



# OPERATING INSTRUCTIONS

EN

Translation of the Original

## DUO 20 M | DUO 20 MC

Rotary vane pump

**PFEIFFER**  **VACUUM**

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## Dear Customer,

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

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

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

Further operating instructions from Pfeiffer Vacuum can be found in the [Download Center](#) on our website.

## Disclaimer of liability

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

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

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# 1 About this manual



## IMPORTANT

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

## 1.1 Validity

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

### 1.1.1 Applicable documents

Designation	Document
Declaration of conformity	A component of these operating instructions

### 1.1.2 Variants

These instructions apply to DuoLine vacuum pumps.

- Duo 20 M
- Duo 20 MC

## 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

### 1.3.3 Stickers on the product

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

	<p><b>Rating plate (example)</b> The rating plate is located on the front right side next to the sight glass</p> <p><b>Motor rating plate (not shown)</b></p>
<p>Vor Inbetriebnahme Pumpe mit Öl füllen Fill the pump with oil before putting into operation Remplir la pompe d'huile avant la mise en route</p>	<p><b>Sticker (red)</b> Fill rotary vane pump with operating fluid before commissioning</p>
<p>ACHTUNG! Vor dem Einfüllen des Öles Drehrichtung der Pumpe prüfen! ATTENTION! Before filling in the oil check direction of rotation of the pump! ATTENTION! Avant remplir l'huile vérifier le sens de rotation de la pompe!</p>	<p><b>Sticker (yellow) – three phase motor only</b> Attention! Check the direction of rotation of the rotary vane pump before filling with operating fluid.</p>
<p>Achtung! nur mit F4 befüllen Attention! only F4 to be used</p>	<p><b>Sticker (orange) – special operating fluid only</b> Attention! Fill rotary vane pump with <b>F4</b> only</p>
<p>Achtung! nur mit D1 befüllen Attention! only D1 to be used</p>	<p><b>Sticker (blue) – special operating fluid only</b> Attention! Fill rotary vane pump with <b>D1</b> only</p>
	<p><b>Sense of rotation arrow (three phase motor only)</b> The direction of rotation arrow indicates the required motor sense of rotation.</p>
<p>ACHTUNG Die Pumpe ist mit einem spannungsumschaltbaren Motor ausgerüstet und kann über einen Schalter im Klemmenkasten umgeschaltet werden. Bitte führen Sie die Umstellung nur gemäß Betriebsanleitung durch. ATTENTION The pump is equipped with a dual voltage motor and is preset via switch in the terminal box. Please refer to the operating instructions to make a voltage change.</p>	<p><b>Sticker for single phase motor with voltage selection</b> Before commissioning, check voltage and change over at the terminal box on the motor if needed.</p>



<p>preset for eingestellt auf 200-230 V / 50 Hz 200-240 V / 60 Hz</p> <p>preset for eingestellt auf 100-110 V / 50 Hz 100-120 V / 60 Hz</p>	<p><b>Sticker for pre-set motor voltage</b></p> <p>Pre-set voltage (230 V or 115 V) of single phase motor with voltage selection</p>
	<p><b>Warning hot surface</b></p> <p>This sticker warns of injuries caused by high temperatures as a result of contact without protection during operation.</p>

Tbl. 1: Stickers on the product

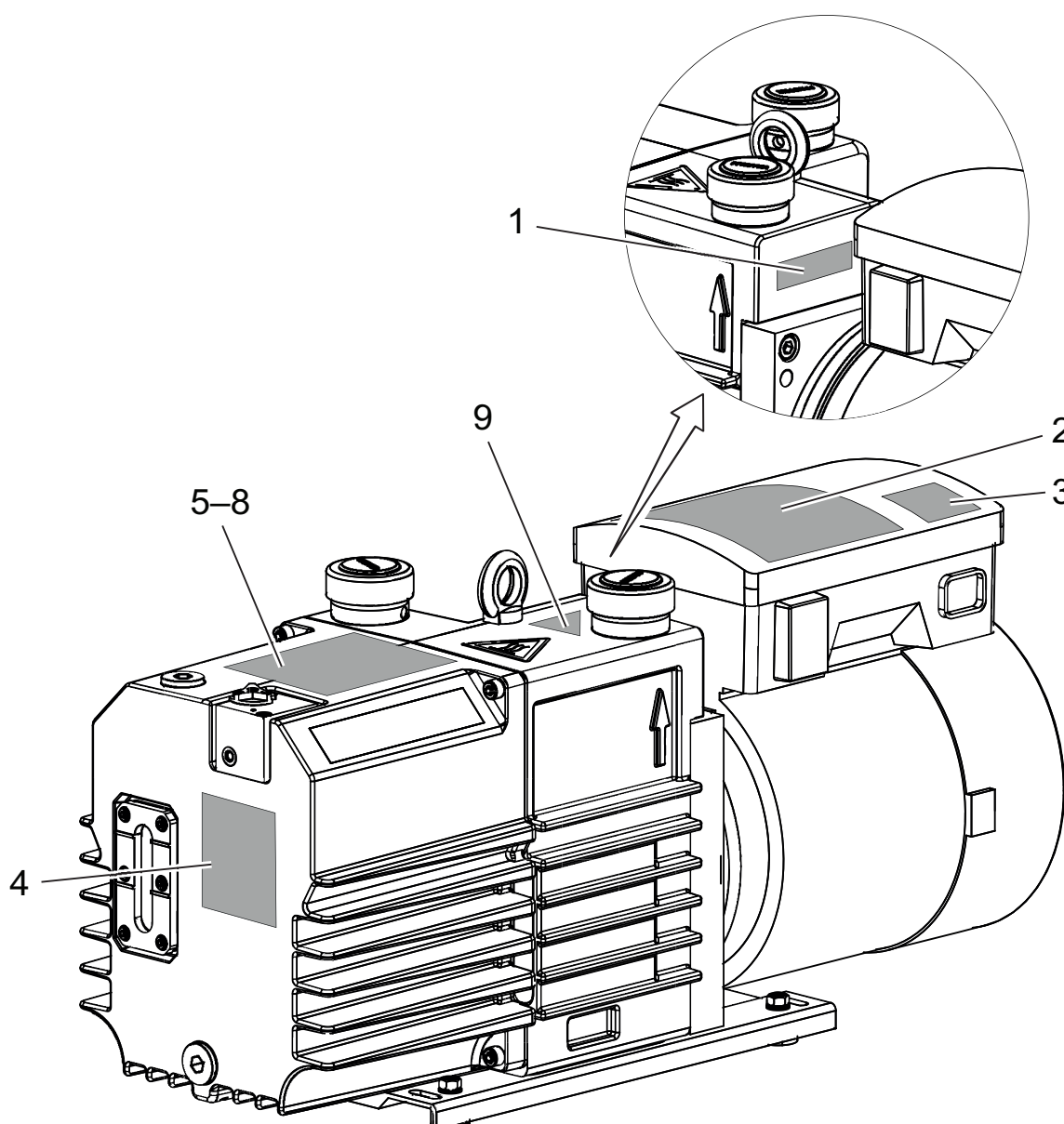


Fig. 1: Position of the stickers on the product

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1 Sense of rotation sticker         | 6 Check direction of rotation note |
| 2 Voltage selection sticker         | 7 Note F4 Operating fluid          |
| 3 Sticker for pre-set motor voltage | 8 Note D1 Operating fluid          |
| 4 Rating plate                      | 9 Warning hot surface              |
| 5 Fill oil note                     |                                    |

### 1.3.4 Abbreviations

Abbreviation	Explanation
OI	Operating instructions
C version	Corrosive gas version
DN	Nominal diameter (Diamètre nominal)
FCR	Fluorinated rubber
$I_N$	Rated (nominal) current
$I_{max}$	Maximum current
ISO	Flange: Connector in accordance with ISO 1609 and ISO 2861
M version	Version with magnetic coupling
PE	Protective ground (protective earth)
ODK	Operating fluid return line (oil drain kit)
PTC	Temperature-dependent resistor (positive temperature coefficient)
M version	Version with magnetic coupling
MC version	Corrosive gas version with magnetic coupling
OME	Oil mist filter (oil mist eliminator)
RSSR	Radial shaft seal ring
WAF	Wrench size
MM	Maintenance manual

Tbl. 2:      **Abbreviations used in this document**

## 2 Safety

### 2.1 General safety information

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

#### **DANGER**

##### **Immediately pending danger**

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

- Instructions to avoid the danger situation

#### **WARNING**

##### **Potential pending danger**

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

- Instructions to avoid the danger situation

#### **CAUTION**

##### **Potential pending danger**

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

- Instructions to avoid the danger situation

#### **NOTICE**

##### **Danger of damage to property**

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

- Instructions to avoid damage to property



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

### 2.2 Safety instructions

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

#### **Risks during transport**

#### **WARNING**

##### **Danger of serious injury due to falling objects**

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

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

## Risks during installation

### **DANGER**

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

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**

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

Igniting and heating synthetic operating fluid 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 operating fluid.

### **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.

### **WARNING**

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

Igniting and heating synthetic operating fluid 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 operating fluid.

### **CAUTION**

#### **Risk of injury from entrapment of body parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. A risk exists of minor injury to fingers and hands (e.g., hematoma), from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

**⚠ 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 and malfunctions****⚠ WARNING****Health hazard through poisoning from toxic contaminated components or devices**

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

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

**⚠ WARNING****Danger of injury from strong magnetic field**

There is a risk of injury for people with pacemakers and medical implants.

- ▶ Make sure that such individuals do not enter the sphere of influence ( $\leq 2$  m) of the magnetic field.
- ▶ Identify rooms in which magnetic couplings are openly accessible with the symbol: **"No access for people with pacemakers"**.
- ▶ Always keep disassembled couplings away from computers, data carriers, and other electronic components.

**⚠ WARNING****Danger of poisoning from toxic vapors**

Igniting and heating synthetic operating fluid 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 operating fluid.

**⚠ WARNING****Health hazard and risk of environmental damage from toxic contaminated operating fluid**

Toxic process media can cause operating fluid contamination. When changing the operating fluid, 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 operating fluid according to locally applicable regulations.

### **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**

#### **Scalding from hot operating fluid**

Danger of burns when draining operating fluid if it comes into contact with the skin.

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

### **CAUTION**

#### **Risk of injury from entrapment of body parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. A risk exists of minor injury to fingers and hands (e.g., hematoma), from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

### **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.

### **CAUTION**

#### **Danger of injury from moving parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

### **Risks during 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.

## 2.3 Safety precautions



### Duty to provide information on potential dangers

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

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



### Infringement of conformity due to modifications to the product

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

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

### General safety precautions when handling the product

- ▶ Observe all applicable safety and accident prevention regulations.
- ▶ Check that all safety measures are observed at regular intervals.
- ▶ Do not expose body parts to the vacuum.
- ▶ Always ensure a secure connection to the earthed conductor (PE).
- ▶ Never disconnect plug connections during operation.
- ▶ Observe the above shutdown procedures.
- ▶ Keep lines and cables away from hot surfaces ( $> 70\text{ °C}$ ).
- ▶ Never fill or operate the unit with cleaning agents or cleaning agent residues.
- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Observe the unit protection class prior to installation or operation in other environments.
- ▶ Provide suitable touch protection, if the surface temperature exceeds  $70\text{ °C}$ .

## 2.4 Safety precautions for vacuum pumps with magnetic coupling

The following safety instructions are only valid for the working with a drive system of a vacuum pump with a magnetic coupling:

### Safety precautions

- ▶ Keep a magnetic coupling away from people with pacemakers.
  - Minimum distance: **2 m**
- ▶ Avoid convergence of magnetic coupling components.
- ▶ Keep magnetized parts away from the magnetic coupling.
- ▶ Always keep a disassembled magnetic coupling away from computers, data carriers and other electronic components.
  - The magnetic coupling can influence operational reliability of electrical and electronic devices.

## 2.5 Limits of use of the product

Installation location	<ul style="list-style-type: none"> <li>• Indoors, protected from dust deposits</li> <li>• Outdoors, protected from direct weather influences</li> </ul>
Installation altitude	max. 1000 m above sea level At installation heights $> 1000\text{ m}$ above sea level, the rated power of the motor must be reduced or the ambient temperature limited due to increased heating of the vacuum pump.
Protection class (according to IEC 61010)	I
Degree of pollution (according to IEC 61010)	2
Overvoltage category	II
Protection class	IP55
permissible angle of inclination	$\pm 10\text{ °}$
Ambient temperature	$+12\text{ °C}$ to $+40\text{ °C}$

Relative humidity of air	max. 85%
Pumped medium intake temperature, max.	+40 °C
Exhaust pressure of the vacuum pump	≤ 1500 hPa absolute
Exhaust pressure at OME	max. atmospheric pressure

**Tbl. 3: Limits of use of the product**

## 2.6 Proper use

- ▶ Use the vacuum pump for vacuum generation only.
- ▶ When pumping media with an oxygen concentration level of  $\geq 21\%$ , only use perfluorinated, synthetic oils (F4, F5, A113) as operating fluid.
- ▶ Adhere to the installation, commissioning, operating, and maintenance instructions.
- ▶ Do not use any accessory parts other than those recommended by Pfeiffer Vacuum.

## 2.7 Foreseeable improper use

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

- Pumping of corrosive media (exception: C version of the rotary vane vacuum pumps)
- Pumping radioactive media
- Pumping of gases that introduce an ignition source to the suction chamber
- Pumping of gases that contain impurities such as particles, dust, or condensate
- Pumping explosive media
- Pumping of media with a propensity to sublimation
- Pumping of fluids
- Use of the vacuum pump in potentially explosive atmospheres
- Use of the vacuum pump outside the specified area of application
- Use for pressure generation
- Use in strong electrical, magnetic, or electromagnetic fields
- Connection to vacuum pumps or equipment which are not suitable for this purpose according to their operating instructions
- Connection to devices with exposed live parts
- Use of accessories or spare parts not listed in these instructions
- Use of operating fluids other than those specified by Pfeiffer Vacuum
- Use of D1 or mineral oil as operating fluid with an oxygen concentration level of  $> 21\%$ .

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

## 2.8 Personnel qualification

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

### Training people

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



## 2.8.1 Ensuring personnel qualification

### Specialist for mechanical work

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

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

### Specialist for electrotechnical work

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

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

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

### Trained individuals

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

## 2.8.2 Personnel qualification for maintenance and repair



### Advanced training courses

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

Adequately trained individuals are:

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

## 2.8.3 Advanced training with Pfeiffer Vacuum

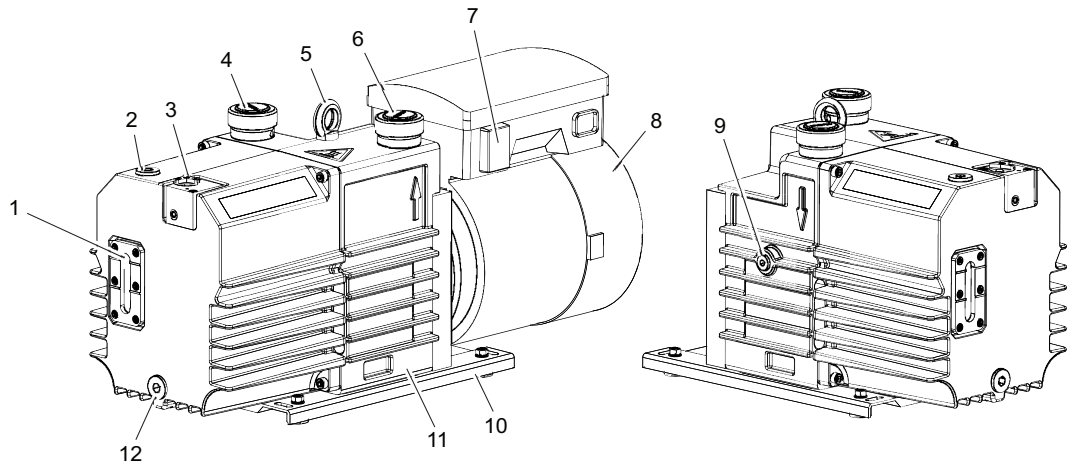
For optimal and trouble-free use of this product, Pfeiffer Vacuum offers a comprehensive range of courses and technical trainings.

For more information, please contact [Pfeiffer Vacuum technical training](#).

### 3 Product description

#### 3.1 Function

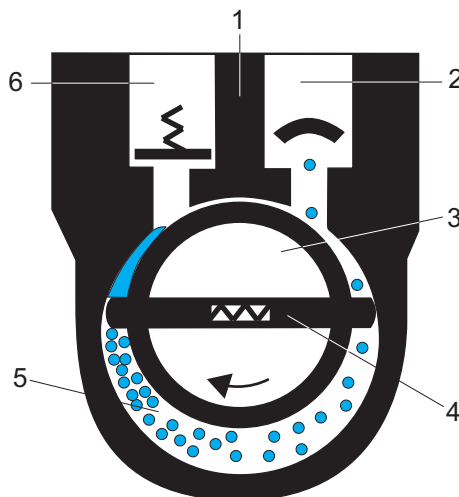
DuoLine rotary vane vacuum pumps are two-stage, oil-sealed rotary positive displacement pumps for use in coarse and medium vacuum. The vacuum pumps are equipped with a safety valve that vacuum seals the vacuum chamber and simultaneously vents the vacuum pump when the pump is at a standstill. The rotary vane pump has a contactless and wear proof drive with magnetic coupling. The pump housing is hermetically sealed.



**Fig. 2: Structure of the rotary vane pump**

- |   |  |
|---|--|
| 1 Sight glass   | 7 Mains switch (single-phase motor only) |
| 2 Filler screw  | 8 Motor                                  |
| 3 Gas ballast valve   | 9 Locking screw (oil pressure switch)    |
| 4 Fore-vacuum connection, DN 25 ISO-KF, with protective cap | 10 Base plate                            |
| 5 Crane lug   | 11 Stand                                 |
| 6 Exhaust connection, DN 25 ISO-KF, with protective cap     | 12 Drain screw                           |

#### 3.2 Operating principle



**Fig. 3: Rotary vane vacuum pump functional principle**

- |                         |                    |
|-------------------------|--------------------|
| 1 Housing               | 4 Vane             |
| 2 Vacuum flange (inlet) | 5 Suction chamber  |
| 3 Rotor                 | 6 Exhaust (outlet) |

The rotary vane pump is an oil-sealed rotational displacement pump. The pumping system is made up of the housing, the eccentrically mounted rotor, and the centrifugally- and spring-loaded radially sliding

vanes, which divide the suction chamber into multiple chambers. The volume of each chamber changes periodically as the rotor rotates. This causes the gas to be drawn in at the vacuum flange and compressed in the suction chamber by the rotation of the rotor, until the exhaust valve opens against the atmospheric pressure at the outlet and expels the gas. The exhaust valve is oil-sealed. When the valve opens, a small quantity of oil penetrates into the suction chamber. In addition to lubrication, this also causes the gaps between the rotor, stator and vanes to seal.

#### **Vacuum safety valve**

Depending on the pump type, rotary vane pumps are equipped with a vacuum safety valve. This separates the rotary vane pump from the vacuum chamber in the event of intentional or unintentional standstill, and vents the pumping system with the displaced gas so that oil does not rise into the vacuum chamber. After switching on, the valve opens after a delay.

#### **Gas ballast valve**

The gas ballast device is used to blend ambient air or inert gas with the process gas in the pumping system. The increase of air content compresses and expels a pumped gas-vapor-mixture within specific limits, without causing condensation in the suction chamber.

#### **Operating fluid, oil**

The pump oil, also known as operating fluid, fulfills various tasks in a rotary vane pump:

- lubrication of all moving parts
- filling part of the dead volume under the exhaust valve
- sealing the gap between the intake and exhaust channel, and between the vanes and the working chamber
- ensuring an optimal temperature balance through heat transfer

### 3.3 Product features

Pump type	Characteristics
Duo 20 M	Standard version with magnetic coupling
Duo 20 MC	MC version; differs compared to the standard version by: <ul style="list-style-type: none"> <li>• Operating fluid F4</li> <li>• Magnetic coupling encapsulated on the pump side</li> <li>• Vane material changed</li> <li>• Hose connection on the gas ballast valve</li> <li>• Leakage rate <math>\leq 1 \times 10^{-6}</math> Pa m<sup>3</sup>/s</li> </ul>

Tbl. 4: Features of the rotary vane pumps

### 3.4 Identifying the product

- To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.
- Observe the motor-specific data on the motor rating plate attached separately.

### 3.5 Scope of delivery

- Rotary vane vacuum pump with motor
- Operating fluid (other than F4, F5 and A113)
- Centering ring with cone sieve and O-ring for the connection flange
- Locking caps for both connection flanges
- Operating instructions

## 4 Transportation and Storage

### 4.1 Transport vacuum pump

#### **WARNING**

##### **Danger of serious injury due to falling objects**

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

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

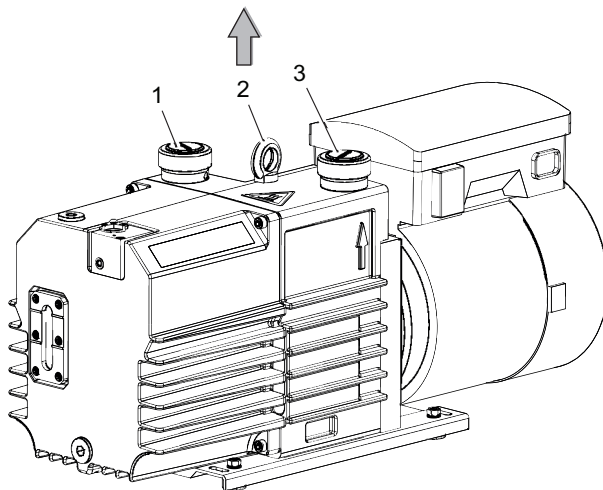


#### **Preparations for transport**

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

#### **General information regarding safe transport**

1. Observe the weight specified on packaging.
2. Use a transport aid if necessary (trolley, lift truck).
3. Transport the product in its original packaging.
4. Always place the product on an adequately sized, level surface.



**Fig. 4: Transport vacuum pump**

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1 Vacuum connection protective cover | 3 Exhaust connection protective cover |
| 2 Crane lug                          |                                       |

#### **Transporting the vacuum pump without its packaging**

1. Unpack the vacuum pump.
2. To protect the inside of the pump, leave both protective caps on the connection flanges during transport.
3. For lifting, use the crane lug provided for this purpose, located on the top of the pump.
4. Lift the vacuum pump out of the transport packaging.
5. Always place the vacuum pump on an adequately sized, level surface.

### 4.2 Storing the vacuum pump



#### **Storage**

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

**Procedure**

1. Fill the vacuum pump with operating fluid up to the upper edge of the sight glass.
2. Close both connection flanges and all openings on the vacuum pump.
3. Make sure that the gas ballast valve is closed.
4. Store the vacuum pump only in dry, dust-free rooms, within the specified ambient conditions.
5. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
6. Change the operating fluid if the storage period is longer than 2 years.

## 5 Installation

### 5.1 Set up the 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.

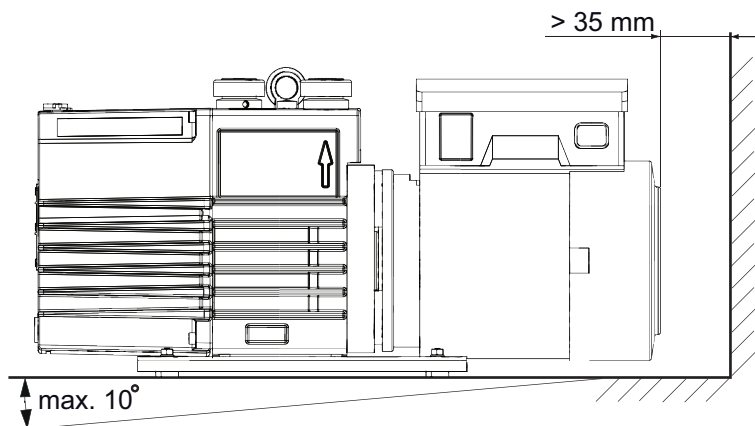


Fig. 5: Minimum distances and permissible inclination

#### Procedure

- When selecting the installation location, observe the requirement for touch protection to prevent burns.
    - Closed housing: no touch protection required
    - Access for trained persons only: no touch protection required
    - Unrestricted access for untrained persons: Touch protection required
  - Pfeiffer Vacuum supports you in implementing the touch protection.
1. Place the vacuum pump on a flat, horizontal surface, to safeguard the operating fluid supply.
  2. Observe the max. permissible angle of inclination of  $\pm 10^\circ$ .
  3. Screw the base plate of the vacuum pump to the mounting surface if necessary.
  4. When installing the pump in a closed housing, ensure adequate air circulation.
  5. Keep the sight glass and gas ballast valve visible and freely accessible.
  6. Keep the voltage and frequency specifications on the motor rating plate visible and freely accessible.
  7. Fill with operating fluid prior to first commissioning.
    - Quantity and type of the operating fluid can be found on the rating plate.

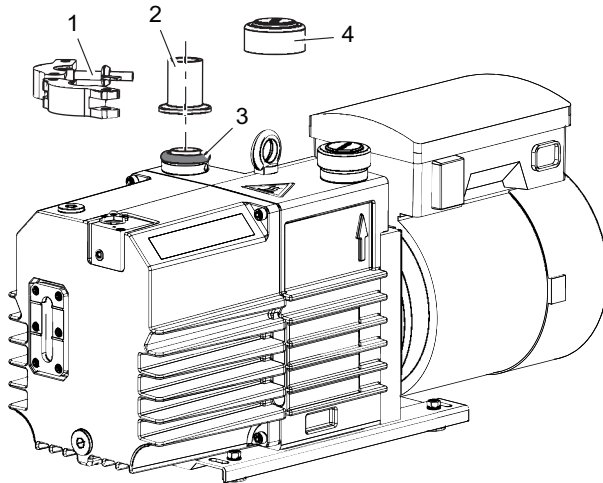
### 5.2 Connect the vacuum side

#### NOTICE

##### Property damage from contaminated gases

Pumping gases that contain contamination damages the vacuum pump.

- ▶ Use suitable filters or separators from the Pfeiffer Vacuum range of accessories, to protect the vacuum pump.



**Fig. 6: Vacuum connection with flange connection**

- |               |  |
|---------------|--|
| 1 Circlip     | 3 Centering ring with cone strainer and o-ring |
| 2 Vacuum line | 4 Protective cap                               |

#### Procedure

1. Remove the protective cap from the vacuum flange.
2. Make sure that the cone sieve and centering ring are in the vacuum flange.
3. Establish the shortest possible connection between vacuum pump and vacuum chamber.
4. Choose a minimum vacuum line cross section equal to the nominal diameter of the connection flange.
5. Depending on the pump type, use PVC or metallic hoses with flange connections from the [Pfeiffer Vacuum component shop](#).
6. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
7. Connect both flanges with a circlip (DN 25 ISO-KF).
8. Use a separator or filter from the Pfeiffer Vacuum line of [accessories](#) if necessary.

## 5.3 Connect the exhaust side

### ⚠ 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.

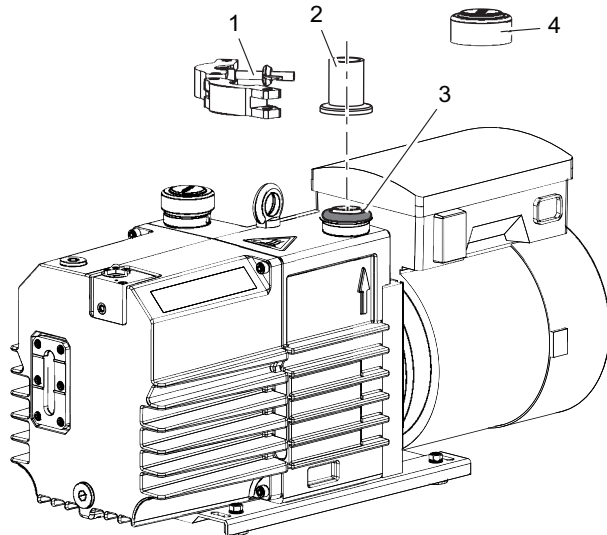
- ▶ Open shut-off units immediately before or at the same time as starting the pump.
- ▶ Observe the maximum permissible pressure of 1,500 hPa (absolute).
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.

### NOTICE

#### **Malfunction and damage to the vacuum pump from inadmissible exhaust line installation**

Negative pressure in the exhaust line causes malfunctions and damage to the vacuum pump. Negative pressure is permitted only in rotary vane vacuum pumps with magnetic coupling.

- ▶ When dissipating gases, make sure that the exhaust pressure is at least 250 hPa higher than the intake pressure.



**Fig. 7: Exhaust connection with flange connection**

- |                |   |
|----------------|---|
| 1 Circlip      | 3 Centering ring with O-ring and cone sieve |
| 2 Exhaust line | 4 Protective cap                            |

#### Procedure

1. Remove the protective cap from the exhaust flange.
2. Ensure that the centering ring with cone sieve is fitted in the exhaust flange.
3. Choose a minimum exhaust line diameter equal to the nominal diameter of the connection flange.
4. Depending on the pump type, use PVC or metallic hoses with flange connections from the [Pfeiffer Vacuum component shop](#).
5. Route the piping downwards from the vacuum pump, to prevent condensate return.
6. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
7. Connect both flanges with a circlip.



#### Protect the pump from condensate

1. Install a condensate separator in the exhaust line if necessary.
2. Use the lowest exhaust line point for the condensate drain.

## 5.4 Fill operating fluid

### ⚠ WARNING

#### Danger of poisoning from toxic vapors

Igniting and heating synthetic operating fluid 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 operating fluid.

### NOTICE

#### Risk of damage due to the use of non-approved operating fluid

Product-specific performance data are not achieved. All liability and warranty claims against Pfeiffer Vacuum are also excluded.

- ▶ Only use approved operating fluids.
- ▶ Only use other application-specific operating fluids after consultation with Pfeiffer Vacuum.

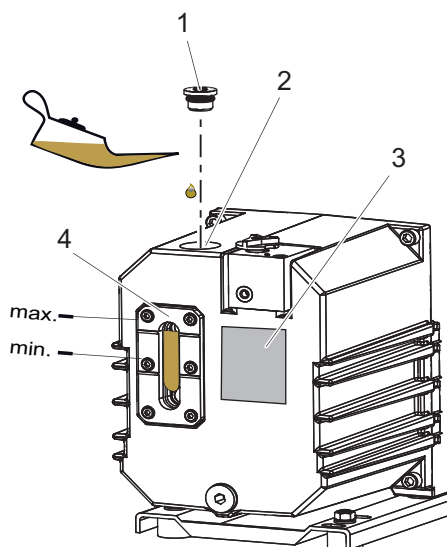
#### Approved operating fluid

- P3 for standard applications
- F4 for corrosive gas model
- D1 for special applications (such as higher operating temperatures)



### The operating fluid type is listed on the rating plate

- Please refer to rating plate for type and quantity of intended operating fluid.



**Fig. 8: Fill operating fluid**

- |                            |                |
|----------------------------|----------------|
| 1 Filler screw with o-ring | 3 Rating plate |
| 2 Filler hole              | 4 Sight glass  |

### Consumable

- Operating fluid of the vacuum pump

### Required tools

- Allen key, **WAF 8**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

### Fill operating fluid

1. Unscrew the filler screw.
2. Refill the operating fluid:
  - Initial filling with cold vacuum pump: A maximum of 3/4 of the min./max. range.
3. Screw in the filler screw again.
  - Be careful with o-ring.
  - Tightening torque: **3.0 Nm**

## 5.5 Connect 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.

### **⚠ CAUTION**

#### **Danger of injury from moving parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- Safely disconnect motor from the mains.
- Secure the motor against reactivation.
- Dismantle the vacuum pump for inspection, away from the system if necessary.

**NOTICE****Risk of property damage from excess voltage**

Incorrect or excessive mains voltage will destroy the motor.

- ▶ Always observe the motor rating plate specifications.
- ▶ Route the mains connection in accordance with locally applicable provisions.
- ▶ Always provide a suitable mains fuse to protect the motor and supply cable in the event of a fault.

Depending on the pump type, different motor designs or mains voltages can be used:

- Single-phase motor for fixed voltage with
  - inbuilt thermic protection switch
  - Mains switch
  - Connecting cable
- Single-phase motor with reversible voltage range
  - thermal protection switch
  - Mains switch
  - Rubber connector
- Three phase motor (without switch and mains cable)

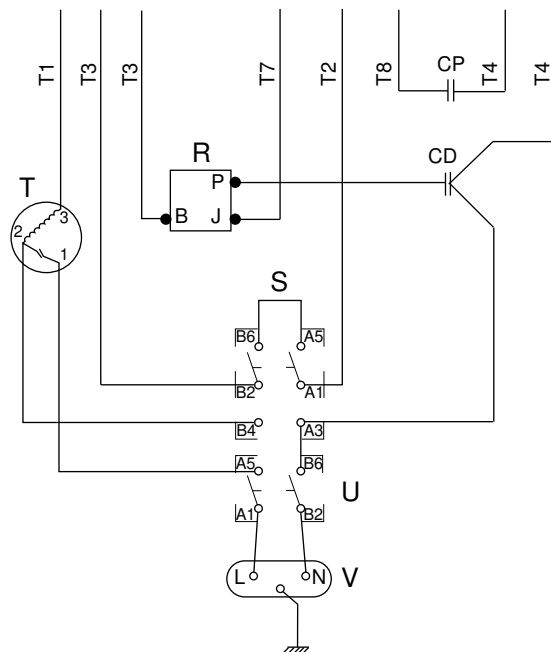
### 5.5.1 Connecting single-phase motors

**NOTICE****Property damage from the voltage range being set incorrectly**

Recommissioning after longer downtimes of the vacuum pump or after changing the oil requires the current settings to be checked.

- ▶ Before switching the vacuum pump on each time, check the currently set voltage range.
- ▶ Make changes to the voltage range only after the vacuum pump has been disconnected from the mains.

Vacuum pumps with single-phase motors are equipped with an installed thermal protection switch. In event of excess temperature, the protection switch interrupts the motor current, but does not offer a permanent shut-down of the motor. Depending on the pump type, different motor versions with rubber connector are possible.



**Fig. 9: Motor circuit diagram, single phase motor**

- |                             |                    |
|-----------------------------|--------------------|
| R Capacitor relay           | U Mains switch     |
| S Voltage selector switch   | V Rubber connector |
| T Thermic protection switch |                    |



**The magnetic coupling does not offer an overload protection.**



The magnetic coupling's torque is so strong that it does not provide any overload protection for the motor.

**On-site protection**

- Provide fuse protection according to the regulations applicable for the region to protect the motor in case of malfunction.

Motor voltage [V], $\pm 5\%$	Frequency [Hz]	Motor rating [kW]	Rated (nominal) current [A]	$I_{\max}$ [A]
100 – 110	50	0.75	12.0	86.1
200 – 230	50	0.75	6.5	48.6
100 – 120	60	0.90	13.0	88.3
200 – 240	60	0.90	6.5	46.4

**Tbl. 5: Recommended fuse ratings for on-site protection**

Switch position:	"1"	"2"
Rocker switch "S"		
Voltage ranges	100 – 110 V / 50 Hz 100 – 120 V / 60 Hz	200 – 230 V / 50 Hz 200 – 240 V / 60 Hz

**Tbl. 6: Permissible voltage ranges for reversible single phase motor**

**Change voltage range (for vacuum pumps with reversible motor)**

1. The mains voltage must be determined on-site each time before the vacuum pump is installed or moved to a different location.
2. Disconnect vacuum pump from mains.
3. Set required voltage range at rocker switch "S" in motor terminal box.

## 5.5.2 Connect three phase motor with 6-pin terminal board

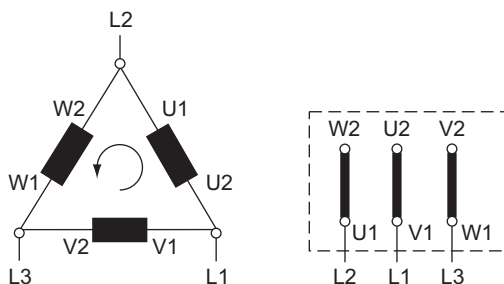
### NOTICE

**Property damage from high starting torque**

The specific load behavior of the vacuum pump requires direct on-line starting at full motor power. Engine damage occurs if a different starting circuit is used.

- Always start the motor directly.
- **Never** use a star-delta start-up circuit.

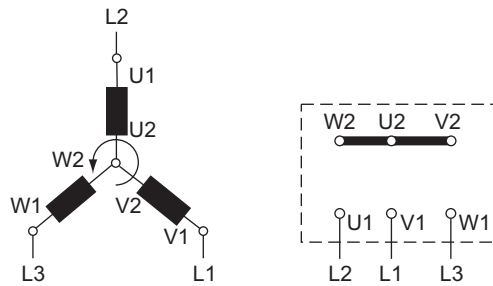
Ports U1 – L2, V1 – L1 and W1 – L3 rotate the motor shaft clockwise when looking at the motor fan.



**Fig. 10: Delta connection for low voltage**

The 3 phases are connected in series, and their connection points connected to the mains. The voltage per phase is equal to the mains voltage, while the mains current is  $\sqrt{3}$  times the phase current. The del-

ta connection is marked with the  $\Delta$  symbol. The voltage between the incoming mains supply lines is called mains voltage. The mains current is the current flowing in the incoming supply lines.



**Fig. 11: Star circuit for high voltage**

The ends of the 3 phases are connected in the star point. The terminal voltage is  $\sqrt{3}$  times the phase voltage, the mains current is equal to the phase current. The star circuit is marked with the Y symbol.

### 5.5.3 Frequency inverter for vacuum pumps with 3-phase motor

Rotary vane pumps with variable rotation speed can be operated within a mains frequency range of 35 to 60 Hz. Start-up is ramped (maximum run-up time: 30 s). Shutdown can take place immediately.

### 5.5.4 Checking the direction of rotation



#### Operating fluid leaks out

The direction of rotation must be checked on vacuum pumps with three phase motors. If the direction of rotation for the vacuum pump is incorrect, there is a risk of operating fluid escaping at the vacuum flange.

- Check the direction of rotation before refilling operating fluid.

#### Procedure

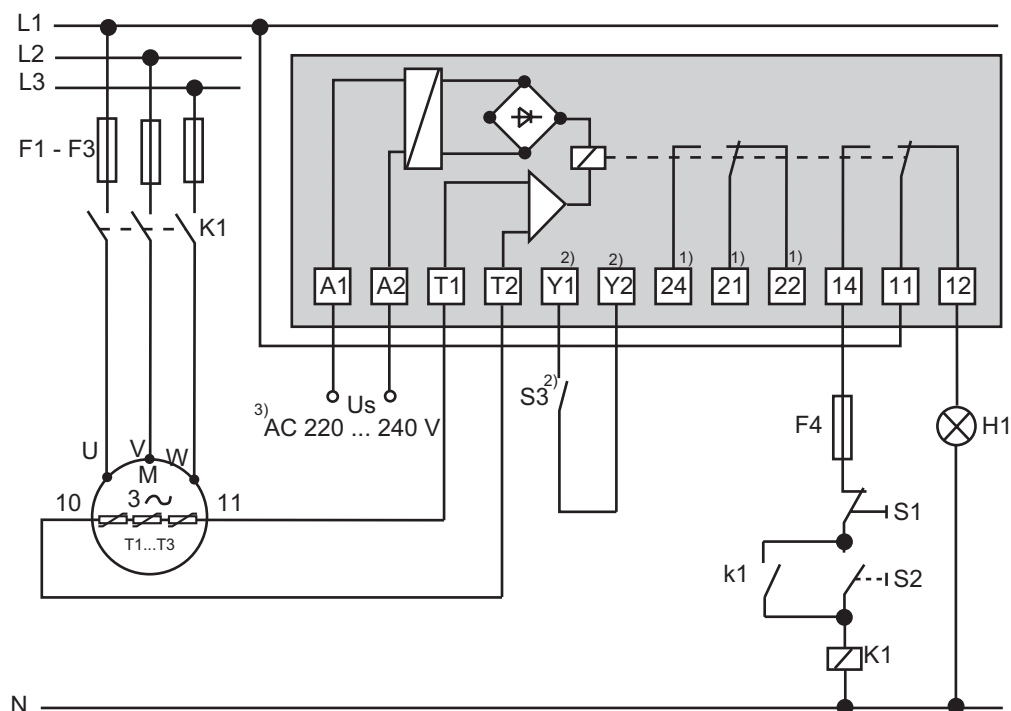
1. Switch on the rotary vane pump briefly (2 to 3 seconds.)
  - The motor and motor fan must rotate clockwise (see the arrow on the fan cover).
2. If the direction of rotation is incorrect, exchange the 2 phases on the connection cable.
3. Refill the operating fluid.

### 5.5.5 Connecting the PTC thermistor tripping unit



#### Tripping units store the shut-down

Pfeiffer Vacuum recommends connecting motors with PTC in the stator winding to a PTC resistor tripping device for protection against overload.



**Fig. 12: Connection example with PTC thermistor tripping unit**

$U_s$	Control voltage	T1 – T3	PTC resistor sensor
$S_1$	OFF button	H1	Tripping indicator
$S_2$	ON button	M	Motor, 3-phase
$S_3$	RESET button	<sup>1)</sup>	For devices with two relay outputs only
K1	Contactor	<sup>2)</sup>	For MSR type (model) only
F1 – F4	Fuses	<sup>3)</sup>	Only for order no.: P 4768 052 FQ and P 4768 052 FE

#### Procedure

- After shut-down, switch the tripping unit back on manually via the installed RESET button or via the external RESET S3.
  - Switching on mains detected as automatic RESET.

### 5.5.6 Setting the motor protection switch



#### The magnetic coupling is not intended for use as overload protection

The torque is too great for it to act as overload protection for the motor.

Motor protection switches are current-dependent protective devices for the drive motors. Protection switches with slow tripping characteristics are suitable. When adjusting the motor protection switch, take into consideration that certain operating conditions (for example, cold pump start) can cause short-term increases in power input.

An increase of 1.5 times the rated current over a 2 minute period is permissible for the drive motors (in accordance with EN 60034-1), without tripping the motor protection switch.

#### Procedure

- Take the settings for the motor protection switch from the following table.
- Set the desired value on the contactor.

Voltage [V]	Frequency [Hz]	Motor rating [kW]	$I_N$ [A]	$I_{max}$ [A]
230	50	0.55	2.8	12
400	50	0.55	1.6	7
275	60	0.65	2.91	13
480	60	0.65	1.67	8

Voltage [V]	Frequency [Hz]	Motor rating [kW]	$I_N$ [A]	$I_{max}$ [A]
200	50	0.55	2.95	13
346	50	0.55	1.7	8
220	60	0.55	2.5	13
380	60	0.55	1.45	8
200	50	0.55	2.95	13
	60	0.55	2.7	11

**Tbl. 7: Motor protection switch settings**

## 6 Operation

### 6.1 Putting the vacuum pump into 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.

#### **Before switching on**

1. Check the operating fluid in the sight glass.
2. Compare the voltage and frequency specifications on the motor rating plate with the available mains voltage and frequency.
3. Protect the vacuum pump from sucking in contaminants using suitable measures.
4. Check the operating fluid at regular intervals.
5. Check the exhaust connection for free passage (max. permissible pressure: 1500 hPa absolute).
6. Actuate the shut-off units so that the shut-off units open before or at the same time as the pump starts up.

### 6.2 Switch vacuum pump on

#### **CAUTION**

##### **Risk of injury from entrapment of body parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. A risk exists of minor injury to fingers and hands (e.g., hematoma), from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

#### **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.

## NOTICE

### **Risk of damage to the drive from increased motor current consumption**

At an intake pressure of approximately 300 hPa and under unfavorable operating conditions (such as for example exhaust side counterpressure), the power input exceeds the rated current.

- ▶ Limit the maximum power input of 1.5 times the rated current to max. 2 minutes (in accordance with EN 60034-1).



### **Cycle operation**

Cycle operation with maximum 10 cycles per hour is possible.

Longer operating phases and short downtimes permit a functionally safe operating condition of the vacuum pump.

### **Operating Conditions**

- The optimal operating condition of the vacuum pump is continuous operation.
- When pumping down dry gases, no special precautions are required.
- Low final pressures are possible with the gas ballast valve closed.

### **Switch vacuum pump on**

1. If required, switch vacuum pump on in each pressure range.
2. Switch vacuum pump on at mains switch, or, in the case of three phase motors, on site via a protective circuit.
3. Prior to process start, allow vacuum pump to warm up for approx. 30 minutes with vacuum connection closed.

### **Inspect operating fluid level**

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

## **6.3 Operating the rotary vane pump with gas ballast**

## NOTICE

### **Risk of damage from condensation in vacuum pump**

During operation without gas ballast, condensation may form as a result of the vapor compatibility of the vacuum pump being exceeded.

- ▶ Pump condensable vapors only when the vacuum pump is warm and the gas ballast valve open.
- ▶ Allow the vacuum pump to run on after process end for another 30 minutes with the gas ballast valve open.
  - This cleans the operating fluid and protects the vacuum pump against corrosion.

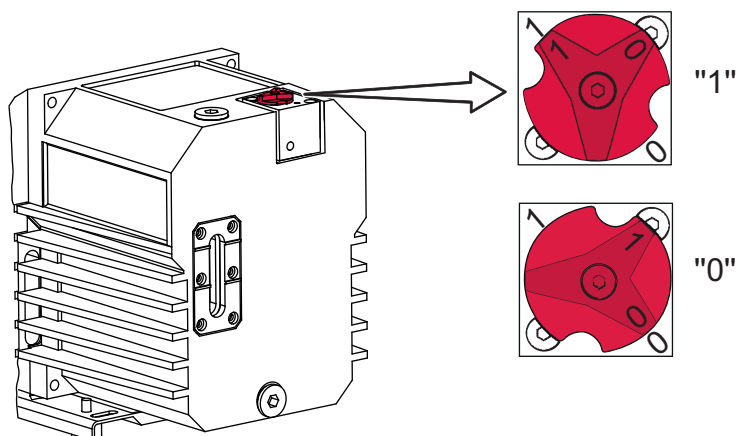
### **Behavior of process gases with condensable vapors**

- ▶ Operate the vacuum pump with gas ballast, i.e. with the gas ballast valve open.

### **6.3.1 Gas ballast valve – standard version**

The gas ballast valve has the function to periodically supply air to the working chamber of the vacuum pump at the beginning of the compression phase. This prevents condensation from forming in the vacuum pump, when pumping down vapors.





**Fig. 13: Gas ballast valve, standard version**

**Open gas ballast valve**

- ▶ Rotate gas ballast valve to the left to open, into position "1".

**Close gas ballast valve**

- ▶ Rotate gas ballast valve to the right to close, into position "0".

### 6.3.2 Gas ballast valve with flushing gas connection

#### NOTICE

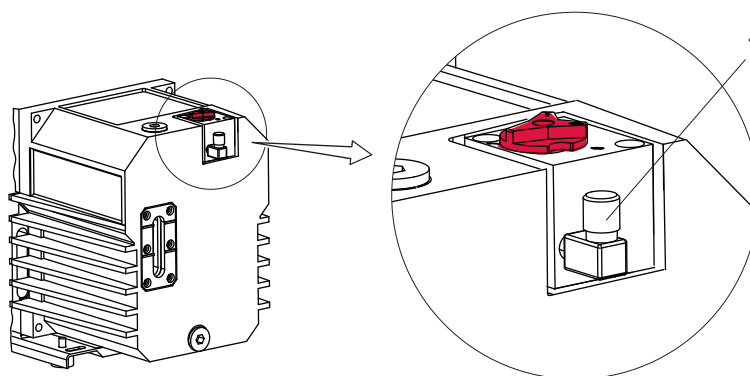
**Risk of damage from unacceptably high flushing gas pressure**

Increased flushing gas pressure compromises the operational reliability of the vacuum pump, and causes increases in power input and operating temperature.

- ▶ Observe the maximum permissible flushing gas pressure of **1,500 hPa (absolute)**.
- ▶ Dose the flushing gas quantity with the dosing screw on the gas ballast valve or on site.

Flushing gas valve installation is optional.

For some processes, Pfeiffer Vacuum recommends the addition of flushing gas to dilute the process gas, and prevent condensation in the vacuum pump.



**Fig. 14: Gas ballast valve with flushing gas connection**

- 1 Flushing gas connection (M 5) with elbow union

**Required tool**

- Open-end wrench, **WAF 7**

**Closing the gas ballast valve**

1. Screw elbow union into flushing gas connection.
2. Connect hose (DN 6 mm) to flushing gas connection, or utilize threaded connector directly.
3. Select type and quantity of the flushing gas utilized according to process.
4. Consult Pfeiffer Vacuum if necessary.

5. Set the flushing gas pressure to max. **1,500 hPa (absolute)**.
6. Set desired gas quantity: **max. 1260 l/h**.

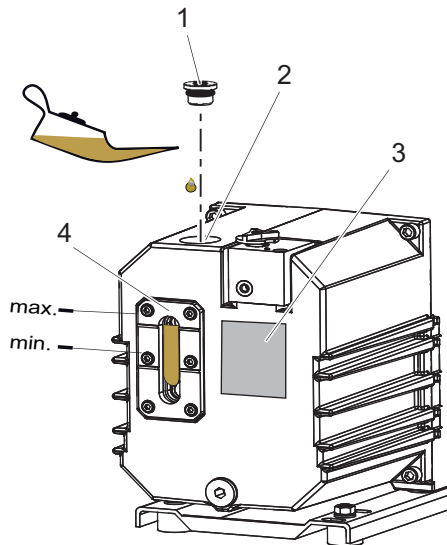
## 6.4 Refilling operating fluid

### **⚠ WARNING**

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

Igniting and heating synthetic operating fluid 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 operating fluid.



**Fig. 15: Fill operating fluid**

- |                            |                |
|----------------------------|----------------|
| 1 Filler screw with o-ring | 3 Rating plate |
| 2 Filler hole              | 4 Sight glass  |

#### **Consumable**

- Operating fluid

#### **Required tools**

- Allen key, **WAF 8**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

#### **Fill operating fluid**

Operating fluid can be refilled during operation in the final vacuum.

1. Unscrew the filler screw.
2. Refill with operating fluid up to the "max." mark before the minimum fill level is reached.
3. Screw in the filler screw again.
  - Be careful with o-ring.
  - Tightening torque: **3.0 Nm**

## 6.5 Switching off the vacuum pump

### **NOTICE**

#### **Contamination from operating fluid backflow**

After the vacuum pump is switched off, there is a risk that the connected vacuum system can become contaminated by backflow. The safety valve on the vacuum pump is not suitable for longer-term sealing.

- ▶ Install an additional shut-off valve in the intake line.
- ▶ Shut off the intake line immediately after switching off the vacuum pump.

**NOTICE****Contamination of the vacuum chamber from operating fluid backflow**

After the vacuum pump is switched off, there is a risk that the connected vacuum system can become contaminated by backflow.

- ▶ Vent the vacuum chamber, regardless of its size, within 30 seconds.
- ▶ Shut off the intake line with an additional shut-off valve, after the vacuum pump is switched off during longer venting operations.

Pfeiffer Vacuum rotary vane pumps have an integral vacuum safety valve on the intake side. The vacuum safety valve automatically closes from a differential pressure of **≥250 hPa** between the exhaust and intake sides, when the vacuum pump is switched off, and vents the vacuum pump.

**Procedure**

1. If required, switch the vacuum pump off in each pressure range.
2. Switch the mains switch off or securely disconnect the drive motor from the mains.
3. Install an additional shut-off valve in the intake line to ensure that the vacuum is maintained in the vacuum chamber.

## 7 Maintenance

### 7.1 Maintenance instructions

#### **WARNING**

##### **Health hazard through poisoning from toxic contaminated components or devices**

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

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

#### **WARNING**

##### **Tilting danger! Serious injury due to tilting of the product**

There is a danger of the vacuum pump not attached tipping over due to changes in the center of gravity or incorrect loading. Serious injuries due to trapping or crushing of limbs, e.g. feet, are the result.

- ▶ Do not use the vacuum pump as a climbing aid.
- ▶ Do not exert any force on the product.
- ▶ Ensure that the product has a safe centre of gravity, when mounting components.
- ▶ Wear protective equipment, e.g. protective shoes

#### **CAUTION**

##### **Danger of injury from moving parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

#### **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.

The following section describes the tasks for cleaning and maintaining the vacuum pump. More advanced works are described in the service instructions.

#### **Prerequisites**

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump cooled

#### **Preparing maintenance**

- ▶ Safely disconnect the drive motor from the mains.
- ▶ Secure the motor against switching back on.
- ▶ For maintenance work, only dismantle the vacuum pump to the extent needed.
- ▶ Dispose of used operating fluid according to applicable regulations in each case.
- ▶ When using synthetic operating fluid, please observe the associated application instructions.
- ▶ Only clean the pump parts using industrial alcohol, isopropanol or similar media.

## 7.2 Maintenance instructions for magnetic coupling

### **WARNING**

#### **Danger of injury from strong magnetic field**

There is a risk of injury for people with pacemakers and medical implants.

- ▶ Make sure that such individuals do not enter the sphere of influence ( $\leq 2$  m) of the magnetic field.
- ▶ Identify rooms in which magnetic couplings are openly accessible with the symbol: **"No access for people with pacemakers"**.
- ▶ Always keep disassembled couplings away from computers, data carriers, and other electronic components.

This safety note applies to **drive system disassembly** in pump versions with magnetic coupling.

## 7.3 Checklist for inspection and maintenance

Pfeiffer Vacuum recommends that all maintenance work is carried out by the manufacturer's service department.

No warranty or liability claims are accepted on the part of Pfeiffer Vacuum, if you

- exceed the required, listed intervals
- perform improper maintenance work
- do not use original spare parts

#### **Reduced maintenance intervals**

Depending on the operating conditions, the required maintenance intervals can be shorter than the reference values specified.

- ▶ Contact [Pfeiffer Vacuum Service](#).



#### **Spare parts**

You can find the corresponding spare parts in the chapter "Spare parts packages".

Action described in document (OI or MM)	Inspection OI	Maintenance level 1 OI	Maintenance level 2 MM	Maintenance level 3 MM	Required material
<b>Interval</b>	<b>daily</b>	<b>≤ yearly</b>	<b>≤ 2 years</b>	<b>≤ 4 years</b>	
<b>Inspection</b>					
Visual and acoustic pump check Check operating fluid: <ul style="list-style-type: none"> <li>• Check fill level</li> <li>• Check color (contamination)</li> <li>• Check vacuum pump for leaks</li> </ul>	■				
Check accessories (in accordance with operating instructions)	■				
<b>Maintenance level 1 – operating fluid replacement</b>					
Clean the outside of the vacuum pump: <ul style="list-style-type: none"> <li>• Pump housing</li> <li>• Clean motor fan cap</li> </ul> Change the operating fluid		■ as required			Operating fluid <sup>1)</sup> Maintenance kit 1
<b>Additional activities:</b> <ul style="list-style-type: none"> <li>• Remove cap</li> <li>• Clean inside of cap and outside of pumping system (without cleaning agent)</li> <li>• Remove and clean gas ballast valve, replace wearing parts</li> </ul>		■ as required			

1) Operating fluid is required for all activities. Order operating fluid separately.

Action described in document (OI or MM)	Inspection OI	Maintenance level 1 OI	Maintenance level 2 MM	Maintenance level 3 MM	Required material
Interval	daily	≤ yearly	≤ 2 years	≤ 4 years	
Replace filter in external accessory (where present), in accordance with operating instructions		■ as required			
<b>Maintenance level 3 – overhaul</b>					
Dismantle and clean vacuum pump, replace seals and all wear parts: <ul style="list-style-type: none"> <li>• Vane</li> <li>• Valves, springs, and sight glass</li> <li>• Silencer nozzle</li> </ul>				■	Overhaul kit

TbI. 8: Maintenance intervals

## 7.4 Change the operating fluid

### WARNING

#### Health hazard and risk of environmental damage from toxic contaminated operating fluid

Toxic process media can cause operating fluid contamination. When changing the operating fluid, 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 operating fluid according to locally applicable regulations.

### CAUTION

#### Scalding from hot operating fluid

Danger of burns when draining operating fluid 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 operating fluid in the first operating year.

The service life may deviate from the reference value specified depending on thermic and chemical loads, and the accumulation of suspended particles and condensate in the operating fluid.



#### Operating fluid type

Fundamentally, when filling, refilling, or changing operating fluid, you must always use the operating fluid type specified on the rating plate. Should process conditions change, you can convert to a different operating fluid type.



#### Safety data sheets

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

The usable life of operating fluid is dependent on the area of application of the rotary vane vacuum pumps.

#### Instructions for when operating fluid should be changed

- Vacuum pump does not reach the specified final pressure.
- Operating fluid soiled, milky or unclear
- Mineral operating fluid with thermic aging (color number > 4)

### 7.4.1 Determine degree of aging of P3 operating fluid

#### **WARNING**

##### **Health hazard and risk of environmental damage from toxic contaminated operating fluid**

Toxic process media can cause operating fluid contamination. When changing the operating fluid, 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 operating fluid according to locally applicable regulations.

You can determine the degree of aging of P3 operating fluid in clean processes using the color chart (in accordance with DIN 51578). The supplementary sheet with the document number PK0219 can be obtained from the [Pfeiffer Vacuum Download Center](#).

#### **Prerequisites**

- Vacuum pump switched off
- Vacuum pump is vented to atmospheric pressure on the suction side
- Vacuum pump cooled

#### **Required aids**

- Test tube
- Pipette with flexible hose
- Allen key, **WAF 8**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

#### **Determine degree of aging of P3 operating fluid**

1. Unscrew the filler screw.
  - Be careful with o-ring.
2. Use the pipette to extract a sample of the operating fluid from the filling port.
3. Pour the sample into a test tube.
4. Check the sample in bright light.
5. If it is a reddish-brown color at the latest (corresponding with color identification number 5), change the operating fluid.
6. Screw in the filler screw.
  - Be careful with o-ring.
  - Tightening torque: **3 Nm**

### 7.4.2 Change the operating fluid

#### **WARNING**

##### **Health hazard and risk of environmental damage from toxic contaminated operating fluid**

Toxic process media can cause operating fluid contamination. When changing the operating fluid, 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 operating fluid according to locally applicable regulations.

#### **CAUTION**

##### **Scalding from hot operating fluid**

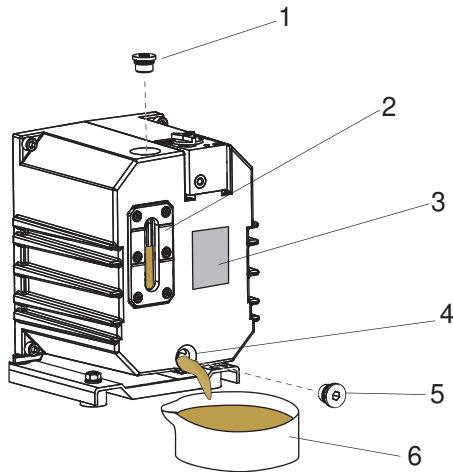
Danger of burns when draining operating fluid if it comes into contact with the skin.

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



#### **Cleaning by changing the operating fluid**

Pfeiffer Vacuum recommends, in cases of heavy contamination with process residues, cleaning the inside of the vacuum pump with several operating fluid changes.



**Fig. 16: Draining the operating fluid**

- |                            |                           |
|----------------------------|---------------------------|
| 1 Filler screw with o-ring | 4 Drain hole              |
| 2 Sight glass              | 5 Drain screw with o-ring |
| 3 Rating plate             | 6 Collection receptacle   |

#### Consumable

- Operating fluid

#### Required tools

- Allen key, **WAF 6**
- Allen key, **WAF 8**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

#### Required aids

- Collection receptacle ( $> 1.5$  l)

#### Prerequisites

- Vacuum pump switched off
- Vacuum pump is vented to atmospheric pressure on the suction side
- Vacuum pump cooled down and touchable, operating fluid still warm

#### Draining the operating fluid

1. Unscrew the filler screw.
  - Be careful with o-ring.
2. Place a collection receptacle below the drain hole.
3. Unscrew the drain screw.
  - Be careful with o-ring.
4. Allow operating fluid to drain into collection receptacle.

#### Agitate remaining operating fluid

1. Screw in the filler screw.
2. Screw in the drain screw.
3. Switch on the vacuum pump with the vacuum flange open for a maximum of 5 seconds.

#### Drain remaining operating fluid

1. Unscrew the drain screw.
2. Gently tilt the vacuum pump.
3. Drain remaining operating fluid.
4. Screw in the drain screw.
5. Dispose of old operating fluid according to applicable regulations.

#### Fill fresh operating fluid

1. Screw the drain screw in up to the stop.
  - Be careful with the O-ring.
  - Tightening torque: **3.0 Nm**
2. Fill new operating fluid.



3. Check level.
4. Screw the drain screw in completely.
  - Be careful with the O-ring.
  - Tightening torque: **3.0 Nm**

### 7.4.3 Rinse and clean rotary vane vacuum pump



#### Cleaning by changing the operating fluid

Pfeiffer Vacuum recommends, in cases of heavy contamination with process residues, cleaning the inside of the vacuum pump with several operating fluid changes.

#### Required tools

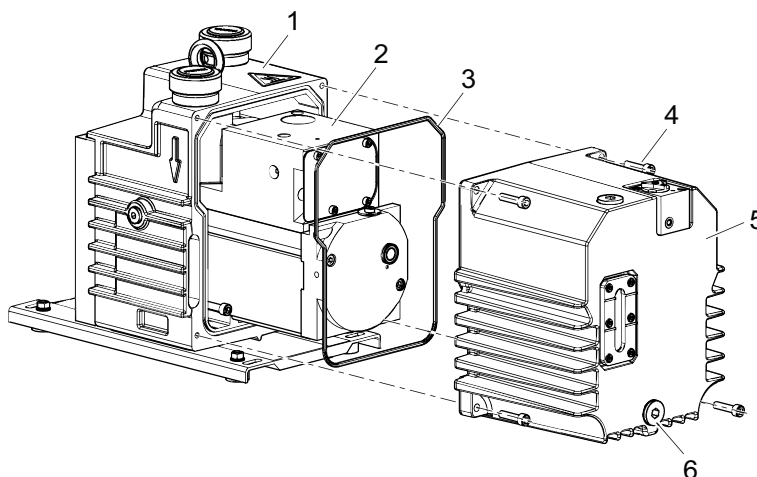
- Allen key, **WAF 5**
- Allen key, **WAF 8**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

#### Prerequisites

- Operating fluid filled

#### Change operating fluid for cleaning

1. Operate vacuum pump with gas ballast open, until it is warm.
2. Perform 2 operating fluid changes.
3. Check pollution level and repeat process if necessary.
4. If accessories are installed, replace corresponding filter elements.



**Fig. 17: Remove rotary vane pump cap**

- |                  |                     |
|------------------|---------------------|
| 1 Stand          | 4 Allen head screws |
| 2 Pumping system | 5 Cap               |
| 3 O-ring         | 6 Drain screw       |

#### Remove and clean cap

1. Drain operating fluid.
2. Unscrew 4 Allen head screws from cap.
3. Remove cap from rotary vane pump stand.
  - Take care with o-ring between cap and stand.
4. Collect any leaking operating fluid.
5. Dispose of operating fluid according to applicable regulations.

#### Clean pumping system and cap

1. Clean pumping system from outside, without using cleaning agents.
2. Clean cap from inside, without using cleaning agents.
3. Screw operating fluid drain screw into drain hole in cap.
  - Be careful with o-ring.
  - Tightening torque: **3.0 Nm**

**Install cap**

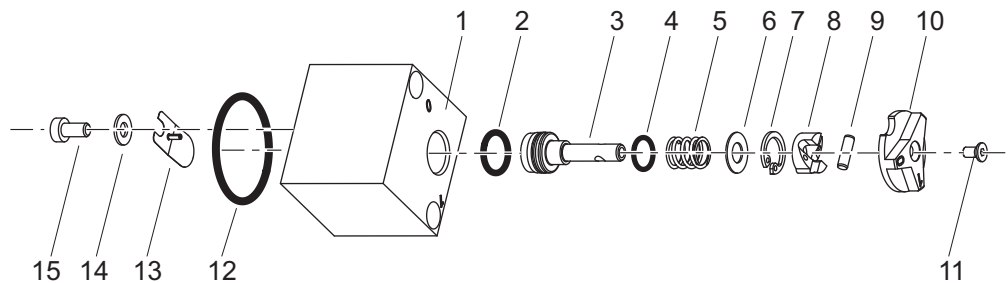
1. Insert o-ring into groove in pump bottom part.
2. Install cap on stand.
3. Tighten the 4 Allan head screws.
  - Tightening torque: **6.0 Nm**.

**Fill fresh operating fluid**

1. Screw the drain screw in up to the stop.
  - Be careful with the O-ring.
  - Tightening torque: **3.0 Nm**
2. Fill new operating fluid.
3. Check level.
4. Screw the drain screw in completely.
  - Be careful with the O-ring.
  - Tightening torque: **3.0 Nm**

**7.5 Remove and clean gas ballast filter**

The gas ballast valve is soiled if the vacuum pump takes in ambient air containing dust.

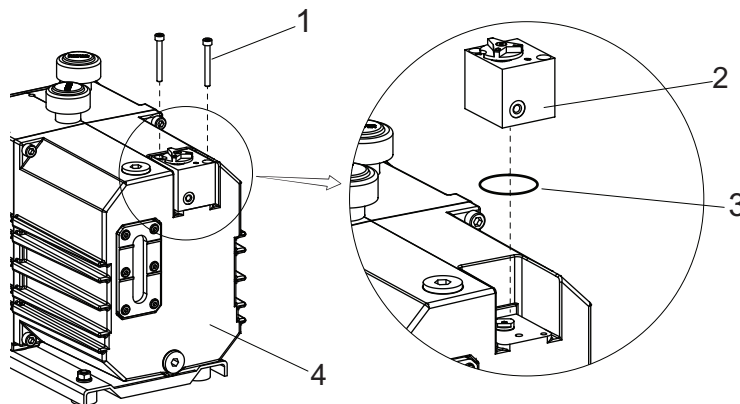


**Fig. 18: Individual parts of the gas ballast valve**

- |                      |                      |
|----------------------|----------------------|
| 1 Valve housing      | 9 Cylinder bolt      |
| 2 O-ring 6 × 2.2     | 10 Rotary knob       |
| 3 Tappet             | 11 Countersink screw |
| 4 O-ring 8 × 2       | 12 O-ring 27 × 2.5   |
| 5 Compression spring | 13 Plate spring      |
| 6 Washer             | 14 Washer            |
| 7 Circlip            | 15 Cylinder screw    |
| 8 Cam plate          |                      |

**7.5.1 Remove gas ballast valve****Required tool**

- Allen key, **WAF 3**



**Fig. 19: Remove gas ballast valve**

- |                  |          |
|------------------|----------|
| 1 Cylinder screw | 3 O-ring |
| 2 Valve housing  | 4 Cap    |

**Procedure**

1. Unscrew cylinder screws.
2. Remove valve housing from cover.
3. Be careful with o-ring.

**7.5.2 Strip and clean gas ballast valve****Required tools**

- Allen key, **WAF 2**
- Allen key, **WAF 3**
- Circlip pliers, **J0**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

**Procedure**

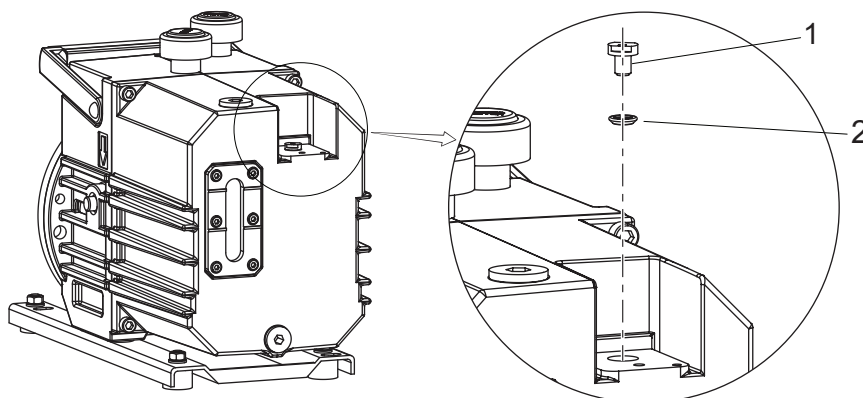
1. Rotate knob to "open" position.
2. Unscrew countersunk head screws.
3. Remove rotary knob.
4. Pull tappet far enough out of valve housing so that you can pull out cylinder bolt.
5. Using pincers, remove cam plate and circlip.
6. Be careful with washer and compression spring.
7. Remove tappet from valve housing.
  - Be careful with o-ring.
8. Unscrew cylinder screw from valve housing underside.
9. Be careful with washer and compression spring.
  - Dowel pin remains in valve housing.
10. Clean all parts and check parts for wear.
11. Replace wear parts according to maintenance kit.

**7.5.3 Remove and clean silencer nozzle**

The silencer nozzle is installed below the gas ballast valve. The nozzle has a type-specific opening. If the nozzle is soiled, it must be cleaned or replaced.

**Required tool**

- Open-end wrench, **WAF 8**



**Fig. 20: Remove silencer nozzle**

- |                   |                  |
|-------------------|------------------|
| 1 Silencer nozzle | 2 O-ring 6 × 2.2 |
|-------------------|------------------|

**Procedure**

1. Unscrew silencer nozzle.
  - Be careful with o-ring.
2. Clean silencer nozzle with compressed air.
3. Replace O-ring.
4. Screw silencer nozzle back in up to stop.
  - Be careful with o-ring.

## 7.5.4 Install gas ballast valve

### Required tools

- Allen key, **WAF 2**
- Allen key, **WAF 3**
- Circlip pliers, **J0**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

### Required consumables

- Operating fluid of rotary vane pump

### Procedure

1. Lightly oil o-rings with operating fluid utilized.
2. Insert o-ring into groove in tappet.
3. Install second o-ring to tappet.
4. Install compression spring and washer.
5. Insert pre-assembled parts in valve housing.
6. Install circlip in valve housing recess.
7. Install circlip by pushing washer downwards against spring force, until circlip engages in valve housing groove.
8. Insert cam plate.
9. Slide cam plate onto tappet.
  - Take care with longitudinal groove in flange housing.
10. Extract tappet, against spring force.
11. Insert cylinder bolt in bore.
12. Rotate cam plate to move tappet to "1" position (open).
13. Install knob to tappet.
14. Tighten countersunk head screws.
  - Tightening torque: **1.0 Nm**.
15. Position leaf spring on dowel pin (curvature facing housing).
16. Bias and fixate leaf spring with cylinder screw and washer.
  - Tightening torque: **2.5 Nm**.
17. Install complete valve with O-ring.
18. Tighten cheese head screws.
  - Tightening torque: **2.5 Nm**.

## 7.6 Changing the operating fluid type



### Possibilities for changing the operating fluid type

The operating fluid type can be changed between mineral operating fluid – **P3** – and synthetic operating fluid – **D1** – only.

It is not possible to change from **P3/D1** to **F4/F5** or vice versa.

### Required consumables

- 3 times the filling quantity of the new operating fluid

### Changing the operating fluid type

1. Change the operating fluid with the new operating fluid **twice** in order to rinse the vacuum pump.
2. Clean any accessories if necessary, such as oil mist filter or oil return, and replace their filter elements.
3. Fill the vacuum pump with operating fluid to one third full.
4. Note the currently used operating fluid type at a suitable location on the vacuum pump, e.g. on the rating plate.

## 8 Decommissioning

### 8.1 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:

1. Switch off the vacuum pump.
2. Vent the vacuum pump.
3. Allow the vacuum pump to cool down.
4. Clean suction chamber.
5. Change the operating fluid.
6. Start the vacuum pump and take it up to operating temperature in order to wet the inside of the pumping system with fresh operating fluid.
7. Fill the vacuum pump to above the “**max.**” mark with operating fluid, up to the upper edge of the sight glass.
8. Seal the vacuum and fore-vacuum flanges as well as any other openings with blind flanges from the Pfeiffer Vacuum [accessories range](#).
9. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
10. Pack the vacuum pump together with a drying agent in a plastic bag, and seal the vacuum pump airtight if it is to be stored in rooms with damp or aggressive atmospheres.
11. For longer storage periods (> 2 years), Pfeiffer Vacuum recommends changing the operating fluid again prior to recommissioning.

### 8.2 Recommissioning

#### NOTICE

##### **Risk of damage to vacuum pump as a result of operating fluid aging**

The operating fluid usability is limited (max. 2 years). Prior to recommissioning, following a shutdown of **2 years or more**, carry out the following work.

- ▶ Change the operating fluid.
- ▶ Change the radial shaft seal rings and other elastomer parts if required.
- ▶ Observe the maintenance instructions – consult Pfeiffer Vacuum if necessary.



##### **Ejection of operating fluid**

Overfilled operating fluid will be ejected at the exhaust connection when starting up the vacuum pump.

- Reduce the operating fluid level to the normal level before recommissioning.

## 9 Recycling and disposal

### **WARNING**

#### **Health hazard through poisoning from toxic contaminated components or devices**

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

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



#### **Environmental protection**

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

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



#### **Environmental protection**

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

### 9.1 General disposal information

Pfeiffer Vacuum products contain materials that you must recycle.

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

### 9.2 Dispose of rotary vane pump

Pfeiffer Vacuum rotary vane pumps contain materials that you must recycle.

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

## 10 Malfunctions

### ⚠ CAUTION

#### Risk of injury from entrapment of body parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically. A risk exists of minor injury to fingers and hands (e.g., hematoma), from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

### ⚠ 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.

### ⚠ CAUTION

#### Danger of injury from moving parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

### 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.

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

Problem	Possible causes	Remedy
Vacuum pump will not start up	<ul style="list-style-type: none"> <li>No mains voltage or voltage does not correspond to the motor data</li> </ul>	<ul style="list-style-type: none"> <li>Check the mains voltage and mains fuse.</li> <li>Check the motor switch.</li> </ul>
	<ul style="list-style-type: none"> <li>Pump temperature too low</li> </ul>	<ul style="list-style-type: none"> <li>Heat the vacuum pump to &gt; 12°C.</li> </ul>
	<ul style="list-style-type: none"> <li>Thermal protection switch has triggered</li> </ul>	<ul style="list-style-type: none"> <li>Determine and eliminate the cause.</li> <li>Allow the vacuum pump to cool down.</li> </ul>
	<ul style="list-style-type: none"> <li>Pumping system contaminated</li> </ul>	<ul style="list-style-type: none"> <li>Clean the vacuum pump.</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>
	<ul style="list-style-type: none"> <li>Pumping system damaged</li> </ul>	<ul style="list-style-type: none"> <li>Clean and maintain the vacuum pump.</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>
	<ul style="list-style-type: none"> <li>Motor faulty</li> </ul>	<ul style="list-style-type: none"> <li>Replace the motor.</li> </ul>

Problem	Possible causes	Remedy
Vacuum pump switches off after a while after being started	<ul style="list-style-type: none"> <li>Thermal protection switch of the motor has triggered</li> </ul>	<ul style="list-style-type: none"> <li>Determine and eliminate the cause of overheating.</li> <li>Allow the motor to cool down.</li> </ul>
	<ul style="list-style-type: none"> <li>Mains fuse triggered due to overload (e.g. cold start)</li> </ul>	<ul style="list-style-type: none"> <li>Bring vacuum pump to permissible ambient temperature range.</li> </ul>
	<ul style="list-style-type: none"> <li>Exhaust pressure too high</li> </ul>	<ul style="list-style-type: none"> <li>Check exhaust line outlet opening and exhaust side accessories.</li> </ul>
Vacuum pump does not reach the specified final pressure	<ul style="list-style-type: none"> <li>Measurement result distorted</li> </ul>	<ul style="list-style-type: none"> <li>Check the measurement instrument.</li> <li>Check the final pressure without system connected.</li> </ul>
	<ul style="list-style-type: none"> <li>Vacuum pump or connected accessory contaminated</li> </ul>	<ul style="list-style-type: none"> <li>Clean the vacuum pump.</li> <li>Check the components for contamination.</li> </ul>
	<ul style="list-style-type: none"> <li>Operating fluid contaminated</li> </ul>	<ul style="list-style-type: none"> <li>Operate the vacuum pump for an extended period of time with gas ballast valve open, or change the operating fluid.</li> </ul>
	<ul style="list-style-type: none"> <li>Operating fluid level too low</li> </ul>	<ul style="list-style-type: none"> <li>Top up the operating fluid.</li> </ul>
	<ul style="list-style-type: none"> <li>Leak in system</li> </ul>	<ul style="list-style-type: none"> <li>Locate and eliminate the leak.</li> </ul>
	<ul style="list-style-type: none"> <li>Vacuum pump is damaged</li> </ul>	<ul style="list-style-type: none"> <li>Contact Pfeiffer Vacuum Service.</li> </ul>
Pumping speed of vacuum pump too low	<ul style="list-style-type: none"> <li>The intake line is not suitably dimensioned</li> </ul>	<ul style="list-style-type: none"> <li>Make sure that connections are short and cross sections adequately dimensioned.</li> </ul>
	<ul style="list-style-type: none"> <li>Exhaust pressure too high</li> </ul>	<ul style="list-style-type: none"> <li>Check exhaust line outlet opening and exhaust side accessories.</li> </ul>
Loss of operating fluid	<ul style="list-style-type: none"> <li>Casing seal is leaking</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace the seal.</li> </ul>
	<ul style="list-style-type: none"> <li>Radial shaft seal ring (RSSR) leaking – not applicable to vacuum pumps with magnetic coupling</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace the RSSR</li> <li>Check and replace the associated bushing also.</li> </ul>
	<ul style="list-style-type: none"> <li>Operational operating fluid loss – no oil mist filter</li> </ul>	<ul style="list-style-type: none"> <li>Install ONF/OME.</li> </ul>
Unusual noises during operation	<ul style="list-style-type: none"> <li>Noise reduction is contaminated</li> </ul>	<ul style="list-style-type: none"> <li>Clean the noise reduction or replace it.</li> </ul>
	<ul style="list-style-type: none"> <li>Pumping system is contaminated or damaged</li> </ul>	<ul style="list-style-type: none"> <li>Clean and maintain the vacuum pump.</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>
	<ul style="list-style-type: none"> <li>Motor bearing is faulty</li> </ul>	<ul style="list-style-type: none"> <li>Change the motor.</li> <li>Contact Pfeiffer Vacuum Service.</li> </ul>

TbI. 9: Troubleshooting for rotary vane pumps



# 11 Service solutions by Pfeiffer Vacuum

## We offer first-class service

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

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

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

## Make use of Pfeiffer Vacuum service

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

**You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.**

**For fast and smooth service process handling, we recommend the following:**



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



- a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
- b) If necessary, drain operating fluid/lubricant.
- c) If necessary, drain coolant.
2. Complete the service request and contamination declaration.



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

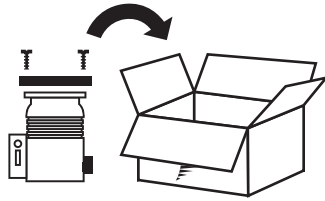


4. You will receive an acknowledgment from Pfeiffer Vacuum.

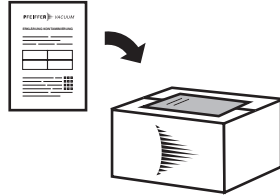
PFEIFFER VACUUM

## Submission of contaminated products

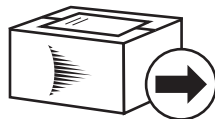
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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



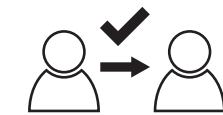
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
  - a) Neutralize the product with nitrogen or dry air.
  - b) Seal all openings with blind flanges, so that they are airtight.
  - c) Shrink-wrap the product in suitable protective foil.
  - d) Package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



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



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



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

PFEIFFER VACUUM

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

## 12 Spare parts

### 12.1 Spare part packages

#### Ordering spare part packages

- ▶ Have the vacuum pump part number to hand, along with other details from the rating plate if necessary.
- ▶ Install original spare parts only.
- ▶ When ordering the inspection set, observe the respective part number of the diaphragm pump.

Spare part package	Pump version	Order number
Maintenance kit 1 – maintenance level 1	M/MC version	PK E31 007 AT
Overhaul kit – maintenance level 3	M version	PK E32 011 -T
	MC version	PK E32 013 -T
Set of vanes	M version	PK E38 006 -T
	MC version	PK E38 005 -T
Coupling set	M version	PK E36 010-T (without index) PK E36 009 -T (from index "A")
	MC version	PK E36 013 -T (from index "A")

Tbl. 10: Spare part packages

### 12.2 Maintenance kit 1 – maintenance level 1

Order no.: PK E31 007 AT

Maintenance kit 1 contains:

- Filler and drain screw seals for one operating fluid change
- Cap seal for cleaning oil chamber
- Seals and consumables for cleaning gas ballast valve

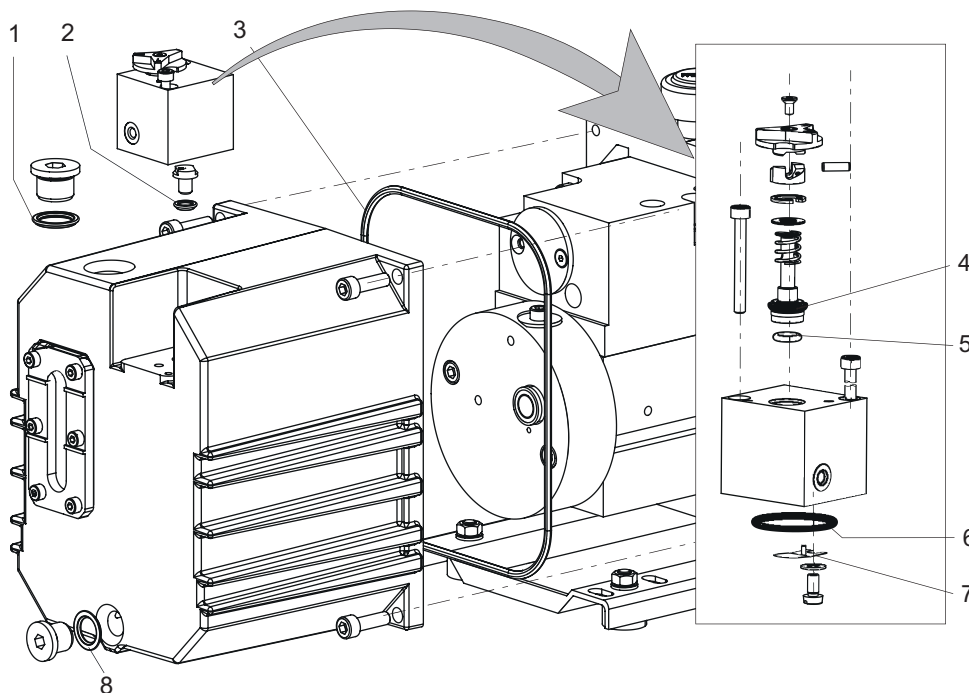


Fig. 21: Content of maintenance kit 1 – maintenance level 1

Item no.	Designation	Size	Scope of delivery
1, 8	O-ring, FKM	15 × 2.5	2
2, 5	O-ring, FKM	6 × 2.2	2
3	O-ring, FKM	205 × 3.0	1
4	O-ring, FKM	8 × 2.0	1
6	O-ring, FKM	27 × 2.5	2
7	Plate spring		1

Tbl. 11: Content of maintenance kit 1

### 12.3 Overhaul kit – Maintenance level 3

The overhaul kit contains all the **wear parts** of the vacuum pump, which must be replaced after the vacuum pump has been dismantled and cleaned:

- Set of seals
- Wear parts of the pumping system (including vane and springs)
- Wear parts of the vacuum safety valve
- Wear parts of the gas ballast valve

### 12.4 Coupling set for versions with magnetic coupling

The coupling set contains:

- Both coupling halves
- Containment shell with O-ring

### 12.5 Set of vanes

The set of vanes contains:

- Vane
- Vane springs

## 13 Accessories

### 13.1 Accessory information

**Dust separators**

Protects the pump against particles from the processes

**Condensate separator**

Protects the vacuum pump against fluids from the intake line and from the condensate return from the exhaust line

**Oil mist filter**

Prevents oil mist from escaping

**Oil return**

Guides separated operating fluid from the oil mist filter back into the rotary vane vacuum pump

**Activated carbon filter**

When mounted on the intake side, protects the vacuum pump and operating fluid against gaseous inorganic contaminants such as acids and lyes

**Catalyser trap**

Prevents backflow of operating fluid vapors (mineral oil only) into the vacuum equipment by separating the oil molecules into CO<sub>2</sub> and water

**Sorption trap**

Use an absorption medium with an extremely porous surface to absorb water or hydrocarbon from the pumped gas

**Cooling trap**

For cooling, e.g. with liquid nitrogen. Prevents backflow of any operating fluid vapors through condensation and protects the vacuum pump and operating fluid against vapors from the process

**PTC resistor tripping device**

Monitors the temperature of the motor winding

**Process monitoring unit**

Monitors the operating fluid level, operating fluid temperature, exhaust pressure

### 13.2 Order accessories

Selection field	Part number
SAS 25, Dust Separator, DN 25 ISO-KF	PK Z60 508
KAS 25 L, condensate separator for pumping speeds up to 35 m <sup>3</sup> /h	PK Z10 033
OME 25 ML, oil mist separator for pumping speeds of up to 30 m <sup>3</sup> /h	PK Z40 158
Oil mist separator OME 25 S	104200
OME 25 ML, oil mist separator for pumping speeds of up to 30 m <sup>3</sup> /h	PK 195 887 -T
Oil return unit ODK from OME 16 M to Duo 5 M, from OME 25 M to Duo 10 M, from OME 25 ML in Duo 20 M	PK 196 172 -T
Oil pressure switch for Duo 5/10/20 M and Penta 20/35	PK 196 484 -T
FAK 025, activated carbon filter	PK Z30 006
URB 025, catalytic trap, 230 V	PT U10 760
URB 025, catalytic trap, 115 V	PT U10 761
Sorption trap ST 25 S	104107
Cold Trap, LN <sub>2</sub> , angled, DN 25 ISO-KF, 4" body, stainless steel / FPM	FTNA-4-1002-NWB
PTC-resistor tripping device for motor protection 24 V AC/DC	P 4768 052 FE
PTC-resistor tripping device for motor protection 220 – 240 V AC	P 4768 052 FQ
Operations monitoring unit 3 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 146 -T

Selection field	Part number
Operations monitoring unit 2 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 147 -T
Operations monitoring unit 1 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 148 -T
Blank flange gas ballast valve with O-ring and screws	PK 196 391 -T
Push-in L-fitting, M5 A for tube 6 mm, with sealing NBR	P 0996 105

**Tbl. 12: Accessories for Duo 20 M**

Selection field	Part number
KAS 25 C, condensate separator, corrosive version for pumping speeds up to 35 m <sup>3</sup> /h	PK Z10 406
Sorption trap ST 25 C, 115 V	066845
Sorption trap ST 25 C, 220 V	066841
Oil Mist Separator OME 25 C	066849
Oil pressure switch for Duo 5/10/20 M and Penta 20/35	PK 196 484 -T
Cold Trap, LN <sub>2</sub> , angled, DN 25 ISO-KF, 4" body, stainless steel / FPM	FTNA-4-1002-NWB
PTC-resistor tripping device for motor protection 24 V AC/DC	P 4768 052 FE
PTC-resistor tripping device for motor protection 220 – 240 V AC	P 4768 052 FQ
Operations monitoring unit 3 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 146 -T
Operations monitoring unit 2 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 147 -T
Operations monitoring unit 1 for Duo 1.6/3/6/11 and Duo 5/10/20 M	PK 196 148 -T
Blank flange gas ballast valve with O-ring and screws	PK 196 391 -T

**Tbl. 13: Accessories for Duo 20 MC**

Selection field	Part 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
D1, synthetic diester based oil, 1 l	PK 005 875 -T
D1, synthetic diester based oil, 5 l	PK 005 876 -T
F4, perfluoropolyether, 0.25 l	PK 005 885 -T
F4, perfluoropolyether, 0.5 l	PK 005 886 -T
F4, perfluoropolyether, 1 l	PK 005 887 -T
F4, perfluoropolyether, 5 l	PK 005 888 -T

**Tbl. 14: Consumables**

## 14 Technical data and dimensions

### 14.1 General

Basis for the technical data of Pfeiffer Vacuum rotary vane pumps:

- Specifications according to PNEUROP committee PN5
- ISO 21360-1: 2016: "Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 1: General description"
- Leak test to ascertain the integral leakage rate according to EN 1779: 1999 technique A1; with 20 % helium concentration, 10 s measurement duration
- Sound pressure level according to ISO 3744, class 2

	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. 15: Conversion table: Pressure units**

	mbar l/s	Pa m³/s	sccm	Torr l/s	atm cm³/s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m³/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 cm³/s	1.01	0.101	59.8	0.76	1

**Tbl. 16: Conversion table: Units for gas throughput**

### 14.2 Technical data

Type designation	Duo 20 M	Duo 20 M	Duo 20 M
Part number	PK D63 105	PK D63 707	PK D63 712
Connection flange (in)	DN 25 ISO-KF	DN 25 ISO-KF	DN 25 ISO-KF
Connection flange (out)	DN 25 ISO-KF	DN 25 ISO-KF	DN 25 ISO-KF
Magnetic coupling	Yes	Yes	Yes
Pumping speed at 50 Hz	20 m³/h	20 m³/h	20 m³/h
Pumping speed at 60 Hz	24 m³/h	24 m³/h	24 m³/h
Gas ballast	Yes	Yes	Yes
Gas ballast pressure	$\leq 1500 \text{ hPa}$	$\leq 1500 \text{ hPa}$	$\leq 1500 \text{ hPa}$
Final pressure with gas ballast	$4 \cdot 10^{-3} \text{ hPa}$	$4 \cdot 10^{-3} \text{ hPa}$	$4 \cdot 10^{-3} \text{ hPa}$
Final pressure without gas ballast	$2 \cdot 10^{-3} \text{ hPa}$	$2 \cdot 10^{-3} \text{ hPa}$	$2 \cdot 10^{-3} \text{ hPa}$
Gas ballast flow	1260 l/h	1260 l/h	1260 l/h
Water vapor capacity 50 Hz	285 g/h	285 g/h	285 g/h
Water vapor capacity 60 Hz	350 g/h	350 g/h	350 g/h
Water vapor tolerance at 50 Hz	20 hPa	20 hPa	20 hPa

Type designation	Duo 20 M	Duo 20 M	Duo 20 M
Water vapor tolerance at 60 Hz	21 hPa	21 hPa	21 hPa
Exhaust pressure, max.	1500 hPa	1500 hPa	1500 hPa
Exhaust pressure, min.	250 hPa	250 hPa	250 hPa
Leakage rate safety valve	$\leq 1 \cdot 10^{-5} \text{ Pa m}^3/\text{s}$	$\leq 1 \cdot 10^{-5} \text{ Pa m}^3/\text{s}$	$\leq 1 \cdot 10^{-5} \text{ Pa m}^3/\text{s}$
Motor type	3-ph motor	1-ph motor	1-ph motor
Switch included	No	Yes	Yes
Mains cable	No	Yes, C14-plug inside the terminal box	Yes, C14-plug inside the terminal box
Cable length	–	2 m	2 m
Motor protection	PTC	Bimetal	Bimetal
Rotation speed at 50 Hz	1500 rpm	1500 rpm	1500 rpm
Rotation speed at 60 Hz	1800 rpm	1800 rpm	1800 rpm
Input voltage(s)	220 – 240 / 380 – 420 V AC, 50 Hz // 255 – 290 / 440 – 500 V AC ( $\pm 5\%$ ), 60 Hz	100 – 110 V AC, 50 Hz // 100 – 120 V AC ( $\pm 5\%$ ), 60 Hz	200 – 230 V AC, 50 Hz // 200 – 240 V AC ( $\pm 5\%$ ), 60 Hz
Mains connection: voltage (selectable)	–	200 – 230, 50 Hz   200 – 240, 60 Hz V	100 – 110, 50 Hz   100 – 120, 60 Hz V
Rated power 50 Hz	0.55 kW	0.75 kW	0.75 kW
Rated power 60 Hz	0.65 kW	0.9 kW	0.9 kW
Emission sound pressure level without gas ballast at 50 Hz	$\leq 55 \text{ dB(A)}$	$\leq 57 \text{ dB(A)}$	$\leq 57 \text{ dB(A)}$
Cooling method	Air	Air	Air
Continuous gas input temperature, max.	40 °C	40 °C	40 °C
Ambient temperature	12 – 40 °C	12 – 40 °C	12 – 40 °C
Shipping and storage temperature	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C
Operating fluid	P3	P3	P3
Operating fluid amount	1 l	1 l	1 l
Protection degree	IP55	IP54	IP54
Weight	37 kg	42.5 kg	42.5 kg

**Tbl. 17: Technical data, Duo 20 M**

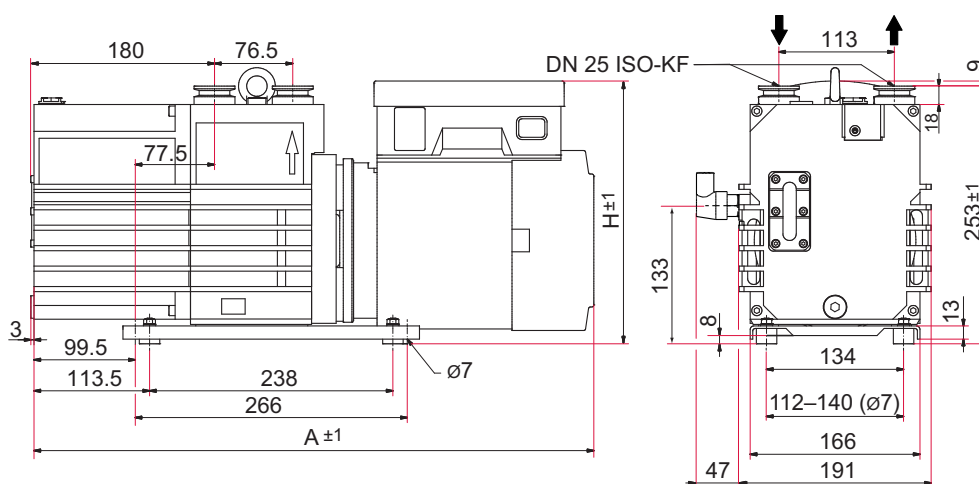
Type designation	Duo 20 MC	Duo 20 MC
Part number	PK D63 727	PK D63 732
Connection flange (in)	DN 25 ISO-KF	DN 25 ISO-KF
Connection flange (out)	DN 25 ISO-KF	DN 25 ISO-KF
Magnetic coupling	Yes	Yes
Corrosive gas version	Yes	Yes
Pumping speed at 50 Hz	20 m <sup>3</sup> /h	20 m <sup>3</sup> /h
Pumping speed at 60 Hz	24 m <sup>3</sup> /h	24 m <sup>3</sup> /h
Gas ballast	Yes	Yes
Gas ballast pressure	$\leq 1500 \text{ hPa}$	$\leq 1500 \text{ hPa}$
Final pressure with gas ballast	$7 \cdot 10^{-3} \text{ hPa}$	$7 \cdot 10^{-3} \text{ hPa}$
Final pressure without gas ballast	$4 \cdot 10^{-3} \text{ hPa}$	$4 \cdot 10^{-3} \text{ hPa}$
Exhaust pressure, max.	1500 hPa	1500 hPa
Exhaust pressure, min.	250 hPa	250 hPa
Leakage rate safety valve	$\leq 1 \cdot 10^{-5} \text{ Pa m}^3/\text{s}$	$\leq 1 \cdot 10^{-5} \text{ Pa m}^3/\text{s}$



Type designation	Duo 20 MC	Duo 20 MC
Integral leakage rate	$\leq 1 \cdot 10^{-6} \text{ Pa m}^3/\text{s}$	$\leq 1 \cdot 10^{-6} \text{ Pa m}^3/\text{s}$
Motor type	1-ph motor	1-ph motor
Switch included	Yes	Yes
Mains cable	Yes, C14-plug inside the terminal box	Yes, C14-plug inside the terminal box
Cable length	2 m	2 m
Motor protection	Bimetal	Bimetal
Rotation speed at 50 Hz	1500 rpm	1500 rpm
Rotation speed at 60 Hz	1800 rpm	1800 rpm
Input voltage(s)	100 – 110 V AC, 50 Hz // 100 – 120 V AC ( $\pm 5\%$ ), 60 Hz	200 – 230 V AC, 50 Hz // 200 – 240 V AC ( $\pm 5\%$ ), 60 Hz
Mains connection: voltage (selectable)	200 – 230, 50 Hz   200 – 240, 60 Hz V	100 – 110, 50 Hz   100 – 120, 60 Hz V
Rated power 50 Hz	0.75 kW	0.75 kW
Rated power 60 Hz	0.9 kW	0.9 kW
Emission sound pressure level without gas ballast at 50 Hz	$\leq 57 \text{ dB(A)}$	$\leq 57 \text{ dB(A)}$
Cooling method	Air	Air
Continuous gas input temperature, max.	40 °C	40 °C
Ambient temperature	12 – 40 °C	12 – 40 °C
Shipping and storage temperature	-25 – 55 °C	-25 – 55 °C
Operating fluid	F4	F4
Operating fluid amount	1 l	1 l
Protection degree	IP54	IP54
Weight	42.5 kg	42.5 kg

Tbl. 18: Technical data, Duo 20 MC

## 14.3 Dimensions


 Fig. 22: Dimensions Duo 20 M / Duo 20 MC  
 Dimensions in mm

Part number	Length "A" [mm]	Height "H" [mm]
PK D63 105	545	212
PK D63 707	551	262
PK D63 712		
PK D63 727		
PK D63 732		

**Tbl. 19: Dimensions**

# Declaration of conformity

Declaration for product(s) of the type:

**Rotary vane pump**

Duo 20 M

Duo 20 MC

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: 2011

DIN EN 1012-2: 2011-12

DIN EN 61000-6-2: 2006

DIN EN ISO 13857: 2008

DIN EN 61000-6-4: 2011

DIN ISO 21360-1 : 2016

DIN EN ISO 2151: 2009

ISO 21360-2: 2012

DIN EN IEC 63000:2019

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

Signature:



(Daniel Sälzer)  
Managing Director

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

Asslar, 2020-09-09



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

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