OPERATING INSTRUCTIONS

EN

Translation of the Original

DUO 3 | DUO 3 M | DUO 3 MC

Rotary vane pump

PFEIFFER VACUUM

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.

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

Disclaimer of liability

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

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

Copyright

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1 About this manual

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

1.1 Validity

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

1.1.1 Applicable documents

Designation	Document
Declaration of conformity	A component of these operating instructions

1.1.2 Variants

These instructions apply to DuoLine vacuum pumps.

- Duo 3
- Duo 3 M
- Duo 3 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

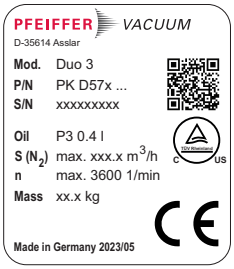
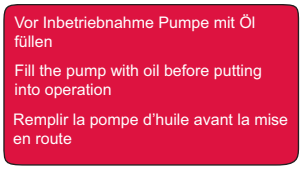
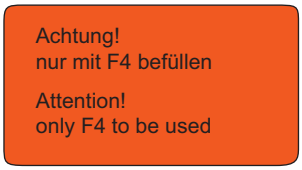
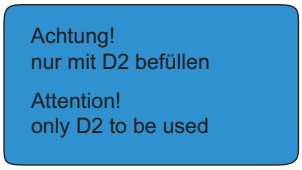
Pictographs used in the document indicate useful information.

Note

Tip

1.3.3 Stickers on product

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

	**Rating plate** (example) Rating plate of the rotary vane vacuum pump **Motor rating plate (not shown)**
	**Sticker (red)** Fill with operating fluid before commissioning
	**Sticker (orange) – special operating fluid only** Caution: fill with **F4** only
	**Sticker (blue) – special operating fluid only** Caution: fill with **D2** only
 	**Sticker for pre-set motor voltage** Pre-set voltage (230 V or 115 V) of single-phase motor
	**Warranty seal** The product is sealed ex factory. Damaging or removing a warranty seal results in loss of the warranty.
	**Warning hot surface** This sticker warns of injuries caused by high temperatures as a result of contact without protection during operation.

Tbl. 1: Stickers on product

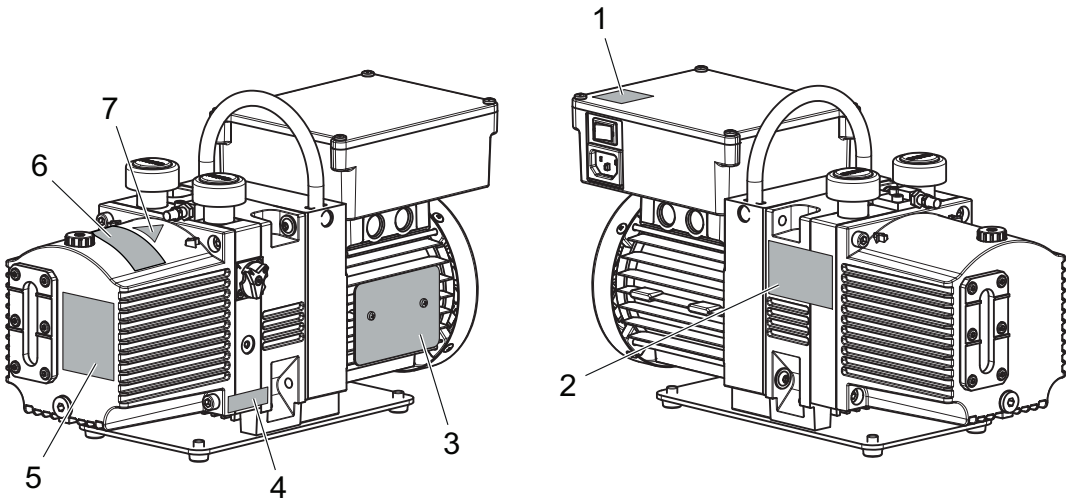


Fig. 1: Position of sticker on product, using the M version as an example

1 Sticker for pre-set motor voltage
2 **Operating fluid F4/D2, alternative to item 6:**
Fill with operating fluid before commissioning
3 Rating plate of the motor
4 Warranty seal
5 Rating plate of the rotary vane vacuum pump
6 **Operating fluid P3:**
Fill with operating fluid before commissioning
Operating fluid F4/D2 (alternative):
Caution: fill with **F4** or **D2** only
7 Hot surface warning sign

1.3.4 Abbreviations

Abbreviation	Explanation
BA	Operating instructions
C version	Corrosive gas version
DN	Nominal diameter (diamètre nominal)
FKM	Fluorinated rubber
I_N	Rated current
I_{max}	Maximum current
ISO	Flange: Connection in accordance with ISO 1609 and ISO 2861
M version	Version with magnetic coupling
MC version	Corrosive gas version with magnetic coupling
ODK	Operating fluid return line (oil drain kit)
OME	Oil mist filter (oil mist eliminator)
PE	Protective earth (earthed conductor)
PTC	Temperature-dependent resistor (positive temperature coefficient)
RSSR	Radial shaft seal ring
WAF	Width Across Flats
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 (≤ 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 °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 °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 product

Installation location	Weatherproof (internal space)
Installation altitude	max. 2000 m above sea level [1)]
Protection class (according to IEC 61010)	I
Degree of pollution (according to IEC 61010)	2
Overvoltage category	II
Permissible protection degree	IP40
Housing type (according to UL 50E)	Type 1
permissible angle of inclination	± 1 °
Ambient temperature	+12 °C to +40 °C

1) When installing at altitudes > 1000 m above sea level, reduce the power of the motor or limit the ambient temperature, as the vacuum pump will heat up more.

Relative air humidity	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 product

2.6 Proper use

- ► Use the vacuum pump for vacuum generation only.
- ► When pumping media with an oxygen concentration level of ≥ 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 pumps)
- Pumping radioactive media
- Pumping of gases that introduce an ignition source to the suction chamber
- Pumping of gases that contain contamination such as particles, dust, or condensate
- Pumping explosive media
- Pumping of media with a propensity to sublimation
- Pumping of fluids
- Using the vacuum pump in potentially explosive atmospheres
- Using the vacuum pump outside the specified area of application
- Using for pressure generation
- Use in strong electrical, magnetic, or electromagnetic fields
- Connecting to vacuum pumps and units that are not designed for this purpose according to their operating instructions
- Connecting to units 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 D2 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 Responsibilities and warranty

Pfeiffer Vacuum shall assume no responsibilities and warranty if the operating company or a third party:

- disregards this document
- does not use the product for its intended purpose
- carries out any modifications to the product (conversions, changes, etc.) that are not listed in the corresponding product documentation
- operates the product with accessories that are not listed in the corresponding product documentation

The operator is responsible for the process media used.

2.9 Owner requirements

Safety-conscious working

1. Only operate the product in a technically flawless state.
2. Operate the product in line with its intended purpose, safety and hazard-conscious and only in compliance with these operating instructions.

3. Fulfill the following instructions and monitor the observation of the following instructions:
   – Proper use
   – Generally applicable safety instructions and accident prevention regulations
   – International, national and locally applicable standards and guidelines
   – Additional product-related guidelines and regulations
4. Only use original parts or parts approved by Pfeiffer Vacuum.
5. Keep the operating instructions available at the place of installation.
6. Ensure personnel qualification.

2.10 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.

2.10.1 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.

2.10.2 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

2.10.3 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.

2.11 Operator requirements

Observing relevant documents and data

1. Read, observe and follow this operating instruction and the work instructions prepared by the operating company, in particular the safety and warning instructions.
2. Install, operate and maintain the product only in accordance with these operating instructions.
3. Carry out all work only on the basis of the complete operating instructions and applicable documents.
4. Comply with the limits of use.
5. Observe the technical data.
6. Please contact the Pfeiffer Vacuum Service Center if your questions on operation or maintenance of the product are not answered in these operating instructions.
   - You can find information in the Pfeiffer Vacuum service area.

3 Product description

3.1 Function

The rotary vane pumps are two-stage, oil-sealed rotary positive displacement pumps for use in coarse and medium vacuum. The rotary vane vacuum pump is available in the standard version with a conventional seal, or as an M version with non-contact and wear-proof drive with magnetic coupling. The pump housing is hermetically sealed.

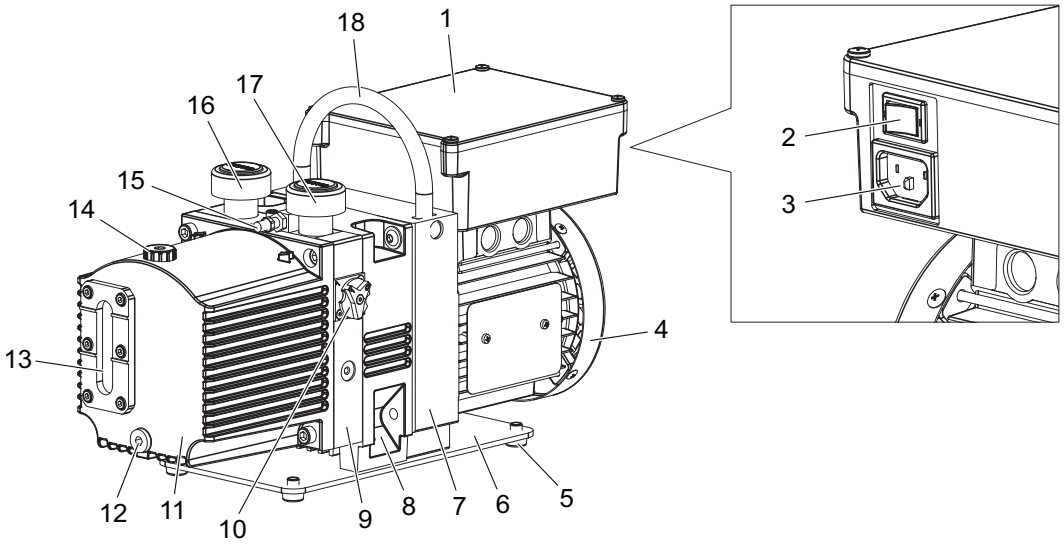


Fig. 2: Structure of the rotary vane pump, using the M version as an example

1 Terminal box
2 Mains switch
3 Rubber connector
4 Motor
5 Rubber feet
6 Base plate
7 Motor flange
8 Intermediate flange (red, only with M version)
9 Stand
10 Gas ballast valve
11 Cap
12 Drain screw for operating fluid
13 Sight glass
14 Filling screw for operating fluid
15 Connection for the operating fluid return
16 Vacuum flange with protective cap
17 Exhaust flange with protective cap
18 Handle

3.1.1 Gas ballast

An integrated gas ballast system serves the controlled supply of ambient air or inert gas into the suction chamber. Gas ballast supports the reduction of condensate accumulating in the pumping system.

3.1.2 Vacuum safety valve

The 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.

3.1.3 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

3.2 Operating principle

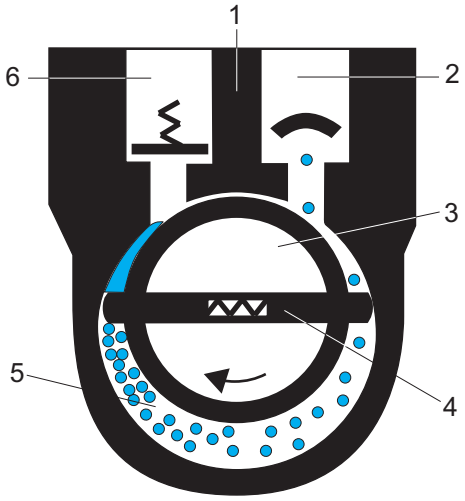


Fig. 3: Rotary vane vacuum pump functional principle

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

The rotary vane pump is an oil-sealed rotary displacement pump. The pumping system comprises the housing, the eccentrically mounted rotor, and the centrifugal 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.

3.3 Identifying the product

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

3.4 Product features

Pump type	Pumping speed	Characteristics
Duo 3	2.5 m^3/h(50 Hz) 2.9 m^3/h(60 Hz)	Standard version: ● Two-stage rotary vane pump ● Single-phase motor ● Gas ballast valve ● Intake side vacuum safety valve
Duo 3 M		M version; differs compared to the standard version by: ● Magnetic coupling
Duo 3 MC		MC version; differs compared to the standard version by: ● Operating fluid F4 ● Magnetic coupling encapsulated on the pump side ● Vane material changed ● Hose connection on the gas ballast valve

Tbl. 4: Features of rotary vane pumps

3.5 Scope of delivery

- Rotary vane vacuum pump with motor
- Operating fluid [2)]
- Centering ring with cone sieve and O-ring for the vacuum flange
- Centering ring with nozzle and O-ring for the exhaust flange
- Locking caps for both connection flanges
- Operating instructions

2) Depending on the special model, the operating fluid is not included in the scope of delivery.

4 Transportation and Storage

4.1 Transporting 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.

Safe transport of the product

1. Observe the weight specified on the 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.

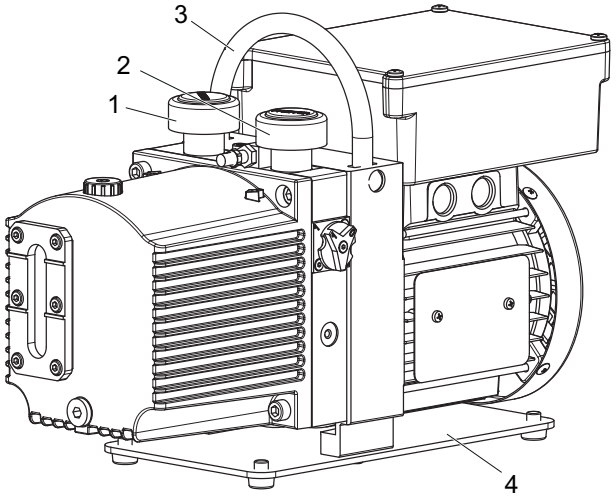


Fig. 4: Transporting the vacuum pump manually

1 Vacuum connection protective cover
2 Exhaust connection protective cover
3 Handle
4 Base plate

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 handle 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 vacuum pump

Storage

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

Safe storing vacuum pump

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 Setting up vacuum pump

⚠ CAUTION

Danger of burns on hot surfaces

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

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

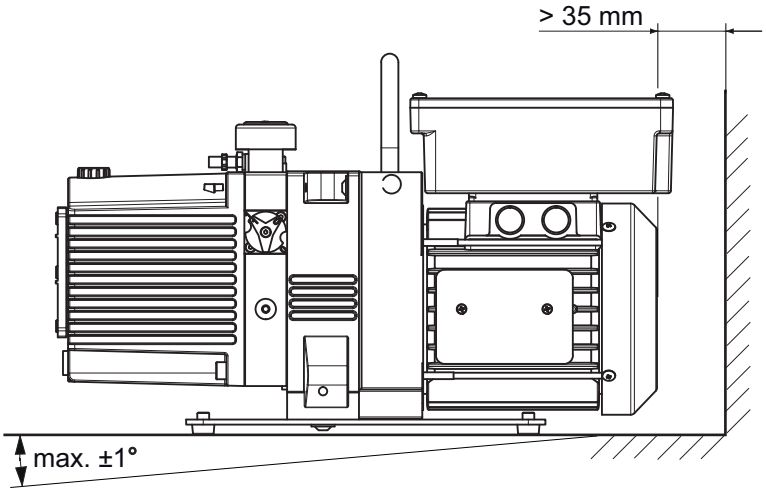


Fig. 5: Minimum distances and permissible inclination

Procedure

- When selecting the installation location, observe the requirement for touch protection to prevent burns.
  - Closed housing: no touch protection required
  - Access for trained individuals only: no touch protection required
  - Unrestricted access for untrained individuals: 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. Screw the base plate of the vacuum pump to the mounting surface if necessary.
3. Observe the max. permissible angles of inclination.
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 Connecting 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.

Installation and operation of accessories

Pfeiffer Vacuum offers a series of special, compatible accessories for its rotary vane pumps.

- You can find information and ordering options for approved accessories online.
- Described accessories are not included in the shipment.

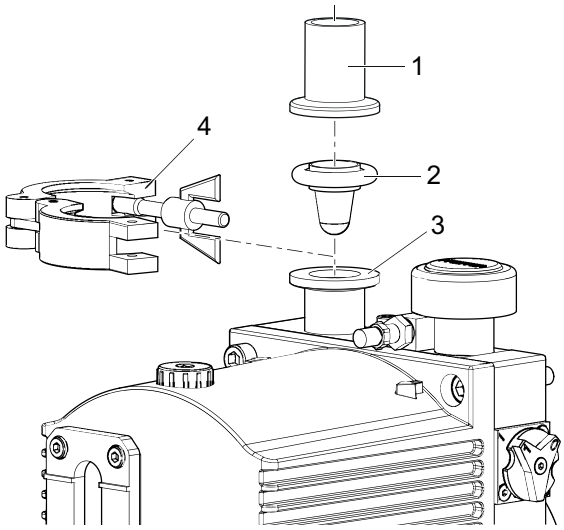


Fig. 6: Vacuum connection with flange connection

1 Intake line
2 Centering ring with cone strainer and o-ring
3 Vacuum flange
4 Clamping ring

Procedure

1. Remove the protective cap from the vacuum flange.
2. Make sure that the centering ring with cone sieve and the O-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.
8. Use a separator or filter from the Pfeiffer Vacuum line of accessories if necessary.

5.3 Connecting 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.

- ► Route the exhaust line without shut-off units.
- ► 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.

Condensate separator

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

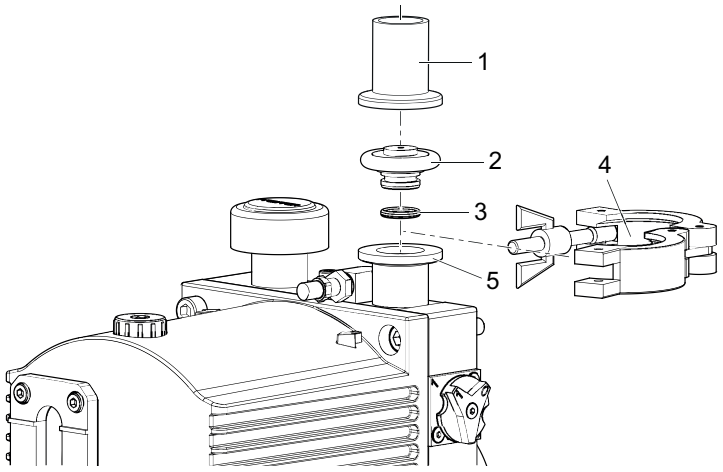


Fig. 7: Exhaust connection with flange connection

1 Exhaust line
2 Centering ring with nozzle and O-rings
3 O-ring
4 Clamping ring
5 Exhaust connection

Procedure

1. Remove the protective cap from the exhaust flange.
2. Observe the centering ring with nozzle including the corresponding O-rings (2×).
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.

5.4 Connecting to mains power supply

DANGER

Danger to life from electric shock

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

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

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.

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.

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.

Depending on the pump type, there are different motor designs or mains voltages.

- Single-phase motor with replaceable voltage range,
  - thermal protection switch,
  - mains switch and
  - Rubber connector

In the event of excess temperature, the thermal protection switch interrupts the motor current, but does not offer a permanent cutoff of the motor.

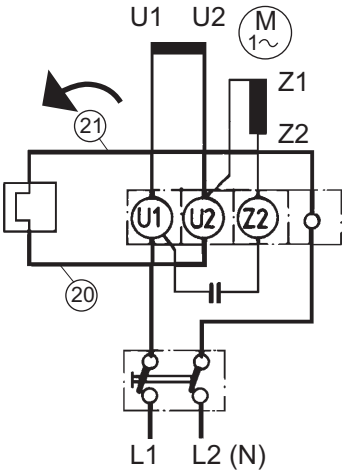


Fig. 8: Motor circuit diagram, single-phase motor with switch

5.4.1 Securing vacuum pump on site

Motor voltage [V]	Frequency [Hz]	Rated (nominal) current [A]	Recommended fuse, slow-blow [A]
115 ± 10%	50	2.3	6
115 ± 10%	60	2.9	6
230 ± 10%	50	1.0	4
230 ± 10%	60	1.5	4
100 – 115 / 200 – 230 ±5%	50	2.6/1.1	6/4
100 – 115 / 200 – 230 ±5%	60	3.1/1.3	6/4

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

On-site fuse protection

► For the protection of the motor in case of malfunction, always provide fuse protection according to the regulations applicable for the region.

5.4.2 Setting voltage range of motor

⚠ 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.

The sticker for the pre-set motor voltage on the cover of the terminal box indicates the set voltage range.

Prerequisites

- Mains voltage determined on site
- Vacuum pump disconnected from mains

Required tools

- Crosshead screwdriver

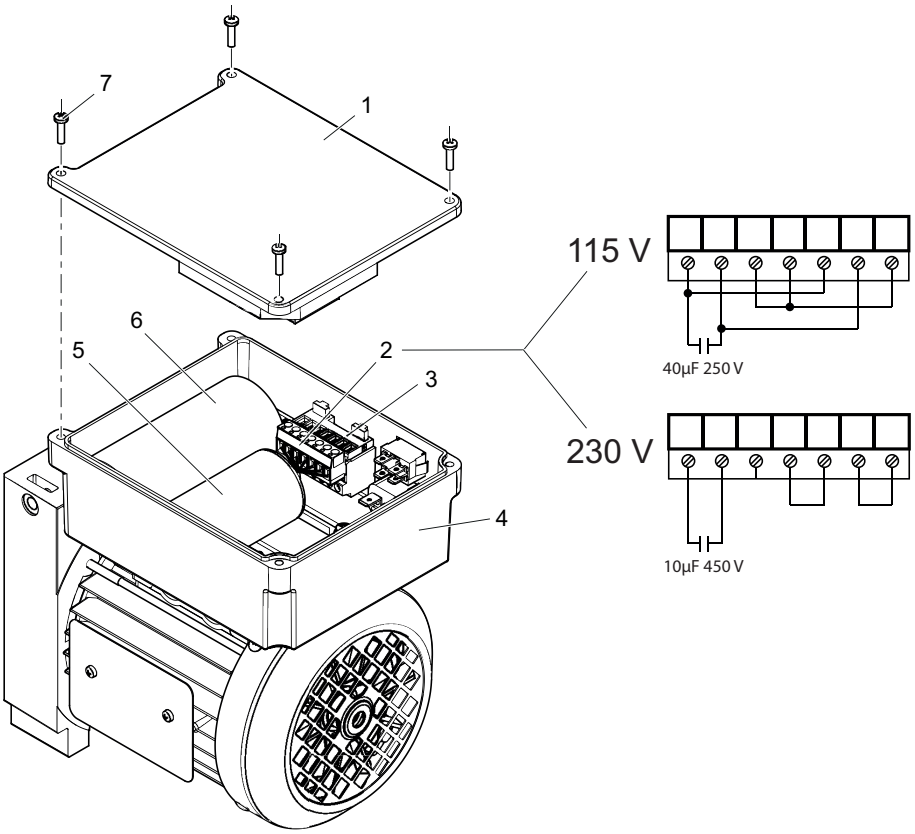


Fig. 9: Opened motor terminal box

1 Cover
2 Printed circuit board connector (female)
3 Rail connection block (male)
4 Terminal box
5 Capacitor for high voltage (200 – 230 V ±5%)
6 Capacitor for low voltage (100 – 115 V ±5%)
7 Screw, 4×

Procedure

1. Loosen the screws from the cover of the terminal box.
2. Remove the cover.
3. Remove the printed circuit board connector of the capacitor from the rail connection block.
4. Insert the printed circuit board connector of the other capacitor for the desired voltage range in the rail connection block.
5. Store the loose printed circuit board connector safely in the terminal box.
6. Place the cover on the terminal box.
7. Hand-tighten the screws.

5.5 Filling up 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 (standard design)
- F4 (operating fluid for corrosive gas version)
- D2 for special applications (such as higher operating temperatures)

Required consumables

- Operating fluid of the vacuum pump

Required tools

- Allen key, **WAF 5**
- Calibrated torque wrench (tightening factor ≤ 2.5)

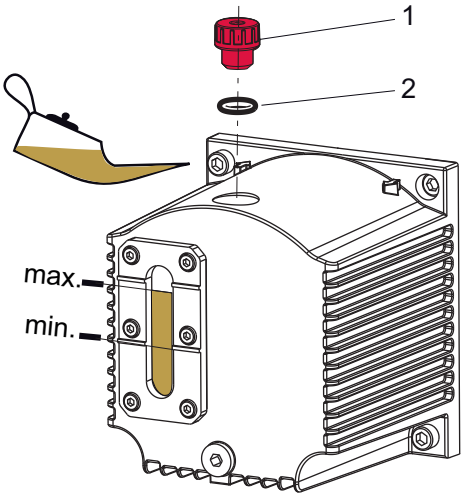


Fig. 10: Filling up operating fluid

1 Filler screw 2 O-ring

Reading operating fluid type on rating plate

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

Filling the operating fluid

1. Unscrew the filler screw.
2. Fill the operating fluid according to the sight glass:
   – Fill level of the initial filling when the vacuum pump is cold: A maximum of 3/4 of the min./max. range.
3. Screw in the filler screw again.
   – Be careful with the O-ring.
   – Tightening torque: **max. 0.3 Nm**

6 Operation

6.1 Commissioning vacuum pump

⚠ WARNING

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

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

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

⚠ CAUTION

Danger of 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.

Procedure

- ► Check the operating fluid in the sight glass.
- ► Compare the voltage and frequency specifications on the motor rating plate with the available mains voltage and frequency.
- ► Protect the vacuum pump from sucking in contamination using suitable measures.
- ► Check the operating fluid at regular intervals.
- ► Check the exhaust connection for free passage (max. permissible pressure: 1,500 hPa absolute).

6.2 Switching on vacuum pump

⚠ 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.

Switching on vacuum pump

1. If required, switch vacuum pump on in each pressure range.
2. Switch the vacuum pump on at the mains switch.
3. Allow the vacuum pump to warm up prior to process start, with the vacuum connection closed, for approx. 30 minutes.

Checking operating fluid level

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

6.3 Operating 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.

The gas ballast valve supplies air to the working chamber of the vacuum pump periodically at the beginning of the compression phase. When pumping down vapors, this air prevents condensation within certain limits in the vacuum pump.

Behavior with 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

No intermediate settings possible

An intermediate setting between open and closed is not possible.

The gas ballast valve supplies air to the working chamber of the vacuum pump periodically at the beginning of the compression phase. When pumping down vapors, this air prevents condensation within certain limits in the vacuum pump.

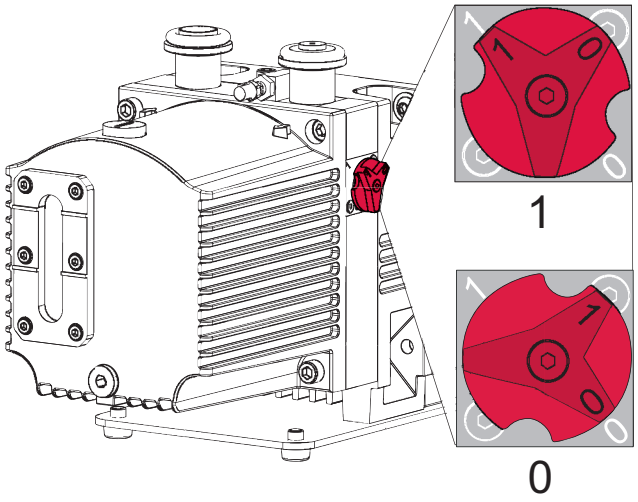


Fig. 11: Gas ballast valve - standard version

Open gas ballast valve

► Rotate the knob on the gas ballast valve to the left to open, into position “**1**”.

Close gas ballast valve

► Rotate the knob on the gas ballast valve to the right to close, into position “**0**”.

6.3.2 Gas ballast valve with inert gas connection

NOTICE

Property damage from impermissibly high inert gas pressure

Increased inert gas pressure compromises operational reliability of the vacuum pump, and causes an increase in power input and operating temperature.

► Observe the maximum permissible inert gas pressure of **1500 hPa (absolute)**.
► Dose the inert gas quantity with the dosing screw on the gas ballast valve or on site.

NOTICE

Property damage due to inert gas intake during vacuum pump standstill

Continued inert gas intake after switching off the vacuum pump will expel the oil film in the pump system, resulting in damage during restart.

► After switching off the vacuum pump, close the supply of inert gas at the gas ballast valve or by closing the on-site gas supply.

If you optionally use inert gas in the process, Pfeiffer Vacuum recommends using the gas ballast valve with inert gas connection. Admission of inert gas dilutes the process gas and avoids condensation of vapors in the vacuum pump within certain limits.

Required tools

- Allen key, **WAF 5**
- Allen key, **WAF 14**
- Calibrated torque wrench (tightening factor ≤ 2.5)

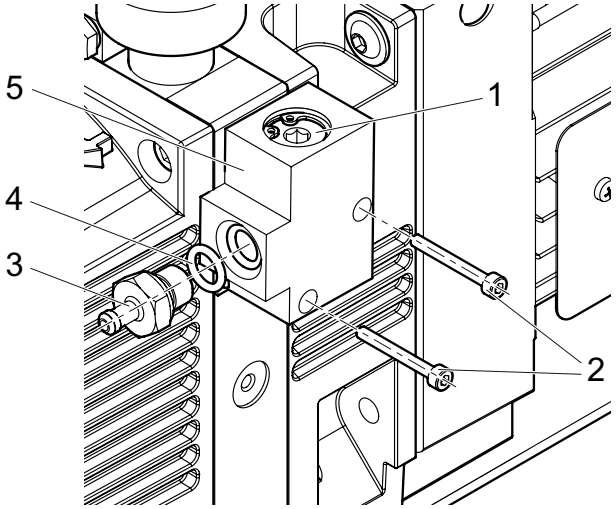


Fig. 12: Gas ballast valve with inert gas connection

1 Dosing screw
2 Hexagon socket screw, 2×
3 Hose connection, G 1/8" (locking screw removed)
4 O-ring
5 Valve housing

Avoiding shearing of hexagon socket screws

Fit the hose connection G 1/8" on the valve housing before you fit the valve housing on the vacuum pump, in order to prevent shearing of the hexagon socket screws.

Connecting gas ballast valve with inert gas connection

1. Unscrew and remove the locking screw from the gas ballast valve.
2. Fit the G 1/8" hose connection (scope of delivery) on the valve housing.
   – Be careful with the o-ring.
   – Tightening torque: **3.0 Nm**
3. Install the valve housing with the hexagon head screws on the vacuum pump.
   – Be careful with the o-ring.
   – Tightening torque: **1.0 Nm**
4. Connect a hose (DN 5 mm) to the hose connection with a hose clamp, or use the G 1/8" threaded connector directly.

Establishing inert gas supply

1. Select the type and quantity of the inert gas used according to the specific process.
   – Consult Pfeiffer Vacuum if necessary.
2. Set the inert gas pressure to **max. 1500 hPa (absolute)**.
3. Make sure that the inert gas pressure is greater than the respective intake pressure.
4. Set the desired gas quantity using the dosing screw.
   – Observe the technical data (gas ballast flow).
   – Turn the dosing screw to the right in order to close the valve.
   – Turn the dosing screw to the left in order to open the valve.

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.

Required tools

- Allen key, **WAF 5**
- Calibrated torque wrench (tightening factor ≤ 2.5)

Required consumables

- Operating fluid of the vacuum pump

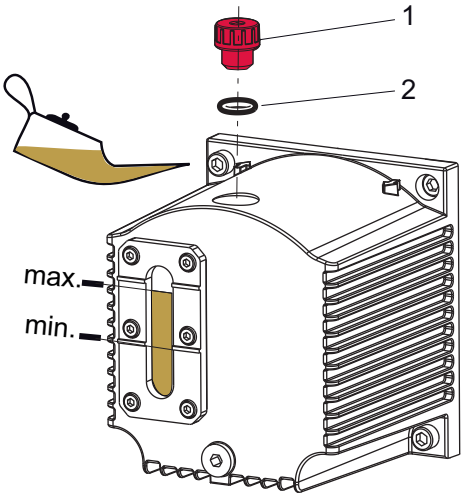


Fig. 13: Refilling operating fluid

1 Filler screw 2 O-ring

Refill operating fluid during operation

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

Procedure

1. Unscrew the filler screw.
2. Refill with operating fluid up to the top marking before the minimum fill level is reached.
3. Screw in the filler screw again.
   - Be careful with the O-ring.
   - Tightening torque: **0.3 Nm**

6.5 Switching off 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.

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.
   - The vacuum safety valve closes automatically when the vacuum pump is switched off, preventing the backflow of gas and operating fluid into the intake line.
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 extend 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 (≤ 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

Maintenance frequency and service lives

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

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

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

We recommend Pfeiffer Vacuum Service for carrying out maintenance work of **Maintenance Level 2** and **Maintenance Level 3** (revision). If the required intervals listed below are exceeded, or if maintenance work is carried out improperly, no warranty or liability claims are accepted on the part of Pfeiffer Vacuum. This also applies if original spare parts are not used.

Action	**Inspection**	**Maintenance level 1**	**Maintenance level 2**	**Maintenance level 3**	**Required materials**
Described in document	**OI**	**OI**	**MM**	**MM**	
Interval	**daily**	**≤ yearly**	**≤ 2 years**	**≤ 4 years**	
Inspection					
Visual and acoustic pump check Check operating fluid: ● Check fill level ● Check color (contamination) ● Check vacuum pump for leaks	■				
Check accessories (in accordance with respective operating instructions)	■				
Maintenance level 1 – operating fluid replacement					
Clean the outside of the vacuum pump: ● Pump housing ● Clean motor fan cap Changing the operating fluid		■			Operating fluid Maintenance kit 1
Additional activities: ● Remove cap ● Clean inside of cap and outside of pumping system (without cleaning agent) ● Remove and clean gas ballast valve, replace wearing parts		■ as required			

Action	Inspection	Maintenance level 1	Maintenance level 2	Maintenance level 3	Required materials
Described in document	**OI**	**OI**	**MM**	**MM**	
Interval	**daily**	**≤ yearly**	**≤ 2 years**	**≤ 4 years**	
Replace filter in external accessory (where present), in accordance with the respective operating instructions		■ as required			
Maintenance level 2 – RSSR change					
• Partially dismantle the vacuum pump • Replace RSSR and coupling half **Not applicable for vacuum pumps with magnetic coupling**			■		Operating fluid RSSR set
Additional activities: Dismantle and clean vacuum pump, replace seals and the following wear parts: • Wear parts, vacuum safety valve (hydraulic piston) • Wear parts, exhaust valve (valve flap) • Wear parts, gas ballast valve (valve flap) • Vane springs			■ as required		Operating fluid Maintenance kit 2
Maintenance level 3 – overhaul					
Dismantle and clean vacuum pump, replace seals and all wear parts: • Vane • Valves, springs, and sight glass • Silencer nozzle				■	Operating fluid Overhaul kit

Tbl. 6: 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 within the first maintenance frequency.

The usable 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 Determining 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.

Scan this QR code or click here and view a document that will help you determine the degree of aging of the P3 operating fluid in clean processes using a color chart (according to DIN 51578). The document with the number PK0219 can also be obtained from the Pfeiffer Vacuum Download Center on request.

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 5**
- Calibrated torque wrench (tightening factor ≤ 2.5)

Determining degree of aging of P3 operating fluid

1. Unscrew the filler screw.
   – Be careful with the 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 the o-ring.
   – Tightening torque:**0.3 Nm**

7.4.2 Changing 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.

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump has cooled so that it can be touched
- Operating fluid still warm

Required tools

- Allen key, **WAF 5**
- Calibrated torque wrench (tightening factor ≤ 2.5)

Required aids

- Collection receptacle (> 0.5 l)

Required consumables

- Operating fluid of the vacuum pump

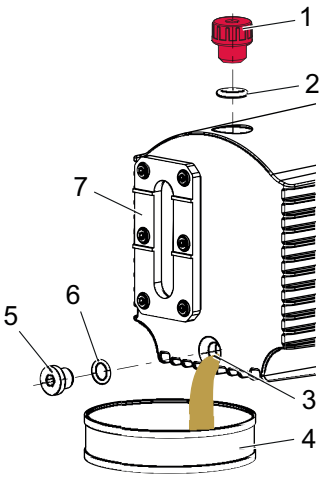


Fig. 14: Draining operating fluid

1	Filler screw	5	Drain screw
2	O-ring	6	O-ring
3	Drain hole	7	Sight glass
4	Collection receptacle		

Draining the operating fluid

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

Agitate remaining operating fluid

1. Screw in the filler screw.
   – Be careful with the O-ring.
2. Screw in the drain screw.
   – Be careful with the O-ring.
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.
   – Be careful with the O-ring.
2. Gently tilt the vacuum pump.
3. Drain remaining operating fluid.
4. Screw in the drain screw.
   – Replace the O-ring.
   – Tightening torque: **6 Nm**
5. Dispose of old operating fluid according to applicable regulations.

Filling fresh operating fluid

1. Screw the drain screw in up to the stop.
   – Be careful with the O-ring.
   – Tightening torque: **6.0 Nm**
2. Fill new operating fluid.
3. Check level.
4. Screw the drain screw in completely.
   – Be careful with the O-ring.
   – Tightening torque: **0.3 Nm**

7.4.3 Rinsing and cleaning rotary vane 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.

Prerequisites

- Fresh operating fluid filled

Required tools

- Allen key, **WAF 5**
- Calibrated torque wrench (tightening factor ≤ 2.5)

Required aids

- Collection receptacle (> 0.5 l)

Changing operating fluid for cleaning

1. Operate the vacuum pump with the gas ballast open, until it is warm.
2. Perform an operating fluid change.
3. Check the pollution level and repeat the changing of the operating fluid if necessary.
4. Replace the corresponding filter elements wherever the accessory is installed.

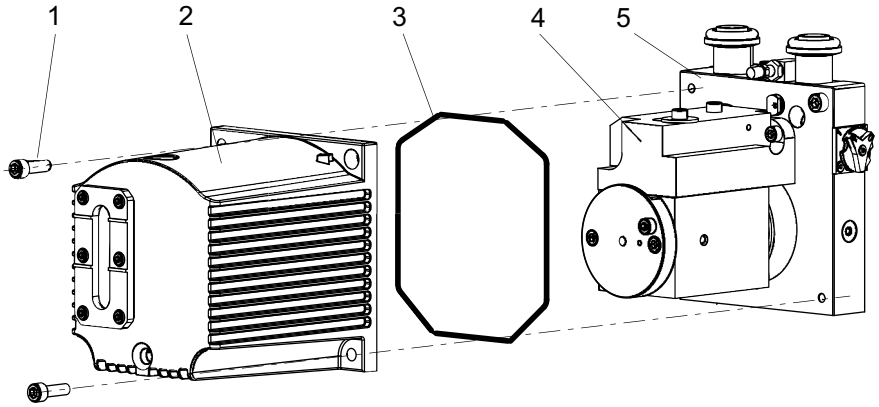


Fig. 15: Remove/fit rotary vane vacuum pump cap

1 Hexagon socket screw (2×)
2 Cap
3 O-ring
4 Pumping system
5 Stand

Removing the cap

1. Drain the operating fluid.
2. Unscrew the hexagon socket screws from the cap.
3. Remove the cap from the stand in axial direction.
   – Take care with the o-ring between cap and stand.
4. Collect any leaking operating fluid.
5. Dispose of operating fluid according to applicable regulations.

Cleaning the pumping system and cap

1. Clean the pumping system from the outside without cleaning agent.
2. Clean the cap from the inside without cleaning agent.

Installing cap

1. Insert the O-ring in the groove in the cap.
2. Install cap on stand.
3. Tighten the hexagon socket screws.
   – Tightening torque: **6.0 Nm**.
4. Screw in the drain screw.
   – Be careful with the o-ring.
   – Tightening torque: **6.0 Nm**
5. Fill with operating fluid and check the fill level.
6. Screw in the filler screw.
   – Be careful with the o-ring.
   – Tightening torque: **0.3 Nm**

7.5 Disassembling and cleaning gas ballast valve

7.5.1 Disassembling and cleaning gas ballast valve (standard version)

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

Required tools

- Allen key, **WAF 2**
- Snap ring pliers, **J0**
- Calibrated torque wrench (tightening factor ≤ 2.5)

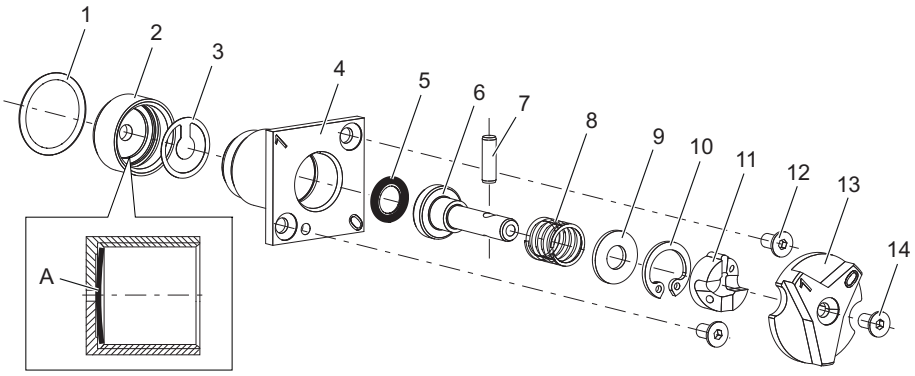


Fig. 16: Gas ballast valve

A	Arched side	8	Compression spring
1	O-ring	9	Washer
2	Screw cap	10	Circlip
3	Valve flap	11	Cam plate
4	Valve housing	12	Countersunk screw, 2×
5	O-ring	13	Head
6	Tappet	14	Countersunk screw
7	Cylinder pin		

Dismantling gas ballast valve

1. Unscrew and remove the countersunk screws (2×) from the valve housing.
2. Pull the valve housing out of the vacuum pump stand.
   – Be careful with the o-ring.
3. Unscrew the screw cap from the valve housing.
4. Watch out for the valve flap in the valve housing.
5. Rotate knob to “open” position.
6. Unscrew the countersink screw the from the head.
7. Remove the head.
8. Pull tappet far enough out of valve housing so that you can pull out cylinder bolt.
9. Remove the cam plate and the circlip using snap ring pliers.
10. Be careful with washer and compression spring.
11. Remove tappet from valve housing.
    – Be careful with the o-ring.
12. Clean all parts and check parts for wear.
13. Replace wear parts according to maintenance kit.

Assembling gas ballast valve

1. Insert o-ring into groove in tappet.
2. Insert the tappet in the valve housing.
3. Install compression spring and washer.
4. Install the circlip in the recess in the valve housing.
5. Slide the cam plate onto the tappet.
   – Take care with longitudinal groove in flange housing.
6. Pull out the tappet against the force of the spring and place the cylinder bolt in the bore.
7. Rotate cam plate to move tappet to "1" position (open).
8. Install knob to tappet.
9. Tighten the countersunk head screw.
   – Tightening torque: **1.0 Nm**.

10. Determine the curve of the valve flap and place the valve flap in the screw cap with the curved side facing downwards.
11. Screw the screw cap and the valve housing hand tight.
12. Install the complete valve with o-ring in the vacuum pump.
13. Tighten the countersunk head screws (2x).
    – Tightening torque: **1.0 Nm**.

7.5.2 Dismantling and cleaning gas ballast valve with inert gas connection

Avoiding shearing of hexagon socket screws

Fit the hose connection G 1/8" on the valve housing before you fit the valve housing on the vacuum pump, in order to prevent shearing of the hexagon socket screws.

Required tools

- Allen key, **WAF 2.5**
- Allen key, **WAF 5**
- Open-end wrench, **WAF 14**
- Snap ring pliers, **J1**
- Calibrated torque wrench (tightening factor ≤ 2.5)

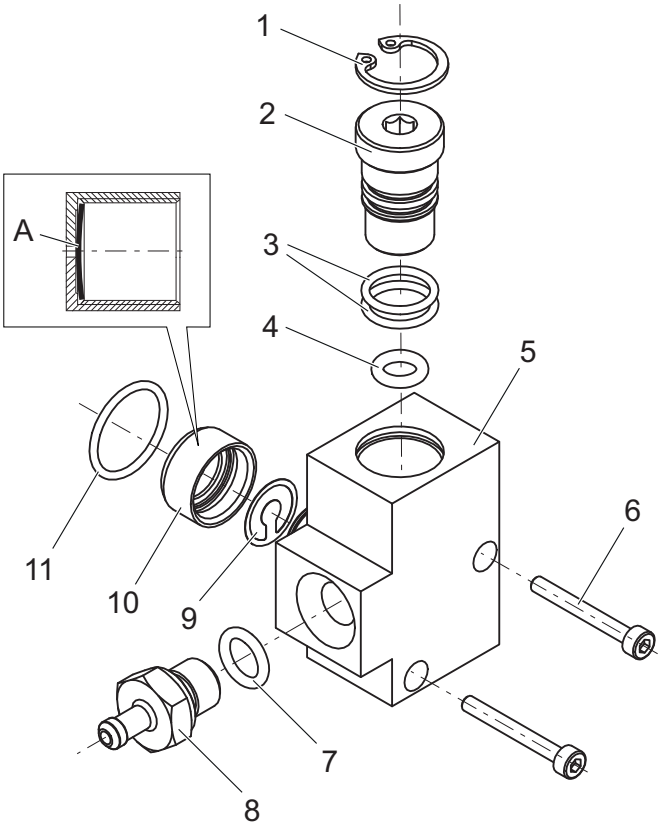


Fig. 17: Gas ballast valve with inert gas connection

A	Arched side	6	Screw, 2×
1	Circlip	7	O-ring
2	Spindle	8	Hose connection
3	O-ring, 2×	9	Valve flap
4	O-ring	10	Screw cap
5	Valve housing	11	O-ring

Dismantling gas ballast valve with inert gas connection

1. Remove the hose of the inert gas line.
2. Disconnect the valve housing from the vacuum pump.
   – Be careful with the o-ring.
3. Unscrew the hose connection the from valve housing.
4. Unscrew the screw cap from the valve housing.

5. Remove the valve flap.
6. Dismantle the circlip using the circlip pliers.
7. Screw the spindle out of the valve housing.
   – Be careful with the O-rings.
8. Clean all parts.
   – Clean especially the bores in the valve housing.
9. Replace the parts according to the spare parts pack.

Assembling gas ballast valve with inert gas connection

1. Place the valve flap with the arched side facing downwards into the screw cap.
2. Screw the screw cap and the valve housing hand tight.
3. Fit the G 1/8" hose connection onto the valve housing.
   – Be careful with the o-ring.
   – Tightening torque: **3.0 Nm**.
4. Slide the O-ring over the screw cap up to the stop.
5. Screw the valve housing to the vacuum pump.
6. Tighten screws.
   – Tightening torque: **1.0 Nm**.
7. Fit the spindle in the valve housing.
   – Be careful with the O-rings.
8. Insert the circlip.
9. Install the hose of the inert gas line.

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 – **D2** – only.

It is not possible to change from **P3/D2** 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:

Procedure

1. Switch off the vacuum pump.
2. Vent the vacuum pump.
3. Allow the vacuum pump to cool down.
4. Change the operating fluid.
5. 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.
6. Fill the vacuum pump to above the **“max.” mark** with operating fluid, up to the upper edge of the sight glass.
7. Seal the vacuum and exhaust flanges as well as any other openings with blank flanges from the Pfeiffer Vacuum accessories range.
8. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
9. 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.
10. 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.

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	• No mains voltage or voltage does not correspond to the motor data	• Check the mains voltage and mains fuse. • Check the motor switch.
	• Pump temperature too low	• Heat the vacuum pump to > 12°C.
	• Thermal protection switch has triggered	• Determine and eliminate the cause. • Allow the vacuum pump to cool down.
	• Pumping system contaminated	• Clean the vacuum pump. • Contact Pfeiffer Vacuum Service.
	• Pumping system damaged	• Clean and maintain the vacuum pump. • Contact Pfeiffer Vacuum Service.
	• Motor faulty	• Replace the motor.

Problem	Possible causes	Remedy
Vacuum pump switches off after a while after being started	• Thermal protection switch of the motor has triggered	• Determine and eliminate the cause of overheating. • Allow the motor to cool down.
	• Mains fuse triggered due to overload (e.g. cold start)	• Bring vacuum pump to permissible ambient temperature range.
	• Exhaust pressure too high	• Check exhaust line outlet opening and exhaust side accessories.
Vacuum pump does not reach the specified final pressure	• Measurement result distorted	• Check the measurement instrument. • Check the final pressure without system connected.
	• Vacuum pump or connected accessory contaminated	• Clean the vacuum pump. • Check the components for contamination.
	• Operating fluid contaminated	• Operate the vacuum pump for an extended period of time with gas ballast valve open, or change the operating fluid.
	• Operating fluid level too low	• Top up the operating fluid.
	• Leak in system	• Locate and eliminate the leak.
	• Vacuum pump is damaged	• Contact Pfeiffer Vacuum Service.
Pumping speed of vacuum pump too low	• The intake line is not suitably dimensioned	• Make sure that connections are short and cross sections adequately dimensioned.
	• Exhaust pressure too high	• Check exhaust line outlet opening and exhaust side accessories.
Loss of operating fluid	• Casing seal is leaking	• Check and replace the seal.
	• Radial shaft seal ring (RSSR) leaking – not applicable to vacuum pumps with magnetic coupling	• Check and replace the RSSR • Check and replace the associated bushing also.
	• Operational operating fluid loss – no oil mist filter	• Install ONF/OME.
Unusual noises during operation	• Noise reduction is contaminated	• Clean the noise reduction or replace it.
	• Pumping system is contaminated or damaged	• Clean and maintain the vacuum pump. • Contact Pfeiffer Vacuum Service.
	• Motor bearing is faulty	• Change the motor. • Contact Pfeiffer Vacuum Service.

Tbl. 7: Troubleshooting for rotary vane pumps

11 Service solutions by Pfeiffer Vacuum

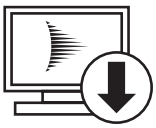
We offer first-class service
High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

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.

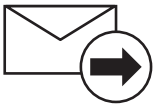
You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.
For fast and smooth service process handling, we recommend the following:



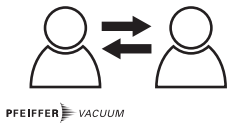
1. Download the up-to-date form templates.
   - Explanations of service requests
   - Service requests
   - Contamination declaration

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.

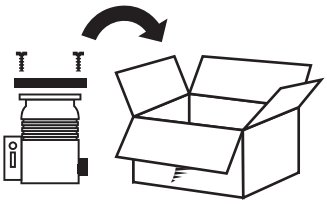


3. Send the forms by email, fax, or post to your local Service Center.

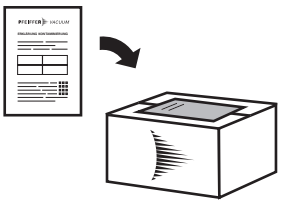


4. You will receive an acknowledgment from Pfeiffer Vacuum.

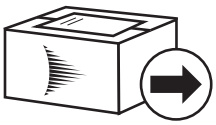
Submission of contaminated products
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree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



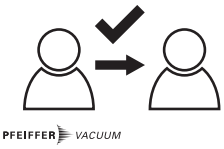
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
a) Neutralize the product with nitrogen or dry air.
b) Seal all openings with blind flanges, so that they are airtight.
c) Shrink-wrap the product in suitable protective foil.
d) Package the product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



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



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



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

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

12 Spare parts

12.1 Ordering spare part packages

Ordering spare parts

- ► Have the part number to hand, along with other details from the rating plate as required.
- ► Install original spare parts only.

Spare part package	Pump version	Order number
Maintenance kit 1 – maintenance level 1	Standard, M/MC version	PK E01 050 CT
Radial shaft seal ring set – maintenance level 2	Standard	PK E06 100 CT
Maintenance kit 2 – maintenance level 2, extended[3)]	Standard	PK E01 040 CT
Maintenance kit 2 – maintenance level 2, extended[4)]	M/MC version	PK E01 041 CT
Overhaul kit – maintenance level 3	Standard	PK E02 040 CT
	M version	PK E02 041 CT
	MC version	PK E02 054 -T
Set of vanes	Standard, M version	PK E08 030 -T
	MC version	PK E08 034 -T
Coupling set	M version	PK E06 011 -T
	MC version	PK E06 012 -T

Tbl. 8: Spare part packages

12.2 Maintenance kit 1 – maintenance level 1

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

12.3 Radial shaft seal ring set – Maintenance level 2

The radial shaft seal ring set contains all parts for changing the seal ring and operating fluid:

- RSSR, coupling and felt ring
- Seals for changing the operating fluid
- Wear parts of the gas ballast valve

12.4 Maintenance kit 2 – Maintenance level 2, extended

Maintenance kit 2 contains all **relevant wear parts**, that have to be replaced after dismantling and cleaning the vacuum pump:

- Set of seals
- Wear parts of the gas ballast valve
- RSSR, coupling and felt ring
- Valves and vane springs

12.5 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:

3) including radial shaft seal ring

4) without radial shaft seal ring

- 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

12.6 Set of vanes

The set of vanes contains:

- Vane
- Vane springs

12.7 Coupling set for versions with magnetic coupling

The coupling set contains:

- Both coupling halves
- Containment shell with O-ring

13 Accessories

View the range of accessories for rotary vane pumps on our website.

13.1 Accessory information

Condensate separator
Protects the pump from liquids from inlet line or backflow from exhaust line

Oil mist filter
Prevents emission of oil mist

Oil return
Returns separated operating fluid from the oil mist separator to the rotary vane pump

Dust separator
Protects the pump against particles from the processes

Zeolite trap
Prevents operating fluid backflow on the intake side

Process monitoring unit
Monitors operating fluid level/temperature and exhaust pressure

Gas ballast valve - conversion kit with hose nozzle
Enables connection of inert gas

Gas ballast valve with solenoid valve
For replacing a standard gas ballast valve

13.2 Ordering accessories

Description	Order no.	
	Standard | M version	MC version
KAS 16, Condensate separator	PK Z10 003	-
OME 16 S, oil mist separator	PK Z40 000	-
OME 16 M, oil mist separator	PK Z40 003	-
OME 16 C, oil mist separator	-	PK Z40 400
Oil return unit from OME 16 S/16 C	PK 005 986 -T	PK 005 986 -T
Oil return unit from OME 16 M	PK 006 080 -T	-
ZFO 16, Zeolite Trap	PK Z70 003	-
SAS 16, dust separator	PK Z60 506	-
Operations monitoring unit 1	PK 196 148 -T	PK 196 148 -T
Operations monitoring unit 2	PK 196 147 -T	PK 196 147 -T
Operations monitoring unit 3	PK 196 146 -T	PK 196 146 -T
Mains cable, 230 V, with safety plug, right angle, Euro C13 socket	PK 050 109	PK 050 109
Mains cable, 115 V, with NEMA plug to Euro C13 socket (angled)	PK 050 110	PK 050 110
Mains cable, 115/230 V, without plug, IEC 320/C13 Socket (Right Angle)	PK 050 111	PK 050 111
Gas ballast valve with dosing spindle and Inert gas connection	PK 195 666 -U	-

Description	Order no.	
	Standard | M version	MC version
Gas ballast valve with solenoid valve, 24 V DC	PK 194 343 -U	PK 194 343 -U
Blank flange, gas ballast valve	PK 007 002 -T	PK 007 002 -T

Tbl. 9: Accessories

Description	Order no.
P3, mineral oil, 0.5 l	PK 001 136 -T
P3, mineral oil, 1 l	PK 001 106 -T
F4, Perfluoropolyether, 0.25 l	PK 005 885 -T
F4, Perfluoropolyether, 0.5 l	PK 005 886 -T

Tbl. 10: 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 Pa = 1 N/m^2						

Tbl. 11: Conversion table: Pressure units

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

Tbl. 12: Conversion table: Units for gas throughput

14.2 Substances in contact with media

Pump parts	Substances in contact with media		
	Standard	M version	MC version
Housing	Aluminum	Aluminum	Aluminum
Inlet/exhaust flange	Stainless steel	Stainless steel	Stainless steel
Sight glass	Float glass	Float glass	Float glass
Stator/stator flange	Cast iron	Cast iron	Cast iron
Rotor	Cast iron (nodular graphite cast iron)	Cast iron (nodular graphite cast iron)	Cast iron (nodular graphite cast iron)
Coupling system	Steel	-	-
Magnetic coupling	-	Steel, nickel-coated magnets	Steel, nickel-coated magnets
Vane	Artificial resin compound, polymer	Artificial resin compound, polymer	Composite material, polymer
Exhaust valve	Stainless steel	Stainless steel	Stainless steel
Vacuum safety valve	Aluminum, FKM, steel	Aluminum, FKM, steel	Aluminum, FKM, steel
Screws	Galvanized steel, stainless steel	Galvanized steel, stainless steel	Galvanized steel, stainless steel
Seals	FKM	FKM	FKM

Pump parts	Substances in contact with media		
	Standard	M version	MC version
Radial shaft seal ring (RSSR)	FKM	-	-
Containment shell	-	Synthetic	Synthetic

Tbl. 13: Materials that make contact with the process media

14.3 Technical data

Type designation	Duo 3	Duo 3	Duo 3	Duo 3	Duo 3
Part number	PK D570 010 A0	PK D570 010 A0	PK D570 010 B0	PK D570 010 B0	PK D570 010 C0
Connection flange (in)	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF
Connection flange (out)	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF
Pumping speed at 50 Hz	2.5 m³/h	2.5 m³/h	2.5 m³/h	2.5 m³/h	2.5 m³/h
Pumping speed at 60 Hz	2.9 m³/h	2.9 m³/h	2.9 m³/h	2.9 m³/h	2.9 m³/h
Final pressure with gas ballast	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa
Final pressure	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa
Gas ballast pressure	1500 hPa	1500 hPa	1500 hPa	1500 hPa	1500 hPa
Gas ballast flow	540 l/h	540 l/h	540 l/h	540 l/h	540 l/h
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, max.	1500 hPa	1500 hPa	1500 hPa	1500 hPa	1500 hPa
Leakage rate safety valve	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s
Water vapor capacity 50 Hz	115 g/h	115 g/h	115 g/h	115 g/h	115 g/h
Water vapor capacity 60 Hz	175 g/h	175 g/h	175 g/h	175 g/h	175 g/h
Water vapor tolerance at 50 Hz	65 hPa	65 hPa	65 hPa	65 hPa	65 hPa
Water vapor tolerance at 60 Hz	80 hPa	80 hPa	80 hPa	80 hPa	80 hPa
Emission sound pressure level without gas ballast at 50 Hz	50 dB(A)	50 dB(A)	50 dB(A)	50 dB(A)	50 dB(A)
Emission sound pressure level without gas ballast at 60 Hz	54 dB(A)	54 dB(A)	54 dB(A)	54 dB(A)	54 dB(A)
Motor protection	Bimetal	Bimetal	Bimetal	Bimetal	Bimetal
Motor type	1-phase motor	1-phase motor	1-phase motor	1-phase motor	1-phase motor
Input voltage 50 Hz	230 V	230 – 240 V	115 V	115 V	100 – 115 / 200 – 230 V
Input voltage 60 Hz	230 V	230 – 240 V	115 V	115 V	100 – 115 / 200 – 230 V
Input voltage: tolerance	±10 %	±10 %	±10 %	±10 %	±5 %
Rotation speed at 50 Hz	3000 rpm	3000 rpm	3000 rpm	3000 rpm	3000 rpm
Rotation speed at 60 Hz	3600 rpm	3600 rpm	3600 rpm	3600 rpm	3600 rpm
Rated power 50 Hz	0.15 kW	0.15 kW	0.15 kW	0.15 kW	0.15 kW

Type designation	Duo 3	Duo 3	Duo 3	Duo 3	Duo 3
Rated power 60 Hz	0.18 kW	0.18 kW	0.18 kW	0.18 kW	0.18 kW
Recommended on-site electric fuse protection	4 A	4 A	6 A	6 A	6 A
Mains cable	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box
Cooling method	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)
Continuous gas input temperature, max.	40 °C	40 °C	40 °C	40 °C	40 °C
Ambient temperature	12 – 40 °C	12 – 40 °C	12 – 40 °C	12 – 40 °C	12 – 40 °C
Temperature: Shipping	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C
Protection degree	IP40	IP40	IP40	IP40	IP40
Operating fluid	P3	P3	P3	P3	P3
Operating fluid amount	0.4 l	0.4 l	0.4 l	0.4 l	0.4 l
Weight	10.5 kg	10.5 kg	10.5 kg	10.5 kg	10.5 kg
Certification	–	–	–	–	–

Tbl. 14: Technical data, Duo 3

Type designation	Duo 3 M	Duo 3 M	Duo 3 M	Duo 3 M	Duo 3
Part number	PK D571 010 A0	PK D571 010 A0	PK D571 010 B0	PK D571 010 B0	PK D571 010 C0
Connection flange (in)	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF
Connection flange (out)	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF	DN 16 ISO-KF
Pumping speed at 50 Hz	2.5 m³/h	2.5 m³/h	2.5 m³/h	2.5 m³/h	2.5 m³/h
Pumping speed at 60 Hz	2.9 m³/h	2.9 m³/h	2.9 m³/h	2.9 m³/h	2.9 m³/h
Final pressure with gas ballast	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa	$3 \cdot 10^{-2}$ hPa
Final pressure	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa	$3 \cdot 10^{-3}$ hPa
Gas ballast pressure	1500 hPa	1500 hPa	1500 hPa	1500 hPa	1500 hPa
Gas ballast flow	540 l/h	540 l/h	540 l/h	540 l/h	540 l/h
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, max.	1500 hPa	1500 hPa	1500 hPa	1500 hPa	1500 hPa
Leakage rate safety valve	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s	$1 \cdot 10^{-5}$ Pa m³/s
Water vapor capacity 50 Hz	115 g/h	115 g/h	115 g/h	115 g/h	115 g/h
Water vapor capacity 60 Hz	175 g/h	175 g/h	175 g/h	175 g/h	175 g/h
Water vapor tolerance at 50 Hz	65 hPa	65 hPa	65 hPa	65 hPa	65 hPa
Water vapor tolerance at 60 Hz	80 hPa	80 hPa	80 hPa	80 hPa	80 hPa
Emission sound pressure level without gas ballast at 60 Hz	54 dB(A)	54 dB(A)	54 dB(A)	54 dB(A)	54 dB(A)
Motor protection	Bimetal	Bimetal	Bimetal	Bimetal	Bimetal
Motor type	1-phase motor	1-phase motor	1-phase motor	1-phase motor	1-phase motor
Input voltage 50 Hz	230 V	230 V	115 V	115 V	100 – 115 / 200 – 230 V

Type designation	Duo 3 M	Duo 3 M	Duo 3 M	Duo 3 M	Duo 3
Input voltage 60 Hz	240 V	230 V	115 V	115 V	100 – 115 / 200 – 230 V
Input voltage: tolerance	±10 %	±10 %	±10 %	±10 %	±5 %
Rotation speed at 50 Hz	3000 rpm	3000 rpm	3000 rpm	3000 rpm	3000 rpm
Rotation speed at 60 Hz	3600 rpm	3600 rpm	3600 rpm	3600 rpm	3600 rpm
Rated power 50 Hz	0.15 kW	0.15 kW	0.15 kW	0.15 kW	0.15 kW
Rated power 60 Hz	0.18 kW	0.18 kW	0.18 kW	0.18 kW	0.18 kW
Recommended on-site electric fuse protection	4 A	4 A	6 A	6 A	6 / 4 A
Mains cable	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box	No, C14-plug inside the terminal box
Cooling method	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)
Continuous gas input temperature, max.	40 °C	40 °C	40 °C	40 °C	40 °C
Ambient temperature	12 – 40 °C	12 – 40 °C	12 – 40 °C	12 – 40 °C	12 – 40 °C
Temperature: Shipping	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C
Protection degree	IP40	IP40	IP40	IP40	IP40
Operating fluid	P3	P3	P3	P3	P3
Operating fluid amount	0.4 l	0.4 l	0.4 l	0.4 l	0.4 l
Weight	11.5 kg	11.5 kg	11.5 kg	11.5 kg	11.5 kg
Certification	–	–	–	–	–

Tbl. 15: Technical data, Duo 3 M

Type designation	Duo 3 MC
Part number	PK D573 A10 C0
Connection flange (in)	DN 16 ISO-KF
Connection flange (out)	DN 16 ISO-KF
Pumping speed at 50 Hz	2.5 m³/h
Pumping speed at 60 Hz	2.9 m³/h
Final pressure with gas ballast	$5 \cdot 10^{-2}$ hPa
Final pressure	$6 \cdot 10^{-3}$ hPa
Gas ballast pressure	1500 hPa
Gas ballast flow	540 l/h
Exhaust pressure, min.	250 hPa
Exhaust pressure, max.	1500 hPa
Leakage rate safety valve	$1 \cdot 10^{-5}$ Pa m³/s
Emission sound pressure level without gas ballast at 50 Hz	50 dB(A)
Emission sound pressure level without gas ballast at 60 Hz	54 dB(A)
Motor protection	Bimetal
Motor type	1-phase motor
Input voltage 50 Hz	100 – 115 / 200 – 230 V
Input voltage 60 Hz	100 – 115 / 200 – 230 V
Input voltage: tolerance	±5 %
Rotation speed at 50 Hz	3000 rpm

Type designation	Duo 3 MC
Rotation speed at 60 Hz	3600 rpm
Rated power 50 Hz	0.15 kW
Rated power 60 Hz	0.18 kW
Recommended on-site electric fuse protection	6 / 4 A
Mains cable	No, C14-plug inside the terminal box
Cooling method	Air (Forced convection)
Continuous gas input temperature, max.	40 °C
Ambient temperature	12 – 40 °C
Temperature: Shipping	-25 – 55 °C
Protection degree	IP40
Operating fluid	F4
Operating fluid amount	0.4 l
Weight	12.7 kg
Certification	CE, cTUVus certified according to UL / CSA 61010-1

Tbl. 16: Technical data, Duo 3 MC

14.4 Dimensions

14.4.1 Standard version

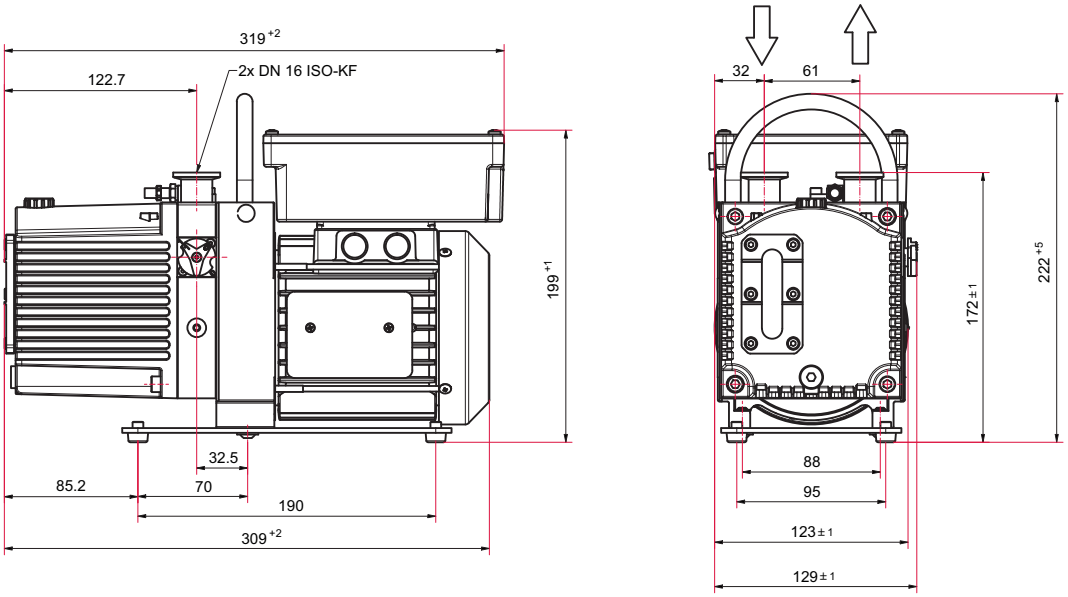


Fig. 18: Dimensions Duo 3

Dimensions in mm

14.4.2 M version

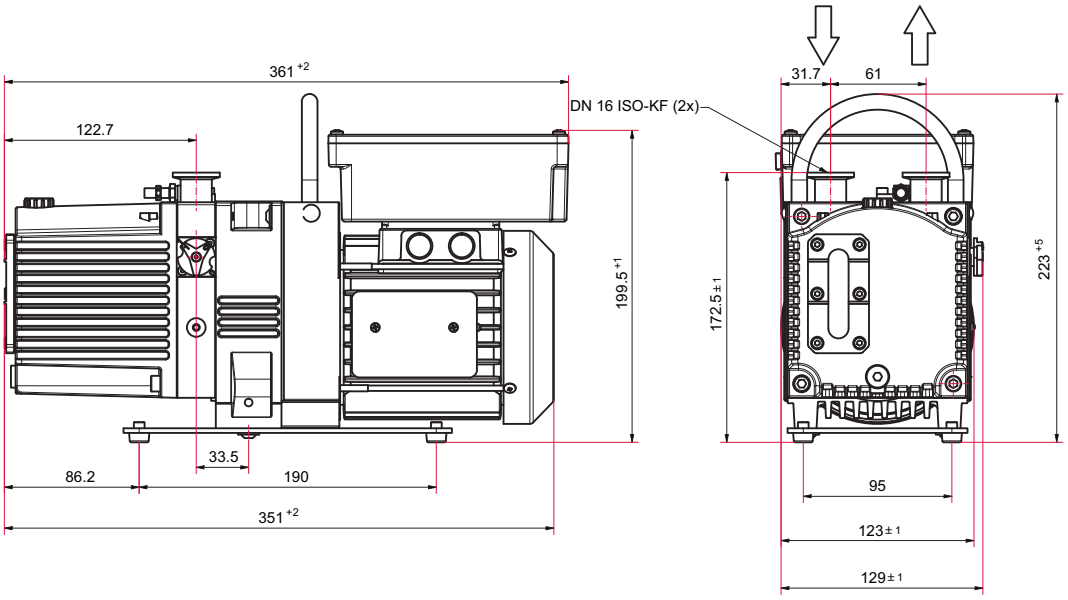


Fig. 19: Dimensions Duo 3 M
Dimensions in mm

14.4.3 MC version

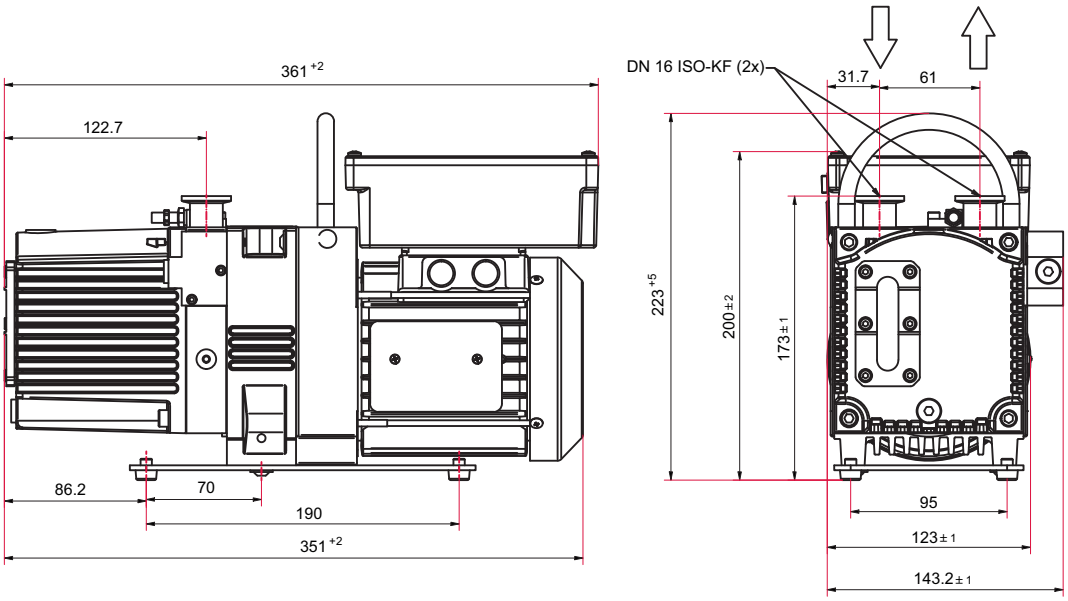


Fig. 20: Dimensions Duo 3 MC
Dimensions in mm

EC Declaration of Conformity

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

Declaration for product(s) of the type:

Rotary vane pump

Duo 3

Duo 3 M

Duo 3 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 61010-1:2020
DIN EN 1012-2: 2011	DIN EN IEC 61000-6-2:2019
DIN EN ISO 13857:2020	DIN EN IEC 61000-6-4:2020
DIN ISO 21360-1:2016	DIN EN ISO 2151:2009
ISO 21360-2:2020	DIN EN IEC 63000:2019

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

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Asslar, 2023-05-25

CE

PFEIFFER VACUUM

UK Declaration of Conformity

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

Declaration for product(s) of the type:

Rotary vane pump

Duo 3

Duo 3 M

Duo 3 MC

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

Supply of Machinery (Safety) Regulations 2008

Electromagnetic Compatibility Regulations 2016

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

Applied standards and specifications:

EN ISO 12100:2010	EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019
EN 1012-2:1996+A1:2009	EN IEC 61000-6-2:2019
EN ISO 13857:2019	EN IEC 61000-6-4:2019
ISO 21360-1:2020	EN ISO 2151:2:2008
ISO 21360-2:2020	EN IEC 63000:2018

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

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Asslar, 2023-05-30

UK CA

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