



OPERATING INSTRUCTIONS

EN

Translation of the Original

DUO 11 ATEX

Rotary vane pump

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Dear Customer,

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

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

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

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

Disclaimer of liability

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

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

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1 About this manual



IMPORTANT

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

1.1 Validity

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

1.1.1 Applicable documents

Designation	Number
Declaration of conformity	A component of these instructions
Operating instructions for the motor	Refer to motor terminal box
Declaration of Conformity for the motor	Motor supplier
Accessories operating instructions	Refer to Accessories

1.1.2 Variants

Pump type	Pump version
Duo 11 ATEX	Version with magnetic coupling

1.2 Target group

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

- Transportation
- Setup (Installation)
- Usage and operation
- Decommissioning
- Maintenance and cleaning
- Storage or disposal

The work described in this document is only permitted to be performed by persons with the appropriate technical qualifications (expert personnel) or who have received the relevant training from Pfeiffer Vacuum.

1.3 Conventions

1.3.1 Instructions in the text

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by an individual step or multi-part action steps.

Individual action step

A horizontal, solid triangle indicates the only step in an action.

- ▶ This is an individual action step.

Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

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

1.3.2 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

1.3.3 Stickers on the product

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

	<p>Rating plate The rating plate of the rotary vane pump is located on the front right-hand side next to the sight glass.</p> <p>Motor rating plate (not shown) The motor rating plate is located on the respective motor.</p>
	<p>Sticker (yellow) Attention! Check the direction of rotation of the rotary vane pump before filling with operating fluid.</p>
	<p>Sticker (red) Fill the rotary vane pump with operating fluid before commissioning.</p>
	<p>Arrow indicating direction of rotation The direction of rotation arrow indicates the required motor rotation direction.</p>
	<p>Closure seal The product is sealed ex-factory. Damaging or removing a closure seal results in loss of the warranty.</p>
	<p>Warning hot surface This sticker warns of injuries caused by high temperatures in case of touching without protection during operation.</p>

Tbl. 1: Stickers on the product

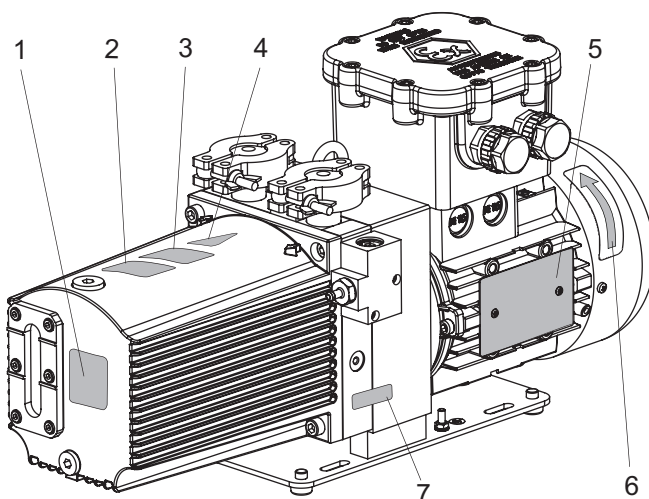


Fig. 1: Position of the labels on the product

- | | |
|--|--|
| <ul style="list-style-type: none"> 1 Rating plate of the rotary vane vacuum pump 2 Attention! Check the direction of rotation of the rotary vane pump before filling with operating fluid 3 Fill rotary vane pump with operating fluid before commissioning 4 Hot surface warning sign | <ul style="list-style-type: none"> 5 Motor rating plate 6 Arrow indicating direction of rotation 7 Closure seal |
|--|--|

1.3.4 Abbreviations

Abbreviation	Explanation
BA	Operating instructions
DN	Nominal diameter (from the French: diamètre nominal)
ISO	International Organization for Standardization
abs.	Absolute
DIN	German Institute for Standardization (Deutsches Institut für Normung)
I_N	Rated (nominal) current
I_{max}	Maximum current
FKM	Fluoropolymer rubber
M version	Version with magnetic coupling
PTC	Temperature-dependent resistor (Positive Temperature Coefficient)
PE	Earthed conductor (protective earth)
OME	Oil mist filter (Oil Mist Eliminator)
ODK	Oil return flow line (Oil Drain Kit)
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
<p>Immediately pending danger</p> <p>Indicates an immediately pending danger that will result in death or serious injury if not observed.</p> <ul style="list-style-type: none"> ▶ Instructions to avoid the danger situation

⚠ WARNING
<p>Potential pending danger</p> <p>Indicates a pending danger that could result in death or serious injury if not observed.</p> <ul style="list-style-type: none"> ▶ Instructions to avoid the danger situation

⚠ CAUTION
<p>Potential pending danger</p> <p>Indicates a pending danger that could result in minor injuries if not observed.</p> <ul style="list-style-type: none"> ▶ Instructions to avoid the danger situation

NOTICE
<p>Danger of damage to property</p> <p>Is used to highlight actions that are not associated with personal injury.</p> <ul style="list-style-type: none"> ▶ Instructions to avoid damage to property

i	<p>Notes, tips or examples indicate important information about the product or about this document.</p>
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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

⚠ DANGER
<p>Risk of explosion from electrostatic charging during transport</p> <p>There is a risk of fatalities when transporting packaging material (foil) and plastic containers in potentially explosive areas. Ignition can cause very serious injuries, and even fatalities.</p> <ul style="list-style-type: none"> ▶ Only unpack the vacuum pump outside of potentially explosive areas.

⚠ DANGER
<p>Risk of explosion when carrying out installation and maintenance work in potentially explosive areas</p> <p>There is a risk of explosion if unsuitable tools are used in potentially explosive areas. Ignition can cause very serious injuries.</p> <ul style="list-style-type: none"> ▶ Transport, installation and maintenance work may not be performed in potentially explosive atmospheres. ▶ Always shut down the vacuum pump before commencing any work.

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

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

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

Risks during installation**⚠ DANGER****Danger to life from electric shock**

Touching exposed and voltage-bearing elements generates an electric shock. Incorrect connection of the mains supply leads to the risk of live housing parts that can be touched. There is a risk to life.

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

⚠ WARNING**Risk of fatalities due to escaping process media**

The manufacturer has no influence on the media being supplied with the vacuum pump. Process media are often toxic, combustible, potentially explosive and/or reactive in other ways. There is a risk of serious or even fatal injuries if these media are permitted to leak into the atmosphere.

- ▶ Refer to the corresponding local guidelines. This information can be obtained from the Department of Health and Safety at Work of the user.
- ▶ Prevent zone entrainment.
- ▶ Connect the pump outlet to the suction system for hazardous media on the system.
- ▶ Perform regular inspections to ensure that there are no leaks at the connection between vacuum pump and suction pipes.

⚠ WARNING**Risk of explosion at increased winding temperature in potentially explosive atmospheres**

If the winding temperature of the motor is not monitored, the motor winding could potentially become a source of ignition. There is a risk of explosion, and consequently the risk of sustaining serious injuries.

- ▶ Always establish the connections directed into the motor terminal boxes with a corresponding PTC thermistor tripping unit of an intrinsically safe electric circuit, suitable for the potentially explosive area.
 - Otherwise, the tripping unit must be installed outside of the potentially explosive area.

⚠ 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

Risk of injury from entrapment of body parts

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ Secure the motor against re-start.

⚠ CAUTION

Property damage from intake of solid particles

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

- ▶ Always use the cone sieve included in delivery in the intake flange.
- ▶ Ensure that the cone sieve is also installed at all times during installation.

Risks during operation

⚠ WARNING

Risk of explosion in the medium to be pumped as a result of increased pressure

With installation on the exhaust side, there is a risk of the exhaust pressure of the vacuum pump exceeding the atmospheric conditions. The ignition temperature of the medium to be pumped is lowered in the suction chamber.

If the ignition temperature of the medium to be pumped falls below a temperature of +135 °C, there is a risk of explosion, and consequently serious injury.

- ▶ Ensure that the ignition temperatures of the medium to be pumped is maintained above a temperature of +135 °C at 2000 hPa abs.

⚠ 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

Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.

⚠ WARNING

Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures

Uncontrolled exchange of gases when opening the housing could potentially generate a potentially explosive mixture of gas and air in the vacuum system or even outside of the vacuum pump. Ignition can cause very serious injuries.

- ▶ Respect segregation of the zones when filling the operating fluid.

⚠ WARNING**Danger of injury from impermissibly high inert gas pressure**

Increased inert gas pressure compromises the operational reliability due to increasing power consumption of the vacuum pump and potentially causes the temperature class threshold to be exceeded. There is a danger of bursting if there is a potentially explosive atmosphere. This leads to injuries caused by flying fragments, the escaping of high pressure, and damage to the unit.

- ▶ Observe the maximum permissible inert gas pressure of **1200 hPa (absolute)**.
- ▶ Dose the inert gas quantity with the dosing screw on the gas ballast valve or on site.

⚠ CAUTION**Risk of injury from entrapment of body parts**

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ 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.

- ▶ Provide suitable touch protection.

Risks during maintenance, decommissioning and in event of malfunctions**⚠ DANGER****Risk of explosion when carrying out installation and maintenance work in potentially explosive areas**

There is a risk of explosion if unsuitable tools are used in potentially explosive areas. Ignition can cause very serious injuries.

- ▶ Transport, installation and maintenance work may not be performed in potentially explosive atmospheres.
- ▶ Always shut down the vacuum pump before commencing any work.

⚠ DANGER**Risk of explosion from electrostatic charging during transport**

There is a risk of fatalities when transporting packaging material (foil) and plastic containers in potentially explosive areas. Ignition can cause very serious injuries, and even fatalities.

- ▶ Only unpack the vacuum pump outside of potentially explosive areas.

⚠ 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

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

Risk of injury from entrapment of body parts

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ Secure the motor against re-start.

⚠ 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 vessel.

⚠ 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.

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 ATEX classification and safety measures

Vacuum pumps of the ATEX series are specially designed and manufactured to comply with the requirements of Directive 2014/34/EU regarding the proper use of equipment and protective systems in potentially explosive areas. The vacuum pumps are delivered with an ATEX-certified motor and are designated as follows:

-  II 3/3G Ex h IIC T4 Gc X +12 °C ≤ Ta ≤ +40 °C

2.4.1 Labeling of the vacuum pump

Classification	Description
Device group	<p>Devices which can be used for applications in potentially explosive atmospheres are divided into two groups:</p> <p>Device group I: Devices for mines susceptible to firedamp (will not be discussed in any more detail here)</p> <p>Device group II: Devices for all other potentially explosive areas with the exception of underground operations in mines and their surface installations which are susceptible to hazardous firedamp and / or combustible dust.</p>
Device category	<p>Device group II is divided into three categories which vary in their respective degree of safety.</p> <p>Devices of Device category 1 are designed to guarantee an extremely high degree of safety. They must guarantee the necessary degree of safety even if malfunctions occur only rarely on the device.</p> <p>Devices of Device category 2 are designed to guarantee a high degree of safety. They must guarantee the necessary degree of safety even with regular occurrences of malfunctions or fault conditions which are generally to be expected.</p> <p>Devices of Device category 3 are designed to guarantee a normal degree of safety. They guarantee the necessary degree of safety for normal operation.</p>

Classification	Description
Combustible materials	<p>G: Gases or vapors D: Dust (will not be discussed in any more detail here)</p> <p>Note: The device may only be used in atmospheres susceptible to explosion due to gases or vapors. Operation in dust-charged, potentially explosive atmospheres is not permitted.</p>
Type of protection	Identification code "Ex h" designated in the standard DIN EN ISO 80079-36 for non-electrical equipment. A protection type established for electrical equipment is not used.
Explosion groups	Gases and vapors are divided into three Explosion groups based on their particular ignition capability (IIA, IIB and IIC). The ignition power in this regard decreases from Explosion group IIA to IIC. (The higher Explosion group, e.g. IIC incorporates the respectively lower IIB and IIA).
Temperature class	<p>Classification of equipment depending on their maximum surface temperature, in accordance with assignment as follows:</p> <p>Temperature class --> Maximum surface temperature/gas temperature:</p> <ul style="list-style-type: none"> ● T1 --> +450 °C ● T2 --> +300 °C ● T3 --> +200 °C ● T4 --> +135 °C ● T5 --> +100 °C ● T6 --> +85 °C <p>The temperature class and the actual maximum surface temperature of the equipment includes a safety margin to the minimum ignition temperature of the potentially explosive atmospheres as stipulated in DIN EN ISO 80079-36.</p>
EPL according to EN 60079	<p>Equipment protection level</p> <p>EPL Ga: Equipment with "extremely high" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation, with foreseeable or infrequent faults/malfunctions.</p> <p>EPL Gb: Equipment with "high" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation, with foreseeable faults/malfunctions.</p> <p>EPL Gc: Equipment with "extended" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation.</p>
X	Special operating conditions must be observed! Special conditions and notes in the operating instructions apply.
Ta	Permissible ambient temperature for operation of the vacuum pump prescribed on the rating plate.

Tbl. 3: ATEX designations

2.4.2 Potential hazards

The ignition hazard assessment for the Duo 11 ATEX was performed in accordance with the harmonized standard ISO 80079-36 (Non-electrical equipment for explosive atmospheres - Basic method and requirements). This assessment includes the identification of hazards described as follows which will not occur if the system is operated properly with the respective safety measures.

Potential hazard	Occurrence due to	Safety measures
Hot surfaces	Heat generated as a result of friction and compression in the pumping system, and in particular at increased intake pressure	Operating fluid dissipates the heat which is produced in the inside of the rotary vane pump on the components cooled by convection. The installation conditions must be observed.
Hot gases	Compression of the required gases	The gas temperatures were determined during tests carried out under permissible application conditions. Observe the information in the operating manual.
Mechanical sparks	No mechanical sparks will be produced during normal operation with normal use of the system	Surfaces on the inside of the rotary vane pump are wetted with operating fluid to cool them.

Potential hazard	Occurrence due to	Safety measures
Electrical sparks	Electric motor	Application of an explosion-proof electric motor. Observe the labeling (refer to rating plate) of the electric motor and the operating instructions.
Static electricity	Rotary vane pump is not earthed	Rotary vane pump is to be integrated in the equipotential bonding at the installation site. Static charging from insulating coats of paint can be excluded as the rotary vane pump is not painted.
Chemical reaction	Reaction between process gas and operating fluid	To be assessed by the user.
Zone entrainment	Leaking rotary vane pump/system	Rotary vane pump undergoes a final inspection with helium leak test within the framework of a production control (leakage rate $< 1 \times 10^{-8}$ Pa m ³ /s).

Tbl. 4: Potential hazards

2.4.3 Safety measures

The following information must be observed or appropriate measures implemented if reliable operation of the rotary vane pump is to be guaranteed:

	Measures/safety equipment	Specification	We recommend
Oil pressure	Monitoring of oil pressure with oil pressure switch (optional): <ul style="list-style-type: none"> Falling below the switch-point will cause a malfunction of the vacuum safety valve. Exceeding the switch-point could indicate an overload of the magnetic coupling. 		X
Exhaust pressure	Monitoring of the exhaust pressure with pressure switch (optional) to protect the rotary vane pump against overload.		X
Operating fluid temperature	Monitoring of the operating fluid temperature with temperature sensor (optional): <ul style="list-style-type: none"> A deviation from the normal value could be indicative of a fault. 		X
Operating fluid level	Monitoring of the operating fluid level with level switch (optional): <ul style="list-style-type: none"> If the fill level falls below the "Min" mark, opening of the change-over contact can be used as a signal to switch off the rotary vane pump. 		X
Motor winding temperature	Connect the temperature sensor in the motor terminal box on the PTC thermistor tripping unit (see chapter "Connecting the PTC thermistor tripping unit", page 30) as prescribed in the motor operating instructions.	X	

Tbl. 5: Measures and safety equipment

2.5 Product usage limits

Parameter	Duo 11 ATEX
Installation location	<ul style="list-style-type: none"> • Indoors, protected against: <ul style="list-style-type: none"> – dust deposits – falling objects – fire-fighting water • Outdoors, protected against: <ul style="list-style-type: none"> – falling objects – direct influence of weather such as rain, splash water, strong drafts and sunlight – fire-fighting water – lightning strike
Installation altitude	max. 1000 m above sea level At installation heights > 1000 m above sea level, the rated power of the motor must be reduced or the ambient temperature limited due to increased heating of the vacuum pump.
Constant intake pressure	≤ 50 hPa
Tank size for pumping out atmospheric pressure	max. 100 liters
Cycle operation	Operating duration > downtime, cycle > 20 mins
Exhaust pressure of the vacuum pump	≤ 1500 hPa abs.
Exhaust pressure at OME	max. atmospheric pressure
Ambient temperature	+12 °C to +40 °C
Relative air humidity	≤ 85 %
Installation surface flatness	Horizontal
Intake temperature of medium to be pumped	≤ 40 °C
Operation with gas ballast	Only permissible with inert gas: ≤ 1200 hPa abs.

Tbl. 6: Permissible ambient and operating conditions

⚠ WARNING

Risk of explosion in the medium to be pumped as a result of increased pressure

With installation on the exhaust side, there is a risk of the exhaust pressure of the vacuum pump exceeding the atmospheric conditions. The ignition temperature of the medium to be pumped is lowered in the suction chamber.

If the ignition temperature of the medium to be pumped falls below a temperature of +135 °C, there is a risk of explosion, and consequently serious injury.

- ▶ Ensure that the ignition temperatures of the medium to be pumped is maintained above a temperature of +135 °C at 2000 hPa abs.

Inspection of media by the user

Testing with ambient air as the medium to be pumped has shown that if the aforementioned ambient and operating conditions are maintained, the maximum surface and gas temperatures do not exceed a value of +130 °C.

With the utilization of dry media being pumped, heating of the pump could become more intense. Appropriate measures are to be implemented to prevent this heating, for example reducing the permanent intake pressure.

1. Check whether the thermal behavior of the media being pumped deviates from the behavior of the ambient air.
2. Ensure suitable countermeasures wherever the difference to the ignition temperature is reduced.

2.6 Proper use

- ▶ Use the vacuum pump for vacuum generation only.
- ▶ Adhere to the installation, commissioning, operating, and maintenance instructions.

- ▶ Use only accessory parts recommended by Pfeiffer Vacuum.
- ▶ Use the vacuum pump to convey potentially explosive atmospheres in accordance with the labeling.
- ▶ Operate the vacuum pump within the application limits of the product (see chapter “Product usage limits”, page 18) and in compliance with the technical data.
- ▶ Observe the corresponding safety measures (see chapter “Safety measures”, page 17).

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 media which are corrosive to or too aggressive for the vacuum pump materials
- pumping media that introduce an ignition source to the suction chamber
- pumping pyrophoric or corrosive media, or media releasing FKM
- pumping media prone to spontaneous, specific exothermic reactions
- pumping media that contain impurities such as particles, dust, or condensate
- pumping media that can condense or cause adhering deposits to form in the suction chamber
- pumping media with a propensity to sublimation
- pumping pressurized media (> atmospheric pressure)
- pumping fluids
- pumping radioactive media
- using the vacuum pump outside the specified area of application
- using the vacuum pump in systems in which sporadic loads and vibrations or periodic forces act on the unit
- using the vacuum pump in strong electrical, magnetic, or electromagnetic fields
- using for media being pumped for which the ignition temperature drops below a temperature limit of T₄, at pressures greater than atmospheric pressure
- using pipes to lift the vacuum pump
- using accessories or spare parts not listed in this manual
- using the vacuum pump as a climbing aid
- painting the vacuum pump, motor and accessories
- using operating fluids that have not been approved by Pfeiffer Vacuum
- using mineral-based operating fluids such as P3, with an oxygen concentration > 21 %.

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

2.8 Personnel qualification

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

Training people

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

2.8.1 Ensuring personnel qualification

Specialist for mechanical work

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

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

Specialist for electrotechnical work

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

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

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

Trained individuals

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

2.8.2 Personnel qualification for maintenance and repair



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

Adequately trained individuals are:

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

2.8.3 Advanced training with Pfeiffer Vacuum

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

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

3 Product description

3.1 Function

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

The rotary vane pump Duo 11 ATEX is a vacuum pump designed for special applications in low and medium vacuum, observing the application limits. A magnetic coupling allows contactless and wear-free operation of the drive, thus ensuring a hermetically sealed and fully enclosed pump housing. An eccentrically mounted rotor in the pump system divides the suction chamber into multiple compartments with 2 radially sliding vanes. The volume of each chamber changes periodically as the rotor rotates. This provides suction of the gas at the vacuum flange, whereby the gas is then compressed in the suction chamber via rotation of the rotor and discharged at the exhaust. The gaps between rotor, stator and vanes are oil-tight to ensure that the pressures are sufficiently reduced to the correct requirements. As well as providing a sealing function, the operating fluid also serves to dissipate the heat generated by compression, lubricate the bearing, and discharge impurities from the pumping system. The rotary vane vacuum pump is fitted with a vacuum safety valve which completely seals the vacuum chambers upon shutdown of the vacuum pump, while at the same time venting the pump.

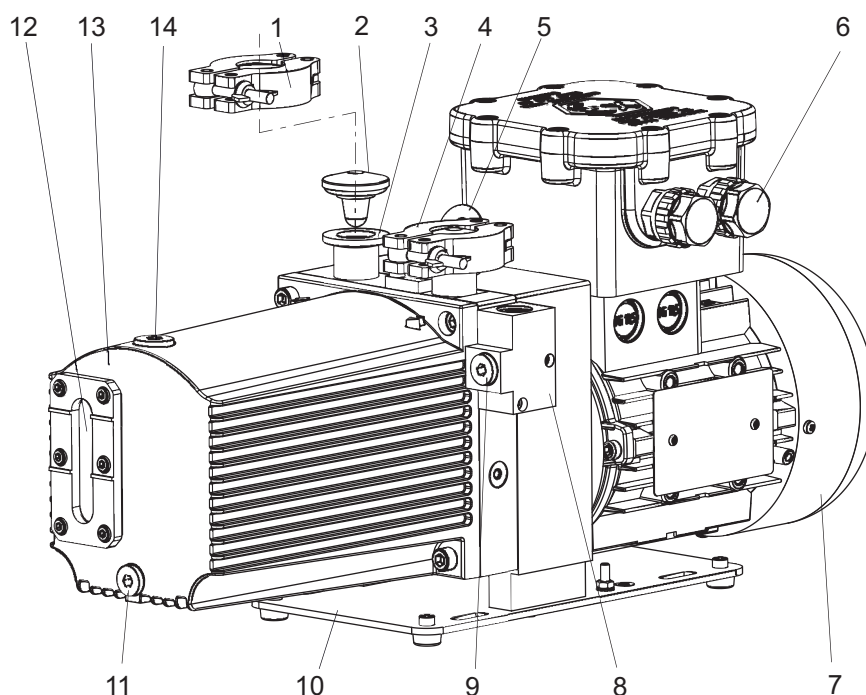


Fig. 2: Design, construction

- | | |
|--------------------------------------|---|
| 1 Circlip of vacuum flange | 8 Gas ballast valve |
| 2 Centering ring and blank flange | 9 Hose connection for inert gas (installed at the factory with locking screw) |
| 3 Vacuum flange | 10 Base plate |
| 4 Circlip of exhaust flange | 11 Drain screw for operating fluid |
| 5 Eye bolt | 12 Sight glass |
| 6 Cable bushing for mains connection | 13 Cap |
| 7 Motor | 14 Filling screw for operating fluid |

3.2 Operating principle

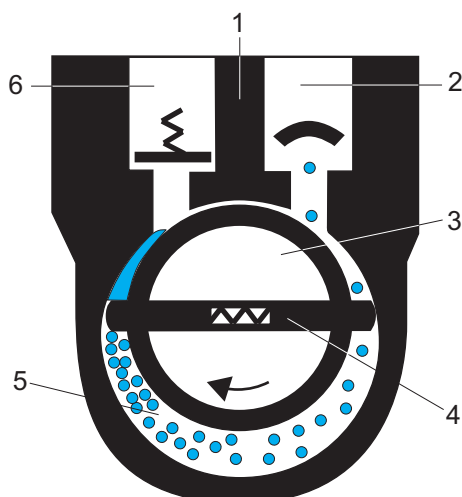


Fig. 3: Rotary vane vacuum pump functional principle

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

The rotary vane pump is an oil-sealed 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 provides suction of the gas at the vacuum flange, which thereby continues to be compressed in the suction chamber via rotation of the rotor until the exhaust valve opens and the gas is discharged against atmospheric pressure.

Gas ballast valve

The gas ballast device is used to blend inert gas with the process gas in the pumping system. An increase in the proportion of inert gas prevents condensation in the suction chamber as the required gas/vapor mixture is compacted within certain limits and discharged.

Operating fluid, oil

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

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

3.3 Scope of delivery

- Rotary vane vacuum pump with motor
- Operating fluid
- Cone sieve with centering ring and O-ring for both connection flanges
- Blank flange for both connection flanges
- Stainless steel circlips
- Connecting elements for inert gas (separate package)
- Documentation
- Optional accessories

3.4 Identifying the product

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

4 Transportation and Storage

4.1 Transporting the vacuum pump

DANGER

Risk of explosion from electrostatic charging during transport

There is a risk of fatalities when transporting packaging material (foil) and plastic containers in potentially explosive areas. Ignition can cause very serious injuries, and even fatalities.

- ▶ Only unpack the vacuum pump outside of potentially explosive areas.

DANGER

Risk of explosion when carrying out installation and maintenance work in potentially explosive areas

There is a risk of explosion if unsuitable tools are used in potentially explosive areas. Ignition can cause very serious injuries.

- ▶ Transport, installation and maintenance work may not be performed in potentially explosive atmospheres.
- ▶ Always shut down the vacuum pump before commencing any work.

WARNING

Risk of serious injury from swinging, toppling or falling objects

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

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



Preparations for transport

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

General information regarding safe transport

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

Transporting the vacuum pump in its packaging

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

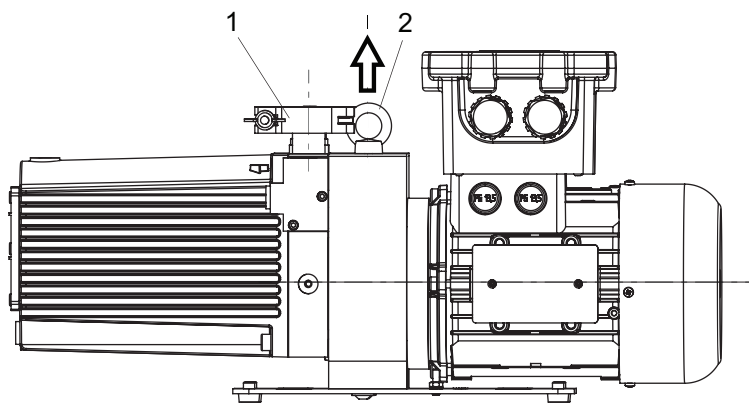


Fig. 4: Lifting and transporting the vacuum pump

- 1 Circlip with blank flange (2×) 2 Eye bolt

Transporting the vacuum pump without its packaging

One eye bolt is included in the scope of delivery. It is securely bolted to the vacuum pump at the factory.

1. Unpack the vacuum pump.
2. Attach a suitable lifting tool onto the eye bolt.
3. Pay attention to the correct use and fastening of the lifting equipment.
4. Lift the vacuum pump out of the transport packaging vertically.
5. Remove the eye bolt following transport and installation as required.
 - Keep the eye bolts for future use.

4.2 Storing the vacuum pump



Storage

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

Procedure

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

5 Installation

⚠ DANGER

Risk of explosion when carrying out installation and maintenance work in potentially explosive areas

There is a risk of explosion if unsuitable tools are used in potentially explosive areas. Ignition can cause very serious injuries.

- ▶ Transport, installation and maintenance work may not be performed in potentially explosive atmospheres.
- ▶ Always shut down the vacuum pump before commencing any work.

5.1 Installing the vacuum pump

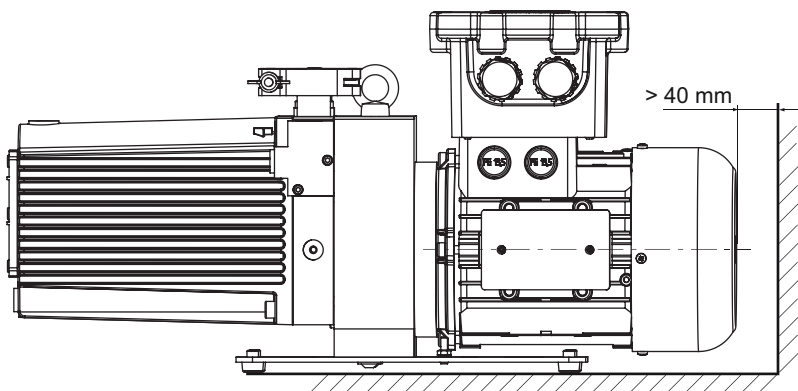


Fig. 5: Minimum distances

Notes on installing the vacuum pump

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. When installing the pump in a closed housing, ensure adequate air circulation.
4. Keep the sight glass and gas ballast valve visible and freely accessible.
5. Keep the voltage and frequency specifications on the motor rating plate visible and freely accessible.
6. Fill with operating fluid prior to first commissioning.
 - Quantity and type according to rating plate.

5.2 Connecting the vacuum side

⚠ CAUTION

Property damage from intake of solid particles

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

- ▶ Always use the cone sieve included in delivery in the intake flange.
- ▶ Ensure that the cone sieve is also installed at all times during installation.

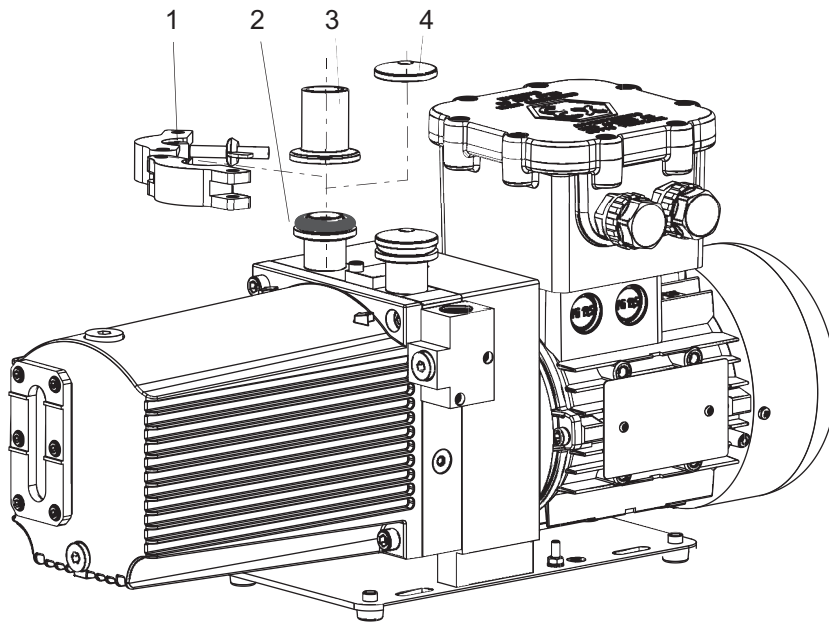


Fig. 6: Vacuum connection with flange connection

- | | |
|---|----------------|
| 1 Circlip | 3 Intake line |
| 2 Centering ring with cone sieve and O-ring | 4 Blank flange |

Connecting the vacuum side

1. Remove the blank flange 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 the vacuum pump and vacuum chamber; equivalent to the nominal flange diameter as a minimum.
4. Metal hoses with flange connections must be used exclusively in this regard.
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 against contamination using suitable measures.

5.3 Connecting the exhaust side

⚠ WARNING

Risk of fatalities due to escaping process media

The manufacturer has no influence on the media being supplied with the vacuum pump. Process media are often toxic, combustible, potentially explosive and/or reactive in other ways. There is a risk of serious or even fatal injuries if these media are permitted to leak into the atmosphere.

- ▶ Refer to the corresponding local guidelines. This information can be obtained from the Department of Health and Safety at Work of the user.
- ▶ Prevent zone entrainment.
- ▶ Connect the pump outlet to the suction system for hazardous media on the system.
- ▶ Perform regular inspections to ensure that there are no leaks at the connection between vacuum pump and suction pipes.

⚠ CAUTION

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

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

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

NOTICE**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.

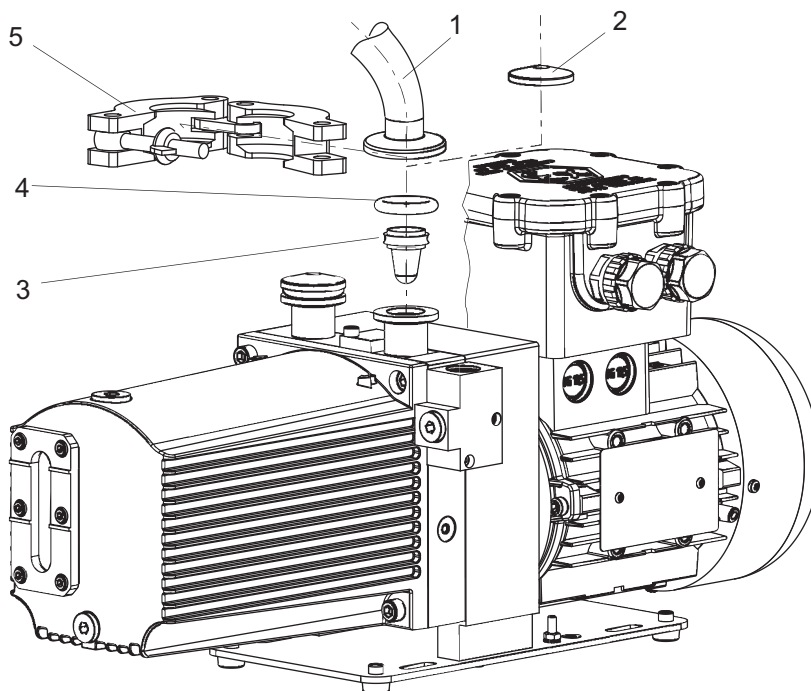


Fig. 7: Exhaust connection with flange connection

- | | |
|----------------------------------|-----------|
| 1 Exhaust line | 4 O-ring |
| 2 Blank flange | 5 Circlip |
| 3 Centering ring with cone sieve | |

Connecting the exhaust side

1. Remove the blank flange from the exhaust flange.
2. Ensure that the centering ring with cone sieve and the O-ring are fitted in the exhaust flange.
3. Choose a minimum exhaust line cross section equal to the nominal diameter of the connection flange.
4. Metal hoses with flange connections must be used exclusively in this regard.
5. Connect both flanges with a suitable circlip.
6. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
7. Route the piping downwards from the vacuum pump, to prevent condensate return.
8. Route process gases safely.
9. Use a suction device to prevent zone entrainment.

**Condensate separator**

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

5.4 Grounding the vacuum pump

A suitable grounding cable must be connected to eliminate any applicative disruptive influences.

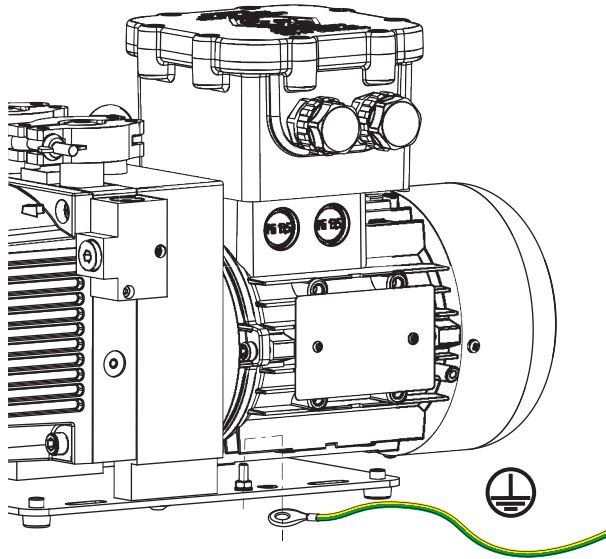


Fig. 8: Connecting the grounding cable

Procedure

1. Connect the ground terminal to the base plate of the vacuum pump with the local equipotential bonding of the potentially explosive area.
2. Route the connection in accordance with locally applicable provisions.
3. In addition to the ground terminal of the vacuum pump, establish a further connection on the motor housing.
 - Refer to the operating instructions of the motor in this regard.

5.5 Establishing mains connection

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

- Three phase motor (without switch and mains cable)

⚠ DANGER

Danger to life from electric shock

Touching exposed and voltage-bearing elements generates an electric shock. Incorrect connection of the mains supply leads to the risk of live housing parts that can be touched. There is a risk to life.

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

⚠ CAUTION

Risk of injury from entrapment of body parts

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ Secure the motor against re-start.

NOTICE

Risk of 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.
 - Pfeiffer Vacuum recommends the circuit breaker type "K" with slow tripping characteristic.

5.5.1 Choosing the cable bushing

Selection of the correct cable bushings is entirely the responsibility of the user.



The cable bushings are chosen in accordance with current EU Directive 2014/34/EU

- Select the power supply cable according to the respective application.
- The cable bushings must be suitable for the power supply cable being used.

Procedure

1. Observe the max. permissible tightening torque for the cable gland on the terminal box.
2. Refer to the operating instructions of the respective motor.

5.5.2 Connect three phase motor with 6-pin terminal board

NOTICE

Property damage from high starting torque

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

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

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

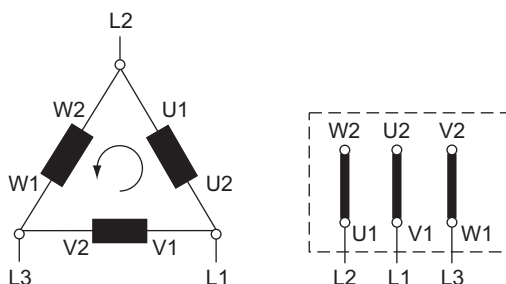


Fig. 9: Delta connection for low voltage

The 3 phases are connected in series, and their connection points connected to the mains. The voltage per phase is equal to the mains voltage, while the mains current is $\sqrt{3}$ times the phase current. The delta connection is marked with the Δ symbol. The voltage between the incoming mains supply lines is called mains voltage. The mains current is the current flowing in the incoming supply lines.

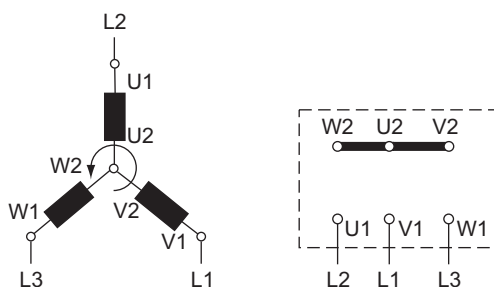


Fig. 10: Star circuit for high voltage

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

5.5.3 Selecting on-site fuse protection



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.

Procedure

1. For the protection of the motor in case of malfunction, always provide fuse protection according to the regulations applicable for the region.
2. Select a fuse with delayed action characteristic in accordance with the following table.

Motor voltage [V]	Frequency [Hz]	Motor rating [kW]	I_N [A]	I_{max} [A]
230	50	0.25	1.28	4.3
400	50	0.25	0.74	2.5
265	60	0.30	1.28	4.3
460	60	0.30	0.74	2.5

Tbl. 7: Current values for fuse layout

5.5.4 Connecting the PTC thermistor tripping unit

WARNING

Risk of explosion at increased winding temperature in potentially explosive atmospheres

If the winding temperature of the motor is not monitored, the motor winding could potentially become a source of ignition. There is a risk of explosion, and consequently the risk of sustaining serious injuries.

- ▶ Always establish the connections directed into the motor terminal boxes with a corresponding PTC thermistor tripping unit of an intrinsically safe electric circuit, suitable for the potentially explosive area.
 - Otherwise, the tripping unit must be installed outside of the potentially explosive area.

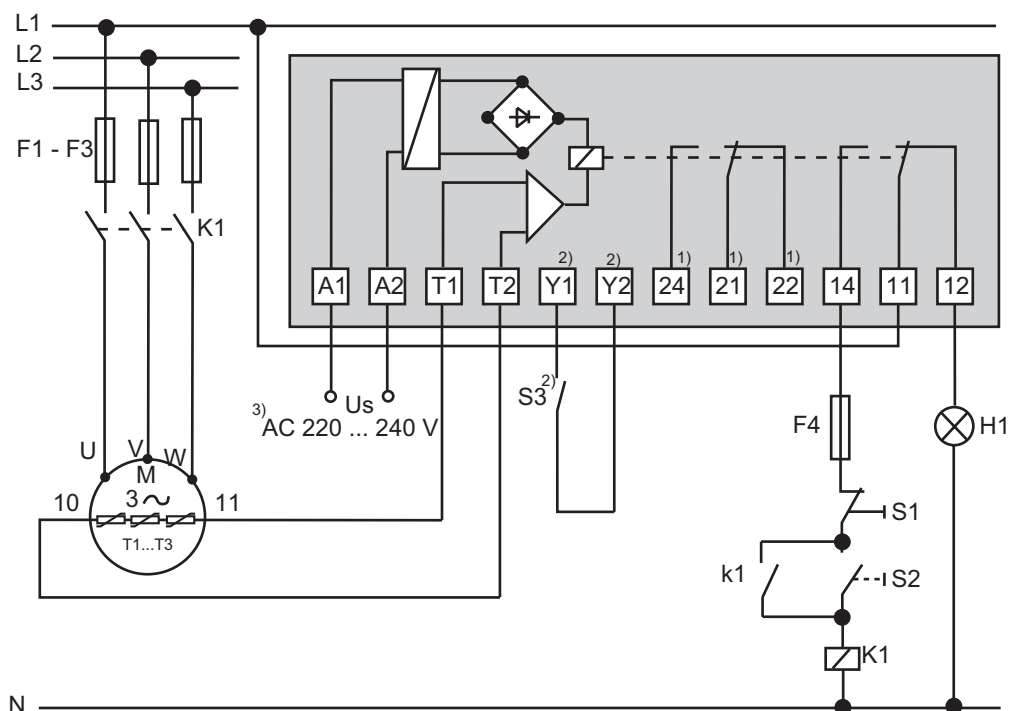


Fig. 11: Connection example with PTC thermistor tripping unit

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

Procedure

- ▶ For motors equipped with PTC in the stator winding, connect a thermistor tripping unit as protection against overload.
- ▶ Observe the supplied operating instructions for the motor with regard to the construction guidelines.
- ▶ After shut-down, switch the tripping unit back on manually via the installed RESET button or via the external RESET S3.
 - Switching on mains detected as automatic RESET.

5.5.5 Checking the direction of rotation



Operating fluid leaks out

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

- Check the direction of rotation before refilling operating fluid.

Procedure

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

5.6 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.

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 operating fluid)

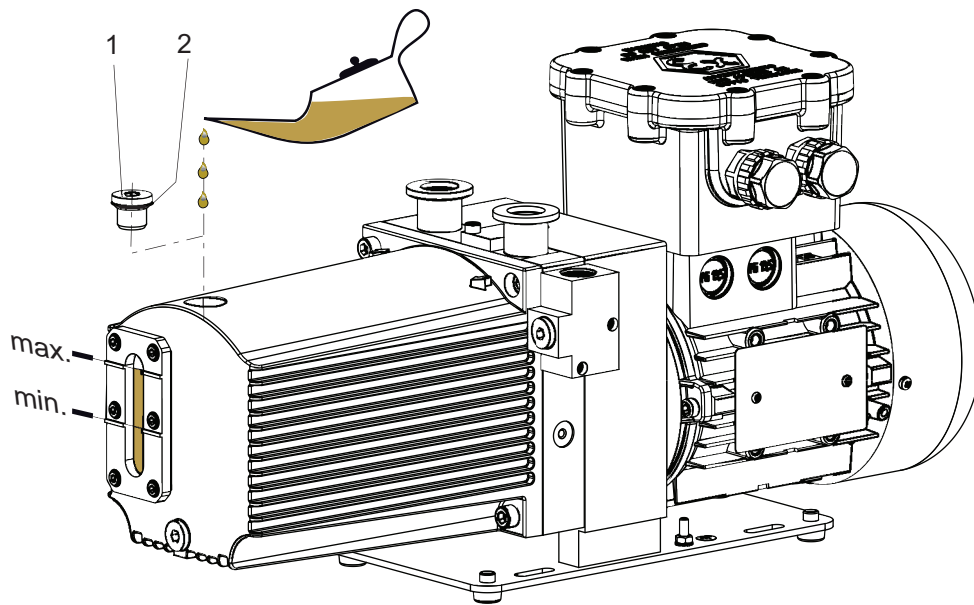


Fig. 12: Filling the operating fluid

- 1 Filling screw for operating fluid 2 O-ring

Consumable

- Operating fluid of the vacuum pump

Required tools

- Allen key, WAF 6 mm
- Torque wrench

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. 3.0 Nm**
 - The operating fluid screw is a constituent part of the leak-tested pump housing.

6 Operation

6.1 Putting the vacuum pump into operation

WARNING

Risk of explosion in the medium to be pumped as a result of increased pressure

With installation on the exhaust side, there is a risk of the exhaust pressure of the vacuum pump exceeding the atmospheric conditions. The ignition temperature of the medium to be pumped is lowered in the suction chamber.

If the ignition temperature of the medium to be pumped falls below a temperature of +135 °C, there is a risk of explosion, and consequently serious injury.

- ▶ Ensure that the ignition temperatures of the medium to be pumped is maintained above a temperature of +135 °C at 2000 hPa abs.

WARNING

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

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

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

CAUTION

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

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

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

Before switching on

1. Check the operating fluid in the sight glass.
2. Compare the voltage and frequency specifications on the motor rating plate with the available mains voltage and frequency.
3. Protect the vacuum pump from sucking in contamination using suitable measures.
4. Check the operating fluid at regular intervals.
5. Check the exhaust connection for free passage (max. permissible pressure: 1500 hPa absolute).

6.2 Switching on the vacuum pump

CAUTION

Risk of injury from entrapment of body parts

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ 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.

- ▶ Provide suitable touch protection.

Operating Conditions

- The optimal operating condition of the vacuum pump is continuous operation.
- Observe the application limits prescribed by (see chapter “Product usage limits”, page 18).
- The lowest possible ultimate pressures can be achieved with the gas ballast valve closed.

Procedure

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

1. Switch the vacuum pump on at the mains switch, or, in the case of three phase motors, on site via a protective circuit.
2. Allow the vacuum pump to warm up prior to process start, with the vacuum flange closed, for approximately 30 minutes.
3. Open the gas ballast valve if condensible vapors are present.
4. 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.

6.3 Operating the vacuum pump with inert gas

If the process requires the supply of inert gas (optional), a supply line is absolutely essential on the gas ballast valve to ensure controlled admission. Inert gas thins the process gas and prevents condensation in the vacuum pump.

⚠ WARNING

Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.

⚠ WARNING

Danger of injury from impermissibly high inert gas pressure

Increased inert gas pressure compromises the operational reliability due to increasing power consumption of the vacuum pump and potentially causes the temperature class threshold to be exceeded. There is a danger of bursting if there is a potentially explosive atmosphere. This leads to injuries caused by flying fragments, the escaping of high pressure, and damage to the unit.

- ▶ Observe the maximum permissible inert gas pressure of **1200 hPa (absolute)**.
- ▶ Dose the inert gas quantity with the dosing screw on the gas ballast valve or on site.

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.

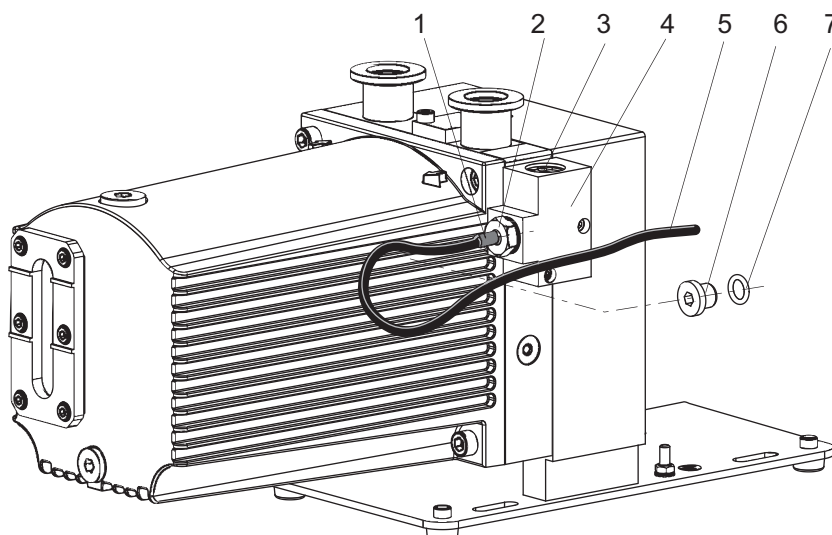


Fig. 13: Gas ballast valve with inert gas connection

- | | |
|-------------------------------|------------------|
| 1 Hose clamp | 5 Inert gas hose |
| 2 Hose connection with O-ring | 6 Locking screw |
| 3 Valve spindle | 7 O-ring |
| 4 Gas ballast valve | |

Required tools

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

Behavior of process gases with condensable vapors

- ▶ Connect a supply line at the gas ballast valve.
 - Connecting elements are included in the separate package
- ▶ Supply the vacuum pump with inert gas during operation via the gas ballast valve.

Fitting the hose connection



Observe the sequence during installation!

1. Disconnect the gas ballast valve from the rotary vane pump.
2. Fit the G 1/8" hose connection onto the valve body.
3. The hose connection must be fitted before screwing the valve body onto the rotary vane pump again, in order to prevent shearing of the bolts.

1. Disconnect the gas ballast valve from the rotary vane pump.
2. Unscrew the locking screw on the gas ballast valve.
3. Screw in the hose connection on the gas ballast valve while at the same time ensuring correct fitting of the O-ring.
 - Tightening torque: **3 Nm**
4. Fit the gas ballast valve again.
 - Tightening torque: **1 Nm**
5. At the same time, ensure correct fitting of the O-ring.
6. Connect the hose (DN 5 mm).
7. Fit the hose clamp.
8. Select the type and quantity of the inert gas used according to the process.
9. Consult Pfeiffer Vacuum if necessary.

Adjusting inert gas flow

The gas ballast quantity is regulated with the valve spindle.

1. Set the inert gas pressure to max. **1200 hPa (absolute)**.
2. Make sure that the inert gas pressure is greater than the respective intake pressure.
3. Set the desired gas quantity using the valve spindle.
 - Clockwise rotation to the stop: Valve closed.
 - Counter-clockwise rotation to the stop: Valve open.

6.4 Refilling operating fluid

⚠ WARNING

Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures

Uncontrolled exchange of gases when opening the housing could potentially generate a potentially explosive mixture of gas and air in the vacuum system or even outside of the vacuum pump. Ignition can cause very serious injuries.

- ▶ Respect segregation of the zones when filling the operating fluid.

Refill with operating fluid before the minimum fill level is reached.

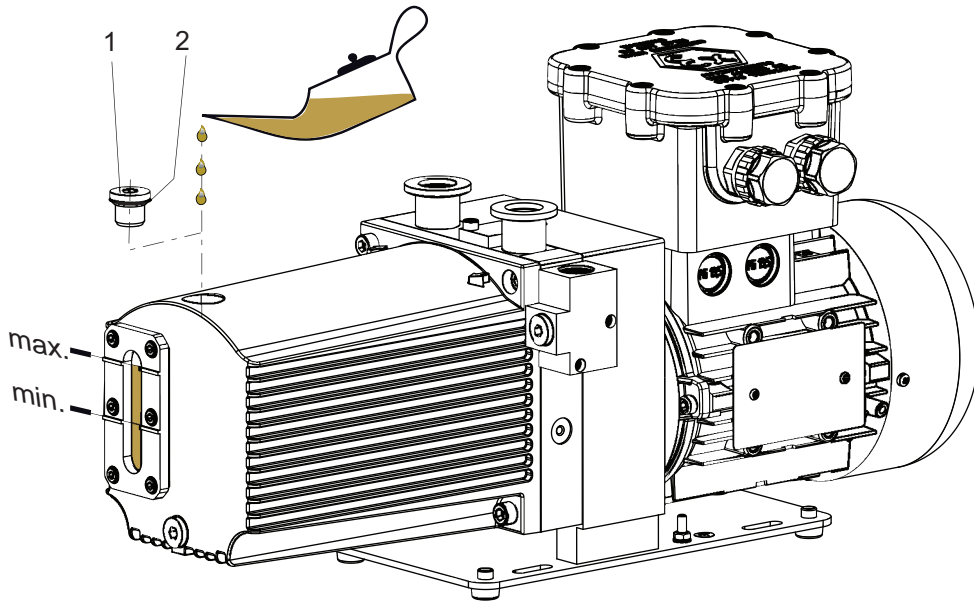


Fig. 14: Filling the operating fluid

- 1 Filling screw for operating fluid
- 2 O-ring

Consumable

- Operating fluid

Required tools

- Allen key, WAF 6 mm
- Calibrated torque wrench (tightening factor ≤ 2.5)

Filling the operating fluid

1. Switch off the vacuum pump.
2. Unscrew the operating fluid filler screw.
3. Refill with operating fluid up to the “max.” mark before the minimum fill level is reached.
4. Screw the operating fluid filler screw back in, taking care of the O-ring.
 - Tightening torque: **3.0 Nm**

6.5 Switching off the vacuum pump

NOTICE

Contamination from operating fluid backflow

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

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

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

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

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

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

Procedure

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

7 Maintenance

7.1 Maintenance instructions

DANGER

Risk of explosion when carrying out installation and maintenance work in potentially explosive areas

There is a risk of explosion if unsuitable tools are used in potentially explosive areas. Ignition can cause very serious injuries.

- ▶ Transport, installation and maintenance work may not be performed in potentially explosive atmospheres.
- ▶ Always shut down the vacuum pump before commencing any work.

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

Risk of injury from entrapment of body parts

During installation and maintenance, the motor may start up uncontrolled. There is a risk 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 connect the motor to the mains during installation.
- ▶ Safely disconnect the motor from the mains prior to maintenance.
- ▶ Secure the motor against re-start.

NOTICE

Damage from incorrect maintenance work

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

- ▶ Ensure that only the following categories of persons are authorized to perform servicing tasks:
 - Pfeiffer Vacuum employees with corresponding qualifications.
 - Persons who have undergone training from Pfeiffer Vacuum and have subsequently taken part in refresher courses at intervals of no more than every two years.
 - Persons who have been awarded official certification in accordance with Article 14 (6) Betr-SichV (Ordinance on Industrial Safety and Health).
- ▶ We recommend taking advantage of our service training offering.

The following safety information is applicable to the **dismantling of drive systems**.

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.

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

Preparing maintenance

1. Safely disconnect the drive motor from the mains.
2. Secure the motor against switching back on.
3. For maintenance work, only dismantle the vacuum pump to the extent needed.
4. Dispose of used operating fluid according to applicable regulations in each case.
5. When using synthetic operating fluid, please observe the associated application instructions.
6. Only use alcohol or similar media to clean the pump parts.
7. Always perform a leak test after carrying out maintenance and inspection work.

7.2 Checklist for inspection and maintenance

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

We recommend that maintenance work at **Levels 2 and 3** (inspection) be carried out by Pfeiffer Vacuum Service. 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.



Notes on maintenance intervals

Depending on the process, the required maintenance intervals may be shorter than the reference values specified in the table.

- Consult with Pfeiffer Vacuum Service about shorter maintenance intervals for extreme loads or for specific processes.

Action described in document	Inspection BA	Maintenance level 1 BA	Maintenance level 2 MM	Maintenance level 3 MM	Required material
Interval	daily	≤ yearly	≤ 2 years	≤ 4 years	
Inspection					
Visual and acoustic pump check Check operating fluid: <ul style="list-style-type: none"> • Check fill level • Check color (contamination) • Check vacuum pump for leaks 	■				
Inspect the OME filter (refer to the operating instructions)	■				
Maintenance level 1 – operating fluid replacement					
Clean the outside of the vacuum pump: <ul style="list-style-type: none"> • Pump housing • Clean motor fan cap Changing the operating fluid		■			Operating fluid ¹⁾ Maintenance kit 1
Additional activities: <ul style="list-style-type: none"> • Remove cap • Clean inside cap and sight glass, and clean the outside of the pumping system (without cleaning agent) • Remove and clean gas ballast valve, replace wearing parts 		■			

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

Action described in document	Inspection BA	Maintenance level 1 BA	Maintenance level 2 MM	Maintenance level 3 MM	Required material
Interval	daily	≤ yearly	≤ 2 years	≤ 4 years	
Replace the filter in the OME (where present) as prescribed in the operating instructions		■ as required			
Maintenance level 2 – dismantling and cleaning					
Dismantle and clean vacuum pump, replace seals and the following wear parts: <ul style="list-style-type: none"> • Wear parts, vacuum safety valve (hydraulic piston) • Wear parts for exhaust valve (valve flap, valve buffer) • Wear parts for gas ballast valve (valve flap) • Vane springs 			■		Maintenance kit 2
Maintenance level 3 – overhaul					
Dismantle and clean vacuum pump, replace seals and all wear parts: <ul style="list-style-type: none"> • Vane • Valves, springs, and sight glass • Silencer nozzle • Check the coupling and replace as necessary 				■	Overhaul kit

Tbl. 8: Maintenance intervals

7.3 Changing the operating fluid



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

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

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 identification 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 Determine degree of aging of P3 operating fluid

WARNING

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

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

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

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

Prerequisites

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

Required aids

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

Determine 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: **3 Nm**

7.3.2 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 if it comes into contact with the skin.

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

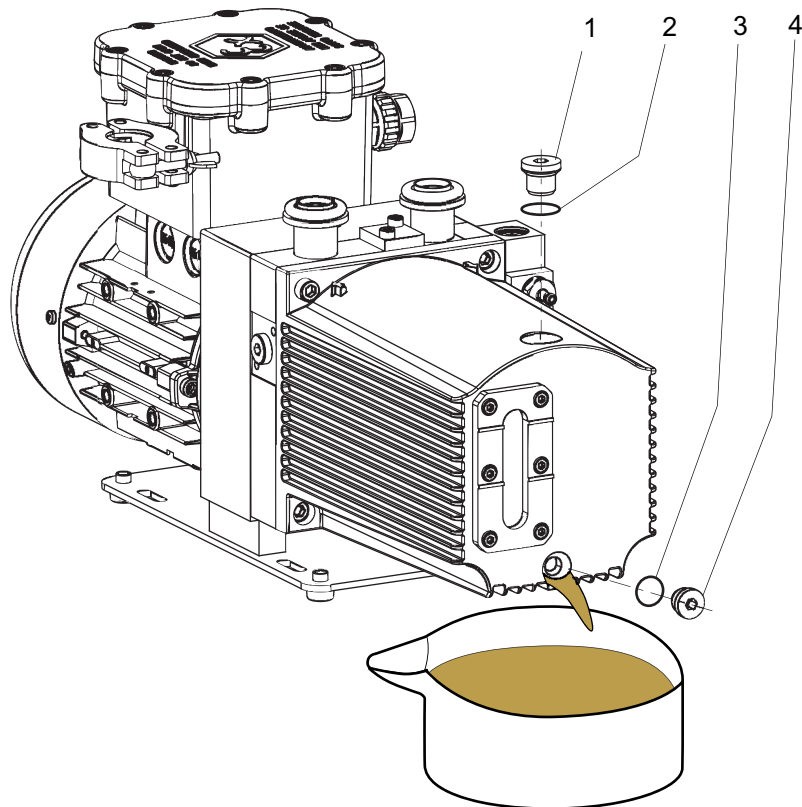


Fig. 15: Draining the operating fluid

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

Consumable

- Operating fluid

Required tools

- Allen key, 5 mm
- Allen key, 6 mm
- Calibrated torque wrench (tightening factor ≤ 2.5)

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: **3.0 Nm**
12. Fill with new operating fluid and check the fill level.
13. Screw in the filler screw while at the same time ensuring correct fitting of the O-ring.
 - Filler screw tightening torque: **3.0 Nm**

7.3.3 Rinsing and cleaning the rotary vane vacuum pump



Cleaning by changing the operating fluid

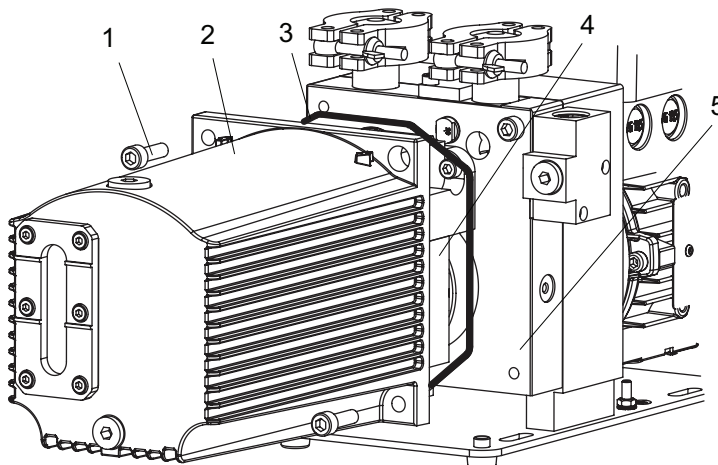
Pfeiffer Vacuum recommends, in cases of heavy contamination with process residues, cleaning the inside of the vacuum pump with several operating fluid changes.

Required tools

- Allen key, 5 mm
- Allen key, 6 mm
- Calibrated torque wrench (tightening factor ≤ 2.5)

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 changing of the operating fluid if necessary.
4. Replace the corresponding filter elements wherever the accessory is installed.

**Fig. 16: Removing/fitting the cap**

- | | |
|-------------------------|------------------|
| 1 Allen head screw (2×) | 4 Pumping system |
| 2 Cap | 5 stand |
| 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.

Install 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: **3.0 Nm**
5. Fill with operating fluid and check the fill level (see chapter “Filling the operating fluid”, page 31).
6. Screw in the operating fluid filler screw.
 - Be careful with the O-ring.
 - Tightening torque: **3.0 Nm**

7.4 Cleaning the inert gas valve

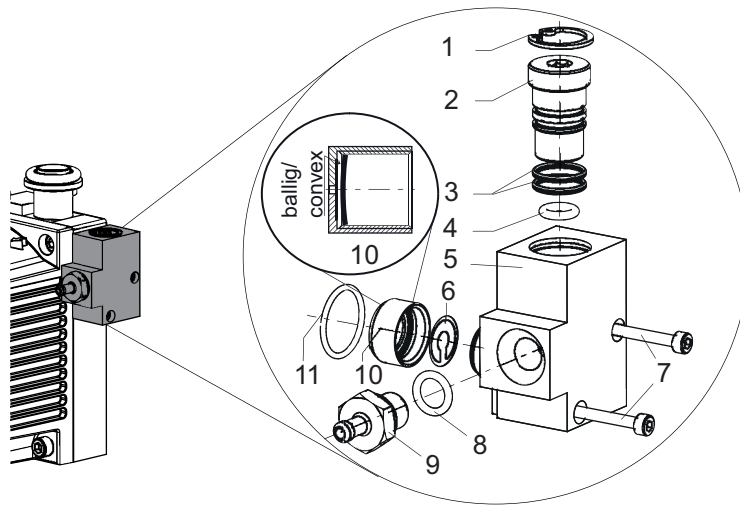


Fig. 17: Valve with inert gas connection

- | | |
|-----------------|-------------------|
| 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, WAF 5 mm
- Open-end wrench, 14 mm WAF
- Circlip pliers J1
- Calibrated torque wrench (tightening factor ≤ 2.5)

Dismantling the valve

1. Dismantle the hose from the inert gas supply 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 the parts - especially the bores in the valve housing.
9. Replace the parts according to the spare parts pack.

Assembling the 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. Observe the **assembly sequence**.
4. First fit the G 1/8" hose connection on the valve housing.
 - Tightening torque: **3.0 Nm**.
5. Slide the O-ring over the screw cap up to the stop.
6. This must be performed before screwing the valve housing onto the vacuum pump in order to avoid shearing the Allen head screws.
7. Tighten the screws.
 - Tightening torque: **1.0 Nm**.
8. Fit the spindle in the valve housing.
9. Insert the circlip.

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:

Prerequisites

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

Procedure

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. Switch off the vacuum pump.
5. Fill the vacuum pump to above the “**max.**” mark with operating fluid, up to the upper edge of the sight glass.
6. Seal the vacuum and exhaust flanges with blank flanges and circlips.
7. Seal additional openings of the vacuum pump as required.
8. Close the gas ballast valve.
9. Store the vacuum pump in a dry, dust-free room outside of the potentially explosive area observing the ambient conditions stipulated.
10. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
11. Please note, the vacuum pump may not be stored in the vicinity of machines, traffic routes, etc., as strong vibrations may damage the bearing.
12. For longer storage periods (> 2 years), Pfeiffer Vacuum recommends changing the operating fluid again prior to recommissioning.

8.2 Recommissioning

DANGER

Risk of explosion from electrostatic charging during transport

There is a risk of fatalities when transporting packaging material (foil) and plastic containers in potentially explosive areas. Ignition can cause very serious injuries, and even fatalities.

- ▶ Only unpack the vacuum pump outside of potentially explosive areas.

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.
- ▶ Replace all elastomer parts.
- ▶ Observe the maintenance instructions – consult Pfeiffer Vacuum if necessary.



Ejection of operating fluid

Operating fluid ejection at the exhaust connection after overfilling.

- Drain operating fluid to the normal level prior to recommissioning.

9 Recycling and disposal

WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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



Environmental protection

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

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



Environmental protection

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

9.1 General disposal information

Pfeiffer Vacuum products contain materials that you must recycle.

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

9.2 Dispose of rotary vane pump

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

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

10 Malfunctions

⚠ CAUTION

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.

NOTICE

Damage from incorrect maintenance work

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

- ▶ Ensure that only the following categories of persons are authorized to perform servicing tasks:
 - Pfeiffer Vacuum employees with corresponding qualifications.
 - Persons who have undergone training from Pfeiffer Vacuum and have subsequently taken part in refresher courses at intervals of no more than every two years.
 - Persons who have been awarded official certification in accordance with Article 14 (6) Betr-SichV (Ordinance on Industrial Safety and Health).
- ▶ We recommend taking advantage of our service training offering.

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

Problem	Possible causes	Remedy
Vacuum pump will not start up	<ul style="list-style-type: none"> • No mains voltage or voltage does not correspond to the motor data 	<ul style="list-style-type: none"> • Check the mains voltage and mains fuse. • If necessary, check the motor switch.
	<ul style="list-style-type: none"> • Pump temperature too low 	<ul style="list-style-type: none"> • Check the mains voltage and mains fuse. • If necessary, check the motor switch.
	<ul style="list-style-type: none"> • Thermal protection switch has triggered 	<ul style="list-style-type: none"> • Determine and eliminate the cause. • Allow the vacuum pump to cool down as required.
	<ul style="list-style-type: none"> • Pumping system contaminated 	<ul style="list-style-type: none"> • Clean the vacuum pump. • If necessary, contact Pfeiffer Vacuum Service.
	<ul style="list-style-type: none"> • Pumping system damaged 	<ul style="list-style-type: none"> • Clean and maintain the vacuum pump. • If necessary, contact Pfeiffer Vacuum Service.
	<ul style="list-style-type: none"> • Motor faulty 	<ul style="list-style-type: none"> • Replace the motor.
Vacuum pump switches off after a while after being started	<ul style="list-style-type: none"> • Thermal protection switch of the motor has triggered 	<ul style="list-style-type: none"> • Determine and eliminate the cause of overheating. • Allow the motor to cool down as required.
	<ul style="list-style-type: none"> • Mains fuse triggered due to overload (e.g. cold start) 	<ul style="list-style-type: none"> • Bring vacuum pump to permissible ambient temperature range.
	<ul style="list-style-type: none"> • Exhaust pressure too high 	<ul style="list-style-type: none"> • Ensure unobstructed outlet opening of exhaust line and exhaust side accessories.

Problem	Possible causes	Remedy
Vacuum pump does not reach the specified ultimate pressure	<ul style="list-style-type: none"> Measurement result distorted 	<ul style="list-style-type: none"> Check the measurement instrument. If necessary, check the ultimate pressure without the vacuum system connected.
	<ul style="list-style-type: none"> Vacuum pump or connected accessory contaminated 	<ul style="list-style-type: none"> Clean the vacuum pump. Check the components for contamination as required.
	<ul style="list-style-type: none"> Operating fluid contaminated 	<ul style="list-style-type: none"> Operate the vacuum pump with inert gas over a longer period. Replace the operating fluid as required.
	<ul style="list-style-type: none"> Operating fluid level too low 	<ul style="list-style-type: none"> Top up the operating fluid.
	<ul style="list-style-type: none"> Leak in system 	<ul style="list-style-type: none"> Locate and eliminate the leak.
	<ul style="list-style-type: none"> Vacuum pump is damaged 	<ul style="list-style-type: none"> Contact Pfeiffer Vacuum Service.
Pumping speed of vacuum pump too low	<ul style="list-style-type: none"> The intake line is not suitably dimensioned 	<ul style="list-style-type: none"> Make sure that connections are short and cross sections adequately dimensioned.
	<ul style="list-style-type: none"> Exhaust pressure too high 	<ul style="list-style-type: none"> Check exhaust line outlet opening and exhaust side accessories.
Loss of operating fluid	<ul style="list-style-type: none"> Casing seal is leaking 	<ul style="list-style-type: none"> Check and replace the seal.
	<ul style="list-style-type: none"> Loss of operating fluid from normal operating conditions – without oil mist filter (OME) 	<ul style="list-style-type: none"> Install an OME.
	<ul style="list-style-type: none"> Loss of operating fluid from normal operating conditions – with oil mist filter (OME) 	<ul style="list-style-type: none"> Clean the OME and ODK, or replace the filter.
Unusual noises during operation	<ul style="list-style-type: none"> Noise reduction is contaminated 	<ul style="list-style-type: none"> Remove the cap. Clean the silencer nozzle. If necessary, contact Pfeiffer Vacuum Service.
	<ul style="list-style-type: none"> Pumping system is contaminated or damaged 	<ul style="list-style-type: none"> Clean and maintain the vacuum pump. If necessary, contact Pfeiffer Vacuum Service.
	<ul style="list-style-type: none"> Motor bearing is faulty 	<ul style="list-style-type: none"> Change the motor. If necessary, contact Pfeiffer Vacuum Service.

Tbl. 9: Troubleshooting for rotary vane pumps

11 Service solutions by Pfeiffer Vacuum

We offer first-class service

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

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

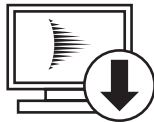
Our professional sales and service employees are available to provide you with reliable assistance, worldwide. Pfeiffer Vacuum offers an entire range of services, from [original replacement parts](#) to [service contracts](#).

Make use of Pfeiffer Vacuum service

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

You can obtain advice on the optimal solution for you, from your [Pfeiffer Vacuum representative](#).

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



1. Download the up-to-date form templates.
 - [Explanations of service requests](#)
 - [Service requests](#)
 - [Contamination declaration](#)

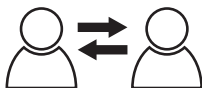
- a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
- b) If necessary, drain operating fluid/lubricant.
- c) If necessary, drain coolant.



2. Complete the service request and contamination declaration.



3. Send the forms by email, fax, or post to your local [Service Center](#).

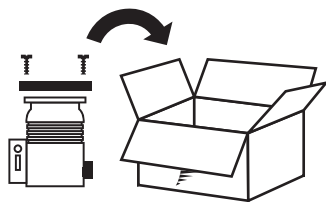


4. You will receive an acknowledgment from Pfeiffer Vacuum.

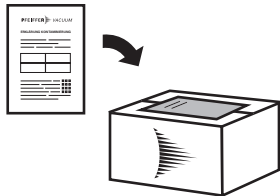
PFEIFFER VACUUM

Submission of contaminated products

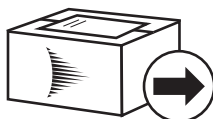
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination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



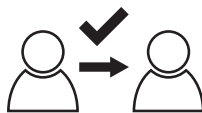
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
 - a) Neutralize the product with nitrogen or dry air.
 - b) Seal all openings with blind flanges, so that they are airtight.
 - c) Shrink-wrap the product in suitable protective foil.
 - d) Package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



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



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



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

PFEIFFER VACUUM

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

12 Spare parts

Observe the following instructions when ordering spare parts:

Procedure

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

Spare parts pack	Order no.
Maintenance kit 1 – maintenance level 1	PK E01 050 -CT
Maintenance kit 2 – maintenance level 2, cleaning and dismantling	PK E01 049 -T
Set of vanes	PK E08 033 -T
Overhaul kit – maintenance level 3	PK E02 080 -T
Coupling set	PK E06 015 -T

Tbl. 10: Spare parts pack Duo 11 ATEX

12.1 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

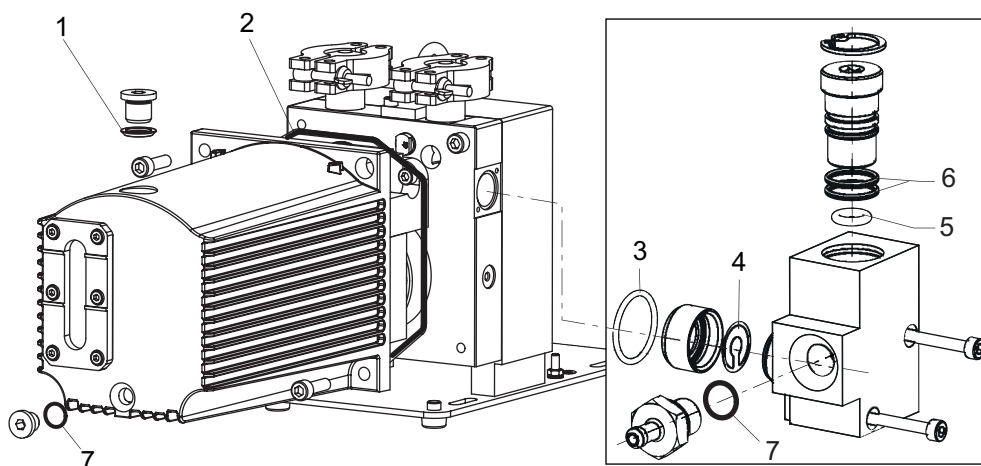


Fig. 18: Content of maintenance kit 1 – maintenance level 1

Item no.	Designation	Size	Scope of delivery
1	O-ring, FPM	10 × 2.5	1
2	O-ring, FPM	123 × 2.5	1
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. 11: Content of maintenance kit 1

12.2 Maintenance kit 2 – maintenance level 2, cleaning and dismantling

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
- Valves and vane springs

12.3 Overhaul kit – Maintenance level 3

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

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

12.4 Coupling set for versions with magnetic coupling

The coupling set contains:

- Both coupling halves
- Containment shell with O-ring

12.5 Set of vanes

The set of vanes contains:

- Vane
- Vane springs

13 Accessories



View the [range of accessories for rotary vane pumps](#) on our website.

13.1 Accessory information

OME 16 ATEX with operating fluid return line

The oil mist filter prevents the oil mist from escaping and channels separated operating fluid back into the rotary vane pump.

Operation monitoring

The operation monitoring monitors the oil pressure and emits a signal in the event of a drop in pressure or if the rotary vane pump shuts down.

Exhaust pressure monitoring

The pressure switch monitors the exhaust pressure of the rotary vane pump.

Operating fluid level monitoring

The level switch monitors the operating fluid fill level of the rotary vane pump.

Operating fluid temperature monitoring

The temperature sensor monitors the temperature of the operating fluid.

13.2 Ordering accessories

Accessories for Duo 11 ATEX	Order no.
OME 16 ATEX, Oil Mist Separator	PK Z40 200
Oil Return Unit ODK from OME 16 ATEX to Duo 11 ATEX	PK 006 081 -T
Operations Monitoring Unit 1, sensor for Oil level	PK 007 100 -T
Operations Monitoring Unit 2, Sensor for Oil Level and Oil Temperature	PK 007 101 -T
Operations Monitoring Unit 3, Sensor for Oil Level, Oil Temperature and Exhaust Pressure	PK 007 102 -T
Operations Monitoring Unit 4, Sensor for Oil Pressure	PK 007 103 -T
PTC Resistor Tripping Device 220 – 240 V AC	P 4768 052 FQ
PTC Resistor Tripping Device 24 V AC/DC	P 4768 052 FE

Tbl. 12: Ordering accessories

Consumables	Order no.
P3, mineral oil, 0.5 l	PK 001 136 -T
P3, mineral oil, 1 l	PK 001 106 -T

Tbl. 13: Consumables

14 Technical data and dimensions

14.1 General

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

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

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^5$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1

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

Tbl. 14: 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. 15: Conversion table: Units for gas throughput

14.2 Substances in contact with the media

Pump parts	Substances in contact with the media
Housing	Aluminium
Inlet/exhaust flange	Stainless steel
Sight glass	Synthetic
Stator/stator flange	Cast iron
Rotor	Cast iron (nodular graphite cast iron)
Magnetic coupling	Steel, nickel-coated magnets
Containment shell	Synthetic
Vane	Artificial resin compound, polymer
Exhaust valve	Stainless steel
Vacuum safety valve	Aluminum, steel, synthetic, FKM
Gas ballast valve	Aluminum, stainless steel, steel, FKM
Screws	Galvanized steel, stainless steel
Seals	FKM (alternative seals upon request)

Tbl. 16: Materials that make contact with the process media

14.3 Technical data

Classification	Duo 11 ATEX
ATEX-certification	II 3/3G Ex h IIC T4 Gc X
Part number	PK D59 905
Connection flange (in)	DN 16 ISO-KF
Connection flange (out)	DN 16 ISO-KF
Pumping speed at 50 Hz	9 m ³ /h
Pumping speed at 60 Hz	10.5 m ³ /h
Final pressure with gas ballast	3 · 10 ⁻² hPa
Final pressure without gas ballast	3 · 10 ⁻³ hPa
Continuous inlet pressure, max.	50 hPa
Continuous gas temperature, max.	40 °C
Exhaust pressure, max.	1500 hPa
Exhaust pressure, min.	250 hPa
Gas ballast	Yes
Gas ballast pressure	≤ 1200 hPa
Water vapor capacity 50 Hz	65 g/h
Water vapor capacity 60 Hz	84 g/h
Water vapor tolerance at 50 Hz	10 hPa
Water vapor tolerance at 60 Hz	11 hPa
Emission sound pressure level without gas ballast at 50 Hz	54 dB(A)
Cooling method, standard	Air
Motor version	3-ph motor
Input voltage 50 Hz	230 / 400 V
Input voltage 60 Hz	265 / 460 V
Input voltage: tolerance	±5 %
Rated power 50 Hz	0.25 kW
Rated power 60 Hz	0.3 kW
Rotation speed at 50 Hz	3000 rpm
Rotation speed at 60 Hz	3600 rpm
Protection category	IP66
Motor protection	PTC
Mains cable included	No
Switch	No
Magnetic coupling	Yes
Leak rate	≤ 1 · 10 ⁻⁸ Pa m ³ /s
Leak rate safety valve	≤ 1 · 10 ⁻⁵ Pa m ³ /s
Operating fluid amount	0.5 l
Operating fluid	P3
Ambient temperature	12 – 40 °C
Shipping and storage temperature	-10 – 40 °C
Weight	15.3 kg

Tbl. 17: Technical data Duo 11 ATEX

14.4 Dimensions

Dimensions in [mm]

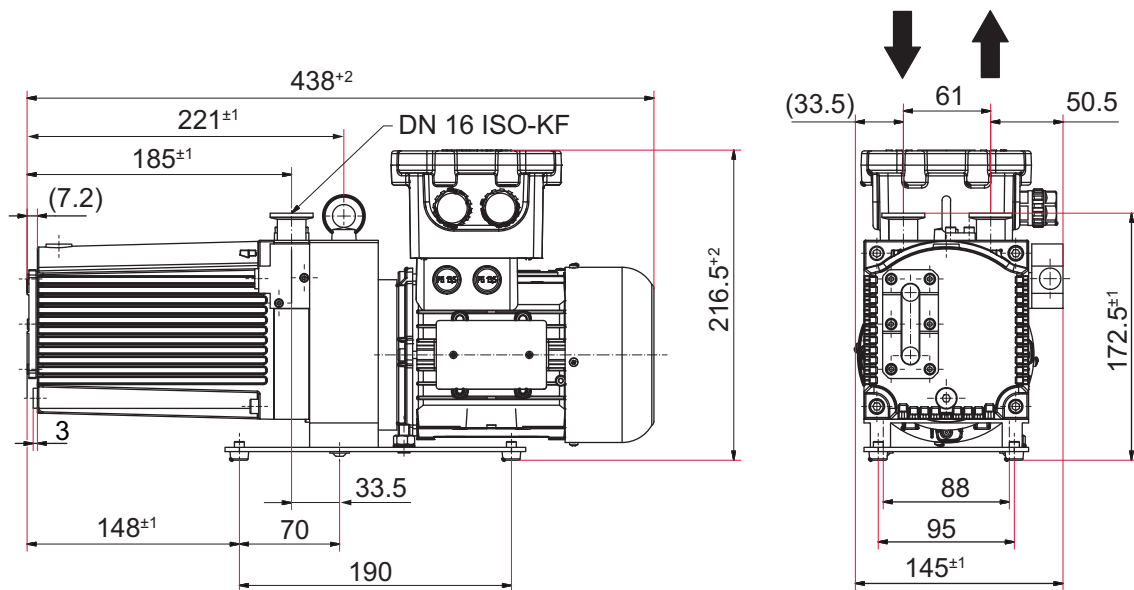


Fig. 19: Dimension diagram Duo 11 ATEX

Declaration of conformity

Declaration for product(s) of the type:

Rotary vane pump

Duo 11 ATEX

Article no.: PK D59 905 C

 II 3/3G Ex h IIC T4 Gc X +12 °C ≤ Ta ≤ +40 °C

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**
- **Explosion protection 2014/34/EU according to article 13 (1) c)**
- **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:

EN ISO 12100: 2011

ISO 80079-37: 2016-12

EN 1012-2: 2011-12

EN 1127-1: 2019

EN ISO 13857: 2008

EN 61000-6-1: 2007

ISO 21360-1: 2016

EN 61000-6-2: 2006

ISO 21360-2: 2012

EN 61000-6-3: 2007 + A1: 2011

EN 61010-1: 2010

EN 61000-6-4: 2007 + A1: 2011

ISO 80079-36: 2016-12

EN ISO 2151: 2: 2008

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

Signature:



(Daniel Sälzer)

Managing Director

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COMPETENCE IN THEORY AND PRACTICE

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

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