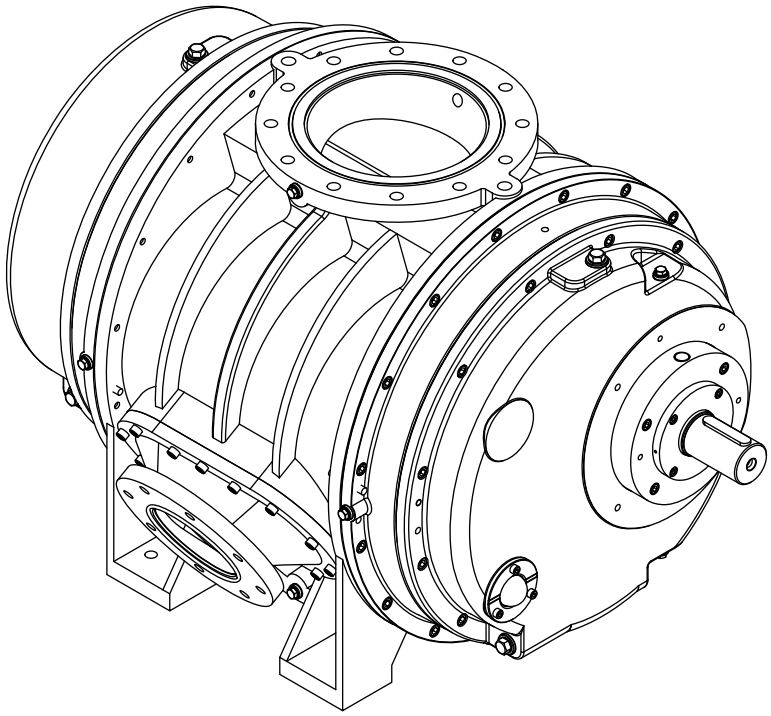


OPERATING INSTRUCTIONS

EN

Translation of the original instructions

OKTA 4000 G

Roots Pump

PFEIFFER VACUUM

PW 0262 BEN/G (1605)

Table of contents

1 About this manual

1.1 Validity

This operating manual is for customers of Pfeiffer Vacuum. It describes the functioning of the designated product and provides the most important information for safe use of the unit. The description follows applicable EU guidelines. All information provided in this operating manual refers to the current state of the product's development. The documentation remains valid as long as the customer does not make any changes to the product.

Up-to-date operating instructions can also be downloaded from www.pfeiffer-vacuum.com.

Applicable documents

Okta 4000 G	Operating instructions
Declaration of Conformity	Part of this document
Operating instructions for accessories (order-specifically)	see section "accessories"*

*also available via www.pfeiffer-vacuum.com

1.2 Conventions

Safety instructions

The safety instructions in Pfeiffer Vacuum operating instructions are the result of risk evaluations and hazard analyses and are oriented on international certification standards as specified by UL, CSA, ANSI Z-535, SEMI S1, ISO 3864 and DIN 4844. In this document, the following hazard levels and information are considered:

DANGER

Imminent danger

Indicates an imminent hazardous situation that will result in death or serious injury.

WARNING

Possibly imminent danger

Indicates an imminent hazardous situation that can result in death or serious injury.

CAUTION

Possibly imminent danger

Indicates an imminent hazardous situation that can result in minor or moderate injury.

NOTICE

Command or note

Command to perform an action or information about properties, the disregarding of which may result in damage to the product.

Pictographs

Prohibition of an action to avoid any risk of accidents, the disregarding of which may result in serious accidents

Warning of a displayed source of danger in connection with operation of the unit or equipment

Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents

Instructions in the text

➔ Work instruction: here you have to do something.

Abbreviations

RSSR: Radial shaft seal ring

MS: Mechanical seal

Symbols used

The following symbols are used consistently throughout in all illustrations:

- Ⓥ Vacuum flange
- Ⓥ Exhaust flange (fore-vacuum flange)
- Ⓔ Electrical connection
- Ⓜ Measuring connection for pressure or gas temperature
- ⓈⒼ Sealing gas connection

2 Safety

2.1 Safety precautions

Duty to inform

Each person involved in the installation, operation or maintenance of the vacuum pump must read and observe the safety-related parts of these operating instructions.

➔ The operator is obligated to make operating personnel aware of dangers originating from the vacuum pump, the pumped medium and the entire system.

Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

➔ For information on order numbers of components, see "Accessories".

➔ Use original accessory parts only.

- Do not expose any body parts to the vacuum.
- Observe the safety and accident prevention regulations.
- Check regularly that all safety precautions are being complied with.
- Do not carry out any unauthorised modifications or conversions to the pumps.
- Depending on the operating and ambient conditions, the surface temperature of the pumps may rise above 100 °C. Use suitable finger guards if necessary.
- When returning the pumps to us please note the instructions in the Service section.
- Depending on the location, sound pressure levels of up to 105 dB(A) can occur. It is therefore important to use appropriate equipment to protect yourself against the noise.

2.2 Protective equipment

Determined situations concerning the handling of vacuum pumps require wearing of personal protective equipment. The owner, respectively the employer are obligated to provide an adequate equipment to any operating persons.

DANGER

Danger to health by hazardous substances during maintenance or installation

Depending on the process vacuum pumps, components or operating fluids can be contaminated by toxic, reactive or radioactive substances.

➔ Wear adequate protective equipment during maintenance and repairs or in case of reinstallation.

CAUTION

Risk of injury through hot surfaces

Vacuum pumps can become hot during operation.

➔ Allow the pump to cool before maintenance and repairs.

➔ If necessary wear protective gloves according to EN 420.

WARNING

Increased noise emission!

Increased noise emission can occur within a limited area surrounding the vacuum pump.

➔ Provide noise protection or

➔ wear hearing protection.

2.3 Proper use

NOTICE

EC conformity

The manufacturer's declaration of conformity becomes invalid if the operator modifies the original product or installs additional components.

➔ Following installation into a plant and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassess it accordingly.

- The vacuum pump may only be used to generate a vacuum.
- Use sealing gas, depending on the process.
- Installation, operating and maintenance regulations must be complied with.
- Other accessories, than those described in this manual, must not be used without the agreement of Pfeiffer Vacuum.
- Only use the standard lubricants for applications with oxygen concentration ≤ 21 %. At higher oxygen concentrations use application-specific lubricant after consulting Pfeiffer Vacuum.

2.4 Improper use

Improper use will cause all claims for liability and warranties to be forfeited. Improper use is defined as usage for purposes deviating from those mentioned above, especially:

- pumping of corrosive gases
- pumping of explosive media
- operation in potentially explosive areas
- operation of the pump with open vacuum or fore-vacuum flange open to the atmosphere
- use of the vacuum pump to generate pressure
- connection to pumps or units which are not suitable for this purpose according to their operating instructions
- connection to units which have exposed voltage-carrying parts
- the evacuation of gases that may form adherent deposits or condensate in the suction chamber

3 Transport and storage

3.1 Transport

WARNING

Danger from falling and swinging loads!

When lifting the pump there is a danger of falling parts.

➔ Make sure that there are no persons under the suspended load.

➔ Close off and supervise the area under the pump.

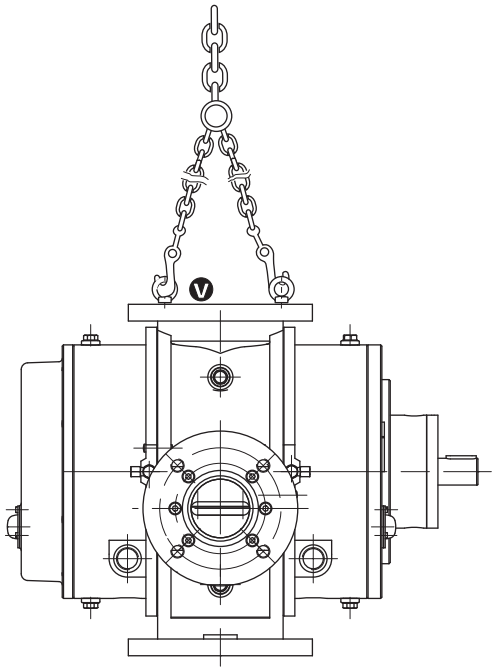


Fig. 1: Transporting the pump

➔ Look for transportation damage when receiving the pump.
➔ Use only a forklift to transport pump packed on pallet.
➔ Unpack pump and undo screws on transport container.
➔ Reuse the transport container of the vacuum pump.
  – Transport or ship vacuum pumps in the original packing preferably.

Transport without packaging

➔ Remove the locking cap from the vacuum and fore-vacuum flange immediately before connecting!
➔ Lift the pump using lifting devices, and use only the ring bolts (threaded holes in the vacuum flange) provided for that purpose on the top side of the pump.
➔ To lift the pump with motor and if accessories are mounted, fit another strap at a suitable position.
➔ Lift the pumping stations using the eyebolts provided on the frame or transport them with a fork lift truck.
  – For versions without a frame and eyebolts, use transport straps for lifting.
  – Do not lift pumping station by the intake flange of the Roots pump.

3.2 Storage

The pumps of standard design are not provided with a corrosion protection. Therefore a special corrosion protection should be provided by the customer and agreed with the manufacturer for longer storage. Otherwise should be proceeded as follows.

➔ Check that all the openings on the pump are securely closed.
➔ Store the pump only indoors, preferably at temperatures between -10 °C and +40 °C.
  – In rooms with moist or aggressive atmospheres, the pump must be airproof shrink-wrapped in a plastic bag together with a bag of desiccant.
  – After storage periods longer than two years, it is recommended to carry out maintenance and change the lubricant before using the pump.

4 Product description

4.1 Product identification

To correctly identify the product when communicating with Pfeiffer Vacuum, always have the information from the rating plate available.

- Pump model and model number
- Serial number
- Type and quantity of the lubricant
- Max. allowable pump speed

For motor-specific data, please see the separately installed motor rating plate.

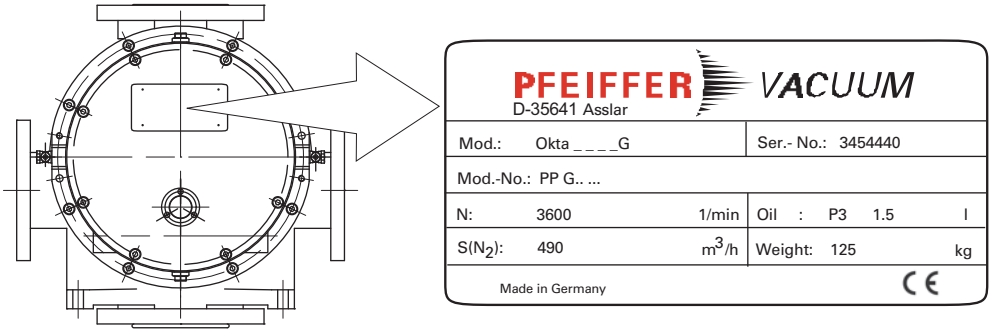


Fig. 2: Product identification on the rating plate

Scope of delivery

- Pump with motor/without motor
- O-rings for the connection flanges
- Protective cover for the connection flanges
- Two eye bolts to lift the pump
- Lubricant (only for standard pump)
- Operating instructions
- Set of screws for the connection flanges

Pump types

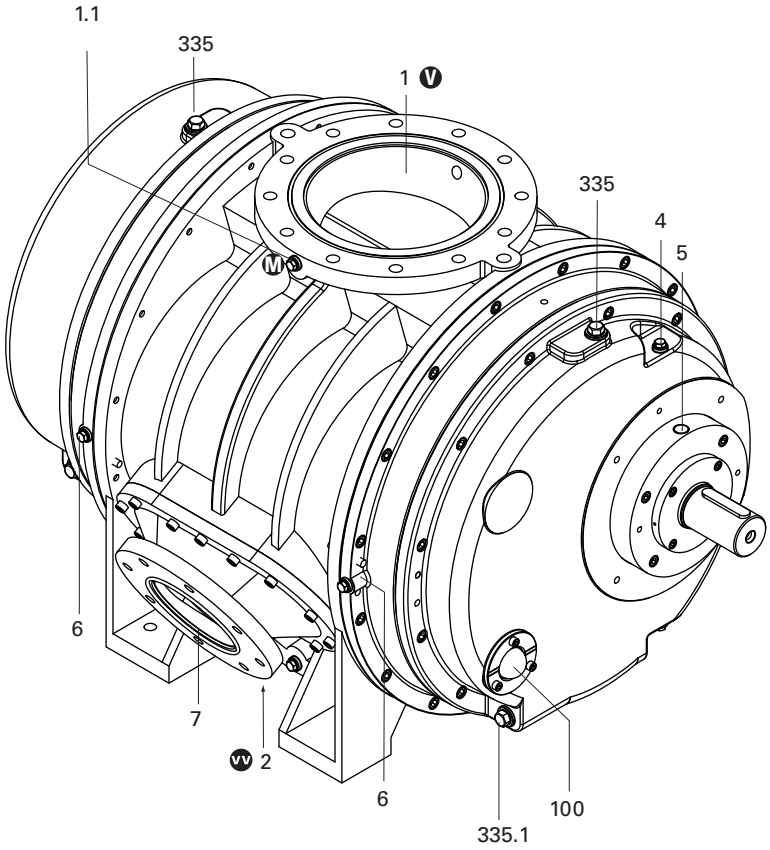
Pump type	Pump designs
Standard version	Pump in standard version: ● Standard motor ● Connection flanges are designed as ISO, DIN or ANSI flanges ● Connections for sealing gas inlet ● Shaft sealed with radial shaft seal ring (RSSR) ● Version with magnetic coupling (only M series)
Special versions	Changes to the standard design ● Shaft sealed with a mechanical seal ● Version with gas cooler ● Special seal materials which are resistant to aggressive media ● Coated pump interior for corrosion protection and/or good anti-sticking properties ● Special housing and piston materials (e.g. stainless steel) ● Particularly pressure-resistant version (10000 hPa) in which the pressurised components are made of spheroidal graphite iron castings

Pump features

Flange model	Vacuum flange/ Fore-vacuum flange	Cooling gas connection	Measuring connection, intake side	Measuring connection, pressure side	Sealing gas connection
Ansi (150 lbs)	10"	6"	1x G 3/8" 1x G 1/2"	1x G 3/8" 1x G 1/2"	4x G 3/8"
DIN	DN 250 PN 10	DN 150 PN 10	1x G 3/8" 1x G 1/2"	1x G 3/8" 1x G 1/2"	4x G 3/8"
DIN ISO	NW 250 ISO-F	NW 160 ISO-F	1x G 3/8" 1x G 1/2"	1x G 3/8" 1x G 1/2"	4x G 3/8"

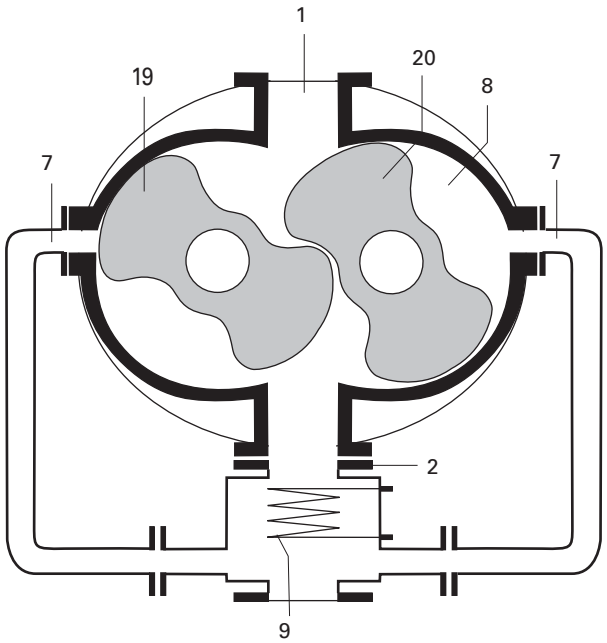
4.2 Function

The vacuum pumps in the OktaLine^{TM} series operate according to the Roots principle. Two rolling pistons which are coupled by a pair of gears counter-rotate and roll in the housing in opposite directions to each other without touching. The **gas circulation-cooled** Roots pumps in the "**G/GM**" series differ from the non-cooled pumps in the OktaLine^{TM} series in that they can be operated without backing pumps. As individual pumps they can be used in the pressure range from 130 bis 1013 hPa. By connecting two pumps in series, the ultimate pressure can be lowered to 20 to 30 hPa. The achievable ultimate pressure can be reduced right down to medium vacuum range in combination with further Roots pumps. The pumping direction of the pumps is vertical from top to bottom, so that any accumulating fluids cannot become deposited in the pump housing.



1	Vacuum flange	4	Connection for oiler for version with radial shaft seal	7	Cooling gas connection
1.1	Measuring connection	5	Connection for sealing medium for version with axial face seal	100	Sight glass
2	Fore-vacuum flange	6	Sealing gas connection	335	Lubricant filler screw (2x)
				335.1	Lubricant drain screw (2x)

Fig. 3: Roots pump Okta 4000 G



1	Vacuum flange
2	Fore-vacuum flange
7	Cooling gas connection
8	Suction chamber
9	Gas cooler
19	Main rotor
20	Slave rotor

Fig. 4: Scheme with gas cooler and cold gas circulation pipe

Cooling (option)

The (usually) water-cooled gas cooler must be positioned at the gas outlet port of the pump. In addition, the pump temperature needs to be monitored by a thermostat, which switches off the pump, if the preset temperature limit is exceeded (e.g. due to failure of the cooling water system).

Shaft sealing

The drive shaft feedthrough can be fitted with radial shaft seal rings or mechanical seals.

Radial shaft seal ring (RSSR)

This form of shaft seal is equipped with an FPM radial shaft seal ring and is used on standard pump versions. Alternatively, depending on the process medium the inner radial shaft seal ring can also be made of PTFE. In this case the housing seals of the pump are also equipped with PTFE covered O-rings.

Mechanical seal

Further improvements in terms of sealing - which may be necessary when pumping aggressive media - can be achieved with the aid of mechanical seals. Mechanical seals are seals for fluids which require a supply of a sealant and a coolant which are neutral in terms of the material being pumped. They also provide a sealing pressure up to 10000 hPa.

4.3 Range of application

Thanks to a forced gas recirculation system the heat of the gas is dissipated by the gas cooler directly after it runs through the compression and discharge phase. This allows the pump to be used under operating conditions, which would not be possible with normal Roots pumps.

5 Installation

CAUTION

Loss of stability!

Risk of injury due to the pump's tipping towards motor as long as the pump is not fastened to the base.

➔ Secure pump with suitable lifting device on motor side.

➔ Wear safety shoes with steel toe cap according to directive EN 347.

5.1 Setting up the pump

When installing the pump, observe the following conditions:

➔ Always place the pump on a firm, even surface.
- Check the load-bearing capacity of the floor at the installation location.
- The vacuum flange serves as the reference surface.
- A drilled hole is provided on each foot for attachment to the mounting surface. Do not distort the pump when screwing on.

➔ When installing the pump in a closed housing, ensure there is sufficient air circulation.
- Both sight glasses must be visible and accessible for inspection and maintenance purposes.
- Voltage and frequency information given on the motor rating plate must be visible.

➔ Where stationary installation is involved, anchor the pump on site.

➔ Fill up with lubricant before operating the first time *(see p. 12, chap. 5.2)*.
- Amount and type according to rating plate

Installation conditions

The vacuum pump must be installed and operated under the following ambient conditions:

Installation location	Inside; must however be protected against dust deposits Outside; must however be protected against direct weather influences
Permissible ambient temperature range	+5 °C ... +40 °C
Relative humidity	Max. 85 %
Installation altitude	Max. 2000 m above m.s.l., the rated power of the motor is reduced by approx. 10 % for installation altitudes > 1000 m and an ambient temperature of 40 °C
Power connections	according to voltage and frequency information given on the motor rating plate

5.2 Filling with lubricant

The type and amount of lubricant is visible on the pump's rating plate for each vacuum pump. Generally only the lubricant used during initial assembly can be used later on.

Permitted lubricants

- P3 (standard lubricant)
- D1 for special applications (e.g. higher operating temperatures)
- Other lubricants permitted on request.

NOTICE

Use permitted lubricants only!

If lubricants are used that have not been approved by Pfeiffer Vacuum, only a limited warranty shall exist. Attainment of the product-specific performance data cannot be guaranteed in such cases.

➔ Use other application-specific lubricants only after first consulting with Pfeiffer Vacuum.

Filling with lubricant

➔ Unscrew lubricant filler screws 335.

➔ Fill gear chamber and bearing chamber (on the drive side) with lubricant.

– Fill level on initial fill: approx. 5 mm above the middle of the sight glass.

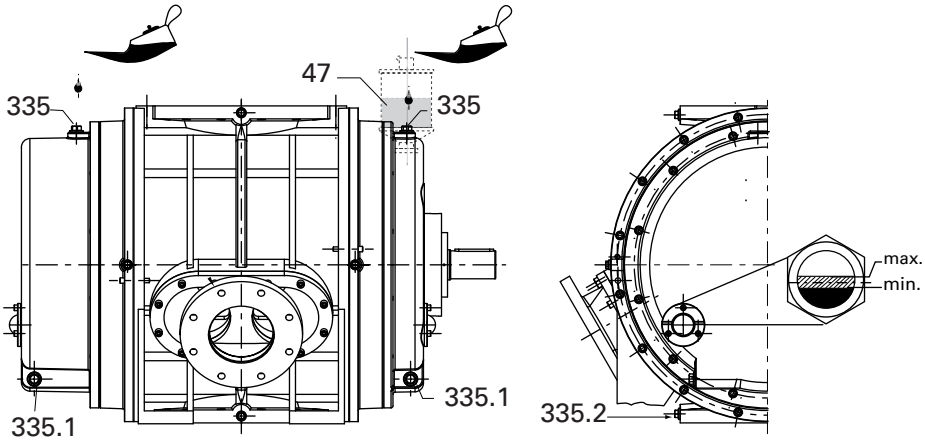


Fig. 5: Filling with lubricant

➔ Screw in lubricant filler screws 335.

➔ Check lubricant level when the pump is running at operating temperature in final vacuum:

– Fill level during operation: as per the sight glass image.

– Check fill level during continuous operation on a daily basis, otherwise each time the pump is switched on. To add lubricant, switch off the pump and vent it to atmospheric pressure.

WARNING

Toxic vapours!

Danger of poisoning when igniting and heating synthetic operating fluids (e.g. F4/F5) above 300 °C.

➔ Observe the application instructions.

➔ Do not allow operating fluid to make contact with tobacco products; observe safety precautions when handling chemicals.

Filling the sealing oil chamber (versions with RSSR only)

The shaft feedthrough of the drive shaft is sealed with sealing oil-covered radial shaft seals, and is fed by an oiler on the shaft sealing housing. The type of sealing oil is the same as the lubricant.

➔ Fill up oiler to halfway with lubricant.

– Oiler 47 should always be filled to a max. of halfway (when the pump is cold); top up as required.

The lubricant expands when the pump heats up, which could cause lubricant to leak if the oiler is overfilled.

Adding sealant for the mechanical seal (versions with MS only)

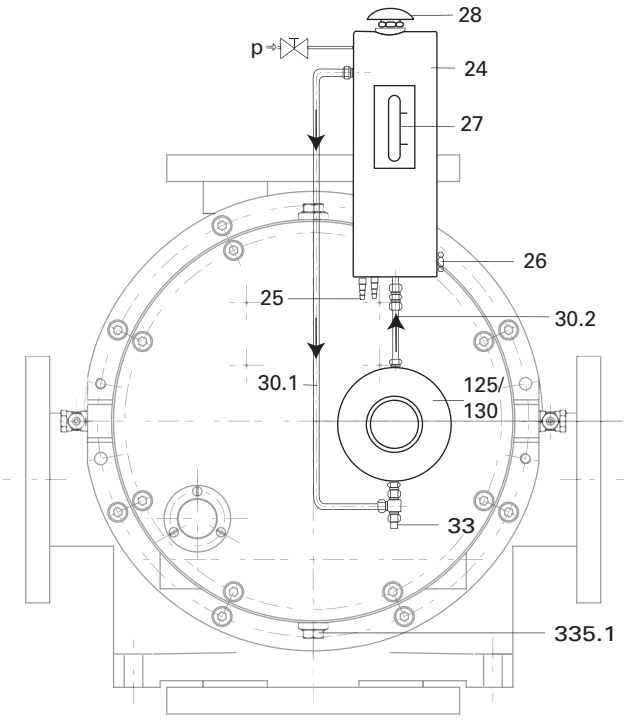
When using a mechanical seal (optional), a cooling of the sealing surfaces is required. The sealant reservoir needs to be attached above the shaft feedthrough on the outside of the pump, on the base frame or in a different suitable location depending on the actual conditions. The mechanical seal is capable of bridging a certain pipe resistance through its own pumping effect. If the supply of sealant is no longer guaranteed, an additional circulation pump must be installed. The pipes and the sealant reservoir are not contained in the scope of supply.

➔ During assembly of the sealant reservoir observe the installation instructions supplied by the manufacturer.

➔ Use the sealant in accordance with the manufacturer's instructions.

Cooling the mechanical seal

The ambient temperatures to which the pump is exposed will vary depending on the location in which it is being used. If the cooling of the sealant (max. +90 °C) is not sufficient for the amount of heat radiated at the sealant reservoir, then an additional water cooling system (25) will need to be connected.



24 Sealant reservoir
25 Cooling water connection
26 Sealant drain
27 Sight glass
28 Sealant filler socket
30.1 Sealant circuit, supply line
30.2 Sealant circuit, return line
33 Blank screw coupling
125 Shaft sealing housing
130 Cover
335.1 Lubricant drain screw

Fig. 6: Sealant reservoir for cooling the mechanical seal

5.3 Connecting the vacuum side

WARNING

Exposed, rotating rolling pistons!

Fingers and hands can become crushed when the intake flange is open.

➔ Keep all body parts out of operating range of the rolling pistons.
➔ Use a wooden handle to rotate the rolling pistons during cleaning.

➔ The connection between the pump and the vacuum chamber should be kept as short as possible and should have at least the nominal diameter of the pump flange. Use a greater nominal diameter on line lengths > 5 m.
➔ Piping to the pump must be suspended or supported.
  – Physical forces from the piping system must not be allowed to act on vacuum pumps.
➔ Clear welded lines of any welding scales, loose parts etc. before installation.

NOTICE

Danger of intake of solid particles!

Even in clean processes, fouling from the system must be anticipated during initial commissioning.

➔ Use a suitable start-up strainer at the intake connection (see accessories).
➔ Ensure that this strainer is only removed when the risk of solid particles entering the pump can be excluded.
➔ Note loss of pumping speed if necessary.

5.4 Connecting the fore-vacuum side

➔ Choose the cross-section of the exhaust line to be at least the size of the nominal connection diameter of the Roots pump's exhaust flange.
➔ Lay the pipes in such a way that the Roots or backing pump will not be subjected to any mechanical tension.
  – Suspension components should be integrated into the piping.
  – Ensure that mating flanges are in a parallel position.
➔ Lay piping from the pump sloping downward so that no condensate can flow back into the pump; otherwise fit a condensate separator.
  – If an air trap is created in the system, then a device for draining condensation water must be provided at the lowest point.

WARNING

Emission of toxic substances from the exhaust!

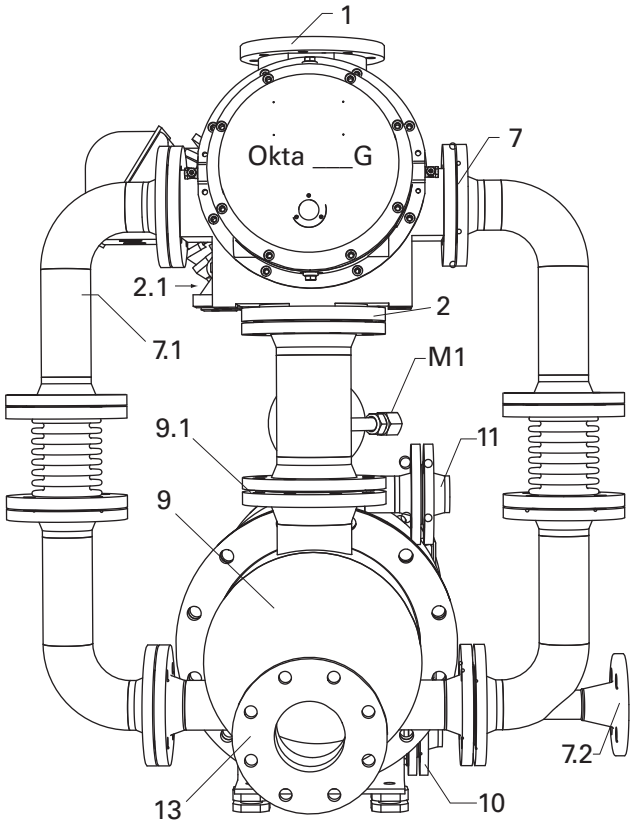
Danger of poisoning from emitted gases or vapours, which can be detrimental to health and/or can pollute the environment, depending on the particular application.

➔ Comply with the applicable regulations when working with toxic substances.
➔ Only officially approved filter systems may be used to separate and remove these substances.

5.5 Connecting a gas cooler (optional)

The chosen gas cooler must be suitable for the location in which the device is used and must be matched to the requirements of the process. Depending on the medium being pumped, gas coolers made of standard steel or stainless steel can be used. These can be adapted by the operator or ordered from Pfeiffer Vacuum. The dimensioning of the cold gas recirculation line (7.1) should also be matched to the gas cooler and the pump.

Assembly



1	Vacuum flange
2	Fore-vacuum flange
2.1	Temperature monitoring (option)
7	Cooling gas connection
7.1	Cold gas circulation line
7.2	Measuring connection
9	Gas cooler
9.1	Flange, gas cooler
10	Cooling water, inlet
11	Cooling water, outlet
13	Exhaust connection (pressure side)
M1	Measuring connection (option)

Fig. 7: Pump with tubular gas cooler

➔ Connect the gas cooler (9) with flange (9.1) to the fore-vacuum flange (2) of the pump. Check that the seal is correctly positioned.

➔ Route the cold gas recirculation lines (7.1) from the gas cooler (9) to the flanges of the cooling gas connections (7); in doing so, make sure that the connections are not subjected to mechanical stress.

➔ Choose the cross-section of the cold gas circulation pipe to be at least the size of the nominal connection diameter.

5.6 Connecting the cooling water

If a gas cooler is used then a cooling water control valve (17) should be used at the cooling water inlet of the gas cooler. Use of this control valve will reduce the consumption of cooling water and keep the pump at the required operating temperature.

Requirements for the cooling water

The cooling water must be filtered in all cases. This keeps dirt deposits and organic suspended particles that could accelerate pitting out of the cooling circuit. Complying with the following requirements for cooling water will prevent corrosion damage:

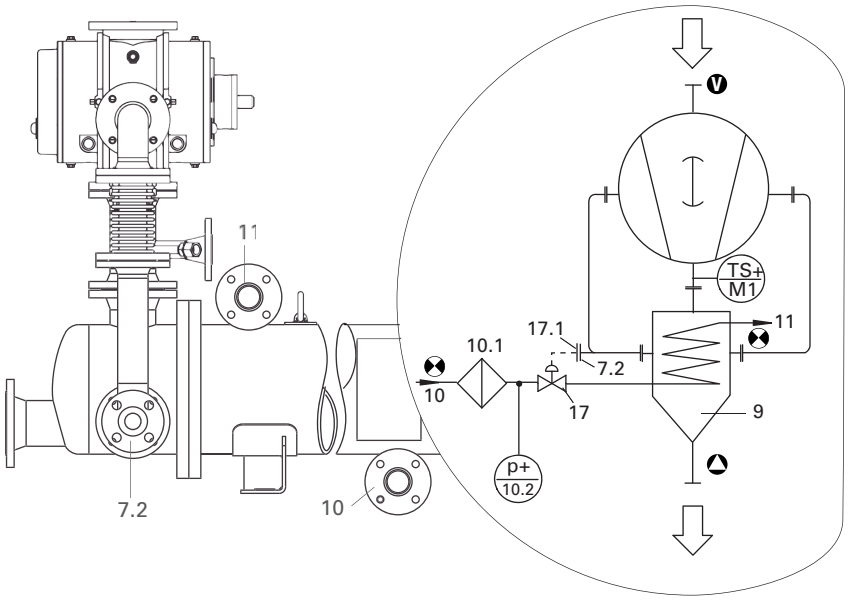
Requirements for the cooling water	
Water filtered, mechanically pure, optically clear, no turbidity, no sediments, chemically neutral	

Requirements for the cooling water	
Min. oxygen content	4 mg/kg
Max. chloride content	100 mg/kg
Max. carbonate hardness for the water temperatures 15 ... 25 °C 30 ... 40 °C	 10 ° dH 6° dH
Max. potassium permanganate usage pH value	10 mg/kg 7 ... 9
Aggressive carbon dioxide and ammonia must not be detectable	
Max. electrical conductivity	500 µS/cm
Max. impurity particle size	25 µm
Permitted inlet overpressure range; if the pressure is higher a pressure reducer valve must be integrated	2000 ... 10000 hPa
Permitted cooling water temperature range	10 ... 30°C

Connecting the cooling water

The connection should be made in a way that the flow can be visually checked. The best method is the free outflow of cooling water via a funnel. If this is not possible because there is no height difference, a flow indicator must be integrated into the line. Standard flow monitors or flow indicators may be used.

➔ Connect the cooling water lines:
- Cooling water inlet (10).
- Cooling water outlet (11); must be pressure-free.



M1	Measuring connection	10	Cooling water, inlet	11	Cooling water, outlet
7.2	Measuring connection	10.1	Dirt trap	17	Cooling water regulating valve
9	Gas cooler	10.2	Pressure switch	17.1	Temperature sensor

Fig. 8: Cooling water connection at the gas cooler

Installing the pressure monitor (optional)

The pumps can be effectively protected against failure of the cooling water system by installing a cooling water pressure monitor.

Assembly

➔ Refer to the installation instructions provided by the manufacturer.

➔ Set switching pressures; set pressure as excess gauge pressure relative to atmospheric pressure:
- minimum: 300 hPa
- maximum:10000 hPa

5.7 Temperature monitoring (option)

In order to protect the pump against thermal overload, a G 3/8" thread for connection of a temperature monitor is provided at the fore-vacuum flange (2) of the pump. We recommend the use of a double thermostat or a PT-100 temperature sensor. The temperature at the high-pressure connection piece (2.1) of the pump must not exceed 120 °C.

5.8 Connecting to the mains power supply

The pumps are supplied with three-phase motors for different voltages and frequencies. The applicable motor type is shown on its rating plate.

DANGER

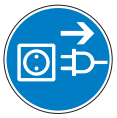
Voltage-bearing elements

Danger to life from electric shock.

➔ The electrical connection can be carried out only by trained and authorised electricians.

➔ Disconnect the power supply and secure it against being switched back on.

➔ Ensure the system is adequately earthed.



NOTICE

Excess voltage!

Danger of destroying the motor.

➔ Power connections must comply with local regulations. Voltage and frequency information given on the motor rating plate must correspond to the mains voltage and frequency values.

➔ To protect the motor and supply cable in case of malfunction, mains fuse protection must be implemented. Recommended: Type K slow blow circuit breaker.

NOTICE

Thermal motor overload!

Inadequate cooling at low motor speeds.

➔ When operating the pump with frequency converter, follow the rotation speed range, specified in the technical data.

The three-phase current motor circuit

The direction of rotation must be checked on pumps with three-phase motors!

The connections U1 - L2, V1 - L1 and W1 - L3 result in a clockwise rotation of the motor shaft as seen looking towards the motor fan.

Delta Connection

The three coils are connected in series with the connection point connected to the mains. The voltage of each coil is the same as the mains voltage whereas the mains current is the cube root of the coil current. Delta connections are denoted by the symbol **Δ**. The voltage between the mains supply lines is called mains voltage. The mains current is the current which flows in the supply lines.

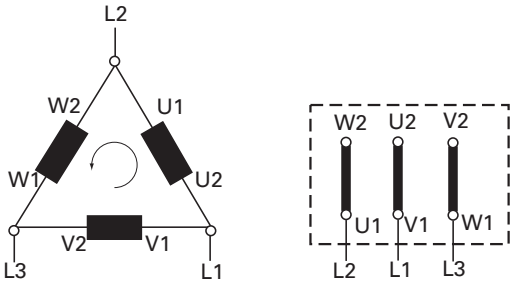


Fig. 9: Motor coil and connecting plate of Delta Connection (for low voltage)

Star Connection

The ends of the three coils are connected at the star center. The terminal voltage is the cube root of the coil voltage; the mains and the coil current are the same. Star connections are denoted by the symbol **Y**.

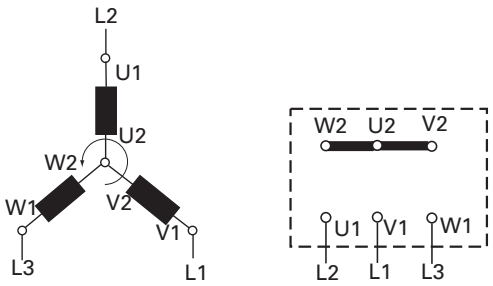


Fig. 10: Motor coil and connecting plate of Star Connection (for high voltage)

Visual inspection of the direction of rotation

➔ Check the direction of rotation of the pump after switching on for the first time:
  – To do this, switch the pump briefly ON and OFF again (for a max. of 5 seconds).

➔ Compare the direction rotation of the motor or the coupling with the directional arrow on the housing cover.
  – Looking from the motor side, the correct direction of rotation is in a clockwise direction.

➔ If the direction of rotation is incorrect: Swap two of the three phase contacts at the connecting cable.

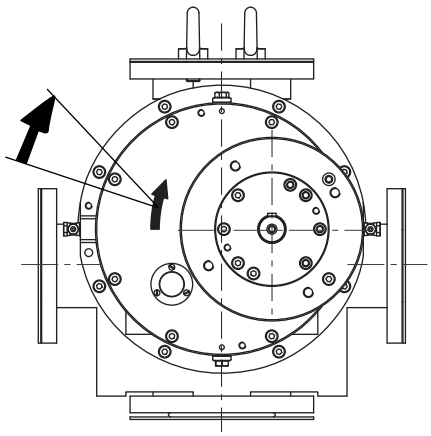


Fig. 11: Checking the direction of rotation

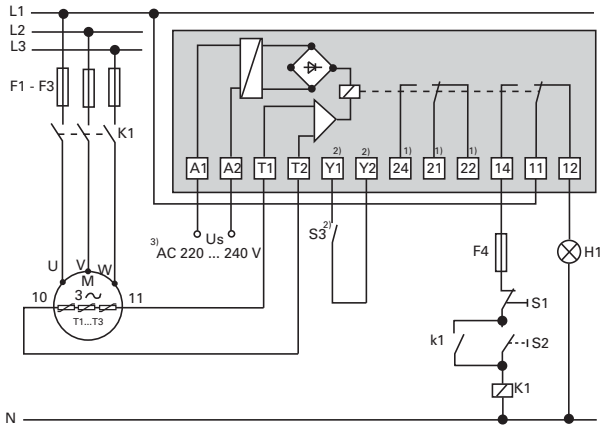
Motor protection

With PTC temperature sensors (3PTC)

Pump motors equipped with PTC temperature sensors (3PTC) in the stator windings can be connected to a PTC resistor tripping device for protection against overload. Other approved motor temperature monitoring can be used also by the operator.

Tripping devices store the shutdown event and need to be manually switched back on again via the integrated RESET button or via the external RESET S3. Mains-ON is detected as an automatic RESET.

➔ Set up the connections so that the directional rotation indicated on the pump is maintained, regardless of the representations in the current flow diagram.



U_S Control voltage
S_1 OFF button
S_2 ON button
S_3 RESET button, external
K1 Contactor
F1 ... F4 Fuses
T1... T3 PTC resistor sensor
H1 Tripping indicator
M Motor, 3-phase

1) Only for devices with two relay outputs
2) Only for MSR type
3) Only for order no.: P 4768 051 FQ

Fig. 12: Connection example for a three-phase AC motor with PTC resistor tripping device

5.9 Connecting accessories

The following accessories are not included in the delivery, and can be ordered separately:

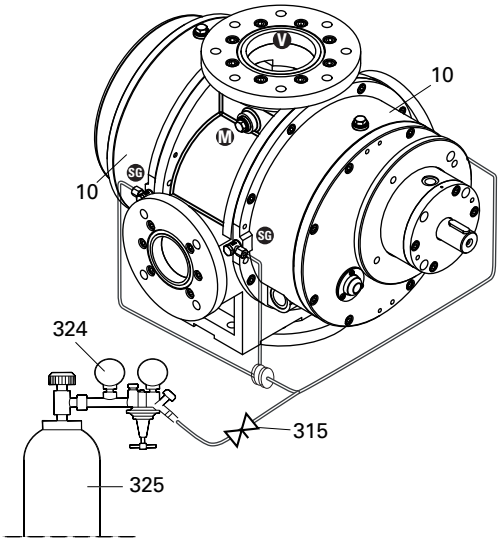
Sealing gas connection

The evacuation of high-boiling media (e.g. solvents) can be damaging to the lubricant. Damage can be avoided by letting in sealing gas (process-specifically) into the shaft passageways between the operating chamber and the gear chamber.

➔ Use sealing gas, depending on the process.

➔ The sealing gas line should be connected to each side of the pump. For pumps with 2 sealing gas holes per bearing bracket, connect sealing gas to all 4 connections (G 1/8").

➔ Connect gas cylinder 325 with pressure reducer 324 to flow meter 315, adjust amount of sealing gas *(see p. 23, chap. 6.2)*



10 Bearing bracket
315 Flow meter with dosing valve
324 Pressure reducer
325 Gas cylinder

Fig. 13: Connecting sealing gas

Connecting flushing air/flushing gas

Depending on requirements, the Roots pump can be flushed continuously or temporarily, if the evacuated medium is causing severe contamination or deposits in the suction chamber. The injection nozzle is set to the maximum fluid quantity of the pump at a pressure of 3000 hPa.

NOTICE

Risk of damage to the pump!

During the flushing and cleaning procedure the flushing liquid and the process medium can pass over into the bearings and oil chambers and can stick there.

➔ To protect the bearings during cleaning, sealing gas must always be used.

➔ Attach flushing adapter to the vacuum flange.

➔ For sealing and throughflow monitoring install a shut-off valve and a flow meter with dosing valve into the inflowing line.

Installing a protective strainer

If there is a risk that solid particles will be carried along in the evacuation process then a protective strainer should be installed in the intake connection piece to protect the Roots pump (see accessories).

6 Operation

6.1 Before switching on

➔ Check lubricant levels at both sight glasses and at the oiler as well.

➔ Protect the pump sufficiently from taking in contaminants by means of suitable precautions (e.g. protective strainer); if necessary, check lubricant regularly or replace at shorter intervals.

➔ Operate shut-off units in the exhaust line in such a way that they open before or at the same time as starting the pump.

➔ Open cooling water supply and ensure sufficient flow; adjust if necessary.

➔ Vent the cooling chambers; to do this, lift the screw on the cooling water control valve 17 with a screwdriver or open bypass line.

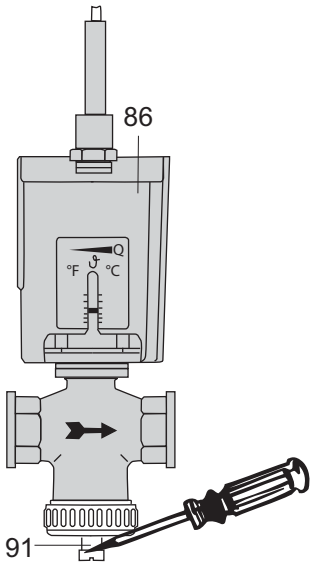


Fig. 14: Venting the cooling chambers

6.2 Switching on the pump

Depending on the application, the pump can discharge directly to the atmosphere or be operated together with a backing pump in a Roots vacuum pumping station.

- In the former case, the pump can be switched on in any pressure range between the final vacuum and atmospheric pressure, as it acts as a backing pump itself.
- In the latter case, in which the pump compresses against one or more backing pumps (e.g. liquid ring pumps), they must be switched on before the Roots pump. In the event of failure of the backing pump(s) the Roots pump must be switched off immediately as neither the motor nor the gas cooler are designed for operation without backing pump.

WARNING

Increased noise emission!

Increased noise emission can occur within a limited area surrounding the vacuum pump.

➔ Provide noise protection or

➔ wear hearing protection.

CAUTION

Hot surface!

Danger of burns if hot parts are touched. Depending on the operating and ambient conditions, the surface temperature of the pump may rise above 100 °C.

➔ In this case, use suitable finger guards.

Adjusting the amount of sealing gas

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

➔ Open gas cylinder 325.

➔ Set a maximum pressure of 2500 hPa at pressure reducer 324.

➔ At dosing valve 315, adjust the desired quantity of sealing gas on the flow meter.

Equation for calculating the sealing gas throughflow

$$Q_S = \frac{S_{th} \cdot p \cdot A_S}{p_0}$$

Q_S= Sealing gas flow under standard conditions [Nm^3/h]

p = Intake pressure [hPa]

p_0= Ambient pressure under standard conditions [hPa]

Δp= Differential pressure max. [hPa]

p_V= Fore-vacuum pressure [hPa]

A_S= Proportion of sealing gas in the operating gas flow ($0.01 \leq A_S \leq 0.08$)

S_{th}= Rated suction capacity of the Roots pump [m^3/h]

Example for Okta 4000 G with 50 hPa intake pressure and 8% sealing gas quantity:

$$Q_S = \frac{4860 \cdot 50 \cdot 0{,}08}{1013} =$$

$$Q_S = 19{,}2\ Nm^3/h$$

This applies to exhaust pressures > 100 hPa:

$$Q_S = \frac{S_{th} \cdot (p_V - \Delta p) \cdot A_S}{p_0}$$

NOTICE

High pressure in the sealing gas line when the pump is switched off!

Risk of damage to the pump seals.

➔ Lower sealing gas pressure to < 1200 hPa or stop sealing gas feed immediately.

Adjusting the flushing fluid quantity

If the extracted medium polymerizes or becomes deposited in the suction chamber, then continuous or discontinuous flushing of the suction chamber can be performed during operation. With a continuous throughflow, depending on the size of the pump the maximum dosing of flushing quantity will be between around 0.25 ... 2 l/min.

➔ Appropriate solvents which are suitable for the medium being pumped should be chosen by the operator.

➔ Set max. flushing quantity in acc. with the following table; use flow meter.

– On pumping stations without an intermediate condenser or collecting containers the quantity of fluid should be selected according to the smallest pump in the pumping station:

Pump type	max. flushing quantity
Okta 8000 G	2.0 l/min
Okta 3000/4000 G	1.5 l/min
Okta 1000/1500 G	1.0 l/min
Okta 500 G	0.5 l/min

NOTICE

High pressures are generated in the working chamber of the pump!

Exceeding the specified flushing quantities can lead to destruction of the pump.

➔ Do not exceed the indicated flushing quantity at 3000 hPa in the indicated time period.

➔ Drain the fluid again.

➔ Always check the vapour compatibility of the downstream pumps.

➔ Dry the pump completely inside after flushing.

6.3 Switching off

In the case of clean processes that convey pure gases, the pump can be switched off in every pressure range and directly after the process end. When the evacuated medium in the suction chamber causes strong contamination or deposits, the vacuum pump should be flushed with air or nitrogen after the process end.

If venting of the vacuum chamber is not required, then the intake port valve must be closed before switching off the pump in order to prevent venting of the vacuum chamber.

WARNING

Exposed, rotating rotors!

Danger of crushing! The rotors will continue to run under vacuum after the motor has been switched off.

➔ Never disconnect any pipe connections at the vacuum flange or fore-vacuum flange or any sealing gas lines while the pump is running.

NOTICE

High pressure in the sealing gas line when the pump is switched off!

Risk of damage to the pump seals.

➔ Lower sealing gas pressure to < 1200 hPa or stop sealing gas feed immediately.

CAUTION

Danger of damage to the inside of the pump!

Danger of contamination of the pump interior when pumping out reactive gases.

➔ After pumping, flush the pump interior with nitrogen.

➔ Close shut-off valve in the intake line and separate the pump from the process.

➔ When inert gas is used: Stop inert gas supply.

➔ Switch off the pump.

➔ Venting should be performed via the suction side, do not ventilate vacuum chambers through the pump.

➔ Switch off process-specific and pump-specific media supplies.

➔ Stop cooling water supply.

Flush pump with flushing gas

➔ Close shut-off valve in the intake line and separate the pump from the process.

➔ Open flushing gas feed at the intake flange.

➔ Pump is operated for an additional 20 to 40 minutes while flushing gas is suctioned in.

➔ When inert gas is used: Stop inert gas supply.

➔ Switch off the pump.
➔ Venting should be performed via the suction side, do not ventilate vacuum chambers through the pump.
➔ Stop flushing gas feed.
➔ Stop cooling water supply.

Switching back on

After switching off the pump it can be switched back on again within 5 minutes. If you wait any longer then leave the pump to cool to ambient temperature before switching back on again.

7 Maintenance

7.1 Precautions

WARNING

Exposed, rotating rolling pistons!

Fingers and hands can become crushed when the intake flange is open.

➔ Keep all body parts out of operating range of the rolling pistons.

➔ Use a wooden handle to rotate the rolling pistons during cleaning.

WARNING

Pump parts may be contaminated from pumped media!

Danger of poisoning due to contact with harmful substances.

➔ Decontaminate the pump before carrying out any maintenance work.

➔ In the event of contamination, take suitable safety precautions to prevent your health from being harmed by any dangerous substances.

➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.

➔ Disconnect the drive motor from the mains and secure it so that it cannot be switched on.

➔ Remove the vacuum pump from the system, if necessary.

➔ Only dismantle the pump as far as necessary to carry out maintenance.

➔ Dispose of used operating fluid in compliance with local regulations.

➔ When using synthetic operating fluids or working with toxic substances or substances contaminated with corrosive gases, the relevant instructions governing their use must be observed.

➔ Use only alcohol or similar agents for cleaning pump parts.

Checklist for inspection, maintenance and overhaul

Certain maintenance and overhaul work should only be performed by Pfeiffer Vacuum Service (PV). Pfeiffer Vacuum will be released from all warranty and liability claims if the required, below listed, intervals are exceeded or maintenance or overhaul procedures are not performed properly. This also applies if replacement parts other than Pfeiffer Vacuum OEM replacement parts are used.

Activity	daily	as required; at least annually	as required; at least every 3 years
Check lubricant levels and colour of gear oil	X		
Check lubricant levels of sealing oil	X		
Visual inspection (leak-tightness/oil leaks)	X		
Check for noises (smoothness of operation)	X		
Change lubricants and sealing oil*		X	
Check temperature sensor (only ATEX version)		X	
Replace O-rings on lubricant filler screws and drain screws			X
Clean suction chambers			X
Replace coupling buffers (toothed ring) at pumps with flexible coupling			X
Clean gear chambers and replace the cover gaskets			X (PV)
Replacement of piston bearings; 4 piston bearings (ball bearing/roller bearing)			X (PV)
Replacement of all wearing parts such as radial shaft seals, protective bushing and all gaskets (including between the housing and end plate)			X (PV)
Check gears and replace if necessary			X (PV)

* Depending on the process, the required replacement intervals for lubricants and the intervals for inspection, maintenance and overhaul may be shorter than the guide values specified in the table. Consult with Pfeiffer Vacuum Service if necessary.

7.2 Changing the lubricant

WARNING

Hot operating fluid!

Danger of burns when draining due to contact with skin.

➔ Wear suitable protective clothing.

➔ Use a suitable collecting vessel.

Depending on the applications, Pfeiffer Vacuum recommends determining the exact service life of the operating fluid during the first year of operation.

The replacement interval may vary from the guide value specified by Pfeiffer Vacuum depending on the thermal and chemical loads, and the accumulation of suspended particles and condensation in the operating fluid.

Gear chamber

The intervals for replacing lubricant in the gear and bearing chambers are heavily dependent upon the operating conditions.

➔ Change the lubricant at least once every year.

➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.

➔ Unscrew lubricant filler screws 335.

➔ Unscrew the lubricant drain screws 335.1 and drain the lubricant; pay attention to the O-rings!

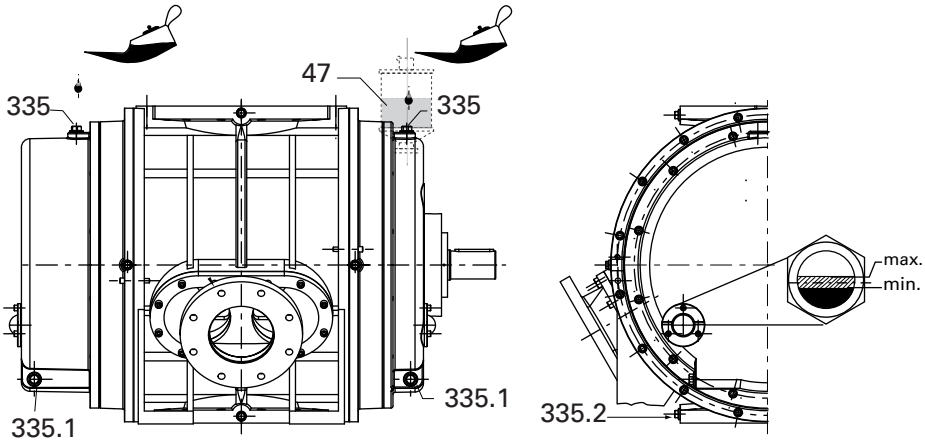


Fig. 15: Filling with lubricant

WARNING

Operating fluid may contain toxic substances from the pumped media!

Danger of poisoning from the emission of harmful substances from the operating fluid.

➔ Wear suitable protective clothing and respirators.

➔ Dispose of operating fluid according to the local regulations

➔ Screw in lubricant drain screws 335.1; pay attention to the O-rings.

➔ Fill with new lubricant and check fill level.

➔ Screw in lubricant filler screws 335.

Request safety data sheets for operating fluids and lubricants

from Pfeiffer Vacuum or download at www.pfeiffer-vacuum.com.

➔ Dispose of operating fluid according to the local regulations.

Change sealing oil (only for version with RSSR)

It is recommended that the sealing oil should be changed on an annual basis.

➔ Unscrew lubricant drain screw 335.2 for the sealing oil chamber at lantern 18; check the O-rings.

➔ Allow the lubricant to drain off.

➔ Screw in lubricant drain screw 335.2 with O-ring.

➔ Fill oiler 47 to halfway with new lubricant (sealing oil).

Falling oil level in the oiler and an oil leak below the lamp indicates a defective **external** radial shaft seal ring. In this case, the pump can continue to operate for a certain time provided the oil loss from the oiler is equalised.

Conversely, an increasing oil level without visible loss below the pump indicates a worn **internal** radial shaft seal ring. All three sealing rings should be replaced immediately as it will cause the oil in the bearing chamber to rise above the permitted level.

Changing the sealant of the mechanical seal

➔ Maintenance work on the mechanical seal and the sealant reservoir should be performed in accordance with the maintenance instructions supplied by the manufacturer; the intervals for changing the sealant may vary from application to application.

➔ Use the sealant in accordance with the manufacturer's instructions.

7.3 Cleaning the suction chamber

WARNING

Exposed, rotating rolling pistons!

Fingers and hands can become crushed when the intake flange is open.

➔ Keep all body parts out of operating range of the rolling pistons.

➔ Use a wooden handle to rotate the rolling pistons during cleaning.

➔ Disconnect the drive motor from the mains and secure it so that it cannot be switched on.

➔ Dismantle the vacuum line and the fore-vacuum line of the pump.

➔ Clean the suction chamber using suitable brushes and cleaning agents.

➔ After cleaning, remove remaining fluids using absorbent materials and dry the working chamber.

➔ Reassemble the pipework.

➔ Remove the means by which the motor was secured against being switched on.

➔ The lubricant should also be replaced *(see p. 28, chap. 7.2)* after every suction chamber cleaning.

7.4 Assembling the motor and coupling

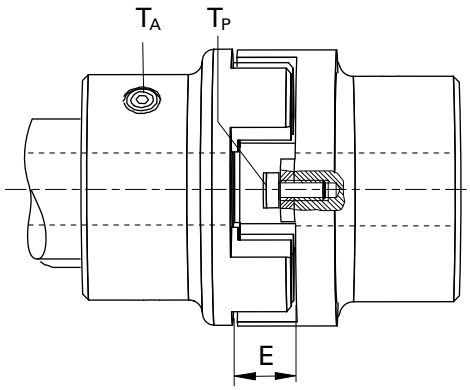
Installing the coupling

When performing installation work on the coupling, it is important to observe the installation instructions of the coupling manufacturer:

www.ktr.com

➔ The shaft of the drive motor must be aligned with the pump shaft:
- Observe the permissible angular and radial displacements.
- Maintain clearance E so that the crown gear can still move axially.

➔ Tighten the screws in the coupling half with the prescribed torque and secure the stud bolt with Loctite 243.



8 Decommissioning

8.1 Shutting down for longer periods

Follow the following procedure before shutting down the pump for a longer period of time:

➔ Switch off the pump.
➔ Clean the suction chamber using suitable brushes and cleaning agents.
➔ Change lubricant.
➔ Close the flange openings by using the original protective covers.
➔ Evacuate the suction chamber to p<1 hPa via the suction-side measuring connection at room temperature and fill the chamber with nitrogen.
➔ Store the pump only indoors, preferably at temperatures between -10 °C and +40 °C.
  – In rooms with moist or aggressive atmospheres, the pump must be airproof shrink-wrapped in a plastic bag together with a bag of desiccant.
  – After storage periods longer than two years, it is recommended to carry out maintenance and change the lubricant before using the pump.
➔ Do not store pump in the vicinity of machines, lanes, etc., because strong vibrations can damage the rotor bearings.
➔ Drying pearls can be inserted to additionally protect the pump inside against corrosion.

8.2 Re-starting

Visually inspect the inner of the pump before taking it into operation. If there is evidence of rust on the parts of the pump which form the housing then do not take it into operation and contact Pfeiffer Vacuum Service.

Depending on how long the pump is taken out of operation, it may be necessary to replace the elastomer parts. In accordance with DIN 7716 and the manufacturer's specifications we recommend replacing the installed elastomer parts after 2 years.

NOTICE

Re-starting

The serviceability of the lubricant without operation is a maximum of 2 years. Before re-starting after a shut-down of **2 years or longer**, carry out the following work.

➔ Replace the lubricant.
➔ Replace bearings.
➔ Follow the maintenance instructions and inform Pfeiffer Vacuum.

➔ Check pump for visible damage and only start up if it is in the correct condition.
➔ If drying pearls were inserted then they should be removed now.
➔ Subject pump to a leak test before restarting operation.

8.3 Disposal

Products or parts thereof (mechanical and electrical components, operating fluids, etc.) may cause environmental burden.

➔ Safely dispose of the materials according to the locally applicable regulations.

9 Malfunctions

Please note the following instructions should the pump malfunction:

CAUTION

Hot surface!

Danger of burns if hot parts are touched. The surface temperature of the pump may rise above 105 °C in case of malfunction.

➔ Carry out work on the pump only after it has cooled to a safe temperature.

9.1 Rectifying malfunctions

Problem	Possible causes	Remedy
Pump does not start	No mains voltage or voltage does not correspond to the motor data	Check mains voltage and mains fuse protection; check motor switch
	Thermal protection switch has responded	Identify cause and delete; let pump cool off if necessary
	Suction chamber dirty	Clean suction chamber.
	Gear wheels damaged	Switch off pump directly! Contact Pfeiffer Vacuum Service if necessary
	Bearing damaged	Replace bearings; contact Pfeiffer Vacuum Service if necessary.
	Motor defective	Replace motor
Pump switches off after a while	Thermal protection switch of the motor has responded	Identify cause of overheating and delete; allow motor to cool off if necessary
Pump does not attain ultimate pressure	Suction chamber dirty	Clean suction chamber.
	Lubricant dirty	Change lubricant
	Backing pump faulty	Check backing pump
	Leak in system	Repair leak
	Operational loss of lubricant at the shaft or mechanical seal	Check and replace radial shaft seals or mechanical seal; contact Pfeiffer Vacuum Service if necessary
Unusual operating noises	Suction chamber dirty	Switch off pump directly and clean suction chamber
	Bearings or gears damaged	Switch off pump directly! Contact Pfeiffer Vacuum Service if necessary
	Motor bearing defective	Switch off motor directly! Replace motor; contact Pfeiffer Vacuum Service if necessary

NOTICE

Service work should be carried out by a qualified person only!

Pfeiffer Vacuum is not liable for any damage to the pump resulting from work carried out improperly.

➔ Take advantage of our service training programs; additional information at www.pfeiffer-vacuum.com.

➔ Please state all the information on the pump rating plate when ordering spare parts.

10 Service

Pfeiffer Vacuum offers first-class service!

- Maintenance/repairs on site by Pfeiffer Vacuum field service
- Maintenance/repairs in a nearby service center or service point
- Fast replacement with exchange products in mint condition
- Advice on the most cost-efficient and quickest solution

Detailed information and addresses at: **www.pfeiffer-vacuum.com (Service)**.

Maintenance and repairs in Pfeiffer Vacuum ServiceCenter

The following steps are necessary to ensure a fast, smooth servicing process:

➔ Download the forms "Service Request" and "Declaration on Contamination".[1)]
➔ Fill out the "Service Request" form and send it by fax or e-mail to your Pfeiffer Vacuum service address.
➔ Include the confirmation on the service request from Pfeiffer Vacuum with your shipment.
➔ Fill in the contamination declaration and enclose it in the shipment (required!).
➔ Dismantle all accessories.
➔ Drain operating fluid/lubricant.
➔ Drain cooling medium, if used.
➔ Send the pump or unit in its original packaging if possible.

Sending of contaminated pumps or devices

No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. “Hazardous substances” are substances and compounds in accordance with the hazardous goods directive (current version). If pumps are contaminated or the declaration on contamination is missing, Pfeiffer Vacuum performs decontamination at the shipper's expense.

➔ Neutralise the pump by flushing it with nitrogen or dry air.
➔ Close all openings airtight.
➔ Seal the pump or unit in suitable protective film.
➔ Return the pump/unit only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

Service orders

All service orders are carried out exclusively according to our repair conditions for vacuum units and components.

1) Forms under www.pfeiffer-vacuum.com

11 Spare parts

11.1 Spare parts packages

The spare parts packages listed here are only applicable for standard models.

Please state all information on the rating plate when ordering spare parts. Other spare parts than those described in this manual must not be used without the agreement of Pfeiffer Vacuum.

Set of seals for pumps with mechanical sealant (mechanical seal separately)

This set of seals includes all of the seal parts such as O-rings, flat seals and square washers. Not included are centering rings for connecting the pumps to the suction and pressure side.

Mechanical seal, complete

This set of seals includes the sealing components including the respective O-rings.

Set of seals for pumps with flexible coupling and radial shaft seal ring

This set of seals includes all of the seal parts such as O-rings, radial shaft seal rings (without protective sleeve), flat seals, square washers, profile seals and supporting rings for the radial shaft sealing rings. Not included are centering rings for connecting the pumps for the suction and pressure side.

Maintenance kit for pumps with flexible coupling and radial shaft seal ring

This maintenance kit contains all of the seal parts in the area of the radial shaft seal rings. The maintenance kit also contains the sealing rings for the filling and drain screws, the buffers for the coupling and the swivel gaskets.

Overhaul kit for pumps with flexible coupling and radial shaft seal

This overhaul kit contains the set of seals, ball bearings, roller bearings, circlips, sight-glasses, protective bushing, oiler, groove nuts and the buffers for the coupling (crown gear).

Overhaul kit for pumps with mechanical sealant

This overhaul kit contains the set of seals, ball bearings, roller bearings, lock plate, groove nut and the sight glasses.

Set of gear wheels

Contains the main wheel and auxiliary wheel.

12 Accessories

Designation	Okta 4000 G
Splinter shield for Okta 4000/4000 M/4000 G/6000/6000 M	PP 031 136 -X

Further detailed accessories are contained in the Pfeiffer Vacuum printed or Online Catalogue.

12.1 Documentation for accessories

Depending on the pump version, supplementary information may be required for safe use of accessories:

	Accessories	No of supplementary information*
	Level switch for monitoring the fill level of lubricants in both oil chambers; including pressure equalisation line	PK 0222 BN

* these documents can be downloaded from the Internet

13 Technical data

13.1 General

Conversion table: pressure units

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^{5}$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1
1 Pa = 1 N/m^2						

Conversion table: gas throughput 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

13.2 Technical data

Okta 4000 G

Parameter	Okta 4000 G
Flange (in)	DN 250 ISO-F
Flange (out)	DN 250 ISO-F
Cooling gas connection	DN 160 ISO-F
Nominal pumping speed	2300-6900 m^3/h
Nominal pumping speed at 50 Hz	4600 m^3/h
Nominal pumping speed at 60 Hz	5500 m^3/h
Ultimate pressure without gas ballast	130 hPa
Nominal rotation speed at 50 Hz	1500 min^{-1}
Nominal rotation speed at 60 Hz	1800 min^{-1}
Rotation speed	from 750 to 2250 min^{-1}
Rotation speed min.	750 min^{-1}
Rotation speed max.	2250 min^{-1}
Leak rate	$1 \cdot 10^{-3}$ Pa m^3/s
Noise level with connected exhaust line	75-105 dB (A)
Ambient temperature	5-40 °C
Protection category	IP 55
Motor rating	max. 132 kW
Shipping and storage temperature	-10-+40 °C
Operating fluid	P3
Operating fluid filling	21 l
Weight: without motor	1150 kg
Cooling method, standard	Gas-cooled
Sealing gas	Yes

13.3 Dimensions

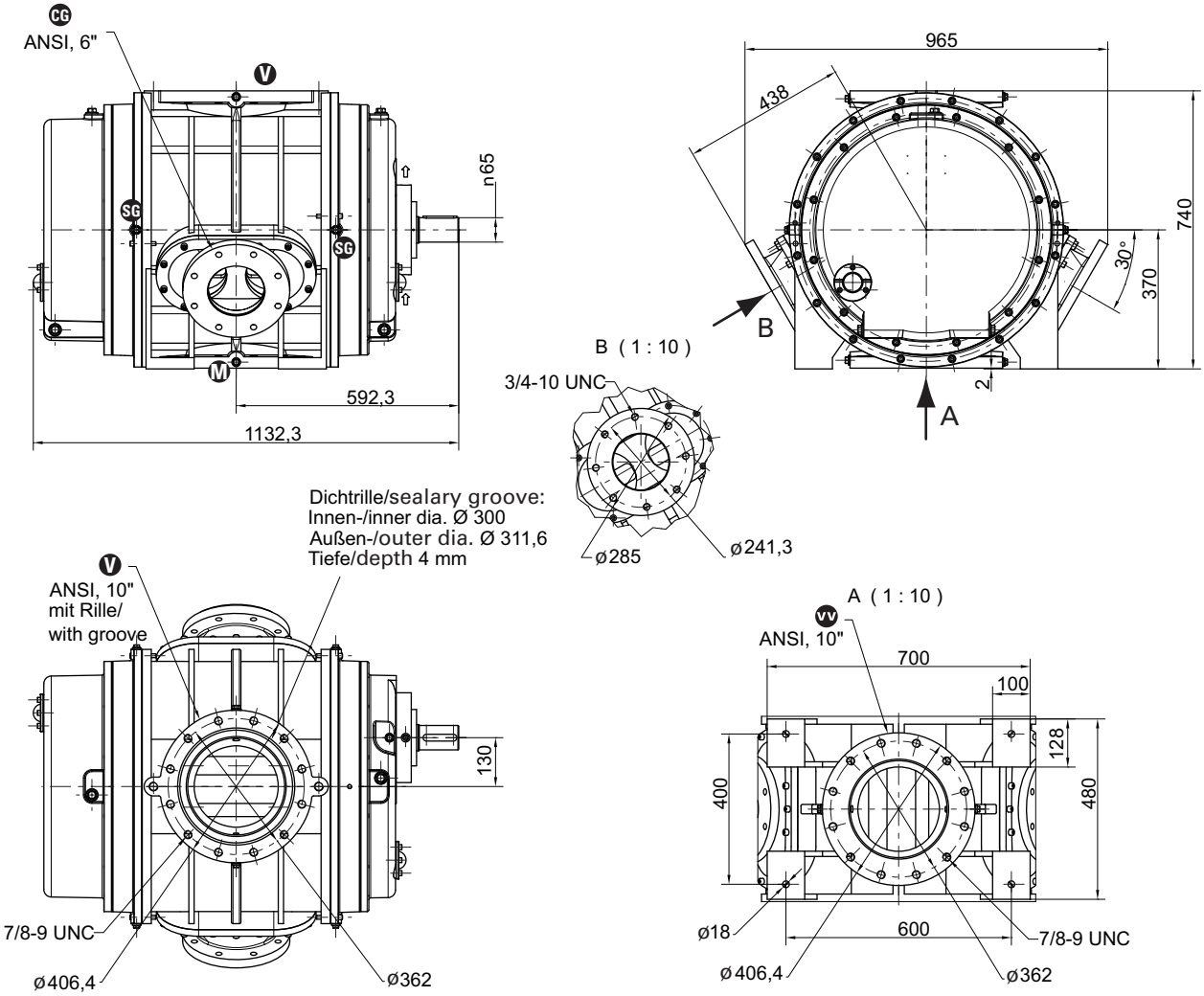


Fig. 16: Okta 4000 G

Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions according to the following **EC directives**:

- **Machinery 2006/42/EC (Annex II, no. 1 A)**
- **Electromagnetic Compatibility 2014/30/EU**
- **Restriction of the use of certain Hazardous Substances 2011/65/EU**

The agent responsible for compiling the technical documentation is Mr. Sebastian Oberbeck, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Aßlar.

Okta 4000 G

Harmonised standards and national standards and specifications which have been applied:

DIN EN ISO 12100 : 2010	ISO 21360-1, 2 : 2012	DIN EN 61000-6-3 : 2007
DIN EN 1012-2 : 2011-12	DIN EN 61000-6-1 : 2007	DIN EN 61000-6-4 : 2007
DIN EN ISO 13857 : 2008	DIN EN 61000-6-2 : 2006	DIN EN ISO 2151 : 2009

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Dr. Ulrich von Hülsen)
Managing Director

2016-05-18

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