



# OPERATING INSTRUCTIONS

EN

Translation of the Original

## HILOBE 2704 | 4504 | 6204

Roots pump

**PFEIFFER**  **VACUUM**

---

## Dear Customer,

Thank you for choosing a Pfeiffer Vacuum product. Your new roots pump should support you in your individual application with full performance and without malfunctions. The name Pfeiffer Vacuum stands for high-quality vacuum technology, a comprehensive and complete range of top-quality products and first-class service. From this extensive, practical experience we have gained a large volume of information that can contribute to efficient deployment and to your personal safety.

In the knowledge that our product must avoid consuming work output, we trust that our product can offer you a solution that supports you in the effective and trouble-free implementation 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.

## Copyright

This document is the intellectual property of Pfeiffer Vacuum and all contents of this document are protected by copyright. They may not be copied, altered, reproduced or published without the prior written permission of Pfeiffer Vacuum.

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

# Table of contents

<b>1</b>	<b>About this manual</b>	<b>8</b>
1.1	Validity	8
1.1.1	Applicable documents	8
1.1.2	Variants	8
1.2	Target group	8
1.3	Conventions	8
1.3.1	Instructions in the text	8
1.3.2	Pictographs	9
1.3.3	Stickers on product	9
1.3.4	Abbreviations	11
<b>2</b>	<b>Safety</b>	<b>12</b>
2.1	General safety information	12
2.2	Safety instructions	12
2.3	Safety precautions	15
2.4	Limits of use	16
2.5	Proper use	17
2.6	Foreseeable improper use	17
2.7	Personnel qualification	17
2.7.1	Ensuring personnel qualification	17
2.7.2	Personnel qualification for maintenance and repair	18
<b>3</b>	<b>Product description</b>	<b>19</b>
3.1	Function	19
3.1.1	Drive	20
3.1.2	Cooling	21
3.1.3	Mounting orientations	21
3.2	Identifying product	21
3.3	Product features	21
3.4	Scope of delivery	21
<b>4</b>	<b>Transportation and Storage</b>	<b>22</b>
4.1	Transporting vacuum pump	22
4.2	Storing vacuum pump	23
<b>5</b>	<b>Installation</b>	<b>24</b>
5.1	Mounting orientations	24
5.2	Setting up vacuum pump	25
5.3	Filling with lubricant	25
5.4	Connecting the vacuum side	27
5.5	Using splinter shield	27
5.6	Connecting the fore-vacuum side	28
5.7	Connecting switch box	29
5.8	Connecting temperature sensors and fan	29
5.9	Implement electrical safety measures	30
5.10	Connecting to mains power supply	31
<b>6</b>	<b>Interfaces</b>	<b>33</b>
6.1	"Remote" interface	33
6.1.1	Voltage output	33
6.1.2	Inputs	34
6.1.3	Outputs	34
6.1.4	RS-485	34
6.2	Using RS-485 interface	34
6.3	Pfeiffer Vacuum protocol for RS-485 interface	35
6.3.1	Telegram frame	35
6.3.2	Telegram description	36

	6.3.3 Telegram example 1	36
	6.3.4 Telegram example 2	36
	6.3.5 Data types	37
<b>7</b>	<b>Parameter set</b>	<b>38</b>
	7.1 General	38
	7.2 Control commands	38
	7.3 Status requests	39
	7.4 Reference value inputs	40
	7.5 Additional parameters for the control unit	40
<b>8</b>	<b>Operation</b>	<b>41</b>
	8.1 Commissioning vacuum pump	41
	8.2 Switching on the vacuum pump	41
	8.3 Adjusting sealing gas amount	42
	8.4 Configuring the connections with the Pfeiffer Vacuum parameter set	42
	8.5 Operating modes	43
	8.5.1 Normal operation	43
	8.5.2 Stand-by operation	44
	8.5.3 Rotation speed setting mode	44
	8.6 Operation monitoring	44
	8.6.1 Operating mode display via LED	44
	8.6.2 Temperature monitoring	45
	8.6.3 Check the lubricant level	45
	8.7 Switching off and venting	45
<b>9</b>	<b>Maintenance</b>	<b>47</b>
	9.1 Maintenance information	47
	9.2 Checklist for inspection and maintenance	47
	9.3 Cleaning air filter	49
	9.4 Changing lubricant	49
	9.4.1 Draining lubricant	50
	9.4.2 Filling with lubricant	51
<b>10</b>	<b>Decommissioning</b>	<b>52</b>
	10.1 Shutting down for longer periods	52
	10.2 Recommissioning	52
<b>11</b>	<b>Recycling and disposal</b>	<b>53</b>
	11.1 General disposal information	53
	11.2 Dispose of HiLobe roots pumps	53
<b>12</b>	<b>Malfunctions</b>	<b>54</b>
	12.1 General	54
	12.2 Troubleshooting	54
	12.3 Error codes	55
	12.4 Warning and malfunction messages when operating with control units	56
<b>13</b>	<b>Service solutions by Pfeiffer Vacuum</b>	<b>57</b>
<b>14</b>	<b>Ordering spare part packages</b>	<b>59</b>
<b>15</b>	<b>Accessories</b>	<b>60</b>
	15.1 Accessory information	60
	15.2 Ordering accessories	60
<b>16</b>	<b>Technical data and dimensions</b>	<b>62</b>
	16.1 General	62
	16.2 Substances in contact with the media	62
	16.3 Technical data	63
	16.4 Dimensions	65



<b>EC Declaration of Conformity</b>	<b>68</b>
<b>UK Declaration of Conformity</b>	<b>69</b>

## List of tables

Tbl. 1:	Stickers on product	10
Tbl. 2:	Abbreviations used	11
Tbl. 3:	Permissible ambient conditions	16
Tbl. 4:	Features of the roots pumps	21
Tbl. 5:	Required properties of the power supply cable	32
Tbl. 6:	Plug arrangement of the D-Sub socket, 15-pin	33
Tbl. 7:	Features of the RS-485 interface	35
Tbl. 8:	Explanation and meaning of the parameters	38
Tbl. 9:	Parameter set   Control commands	39
Tbl. 10:	Parameter set   Status requests	40
Tbl. 11:	Parameter set   Reference value inputs	40
Tbl. 12:	Parameters for control unit functions	40
Tbl. 13:	Configuration with parameters [P:019] and [P:024]	43
Tbl. 14:	Configuration with parameters [P:060] and [P:061]	43
Tbl. 15:	Meaning of the LEDs	45
Tbl. 16:	Maintenance intervals	48
Tbl. 17:	Troubleshooting	55
Tbl. 18:	Error messages of the electronic drive unit	56
Tbl. 19:	Warning messages of the electronic drive unit	56
Tbl. 20:	Warning and malfunction messages	56
Tbl. 21:	HiLobe spare part packages	59
Tbl. 22:	Accessories	61
Tbl. 23:	Consumables	61
Tbl. 24:	Conversion table: Pressure units	62
Tbl. 25:	Conversion table: Units for gas throughput	62
Tbl. 26:	Materials that make contact with the process media	62
Tbl. 27:	Technical data HiLobe   vertical direction of flow	63
Tbl. 28:	Technical data HiLobe   horizontal direction of flow	64

# List of figures

Fig. 1:	Position of stickers on product with vertical direction of flow	10
Fig. 2:	Position of stickers on product with horizontal direction of flow	11
Fig. 3:	Max. permissible pressure differential between input and output sides, in accordance with pump rotation speed	16
Fig. 4:	Design, vertical direction of flow	19
Fig. 5:	Design, horizontal direction of flow	20
Fig. 6:	Design, switch box	20
Fig. 7:	Transporting vacuum pump	23
Fig. 8:	Mounting orientation: Vertical direction of flow	24
Fig. 9:	Mounting orientation: Horizontal direction of flow	24
Fig. 10:	Minimum distances	25
Fig. 11:	Filling with lubricant	26
Fig. 12:	Splinter shield mounting orientation	28
Fig. 13:	Connecting switch box	29
Fig. 14:	Connecting extension cable	30
Fig. 15:	Mains connection pin assignment	31
Fig. 16:	Pin assignment of the D-Sub socket, 15-pin	33
Fig. 17:	Cross-link via connection RS-485 using connection cables and accessories	35
Fig. 18:	Replace the filter mat of the fan	49
Fig. 19:	Draining lubricant	50
Fig. 20:	Filling with lubricant	51
Fig. 21:	HiLobe 2704, HiLobe 4504, HiLobe 6204	65
Fig. 22:	HiLobe 2704 H, HiLobe 4504 H, HiLobe 6204 H	66
Fig. 23:	Electronic drive unit RC 7500/RC 11000	67

# 1 About this manual



## IMPORTANT

Read carefully before use.

Keep the manual for future consultation.

## 1.1 Validity

These operating instructions are 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 these 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
Declaration of conformity	A component of these instructions

You can find this document in the [Pfeiffer Vacuum Download Center](#).

### 1.1.2 Variants

- HiLobe 2704
- HiLobe 4504
- HiLobe 6204
- HiLobe 2704 H
- HiLobe 4504 H
- HiLobe 6204 H

## 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.



Note



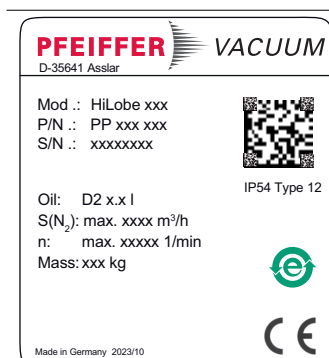
Tip



Qr code is linked to further online information.  
We recommend viewing on a tablet computer.  
Pay attention to the amount of data that is generated.

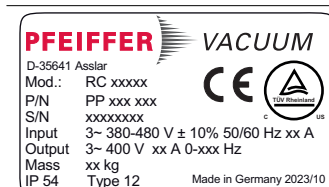
## 1.3.3 Stickers on product

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



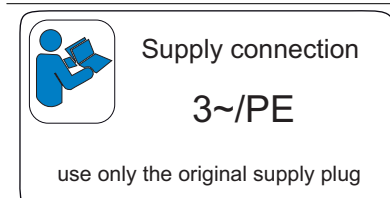
### Rating plate (example)

The rating plate for the vacuum pump is located on the metal casing near the motor connection plug.



### Rating plate of the electronic drive unit (example)

The rating plate is located on the switch box of the electronic drive unit.



### Mains connection

This sticker indicates that you must use the original power supply connector.





### Operating instructions note

This sticker indicates that this operating instructions must be read before performing any tasks.



### Warning hot surface

This sticker warns of injuries caused by high temperatures as a result of contact without protection during operation.

	<b>Warranty seal</b> The product is sealed ex factory. Damaging or removing a warranty seal results in loss of the warranty.
	<b>Oil can</b> The "Oil can" icon indicates the lubricant filler screws.

Tbl. 1: Stickers on product

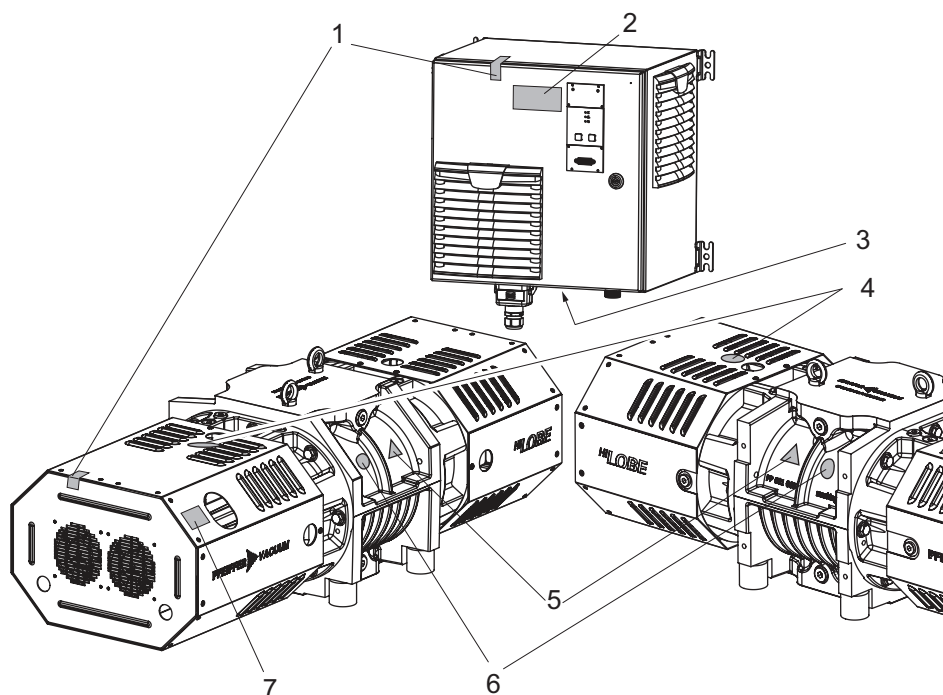
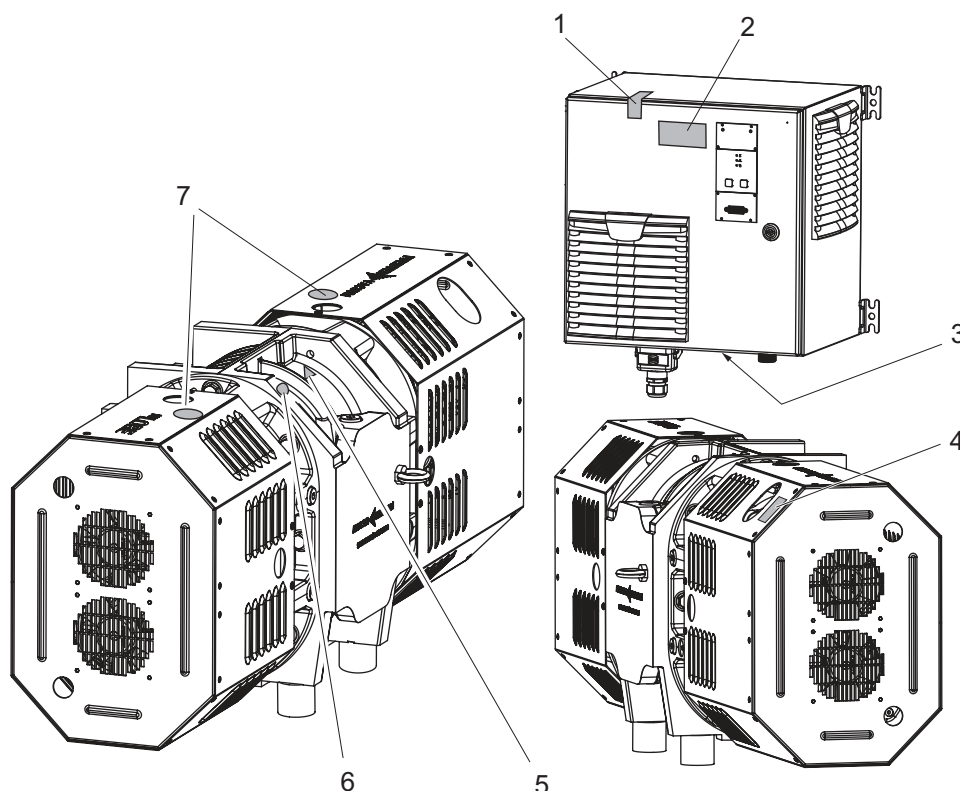


Fig. 1: Position of stickers on product with vertical direction of flow

- |  |   |
|--|---|
| 1 Warranty seal  | 5 Warning notice: hot surface           |
| 2 Rating plate of the electronic drive unit            | 6 Note: Read the operating instructions |
| 3 Note: Original power supply plug (not shown in fig.) | 7 Rating plate of the vacuum pump       |
| 4 Note: Filling ports for lubricant                    |   |



**Fig. 2: Position of stickers on product with horizontal direction of flow**

- |  |   |
|--|---|
| 1 Warranty seal  | 5 Warning notice: hot surface           |
| 2 Rating plate of the electronic drive unit            | 6 Note: Read the operating instructions |
| 3 Note: Original power supply plug (not shown in fig.) | 7 Note: Filling ports for lubricant     |
| 4 Rating plate of the vacuum pump                      |   |

### 1.3.4 Abbreviations

Abbreviation	Explanation
<b>BA</b>	Operating instructions
<b>FKM</b>	Fluoropolymer rubber
<b>FC</b>	Frequency converter
<b>n.c.</b>	not connected
<b>PE</b>	Protective earth (earthed conductor)
<b>PV</b>	Pfeiffer Vacuum
<b>[P:xxx]</b>	Electronic drive unit control parameters. Printed in bold as a three-digit number in square brackets. Frequently displayed in conjunction with a short description: Example: [P:xxx] Software version
<b>remote</b>	15-pin D-Sub connecting socket on the control panel of the switch box
<b>RS-485</b>	Standard for a physical interface for asynchronous serial data transmission (recommended standard)
<b>SI</b>	Service instructions
<b>Ssc</b>	Short-circuit capacity

**Tbl. 2: Abbreviations used**

## 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**

##### **Risk of serious injury from swinging, toppling or falling objects**

During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.

- Secure the danger zone if necessary.
- Pay attention to the center of gravity of the load during transport.
- Ensure even movements and moderate speeds.
- Observe safe handling of the transport devices.
- Avoid sloping attachment aids.
- Never stack products.
- Wear protective equipment, e.g. safety shoes.



## Risks during installation

**⚠ DANGER****Danger to life from electric shock**

Touching exposed and voltage-bearing elements causes an electric shock. Improper connection of the mains supply leads to the risk of touchable live housing parts. There is a risk to life.

- ▶ Before the installation, check that the connection leads are voltage-free.
- ▶ Make sure that electrical installations are only carried out by qualified electricians.
- ▶ Provide adequate grounding for the device.
- ▶ After connection work, carry out an earthed conductor check.

**⚠ DANGER****Danger to life from electric shock**

When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.

- ▶ Connect only suitable devices to the bus system.

**⚠ 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 suitable motor protection switch.

**⚠ WARNING****Risk of fatal injury due to electric shock on account of incorrect installation**

The device's power supply uses life-threatening voltages. Unsafe or improper installation can lead to life-threatening situations from electric shocks obtained from working with or on the unit.

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

**⚠ WARNING****Risk of crushing from rotating parts**

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- ▶ Keep limbs out of the reach of the roots pump.

**⚠ CAUTION****Danger of injury from bursting as a result of high pressure in the exhaust line**

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g. increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- ▶ Route the exhaust line without shut-off units.
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.

### CAUTION

#### **Electric shock and damage to the vacuum pump and electronic drive unit due to improper connection and disconnection of components**

With existing power supply connection to the switch box, there is a risk of electric shock when making contact with the motor connecting plug. Even after the power supply has been switched off, the vacuum pump continues to deliver electrical energy during its run-down period. If the units are disconnected prematurely, there is the risk of electric shock, and destruction of electric components.

- ▶ Always interrupt the power supply connection at the switch box before connecting the power supply plug to the motor.
- ▶ With existing power supply connection to the switch box or when the pistons are running, never disconnect the motor connecting plug.
- ▶ After switching off, wait at least another 5 minutes until the capacitors have discharged before separating the cable connection.

### CAUTION

#### **Danger of burns on hot surfaces**

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C. If access to the vacuum pump is unrestricted, there is a danger of burns due to contact with hot surfaces.

- ▶ Install suitable touch protection if the vacuum pump is accessible to untrained persons.
- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Contact Pfeiffer Vacuum for suitable touch protection in system solutions.

### **Risks during operation**

### WARNING

#### **Danger of poisoning due to toxic process media escaping from the exhaust pipe**

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. There is a risk of injury and fatality due to poisoning in processes with toxic process media.

- ▶ Observe the pertinent regulations for handling toxic process media.
- ▶ Safely purge toxic process media via an exhaust line.
- ▶ Use appropriate filter equipment to separate toxic process media.

### CAUTION

#### **Danger of injury from bursting as a result of high pressure in the exhaust line**

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g. increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- ▶ Route the exhaust line without shut-off units.
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.

### CAUTION

#### **Danger of burns on hot surfaces**

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C. If access to the vacuum pump is unrestricted, there is a danger of burns due to contact with hot surfaces.

- ▶ Install suitable touch protection if the vacuum pump is accessible to untrained persons.
- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Contact Pfeiffer Vacuum for suitable touch protection in system solutions.

## Risks during maintenance, decommissioning, disposal and in event of malfunctions

### **WARNING**

#### **Danger to life from electric shock during maintenance and service work**

There is a danger to life from electric shock when making contact with live components that still exist after the vacuum pump has been switched off.

- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Wait until the vacuum pump comes to a standstill (rotation speed = 0).
- ▶ After switching off the vacuum pump, wait another 5 minutes until the capacitors have discharged.

### **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**

#### **Risk of crushing from rotating parts**

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- ▶ Keep limbs out of the reach of the roots pump.

### **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.

### **CAUTION**

#### **Scalding from hot lubricant**

Danger of scalding when draining lubricant if it comes into contact with the skin.

- ▶ Wear protective equipment.
- ▶ Use a suitable collection receptacle.

## 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.

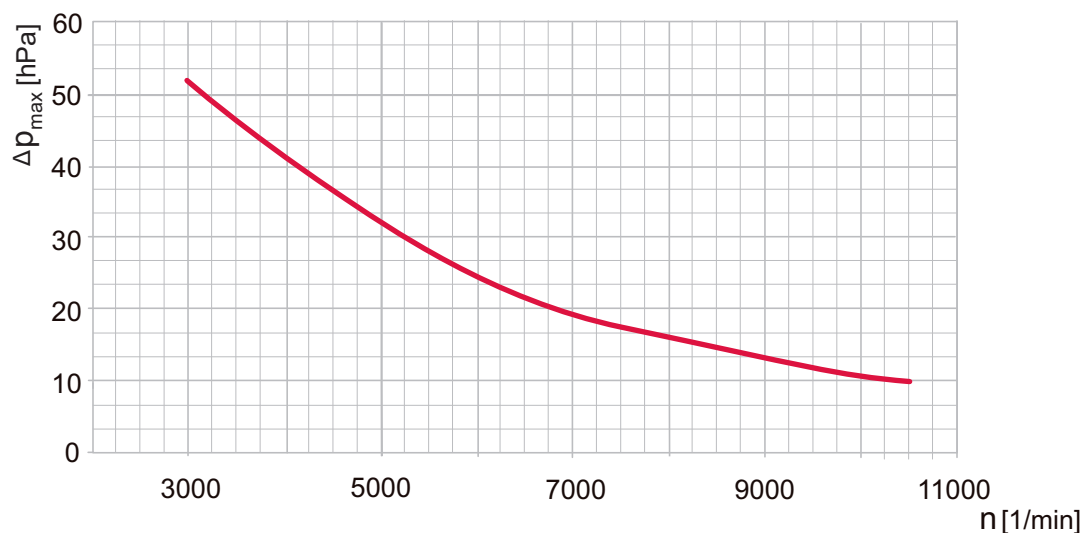
### General safety precautions

- ▶ Do not expose body parts to the vacuum.
- ▶ Observe the safety and accident prevention regulations, if necessary wear personal protective equipment.
- ▶ Check all safety measures at regular intervals.
- ▶ Always ensure a secure connection to the earthed conductor (PE), protection class I.
- ▶ During operation, make sure that plug-and-socket connections are securely fitted.
- ▶ Never operate the vacuum pump with open vacuum flange.
- ▶ Never make your own conversions or modifications to the vacuum pump.
- ▶ Before returning the vacuum pump, observe the notes in the chapter Service.

## 2.4 Limits of use

Parameter	HiLobe
Installation location	weatherproof (internal space)
Installation altitude	max. 2000 m above sea level <sup>1)</sup>
Installation surface flatness	horizontal, max. permissible angle of inclination: $\pm 3^\circ$
Ambient temperature	+5 °C to +40 °C
Relative humidity of air	max. 85 %
Permanent intake pressure in circulation mode	< 1100 hPa (abs.)
Permanent intake pressure in vacuum mode	depending on max. pressure differential
Max. gas temperature, pressure side	250 °C
Loss of pumping speed for backing pump	$\leq 10:1$
Degree of pollution	2
Protection class	I
Overvoltage category	II
Permissible protection degree	IP54 Type 12 according to UL 50E

**Tbl. 3: Permissible ambient conditions**



**Fig. 3: Max. permissible pressure differential between input and output sides, in accordance with pump rotation speed**

1) at installation altitudes > 1,000m above m.s.l. and an ambient temperature of 40 °C the rated power of the motor reduces by around 10 %

## 2.5 Proper use

- ▶ Use the vacuum pump for vacuum generation only.
- ▶ To protect the lubricant and the bearing, use sealing gas if high boiling, corrosive or particle-laden media (e.g. solvents) are pumped.
- ▶ Operate the vacuum pump within the application limits of the product and in compliance with the technical data.
- ▶ Adhere to the installation, commissioning, operating, and maintenance instructions.
- ▶ Use only accessory parts recommended by Pfeiffer Vacuum.

## 2.6 Foreseeable improper use

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

- Pumping explosive media
- Pumping radioactive media
- Pumping media that can corrode or not be withstood by the vacuum pump materials
- Pumping media that introduce an ignition source to the suction chamber
- Pumping media that form adhesive deposits inside the suction chamber and cause the pistons to touch or jam
- Pumping pressurized media (> atmospheric pressure)
- Pumping fluids that do not serve cleaning
- Pumping media prone to spontaneous, specific exothermic reactions
- Use in potentially explosive areas
- Use in systems in which sporadic loads and vibrations or periodic forces act on the device
- Use in strong electrical, magnetic, or electromagnetic fields
- Use with vacuum and/or fore-vacuum flange open to the atmosphere
- Setting of frequency converter parameters outside of permissible value range
- Use of lubricants not specified by Pfeiffer Vacuum
- Use of pipes to lift the vacuum pump
- Use of accessories or spare parts not listed in these instructions
- Using the vacuum pump as a climbing aid
- Use of mineral-based lubricants, such as P3, with an oxygen concentration > 21 %

Mineral-based lubricants are combustible and ignite at high temperatures, and when they come into contact with pure oxygen. These lubricants oxidize heavily and thus lose their lubricating capacity.

## 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.

### 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 electrical engineering 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 expressly 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**

Adequately trained individuals are:

- **Maintenance level 1**
  - Customer with technical education
  - Pfeiffer Vacuum service technician
- **Maintenance level 3**
  - Pfeiffer Vacuum service technician

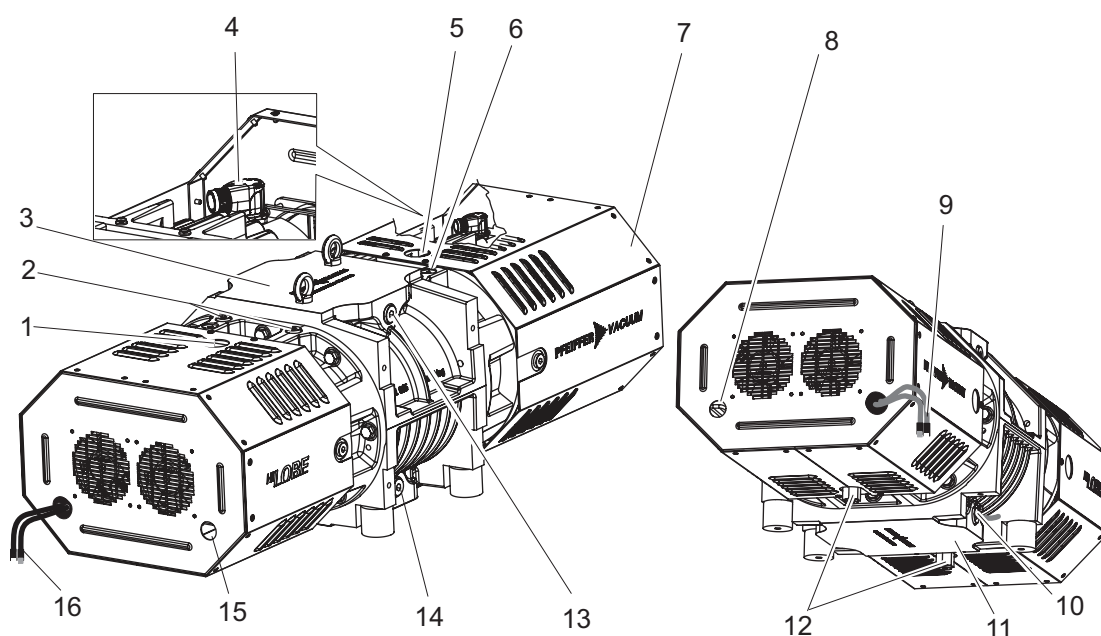
## 3 Product description

### 3.1 Function

The operating principle of the **HiLobe** roots pump is based on 2 synchronous pistons that rotate in a housing without touching. The pumping effect is produced as a result of the opposing rotation of 2 figure-of-eight shaped roots pistons. While suction chambers are formed between the rolling pistons and the housing, the rolling pistons continuously form a mutual seal without touching each other or the housing. A pair of gears positioned on the extended shaft ends, causes the opposing, synchronous running of the roots pistons. Lubrication is limited to the two bearing and gear chambers which are arranged separately from the suction chambers.

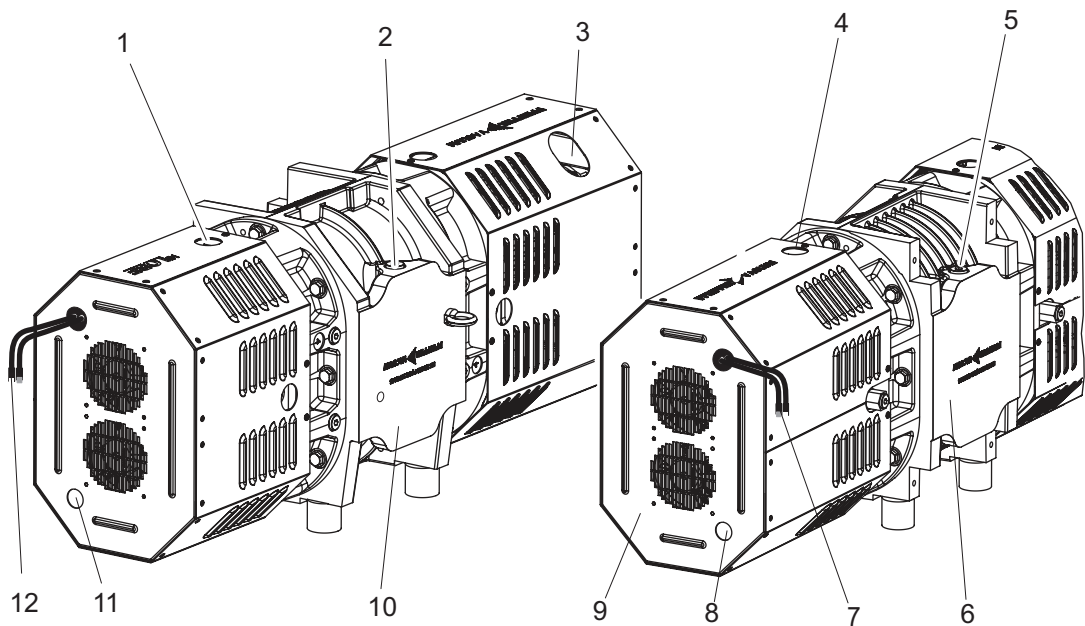


Scan the QR code or [click here](#) and see how Pfeiffer Vacuum roots pumps work.



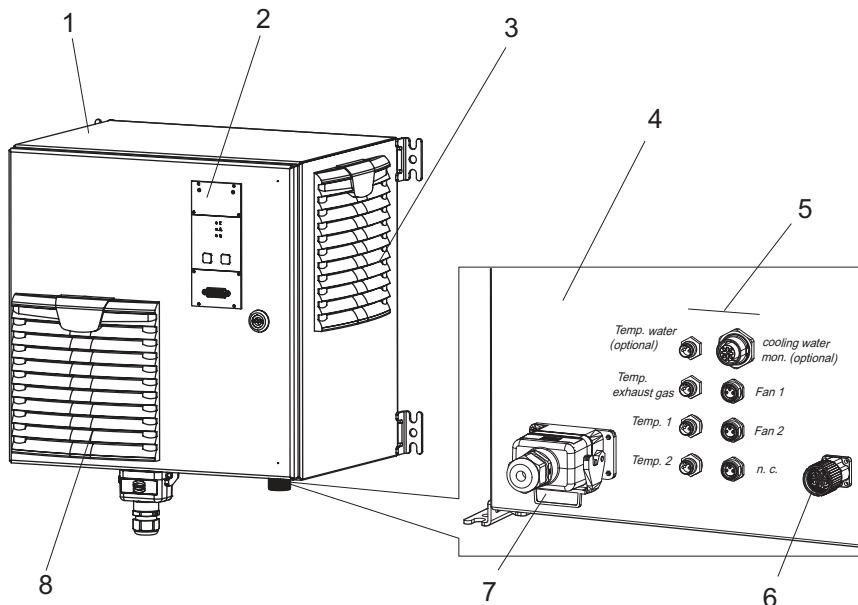
**Fig. 4:** Design, vertical direction of flow

- |  |   |
|--|---|
| 1 Filler screw                               | 9 Connecting cable, fan/temperature sensor  |
| 2 Sealing gas connection, opposite side (2x) | 10 Gas temperature sensor                   |
| 3 Vacuum flange with flange cover (foil)     | 11 Fore-vacuum flange                       |
| 4 Motor power supply plug                    | 12 Drain screw                              |
| 5 Filler screw                               | 13 Measurement connection, vacuum side      |
| 6 Sealing gas connection, motor side (2x)    | 14 Measurement connection, fore-vacuum side |
| 7 Fan cover                                  | 15 Sight glass, opposite side               |
| 8 Sight glass, motor side                    | 16 Connecting cable, fan/temperature sensor |



**Fig. 5: Design, horizontal direction of flow**

- |   |   |
|---|---|
| 1 Filler screw                                | 7 Connecting cable, fan/temperature sensor  |
| 2 Measurement connection, vacuum side         | 8 Sight glass, motor side                   |
| 3 Motor power supply plug                     | 9 Fan cover                                 |
| 4 Filler screw                                | 10 Vacuum flange with flange cover (foil)   |
| 5 Gas temperature sensor connector            | 11 Sight glass, opposite side               |
| 6 Fore-vacuum flange with flange cover (foil) | 12 Connecting cable, fan/temperature sensor |



**Fig. 6: Design, switch box**

- |                                |                              |
|--------------------------------|------------------------------|
| 1 Switch box                   | 5 Sensor connections         |
| 2 Operator panel               | 6 Motor connection           |
| 3 Ventilation grille, inlet    | 7 Mains connection           |
| 4 Underside of control cabinet | 8 Ventilation grille, outlet |

### 3.1.1 Drive

The drive of the vacuum pump is carried out coupling-free in "Cantilever design". Due to the motor design, the vacuum pump is compact, hermetically sealed and also has a high efficiency. The frequency converter takes over the control of the vacuum pump and permits the adjustment of the speed to the actual process requirements (in the valid speed range).



### 3.1.2 Cooling

The vacuum pump is equipped with active sensor-monitored air cooling.

### 3.1.3 Mounting orientations

The vacuum pump is available in 2 versions; for either vertical or horizontal direction of flow. The mounting orientation is defined at the factory prior to delivery. Subsequent alteration of the mounting orientation by the user is not permissible. The oil supply is different for each version, whereby an impermissible mounting orientation will lead to deficient lubrication of the bearing.

## 3.2 Identifying product

To ensure unambiguous identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate at hand.

The following information is shown on the rating plates:

- Pump model
- Model number
- Type and quantity of the lubricant
- Max. allowable pump rotation speed
- Date of manufacture
- Input voltage range (motor rating plate)

## 3.3 Product features

Pump type	Nominal pumping speed	Inlet/direction of flow
HiLobe 2704	890 – 2700 m <sup>3</sup> /h	top/vertical
HiLobe 4504	890 – 4440 m <sup>3</sup> /h	top/vertical
HiLobe 6204	890 – 6220 m <sup>3</sup> /h	top/vertical
HiLobe 2704 H	890 – 2700 m <sup>3</sup> /h	lateral/horizontal
HiLobe 4504 H	890 – 4440 m <sup>3</sup> /h	lateral/horizontal
HiLobe 6204 H	890 – 6220 m <sup>3</sup> /h	lateral/horizontal

**Tbl. 4: Features of the roots pumps**

## 3.4 Scope of delivery

- Vacuum pump with switch box and frequency converter
- Flange cover (foil) for the connection flange
- Seal for the connection flange
- Reinforcing flange with 4 fixing screws
- Screw kit for the connection flange
- Mating plug for the mains connection
- 2 temperature sensors
- Cable set, 2 m
- Lubricant D2 (for standard pump)
- Operating instructions

## 4 Transportation and Storage

### 4.1 Transporting vacuum pump

#### **WARNING**

##### **Risk of serious injury from swinging, toppling or falling objects**

During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.

- ▶ Secure the danger zone if necessary.
- ▶ Pay attention to the center of gravity of the load during transport.
- ▶ Ensure even movements and moderate speeds.
- ▶ Observe safe handling of the transport devices.
- ▶ Avoid sloping attachment aids.
- ▶ Never stack products.
- ▶ Wear protective equipment, e.g. safety shoes.



#### **Instructions for safe transport**

- Only remove the flange covers for the connection flange once the pipes have been mounted.
- Fill the gear and bearing chambers with lubricant only once the final installation position is reached.



#### **Packing**

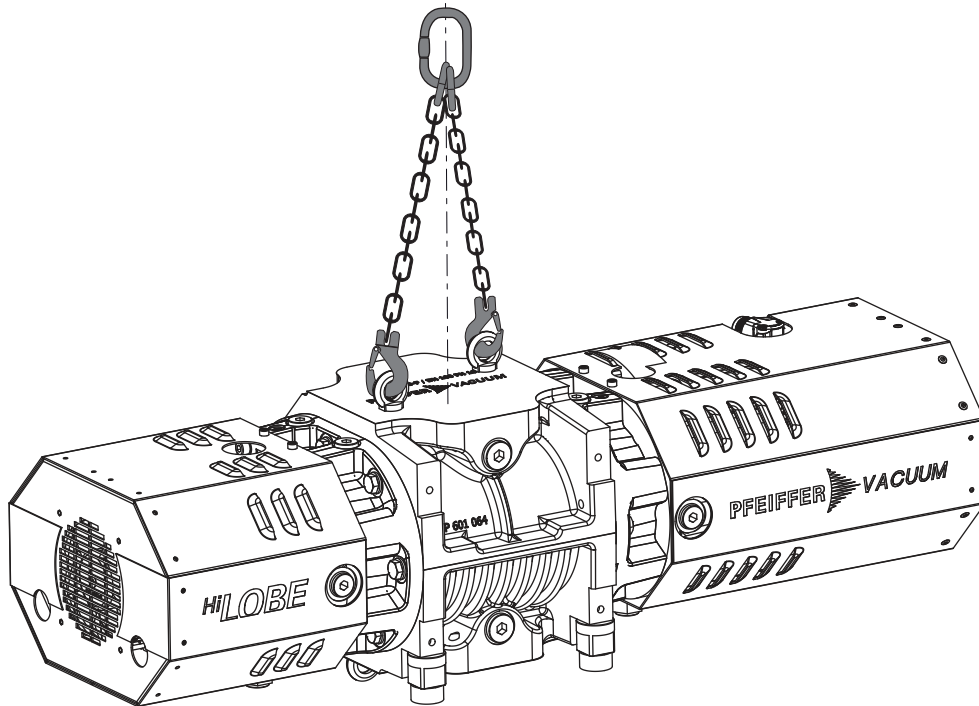
Pfeiffer Vacuum recommends storing the transport packaging.

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

1. Observe weight specified on the rating plate.
2. Where possible, always transport or ship the roots pump in its original packaging.
3. Remove the protective cover only immediately prior to installation.

#### **Transporting vacuum pump with packaging**

1. Use a pallet truck to transport the vacuum pump in its packaging.
2. Note the center of gravity of the load.
3. Observe safe handling of manually operated transport devices.
4. Ensure harmonious movements and moderate speeds.
5. Ensure a flat substrate.
6. Wear personal protective equipment, e.g. safety shoes.



**Fig. 7: Transporting vacuum pump**

#### Transporting vacuum pump without packaging

2 eye bolts are included in the shipment, which are firmly bolted to the vacuum pump ex-factory.

1. Unpack the vacuum pump.
2. Attach suitable lifting tools to both eye bolts.
3. Pay attention to the correct use and fastening of the lifting equipment.
4. Lift the vacuum pump out of the transport packaging vertically.
5. Remove the eye bolts after transport.
6. Keep the eye bolts for future use.

## 4.2 Storing vacuum pump

Neither the suction chamber nor the pistons in the roots pump in the roots pump interior are provided with **corrosion protection**.



#### Storage

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

#### Procedure

1. Vacuum-seal both connection flanges.
2. Store the roots pump only in dry, dust-free rooms, within the specified ambient conditions.
3. Evacuate and then fill the suction chamber with nitrogen to achieve the best corrosion protection for the roots pump.
4. In rooms with humid or aggressive atmospheres, seal the roots pump airtight in a plastic bag, together with a drying agent.
5. Change the lubricant after a storage period of more than 2 years.
6. If you intend to store the roots pump for longer periods, we recommend that you use a special corrosion protection agreed with Pfeiffer Vacuum.

## 5 Installation

### 5.1 Mounting orientations

#### NOTICE

##### Damage to the vacuum pump due to incorrect mounting orientation

Impermissible mounting orientations will result in contamination of the process vacuum or damage to the vacuum pump.

- ▶ Operate the vacuum pump only with the prescribed mounting orientation.
  - Changing the mounting orientation is only possible via factory conversion!

The respective mounting orientation of the roots pump is defined at the factory during production:

- Vertical direction of flow (standard)
- Horizontal direction of flow (option), turned by 90°

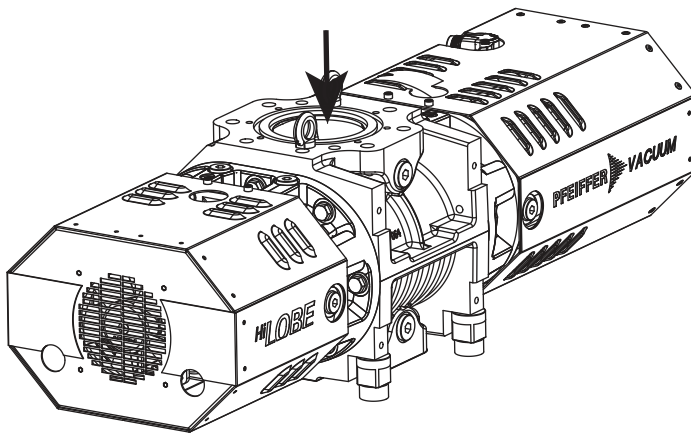


Fig. 8: Mounting orientation: Vertical direction of flow

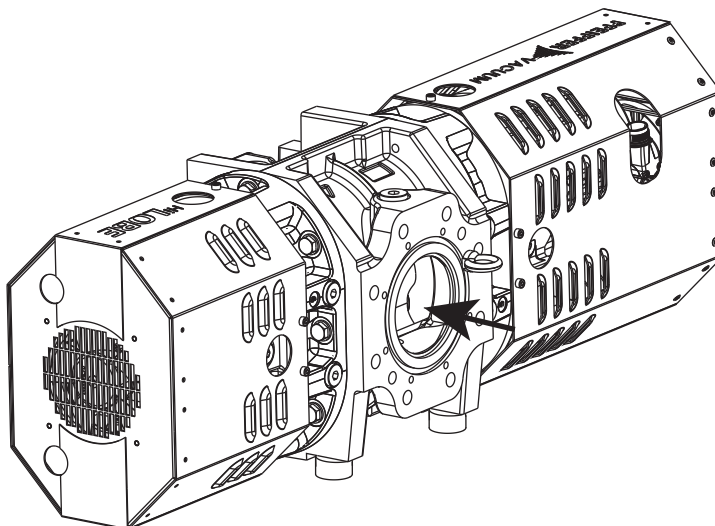


Fig. 9: Mounting orientation: Horizontal direction of flow

## 5.2 Setting up vacuum pump

### ⚠ CAUTION

#### Danger of burns on hot surfaces

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C. If access to the vacuum pump is unrestricted, there is a danger of burns due to contact with hot surfaces.

- ▶ Install suitable touch protection if the vacuum pump is accessible to untrained persons.
- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Contact Pfeiffer Vacuum for suitable touch protection in system solutions.

#### 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.

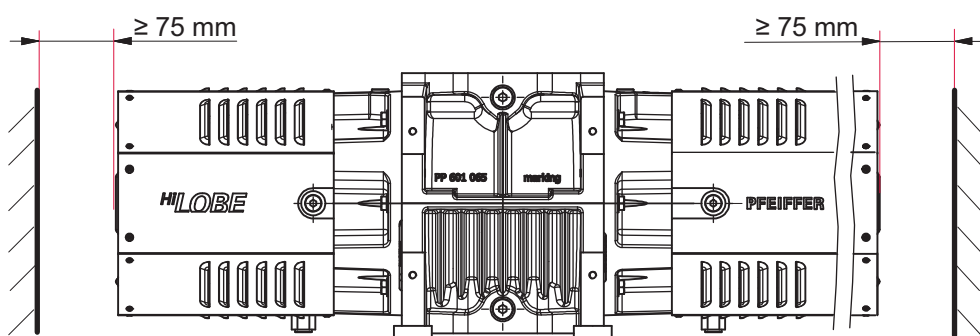


Fig. 10: Minimum distances

#### Required aids

- Fastening material 4 × M10

#### Procedure

1. Check the carrying capacity of the floor at the installation location.
2. Ensure sufficient space under the vacuum pump for a collection receptacle when filling or changing lubricant.
3. Ensure the prescribed mounting orientation of the vacuum pump before the vacuum pump is filled with lubricant for the first time.
4. Place the vacuum pump on a flat, horizontal and fixed surface, to safeguard the lubricant supply.
  - Reference surface is the vacuum flange.
5. Screw the vacuum pump to the base without tension.
6. Maintain the minimum distances to bordering surfaces to guarantee sufficient air circulation.
7. Leave the filling/drain holes and sight glasses freely accessible.
8. Fill with lubricant prior to first commissioning.

## 5.3 Filling with lubricant

### NOTICE

#### Property damage from using non-approved lubricant

Attainment of product-specific performance data is not ensured. If non-approved lubricants are used, all liability and warranty claims against Pfeiffer Vacuum are excluded.

- ▶ Use only lubricants approved by Pfeiffer Vacuum.
- ▶ Use alternative, application-specific lubricants only following consultation with Pfeiffer Vacuum.

### Permissible lubricants

- D2 (standard lubricant)
- P3, optional
- Other lubricants on request

### The lubricant type is specified on the rating plate

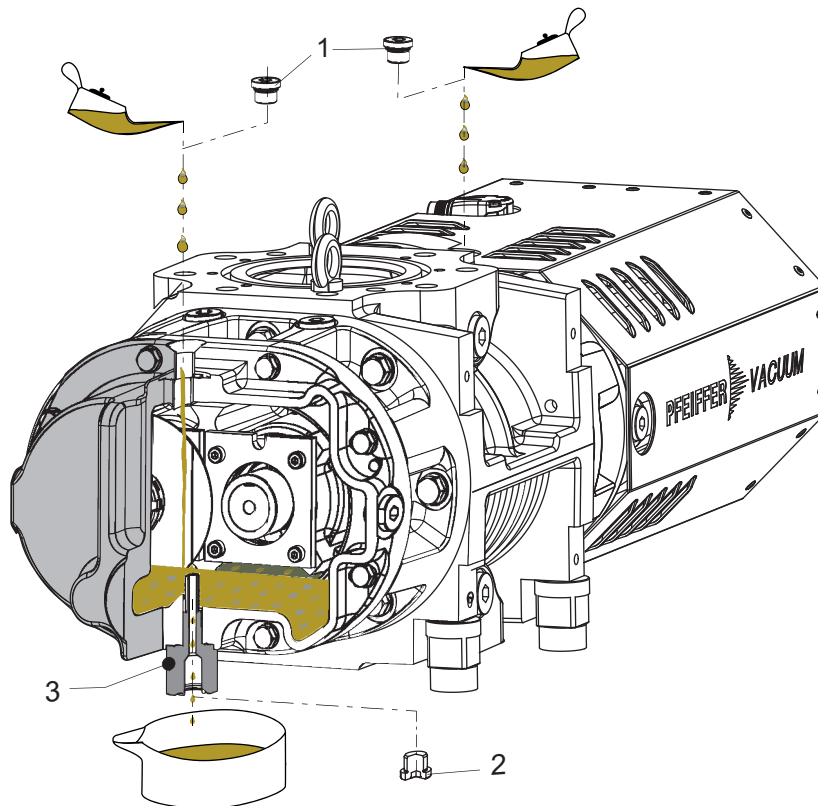
- ▶ Please refer to rating plate of the vacuum pump for type and quantity of intended lubricant.
  - Only the lubricant used during initial installation is permissible.
  - D2 is permitted as a replacement for D1.
- ▶ Contact Pfeiffer Vacuum if you want to use another type of lubricant.

### Required consumables

- Lubricant of the vacuum pump

### Required tools

- Allen key, **WAF 8**
- Ring spanner, **WAF 27**



**Fig. 11: Filling with lubricant**

- |                 |                      |
|-----------------|----------------------|
| 1 Filler screws | 3 Fill level limiter |
| 2 Drain screw   |                      |



For the safe filling of the lubricant, there is one fill level limiter each in both oil chambers of the roots pump that determines the max. fill level via a riser tube. Both sight glasses serve only for loss checks.

- Filling quantity, motor side: approx. 1.7 l
- Filling quantity, opposite side: approx. 1.5 l

### Filling with lubricant

1. Make sure that there is sufficient space underneath the vacuum pump to place a collection receptacle for the lubricant.
2. Unscrew the filler screws.
3. Hold the fill level limiter with the ring spanner and unscrew the drain screw at the same time.
4. Place a collection receptacle under each drain.

5. Fill the lubricant on both sides up to the maximum fill level.
  - Once full, lubricant overfills the fill level limiter, and drips out of the drain hole.
  - Fill level is visible in the center of the sight glass.
6. Screw the filler and drain screws back in.

## 5.4 Connecting the vacuum side

### **WARNING**

#### **Risk of crushing from rotating parts**

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- ▶ Keep limbs out of the reach of the roots pump.

### **NOTICE**

#### **Property damage from intake of solid particles**

During commissioning, there is a risk of damage to the suction chamber from dirt from the system or the pipes.

- ▶ Use a suitable protective strainer ("start-up strainer") in the intake flange.
- ▶ Ensure that this strainer is only removed when the risk of solid particles entering the vacuum pump can be excluded.
  - Observe any pumping speed decrease.

#### **Required tools**

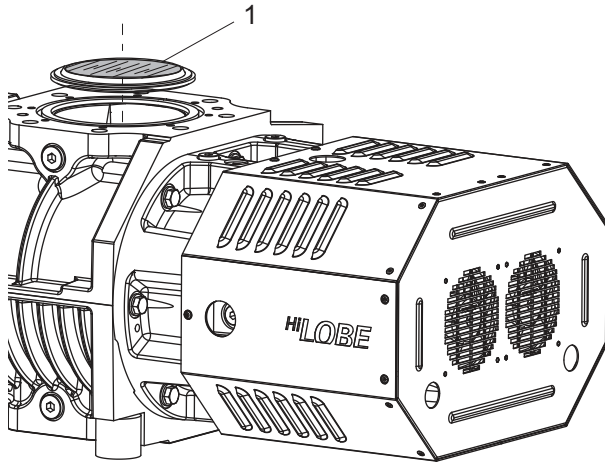
- Ring spanner, **WAF 13** with flange DN 160 ISO-F
- Ring spanner, **WAF 30** with flange DN 150 PN16

#### **Connecting the vacuum side**

1. Degrease the connection flange.
2. Clear welded lines of any scaling, loose particles etc. prior to installation.
3. Route the piping between the vacuum pump and vacuum chamber so that it remains as short as possible; at a minimum, the nominal diameter of the pump flange.
4. Select a larger nominal diameter for pipe lengths > 5 m.
5. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
6. Always use **all** prescribed bolts for fastening the flanges and consider the prescribed pressure stage for PN 16.

## 5.5 Using splinter shield

Pfeiffer Vacuum centering rings with splinter shield in the vacuum flange protect the roots pump against foreign matter from the vacuum chambers. The pumping speed is reduced according to the passage guide values and the size of the vacuum flange.



**Fig. 12: Splinter shield mounting orientation**

1  
Splinter shield

**Procedure**

- When installing the vacuum flange, pay attention to the correct mounting orientation of the splinter shield.

## 5.6 Connecting the fore-vacuum side

### **⚠ WARNING**

**Risk of crushing from rotating parts**

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- Keep limbs out of the reach of the roots pump.

### **⚠ CAUTION**

**Danger of injury from bursting as a result of high pressure in the exhaust line**

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g. increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- Route the exhaust line without shut-off units.
- Observe the permissible pressures and pressure differentials for the product.
- Check the function of the exhaust line on a regular basis.

### **NOTICE**

**Risk of damage from gas backflow into the roots pump**

Due to the backflow of process gas, the electronic equipment is susceptible to irreversible damage caused by regenerative energy produced with rotation of the piston.

- Equip the vacuum pump with a facility that prevents the backflow of gases.
- Use, e.g. a shut-off facility on the fore-vacuum side and block the line directly after switching off the vacuum pump.
- As an alternative, use a backing pump with integrated vacuum safety valve.

**Required tools**

- Ring spanner, **WAF 13** with flange DN 160 ISO-F
- Ring spanner, **WAF 30** with flange DN 150 PN16



**Condensate separator**

Pfeiffer Vacuum recommends installing a condensate separator, with condensate drain at the lowest point of the exhaust line.



### Connecting the fore-vacuum side

1. Choose a minimum pipe cross section equal to the nominal diameter of the pressure flange.
2. Clear welded lines of any scaling, loose particles etc. prior to installation.
3. Route the pipes so that no mechanical stresses can act on the roots pump or the backing pump.
4. Install a bellows in the piping if necessary.
5. Ensure that mating flanges are in a parallel position.
6. Install the pipes downward from the vacuum pump, so that condensate does not flow back in.

## 5.7 Connecting switch box

### ⚠ CAUTION

#### Electric shock and damage to the vacuum pump and electronic drive unit due to improper connection and disconnection of components

With existing power supply connection to the switch box, there is a risk of electric shock when making contact with the motor connecting plug. Even after the power supply has been switched off, the vacuum pump continues to deliver electrical energy during its run-down period. If the units are disconnected prematurely, there is the risk of electric shock, and destruction of electric components.

- Always interrupt the power supply connection at the switch box before connecting the power supply plug to the motor.
- With existing power supply connection to the switch box or when the pistons are running, never disconnect the motor connecting plug.
- After switching off, wait at least another 5 minutes until the capacitors have discharged before separating the cable connection.

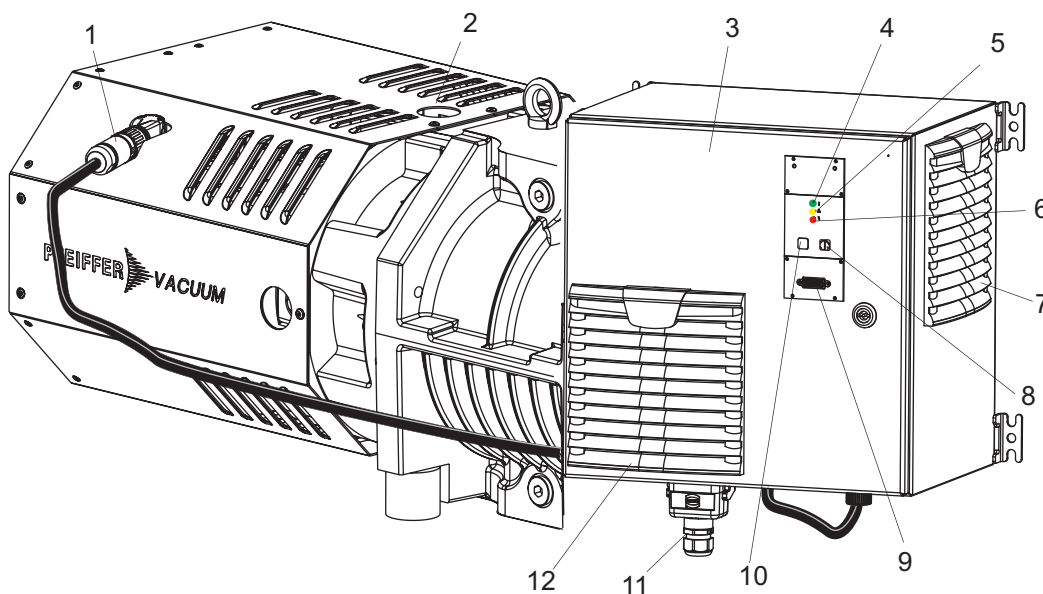




Fig. 13: Connecting switch box

- |                          |  |
|--------------------------|--|
| 1 Motor connecting cable | 7 Fan, outlet  |
| 2 Fan cover              | 8 On/off button     |
| 3 Electronic drive unit  | 9 "Remote" interface   |
| 4 Status LED, green      | 10 Stand-by button  |
| 5 Status LED, yellow     | 11 Mains connection  |
| 6 Status LED, red        | 12 Fan, inlet  |

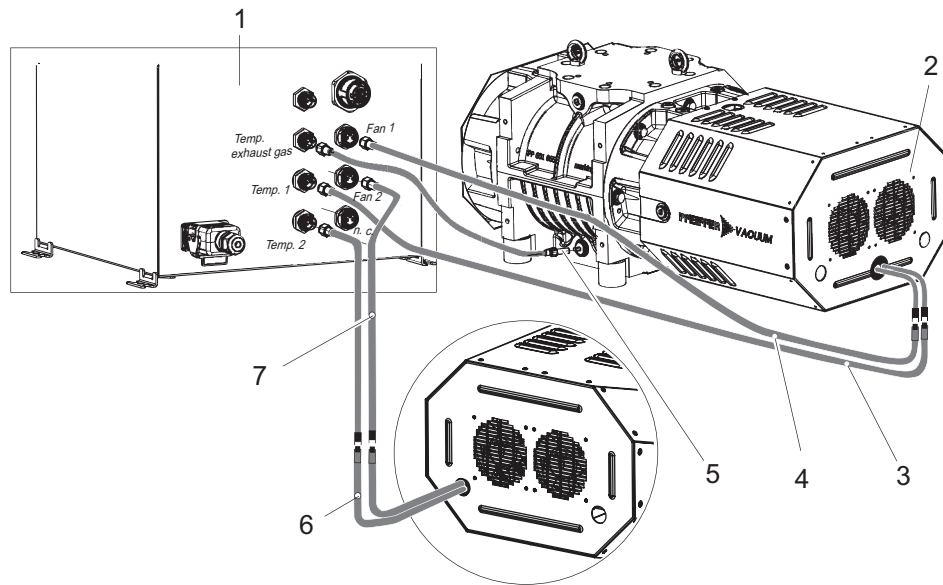
#### Connection of motor connecting cable

- Connect the motor connecting cable to the motor.

## 5.8 Connecting temperature sensors and fan

The roots pump has an M 6 connecting thread on each of its two oil chambers with pre-assembled temperature sensors for temperature monitoring. The respective cables are routed to the outside through a

hole in the fan covers. The second cable is provided in each case for connecting the fans. An additional temperature sensor on the fore-vacuum flange monitors the gas temperature.



**Fig. 14: Connecting extension cable**

- |  |  |
|--|--|
| 1 Electronic drive unit                  | 5 Gas temperature sensor                 |
| 2 Motor side                             | 6 Connecting cable, temperature sensor 2 |
| 3 Connecting cable, temperature sensor 1 | 7 Connecting cable, fan 2                |
| 4 Connecting cable, fan 1                |  |

#### Connecting extension cable

The sensor and fan cable are safeguarded geometrically against interchanging.

1. Connect the connecting cables of both temperature sensors to the connections (temp. 1/2) provided on the switch box.
2. Connect the connecting cables of both fans to the connections (fan 1/2) provided on the switch box.
3. Connect the connecting cable of the gas temperature sensor to the connection.

## 5.9 Implement electrical safety measures

### **⚠ 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 suitable motor protection switch.

#### Installing the mains disconnection device

1. The power details for the setting value can be found on the motor rating plate.
2. Install the circuit breaker within reach of the vacuum pump during building installation.
3. Label the circuit breaker as a disconnect device for the vacuum pump.

## 5.10 Connecting to mains power supply

### **⚠ DANGER**

#### **Danger to life from electric shock**

Touching exposed and voltage-bearing elements causes an electric shock. Improper connection of the mains supply leads to the risk of touchable live housing parts. There is a risk to life.

- ▶ Before the installation, check that the connection leads are voltage-free.
- ▶ Make sure that electrical installations are only carried out by qualified electricians.
- ▶ Provide adequate grounding for the device.
- ▶ After connection work, carry out an earthed conductor check.

### **⚠ WARNING**

#### **Risk of fatal injury due to electric shock on account of incorrect installation**

The device's power supply uses life-threatening voltages. Unsafe or improper installation can lead to life-threatening situations from electric shocks obtained from working with or on the unit.

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

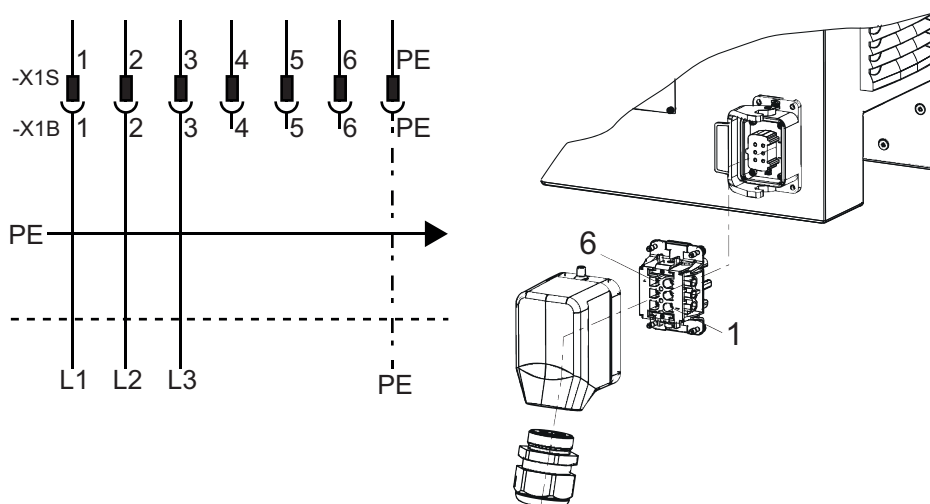


#### **Electromagnetic compatibility**

The electronic drive unit of the vacuum pump complies with the conditions of standard IEC 61000-3-12 stipulating that the permissible short-circuit capacity is observed at the supply terminal of the customer's system with the public network.

- Do not install the vacuum pump in living areas as the electronic drive unit does not provide any protection for the radio reception.
- Ensure that the vacuum pump is connected only to a supply terminal featuring a short-circuit capacity of  $S_{sc} \geq 351$ .
- If necessary, consult the distribution network operator.

The vacuum pumps are intended for operation only with original electronic drive unit and frequency converter. The respectively valid input voltage range can be seen on the rating plate.



**Fig. 15: Mains connection pin assignment**

1	Phase L1	5	n. c.
2	Phase L2	6	n. c.
3	Phase L3	PE	Earthed conductor
4	n. c.		

Electronic drive unit	L1   L2   L3 and PE cable cross section	Dielectric strength	Flammability properties
RC 5500	$\geq 2.5 \text{ mm}^2$	$\geq 600 \text{ V}$	flame-retardant
RC 7500 / RC 11000	$\geq 6.0 \text{ mm}^2$		
RC 15000	$\geq 10.0 \text{ mm}^2$		

**Tbl. 5: Required properties of the power supply cable**

**Connecting to mains power supply**

- ▶ Ensure the correct supply voltage.
- ▶ Assemble your own power supply cable using the original power supply connector from the scope of delivery.

## 6 Interfaces

### 6.1 "Remote" interface

#### NOTICE

##### Property damage on the electronics

Separating all plug-and-socket connections within the bus system with voltage supply switched on may lead to the destruction of electronic components.

- Always disconnect the voltage supply before removing the connecting plug.
- After switching off the power supply pack, wait until the residual load has dispersed completely before disconnecting the plug-and-socket connection.

The 15-pin sub-D connection with the "remote" designation offers the possibility to operate the electronic drive unit via remote control. The following specifications are the factory settings for the electronic drive unit. They can be configured with the Pfeiffer Vacuum parameter set.

- Utilize the screened plug and cable.

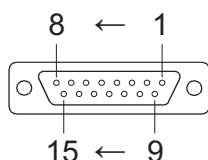


Fig. 16: Pin assignment of the D-Sub socket, 15-pin

Pin	Function	Description, factory setting
1	n.c.	
2	DI access request	V+: Control via DIs, --> GND/open: Control unlocked
3	DI1	V+: Rotation speed setting mode, --> GND/open: no rotation speed setting mode
4	n.c.	
5	DI pumping station	V+: Vacuum pump on, --> GND/open: Vacuum pump off
6	DI stand-by	V+: Stand-by, --> GND/open: no stand-by
7	+24 V DC output (V+)	Reference voltage for all digital inputs (5 W max.)
8	DO1	GND: Error, V+: no error (current max. 80 mA)
9	DO2	GND: Vacuum pump off, V+: Vacuum pump on (current max. 80 mA)
10	n.c.	
11	n.c.	
12	n.c.	
13	RS-485	D+
14	RS-485	D-
15	Ground (GND)	Ground connection of the voltage supply; reference ground for all digital inputs and outputs

Tbl. 6: Plug arrangement of the D-Sub socket, 15-pin

#### 6.1.1 Voltage output

**24 V DC output / pin 7:** Inputs 2 to 6 are activated if they are connected to pin 7 (active high) with +24 VDC. They can also be activated via an external PLC. The functions are deactivated by "PLC high level" and by "PLC low level".

- PLC High level: +13 V to +33 V
- PLC Low level: -33 V to +7 V
- Ri: 7 kΩ
- $I_{\max} < 200 \text{ mA}$

## 6.1.2 Inputs

The digital inputs switch various electronic drive unit functions. Inputs are assigned with functions ex-factory. You can configure them via the RS-485 interface and the Pfeiffer Vacuum parameter set.

### DI remote priority/pin 2

V+: The "remote" connection has control priority over all other control sources.

open Remote priority "inactive"

### DI1 (rotation speed setting mode)/pin 3

V+: Rotation speed setting mode "active"

open Rotation speed setting mode "inactive"

### DI pumping station/pin 5

V+: Vacuum pump on.

Control of all components connected and malfunction acknowledgement.

open Vacuum pump off

### DI stand-by / pin 6

V+: Stand-by activated

The stand-by rotation speed is fixed at 30 Hz.

GND/open Stand-by off

## 6.1.3 Outputs

The digital outputs have a maximum load limit of 24 V/80 mA per output. All outputs listed are configurable with the Pfeiffer Vacuum parameter set via the RS-485 interface (description relates to factory settings).

### DO1/Pin 8

V+: No errors

After applying the voltage supply, the digital output DO1 permanently outputs V+ meaning which means "no error".

GND Error

"Active low" signifies "Error" (common error message).

### DO2/Pin 9

V+: Vacuum pump on

"Active high" means "Vacuum pump on" and rotates at set rotation speed.

Example: use the signal for the message vacuum pump "Ready for operation".

GND: Vacuum pump off

## 6.1.4 RS-485

### Connecting RS-485 via D-Sub

- Connect a Pfeiffer Vacuum control unit or an external PC via pin 13 and pin 14 at the D-Sub connection of the electronic drive unit.

## 6.2 Using RS-485 interface

### DANGER

#### Danger to life from electric shock

When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.

- Connect only suitable devices to the bus system.

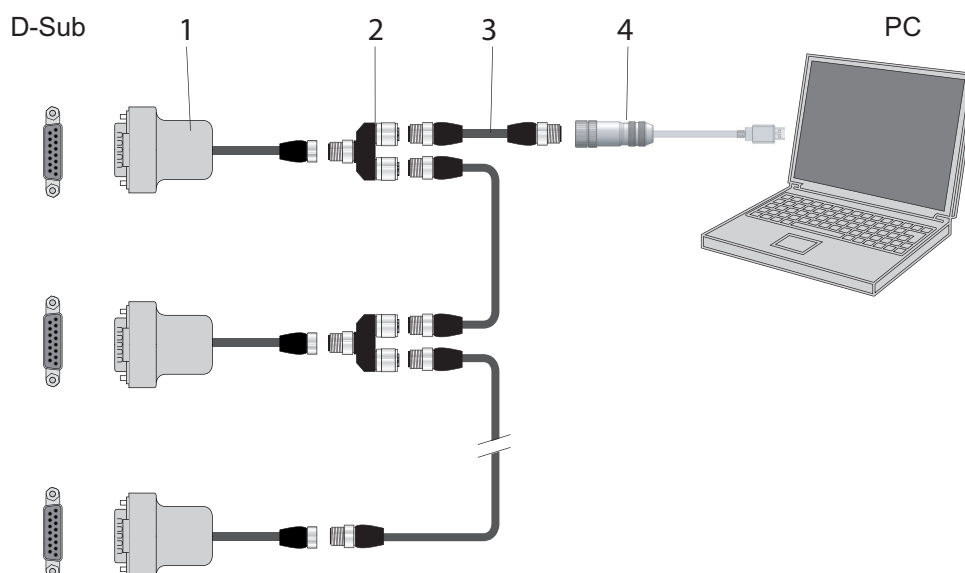
The interface designated “RS-485” is intended for connecting a Pfeiffer Vacuum control unit or a external PC. The connections are galvanically safe and are isolated from the maximum supply voltage for the electronic drive unit.

Designation	Value
Serial interface	RS-485
Baud rate	9600 Baud
Data word length	8 bit
Parity	none (no parity)
Start bits	1
Stop bits	1

**Tbl. 7: Features of the RS-485 interface**

#### Connecting Pfeiffer Vacuum control units or a PC

- Use the connection cable from the scope of delivery of the control unit or from the [Pfeiffer Vacuum accessories](#).
- Connect a control unit to the RS-485 interface.
- Connect a PC via the USB/RS-485 converter.



**Fig. 17: Cross-link via connection RS-485 using connection cables and accessories**

- |                          |                              |
|--------------------------|------------------------------|
| 1 RS-485 to M12 adapter  | 3 M12 to M12 interface cable |
| 2 Y-connector for RS-485 | 4 USB RS-485 converter       |

#### Networking as RS-485 bus

The group address for the electronic drive unit is **902**.

1. Install the devices according to the specification for RS-485 interfaces.
2. Make sure that all devices connected to the bus have different RS-485 device addresses [**P:797**].
3. Connect all devices with RS-485 D+ and RS-485 D- to the bus.

## 6.3 Pfeiffer Vacuum protocol for RS-485 interface

### 6.3.1 Telegram frame

The telegram frame of the Pfeiffer Vacuum protocol contains only ASCII code characters [32; 127], the exception being the end character of the telegram  $C_R$ . Basically, a host (e.g. a PC) sends a telegram, which a device (e.g. electronic drive unit or gauge) responds to.

a2	a1	a0	*	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	$C_R$
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	-------

a2 – a0	Device address ○ <ul style="list-style-type: none"> <li>Individual address of the unit ["001";"255"]</li> <li>Group address "9xx" for all identical units (no response)</li> <li>Global address "000" for all units on the bus (no response)</li> </ul>
*	Action according to telegram description
n2 – n0	Pfeiffer Vacuum parameter numbers
l1 – l0	Data length dn to d0
dn – d0	Data in the respective data type (see chapter "Data types", page 37).
c2 – c0	Checksum (sum of ASCII values of cells a2 to d0) modulo 256
C <sub>R</sub>	carriage return (ASCII 13)

### 6.3.2 Telegram description

**Data query**  --> ○ ?

a2	a1	a0	0	0	n2	n1	n0	0	2	=	?	c2	c1	c0	C <sub>R</sub>
----	----	----	---	---	----	----	----	---	---	---	---	----	----	----	----------------

**Control command**  --> ○ !

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	C <sub>R</sub>
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	----------------

**Data response / Control command understood** ○ --> 

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	C <sub>R</sub>
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	----------------

**Error message** ○ --> 


a2	a1	a0	1	0	n2	n1	n0	0	6	N	O	_	D	E	F	c2	c1	c0	C <sub>R</sub>
										_	R	A	N	G	E				
										_	L	O	G	I	C				

NO\_DEF                      Parameter number n2–n0 no longer exists  
\_RANGE                      Data dn–d0 outside the permissible range  
\_LOGIC                      Logical access error

### 6.3.3 Telegram example 1


**Data query**

Current rotation speed (parameter [P:309], device address: "123")

 --> ○ ?	1	2	3	0	0	3	0	9	0	2	=	?	1	1	2	C <sub>R</sub>
ASCII	49	50	51	48	48	51	48	57	48	50	61	63	49	49	50	13

**Data response: 633 Hz**


Current rotation speed (parameter [P:309], device address: "123")

○ --> 	1	2	3	1	0	3	0	9	0	6	0	0	0	6	3	3	0	3	7	C <sub>R</sub>
ASCII	49	50	51	49	48	51	48	57	48	54	48	48	48	54	51	51	48	51	55	13

### 6.3.4 Telegram example 2

**Control command**


Switch on the pumping station (parameter [P:010], device address: "042")

 --> ○ !	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	C <sub>R</sub>
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

**Control command understood**

Switch on the pumping station (parameter [P:010], device address: "042")



○ --> 	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	C <sub>R</sub>
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

### 6.3.5 Data types

No.	Data type	Description	Length l1 – l0	Example
0	boolean_old	Logical value (false/true)	06	000000 is equivalent to false 111111 is equivalent to true
1	u_integer	Positive whole number	06	000000 to 999999
2	u_real	Fixed point number (unsigned)	06	001571 corresponds with 15.71
4	string	Any character string with 6 characters. ASCII codes between 32 and 127	06	TC_110, TM_700
6	boolean_new	Logical value (false/true)	01	0 is equivalent to false 1 is equivalent to true
7	u_short_int	Positive whole number	03	000 to 999
10	u_expo_new	Positive exponential number. The last of both digits are the exponent with a deduction of 20.	06	100023 is equivalent to $1,0 \cdot 10^3$ 100000 is equivalent to $1,0 \cdot 10^{-20}$
11	string16	Any character string with 16 characters. ASCII codes between 32 and 127	16	BrezelBier&Wurst
12	string8	Any character string with 8 characters. ASCII codes between 32 and 127	08	Example

## 7 Parameter set

### 7.1 General


Important settings and function-related characteristics are factory-programmed into the electronic drive unit as parameters. Each parameter has a three-digit number and a description. The parameter can be accessed via Pfeiffer Vacuum control units or externally via RS-485 using Pfeiffer Vacuum protocol.

The vacuum pump starts in standard mode with factory default pre-set parameters.




#### Non-volatile data storage




When switching off or in the event of unintentional voltage drop, the **parameters** and the operating hours stay saved in the electronics.

#	Three digit number of the parameter
Indicator	Display of parameter description
Description	Brief description of the parameters
Functions	Function description of the parameters
Data type	Type of formatting of the parameter for the use with the Pfeiffer Vacuum protocol
Access type	R (read): Read access; W (write): Write access
Unit	Physical unit of the described variable
min. / max.	Permissible limit values for the entry of a value
default	Factory default pre-setting (partially pump-specific)
	The parameter can be saved persistently in the electronic drive unit

Tbl. 8: Explanation and meaning of the parameters







### 7.2 Control commands


#	Indicator	Designations	Functions	Data type	Access type	Unit	min.	max.	default	
002	Stand-by	Stand-by	0 = off 1 = on	0	RW		0	1	0	✓
009	ErrorAckn	Malfunction acknowledgment		0	W		1	1		
010	PumpgStatn	Pump	0 = off 1 = on	0	RW		0	1	0	
013	BrakeOn	Activate braking resistance	0 = off 1 = on	0	RW		0	1	1	✓
019	Cfg DO2	Output DO2 configuration	1 = No error 2 = Error 5 = Set rotation speed reached 6 = Pump on 9 = "0" 10 = "1" 11 = Remote priority active	7	RW		0	20	6	✓
024	Cfg DO1	Output DO1 configuration	Settings, see [P:019]	7	RW		0	20	1	✓
026	SpdSetMode	Rotation speed setting mode	0 = off 1 = on	7	RW		0	1	0	✓

#	Indicator	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
056	VentOnOff	Fan	0 = off 1 = on valid only for pumps with fan	0	RW		0	1	1	
060	CtrlViaInt	Operate via interface	1 = remote 2 = RS-485 4 = PV.can 32 = Keys on the front panel 255 = Interface selection	7	RW		1	255	1	
061	IntSelLckd	Interface selection locked	0 = off 1 = on	0	RW		0	1	0	
095	FactoryReset	Factory settings	0 = no 1 = yes, only possible while stationary	0	RW		0	1	0	no

Tbl. 9: Parameter set | Control commands


### 7.3 Status requests

#	Indicator	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
303	Error code	Error code		4	R					
309	ActualSpd	Actual rotation speed (Hz)		1	R	Hz				
310	DrvCurrent	Supply current	Current in (A)	2	R	A				
311	OpHrsPump	Pump operating hours		1	R	h				
312	Fw version	Software version interface circuit board		4	R					
313	DrvVoltage	Supply voltage	Voltage in (V)	2	R	V				
315	Nominal Spd	Nominal rotation speed (Hz)		1	R	Hz				
316	DrvPower	Drive power	Output in (W)	1	R	W				
324	TempPwrstg	Temperature power electronics		1	R	°C				
342	TempOilL	Current oil temperature, floating bearing side	Temperature (in °C)	1	R	°C				
343	TempExhGas	Current exhaust gas temperature	Temperature (in °C)	1	R	°C				
347	TempOilF	Current oil temperature, fixed bearing side	Temperature (in °C)	1	R	°C				
349	ElecName	Device name designation		4	R					
354	HW Version	Hardware version interface circuit board		4	R					
360	ErrHist1	Error code history, item 1		4	R					
361	ErrHist2	Error code history, item 2		4	R					
362	ErrHist3	Error code history, item 3		4	R					
363	ErrHist4	Error code history, item 4		4	R					

#	Indicator	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
364	ErrHist5	Error code history, item 5		4	R					✓
389	ActTorque	Current torque		2	R	Nm				
398	ActualSpd	Actual rotation speed (rpm)		1	R	rpm				
399	NominalSpd	Nominal rotation speed (rpm)		1	R	rpm				

Tbl. 10: Parameter set | Status requests

## 7.4 Reference value inputs

#	Indicator	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
706	DefaultSpd	Specification in normal operation	Rotation speed as a % of the nominal speed	2	RW	%	25	100	100	✓
707	SpdSVal	Set value in rotation speed setting mode	Set rotation speed as % of nominal rotation speed	2	RW	%	25	100	75	✓
708	MotTorSVal	Torque specification	Start-up torque in %	2	RW	%	50	100	100	✓
717	StdbySVal	Specification in stand-by operation	Rotation speed as a % of the nominal speed	2	RW	%	12	100	30	✓
797	RS485Adr	RS-485 Interface address		1	RW		1	255	1	✓

Tbl. 11: Parameter set | Reference value inputs


## 7.5 Additional parameters for the control unit



### Additional parameters in the control unit

The basic parameter set is set in the electronic drive unit ex-factory. For controlling connected external components (e.g. vacuum measuring equipment), additional parameters (extended parameter set) are available in the corresponding Pfeiffer Vacuum control units.

- Refer to the corresponding operating instructions of the respective components.
- Select the extended parameter set with parameter **[P:794] = 1**.

#	Indicator	Description	Functions	Data type	Access type	Unit	min.	max.	de-fault	
340	Pressure	Actual pressure value (ActiveLine)		7	R	hPa	$1 \cdot 10^{-10}$	$1 \cdot 10^3$		
350	Ctr Name	Control unit type		4	R					
351	Ctr Software	Control unit software version		4	R					
738	Gauge type	Type of pressure gauge		4	RW					
794	Param set	Parameter set	0 = Basic parameter set 1 = Extended parameter set	7	RW		0	1	0	
795	Servicelin	Insert service line		7	RW				795	

Tbl. 12: Parameters for control unit functions

## 8 Operation

### 8.1 Commissioning vacuum pump

#### **WARNING**

##### **Danger of poisoning due to toxic process media escaping from the exhaust pipe**

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. There is a risk of injury and fatality due to poisoning in processes with toxic process media.

- ▶ Observe the pertinent regulations for handling toxic process media.
- ▶ Safely purge toxic process media via an exhaust line.
- ▶ Use appropriate filter equipment to separate toxic process media.

#### **CAUTION**

##### **Danger of burns on hot surfaces**

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C. If access to the vacuum pump is unrestricted, there is a danger of burns due to contact with hot surfaces.

- ▶ Install suitable touch protection if the vacuum pump is accessible to untrained persons.
- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Contact Pfeiffer Vacuum for suitable touch protection in system solutions.

#### **Observe before switching on**

- Check the lubricant levels on both sight glasses.
- Make sure that the suction chamber is free from all foreign matters.
  - Protect the vacuum pump from sucking in contaminants using suitable measures (e.g. dust filter).
- Check the vacuum pump for visible damage and put the vacuum pump into operation only in a correct state.
- Make sure that the shut-off units on the pressure side open before starting the pump.
- Check the plausibility of the measured values for oil temperature and gas temperature.


### 8.2 Switching on the vacuum pump

The "Pumping station" parameter **[P:010]** comprises operation of the vacuum pump with control of all connected interfaces and configurations.

#### **Procedure**

After successfully completing the self-test, the electronic drive unit resets pending and corrected error messages.

You can switch on the vacuum pump in every pressure range, between atmospheric pressure and ultimate pressure.

1. Switch the voltage supply on.
2. Switch the vacuum pump on by pressing the  button once.
3. Allow the vacuum pump to warm up prior to process start, with the vacuum flange closed, for approx. 30 minutes.

#### **Alternative: Switch on via the Pfeiffer Vacuum parameter**

- ▶ Set the parameter **[P:010]** to the value "1".

## 8.3 Adjusting sealing gas amount

### **WARNING**

#### **Risk of injury from reactive, potentially explosive or other hazardous gas/air mixtures**

Uncontrolled gas inlet of air or gases containing oxygen provides ideal conditions for the formation of unexpected explosive gas/air mixtures in the vacuum system. This results in severe injuries.

- Use only inert gases for supplying the sealing gas supply in order to avoid a potential ignition.

### **NOTICE**

#### **Property damage from impermissibly high sealing gas pressure**

Excessive sealing gas pressure leads to damage to the seals after switching on the vacuum pump.

- Make sure that the sealing gas pressure inside the pump does not exceed 1200 hPa.
- Stop the sealing gas supply immediately after switching off the vacuum pump.



#### **Notes on using sealing gas**

The set quantity of sealing gas influences effective pumping speed and achievable ultimate pressure. Depending on the operating pressure, the empirical value for the supplied sealing gas amount is between 1 % (for a high operating pressure) and 8 % (for a lower operating pressure) of the effective suction capacity.

- Use inert gases such as nitrogen (N<sub>2</sub>).

#### **Procedure**

1. Open the sealing gas supply on the gas cylinder.
2. Set a max. pressure of 2500 hPa on the pressure reducer.
3. Set the desired quantity of sealing gas on the dosing valve of the flow meter.

#### **Formula for calculating sealing gas flow:**

$$Q_S = (S_{th} \times p \times A_S) / p_0$$

- $Q_S$  = Sealing gas flow under standard conditions [Nm<sup>3</sup>/h]
- $p$  = Intake pressure [hPa]
- $p_0$  = Ambient pressure under standard conditions [hPa]
- $\Delta p$  = Differential pressure max. [hPa]
- $p_v$  = Fore-vacuum pressure [hPa]
- $A_S$  = Sealing gas content at the operating gas flow ( $0.01 \leq A_S \leq 0.08$ )
- $S_{th}$  = Rated volume flow rate of the roots pump [m<sup>3</sup>/h]

#### **Example for HiLobe 620x with e.g. 20 hPa intake pressure and 8 % sealing gas content**

$$Q_S = (6220 \times 20 \times 0.08) / 1013$$

$$Q_S = 9.82 \text{ Nm}^3/\text{h}$$

#### **At discharge pressures > 100 hPa:**

$$Q_S = (S_{th} \times (p_v - \Delta p) \times A_S) / p_0$$

## 8.4 Configuring the connections with the Pfeiffer Vacuum parameter set

The electronic drive unit is pre-configured with the factory default basic functions and is ready for operation. For individual requirements, you can configure most connections for the electronic drive unit with the parameter set.

#### **Configure the digital outputs**

- Perform the configuration as per the following table:

Option	Description
1 = No error	active, with trouble-free operation
2 = Error	active, if the error message is active
5 = Set rotation speed reached	active, once the set rotation speed is reached

Option	Description
6 = Pump on	active, if pump on, motor on and no error
9 = always 0	GND for the control of an external device
10 = always 1	V+ for the control of an external device
11 = Remote	active, if the remote priority is active

**Tbl. 13: Configuration with parameters [P:019] and [P:024]**

#### Configure the interface

- Perform the configuration as per the following table:

Option [P:060]	Description
1 = remote	Operation via connection "remote"
2 = RS-485	Operation via connection "RS-485"
4 = PV.can	For service purposes only
32 = Keys on the front panel	Manual operation
<b>Option [P:061]</b>	
0 = off	Interface selection can be set via [P:060].
1 = on	Interface selection locked

**Tbl. 14: Configuration with parameters [P:060] and [P:061]**

## 8.5 Operating modes

The following operating modes are possible:

- Operating without control unit
- Operation via an external control unit
- Operation via RS-485 and Pfeiffer Vacuum display and control unit or PC



#### Automatic start

After bypassing the contacts at pins 2, 7 and 5 on the "remote" connecting plug or when using a connecting cable with respective bridges and applying the supply voltage, the vacuum pump starts up immediately.

Pfeiffer Vacuum therefore recommends switching on the voltage supply immediately before operation.

#### Operate without control unit

- Provide the current supply.

After applying the operating voltage, the vacuum pump carries out a self-test to check the supply voltage.

#### Operate via the external control

- Connect the remote control via the "remote" 15-pin D-Sub socket.

The control is carried out by means of "PLC level".

#### Operate with peripheral devices or PC

1. When handling the Pfeiffer Vacuum display and control units, observe the respective operating instructions:
  - Operating instructions at the [Download Center](#).
2. Connect the respective peripheral device to the 15-pin D-Sub socket.
3. Make the desired settings via the RS-485 using the peripheral device.

### 8.5.1 Normal operation



#### Permissible rotation speed range of the vacuum pump

Parameterization is subject to the permissible rotation speed range of the respective vacuum pump. The electronic drive unit regulates automatically to the next valid value.

The vacuum pump starts in normal operation with the pump-specific nominal rotation speed.

#### Set parameters

1. Set parameter **[P:002]** to "0".
2. Query the actual speed via parameter **[P:398]**.
3. Set the desired speed via parameter **[P:706]**.

## 8.5.2 Stand-by operation



#### Permissible rotation speed range of the vacuum pump

Parameterization is subject to the permissible rotation speed range of the respective vacuum pump. The electronic drive unit regulates automatically to the next valid value.

Pfeiffer Vacuum recommends stand-by operation for the vacuum pump during breaks in processes or production.

- If stand-by operation is active, the electronic drive unit reduces the rotation speed of the vacuum pump in the range of **12 to 100%** of the nominal speed.
- The factory configuration for stand-by is 30%.
- Stand-by operation has priority over rotation speed setting mode.

#### Set the stand-by rotation speed

1. Set the parameter **[P:717]** to the required value in %.
2. Set the parameter **[P:002]** to "1".
3. Query the actual speed via parameter **[P:398]**.

## 8.5.3 Rotation speed setting mode



#### Permissible rotation speed range of the vacuum pump

Parameterization in rotation speed setting mode is subject to the permissible rotation speed range of the respective vacuum pump. The electronic drive unit regulates automatically to the next valid value.

The set rotation speed is selected via the parameter **[P:707]** in the range **25 to 100 %** of the set rotation speed.

Rotation speed setting mode has priority over normal operation.









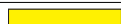
#### Set the rotation speed setting mode

1. Set the parameter **[P:707]** to the required value in %.
2. Set the parameter **[P:026]** to "1".
3. Query the set rotation speed via parameter **[P:309]** or **[P:398]**.





## 8.6 Operation monitoring

### 8.6.1 Operating mode display via LED

LEDs on the operator panel of the electronic drive unit indicate the respective operating status of the vacuum pump.

LED	Symbol	LED status	Display	Meaning
<div>Green</div> 		Off		without current
		On, flashing		"Pump OFF"
		On, constant		"Pump ON"
<div>Yellow</div> 		Off		no warning
		On, constant		Warning



LED	Symbol	LED status	Display	Meaning
Red 		Off		No errors
		On, constant		Error

Tbl. 15: Meaning of the LEDs

## 8.6.2 Temperature monitoring

Depending on the sensor type, temperature thresholds for warning and malfunction messages are stored immutably in the parameter set of the electronic drive unit. If a measured value exceeds the threshold, the vacuum pump is switched to a safe state.

### Warnings


- With an oil temperature ( $T > 85\text{ °C}$ ), only a **"Warning"** is issued.
- With a gas temperature ( $T > 250\text{ °C}$ ), a **"warning"** is issued.

### Malfunction messages

- With an oil temperature ( $T > 95\text{ °C}$ ), the vacuum pump switches off with a **"malfunction message"**.
- With a gas temperature ( $T > 300\text{ °C}$ ), the vacuum pump switches off with a **"malfunction message"**.
- If the oil temperature sensor is not connected or is defective, the vacuum pump does not start up and a **malfunction message** is displayed.

### Acknowledge error - Query status

After cooling down, the vacuum pump does **not** start automatically.

- Switch the vacuum pump back on by pressing the  button or by setting parameter **[P:010]** to "1".

## 8.6.3 Check the lubricant level

### Check the lubricant level

1. Regularly check the lubricant level while the vacuum pump is running and at operating temperature.
2. Make sure that the level is in the area at the center of the sight glass.
3. Check operating fluid fill level daily during continuous operation, and every time vacuum pump is switched on.

## 8.7 Switching off and venting

### WARNING

#### Risk of crushing on rotating parts when reaching into the open flange

The pistons continue to run in the vacuum after switching off the motor, and can trap fingers and hands within their reach.

- Wait until the vacuum pump comes to a complete standstill.
- Secure the vacuum pump against re-start.

### NOTICE

#### Risk of damage from gas backflow into the roots pump


Due to the backflow of process gas, the electronic equipment is susceptible to irreversible damage caused by regenerative energy produced with rotation of the piston.

- Equip the vacuum pump with a facility that prevents the backflow of gases.
- Use, e.g. a shut-off facility on the fore-vacuum side and block the line directly after switching off the vacuum pump.
- As an alternative, use a backing pump with integrated vacuum safety valve.

The "Pumping station" parameter **[P:010]** comprises operation of the vacuum pump with control of all connected interfaces and configurations.

### **Procedure with clean processes**

You can switch off the vacuum pump in every pressure range, between atmospheric pressure and ultimate pressure directly after the process end.

1. Close the shut-off valve in the vacuum line and disconnect the vacuum pump from the process.
2. Switch the running vacuum pump off by pressing the  button once.
3. Vent the vacuum pump via the intake side to avoid the gas backstreaming.
4. Switch off the process- and pump-specific media supply (e.g. the sealing gas supply).

### **Alternative: Switch off via the Pfeiffer Vacuum parameter**

- Set the parameter **[P:010]** to the value "0".

### **Procedure with contaminated medium**

1. Close the shut-off valve in the vacuum line and disconnect the vacuum pump from the process.
2. At the end of the process, continue to operate the vacuum pump with flushing gas supply at the vacuum flange for another approx. 20 to 40 minutes.
  - Use dry air or nitrogen.
3. Then stop the flushing gas supply.
4. Switch off the vacuum pump.
5. Vent the vacuum pump via the intake side to avoid the gas backstreaming.
6. Switch off the process- and pump-specific media supply (e.g. the sealing gas supply).

## 9 Maintenance

### 9.1 Maintenance information

#### **WARNING**

##### **Danger to life from electric shock during maintenance and service work**

There is a danger to life from electric shock when making contact with live components that still exist after the vacuum pump has been switched off.

- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Wait until the vacuum pump comes to a standstill (rotation speed = 0).
- ▶ After switching off the vacuum pump, wait another 5 minutes until the capacitors have discharged.

#### **WARNING**

##### **Risk of crushing from rotating parts**

Fingers and hands may be caught by rotating pistons within the connection flange. This results in severe injuries.

- ▶ Keep limbs out of the reach of the roots pump.

#### **NOTICE**

##### **Danger of property damage from improper maintenance**

Unprofessional work on the vacuum pump will lead to damage for which Pfeiffer Vacuum accepts no liability.

- ▶ We recommend taking advantage of our service training offering.
- ▶ When ordering spare parts, specify the information on the nameplate.

#### **Cleaning and maintenance work**

- Cleaning/changing the air filter
- Cleaning the suction chamber and roots piston
- Changing lubricant
- Any more extensive tasks are part of maintenance **level 3**

#### **Preparing maintenance**

1. Switch off the vacuum pump.
2. Allow the vacuum pump to cool if needed
3. Vent the vacuum pump to atmospheric pressure via the intake side.
4. Disconnect the electronic drive unit from the mains.
5. Secure the electronic drive unit against re-start.
6. After switching off the vacuum pump, wait for at least another 5 minutes until the capacitors have discharged before starting any work.
7. Remove the vacuum pump from the system if necessary.

### 9.2 Checklist for inspection and maintenance



#### **Maintenance frequency and service lives**

Maintenance frequency and service lives are process-dependent. Chemical and thermic loads or contamination reduce the recommended reference values.

- Determine the specific service lives during the first operating interval.
- Consult with Pfeiffer Vacuum Service if you wish to reduce the maintenance frequency.

**Maintenance level**

We recommend that Pfeiffer Vacuum Service (PV) carry out maintenance work at level 3. Pfeiffer Vacuum will be released from all warranty and liability claims if maintenance work is not carried out properly. This also applies wherever parts other than original spare parts are used.

You can carry out maintenance work at **Maintenance Level 1** yourself.

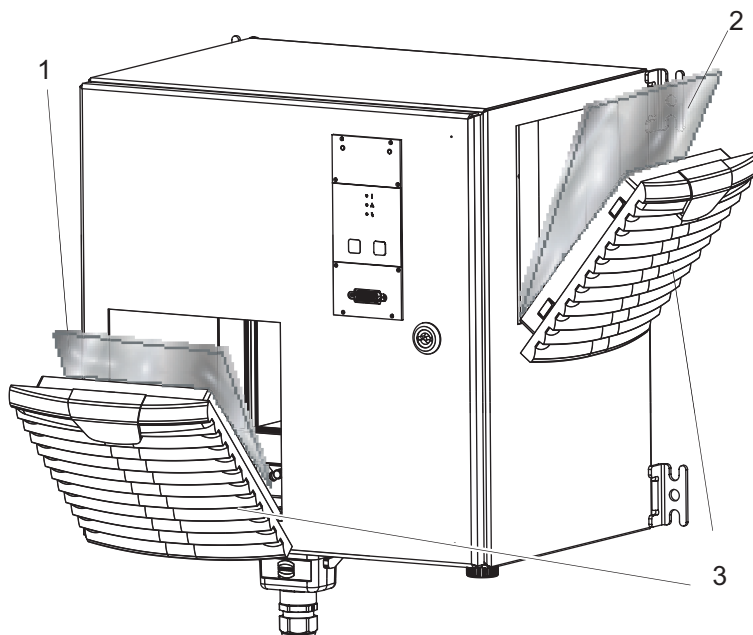
Action	Inspection	Maintenance level 1	Maintenance level 3	Required Material
described in document	BA	BA	SI	
Interval	daily	≤ 1 year	every 4 years or after 35,000 operating hours	
Inspection				
Visual and acoustic pump test	■			
<ul style="list-style-type: none"><li>• Checking lubricant level and color of the lubricant</li><li>• Checking vacuum pump for leaks</li></ul>				
<ul style="list-style-type: none"><li>• Check the vacuum pump for noises (quiet running)</li></ul>	■			
Maintenance level 1 – lubricant change				
<ul style="list-style-type: none"><li>• Changing lubricant</li></ul>		■		Lubricant Maintenance kit 1
<ul style="list-style-type: none"><li>• Replace the air filter (2x) on the electronic drive unit</li></ul>		■		
Maintenance level 3 – overhaul				
<ul style="list-style-type: none"><li>• Dismantling and cleaning vacuum pump</li><li>• Replace the seals and all wearing parts</li></ul>			■ (PV)	Maintenance kit 3
Optionally: Cleaning the suction chamber				
Work on-site without removing the vacuum pump: <ul style="list-style-type: none"><li>• clean the suction chamber and piston</li></ul>	as required			Maintenance kit for Cleaning the suction chamber

**Tbl. 16: Maintenance intervals**



Scan this qr code or [click here](#) and see the service level 1, lubricant replacement.

## 9.3 Cleaning air filter



**Fig. 18: Replace the filter mat of the fan**

- |                         |                 |
|-------------------------|-----------------|
| 1 Air intake filter mat | 3 Louvre grille |
| 2 Air outlet filter mat |                 |

### Required tools

- Screwdriver

### Clean or replace filter

1. Carefully lever off the louver grille using a screwdriver.
2. Remove the filter mats.
3. Clean or replace the filter mats.
4. Pay attention to the intake side and outlet side of the louver grille.
  - The direction of flow is from the soft side of the filter mat to the rough side.
5. Close the louver grille.

## 9.4 Changing lubricant

### **⚠ WARNING**

#### **Health hazard and environmental damage from toxic contaminated lubricant**

Toxic process media can cause lubricant contamination. When changing the lubricant, there is a health hazard due to contact with poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Wear suitable personal protective equipment when handling these media.
- ▶ Dispose of the lubricant according to locally applicable regulations.

### **⚠ WARNING**

#### **Danger of poisoning from toxic vapors**

Igniting and heating synthetic lubricants generates toxic vapors. Danger of poisoning if inhaled.

- ▶ Observe the application instructions and precautions.
- ▶ Do not allow tobacco products to come into contact with the lubricant.

### ⚠ CAUTION

#### Scalding from hot lubricant

Danger of scalding when draining lubricant if it comes into contact with the skin.

- ▶ Wear protective equipment.
- ▶ Use a suitable collection receptacle.



#### Pfeiffer Vacuum recommends determining the precise service life of the lubricant in the first operating year.

The usable life may deviate from the reference value specified depending on thermic and chemical loads, or due to penetrating process media in gear and bearing chambers.



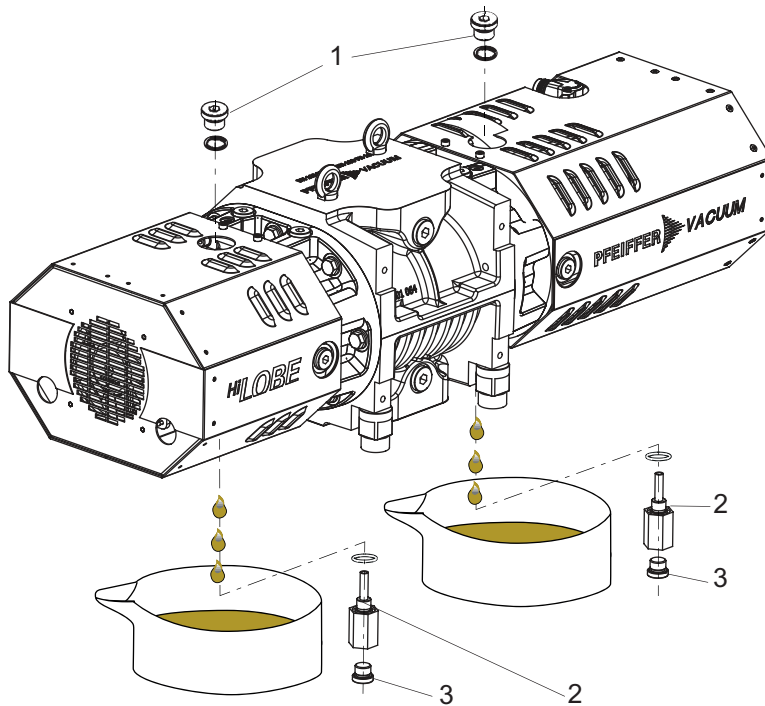
#### Safety data sheets

You can obtain the safety data sheets for lubricants from Pfeiffer Vacuum on request, or from the [Pfeiffer Vacuum Download Center](#).

## 9.4.1 Draining lubricant

### Required tools

- Allen key, **WAF 8**
- Ring spanner, **WAF 27**



**Fig. 19: Draining lubricant**

- |                           |                          |
|---------------------------|--------------------------|
| 1 Filler screws with seal | 3 Drain screws with seal |
| 2 Fill level limiter      |                          |

### Draining lubricant



#### Unscrew the fill level limiter

To drain the lubricant, in addition to the drain screw, also unscrew the fill level limiter on the pump bottom side.

1. Make sure that there is sufficient space underneath the vacuum pump to place a collection receptacle for the lubricant.
2. Unscrew the filler screws.
3. Place the collection receptacle underneath.

4. Hold the fill level limiter with the ring spanner and unscrew the drain screw at the same time.
5. Unscrew the fill level limiter and allow the lubricant to drain.

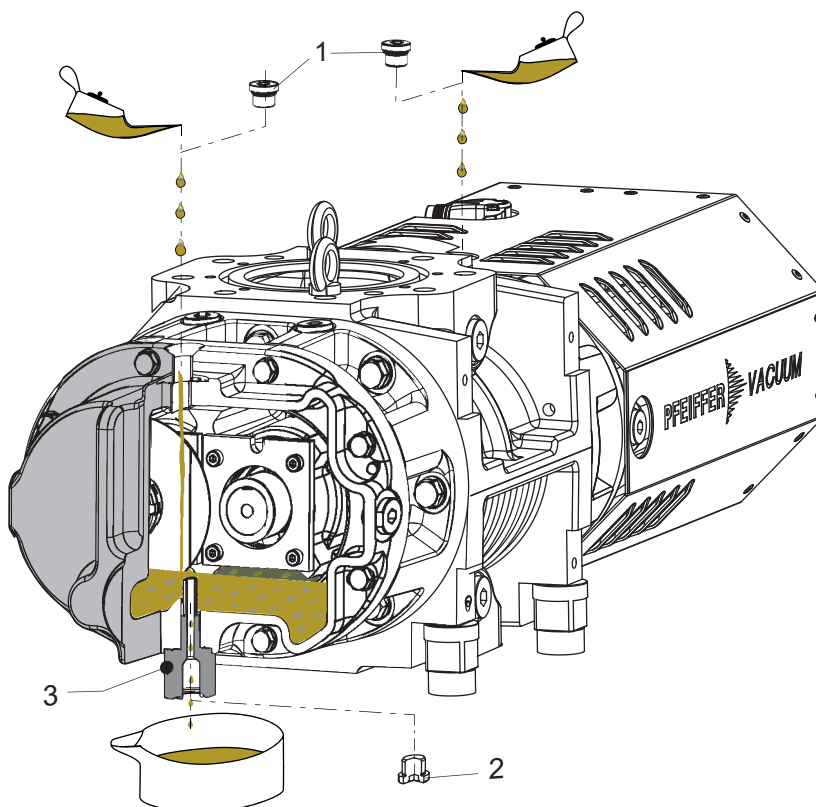
### 9.4.2 Filling with lubricant

#### Required consumables

- Lubricant of the vacuum pump

#### Required tools

- Allen key, **WAF 8**
- Ring spanner, **SW 27**



**Fig. 20: Filling with lubricant**

- |                 |                      |
|-----------------|----------------------|
| 1 Filler screws | 3 Fill level limiter |
| 2 Drain screw   |                      |

#### Filling with lubricant

1. Screw the fill level limiter back in.
2. Place a collection receptacle under each drain.
3. Fill the lubricant on both sides up to the maximum fill level.
  - Once full, lubricant overfills the fill level limiter, and drips out of the drain hole.
4. Screw the filler and drain screws back in.

## 10 Decommissioning

### 10.1 Shutting down for longer periods

Before shutting down the vacuum pump, observe the following instructions to adequately protect the interior of the vacuum pump (suction chamber) from corrosion:

**Procedure for a longer downtime of the vacuum pump (> 1 year)**

1. Allow the vacuum pump to cool down.
2. Clean suction chamber.
3. Change the lubricant.
4. Seal the vacuum flange and fore-vacuum flange and any other openings with screw caps.
5. Evacuate the pump interior via the measurement connection on the vacuum side, to  $p < 1 \text{ hPa}$ .
6. Vent the suction chamber of the vacuum pump through the measurement connection using dry air or nitrogen.
7. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
8. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
9. For storage durations of more than 2 years, we recommend you carry out maintenance and a lubricant change prior to recommissioning.
10. Please note, the vacuum pump may not be stored in the vicinity of machines, traffic routes, etc., as strong vibrations may damage the bearing.

### 10.2 Recommissioning

#### NOTICE

**Damage to the roots pump due to aging of the lubricant**

The useful life of the lubricant is limited (max. 2 years). Prior to recommissioning, carry out the following operations following inactivity of **2 years or more**:

- ▶ Observe the maintenance instructions – consult Pfeiffer Vacuum where necessary.
- ▶ Change the lubricant.
- ▶ Check the bearings and replace any aged elastomer parts.

**Procedure when recommissioning the vacuum pump**

1. Check the roots pump for visible damage and operate the roots pump only in an appropriate operating status.
2. Check the interior of the pump for contaminants.
3. Remove any drying pearls from the suction chamber.
4. Do not operate the vacuum pump if there is evidence of rust on the parts which form the housing. Contact [Pfeiffer Vacuum Service](#).
5. Perform a leak test prior to recommissioning the vacuum pump as required.



# 11 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.

## 11.1 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

## 11.2 Dispose of HiLobe roots pumps

Pfeiffer Vacuum roots pumps from the HiLobe series contain materials that you must recycle.

1. Fully drain the lubricant.
2. Disconnect the electronic drive unit.
3. Dismantle the motor.
4. Decontaminate the components that come into contact with process gases.
5. Separate the components into recyclable materials.
6. Recycle the non-contaminated components.
7. Dispose of the product or components in a safe manner according to locally applicable regulations.

## 12 Malfunctions

### 12.1 General

#### **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.

#### **CAUTION**

##### **Danger of burns on hot surfaces**

In the event of a fault, the surface temperature of the vacuum pump can increase to above 105 °C.

- Allow the vacuum pump to cool down before carrying out any work.
- Wear personal protective equipment if necessary.



##### **No automatic restart following a power failure or error state**

After restoring the power supply, the vacuum pump remains in the "Switched Off" state.

- Switch the vacuum pump on actively.

Vacuum pump and electronic drive unit malfunctions always result in a warning or error message. In both cases, you will receive an error code that you can read out via the interfaces of the electronic drive unit. Generally, the LEDs on the control panel display the operating messages. If an error occurs, switch off the vacuum pump and connected devices.

### 12.2 Troubleshooting

Should malfunctions occur, you can find information about potential causes and how to fix them here:

Problem	Possible causes	Remedy
The vacuum pump does not start up and no LED lights up on the operator panel of the electronic drive unit	• No mains voltage or operating voltage incorrect	• Check the mains voltage. • Check the mains fuse.
	• Electronic drive unit defective	• Contact Pfeiffer Vacuum Service.
Vacuum pump will not start up	• Suction chamber dirty	• Switch off the vacuum pump immediately. • Clean suction chamber. • If necessary, contact Pfeiffer Vacuum Service.
Vacuum pump switches off after a while after being started	• Thermal protection switch of the motor or the vacuum pump has triggered • Thermal protection switch of the motor and/or the oil temperature sensors of the vacuum pump have triggered	• Determine the cause and eliminate the fault. • Allow the vacuum pump or the motor to cool as necessary. • Observe the intended use.
Vacuum pump/pumping station does not reach ultimate pressure	• Backing pump faulty	• Check the backing pump.
	• Leak in system	• Examine the system for leaks and, if necessary, carry out a leak test. • Eliminate leaks. • Check the calibration of the measurement instruments. • Check if auxiliary gases such as sealing gas and/or gas ballast are allowed to enter the vacuum pump.
	• Condensate and/or other outgassing impurities in the operation fluid	• Replace the lubricant.

Problem	Possible causes	Remedy
Unusual noises during operation	<ul style="list-style-type: none"> <li>Suction chamber dirty</li> </ul>	<ul style="list-style-type: none"> <li>Switch off the vacuum pump immediately.</li> <li>Clean suction chamber.</li> </ul>
	<ul style="list-style-type: none"> <li>Damage to the bearing or gear wheels</li> </ul>	<ul style="list-style-type: none"> <li>Switch off the vacuum pump immediately.</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>
	<ul style="list-style-type: none"> <li>Imbalance due to deposits on or in the pistons</li> </ul>	<ul style="list-style-type: none"> <li>Clean the pistons.</li> </ul>
LEDs on the operator panel do not match the operating state of the vacuum pump (e.g., LED status: "off" even though voltage supply is present)	<ul style="list-style-type: none"> <li>Operator panel circuit board is defective due to overvoltage or faulty pin assignment at the "remote" interface</li> <li>24 V applied via third-party power supply with deviating potential</li> </ul>	<ul style="list-style-type: none"> <li>Replace electronic drive unit RC</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>

Tbl. 17: Troubleshooting

## 12.3 Error codes

Errors (\*\* Error E—— \*\*) always cause the connected peripheral devices to be switched off.

Warnings (\* Warning F —— \*) are only displayed and do not cause components to be switched off.

### Handling malfunction messages

1. Read out error codes via Pfeiffer Vacuum control units or a PC.
2. Remove the cause of the malfunction.
3. Reset the malfunction message with parameter **[P:009]**.
  - Use preconfigured interfaces or screen tiles on Pfeiffer Vacuum control units.

Error code	Problem	Possible causes	Remedy
Err001	Excess rotation speed	<ul style="list-style-type: none"> <li>Error in the frequency converter (FC)</li> </ul>	<ul style="list-style-type: none"> <li>Contact <a href="#">Pfeiffer Vacuum Service</a></li> </ul>
Err002	Motor excess voltage	<ul style="list-style-type: none"> <li>Error in the frequency converter (FC)</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
		<ul style="list-style-type: none"> <li>[P:013] was not activated during pump operation with braking resistance</li> </ul>	<ul style="list-style-type: none"> <li>Check [P:013] and select as appropriate for the equipment, if applicable: RC 5500 = activated RC 7500/ RC 11000 = activated RC 15000 = activated</li> </ul>
		<ul style="list-style-type: none"> <li>[P:013] was activated during pump operation without braking resistance</li> </ul>	
Err021	Characteristic resistor not detected	<ul style="list-style-type: none"> <li>Characteristic resistor not present or defective</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err023	Motor undervoltage	<ul style="list-style-type: none"> <li>Error in the frequency converter (FC)</li> </ul>	<ul style="list-style-type: none"> <li>Check the mains input voltage</li> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err042	Checksum errors	<ul style="list-style-type: none"> <li>Inconsistent software</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err045	Excess temperature of motor or braking resistor	<ul style="list-style-type: none"> <li>Insufficient cooling</li> <li>Fan filter mats soiled in control cabinet</li> </ul>	<ul style="list-style-type: none"> <li>Check the cooling</li> <li>Clean the fan filter mats or replace them</li> </ul>
Err091	Hardware error	<ul style="list-style-type: none"> <li>Hardware not detected</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err098	Internal communication error	<ul style="list-style-type: none"> <li>Failure of the internal voltages, as a result of Err023</li> </ul>	<ul style="list-style-type: none"> <li>Check the mains input voltage</li> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err104	External error	<ul style="list-style-type: none"> <li>Error in the backing pump of the HiLobe pumping station</li> </ul>	<ul style="list-style-type: none"> <li>Check the backing pump of the HiLobe pumping station</li> </ul>
Err107	Overloading of the FC	<ul style="list-style-type: none"> <li>Permanent overload</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err115	Invalid pump temperature signal	<ul style="list-style-type: none"> <li>Oil temperature sensors defective or not connected</li> </ul>	<ul style="list-style-type: none"> <li>Check the sensors and their cables</li> <li>Replace the sensors and their cables, if required</li> </ul>
Err117	Vacuum pump excess temperature	<ul style="list-style-type: none"> <li>Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>Improve the cooling</li> <li>Check the operating conditions</li> <li>Observe the intended use</li> </ul>

Error code	Problem	Possible causes	Remedy
Err118	Overtemperature of the cooling element (FC)	<ul style="list-style-type: none"> <li>Insufficient cooling</li> <li>Ambient temperature too high</li> </ul>	<ul style="list-style-type: none"> <li>Improve the cooling</li> <li>Check the operating conditions</li> <li>Observe the intended use</li> </ul>
Err173	Motor excess current (FC)	<ul style="list-style-type: none"> <li>Suction chamber dirty</li> <li>Short-circuit</li> </ul>	<ul style="list-style-type: none"> <li>Check the vacuum pump</li> <li>Contact Pfeiffer Vacuum Service</li> </ul>
Err177	Overload (FC)	<ul style="list-style-type: none"> <li>Suction chamber contaminated – Vacuum pump clogged over a longer period or overloaded</li> <li>Short-circuit</li> </ul>	<ul style="list-style-type: none"> <li>Check the vacuum pump</li> <li>Contact Pfeiffer Vacuum Service</li> <li>Observe the intended use</li> </ul>
Err323	Excess temperature at exhaust (during operation with gas outlet temperature sensor)	<ul style="list-style-type: none"> <li>Outlet temperature &gt; 300°C</li> <li>Maximum permissible pressure differential was exceeded</li> </ul>	<ul style="list-style-type: none"> <li>Check the vacuum pump</li> <li>Check the operating conditions</li> <li>Acknowledge the error</li> </ul>

Tbl. 18: Error messages of the electronic drive unit

Error code	Problem	Possible causes	Remedy
Wrn030	Pre-alarm: Excess temperature at exhaust	<ul style="list-style-type: none"> <li>Outlet temperature &gt; 250°C</li> <li>Maximum permissible pressure differential was exceeded</li> </ul>	<ul style="list-style-type: none"> <li>Improve the cooling</li> <li>Check the operating conditions</li> </ul>
Wrn100	Current rotation speed outside of value range for stand-by operation	<ul style="list-style-type: none"> <li>Minimum rotation speed in accordance with specification in [P:717] stand-by operation not reached</li> </ul>	<p>Target rotation speed is automatically raised.</p> <ul style="list-style-type: none"> <li>Change the permissible rotation speed range in [P:717]</li> </ul>
Wrn117	Pre-alarm: Vacuum pump excess temperature	<ul style="list-style-type: none"> <li>Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>Improve the cooling</li> <li>Check the operating conditions</li> <li>Observe the intended use</li> </ul>

Tbl. 19: Warning messages of the electronic drive unit

## 12.4 Warning and malfunction messages when operating with control units

Besides the device-specific warning and error messages on the electronic drive unit, additional messages are displayed with the connected control unit.

Indicator	Problem	Possible causes	Remedy
* Warning F110 *	Pressure gauge	<ul style="list-style-type: none"> <li>Pressure gauge faulty</li> <li>Connection to the pressure gauge disconnected during operation</li> </ul>	<ul style="list-style-type: none"> <li>Check the cable connection</li> <li>Carry out a restart with pressure gauge connected</li> <li>Replace the pressure gauge completely</li> </ul>
** Error E040 **	Hardware error	<ul style="list-style-type: none"> <li>external RAM faulty</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
** Error E042 **	Hardware error	<ul style="list-style-type: none"> <li>EPROM checksum incorrect</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
** Error E043 **	Hardware error	<ul style="list-style-type: none"> <li>E<sup>2</sup>PROM write error</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>
** Error E090 **	Internal device error	<ul style="list-style-type: none"> <li>RAM not large enough</li> <li>Unit is connected to incorrect electronic drive unit</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> <li>Connect the unit to the correct electronic drive unit</li> </ul>
** Error E698 **	Communication error	<ul style="list-style-type: none"> <li>Electronic drive unit is not responding</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service</li> </ul>

Tbl. 20: Warning and malfunction messages

## 13 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.

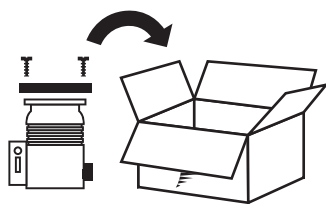


4. You will receive an acknowledgment from Pfeiffer Vacuum.

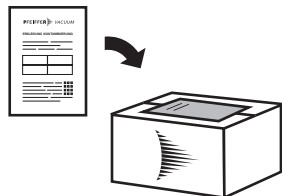
PFEIFFER VACUUM

### Submission of contaminated products

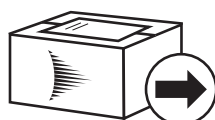
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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

## 14 Ordering spare part packages

Observe the following instructions when ordering spare parts:

### Procedure

- ▶ Have the vacuum pump part number, and any other necessary details from the rating plate, to hand when ordering spare parts.
- ▶ Use only original spare parts.

Spare part packages	Pump version	Order number
Maintenance kit 1	HiLobe 2704 HiLobe 2704 H HiLobe 4504 HiLobe 4504 H HiLobe 6204 HiLobe 6204 H	PP E47 100 -T
Maintenance kit 3	HiLobe 2704 HiLobe 2704 H HiLobe 4504 HiLobe 4504 H HiLobe 6204 HiLobe 6204 H	PP E42 100 -T
Maintenance kit for cleaning the suction chamber	HiLobe 2704 HiLobe 2704 H HiLobe 4504 HiLobe 4504 H HiLobe 6204 HiLobe 6204 H	PP E48 100 -T

Tbl. 21: HiLobe spare part packages

## 15 Accessories



View the line of accessories for Pfeiffer Vacuum roots pumps online at [pfeiffer-vacuum.de](http://pfeiffer-vacuum.de).

### 15.1 Accessory information

#### Fixing materials

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

#### Display units and cable

Display and operating units are used to check and adjust operating parameters. Mains, interface, connection, and extension cables provide a secure and suitable connection. Different lengths on request.

#### Process accessories

Gearbox evacuation, sealing gas set, spraying equipment and temperature sensors permit process-specific adaptations.

### 15.2 Ordering accessories

Selection field	Part number
OmniControl 001 Mobile, control units	PE D20 000 0
OmniControl 001, rack unit without integrated power supply pack	PE D40 000 0
RJ 45 interface cable on M12 for HiPace	PM 051 726 -T
Accessories package for HPU 001/PC	PM 061 005 -T
USB RS-485 converter	PM 061 207 -T
Interface cable, M12 m straight / M12 m straight, 3 m	PM 061 283 -T
TCS 11, adapter for TC 110/120 with RS-485 interface	PM 061 636 -U
Interface cable, M12 m straight / M12 m angled, 0.7 m	PM 061 791 -T
Centering ring with multifunction coating and integrated splinter shield, DN 160 ISO-K/-F	PM 016 217 AU
Spray lance G 1/2" for Okta 500/M/ATEX   Okta 1000/M/ATEX   Okta 2000/M/ATEX   HiLobe 1001 - HiLobe 2101   HiLobe 1002 - HiLobe 1302   HiLobe 1004 - HiLobe 2104   HiLobe 2704 - HiLobe 6204	PP 042 765 -U
Collar flange, 304/1.4301, DN ISO-K, stainless steel	320FLU160
Collar flange, S235JR/1.0038, DN 160 ISO-K, nickel-plated steel	350FLU160
Centering ring with outer ring for vacuum flange and fore-vacuum flange for Okta 1000/M   Okta 1500 G   Okta 2000/M   Okta 4000/M   Okta 6000/M, DN ISO-F	PF 303 116 -T
Coupling set	PM 061 682 -X
Clamping bracket set for Okta 1000/M   Okta 2000/M, DN ISO-K, stainless steel	PP 043 879 -T
Clamping bracket set for Okta 1000/M   Okta 2000/M, DN ISO-K, steel, galvanized	PP 043 880 -T
Clamping bracket set for Okta 1000/M   Okta 2000/M, DN ISO-K, steel, galvanized	PP 043 881 -T
Blank flange set for Okta 1000/M   Okta 2000/M, Stainless steel	PP 043 883 -T
Blank flange set for Okta 1000/M   Okta 2000/M, DN ISO-K, stainless steel	PP 043 884 -T
Blank flange set for Okta 1000/M/ATEX   Okta 2000/M/ATEX, DN PN16, stainless steel	PP 043 885 -T
Gear box evacuation (plastic tube) for HiLobe 100x – 210x, G 3/8 (3x)	PP 100 092 -T
Extension cable package 3 m	PP 100 304 -T
Extension cable package 5 m	PP 100 306 -T
Extension cable package 10 m	PP 100 311 -T



Selection field	Part number
Extension cable package 20 m	PP 100 321 -T
Extension cable package 30 m	PP 100 331 -T

**Tbl. 22: Accessories**

Description	Order number
P3, mineral oil, 1 l	PK 001 106 -T
P3, mineral oil, 5 l	PK 001 107 -T
P3, mineral oil, 20 l	PK 001 108 -T
D2, synthetic diester based oil, 1 l	PK 005 875 AT
D2, synthetic diester based oil, 5 l	PK 005 876 AT
D2, synthetic diester based oil, 20 l	PK 005 877 AT

**Tbl. 23: Consumables**

## 16 Technical data and dimensions

### 16.1 General

Basis for the technical data of Pfeiffer Vacuum roots pumps

- Specifications according to PNEUROP committee PN5
- ISO 21360-1: 2016 "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"
- Leak test to ascertain the integral leakage rate according to EN 1779: 1999 technique A1; with 100 % helium concentration, 10 s measurement duration
- Sound pressure level: 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. 24: 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. 25: Conversion table: Units for gas throughput**



#### Special versions

The technical data and dimensions for the vacuum pump refer to the specified standard version.

- For deviations in special versions, please refer to the rating plates or the enclosed information.

### 16.2 Substances in contact with the media

Pump parts	Substances in contact with the media
Pump housing	Cast iron (spheroidal graphite cast iron)
Rotor	Cast iron (spheroidal graphite cast iron)
Seals	FKM

**Tbl. 26: Materials that make contact with the process media**

## 16.3 Technical data

Type designation	HiLobe 2704	HiLobe 4504	HiLobe 6204
Part number	PP V40 401	PP V41 401	PP V42 401
Connection flange (in)	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16
Connection flange (out)	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16
Mounting orientation	Vertical, inlet on top	Vertical, inlet on top	Vertical, inlet on top
Electronic drive unit	RC 7500	RC 7500	RC 7500
Nominal pumping speed	890 – 2 700 m³/h	890 – 4 440 m³/h	890 – 6 220 m³/h
Max. permissible pressure differential at max. rotation speed	35 hPa	17 hPa	10 hPa
Max. permissible pressure differential at min. rotation speed	50 hPa	50 hPa	50 hPa
Emission sound pressure level (EN ISO 2151) at intake pressure 1 hPa	62 dB(A)	65 dB(A)	65 dB(A)
Cooling method	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)
Rotation speed	1 500 – 4 500 rpm	1 500 – 7 500 rpm	1 500 – 10 500 rpm
Protection degree	IP54, Type 12	IP54, Type 12	IP54, Type 12
Integral leak rate	$< 1 \cdot 10^{-6}$ Pa m³/s	$< 1 \cdot 10^{-6}$ Pa m³/s	$< 1 \cdot 10^{-6}$ Pa m³/s
Input voltage(s)	380 – 480 V AC (±10 %), 50/60 Hz	380 – 480 V AC (±10 %), 50/60 Hz	380 – 480 V AC (±10 %), 50/60 Hz
Motor type	3-phase motor	3-phase motor	3-phase motor
Rated power at max. rotation speed	3.5 kW	5.5 kW	7.5 kW
Recommended on-site electric fuse protection	25 A	25 A	25 A
Motor protection	PTC	PTC	PTC
Operating fluid	D2	D2	D2
Operating fluid amount	3.2 l	3.2 l	3.2 l
I/O interfaces	RS-485, PV can	RS-485, PV can	RS-485, PV can
Ambient temperature	5 – 40 °C	5 – 40 °C	5 – 40 °C
Shipping and storage temperature	-10 – 40 °C	-10 – 40 °C	-10 – 40 °C
Paint finish color	RAL 7035	RAL 7035	RAL 7035
Weight	280 kg	280 kg	280 kg

**Tbl. 27: Technical data HiLobe | vertical direction of flow**

Type designation	HiLobe 2704 H	HiLobe 4504 H	HiLobe 6204 H
Part number	PP V50 401	PP V51 401	PP V52 401
Connection flange (in)	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16
Connection flange (out)	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16	DN 160 ISO-F   DN 150 PN 16
Mounting orientation	Horizontal, inlet on the side	Horizontal, inlet on the side	Horizontal, inlet on the side
Electronic drive unit	RC 7500	RC 7500	RC 7500
Nominal pumping speed	890 – 2 700 m³/h	890 – 4 440 m³/h	890 – 6 220 m³/h
Max. permissible pressure differential at max. rotation speed	35 hPa	17 hPa	10 hPa

Type designation	HiLobe 2704 H	HiLobe 4504 H	HiLobe 6204 H
Max. permissible pressure differential at min. rotation speed	50 hPa	50 hPa	50 hPa
Emission sound pressure level (EN ISO 2151) at intake pressure 1 hPa	62 dB(A)	65 dB(A)	65 dB(A)
Cooling method	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)
Rotation speed	1 500 – 4 500 rpm	1 500 – 7 500 rpm	1 500 – 10 500 rpm
Protection degree	IP54, Type 12	IP54, Type 12	IP54, Type 12
Integral leak rate	$< 1 \cdot 10^{-6} \text{ Pa m}^3/\text{s}$	$< 1 \cdot 10^{-6} \text{ Pa m}^3/\text{s}$	$< 1 \cdot 10^{-6} \text{ Pa m}^3/\text{s}$
Input voltage(s)	380 – 480 V AC ( $\pm 10 \%$ ), 50/60 Hz	380 – 480 V AC ( $\pm 10 \%$ ), 50/60 Hz	380 – 480 V AC ( $\pm 10 \%$ ), 50/60 Hz
Motor type	3-phase motor	3-phase motor	3-phase motor
Rated power at max. rotation speed	3.5 kW	5.5 kW	7.5 kW
Recommended on-site electric fuse protection	25 A	25 A	25 A
Motor protection	PTC	PTC	PTC
Operating fluid	D2	D2	D2
Operating fluid amount	3.2 l	3.2 l	3.2 l
I/O interfaces	RS-485, PV can	RS-485, PV can	RS-485, PV can
Ambient temperature	5 – 40 °C	5 – 40 °C	5 – 40 °C
Shipping and storage temperature	-10 – 40 °C	-10 – 40 °C	-10 – 40 °C
Paint finish color	RAL 7035	RAL 7035	RAL 7035
Weight	280 kg	280 kg	280 kg

**Tbl. 28: Technical data HiLobe | horizontal direction of flow**

## 16.4 Dimensions

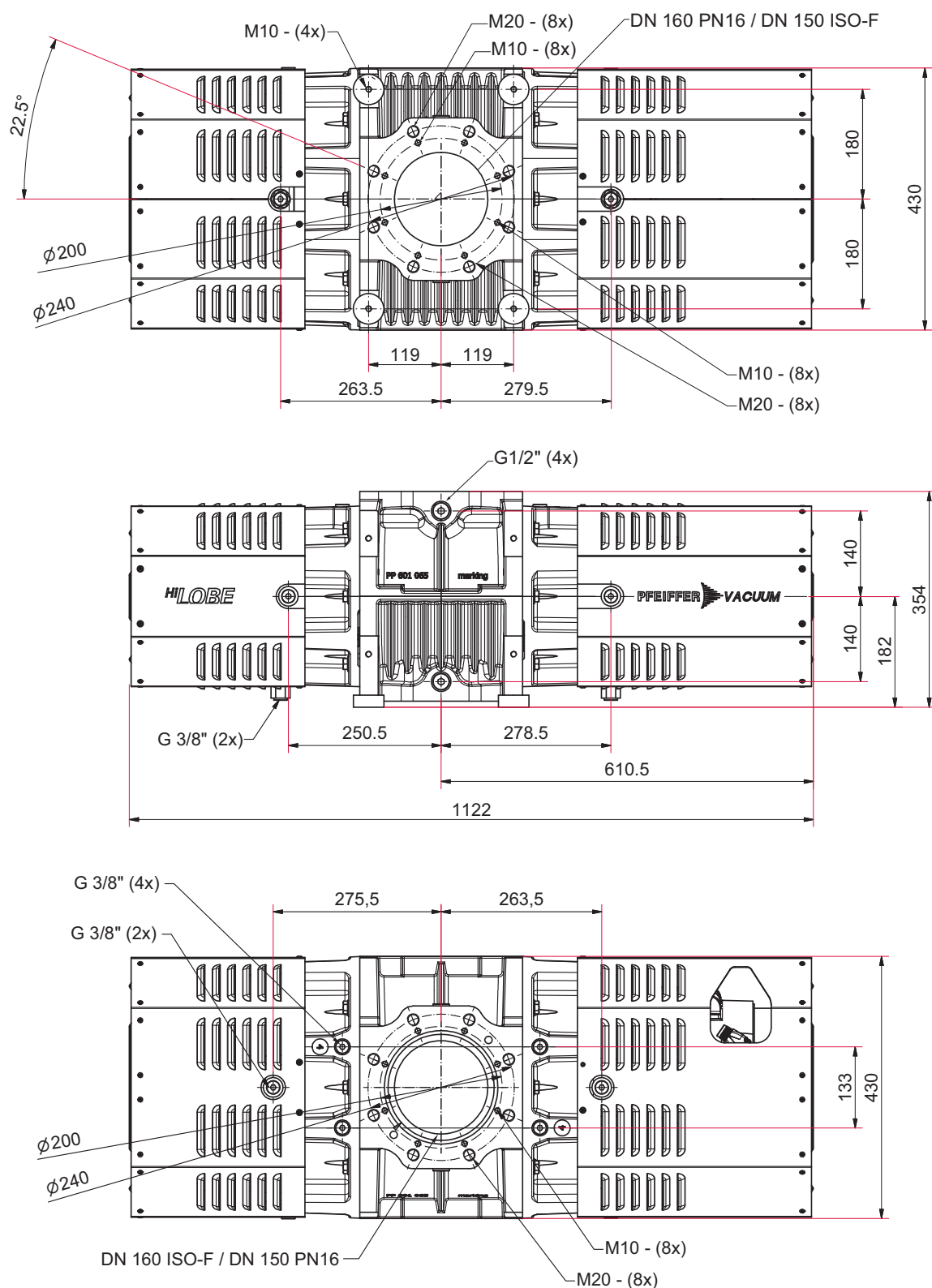


Fig. 21: HiLobe 2704, HiLobe 4504, HiLobe 6204

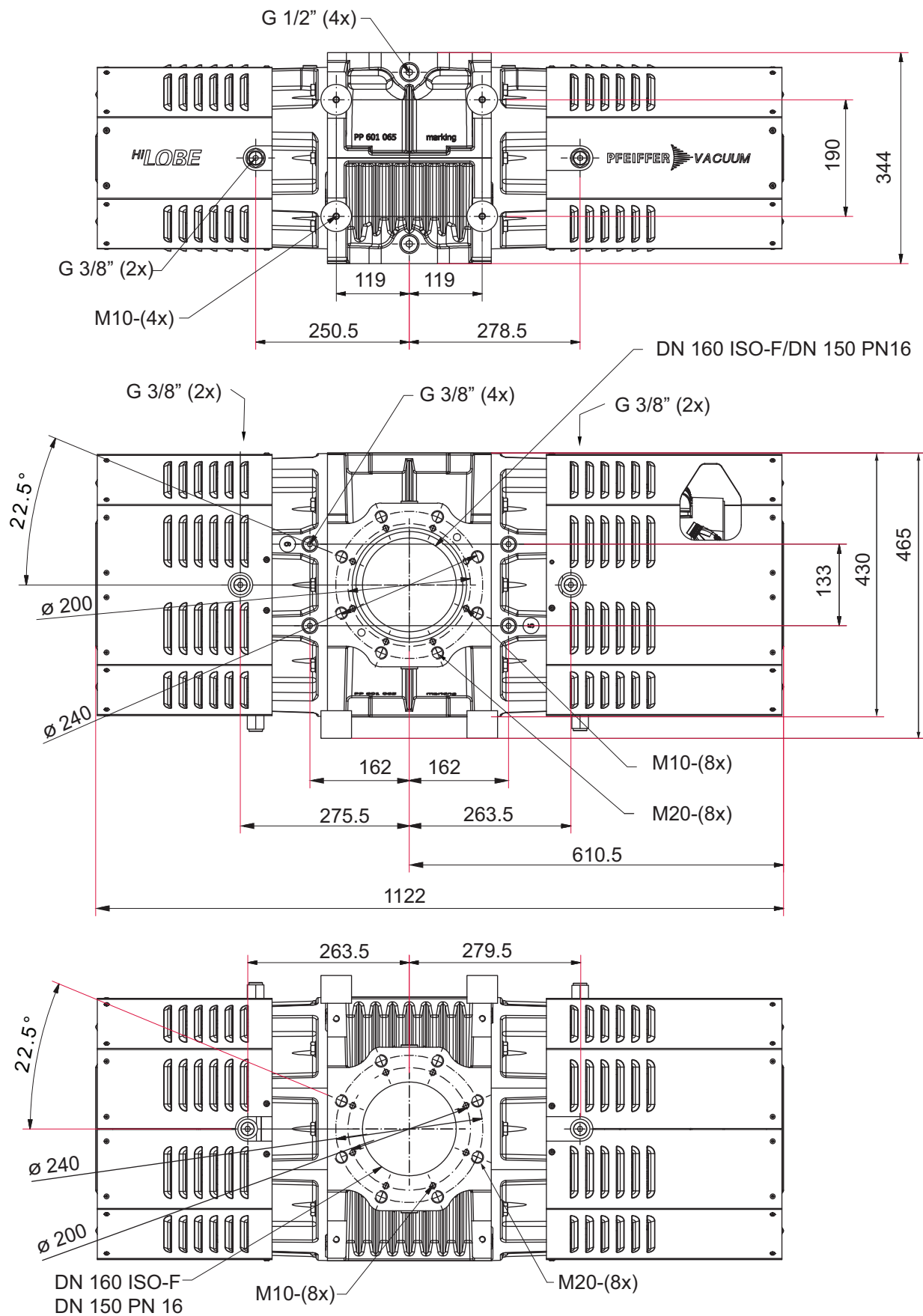
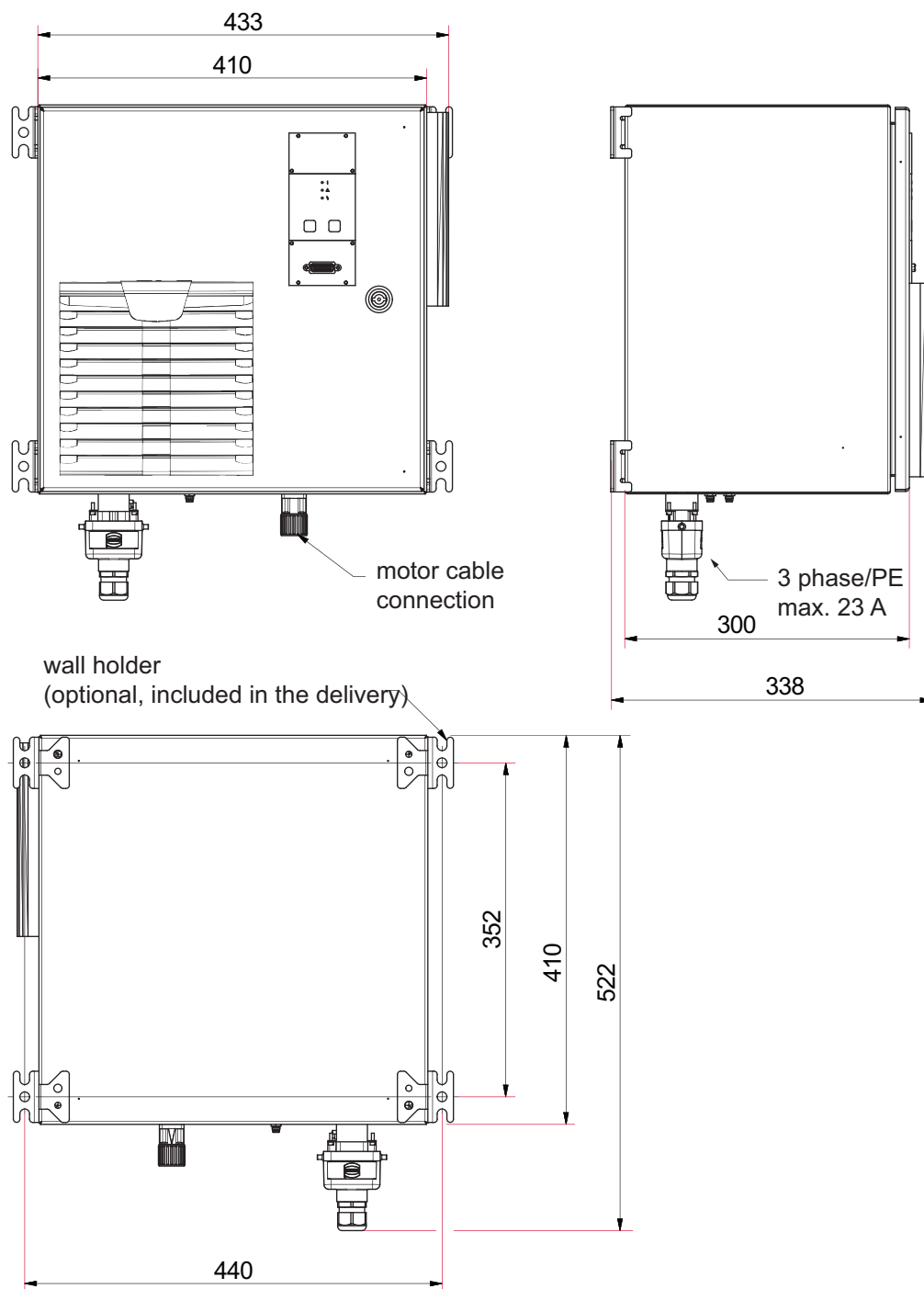


Fig. 22: HiLobe 2704 H, HiLobe 4504 H, HiLobe 6204 H



**Fig. 23: Electronic drive unit RC 7500/RC 11000**  
Dimensions in mm

# EC Declaration of Conformity

Declaration for product(s) of the type:

**Roots pump**

**HiLobe 2704**

**HiLobe 4504**

**HiLobe 6204**

**HiLobe 2704 H**

**HiLobe 4504 H**

**HiLobe 6204 H**

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 61010-1: 2020

DIN EN 1012-2: 2011

DIN EN IEC 61000-3-11: 2021

DIN EN ISO 13857: 2020

DIN EN 61000-3-12: 2012

DIN ISO 21360-1: 2020

DIN EN IEC 61000-6-2: 2019

ISO 21360-2: 2020

DIN EN IEC 61000-6-4: 2020

DIN EN ISO 2151: 2009

DIN EN 60529: 2014

DIN EN 60204-1: 2019

DIN EN IEC 63000: 2019

The authorized representative for the compilation of technical documents is  
Dr. Adrian Wirth, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Asslar, Germany.

Signature:



(Daniel Sälzer)  
Managing Director

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

Asslar, 2020-02-17





# 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:

**Roots pump**

**HiLobe 2704**

**HiLobe 4504**

**HiLobe 6204**

**HiLobe 2704 H**

**HiLobe 4504 H**

**HiLobe 6204 H**

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

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

**Electrical Equipment (Safety) Regulations 2016**

**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 61010-1+A1:2010
EN 1012-2+A1:1996	EN IEC 61000-3-11: 2019
ISO 13857: 2019	EN 61000-3-12: 2011
ISO 21360-1: 2020	EN IEC 61000-6-2: 2019
ISO 21360-2: 2020	EN IEC 61000-6-4: 2019
EN ISO 2151: 2008	EN 60529: 1991 + A1: 2000 + A2: 2013
EN 60204-1: 2018	EN 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, 2023-09-04

**UK  
CA**





## VACUUM SOLUTIONS FROM A SINGLE SOURCE

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

## COMPLETE RANGE OF PRODUCTS

From a single component to complex systems:

We are the only supplier of vacuum technology that provides a complete product portfolio.

## COMPETENCE IN THEORY AND PRACTICE

Benefit from our know-how and our portfolio of training opportunities!

We support you with your plant layout and provide first-class on-site service worldwide.

ed. E - Date 2310 - P/N:PW0333BEN



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

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

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