

OPERATING INSTRUCTIONS

EN

Translation of the original instructions

HIPACE 700

Turbopump

PFEIFFER VACUUM

PT 0209 BEN/I (1604)

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1 About this manual

1.1 Validity

This operating manual is for customers of Pfeiffer Vacuum. It describes the functioning of the designated product and provides the most important information for safe use of the unit. The description follows applicable EU guidelines. All information provided in this operating manual refers to the current state of the product's development. The documentation remains valid as long as the customer does not make any changes to the product.

Up-to-date operating instructions can also be downloaded from www.pfeiffer-vacuum.com.

1.1.1 Applicable documents

HiPace 700, depending on the model	Operating instructions
Operating instructions "Electronic drive unit TC 400", standard	PT 0203 BN*
Operating instructions "Electronic drive unit TC 400 PB", Profibus	PT 0244 BN*
Operating instructions "Electronic drive unit TC 400 E74", acc. Semi E74	PT 0302 BN*
Operating instructions "Electronic drive unit TC 400 DN", DeviceNet	PT 0352 BN*
Operating instructions "Electronic drive unit TC 400 EC", EtherCAT	PT 0452 BN*
Declaration of conformity	Part of this document

*also available via www.pfeiffer-vacuum.com

1.2 Conventions

1.2.1 Safety instructions

The safety instructions in Pfeiffer Vacuum operating instructions are the result of risk evaluations and hazard analyses and are oriented on international certification standards as specified by UL, CSA, ANSI Z-535, SEMI S1, ISO 3864 and DIN 4844. In this document, the following hazard levels and information are considered:

DANGER

Imminent danger

Indicates an imminent hazardous situation that will result in death or serious injury.

WARNING

Possibly imminent danger

Indicates an imminent hazardous situation that can result in death or serious injury.

CAUTION

Possibly imminent danger

Indicates an imminent hazardous situation that can result in minor or moderate injury.

NOTICE

Command or note

Command to perform an action or information about properties, the disregarding of which may result in damage to the product.

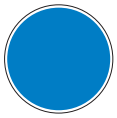
1.2.2 Pictographs



Prohibition of an action to avoid any risk of accidents, the disregarding of which may result in serious accidents



Warning of a displayed source of danger in connection with operation of the unit or equipment



Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents



Important information about the product or this document

1.2.3 Instructions in the text

➔ Work instruction: here you have to do something.

1.2.4 Abbreviations

DCU:	Display Control Unit
HPU:	Handheld Programming Unit
TC:	Electronic drive unit for turbopump
TPS:	Mains pack

1.2.5 Symbols used

The following symbols are used consistently throughout the diagrams:

- Ⓗ High vacuum flange
- ⓋⓋ Fore-vacuum flange
- Ⓥ Vacuum flange of the backing pump
- Exhaust flange of the backing pump
- Electrical connection
- ⓈⒼ Sealing gas connection
- Ⓕ Venting connection
- Cooling water connection

2 Safety

2.1 Safety precautions



Duty to inform

Each person involved in the installation, operation or maintenance of the vacuum pump must read and observe the safety-related parts of these operating instructions.

➔ The operator is obligated to make operating personnel aware of dangers originating from the vacuum pump, the pumped medium and the entire system.



Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

➔ For information on order numbers of components, see "Accessories".

➔ Use original accessory parts only.



NOTICE

Checking the safety system against excess rotation speed

To provide the functioning of the integrated safety system for avoiding excess rotation speed, the pump must run-up from the standstill at least once a year.

➔ Switch off the pump and await the complete standstill (rotation speed = 0 Hz).

➔ Run-up the pump according to this operating instructions.



WARNING

Danger of unsafe electrical installation

Safe operation after installation is the responsibility of the operator.

➔ Do not independently modify or change the pump and electrical equipment.

➔ Make sure that the system is integrated in an emergency off safety circuit.

➔ Consult Pfeiffer Vacuum for special requirements.



WARNING

Danger due to lack of power disconnection device

Pump and electronic drive unit are not equipped with a power disconnection device. Installation of a user-supplied power disconnection device in accordance with SEMI-S2.

➔ Fit a circuit breaker with an interruption rating of min. 10,000 A.



WARNING

Danger of electric shock

In case of defect, the parts connected to the mains supply are under voltage.

➔ Always keep the mains connection freely accessible so you can disconnect it at any time.

- Do not expose any body parts to the vacuum.
- Observe all safety and accident prevention regulations.
- Regularly check the proper observance of all safety measures.
- **Power supply:** The turbopump power supply must apply to the requirements of double insulation between mains input voltage and operating voltage according to the regulations of IEC 61010 and IEC 60950. Therefore Pfeiffer Vacuum recommends to use exclusively original-power packs and -accessories. Only in this case Pfeiffer Vacuum is able to guarantee the compliance of the European and North American guidelines.
- A safe connection to the protective earthing conductor (PE) is recommended (protection class III).

- Do not loosen any plug connection during operations.
- Wait for the rotor to reach standstill before peforming work on the high vacuum flange.
- Keep leads and cables well away from hot surfaces (> 70 °C).
- Never fill or operate turbopump with cleaning agent.
- Do not operate the turbopump with open high vacuum flange.
- Do not carry out any unauthorized modifications or conversions to the pump.
- When returning the turbopump observe the shipping instructions.

2.2 Protective equipment

Determined situations concerning the handling of vacuum pumps require wearing of personal protective equipment. The owner, respectively the employer are obligated to provide an adequate equipment to any operating persons.



DANGER

Danger to health by hazardous substances during maintenance or installation

Depending on the process vacuum pumps, components or operating fluids can be contaminated by toxic, reactive or radioactive substances.

➔ Wear adequate protective equipment during maintenance and repairs or in case of reinstallation.



WARNING

Risk of injury through falling objects

When transporting vacuum pumps by hand, there is a danger through loads slipping and falling down.

➔ Carry small and mid-size vacuum pumps two-handed.
➔ Carry vacuum pumps > 20 kg by a suitable lifting device.
➔ Wear safety shoes with steel toe cap according to directive EN 347.



CAUTION

Risk of injury through hot surfaces

Vacuum pumps can become hot during operation.

➔ Allow the pump to cool before maintenance and repairs.
➔ If necessary wear protective gloves according to EN 420.



CAUTION

Risk of injury through sharp edges

Rotor and stator disks of turbopumps have very sharp edges.

➔ Before any working wait for the complete standstill of the pump.
➔ Do not reach in the high vacuum flange.
➔ If necessary wear protective gloves according to EN 420.

2.3 Proper use



NOTICE

EC conformity

The manufacturer's declaration of conformity becomes invalid if the operator modifies the original product or installs additional components.

➔ Following installation into a plant and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassess it accordingly.

- The vacuum pump may only be used to generate a vacuum.
- Only operate the turbopump with an approved backing pump.

2.4 Improper use

Improper use will cause all claims for liability and warranties to be forfeited. Improper use is defined as usage for purposes deviating from those mentioned above, especially:

- installation of the pump with unspecified mounting material
- pumping of corrosive or explosive media
- pumping of condensing vapors
- pumping of liquids
- pumping of dusts
- operation with improper high gas throughput
- operation with improper high fore-vacuum pressures
- operation with improper high levels of insulated heat input
- operation in improper high magnetic fields
- operation with improper gas mode
- venting with improper high venting rates
- use of the vacuum pump to generate pressure
- operation of the devices in areas with ionizing radiation
- operation in potentially explosive areas
- use of the devices in systems in which impact-like stress and vibrations or periodic forces affect the devices
- use of accessories or spare parts, which are not named in this manual



Closure seal

The product is sealed at the factory. Damaging or removal of a closure seal leads to the loss of liability and warranty entitlements.

➔ Do not open the product within its warranty period!

➔ For process-related shorter maintenance intervals please contact the Pfeiffer Vacuum Service.

3 Transport and storage

3.1 Transport

➔ Reuse the transport container of the vacuum pump.
  – Transport or ship vacuum pumps in the original packing preferably.
➔ Only remove the protective covers from the high vacuum and the fore-vacuum side immediately before connection.
➔ Keep the original protective covers.
➔ Always transport the turbopump in its upright position.

3.2 Storage

➔ Close the flange openings by using the original protective covers.
➔ Close further connection ports by using the corresponding protective covers.
➔ Store the pump only indoors at temperatures between -25 °C and +55 °C.
➔ In rooms with moist or aggressive atmospheres, the pump must be airproof shrink-wrapped in a plastic bag together with a bag of desiccant.

4 Product description

4.1 Product identification

4.1.1 Pump types

The product designation consists of a family designation (1), the size (2), which is oriented on the pumping speed, and if applicable the additional properties (3) of the pump.

HiPace(1) **700**(2) (3)

1. Family designation	2. Model designation	3. Property designation
HiPace	**700** = Model designation of the pump related to its pumping speed class	**none** = Standard version **U** = Upside-down installation orientation **C** = Corrosive gas version **P** = Process **M** = Active magnetic bearing **T** = Temperature management system **E** = High Efficiency **H** = High Compression **I** = Ion implantation

4.1.2 Pump features

This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements.

For information about other certifications, if applicable, please see the signet on the product or:

- www.tuvdotcom.com
- TUVdotCOM-ID 0000021320

Characteristics	HiPace 700		
HV flange	DN 160 ISO-K	DN 160 ISO-F	DN 160 CF-F
Flange material	Aluminium	Aluminium	Stainless steel

To correctly identify the product when communicating with Pfeiffer Vacuum, always have the information from the rating plate available.

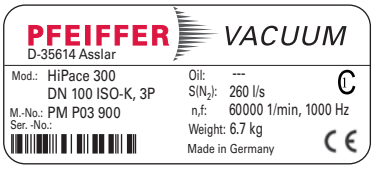


Fig. 1: Example for a rating plate

4.1.3 Variants

- HiPace 700 with TC 400 and 24 V DC ± 5 %
- HiPace 700 with TC 400 and 48 V DC ± 5 %

4.1.4 Scope of delivery

- Turbopump with electronic drive unit
- Mating plug for the connection "*remote*" on the TC 400 (type dependent)
- Mating plug for the connection "*E74*" on the TC 400 (type dependent)
- Protective cover for the high vacuum flange and the fore-vacuum flange
- Operating instructions

4.2 Function

The turbopump HiPace 700 forms a complete unit together with the electronic drive unit TC 400. For the voltage supply only Pfeiffer Vacuum power supplies may be used (e.g.TPS or DCU).

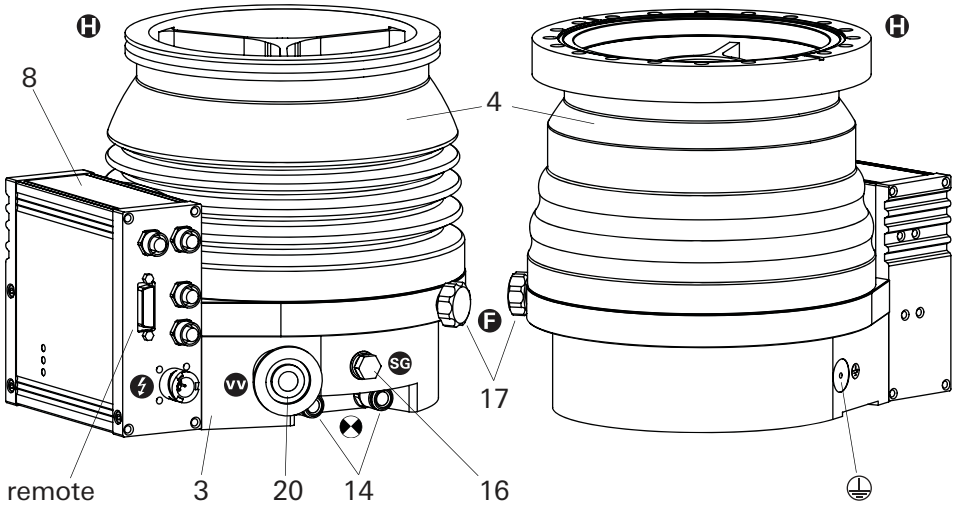


Fig. 2: View of HiPace 700 with TC 400

3	Pump lower part	14	Cooling water connection	17	Venting connection
4	Pump casing	16	Sealing gas connection	20	Fore-vacuum connection
8	Electronic drive unit TC 400				

4.2.1 Cooling

- Water cooling
- Air cooling (optional)

In the case of excess temperature the electronic drive unit reduces the drive power automatically. Depending on the application and the HiPace different cooling variants are selectable.

4.2.2 Rotor bearing

Hybrid bearing TurboDrag pump

- High vacuum side: maintenance-free permanent magnetic bearing
- Fore-vacuum side: ceramic ball bearing

4.2.3 Drive

Electronic drive unit TC 400

4.3 Range of application

The pump HiPace 700 must be installed and operated under the following ambient conditions:

Installation location	weather protected (indoors)
Protection category	IP 54
Protection class	III
Temperature	+5 °C to +35 °C with air cooling +5 °C to +40 °C with water cooling
Relative humidity	max. 80 %, at T ≤ 31 °C, up to max. 50% at T ≤ 40 °C
Atmospheric pressure	750 hPa - 1060 hPa
Installation altitude	2000 m max.
Degree of pollution	2
Permissible surr. magnetic field	≤6 mT
Overvoltage category	II
Connection voltage TC, depending on the variants	24 V DC ±5% 48 V DC ±5%



Remarks to ambient conditions

The specified permissible ambient temperatures apply to operation of the turbopump at maximum permissible fore-vacuum pressure or at maximum gas throughput depending on the cooling method. The turbopump is intrinsically safe by a redundant temperature monitoring.

- By reducing the fore-vacuum pressure or gas throughput, the turbopump can be operated at higher ambient temperatures.
- If the maximum permissible operating temperature of the turbopump is exceeded, the electronic drive unit reduces drive power first and switches off then, if necessary.

5 Installation



WARNING

Danger from the turbopump being ripped off

If the rotor is suddenly blocked, torques of up to 4200 Nm could occur, which could cause the turbopump to be ripped off if it is not properly affixed. The energy that this would release could throw the entire pump or pieces from its interior through the room. That would cause severe, possibly fatal, injuries as well as serious property damage.

➔ Carefully follow the installation instructions in this handbook.

➔ Only use approved original parts from Pfeiffer Vacuum (Accessories) for the installation.



Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

➔ For information on order numbers of components, see "Accessories".

➔ Use original accessory parts only.

5.1 Preparatory work

When installing the pump, observe the following conditions:

- the ambient conditions specified for the range of application
- When using a casing heating and a water cooling unit the temperature of the connected flange of the vacuum chamber must not exceed 120 °C.
- It is not allowed to operate the device in systems where impact-like stresses and vibrations or periodically forces occur.

➔ Ensure sufficient cooling for the turbopump.

➔ Where magnetic fields > 6 mT are involved, a suitable shielding must be used. Check installation location and consult Pfeiffer Vacuum if needed!

➔ The maximum permissible rotor temperature for the turbopump is 90 °C. If high temperatures arise for process reasons, the radiated heat input must not exceed 4.2 W. Install suitable screening sheets, if necessary (design information on request).

5.2 Set-up

- Ensure the greatest possible cleanliness when installing any high vacuum parts. Unclean components prolong the pump-down time.
- All flange components must be grease-free, dust-free and dry at installation.
- The operating fluid reservoir is already installed and filled for the turbopump HiPace 700.

5.2.1 Earthquake safety

An earthquake can result in contact with the safety bearings. All forces occuring hereby are safely absorbed by the properly installed flange connections.

➔ Secure the vacuum chamber against shifting and tipping on customers side.

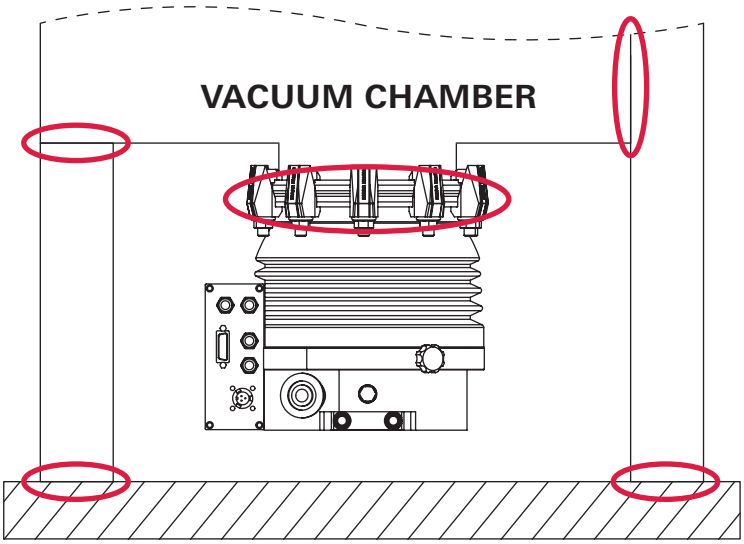


Fig. 3:	Example: How to secure against shifting and tipping by external tremors
⬭	= Safety connection, implementation each by the customer

5.2.2 Use of a splinter shield or protection screen

Pfeiffer Vacuum centering rings with splinter shield or protection screen in the high vacuum flange protect the turbopump against foreign bodies coming from the chamber. Thus, the pumping speed of the pump is reduced.

	Reduced pumping speed in %			
	H_2	He	N_2	Ar
Splinter shield DN 160	6	9	20	23
Protection screen DN 160	1	2	6	7

5.2.3 Vibration damper



WARNING

Danger from the turbopump and vibration damper being torn-off

In case of sudden blocking of the rotor, an applied vibration damper cannot compensate any of the occurring forces. There is a danger of the turbopump being torn-off and thereby resulting severest injuries and property damages. Applicable safeguards must be taken to compensate possible occurring torques.

➔ Definitely consult with Pfeiffer Vacuum.

➔ Do not exceed the max. permissible temperature at the vibration damper (100 °C).

5.3 Mounting orientation

When using dry backing pumps, Pfeiffer Vacuum HiPace pumps are designed for installation in any orientation.

➔ Support pipes in front of the vacuum pump or remove them. No force from the pipe system may be exerted on the fixed pump.

➔ To avoid contamination via the fore-vacuum line when using oil-sealed backing pumps the fore-vacuum flange should always point vertically downward (± 25°).

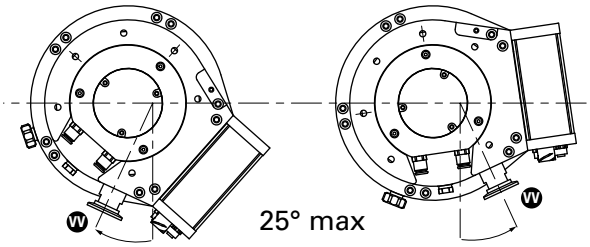


Fig. 4: Recommended orientation of the fore-vacuum flange

The maximum axial loading capacity of the high vacuum flange is 1000 N (equals 100 kg). A one-sided load on the high vacuum flange is not permitted.

5.4 Installing the high vacuum flange

If the rotor is suddenly blocked, the torques arising from the system and the high vacuum flange must be absorbed. Only the components listed in the following can be used to fasten the turbopumps to the high vacuum flange. The installation elements for turbopumps are special designs by Pfeiffer Vacuum. In all operating conditions, the tensile strength of the flange material must be at least 170 N/mm^2.

➔ Secure the vacuum chamber against shifting and tipping on customers side.



DANGER

Danger to life - impermissible fastening

Twisting or tearing-off is possible in case the rotor is suddenly blocked due to the fastening of pumps on a vacuum chamber with different flange variants.

➔ Use only the correct mounting kit from Pfeiffer Vacuum.

➔ Pfeiffer Vacuum will not accept any liability for all damages resulting from impermissible fastening.



NOTICE

Observe shape tolerances for the counter flange

Unevennesses of the customer supplied counter flange can lead to warping of the pump casing despite proper fastening. Leakiness and negative running characteristics can be the result.

➔ Do not exceed an evenness of max. 0.05 mm for the whole surface.

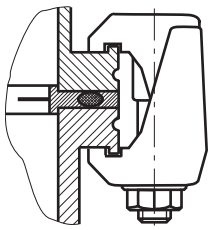


Mounting of ISO flanges

If the rotor suddenly blocks the connection of high vacuum flanges of types ISO-KF or ISO-K can lead to twisting despite proper installation.

- The tightness of the high vacuum flange is not at risk thereby.

5.4.1 Installation of ISO-K flange with ISO-K flange



For the installation the following components are exclusively authorized:

- the valid mounting kit of the Pfeiffer Vacuum accessories programme
- mounting materials including protection screen or splinter shield are optionally available

➔ Mind that the sealing surfaces are not damaged.

1) Connect the flanges according to the drawing and with the component parts of the mounting kit.
2) Use the required number of **10** claw clamps.
3) Tighten the claw clamps crosswise in three steps.
4) Tightening torque: 5, 15, 25 ±2 Nm

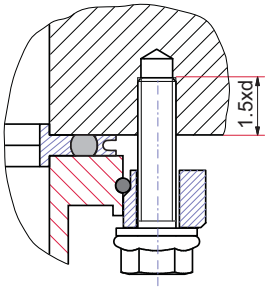
5.4.2 Installation of ISO-K flange with ISO-F flange

The connection types for installation of ISO-K to ISO-F flange are "hex screw and threaded hole," "stud screw and threaded hole," and "stud screw and through hole".

For the installation the following components are exclusively authorized:

- the valid mounting kit of the Pfeiffer Vacuum accessories programme
- mounting materials including protection screen or splinter shield are optionally available

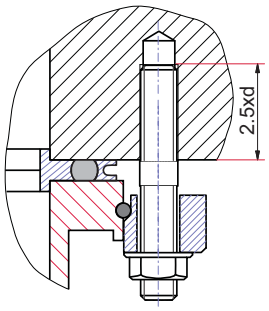
Hexagon screw and threaded hole



➔ Mind that the sealing surfaces are not damaged.

1) Put the collar flange over the high vacuum flange of the turbopump.
2) Insert the retaining ring into the groove of the high vacuum flange.
3) Fasten the turbo pump with collar flange and centering ring to the counter flange as shown in the graphic.
4) Use the required number of **8** hex screws with washer.
5) Screw hex screws 1.5 x d into the threaded holes.
   – The tensile strength of the flange material must be at least 270 N/mm^2 in all operating conditions.
6) Tighten the hex screws crosswise in three steps.
7) Tightening torque DN 160: 5, 10, 16 ± 1 Nm

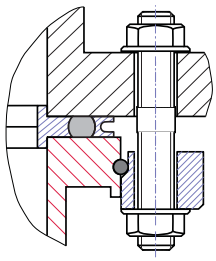
Stud screw and threaded hole



➔ Mind that the sealing surfaces are not damaged.

1) Use the required number of **8** stud screws and nuts.
2) Screw in the stud screws with the shorter threaded end 2.5 x d in the bore holes on the counter flange.
3) Put the collar flange over the high vacuum flange of the turbopump.
4) Insert the retaining ring into the groove of the high vacuum flange.
5) Fasten the turbo pump with collar flange and centering ring to the counter flange as shown in the graphic.
6) Tighten the nuts crosswise in three steps.
7) Tightening torque DN 160: 5, 10, 16 ± 1 Nm

Stud screw and through hole



➔ Mind that the sealing surfaces are not damaged.

1) Put the collar flange over the high vacuum flange of the turbopump.
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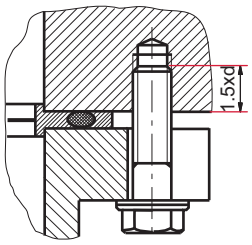
5.4.3 Installation of ISO-F with ISO-F flange

The connection types for installation of ISO-F to ISO-F flange are "hex screw and threaded hole," "stud screw and threaded hole," and "stud screw and through hole".

For the installation the following components are exclusively authorized:

- the valid mounting kit of the Pfeiffer Vacuum accessories programme
- mounting materials including protection screen or splinter shield are optionally available

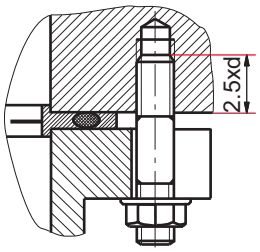
Hexagon screw and threaded hole



➔ Mind that the sealing surfaces are not damaged.

1) Connect the flanges according to the drawing and with the component parts of the mounting kit.
2) Use the required number of **8** hex screws with washer.
3) Screw hex screws 1.5 x d into the threaded holes.
   – The tensile strength of the flange material must be at least 270 N/mm^2 in all operating conditions.
4) Tighten the hex screws crosswise in three steps.
5) Tightening torque DN 160: 10, 20, 38 ± 3 Nm

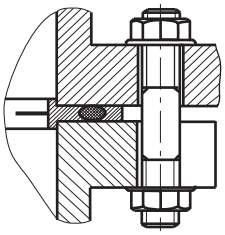
Stud screw and threaded hole



➔ Mind that the sealing surfaces are not damaged.

1) Use the required number of **8** stud screws and nuts.
2) Screw in the stud screws with the shorter threaded end 2.5 x d in the bore holes on the counter flange.
3) Connect the flanges according to the drawing and with the component parts of the mounting kit.
4) Tighten the nuts crosswise in three steps.
5) Tightening torque DN 160: 10, 20, 38 ± 3 Nm

Stud screw and through hole



➔ Mind that the sealing surfaces are not damaged.

1) Connect the flanges according to the drawing and with the component parts of the mounting kit.
2) Use the required number of **8** stud screws and nuts.
3) Tighten the nuts crosswise in three steps.
4) Tightening torque DN 160: 10, 20, 38 ± 3 Nm

5.4.4 Installation of CF- flanges



NOTICE

Assembly of CF flanges!

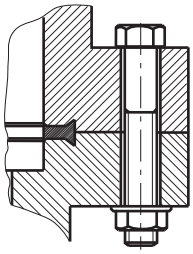
Loss of sealing capability due to a lack of cleanliness when handling the sealing and CF flange.

➔ Assemble the sealing dry and oil-free.
➔ Always wear gloves when handling the components.
➔ Do not damage the surfaces and cutting edges.

The connection types for installation of CF to CF flange are "hexagon screw and through hole", "stud screw and threaded hole" as well as "stud screw and through hole".

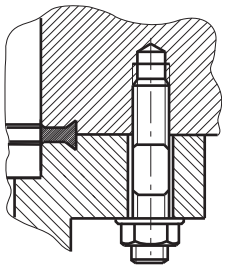
- the valid mounting kit of the Pfeiffer Vacuum accessories programme
- A copper seal
- protection screen or splinter shield are optionally

Hexagon screw and through hole



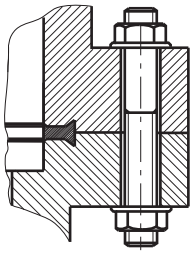
1) If used: Insert protective screen or splinter shield with the clamping lugs downward into the high vacuum flange of the turbopump.
2) Place the seal exactly in the hollow.
3) Connect the flanges using **20** hexagon-head screws (M8) with washers and bolts.
4) Tighten the screw connections circularly.
5) Tightening torque: 22 ± 2 Nm
6) After this, check the torque, since flowing of the sealing material may make it necessary to tighten the screws again.

Stud screw and threaded hole



1) Screw in the stud screws (**20** pieces, M8) with the shorter threaded end into the threaded holes of the counter flange.
2) If used: Insert protective screen or splinter shield with the clamping lugs downward into the high vacuum flange of the turbopump.
3) Place the seal exactly in the hollow.
4) Connect the flanges using washers and nuts.
5) Tighten the screw connections circularly.
6) Tightening torque: 22 ± 2 Nm
7) After this, check the torque, since flowing of the sealing material may make it necessary to tighten the screws again.

Stud screw and through hole



1) If used: Insert protective screen or splinter shield with the clamping lugs downward into the high vacuum flange of the turbopump.
2) Place the seal exactly in the hollow.
3) Connect the flanges using **20** hexagon-head screws (M8) with washers and bolts.
4) Tighten the screw connections circularly.
5) Tightening torque: 22 ± 2 Nm
6) After this, check the torque, since flowing of the sealing material may make it necessary to tighten the screws again.

5.5 Connecting the fore-vacuum side

Recommendation: As backing pump, use a suitable vacuum pump from the Pfeiffer Vacuum programme.



WARNING

Damage to health due to poisonous gases

Process gases can damage health and contaminate the environment.

➔ Safely lead away the gas emission from the backing pump!

➔ Observe all safety recommendations of the gas producer.

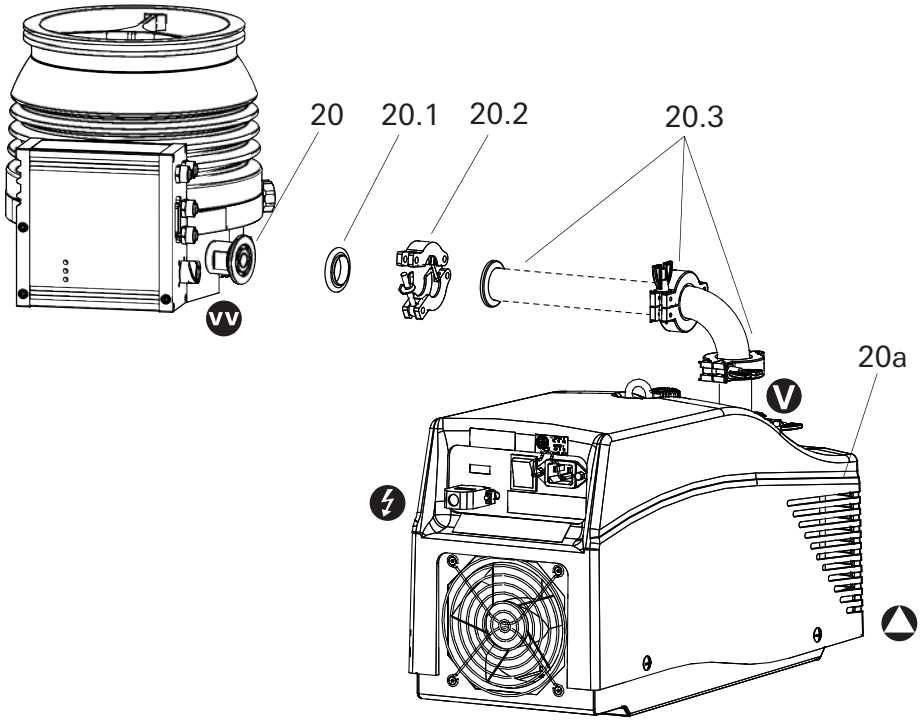


Fig. 5: Connecting the backing pump

20	Fore-vacuum connection	20.1	Centering ring	20.3	Vacuum components
20a	Backing pump	20.2	Clamping ring		



NOTICE

Design of the fore-vacuum connection regarding sudden twisting of the pump

If the rotor suddenly blocks the connection of high vacuum flanges of types ISO-KF or ISO-K can lead to twisting despite proper installation.

➔ Keep masses small, which can be installed directly to the pump.

➔ Connect flexible line elements directly to the turbopump, if necessary.

➔ With rigid pipe connections: Install bellows for attenuation of vibrations in the connection line.

➔ Connect the fore-vacuum line with small-flange components or threaded hose couplings. Do not narrow the free cross section of the fore-vacuum flange!

➔ The backing pump is connected electrically via a relay box.

➔ For connection and operation of the backing pump see its operating instructions.



Backing pump control

Backing pump control via electronic drive unit of the turbopump is possible using a relay box or respective connection cables of the accessory programme.

➔ Refer to the operating instructions of the respective accessory.

5.6 Connections to the turbopump

5.6.1 Electronic drive unit

Turbopumps with integrated electronic drive unit are designed for various applications. Therefore different connection panels are available.

- TC 400 in standard version
- TC 400 PB for Profibus linking
- TC 400 E74 in dependence on specification SEMI E74
- TC 400 DN for DeviceNet linking
- TC 400 EC for EtherCAT linking

Detailed description for function, configuration and operation with the respective connection panel are given in the specific operating instructions for the electronic drive unit.

5.6.2 Earthing

Pfeiffer Vacuum recommends to connect an appropriate earthing wire to derive applicative interferences.

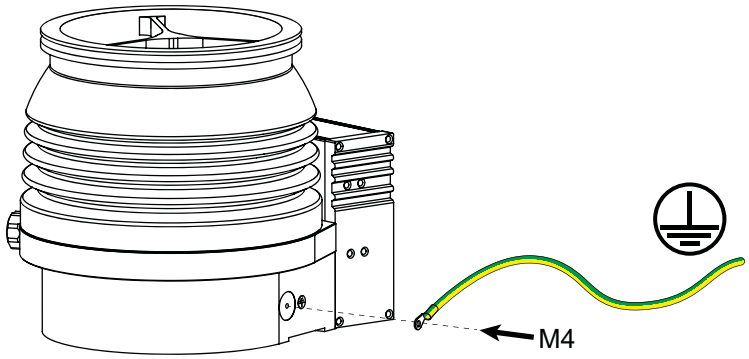


Fig. 6: Installing the earthing connection

5.6.3 Power and electrical supply

For voltage supply of the electronic drive unit TC 400, only use original power supplies (e.g. TPS 400 or DCU 400). Use of other power supplies only after consultation with Pfeiffer Vacuum. Connecting cables are available from the Pfeiffer Vacuum accessories.



WARNING

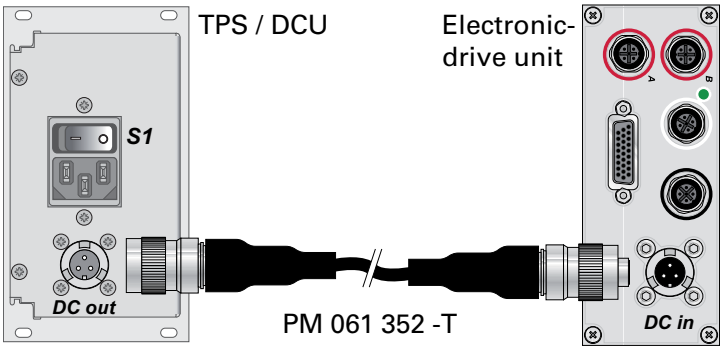
Danger of electric shock

In case of defect, the parts connected to the mains supply are under voltage.

➔ Always keep the mains connection freely accessible so you can disconnect it at any time.

➔ Make sure that the voltage of the turbopump is valid.

HiPace	V DC	Drive unit	Power supply	Power supply with DCU
HiPace 700	24	TC 400	TPS 310/311	DCU 310
HiPace 700	48	TC 400	TPS 400/401	DCU 400



➔ Switch off switch **S1** on the power pack (position "0").

➔ Insert the connection cable with the socket in the connection "*DC in*" on the electronic drive unit and close the bayonet lock.

➔ Insert the connection cable with the plug in the connection "*DC out*" on the power supply and close the bayonet lock.

5.6.4 Remote plug

The shipment includes a mating plug for the 26-pin connection with the designation "*remote*" on the TC 400. The mating plug bridges the following connections with the supply voltage (Pin 1), allowing the turbopump to operate without an additional operating unit or remote control:

- Pin 2, Enable venting "on"
- Pin 3, Motor pump "on"
- Pin 4, Pumping station "on"
- Pin 14, Remote access request

➔ Place and fix the mating plug on the connection "*remote*" on the TC 400.



CAUTION

Automatic start

After bridging the contacts Pin 1, 3, 4, 14 on the connection "*remote*" or using the mating plug supplied **and** setting up the supply voltage, the turbopump will run up immediately.

➔ Switch on the mains supply on the turbopump immediately before operation.

5.7 Accessory connection

Up to 4 accessories can be connected to the electronic drive unit TC 400. M12 sockets with the designation "*accessory*" are available for this purpose. The accessory connections have been preconfigured at the factory. If the units listed below are connected with the preconfigured connection, they are immediately ready for operation according to the factory settings. It is possible to connect other accessories; to do so, settings must be made on the electronic drive unit.



➔ To connect two units to one accessory connection, use the appropriate Y-Connector from the Pfeiffer Vacuum range of accessories.

➔ Connect the adapter to the appropriate red-coded connection on the TC 400.

➔ Settings can be made via the interfaces of the TC 400 (*remote*, *RS-485*, *Profibus* or *DeviceNet*).

Accessory connection	Connection with Y-connector	Preset accessory
Accessory A	Acc. A to Y-1	Air cooling unit
Accessory A	Acc. A to Y-2	Backing pump
Accessory B	Acc. B to Y-1	Venting valve
Accessory B	Acc. B to Y-2	Casing heating unit

Table 1: Overview of factory preset accessory connections on the TC 400

5.7.1 Air cooling

As an option, turbopumps with the electronic drive unit TC 400 may be operated with air cooling up to an ambient temperature of +35 °C.

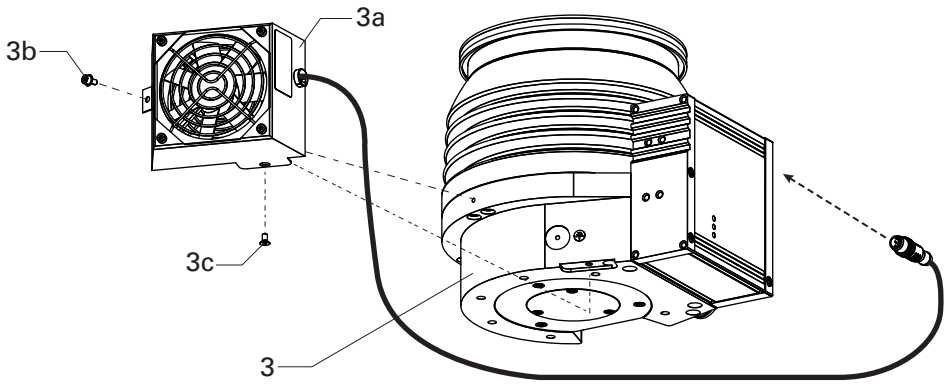


Fig. 7: Connecting the air cooling

3	Pump lower part	3b	Allen head screw
3a	Air cooling unit	3c	Counter-sunk screw

➔ Fix the air cooling unit to the holes of the turbopump using two screws.

➔ Plug in and fix the accessory's control lead to the corresponding accessory connection port on the electronic drive unit.

➔ Default for air cooling is "*accessory A1*".

5.7.2 Venting valve

The Pfeiffer Vacuum venting valve is used for automatic venting in case of shut-down or power failure.

The permissible connection pressure is max. 1500 hPa absolute.

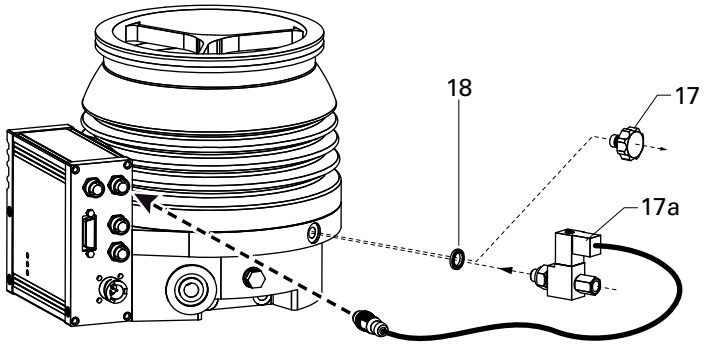


Fig. 8: Connecting the venting valve

18	Seal ring	17	Venting screw	17a	Venting valve

➔ Unscrew the venting screw with seal ring from the venting connection.

➔ Screw in the venting valve with seal ring.

➔ Plug in and fix the accessory's control lead to the corresponding accessory connection port on the electronic drive unit.

➔ Default for the venting valve is "*accessory B1*".

➔ If neccessary install a venting gas supply (e.g. inert gas) to the intake (G 1/8") of the solenoid valve.

5.7.3 Sealing gas connection

The turbopump must be operated with sealing gas to protect it, such as in the case of unclean processes or high gas throughput. The supply is made via a sealing gas valve or alternatively via a sealing gas throttle without control. The activation of the control valve for the sealing gas connection is not pre-installed in the electronic drive unit and has to be configured via their interfaces.

The permissible connection pressure is max. 1500 hPa absolute.

- When operating the pump with more than 50 % of the maximum gas throughput, sealing gas must be used to ensure rotor cooling.
- The sealing gas flow rate amounts 12-15 sccm for the HiPace 700.

Sealing gas supply with control valve

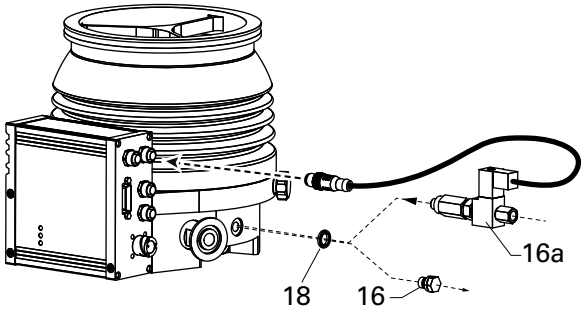


Fig. 9: Connecting the sealing gas valve

18 Seal ring 16 Locking screw 16a Sealing gas valve

➔ Unscrew the locking screw with seal ring out of the sealing gas connection.

➔ Screw the sealing gas valve with seal ring into the sealing gas connection.

➔ Insert the control cable of the accessory into a free accessory connector on the TC 400 and tighten.

➔ Make the settings and control via the interfaces of the electronic drive unit.

➔ Install the sealing gas supply (e.g. inert gas) via a connection adapter or on the inlet side (G 1/8") of the control valve.

Sealing gas supply without control valve

➔ Unscrew the locking screw with seal ring out of the sealing gas connection.

➔ Screw the sealing gas throttle with sealing ring into the sealing gas connection.

5.7.4 Heating jacket

The turbopump and vacuum chamber can be heated to reach the ultimate pressure more quickly. Use of a heating jacket is only permissible for pumps with the high vacuum flange in stainless steel design. The heating duration depends on the degree of contamination as well as the ultimate pressure to be reached and should be at least 4 hours.

NOTICE

Dangerous excess temperatures

Process-related high temperatures can result in impermissible excess temperatures and thus damage to the turbopump.

➔ Water cooling must be used when employing a casing heating or during operation with heated vacuum chambers.

➔ Do not introduce any additional energy into the pump *(see p. 27, chap. 6.1)*.



CAUTION

Risk of burns

High temperatures arise when the turbopump or vacuum chamber are baked out. As a result, there is a danger of burns from touching hot parts, even after the casing heating is switched off!

➔ Thermally insulate heating jacket, pump housing and vacuum chamber, if possible during installation.

➔ Do not touch heating jacket, pump casing and vacuum chamber during bake out.

- When using a casing heating and a water cooling unit the temperature of the connected flange of the vacuum chamber must not exceed 120 °C.
- The maximum permissible rotor temperature for the turbopump is 90 °C. If high temperatures arise for process reasons, the radiated heat input must not exceed 4.2 W. Install suitable screening sheets, if necessary (design information on request).

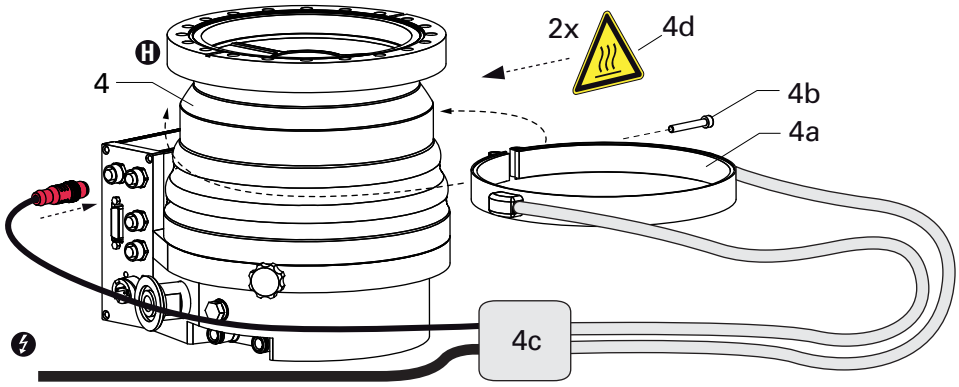


Fig. 10: Connecting the heating jacket

4	Pump casing	4b	Fixing screw	4d	Warning sticker
4a	Heating jacket	4c	Heating relay box		

➔ Bend open the outer heating jacket on the tensioning strap and place it sidewards on to the cylindrical segment of the pump casing.
  – Do not bend the heating straps!
  – The heating jacket must seat completely on the casing segment.

➔ Fix the heating jacket with the fixing screw on the casing.
  – Observe the tightening torque for the fixing screw!

Fixing screw	Tightening torque in cold condition	Tightening torque during the heating-up	Singular retightening after the cooling down
M5	6 Nm	7 Nm	7 Nm
M6	11 Nm	12 Nm	12 Nm

Table 2: Tightening torques for fixing screws of heating jackets

➔ Plug in and fix the accessory's control lead to the corresponding accessory connection port on the electronic drive unit.

➔ Default for the casing heating is "*accessory B2*".

➔ Establish the mains supply for the relay box according to the accessory operating instructions.

5.7.5 Water cooling

The turbopumps HiPace 700 with TC 400 have water cooling as standard equipment.

- In case of increased backing pressure (> 0.1 hPa) and/or operation with high gas throughputs, either air or water cooling may be used.
- Generally use water cooling if the ambient temperature is > +35 °C.

Cooling water requirements

Cooling water connection	Socket connection
Hose lines	External diameter 8 mm Internal diameter 6 mm

Cooling water quality	filtrated, mechanically clean, optically clear, no turbidity, no sediments, chemically neutral
Oxygen content max.	4 mg/kg
Chloride content max.	100 mg/kg
Water hardness max.	10 °dH 12.53 °e 17.8 °fH 178 ppm $CaC0_3$
Consumption of potassium permanganate max.	10 mg/kg
Carbon dioxide content max.	undetectable
Ammonia content max.	undetectable
pH-value	7 - 9
Fore-line overpressure max.	6000 hPa
Cooling water temperature	refer to "Technical Data"
Cooling water consumption at max. gas throughput	refer to "Technical Data"

Connecting to a cooling water system

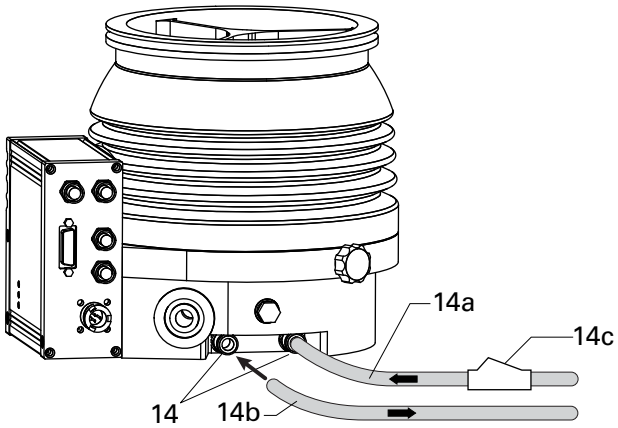


Fig. 11: Connecting the cooling water

14	Cooling water connection	14b	Return line
14a	Fore-line	14c	Dirt trap

➔ Insert hoses for the water cooling fore- and return-line as far as they will go in one cooling water connection each.

➔ **Recommendation:** install dirt trap in the fore-line.

6 Operation

6.1 Commissioning

The following important settings are programmed in the electronic drive unit ex factory.

- Parameter **[P:027]** Gas mode: 0 = heavy gases
- Parameter **[P:700]** Set value max. run-up time monitoring: 8 min
- Parameter **[P:701]** Rotation speed switchpoint: 80% of the nominal roation speed
- Parameter **[P:707]** Set value in rotation speed setting mode: 65 % of the nominal rotation speed
- Parameter **[P:708]** Set value power consumption: 100 %
- Parameter **[P:720]** Venting rotation speed at delayed venting: 50 % of the nominal rotation speed
- Parameter **[P:721]** Venting time: 3600 s

➔ When water cooling is used: Open cooling water supply and check the flow.
➔ When sealing gas is used: Open the sealing gas supply and check the flow.
➔ Establish the mains for the power supply.



NOTICE

Risk of destroying the pump by inputting too much energy

Simultaneous loading by means of high drive power (gas flow rate, fore-vacuum pressure), high heat radiation, or strong magnetic fields results in uncontrolled heating of the rotor and may destroy the pump.

➔ Reduced limit values apply when combining these loads.
➔ If necessary consult with Pfeiffer Vacuum.



NOTICE

Danger of the pump being destroyed

Pumping of gases with a higher molecular mass in the wrong gas mode can lead to destruction of the pump.

➔ Ensure the gas mode is correctly set.
➔ Contact Pfeiffer Vacuum before using gases with a greater molecular mass (> 80).

6.2 Operation modes

The following operation modes are available:

- Operation without operating unit
- Operation via "*remote*" connection
- Operation via RS-485 and Pfeiffer Vacuum display and control units or PC
- Operation via field bus

6.3 Function description



WARNING

Danger due to open high vacuum flange

The rotor of the turbopump turns at high speed. If the high vacuum flange is open, there is a danger of cut injuries and that the pump can be destroyed by objects falling into it.

➔ Never operate the pump with an open high vacuum flange.

6.3.1 Operation without operating unit



CAUTION

Automatic start

After bridging the contacts Pin 1, 3, 4, 14 on the connection "*remote*" or using the mating plug supplied **and** setting up the supply voltage, the turbopump will run up immediately.

➔ Switch on the mains supply on the turbopump immediately before operation.

➔ For operation without the control unit, the 26-pole D-Sub plug must be in the "*remote*" connection on the TC 400.

➔ Switch on the supply voltage with switch S1 on the power supply.

After operating voltage is applied, the TC 400 performs a self-test to check the supply voltage. Once the self-test has been successfully completed on the TC 400, the turbopump and the backing pump - if connected - begin to operate.

6.3.2 Operation via "*remote*" connection

Remote control is possible via the 26-pin D-sub connector labelled "*remote*" on the electronic drive unit. The accessible individual functions are mapped to "PLC levels".

➔ Consider the following manuals for the operation via remote control:

- Operating instructions "Electronic drive unit TC 400"

6.3.3 Operation with DCU or HPU

➔ Consider the following manuals for the operation via Pfeiffer Vacuum display and control units:

- Operating instructions "DCU"
- Operating instructions "HPU"
- Operating instructions "Electronic drive unit TC 400"

➔ Switch on the supply voltage with switch S1 on the power supply or on the DCU 400.

➔ Settings are possible via interface RS-485 by using DCU, HPU or PC.

6.3.4 Operation via fieldbus

Integrating and operating Pfeiffer Vacuum turbopumps in the customer's field bus system is possible for electronic drive units with a corresponding field bus panel.

➔ Consider the following manuals for the operation via field bus:

- Operating instructions for the electronic drive unit with the respective connection panel

6.4 Monitoring of the operation conditions

6.4.1 Temperature monitoring

The drive power is reduced in case of impermissible motor temperature or impermissibly high housing temperature. This can cause falling below the rotation speed switchpoint and so result in turning off the turbopump.

6.4.2 Operation display via LED

LEDs in the front panel of the electronic drive unit show basic operating conditions of the turbopump. A differentiated malfunction and warning display is possible only for operation with DCU or HPU.

LED	Symbol	LED status	Display	Meaning
Green		Off		currentless
		On, flashing		"Pumping Station OFF", rotation speed ≤ 60 min^{-1}
		On, invers flashing		"Pumping Station ON", set rotation speed not attained
		On, constantly		"Pumping Station ON", set rotation speed attained
		On, blinking		"Pumping Station OFF", rotation speed > 60 min^{-1}
Yellow		Off		no warning
		On, constantly		Warning
Red		Off		no malfunction
		On, constantly		Malfunction

Fig. 12: Behaviour and meaning of LEDs on the electronic drive unit

6.5 Switching off and venting

6.5.1 Switching off

After the turbopump is switched off, it must be vented to avoid contamination due to particles streaming back from the fore-vacuum area.

➔ Close the fore-vacuum: Switch off the backing pump or close a fore-vacuum valve.
➔ Switch off the turbopump on the control unit or via remote control.
➔ Venting (possibilities see below)
➔ For water cooling: Shut off the water supply.

6.5.2 Venting

Manually venting

➔ Open the venting screw (included) in the venting connection of the turbopump about one turn.

Venting with Pfeiffer Vacuum Venting Valve

➔ Enable venting via the functions of the electronic drive unit.
➔ Settings are possible via interface RS-485 by using DCU, HPU or PC.

Venting rotation speed	Switch off the pumping station	Mains power failure[1)]
50 % of the nominal rotation speed	Venting valve opens for 3600 s (1 h, works setting)	Venting valve opens for 3600 s (1 h, works setting)

[1)] When mains power is restored the venting procedure is aborted.

Basic information for the rapid venting

Venting of the vacuum chamber in two steps. Ask for details on individual solutions from Pfeiffer Vacuum.

➔ Vent for 20 seconds at a rate of pressure rise of max. 15 hPa/s.
  – The valve cross section for the venting rate of 15 hPa/s must be adapted to the size of the vacuum chamber.
  – For small vacuum chambers, use the Pfeiffer Vacuum venting valve.
➔ Then vent with an additional venting valve of any desired size.

7 Maintenance / replacement



WARNING

Contamination of parts and operating fluid by pumped media is possible.

Poisoning hazard through contact with materials that damage health.

➔ In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.

➔ Decontaminate affected parts before carrying out maintenance work.



NOTICE

Disclaimer of liability

Pfeiffer Vacuum accepts no liability for personal injury or material damage, losses or operating malfunctions due to improperly performed maintenance. The liability and warranty entitlement expires.

7.1 Maintenance intervals and responsibilities

- Clean the turbopump externally with a lint-free cloth and little industrial alcohol.
- Replace the operating fluid reservoir and electronic drive unit yourself.
- Change the operating fluid reservoir at least every 4 years.
- Change the turbopump bearing at least every 4 years.
  – Contact Pfeiffer Vacuum Service.
- Clarify shorter maintenance intervals for extreme loads or impure processes with Pfeiffer Vacuum Service.
- For all other cleaning, maintenance or repair work, please contact your Pfeiffer Vacuum service location.

7.2 Replacing the operating fluid reservoir





WARNING

Poisoning hazard through contact with materials that damage health.

The operating fluid reservoir and parts of the pump may contain toxic substances from the pumped media.

➔ Dispose of operating fluid reservoir in accordance with the applicable regulations. Safety data sheet on request or under www.pfeiffer-vacuum.com

➔ Prevent health hazards or environmental damage due to contamination by means of appropriate safety precautions.

➔ Decontaminate affected parts before carrying out maintenance work.



Operating fluid filling

The operating fluid reservoir is sufficiently filled with operating fluid.

➔ Do not add additional operating fluid.

➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.

➔ Remove the vacuum pump from the system, if necessary.

➔ Close the flange openings by using the original protective covers.

➔ Turn the turbopump over onto the closed high vacuum flange.

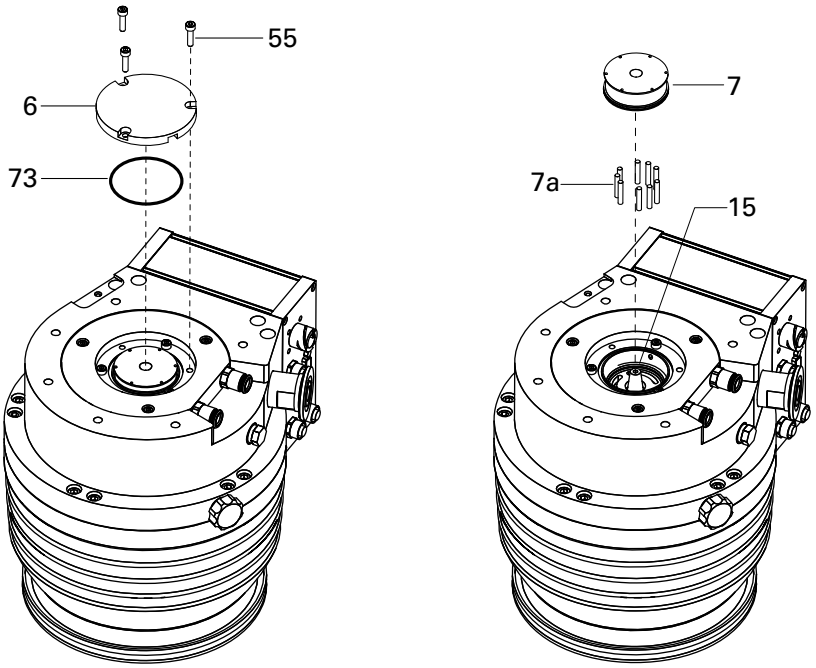


Fig. 13: Assembly / Disassembly of the operating fluid reservoir

6	End cover	7 a	Poroplast rod	55	Allen head screw
7	Operating fluid reservoir	15	Injection tip	73	O-ring

➔ Screw out the Allen head screws (3x) from the end cover at the bottom of the turbopump.

➔ Remove the end cover. Pay attention to the O-ring.

➔ Remove the operating fluid reservoir out of the bearing cartridge.

➔ Using tweezers, pull out the Poroplast rods (9x).

➔ Remove impurities from the turbopump and the end cover with a clean, lint-free cloth. **Do not use any cleaning fluids!**

➔ Using tweezers, insert the new Poroplast rods (9x).

➔ Install the new operating fluid reservoir in the bearing mounting of the turbopump with the felt side oriented toward the nozzle tip.

➔ For the HiPace turbopumps the operating fluid reservoir can be inserted completely into the bearing cartridge.

➔ Screw in the end cover with the new O-ring.

– Tightening torque: **2.5 Nm**.

7.3 Replacing the electronic drive unit

NOTICE

Damages to the pump and drive

Even after the mains power is switched off, the subsequently running pump delivers electric power to the electronic drive unit. There is a danger of electric body contact by premature separating the pump from the electronic drive unit.

➔ Never separate the electronic drive unit from the pump when the mains power is connected or the rotor is running.

Operating parameters of the electronic drive unit

The factory operating parameters are always preset with replacement shipments.

➔ The use of a HPU enables the storing and the reuse of an existing parameter record.

➔ Reset any individually changed application parameters.

➔ Refer to the manual "Electronic drive unit".

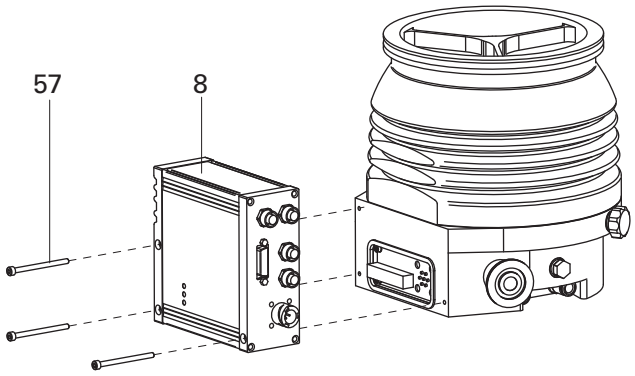


Fig. 14: Assembly / disassembly of the TC 400

8 Electronic drive unit 57 Allen head screw

➔ Do not exercise any mechanical load on the electronic drive unit.

➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.

➔ Only separate the pump and the electronic drive unit from each other after disconnecting the supply voltage and the complete standstill of the pump.

➔ Remove the vacuum pump from the system, if necessary.

➔ Unscrew Allen head screws (3x) from the electronic drive unit.

➔ Pull the electronic drive unit off the pump.

➔ Don’t touch any electrostatic sensitive devices.

➔ Screw on and connect new electronic drive unit to the turbopump.

– Tightening torque: **2.5 Nm**.

7.3.1 Rotation speed set value

The typical nominal rotation speed of a turbopump is factory-set in the electronic drive unit. If the electronic drive unit is replaced or a different pump type is used, the reference set value of the nominal rotation speed must be confirmed. This procedure is part of a redundant safety system for avoiding excess rotation speeds.

HiPace	Nominal rotation speed confirmation [P:777]
300	1000 Hz
400 / 700 / 800	820 Hz

➔ Adjust the parameter **[P:777]** according to the pump type.

➔ **Alternatively**: If no display and control unit is available, please use the "SpeedConfigurator" of the spare parts delivery.

8 Decommissioning

8.1 Shutting down for longer periods



WARNING

Contamination of parts and operating fluid by pumped media is possible.

Poisoning hazard through contact with materials that damage health.

➔ In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.

➔ Decontaminate affected parts before carrying out maintenance work.

If the turbopump should be shut down for longer than a year:

➔ Remove the vacuum pump from the system, if necessary.

➔ Replace the operating fluid reservoir if necessary.

➔ Close the high vacuum flange of the turbopump.

➔ Evacuate turbopump via the fore-vacuum flange.

➔ Vent turbopump via the venting connection with oil-free, dry air or inert gas.

➔ Close the flange openings by using the original protective covers.

➔ Close further connection ports by using the corresponding protective covers.

➔ Place pump upright on rubber feet.

➔ Store the pump only indoors at temperatures between -25 °C and +55 °C.

➔ In rooms with moist or aggressive atmospheres, the pump must be airproof shrink-wrapped in a plastic bag together with a bag of desiccant.

8.2 Re-starting



NOTICE

Risk of damage to the pump following recommissioning

The operating fluid in the turbo pump has a limited shelf life. The length of its shelf life is as follows:

- max. 2 years without operation or
- a total of max. 4 years following periods of operation and nonoperation.

➔ Follow the maintenance instructions and inform Pfeiffer Vacuum.

➔ Check turbopump for contamination and moisture.

➔ Clean the turbopump externally with a lint-free cloth and little industrial alcohol.

➔ If necessary, have Pfeiffer Vacuum Service clean the turbopump completely.

➔ If necessary, have the bearings replaced. Take into account the total running time.

➔ Replace the operating fluid reservoir if necessary.

➔ Installation and commissioning in accordance with the operating instructions.

8.3 Disposal

Products or parts thereof (mechanical and electrical components, operating fluids, etc.) may cause environmental burden.

➔ Safely dispose of the materials according to the locally applicable regulations.

9 Malfunctions

If malfunctions on the pump occur, you will find possible causes and instructions for repair in the following table.

9.1 Rectifying malfunctions

Problem	Possible causes	Remedy
Pump does not start; none of the built-in LEDs on the TC 400 lights up	• Electrical supply interrupted	⇨ Check plug contacts on the power supply ⇨ Check supply lines on the power supply ⇨ Check the output voltage (24 / 48 V DC) on the connection "DC out" of the power supply ⇨ Check the plug contacts on the TC
	• Operating voltage incorrect	⇨ Apply correct operating voltage ⇨ Observe the rating plate
	• No operating voltage applied	⇨ Apply operating voltage
	• TC 400 defective	⇨ Exchange the TC 400 ⇨ Contact the Pfeiffer Vacuum Service
Pump does not start; green LED on the TC 400 is flashing	• At operation without control panel: Pins 1-3, 1-4 or 1-14 are not connected on the "remote" connection	⇨ Connect the pins 1-3, 1-4 or 1-14 on the "remote" connection ⇨ Install the mating plug (scope of delivery) to the "remote" connection.
	• At operation via RS-485: Bridge at Pin 1-14 prevents control commands	⇨ Remove the bridge betwenn pins 1 and 14 from the "remote" connection ⇨ Remove the mating plug from the "remote" connection.
	• At operation via RS-485 (without mating plug): Parameters of the electronic drive unit not set	⇨ Set parameters **[P: 010]** and **[P: 023]** "ON" via interface RS-485. ⇨ Please refer to operating instructions of the electronic drive unit.
	• Voltage drop in the cable too high	⇨ Use a suitable cable
Pump does not attain the final rotational speed within the specified run-up time	• Fore-vacuum pressure too high	⇨ Ensure function and suitability of the backing pump
	• Leak	⇨ Perform leak detection ⇨ Check sealings and flange fastenings ⇨ Eliminate leaks
	• Gas throughput too high	⇨ Reduce process gas supply
	• Rotor runs hard, bearing defective	⇨ Check the bearing for noises ⇨ Contact the Pfeiffer Vacuum Service
	• Setpoint for run-up time to low	⇨ Extend the run-up time via DCU, HPU or PC
	• Thermal overload: – Lack of air ventilation – Water flow too low – Fore-vacuum pressure too high – Ambient temperature too high	⇨ Reduce thermal loads – Ensure adequate cooling – Ensure the cooling water flow – Lower the fore-vacuum pressure – Adjust ambient conditions
Pump does not attain the ultimate pressure	• Pump is dirty	⇨ Bake out the pump ⇨ Cleaning in case of heavy contamination – Contact the Pfeiffer Vacuum Service
	• Vacuum chamber, pipes or pump are leaky	⇨ Leak detection starting from the vacuum chamber ⇨ Eliminate leaks
Unusual noises during operation	• Bearing damage	⇨ Contact the Pfeiffer Vacuum Service
	• Rotor damage	⇨ Contact the Pfeiffer Vacuum Service
	• Splinter shield or protective screen are loose	⇨ Correct the seat of the splinter shield or the protective screen ⇨ Observe the installation notes
Red LED on the TC 400 is on	• Collective fault	⇨ Reset by switching the mains OFF/ON ⇨ Reset via pin 13 on the "REMOTE" connection ⇨ Differentiated malfunction display is possible via RS-485[1)] ⇨ Contact the Pfeiffer Vacuum Service

1) If no Pfeiffer Vacuum display and control unit is available, please contact the Pfeiffer Vacuum Service.

10 Service

Pfeiffer Vacuum offers first-class service!

- Operating fluid and bearing change on the spot by Pfeiffer Vacuum FieldService
- Maintenance / repair in the nearby ServiceCenter or ServicePoint
- Fast replacement with exchange products in mint condition
- Advice on the most cost-efficient and quickest solution

Detailed information, addresses and forms at: **www.pfeiffer-vacuum.com (Service**).

Maintenance and repair in the Pfeiffer Vacuum ServiceCenter

The following steps are necessary to ensure a fast, smooth servicing process:

➔ Download the forms "Service Request" and "Declaration on Contamination".[1)]
➔ Fill out the "Service Request" form and send it by fax or e-mail to your Pfeiffer Vacuum service address.
➔ Include the confirmation on the service request from Pfeiffer Vacuum with your shipment.
➔ Fill out the declaration on contamination and include it in the shipment (required!).
➔ Dismantle all accessories.
➔ Drain the operating fluid (applies for turbopumps with pumping speed > 800 l/s).
➔ Leave electronic drive on the pump.
➔ Close the flange openings by using the original protective covers.
➔ If possible, send pump or unit in the original packaging.

Sending of contaminated pumps or devices

No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. “Hazardous substances” are substances and compounds in accordance with the hazardous goods directive (current version). If pumps are contaminated or the declaration on contamination is missing, Pfeiffer Vacuum performs decontamination at the shipper's expense.

➔ Neutralise the pump by flushing it with nitrogen or dry air.
➔ Close all openings airtight.
➔ Seal the pump or unit in suitable protective film.
➔ Return the pump/unit only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

Exchange unit

The factory operating parameters are always preset with exchange units. If you use changed parameters for your application, you have to set these again.

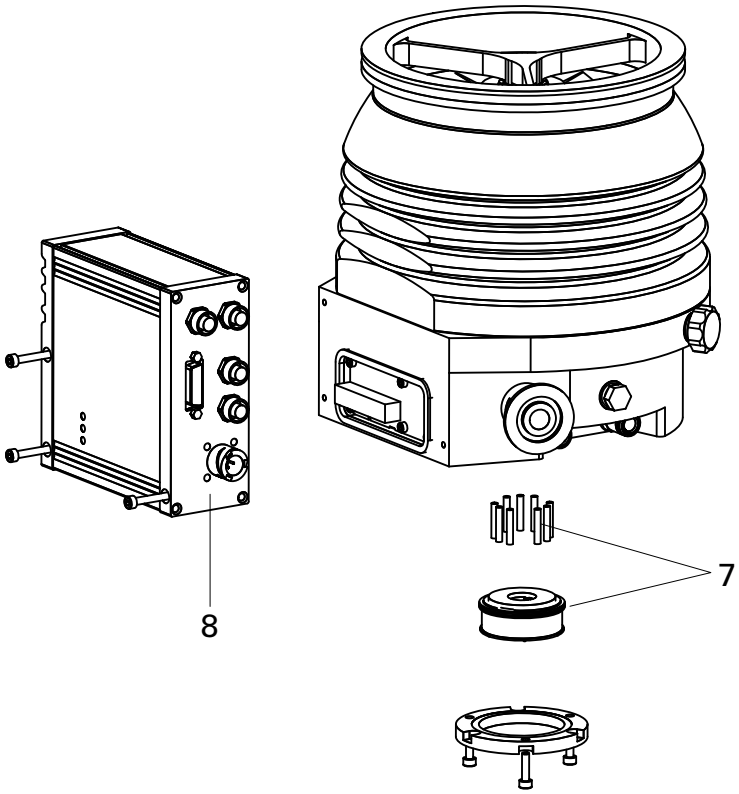
Service orders

All service orders are carried out exclusively according to our repair conditions for vacuum units and components.

1) Forms under www.pfeiffer-vacuum.com

11 Spare parts HiPace 700

Item	Designation	Order number	Notes	Pieces	Order qty
7	Operating fluid reservoir	PM 143 452 -T	incl. Poroplast rods	1	
8	Electronic drive unit TC 400	according to the rating plate	depends on the connection panel	1	
93	Mating plug "remote"	PM 061 378 -X	with bridges	1	



Please also specify model number of the the rating plate when ordering accessories or spare parts.

12 Accessories

12.1 HiPace 700, 48 V DC

Designation	DN 160 ISO-K	DN 160 CF-F	DN 160 ISO-F
Mounting kit for HiPace with DN 160 ISO-K, including coated centering ring and bracket screws	PM 016 375 -T		
Mounting kit for HiPace with DN 160 ISO-K, including coated centering ring, protection screen, bracket screws	PM 016 377 -T		
Mounting kit for HiPace with DN 160 ISO-K, including coated centering ring, splinter shield and bracket screws	PM 016 376 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring with protection screen, stud screws	PM 016 957 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring with splinter shield, stud screws	PM 016 956 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring, stud screws	PM 016 955 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring with protevtion screen, hexagon bolts	PM 016 952 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring with splinter shield, hexagon bolts	PM 016 951 -T		
Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring, hexagon bolts	PM 016 950 -T		
Set of hexagon screws for trough hole, DN 160 CF-F		PM 016 691 -T	
Set of stud screws for trough hole, DN 160 CF-F		PM 016 693 -T	
Set of stud screws for trough hole, DN 160 CF-F		PM 016 735 -T	
Mounting kit for DN 160 ISO-F, including coated centering ring, hexagon screws			PM 016 460 -T
Mounting kit for DN 160 ISO-F, including coated centering ring, protection screen, hexagon screws			PM 016 462 -T
Mounting kit for DN 160 ISO-F, including coated centering ring, splinter shield, hexagon screws			PM 016 461 -T
Mounting kit for DN 160 ISO-F, including coated centering ring, stud screws			PM 016 465 -T
Mounting kit for DN 160 ISO-F, including coated centering ring, protection screen, stud screws			PM 016 467 -T
Mounting kit for DN 160 ISO-F, including coated centering ring, splinter shield, stud screws			PM 016 466 -T
Centering ring with multifunction coating, DN 160 ISO-K/-F	PM 016 216 -U		PM 016 216 -U
Centering ring with multifunction coating and integrated protection screen, DN 160 ISO-K/-F	PM 016 218 -U		PM 016 218 -U
Centering ring with multifunction coating and integrated splinter shield, DN 160 ISO-K/-F	PM 016 217 -U		PM 016 217 -U
Vibration damper for HiPace with DN 160 ISO-K/F	PM 006 492 -X		PM 006 492 -X
Protection screen for DN 160 CF-F		PM 016 339	
Splinter shield for turbopumps, DN 160 CF-F		PM 016 318	
Vibration damper for HiPace DN 160 CF-F		PM 006 493 -X	
TPS 400, power supply 48 V DC, for wall/standard rail fitting	PM 061 343 -T	PM 061 343 -T	PM 061 343 -T
TPS 401, power supply 48 V DC, 19" partial plug-in 3HU	PM 061 347 -T	PM 061 347 -T	PM 061 347 -T
DCU 400, Display control unit incl. power supply	PM C01 823	PM C01 823	PM C01 823
Mains cable 230 V AC, CEE 7/7 to C13, 3 m	P 4564 309 ZA	P 4564 309 ZA	P 4564 309 ZA
Mains cable 115 V AC, NEMA 5-15 to C13, 3 m	P 4564 309 ZE	P 4564 309 ZE	P 4564 309 ZE
Mains cable 208 V AC, NEMA 6-15 to C13, 3 m	P 4564 309 ZF	P 4564 309 ZF	P 4564 309 ZF
DCU 002, Display Control Unit	PM 061 348 -T	PM 061 348 -T	PM 061 348 -T
HPU 001, Handheld Programming Unit	PM 051 510 -T	PM 051 510 -T	PM 051 510 -T
Accessories package for HPU 001/PC	PM 061 005 -T	PM 061 005 -T	PM 061 005 -T
Connection cable for HiPace with TC 400/TM 700 to power supply TPS/DCU 310/311/400/401	PM 061 352 -T	PM 061 352 -T	PM 061 352 -T
Backing pump relay box, single phase 20 A, for TC 400 and TCP 350, M12 plug	PM 061 375 -T	PM 061 375 -T	PM 061 375 -T
Relay box, shielded, for backing pumps, 1-phase 7 A for TC 400/1200, TM 700 and TCP 350, M12	PM 071 284 -X	PM 071 284 -X	PM 071 284 -X
TVV 001 fore-vacuum safety valve, 230 V AC	PM Z01 205	PM Z01 205	PM Z01 205
TVV 001 fore-vacuum safety valve, 115 V AC	PM Z01 206	PM Z01 206	PM Z01 206

Designation	DN 160 ISO-K	DN 160 CF-F	DN 160 ISO-F
Heating jacket for HiPace 400/700/800 with TC 400, 230 V AC, safety plug		PM 061 369 -T	
Heating jacket for HiPace 400/700/800 with TC 400, 208 V AC, UL plug		PM 061 370 -T	
Heating jacket for HiPace 400/700/800 with TC 400, 115 V AC, UL plug		PM 061 371 -T	
Venting valve, shielded, 24 V DC, G 1/8", for connection to TC 400/1200 and TM 700	PM Z01 291	PM Z01 291	PM Z01 291
TTV 001, dryer for venting turbopumps	PM Z00 121	PM Z00 121	PM Z00 121
Sealing gas valve, shielded for HiPace 300 with TC 400 and TM 700, TCP 350	PM Z01 312	PM Z01 312	PM Z01 312
Sealing gas throttle for HiPace 300	PM Z01 317	PM Z01 317	PM Z01 317
Air cooling for HiPace 400/700 and 800 with TC 400	PM Z01 303	PM Z01 303	PM Z01 303
USB converter to RS-485 interface	PM 061 207 -T	PM 061 207 -T	PM 061 207 -T
Interface cable, M12 m straight/M12 m straight, 3 m	PM 061 283 -T	PM 061 283 -T	PM 061 283 -T
HiPace - ACP connection cable	PM 071 142 -X	PM 071 142 -X	PM 071 142 -X
Control cable for pumping stations 0.7 m	PM 061 675 AT	PM 061 675 AT	PM 061 675 AT
Y-Connector M12 to RS-485	P 4723 010	P 4723 010	P 4723 010
Y-connector, shielded, M12 for accessories	P 4723 013	P 4723 013	P 4723 013
RJ 45 interface cable on M12 for HiPace	PM 051 726 -T	PM 051 726 -T	PM 051 726 -T
Termination resistor for RS-485	PT 348 105 -T	PT 348 105 -T	PT 348 105 -T
Wall rail fitting for TPS 110/180/310/400	PM 061 392 -T	PM 061 392 -T	PM 061 392 -T
Front panel kit for TPS 401	PM 061 396 -T	PM 061 396 -T	PM 061 396 -T
Power separator for RS-485	PT 348 132 -T	PT 348 132 -T	PT 348 132 -T
TIC 010, Adapter for two sensors	PT R70 000	PT R70 000	PT R70 000
RPT 010, Digital Piezo/Pirani Sensor	PT R71 100	PT R71 100	PT R71 100
IKT 010, Digital Cold Cathode Sensor, low current	PTR 72 100	PTR 72 100	PTR 72 100
IKT 011, Digital Cold Cathode Sensor, high current	PT R73 100	PT R73 100	PT R73 100

12.2 Differences at HiPace 700, 24 V DC

Designation	DN 160 ISO-K	DN 160 CF-F	DN 160 ISO-F
TPS 310, mains pack for wall/standard rail fitting	PM 061 342 -T	PM 061 342 -T	PM 061 342 -T
TPS 311, mains pack 19" rack module 3HU	PM 061 346 -T	PM 061 346 -T	PM 061 346 -T
Front panel kit for TPS 311	PM 061 395 -T	PM 061 395 -T	PM 061 395 -T
DCU 310, Display control unit incl. power supply	PM C01 822	PM C01 822	PM C01 822

13 Technical data and dimensions

13.1 General

Basic principles for the Technical Data of Pfeiffer Vacuum Turbopumps:

Maximum values refer exclusively to the input as a single load.

- Recommendations of PNEUROP committee PN5
- ISO 21360; 2007: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"
- ISO 5302; 2003: "Vacuum technology - Turbomolecular pumps - Measurement of performance characteristics"
- Ultimate pressure: using a test dome and a 48 hrs. period of baking out
- Gas throughput: water cooling; backing pump = rotary vane pump (10 m^3/h)
- Cooling water consumption: at max. gas throughput, cooling water temp. 25 °C
- Integral leak rate: using a Helium concentration of 100 %, period 10 s
- Sound pressure level: Distance 1 m to the pump

Conversion table: pressure units

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^{5}$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1

1 Pa = 1 N/m^2

Conversion table: gas throughput units

	mbar·l/s	Pa·m^3/s	sccm	Torr·l/s	atm·cm^3/s
mbar·l/s	1	0.1	59.2	0.75	0.987
Pa·m^3/s	10	1	592	7.5	9.87
sccm	$1.69 \cdot 10^{-2}$	$1.69 \cdot 10^{-3}$	1	$1.27 \cdot 10^{-2}$	$1.67 \cdot 10^{-2}$
Torr·l/s	1.33	0.133	78.9	1	1.32
atm·cm^3/s	1.01	0.101	59.8	0.76	1

13.2 HiPace 700, 48 V DC

Parameter	HiPace® 700	HiPace® 700	HiPace® 700
Flange (in)	DN 160 ISO-K	DN 160 CF-F	DN 160 ISO-F
Flange (out)	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"
Pumping speed for Ar	665 l/s	665 l/s	665 l/s
Pumping speed for H_2	555 l/s	555 l/s	555 l/s
Pumping speed for He	655 l/s	655 l/s	655 l/s
Pumping speed for N_2	685 l/s	685 l/s	685 l/s
Compression ratio for Ar	$> 1 \cdot 10^{11}$	$> 1 \cdot 10^{11}$	$> 1 \cdot 10^{11}$
Compression ratio for H_2	$4 \cdot 10^{5}$	$4 \cdot 10^{5}$	$4 \cdot 10^{5}$
Compression ratio for He	$3 \cdot 10^{7}$	$3 \cdot 10^{7}$	$3 \cdot 10^{7}$
Compression ratio for N_2	$> 1 \cdot 10^{11}$	$> 1 \cdot 10^{11}$	$> 1 \cdot 10^{11}$
Gas throughput at full rotational speed for Ar	3.5 hPa l/s	3.5 hPa l/s	3.5 hPa l/s
Gas throughput at full rotational speed for He	20 hPa l/s	20 hPa l/s	20 hPa l/s
Gas throughput at full rotational speed for H_2	> 14 hPa l/s	> 14 hPa l/s	> 14 hPa l/s
Gas throughput at full rotational speed for N_2	6.5 hPa l/s	6.5 hPa l/s	6.5 hPa l/s
Fore-vacuum max. for Ar	11 hPa	11 hPa	11 hPa
Fore-vacuum max. for H_2	6 hPa	6 hPa	6 hPa

Parameter	HiPace® 700	HiPace® 700	HiPace® 700
Fore-vacuum max. for He	11 hPa	11 hPa	11 hPa
Fore-vacuum max. for N_2	11 hPa	11 hPa	11 hPa
Run-up time	2 min	2 min	2 min
Ultimate pressure according to PNEUROP	< 1 · 10^{-7} hPa	< 5 · 10^{-10} hPa	< 1 · 10^{-7} hPa
Rotation speed ± 2 %	49200 min^{-1}	49200 min^{-1}	49200 min^{-1}
Rotation speed variable	60-100 %	60-100 %	60-100 %
Power characteristic line in gas mode 1, vertex A	214/49200 W/min^{-1}	214/49200 W/min^{-1}	214/49200 W/min^{-1}
Power characteristic line in gas mode 1, vertex B	240/42000 W/min^{-1}	240/42000 W/min^{-1}	240/42000 W/min^{-1}
Power characteristic line in gas mode 0, vertex C	200/49200 W/min^{-1}	200/49200 W/min^{-1}	200/49200 W/min^{-1}
Power characteristic line in gas mode 0, vertex D	200/42000 W/min^{-1}	200/42000 W/min^{-1}	200/42000 W/min^{-1}
Power characteristic line in gas mode 2, vertex E	340/49200 W/min^{-1}	340/49200 W/min^{-1}	340/49200 W/min^{-1}
Power characteristic line in gas mode 2, vertex F	350/46800 W/min^{-1}	350/46800 W/min^{-1}	350/46800 W/min^{-1}
Sound pressure level	≤ 50 dB (A)	≤ 50 dB (A)	≤ 50 dB (A)
Relative humidity of air	5–85, non-condensing %	5–85, non-condensing %	5-85, non-condensing %
Protection category	IP54	IP54	IP 54
Connection pressure max. for venting/sealing gas valve	1500 hPa	1500 hPa	1500 hPa
Operating voltage	48 (± 5 %) V DC	48 (± 5 %) V DC	48 (± 5 %) V DC
Operating voltage power supply	90-265 V AC	90-265 V AC	90-265 V AC
Integral leak rate	< 1 · 10^{-8} Pa m^3/s	< 1 · 10^{-8} Pa m^3/s	< 1 · 10^{-8} Pa m^3/s
Power consumption max.	400 W	400 W	400 W
Current consumption max.	8.4 A	8.4 A	8.4 A
Shipping and storage temperature	-25-+55 °C	-25-+55 °C	-25-+55 °C
Mounting orientation	in any orientation	in any orientation	in any orientation
Venting connection	G 1/8"	G 1/8"	G 1/8"
Weight	11.5 kg	17.4 kg	12.1 kg
Cooling method, standard	Water	Water	Water
Cooling method, optional	Air	Air	Air
Cooling water temperature	15-35 °C	15-35 °C	15-35 °C
Cooling water consumption	100 l/h	100 l/h	100 l/h
Permissible irradiated thermal power max.	4.2 W	4.2 W	4.2 W
Permissible magnetic field max.	6 mT	6 mT	6 mT
Interfaces	RS-485, Remote	RS-485, Remote	RS-485, Remote

13.3 Differences at HiPace 700, 24 V DC

Parameter	HiPace® 700	HiPace® 700	HiPace® 700
Flange (in)	DN 160 ISO-K	DN 160 CF-F	DN 160 ISO-F
Run-up time	4 min	4 min	4 min
Operating voltage	24 (± 5 %) V DC	24 (± 5 %) V DC	24 (± 5 %) V DC
Power consumption max.	300 W	300 W	300 W
Current consumption max.	12.5 A	12.5 A	12.5 A

13.4 Dimensions

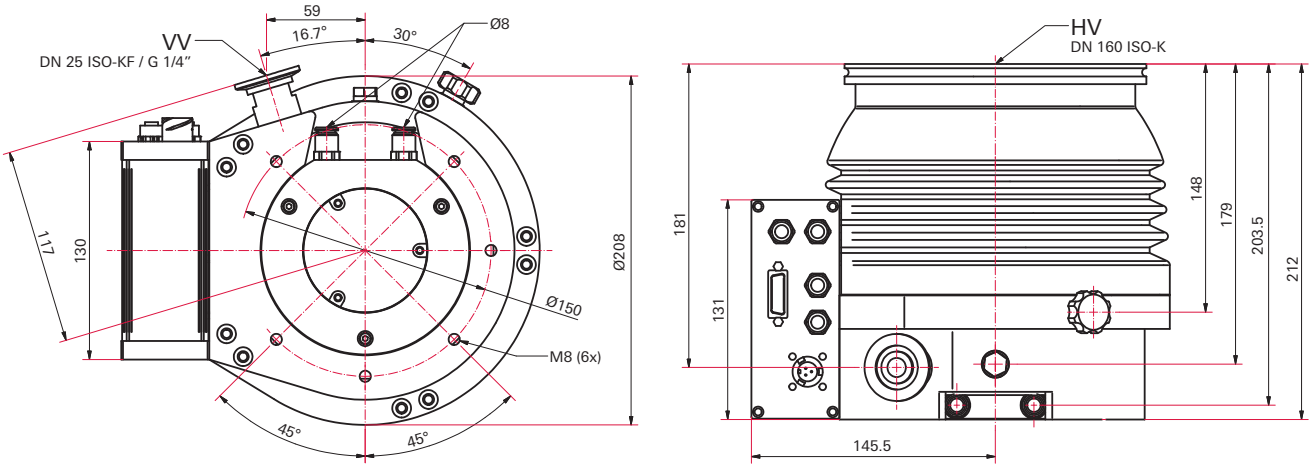


Fig. 15: HiPace 700, DN 160 ISO-K

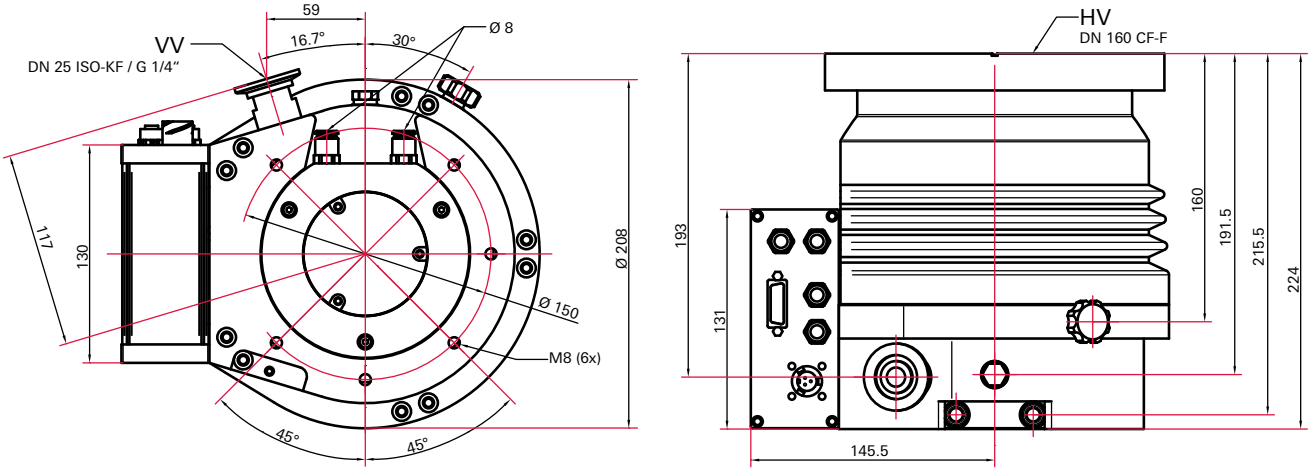


Fig. 16: HiPace 700, DN 160 CF-F

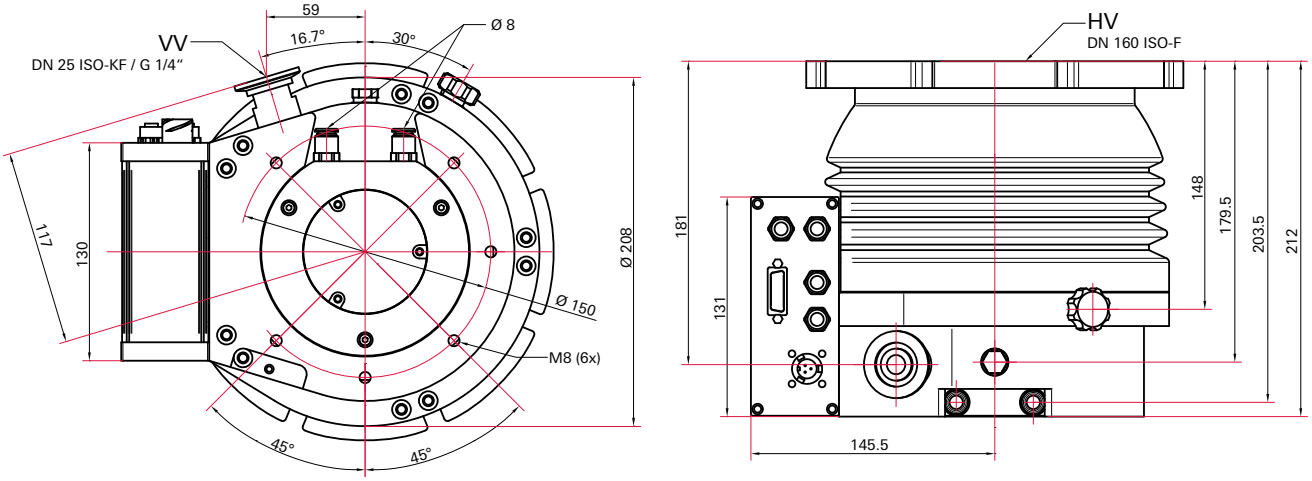


Fig. 17: HiPace 700, DN 160 ISO-F

Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions according to the following **EC directives**:

- **Machinery 2006/42/EC (Annex II, no. 1 A)**
- **Electromagnetic Compatibility 2014/30/EU**

The agent responsible for compiling the technical documentation is Mr. Helmut Bernhardt, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Aßlar.

HiPace 700

Harmonised standards and national standards and specifications which have been applied:

DIN EN ISO 12100 : 2011-03
DIN EN 1012-2 : 1996
DIN EN 61000-3-2 : 2010
DIN EN 61000-3-3 : 2009
DIN EN 61010-1 : 2010
DIN EN 61326-1 : 2013
DIN EN 62061 : 2013

Signature:



Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Dr. Ulrich von Hülsen)
Managing Director

2016-04-21

PFEIFFER VACUUM

VACUUM SOLUTIONS FROM A SINGLE SOURCE

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

COMPLETE RANGE OF PRODUCTS

From a single component to complex systems:
We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE

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