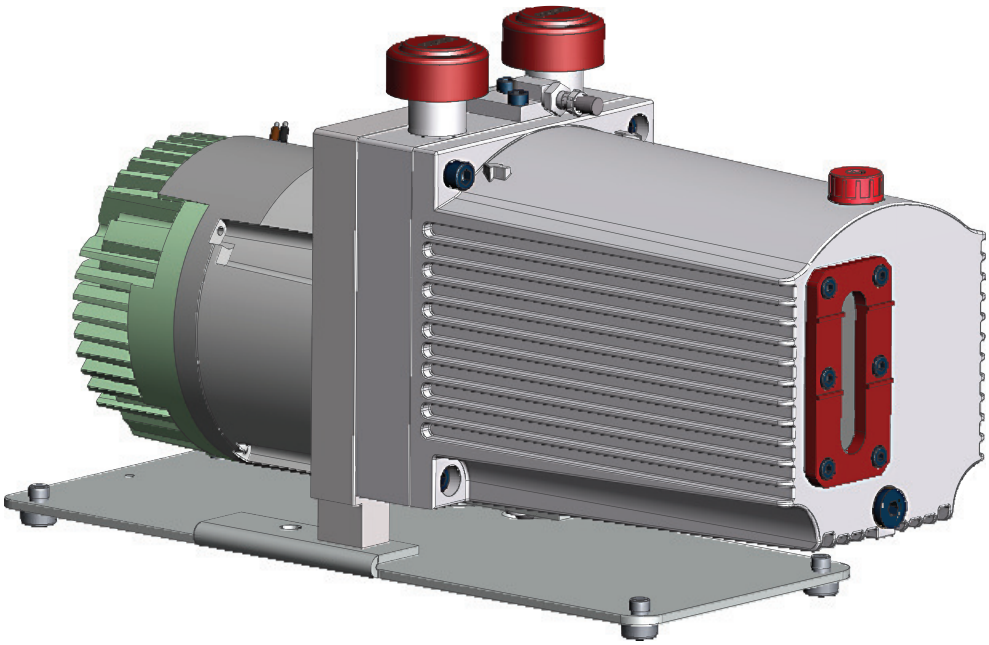


OPERATING INSTRUCTIONS

EN

Translation of the Original

DUO 11 DC

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

Table of contents

1 About this manual

IMPORTANT

Read carefully before use.

Keep the manual for future consultation.

1.1 Validity

These operating instructions are for customers of Pfeiffer Vacuum. They describe the function of the designated product and provide the most important information for safe usage of the product. The descriptions comply with applicable directives. All information provided in these operating instructions refer to the current development status of the product. The documentation remains valid as long as the customer does not modify the product in any way.

1.2 Applicable documents

Designation	Document
Declaration of conformity	A component of these instructions

1.3 Target group

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

- transport,
- 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.

1.4 Conventions

1.4.1 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. ...

1.4.2 Pictographs

Pictographs used in the document indicate useful information.

Note

Tip

1.4.3 Stickers on the product

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

PFEIFFER VACUUM D-35641 Asslar Mod.: DUO 11 DC Mod.-Nr.: PK D59 XXX Ser.- Nr.: 0014440 $S_{(N_2)}$: max. 9 m³/h Oil : Inland 45 0.5 l Mass : 9 kg $n_{max.}$: 3000 1/min Made in Germany 2018/01 CE	**Rating plate** (example) The rating plate is located on the front right side next to the sight glass.
Vor Inbetriebnahme Pumpe mit Öl füllen Fill the pump with oil before putting into operation Remplir la pompe d'huile avant la mise en route	**Sticker (red)** Fill pump with operating fluid prior to commissioning
	Warning hot surface This sticker warns of injuries caused by high temperatures in case of touching without protection during operation.
warranty seal PFEIFFER VACUUM	**Closure seal** The product is sealed ex-factory. Damaging or removing a closure seal results in loss of the warranty.

Tbl. 1: Stickers on the product

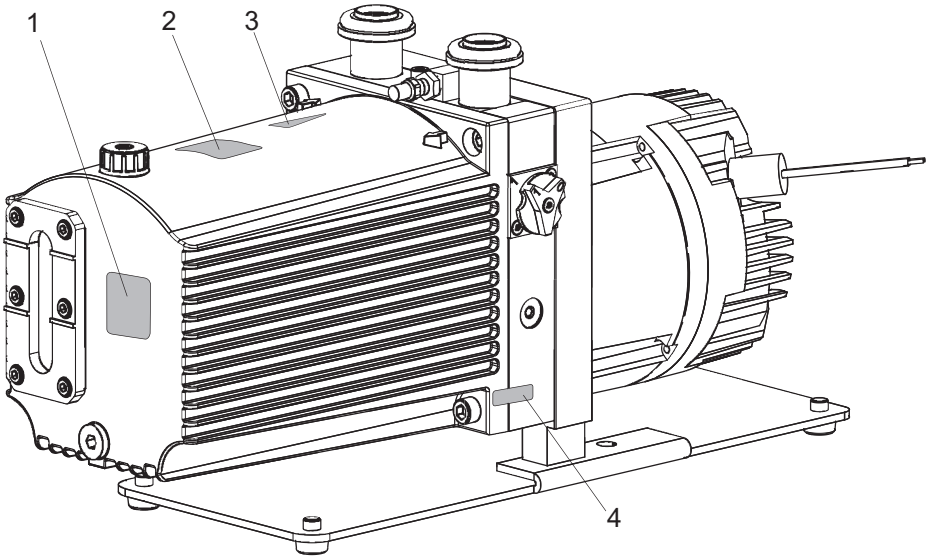


Fig. 1: Position of the labels on the product

1 Rating plate
2 Sticker: Fill pump with operating fluid prior to commissioning
3 Warning notice: hot surface
4 Closure seal

1.4.4 Abbreviations

Abbreviation	Explanation
DC version	Direct Current
M version	Version with magnetic coupling
OME	Oil mist filter (Oil Mist Eliminator)
ODK	Operating fluid return line (Oil Drain Kit)
RSSR	Radial shaft seal ring
WAF	width across flats

Tbl. 2: Abbreviations used in this document

2 Safety

2.1 General safety instructions

This document includes the following four risk levels and one information level.

⚠ DANGER

Imminent danger

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

► Instructions on avoiding the hazardous situation

⚠ WARNING

Possibly imminent danger

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

► Instructions on avoiding the hazardous situation

⚠ CAUTION

Possibly imminent danger

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

► Instructions on avoiding the hazardous situation

NOTICE

Danger of property damage

Notice is used to address practices not related to physical injury.

► Instructions on avoiding property damage

Notes, tips or examples indicate important information on the product or on 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

⚠ 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.

⚠ 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.

Risks during operation

⚠ WARNING

Danger of poisoning due to emission of toxic process gases from the exhaust

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ► Observe the relevant regulations for handling toxic substances.
- ► Safely purge toxic process gases via an exhaust line.
- ► Use suitable filter equipment to separate toxic substances.

⚠ CAUTION

Risk of injury from bursting due to high pressure in the exhaust line

Faulty or insufficient exhaust lines cause hazardous situations, e.g. increase in exhaust pressure. There is a risk of bursting. It is not possible to rule out the risk of injuries due to broken pieces flying around, high escaping pressure and damage to the equipment.

- ► Lay the exhaust line without shut-off units.
- ► Observe the permissible pressures and pressure differentials of the product.
- ► Check the exhaust line regularly for correct function.

⚠ 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.

- ► Provide suitable touch protection.

⚠ 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.

Risks during maintenance, decommissioning and in event of 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.

⚠ 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.

⚠ 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.

⚠ CAUTION

Scalding from hot operating fluid

Danger of burns when draining operating fluid in case of skin contact.

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

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

⚠ CAUTION

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 working on it.
- ► Wear personal protective equipment if necessary.

2.3 Safety precautions

Duty to provide information on potential dangers

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

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

Infringement of conformity due to modifications to the product

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

- Following installation into a system, the operator is required to check and re-evaluate as necessary 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 Product usage limits

Parameter	DuoLine
Ambient temperature	-20 °C to +40 °C
Pumped medium intake temperature, max.	+40 °C

Tbl. 3: Usage limits of the vacuum pump

2.6 Proper use

Procedure

- ► 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. Improper use is any, even unintended, use, which is contrary to the product purpose; and in particular:

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

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

3 Product description

3.1 Identifying the product

Procedure

- ► To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.
- ► Note motor-specific data on the separately attached mototr rating plate.
- ► Learn about certifications through test seals on the product or at www.tuvdotcom.com with company ID no. 000021320.

3.2 Shipment

- Vacuum pump with motor
- Operating fluid Inland 45
- Cone sieve with centering ring and O-ring for both connection flanges
- Locking caps for both connection flanges
- Operating instructions

3.3 Function

DuoLine rotary vane vacuum pumps™ are two-stage oil-sealed rotary positive displacement pumps for use in coarse and medium vacuum. The vacuum pumps are equipped with a safety valve that vacuum seals the vacuum chamber and simultaneously vents the vacuum pump when the pump is at a standstill. The rotary vane 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.

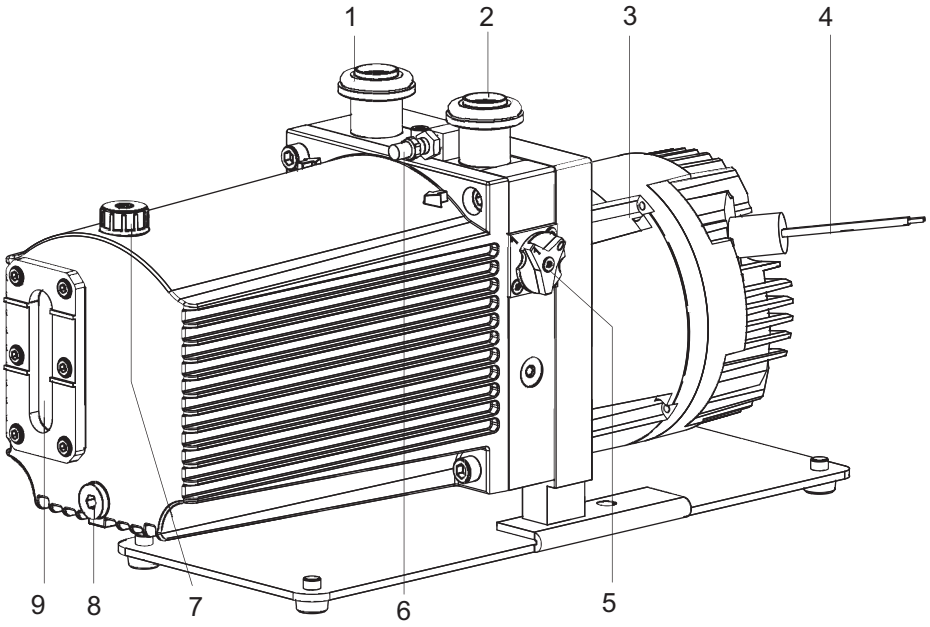


Fig. 2: Structure of the rotary vane vacuum pump

1	Vacuum flange	6	Connection for the operating fluid return
2	Exhaust flange	7	Filling screw for operating fluid
3	DC motor	8	Drain screw for operating fluid
4	24 V/DC supply voltage connecting cable	9	Sight glass
5	Gas ballast valve		

3.4 Operating principle

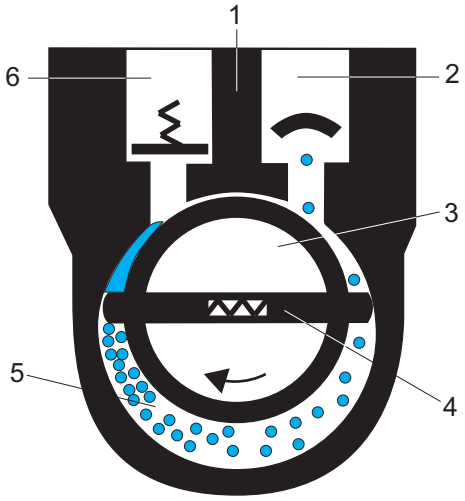


Fig. 3: UnoLine and DuoLine operating principle

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

The rotary vane pump is an oil-sealed rotary displacement pump. The pumping system is made up of the housing, the eccentrically mounted rotor, and the centrifugally- and spring-loaded radially sliding vanes, which divide the suction chamber into multiple chambers. The volume of each chamber changes periodically as the rotor rotates. This causes the gas to be drawn in at the vacuum flange, and compressed in the suction chamber by the rotation of the rotor until the exhaust valve opens against the atmospheric pressure at the outlet and expels the gas. The exhaust valve is oil-sealed. When the valve opens, a small quantity of oil penetrates into the suction chamber. In addition to lubrication, this also causes the gaps between the rotor, stator, and vanes to seal.

Vacuum safety valve

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

Gas ballast valve

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

Operating fluid, oil

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

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

4 Transportation and Storage

4.1 Transporting the vacuum pump

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

⚠ 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.

Instructions for safe transport

1. Observe the weight specified on packaging.
   – Use a transport aid if necessary (trolley, lift truck).
2. Transport the product in its original packaging.

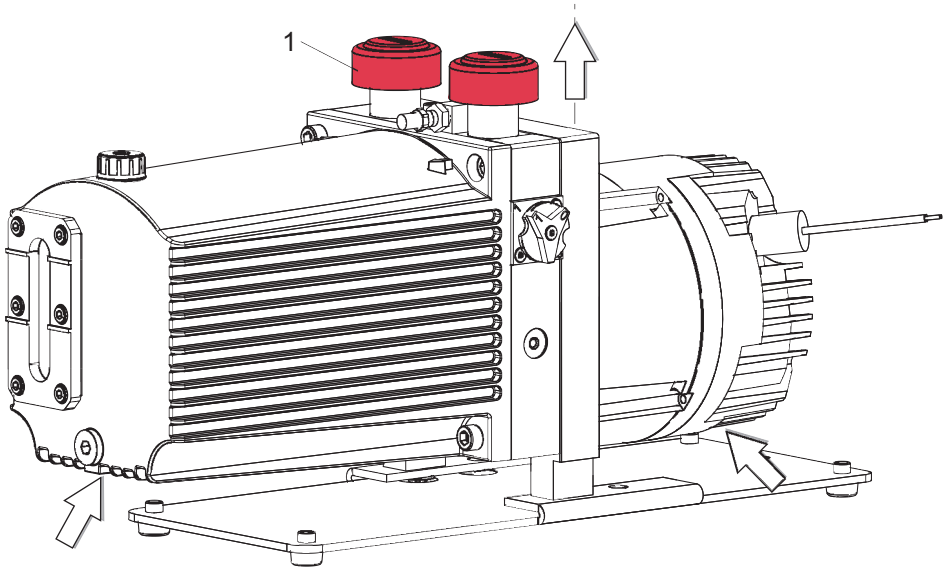


Fig. 4: Lifting and transporting the vacuum pump

1 Protective cap

Transport without packaging

1. Unpack the vacuum pump.
2. To protect the inside of the pump, leave both protective covers on the connection flanges during the transport phase.
3. Lift the vacuum pump out of the transport packaging by hand.

4.2 Storing the vacuum pump

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

Procedure

1. Fill the vacuum pump with operating fluid up to the upper edge of the sight glass.
2. Close both connection flanges and all openings on the vacuum pump.

3. Make sure that the gas ballast valve is closed.
4. Store the vacuum pump only in dry, dust-free rooms, within the specified ambient conditions.
5. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
6. Change the operating fluid if the storage period is longer than 2 years.

5 Installation

5.1 Installing the vacuum pump

Installation location	• Indoors, protected from dust deposits • Outdoors, protected from direct weather influences
Installation altitude	max. 2000 m
Orientation	as level as possible; max. permissible angle of inclination: ±10°
Ambient temperature	-20 °C to +40 °C
Relative air humidity	max. 85%

Tbl. 4: Ambient conditions

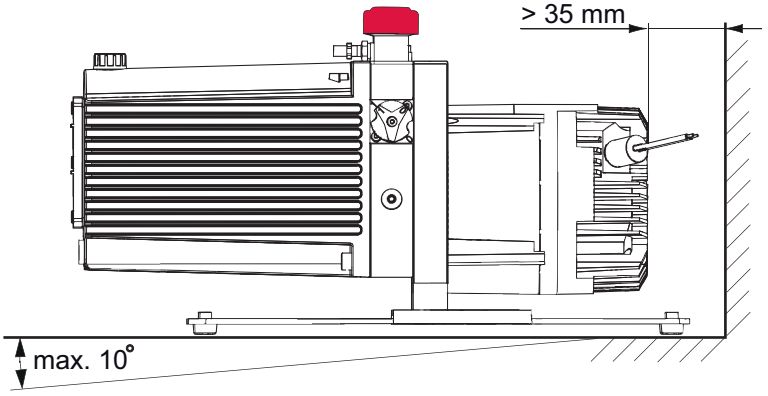


Fig. 5: Minimum distances and permissible inclination

Notes on installing the vacuum pump

1. Fill with operating fluid prior to first commissioning.
   – Quantity and type according to rating plate.
2. Place the vacuum pump on a flat, horizontal surface, to safeguard the operating fluid supply.
3. Screw the base plate of the vacuum pump to the mounting surface if necessary.
4. When installing the pump in a closed housing, ensure adequate air circulation.
5. Keep the sight glass and gas ballast valve visible and freely accessible.
6. Keep the voltage and frequency specifications on the motor rating plate visible and freely accessible.

5.2 Connecting the vacuum side

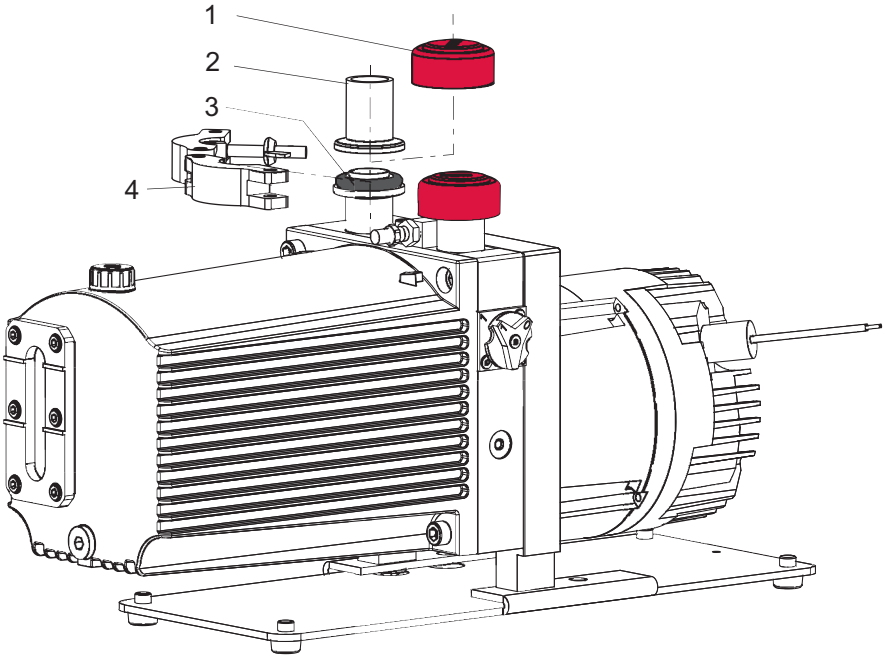


Fig. 6: Vacuum connection with flange connection

1	Protective cap	3	Cone sieve with O-ring
2	Intake line	4	Circlip

Before establishing the flange connection, make sure that the cone sieve and centering ring are in the intake duct.

1. Remove the protective cap from the vacuum flange.
2. Make sure that the cone sieve and centering ring are in the vacuum flange.
3. Establish the shortest possible connection between the vacuum pump and vacuum chamber; equivalent to the nominal flange diameter as a minimum.
4. Depending on the pump type, use metallic hoses or PVC hoses with flange connections.
5. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
6. Connect both flanges with a circlip (DN 16 ISO-KF).
7. Protect the vacuum pump from sucking in impurities through suitable measures.
8. Use a separator or filter from the Pfeiffer Vacuum line of accessories if necessary.

5.3 Connecting the exhaust side

⚠ WARNING

Danger of poisoning due to emission of toxic process gases from the exhaust

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ► Observe the relevant regulations for handling toxic substances.
- ► Safely purge toxic process gases via an exhaust line.
- ► Use suitable filter equipment to separate toxic substances.

⚠ CAUTION

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

Faulty or short exhaust lines cause hazardous situations, e.g. exhaust pressure increase. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

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

NOTICE

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

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

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

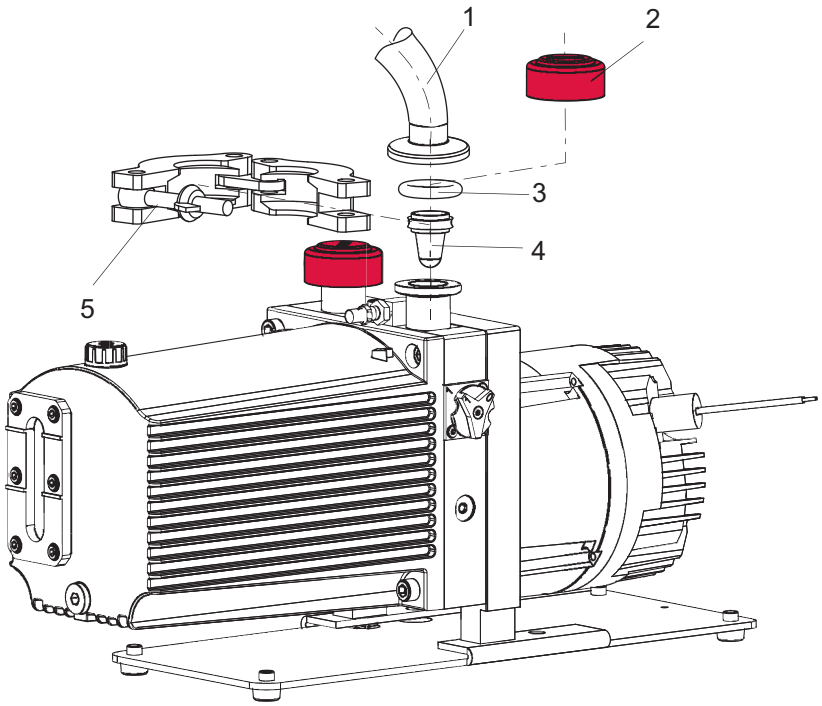


Fig. 7: Exhaust connection with flange connection

1	Exhaust line	4	Centering ring with cone sieve
2	Protective cap	5	Circlip
3	O-ring		

Connecting the exhaust side

1. Remove the protective cap from the exhaust flange.
2. Be careful with the cone sieve and O-ring.
3. Choose a minimum exhaust line cross section equal to the nominal diameter of the connection flange.
4. Depending on the pump type, use metallic hoses or PVC hoses with flange connections.
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 suitable circlip.

1. Install a condensate separator in the exhaust line if necessary, in order to prevent condensate return.
2. Use the lowest exhaust line point for the condensate drain.

5.3.1 Install OME 16 S

With a high gas throughput, Pfeiffer Vacuum recommends the optional use of an oil mist filter (OME 16 S). It prevents oil mist from escaping at the exhaust and collects the oil separated in the housing of the separator.

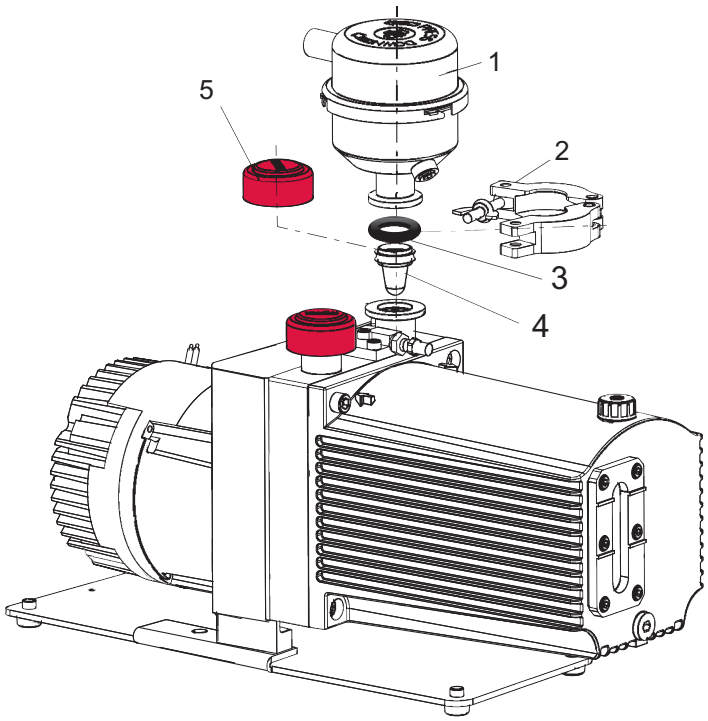


Fig. 8: Install OME 16 S on the exhaust flange

1	OME 16 S	4	Centering ring with cone sieve
2	Circlip	5	Protective cap
3	O-ring		

Install OME 16 S

1. Switch off the vacuum pump.
2. Allow the vacuum pump to cool down.
3. Install the OME 16 S on the exhaust side of the vacuum pump.
4. Connect both flanges using a circlip (DN 16 ISO-KF) and at the same time, observe the correct fit of the O-ring.

5.3.2 Install ODK

The installation of an operating fluid return line (OKD) between the OME and the vacuum pump that returns the separated oil to the vacuum pump via a hose is optional.

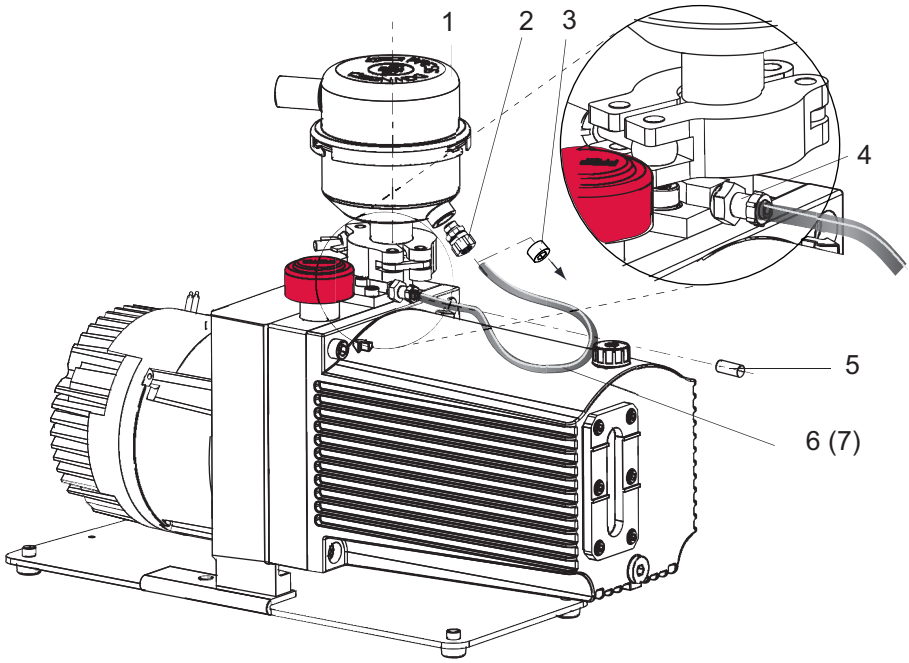


Fig. 9: Install the ODK to OME 16 S

1	OME 16 S	5	Locking cap
2	Coupling I	6	Operating fluid return hose
3	Locking screw	7	Spiral spring
4	Coupling II		

Required tools

- Allan key (included in the OME 16 S shipment)
- Open-end wrench, 12 WAF
- Open-end wrench, 13 WAF

Install ODK

1. Place a collection receptacle below the drain hole of the OME.
2. Unscrew the locking screw on the **OME** and drain the operating fluid present.
3. Screw in coupling I instead of the locking screw.
4. Be careful with the sealing ring.
5. Loosen coupling II and take off the locking cap.
6. Guide the spiral spring into the operating fluid return hose.
   – The spiral spring serves as an anti-kink device.
7. Mount the operating fluid return hose on both sides.
8. Route the hose as short and kink-free as possible.
9. Screw the lock nut of both couplings tight.

5.4 Connecting the voltage supply

NOTICE

Property damage due to incorrect polarity

Incorrect or excessive supply voltage will destroy the motor.

- ► Always observe the motor rating plate specifications.
- ► When connecting the supply cable, observe the colored marking on the corresponding strands.
- ► Always provide a suitable mains fuse to protect the motor and supply cable in the event of a fault.

Connecting the DC motor

- ► Connect the +24 V DC voltage supply (in accordance with rating plate) to the corresponding strands.

Assignment	Strand color of the connecting lead
+24 V DC	black/white
GND (0 V)	brown/white

5.4.1 Motor protection

For pumps with magnetic coupling, the coupling does not provide overload protection!

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

Resetting the overload protection of the motor

If the vacuum pump blocks, the motor electronics switch off the motor automatically.

► Disconnect the motor from the mains for at least 30 seconds to reset the overload protection.

5.5 Filling the operating fluid

The operating fluid type intended for the vacuum pump and the respective filling quantity are indicated on the rating plate. Only the operating fluid used during initial installation is permissible.

⚠ 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

- Inland 45 (standard operating fluid)

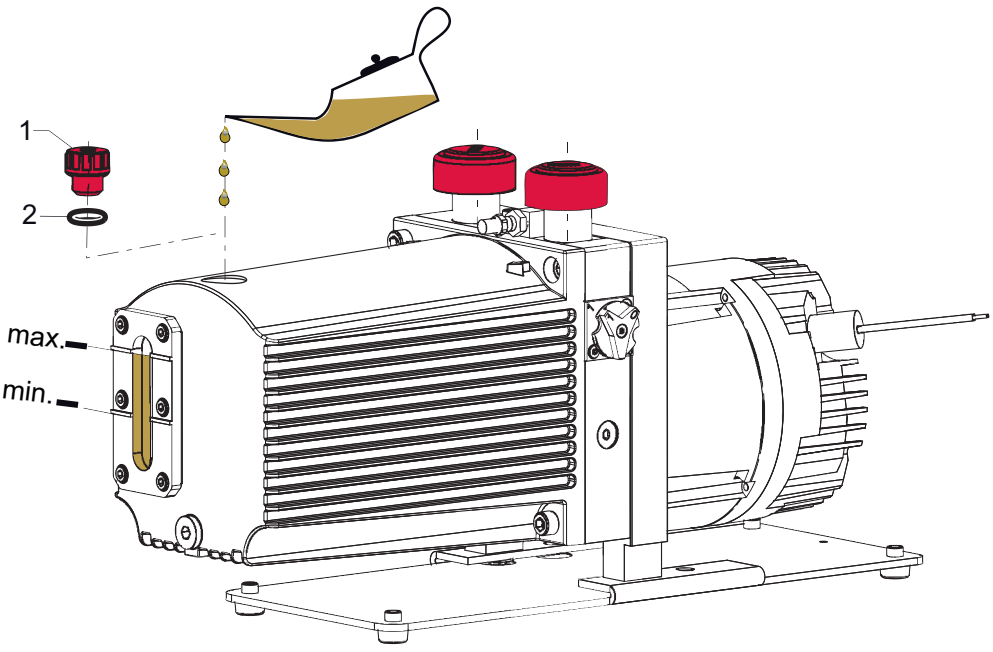
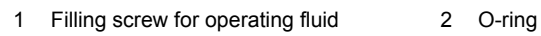


Fig. 10: Filling the operating fluid



1 Filling screw for operating fluid 2 O-ring

Consumable

- Operating fluid of the vacuum pump

Required tool

- Allen key, WAF 5 mm

Filling the operating fluid

1. Unscrew the operating fluid filler screw.
2. Refill the operating fluid:
   – Initial filling with cold vacuum pump: A maximum of 3/4 of the min./max. range.
3. Screw the operating fluid filler screw back in; take care of the O-ring in the process.
   – Tightening torque: **max. 0.3 Nm**

6 Operation

6.1 Putting the vacuum pump into operation

Before switching on

1. Check the operating fluid in the sight glass.
2. Compare the frequency specifications on the rating plate with the available supply voltage.
3. Adequately protect the vacuum pump from sucking in impurities through appropriate measures (e.g. dust filter).
4. Check the operating fluid regularly or change it more frequently.
5. Check the exhaust connection for free passage (max. permissible pressure: 1,500 hPa absolute).
6. Actuate the shut-off units so that the shut-off units open before or at the same time as the pump starts up.

6.2 Switching on the vacuum pump

The vacuum pump can be switched on in each pressure range, between atmospheric pressure and ultimate pressure. The optimal operating condition of the vacuum pump is achieved in continuous operation. Cycle mode is possible, however do not exceed 10 cycles per hour and the operating phase should always be longer than the downtime.

When pumping down dry gases, no special precautions are required. In order to achieve the lowest possible ultimate pressures, the gas ballast valve should be closed.

⚠ 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.

► Provide suitable touch protection.

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).

The vacuum pumps are equipped with an open-ended cable for connecting on-site.

1. Switch on the vacuum pump or apply voltage to the connecting cable.
2. Allow the vacuum pump to warm up prior to process start, with the vacuum flange closed, for approximately 30 minutes.
3. Check the operating fluid level with the vacuum pump running and at operating temperature.
   – The fill level must move within the marks on the sight glass edge during operation.
   – Check the operating fluid fill level daily during continuous operation or after every time the vacuum pump is switched on.
     – The fluid can be refilled during operation in the final vacuum.

6.3 Operating the rotary vane pump with gas ballast

NOTICE

Risk of damage from condensation in vacuum pump

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

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

Behavior of process gases with condensable vapors

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

6.3.1 Gas ballast valve (standard version)

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

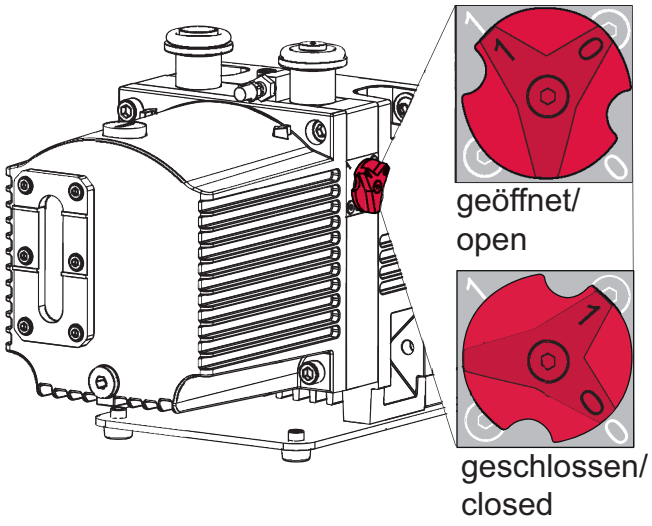


Fig. 11: Gas ballast valve (standard version)

No intermediate settings possible

An intermediate setting between open and closed is not possible.

Open gas ballast valve

- ► Rotate 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 flushing gas connection (option)

NOTICE

Risk of damage from unacceptably high flushing gas pressure

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

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

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

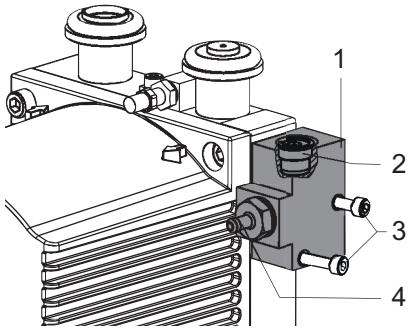


Fig. 12: Gas ballast valve with flushing gas connection (option)

1	Valve body	3	Allen head screw (2x)
2	Dosing screw	4	Hose connection, flushing gas

Required tools

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

Connecting the gas ballast valve with flushing gas connection

1. Note the **assembly sequence**:
    1. First install the hose connection G 1/8" to the valve body.
    2. Only thereafter, screw the valve body onto the vacuum pump in order to avoid the Allen head screws from shearing off.
2. Connect a hose (DN 5 mm) to the flushing gas connection, or use the G 1/8" threaded connector directly.
3. Install the valve body with the Allen head screws on the vacuum pump.
    – Tightening torque: **max. 1.0 Nm**
4. Select the type and quantity of the flushing gas used according to the process.
    – Consult Pfeiffer Vacuum if necessary.
5. Set the flushing gas pressure to max. **1,500 hPa (absolute)**.
6. Set the desired gas quantity using the dosing screw: **max. 540 l/h**.
    – Clockwise rotation to the stop: Valve closed.
    – Counter-clockwise rotation to the stop: Valve open.

6.3.3 Gas ballast valve with solenoid valve

NOTICE

Risk of damage from unacceptably high flushing gas pressure

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

► Observe the maximum permissible flushing gas pressure of **1,500 hPa (absolute)**.
► Dose the flushing gas quantity on-site - dosing is not possible using the solenoid valve.

The use of an optional electromagnetic valve to externally control the flushing gas flow facilitates handling of the gas ballast, and allows the process-driven intake of clean air or other gases.

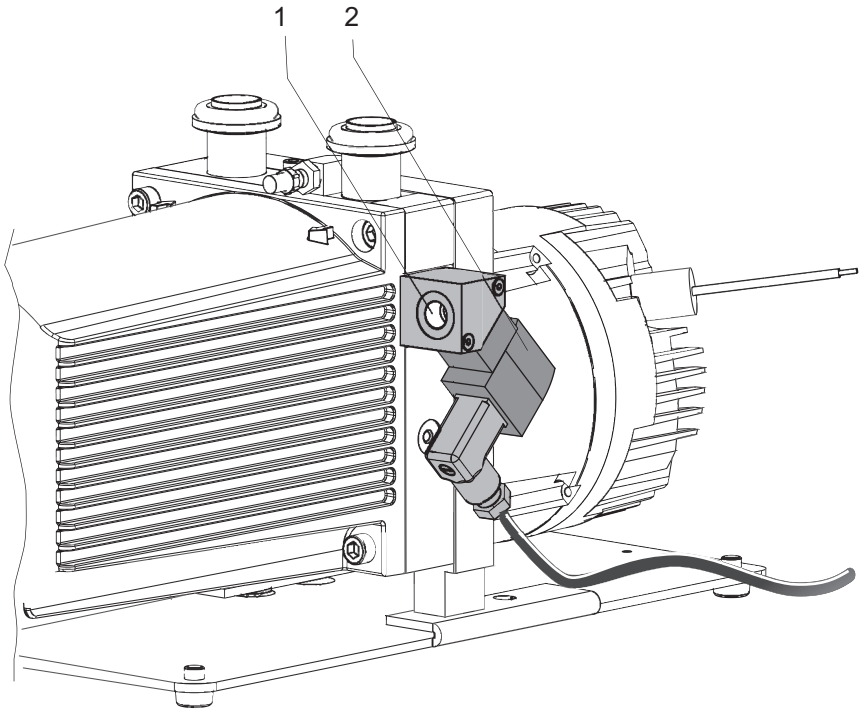


Fig. 13: Gas ballast inlet with solenoid valve

1 Flushing gas connection, G 1/8" 2 Solenoid valve

Classification advanced	Gas Ballast Valve with Solenoid Valve
Order number	PK 194 343 -U
Connection	G 1/8"
Operating voltage: DC	24 V
Input voltage: tolerance	±10 %
Power consumption	4 W
Pressure max. (absolute)	1500 hPa
Gas flow	540 l/h
Contact	Normally closed

Tbl. 5: Technical data, solenoid valve

6.4 Refilling operating fluid

If the operating fluid has reached the minimum fill level, it must be refilled. The fluid can be refilled during operation in the final vacuum.

⚠ WARNING

Danger of poisoning from toxic vapors

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

- ► Observe the application instructions and precautions.
- ► Do not allow tobacco products to come into contact with the operating fluid.

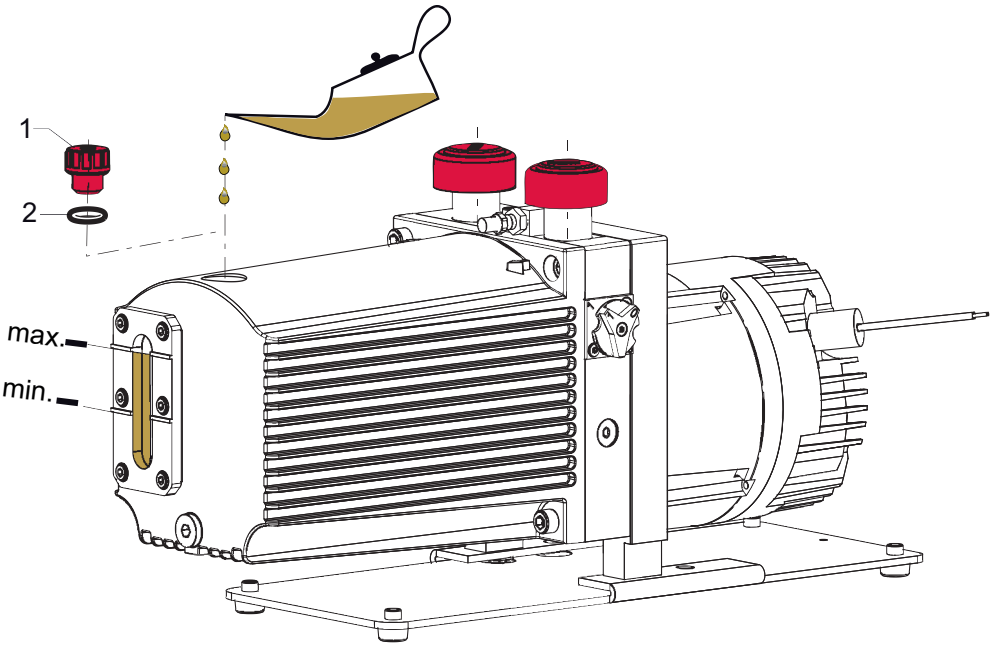


Fig. 14: Refilling operating fluid

1 Filling screw for operating fluid 2 O-ring

Consumable

- Operating fluid of the vacuum pump

Required tools

- Allen key, WAF 5 mm
- Torque wrench

Refilling operating fluid

1. Unscrew the operating fluid filler screw.
2. Refill operating fluid up to the “max.” marking, with the vacuum pump at operating temperature.
3. Screw the operating fluid filler screw back in, taking care of the O-ring.
   – Tightening torque: **max. 0.3 Nm**

6.5 Switching off the vacuum pump

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

Procedure

You can switch off the vacuum pump in any pressure range.

1. Switch the mains switch off or securely disconnect the voltage supply from the mains.
2. Note the procedure for safe maintenance of the vacuum in the vacuum chamber.

6.5.1 Venting the vacuum chamber

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.

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

6.5.2 Maintain vacuum in the vacuum chamber

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.

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.

⚠ 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 a replacement part, provide the data from the pump rating plate where possible.

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

Preparing maintenance

Prerequisites

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

- ► 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.

7.1.1 Maintenance instructions for M or MC version 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.

7.2 Checklist for inspection and maintenance

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

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

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

Reduced maintenance intervals

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

► Contact Pfeiffer Vacuum Service.

Action	Inspection	Maintenance level 1	Maintenance level 2	Maintenance level 3	Required material
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[1)] 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			
Replace filter in external accessory (where present), in accordance with the respective operating instructions		■ as required			
Maintenance level 2 – RSSR change					

1) Operating fluid is required for all maintenance activities, and must be ordered separately in each case.

Action	Inspection	Maintenance level 1	Maintenance level 2	Maintenance level 3	Required material
described in document	**OI**	**OI**	**MM**	**MM**	
Interval	**daily**	**≤ yearly**	**≤ 2 years**	**≤ 4 years**	
• Partially dismantle the vacuum pump • Replace RSSR and coupling half **Not applicable for vacuum pumps with magnetic coupling**			■		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		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				■	Overhaul kit

Tbl. 6: Maintenance intervals

7.3 Changing 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 in case of skin contact.

► Wear protective equipment.
► Use a suitable collection receptacle.

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

The 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.

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

- The vacuum pump does not reach the specified ultimate pressure.
- Operating fluid is perceptibly polluted, milky, or cloudy when viewed through the sight glass.
- It is possible to detect thermal aging of the operating fluid from its color number (applies to mineral oils only).

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.

7.3.1 Draining 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 in case of skin contact.

► Wear protective equipment.
► Use a suitable collection receptacle.

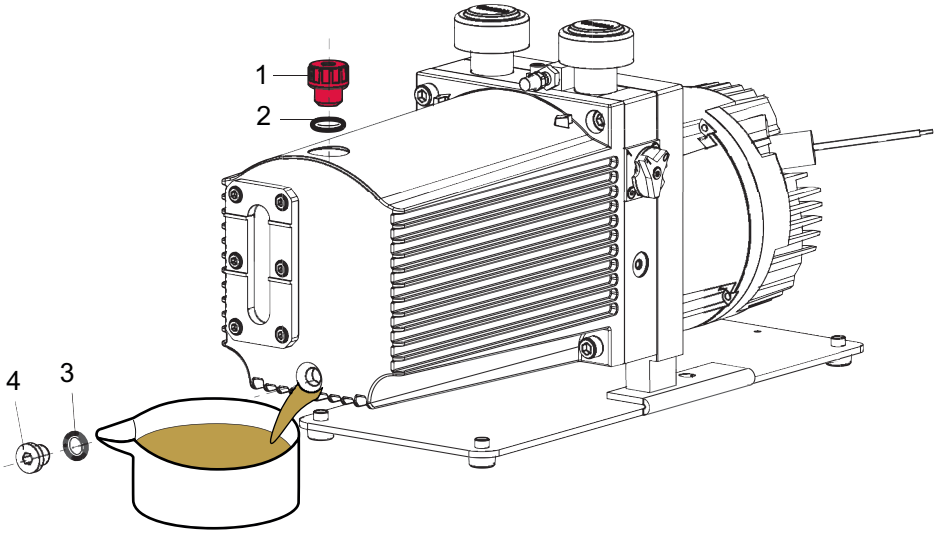


Fig. 15: Draining the operating fluid

1	Filling screw for operating fluid	3	O-ring
2	O-ring	4	Drain screw for operating fluid

Consumable

- Operating fluid of the vacuum pump

Required tools

- Allen key, 5 mm
- Torque wrench

Draining the operating fluid

1. Shut down the vacuum pump and allow it to cool if necessary.
2. Vent the vacuum pump to atmospheric pressure via the intake side.
3. Unscrew in the operating fluid filler screw, watching out for the O-ring at the same time.
4. Place a collection receptacle below the drain hole.
5. Unscrew in the operating fluid drain screw.
6. Drain the operating fluid in a warm state, if possible.
7. Screw the filler and drain screws back in.
8. Switch on the vacuum pump with the vacuum flange open for max. 5 seconds.
9. Tilt the vacuum pump slightly to completely empty it and drain the remaining operating fluid.
10. In the event of heavy contamination, change the operating fluid several times (flushing).
11. Screw in the drain screw, watching out for the O-ring in the process.
    – Drain screw tightening torque: **max. 6.0 Nm**
12. Fill with new operating fluid and check the fill level.
13. Finally screw in the filler screw, watching out for the O-ring in the process.
    – Filler screw tightening torque: **max. 0.3 Nm**

7.3.2 Rinsing and cleaning the rotary vane vacuum pump

Cleaning by changing the operating fluid

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

Required tools

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

Prerequisites

- Operating fluid has been drained.

Change 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 process if necessary.
4. If accessories are installed, replace the corresponding filter elements.

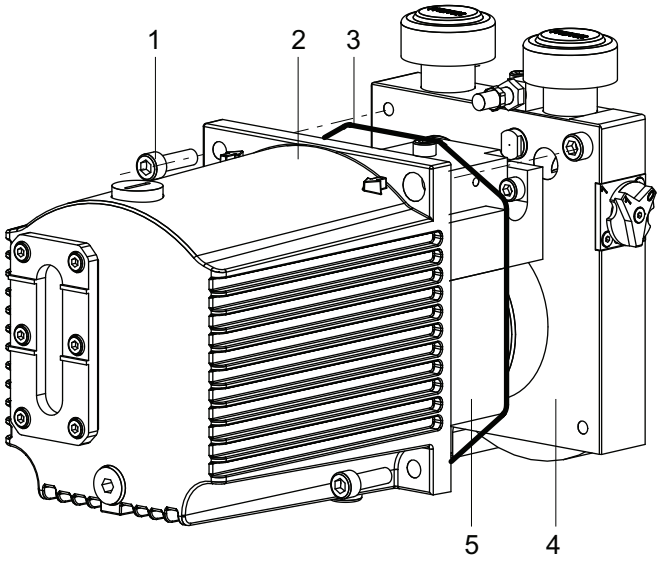


Fig. 16: Remove/fit rotary vane vacuum pump cap

1	Allen head screw (2x)	4	stand
2	Cap	5	Pumping system
3	O-ring		

Remove the cap

1. Drain the operating fluid.
2. Unscrew both Allen head 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 the cap

1. Insert the O-ring in the groove in the cap.
2. Install cap on stand.
3. Tighten both Allen head screws.
   – Tightening torque: **6.0 Nm**.
4. Screw in the operating fluid 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 operating fluid filler screw.
   – Be careful with the O-ring.
   – Tightening torque: **max. 0.3 Nm**

7.4 Cleaning the gas ballast valve

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

7.4.1 Gas ballast valve (standard version)

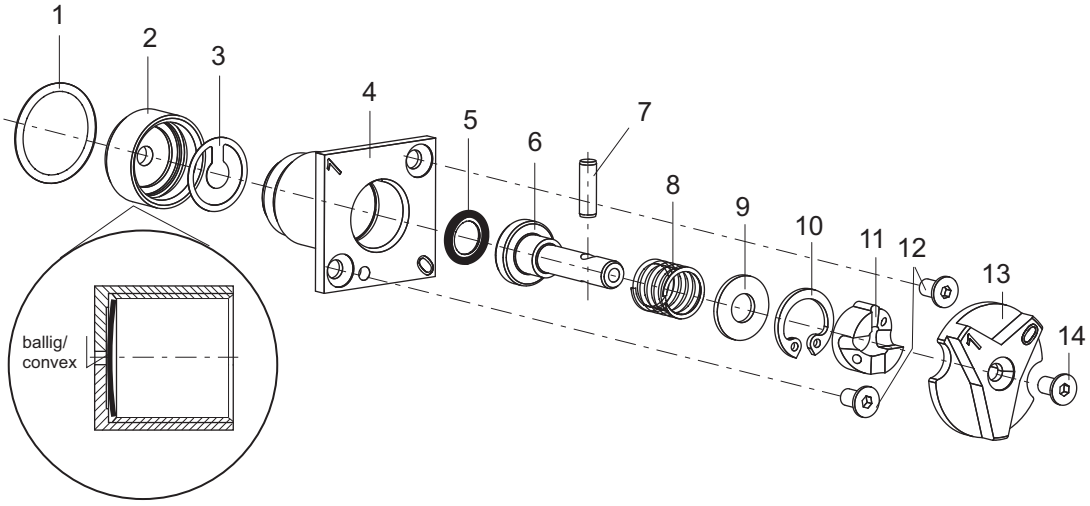


Fig. 17: Gas ballast valve (standard version)

1	O-ring	8	Compression spring
2	Screw cap	9	Washer
3	Valve flap	10	Circlip

4	Valve housing	11	Cam plate
5	O-ring	12	Countersink screw (2×)
6	Tappet	13	Head
7	Cylinder bolt	14	Countersink screw

Required tools

- Allen key, WAF 2 mm
- Circlip pliers J0
- Calibrated torque wrench (tightening factor ≤ 2.5)

Dismantle gas ballast valve

1. Unscrew the countersink screws (2x).
2. Pull the valve housing out of the vacuum pump stand.
   – Be careful with the O-ring.
3. Unscrew the countersink screw the from the head.
4. Remove the head.
5. Unscrew the screw cap from the valve housing.
6. Watch out for the valve flap in the valve housing.
7. Pull the tappet far enough out of the valve housing so that you can pull out the cylinder bolt.
8. Using circlip pliers, remove the cam plate and the circlip.
9. Take care of the washer and the compression spring.
10. Remove tappet from valve housing.
    – Be careful with the O-ring.
11. Clean all parts and check the parts for wear.
12. Replace wear parts according to the maintenance set.

Assemble gas ballast valve

1. Determine the curve of the valve flap and place the valve flap in the screw cap with the curved side facing downwards.
2. Screw the screw cap and the valve housing hand tight.
3. Insert the O-ring in the groove in the tappet.
4. Insert the tappet in the valve housing.
5. Install the compression spring and the washer.
6. Install the circlip in the recess in the valve housing.
7. Slide cam plate onto tappet.
   – Take care with the longitudinal groove in the flange housing.
8. Pull out the tappet against the force of the spring and place the cylinder bolt in the bore.
9. Rotate the cam plate to move the tappet to the "1" position (open).
10. Install knob to tappet.
11. Tighten the countersunk head screw.
    – Tightening torque: **1.0 Nm**.
12. Install the complete valve with O-ring in the vacuum pump.
13. Tighten the countersunk head screws (2x).
    – Tightening torque: **1.0 Nm**.

7.4.2 Gas ballast valve with flushing gas connection (option)

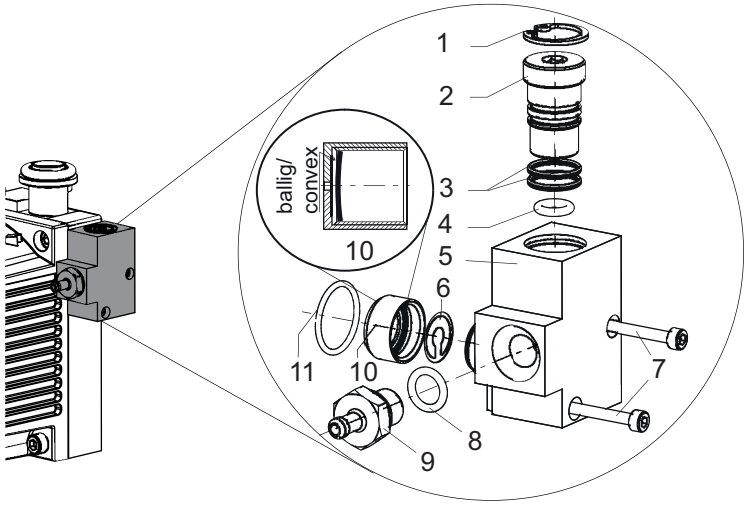


Fig. 18: Gas ballast valve with flushing gas connection (option)

1	Circlip	7	Screw (2×)
2	Spindle	8	O-ring
3	O-ring (2x)	9	Hose connection
4	O-ring	10	Screw cap
5	Valve housing	11	O-ring
6	Valve flap		

Required tools

- Allen key, WAF 2.5 mm
- Open-end wrench, 14 mm WAF
- Circlip pliers J1
- Calibrated torque wrench (tightening factor ≤ 2.5)

Remove the gas ballast valve with flushing gas connection

1. Dismantle the hose from the flushing gas supply line.
2. Unscrew the hose connection the from valve housing.
3. Dismantle the valve housing.
   – Be careful with the O-ring.
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 the parts - especially the bores in the valve housing.
9. Replace the parts according to the spare parts pack.

Assemble the gas ballast valve with flushing gas connection

1. Determine the curve of the valve flap and place the valve flap in the screw cap with the curved side facing downwards.
2. Screw the screw cap and the valve housing hand tight.
3. Install the hose connection.
   – Tightening torque: **3.0 Nm**.
4. Fit the valve housing.
5. Tighten the screws.
   – Tightening torque: **1.0 Nm**.

7.5 Changing the operating fluid type

Possibilities for changing the operating fluid type

The operating fluid type can be changed between mineral operating fluid – **P3** – and synthetic operating fluid – **D1** – only. It is not possible to change from **P3/D1** to **F4/F5** or vice versa.

- For 2 required flushing operations and the final filling, 3 times the filling quantity of fresh operating fluid is required.

Procedure

1. Carry out **2** flushing operations with the new operating fluid as described above.
2. Clean any accessories if necessary, such as ONF | OME or ORF | ODK, and replace their filter elements.
   – Note any requirement for additional operating fluid.
3. Finally, fill the vacuum pump with a one third fill of operating fluid.
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 Decommissioning the vacuum pump for longer periods

Before shutting down the vacuum pump, observe the following instructions to adequately protect the interior of the vacuum pump (pumping system) against corrosion:

Procedure

Prerequisites

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

1. Remove the vacuum pump from the vacuum system if necessary.
2. Change the operating fluid.
3. 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.
4. Fill the vacuum pump to above the **"max." mark** with operating fluid, up to the upper edge of the sight glass.
5. Close the vacuum and exhaust flanges with the original screw caps.
6. Store the vacuum pump only in dry, dust-free rooms, within the specified ambient conditions.
7. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
8. 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 re-commissioning.

8.3 Disposing of the vacuum pump

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

Procedure

- ► Dispose of all substances safely according to local regulations.

9 Malfunctions

⚠ 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 working on it.
- ► Wear personal protective equipment 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 a replacement part, provide the data from the pump rating plate where possible.

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 if necessary.
	• Pump temperature too low	• Check mains voltage and mains fuse; check motor switch.
	• Thermal protection switch has triggered	• Identify and eliminate the cause; allow vacuum pump to cool if necessary.
	• Pumping system contaminated	• Clean the vacuum pump; contact Pfeiffer Vacuum if necessary.
	• Pumping system damaged	• Clean and service the vacuum pump; contact Pfeiffer Vacuum if necessary.
	• Motor faulty	• Replace the motor.
Vacuum pump switches off after a while after being started	• Thermal protection switch of the motor has triggered	• Identify and eliminate the cause of the overheating; allow motor to cool if necessary.
	• 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.

Problem	Possible causes	Remedy
Vacuum pump does not reach the specified ultimate pressure	• Measurement result distorted	• Check measurement instrument, check ultimate pressure with system disconnected.
	• Vacuum pump or connected accessory contaminated	• Clean the vacuum pump and check the components for pollution.
	• 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	• Refilling 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 if necessary.
	• Radial shaft seal ring (RSSR) leaking – not applicable to vacuum pumps with magnetic coupling	1. Check and replace the RSSR if necessary. 2. Check and also replace the associated bushing if necessary.
	• Operational operating fluid loss – no oil mist filter (ONF/OME)	• Install ONF/OME.
	• Operational operating fluid loss – with oil mist filter (ONF/OME)	• Clean ONF/OME and oil return (ODK); replace filter if necessary.
Unusual noises during operation	• Noise reduction is contaminated	• Clean the noise reduction or replace it.
	• Pumping system is contaminated or damaged	• Clean and service the vacuum pump; contact Pfeiffer Vacuum if necessary.
	• Motor bearing is faulty	• Replace the motor; contact Pfeiffer Vacuum if necessary.

Tbl. 7: Troubleshooting for rotary vane pumps

10 Service solutions from Pfeiffer Vacuum

We offer first class service

Long vacuum component service life, coupled with low downtimes, are clear expectations that you have of us. We satisfy your needs with capable products and outstanding service.

We are consistently striving to perfect our core competence, service for vacuum components. And our service is far from over once you've purchased a product from Pfeiffer Vacuum. It often enough really just begins then. In proven Pfeiffer Vacuum quality, of course.

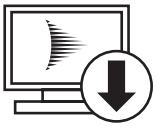
Our professional sales engineers and service technicians stand ready to provide hands-on support to you worldwide. Pfeiffer Vacuum offers a complete portfolio of service offerings, ranging from genuine spare parts right through to service agreements.

Take advantage of Pfeiffer Vacuum Service

Whether for preventative on-site service from our field service, fast replacement with as-new replacement products or repair in a Service Center close to you; you have various options for upholding your equipment availability. Detailed information and addresses can be found on our website in the Pfeiffer Vacuum Service section.

Advice on the optimum solution is available from your Pfeiffer Vacuum contact partner.

For quick and smooth handling of the service process, we recommend the following steps:



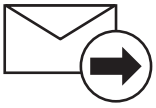
1. Download the current form templates.
   - Declaration of Service Request
   - Service Request
   - Declaration of Contamination

a. Dismantle all accessories and keep them (all external mounted parts as valve, inlet screen, etc.).

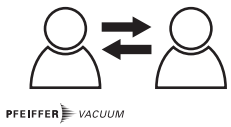
b. Drain the operating fluid/lubricant as necessary.

c. Drain the cooling medium as necessary.

2. Fill out the service request and the declaration of contamination.



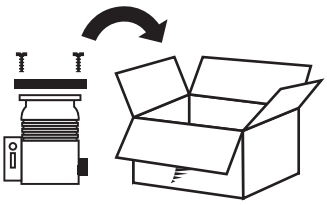
3. Send the forms via email, fax or post to your local Service Center.



4. You will receive a response from Pfeiffer Vacuum.

Sending of contaminated products

No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. If products are contaminated or if the declaration of contamination is missing, Pfeiffer Vacuum will contact the customer before starting maintenance. In addition, depending on the product and the level of contamination **additional decontamination costs** may be required.



5. Prepare the product for transport in accordance with the details in the declaration of contamination.

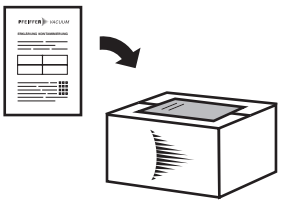
a) Neutralize the product with nitrogen or dry air.

b) Close all openings with airtight blank flanges.

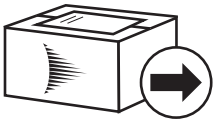
c) Seal the product in appropriate protective film.

d) Only pack the product in suitable, stable transport containers.

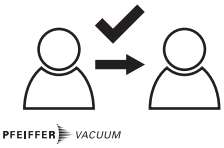
e) Observe the applicable transport conditions.



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



7 Then send your product to your local Service Center.



8 You will receive a confirmation message/a quotation from Pfeiffer Vacuum.

For all service orders, our General Terms and Conditions of Sales and Supply and General Terms and Conditions of Repair and Maintenance apply to vacuum equipment and components.

11 Spare parts

11.1 Ordering spare parts packs

Observe the following instructions when ordering spare parts:

Spare parts ordering

- ► Where possible, have the vacuum pump part number to hand, along with other details from the rating plate if necessary.
- ► Only use original spare parts.

Spare parts pack	Order no.
Maintenance kit 1 – maintenance level 1	PK E01 050 CT
Radial shaft seal ring set – maintenance level 2	PK E06 103 -T
Maintenance kit 2 – maintenance level 2, extended[2)]	PK E01 051 CT
Overhaul kit – maintenance level 3	PK E02 057 -T
Set of vanes	PK E08 032 -T

Tbl. 8: Spare parts pack Duo 11 DC

11.1.1 Maintenance kit 1 – maintenance level 1

Order no.: PK E01 050 CT

Maintenance kit 1 contains:

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

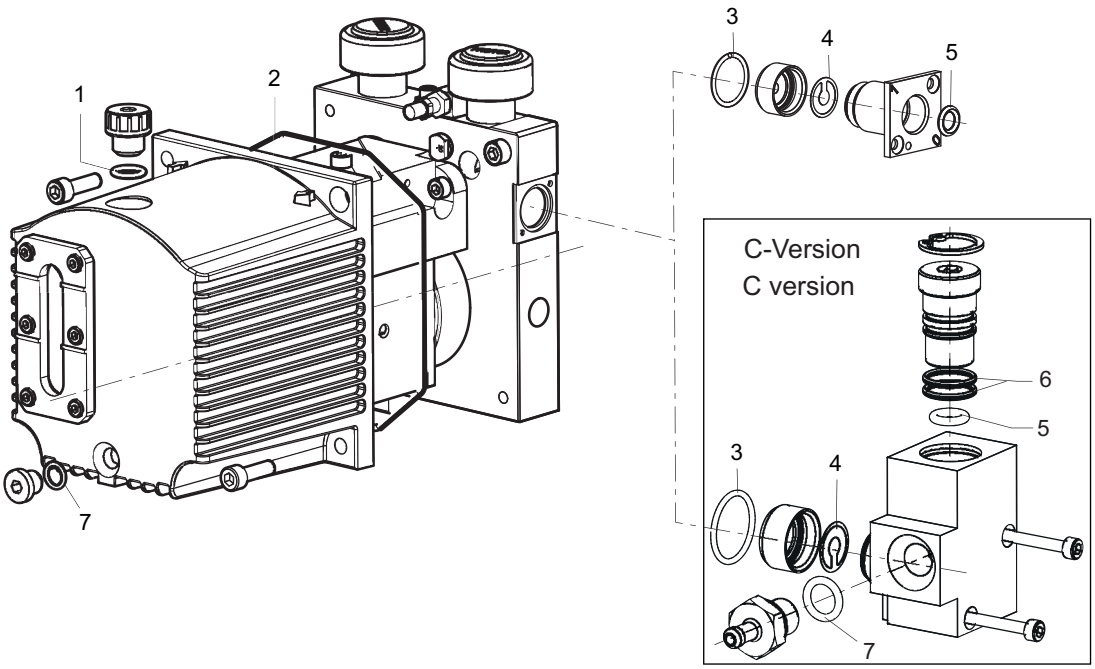


Fig. 19: Content of maintenance kit 1 – maintenance level 1

Item no.	Designation	Size	Shipment
1	O-ring, FPM	10 × 2.5	1
2	O-ring, FPM	123 × 2.5	1

2) including radial shaft seal ring

Item no.	Designation	Size	Shipment
3	O-ring, FPM	16.5 × 1.5	1
4	Valve flap		1
5	O-ring, FPM	6 × 2.2	1
6	O-ring, FPM	11 × 1.5	2
7	O-ring, FPM	8 × 2	2

Tbl. 9: Content of maintenance kit 1

11.1.2 Radial shaft seal ring set – maintenance level 2

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

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

11.1.3 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

11.1.4 Overhaul kit – maintenance level 3

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

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

11.1.5 Set of vanes

The set of vanes contains:

- Vane
- Vane springs

11.1.6 Coupling set for versions with magnetic coupling

The coupling set contains:

- two coupling halves
- containment shell with O-ring

12 Technical data and dimensions

12.1 General

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

- Specifications according to PNEUROP committee PN5
- ISO 21360; 2007: “Vacuum technology - Standard methods for measuring vacuum-pump performance - General description”

	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. 10: 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. 11: Conversion table: Units for gas throughput

12.2 Technical data

Classification	Duo 11 DC
Order number	PK D59 553
Flange (in)	DN 16 ISO-KF
Flange (out)	DN 16 ISO-KF
Pumping speed	9 m³/h
Ultimate pressure with gas ballast	$3 \cdot 10^{-2}$ hPa
Ultimate pressure without gas ballast	$3 \cdot 10^{-3}$ hPa
Leak rate safety valve	≤ $1 \cdot 10^{-5}$ Pa m³/s
Exhaust pressure, max.	1500 hPa
Exhaust pressure, min.	Atmospheric pressure
Gas ballast	Yes
Cooling method, standard	Air
Ambient temperature	-20 – 40 °C
Shipping and storage temperature	-25 °C – 55 °C
Motor version	DC motor

Classification	Duo 11 DC
Supply: Voltage V DC max.	24 V DC
Voltage: Range	±10 %
Rated current absorption	9.8 A
Current consumption max.	16 A
Recommended mains fuse capacity	16 A
Power consumption max.	0.34 kW
Rotation speed max.	3000 rpm
Motor protection	Electronically
Protection category	IP20
Operating fluid	Inland 45
Operating fluid filling	0.5 l
Switch New	No
Mains cable included	Yes
Weight: with motor	9 kg

Tbl. 12: Technical data, Duo 11 DC

12.3 Dimensions

All dimensions in mm

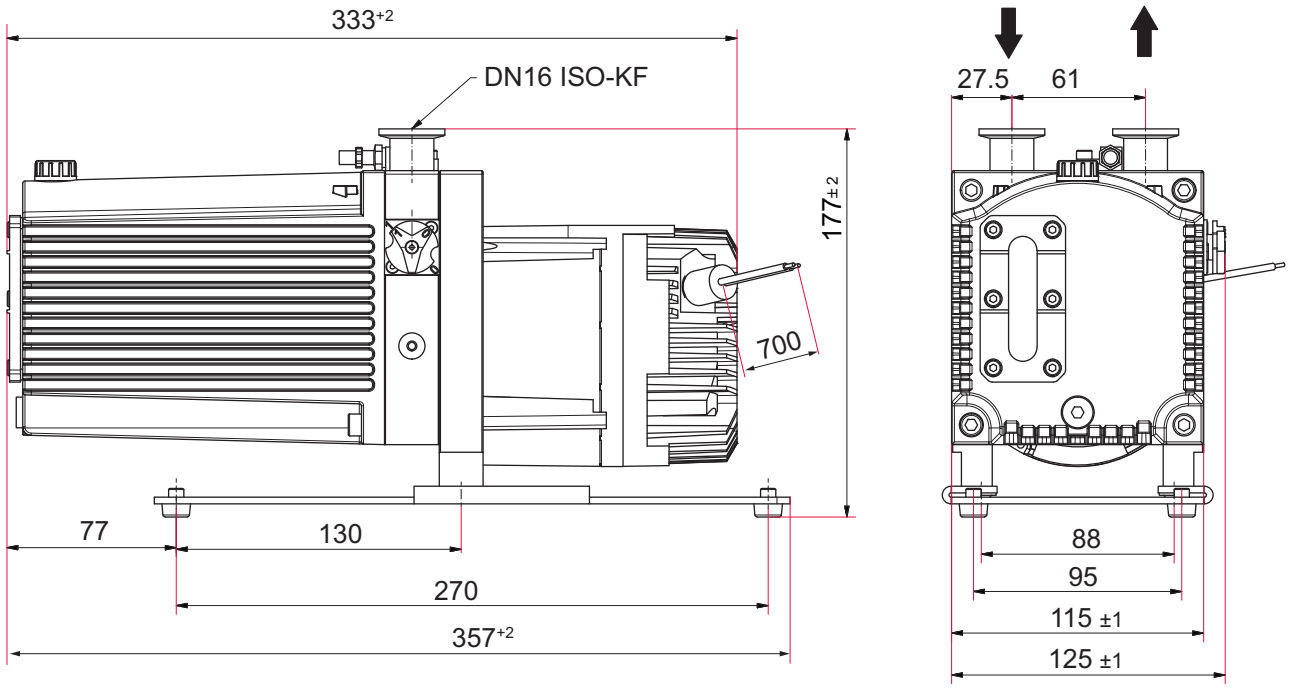


Fig. 20: Dimension diagram DUO 11 DC

13 Accessories

Accessories for Duo 11 DC	Order no.
SAS 16, DN 16 ISO-KF	PK Z60 506
KAS 16, Condensate Separator	PK Z10 003
OME 16 M, Oil Mist Separator	PK Z40 003
Oil Return Unit from OME 16 M to Duo 1.6, 3, 6, 11, Uno 6	PK 006 080 -T
OME 16 S, Oil Mist Separator	PK Z40 000
Oil Return Unit from OME 16 S	PK 005 986 -T
ZFO 16, Zeolite Trap	PK Z70 003
Operations Monitoring Unit 1	PK 196 148 -T
Operations Monitoring Unit 2	PK 196 147 -T
Operations Monitoring Unit 3	PK 196 146 -T
Gas Ballast Valve with Solenoid Valve	PK 194 343 -U
Gas Ballast Valve Conversion Kit with Hose Nozzle	PK 195 666 -U
Blank Flange, Gas Ballast Valve	PK 007 002 -T
TPS 310, Power Supply Pack for Wall/Standard Rail Fitting	PM 061 342 -T

Tbl. 13: Accessories for Duo 11 DC

Consumables for Duo 11 DC	Order no.
Inland 45, PAO (poly-alpha-olefin) based, 0.5 l	PK 005 930 -T

Tbl. 14: Consumables

Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions of the following EC 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

The authorized representative for the compilation of technical documents is Mr. Sebastian Oberbeck, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Aßlar, Germany.

DuoLine

Duo 11 DC | Duo 11 M DC

Harmonized standards and applied national standards and specifications:

EN ISO 12100: 2011	EN 61000-6-1: 2007
EN 1012-2: 2011-12	EN 61000-6-2: 2006
EN ISO 13857: 2008	EN 61000-6-3: 2007 + A1: 2011
ISO 21360-1, 2: 2012	EN 61000-6-4: 2007 + A1: 2011
EN 61010-1: 2010	EN ISO 2151: 2: 2008

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Dr. Ulrich von Hülsen)
Managing director

Asslar, 2018-02-12

PFEIFFER VACUUM

VACUUM SOLUTIONS FROM A SINGLE SOURCE

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COMPLETE RANGE OF PRODUCTS

From a single component to complex systems:
We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE

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

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