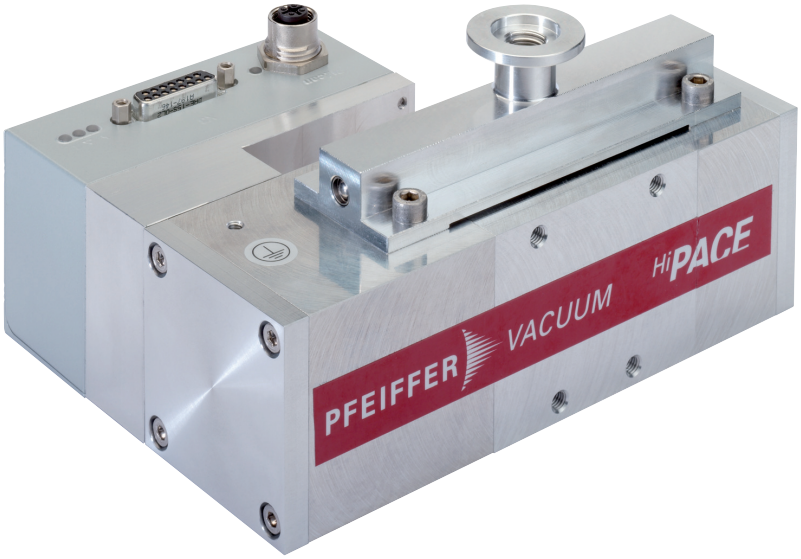

OPERATING INSTRUCTIONS

EN

Translation of the Original

HIPACE 10 ▶

Turbopump

PFEIFFER VACUUM

Dear Customer,

Thank you for choosing a Pfeiffer Vacuum product. Your new turbopump is designed to support you by its performance, its perfect operation and without interfering your individual application. The name Pfeiffer Vacuum stands for high-quality vacuum technology, a comprehensive and complete range of top-quality products and first-class service. With this expertise, we have acquired a multitude of skills contributing to an efficient and secure implementation of our product.

Knowing that our product must not interfere with your actual work, we are convinced that our product offers you the solution that supports you in the effective and trouble-free execution of your individual application.

Please read these operating instructions before putting your product into operation for the first time. If you have any questions or suggestions, please feel free to contact info@pfeiffer-vacuum.de.

Further operating instructions from Pfeiffer Vacuum can be found in the Download Center on our website.

Disclaimer of liability

These operating instructions describe all models and variants of your product. Note that your product may not be equipped with all features described in this document. Pfeiffer Vacuum constantly adapts its products to the latest state of the art without prior notice. Please take into account that online operating instructions can deviate from the printed operating instructions supplied with your product.

Furthermore, Pfeiffer Vacuum assumes no responsibility or liability for damage resulting from the use of the product that contradicts its proper use or is explicitly defined as foreseeable misuse.

Copyright

Table of contents

List of tables

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1 About this manual ▶

IMPORTANT
Read carefully before use.
Keep the manual for future consultation.

1.1 Validity ▶

This operating instructions is a customer document of Pfeiffer Vacuum. The operating instructions describe the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in this operating instructions refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

1.1.1 Applicable documents ▶

Document	Number
Electronic drive unit TC 110. standard	PT 0204 BN
Electronic drive unit TC 110 PB, profibus	PT 0245 BN
Electronic drive unit TC 110 RS	PT 0351 BN
Declaration of conformity	A component of these instructions

1.1.2 Variants ▶

- HiPace 10, DN 25, TC 110

1.2 Target group ▶

These operating instructions are aimed at all persons performing the following activities on the product:

- Transportation
- Setup (Installation)
- Usage and operation
- Decommissioning
- Maintenance and cleaning
- Storage or disposal

The work described in this document is only permitted to be performed by persons with the appropriate technical qualifications (expert personnel) or who have received the relevant training from Pfeiffer Vacuum.

1.3 Conventions ▶

1.3.1 Pictographs ▶

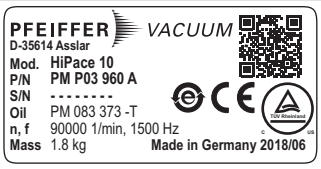
Pictographs used in the document indicate useful information.

Note

Tip

1.3.2 Stickers on the product ▶

This section describes all the stickers on the product along with their meanings.

	**Rating plate** (example) The rating plate is located beneath the high vacuum connection and to the left of the TC adapter.
	**Warranty seal** The product is sealed ex-factory. Damaging or removing a warranty seal results in loss of the warranty.
	**Operating instructions note** This sticker indicates that this operating instructions must be read before performing any tasks.
	**Protection class** The sticker describes protection class III for the product. Its placement indicates the position for the ground connection.
	**Warning** This sticker warns against risk of injury with the high vacuum connection open.

Tbl. 1: Stickers on the product

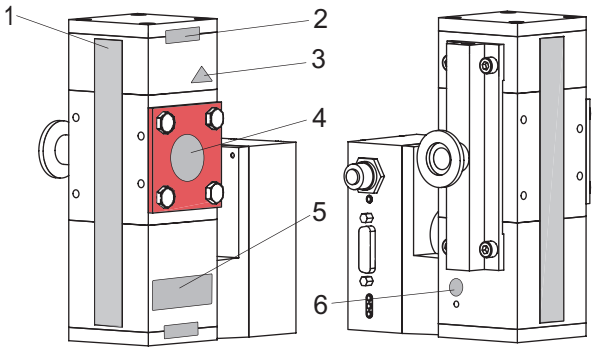


Fig. 1: Position of the stickers on the product ▶

1 Banner with Pfeiffer Vacuum logo
2 Warranty seal
3 Warning sign "Risk of injury with high vacuum connection open"
4 Operating instructions note
5 Rating plate
6 Information regarding ground connection

1.3.3 Abbreviations ▶

Abbreviation	Meaning in this document
d	Diameter value (in mm)
DC	Direct current
DCU	Display Control Unit (Pfeiffer Vacuum display and control unit).
DN	Nominal diameter as size description
f	Rotation speed value of a vacuum pump (frequency, in rpm or Hz)
HPU	Handheld Programming Unit. Aid for control and monitoring of pump parameters
HV	High vacuum flange, high vacuum side
ISO	Flange: Connector in accordance with ISO 1609 and ISO 2861
LED	Illuminating diode
PE	Earthed conductor (protective earth)

Abbreviation	Meaning in this document
[P:xxx]	Electronic drive unit control parameters. Printed in bold as three-digit number in square brackets. Frequently displayed in conjunction with a short description. Example: **[P:312]** software version
S1	S1 switch on power supply pack
T	Temperature (in °C)
TC	Turbopump electronic drive unit (turbo controller)
TCS	Interface adapter
RS-485	Communications interface
TPS	Voltage supply (turbo power supply)
VV	Fore-vacuum flange, fore-vacuum connection
X3	15-pole D-Sub connecting socket on the turbopump electronic drive unit

Tbl. 2: Abbreviations used in this document

1.3.4 Instructions in the text ►

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by an individual step or multi-part action steps.

Individual action step

A horizontal, solid triangle indicates the only step in an action.

► This is an individual action step.

Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

1. Step 1
2. Step 2
3. ...

1.4 Trademark proof ►

- Torx® is a registered trading name of ACUMENT INTELLECTUAL PROPERTIES, LLC.
- Profibus® is a registered trading name of Profibus Nutzerorganisation e.V.

2 Safety ▶

2.1 General safety information ▶

The following 4 risk levels and 1 information level are taken into account in this document.

⚠ DANGER

Immediately pending danger

Indicates an immediately pending danger that will result in death or serious injury if not observed.

► Instructions to avoid the danger situation

⚠ WARNING

Potential pending danger

Indicates a pending danger that could result in death or serious injury if not observed.

► Instructions to avoid the danger situation

⚠ CAUTION

Potential pending danger

Indicates a pending danger that could result in minor injuries if not observed.

► Instructions to avoid the danger situation

NOTICE

Danger of damage to property

Is used to highlight actions that are not associated with personal injury.

► Instructions to avoid damage to property

Notes, tips or examples indicate important information about the product or about this document.

2.2 Safety instructions ▶

All safety instructions in this document are based on the results of the risk assessment carried out in accordance with Machinery Directive 2006/42/EC Annex I and EN ISO 12100 Section 5. Where applicable, all life cycle phases of the product were taken into account.

Risks during transport

⚠ WARNING ▶

Danger of serious injury due to falling objects

Due to falling objects there is a risk of injuries to limbs through to broken bones.

► Take particular care and pay special attention when transporting products manually.
► Do not stack the products.
► Wear protective equipment, e.g. safety shoes.

Risks during installation

⚠ DANGER ▶

Danger to life from electric shock

Power supply packs that are not specified or are not approved will lead to severe injury to death.

- ▶ Make sure that the power supply pack meets the requirements for double isolation between mains input voltage and output voltage, in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Make sure that the power supply pack meets the requirements in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Where possible, use original power supply packs or only power supply packs that correspond with the applicable safety regulations.

⚠ WARNING ▶

Risk of cuts on moving, sharp-edged parts when reaching into the open high vacuum flange

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips). There is a risk of hair and loose clothing being drawn in. Objects falling in destroy the turbopump during subsequent operation.

- ▶ Only remove the original protective covers immediately prior to connecting the high vacuum flange.
- ▶ Do not reach into the high vacuum connection.
- ▶ Wear protective gloves during installation.
- ▶ Do not start the turbopump with open vacuum connections.
- ▶ Always carry out the mechanical installation before electrical connection.
- ▶ Prevent access to the high vacuum connection of the turbopump from the operator side (e.g. open vacuum chamber).

⚠ WARNING ▶

Danger to life from poisoning where toxic process media leak from damaged connections

Sudden twisting of the turbopump in the event of a fault causes fittings to accelerate. There is the risk of damaging on-site connections (e.g., fore-vacuum line) and resulting leaks. This results in leakage of process media. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Keep masses connected to the turbopump as low as possible.
- ▶ Use flexible lines to connect to the turbopump where necessary.

⚠ WARNING ▶

Risk of danger to life through missing mains disconnection device

The vacuum pump and electronic drive unit are **not** equipped with a mains disconnection device (mains switch).

- ▶ Install a mains disconnection device according to SEMI-S2.
- ▶ Install a circuit breaker with an interruption rating of at least 10,000 A.

⚠ WARNING ▶

Risk of injury due to incorrect installation

Dangerous situations may arise from unsafe or incorrect installation.

- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Ensure the integration into an Emergency Off safety circuit.

Risks during operation

⚠ WARNING ▶

Danger to life from electric shock in the event of a fault

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

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

⚠ WARNING ▶

Danger of cut injuries from unexpected start up.

The use of mating plugs of the electronic drive unit (accessories) enables the automatic run-up of the vacuum pump as soon the power is turned on. Attaching mating plugs before or during the installation leads to the movement of parts hence the risk of cut injuries by sharp-edged in the exposed high vacuum flange.

- ▶ Only connect mating plugs after the mechanical installation.
- ▶ Only switch on the vacuum pump immediately prior to operation.

⚠ WARNING ▶

Risk of serious injury in the event of vacuum pump destruction due to over pressure

Gas entry with very high over pressure results in destruction of the vacuum pump. There is a risk of serious injury due to ejected objects.

- ▶ Never exceed the permissible 1500 hPa (absolute) inlet pressure on the suction side or the venting and sealing gas connection.
- ▶ Make sure that high, process-related over pressures cannot directly enter the vacuum pump.

⚠ WARNING ▶

Risk of burns on hot surfaces when using additional equipment for heating during operation

The use of additional equipment for heating the vacuum pump or for optimizing the process generates very high temperatures on surfaces that can be touched. There is a risk of burning.

- ▶ If necessary, set up a contact guard.
- ▶ If necessary, apply the warning stickers provided for this at the danger points.
- ▶ Ensure adequate cooling down before working on the vacuum pump or in its vicinity.
- ▶ Wear protective equipment, e.g., gloves.

Risks during maintenance and decommissioning

⚠ WARNING ▶

Danger to life from electric shock during maintenance and service work

The device is only completely de-energized when the mains plug has been disconnected and the turbopump is at a standstill. There is a danger to life from electric shock when making contact with live components.

- ▶ Before performing all work, switch off the main switch.
- ▶ Wait until the turbopump comes to a standstill (rotation speed =0).
- ▶ Remove the mains plug from the device.
- ▶ Secure the device against unintentional restarting.

⚠ WARNING ▶

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

⚠ WARNING ▶

Risk of poisoning from contact with harmful substances

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

- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Prevent health hazards or environmental impacts with adequate safety precautions.
- ▶ Observe the operating fluid safety data sheet.
- ▶ Dispose of the operating fluid reservoir according to applicable regulations.

Risks in the event of malfunctions

⚠ WARNING ▶

Danger to life from the turbopump breaking away in the event of a fault

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. If the turbopump is **not** properly secured, it can shear off. The energy that this would release could throw the entire turbopump or shattered pieces from its interior through the surrounding space. Potentially dangerous gases can escape. There is a risk of very serious injuries, including death, and extensive property damage.

- ▶ Follow the installation instructions for this turbopump.
- ▶ Observe the requirements regarding stability and design of the counter flange.
- ▶ Use only original accessories or fixing material approved by Pfeiffer Vacuum for the installation.

⚠ WARNING ▶

Danger to life from poisoning where toxic process media leak from damaged connections

Sudden twisting of the turbopump in the event of a fault causes fittings to accelerate. There is the risk of damaging on-site connections (e.g., fore-vacuum line) and resulting leaks. This results in leakage of process media. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Keep masses connected to the turbopump as low as possible.
- ▶ Use flexible lines to connect to the turbopump where necessary.

2.3 Safety precautions ▶

Duty to provide information on potential dangers ▶

The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.

Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety-related parts of this document.

Infringement of conformity due to modifications to the product ▶

The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

General safety precautions when handling the product

- ▶ Observe all applicable safety and accident prevention regulations.
- ▶ Check that all safety measures are observed at regular intervals.
- ▶ Do not expose body parts to the vacuum.
- ▶ Always ensure a secure connection to the earthed conductor (PE).
- ▶ Never disconnect plug connections during operation.
- ▶ Observe the above shutdown procedures.
- ▶ Before working on the high vacuum connection, wait until the rotor has stopped completely (rotation speed f = 0).
- ▶ Never put the device into operation with the high vacuum connection open.
- ▶ Keep lines and cables away from hot surfaces (> 70°C).
- ▶ Never fill or operate the unit with cleaning agents or cleaning agent residues.
- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Observe the unit protection class prior to installation or operation in other environments.

2.4 Limits of use of the product ▶

Installation location	weatherproof (internal space)
Air pressure	770 hPa to 1060 hPa
Installation altitude	max. 5000 m
Rel. air humidity	max. 80%, at T <31°C, up to max. 50% at T <40°C
Protection class	III
Excess voltage category	II
Permissible protection degree	IP54
Degree of contamination	2
Ambient temperature	5 °C to 35 °C
Permissible surrounding magnetic field	3 mT
Maximum irradiated thermal output	0.6 W
Maximum permissible rotor temperature of the turbopump	90°C
Maximum permissible bakeout temperature at the high vacuum flange	120°C

Tbl. 3: Permissible ambient conditions

Notes on ambient conditions ▶

The specified permissible ambient temperatures apply to operation of the turbopump at maximum permissible backing pressure or at maximum gas throughput, depending on the cooling type. The turbopump is intrinsically safe thanks to redundant temperature monitoring.

- The reduction in backing pressure or gas throughput permits operation of the turbopump at higher ambient temperatures.
- If the maximum permissible operating temperature of the turbopump is exceeded, the electronic drive unit first reduces the drive output and then switches it off where necessary.

2.5 Proper use ▶

- ▶ Use the turbopump only for generating vacuum.
- ▶ Use the turbopump only in combination with a suitable backing pump that can deliver up to the required maximum fore-vacuum pressure.
- ▶ Use the turbopump only in closed indoor areas.
- ▶ Use the turbopump only for the evacuation of dry and inert gases.

2.6 Foreseeable improper use ▶

Improper use of the product invalidates all warranty and liability claims. Any use that is counter to the purpose of the product, whether intentional or unintentional, is regarded as misuse, in particular:

- Establishing the voltage supply without correct installation
- Installation with non-specified fastening material
- Pumping explosive media
- Pumping of corrosive media
- Pumping of condensing vapors
- Pumping of fluids
- Pumping of dust
- Operation with impermissible high gas throughput
- Operation with impermissible high fore-vacuum pressure
- Operation with excessively high irradiated heat output
- Operation in impermissible high magnetic fields
- Operation in an incorrect gas mode
- Venting with impermissible high venting rates
- Use for pressure generation
- Use in areas with ionizing radiation
- Operation in explosion-hazard areas
- Use in systems in which sporadic loads and vibrations or periodic forces act on the device
- The causing of hazardous operating conditions by a presetting on the electronic drive unit that is contrary to the process
- Use of accessories or spare parts that are not listed in these instructions

2.7 Personnel qualification ▶

The work described in this document may only be carried out by persons who have appropriate professional qualifications and the necessary experience or who have completed the necessary training as provided by Pfeiffer Vacuum.

Training people

1. Train the technical personnel on the product.
2. Only let personnel to be trained work with and on the product when under the supervision of trained personnel.
3. Only allow trained technical personnel to work with the product.
4. Before starting work, make sure that the commissioned personnel have read and understood these operating instructions and all applicable documents, in particular the safety, maintenance and repair information.

2.7.1 Ensuring personnel qualification

Specialist for mechanical work

Only a trained specialist may carry out mechanical work. Within the meaning of this document, specialists are people responsible for construction, mechanical installation, troubleshooting and maintenance of the product, and who have the following qualifications:

- Qualification in the mechanical field in accordance with nationally applicable regulations
- Knowledge of this documentation

Specialist for electrotechnical work

Only a trained electrician may carry out electrical engineering work. Within the meaning of this document, electricians are people responsible for electrical installation, commissioning, troubleshooting, and maintenance of the product, and who have the following qualifications:

- Qualification in the electrical engineering field in accordance with nationally applicable regulations
- Knowledge of this documentation

In addition, these individuals must be familiar with applicable safety regulations and laws, as well as the other standards, guidelines, and laws referred to in this documentation. The above individuals must have an explicitly granted operational authorization to commission, program, configure, mark, and earth devices, systems, and circuits in accordance with safety technology standards.

Trained individuals
Only adequately trained individuals may carry out all works in other transport, storage, operation and disposal fields. Such training must ensure that individuals are capable of carrying out the required activities and work steps safely and properly.

2.7.2 Personnel qualification for maintenance and repair

Advanced training courses
Pfeiffer Vacuum offers advanced training courses to maintenance levels 2 and 3.

Adequately trained individuals are:

- **Maintenance level 1**
  - Customer (trained specialist)
- **Maintenance level 2**
  - Customer with technical education
  - Pfeiffer Vacuum service technician
- **Maintenance level 3**
  - Customer with Pfeiffer Vacuum service training
  - Pfeiffer Vacuum service technician

2.7.3 Advanced training with Pfeiffer Vacuum

For optimal and trouble-free use of this product, Pfeiffer Vacuum offers a comprehensive range of courses and technical trainings.

For more information, please contact Pfeiffer Vacuum technical training.

3 Product description ▶

3.1 Identifying the product ▶

- ▶ To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.
- ▶ Learn about certifications through test seals on the product or at www.certipedia.com with company ID no. 000021320.

3.1.1 Product types ▶

The product designation of Pfeiffer Vacuum turbopumps from the HiPace series is composed of the family name, the size (which is based on the pumping speed of the vacuum pump) and, if required, an additional feature description.

Family	Size/model	Property, attribute, feature
HiPace	10 to 2800	**none** = Standard version
		mini = Compact version
		U = Overhead version
		C = Corrosive gas version
		P = Process
		M = Active magnetic bearing
		T = Temperature management
		Plus = Low vibration, low magnetic field
		E = High efficiency
		H = High compression
		I = Ion implantation

Tbl. 4: Product designation of Pfeiffer Vacuum HiPace turbopumps

3.1.2 Product features ▶

Feature	Version	
HV flange	DN 25	DN 40
Flange material	Aluminium	
Operating fluid reservoir	Pump article number ≤ index "B": Operating fluid **TL 011**	
	Pump article number ≥ index "C": Operating fluid **TL 022**	

Tbl. 5: Turbopump features

3.2 Functional properties ▶

The turbopump forms a compact unit with the electronic drive unit TC 110. The Pfeiffer Vacuum power supply packs serve as voltage supply.

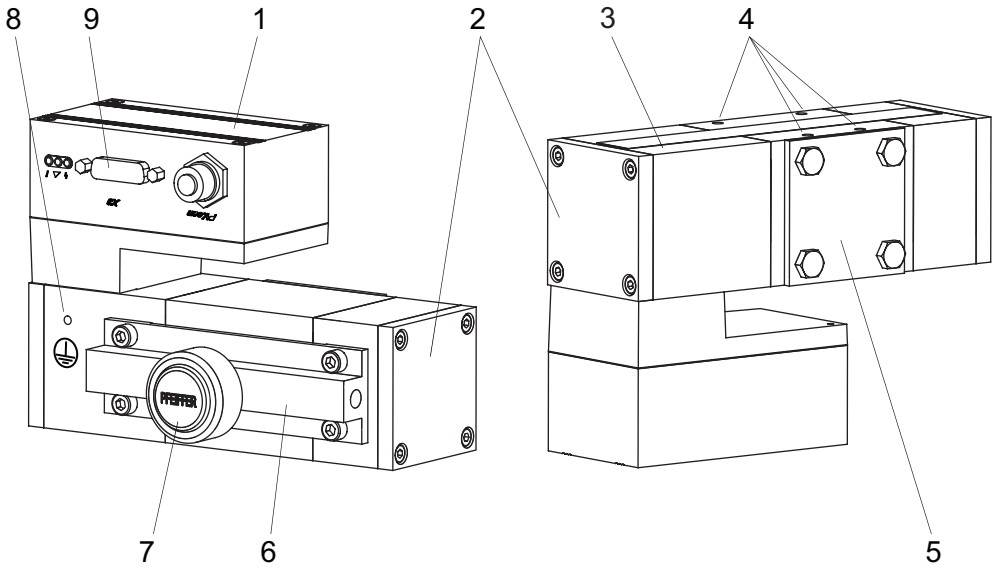


Fig. 2: HiPace 10 design ▶

1 Electronic drive unit TC 110
2 Screw caps (Bearing sides)
3 Pump housing
4 Fixing holes
5 Protective cover (high vacuum connection)
6 Fore-vacuum connection adapter
7 Protective cover (fore-vacuum coonection)
8 Ground terminal
9 Multifunction connection "*X3*"

3.2.1 Cooling ▶

- Convection cooling

The electronic drive unit automatically regulates the drive power down in the event of excessive temperatures.

3.2.2 Rotor bearing ▶

Ball bearing-mounted turbopump

- One ball bearing is fitted at each shaft end in the fore-vacuum area respectively.

Permanent lubrication and performance of the ball bearings is ensured by two operating fluid reservoirs.

3.2.3 Drive ▶

Various connection panels are available for the integrated electronic drive unit, depending on the respective application:

- TC 110 in standard design
- TC 110 PB for Profibus
- TC 110 RS with RS-485 interface

3.3 Shipment ▶

- Turbopump with electronic drive unit
- Protective cover for the high vacuum connection
- Protective cover for the fore-vacuum connection
- Operating instructions

4 Transportation and Storage ▶

4.1 Transport ▶

⚠ WARNING ▶

Danger of serious injury due to falling objects

Due to falling objects there is a risk of injuries to limbs through to broken bones.

- ▶ Take particular care and pay special attention when transporting products manually.
- ▶ Do not stack the products.
- ▶ Wear protective equipment, e.g. safety shoes.

We recommend

Pfeiffer Vacuum recommends keeping the transport packaging and original protective cover.

Instructions for safe transport

- ▶ Transport the turbopump only within the permissible temperature limits.
- ▶ Observe weight specified on the rating plate.
- ▶ Where possible, always transport or ship the turbopump in its original packaging.
- ▶ Always carry the turbopump with both hands.
- ▶ Remove the protective cover only immediately prior to installation.

4.2 Storage ▶

We recommend

Pfeiffer Vacuum recommends storing the products in their original transport packaging.

Storing the turbopump

1. Seal all flange openings with the original protective caps.
2. Seal all other connections (e.g. venting connection) with the corresponding original parts.
3. Store the turbopump only indoors within the permissible temperature limits.
4. In rooms with humid or aggressive atmospheres: Hermetically seal the turbopump together with a drying agent in a plastic bag.

5 Installation ▶

The installation of the turbopump and its fastening is of outstanding importance. The rotor of the turbopump revolves at very high speed. In practice it is not possible to exclude the risk of the rotor touching the stator (e.g. due to the penetration of foreign bodies into the high vacuum connection). The kinetic energy released acts on the housing and on the anchoring of the turbopump within fractions of a second.

Comprehensive tests and calculations conforming to ISO 27892 confirm the safety of the turbopump both against crashes (destruction of the rotor blade) and against bursting (breakage of the rotor shaft). The experimental and theoretical results are expressed in safety measures and recommendations for the correct and safe fastening of the turbopump.

5.1 Preparatory work ▶

⚠ WARNING ▶

Risk of cuts on moving, sharp-edged parts when reaching into the open high vacuum flange

With the high vacuum flange open, access to sharp-edged parts is possible. A manual rotation of the rotor increases the danger situation. There is the risk of cuts, up to the separation of body parts (e.g. fingertips). There is a risk of hair and loose clothing being drawn in. Objects falling in destroy the turbopump during subsequent operation.

- ▶ Only remove the original protective covers immediately prior to connecting the high vacuum flange.
- ▶ Do not reach into the high vacuum connection.
- ▶ Wear protective gloves during installation.
- ▶ Do not start the turbopump with open vacuum connections.
- ▶ Always carry out the mechanical installation before electrical connection.
- ▶ Prevent access to the high vacuum connection of the turbopump from the operator side (e.g. open vacuum chamber).

General notes for the installation of vacuum components ▶

- ▶ Choose an installation location that permits access to the product and to supply lines at all times.
- ▶ Observe the ambient conditions given for the limits of use.
- ▶ Provide the highest possible level of cleanliness during assembly.
- ▶ Ensure that flange components during installation are grease-free, dust-free and dry.

Select the installation location

1. Observe the instructions for transport to the installation location.
2. Make sure that there are sufficient cooling options for the turbopump.
3. Install suitable shielding if the surrounding magnetic fields exceed the permissible levels.
4. Install suitable shielding so that the irradiated thermal output does not exceed the permissible values when high temperatures occur due to the process.
5. Observe the permissible temperatures for the vacuum connection.

5.2 Connecting the high vacuum side ▶

5.2.1 Requirements for the dimensioning of a counter flange ▶

NOTICE ▶

Risk of damage due to incorrect counter flange design

Unevenness on the operator-side counter flange results in stresses in the vacuum pump housing, even when properly attached. This can produce leakage or negative changes in running characteristics.

- ▶ Adhere to the shape tolerances for the counter flange.
- ▶ Observe the maximum flatness deviations over the entire surface.

The assembly of vertical superstructural parts on the high vacuum connection is the responsibility of the operating company. The loading capacity of the high vacuum flange is specific for the turbopump used. The total weight of superstructural parts must not exceed the maximum values specified.

If the rotor is suddenly blocked, the torques arising from the system and the high vacuum flange must be absorbed. The installation elements for turbo pumps are special designs by Pfeiffer Vacuum.

Maximum torque occurring in the event of a burst[1)]	Maximum permissible axial load on the high vacuum flange[2)]	Flatness	Minimum tensile strength of the flange material in all operating conditions	Engagement depth of the fixing screws	Maximum permissible surrounding magnetic field	Maximum permissible irradiated thermal output
80 Nm	200 N (equivalent to 20 kg)	± 0.05 mm	170 N/mm²	2.5 x d	3.0 mT	0.6 W
			270 N/mm²	1.5 x d		

Tbl. 6: Requirements for the dimensioning of customer-specific high vacuum connection

5.2.2 Consider the earthquake protection ▶

NOTICE ▶

Vacuum pump damage caused by external vibrations

In the event of earthquakes or other external vibrations, there is the risk of the rotor coming into contact with the safety bearings, or the housing wall touching the turbopump. This can produce mechanical loads up to and including destruction of the turbopump.

- ▶ Make sure that all flange and safety connections absorb the resulting forces.
- ▶ Secure the vacuum chamber against displacement or tipping.

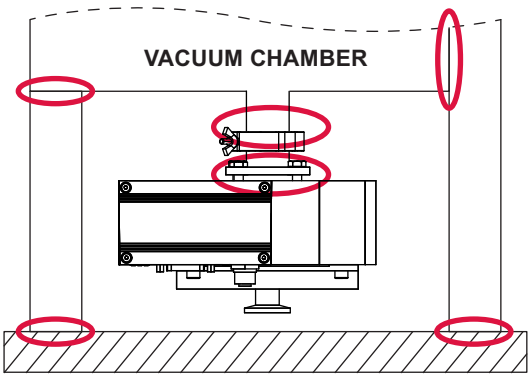


Fig. 3: Example: Secure against displacement and tipping caused by external vibrations ▶

Safety connection, customer-side

5.2.3 Using a mesh screen ▶

Pfeiffer Vacuum centering rings with mesh screen in the high vacuum flange protect the turbopump against foreign matter from the chambers. The pumping speed of the turbopump reduces according to the passage guide values and the size of the high vacuum flange.

1) The theoretically calculated torque in the event of a burst (rotor shaft breakage) according to ISO 27892 was not reached in any experimental test.

2) A one-sided load is not permitted.

Flange size	Reduced pumping speed in % for the gas type			
	H_2	He	N_2	Ar
Mesh screen DN 25	3	8	27	47

Tbl. 7: Behavior of the pumping speed using a mesh screen

► Use centering rings with integrated mesh screen for ISO flanges.

5.2.4 Mounting orientations ►

Pfeiffer Vacuum turbopumps from the HiPace series are suitable for use with dry compressing backing pumps for mounting in **all** orientations.

► When using oil-sealed backing pumps, avoid backflow from the fore-vacuum range.

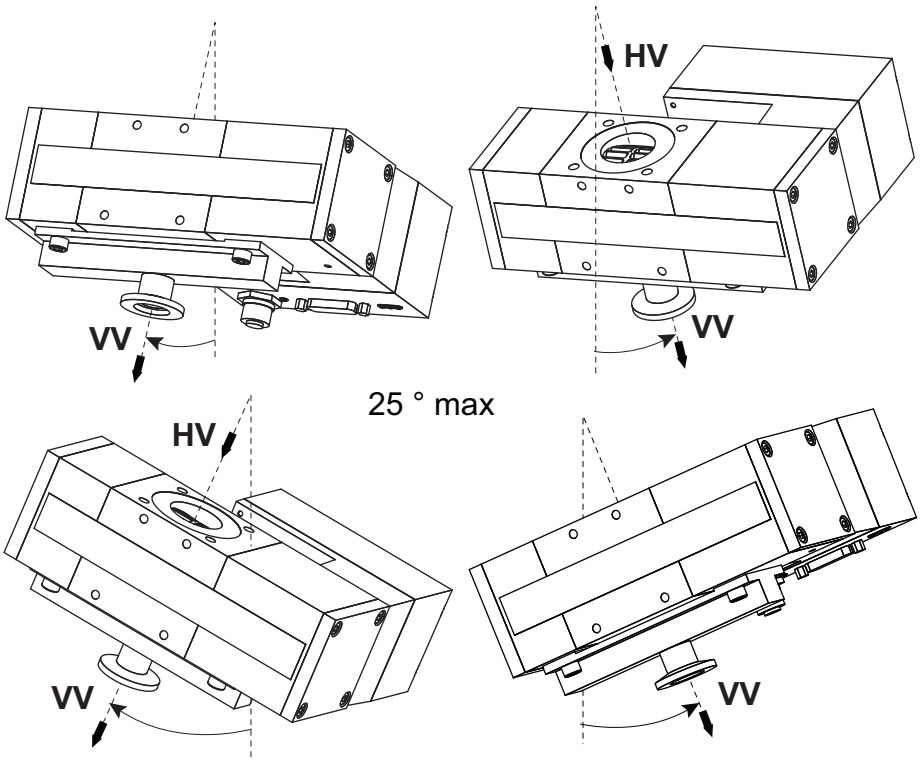


Fig. 4: Recommended alignment of the fore-vacuum connection when using oil-sealed backing pumps ►

Determine a horizontal mounting orientation of the turbopump with oil-sealed backing pumps

1. Always align the fore-vacuum connection downwards vertically.
   – Permissible deviation ±25°
2. Support the tube connections in front of the turbopump.
3. Do not allow any forces from the piping system to act on the turbopump.
4. Do not load the high vacuum flange of the turbopump on one side.

5.2.5 Attaching ISO-KF flange to DN 25 ►

ISO flange connections ►

For the connection of flanges in ISO-KF or ISO-K design, twisting may occur in the event of sudden blockage of the rotor, despite correct installation.

- Leak-tightness of the flange connection, however, is not jeopardized in this regard.

Required tools

- Open-end wrench, SW 10
- Calibrated torque wrench (tightening factor ≤ 1.6)

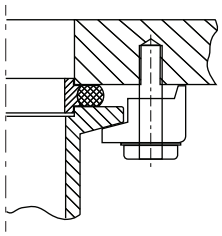


Fig. 5: Flange connection for DN 25 onto DN 25 ISO-KF ▶

Establishing the high vacuum connection

1. Use only the approved mounting kit from Pfeiffer Vacuum for connection.
2. Ensure that the sealing surfaces are clean and undamaged.
3. Connect the flange with the components of the mounting kit according to the figure.
   – Centering ring with mesh screen is optional.
4. Tighten the 4 screws crosswise in three stages.
   – Tightening torque: maximum **5 Nm ± 10 %**

5.3 Connecting the fore-vacuum side ▶

⚠ WARNING ▶

Danger to life from poisoning where toxic process media leak from damaged connections

Sudden twisting of the turbopump in the event of a fault causes fittings to accelerate. There is the risk of damaging on-site connections (e.g., fore-vacuum line) and resulting leaks. This results in leakage of process media. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Keep masses connected to the turbopump as low as possible.
- ▶ Use flexible lines to connect to the turbopump where necessary.

Suitable backing pump ▶

Use the turbopump only in combination with a suitable backing pump that can deliver up to the required maximum fore-vacuum pressure. To achieve the fore-vacuum pressure, use a suitable vacuum pump or a pumping station from the Pfeiffer Vacuum range.

In this case, the backing pump is also controlled directly via the turbopump electronic drive unit interfaces (e.g., relay box or connection cable).

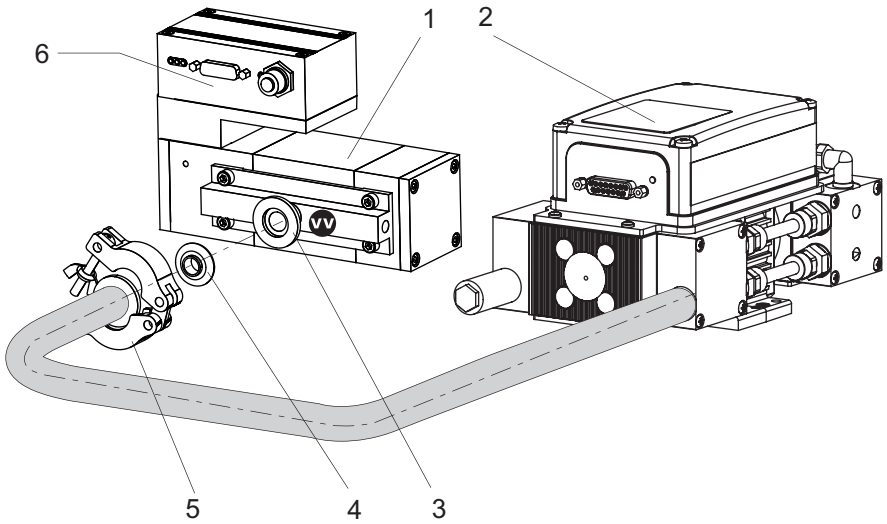


Fig. 6: Example of fore-vacuum connection on HiPace 10 ▶

1 Turbopump
2 Backing pump (MVP)
3 Fore-vacuum flange of turbopump
4 Centering ring
5 Circlip
6 TC 110

Procedure

1. Install a fore-vacuum connection with small flange components, e.g. connection elements and pipe components DN 16 ISO-KF from the Pfeiffer Vacuum range of components.
2. Choose a minimum fore-vacuum line cross section equal to the nominal diameter of the fore-vacuum flange.
3. With rigid pipe connections, include bellows to attenuate external vibrations.
4. Implement measures to counteract the backflow of operating fluids or condensate from the fore-vacuum area.
5. Observe the information in the operating manual of the backup pump or pumping station when connecting and operating it.

5.4 Connecting accessories ▶

Installation and operation of accessories ▶

Pfeiffer Vacuum offers a series of special, compatible accessories for its products.

- Information and ordering options for approved accessories for hybrid bearing turbopumps can be found online.

Connect accessory devices to the TC 110 ▶

- The use of Pfeiffer Vacuum accessories via the TC 110 electronic drive unit is only possible using the corresponding connection cable and/or adapter on the X3 multifunctional connection.
- Configure the required accessory output via RS-485 using Pfeiffer Vacuum display and control units or PC.

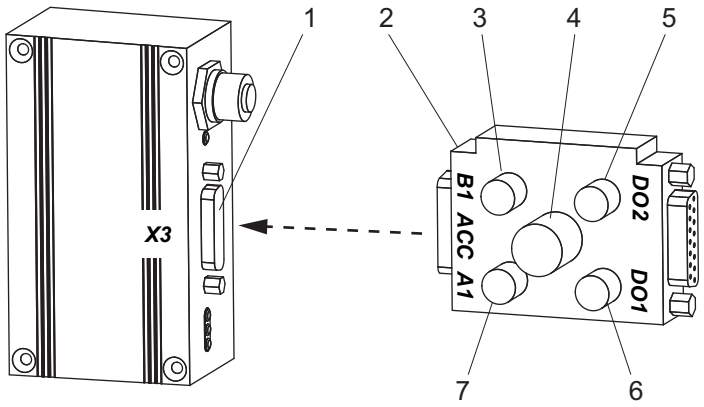


Fig. 7: Example of accessory connection via adapter TCS 12 ▶ ▶

1 Multifunction connection X3
2 Adapter TCS
3 Accessory connection B1
4 Connection RS-485
5 Digital output DO2
6 Digital output DO1
7 Accessory connection A1

Connecting pre-configured accessories

- ▶ Observe the installation instructions in the operating instructions for the relevant accessory.
- ▶ Note the existing configuration of existing connections and control lines.
- ▶ Connect only matching accessory devices to the electronic drive unit.

Using additional accessories

- ▶ Observe the installation instructions in the operating instructions for the relevant accessory.
- ▶ Note the existing configuration of existing connections and control lines.
- ▶ Use the Pfeiffer Vacuum display and control unit DCU 002, or a DCU with integrated power supply pack.

5.5 Connecting the electrical supply ▶

⚠ WARNING ▶

Risk of danger to life through missing mains disconnection device

The vacuum pump and electronic drive unit are **not** equipped with a mains disconnection device (mains switch).

- ▶ Install a mains disconnection device according to SEMI-S2.
- ▶ Install a circuit breaker with an interruption rating of at least 10,000 A.

⚠ WARNING ▶

Risk of injury due to incorrect installation

Dangerous situations may arise from unsafe or incorrect installation.

- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Ensure the integration into an Emergency Off safety circuit.

5.5.1 Grounding the vacuum pump ▶

Pfeiffer Vacuum recommends connecting a suitable grounding cable to discharge applicative interferences.

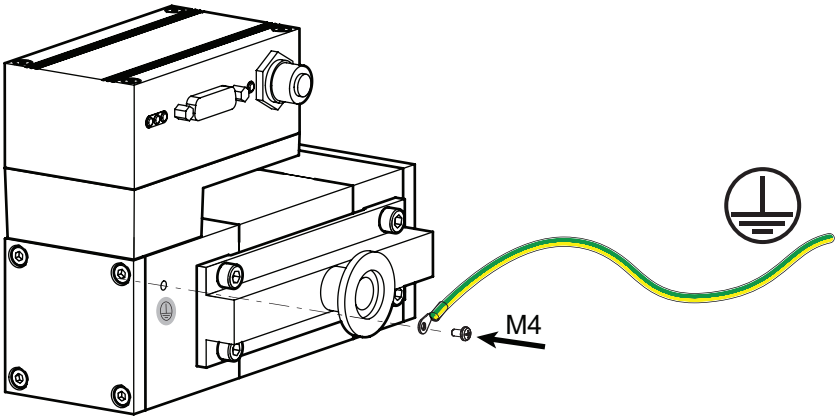


Fig. 8: Example: Connecting the grounding cable ▶

1. Use the turbopump ground terminal (M4 female thread).
2. Route the connection in accordance with locally applicable provisions.

5.5.2 Establishing the electric connection ▶

⚠ DANGER ▶

Danger to life from electric shock

Power supply packs that are not specified or are not approved will lead to severe injury to death.

- ▶ Make sure that the power supply pack meets the requirements for double isolation between mains input voltage and output voltage, in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Make sure that the power supply pack meets the requirements in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Where possible, use original power supply packs or only power supply packs that correspond with the applicable safety regulations.

⚠ WARNING ▶

Danger of cut injuries from unexpected start up.

The use of mating plugs of the electronic drive unit (accessories) enables the automatic run-up of the vacuum pump as soon the power is turned on. Attaching mating plugs before or during the installation leads to the movement of parts hence the risk of cut injuries by sharp-edged in the exposed high vacuum flange.

- ► Only connect mating plugs after the mechanical installation.
- ► Only switch on the vacuum pump immediately prior to operation.

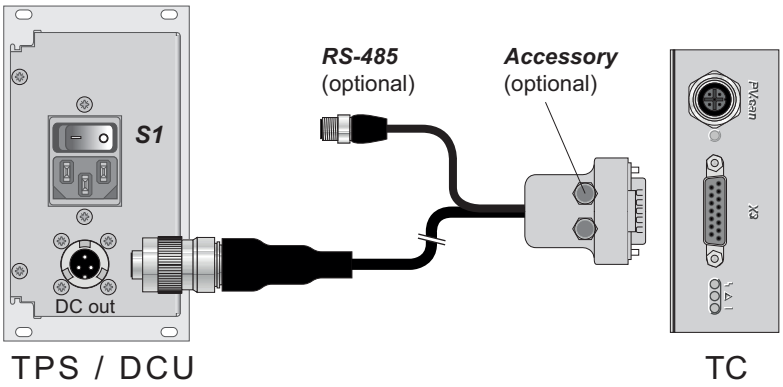


Fig. 9: Connecting the electronic drive unit to a power supply pack ▶

Original power supply packs (e.g. TPS 110 or DCU 110) and connection cable are available for electronic drive unit TC 110 voltage supply.

▶

Type of connection cable	Function
Connection cable with RS-485 interface and bridges from TC 110|TC 120 to power supply unit	• Power supply via power supply unit • Automatic startup via bridges on pins 2, 5, 7 • Connection to display and control unit via RS-485
Connection cable with RS-485 interface and accessory connections from TC 110|TC 120 to power supply unit	• Power supply via power supply unit • Connection of accessory devices with M8 plug • Connection to display and control unit via RS-485
Connection bridges from TC 110|TC 120 to power supply unit	• Power supply via power supply unit • Automatic startup via bridges on pins 2, 5, 7
Connection cable with bridges and accessory connections from TC 110|TC 120 to power supply unit	• Power supply via power supply unit • Automatic startup via bridges on pins 2, 5, 7 • Connection of accessory devices with M8 plug

Connecting the electronic drive unit

1. Make sure that you have the correct supply voltage.
2. Make sure that the “S1” power supply pack master switch is off prior to connection.
3. Plug the 15-pole connection cable plug into the "X3" connection on the electronic drive unit and secure it.
4. Plug the connecting socket with the bayonet catch into the “DC out” connection on the power supply pack, and lock it.
5. **When using a display and control unit:** Connect the “RS-485” connector of a suitable connection cable to the display and control unit.

6 Operation ▶

6.1 Commissioning ▶

Important settings and function-related variables are factory-programmed into the vacuum pump electronic drive unit as parameters. Each parameter has a three-digit number and a description. Parameter-driven operation and control is supported via Pfeiffer Vacuum displays and control units, or externally via RS-485 using Pfeiffer Vacuum protocol.

⚠ WARNING ▶

Danger of cut injuries from unexpected start up.

The use of mating plugs of the electronic drive unit (accessories) enables the automatic run-up of the vacuum pump as soon the power is turned on. Attaching mating plugs before or during the installation leads to the movement of parts hence the risk of cut injuries by sharp-edged in the exposed high vacuum flange.

- ▶ Only connect mating plugs after the mechanical installation.
- ▶ Only switch on the vacuum pump immediately prior to operation.

⚠ WARNING ▶

Danger to life from electric shock in the event of a fault

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

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

NOTICE ▶

Vacuum pump destruction due to excessive energy input during operation

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

- ▶ Consult Pfeiffer Vacuum before combining varying loads on the vacuum pump. Lower limit values apply.

NOTICE ▶

Turbopump destruction due to gases with too high molecular masses

The pumping of gases with impermissible high molecular masses leads to the destruction of the turbopump.

- ▶ Make sure that the gas mode is set correctly by **[P:027]** in the electronic drive unit.
- ▶ Consult Pfeiffer Vacuum before you use gases with higher molecular masses (> 80).

Parameter	Name	Designation	Adjustment, setting
[P:027]	GasMode	Gas mode	0 = heavy gases
[P:700]	RUTimeSVal	Set value run-up time	8 min.
[P:701]	SpdSwPt1	Rotation speed switch point 1	80 %
[P:707]	SpdSVal	Speed-control operation specification	65 %
[P:708]	PwrSVal	Set value power consumption	100 %
[P:720]	VentSpd	Venting at rotation speed, delayed venting	50 %
[P:721]	VentTime	Venting time, delayed venting	3600 sec.

Tbl. 8: Preconfigured setting values as shipped

Putting the turbopump into operation

- ▶ Provide the current supply for the power supply pack.

6.2 Operating modes ▶

The turbopump can be operated in different ways.

- Operation without control unit
- Operation via connection "X3"
- Operation via interface RS-485 and Pfeiffer Vacuum display and control unit or PC
- Operation via connection "E74"
- Operation via field bus

6.2.1 Operation without operating unit ▶

Automatic start ▶

The turbopump starts up immediately on bridging the pin 2, 5, 7 contacts on the "X3" connection or using the a connection cable "with bridges" and running the supply voltage.

Notes on operation without control unit

1. Only use the approved Pfeiffer Vacuum connection cables with bridges on the "X3" connection on the electronic drive unit.
2. Only switch on the power supply of the turbopump immediately before operation.

After applying the operating voltage, the electronic drive unit carries out a self-test to check the supply voltage. After completing the self-test successfully, the turbopump starts and activates connected additional equipment according to the configuration.

6.2.2 Operation via multi-function connection "X3" ▶

Remote control is available via the 15 Pole D-Sub connection with the “X3” designation on the electronic drive unit. The accessible individual functions are mapped to "PLC levels".

Instructions for remote control operation

▶ See the electronic drive unit operating instructions.

6.2.3 Operation via Pfeiffer Vacuum display and control unit ▶

The connection of a Pfeiffer Vacuum display and control panel permits the controlling of the turbopump via the parameters fixed in the electronic drive unit.

Instructions for operation with display and control unit

1. When handling the Pfeiffer Vacuum display and control unit, observe the associated operating instructions:
   – "DCU" operating instructions available from the Download Center.
   – "HPU" operating instructions available from the Download Center.
2. Observe the electronic drive unit operating instructions from the turbopump scope of delivery.
3. Connect the “RS-485” connector of a suitable connection cable to the DCU.
4. Switch on the turbopump current supply via the external power supply pack or the DCU with integrated power supply pack.

6.2.4 Operation via field bus ▶

Integrating and operating Pfeiffer Vacuum turbopumps in the customer's field bus system is possible when using an electronic drive unit with a corresponding connection panel.

The following are available:

- Profibus

Instructions for field bus operation

▶ See the operating manual of the electronic drive unit with corresponding connection panel.

6.3 Switching on the turbopump ▶

⚠ WARNING ▶

Risk of burns on hot surfaces when using additional equipment for heating during operation

The use of additional equipment for heating the vacuum pump or for optimizing the process generates very high temperatures on surfaces that can be touched. There is a risk of burning.

- ▶ If necessary, set up a contact guard.
- ▶ If necessary, apply the warning stickers provided for this at the danger points.
- ▶ Ensure adequate cooling down before working on the vacuum pump or in its vicinity.
- ▶ Wear protective equipment, e.g., gloves.

⚠ WARNING ▶

Risk of serious injury in the event of vacuum pump destruction due to over pressure

Gas entry with very high over pressure results in destruction of the vacuum pump. There is a risk of serious injury due to ejected objects.

- ▶ Never exceed the permissible 1500 hPa (absolute) inlet pressure on the suction side or the venting and sealing gas connection.
- ▶ Make sure that high, process-related over pressures cannot directly enter the vacuum pump.

Switching on the turbopump

- ▶ Connect the power supply pack to the mains power supply on the customer-side.
- ▶ Switch on the power supply pack.

6.4 Operation monitoring ▶

6.4.1 Operating mode display via LED ▶

LEDs on the electronic drive unit show the basic operating states of the vacuum pump. A differentiated error and warning display is only possible for operation with the Pfeiffer Vacuum display and control unit or a PC.

LED	Symbol	LED status	Display	Meaning
Green		Off		Currentless
		On, flashing		"pumping station OFF", rotation speed ≤ 60 rpm
		On, inverse flashing		"pumping station ON", set rotation speed not reached
		On, constant		"pumping station ON", set rotation speed reached
		On, flashing		"pumping station OFF", speed > 60 rpm
Yellow		Off		No warning
		On, constant		Warning
Red		Off		No error, no warning
		On, constant		Error, malfunction

Tbl. 9: Behavior and meaning of the LEDs on the electronic drive unit ▶

6.4.2 Temperature monitoring ▶

If threshold values are exceeded, output signals from temperature sensors bring the turbopump to a safe condition. Depending on the type, temperature thresholds for warning and error messages are immutably stored in the electronic drive unit. For information purposes, various status requests are set up in the parameter set.

- In order to avoid switching off the turbopump, the electronic drive unit already reduces the power consumption in case of exceeding the warning threshold for excess temperature.
  - Examples are an impermissible motor temperature, or impermissibly high housing temperature.
- Further reduction of drive power and thus decreasing speed can potentially lead to underrun the rotation speed switchpoint. The turbopump switches off.
- Exceeding the temperature threshold for error messages switches off the turbopump immediately.

6.5 Switching off and venting ▶

We recommend ▶

Vent the turbopump after shutdown. By doing so, you prevent particles flowing back into the vacuum system from the fore-vacuum area.

6.5.1 Switching off ▶

Notes for switching off the turbopump

1. Shut down the turbopump via the control unit or remote control.
2. Close the fore-vacuum line.
3. Switch off the backing pump, if necessary.
4. Vent the turbopump (options see below).
5. Close the supply lines (e.g. for cooling water or sealing gas).

6.5.2 Venting ▶

NOTICE ▶

Turbopump damage due to unacceptably high pressure rise when venting

Unacceptably high pressure rise rates place heavy loads on the rotor and the turbopump bearing. This can produce mechanical damage to the turbopump, up to and including failure.

► Observe the prescribed maximum **200 hPa/s** rate of pressure rise.
► Avoid uncontrolled venting of very small volumes.

Manual venting

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

1. Ensure that the vacuum system is shut down.
2. Vent the turbopump to atmospheric pressure on the high vacuum side.
3. Wait for pressure equalization to atmospheric pressure in the vacuum system.

7 Maintenance ▶

7.1 General maintenance information ▶

⚠ WARNING ▶

Danger to life from electric shock during maintenance and service work

The device is only completely de-energized when the mains plug has been disconnected and the turbopump is at a standstill. There is a danger to life from electric shock when making contact with live components.

- ▶ Before performing all work, switch off the main switch.
- ▶ Wait until the turbopump comes to a standstill (rotation speed =0).
- ▶ Remove the mains plug from the device.
- ▶ Secure the device against unintentional restarting.

⚠ WARNING ▶

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

⚠ WARNING ▶

Risk of cuts on moving, sharp-edged parts when reaching into the open high vacuum connection

Incorrect handling of the turbopump before maintenance work results in hazardous situations with risk of injury. There is a risk of cuts from accessing sharp-edged, rotating parts when removing the turbopump.

- ▶ Wait until the turbopump comes to a standstill (rotation speed f=0).
- ▶ Switch the turbopump off properly.
- ▶ Secure the turbopump against re-start.
- ▶ Seal open connections immediately following removal, using the original protective cover.

7.2 Maintenance intervals and responsibilities ▶

Recommendations for performing maintenance measures

1. Clean the turbopump exterior with a lint-free cloth and a little isopropanol.
2. Replace the electronic drive unit as an independent unit.
3. Replace the operating fluid reservoir as an independent unit.
4. Pay attention to when the operating fluid must be changed.
5. Change the operating fluid reservoir at least every 4 years.
6. Have Pfeiffer Vacuum Service replace the rotor bearing of the turbopump at least every 4 years.
7. Consult with Pfeiffer Vacuum Service about shorter maintenance intervals for extreme loads or impure processes.
8. For all other cleaning, maintenance or repair work, contact the appropriate Pfeiffer Vacuum Service location.

7.3 Replace operating fluid reservoir ▶

⚠ WARNING ▶

Risk of poisoning from contact with harmful substances

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

- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Prevent health hazards or environmental impacts with adequate safety precautions.
- ▶ Observe the operating fluid safety data sheet.
- ▶ Dispose of the operating fluid reservoir according to applicable regulations.

You will find the safety data sheet in the Pfeiffer Vacuum Download Center.

NOTICE ▶

Damage to sealing surfaces from unsuitable tools

The use of unsuitable tools for removal or insertion of sealing rings damages the sealing surfaces, causing vacuum pump leakage.

- ▶ Never use sharp, metallic tools (e.g. tweezers).
- ▶ Only remove sealing rings with an O-ring picker.

The HiPace 10 has two operating fluid reservoirs for lubrications of the ball bearings, with or without capillary rods depending on the design.

- When replacing the operating fluid reservoirs, see the pump rating plate to determine the correct operating fluid:
  - Pump article number ≤ index "B": Operating fluid **TL 011**
  - Pump article number ≥ index "C": Operating fluid **TL 022**
- Always replace both sides at the same time.

Preparatory work ▶

1. Do not apply any mechanical loads to the electronic drive unit.
2. Switch off the turbopump (see chapter “Switching off”, page 30).
3. Vent the vacuum system to atmospheric pressure (see chapter “Venting”, page 30).
4. Interrupt the electric supply.
5. Remove all cables from the electronic drive unit.
6. **If dismantling the turbopump from the system:** Close all openings with the original protective covers and screw plugs.

7.3.1 Change operating fluid reservoir bearing side 1 ▶

Required tools

- Allen key, WAF 3 mm
- Tweezers
- O-ring picker
- Calibrated torque wrench (tightening factor ≤ 1.6)

Required consumables

- Clean, lint-free cloth
- Laboratory gloves

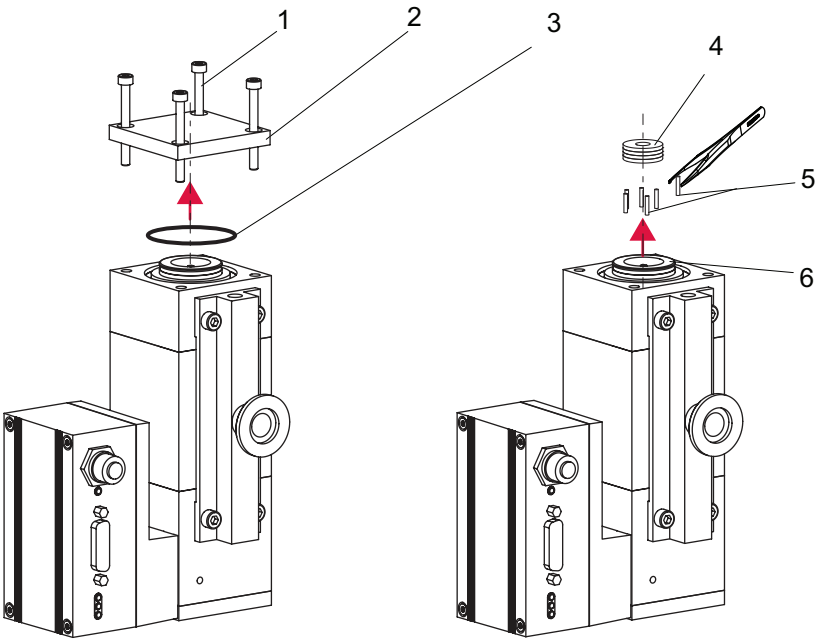


Fig. 10: Remove operating fluid reservoir ▶

1 Interior hexagon socket screw
2 Screw cap
3 O-ring
4 Operating fluid reservoir
5 Capillary rods (6×), if present
6 Bearing housing

Remove operating fluid reservoir

1. Wear laboratory gloves to avoid skin contact.
2. Remove any external impurities from the turbopump using a clean, lint-free cloth.
3. Stand the turbopump upright.
4. Unscrew all 4 cylinder screws from closing cap on this bearing side.
5. Remove closing cap.
6. Remove o-ring from groove using an o-ring picker.
   – Avoid damage caused by scratches.
7. Use tweezers to remove operating fluid reservoir from bearing housing.
8. Use tweezers to remove the old capillary rods, if present, from the bearing housing.
9. Clean closing cap with a clean, lint-free cloth.
   – Do **not use cleaning agents**.

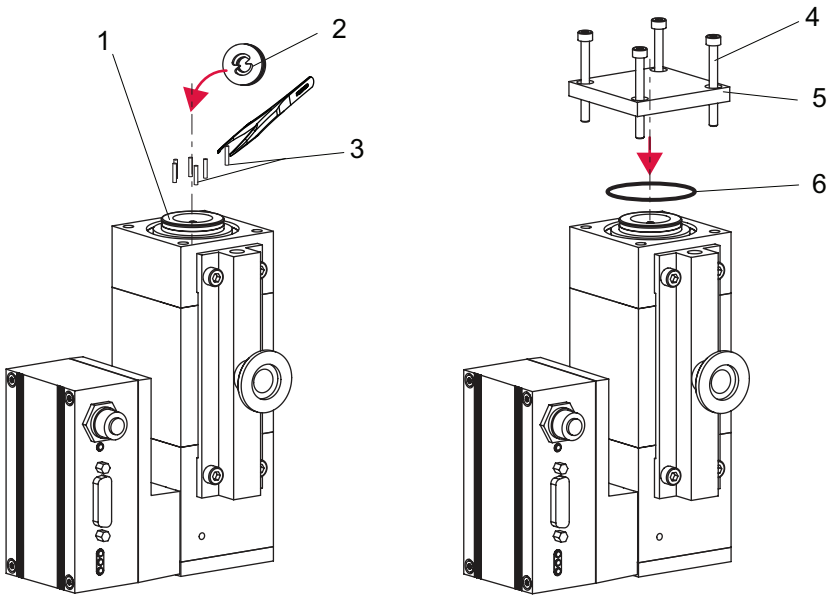


Fig. 11: Assemble operating fluid reservoir ▶

1 Bearing housing
2 Operating fluid reservoir
3 Capillary rods (6×), if present
4 Interior hexagon socket screw
5 Screw cap
6 O-ring

Ensure correct installation orientation of operating fluid reservoir.

Felt washer with the two cams aligned in installation orientation.

Assemble operating fluid reservoir

1. Wear laboratory gloves to avoid skin contact.
2. Use tweezers to insert all new capillary rods, if present.
3. Use tweezers to insert new operating fluid reservoir into bearing housing.
4. Push operating fluid reservoir into bearing housing up to the stop.
5. Insert new o-ring in groove of bearing housing.
6. Fit closing cap.
7. Screw in all 4 cylinder screws by hand.

7.3.2 Change operating fluid reservoir bearing side 2 ▶

Required tools

- Allen key, WAF 3 mm
- Tweezers
- O-ring picker
- Calibrated torque wrench (tightening factor ≤ 1.6)

Required consumables

- Clean, lint-free cloth
- Laboratory gloves

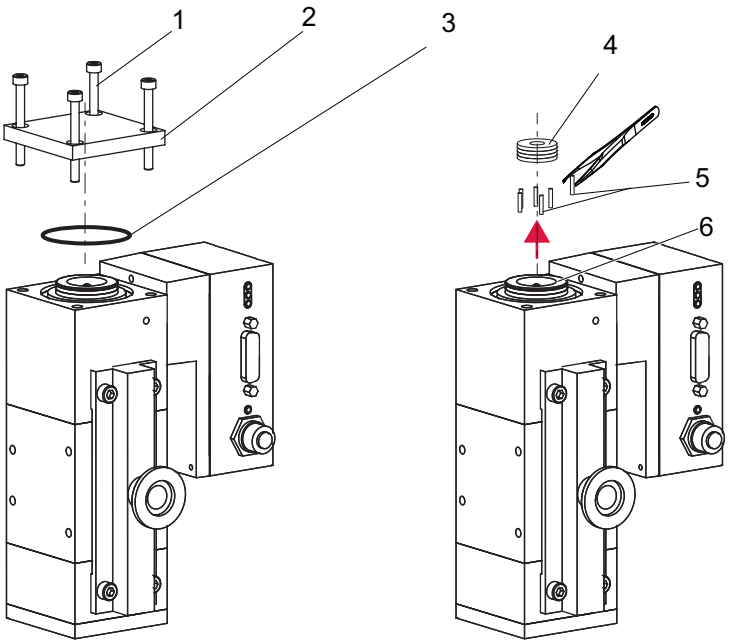


Fig. 12: Remove operating fluid reservoir ▶

1 Interior hexagon socket screw
2 Screw cap
3 O-ring
4 Operating fluid reservoir
5 Capillary rods (6×), if present
6 Bearing housing

Remove operating fluid reservoir

1. Wear laboratory gloves to avoid skin contact.
2. Remove any external impurities from the turbopump using a clean, lint-free cloth.
3. Stand the turbopump upright.
4. Unscrew all 4 cylinder screws from closing cap on this bearing side.
5. Remove closing cap.
6. Remove o-ring from groove using an o-ring picker.
   – Avoid damage caused by scratches.
7. Use tweezers to remove operating fluid reservoir from bearing housing.
8. Use tweezers to remove the old capillary rods, if present, from the bearing housing.
9. Clean closing cap with a clean, lint-free cloth.
   – Do **not use cleaning agents**.

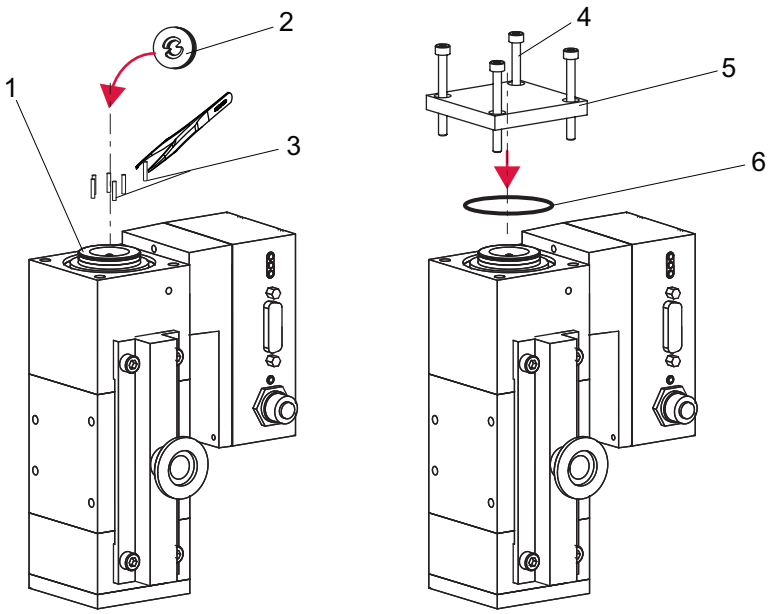


Fig. 13: Assemble operating fluid reservoir ▶

1	Bearing housing	4	Interior hexagon socket screw
2	Operating fluid reservoir	5	Screw cap
3	Capillary rods (6×), if present	6	O-ring

Ensure correct installation orientation of operating fluid reservoir.

Felt washer with the two cams aligned in installation orientation.

Assemble operating fluid reservoir

1. Use tweezers to insert all new capillary rods, if present.
2. Use tweezers to insert new operating fluid reservoir into bearing housing.
3. Push operating fluid reservoir into bearing housing up to the stop.
4. Insert new o-ring in groove of bearing housing.
5. Fit closing cap.
6. Screw in all 4 cylinder screws by hand.

7.3.3 Tighten screws of closing cap ▶

Required tools

- Allen key, WAF 3 mm
- Calibrated torque wrench (tightening factor ≤ 1.6)

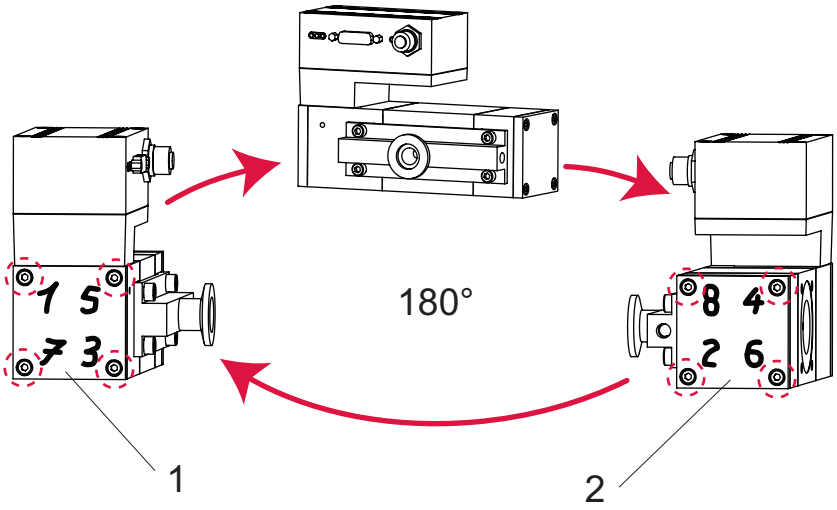


Fig. 14: Screw assembly sequence for closing cap assembly ▶

1 Closing cap drive side with marking
2 Closing cap opposite side with marking

Tighten screws of closing cap

1. Place turbopump flat on table.
2. Use marker pen to number all cylinder screws on the two closing caps as shown in figure.
3. Tighten screws in sequence **1-2-3-4-5-6-7-8** in multiple rounds.
4. In last round, ensure tightening torque of **2.0 Nm**.
5. Wipe numeric markings off closing caps.

7.3.4 Performing running test ▶

Prerequisite

- Fore-vacuum flange mounted

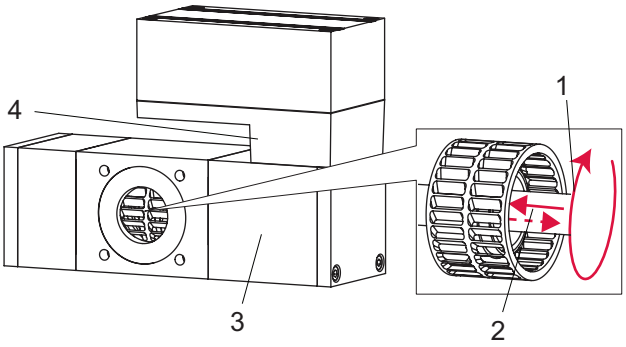


Fig. 15: Rotor check ▶

1 Check true running
2 Check axial clearance
3 Motor side
4 Adapter

Performing running test ▶

1. Use finger to rotate rotor lightly, radially in direction of adapter.
   – The rotor action is smooth.
   – If installed correctly, a V will be evident beneath the rotating rotor blades.
2. Press rotor **carefully**, exerting slight pressure with your finger, axially into side opposite motor.
   – The rotor automatically returns to the original position.
3. Loosen screws on closing caps and repeat assembly of closing caps if rotor action is sluggish – there may be distortion in the housing.

7.4 Replacing the electronic drive unit ▶

NOTICE ▶

Damage to the turbopump and electronic drive unit due to improper disconnection of components

Even after the mains power is switched off, the turbopump continues to deliver electrical energy during its run-down period. If the turbopump and electronic drive unit are disconnected prematurely, there is the risk of a short-circuit to ground and consequently the destruction of electronic components.

- ▶ Never disconnect the turbopump and electronic drive unit from each other if power is still connected or if the rotor is running.
- ▶ Monitor the turbopump's rotation speed via the parameters available in the electronic drive unit (e.g. **[P:398]**).
- ▶ Wait until the turbopump comes to a standstill (rotation speed f = 0).

NOTICE ▶

Property damage from electrostatic discharge

Neglecting the electrostatic hazard for electronic components results in their damage or destruction

- ▶ Implement ESD safety measures at the workstation.
- ▶ Observe EN 61340 "Protection of electronic devices from electrostatic phenomena".

Backing up settings made by the customer ▶

The factory operating parameters are always preset in replacement units. All settings made by the customer to the original electronic drive unit are lost when it is replaced. To preserve your custom settings, you have the following options:

1. Back up all your settings as a parameter set in a HPU.
2. Load a backup parameter set by means of a HPU into the new electronic drive unit.
3. Program the individual settings into the new electronic drive unit by hand.
4. Observe the operating instructions of the electronic drive unit and the HPU.

The electronic drive unit of the turbopump cannot be repaired. In the event of a defect, replace the entire electronic drive unit with a replacement part.

Preparatory work ▶

1. Do not apply any mechanical loads to the electronic drive unit.
2. Switch off the turbopump (see chapter “Switching off”, page 30).
3. Vent the vacuum system to atmospheric pressure (see chapter “Venting”, page 30).
4. Interrupt the electric supply.
5. Remove all cables from the electronic drive unit.
6. **If dismantling the turbopump from the system:** Close all openings with the original protective covers and screw plugs.

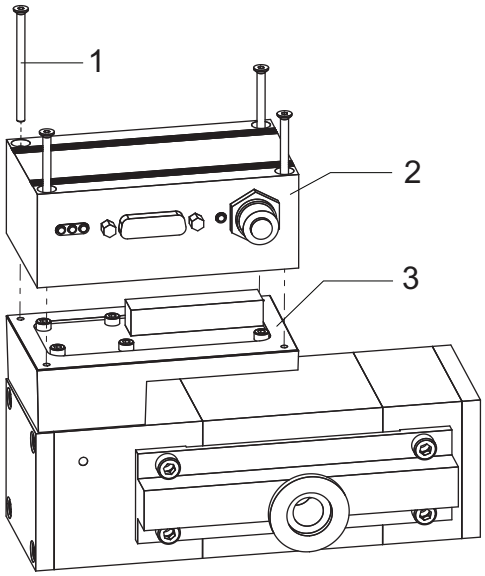


Fig. 16: Installing and removing the electronic drive unit TC 110 ▶

1 Torx screw
2 Electronic drive unit
3 Adapter plate

Required tools

- Torx screwdriver TX 10
- Calibrated torque wrench (tightening factor ≤ 1.6)

Procedure ▶

1. Install the turbopump upright if required.
2. Unscrew all 4 Torx screws from the electronic drive unit.
3. Pull the old electronic drive unit off the turbopump, taking care to keep it straight.
4. Place a new electronic drive unit straight onto the adapter plate connection of the turbopump.
5. Screw the electronic drive unit to the turbopump with all 4 Torx screws.
   – Tightening torque: **0.6 Nm**

7.5 Confirming the speed specification ▶

The typical nominal rotation speed of a turbopump is preset ex factory in the electronic drive unit. If the electronic drive unit is replaced or a different pump type is used, the set value settings of the nominal rotation speed is cleared. The manual confirmation of the nominal rotation speed is part of a redundant safety system as a measure for preventing excess rotation speed.

The redundant confirmation of the nominal rotation speed of a turbopump is possible by adjusting the **[P:777] NomSpdConf** parameter in the electronic drive unit.

HiPace	Nominal rotation speed
10 | 30 | 60 | 80	1500 Hz
300	1000 Hz
350 | 450	1100 Hz
400 | 700 | 800	820 Hz

Tbl. 10: Characteristic nominal rotation speeds of the turbopumps

Required aids

- A connected Pfeiffer Vacuum display and control unit.
- Knowledge of the configuration and setting of electronic drive unit operating parameters.

Adjusting the nominal rotation speed confirmation ▶

1. Observe the display and control unit operating instructions.
2. See the electronic drive unit operating instructions.
3. Set the parameter **[P:794]** to "1" and activate the expanded parameter set.

4. Open and edit the parameter **[P:777]**.
5. Set the parameter **[P:777]** to the required value of the nominal rotation speed in Hertz.

Alternative to adjusting the nominal rotation speed confirmation

A Pfeiffer Vacuum SpeedConfigurator for the one-time immediate setting of parameter **[P:777]** is included with the replacement units.

8 Decommissioning ▶

8.1 Shutting down for longer periods ▶

⚠ WARNING ▶

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

Procedure for a longer downtime of the turbopump (> 1 year)

1. Remove the turbopump from the vacuum system if necessary.
2. Replace the operating fluid reservoir of the turbopump as necessary.
3. Close the high vacuum connection of the turbopump.
4. Evacuate the turbopump via the fore-vacuum connection.
5. Vent the turbopump with dry, oil-free air or inert gas.
6. Close all flange openings with the original protective caps.
7. Store the turbopump with the high vacuum flange pointing upwards.
8. Store the turbopump indoors only, within the specified temperature range.
9. In rooms with humid or aggressive atmospheres: Hermetically seal the turbopump together with a drying agent in a plastic bag.

8.2 Recommissioning ▶

NOTICE ▶

Risk of damage to the turbopump as a result of operating fluid aging after recommissioning

The shelf life of the operating fluid of the turbopump is limited. Aging of the operating fluid may lead to the failure of the ball bearing and cause damage to the turbopump.

- ▶ Pay attention to when the operating fluid must be changed:
  - after maximum 2 years without operation,
  - after maximum 4 years combined operation and downtimes.
- ▶ Observe the maintenance instructions and inform Pfeiffer Vacuum Service.

Procedures for recommissioning the turbopump

1. Check the turbopump for pollution and moisture.
2. Clean the turbopump exterior with a lint-free cloth and a little isopropanol.
3. If necessary, arrange for Pfeiffer Vacuum Service to completely clean the turbopump.
4. Observe the total running time of the turbopump and if necessary, arrange for Pfeiffer Vacuum Service to replace the bearing.
5. Change the operating fluid reservoirs of the turbopump.
6. Install the turbopump according to these instructions (see chapter “Installation”, page 20).
7. Recommission the turbopump according to these instructions 27.

9 Recycling and disposal ▶

⚠ WARNING ▶

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

Environmental protection ▶

You **must** dispose of the product and its components in accordance with all applicable regulations for protecting people, the environment and nature.

- Help to reduce the wastage of natural resources.
- Prevent contamination.

Environmental protection ▶

The product and its components **must be disposed of in accordance with the applicable regulations relating to environmental protection and human health**, with a view to reducing natural resource wastage and preventing pollution.

9.1 General disposal information

Pfeiffer Vacuum products contain materials that you must recycle.

- ▶ Dispose of our products according to the following:
  - Iron
  - Aluminium
  - Copper
  - Synthetic
  - Electronic components
  - Oil and fat, solvent-free
- ▶ Observe the special precautionary measures when disposing of:
  - Fluoroelastomers (FKM)
  - Potentially contaminated components that come into contact with media

9.2 Dispose of turbopumps ▶

Pfeiffer Vacuum turbopumps contain materials that you must recycle.

1. Remove the complete operating fluid reservoir.
2. Remove the electronic drive unit.
3. Decontaminate components that come into contact with process gases.
4. Separate the components into recyclable materials.
5. Recycle the non-contaminated components.
6. Dispose of the product or components in a safe manner according to locally applicable regulations.

10 Malfunctions ▶

⚠ WARNING ▶

Danger to life from poisoning where toxic process media leak from damaged connections

Sudden twisting of the turbopump in the event of a fault causes fittings to accelerate. There is the risk of damaging on-site connections (e.g., fore-vacuum line) and resulting leaks. This results in leakage of process media. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Keep masses connected to the turbopump as low as possible.
- ▶ Use flexible lines to connect to the turbopump where necessary.

⚠ WARNING ▶

Danger to life from the turbopump breaking away in the event of a fault

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. If the turbopump is **not** properly secured, it can shear off. The energy that this would release could throw the entire turbopump or shattered pieces from its interior through the surrounding space. Potentially dangerous gases can escape. There is a risk of very serious injuries, including death, and extensive property damage.

- ▶ Follow the installation instructions for this turbopump.
- ▶ Observe the requirements regarding stability and design of the counter flange.
- ▶ Use only original accessories or fixing material approved by Pfeiffer Vacuum for the installation.

Should malfunctions occur, you can find information about potential causes and how to fix them here. The operating manual of the associated electronic drive unit contains more detailed error descriptions.

Problem	Possible causes	Remedy
Turbopump will not start up; none of the built-in LEDs on the electronic drive unit light up	• Current supply interrupted	1. Check the plug contacts on the power supply pack. 2. Check the current supply lines. 3. Check the output voltage at the power supply pack “DC out” connection: — **24 V DC**!
	• Incorrect operating voltage	1. Observe the electronic drive unit rating plate. 2. Supply the correct operating voltage.
	• No operating voltage present	1. Supply the correct operating voltage. 2. Switch on the power supply pack.
	• Electronic drive unit defective	1. Replace the electronic drive unit. 2. Contact Pfeiffer Vacuum Service.
Turbopump will not start up; green LED on the electronic drive unit is flashing	• **For operation without control unit:** Pins 2-7 and 5-7 on the “X3” connection are not connected	1. Connect the connections according to the electronic drive unit connection diagram. 2. Check the bridges on the connection cable.
	• **For operation via RS-485:** The bridge between pins 5 and 7 inhibits control commands	1. Remove the bridge from the “X3” connection. 2. Check the connection cable.
	• **For operation via RS-485:** Parameters not set in the electronic drive unit	1. Set the parameters **[P: 010]** and **[P: 023]** via the interface RS-485 to 1 = "ON".
	• Voltage drop in the cable is too high	1. Check the connection cable. 2. Use a suitable connection cable.

Turbopump fails to reach the nominal rotation speed within the set run-up time	• fore-vacuum pressure too high	1. Check backup pump compatibility (see technical data). 2. Check that the backup pump is working.
	• Leakage on the turbopump	1. Carry out leak detection. 2. Check seals and flange connections. 3. Eliminate leaks.
	• Gas throughput too high	1. Reduce the process gas load.
	• Rotor not running smoothly, defective bearing	1. Check the turbopump for noise development 2. Contact Pfeiffer Vacuum Service.
	• Run-up time setpoint adjusted too low	1. Extend the run-up time setpoint **[P:700]** via a display and control unit.
	Thermal load due to: • lack of ventilation • water flow too low • fore-vacuum pressure too high • ambient temperature too high	1. Reduce the thermal load. — Ensure adequate air supply. — Adjust the cooling water flow. — Reduce the fore-vacuum pressure. — Adapt the ambient conditions.
Turbopump not achieving the ultimate pressure	• Turbopump is polluted	1. Heat the turbopump if required. 2. Have it cleaned. 3. Contact Pfeiffer Vacuum Service.
	• Vacuum chamber, pipes or turbopump leaking	1. Carry out leak detection starting from the vacuum chamber. 2. Check seals and flange connections. 3. Eliminate leaks in the vacuum system.
Unusual noises during operation	• Rotor bearing damaged	1. Contact Pfeiffer Vacuum Service.
	• Rotor damaged	1. Contact Pfeiffer Vacuum Service.
	• Splinter shield or protective screen loose	1. Check and correct the seat of the splinter shield or protective screen in the high vacuum flange. 2. Follow the installation instructions.
Red LED on the electronic drive unit illuminates	• Group error	1. Reset the malfunction by switching the current supply off and on. 2. Reset the malfunction with V+ on pin 6 on the “X3” connection. 3. Set the parameter **[P: 009]** via the interface RS-485 to 1 = Malfunction acknowledgment. 4. Set the parameter **[P: 010]** via the interface RS-485 to 0 = off and then 1 = On and Malfunction acknowledgment. 5. Carry out a differentiated malfunction analysis with a display and control unit. 6. Contact Pfeiffer Vacuum Service.

Tbl. 11: Troubleshooting turbopumps

11 Service solutions by Pfeiffer Vacuum ▶

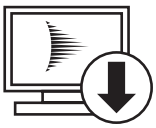
We offer first-class service
High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

We are always focused on perfecting our core competence – servicing of vacuum components. Once you have purchased a product from Pfeiffer Vacuum, our service is far from over. This is often exactly where service begins. Obviously, in proven Pfeiffer Vacuum quality.

Our professional sales and service employees are available to provide you with reliable assistance, worldwide. Pfeiffer Vacuum offers an entire range of services, from original replacement parts to service contracts.

Make use of Pfeiffer Vacuum service
Whether preventive, on-site service carried out by our field service, fast replacement with mint condition replacement products, or repair carried out in a Service Center near you – you have various options for maintaining your equipment availability. You can find more detailed information and addresses on our homepage, in the Pfeiffer Vacuum Service section.

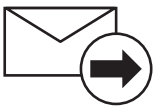
You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.
For fast and smooth service process handling, we recommend the following:



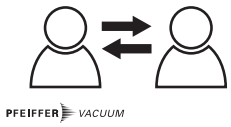
1. Download the up-to-date form templates.
   - Explanations of service requests
   - Service requests
   - Contamination declaration

a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
b) If necessary, drain operating fluid/lubricant.
c) If necessary, drain coolant.

2. Complete the service request and contamination declaration.

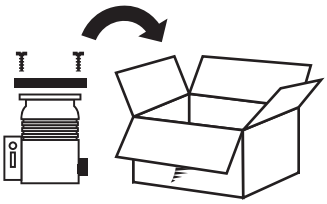


3. Send the forms by email, fax, or post to your local Service Center.

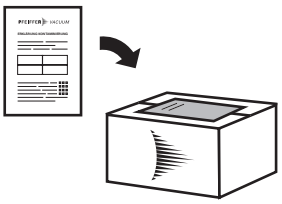


4. You will receive an acknowledgment from Pfeiffer Vacuum.

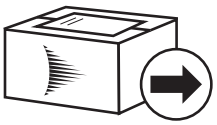
Submission of contaminated products
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination costs** may be incurred.



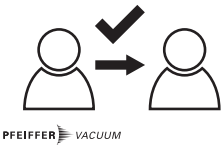
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
a) Neutralize the product with nitrogen or dry air.
b) Seal all openings with blind flanges, so that they are airtight.
c) Shrink-wrap the product in suitable protective foil.
d) Package the product in suitable, stable transport containers only.
e) Maintain applicable transport conditions.



6. Attach the contamination declaration to the **outside** of the packaging.



7. Now send your product to your local Service Center.



8. You will receive an acknowledgment/quotation, from Pfeiffer Vacuum.

Our sales and delivery conditions and repair and maintenance conditions for vacuum devices and components apply to all service orders.

12 Spare parts HiPace 10 ▶

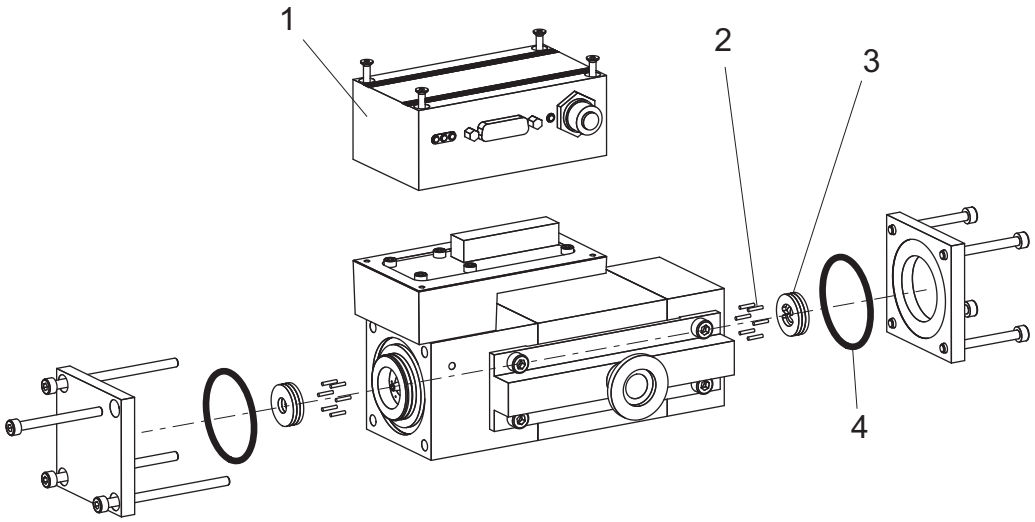


Fig. 17: Spare parts HiPace 10 ▶

1 Electronic drive unit TC 110
2 Capillary rods
3 Operating fluid reservoir
4 O-ring

Position	Designation	Order number	Remark
1	Electronic drive unit TC 110	according to version	refer to the rating plate
2× each 2, 3, 4	Operating fluid reservoir TL 022	PM 193 943 -T	Valid for pump article no. ≥ index "C", refer to the rating plate
2× each 3, 4	Operating fluid reservoir TL 011	PM 083 373 -T	Valid for pump article no. ≤ index "B" refer to the rating plate

Tbl. 12: Available spare parts

13 Accessories ▶

View the range of accessories for hybrid bearing turbopumps on our website.

14 Technical data and dimensions ▶

14.1 General ▶

This section describes the basis for the technical data of Pfeiffer Vacuum turbopumps.

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

- Specifications according to PNEUROP committee PN5
- ISO 27892 2010:"Vacuum technology - Turbomolecular pumps - Measurement of rapid shutdown torque"
- ISO 21360 2012: “Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 1: General description”
- ISO 21360 2018: "Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 4: Turbomolecular vacuum pumps"
- Ultimate pressure with test dome after 48 h bake out duration
- Gas throughput with water cooling; backing pump = rotary vane pump (10 m^3/h)
- Cooling water consumption at maximum gas throughput, cooling water temperature 25 °C
- Integral leakage rate with 100 % helium concentration, 10 s measurement duration
- Sound pressure level at distance to vacuum pump = 1 m

	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						

Tbl. 13: Conversion table: Pressure 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

Tbl. 14: Conversion table: Units for gas throughput ▶

14.2 Technical data ▶

Selection field	HiPace® 10 with TC 110, DN 25
Part number	PM P03 960
Connection flange (in)	DN 25
Connection flange (out)	DN 16 ISO-KF/G 1/8"
Gas throughput at final rotation speed for N_2	0.37 hPa·l/s
Gas throughput at final rotation speed for Ar	0.37 hPa·l/s
Gas throughput at final rotation speed for H_2	2.78 hPa·l/s
Gas throughput at final rotation speed for He	0.48 hPa·l/s
Run-up time	0.9 min

Selection field	HiPace® 10 with TC 110, DN 25
Final pressure according to PNEUROP	< $5 \cdot 10^{-5}$ hPa
Fore-vacuum max. for Ar	25 hPa
Fore-vacuum max. for H_2	15 hPa
Fore-vacuum max. for He	22 hPa
Fore-vacuum max. for N_2	25 hPa
Pumping speed for Ar	11.5 l/s
Pumping speed for H_2	3.7 l/s
Pumping speed for He	6 l/s
Pumping speed for N_2	10 l/s
Compression ratio for Ar	$2.5 \cdot 10^7$
Compression ratio for H_2	$3 \cdot 10^2$
Compression ratio for He	$3 \cdot 10^3$
Compression ratio for N_2	$3 \cdot 10^6$
Integral leakage rate	< $2 \cdot 10^{-8}$ Pa m³/s
Rotation speed ± 2 %	90000 rpm
Rotation speed variable	50 – 100 %
Performance curve in gas mode 0, vertex C	24/90000 W/min^{-1}
Performance curve in gas mode 0, vertex D	24/90000 W/min^{-1}
Performance curve in gas mode 1, vertex A	24/90000 W/min^{-1}
Performance curve in gas mode 1, vertex B	24/90000 W/min^{-1}
Performance curve in gas mode 2, vertex E	24/90000 W/min^{-1}
Performance curve in gas mode 2, vertex F	24/90000 W/min^{-1}
Cooling method, standard	Convection
Sound pressure level	<50 dB(A)
Electronic drive unit	with TC 110
I/O interfaces	RS-485, Remote
Operating voltage: DC	24 V
Input voltage: tolerance	±5 %
Permissible irradiated thermal output max.	0.6 W
Power consumption max.	28.8 W
Current consumption max.	1.2 A
Protection degree	IP54
Permissible radial magnetic field max.	3 mT
Pumping speed category	10 l/s
Relative humidity of air	5 – 85 %, non-condensing
Shipping and storage temperature	-25 – 55 °C
Weight	1.8 kg

Tbl. 15: HiPace 10 ▶

14.3 Dimensions ▶

Dimensions in mm

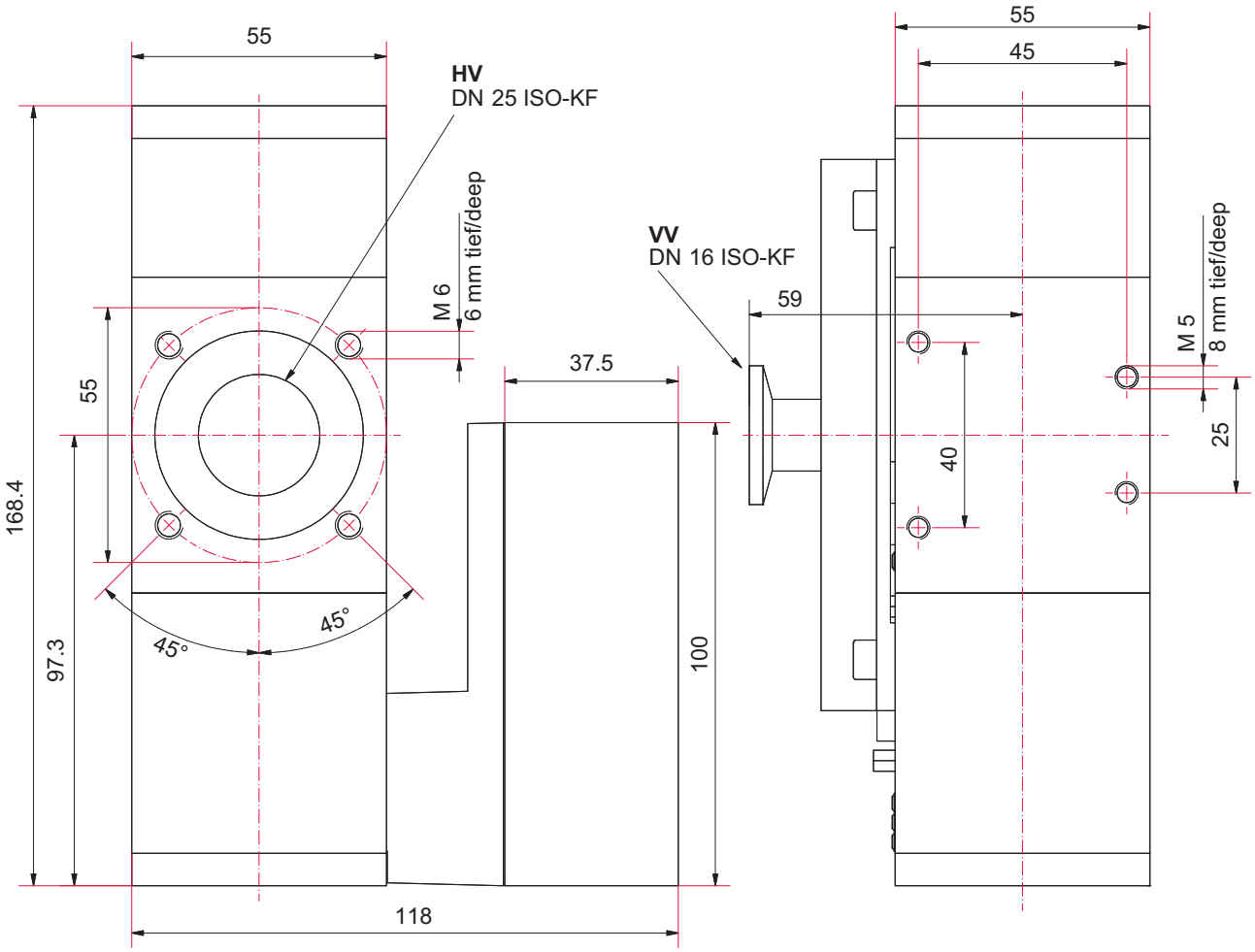


Fig. 18: HiPace 10 | TC 110 | DN 25 ISO-K ▶

Declaration of conformity

Declaration for product(s) of the type:

Turbopump
HiPace 10

We hereby declare that the listed product satisfies all relevant provisions of the following **European Directives**.

Machinery 2006/42/EC (Annex II, no. 1 A)
Electromagnetic compatibility 2014/30/EU
Restriction of the use of certain hazardous substances 2011/65/EU
Restriction of the use of certain hazardous substances, delegated directive 2015/863/EU

►

Harmonized standards and applied national standards and specifications:

DIN EN ISO 12100: 2011
DIN EN 1012-2: 2011
DIN EN 61000-3-2: 2015
DIN EN 61000-3-3: 2014
DIN EN 61010-1: 2011
DIN EN 61326-1: 2013
DIN EN 62061: 2013
ISO 21360-1: 2016
ISO 21360-4: 2018
DIN EN IEC 63000: 2019

The authorized representative for the compilation of technical documents is Mr. Tobias Stoll, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Asslar, Germany.

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Aßlar, 2020-11-05

CE

PFEIFFER VACUUM

Notizen / Notes:

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

Benefit from our know-how and our portfolio of training opportunities!
We support you with your plant layout and provide first-class on-site service worldwide.

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Are you looking for a perfect vacuum solution? Please contact us

Pfeiffer Vacuum GmbH
Headquarters • Germany
T +49 6441 802-0
info@pfeiffer-vacuum.de

www.pfeiffer-vacuum.com

PFEIFFER VACUUM