OPERATING INSTRUCTIONS

EN

BA 251/501

Rotary Vane Pump

PFEIFFER VACUUM

PK 0156 BEN/L (1607)

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.

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

Important information about the product or this document

Instructions in the text

➔ Work instruction: here you have to do something.

Symbols used

The following symbols are used consistently throughout in all illustrations:

- Vacuum flange
- Exhaust flange
- Gas ballast valve
- Power 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 70 °C. Use suitable finger guards if necessary.
- When returning the pumps to us please note the instructions in the Service section.

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.
- Only use the vacuum pump for applications with oxygen concentration ≤ 21%.
- 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.

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
- pumping of gases containing impurities such as particles, dusts and condensate; note the vapour compatibility levels of the pump
- pumping of substances that tend to sublime
- use of the vacuum pump to generate pressure
- pumping of liquids
- the use of operating fluids not specified by Pfeiffer Vacuum
- 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
- operation of the devices in areas with ionizing radiation

3 Transport and storage

3.1 Transport

➔ Remove the locking cap from the vacuum and exhaust flange immediately before connecting!
  – Check the cone strainer, paying attention to the O-ring.

➔ Use only the eye bolt on the top side of the pump to lift the pump.

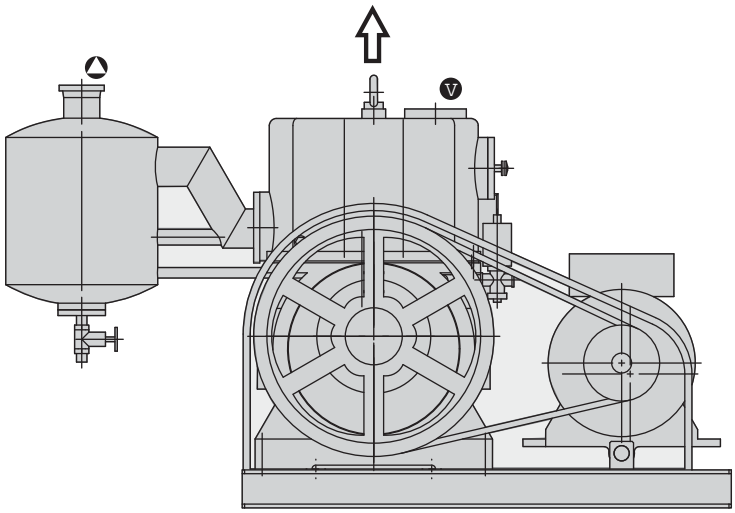


Fig. 1: Transporting the pump

3.2 Storage

➔ Check that all the openings on the pump are securely closed.

➔ Fill up the pump with new operating fluid to the top edge of the sight glass.

➔ Store the pump only dry and dust-free indoors within the specified environmental conditions.
  – 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 operating fluid 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 amount of operating fluid
- Date of manufacture

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

Scope of delivery

- Pump with/without motor
- Operating fluid P3 (for standard pump)
- Centering ring with O-ring
- Flange cover for vacuum and exhaust flange
- Operating instructions

Pump types

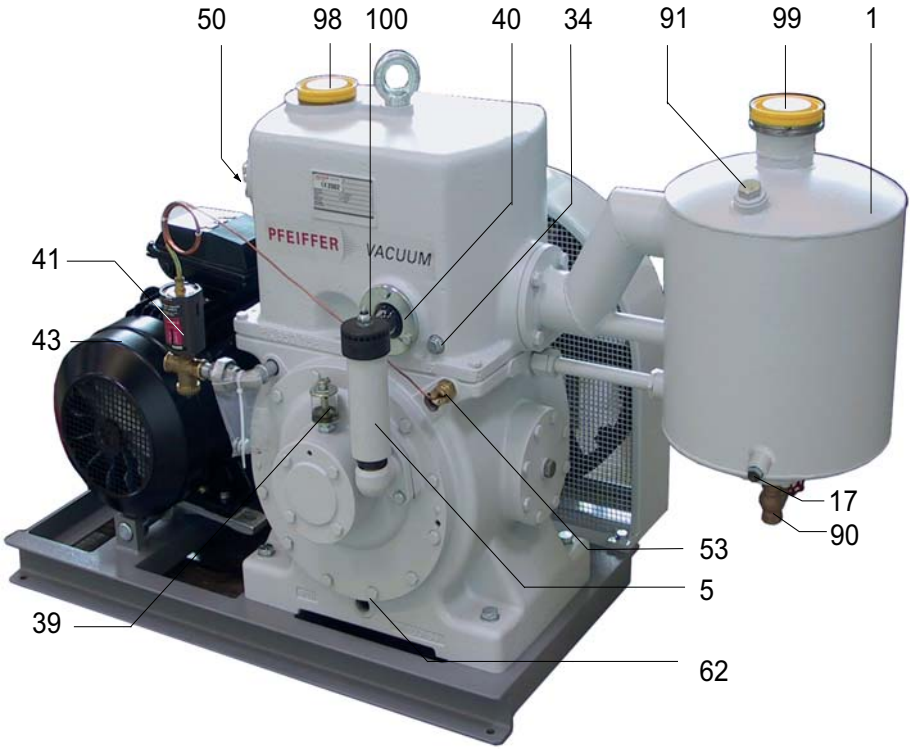
Pump type	Pump designs
BA 251	Pump on/without base frame
BA 501	Pump on/without base frame

4.2 Function

The water cooled rotary vane pumps of the UnoLine™ Plus series are fitted with an operating fluid collecting vessel with return line which ensures constant and slow circulation of the operating fluid. Condensates, dirt and other particles are separated from the operating fluid and deposited in the sump of the vessel. This system provides the pumps with a very large supply of operating fluid (BA 251 approx. 17 l, BA 501 approx. 45 l).

The spring loaded pump valves are of wear-resistant stainless steel. The pump is "V" belt driven. Pump and motor are mounted together in a base frame.

A cooling water controller regulates, contingent on the pump temperature, the cooling water flow level so that the pump operating temperature is maintained.



1 Operating fluid collecting vessel with return line
5 Gas ballast valve
17 Connection (G1/2") for external oil filter (optional)
34 Level switch connection
39 Oiler
40 Sight glass
41 Cooling water controller
43 Motor
50 Venting or measuring connection
53 Temperature sensor
62 Cooling water drain
90 Operating fluid and condensate drain valve
91 Operating fluid filler screw (G 1")
98 Vacuum connection
99 Exhaust connection
100 Needle valve

Fig. 2: Rotary Vane Pump BA 251 / BA 501

Range of application

Being of a robust design, the pumps are especially suitable for vacuum generation in industrial applications. The pumps can be used as stand-alone units or as the pre-stage to roots pumps.

5 Installation

5.1 Setting up the pump

Installation location

Observe the following requirements when setting up the pump:

- Consider the load-bearing capacity of the installation site.
- Maximum installation altitude 2000 m (above mean sea level)
- Permissible ambient temperature: +12 ... 40°C
- Maximum relative humidity 85%

➔ Fill up with operating fluid before operating the first time *(see p. 18, chap. 5.6)*.
  – Amount and type according to rating plate

➔ Set up the pump on an even, horizontal surface.
  – The base frame has four holes for anchoring onto the base.
  – As an alternative, the base frame can be mounted flexibly on 4 vibration isolators*(see p. 43, chap. 12)*.

➔ When installing the pump in a closed housing, ensure there is sufficient air circulation.
  – Sight glass and gas ballast valve must be visible and readily accessible.
  – Voltage and frequency information given on the motor rating plate must be visible.

5.2 Connecting the vacuum side

The vacuum connection can be carried out on the vertical port 98 or at the lateral venting connection 50 (after removing the blank flange).

➔ Remove locking cap from the vacuum flange;
  – pay attention to the cone strainer and the respective O-ring in the intake port.

➔ Clear welded lines of any welding scales, loose parts etc. before installation.

➔ The connection between the pump and the vacuum chamber should be kept as short as possible.
  – Depending on the pump type, use metallic hoses or PVC hoses with flange connections.
  – Separators, filters etc. may be installed upstream to protect the pump (see accessories). However, please observe the loss of pumping capacity due to the conductivity of the accessories.

5.3 Connecting the exhaust side

CAUTION

High pressure in the exhaust line!

Danger of damage to the seals and danger of the pump bursting.

➔ Install the line without shut-off valves on the exhaust side.

➔ If there is danger of a build-up of excess pressure (> 1500 hPa abs.) in the lines, observe all official accident prevention safety regulations.

➔ Choose the cross-section of the exhaust line to be at least the size of the nominal connection diameter of the vacuum pump's exhaust connection.

➔ Piping to the pump must be suspended or supported.
  – Physical forces from the piping system must not be allowed to act on vacuum pumps.

➔ 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.

5.4 Connecting the cooling water

BA series pumps are fitted with a cooling water regulator 41 as standard equipment. The regulator's job is to keep the pump at its optimum 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	
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 cooling water

The connection must be made so 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.

➔ Screw in cooling water drain screw 62; pay attention to the O-ring.
  – Locking screw included in the scope of delivery.

➔ Connecting the cooling water pipe at the inlet (cooling water controller 41) (G 1/2").

➔ Connecting the cooling water pipe at cooling water outlet 41.1 (G 1/2").

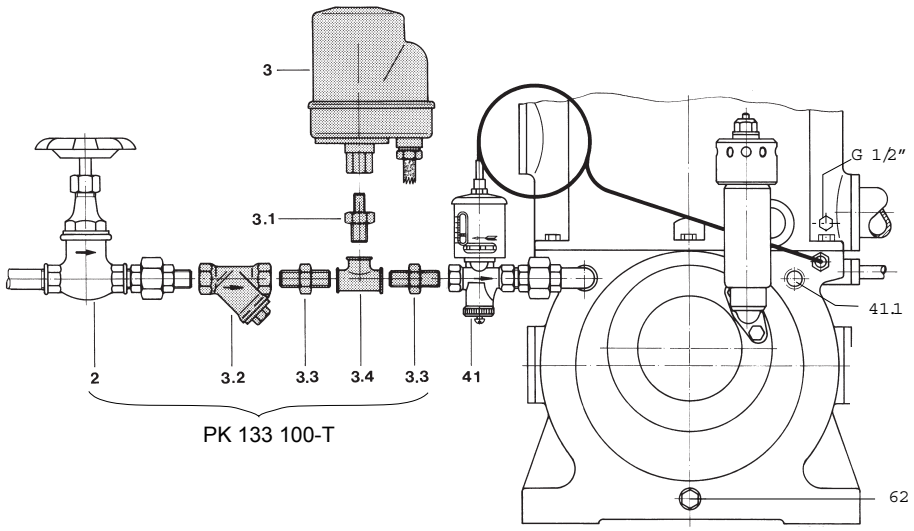
Mounting the cooling water unit (optional)

The cooling water connection unit includes the following components and is mounted as shown in Fig. 3:

– Shut-off valve
– Dirt trap
– Pressure monitor and
– Fastening clip

Installing pressure monitor (option)

The pressure monitor can be used as an effective means of monitoring the pump against cooling water failure.



2 Shut-off valve
3 Pressure monitor
3.1 Reducing nipple G 3/8 ... 1/2"
3.2 Dirt trap G 1/2"
3.3 Nipple G 1/2"
3.4 Tee G 1/2"
41 Cooling water controller, (inlet)
41.1 Cooling water connection, outlet
62 Cooling water drain

Fig. 3: Cooling water pressure monitor connection

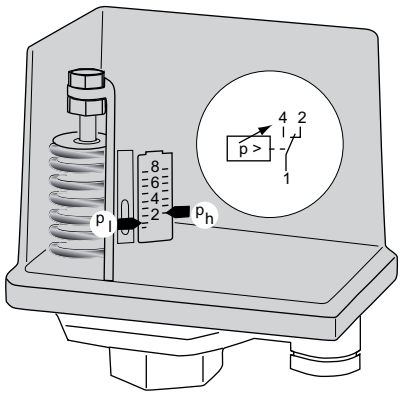
Assembly

➔ Set pressure monitor 3 in the permissible pressure range of 2 ... 10 bar.
– Liquid pressure hammers must not impact the unit.

➔ Always assemble pressure monitor 3 upright with the pressure connection to the bottom;
– pay attention to inflexible and vibration-free pressure lines. If vibrations are to be expected (not pump induced), then the unit is to be fastened to a wall or to something similar.

Setting

Set pressure as overpressure based on atmospheric pressure:



– Contact rating at 230 V/AC 1 : 16 A (resistive load)
– Contact rating at 230 V/AC 15 : 6 A (inductive load)
– Contact rating at 230 V/DC 13 : 0.1 A (inductive load)

Fig. 4: Set pressure monitor 3

➔ Set switch-point p_h at 2 bar;
– contact 1-4 closes at cooling water pressure of > 2 bar.

➔ Set switch-point p_l at 1 bar;
– if the pressure drops to < 1 bar, contact 1-2 closes and contact 1-4 opens.

5.5 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. The drive motor belt pulley has different diameters for 50 Hz and 60 Hz.

If the pumps are delivered without a motor, permissible pumping rotation speeds are to be taken into account when selecting the motor (see Technical Data).

DANGER

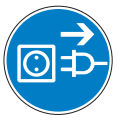
Voltage-bearing elements

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.

Three-phase motor

The three phase current motor circuit

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.

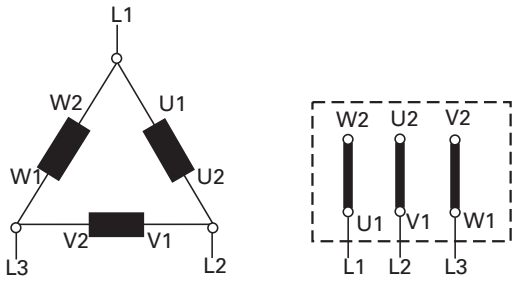


Fig. 5: Motor coil and connecting plate of Delta Connection (for low voltage)

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**.

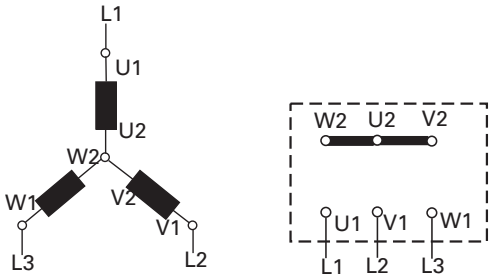


Fig. 6: Motor coil and connecting plate of Star Connection (for high voltage)

NOTICE

Do not start with star/delta connection.

➔ Always start motor directly.

Checking the direction of rotation

The direction of rotation must be checked on pumps with three-phase motors! The direction of rotation is marked on the pump housing by an arrow.

CAUTION

Destruction of or damage to the pump!

The pump can be destroyed if the direction of the motor rotation is incorrect.

➔ Remove V-belts and check direction of rotation prior to commissioning the pump.

CAUTION

Operating fluids may leak out!

If the direction of rotation is incorrect, there is a danger that operating fluids may leak at the vacuum flange.

➔ Always check the direction of rotation before filling in operating fluid.

➔ Remove the locking cap from the exhaust flange.

➔ **Slacken** V-belt.

➔ Switch on the motor briefly (2 to 3 sec.).

– Motor belt pulley turn in a clockwise direction (see the arrow on the pump housing).

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

➔ Fill up the operating fluid.

➔ Refit belts and guards *(see p. 32, chap. 7.5)*.

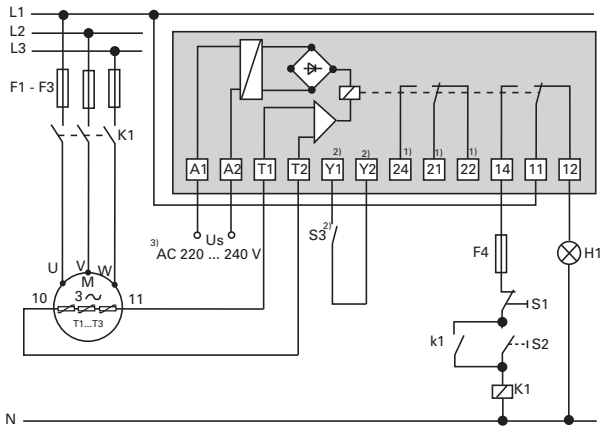
Motor protection

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

With motor protection switch

Suitable are protection switches with slow triggering characteristics. The drive motor can have a power consumption that is higher than the rated current I_N. According to DIN EN 60034-1 it is permissible to exceed the rated current I_N 1.5 times for a period of 2 minutes. The setting must permit the overload ability of the motor and can be found in the following table.

BA 251

Voltage [V]	Frequency [Hz]	Motor rating [kW]	I_N [A]	I_{max} [A]
230	50	11	34.3	322
400	50	11	19.8	186
265	60	13	34.5	331
460	60	13	19.9	191

BA 501

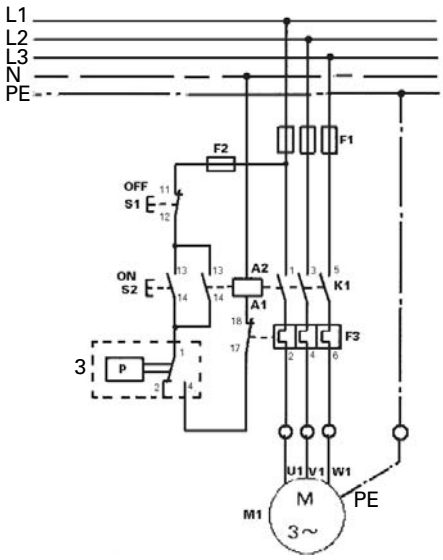
Voltage [V]	Frequency [Hz]	Motor rating [kW]	I_N [A]	I_{max} [A]
400	50	15	27.5	261
690	50	15	15.9	151
460	60	18	28.1	267

Frequency converter (valid for three phase motors)

Operation of rotary vane pumps with variable rotation speeds is possible in the mains frequency range between 35 and 60 Hz. The start-up can use a ramp (run-up time: max. 30 s); the shutdown can occur directly.

Electrical connection with cooling water pressure monitor

Prepare the circuitry of the motor with cooling water pressure monitor 3 according to the circuit diagram. A combination with a PTC resistor temperature sensor (3TF) is also possible.



3 Pressure monitor
F3 Motor protection switch

Fig. 8: Connection with cooling water pressure monitor

5.6 Filling up the operating fluid

The type and amount of operating fluid should be visible on the pump's rating plate for every rotary vane pump.

The delivery consignment for the **standard pump** contains sufficient operating fluid for one filling. The use of other operating fluids requires prior authorisation from Pfeiffer Vacuum.

Permissible operating fluid

- P3 (standard operating fluid)
- Operating fluid for special applications on request

NOTICE

Use approved operating fluids only!

The use of operating fluids that have not been approved by Pfeiffer Vacuum shall result in a limited warranty. In such cases, it is not possible to guarantee that product-specific performance data will be achieved.

➔ Prior consultation is required before using other application-specific operating fluids.

Filling up the operating fluid

➔ Unscrew operating fluid filler screw 91.

➔ Fill up the operating fluid.

– First fill when the pump is cold: Maximum 3/4 of the min./max. range.

➔ Screw in operating fluid filler screw 91.

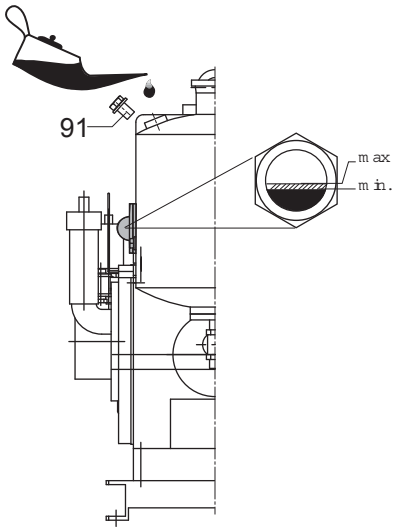


Fig. 9: Filling up the operating fluid

Check oiler

The bearing oil chambers are factory-filled with P3 lubricant.

➔ Prior to commissioning, check fill level of both oiler 39;

– The oiler should always be filled to a max. of one-third (when the pump is cold); top up as required.

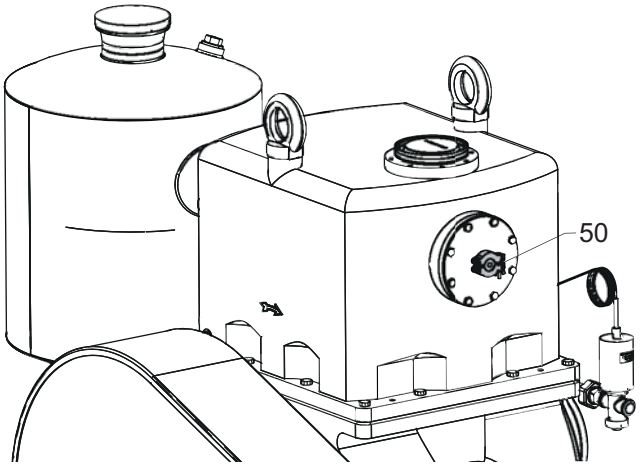
5.7 Setting up ventilation or measurement connection

The ventilation or measurement connection complies with DN 10 ISO-KF and for serial-production pumps is sealed vacuum-tight with a blank flange.

Other connection possibilities:

- manually or electrically activated valve for ventilating the pump at standstill
- Vacuum gauge for pressure measurement

- Operating fluid feedback for returning operating fluid from the oil mist filter and oil feedback unit



5.8 Operating fluid level monitoring (option)

A level switch 83.2, which is installed at the pump dome 6 (oil sump) is used for monitoring the operating fluid level.

Electrical connection of the level switch 83.2 must be carried out, so that an alarm is released and the pump is switched off, if the operating fluid level falls below the permissible level. The level switch is preset ex works.

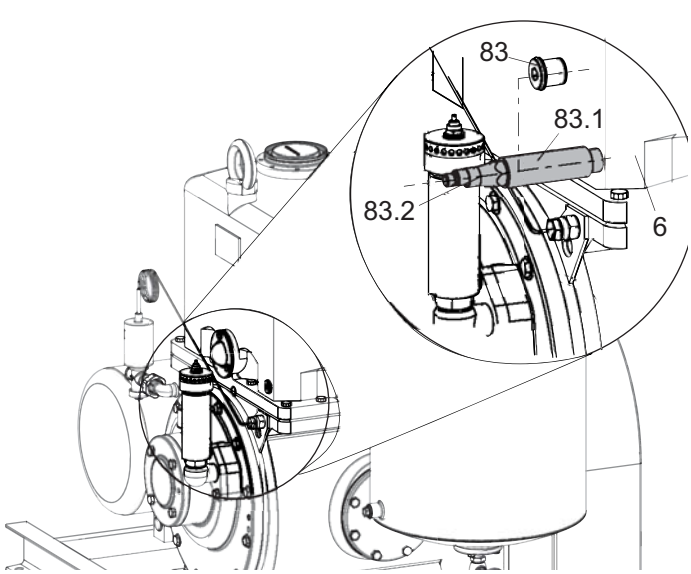


Fig. 10: Operating fluid level monitoring

Parameter	Operating fluid level monitoring
Protection category	IP 67
Current max.	35 mA
Contact	Closing contact, normally open at min. filling level
Contact rating	PNP output, max. 20 mA
Supply: Voltage	12-30 V DC

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

➔ Drain off operating fluid partially.

➔ Loosen locking screw 83 and screw it out.

➔ Install extension 83.1 between the pump dome and the level switch 83.2 as a protection against excessively high temperatures.

Make sure the operating fluid level monitoring is functioning properly!

Varying operating conditions such as change in temperature impact the proper functioning of the operating fluid level monitoring.

➔ The pump has to be running.

➔ Create reproducible operating conditions; e.g. measure ultimate pressure or intake pressure ≤ 500 hPa;

– if the intake pressure cannot be measured, then, for example, allow for a time delay of ≥ 10 min between the reaction and the alarm

➔ Disable the alarm signal during the warm-up phase or in the case of high process-dependant gas throughput, if necessary.

5.9 Operating fluid temperature monitoring (option)

A resistance thermometer 34.1, which is installed at the pump dome (oil sump) is used for monitoring the operating fluid temperatur.

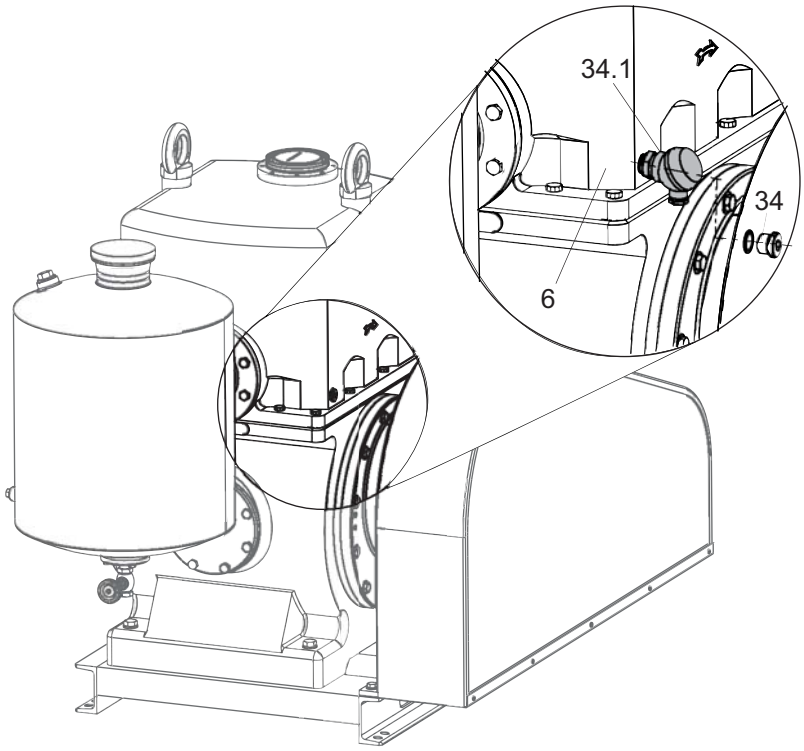


Fig. 11: Install the temperature sensor

Parameter	Resistance thermometer
Protection category	IP 65
Method of measurement	PT 100
Temperature range	-50-+400 °C

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

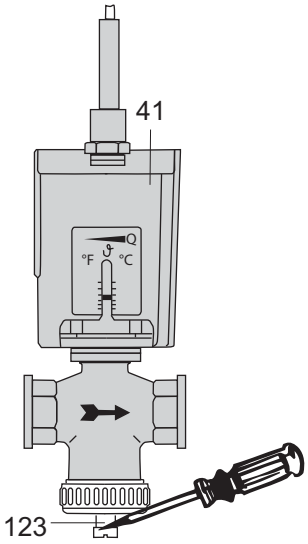
➔ Drain off operating fluid partially.

➔ Unscrew locking screw 34 (G 1/2").

➔ Screw in resistance thermometer 34.1; take care with O-ring.

6 Operation

6.1 Before switching on



➔ Compare the voltage and frequency information on the rating plate with the mains voltage and frequency values.

➔ Check that the exhaust connection allows free flow (max. permissible pressure 1500 hPa absolute).

– Activate the shut-off valves in such a way that they open before or at the same time as the pump is started.

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

➔ Open cooling water supply;

– lever down screw 123 at the cooling water controller 41 by using a screwdriver and vent the cooling chambers.

➔ Switch on pump only with vented suction chamber, because the normal power of the motor is insufficient for starting up under vacuum.

6.2 Switching on the pump

The pump can be switched on in any pressure range between atmospheric and ultimate pressure.

The ideal operating condition of the pump is achieved during continuous operation. Cyclic operation is possible, but 10 cycles per hour should not be exceeded and the operating phase should always be longer than the downtime (non-operation time).

No special precautions are necessary when pumping dry gases. In order to attain the lowest possible ultimate pressures, the gas ballast valve should be closed.

NOTICE

V-belts are used as an overload protection

Upon activation of the motor, brief slippage can occur; this is perceived as a whistling sound.

➔ This is not a sign of insufficient belt tension!

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 70 °C.

➔ In this case, use suitable finger guards.

NOTICE

Increased motor current draw (> rated current) !

With an intake pressure of about 300 h/Pa, the pump has the highest power requirement, which can increase even further under unfavorable operating conditions (e.g. counter-pressure on exhaust side.

➔ Limit the max. power consumption for 1.5 times the rated current for 2 minutes max. (according to DIN EN 60034-1.

NOTICE

Pump damage caused by overheating!

Inadequate cooling may cause pump damage.

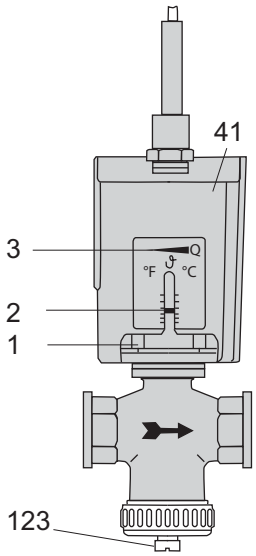
➔ Vent the cooling chambers and ensure a water flow prior to commissioning or subsequently switching on the pump!

➔ Switch on the pump with the vacuum flange closed and allow to warm up for 15 minutes.

➔ Check operating fluid level only when the pump is warm and running; therefore
- close vacuum flange and gas ballast valve,
- correct filling level during operations: within the markings at the sight glass frame,
- check operating fluid daily in non-stop operation, otherwise whenever the pump is switched on. Refilling is possible when the pump is in final vacuum operation.

Setting cooling water

The cooling water controller 41 is a continuously operating control valve that is controlled by the temperature-dependent cooling agent. The thermal sensor is submerged in the operating fluid and connected via a capillary tube to the bellows in the valve head. The cooling water controller 41 is factory-set. If other temperatures are required, the pump temperature can be changed by turning setting disk 1. The respective settings, as well as the maximum temperature, must only be made after consulting with Pfeiffer Vacuum.



1 Setting disk
2 Setting scale
3 Arrow for temperature setting
41 cooling water controller
123 Vent screw

Fig. 12: Cooling water controller 41

➔ With a screw driver set setting disk 1 of the cooling water controller to the desired operating temperature.
  – Factory setting is 50 °C, i.e. bearing oil temperature < 85 °C.
  – Replacement controllers are not preset, set temperature is 50 °C measured outside on the immersion tube of temperature sensor 53.

6.3 Pumping condensable vapours

To increase water vapour compatibility, the pump is fitted with a gas ballast valve 5.

To avoid condensation in the pump when pumping condensable vapours, air or inert gas (option) is fed into the working chamber at the beginning of the compression phase via the gas ballast valve 5.

NOTICE

Bad final vacuum and damage to the pump!

Danger of condensation and corrosion due to exceeding the water vapour compatibility during operation without gas ballast or in case of insufficient supply of flushing gas.

➔ Only pump vapours when the pump is warm and the gas ballast valve is open.

➔ When the process has been completed, allow the pump to continue running for about 30 minutes with the vacuum flange closed and the gas ballast open for operating fluid regeneration purposes.

Gas ballast valve standard version

If valve nut 103 of gas ballast valve 5 is turned counterclockwise until it stops, the valve is opened. If the lock nut is turned clockwise until it stops, the valve closes. An intermediate position is not possible.

The silencer constantly supplies small amounts of ambient air for the pump and thus aids the quiet running of the pump at ultimate pressure when the gas ballast valve is closed.

100 Needle valve (silencer)
103 Valve nut

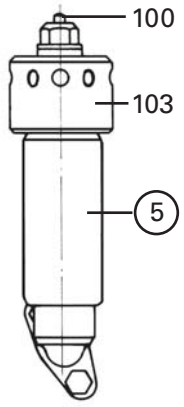


Fig. 13: Gas ballast valve 5 in standard version

The silencer is factory-set and should not be changed, otherwise the pump's final vacuum without gas ballast valve and also noise development are impacted adversely.

Conversion kit for gas ballast valve (option)

Conversion set 121 is available for the gas ballast valve for connecting flushing gas, a dust separator and/or a solenoid valve to small flange connection KF 10.

5 Gas ballast valve
111 Needle valve
121 Conversion set DN 10 KF (complete)
A Solenoid valve (option)
B Dust separator SAS 016 (option)

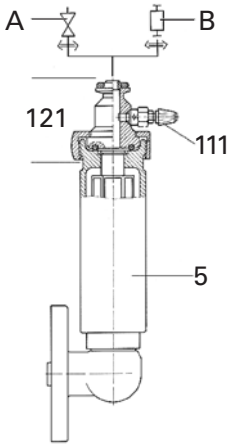


Fig. 14: Conversion set for gas ballast valve with solenoid valve and/or dust separator

- **Dust separator**:
  - A dust separator should be used if dust laden air is sucked in. It should be noted that when the dust separator becomes fouled the amount of gas ballast fed decreases and the risk of condensation from process media increases.
- **Solenoid valve**:
  - Controlled inlet of ambient air or connecting inert gas possible.

Checking the adjustments

NOTICE

Flushing gas pressure higher than allowed endangers the operational reliability of the pump.

The power input of the pump, the temperature and the ejection of operating fluid will increase.

➔ Observe the maximum permissible flushing gas pressure of 1500 hPa (absolute).

➔ Set the amount of flushing gas on site; dosing is not possible when using a solenoid valve!

➔ Reset the silencer using needle valve 111 after converting the gas ballast valve.

➔ In case of intake air exposed to dust install dust separator on the gas ballast valve.

➔ Set flushing gas pressure; maximum pressure 1500 hPa (absolute).

– Select the type and amount of flushing gas depending on the process; consult Pfeiffer Vacuum if necessary.

6.4 Topping up the operating fluid

If the operating fluid has reached its minimum filling level, the operating fluid must be topped up. The fluid can be topped up during operation in the final vacuum.

Filling up the operating fluid

➔ Unscrew operating fluid filler screw 91.

➔ When the pump is at operation temperature, top up the operating fluid up to the "max." marking.

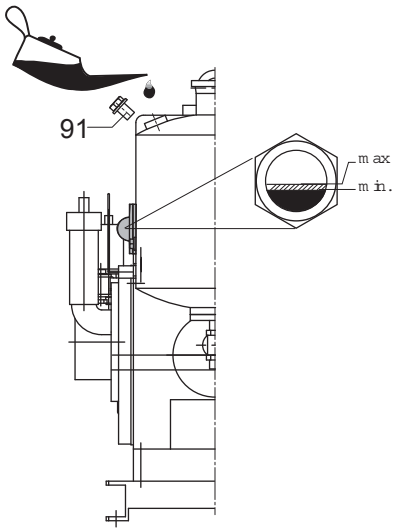


Fig. 15: Filling up the operating fluid

➔ Screw in operating fluid filler screw 91.

6.5 Switching off and venting

The pump can be switched off in any pressure range.

CAUTION

Danger of backflow of operating fluid into the intake line!

Contamination of the connected vacuum system!

➔ Because the pump has no internal safety valve, install an additional shut-off valve in the intake line.

➔ Shut off the intake line and vent the pump immediately after switching off the pump.

NOTICE

Damage to drive and pump because of oil stroke when switching on!

If the pump is not vented sufficiently after switching off, the rotor can rotate backwards and suck operating fluid into the suction chamber.

➔ Always vent the pump sufficiently to avoid rising operating fluid.

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

➔ Disconnect intake line after switching off the pump so that operating fluid does not flow back into the vacuum line.

– An electro-pneumatic activated shut-off valve (see Accessories) can be used for this purpose; the valve's control can be coupled with the motor voltage.

➔ Open magnetic venting valve at measurement connection 50 and vent the pump.

– To prevent premature venting the venting valve can be coupled with the shut-off valve's position indicator.

➔ If the ambient temperature is less than 0 °C, the cooling water must be drained at Pos. 62 after the pump is switched off and after prolonged down time *(see p. 12, chap. 5.4)*.

7 Maintenance

7.1 Precautions

WARNING

Danger of injury from moving parts!

After power failure or motor shutdown due to overheating, the motor may restart automatically.

➔ Secure the motor so that it cannot be switched on while any work is being performed on the pump.

➔ If necessary, dismantle the pump from the installation for inspection.

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.

➔ 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	as required; at least annually	as required; at least every 2 years	as required; at least every 4 years
Check operating fluid level	X				
Visual inspection (leak-tightness/oil leaks)	X				
Check cooling water flow lines		X			
Clean cooling water flow lines		X			
Clean gas ballast valve		X			
Clean the fan cap of the motor		X			
Check "V" belt drive			X		
Change operating fluid			X		
Change "V" belts				X	
Replace radial shaft seals				X (PV)	
Replace exhaust valves					X (PV)
Replace vanes					X (PV)
Replace bearings					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 operating fluid

The service life of the operating fluid is dependent on the application area for the pump. It must be changed if:

- The specified ultimate pressure is no longer reached
- The operating fluid in the sight glass is visibly contaminated, milky, or cloudy
- The operating fluid is thermally aged, identifiable by its color ID value (applies to mineral oils only).

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.

➔ The level of deterioration of organic operating fluids (P3, for example) can be read off the colour scale in accordance with DIN 51578; request the supplementary sheet PK 0219 BN or download it from the Internet.

➔ Fill the specimen in a test tube or some similar vessel and test by holding against the light.

➔ Where discolouration is dark yellow to red brown (equivalent to 4 ... 5 on the scale) change operating fluid.

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

➔ Open operating fluid drain screw 90 and drain operating fluid.

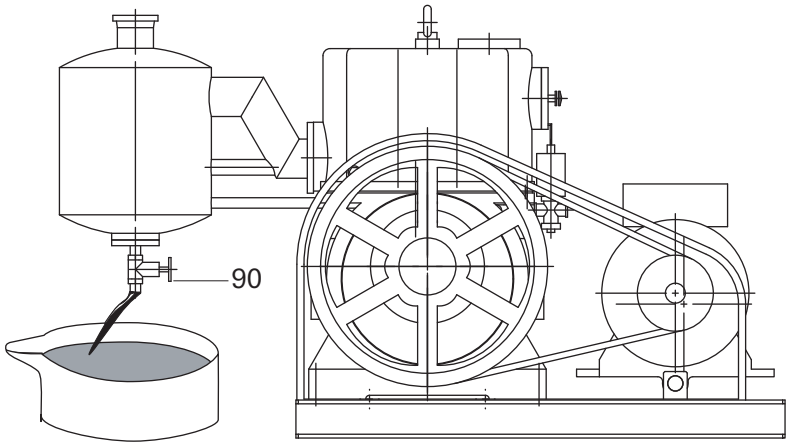


Fig. 16: Draining the operating fluid

WARNING

Hot operating fluid!

Danger of burns when draining due to contact with skin.

➔ Wear suitable protective clothing.

➔ Use a suitable collecting vessel.

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

➔ Allow the pump to run for approx. 10 seconds with open gas ballast valve 5 so that the remaining operating fluid drains from the pump body.

– In case of serious contamination, the operating fluid will have to be changed several times (flushing):

➔ Close operating fluid drain valve 90.

Flushing and cleaning

➔ Fill up with operating fluid to the middle of the sight glass.

➔ Operate the pump with the gas ballast open until the pump has warmed up.

➔ Drain the operating fluid again and check for contamination, flush again if necessary.

➔ Screw the operating fluid drain screw 90 back in.

➔ Fill up with operating fluid and check the filling level *(see p. 18, chap. 5.6)*.

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.

7.3 Changing the kind of operating fluid

When filling up, topping up or changing the operating fluid, always use the type of operating fluid indicated on the pump type plate. If, for example, amended process conditions require the use of a different operating fluid, the fluid can be changed as follows:

NOTICE

Changing the type of operating fluid.

A change of operating fluid type can be only be made between mineral (P3) and synthetic operating fluid (D1). It is not possible to change from these two types to F4/F5 or the other way round!

➔ For the two flushing processes and final fill, the pump needs to be filled up three times with fresh operating fluid, and this is the amount of operating fluid required.

➔ Perform two flushing processes with the new operating fluid.

➔ Clean any accessories present such as the ONF/OME or ORF/ODK and replace their filter elements; pay attention to whether more operating fluid is required.

➔ Fill the pump for the final time with the third filling.

➔ Note down the current type of operating fluid in an appropriate place on the pump (preferably on the type plate).

7.4 Clean the cooling water chambers

Contamination and calcium deposits can affect the pump's cooling water circuit and bring about an elevated operating temperature. This can be avoided, depending on the cooling water quality, by cleaning the cooling water chambers at regular intervals.

➔ Stop cooling water feed and drain cooling chamber at outlet 62.
➔ Remove flanges 14, 15 and 95; observe seals 22 and 23 *(see p. 41, chap. 11.2)*.
➔ Clean the cooling water chamber with a suitable agent.
➔ Remount flanges with seals and screw outlet screw 62 back in.
➔ Restore cooling water feed *(see p. 12, chap. 5.4)* and bleed cooling chambers.

Cleaning the dirt trap

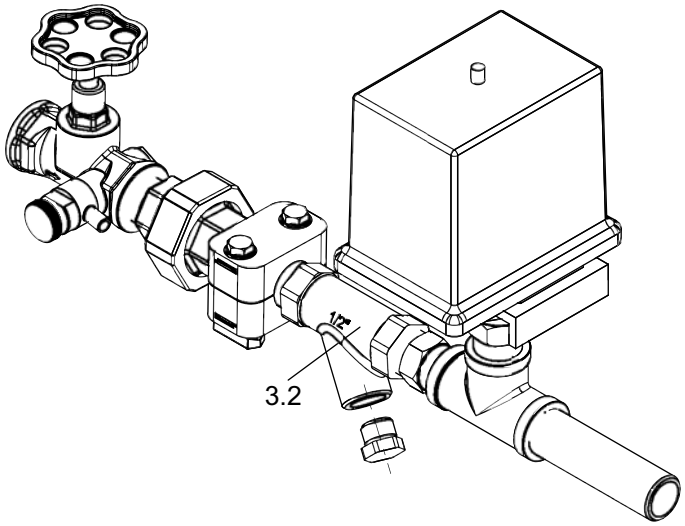


Fig. 17: Cleaning the dirt trap

➔ Stop cooling water supply.
➔ Open sealing plug on dirt trap 3.2; pay attention to seal.
➔ Clean sieve insert.

7.5 Checking the "V" belt drive

The correct belt bias is crucial to efficient power transmission and achieving the usual belt lifespans. The belts will fail prematurely if the bias is too low or too high. Excessive belt bias frequently results in pump or motor bearing defects.

The V-belt drive must be checked regularly for wear, damage and V-belt bias.

WARNING

If drive belts are exposed!

Fingers and hands can become crushed while carrying out service activities.

➔ Isolate power before removing belt guard.
➔ Do not expose any body parts to the operating range of the belt drive.
➔ Wear close-fitting clothing.
➔ Remount belt guard on completion of the work.

Fitting the "V" belts

Observe the following instructions carefully:

➔ If one or several belts fail, a new set must be mounted.
  – Use only measured V-belt sets.

➔ Align shafts and pullies.
  – The maximum deviation of the pully alignment must not exceed 1°.

➔ Reduce the motor distance so that the belt can be fitted into the grooves without force. The use of levers, screwdrivers etc. to force fit is not permitted.

➔ Do not use belt wax or spray.

Setting the V-belt bias

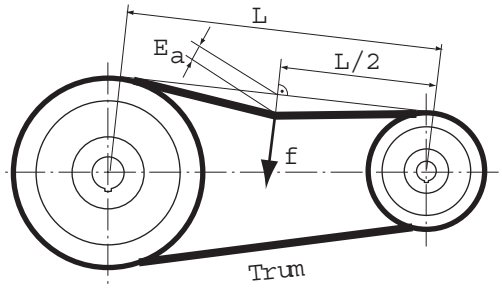
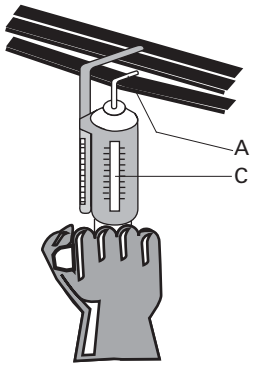


Fig. 18: Setting the belt bias

Setting values for correct V-belt bias	**BA 251 50/60 Hz**	**BA 501 50/60 Hz**
Impression depth of strand (E_a)	15+2 mm	21+2
Test load for belt bias (f)	50 N	50 N
Branch length of gear, theoretical (L)	488 mm	697 (50 Hz) 705 (60 Hz)

A Load hook
C Scale for test load



➔ Place spring balance with load hook A in centre of strand.

➔ Apply required test load f of 50 N according to scale C; pull spring balance at right-angle to the strand.

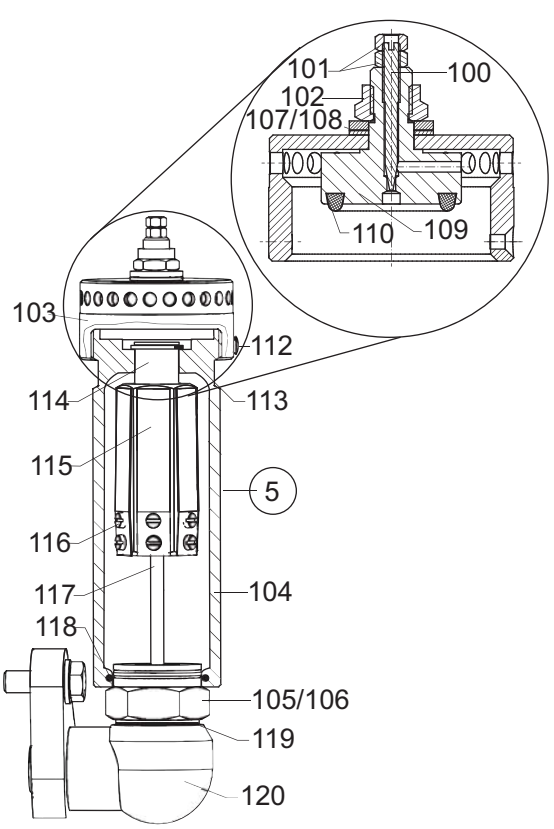
➔ If necessary, correct the bias until the setpoint value is reached.

➔ Observe the drive during the first few hours of operation and retension after approx. 0.5 to 4 hours running time under full load.

➔ Check the belt bias again after approx. 24 hours of operation and correct if necessary.

7.6 Cleaning the gas ballast valve

Gas ballast valve 5 is only exposed to contamination if dusty air is sucked in.



100 Needle valve
101 Locking nut
102 Self-locking nut
103 Valve nut
104 Valve housing
105 Intermediate piece
106 Clamping block
107 Washer
108 Washer
109 Valve plate
110 Gasket
112 Retention screw
113 Circlip
114 Valve insert
115 Valve spring
116 Screw
117 Screw
118 O-ring
119 Sealing ring
120 Angle piece

Fig. 19: Gas ballast valve

➔ Unscrew gas ballast valve from angle piece 120, observe sealing ring 119.
➔ Loosen retention screw 112 and unscrew valve nut 103.
➔ Loosen locking nut 101 and unscrew needle valve 100.
➔ Loosen self-locking nut 102 and remove plain washers 107 and 108.
➔ Remove valve plate 109.
➔ Unscrew screw 117 and remove parts 105 and 106; observe O-ring 118.
➔ Lever out valve insert 114 and remove circlip 113.
➔ Pull valve insert 114 from valve housing 104.
➔ Undo screws 116 and remove valve springs 115.
➔ Clean all parts and examine for wear. Replace gasket 110 if necessary.
➔ Reassemble in the reverse sequence.

Once the gas ballast valve has been removed and re-assembled, the silencer must be reset!

7.7 Set/adjust the silencer

If the silencer is not functioning, a knocking noise becomes audible at final vacuum. This does not damage the pump, although can have a negative affect at the installation location.

The silencer is set using a standard screwdriver when the pump is running at operating temperature and vacuum flange and gas ballast valve are closed.

➔ Close needle valve 100/111 and wait until you hear oil hammer.

➔ Untwist needle 100/111 until the oil hammer noise disappears (approx. 1/2 rotation).

➔ Hold needle valve 100/111 in position with the screwdriver and tighten fixing nut 101.

If the silencer is set correctly, the pump vacuum has a total pressure of
$< 6.0 \bullet 10^{-2}$ hPa.

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.
➔ Change the operating fluid *(see p. 29, chap. 7.2)*.
➔ Switch pump on and bring to operating temperature.
➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.
➔ Close the flange openings by using the original protective covers.
➔ Stop cooling water feed and remove cooling water intake and output lines.
➔ Unscrew cooling water drain screw 62 and empty cooling water chambers to avoid rust and frost damage.
➔ Fill in additional operating fluid in accordance with table below:
  – BA 251: 5 l
  – BA 501: 10 l
➔ Store the pump only dry and dust-free indoors within the specified environmental conditions.
  – 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 operating fluid before using the pump.
➔ Do not store pump in the vicinity of machines, lanes, etc., because strong vibrations can damage the rotor bearings.

8.2 Re-starting

Emission of operating fluid!
Danger of the operating fluid being emitted at the exhaust flange if overfilled.
➔ Drain the operating fluid to the normal level before restarting the pump.

Visually inspect the inner of the pump dome 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 radial shaft sealing rings. With reference to DIN 7716 and the manufacturer's specifications we recommend replacing the installed elastomer parts after 2 years. After this time the bearings should also be replaced; contact Pfeiffer Vacuum Service.

➔ If drying pearls were inserted then they should be removed now. Improper handling can cause failure of the pump.

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.

NOTICE

Motor overload!

Depending on the malfunction (e.g. blocking during cold start), the motor may not be sufficiently protected by the built-in thermal protection switch from damage through overheating.

➔ Implement an additional network safety device.

9.1 Rectifying malfunctions

Problem	Possible causes	Remedy
Pump will not start up	No mains voltage or voltage does not correspond to the motor data	Check mains voltage and mains fuse protection; check motor switch
	Ambient temperature too low	Warm up pump to > 12 °C
	Suction chamber not flooded	Flood on suction side after switching off pump
	Thermal cut-off switch has responded	Detect and fix cause of overheating; allow pump to cool off if necessary.
	Defective motor cut-off switch (building side)	Re-set or replace switch.
	Dirty pump system	Clean pump; notify Pfeiffer Vacuum service department, if necessary.
	Damaged pump system	Clean and overhaul pump; notify Pfeiffer Vacuum service department, if necessary.
	Motor defective	Replace motor
Pump switches off after a while after being started	Thermal protection switch of the motor has responded	Detect and fix cause of overheating; allow pump to cool off if necessary.
	Mains fuse protection triggered due to overload (e.g. cold start)	Warm up pump
	Exhaust pressure too high	Check opening of exhaust line and exhaust accessories
High increase in operating temperature	Fault in cooling water circuit	Check flow paths for dirt and lime deposits; clean, if necessary.
Pump not achieving the ultimate pressure	Leak in the system	Fix leak
	Falsified measuring result	Check gauge, test ultimate pressure without connected system.
	Pump or connected accessories dirty	Clean pump and check components for dirt.
	Dirt in operating fluids	Operate pump for a longer period of time with opened gas ballast valve or replace operating fluids
	Gas ballast valve is open	Close valve.
	Silencer is open	Set/adjust the silencer
	Operating fluids fill level too low	Fill up operating fluids
	Pump is damaged	Contact Pfeiffer Vacuum Service.
Pumping speed of pump too low	Intake line not well-dimensioned	Keep connections as short as possible and see that cross-sections are sufficiently dimensioned
	Exhaust pressure too high	Check opening of exhaust line and exhaust accessories

Problem	Possible causes	Remedy
Loss of operating fluids in pump and oiler	Leaking O-ring in pump dome	Check for tightness; replace O-ring, if necessary
	Leaking radial shaft seal ring	Check seal ring and replace, if necessary
	Operation-related loss of operating fluids; operating fluid in exhaust lines	Install oil mist filter and oil return unit, if necessary
Unusual noises during operation	V-belt tension too low	Check V-belt tension
	Dirt in silencer	Clean or replace the silencer.
	Damage in pump system	Clean and overhaul pump; notify Pfeiffer Vacuum service department, if necessary.
	Motor bearing defective	Replace motor; notify Pfeiffer Vacuum service department, 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

Set of seals

The set of seals contains all seals of the assembly groups and the subassemblies including the radial shaft seals.

Maintenance kit

The pack contains the following parts:

- Radial shaft seal rings
- The O-rings of the operating fluid filler and drain screw when changing the operating fluid
- The O-ring for the pump dome, after cleaning the operating fluid sump

Set of vanes

The kit contains the vanes of the pump stage, the vane springs and the guide pins (only for the BA 501).

Overhaul kit

The kit contains all wearing parts of the pump:

- Set of seals
- Wearing parts of the pumping system
- Wearing parts of the gas ballast valve
- Oiler
- Fan belt (only for pumps with motor)

Set of discharge valves

The kit contains the wearing parts of the discharge valves. Also the O-ring of the pump dome is included.

Cooling water controller

- Cooling water controller
- Sleeve of the thermal sensor
- Parts of the piping

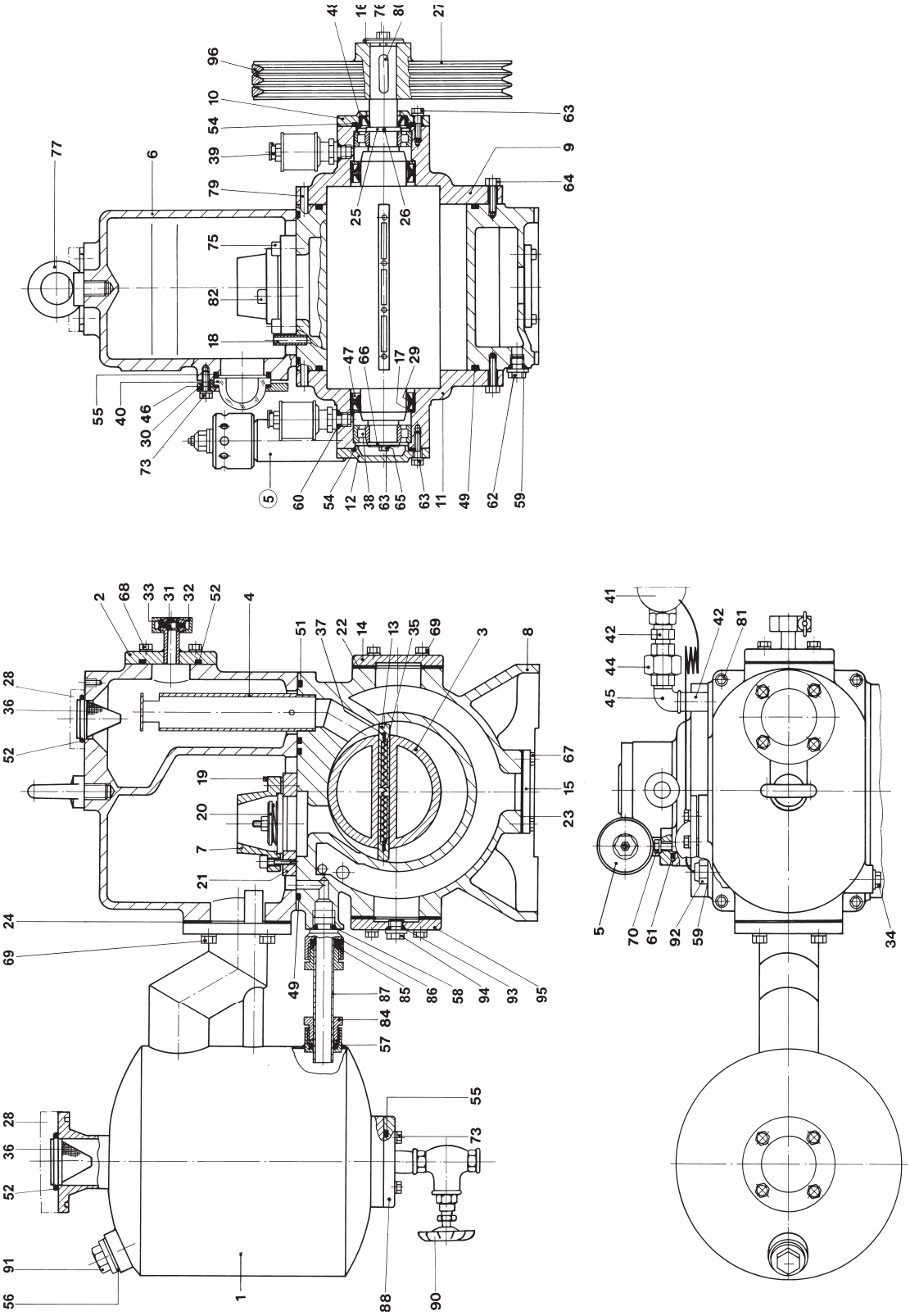
11.1 Spare parts packages

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.

Article no.:	Pump type	seals	Mainte-nancekit	kit	valves	Set of vanes	Cooling water controller
PK C42 602	BA 251 / 50 Hz	PK E40 001 -T	PK E41 001 -T	PK E42 002 -T	PK E45 002 -T	PK E48 001 -T	PK 081 950 -T
PK C42 637	BA 251 / 60 Hz	PK E40 001 -T	PK E41 001 -T	PK E42 002 -T	PK E45 002 -T	PK E48 001 -T	PK 081 950 -T
PK C43 602	BA 501 / 50 Hz	PK E40 002 -T	PK E41 002 -T	PK E42 004 -T	PK E45 001 -T	PK E48 002 -T	PK 081 950 -T
PK C43 637	BA 501 / 60 Hz	PK E40 002 -T	PK E41 002 -T	PK E42 004 -T	PK E45 001 -T	PK E48 002 -T	PK 081 950 -T

11.2 Drawings



1	Condensate separator with operating fluid return unit	37	Guide pin (only for BA 501)	80	Key
2	Cover	38	Cylinder roller bearing	81	Screw
3	Rotor	39	Oiler	83	Locking screw with sealing ring
4	Intake pipe	40	Sight glass	84	Pressure piece
5	Gas ballast valve	41	Cooling water controller	85	Pressure ring
6	Pump dome	42	Double nipple	86	Screw-in sleeve
7	Valve crown	44	Screwed connection	87	Pipe
8	Pump body	45	Angle	88	Flange
9	Bearing housing/drive side	46	Seal	90	Operating fluid and condensate drain valve
10	Bearing cover/drive side	47	Radial shaft seal	91	Operating fluid filler screw
11	Bearing housing/non drive side	48	Radial shaft seal	92	Sleeve
12	Bearing cover/non drive side	49	O-ring	93	O-ring
13	Vane	51	O-ring	94	Locking screw
14	Blank flange	52	O-ring	95	Flange
15	Blank flange	54	O-ring	96	"V" belt
16	Washer	55	O-ring		
17	Spacer ring	56	O-ring		
18	Pipe	57	O-ring		
19	Valve pipe	57	O-ring		
20	Exhaust valve	58	O-ring		
21	Valve seat	59	O-ring		
22	Seal	60	O-ring		
23	Seal	61	O-ring		
24	Seal	63	Screw		
25	Setting ring	64	Screw		
26	Set screw	65	Spring washer		
27	"V" belt pulley	66	Washer		
28	Flange cover	67	Screw		
29	Supporting ring	68	Screw		
30	Window ring	69	Screw		
31	Centering ring	70	Screw		
32	Tensioning ring	73	Screw		
33	Blank flange	75	Screw		
34	Locking screw with sealing ring	76	Screw		
35	Vane spring	77	Ring screw		
36	Strainer	79	Dowel pin		

12 Accessories

Designation	BA 251
KAS 63, condensate separator	PK Z10 010
OME 100 M, oil mist filter for pumping speeds up to 300 m^3/h	PK Z40 012
Oil return unit, ORF 005, standard version	PK Z90 065
ZFO 063, zeolite trap	PK Z70 010
FAK 063, activated carbon filter	PK Z30 010
KLF 063, cold trap	PK Z80 010
PTC-resistor tripping device	P 4768 051 FQ
Operating fluid level monitoring, 24 V DC for BA 251/501	PK 133 115 -T
Reducing piece, stainless steel, DN 100/63 ISO-K	PF 321 210-X
Cooling water connection unit for BA 251/501	PK 133 100 -T
Pressure monitor for cooling water circulation system BA 251/501	P 4747 161 MF
Resistance thermometer PT 100	PK 132 101 -T
EVB 063 PA, Angle valve, electropneumatic, with PI, with PV, 24 V DC	PF B18 201
SAS 16, dust separator, DN 16 ISO-KF, polyester filter	PK Z60 506
VFS 010, Air venting valve 24 V DC	PK V52 024
Vibration isolators for BA 251/501	PK 132 855 -T
Conversion kit for gas ballast valve to KF connection	PK 133 863 -T
SAS 63 dust separator, DN 63 ISO-K, polyester filter	PK Z60 511
Magnetic gas ballast valve 230 V-50/60 Hz	PK V52 001

Designation	BA 501
KAS 100, condensate separator	PK Z10 012
OME 160 M, oil mist filter for pumping speeds of up to 500 m^3/h	PK Z40 014
Oil return unit, ORF 005, standard version	PK Z90 065
FAK 100, activated carbon filter	PK Z30 012
PTC-resistor tripping device	P 4768 051 FQ
Operating fluid level monitoring, 24 V DC for BA 251/501	PK 133 115 -T
Reducing piece, stainless steel, DN 160/100 ISO-K	PF 321 221 -X
Cooling water connection unit for BA 251/501	PK 133 100 -T
Pressure monitor for cooling water circulation system BA 251/501	P 4747 161 MF
Resistance thermometer PT 100	PK 132 101 -T
EVB 100 PA, Angle valve, electropneumatic, with PI, with PV, 24 V DC	PF B28 201
SAS 16, dust separator, DN 16 ISO-KF, polyester filter	PK Z60 506
Supporting frame for OME 160 M with BA 501	PK 133 904 -T
VFS 010, Air venting valve 24 V DC	PK V52 024
Vibration isolators for BA 251/501	PK 132 855 -T
Conversion kit for gas ballast valve to KF connection	PK 133 863 -T
SAS 100 dust separator, DN 100 ISO-K, polyester filter	PK Z60 512
Magnetic gas ballast valve 230 V-50/60 Hz	PK V52 001

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

13 Technical data and dimensions

13.1 General

- Recommendations of PNEUROP committee PN5
- ISO 21360; 2007: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"

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

Parameter	BA 251	BA 501
Flange (in)	DN 63 ISO-F	DN 100 ISO-F
Flange (out)	DN 63 ISO-K	DN 100 ISO-K
Pumping speed at 50 Hz	250 m^3/h	500 m^3/h
Pumping speed at 60 Hz	250 m^3/h	500 m^3/h
Ultimate pressure with gas ballast	1 hPa	1 hPa
Ultimate pressure without gas ballast	$5 \cdot 10^{-2}$ hPa	$5 \cdot 10^{-2}$ hPa
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, max.	1500 hPa	1500 hPa
Nominal rotation speed at 50 Hz	1500 min^{-1}	1500 min^{-1}
Nominal rotation speed at 60 Hz	1800 min^{-1}	1800 min^{-1}
Nominal rotation speed pump, 50 Hz	490 min^{-1}	345 min^{-1}
Nominal rotation speed pump, 60 Hz	490 min^{-1}	345 min^{-1}
Emission sound pressure level without gas ballast at 50 Hz	≤ 63 dB (A)	≤ 65 dB (A)
Emission sound pressure level without gas ballast at 60 Hz	≤ 63 dB (A)	≤ 65 dB (A)
Ambient temperature	12-40 °C	12-40 °C
Protection category	IP 55	IP 55
Rated power 50 Hz	11 kW	15 kW
Rated power 60 Hz	13 kW	18 kW
Mains requirement: voltage 50 Hz	230/400 (± 5%) V	400/690 (± 5%) V
Mains requirement: voltage 60 Hz	265/460 (± 5%) V	460 (± 5%) V
Switch	No	No
Mains cable	No	No
Shipping and storage temperature	-25-+55 °C	-25-+55 °C
Operating fluid	P3	P3
Operating fluid filling	17 l	45 l
Weight: with motor	570 kg	1100 kg
Cooling method, standard	Water	Water
Cooling water pressure	2000-10000 hPa	2000-10000 hPa
Cooling water temperature	10-30 °C	10-30 °C
Cooling water consumption	> 50 l/h	> 90 l/h
Temperature: Operating	80 °C	80 °C

Table 1: Typical ultimate pressure according to PNEUROP

13.3 Dimensions

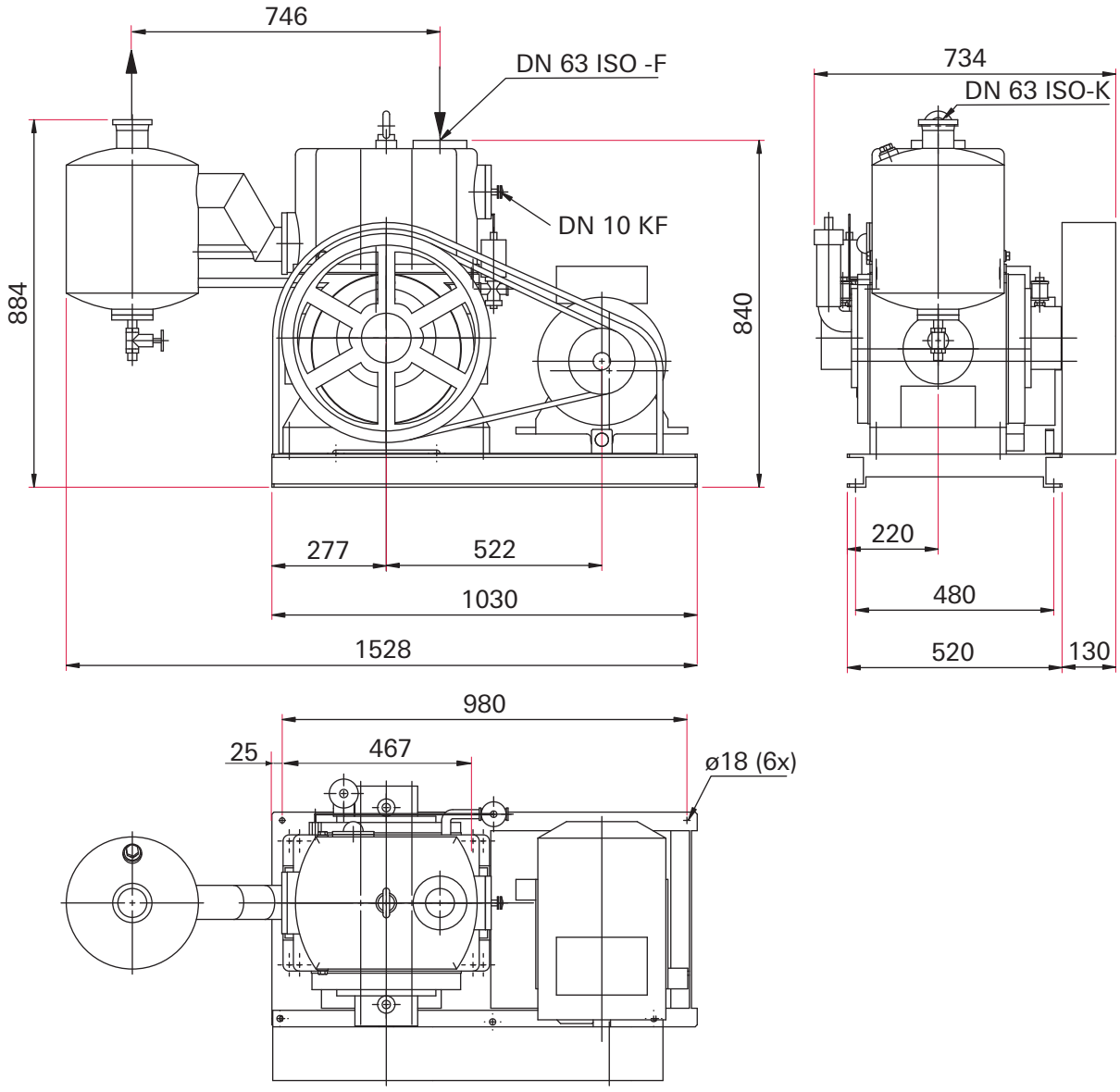


Fig. 20: BA 251

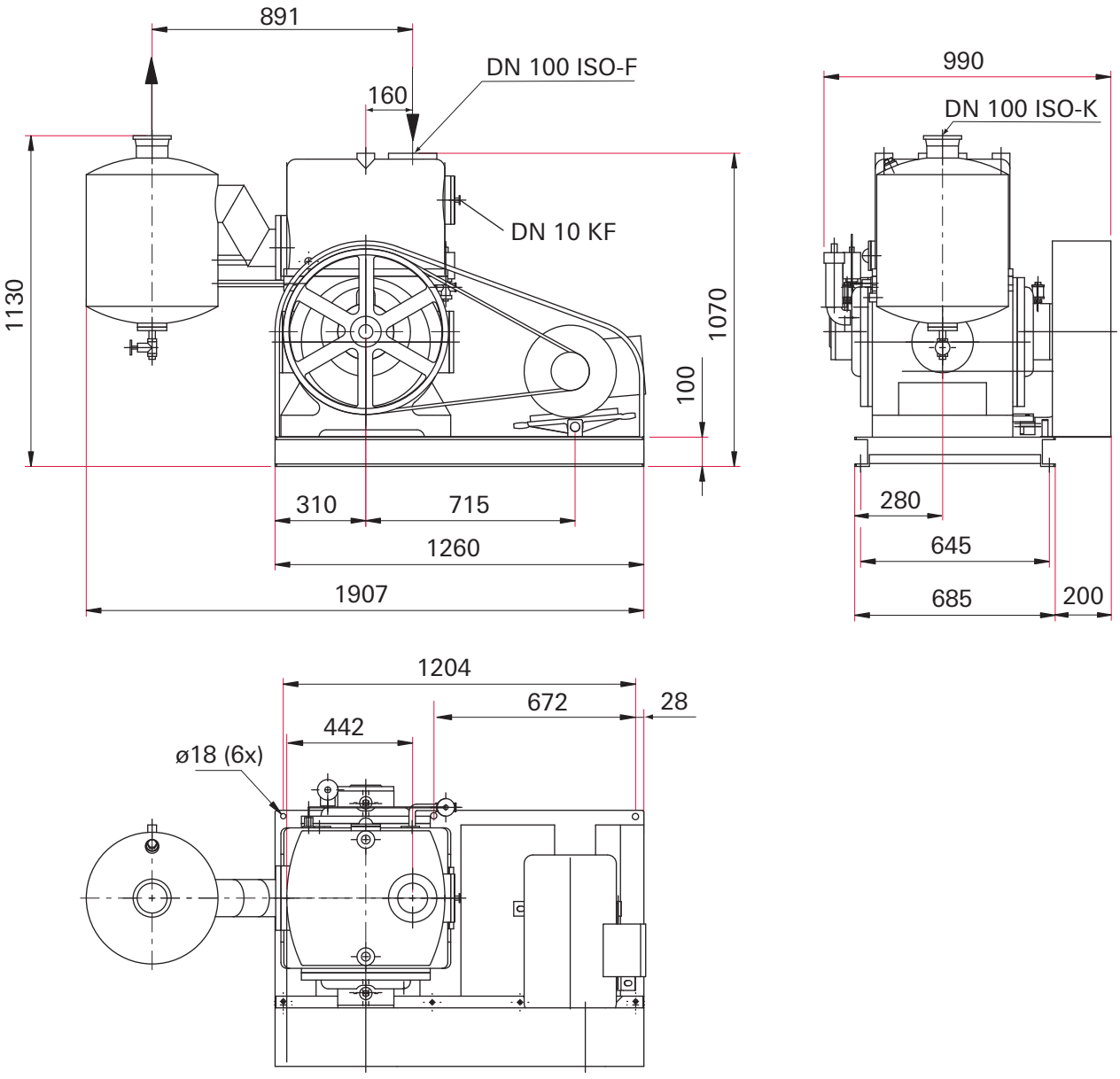
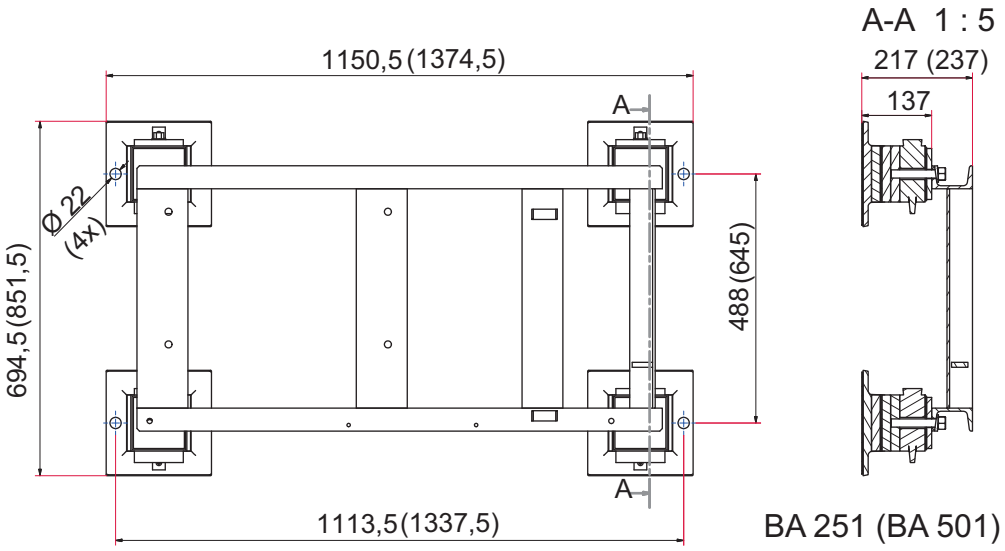

891
160
DN 100 ISO-F
DN 10 KF
1130
1070
100
310
715
1260
1907
990
DN 100 ISO-K
280
645
685
200
1204
672
28
442
ø18 (6x)

Fig. 21: BA 501

Frame with vibration isolators



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.

UnoLine™ Plus
BA 251/501

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

2016-07-27

PFEIFFER VACUUM

VACUUM SOLUTIONS FROM A SINGLE SOURCE

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

COMPLETE RANGE OF PRODUCTS

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

COMPETENCE IN THEORY AND PRACTICE

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

Are you looking for a perfect vacuum solution? Please contact us:

Pfeiffer Vacuum GmbH
Headquarters • Germany
T +49 6441 802-0
info@pfeiffer-vacuum.de

www.pfeiffer-vacuum.com

PFEIFFER VACUUM