000 LN_2
Application										
General research	■	■	■	■	■	■	■	■	■	■
Evaporation coating systems	■	■	■	■	■	■	■	■		
Transfer chambers / Loadlock	■	■	■	■	■	■				
Metallization systems	■	■	■	■	■	■	■	■		
Sputtering systems	■	■	■	■	■					
Ion implanters	■	■	■	■						
Electron beam welding systems	■	■	■	■	■	■				
Space simulation chambers	■	■	■	■	■	■	■	■	■	■
UHV systems	■	■	■							
Beam tubes in particle accelerators	■	■								
Vacuum furnaces				■	■	■	■	■	■	■
Model versions										
Basic version without electronics, with Si diode on the 2. stage (BasicLine)	■	■	■	■	■	■	■	■		
Basic version with electronics und integrated controller, with temperature sensors and electric heaters on both stages (iClassicLine)	■	■	■	■	■	■	■	■		
Basic version with liquid nitrogene cooling, temperature sensors and electric heaters on both stages and abnormal temperature protection									■	■
Purgegas option, on request	■	■	■	■	■					

Accessories	Page										
Compressor unit COOLPAK 2000 Series		■	■	■							
Compressor unit COOLPAK 6000 H Series		[■]	[■]	[■]	■	■	■	■	■	■	■
Flexible pressure lines (different length and diameters)		■	■	■	■	■	■	■	■	■	■
Gas manifold GD 2 for multiple operation		■	■	■	■ *)	■ *)					
Gas manifold GD 4 for multiple operation		■	■	■							
Low temperature measuring instrument MODEL 211 S (BasicLine Series only)		■	■	■	■	■	■	■	■	■	■

[■] = For dual and multiple operation only

Applications and Accessories, Cryogenics

Cold heads	COOLPOWER 50	COOLPOWER 140 T	COOLPOWER 7/25	COOLPOWER 5/100	COOLPOWER 5/100 T	COOLPOWER 10 MD
Application						
Cooling of samples and detectors	■	■	■	■	■	■
Cooling of superconductors	(■)	(■)	■	■	(■)	■
Cooling of cryopanels	■	■	■	■	■	■
Cleaning of gases	■	■	■	■	■	■
Calibration of sensors			■	■		■
Optical spectroscopy			■	■		■
Infrared spectroscopy			■	■		■
Matrix spectroscopy			■	■		■
Testing of superconductors			■	■		■
Cooling of superconducting magnets, coils and components HT_c+ LT_c	(■)	(■)	■	■	(■)	■
Model versions						
Basic version without electronics, with Si diode on the 2. stage (BasicLine)	■	■	■	■	■	■
Basic version with electronics und integrated controller, with temperature sensors and electric heaters on both stages (iClassicLine)	■	■	■	■	■	■
Basic version with liquid nitrogene cooling, temperature sensors and electric heaters on both stages and abnormal temperature protection						
Purgegas option, on request	■	■	■	■	■	

Accessories	Page						
Compressor unit COOLPAK 2000 Series		■		■			
Compressor unit COOLPAK 6000 H / 6200 H			■		■		
Compressor unit COOLPAK 6000 HMD/6200 HMD						■	■
Low temperature controller MODEL 9700				■	■		
Low temperature measurement instrument MODEL 211S		■	■	■	■	■	■
Temperature sensor		■	■	■	■	■	■

(■) = Only high T_c superconductors

Conversion of Units

Celsius, Fahrenheit, Kelvin
Kelvin (abbreviated as K) is the unit of temperature.

Temperatures on the Kelvin scale are converted into temperatures on the Celsius scale as follows:

n °C = (n + 273.15) K.

Since the following equation applies between Celsius scale and Fahrenheit scale

n °F = 5/9 (n – 32) °C

it follows that

n °F = 5/9 (n + 459.67) K.

The inverse equations are as follows:

m K = (m – 273.15) °C

m °C = (1.8 m + 32) °F

m K = (1.8 m – 459.67) °F.

The following applies in particular to absolute zero:

0 K = -273.15 °C ; -459.67 °F.

bar, psi
1 bar = 14.5 psi
1 MPa = 10 bar

Cryo Pumps

Cryo pumps are gas entrapment vacuum pumps for the pressure range from 10^{-3} to ≤ 10^{-11} mbar (0.75 x 10^{-3} to ≤ 0.75 x 10^{-11} Torr). The principle of operation is that gaseous substances are bound to the cold surfaces within the pump by means of cryocondensation, cryosorption or cryotrapping.

In order to be able to produce a high or ultra-high vacuum the cold surfaces (cryopanels) must be cooled to a sufficiently low temperature. Depending on the type of cooling system used a difference is made between refrigerator cryo pumps, bath cryo pumps and evaporator cryo pumps.

Leybold manufactures only cryo pumps which are cooled by means of a refrigerator.

Advantages to the User

Advantages offered by the Pumping Principle

- High effective pumping speed for all gases
- Extremely high pumping speed for water vapor

For a given diameter of the high vacuum flange, the cryopump offers the highest pumping speed of all high vacuum pumps.

Advantages offered by Design

In contrast to gas transfer high vacuum pumps (mechanically suspended turbomolecular pumps, for example), cryo pumps do not have any mechanically moving, oil, or grease lubricated parts on the vacuum side.

The following advantages are a direct result of this design characteristic:

- Hydrocarbon-free vacuum in the pressure range from 10^{-3} to ≤ 10^{-11} mbar (0.75 x 10^{-3} to ≤ 0.75 x 10^{-11} Torr).
- Insensitivity to mechanical disturbances from particles coming from the process or external vibrations.

Further Advantages

- Much more compact than comparable pump systems offering a pumping speed of over 1500 l x s^{-1}
- Backing pump is only required during start-up and during regeneration
- Easy process control and pump control via computer
- Favorable price-to-performance ratio and low running costs especially at higher pumping speeds

The cryo pumps are cooled by the well-proven two-stage cold heads from Leybold's COOLPOWER line (Gifford/McMahon principle).

The design of a refrigerator cryopump from the COOLVAC range is shown schematically in the figure below.

The first stage of the cold head **(9)** cools the thermal radiation shield **(5)** and the baffle **(6)** of the pump.

Depending on the type of pump and the operating conditions operating temperatures of 45 to 80 K are attained. Correspondingly water vapor condenses at this temperature.

The thermal shield and baffle are made of copper which conducts heat very well so as to optimally utilize the refrigerating capacity which is available.

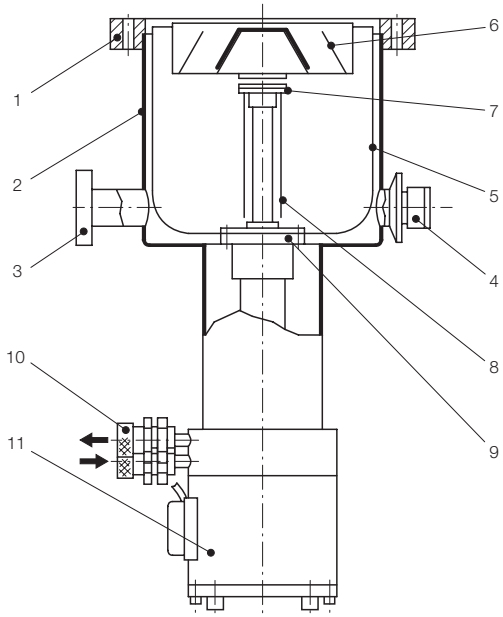
Moreover, the thermal shield is metallized so that reflective losses will be minimal.

The second stage of the cold head **(7)** is used to cool the cryopanels **(8)**. Depending on the operating conditions, operating temperatures of 10 to 20 K are attained.

Here the process of cryocondensation of N_2, O_2 and argon will take place.

The active pumping surfaces are made of copper of high thermal conductivity and they are tightly linked thermally to the second stage of the cold head. H_2, Ne and He are also adsorbed on to these surfaces which are partly covered with activated charcoal.

1 High vacuum flange
2 Pump body
3 Foreline flange
4 Safety valve with flange connection for connection of an exhaust line
5 Thermal radiation shield
6 Baffle
7 Second stage of the cold head
8 Cryopanels
9 First stage of the cold head
10 Helium gas connections
11 Cold head motor with housing and electrical connections



COOLVAC refrigerator cryopump

All cryo pumps from the COOLVAC range are equipped with a safety valve (respectively with a bursting disk in the case of the UHV variants) which is set in the factory so that it will open at an overpressure of 150 mbar (113 Torr).

In order to be able to safely remove any gases which may present a health hazard when the safety valve responds, the valve is equipped with an additional DN 40 KF flange where an exhaust line is connected.

The pump's body, all flanges and the safety valve are made of high-quality stainless steel.

Multiple Operation of Refrigerator Cryo Pumps

The powerful Leybold compressor units COOLPAK 6000 HD open up the possibility of operating two cold heads or refrigerator cryo pumps simultaneously.

Advantages to the User

- Significantly reduced investment and operating costs
- Small footprint

Regenerating Cryo Pumps

An important aspect in the operation of cryo pumps is that of regeneration. Since a cryopump is a gas entrapment pump, the gasses which have accumulated in the pump during the "pumping" mode must from time to time be removed from the pump. This is done by switching the compressor unit off and by warming up the cryopanels to room temperature or sightly higher so that the released substances can be pumped out by a forevacuum pump.

Cryo Pumps without Electric Regeneration System

The cryopump is warmed up to room temperature by purging the inside of the pump with a dry, pre-warmed inert gas (such as nitrogen). In this case it is not possible to set up defined and controlled temperatures within the cryopump. Thus the simultaneous presence of gases such as hydrogen and oxygen in the pump can not be entirely excluded. The formation of ignitable gas mixtures is only prevented by the diluting effect of the dry inert gas.

Cryo Pumps with Fully Automatic Electric Regeneration System from Leybold

The cryopump is warmed up to room temperature by heating the 1st and 2nd stages of the cold head with electric heaters. In this case, a defined and controlled temperature distribution within the cryopump can be set up. This controlled warming process ensures that the pumped gases are removed sequentially, i.e. the pumped gases are released one after the other in the following sequence:

- Gases adsorbed at the cryopanels (e.g. hydrogen, helium, neon),
- Gases condensed at the cryopanels (e.g. nitrogen, oxygen, argon),
- Gases and vapors which have condensed on to the baffle and thermal radiation shield (e.g. water vapor).

The electric method of regeneration from Leybold prevents gases such as hydrogen and oxygen from being present in the pump at the same time. This excludes the formation of ignitable gas mixtures right from the start.

Cryo pumps without fully automatic control and without electric regeneration system belong to the BasicLine (BL), like the COOLVAC 800 BL, for example.

The warming up process is fully automatic. Pressure and temperature distribution within the pump are set up and controlled by the control system at all times. The sequential regeneration of pumped gases prevents the formation of ignitable gases right from the start.

This ensures the utmost safety during the regeneration of cryo pumps from Leybold.

In the case of cryogenic pumps with fully automatic control there exist two cryopump lines.

1. The COOLVAC BasicLine (COOLVAC BL) offering the following pumping speed class for Nitrogen in l/s: 800; COOLVAC 800 BL, for example.
   Other pumping speed classes from 1 500 to 18 000 l/s are available on request.
   For more information please contact your local Leybold representative.
2. The COOLVAC ClassicLine (COOLVAC CL) offering the following pumping speed classes for nitrogen in l/s: 800, 1 500, 2 000, 3 000, 5 000, 10 000 and 18 000; COOLVAC 1500 CL, for example.

In the price list the designators "V" appears in connection with the pump designations.
"V":
The high vacuum flange is located at the top and the cold head below, as is the case for the COOLVAC 1500 CL-V, DN 200 CF.

Notes

Cold Heads

A refrigerator (cold head) is a gas cooling machine which operates on the basis of a thermodynamic cycle to produce cryogenic temperatures ($T \leq 120$ K).

Refrigerators operating according to the Gifford/McMahon principle have succeeded over other methods of cooling cryo pumps and cryostats. It is thus employed exclusively by Leybold.

In order to account for individual requirements from customers, Leybold offers customized cryostats as well.

Gifford/McMahon-Refrigerators

Advantages to the User

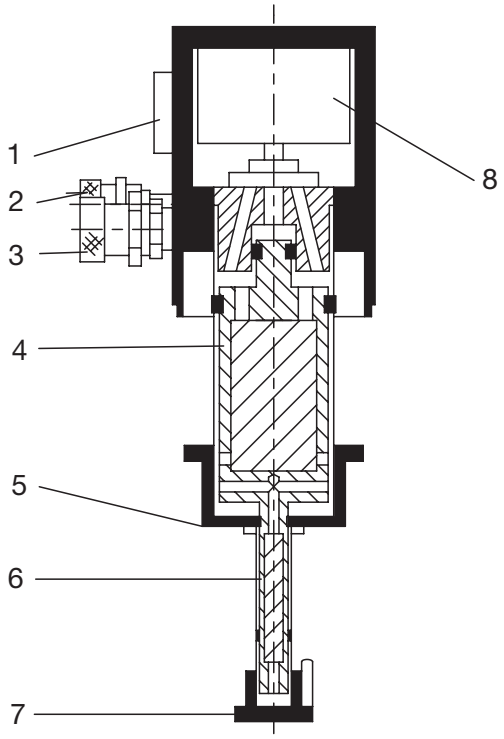
- Low temperatures on a single key press
- No liquid helium and no liquid nitrogen are required
- Very simple to operate
- High refrigerating capacity from a small volume
- Easy process control and temperature control via a computer

Advantages by Design

- No space problems since cold head and compressor unit can be installed and operated apart
- Installation of the cold head basically in any orientation
- High reliability
- Long periods of operation without maintenance

Typical Applications

- Cooling of cryopanels in cryo pumps thereby producing high or ultra-high vacuum
- Cooling of superconducting magnets; in magnetic resonance tomographs, for example
- Cooling of samples and detectors; especially for cooling of
- samples for spectroscopic analysis in the areas of solid state and surface physics
- high temperature superconductors
- superconductors and semiconductors
- infrared and gamma detectors
- Calibration of sensors



1 Electrical connection and current lead-through for cold head motor
2 Helium high pressure connection
3 Helium low pressure connection
4 Displacement piston, 1st stage
5 1st (refrigerator) stage ($T_{end} > 20$ K)
6 Displacement piston, 2nd stage
7 2nd (refrigerator) stage ($T_{end} < 20$ K)
8 Cold head motor

Dual-stage Gifford/McMahon cold head (schematic diagram)

Cold Heads from the COOLPOWER Range

The standard range of single-stage and two-stage cold heads matches a wide range of applications.

Leybold is offering refrigerators with usable refrigerating powers of 140 W at 80 K
(COOLPOWER 140 T, single-stage) and down to 3.5 W at 10 K
(COOLPOWER 5/100 T; dual-stage).

The cold heads basically consist of three subassemblies:

- Drive and control unit for the displacer
- Displacer
- First stage of the cold head (and second stage in the case of two-stage cold heads).

Pneumatically driven Cold Heads

Advantages

- **Simple Design**
  The pneumatic drive system for the displacer of these cold heads from Leybold consists of only two mechanically moving components: the rotating control valve and the synchronous motor driving the control valve.
- **Easy and quick maintenance**
  All Leybold cryo pumps from the COOLVAC range are equipped with pneumatically driven Leybold cold heads.
  Owing to the simple design of the built-in cold heads, maintenance is easy. Maintenance can be performed in place without detaching the cryopump from the vacuum chamber.

Mechanically driven Cold Heads

Advantages

In the case of the mechanically driven Leybold cold heads, the displacer is moved through the so-called “Scotch yoke” directly by the drive motor. This elaborate mechanism allows the gas flow and the movement of the displacer to be precisely controlled through which it is possible to attain with two-stage cold heads especially high refrigerating capacities in the range of lowest temperatures (refrigerators of the COOLPOWER 10 MD line).

Advantages Through High Reliability

As to reliability, Leybold cold heads are top performers.

Especially high reliability is required for medical instrumentation, specifically in connection with nuclear spin tomographs. In this application cold heads are used to cool superconducting magnets and they are thus exposed to strong magnetic fields.

The leading manufacturers of nuclear spin tomographs have therefore decided to use Leybold cold heads to cool the superconducting magnets.

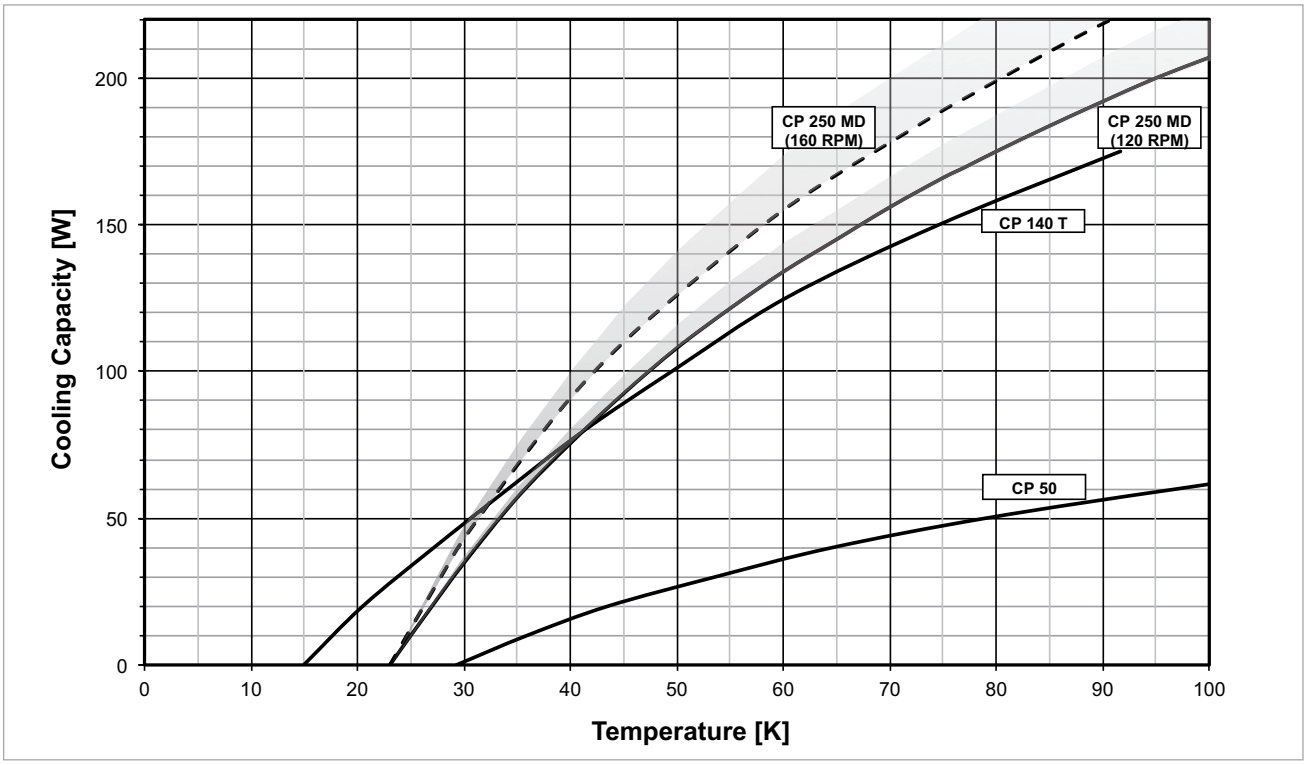
Kälteistungsdiagramme (siehe nächste Katalogseite)

Auf der folgenden Katalogseite finden Sie die Kälteleistungsdiagramme unserer einstufigen und zweistufigen Kaltköpfe COOLPOWER.

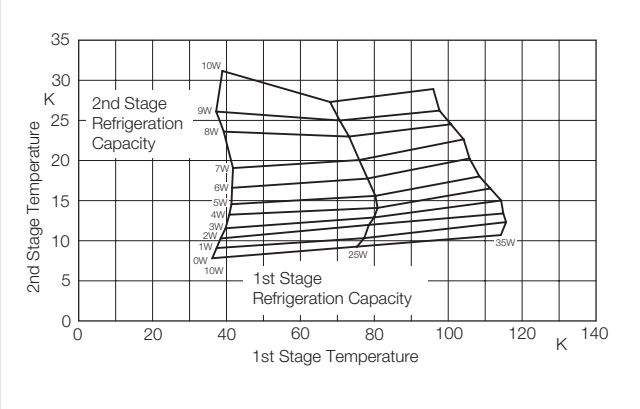
Im Diagramm unten ist am Beispiel des Refrigeratorkaltkopfs COOLPOWER 5/100 die Interpretation der Diagramme für unsere zweistufigen Kaltköpfe erläutert: Werden Wärmeleistungen an der 1. Stufe von 100 W und simultan an der 2. Stufe von 6 W angelegt, so ergeben sich aus dem Schnittpunkt (●) 100 W / 6 W der beiden Linien konstanter Kälteleistung 1. Stufe / 2. Stufe die zu erwartenden Temperaturen für die 1. Kaltkopf-Stufe bzw. für die 2. Kaltkopf-Stufe von 80 K bzw. 20 K.

Ohne thermische Belastung (linke unterer Schnittpunkt (○) 0W / 0W des Kennlinienfelds) ergeben sich stattdessen Endtemperaturen von < 30 K bzw. von < 10 K an der 1. Stufe bzw. an der 2. Stufe

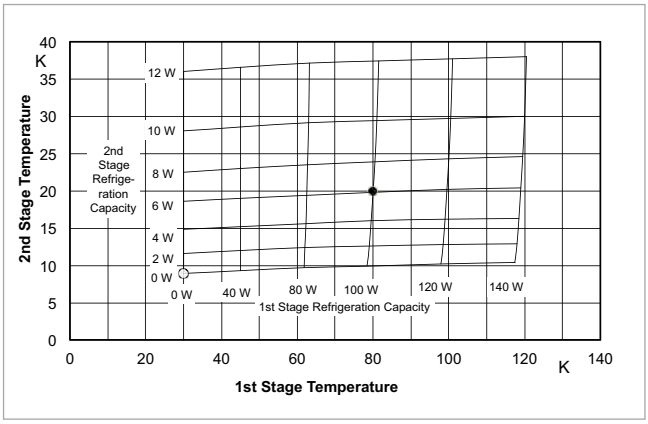
Refrigerating Capacity of Cryogenic Cold Heads



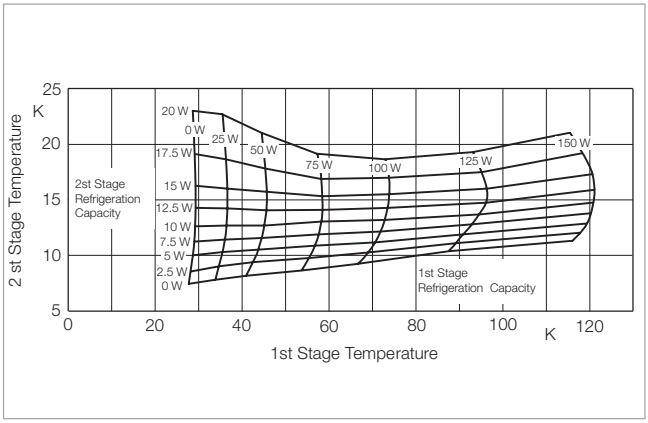
Typical refrigerating capacity of the cold head COOLPOWER 50, COOLPOWER 140 T and COOLpower 250 MD



Typical refrigerating capacity of the cold head COOLPOWER 7/25



Typical refrigerating capacity of the cold head COOLPOWER 5/100



Typical refrigerating capacity of the cold head COOLPOWER 10 MD

The refrigerating capacities stated apply to vertical operation with the cold end at the bottom.

Compressor Units

COOLPAK 2000 to 6000 compressors are available for single operation of the remaining cold heads from the COOLPOWER line as well as for multiple operation of cryo pumps and cryostats.

The period during which no maintenance will be required on the Leybold compressor units depends on the service life of the adsorber. If the values for the ambient temperature and the cooling water entry temperature remain within the specified range, Leybold guarantees a service life for the adsorber - and thus a period during which no maintenance will be required - of 18 000 operating hours.

The possibilities for single and multiple operation of refrigerator cryo pumps are given in the following table:

	For the operation of	
Compressor Unit	**Cold Head**	**Cryo Pumps**
COOLPAK 2000/2200	1 x COOLPOWER 50 or 7/25	1 x COOLVAC 1500/2000/3000
COOLPAK 6000 HD	2 x COOLPOWER 50 oder 7/25 or 1 x COOLPOWER 5/100	2 x COOLVAC 1500/2000/3000 or 1 x COOLVC 5000 / 10000
COOLPAK 6000 H/6200 H	1 x COOLPOWER 140 T 1 x COOLPOWER 5/100	3 x COOLVAC 1500 iCL /2000 iCL 2 x COOLVAC 3000 iCL 1 x COOLVAC 5000/10000
COOLPAK 6000 HMD/6200 HMD	1 x COOLPOWER 10 MD	1 x COOLVAC 30000 BL LN2/ 60000 BL LN2

Products Cryo Pumps

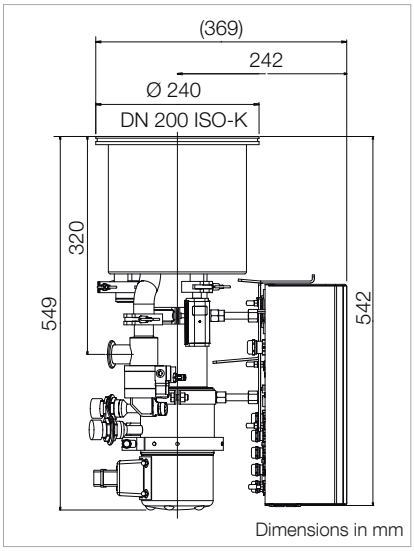
Cryo Pumps with fully Automatic Control, ClassicLine COOLVAC 1500 iCL

Advantages to the User

- Hydrocarbon-free high vacuum
- High capacity for argon and hydrogen
- High crossover value
- Simple operation
- Trouble-free integration into complex systems
- Fully automatic regeneration through Cryo Compact Control
- Easy servicing

Typical Applications

- Evaporators
- Sputtering systems
- Ion implanters
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 1500 iCL (DN 200 ISO-K)

Technical Data		COOLVAC 1500 iCL
High vacuum (HV) flange	DN	200 ISO-K / 200 CF / 6" ANSI
Fore vacuum flange	DN	25 KF
Flange for connection a gauge head	DN	16 KF
Flange for the electrical connection	DN	16 KF
Safety valve with flange connection for gas exhaust line	DN	40 KF
4-way current feedthrough for Si diode on a flange	DN	16 KF
Heaters		
1st stage	W	160
	V AC	42
2nd stage	W	90
	V AC	42
Temperature sensor		
1st stage		PT 100
2nd stage		Si-Diode
Built-in cold head	COOLPOWER	7/25
Weight	kg (lbs)	25 (55.1)
Cooldown time to T_2 = 20 K	min	60
Crossover value	mbar x l (Torr x l)	210 (15.,5)
Pumping speed		
H_2O	l x s^{-1}	4600
Ar / N_2	l x s^{-1}	1200 / 1500
H_2	l x s^{-1}	2500
Capacity		
Ar / N_2	bar x l	1000 / 1000
H_2 at 10^{-6} mbar	bar x l	2,0
Max. throughput		
Ar / N_2	mbar x l x s^{-1} (Torr x l x s^{-1})	12 (9) / 12 (9)
H_2O	mbar x l x s^{-1} (Torr x l x s^{-1})	6 (4.5)
Helium connections (Self-sealing couplings: outside thread, type 5400-S2-8)	DN	1/2"

Ordering Information

COOLVAC 1500 iCL

	Single Operation		Dual operation		Multiple operation	
	Europe	USA/Japan	Europe	USA/Japan	Europe	USA/Japan
	Part No.		Part No.		Part No.	
COOLVAC 1500 iCL						
DN 200 CF	844201V0002		844201V0002 (2x)		844201V0002 (3x)	
DN 6“ ANSI	844201V0004		844201V0004 (2x)		844201V0004 (3x)	
DN 200 ISO-K	844201V0006		844201V0006 (2x)		844201V0006 (3x)	
Compressors, flexlines and cables						
Compressor						
CP 2000	840000V2000	–	–	–	–	–
CP 2200	–	840000V2200	–	–	–	–
CP 6000 H	–	–	840000V6001	–	840000V6001	–
CP 6200 H	–	–	–	840000V6201	–	840000V6201
Power supply cable for compressor	–		1)		1)	
Set of flexlines						
FL 4.5 (1/2“, 1/2“)	892 87		892 87 (2x)		892 87 (3x)	
or FL 9.0 (1/2“, 1/2“)	892 88		892 88 (2x)		892 88 (3x)	
or FL 18.0 HP (1/2“) + FL 18.0 LP (1/2“)	840203 + 840204		840203 (2x) + 840204 (2 x)		840203 (3x) + 840204 (3 x)	
Gas manifold (1 piece each)						
GD 2	–		840 253 (2x)		–	
GD 4	–		–		840 254 (2x)	
Compressor unit control cable [2]						
COOLPAK control cable, 5 m (16.4 ft)	844231V4005		844231V4005 (2x)		844231V4005 (3x)	
or COOLPAK control cable, 10 m (32.81 ft)	844231V4010		844231V4010 (2x)		844231V4010 (3x)	
or COOLPAK control cable, 20 m (65.62 ft)	844231V4020		844231V4020 (2x)		844231V4020 (3x)	
COOLPAK adapter for multi control	–		844231V5003		844231V5003	
Optional electronics, cables and equipment						
CRYOVISION control unit	844231V0002		844231V0002		844231V0002	
CRYOVISION control cables						
CRYOVISION control cable, 5 m (16.4 ft)	844231V2005		844231V2005		844231V2005	
or CRYOVISION control cable, 10 m (32.81 ft)	844231V2010		844231V2010		844231V2010	
or CRYOVISION control cablel, 20 m (65.62 ft)	844231V2020		844231V2020		844231V2020	
Network control cable for the link between the pumps						
CRYOVISION / Network control cable, 5 m (16.4 ft)	–		844231V2005		844231V2005 (2x)	
or CRYOVISION / Network control cable, 10 m (32.81 ft)	–		844231V2010		844231V2010 (2x)	
or CRYOVISION / Network control cable, 20 m (65.62 ft)	–		844231V2020		844231V2020 (2x)	
Optional interface module						
COOLVAC ProfiBus module ProfiBus - RS232 Converter for COOL.DRIVE and CRYOVISION either COOLVAC ProfiBus module conected to COOL.DRIVE control and monitoring unit of each cryo pump (in this case CRYOVISION and network control not to apply)	844000V1		844000V1 (2x)		844000V1 (3x)	
or COOLVAC ProfiBus module conected to CRYOVISION [3]	844000V1		844000V1		844000V1	

The arrangement of the components is shown in the chapter “Accessories” under the heading “COOLVAC ClassicLine, System Components”

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines
3) At multiple operation with reduced communication speed to single cryo pumps

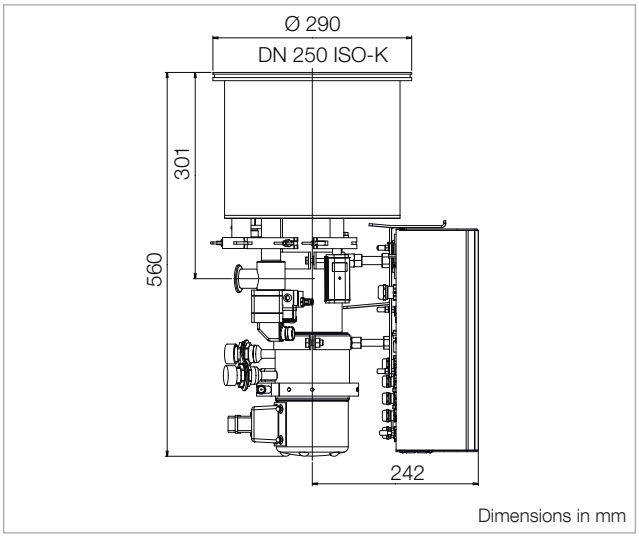
COOLVAC 2000 iCL

Advantages to the User

- Hydrocarbon-free high vacuum
- High capacity for argon and hydrogen
- High crossover value
- Simple operation
- Trouble-free integration into complex systems
- Fully automatic regeneration through integrated COOL.DRIVE controller
- Easy on-site servicing without pump disassembling and reconditioning of the vacuum system possible

Typical Applications

- Evaporators
- Sputtering systems
- Ion implanters
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 2000 iCL (DN 250 ISO-K)

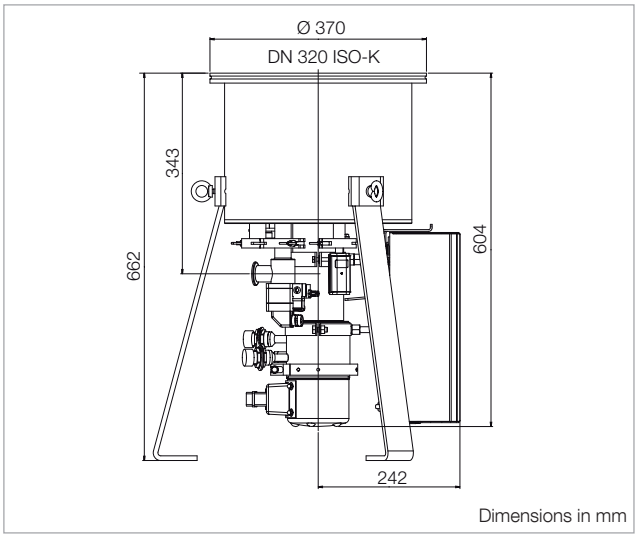
COOLVAC 3000 iCL

Advantages to the User

- Hydrocarbon-free high vacuum
- High capacity for argon and hydrogen
- High crossover value
- Simple operation
- Trouble-free integration into complex systems
- Fully automatic regeneration through integrated COOL.DRIVE controller
- Easy on-site servicing without pump disassembling and reconditioning of the vacuum system possible

Typical Applications

- Evaporators
- Sputtering systems
- Ion implanters
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 3000 iCL (DN 320 ISO-K)

Technical Data

COOLVAC

		2000 iCL	3000 iCL
High vacuum (HV) flange	DN	250 ISO-K / 250 CF / 8" ANSI	320 ISO-K / 10" ANSI
Fore vacuum flange	DN	25 KF	25 KF
Flange for connection a gauge head	DN	16 KF	16 KF
Flange for the electrical connection	DN	16 CF	16 CF
Safety valve with flange connection for gas exhaust line	DN	40 KF	40 KF
4-way current feedthrough for Si diode on a flange	DN	16 KF	16 KF
Heaters			
1st stage	W	160	160
	V AC	42	42
2nd stage	W	90	90
	V AC	42	42
Temperature sensor			
1st stage		Pt100	Pt100
2nd stage		Si diode	Si diode
Built-in cold head	COOLPOWER	7/25	7/25
Weight	kg (lbs)	25 (55.2)	35 (77.3)
Cooldown time to T_2 = 20 K	min	70	80
Crossover value	mbar x l (Torr x l)	250 (187)	500 (375)
Pumping speed			
H_2O	l x s^{-1}	7000	10500
Ar / N_2	l x s^{-1}	1600 / 2100	2500 / 3000
H_2	l x s^{-1}	3200	6000
Capacity			
Ar / N_2	bar x l	1600 / 1600	2500 / 2500
H_2 at 10^{-6} mbar	bar x l	15	28
Max. throughput			
Ar / N_2	mbar x l x s^{-1} (Torr x l x s^{-1})	12 (9) / 12 (9)	15 (11.2) / 15 (11.2)
H_2O	mbar x l x s^{-1} (Torr x l x s^{-1})	6 (4.5)	10 (7.5)
Helium connections (Self-sealing couplings: outside thread, type 5400-S2-8)	DN	1/2"	1/2"

Ordering Information

COOLVAC 2000 iCL

	Single Operation		Dual operation		Multiple operation	
	Europe	USA/Japan	Europe	USA/Japan	Europe	USA/Japan
	Part No.		Part No.		Part No.	
COOLVAC 2000 iCL						
DN 250 CF	844251V0002		844251V0002 (2x)		844251V0002 (3x)	
DN 8“ ANSI	844251V0004		844251V0004 (2x)		844251V0004 (3x)	
DN 250 ISO-K	844251V0006		844251V0006 (2x)		844251V0006 (3x)	
Compressors, flexlines and cables						
Compressor						
CP 2000	840000V2000	–	–	–	–	–
CP 2200	–	840000V2200	–	–	–	–
CP 6000 H	–	–	840000V6001	–	840000V6001	–
CP 6200 H	–	–	–	840000V6201	–	840000V6201
Power supply cable for compressor	–		1)		1)	
Set of flexlines						
FL 4.5 (1/2“, 1/2“)	892 87		892 87 (2x)		892 87 (3x)	
or FL 9.0 (1/2“, 1/2“)	892 88		892 88 (2x)		892 88 (3x)	
or FL 18.0 HP (1/2“) + FL 18.0 LP (1/2“)	840203 + 840204		840203 (2x) + 840204 (2 x)		840203 (3x) + 840204 (3 x)	
Gas manifold (1 piece each)						
GD 2	–		840 253 (2x)		–	
GD 4	–		–		840 254 (2x)	
Compressor unit control cable [2]						
COOLPAK control cable, 5 m	844231V4005		844231V4005 (2x)		844231V4005 (3x)	
or COOLPAK control cable, 10 m	844231V4010		844231V4010 (2x)		844231V4010 (3x)	
or COOLPAK control cable, 20 m	844231V4020		844231V4020 (2x)		844231V4020 (3x)	
COOLPAK adapter for multi control	–		844231V5003		844231V5003	
Optional electronics, cables and equipment						
CRYOVISION Steuer- und Anzeigeeinheit	844231V0002		844231V0002		844231V0002	
CRYOVISION control cables						
CRYOVISION control cable, 5 m	844231V2005		844231V2005		844231V2005	
or CRYOVISION control cable, 10 m	844231V2010		844231V2010		844231V2010	
or CRYOVISION control cablel, 20 m	844231V2020		844231V2020		844231V2020	
Network control cable for the link between the pumps						
CRYOVISION / Network control cable, 5 m	–		844231V2005		844231V2005 (2x)	
oder CRYOVISION / Network control cable, 10 m	–		844231V2010		844231V2010 (2x)	
oder CRYOVISION / Network control cable, 20 m	–		844231V2020		844231V2020 (2x)	
Optional interface module						
COOLVAC ProfiBus module ProfiBus - RS232 Converter for COOL.DRIVE and CRYOVISION either COOLVAC ProfiBus module conected to COOL.DRIVE control and monitoring unit of each cryo pump (in this case CRYOVISION and network control not to apply)	844000V1		844000V1 (2x)		844000V1 (3x)	
or COOLVAC ProfiBus module conected to CRYOVISION [3]	844000V1		844000V1		844000V1	

The arrangement of the components is shown in the chapter “Accessories” under the heading “COOLVAC ClassicLine, System Components”

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines
3) At multiple operation with reduced communication speed to single cryo pumps

Ordering Information

COOLVAC 3000 iCL

	Single Operation		Dual operation	
	Europe	USA/Japan	Europe	USA/Japan
	Part No.		Part No.	
COOLVAC 3000 iCL				
DN 10“ ANSI	844321V0004		844321V0004 (2x)	
DN 320 ISO-K	844321V0006		844321V0006 (2x)	
Compressors, flexlines and cables				
Compressor				
CP 2000	840000V2000	–	–	–
CP 2200	–	840000V2200	–	–
CP 6000 H	–	–	840000V6001	–
CP 6200 H	–	–	–	840000V6201
Power supply cable for compressor	–		1)	
Set of flexlines				
FL 4.5 (1/2“, 1/2“)	892 87		892 87 (2x)	
or FL 9.0 (1/2“, 1/2“)	892 88		892 88 (2x)	
or FL 18.0 HP (1/2“) + FL 18.0 LP (1/2“)	840203 + 840204		840203 (2x) + 840204 (2 x)	
Gas manifold (1 piece each)				
GD 2	–		840 253 (2x)	
Compressor unit control cable [2]				
COOLPAK control cable, 5 m (16.4 ft)	844231V4005		844231V4005 (2x)	
or COOLPAK control cable, 10 m (32.81 ft)	844231V4010		844231V4010 (2x)	
or COOLPAK control cable, 20 m (65.62 ft)	844231V4020		844231V4020 (2x)	
COOLPAK adapter for multi control	–		844231V5003	
Optional electronics, cables and equipment				
CRYOVISION control unit	844231V0002		844231V0002	
CRYOVISION control cables				
CRYOVISION control cable, 5 m (16.4 ft)	844231V2005		844231V2005	
or CRYOVISION control cable, 10 m (32.81 ft)	844231V2010		844231V2010	
or CRYOVISION control cablel, 20 m (65.62 ft)	844231V2020		844231V2020	
Network control cable for the link between the pumps				
CRYOVISION / Network control cable, 5 m (16.4 ft)	–		844231V2005	
or CRYOVISION / Network control cable, 10 m (32.81 ft)	–		844231V2010	
or CRYOVISION / Network control cable, 20 m (65.62 ft)	–		844231V2020	
Optional interface module				
COOLVAC ProfiBus module ProfiBus - RS232 Converter for COOL.DRIVE and CRYOVISION either COOLVAC ProfiBus module conected to COOL.DRIVE control and monitoring unit of each cryo pump (in this case CRYOVISION and network control not to apply)	844000V1		844000V1 (2x)	
or COOLVAC ProfiBus module conected to CRYOVISION [3]	844000V1		844000V1	

The arrangement of the components is shown in the chapter “Accessories” under the heading “COOLVAC ClassicLine, System Components”

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines
3) At multiple operation with reduced communication speed to single cryo pumps

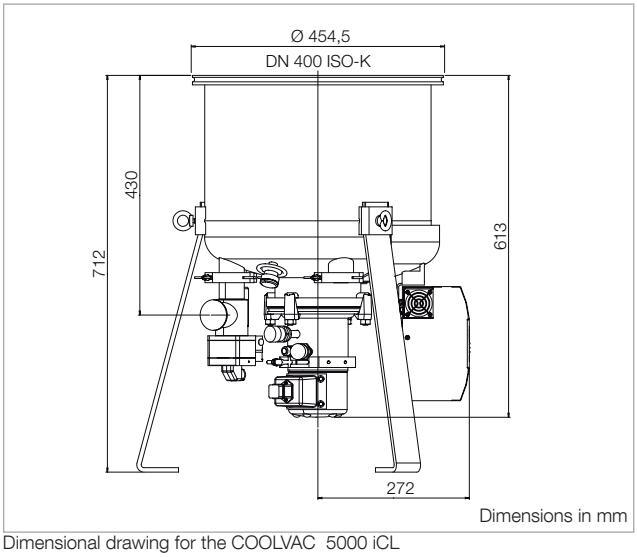
COOLVAC 5000 iCL

Advantages to the User

- Hydrocarbon-free high vacuum
- High capacity for argon and hydrogen
- High crossover value
- Simple operation
- Trouble-free integration into complex systems
- Fully automatic regeneration through integrated COOL.DRIVE controller
- Easy on-site servicing without pump disassembling and reconditioning of the vacuum system possible

Typical Applications

- Evaporators
- Electron beam welding systems
- Ion implanters
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 5000 iCL

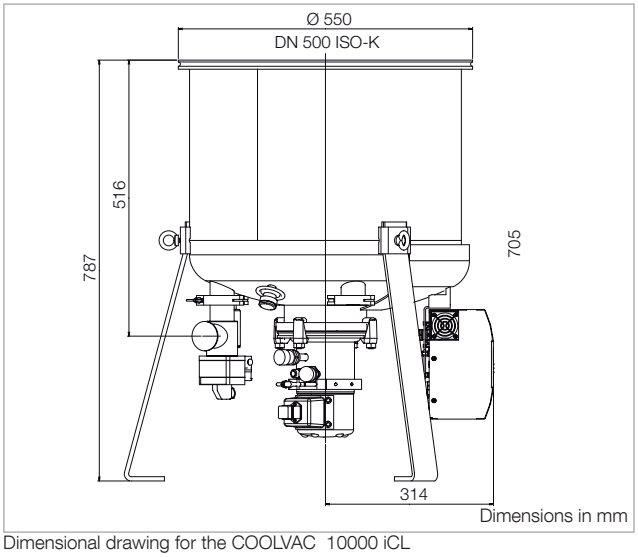
COOLVAC 10000 iCL

Advantages to the User

- Hydrocarbon-free high vacuum
- High capacity for argon and hydrogen
- High crossover value
- Simple operation
- Trouble-free integration into complex systems
- Fully automatic regeneration through integrated COOL.DRIVE controller
- Easy on-site servicing without pump disassembling and reconditioning of the vacuum system possible

Typical Applications

- Evaporators
- Electron beam welding systems
- Ion implanters
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 10000 iCL

Technical Data

COOLVAC

		5000 iCL	10000 iCL
High vacuum (HV) flange	DN	400 ISO-K	500 ISO-K
Fore vacuum flange	DN	40 KF	40 KF
Flange for connection of a gauge head	DN	16 KF	16 KF
Flange for the electrical connection	DN	40 KF	40 KF
Safety valve with flange connection for gas exhaust line	DN	40 KF	40 KF
4-way current feedthrough for Si diode on a flange	DN	16 KF	16 KF
Heaters			
1st stage	W	160	160
	V AC	42	42
2nd stage	W	90	90
	V AC	42	42
Temperature sensor			
1st stage		Pt100	Pt100
2nd stage		Si diode	Si diode
Built-in cold head	COOLPOWER	5/100	5/100
Weight	kg (lbs)	42 (92.7)	50 (110.4)
Cooldown time to T_2 = 20 K	min	100	150
Crossover value	mbar x l (Torr x l)	700 (525)	800 (600)
Pumping speed			
H_2O	l x s^{-1}	18000	30000
Ar / N_2	l x s^{-1}	4000 / 5200	8400 / 10000
H_2	l x s^{-1}	6200	12000
Capacity			
Ar / N_2	bar x l	3000 / 3000	5500 / 5500
H_2 at 10^{-6} mbar	bar x l	32	45
Max. throughput			
Ar / N_2	mbar x l x s^{-1} (Torr x l x s^{-1})	10 (7.5) / 10 (7.5)	10 (7.5) / 10 (7.5)
H_2	mbar x l x s^{-1} (Torr x l x s^{-1})	7 (5.3)	7 (5.3)
Helium connection (Self-sealing couplings: outside thread, types 5400-S2-8	DN	1/2"	1/2"

Ordering Information

	COOLVAC 5000 iCL		COOLVAC 10000 iCL	
	Europa	USA/Japan	Europa	USA/Japan
	Part No.		Part No.	
COOLVAC 5000 iCL, DN 400 ISO-K	844411V0006		–	
COOLVAC 10000 iCL, 20" ANSI	–		844511V0004	
COOLVAC 10000 iCL, DN 500 ISO-K	–		844511V0006	
Compressors, flexlines and cables				
Compressor				
CP 6000 H	840000V6001	–	840000V6001	–
CP 6200 H	–	840000V6201	–	840000V6201
Power supply cable for compressor	–		1)	
Set of flexlines				
FL 4.5 (1/2“, 1/2“)	892 87		892 87 (2x)	
or FL 9.0 (1/2“, 1/2“)	892 88		892 88 (2x)	
or FL 18.0 HP (1/2“) + FL 18.0 LP (1/2“)	840203 + 840204		840203 (2x) + 840204 (2 x)	
Compressor unit control cable [2]				
COOLPAK control cable, 5 m (16.4 ft)	844231V4005		844231V4005 (2x)	
or COOLPAK control cable, 10 m (32.81 ft)	844231V4010		844231V4010 (2x)	
or COOLPAK control cable, 20 m (65.62 ft)	844231V4020		844231V4020 (2x)	
Optional electronics, cables and equipment				
CRYOVISION control unit	844231V0002		844231V0002	
CRYOVISION control cables				
CRYOVISION control cable, 5 m (16.4 ft)	844231V2005		844231V2005	
or CRYOVISION control cable, 10 m (32.81 ft)	844231V2010		844231V2010	
or CRYOVISION control cablel, 20 m (65.62 ft)	844231V2020		844231V2020	
Optional interface module				
COOLVAC ProfiBus module ProfiBus - RS232 Converter for COOL.DRIVE and CRYOVISION	844000V1		844000V1	

The arrangement of the components is shown in the chapter “Accessories” under the heading “COOLVAC ClassicLine, System Components”

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines

Notes

COOLVAC 18000 iCL

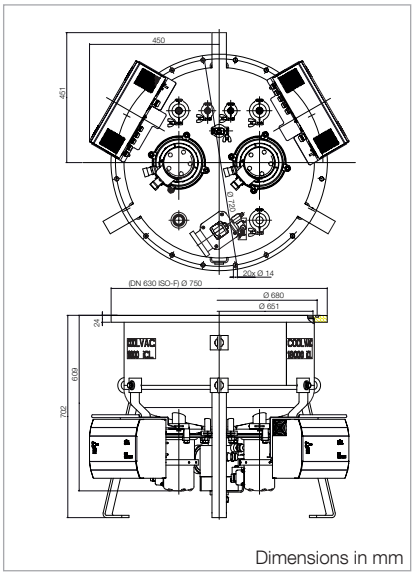
COOLVAC 18000 iCL with flange DN 630 ISO-F

Advantages to the User

- Hydrocarbon-free high vacuum
- High pumping speed for water vapor and nitrogen
- Fast, safe and efficient regeneration with the electric regeneration system
- Simple operation

Typical Applications

- Space simulation chambers
- Evaporators
- Electron beam welding systems
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 18000 iCL

COOLVAC 30000 iCL

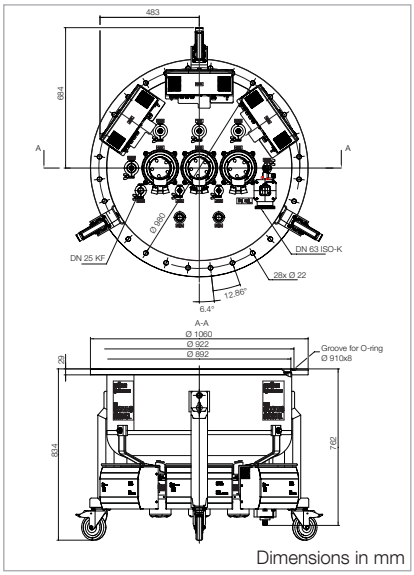
COOLVAC 30000 iCL with specialflange

Advantages to the User

- Hydrocarbon-free high vacuum
- High pumping speed for water vapor and nitrogen
- Fast, safe and efficient regeneration with the electric regeneration system
- Simple operation

Typical Applications

- Space simulation chambers
- Evaporators
- Electron beam welding systems
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 30000 iCL

COOLVAC 60000 iCL

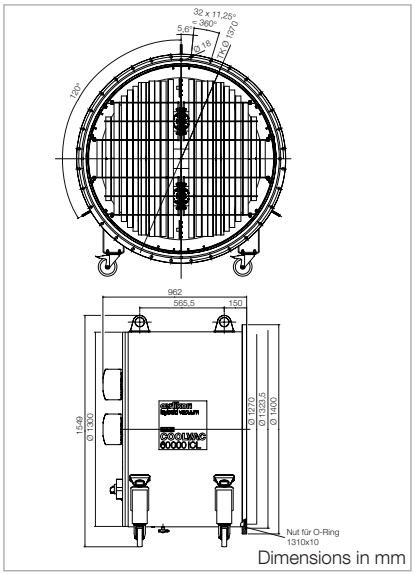
COOLVAC 60000 iCL with flange DN 1250 ISO-F

Advantages to the User

- Hydrocarbon-free high vacuum
- High pumping speed for water vapor and nitrogen
- Fast, safe and efficient regeneration with the electric regeneration system
- Simple operation

Typical Applications

- Space simulation chambers
- Evaporators
- Electron beam welding systems
- Optical coating systems
- Metallization systems



Dimensional drawing for the COOLVAC 60000 iCL

Techncal Data		COOLVAC 18000 iCL	COOLVAC 30000 iCL	COOLVAC 60000 iCL
High vacuum flange	DN	630 ISO-F	35"ANSI	1250 ISO-F
Fore vacuum flange	DN	63 ISO-K	63 ISO-K	63 ISO-K
Flange with current feedthrough for silicon diode	DN	25 KF (2x)	16 KF (2x)	16 KF (2x)
Flange for other purposes	DN	40 KF	40 KF	40 KF
Safety valve with DN 40 KF flange connection for gas exhaust line	DN	40 KF	40 KF	40 KF
(opening pressure)	mbar	1150 +/-40	1150 +/-40	1150 +/-40
Pumping speed				
H_2O	l x s^{-1}	46000	93000	180000
Ar / N_2	l x s^{-1}	13500 / 18000	25000 / 30000	47000 / 57000
H_2	l x s^{-1}	14000	30000	60000
Capacity				
Ar / N_2	bar x l	6000	6500	9000
H_2 bei 10^{-6} mbar	bar x l	65	100	150
Built-in cold head	COOLPOWER	5/100 (2x)	5/100 (2x) and 140T (1x)	5/100 (2x) and 140T (2x)
Max. throughput				
Ar / N_2	mbar x l x s^{-1} (Torr x l x s^{-1})	14 (10.5)	14 (10.5)	25 (18.75)
H_2	mbar x l x s^{-1} (Torr x l x s^{-1})	7 (5.25)	7 (5.25)	12 (9)
Crossover value at 20 K	mbar x l (Torr x l))	800 (600)	1200 (900)	1000 (750)
Cool down time to 20 K	min	180	260	330
Overall height	mm	see drawing	see drawing	see drawing
Weight	kg (lbs)	131 (289)	258 (569)	466 (1027)
Silicon diode for temperature measure-ments at the second stage of the cold head		built-in (2x)	built-in (2x)	built-in (2x)
Regeneration heaters at the				
first stage of the cold head		built-in (2x)	built-in (3x)	built-in (4x)
second stage of the cold head		built-in (2x)	built-in (2x)	built-in (2x)

Ordering information

	COOLVAC 18000 iCL		COOLVAC 30000 iCL		COOLVAC 60000 iCL	
	Europe	USA/Japan	Europe	USA/Japan	Europe	USA/Japan
	Part No.		Part No.		Part No.	
COOLVAC 18 000 iCL, DN 630 ISO-F	844631V0006		–		–	
COOLVAC 30 000 iCL, 35" ANSI	–		844891V9005		–	
COOLVAC 60 000 iCL, DN 1250 ISO-F	–		–		844896V9005	
Compressors, flexlines and cables						
Compressor						
CP 6000 H	840000V6001 (2x)	–	840000V6001 (3x)	–	840000V6001 (4x)	–
CP 6200 H	–	840000V6201 (2x)	–	840000V6201 (3x)	–	840000V6201 (4x)
Power supply cable for compressor	1)					
Set of flexlines						
FL 4.5 (1/2“, 1/2“)	892 87 (2x)		892 87 (3x)		892 87 (4x)	
or FL 9.0 (1/2“, 1/2“)	892 88 (2x)		892 88 (3x)		892 88 (4x)	
or FL 18.0 HP (1/2“) + FL 18.0 LP (1/2“)	840203 (2x) + 840204 (2x)		840203 (3x) + 840204 (3 x)		840203 (4x) + 840204 (4 x)	
Compressor unit control cable [2]						
COOLPAK control cable, 5 m (16.4 ft)	844231V4005 (2x)		844231V4005 (3x)		844231V4005 (4x)	
or COOLPAK control cable, 10 m (32.81 ft)	844231V4010 (2x)		844231V4010 (3x)		844231V4010 (4x)	
or COOLPAK control cable, 20 m (65.62 ft)	844231V4020 (2x)		844231V4020 (3x)		844231V4020 (4x)	
Optional electronics, cables and equipment						
CRYOVISION control unit	844231V0002					
CRYOVISION network / control cable						
CRYOVISION / Network control cable, 5 m (16.4 ft)	844231V2005					
or CRYOVISION / Network control cable, 10 m (32.81 ft)	844231V2010					
or CRYOVISION / Network control cable, 20 m (65.62 ft)	844231V2020					
Optional interface module						
COOLVAC ProfiBus module ProfiBus - RS232 Converter for COOL.DRIVE and CRYOVISION	844000V1					

The arrangement of the components is shown in the chapter “Accessories” under the heading “COOLVAC ClassicLine, System Components”

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines

Cryo Pumps with Liqiud Nitrogene Cooling of Radiation Shield and Baffle of Cryo Pump

COOLVAC 30000 BL LN_2 und COOLVAC 60000 BL LN_2

COOLVAC 30000 BL LN_2

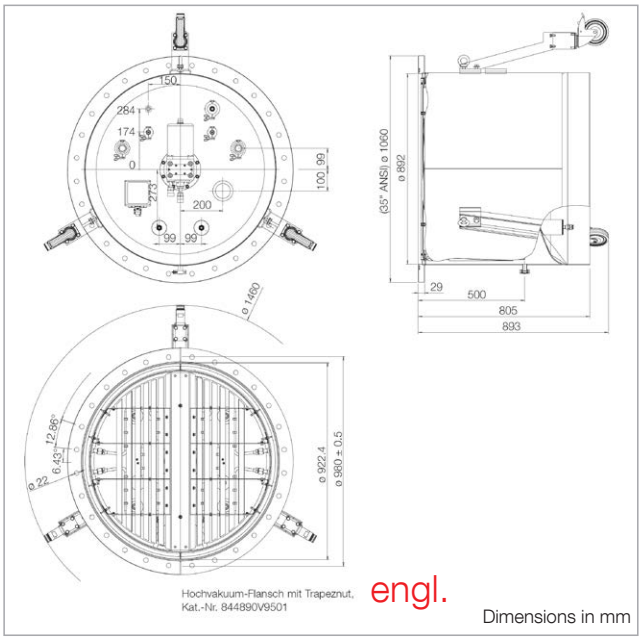
COOLVAC 60000 BL LN_2 with flange DN 1250 ISO-F

Advantages to the User

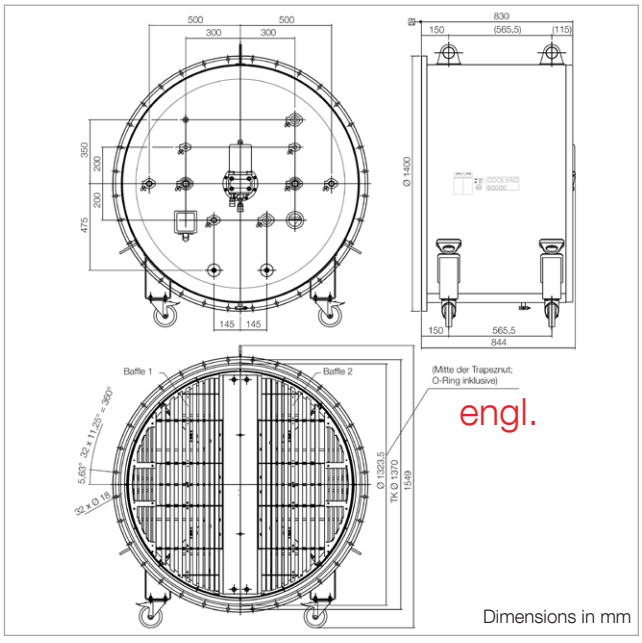
- Hydrocarbon-free high vacuum
- High pumping speed for water vapor and nitrogen
- Operating with only one compressor unit through liquid nitrogene (LN_2) cooling of radiation shield and baffle
- Controlling of radiation shield and baffle temperatures by additional temperature sensor

Typical Applications

- Space simulation chambers
- Vacuum furnaces



Dimensional drawing of COOLVAC 30000 BL LN_2



Dimensional drawing of COOLVAC 60000 BL LN_2

Technische Daten	COOLVAC 30000 BL LN_2	COOLVAC 60000 BL LN_2
High vacuum flange DN	35"ANSI	1250 ISO-F
Fore vacuum flange DN	63 ISO-K	63 ISO-K
Flange with 4-pole current feedthrough for silicon diode* DN	16 KF (2x)	16 KF (2x)
Flange with 6-pole current feedthrough for 3 Pt100 (radiation shield and baffle halfs) DN	40 KF	40 KF
Safety valve with DN 40 KF flange connection for gas exhaust line DN (opening pressure) mbar	40 KF 1150 +/-40	40 KF 1150 +/-40
Flange with abnormal temperature protection for the regeneration heaters of the built-in cold head DN	40 KF	40 IKF
Pumping speed H_2O $l \times s^{-1}$ Ar / N_2 $l \times s^{-1}$ H_2 $l \times s^{-1}$	 93000 25000 / 30000 30000	 180000 47000 / 57000 60000
Capacity Ar / N_2 bar x l H_2 at 10^{-6} mbar bar x l	 6500 100	 9000 150
Built-in cold head COOLPOWER	10 MD	10 MD)
Max. throughput Ar / N_2 mbar x l x s^{-1} (Torr x l x s^{-1})	 > 15 (11.25)	 > 30 (22.5)
Crossover value at 20 K mbar x l (Torr x l)	2000 (1500)	3000 (2250)
LN_2 consumption, ca. l/h	7	10
LN_2 connections	SWAGELOK	SS-8-VCR (1/2")
Abkühlzeit auf 20 K, ca. h	5	6
Overall height mm	see drawing	see drawing
Weight kg (lbs)	ca. 300 (661)	ca. 400 (882)
Silicon diode for temperature measure-ments at the second stage of the cold head	built-in	built-in
Regeneration heaters at the first stage of the cold head second stage of the cold head	 built-in built-in	 built-in built-in

*temperature sensor at the second stage of the cold head

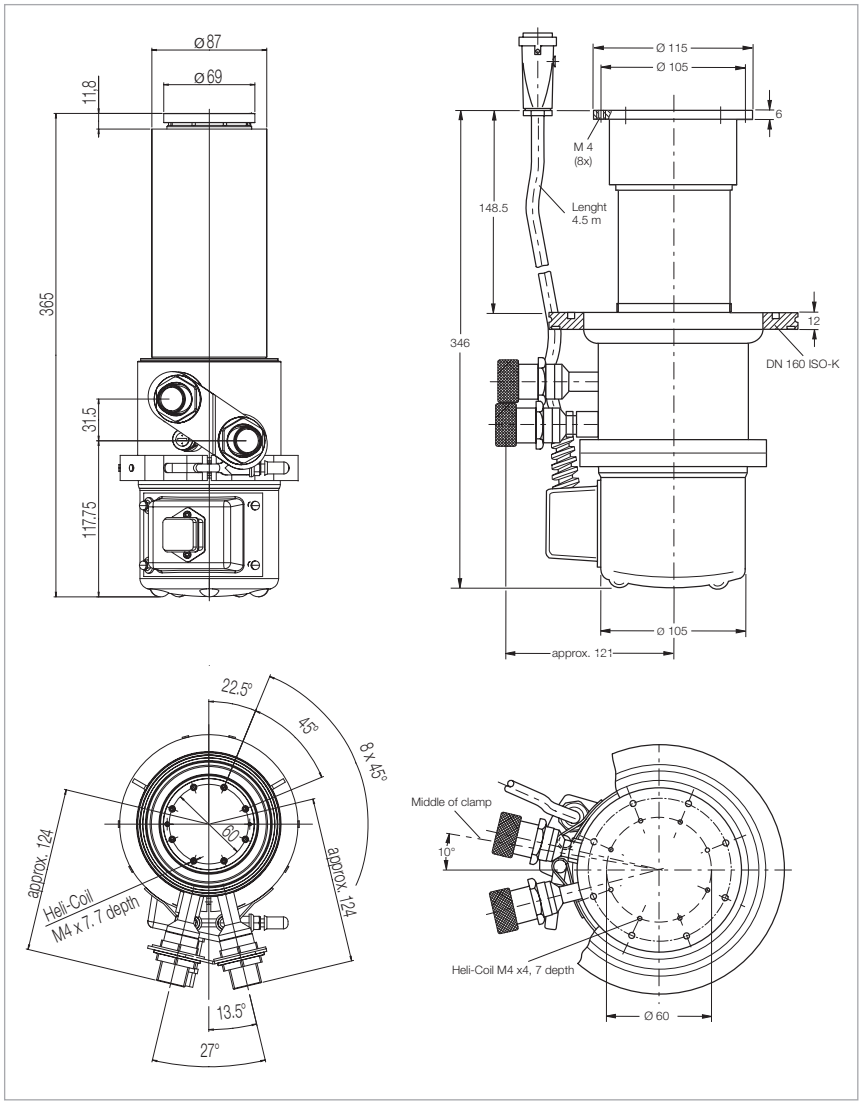
Ordering information

	COOLVAC 30000 BL LN_2		COOLVAC 60000 BL LN_2	
	Europe	USA/Japan	Europe	USA/Japan
	Part No.		Part No.	
COOLVAC 30 000 BL LN_2, 35" ANSI	844890V9501		–	
COOLVAC 60 000 BL LN_2, DN 1250 ISO-F	–		844895V9503	
Compressors, flexlines and cables				
Compressor				
CP 6000 HMD, 400 V / 50 Hz / 460 V / 60 Hz / 3-ph.	840000V6002	–	840000V6002	–
CP 6200 HMD, 200 V / 50 Hz / 200 - 230 V / 60 Hz / 3-ph.	–	840000V6202	–	840000V6202
Power supply cable for compressor	1)			
Flexible pressure line (for operating mechanically driven cold heads)				
9 m (29.53 ft), FL9 HP - DN20 (8f/8f) + FL9 LP - DN32 (8f/8f)	840217 + 840218V0032			
20 m (65.62 ft), FL20 HP - DN20 (8f-ELB/8f) + FL20 LP - DN32 (8f-ELB/8f)	840230V0020 + 840231V0032			
Cable cold head motor compüressor unit [2]				
9 m (29.53 ft)	842 110			
20 m (65.62 ft)	842 112			
30 m (98.43 ft)	842 114			
Optional equipment and cables				
Low temperature measuring instrument MODEL 211S	844 110			
HV cable, 4-way, with plug to the MODEL 211S				
10 m (32.81 ft)	844 113			
20 m (65.62 ft)	844113V20			
30 m (98.43 ft)	844113V30			
Heizungsnetzgerät HU1 inklusive 5 m Anschlusskabel				
Netzgerät zum Aufwärmen des eingebauten Kaltkopfs COOLPOWER 10 MD auf Raumtemperatur während des Regenerierens der Kryopumpe	890 79			
Connection cable for HU1, 30 m (98.43 ft)	840002988			
Additional accessories (selection)				
Forevacuum valves [3]				
Right-Angle DN 63 ISO-K, electropneumatically operated, with pilot valve 24 V DC, Aluminum body	10800V01			
Right-Angle DN 63 ISO-K, electropneumatically operated, with pilot valve 24 V DC, stainless steel body	10810V01			
Pressure sensor				
THERMOVAC Transmitter TTR 91 N, DN 16 ISO-KF (without switching threshold)	230035V02			
THERMOVAC Transmitter TTR 91 N, DN 16 ISO-KF, (with switching threshold, 2SP)	230040V02			
Connection cable to TTR 91 N, FCC 68 on both ends, 8-way shielded [4]	Typ A			
10 m (32.81 ft)	230 012			
20 m (65.62 ft)	124 28			
30 m (98.43 ft)	124 29			

1) See Ordering Information for the compressor units COOLPAK
2) The length of the control cable should match to the length of the flexlines
3) See catalog "Valves" for additional right-angle valves

Cold Heads, Pneumatically Driven
Single-Stage Cold Heads
COOLPOWER 50 and 140 T

Single-stage cold head's COOLPOWER 50 (left) and 140 T (right)



Dimensional drawing for the COOLPOWER 50 (left) and COOLPOWER 140 T (right)

Advantages to the User

- For installation mostly in any orientation
- High refrigerating capacity
- No liquid refrigerants are required
- Very simple to operate
- Short cooldown time

Typical Applications

- Cooling of cryopanels in cryo pumps and thus generation of high vacuum and ultra-high vacuum pressures
- Calibration of sensors
- Cooling of samples and detectors; especially for cooling of
  - samples for spectroscopic investigations in solid state and surface physics
  - high temperature superconductor and semiconductor conditions
  - infrared and gamma detectors

Technical Data

	COOLPOWER 50	COOLPOWER 140 T
Refrigeration capacity at 50/60 Hz [1]		
at 80 K, approx. W	50	140
at 20 K, approx. W	–	20
Lowest attainable temperature [1] K	≤ 26	# 15
Cooldown time down		
to 20 K min	–	≤ 55
to 20 K, approx. min	20	–
Permissible ambient temperature °C (°F)	+10 to +40 (+50 to +104)	+10 to +40 (+50 to +104)
He filling pressure at room temperature bar	16	16
He connections		
Self-sealing screwed connections		
High pressure connection	1/2" [2]	1/2" [3]
Low pressure connection	1/2" [2]	1/2" [3]
Weight kg (lbs)	8 (17.7)	12 (26.5)
Length of the electrical connection line to the compressor unit m (ft)	–	4.5 (15.75)

Ordering Information

	COOLPOWER 50 Part No.	COOLPOWER 140 T Part No.
Cold head		
with DN 100 CF-R	**842050V0001**	**–**
with DN 160 ISO-K	**–**	**842 030**
with weld-on pipe	**842050V0000**	**–**
other flanges	**upon request**	**upon request**
Accessories		
Connecting cable compressor – cold head, 4.5 m (15.75 ft)	**E 400000323**	included with the cold head
Compressor unit (for operation of one cold head)		
COOLPAK 2000	**840000V2000**	**–**
COOLPAK 2000 A	**840000V2010**	**–**
COOLPAK 2200	**840000V2200**	**–**
COOLPAK 2200 A	**840000V2210**	**–**
COOLPAK 6000 H		
400 V/50 Hz; 470 V/60 Hz	**–**	**840000V6001**
COOLPAK 6200 H		
200 V/50 Hz; 200 V, 230 V/60 Hz	**–**	**840000V6201**
Power supply cable	see Ordering Information for the compressor units COOLPAK	see Ordering Information for the compressor units COOLPAK
Set of flexlines		
FL 4.5 (1/2", 1/2")	**892 87**	**892 87**
or FL 9.0 (1/2", 1/2")	**892 88**	**892 88**
and EL 4.5 (electric extension cable)	**893 74**	**893 74**
Options		
Temperature measurement		
Silicon diode	**890 89**	**890 89**
Low temperature measuring instrument	**upon request**	**upon request**
Measuring cable	**upon request**	**upon request**

[1] The refrigerating capacities and temperatures stated apply only to vertical operation with the cold end at the bottom

[2] Series 5400 from Aeroquip or compatible types

[3] Series 8 from Aeroquip

Dual-Stage Cold Heads COOLPOWER 7/25, 5/100 and 5/100 T

Dual-stage cold head COOLPOWER 7/25

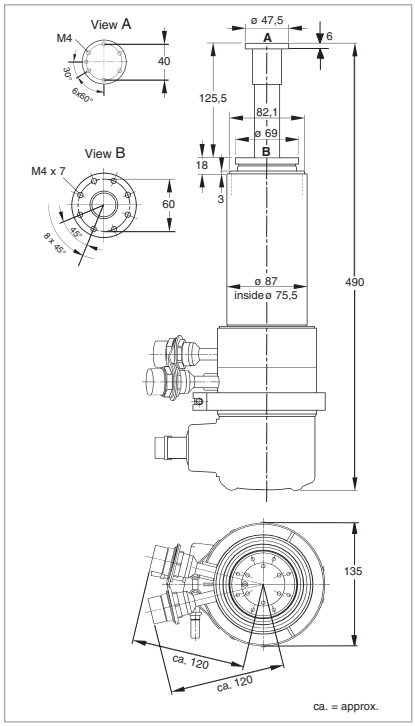
Dual-stage cold heads COOLPOWER 5/100 and COOLPOWER 5/100 T

Advantages to the User

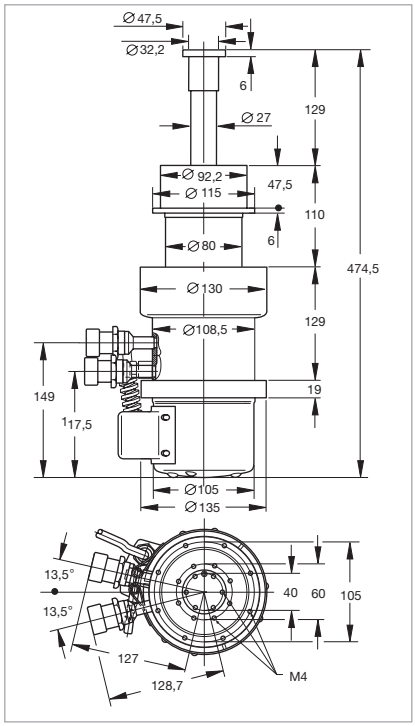
- For installation in any orientation
- High refrigerating capacity
- No liquid refrigerants are required
- Very simple to operate
- Short cooldown time

Typical Applications

- Cooling of cryopanels in cryo pumps and thus generation of high vacuum and ultra-high vacuum pressures
- Cooling of samples and detectors; especially for cooling of
  - samples for spectroscopic investigations in solid state and surface physics
  - high temperature superconductors
  - superconductors and semi conductors
  - infrared and gamma detectors
- Calibration of sensors
- Cooling of accelerator components in the area of high energy physics
- Cooling of superconducting magnets; in nuclear magnetic resonance tomographs, for example (only COOLPOWER 5/100 and 5/100 T)



Dimensional drawing for the COOLPOWER 7/25



Dimensional drawing for the COOLPOWER 5/100 and COOLPOWER 5/100 T

Technical Data

		COOLPOWER 7/25	COOLPOWER 5/100	COOLPOWER 5/100 T
Refrigeration capacity at 50/60 Hz [1]				
1st stage at 80 K, approx.	W	25	100	100
2st stage at 20 K, approx.	W	7	5	7.5
2st stage at 10 K, approx.	W	–	–	3.5
2st stage at 40 K, approx.	W	–	–	35
Lowest attainable temperature [1]				
1st stage, approx.	K	≤ 35	≤ 35	≤ 35
2nd stage, approx.	K	≤ 10	≤ 10	6
Cooldown time of the				
2nd stage to 20 K, approx.	min	20	20	20
1st stage to 80 K, approx.	min	20	20	20
2nd stage to 10 K, approx.	min	–	–	35
1st stage to 40 K, approx.	min	–	–	30
2nd stage to 6 K, approx.	min	–	–	45
1st stage to 30 K, approx.	min	–	–	40
Permissible ambient temperature	°C (°F)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)
He filling pressure at room temperature	bar	16	16	16
He connections				
Self-sealing screwed connections				
High pressure connection		1/2" (#8 [2])	1/2" (#8 [2])	1/2" (#8 [2])
Low pressure connection		1/2" (#8)	1/2" (#8)	1/2" (#8)
Weight	kg (lbs)	11 (24.3)	11 (24.3)	11 (24.3)
Length of the electrical connection line to the compressor unit (included with cold head)	m (ft)	4.5 (15.75)	4.5 (15.75)	4.5 (15.75)

Ordering Information

	COOLPOWER 7/25 Part No.	COOLPOWER 5/100 Part No.	COOLPOWER 5/100 T Part No.
Cold head			
COOLPOWER 7/25	842 040	–	–
COOLPOWER 5/100 with weld-on pipe	–	893 05	–
COOLPOWER 5/100 T	–	–	129 78
Accessories			
Connecting cable compressor – cold head, 4.5 m (15.75 ft)	**E 400000323**	included with the cold head	included with the cold head
Compressor unit (for operation of one cold head)			
COOLPAK 2000	**840000V2000**	**–**	**–**
COOLPAK 2000 A	**840000V2010**	**–**	**–**
COOLPAK 2200	**840000V2200**	**–**	**–**
COOLPAK 2200 A	**840000V2210**	**–**	**–**
COOLPAK 6000 H	**–**	**840000V6001**	**840000V6001**
COOLPAK 6200 H	**–**	**840000V6201**	**840000V6201**
Power supply cable	[3]	[3]	[3]
Set of flexlines			
FL 4.5 (1/2", 1/2")	**892 87**	**892 87**	**892 87**
or FL 9.0 (1/2", 1/2")	**892 88**	**892 88**	**892 88**
and EL 4.5 (electric extension cable)	**893 74**	**893 74**	**893 74**
Options			
Temperature measurement / control			
Silicon diode	**890 89**	**890 89**	**890 89**
Low temperature measuring instrument	**upon request**	**upon request**	**upon request**
Measuring cable	**upon request**	**upon request**	**upon request**
Electrical heaters	**upon request**	**upon request**	**upon request**
Low temperature controller MODEL 9700	**842 400**	**842 400**	**842 400**
Measuring cable, 3 m (10.5 ft) long	**842 401**	**842 401**	**842 401**

[1] The refrigerating capacities and temperatures stated apply to vertical operation with the cold end at the bottom

[2] Series 8 from Aeroquip

[3] See Ordering Information for the compressor units COOLPAK

Cold Heads, Mechanically Driven
Dual-Stage Cold Head COOLPOWER 10 MD

Dual-stage Cold Head COOLPOWER 10 MD

COOLPOWER 10 MD - the strongest 10 K GM cooler available on the market:

- High 2nd stage cooling capacity of > 18 W at 20 K
- High 1st stage cooling capacity of > 25 W at 40 K and 110 W at 80 K

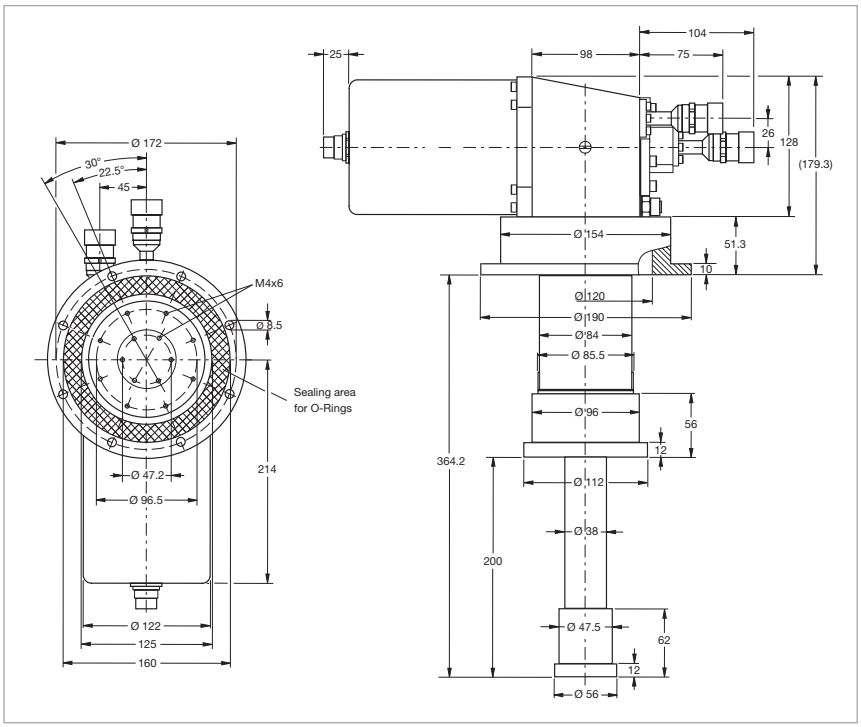
Advantages to the User

- Excellent cooling performance
- 18 W at 20 K by press-button operation
- High reliability
- Design optimized for MTBF 100,000 h
- Long and maintenance-free operation
- Low vibration due to directly driven displacer
- No liquid refrigerants are required
- Very simple to operate
- Short cooldown time
- Easy operation
  - Plug & Cool - as usual for all Leybold GM coolers
  - Simple variation of motor speed via the COOLPAK MD compressor unit

Typical Applications

The COOLPOWER 10 MD is a mechanically driven double-stage Gifford McMahon (GM) cryo cooler and ideally suited for

- Cooling of cryo probes in NMR spectrometers
- Shield cooling of superconducting magnets in MRI
- Cooling of cryopanels in special Cryo pumps and thus generation of high vacuum and ultra-high vacuum pressures
- Cooling of larger samples and devices; especially
  - High temperature superconductor coils, wires and bulk materials
  - Recondensation of liquid refrigerants such as H_2, Ne
  - Samples for spectroscopic investigations in solid state and surface physics
  - Infrared and gamma detectors
- Calibration of sensors



Dimensional drawing for the COOLPOWER 10 MD

Technical Data — COOLPOWER 10 MD

Refrigeration capacity at 50/60 Hz [1]		
1st stage at 80 K, approx.	**W**	110
2st stage at 20 K, approx.	**W**	18
Lowest attainable temperature [1]		
1st stage, approx.	**K**	≤ 28
2nd stage, approx.	**K**	≤ 8
Cooldown time of the		
2nd stage to 20 K, approx.	**min**	25
Permissible ambient temperature	**°C (°F)**	+5 to +40 (+41 to +104)
He filling pressure at room temperature	**bar**	16
He connections		
Self-sealing screwed connections		
High pressure connection		1/2" (#8 [2])
Low pressure connection		1/2" (#8)
Weight	**kg (lbs)**	20 (44.15)

Ordering Information — COOLPOWER 10 MD

	Part No.
Cold head COOLPOWER 10 MD	**842 010**
Accessories	see Ordering Information for the compressor unit COOLPAK 6000 HMD/6200 HMD, connecting cable and flexline

[1] The refrigerating capacities and temperatures stated apply to vertical operation with the cold end at the bottom

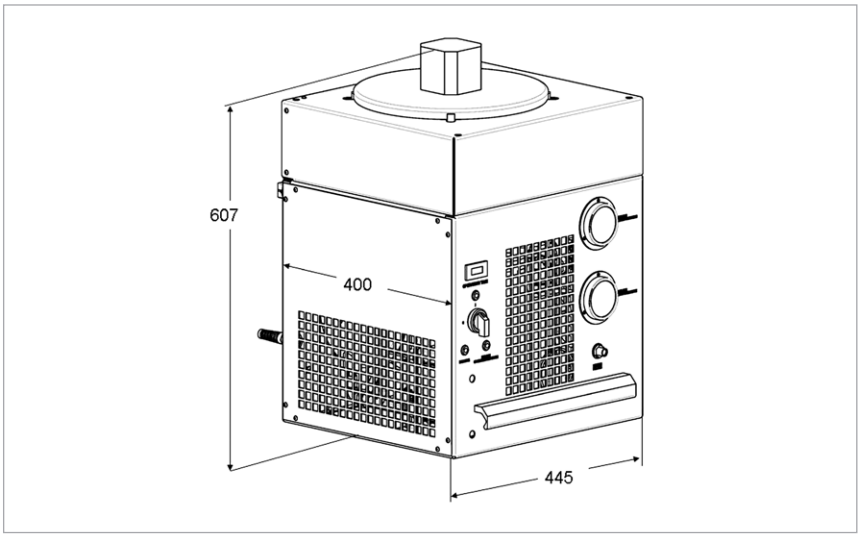
[2] Series 8 from Aeroquip

Compressor Units for Pneumatically Driven Cold Heads and Pumps, Air Cooling COOLPAK 2000 A/2200 A

Compressor unit COOLPAK 2000 A (2200 A is similar)

Advantages to the User

- High efficiency and increased performance for cryogenic pumps and refrigerators
- High long-term reliability due to long-life and highly efficient components and improved oil management
- Very quiet and low vibration operation through the innovative horizontally suspended scroll compressor
- Simple installation and operation
- Global mains voltage compatibility
- Perfect integration within complex systems due to the 24 V Sub-D interface
- Simple adsorber replacement, otherwise maintenance-free
- Small footprint
- Low cost of ownership



Dimensional drawing of the COOLPAK 2000 A/2200 A

Technical Data

		COOLPAK	
		2000 A (50 Hz)	2200 A (60 Hz)
Number of electrical connections for cold heads		1	1
Helium system filling pressure at room temperature	bar	15	14
Ambient temperature	°C (°F)	+5 to +30 (+41 to +86)	+5 to +30 (+41 to +86)
Mains voltage (single phase)	V	230 ± 10%	208 ± 10%
Operating current			
with cooled down cold head	A	9.5 to 10.5	11.5 to 12.5
with warmed up cold head	A	12.0	13.0
Electric power consumption			
with cooled down cold head	kW	2.2	2.3
with warmed up cold head	kW	2.4	2.5
Remote control through interface		24 V DC	24 V DC
Helium connections			
self-sealing fittings			
high-pressure side (outside thread)		1/2"	1/2"
low-pressure side (outside thread)		1/2"	1/2"
Noise level (at a distance of 1 m (3.5 ft))	dB(A)	< 55	< 55
Dimensions (W x H x D)	mm (in.)	445 x 607 x 400 (17.52 x 23.90 x 15.74)	445 x 607 x 400 (17.52 x 23.90 x 15.74)
Weight	kg (lbs)	69 (152.32)	69 (152.32)

Ordering Information

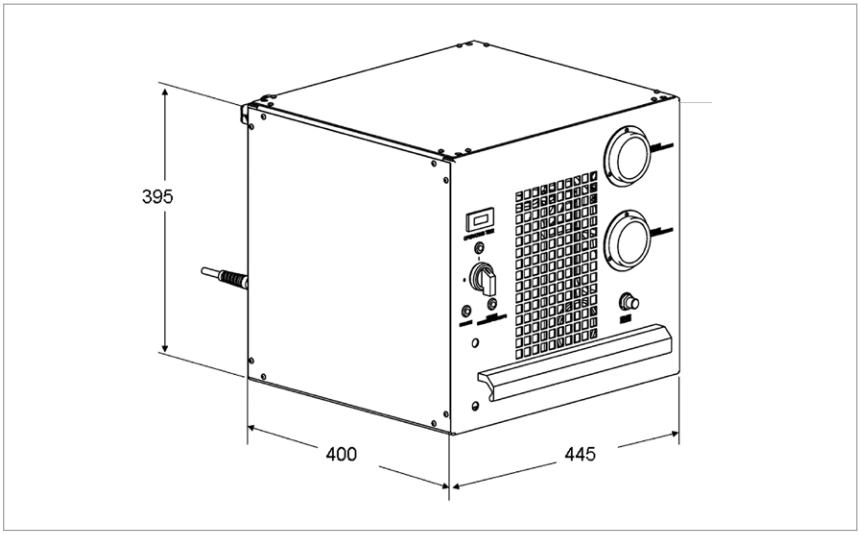
	COOLPAK	
	2000 A (50 Hz)	2200 A (60 Hz)
	Part No.	**Part No.**
Compressor unit	**840000V2010**	**840000V2210**
Accessories, optional		
19" installation kit	**840 022**	**840 022**
RC adapter box (for operating older cold heads of type RGD, RGS or COOLPOWER 20 / 210 / 30 / 510)	**840 910**	**840 910**
Spare parts		
Absorber CPS-V8	**E 840001973**	**E 840001973**

Compressor Units for Pneumatically Driven Cold Heads and Pumps, Water Cooling COOLPAK 2000/2200

Compressor unit COOLPAK 2000 (2200 is similar)

Advantages to the User

- High efficiency and increased performance for cryogenic pumps and refrigerators
- High long-term reliability due to long-life and highly efficient components and improved oil management
- Very quiet and low vibration operation through the innovative horizontally suspended scroll compressor
- Simple installation and operation
- Global mains voltage compatibility
- Perfect integration within complex systems due to the 24 V Sub-D interface
- Simple adsorber replacement, otherwise maintenance-free
- Small footprint
- Low cost of ownership



Dimensional drawing of the COOLPAK 2000/2200

Technical Data

		COOLPAK	
		2000 (50 Hz)	2200 (60 Hz)
Number of electrical connections for cold heads		1	1
Helium system filling pressure at room temperature	bar	15	14
Ambient temperature	°C (°F)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)
Cooling water consumption		< 5	< 5
Cooling water feed temperature	°C (°F)	+5 to +25 (+41 to +77)	+5 to +25 (+41 to +77)
Mains voltage (single phase)	V	230 ± 10%	208 ± 10%
Operating current			
with cooled down cold head	A	9.5 to 10.5	11.5 to 12.5
with warmed up cold head	A	12.0	13.0
Electric power consumption			
with cooled down cold head	kW	2.2	2.3
with warmed up cold head	kW	2.4	2.5
Remote control through interface	V DC	24	24
Helium connections			
self-sealing fittings			
high-pressure side (outside thread)		1/2"	1/2"
low-pressure side (outside thread)		1/2"	1/2"
Water connections	DN	10	10
Noise level (at a distance of 1 m (3.5 ft))	dB(A)	< 55	< 55
Dimensions (W x H x D)	mm (in.)	445 x 395 x 400 (17.52 x 15.55 x 15.74)	445 x 395 x 400 (17.52 x 15.55 x 15.74)
Weight	kg (lbs)	69 (152.32)	69 (152.32)

Ordering Information

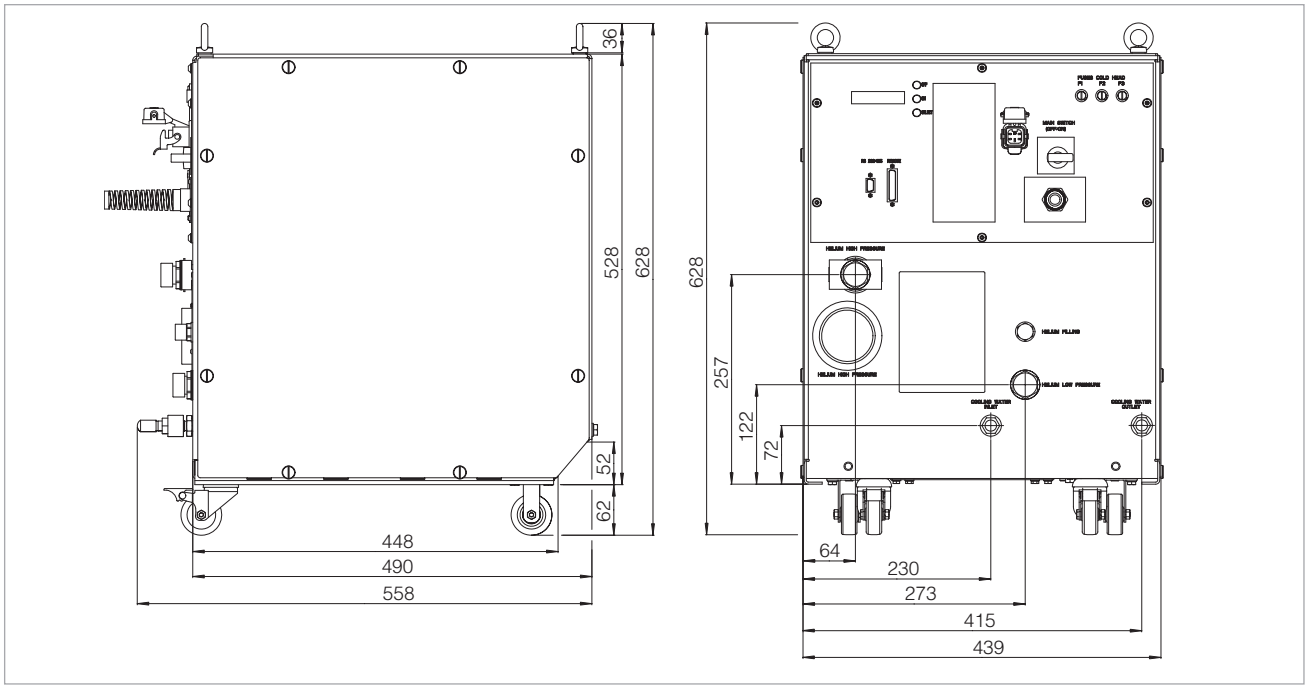
	COOLPAK	
	2000 (50 Hz)	2200 (60 Hz)
	Part No.	Part No.
Compressor unit	**840000V2000**	**840000V2200**
Accessories, optional		
19" installation kit	**840 022**	**840 022**
RC adapter box (for operating older cold heads of type RGD, RGS or COOLPOWER 20 / 210 / 30 / 510)	**840 910**	**840 910**
Spare parts		
Absorber CPS-V8	**E 840001973**	**E 840001973**

Compressor Units for Pneumatically Driven Cold Heads and Pumps, Water Cooling COOLPAK 6000 H/6200 H/6000 HD

Compressor units COOLPAK 6000 H/6200 H/6000 HD

Advantages to the User

- Highly effective and even more powerful when connected with Leybold cryo pumps and refrigerators
- Excellent long-term reliability owing to the modular design and the long life components
- Silent and low vibration operation through scroll compressors
- Simple installation and operation
- Global power supply compatibility
- Easy integration in complex systems due to 24 V DC or RS 232 C interfaces
- Almost maintenance-free
- Small footprint
- Low cost of ownership



Dimensional drawing for the COOLPAK 6000 H/6200 H/6000 HD

Technical Data

	COOLPAK			
	6000 H / 6000 HD		6200 H	
	50 Hz	60 Hz	50 Hz	60 Hz
Number of electrical connections for cold heads	1	1	1	1
Helium system filling pressure at room temperature bar	17	16	15	14
Ambient temperature °C (°F)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)	+5 to +40 (+41 to +104)
Cooling-water consumption [1] l/min	5.0	5.0	5.0	5.0
Cooling-water entry temperature °C (°F)	+5 to +25 (+41 to +77)	+5 to +25 (+41 to +77)	+5 to +25 (+41 to +77)	+5 to +25 (+41 to +77)
Main voltage (3 phase) upon delivery V	380 - 400 ± 10%	–	230 [2] + 1% / - 10%	230 ± 10%
alternative setting V	–	470 ± 10%	200 ± 10%	200 ± 10%
Operating currents				
with the cold head cool A	10 to12	–	20 to 22	–
with the cold head warm A	11 to 13	–	22 to 25	–
Electrical power consumption				
with the cold head cool kW	6.5 to 7.5	7.0 to 8.0	6.5 to 7.5	7.0 to 8.0
with the cold head warm kW	7.0 to 8.0	7.5 to 8.5	7.0 to 8.0	7.5 to 8.5
Remote control via interface	24 V DC or RS 232 C	24 V DC or RS 232 C	24 V DC or RS 232 C	24 V DC or RS 232 C
Helium connections				
Self-sealing couplings				
High pressure connection (outside thread)	1/2"	1/2"	1/2"	1/2"
Low pressure connection (outside thread)	1/2"	1/2"	1/2"	1/2"
Water connections	Hose nozzle DN 12 / G 1/2" outside thread	Hose nozzle DN 12 / G 1/2" outside thread	Hose nozzle DN 12 / G 1/2" outside thread	Hose nozzle DN 12 / G 1/2" outside thread
Sound level (at 1 m (3.5 ft) distance) dB(A)	60	60	60	60
Dimensions (W x H x D) mm (in.)	440 x 589 x 558 (17.32 x 23.19 x 21.97)	440 x 589 x 558 (17.32 x 23.19 x 21.97)	440 x 589 x 558 (17.32 x 23.19 x 21.97)	440 x 589 x 558 (17.32 x 23.19 x 21.97)
Weight kg (lbs)	104 (230)	104 (230)	104 (230)	104 (230)

Ordering Information

	COOLPAK			
	6000 H / 6000 HD		6200 H	
	50 Hz	60 Hz	50 Hz	60 Hz
	Part No.	Part No.	Part No.	Part No.
Compressor unit without power supply cable				
Connection for 1 cold head (CP ... H)	**840000V6001**	**840000V6001**	**840000V6201**	**840000V6201**
Connection for 2 cold heads (CP ... HD)	**840000V6004**	**840000V6004**	–	–
Power supply cable				
3.5 m (12.25 ft) CEE plug, 32 A/6h, 3-pol +N+PE	**893 95**	–	–	–
NEMA plug, L 16-20 P, 20 A/480 V, 3-pol +PE (AWG 12)	–	**893 96**	–	–
10 m (35.0 ft) with end splice (AWG 10)	–	–	**840 111** [3]	**840 111** [3]
20 m (70.0 ft) with end splice (AWG 10)	–	–	**840 112** [3]	**840112** [3]
Accessories				
Water cooling discharge throttle	**E 840000133** [4]	**E 840000133** [4]	–	–
Spare parts				
Adsorber CACP 4000/6000	**E 840002863**	**E 840002863**	**E 840002863**	**E 840002863**

[1] At a cooling water entry temperature of 25 °C (77 °F)
[2] At 14 bar filling pressure
[3] Also suitable for COOLPAK 6000 H(D)
[4] Only for COOLPAK 6000 HD

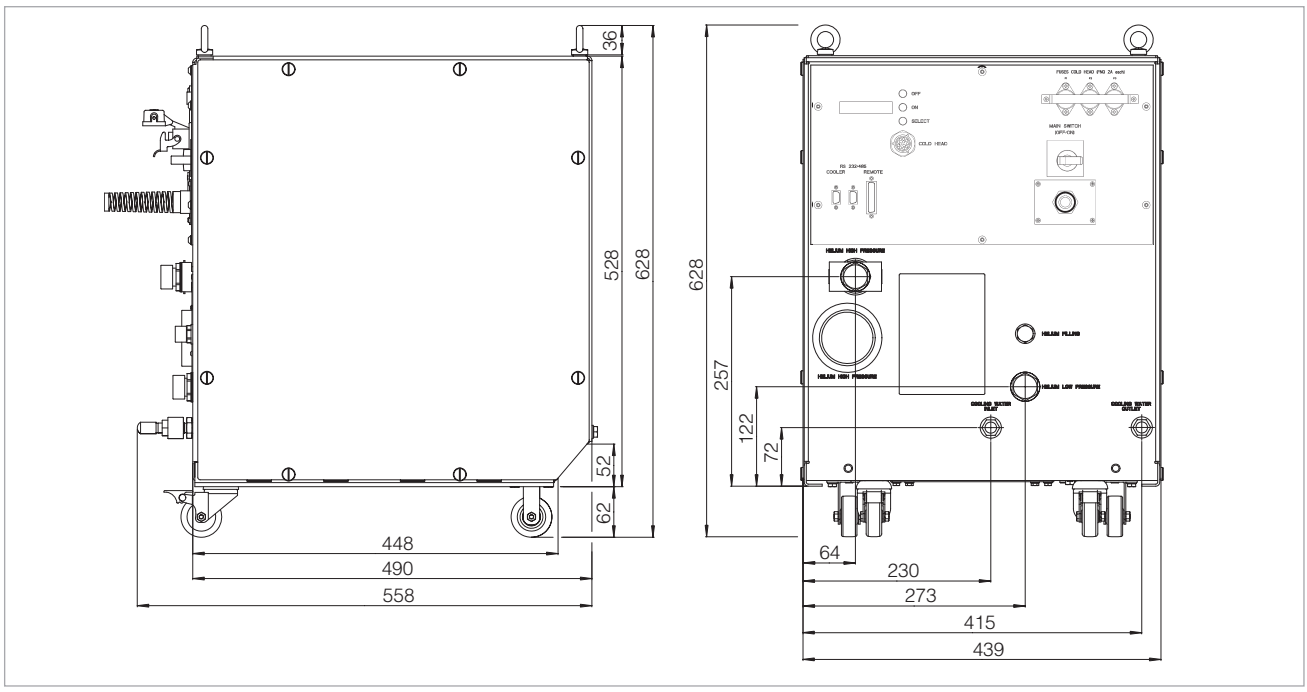
Compressor Units for Mechanically Driven Cold Heads and Pumps, Water Cooling COOLPAK 6000 HMD/6200 HMD

Compressor unit COOLPAK 6000 HMD/6200 HMD

Serves the purpose of individually driving the cold heads with mechanically driven displacers; i.e. COOLPOWER 10 MD, but also older cold heads like COOLPOWER 150, 130, 4.2 GM, 0.5 WATT and 4.2 ONE WATT.

Advantages to the User

- Compact
- Simple to operate
- Can be controlled remotely
- Selectable voltages
- Low noise
- UL approved
- Long maintenance-free period of operation
- Variable cold head motor speed



Dimensional drawing for the COOLPAK 6000 HMD/6200 HMD

Technical Data

	COOLPAK 6000 HMD	COOLPAK 6200 HMD
Mains voltage	50 Hz, 400 ± 10% 60 Hz, 460 ± 10%	50 Hz, 200 ± 10% 60 Hz, 200 - 230 ± 10%
	For all other Technical Data, see COOLPAK 6000 H and 6200 H	

Ordering Information

	COOLPAK 6000 HMD Part No.	COOLPAK 6200 HMD Part No.
Compressor type		
400 V/3-ph. 50 Hz or 460 V/3-ph. 60 Hz ± 10%	**840000V6002**	**–**
200 V/3-ph. 50 Hz or 200-230 V/3-ph. 60 Hz ± 10%	**–**	**840000V6202**
Flexible pressure line (for operating mechanically driven cold heads)		
6 m (21.0 ft) (High-pressure) FL6 HP-DN 20 (8f/8f)	**840 210**	**840 210**
6 m (21.0 ft) (Low-pressure) FL6 LP-DN 16 (8f/8f)	**840 211**	**840 211**
9 m (31.5 ft) (High-pressure) FL9 HP-DN 20 (8f/8f)	**840 217**	**840 217**
9 m (31.5 ft) (Low-pressure) FL9 LP-DN 16 (8f/8f)	**840 218**	**840 218**
20 m (75.0 ft) (High-pressure) FL20 HP-DN 16 (8f/8f)	**840 230**	**840 230**
20 m (75.0 ft) (Low-pressure) FL20 LP-DN 16 (8f/8f)	**840 231**	**840 231**
Connection cable for the cold heads COOLPOWER 10 MD, 150, 130, 4.2 GM, 0.5 WATT and 4.2 ONE WATT		
9.0 m (31.5 ft)	**842 110**	**842 110**
20.0 m (75.0 ft)	**842 112**	**842 112**
30.0 m (105.0 ft)	**842 114**	**842 114**
Power supply cable		
3.5 m (12.25 ft) CEE plug, 32 A/6h, 3-pol +N+PE	**893 95**	**–**
NEMA plug, L 16-20 P, 20 A/480 V, 3-pol +PE (AWG 12)	**893 96**	**–**
10 m (35.0 ft) with end splice (AWG 10)	**–**	**840 111** [1]
20 m (75.0 ft) with end splice (AWG 10)	**–**	**840 112** [1]
Accessories		
Water cooling discharge throttle	**E 840000133**	**E 840000133**

[1] Also suitable for COOLPAK 4000(D)/6000(D)

General Accessories for Compressor Units COOLPAK

Technical Data

	Length	Connections on both sides (inside thread)	
		High pressure line (HD)	Low pressure line (ND)
Flexlines [1), 2)]			
FL 4.5 (1/2", 1/2")	4.5 m (15.75 ft)	1/2"	1/2"
FL 9.0 (1/2", 1/2")	9.0 m (31.50 ft)	1/2"	1/2"

Accessories for Flexlines	Adaptor Outside thread (m)	Adaptor Inside thread (f)
Adaptor for flexlines		
AD (1/2" m, 3/4" f)	1/2"	3/4"
AD (1/2" f, 3/4" m)	3/4"	1/2"

	Connections Outside thread (m)	Connections Inside thread (f)
Elbow 1/2" for flexlines	1/2"	1/2"
Isolating piece 1/2" for flexlines	1/2"	1/2"

	Connections on both sides Outside thread (m)
Coupling 1/2" for interconnecting two 1/2“ flexlines	1/2"

	Gas Distributors required quantity	Gas Manifold - Connections At the compressor (inside thread)	Gas Manifold - Connections At the cold head (outside thread)
Gas manifold (1 piece each)			
GD 2 (for dual operation) [2)]	2	1/2"	2 x 1/2"
GD 4 (for up to quad operation) [2)]	2	1/2"	4 x 1/2"

	Length
EL 4.5 extension cable for linking cold head and compressor unit	4.5 m (15.75 ft)

Ordering Information

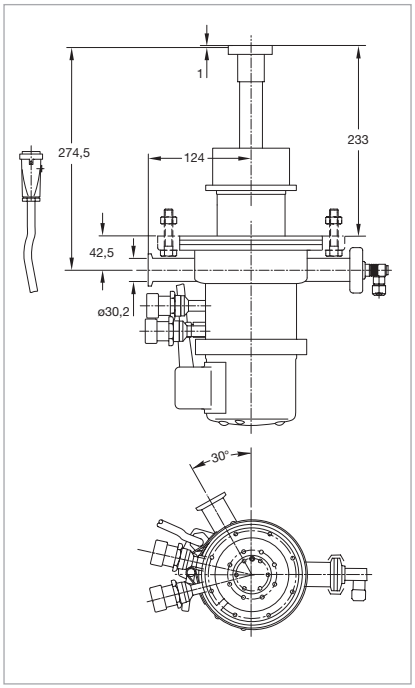
General Accessories

	Part No.
Flexlines [1), 2)]	
FL 4.5 (1/2", 1/2")	**892 87**
FL 9.0 (1/2", 1/2")	**892 88**
Adaptor	
AD (1/2" m, 3/4" f)	**892 89**
AD (1/2" f, 3/4" m)	**892 90**
Elbow 1/2"	**891 73**
Coupling 1/2"	**891 71**
Gas manifold (1 piece each)	
GD 2 (for dual operation) [2)]	**840 253 (2x)**
GD 4 (for up to quad operation) [2)]	**840 254 (2x)**
EL 25 extension cable for linking cold head and compressor unit [2)]	**200 20 900**
EL 4.5 extension cable for linking cold head and compressor unit [2)]	**893 74**

All flexible pressure lines, adaptor pieces, bends, isolating pieces, line couplings and gas manifolds are equipped with self-sealing Aeroquip fittings and filled in the factory with high-purity helium gas (purity: 99.999%). The filling pressure is 16 bar

[1)] Minimum bending radius: 30 cm (11.81 in.)
[2)] Only suited for pneumatically driven cold heads and cryo pumps

Refrigerator Cryostat based on the RDK 6-320



Basic unit RDK 6-320

The RDK 6-320 basic unit includes the COOLPOWER 5/100 T two-stage cold head. Its high refrigerating capacity at low temperatures permits experiments which previously could not be performed by relying on refrigerators and which required the use of liquid helium.

The RDK 6-320 basic unit is a complete system for measurements in the temperature range between 6 and 320 K.

The COOLPOWER 5/100 T cold head is augmented by:

- Silicon diode for measuring the temperatures at the second stage of the cold head
- Heater at the second stage of the cold head provided with overheating protection
- 11-way current feedthrough with matching external connector
- DN 25 KF pumpdown port
- DN 160 ISO-K vacuum flange

Advantages to the User

- Compact
- Very reliable
- Comprehensive range of accessories from one source
- For installation in any orientation
- Simple to operate
- Short cooldown time
- Cost-effective in long-term experiments since no liquid helium is required
- Simple and rapid servicing through the use of the standard COOLPOWER 5/100 T cold head with pneumatic drive system for the displacer

Typical Applications

- Cooling of samples and detectors
- Material research and testing
- Spectroscopic applications
- Matrix isolation spectroscopy with neon and argon

General Remarks on Refrigerator Cryostats

Isolating Vacuum

A two-stage rotary vacuum pump will normally be adequate to produce an isolating vacuum. However, this pump should be equipped on the suction side with an adsorption trap and a isolation valve.

If the application requires that the cold surfaces remain free of hydrocarbons, we recommend the use of our small turbomolecular pump system PT 50 (see Catalog Part “Vacuum Pump Systems” Section “High Vacuum Pump Systems).

Temperature Measurement

In order to avoid measurement errors due to thermal resistances, the temperature at the sample should preferably be measured by a second optional silicon diode which is installed as close to the sample as possible. If possible it should be maintained at the same temperature level as that of the probe.

Temperature Control

The temperature at the second stage of the cold head (or that of the probe) is controlled by heating against the cooling effect produced by the refrigerator (while the cold head is running).

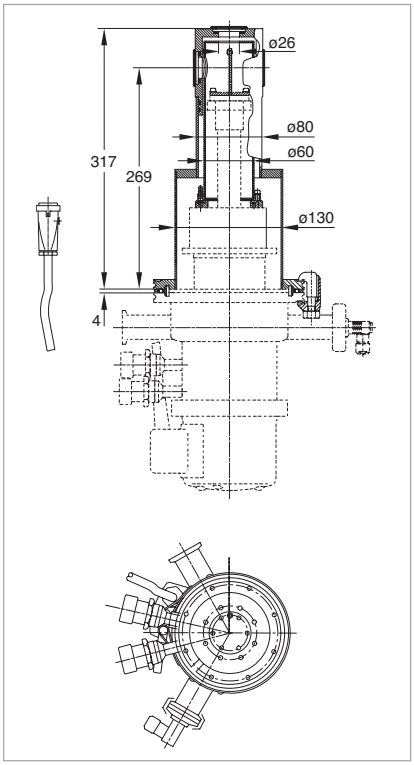
Optical Refrigerator Cryostat based on the RDK 6-320

Optical refrigerator cryostat RDK 6-320

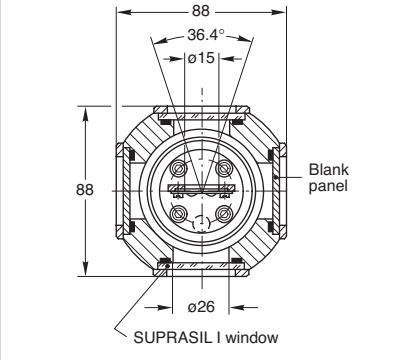
Upgraded as an optical cryostat (option) the RDK 6-320 is tailor-made for experiments involving temperatures down to about 7 K.

Supplied Equipment

- Basic unit RDK 6-320
- Temperature attenuation disk out of Pb Sn
- Sample holder out of Al 99.5
- Thermal radiation shield out of E-Cu
- Vacuum jacket out of aluminum / stainless steel
- Five exchangeable windows (four windows on the sides, one window in the longitudinal axis of the cryostat); two windows on the sides and the window in the longitudinal axis are made of SUPRASIL I, the two other windows are blanked off and are made of brass



Dimensional drawing for the optical refrigerator cryostat



Section through the window area

Technical Data

RDK 6-320

Temperature range	
2nd stage of the cold head K	6 to 320
1st stage of the cold head K	28 to 320
Silicon diode for temperature measurements at the 2nd stage of the cold head	built-in
Heater at the 2nd stage of the cold head	built-in
Heating power W	50
Heating current A	1
Heating voltage V DC	50
Permissible ambient temperature °C (°F)	+5 to +40 (+41 to +104)
He filling pressure at room temperature bar	16
He connections	
Self-sealing screwed connections	
High pressure connection (outside thread)	1/2"
Low pressure connection (outside thread)	1/2"
Length of the connection cable to the compressor unit m (ft)	4.5 (15.75) [included)]
Weight kg (lbs)	13 (28.7)

Ordering Information

RDK 6-320

	Part No.
Basic unit RDK 6-320	**842 403**
Optical cryostat consisting of RDK 6-320 and Expansion Kit ROK	**842 404**
Compressor unit	
COOLPAK 6000 H 400 V/50 Hz; 470 V/60 Hz	**840000V6001**
COOLPAK 6200 H 200 V/50 Hz; 200 V, 230 V/60 Hz	**840000V6201**
Power supply cable	see Ordering Information for the compressor units COOLPAK
Flexlines FL 4.5 (1/2", 1/2")	**892 87**
Temperature measurement at 2nd stage with low temperature controller MODEL 9700	**842 400**
Sensor cable, 3 m (10.5 ft) long	**842 401**

Accessories for Cryo Pumps / Cryogenics

Controllers and Monitoring Units for Cryo Pumps

Advantages to the User

- Interface to external system controller
- For easy integration with external system controllers
- For safe pumping of hydrogen

Typical Applications

- For automated operation of the COOLVAC cryo pumps of the ClassicLine

System Controller COOLVAC SC

System controller COOLVAC SC

The intelligent COOLVAC system controller SC automatically controls and monitors up to 30 COOLVAC pumps.
Online monitoring, help functions and a service interface for easy diagnostic are just a few user friendly features.
It can be installed as a “stand alone system” or remote controlled via an interface.

Design Features

- 1/4 19" rack module
- 3 height units (HU)
- Dimensions (W x H x D)
  106 x 129 x 178 mm
  (4.17 x 5.08 x 7.01)
- Operation through pushbuttons

Supplied equipment

- Network terminator
  (Part No. 400 000 114)
- Hardware interlock plug
  (Part No. 400 000 133)
- O modem adapter for connection to the PC

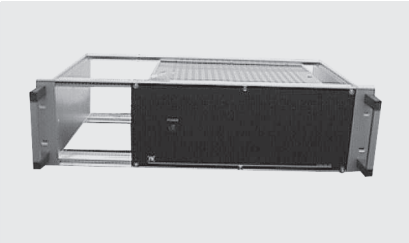
Technical Data — COOLVAC SC

Operating voltage		Supply through RS 485 C cable from COOLVAC PM
Dimensions (W x H x D)	mm (in.)	106 x 129 x 178 (4.17 x 5.08 x 7.01) [1/4 19", 3 HU]

Ordering Information — COOLVAC SC

	Part No.
System controller COOLVAC SC	**844 230**
System controller COOLVAC SC with Profibus interface	**844230V0004**

Power Supply PS for up to Two Cryo Pumps



Power supply PS

The COOLVAC power supply PS provides the power for the cold head motor, the electrical heaters and the supplies voltage to the electronics for up to 2 COOLVAC pumps.
Controlled via the system controller SC the PS turns the compressor unit on and off if required by the connected pumps.

The system controller COOLVAC SC (not included) will fit into the empty space.

Design Features

- 19" rack module
- 3 height units (HU)
- Dimensions (W x H x D)
  483 x 135 x 320 mm
  (19.02 x 5.31 x 12.60)

Supplied equipment

- Approximately 3 m (10.5 ft) long mains cord

Technical Data

		PS for double connection
Power consumption, approx.	VA	900
Supply voltage, factory preset (optional 115 V AC is possible [1])	V AC	230 ± 10%, 1 phase
Output power	W	2 x 250
Rack mounting		Through 19" installation frame
Dimensions (W x H x D)	mm (in.)	483 x 135 x 320 (19.02 x 5.31 x 12.60) [3/4 19", 3 HU]
Weight	kg (lbs)	10 (22.1)

Ordering Information

	PS for double connection
	Part No.
Power supply PS for up to 2 cryo pumps	**844 135**

[1] Please contact Leybold

Power supply PS for up to Three Cryo Pumps

Power supply PS

The COOLVAC power supply PS provides the power for the cold head motor, the electrical heaters and the supplies voltage to the electronics for up to 3 COOLVAC pumps.
Controlled via the system controller SC the PS turns the compressor unit on and off if required by the connected pumps.

Design Features

- 19" rack module
- 4 height units (HU)
- Dimensions (W x H x D)
  483 x 177 x 440 mm
  (19.02 x 6.97 x 17.32)
- Single LED indicates correct direction of rotation for the rotating field

Supplied equipment

- 20 m (70 ft) long mains cord, fitted, without plug
- 19" mounting brackets for rack mounting

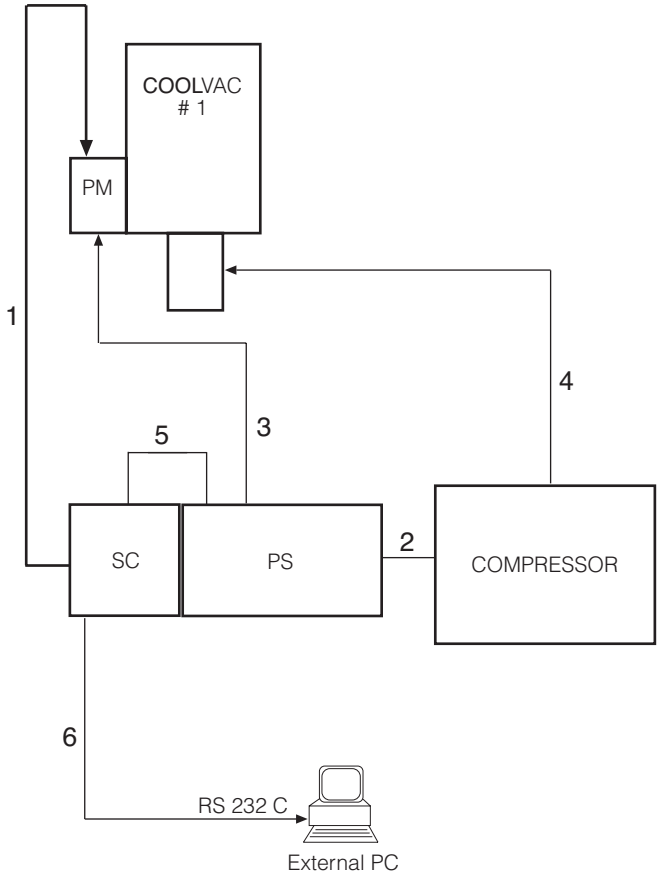
Technical Data

		PS for multiple connection
Nominal voltage (3 phase) factory default switchable to	 V AC V AC	 3 x 200 + PE 3 x 400 + PE 3 x 460 to 480 + PE
Voltage tolerance		± 10%
Frequency range	Hz	47 to 63
Fusing		Power switch
Ambient temperature range	°C (°F)	0 to +40 (+32 to +104)
Protection type	IP	20
Dimensions (W x H x D) [without handles]	 mm (in.)	 483 x 177 x 440 (19.02 x 6.97 x 17.32) [19", 4 HU]
Weight (including cord)	kg (lbs)	38.8 (85.65)

Ordering Information

	PS for multiple connection Part No.
Power supply PS for up to 3 cryo pumps	**844 235**

COOLVAC ClassicLine, Single System Configuration

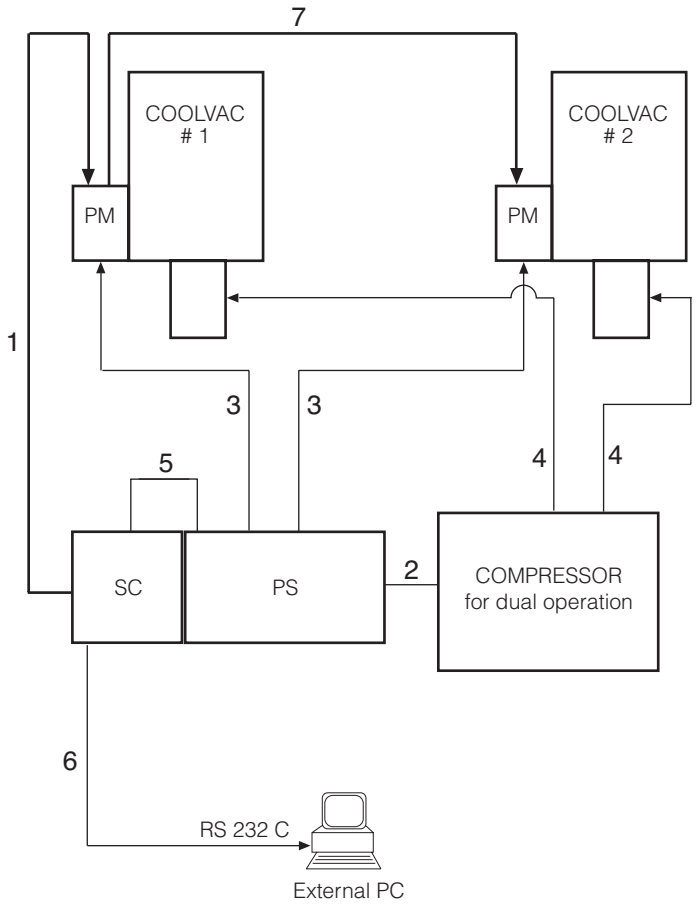


PM = Pump module (included with the pump)
SC = System controller
PS = Power supply
1 = e.g. Part No. 844 262
2 = e.g. Part No. 844 139
3 = e.g. Part No. 844 138
4 = Part No. E 400000323 (necessary only for COOLVAC 800 CL, 1500 CL, 2000 CL und 3000 CL)
5 = Part No. 844 141
6 = to be provided by the customer

Single System Configuration

COOLVAC ClassicLine, Dual System Configuration

Only for European mains voltages and for compressors suited for dual operation



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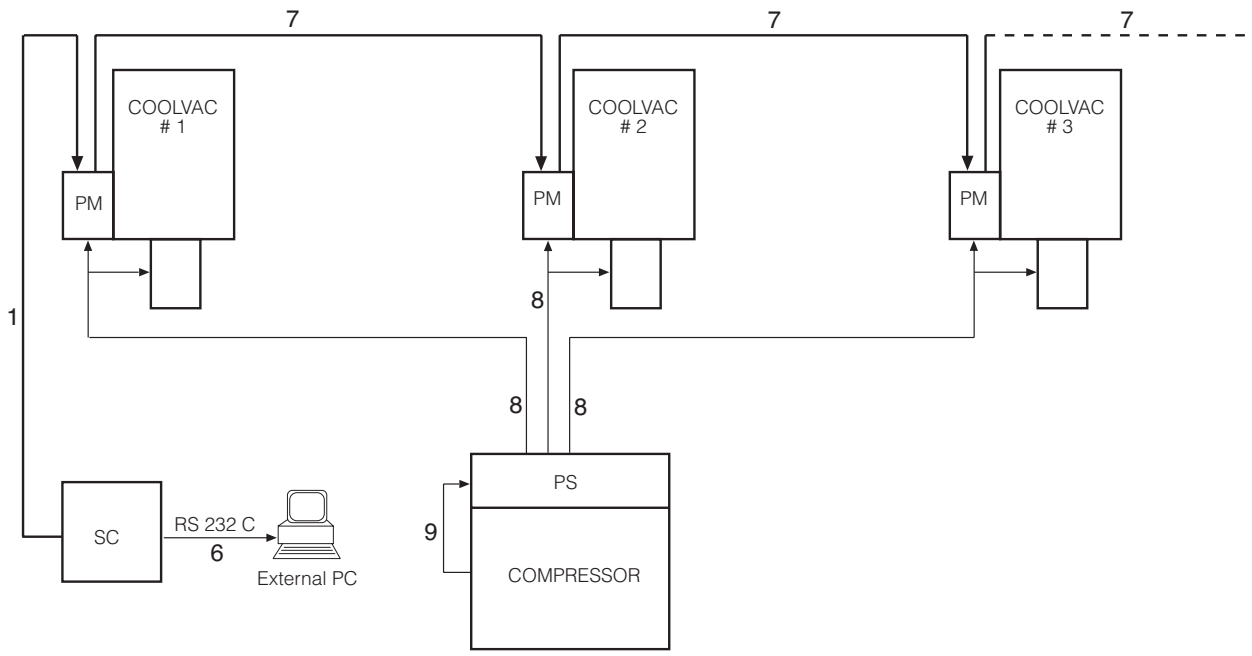
3 = e.g. Part No. 844 138
4 = Part No. E 400000323 (necessary only for COOLVAC 800 CL, 1500 CL, 2000 CL und 3000 CL)
5 = Part No. 844 141
6 = to be provided by the customer
7 = e.g. Part No. 844 256

Dual System Configuration

COOLVAC ClassicLine, Dual and Multiple System Configuration



PM = Pump module (included with the pump)
SC = System controller
PS = Power supply
1 = e.g. Part No. 844 262
6 = to be provided by the customer
7 = e.g. Part No. 844 256
8 = e.g. Part No. 844 252
9 = Part No. 844 265

Dual and Multiple System Configuration

Low Temperature Controller MODEL 9700

Low temperature controller MODEL 9700

Advantages to the User

- Microprocessor controlled PID controller
- Digital temperature readout in Kelvin
- Control by means of counter heating
- High control accuracy over the entire temperature range (1.5 to 450 K)
- Electric heating power up to 50 W
- Programmable heater power limit
- Generation of linear temperature ramps
- Up to 50 program steps are programmable
- Standard interface RS 232 C and IEEE-488
- Data from two sensors can be displayed
- Analogue temperature outputs for both channels
- Can be used in three operating modes
  - Manual
  - Program
  - External computer control

Typical Applications

- Temperature control at refrigerator cryostats

Technical Data — MODEL 9700

Mains connection, 50/60 Hz	V AC	85 to 240
Power consumption, max.	W	150
Entry of data		3 x 4 membrane key pad
Data memory		EPROM
Display		Two line, 20 digit LED digital display
Temperature measurement Sensors		2 x silicon diodes type D or 2 x silicon diodes with standard temperature resistance characteristics
Measurement current	µA	10
Measurement range	K	1.5 to 450
Measurement range of the silicon diode type D	K	1.4 to 325 K
Number of channels		2
Resolution		Simultaneous display of both channels
A/D converter resolution	bit	24
Switching outputs		2 relays (n.o. and n.c. contacts)
Temperature resolution	K	0.1
Temperature control		PID controller
Heating power, max.	W	50
Heating current, max.	A	1
Heating voltage, max.	V DC	0 to 50
Computer interface		RS 232 C and IEEE-488
Permissible ambient temperature	°C (°F)	+10 to +30 (+50 to +86)
Mechanical design/cabinet		Table-top unit (8.5" x 3.5" x 12")
Dimensions (W x H x D) [high H without feet]	mm (in.)	215.9 x 88 x 304.8 (8.5 x 3.5 x 12.0)
Weight	kg (lbs)	2.3 (5)
Dimensions of the packaging (W x H x D)	mm (in.)	360 x 230 x 450 (14.17 x 9.06 x 17.72)
Weight (incl. packaging, approx.)	kg (lbs)	4.2 (9.3)
Length of mains cord	m (ft)	2.5 (8.75)

Ordering Information — MODEL 9700

	Part No.
Low temperature controller MODEL 9700	**842 400**
Sensor cable, 3 m (10.5 ft) long	**842 401**
Silicon diode type D with connection cable and miniature plugs	**890 89**

Low Temperature Measuring Instrument MODEL 211S

Low temperature measuring instrument MODEL 211S

Advantages to the User

- Supports one silicon diode
- 3-digit LED display
- Temperature readout between 1 and 450 Kelvin
- Two trigger thresholds
- RS 232 C interface

Typical Applications

- Temperature measurements on cryostats
- Temperature measurements on cryo pumps for monitoring their operation and to control pump systems

Technical Data — MODEL 211S

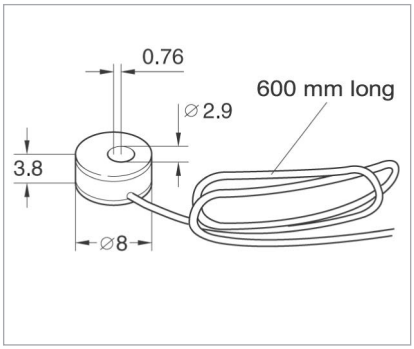
Measurement current	µA	10
Display		LED, 5-digits
Temperature range	K	1.4 to 475
Resolution		0.001 K from 1.4 to 99.9 K 0.01 K from 100 to 475 K
Accuracy		±0.05 K from 1.5 to 99.9 K ±0.05 K from 100 to 475 K
Power supply voltage		5 V DC at 1 A through the supplied 100-240 V AC power adaptor
Trigger thresholds		2
Switched output		2 relays (n.c. and n.o.) 30 V DC at 1 A
Analog output Voltage Current	 V mA	 0 to 10 4 to 20
RS 232 C interface		a) Temperature output b) External adjustment of switching thresholds
Admissible ambient temperature	°C (°F)	+15 to +35 (+59 to +95)
Mechanical design/housing		Benchtop unit
Dimensions (W x H x D)	mm (in.)	96 x 48 x 166 (3.78 x 1.89 x 6.54)
Weight (including packaging), approx.	kg (lbs)	0.45 (1.0)

Ordering Information — MODEL 211S

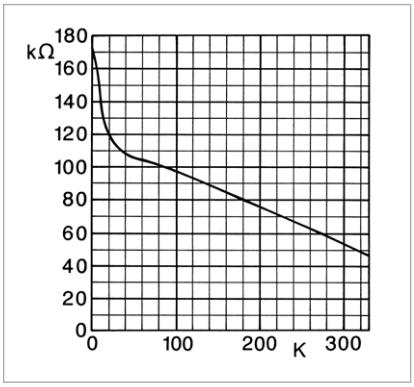
	Part No.
Low temperature measuring instrument MODEL 211S	**844 110**
HV cable 2-way with plug, 10 m (35.0 ft) long [1]	**844 112**
HV cable 4-way with plug, 10 m (35.0 ft) long [1]	**844 113**
UHV cable 4-way with plug, 10 m (35.0 ft) long [1]	**844 114**
Silicon diode, type D, with connecting cable and micro plugs - without current feedthrough	**890 89**
HV current feedthrough on a flange DN 25 KF, 2-way	**200 19 256**
UHV current feedthrough on a flange DN 16 CF, 4-way	**500 217**

[1] For COOLPOWER and COOLVAC pumps

Temperature Sensor



Dimensional drawing for the silicon diode, type D



Standard characteristic of the silicon diode

In contrast to vapor pressure thermometers, electric temperature sensors can be used for continuous measurements within a wide range of temperatures.

Silicon diodes offer a negative temperature coefficient of resistance, i.e. their resistance drops as the temperature increases. The slope of the temperature/resistance characteristic and the absolute resistance are decisive regarding the suitability of these diodes. The slope determines the sensitivity of the sensor and a high electrical resistance permits accurate measurements while keeping the thermal load small (microwatts).

In systems which are degassed at high temperatures, silicon diodes can only be fitted after degassing has been completed.

The silicon diode type D matches the low temperature display unit and the low temperature control unit MODEL 9700.

Technical Data

Silicon Diode Type D

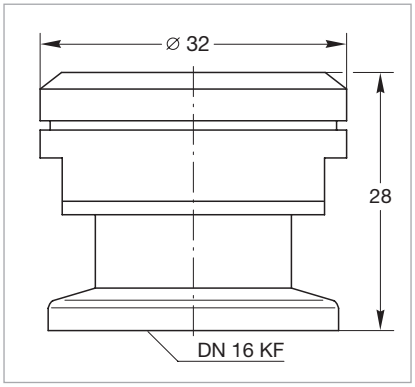
Temperature range	**K**	1.4 to 325
Temperature coefficient (dR/dT)		
qualitative		Negative in the entire temperature range
quantitative	**Ω/K**	Non-linear characteristic
Measurement current	**µA**	10
Bakeable to	**°C (°F)**	+60 (+140)

Ordering Information

Silicon Diode Type D

	Part No.
Temperature sensor	**890 89**
Silicon diode with 4-way electrical feedthrough	**200 20 694**
Flange DN 16 ISO-KF	**200 20 616**

Safety Valve



Dimensional drawing for the safety valve

Typical Applications

- Protecting sealed vacuum systems like cryo pumps, cryostats, lifting devices, for example against internal overpressures
- Mandatory for systems which are separated when cold, as a means of protection against overpressures

Technical Data

Safety Valve

Responding pressure	mbar	150 ± 40, over-pressure
Flow at 140 mbar	l x h^{-1}	500
Valve disk		Spring loaded, with O-ring seal
Leak rate in the closed state mbar x l x s^{-1} (Torr x l x s^{-1})		< 1 x 10^{-8} (< 0.75 x 10^{-8})
Connection	DN	16 KF
Diameter	mm (in.)	32 (1.26)
Material		Steel 1.4305
Overall height	mm (in.)	28 (1.10)
Weight	kg (lbs)	0.3 (0.7)

Ordering Information

Safety Valve

	Part No.
Safety valve on DN 16 KF flange	**890 39**

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