



# OPERATING INSTRUCTIONS

EN

Translation of the Original

## HIPACE 700 M

Turbopump

---

## 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](mailto: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.

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We reserve the right to make changes to the technical data and information in this document.

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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                            |
|---------------------------------------------------------------------------------|-----------------------------------|
| Operating instructions, electronic drive unit TM 700, Standard                  | PT 0329 BN                        |
| Operating instructions, electronic drive unit TM 700 PB, Profibus               | PT 0354 BN                        |
| Operating instructions, electronic drive unit TM 700 E74, according to Semi E74 | PT 0355 BN                        |
| Operating instructions, electronic drive unit TM 700 DN, DeviceNet              | PT 0356 BN                        |
| Operating instructions, electronic drive unit TM 700 EC, EtherCat               | PT 0503 BN                        |
| Declaration of conformity                                                       | A component of these instructions |

Current documents are available from the [Pfeiffer Vacuum Download Center](#).

### 1.1.2 Variants

- HiPace 700 M, DN 160 ISO-K, TM 700, 48 V DC
- HiPace 700 M, DN 160 ISO-F, TM 700, 48 V DC
- HiPace 700 M, DN 160 CF-F, TM 700, 48 V DC

## 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 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.

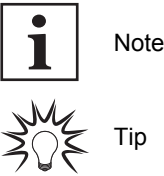
Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

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

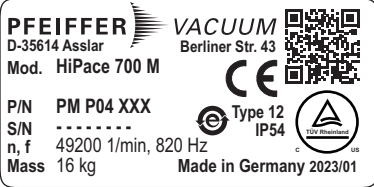
1.3.2 Pictographs

Pictographs used in the document indicate useful information.



1.3.3 Stickers on product

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

|                                                                                     |                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p><b>Rating plate (example)</b></p> <p>The rating plate of the turbopump is located on the lower part of the vacuum pump.</p> <p><b>Rating plate of the electronic drive unit</b></p> <p>The rating plate of the electronic drive unit is located on its outside next to the LEDs.</p> |
|  | <p><b>Operating instructions note</b></p> <p>This sticker indicates that this operating instructions must be read before performing any tasks.</p>                                                                                                                                      |
|  | <p><b>Protection class</b></p> <p>This sticker describes protection class 1 for the product. The positioning indicates the position for the ground connection.</p>                                                                                                                      |
|  | <p><b>Warranty seal</b></p> <p>The product is sealed ex factory. Damaging or removing a warranty seal results in loss of the warranty.</p>                                                                                                                                              |

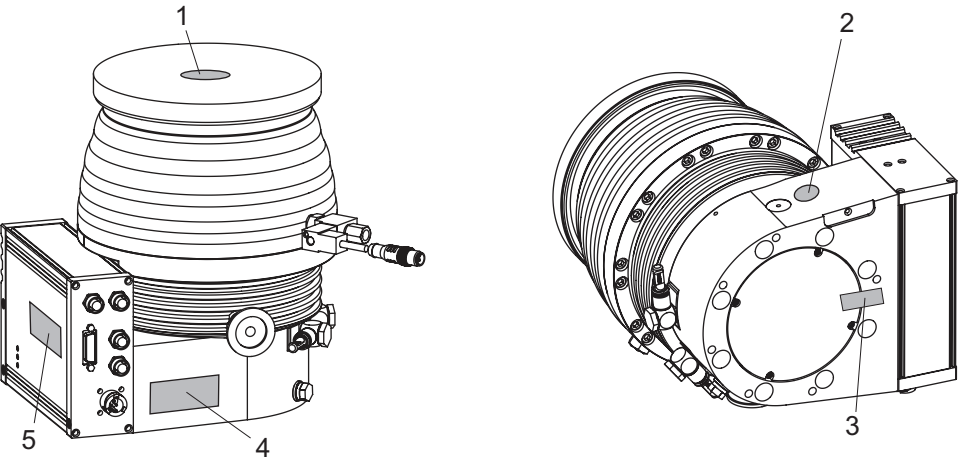


Fig. 1: Position of the stickers on the product

- 1

Operating instructions note
- 2

Information regarding ground connection
- 3

Warranty seal
- 4

Rating plate of the turbopump
- 5

Rating plate of the electronic drive unit

### 1.3.4 Abbreviations

| Abbreviation | Meaning in this document                                                                                                                                                                                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CF           | Flange: Metal-sealed connector in accordance with ISO 3669                                                                                                                                                      |
| d            | Diameter value (in mm)                                                                                                                                                                                          |
| DC           | Direct current                                                                                                                                                                                                  |
| DN           | Nominal diameter as size description                                                                                                                                                                            |
| f            | Rotation speed value of a vacuum pump (frequency, in rpm or Hz)                                                                                                                                                 |
| HV           | High vacuum flange, high vacuum side                                                                                                                                                                            |
| ISO          | Flange: Connection in accordance with ISO 1609 and ISO 2861                                                                                                                                                     |
| LED          | Light emitting diode                                                                                                                                                                                            |
| PE           | Protective earth (earthed conductor)                                                                                                                                                                            |
| FKM          | Fluoropolymer rubber                                                                                                                                                                                            |
| [P:xxx]      | Electronic drive unit control parameters. Printed in bold as a three-digit number in square brackets. Frequently displayed in conjunction with a short description.<br>Example: <b>[P:312]</b> software version |
| remote       | 26-pole D-Sub connecting socket on the turbopump electronic drive unit                                                                                                                                          |
| WAF          | Width Across Flats                                                                                                                                                                                              |
| T            | Temperature (in °C)                                                                                                                                                                                             |
| TM           | Turbopump electronic drive unit (turbo controller) and magnetic bearing controller                                                                                                                              |
| TPS          | Voltage supply (turbo power supply)                                                                                                                                                                             |
| VV           | Fore-vacuum flange, fore-vacuum connection                                                                                                                                                                      |

Tbl. 1: Abbreviations used in this document

## 1.4 Trademark proof

- DeviceNet® is a registered trademark of Open DeviceNet Vendor Association Inc.
- Profibus® is a registered trademark of Profibus Nutzerorganisation e.V.
- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

## 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 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.

**⚠ 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 injury caused by the turbopump breaking away with the vibration compensator in the event of a malfunction**

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. When using a vibration compensator, this will probably lead to the turbopump being sheared off in use. 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.

- ▶ Take suitable safety precautions on-site for the compensation of the occurring torques.
- ▶ Before installing a vibration compensator, you must first of all contact Pfeiffer Vacuum.

### **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.

#### **Risks during operation**

### **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.

### **CAUTION**

#### **Risk of injuries due to contact with vacuum when venting**

While venting the vacuum pump there is a risk of minor injuries due to the direct contact of body parts with the vacuum, e.g. hematomas.

- ▶ Do not fully unscrew the venting screw out of the housing during venting.
- ▶ Keep a distance from automatic venting device, such as venting valves.

## Risks during maintenance, decommissioning and disposal

### **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  $f = 0$ ).
- ▶ 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.

### **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.

## Risks in the event of malfunctions

### **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 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.

### **WARNING**

#### **Risk of injury caused by the turbopump breaking away with the vibration compensator in the event of a malfunction**

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. When using a vibration compensator, this will probably lead to the turbopump being sheared off in use. 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.

- ▶ Take suitable safety precautions on-site for the compensation of the occurring torques.
- ▶ Before installing a vibration compensator, you must first of all contact Pfeiffer Vacuum.

## 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 ( $> 70^{\circ}\text{C}$ ).
- ▶ 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 product

|                                                                      |                                                                                                                                       |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Installation location                                                | Weatherproof (indoors)                                                                                                                |
| Air pressure                                                         | 530 hPa to 1060 hPa                                                                                                                   |
| Installation altitude                                                | Max. 5000 m <sup>1)</sup>                                                                                                             |
| Rel. air humidity                                                    | max. 80%, at $T < 31^{\circ}\text{C}$ ,<br>up to max. 50% at $T < 40^{\circ}\text{C}$                                                 |
| Protection class                                                     | III                                                                                                                                   |
| Overvoltage category                                                 | II                                                                                                                                    |
| Permissible protection degree                                        | IP54<br>Type 12 according to UL 50E                                                                                                   |
| Degree of pollution                                                  | 2                                                                                                                                     |
| Ambient temperature                                                  | 5 °C to 30 °C with convection cooling without<br>gas throughput<br>5 °C to 35 °C with air cooling<br>5 °C to 40 °C with water cooling |
| Permissible surrounding magnetic field                               | 5.0 mT                                                                                                                                |
| Maximum irradiated thermal output                                    | 2.4 W                                                                                                                                 |
| Maximum permissible rotor temperature of the turbo-<br>pump          | 110 °C                                                                                                                                |
| Maximum permissible bakeout temperature at the<br>high vacuum flange | 120 °C                                                                                                                                |

**Tbl. 2: 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 improper use; in particular:

1) Given sufficient cooling of the turbopump

- Establishing the voltage supply without correct installation
- Installing with non-specified fastening material
- Pumping explosive media
- Pumping of corrosive media
- Pumping of condensing vapors
- Pumping of fluids
- Pumping of dust
- Operating with impermissible high gas throughput
- Operating with impermissible high fore-vacuum pressure
- Operation with excessive irradiated heat output
- Operating in impermissible high magnetic fields
- Operating in an incorrect gas mode
- Venting with impermissible high venting rates
- Using for pressure generation
- Using in areas with ionizing radiation
- Operating in potentially explosive areas
- Using in systems in which sporadic loads and vibrations or periodic forces act on the device
- Causing of hazardous operating conditions by a presetting on the electronic drive unit that is contrary to the process
- Using 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 Function

HiPace M series turbopumps are equipped with 5-axis magnetic bearings; they are therefore maintenance-free for the entire service life of the pump. The absence of lubrication rules out the risk of hydrocarbon contamination in the event of a system malfunction.

The turbopump forms a compact unit with the TM 700 electronic drive unit and magnetic bearing controller. Pfeiffer Vacuum power supply packs provide the voltage supply.

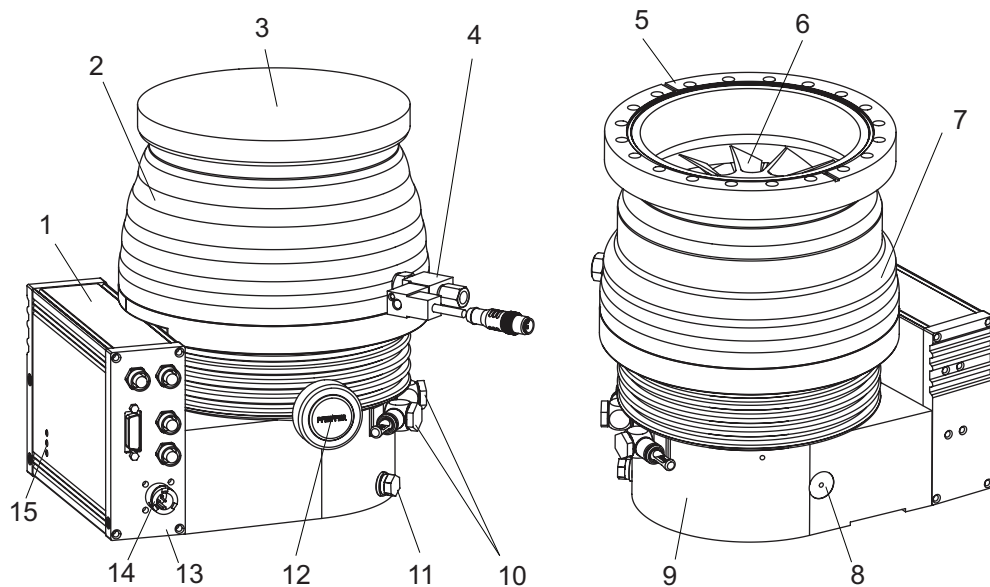


Fig. 2: HiPace 700 M design

- |                                                 |                                                              |
|-------------------------------------------------|--------------------------------------------------------------|
| 1 Electronic drive unit TM 700                  | 9 Pump bottom part                                           |
| 2 Pump housing, aluminum                        | 10 Cooling water connection                                  |
| 3 Protective cap for the high vacuum connection | 11 Sealing gas connection                                    |
| 4 Venting valve                                 | 12 Protective cover for fore-vacuum connection, DN 25 ISO-KF |
| 5 High vacuum connection, DN 160 CF-F           | 13 Connection panel of the electronic drive unit             |
| 6 Turbo rotor                                   | 14 Connecting plug for voltage supply DCin                   |
| 7 Pump housing, stainless steel                 | 15 LED operating mode display                                |
| 8 Ground terminal                               |                                                              |

#### 3.1.1 Cooling

- Convection cooling
- Water cooling
- Air cooling (optional)

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

#### 3.1.2 Rotor bearing

- Active 5-axis magnetic bearing

Operation is maintenance-free due to the use of magnetic bearings.

#### 3.1.3 Venting connection

The pre-assembled Pfeiffer Vacuum venting valve is used for automatic venting of the turbopump after switching off or in the event of a power failure.

#### 3.1.4 Drive

- Electronic drive unit TM 700
  - Operating voltage 48 V DC

## 3.2 Scope of delivery

- Turbopump with electronic drive unit and magnetic bearing controller
- Venting valve
- Protective cap for the high vacuum connection
- Protective cap for the fore vacuum connection
- Operating instructions

## 3.3 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](http://www.certipedia.com) with company ID no. [000021320](https://www.certipedia.com/en/certificates/000021320).

### 3.3.1 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 | <b>none</b> = Standard version                  |
|        |            | <b>mini</b> = Compact version                   |
|        |            | <b>U</b> = Overhead version                     |
|        |            | <b>C</b> = Corrosive gas version                |
|        |            | <b>P</b> = Process                              |
|        |            | <b>M</b> = Active magnetic bearing              |
|        |            | <b>T</b> = Temperature management               |
|        |            | <b>Plus</b> = Low vibration, low magnetic field |
|        |            | <b>E</b> = High efficiency                      |
|        |            | <b>H</b> = High compression                     |
|        |            | <b>I</b> = Ion implantation                     |

Tbl. 3: Product designation of Pfeiffer Vacuum HiPace turbopumps

### 3.3.2 Product features

| Feature                | Version      |              |                 |
|------------------------|--------------|--------------|-----------------|
| <b>HV flange</b>       | DN 160 ISO-K | DN 160 ISO-F | DN 160 CF-F     |
| <b>Flange material</b> | Aluminium    | Aluminium    | Stainless steel |

Tbl. 4: Turbopump features

## 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.



#### **Recommendation**

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

#### **Safe transport of the product**

- ▶ 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 blades) 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).

#### **NOTICE**

##### **Damage to pump caused by external vibrations**

Vibrations from outside or impacts on the pump can overload the magnetic bearings resulting in stress on the landing bearings.

- ▶ Lateral and tilting movements of the pump must be avoided.
- ▶ External agitation must be compensated for by an appropriate system design.
- ▶ Secure the vacuum chamber provided by the customer against moving and tilting.

#### **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 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.



##### Superstructural parts and fittings on the high vacuum connection

Installing superstructural parts and fittings to 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 axial values specified.
- Make sure that all the torques generated if the rotor blocks suddenly, are absorbed by the system on the operator side and the high vacuum connection.
- Only use the approved mounting kits of Pfeiffer Vacuum for the high vacuum connection of the turbopump.

| Parameter                                                                                                                        | HiPace 700 M<br>HiPace 800 M                                         |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Maximum torque occurring in the event of a burst <sup>2)</sup>                                                                   | 6500 Nm                                                              |
| Maximum permissible axial load on the high vacuum flange <sup>3)</sup>                                                           | 500 N<br>(equivalent to 50 kg)                                       |
| Flatness                                                                                                                         | ± 0.05 mm                                                            |
| Minimum tensile strength of the flange material in all operating states in relation to the engagement depth of the fixing screws | 170 N/mm <sup>2</sup> at 2.5 x d<br>270 N/mm <sup>2</sup> at 1.5 x d |
| Maximum permissible surrounding magnetic field                                                                                   | 5.0 mT                                                               |
| Maximum permissible irradiated thermal output                                                                                    | 2.4 W                                                                |

**Tbl. 5: Requirements for the dimensioning of high vacuum connection supplied by the customer**

### 5.2.2 Considering 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.

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

3) A one-sided load is not permitted.

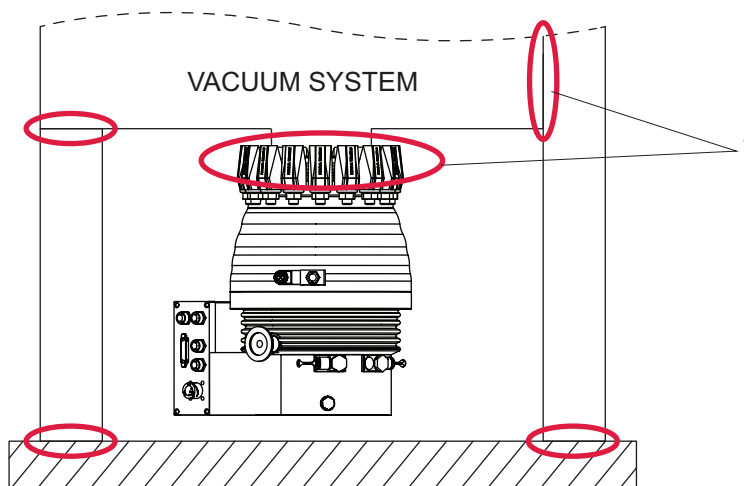


Fig. 3: Example: Safety connections

1 Safety connection, customer-side

### 5.2.3 Using a splinter shield or protective screen

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

| Flange size              | Reduced pumping speed in % by gas type |    |                |    |
|--------------------------|----------------------------------------|----|----------------|----|
|                          | H <sub>2</sub>                         | He | N <sub>2</sub> | Ar |
| Splinter shield DN 160   | 6                                      | 9  | 20             | 23 |
| Protective screen DN 160 | 1                                      | 2  | 6              | 7  |

Tbl. 6: Reduction of the pumping speed when using a splinter shield or protective screen

- With ISO flanges, use centering rings with protective screen or splinter shield.

### 5.2.4 Using the vibration compensator

#### ⚠ WARNING

**Risk of injury caused by the turbopump breaking away with the vibration compensator in the event of a malfunction**

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. When using a vibration compensator, this will probably lead to the turbopump being sheared off in use. 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.

- Take suitable safety precautions on-site for the compensation of the occurring torques.
- Before installing a vibration compensator, you must first of all contact Pfeiffer Vacuum.

Pfeiffer Vacuum vibration compensators are suitable for use on vibration-sensitive systems.

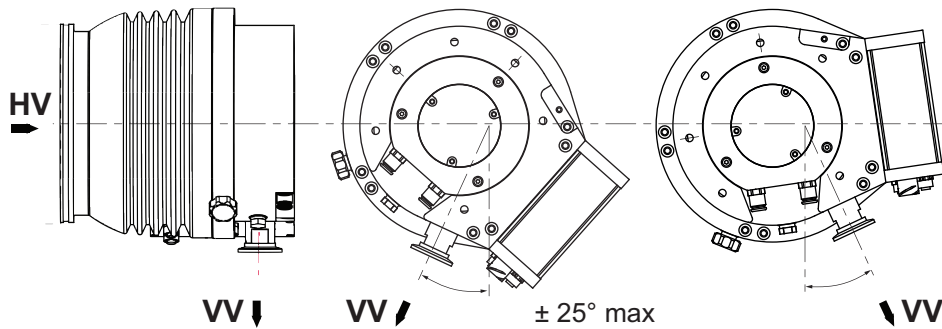
#### Installing the vibration compensator

1. Install the vibration compensator only with vertical passage.
2. Consider the flow resistance.
3. Secure the turbopump additionally to the high vacuum flange.
4. Observe the fastening of the ISO flanges.

### 5.2.5 Mounting orientations

Pfeiffer Vacuum turbopumps of 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 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  $\pm 25^\circ$
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.

### 5.2.6 Attaching ISO-K flange onto ISO-K



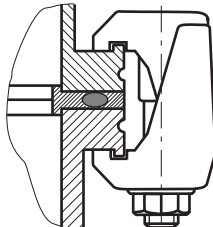
#### ISO flange connections

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

- Wrench, WAF 15
- Calibrated torque wrench (Tightening factor  $\leq 1.6$ )



**Fig. 5: Flange connection ISO-K to ISO-F, bracket screws**

#### Connection with bracket screw

1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Connect the flange with the components of the mounting kit according to the figure.
3. Use for all prescribed components for the turbopump.
4. Tighten the bracket screws cross-wise in 3 steps.
  - Tightening torque: **5, 15, 25  $\pm$  2 Nm**

### 5.2.7 Attaching ISO-K flange to ISO-F

The connection types for ISO-K flange installation with ISO-F flange are:

- "Hexagon head screw and tapped hole"
- "Stud screw with tapped hole"
- "Stud screw with through hole"



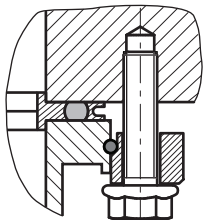
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For the connection of flanges in ISO-KF or ISO-K design, twisting may occur in the event of sudden blockage of the rotor, despite correct installation.

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

### Required tools

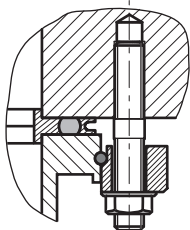
- Hexagon wrench (15 WAF)
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )



**Fig. 6: Flange connection ISO-K to ISO-F, hexagon head screw and tapped hole**

### Connection of the hexagon head screw and tapped hole

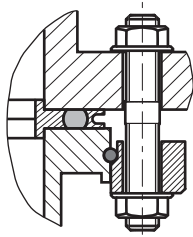
1. Only use the approved mounting kits of Pfeiffer Vacuum for the connection of the turbopump.
2. Place the collar flange over the high vacuum flange of the turbopump.
3. Insert the snap ring in the side groove on the high vacuum flange of the turbopump.
4. Attach the turbopump with collar flange, snap ring and centering ring to the counter flange according to the figure.
5. Use all prescribed components for the turbopump.
6. Screw the hexagon head screws into the tapped holes.
  - Observe the minimum tensile strength of the flange material and the screw depth.
7. Fasten the hexagon head screws cross-wise in 3 steps.
  - Tightening torque: **5, 15, 25  $\pm$  2 Nm**



**Fig. 7: Flange connection ISO-K to ISO-F, stud screw and tapped hole**

### Connection of the stud screw and tapped hole

1. Only use the approved mounting kits of Pfeiffer Vacuum for the connection of the turbopump.
2. Screw in the required number of stud screws with the shorter end in the holes on the counter flange.
  - Observe the minimum tensile strength of the flange material and the screw depth.
3. Place the collar flange over the high vacuum flange of the turbopump.
4. Insert the snap ring in the side groove on the high vacuum flange of the turbopump.
5. Attach the turbopump with collar flange, snap ring and centering ring to the counter flange according to the figure.
6. Use all prescribed components for the turbopump.
7. Secure the nuts cross-wise in 3 steps.
  - Tightening torque: **5, 15, 25  $\pm$  2 Nm**



**Fig. 8: Flange connection ISO-K to ISO-F, stud screw and through hole**

#### Connection of the stud screw and through hole

1. Only use the approved mounting kits of Pfeiffer Vacuum for the connection of the turbopump.
2. Place the collar flange over the high vacuum flange of the turbopump.
3. Insert the snap ring in the side groove on the high vacuum flange of the turbopump.
4. Attach the turbopump with collar flange, snap ring and centering ring to the counter flange according to the figure.
5. Use all prescribed components for the turbopump.
6. Tighten the nuts cross-wise in 3 steps.
7. Tightening torque: **5, 15, 25 ± 2 Nm**

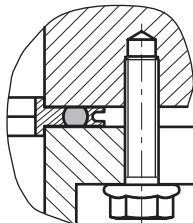
### 5.2.8 Attaching ISO-F flange to ISO-F

The connection types for ISO-F flange installation with ISO-F flange are:

- "Hexagon head screw and tapped hole"
- "Hexagon head screw and through hole"
- "Stud screw with tapped hole"
- "Stud screw with through hole"

#### Required tools

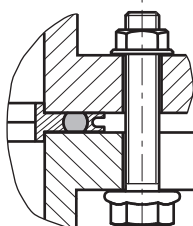
- Hexagon wrench (15 WAF)
- Calibrated torque wrench (tightening factor ≤ 1.6)



**Fig. 9: Flange connection ISO-F, hexagon head screw and tapped hole**

#### Connection of the hexagon head screw and tapped hole

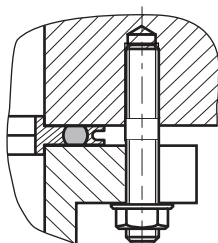
1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Attach the turbopump with centering ring to the counter flange according to the figure.
3. Use all prescribed components for the turbopump.
4. Screw the required number of hexagon head screws into the tapped hole.
  - Observe the minimum tensile strength of the flange material and the screw depth.
5. Fasten the hexagon head screws cross-wise in 3 steps.
  - Tightening torque: **10, 20, 38 ± 3 Nm**



**Fig. 10: Flange connection ISO-F, hexagon head screw and through hole**

### Connection of the hexagon head screw and through hole

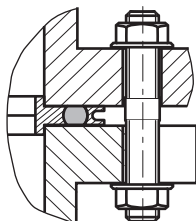
1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Attach the turbopump with centering ring to the counter flange according to the figure.
3. Use all prescribed components for the turbopump.
4. Push the hexagon head screws through the holes of the turbopump and counter flange.
5. Secure the hexagon nuts.
6. Fasten the screw connections cross-wise in 3 steps.
  - Tightening torque: **10, 20, 38 ± 3 Nm**



**Fig. 11: Flange connection ISO-F, stud screw and tapped hole**

### Connection of the stud screw and tapped hole

1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Screw in the stud screws with the shorter end in the tapped holes on the counter flange.
  - Observe the minimum tensile strength of the flange material and the screw depth.
3. Attach the turbopump with centering ring to the counter flange according to the figure.
4. Use all prescribed components for the turbopump.
5. Secure the hexagon nuts.
6. Tighten the nuts cross-wise in 3 steps.
  - Tightening torque: **10, 20, 38 ± 3 Nm**



**Fig. 12: Flange connection ISO-F, stud screw and through hole**

### Connection of the stud screw and through hole

1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Attach the turbopump with centering ring to the counter flange according to the figure.
3. Use all prescribed components for the turbopump.
4. Fasten the screw connections cross-wise in 3 steps.
  - Tightening torque: **10, 20, 38 ± 3 Nm**

## 5.2.9 Attaching CF flange to CF-F

The connection types for CF installation with CF flange are:

- "Hexagon head screw and through hole"
- "Stud screw with tapped hole"
- "Stud screw with through hole"

### NOTICE

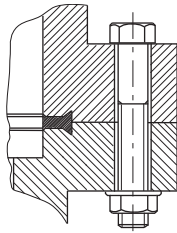
#### Leaks may occur due to the incorrect installation of CF flanges

Inadequate cleanliness when handling CF flanges and copper gaskets results in leaks and may cause process damage.

- ▶ Always wear suitable gloves before touching or fitting any components.
- ▶ Fit seals only if dry and free of grease.
- ▶ Take care of damaged surfaces and cut edges.
- ▶ Replace the damaged components.

#### Required tools

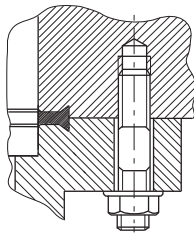
- Hexagonal wrench (13 WAF)
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )



**Fig. 13: Flange connection CF-F, hexagon head screw and through hole**

#### Connection of the hexagon head screw and through holes

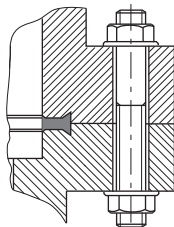
1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. If used: Insert the protective screen or splinter shield with clamping lugs downwards in the turbopump high vacuum flange.
3. Place the seal exactly in the hollow.
4. Connect the flange with the components of the mounting kit according to the figure.
5. Tighten the screw couplings all the way around.
  - Tightening torque:  **$22 \pm 2$  Nm**
6. Then check the torque, since flowing of the sealing material may make it necessary to re-tighten the screws.



**Fig. 14: Flange connection CF-F, stud screw and tapped hole**

#### Connection of the stud screw and tapped hole

1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. Screw in the required number of stud screws with the shorter end in the holes on the counter flange.
3. If used: Insert the protective screen or splinter shield with clamping lugs downwards in the turbopump high vacuum flange.
4. Place the seal exactly in the hollow.
5. Connect the flange with the components of the mounting kit according to the figure.
6. Tighten the screw couplings all the way around.
  - Tightening torque:  **$22 \pm 2$  Nm**
7. Then check the torque, since flowing of the sealing material may make it necessary to re-tighten the screws.



**Fig. 15: Flange connection CF-F, stud screw and through hole**

#### Connection of the stud screw and through hole

1. For the connection of the turbopump, use only the approved mounting kits from Pfeiffer Vacuum.
2. If used: Insert the protective screen or splinter shield with clamping lugs downwards in the turbopump high vacuum flange.

3. Place the seal exactly in the hollow.
4. Connect the flange with the components of the mounting kit according to the figure.
5. Tighten the screw couplings all the way around.
  - Tightening torque:  $22 \pm 2 \text{ Nm}$
6. Then check the torque, since flowing of the sealing material may make it necessary to re-tighten the screws.

### 5.3 Connecting 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.

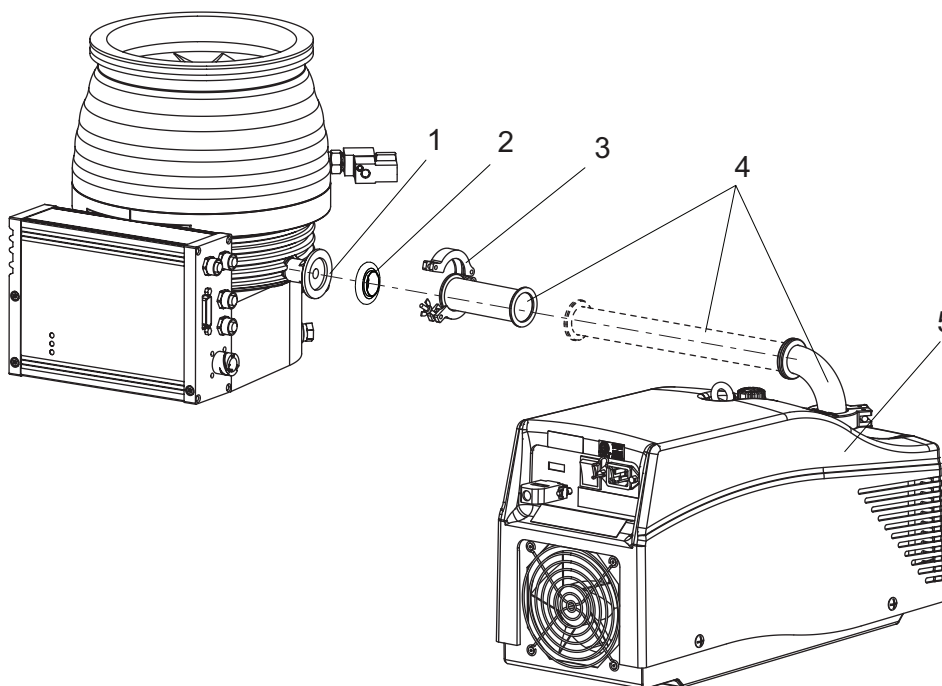
- Keep masses connected to the turbopump as low as possible.
- Use flexible lines to connect to the turbopump where necessary.



#### **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. 16: Example of fore-vacuum connection on HiPace 700 M**

- |                                    |                                              |
|------------------------------------|----------------------------------------------|
| 1 Turbopump fore-vacuum connection | 4 Vacuum components DN 25 ISO-KF             |
| 2 Centering ring                   | 5 Backing pump (e.g. multi-stage roots pump) |
| 3 Circlip                          |                                              |

#### **Establishing the fore-vacuum connection**

1. With rigid pipe connections, include bellows to attenuate external vibrations.
2. Install a fore-vacuum connection with small flange components, e.g. connection elements and pipe components DN 25 ISO-KF from the [Pfeiffer Vacuum Components Shop](#).

3. Implement measures to counteract the backflow of operating fluids or condensate from the fore-vacuum area.
4. Observe the information in the operating instructions of the backup pump or pumping station when connecting and operating it.

## 5.4 Making cooling water connection

### **WARNING**

#### **Risk of scalding from suddenly escaping hot cooling water**

The turbopump water connections are open to both sides. When connecting the cooling water supply, there is a risk of scalding from suddenly escaping, hot cooling water at over pressure.

- ▶ Prior to installation, ensure that pressure is discharged from the cooling water system, and that it is cooled down.
- ▶ Wear protective equipment, e.g., safety goggles and gloves.

#### **Recommendations for cooling the turbopump**

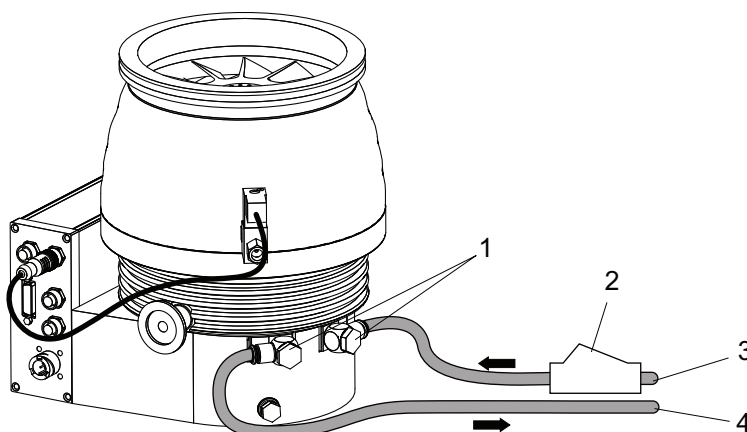
- ▶ Use additional cooling in the event of increased fore-vacuum pressure ( $> 0.1$  hPa).
- ▶ Use additional cooling if operating with high gas throughput.
- ▶ Always use water cooling at ambient temperatures  $> 35$  °C.

| Parameter                     | Cooling water                                                                                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Appearance                    | <ul style="list-style-type: none"> <li>• filtered</li> <li>• mechanically clear</li> <li>• visually clear</li> <li>• no turbidity</li> <li>• no sediment</li> <li>• free from grease and oil</li> </ul> |
| pH value                      | 7 to 9                                                                                                                                                                                                  |
| Carbonate hardness, max.      | 10 °dH<br>12.53 °e<br>17.8 °fH<br>178 ppm $\text{CaCO}_3$                                                                                                                                               |
| Chloride content, max.        | 100 mg/l                                                                                                                                                                                                |
| Sulfate content, max.         | 240 mg/l                                                                                                                                                                                                |
| Carbonic acid content, max.   | not detectable                                                                                                                                                                                          |
| Ammonia content, max.         | not detectable                                                                                                                                                                                          |
| Electrical conductivity, max. | 500 $\mu\text{S}/\text{cm}$                                                                                                                                                                             |
| Particle size, max.           | 150 $\mu\text{m}$                                                                                                                                                                                       |
| Cooling water temperature     | see "Technical data"                                                                                                                                                                                    |
| Cooling water flow            | see "Technical data"                                                                                                                                                                                    |
| Cooling water pressure, max.  | 6000 hPa                                                                                                                                                                                                |

**Tbl. 7: Requirements on the cooling water composition**

| Connection to the turbopump         | External cooling water supply |
|-------------------------------------|-------------------------------|
| Banjo fitting with insertion system | Hose cable                    |
|                                     | External hose diameter 8 mm   |
|                                     | Internal hose diameter 6 mm   |

**Tbl. 8: Requirements on the cooling water connection**



**Fig. 17: Connecting the cooling water supply**

- |                            |               |
|----------------------------|---------------|
| 1 Cooling water connection | 3 Feed line   |
| 2 Dirt trap                | 4 Return line |

#### Required tools

- Hexagon wrench (14 WAF)
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )

#### Connecting a cooling water supply

**Requirements:** The customer-side cooling system is closed and depressurized. The provided hose connections correspond to the turbopump connections.

1. If necessary, use a dirt trap in the feed line.
2. Insert the hoses for the cooling water feed line and return line as far as they will go into respective connections on the turbopump.
3. Adjust the banjo fittings according to your requirements.
  - Tightening torque for the banjo fitting: **3 to 3.5 Nm**

## 5.5 Connecting venting valve

- The permissible inlet pressure for venting gas is 1,500 hPa absolute.

#### Connect the venting valve to the accessory connection "accessory B1"

- Screw the control line of the venting valve into a free accessory connection on the electronic drive unit.
  - The specification in the configuration is "accessory B1".

#### Establish the venting gas supply

In case you want to use dry room air as venting gas, the venting valve is ready for operation immediately.

If you wish to use a different inert gas (e.g. nitrogen  $N_2$ ) as the venting gas, follow the steps below.

1. Provide an external venting gas supply with a maximum inlet pressure of 1,500 hPa absolute.
2. Connect the venting gas supply to the inlet side (G 1/8") of the valve.
3. If required, use a connecting adapter for the valve inlet side (not included in the shipment).

## 5.6 Connecting accessories



#### Installing and operating accessories

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

- Information and ordering options for the approved [range of accessories for magnetically levitated turbopumps](#) can be found online.



### Auxiliary connection to electronic drive unit TC 400 and TM 700

The electronic drive unit of the turbopump offers space for the connection of maximum 4 accessory devices. M12 connector sockets with the designation "accessory" are available for this purpose.

- The accessory connections have been preconfigured at the factory.
- After connecting pre-configured accessory devices, these are immediately ready for operation according to the factory settings.
- The use of other accessories for turbopumps is possible and requires settings in the configuration of the electronic drive unit.
- The desired accessory output is configured via RS-485 using Pfeiffer Vacuum control units or a PC.
- For detailed information see the "Electronic drive unit TC 400" or "Electronic drive unit TC 700" operating instructions.

|  | Electronic drive unit connection | Accessory connection | Y-connector | Pre-set configuration      |
|--|----------------------------------|----------------------|-------------|----------------------------|
|  | Acc. A                           | A1                   | Y-1         | Fan (continuous operation) |
|  |                                  | A2                   | Y-2         | Backing pump               |
|  | Acc. B                           | B1                   | Y-1         | Venting valve              |
|  |                                  | B2                   | Y-2         | Heating                    |

**Tbl. 9: Pre-set accessory connections to electronic drive unit TM 700**

#### Connect 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.
- ▶ Use the Y-connector from the accessories range if you want to connect 3 or 4 devices.

#### Using additional accessories

- ▶ Observe the installation instructions in the operating instructions for the relevant accessory.
- ▶ Note the existing configuration of existing connections.
- ▶ Use a Pfeiffer Vacuum control unit for the configuration if needed.

## 5.7 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.

### 5.7.1 Grounding turbopump

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

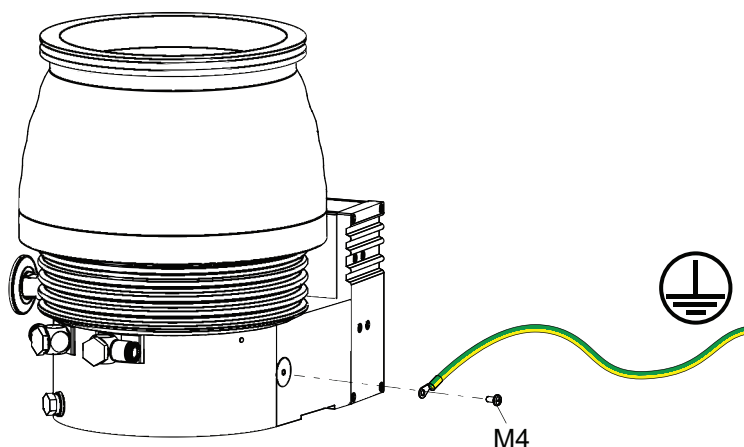


Fig. 18: Example: Connecting the grounding cable

#### Procedure

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

## 5.7.2 Establishing 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.

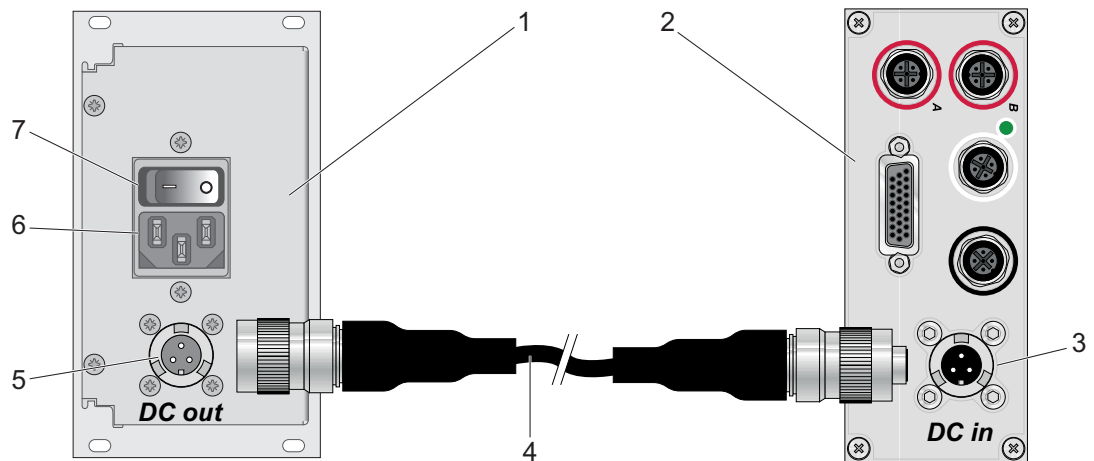
- ▶ Make sure that the power supply pack meets the requirements for double isolation between mains input voltage and output voltage, in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Make sure that the power supply pack meets the requirements in accordance with IEC 61010-1 IEC 60950-1 and 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. 19: Connecting electronic drive unit to power supply pack**

- |                                                           |                           |
|-----------------------------------------------------------|---------------------------|
| 1 Power supply pack   Control unit with power supply pack | 5 Connecting socket DCout |
| 2 Turbopump electronic drive unit                         | 6 Mains connection ACin   |
| 3 DCin connection                                         | 7 Main switch             |
| 4 Connection cable, e.g., PM 061 352 -T                   |                           |

#### Connecting electronic drive unit

1. Ensure the correct supply voltage.
2. Make sure that the power supply pack main switch is off prior to connection.
3. Use a suitable connection cable from the Pfeiffer Vacuum accessories range.
4. Insert the connecting cable into the connection "DCin" on the electronic drive unit and close the bayonet lock.
5. Insert the connecting cable into the connection "DCout" on the power supply pack and close the bayonet lock.

## 6 Operation

### 6.1 Commissioning

#### **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.

#### **NOTICE**

##### **Safety bearing wear in case of overload during operation**

Safety bearings, which prevent overloading of the magnetic bearings in case of contact between the rotor and stator, are subject to wear if overloaded. They are wear-free in case of trouble-free operation.

- ▶ Do not expose the running turbopump to impacts, vibrations or abrupt changes in position, especially tilting movements.
- ▶ Avoid pressure fluctuations on the high-vacuum or fore-vacuum side.
- ▶ Only vent the turbopump via the supplied venting valve.
- ▶ Maintain the mains supply without interruption.

#### **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).

Important settings and function-related variables are programmed ex factory as parameters in the vacuum pump electronic drive unit. 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.

Each time the mains voltage is switched on, and whenever an error is acknowledged, the electronic drive unit carries out magnetic bearing calibration. Calibration is noticeable in the form of regular metallic knocking noises, but this does not result in wear on the safety bearing.

| Parameter      | Name     | Designation             | Setting                        |
|----------------|----------|-------------------------|--------------------------------|
| <b>[P:027]</b> | GasMode  | Gas mode                | 0 = heavy gases                |
| <b>[P:030]</b> | VentMode | Venting mode            | 2 = direct venting             |
| <b>[P:035]</b> | CfgAccA1 | Accessory connection A1 | 0 = fan (continuous operation) |
| <b>[P:036]</b> | CfgAccB1 | Accessory connection B1 | 1 = Venting valve              |

| Parameter | Name       | Designation                                | Setting          |
|-----------|------------|--------------------------------------------|------------------|
| [P:037]   | CfgAccA2   | Accessory connection A2                    | 3 = backing pump |
| [P:038]   | CfgAccB2   | Accessory connection B2                    | 2 = heating      |
| [P:700]   | RUTimeSVal | Set value run-up time                      | 8 min.           |
| [P:701]   | SpdSwPt1   | Rotation speed switch point 1              | 80 %             |
| [P:707]   | SpdSVal    | Setpoint rotation speed setting mode       | 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. 10: Factory setting of the electronic drive unit when delivered**

#### Notes for turbopump commissioning

1. Ensure safe installation.
2. Ensure a sufficient fore-vacuum pressure.
3. Observe the cooling water flow and flow rate.
4. When using sealing gas, observe the sealing gas flow and throughput.
5. Provide the current supply for the product.

## 6.2 Operating modes

The turbopump can be operated in different modes.

- Operating without control unit
- Operation via connection "E74"
- Operation via "remote" connection
- Operating via RS-485 interface from Pfeiffer Vacuum control unit or PC
- Operation via field bus

### 6.2.1 Operating without operating unit



#### Automatic start

When using the supplied mating plug on the electronic drive unit or bridging contacts according to the terminal lay-out, the turbopump is ready for operation. Once the supply voltage is provided, the turbopump starts up immediately.

#### Instructions for operation without control panel

1. Use only the approved Pfeiffer Vacuum mating plug with bridges on the connection of the electronic drive unit.
2. Switch on the mains supply of the turbopump only 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 "remote"

Remote control is available via the 26-pole D-sub connector with the "remote" designation on the electronic drive unit. The accessible individual functions are mapped to "PLC levels".

#### Instructions for remote control operation

- See the operating instructions of the electronic drive unit for the standard version.

### 6.2.3 Operation via connection "E74"

Operation is possible via the 15-pole D-sub connection with the "E74" designation on the electronic drive unit. Besides the signals defined in the Directive SEMI E74-0301, the connection is provided with an inverted alarm signal and an analog output.

#### Instructions for operation with E74

- See the operating instructions of the electronic drive unit with E74 version.

## 6.2.4 Operation via Pfeiffer Vacuum control unit

Connecting a Pfeiffer Vacuum control unit allows the turbopump to be controlled via static parameters stored in the electronic drive unit.

### Using control unit

1. Observe the appropriate operating instructions for handling Pfeiffer Vacuum control units:
  - Operating instructions available from the [Download Center](#).
2. Observe the electronic drive unit operating instructions from the scope of delivery of the vacuum pump.
3. Connect the control unit to the "RS-485" port on the electronic drive unit.
  - Use a suitable connection cable with an "RS-485" connector for this.
4. Switch on the turbopump power supply via the external power supply pack or the control unit with integrated power supply pack.

## 6.2.5 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
- EtherCAT
- DeviceNet

### Instructions for field bus operation

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

## 6.3 Switching on the turbopump

### **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 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 control unit or a PC.

| LED                                                                                         | Symbol                                                                            | LED status           | Display                                                                           | Meaning                                              |
|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------|------------------------------------------------------|
| Green<br>  |  | Off                  |  | Currentless                                          |
|                                                                                             |                                                                                   | On, flashing         |  | "pumping station OFF", rotation speed $\leq 60$ 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<br> |  | Off                  |  | No warning                                           |
|                                                                                             |                                                                                   | On, constant         |  | Warning                                              |
| Red<br>    |  | Off                  |  | No error, no warning                                 |
|                                                                                             |                                                                                   | On, constant         |  | Error, malfunction                                   |

Tbl. 11: 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.

### 6.4.3 Safety bearing wear

Safety bearing wear depends on how serious the impact of the interference is on the running rotor. The magnetic bearing sensor system permanently monitors the current wear of the safety bearings. The electronic drive unit totals the wear and outputs it as a percentage of the possible maximum value.

- Appropriate warning messages are output from 75% of the maximum value.
- Appropriate error messages are output from 100% of the maximum value.

#### Monitoring safety bearing wear

1. Use parameter **[P:329]** to display the current safety bearing wear as a percentage.
2. Decommission the pump if the total stress has reached 100%.
3. Contact Pfeiffer Vacuum service.

### 6.4.4 Balance

The magnetic bearing sensorics permanently monitor the current rotor balance. The balance condition is measured as a percentage of the maximum possible stress on the rotor and displayed on the Pfeiffer Vacuum control unit or output on the PC via the RS-485 interface.

- The respective warning messages output is carried out from 75% of the permissible imbalance.
- The respective error messages output is carried out from 100% of the permissible imbalance.

**Monitoring balance**

1. Parameter **[P:358]** is used to display the current balance of the rotor in %.
2. Decommission the pump if the permissible imbalance has reached 100%.
3. Contact Pfeiffer Vacuum service.

## 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.
5. Close the supply lines (e.g. for cooling water or sealing gas).

### 6.5.2 Electric brake

After switching off the pump, Pfeiffer Vacuum recommends the using the electric brake function. It reduces the slow-down time and permits the controlled braking of the rotor until the pump comes to a standstill.

**Using electrical brake**

- Set parameter **[P:013]** to value of "1".

### 6.5.3 Emergency power supply

#### NOTICE

**Damage to turbopump due to unintended operation**

Active magnetic bearings require a constant power supply. The motor acts as a generator and supplies the drive electronics in the event of a power failure. Below a rotation speed of approx. 6000 rpm, the kinetic energy of the rotor will no longer be sufficient to supply the magnetic bearings. The electronic drive unit switches off. The rotor will run down audibly in the safety bearings. This results in wear on the safety bearings.

- Do not switch off the pump by disconnecting the mains power supply.

**LED status**

- The green LED on the electronic drive unit shows the current operating status.
- The yellow LED on the electronic drive unit is lit ("Undervoltage" warning).

### 6.5.4 Venting

#### ⚠ CAUTION

**Risk of injury from contact with vacuum during venting**

When venting the vacuum pump, there is the risk of minor injuries due to direct contact of body parts with the vacuum, e.g. hematoma.

- Keep away from automatic venting units, such as venting valves.

**NOTICE****Turbopump damage due to unacceptably high pressure rise when venting**

Impermissibly high rates of pressure rise subject the rotor, magnetic bearing and safety bearing to stress. This can produce mechanical damage to the turbopump, up to and including failure.

- ▶ Exclusively use the supplied venting valve to vent the turbopump
- ▶ Observe the prescribed maximum **15 hPa/s** rate of pressure rise.
- ▶ Avoid manual and uncontrolled venting of very small volumes.
- ▶ First vent via the Pfeiffer Vacuum venting valve up to a rotation speed of 6000 rpm before using an additional ventilation system.

**Required aids**

- Dry, oil-free air or inert gas

**Cyclic venting with venting valve**

The electronic drive unit controls the venting rate and vents the turbopump by means of cyclic opening and closing of the venting valve. The venting valve is normally closed.

Control is via the turbopump electronic drive unit, and configuration of parameters **[P:012]** and **[P:030]**. In the event of a power failure, the turbopump continues to deliver sufficient energy during its run-down period to initiate a proper venting process. When power is restored, the venting process is interrupted.

1. Vent the turbopump with dry, oil-free air or inert gas.
2. Switch off the turbopump.
  - The venting process starts automatically.
3. Wait for pressure equalization to atmospheric pressure in the vacuum system.

| Venting speed [P:720] | Venting duration [P:721] | Venting duration in the event of a power failure |
|-----------------------|--------------------------|--------------------------------------------------|
| 50% of rated speed    | 3600 s                   | 3600 s                                           |

**Tbl. 12: Factory settings for delayed venting in turbopumps**

**General information for fast venting**

We recommend fast venting of larger volumes in 4 steps.

1. Use a Pfeiffer Vacuum venting valve for the turbopump, or match the valve cross-section to the size of the recipient and maximum venting rate.
2. Vent the vacuum system at a maximum rate of pressure rise of **15 hPa/s** until a speed of 6000 rpm is reached.
3. Then vent the system with a second venting valve of any size; for example, directly at the vacuum chamber.
4. 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  $f = 0$ ).
- ▶ 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. Comply with the mandatory inspection period for electrical safety devices that is valid locally in each case.
4. For all other cleaning, maintenance or repair work, contact the appropriate Pfeiffer Vacuum Service location.

## 7.3 Replacing electronic drive unit

### NOTICE

#### Damage to the vacuum pump and electronic drive unit due to improper disconnection of components

Even after the power supply has been switched off, the vacuum pump continues to deliver electrical energy during its run-down period. If the vacuum pump and electronic drive unit are disconnected prematurely, there is the risk of body contact and consequently the destruction of electronic components.

- ▶ Never disconnect the vacuum pump and electronic drive unit from each other if power is still connected or if the rotor is running.
- ▶ Monitor the rotation speed via the parameters available in the electronic drive unit (e.g. **[P:398]**).
- ▶ Wait until the vacuum pump 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 an HPU.
2. Load a backup parameter set by means of HPU into the new electronic drive unit.
3. Program the individual settings into the new electronic drive unit by hand.
4. See 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 spare part.

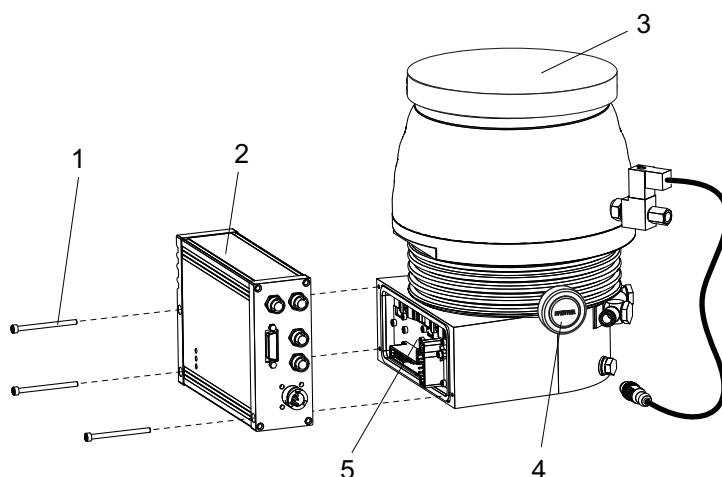
#### Prerequisites

- Turbopump off
- Turbopump cooled
- Vacuum system vented to atmospheric pressure
- Electrical supply disconnected
- All cables disconnected from the electronic drive unit
- All openings sealed with the original protective covers, and any screw plugs.

### 7.3.1 Removing electronic drive unit

#### Required tools

- Allen key, **WAF 3**



**Fig. 20: Removal of electronic drive unit TM 700**

- |                                           |                                           |
|-------------------------------------------|-------------------------------------------|
| 1 Hexagon socket screw                    | 4 Fore-vacuum connection protective cover |
| 2 Electronic drive unit                   | 5 Circuit board                           |
| 3 High vacuum connection protective cover |                                           |

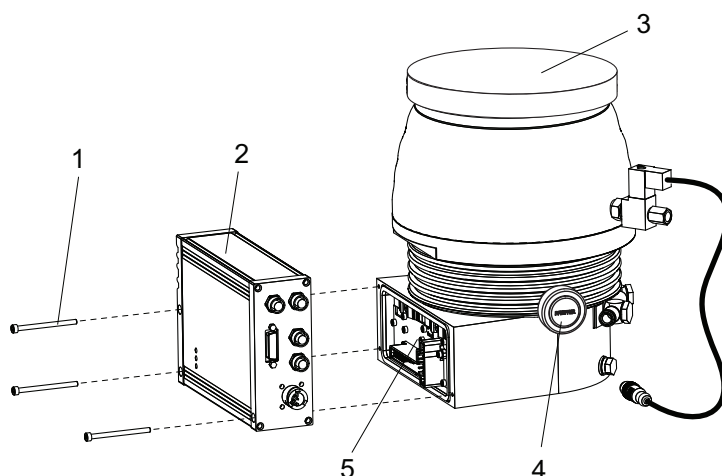
#### Procedure

1. Set the turbopump upright if required.
2. Unscrew all 3 Allen head screws from the electronic drive unit.
3. Pull the old electronic drive unit off the turbopump, taking care to keep it straight.

## 7.3.2 Installing electronic drive unit

#### Required tools

- Allen key, **WAF 3**
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )



**Fig. 21: Installation of electronic drive unit TM 700**

- |                                           |                                           |
|-------------------------------------------|-------------------------------------------|
| 1 Hexagon socket screw                    | 4 Fore-vacuum connection protective cover |
| 2 Electronic drive unit                   | 5 Circuit board                           |
| 3 High vacuum connection protective cover |                                           |

#### Procedure

1. Set the turbopump upright if required.
2. Place a new electronic drive unit straight onto the adapter plate connection of the turbopump.
3. Screw the electronic drive unit to the turbopump with all 3 Allen head screws.
  - Tightening torque: **2.5 Nm**

### 7.3.3 Confirming 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. 13: Characteristic nominal rotation speeds of the turbopumps**

#### Required aids

- Connected Pfeiffer Vacuum control unit
- Knowledge of the configuration and setting of electronic drive unit operating parameters

#### Adjusting nominal rotation speed confirmation

1. Observe the operating instructions of the control unit.
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. Vent the turbopump via the venting connection with dry, oil-free air or inert gas.
2. Remove the turbopump from the vacuum system if necessary.
3. Seal all flange openings with the original protective caps.
4. Store the turbopump upright with the high vacuum flange upwards.
5. Store the turbopump indoors only, within the specified temperature range.
6. In rooms with humid or aggressive atmospheres: Hermetically seal the turbopump together with a drying agent in a plastic bag.

### 8.2 Recommissioning

#### **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. Install the turbopump according to these instructions ([see chapter "Installation", page 21](#)).
5. Recommission the turbopump according to these instructions.

## 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.

### 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 Disposing of turbopumps

Pfeiffer Vacuum turbopumps contain materials that you must recycle.

1. Remove the electronic drive unit.
2. Decontaminate components that come into contact with process gases
3. Separate the components into recyclable materials.
4. Recycle the non-contaminated components.
5. Dispose of the product or components safely according to locally applicable regulations.

## 10 Malfunctions

### 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 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.

### WARNING

#### **Risk of injury caused by the turbopump breaking away with the vibration compensator in the event of a malfunction**

Sudden jamming of the rotor generates high destructive torques in accordance with ISO 27892. When using a vibration compensator, this will probably lead to the turbopump being sheared off in use. 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.

- ▶ Take suitable safety precautions on-site for the compensation of the occurring torques.
- ▶ Before installing a vibration compensator, you must first of all contact Pfeiffer Vacuum.

Should malfunctions occur, you can find information about potential causes and how to fix them here. The operating instructions 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 | <ul style="list-style-type: none"> <li>• Current supply interrupted</li> </ul>      | <ul style="list-style-type: none"> <li>• Check the plug contacts on the power supply pack.</li> <li>• Check the current supply lines.</li> <li>• Check the output voltage at the power supply pack "DC out" connection.               <ul style="list-style-type: none"> <li>– Depending on the version of the power supply pack, 24 V DC or 48 V DC are present.</li> </ul> </li> </ul> |
|                                                                                              | <ul style="list-style-type: none"> <li>• Incorrect operating voltage</li> </ul>     | <ul style="list-style-type: none"> <li>• Observe the electronic drive unit rating plate.</li> <li>• Supply the correct operating voltage.</li> </ul>                                                                                                                                                                                                                                     |
|                                                                                              | <ul style="list-style-type: none"> <li>• No operating voltage present</li> </ul>    | <ul style="list-style-type: none"> <li>• Supply the correct operating voltage.</li> <li>• Switch on the power supply pack.</li> </ul>                                                                                                                                                                                                                                                    |
|                                                                                              | <ul style="list-style-type: none"> <li>• Electronic drive unit defective</li> </ul> | <ul style="list-style-type: none"> <li>• Replace the electronic drive unit.</li> <li>• Contact Pfeiffer Vacuum Service.</li> </ul>                                                                                                                                                                                                                                                       |

|                                                                                 |                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turbopump will not start up; green LED on the electronic drive unit is flashing | <ul style="list-style-type: none"> <li>• <b>For operation without control unit:</b> Pins 1-3 and 1-14 on the "remote" connection are not connected</li> </ul>                                                      | <ul style="list-style-type: none"> <li>• Connect the connections according to the electronic drive unit connection diagram.</li> <li>• Check the bridges on the connection cable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                 | <ul style="list-style-type: none"> <li>• <b>For operation via RS-485:</b> The bridge between pins 1 and 14 inhibits control commands</li> </ul>                                                                    | <ul style="list-style-type: none"> <li>• Remove the bridge at the "remote" connection.</li> <li>• Check the connection cable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                 | <ul style="list-style-type: none"> <li>• <b>For operation via RS-485:</b> Parameters not set in the electronic drive unit</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>• Set the parameters <b>[P: 010]</b> and <b>[P: 023]</b> via the interface RS-485 to 1 = "ON".</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                 | <ul style="list-style-type: none"> <li>• Voltage drop in the cable is too high</li> </ul>                                                                                                                          | <ul style="list-style-type: none"> <li>• Check the connection cable.</li> <li>• Use a suitable connection cable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Turbopump fails to reach the nominal rotation speed within the set run-up time  | <ul style="list-style-type: none"> <li>• Fore-vacuum pressure too high</li> </ul>                                                                                                                                  | <ul style="list-style-type: none"> <li>• Check backup pump compatibility (see technical data).</li> <li>• Check that the backup pump is working.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                 | <ul style="list-style-type: none"> <li>• Leakage on the turbopump</li> </ul>                                                                                                                                       | <ul style="list-style-type: none"> <li>• Carry out leak detection.</li> <li>• Check seals and flange connections.</li> <li>• Eliminate leaks.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                 | <ul style="list-style-type: none"> <li>• Gas throughput too high</li> </ul>                                                                                                                                        | <ul style="list-style-type: none"> <li>• Reduce the process gas load.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                 | <ul style="list-style-type: none"> <li>• Rotor not running smoothly, defective bearing</li> </ul>                                                                                                                  | <ul style="list-style-type: none"> <li>• Check the turbopump for noise development</li> <li>• Contact Pfeiffer Vacuum Service.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                 | <ul style="list-style-type: none"> <li>• Run-up time setpoint adjusted too low</li> </ul>                                                                                                                          | <ul style="list-style-type: none"> <li>• Use a control unit to extend the set value run-up time <b>[P:700]</b>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                                                 | <b>Thermal load due to:</b> <ul style="list-style-type: none"> <li>• lack of ventilation</li> <li>• water flow too low</li> <li>• Fore-vacuum pressure too high</li> <li>• ambient temperature too high</li> </ul> | <ul style="list-style-type: none"> <li>• Reduce the thermal load. <ul style="list-style-type: none"> <li>— Ensure adequate air supply.</li> <li>— Adjust the cooling water flow.</li> <li>— Reduce the fore-vacuum pressure.</li> <li>— Adapt the ambient conditions.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                           |
| Turbopump not achieving the ultimate pressure                                   | <ul style="list-style-type: none"> <li>• Turbopump is polluted</li> </ul>                                                                                                                                          | <ul style="list-style-type: none"> <li>• Heat the turbopump if required.</li> <li>• Have it cleaned.</li> <li>• Contact Pfeiffer Vacuum Service.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                 | <ul style="list-style-type: none"> <li>• Vacuum chamber, pipes or turbopump leaking</li> </ul>                                                                                                                     | <ul style="list-style-type: none"> <li>• Carry out leak detection starting from the vacuum chamber.</li> <li>• Check seals and flange connections.</li> <li>• Eliminate leaks in the vacuum system.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                         |
| Unusual noises during operation                                                 | <ul style="list-style-type: none"> <li>• Rotor bearing damaged</li> </ul>                                                                                                                                          | <ul style="list-style-type: none"> <li>• Contact Pfeiffer Vacuum Service.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                 | <ul style="list-style-type: none"> <li>• Rotor damaged</li> </ul>                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Contact Pfeiffer Vacuum Service.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                 | <ul style="list-style-type: none"> <li>• Splinter shield or protective screen loose</li> </ul>                                                                                                                     | <ul style="list-style-type: none"> <li>• Check and correct the seat of the splinter shield or protective screen in the high vacuum flange.</li> <li>• Follow the installation instructions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
| Red LED on the electronic drive unit illuminates                                | <ul style="list-style-type: none"> <li>• Group error</li> </ul>                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Reset the malfunction by switching the current supply off and on.</li> <li>• Reset the malfunction with V+ on pin 13 on the "remote" connection.</li> <li>• Set the parameter <b>[P: 009]</b> via the RS-485 interface to 1 = malfunction acknowledgment.</li> <li>• Set the parameter <b>[P: 010]</b> via the RS-485 interface to 0 = off and then 1 = on and malfunction acknowledgment.</li> <li>• Carry out a differentiated malfunction analysis with a display and control unit.</li> <li>• Contact Pfeiffer Vacuum Service.</li> </ul> |

TbL 14: 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.

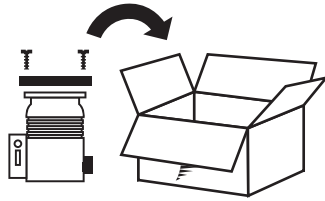


4. You will receive an acknowledgment from Pfeiffer Vacuum.

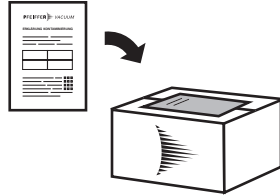
PFEIFFER VACUUM

## Submission of contaminated products

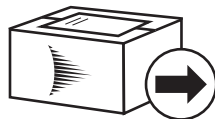
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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



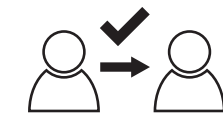
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
  - a) Neutralize the product with nitrogen or dry air.
  - b) Seal all openings with blind flanges, so that they are airtight.
  - c) Shrink-wrap the product in suitable protective foil.
  - d) Package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

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 for HiPace 700 M

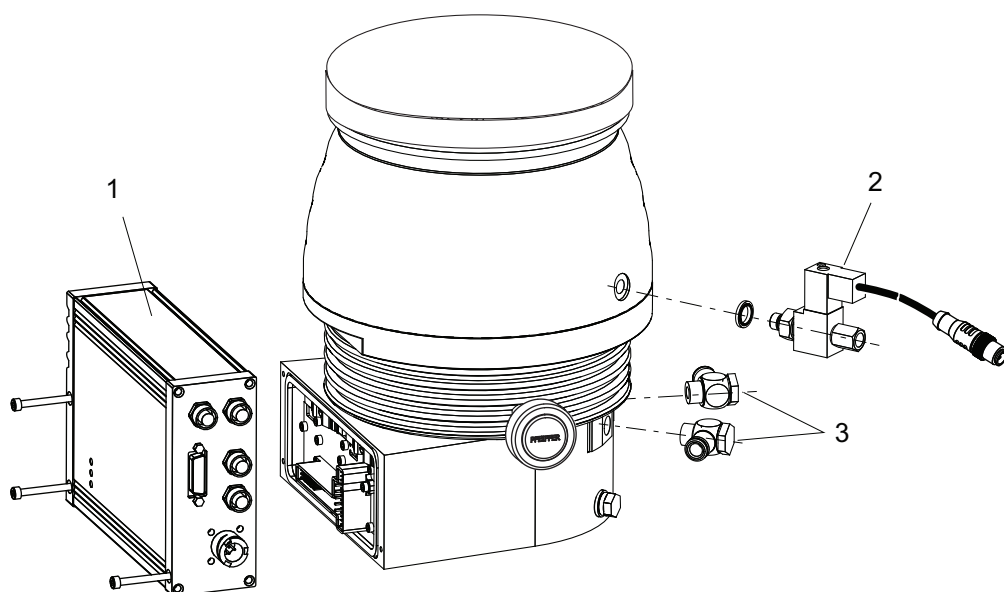


Fig. 22: Spare parts for HiPace 700 M

| Position | Designation                     | Order number              | Remark                            | Pieces |
|----------|---------------------------------|---------------------------|-----------------------------------|--------|
| 1        | Electronic drive unit<br>TM 700 | refer to the rating plate | depending on the connection panel | 1      |
| 2        | Venting valve                   | PM Z01 291                | Incl. sealing ring                | 1      |
| 3        | Banjo fitting                   | P 4131 007 E              | Water cooling                     | 2      |

Tbl. 15: Overview of spare parts available for HiPace 700 M

## 13 Accessories



View the [range of accessories for magnetically levitated turbopumps](#) on our website.

### 13.1 Accessory information

#### Fixing materials

Type-specific assembled packages, with centering ring and seal, ensure the secure fastening of the vacuum pump. Optionally with splinter shield or protective screen.

#### Power supply packs and control units

Power supply packs for optimal voltage supply of Pfeiffer Vacuum products are characterized by their compact size and adapted power supply with maximum reliability. Display and operating units are used to check and adjust operating parameters.

#### Cable and adapter

Mains, interface, connection, and extension cables provide a secure and suitable connection. Different lengths on request

#### Sealing gas supply

Sealing gas is used to protect the vacuum pump from dusty and corrosive processes, or excessive gas throughputs. Sealing gas prevents the ingress of damaging substances into the motor and bearing area. The supply is carried out either via a sealing gas valve or a sealing gas throttle without control.

#### Air cooling

For processes with low gas throughputs and good fore-vacuum pressure, air cooling can be used independently of a water supply. Automatic control through the integrated electronic drive unit of the turbopump.

#### Heating

Heating jackets enable the ultimate pressure to be reached more quickly during process cleaning. Automatic control through the integrated electronic drive unit of the turbopump.

#### Backing pump control

The electronic drive unit of the turbopump enables useful control of backing pumps. Depending on the backing pump used, different operating modes are available.

#### Integrated pressure measurement

Evaluation and control by the integrated electronic drive unit, independently of an additional power supply.

### 13.2 Ordering accessories

| Selection field                                                 | Part number    |
|-----------------------------------------------------------------|----------------|
| Connection kit for mounting pumps, DN 25 ISO-KF                 | 120SWS025-1000 |
| Mains cable 230 V AC, CEE 7/7 to C13, 3 m                       | P 4564 309 ZA  |
| Mains cable 115 V AC, NEMA 5-15 to C13, 3 m                     | P 4564 309 ZE  |
| Mains cable 208 V AC, NEMA 6-15 to C13, 3 m                     | P 4564 309 ZF  |
| Y-connector M12 for RS-485                                      | P 4723 010     |
| Y-Connector, shielded, M12 for accessories                      | P 4723 013     |
| OmniControl 001 Mobile, control units                           | PE D20 000 0   |
| OmniControl 001, rack unit without integrated power supply pack | PE D40 000 0   |
| OmniControl 400, rack unit with integrated power supply pack    | PE D70 000 0   |
| OmniControl 400, table unit with integrated power supply pack   | PE E70 000 0   |
| OmniControl 200 with PKR 361, 25 KF                             | PT 440 955 -T  |
| OmniControl 200 mit PKR 361, 40 CF                              | PT 440 957 -T  |
| Vibration damper for HiPace with DN 160 ISO-K/F                 | PM 006 492 AX  |

| Selection field                                                                                                         | Part number      |
|-------------------------------------------------------------------------------------------------------------------------|------------------|
| Centering ring with multifunction coating, DN 160 ISO-K/-F                                                              | PM 016 216 -U    |
| Centering ring with multifunction coating and integrated splinter shield, DN 160 ISO-K/-F                               | PM 016 217 AU    |
| Centering ring with multifunction coating and integrated protection screen, DN 160 ISO-K/-F                             | PM 016 218 AU    |
| Mounting kit for HiPace 700 M, DN 160 ISO-K, including coated centering ring and bracket screws                         | PM 016 385 -T    |
| Mounting kit for HiPace 700 M, DN 160 ISO-K, including coated centering ring, splinter shield, bracket screws           | PM 016 386 -T    |
| Mounting kit for HiPace 700, DN 160 ISO-K, including coated centering ring, protection screen and bracket screws        | PM 016 387 -T    |
| Sealing gas monitoring unit G 1/8"                                                                                      | PM 016 911 -U    |
| Mounting kit for DN 160 ISO-K to ISO-F, with collar flange, coated centering ring, hexagon bolts                        | PM 016 950 -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 with protection screen, hexagon bolts | PM 016 952 -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 splinter shield, stud screws     | PM 016 956 -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-F, including coated centering ring, hexagon screws                                          | PM 016 460 -T    |
| Mounting kit for HiPace 700, 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, protective screen, hexagon screws                       | PM 016 462 -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    |
| Elastomer seal, FKM, DN 160 CF                                                                                          | 402DFL160-S2     |
| Elastomer seal, FKM, DN 160 CF                                                                                          | 402DFL160-Z      |
| Copper gasket, vacuum-annealed, DN 160 CF                                                                               | 490DFL160-G-S5   |
| Copper gasket, OFHC copper, DN 160 CF                                                                                   | 490DFL160-S5     |
| Copper gasket, silver-plated, vacuum-annealed, DN 160 CF                                                                | 490DFL160-S-G-S5 |
| Copper gasket, silver-plated, DN 160 CF                                                                                 | 490DFL160-S-S5   |
| Vibration damper for HiPace DN 160 CF-F                                                                                 | PM 006 493 AX    |
| Splinter shield for turbopumps, DN 160 CF-F                                                                             | PM 016 318       |
| Protection screen for DN 160 CF-F                                                                                       | PM 016 339       |
| Hexagon screw set for flanges with through holes, DN 160 CF-F                                                           | PM 016 691 -T    |
| Set of stud screws for flanges with a threaded hole, DN 160 CF-F                                                        | PM 016 693 -T    |
| Set of stud screws for flanges with through-hole, DN 160 CF-F                                                           | PM 016 735 -T    |
| Heating sleeve, shielded, for HiPace® 400/700/800 with TC 400 PB/TM 700, 230 V AC, safety plug                          | PM 071 269 -T    |
| Heating sleeve, shielded, for HiPace® 400/700/800 with TC 400 PB/TM 700, 208 V AC, ul plug                              | PM 071 270 -T    |
| Heating sleeve, shielded, for HiPace® 400/700/800 with TC 400 PB/TM 700, 115 V AC, ul plug                              | PM 071 271 -T    |
| UHV Gate valve, DN 160 CF, UNF, electro-pneumatic, PI (RS)/PV 24 V DC, SS/Cu/FKM                                        | GVMP-S10642      |
| HV gate valve, DN 160 ISO-F, electro-pneumatic, PI (RS)/PV 24 V DC, SS/FKM                                              | GVP-S10342       |
| HPU 001, handheld programming unit                                                                                      | PM 051 510 -T    |

| Selection field                                                                               | Part number   |
|-----------------------------------------------------------------------------------------------|---------------|
| Accessories package for HPU 001/PC                                                            | PM 061 005 -T |
| USB RS-485 converter                                                                          | PM 061 207 -T |
| Coupling M12 for RS-485                                                                       | PM 061 270 -X |
| Interface cable, M12 m straight / M12 m straight, 3 m                                         | PM 061 283 -T |
| TPS 400, power supply pack 48 V DC, for wall/standard rail fitting                            | PM 061 343 -T |
| TPS 401, power supply pack 48 V DC, 19" partial plug-in 3HU                                   | PM 061 347 -T |
| Connection cable for HiPace with TC 400/TM 700 to power supply pack TPS/DCU 310/311/400/401   | PM 061 352 -T |
| Wall rail fitting for TPS 110/180/310/400                                                     | PM 061 392 -T |
| Front panel kit for TPS 401                                                                   | PM 061 396 -T |
| Control cable for pumping stations 0.7 m                                                      | PM 061 675 AT |
| HiPace – ACP connection cable                                                                 | PM 071 142 -X |
| Relay box, shielded, for backing pumps, 1-phase 7 A for TC 400/1200, TM 700 and TCP 350, M12  | PM 071 284 -X |
| Relay box, shielded, for backing pumps, 1-phase 20 A for TC 400/1200, TM 700 and TCP 350, M12 | PM 071 285 -X |
| TTV 001, Drier for venting turbopumps                                                         | PM Z00 121    |
| TVV 001, fore-vacuum safety valve, 230 V AC                                                   | PM Z01 205    |
| TVV 001, fore-vacuum safety valve, 115 V AC                                                   | PM Z01 206    |
| Venting valve, shielded, 24 V DC, G 1/8", for connection to TC 400/1200 and TM 700            | PM Z01 291    |
| Sealing gas valve, shielded for HiPace 300 with TC 400 and TM 700, TCP 350                    | PM Z01 312    |
| Sealing gas throttle for HiPace 300                                                           | PM Z01 317    |
| Shielded air cooling for HiPace 400/700/800 and 300 M/700 M/800 M with TC 400 PB/TM 700       | PM Z01 363    |
| Terminal resistor for RS-485                                                                  | PT 348 105 -T |
| Power separator for RS-485                                                                    | PT 348 132 -T |
| TIC 010, adapter for two sensors                                                              | PT R70 000    |
| RPT 010, digital Piezo/Pirani sensor                                                          | PT R71 100    |
| IKT 010, digital cold cathode sensor, low current                                             | PT R72 100    |
| IKT 011, digital cold cathode sensor, high current                                            | PT R73 100    |

Tbl. 16: HiPace 700 M | Accessories

## 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<sup>3</sup>/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                   |

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

Tbl. 17: Conversion table: Pressure units

|                        | mbar l/s             | Pa m <sup>3</sup> /s | sccm | Torr l/s             | atm cm <sup>3</sup> /s |
|------------------------|----------------------|----------------------|------|----------------------|------------------------|
| mbar l/s               | 1                    | 0.1                  | 59.2 | 0.75                 | 0.987                  |
| Pa m <sup>3</sup> /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 <sup>3</sup> /s | 1.01                 | 0.101                | 59.8 | 0.76                 | 1                      |

Tbl. 18: Conversion table: Units for gas throughput

### 14.2 Technical data

| Type designation                     | HiPace® 700 M           | HiPace® 700 M           | HiPace® 700 M            |
|--------------------------------------|-------------------------|-------------------------|--------------------------|
| Connection flange (in)               | DN 160 ISO-K            | DN 160 ISO-F            | DN 160 CF-F              |
| Connection flange (out)              | DN 25 ISO-KF            | DN 25 ISO-KF            | DN 25 ISO-KF             |
| Final pressure                       | $< 1 \cdot 10^{-7}$ hPa | $< 1 \cdot 10^{-7}$ hPa | $< 5 \cdot 10^{-10}$ hPa |
| Compression ratio for Ar             | $> 1 \cdot 10^{11}$     | $> 1 \cdot 10^{11}$     | $> 1 \cdot 10^{11}$      |
| Compression ratio for H <sub>2</sub> | $2 \cdot 10^5$          | $2 \cdot 10^5$          | $2 \cdot 10^5$           |
| Compression ratio for He             | $> 1 \cdot 10^7$        | $> 1 \cdot 10^7$        | $> 1 \cdot 10^7$         |
| Compression ratio for N <sub>2</sub> | $> 1 \cdot 10^{11}$     | $> 1 \cdot 10^{11}$     | $> 1 \cdot 10^{11}$      |
| Pumping speed for Ar                 | 660 l/s                 | 660 l/s                 | 660 l/s                  |

| Type designation                                              | HiPace® 700 M                               | HiPace® 700 M                               | HiPace® 700 M                               |
|---------------------------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|
| Pumping speed for H <sub>2</sub>                              | 480 l/s                                     | 480 l/s                                     | 480 l/s                                     |
| Pumping speed for He                                          | 600 l/s                                     | 600 l/s                                     | 600 l/s                                     |
| Pumping speed for N <sub>2</sub>                              | 685 l/s                                     | 685 l/s                                     | 685 l/s                                     |
| Gas throughput at final rotation speed for Ar                 | 8 hPa·l/s                                   | 8 hPa·l/s                                   | 8 hPa·l/s                                   |
| Gas throughput at 0.1 hPa HV pressure for N <sub>2</sub>      | 16 hPa·l/s                                  | 16 hPa·l/s                                  | 16 hPa·l/s                                  |
| Gas throughput at 0.1 hPa HV pressure for He                  | 16 hPa·l/s                                  | 16 hPa·l/s                                  | 16 hPa·l/s                                  |
| Gas throughput at 0.1 hPa HV pressure for H <sub>2</sub>      | 9 hPa·l/s                                   | 9 hPa·l/s                                   | 9 hPa·l/s                                   |
| Gas throughput at 0.1 hPa HV pressure for Ar                  | 16 hPa·l/s                                  | 16 hPa·l/s                                  | 16 hPa·l/s                                  |
| Gas throughput at final rotation speed for N <sub>2</sub>     | 13 hPa·l/s                                  | 13 hPa·l/s                                  | 13 hPa·l/s                                  |
| Fore-vacuum max. for N <sub>2</sub>                           | 8 hPa                                       | 8 hPa                                       | 8 hPa                                       |
| Fore-vacuum max. for Ar                                       | –                                           | –                                           | –                                           |
| Fore-vacuum max. for H <sub>2</sub>                           | –                                           | –                                           | –                                           |
| Fore-vacuum max. for He                                       | –                                           | –                                           | –                                           |
| Rotation speed ± 2 %                                          | 49200 rpm                                   | 49200 rpm                                   | 49200 rpm                                   |
| Rotation speed variable                                       | –                                           | –                                           | –                                           |
| Operating voltage: DC                                         | 48 V                                        | 48 V                                        | 48 V                                        |
| Power consumption max.                                        | 300 W                                       | 300 W                                       | 300 W                                       |
| Input voltage: tolerance                                      | ±10 %                                       | ±10 %                                       | ±10 %                                       |
| Current, max.                                                 | 7,5 A                                       | 7,5 A                                       | 7,5 A                                       |
| Run-up time                                                   | 4 min                                       | 4 min                                       | 4 min                                       |
| Position of power supply pack                                 | External power supply pack                  | External power supply pack                  | External power supply pack                  |
| Electronic drive unit                                         | TM 700                                      | TM 700                                      | TM 700                                      |
| I/O interfaces                                                | RS-485, Remote                              | RS-485, Remote                              | RS-485, Remote                              |
| I/O interfaces                                                | RS-485, Remote                              | RS-485, Remote                              | RS-485, Remote                              |
| Mounting orientation                                          | Arbitrary                                   | Arbitrary                                   | Arbitrary                                   |
| Bearing                                                       | Magnet                                      | Magnet                                      | Magnet                                      |
| Cooling method                                                | Water                                       | Water                                       | Water                                       |
| Cooling water flow                                            | 80 l/h                                      | 80 l/h                                      | 80 l/h                                      |
| Cooling water temperature                                     | 15 – 35 °C                                  | 15 – 35 °C                                  | 15 – 35 °C                                  |
| Cooling method, optional                                      | Air, Convection                             | Air, Convection                             | Air, Convection                             |
| Sound pressure level                                          | ≤45 dB(A)                                   | ≤45 dB(A)                                   | ≤45 dB(A)                                   |
| Venting connection                                            | G 1/8"                                      | G 1/8"                                      | G 1/8"                                      |
| Max. connection pressure (abs.) for venting/sealing gas valve | 1500 hPa                                    | 1500 hPa                                    | 1500 hPa                                    |
| Integral leakage rate                                         | < 1 · 10 <sup>-8</sup> Pa m <sup>3</sup> /s | < 1 · 10 <sup>-8</sup> Pa m <sup>3</sup> /s | < 1 · 10 <sup>-8</sup> Pa m <sup>3</sup> /s |
| Relative humidity of air                                      | 5 – 85 %, non-condensing                    | 5 – 85 %, non-condensing                    | 5 – 85 %, non-condensing                    |
| Sound pressure level                                          | ≤ 45 dB(A)                                  | ≤ 45 dB(A)                                  | ≤ 45 dB(A)                                  |
| Protection degree                                             | IP54                                        | IP54                                        | IP54                                        |
| Permissible radial magnetic field max.                        | 5 mT                                        | 5 mT                                        | 5 mT                                        |
| Permissible irradiated thermal output max.                    | 2.4 W                                       | 2.4 W                                       | 2.4 W                                       |

| Type designation                 | HiPace® 700 M | HiPace® 700 M | HiPace® 700 M |
|----------------------------------|---------------|---------------|---------------|
| Shipping and storage temperature | -25 – 55 °C   | -25 – 55 °C   | -25 – 55 °C   |
| Weight                           | 15.7 kg       | 16.4 kg       | 20.8 kg       |

Tbl. 19: Technical data for HiPace 700 M | TM 700

### 14.3 Substances in contact with the media

| Substances in contact with the media |
|--------------------------------------|
| Aluminum alloy                       |
| Stainless steel                      |
| rare-earth magnet                    |
| carbon-fiber-reinforced plastic      |
| Epoxy resin                          |
| FKM                                  |
| Silver                               |
| Oxide ceramic, as required           |

Tbl. 20: Materials that make contact with the process media

### 14.4 Dimensions

Dimensions in mm

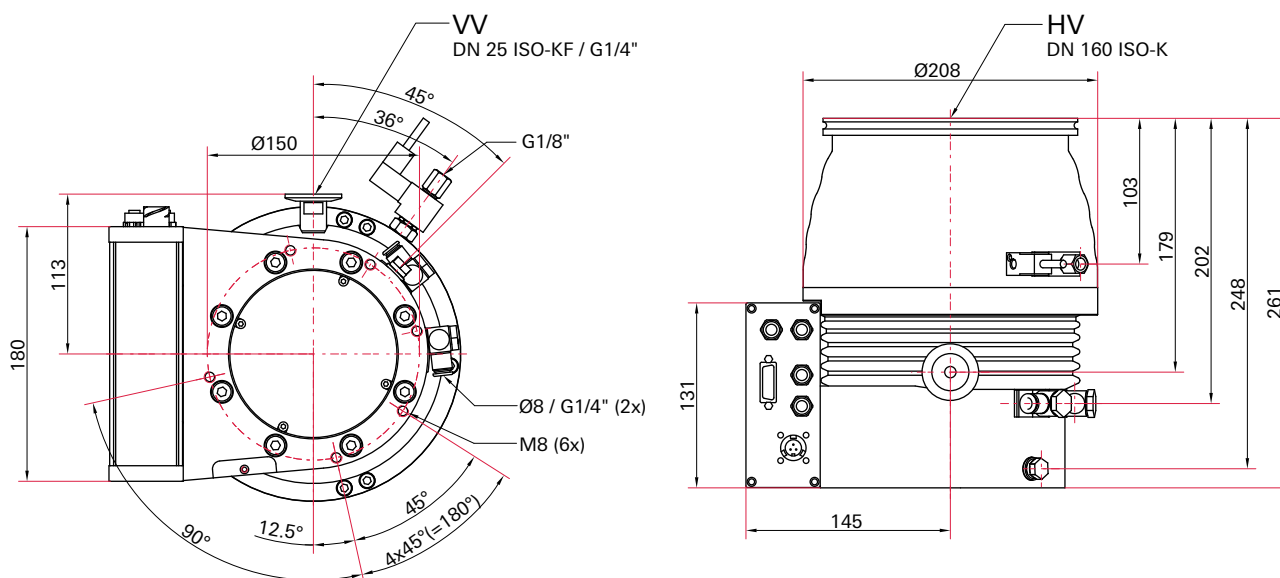
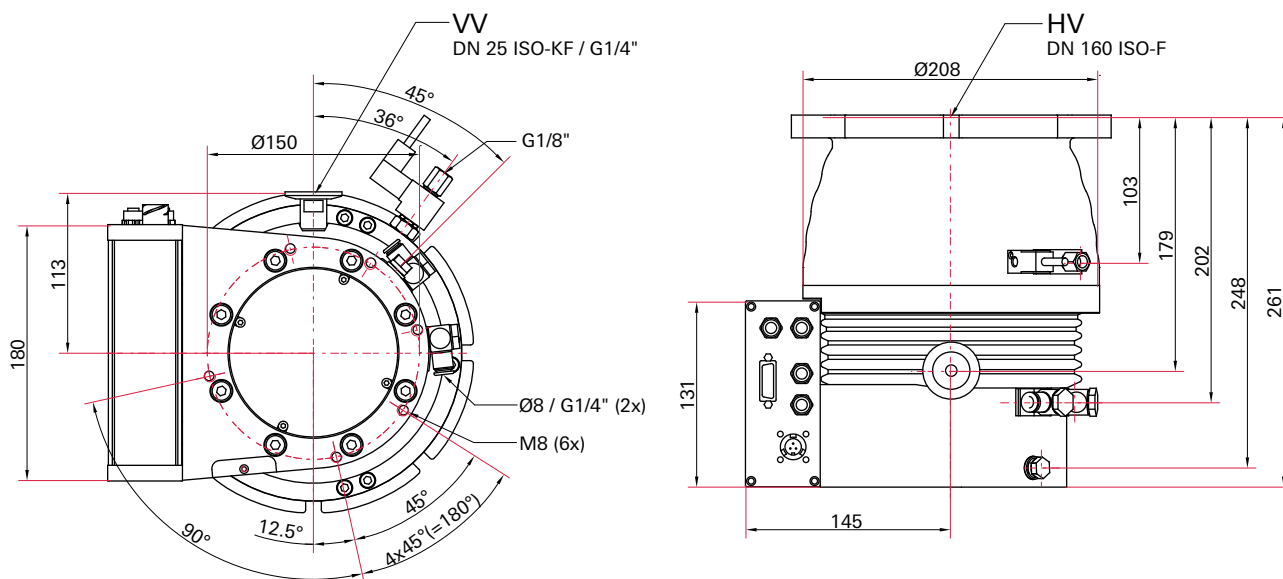
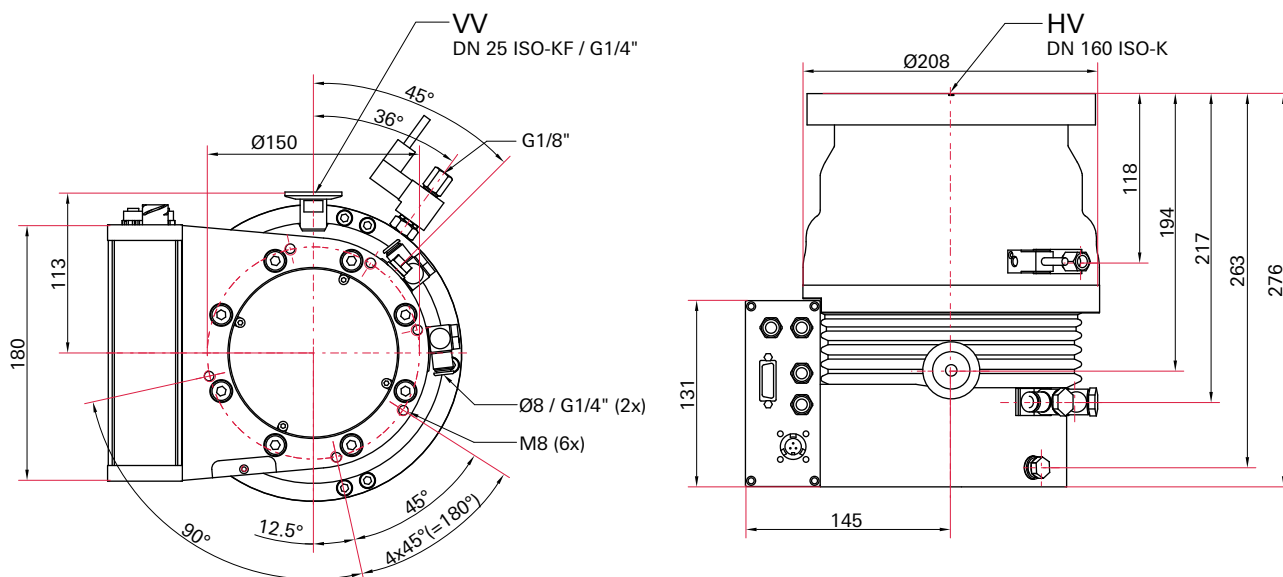


Fig. 23: Dimensions HiPace 700 M, ISO-K, PM902229



**Fig. 24: Dimensions HiPace 700 M, ISO-F, PM902286**



**Fig. 25: Dimensions HiPace 700 M, CF-F, PM902287**

# EC Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

## **Turbopump**

HiPace 700 M

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 61326-1 : 2013

DIN EN 1012-2 : 2011

DIN EN 62061 : 2016

DIN EN IEC 61000-3-2 : 2019

DIN ISO 21360-1 : 2020

DIN EN 61000-3-3 : 2020

ISO 21360-4 : 2018

DIN EN 61010-1 : 2020

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:



(Daniel Sälzer)  
Managing Director

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

Asslar, 2023-01-09



# UK Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

## **Turbopump**

HiPace 700 M

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

**Supply of Machinery (Safety) Regulations 2008**

**Electromagnetic Compatibility Regulations 2016**

**The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012**

## **Applied standards and specifications:**

|                       |                  |
|-----------------------|------------------|
| ISO 12100:2010        | IEC 61326-1:2012 |
| EN 1012-2+A1:1996     | IEC 62061:2005   |
| IEC 61000-3-2:2018    | ISO 21360-1:2020 |
| IEC 61000-3-3+A1:2013 | ISO 21360-4:2018 |
| IEC 61010-1+A1:2010   | IEC 63000:2018   |

The manufacturer's authorized representative in the United Kingdom and the authorized agent for compiling the technical documentation is Pfeiffer Vacuum Ltd, 16 Plover Close, Interchange Park, MK169PS Newport Pagnell.

Signature:



(Daniel Sälzer)  
Managing Director

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

Asslar, 2023-01-09

**UK  
CA**



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

[www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)

