OPERATING INSTRUCTIONS

EN

Translation of the original instructions

HENA 401/631

Rotary Vane Pump

PFEIFFER VACUUM

PD 0088 BEN/A (1604)

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

Hena 401/631	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

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

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.

CAUTION

Operating fluid overflows into the pump system if the pump is tilted!

Vane fractures when pump starts up.

➔ Only transport pump without operating fluid.

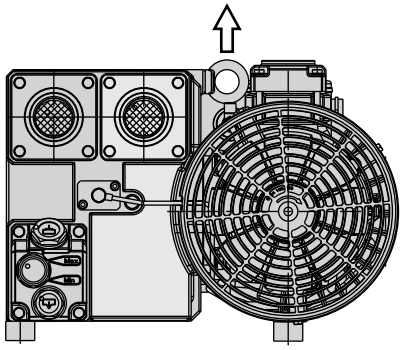


Fig. 1: Unpack and lift pump

➔ 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 exhaust flange immediately before connecting!

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

➔ To lift the pump without motor and if accessories are mounted, fit another strap at a suitable position.

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 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 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 and use it:

- Pump model and model number
- Serial number
- Type and amount of operating fluid
- Date of manufacture

Please find the voltage range and motor-related data on the separately attached motor rating plate.

Scope of delivery

- Pump with drive unit
- Operating fluid (except F4 and F5)
- Operating instructions

Pump types

Pump type	Pump versions
Hena 401	Standard version of pump ● Vacuum connection and outlet connection: G3" ● Operating fluid return unit via float valve ● Three-phase motors with 3 PTC motor protection ● Gas ballast valve
Hena 631	Standard version of pump ● Vacuum connection and outlet connection: G3" ● Operating fluid return unit via float valve ● Three-phase motors with 3 PTC motor protection ● Gas ballast valve

4.2 Function

The HenaLine™ series pumps are oil-sealed, single stage operating rotary vane pumps with air cooling and circulatory lubrication. A vacuum safety valve in the intake flange closes the intake line automatically and prevents operating fluid back-streaming when the pump is switched off. An integrated oil mist filter cleans the pumped gas and prevents the expulsion of operating fluid mist at the exhaust. The operating fluid, collected in the separator, is fed back to the pump. In addition there is a filter mounted at the operating fluid separator, which cleans the operating fluid.

Fig. 2: Hena 401/631

1	Vacuum flange	88	Operating fluid filler screw (manometer)	100	Operating fluid filter
2	Exhaust flange			194	Float valve
75	Operating fluid separator	95	Operating fluid drain screw	321	Radial fan
83	Sight glass				

Oil circulation

The vacuum pump requires operating fluid for sealing the gap, for lubrication and for cooling. The operating fluid reservoir is on the pressure side of the vacuum pump on the floor of the operating fluid separator. The pressure differential between the pressure side and suction side automatically causes operating fluid to be sucked in over the supply lines from the operating fluid separator and feed into the pumping system. The incoming operating fluid, together with the incoming gas, is pumped through the vacuum pump and exhausted into the operating fluid separator as oil mist. Operating fluid that is separated at the exhaust filters collects in the upper part of operating fluid separator 75 and is returned via operating fluid return line directly to the intake side.

Cooling

The vacuum pump is cooled by heat radiation from the surface of the vacuum pump, the air flow of the two fan impellers, and by the pumped gas.

4.3 Range of application

The vacuum pump is intended for the evacuation of air or other non-aggressive, non-poisonous and non-explosive gases. Pumping media with a higher density than air results in a higher thermal and mechanical load on the vacuum pump and the drive, and is only permitted after prior consultation with Pfeiffer Vacuum.

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 1000 m (above mean sea level)
- Permissible ambient temperature: +12 ... 40°C
- Maximum relative humidity 95%

➔ Fill up with operating fluid before operating the first time *(see p. 17, chap. 5.5)*.
  – Amount and type according to rating plate

➔ Always place the pump on a firm, even surface.
  – Where stationary installation is involved, anchor the pump on site.

➔ 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.

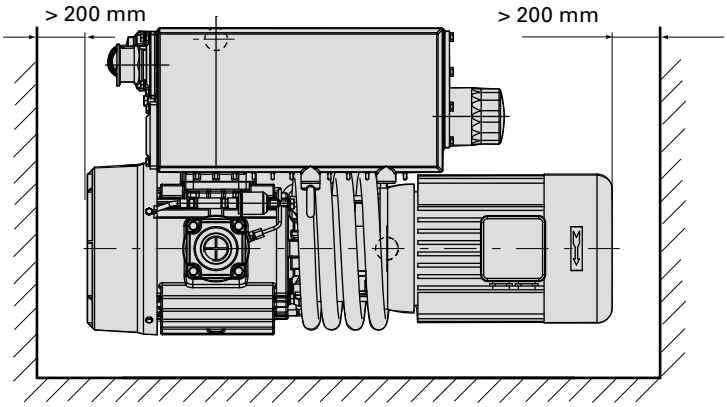


Fig. 3: Setting up the pump

5.2 Connecting the vacuum side

➔ Remove the locking cap from the vacuum connection.

➔ 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!

Risk of damage to the seals and risk of pump bursting.

➔ Always use lines without shut-off devices on the exhaust side.

➔ Do not use overpressure or underpressure - maintain atmospheric pressure.

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.

➔ 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.

5.4 Connecting to the mains power supply

Depending on the pump type, different motor versions or mains voltages are possible:

- Three phase motor (with 3 PTC) without switch, without mains cable

DANGER

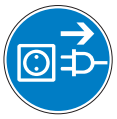
Voltage-bearing elements

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.

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.

Three-phase motor

Switching of multi-voltage motors.

The standard motor can be connected in 3 different switching configurations. Note the voltage on the motor rating plate in each case.

Multi-voltage motor (low voltage)

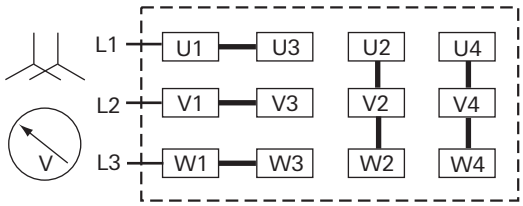


Fig. 4: Double star circuit

Multi-voltage motor (medium voltage)

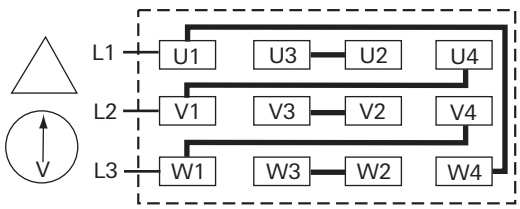


Fig. 5: Delta circuit

Multi-voltage motor (high voltage)

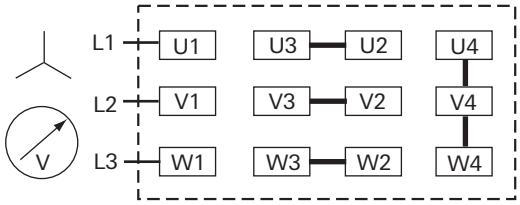


Fig. 6: Star circuit

Circuit for motor designs with 6-pole terminal strip

Delta circuit

The three phases are switched one behind other and the connecting points are connected to the mains. The voltage per phase is equal to the mains voltage, on the other hand, the mains current is √3 times the phase current. The delta circuit is identified by the **Δ** symbol. The voltage between the mains incoming supply lines is called mains voltage. The mains current is the current flowing in the incoming supply lines.

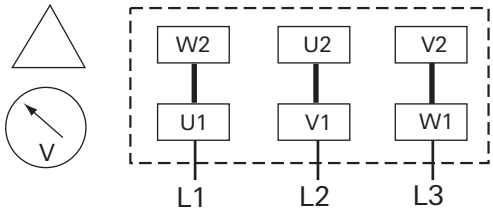


Fig. 7: Delta circuit (low voltage)

Star circuit

The ends of the three phases are connected in the star point. The terminal voltage is √3 times the phase voltage, the mains current is equal to the phase current. The star circuit is identified by the **Y** symbol.

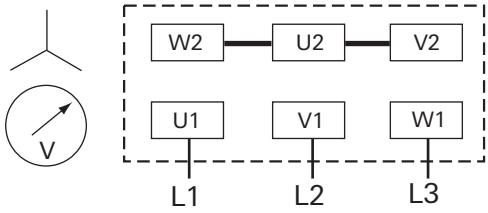


Fig. 8: Star circuit (for high voltage)

NOTICE

Do not start with star/delta connection.

➔ Always start motor directly.

Checking the direction of rotation

The control of the direction of rotation is required for pumps with three-phase motors!

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.

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

– Rotation must be in a clockwise direction in view of the shaft end of the motor (see the arrow on the fan cover).

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

➔ Fill up the operating fluid.

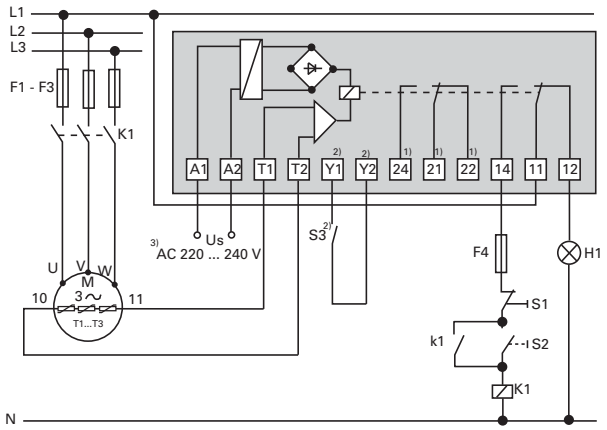
Motor protection

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. 9: 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.

Hena 401

Voltage [V]	Frequency [Hz]	Motor rating [kW]	I_N [A]	I_{max} [A]
190 ... 208	50	13.5	59.2	308
220 ... 240	50	13.5	51.2	266
380 ... 415	50	13.5	29.6	154
220 ... 230	60	15.0	58.2	291
440 ... 460	60	15.0	29.1	146

Hena 631

Voltage [V]	Frequency [Hz]	Motor rating [kW]	I_N [A]	I_{max} [A]
190 ... 208	50	15.0	64.4	335
220 ... 240	50	15.0	55.7	279
380 ... 415	50	15.0	32.2	168
220 ... 230	60	18.5	69.6	244
440 ... 460	60	18.5	34.8	122

Motor control system

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.

5.5 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.

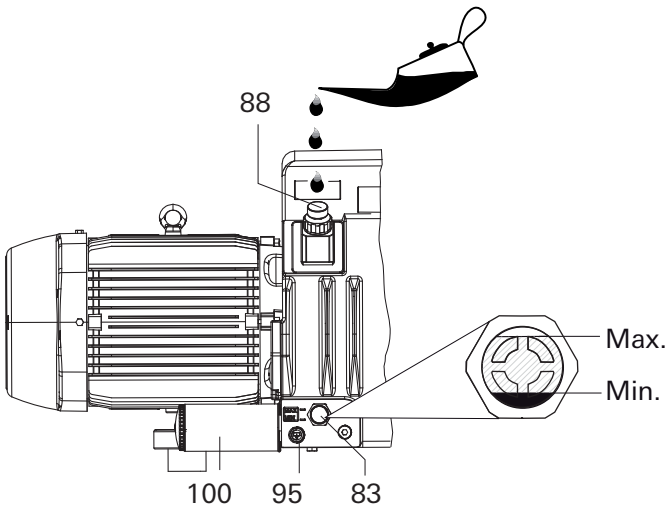
➔ Prior consultation is required before using other application-specific operating fluids.

Filling up the operating fluid

➔ Unscrew operating fluid filler screw 88.

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

– Filling quantity approx. 12/15 l of operating fluid.



83 Sight glass
88 Operating fluid filler screw
95 Operating fluid drain screw
100 Operating fluid filter

Fig. 10: Filling up the operating fluid

➔ Screw in operating fluid filler screw 88.

➔ Close intake port valve (if present) or cover intake flange.

➔ Start pump and run it for max. 5 minutes.

➔ Switch off pump and wait until the operating fluid has collected in the separator box.

➔ Check fill level: The correct fill level is between the markings on the sight glass.

– If the fill level drops below the "Min" marking, add operating fluid.

➔ Open intake port valve.

5.6 Exhaust gas temperature monitoring

Temperature switches, which are installed at the oil mist filter are used for monitoring the gas temperature.

Electrical connection of the temperature switch 202(1x) must be carried out, so that an alarm is released and the pump is switched off, if the gas temperature exceeds 110 °C. The temperature switch is preset ex works.

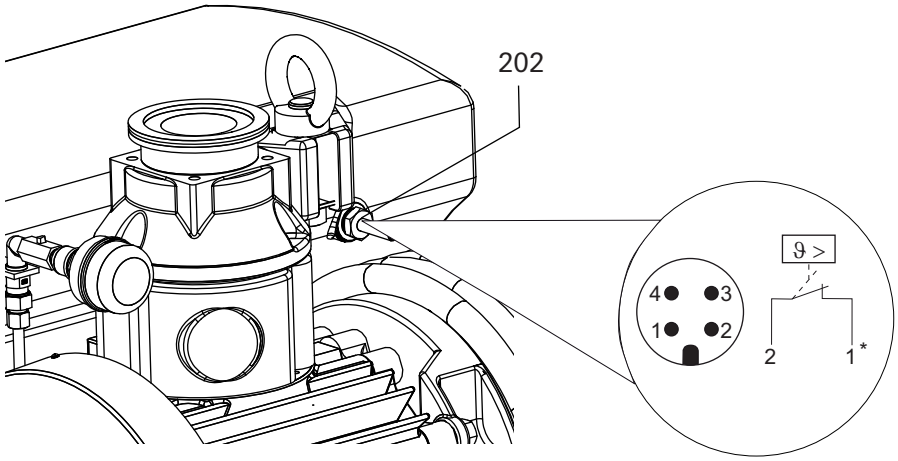


Fig. 11: Exhaust gas temperature monitoring

* 1 --> braun 2 --> weiß

Parameter	Exhaust gas temperature monitoring
Connection	M12x1, 4-pin
Protection category	IP65
Pressure max.	10000 hPa
Accuracy	± 5 %
Cable length	3 m
Material	Stainless steel
Set point	110 °C
Set point: Current max.	AC/DC ≤ 1 A
Switching voltage	AC/DC ≤ 250 V 50/60 Hz
Temperature: Operating	-25-+130 °C

5.7 Operating fluid temperature monitoring (option)

A temperature switch 488 can be installed at the operating fluid separator 75 (oil sump) for monitoring the operating fluid temperature.

The pump-specific switch point of the temperature switch 488 must be set, so that an alarm is triggered and the pump is switched off, when the operating fluid temperature exceeds 110 °C.

Parameter	Operating fluid temperature switch
Protection category	IP54
Current max.	2 A AC / 0.25 A DC
Contact	Two-way contact
Set point	adjustable
Switching voltage	230 V AC / V DC

5.8 Operating fluid level monitoring (option)

A level switch 496, which is fixed to the operating fluid separator 75 (oil sump), is used to monitor the operating fluid level. If the fill level falls below the "Min" mark, the opening of the change-over contact can be used as a signal to switch off the pump.

Parameter	Operating fluid level monitoring
Schutzart	IP 65
Current max.	1 A
Contact	opens if level < min.
Switching voltage	max. 230 V AC / 48 V DC
Switching power max.	26 VA / 20 W

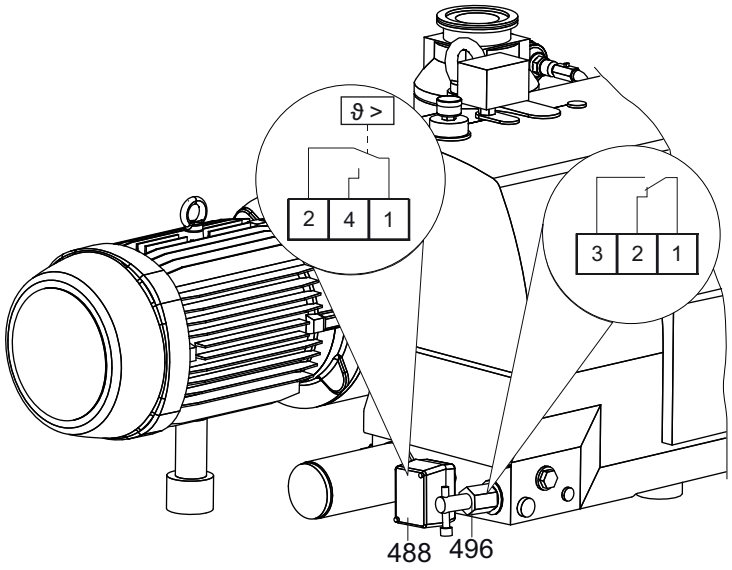


Fig. 12: Operating fluid temperature and operating fluid level monitoring

5.9 Connecting the heat exchanger (option)

NOTICE

Damage to the pump rotor

For applications with short evacuating cycles or increased ambient temperature the rotor can get blocked after switching off and restarting the motor, because of different rates at which the pump housing and the rotor cool down.

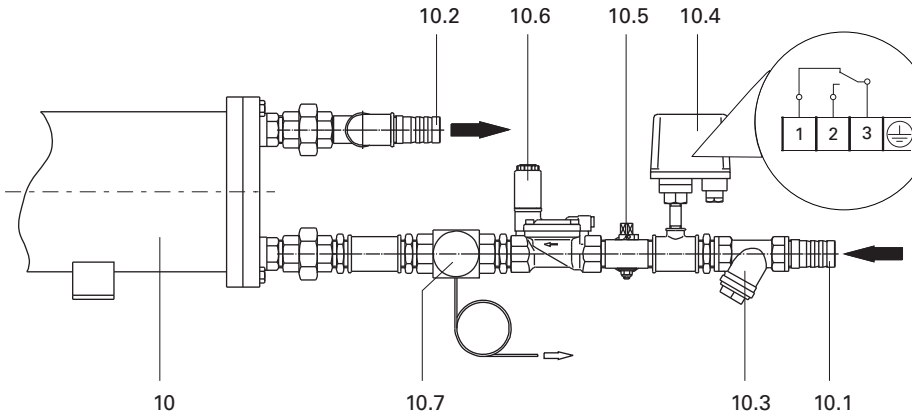
➔ Switch off water cooling supply as well as a separately driven fan immediately when switching off the pump.

With applications with unfavorable environmental conditions additionally an oil/water heat exchanger can be used. The installation can take place only in the work and is later not possible.

A cooling water regulator valve 10.7 controls by means of a temperature sensor the operating fluid of the pump and controls the cooling water flow. Depending on the operating conditions and the cooling water temperature the water flow can be adjusted between 0 (maximum flow) and position 5 (minimum flow).

A solenoid valve, which is also part of the cooling water unit, must be connected on site so that the cooling water flow stops when the pump is switched off.

Additionally the cooling water pressure can be monitored with a pressure switch 10.4.



10	Heat exchanger (water/oil)	10.3	Filter	10.6	Solenoid valve
10.1	Cooling water inlet	10.4	Pressure switch	10.7	Cooling water regulator valve
10.2	Cooling water outlet	10.5	Ball valve (bypass)		

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 ... 6000 hPa
Permitted cooling water temperature range	15 ... 40°C

Connecting the cooling water

➔ Connect the cooling water lines:
  – Cooling water inlet (10.1).
  – Cooling water outlet (10.2); must be pressure-free.

➔ Open the cooling water feed.

➔ Open the venting 10.5 and fill the cooling system until cooling water comes out of the outlet.

➔ Close venting 10.5.

➔ Connect cooling water line at the outlet.

➔ Stop cooling water supply.

➔ Connect the pressure switch and solenoid valve for monitoring and controlling the cooling water flow according to the supplier's documentation.

6 Operation

6.1 Before switching on

➔ Check the operating fluid level in the sight glass.

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

➔ Check that exhaust connection is free flowing (atmospheric pressure).

➔ 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 and ensure sufficient flow; adjust if necessary.

6.2 Switching on the pump

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

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.

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).

WARNING

Danger of burns from exiting hot oil mist!

During operation, the operating fluid separator is filled with hot, pressurised oil mist.

➔ Only operate the vacuum pump with the operating fluid filler screw securely fitted.

➔ Open the blanking plugs on the separator only when the pump is switched off.

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.

➔ Switch on the pump with the vacuum flange closed and allow to warm up for 30 minutes.

Permissible operating conditions

Type / Version	Intake pressure for continuous operation	Intake pressure for intermittent operation
Hena 401/631 Operating fluid return via float valve	< 800 hPa unlimited	< 800 hPa unlimited

Operating fluid return via float valve

The pumps are fitted with an operating fluid return as standard. If the operating fluid collected in the operating fluid separator 75 reaches a definite level, the float valve opens and the ejected operating fluid is returned to the pump's intake flange.

NOTICE

The operating fluid return only works properly if the working pressure is < 800 hPa.

6.3 Pumping condensable vapours

Should the process gases contain condensable gases, the rotary vane pump must be operated with gas ballast (i.e. with an open gas ballast valve).

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.

Pumping condensable vapours

To avoid condensation in the pump when pumping condensable vapours, air is periodically fed into the working chamber at the beginning of the compression phase via the gas ballast valve 477.

The gas ballast valve is closed when turning to the right to position 0 and open when turning to the left to position 1. Intermediate settings are not possible.

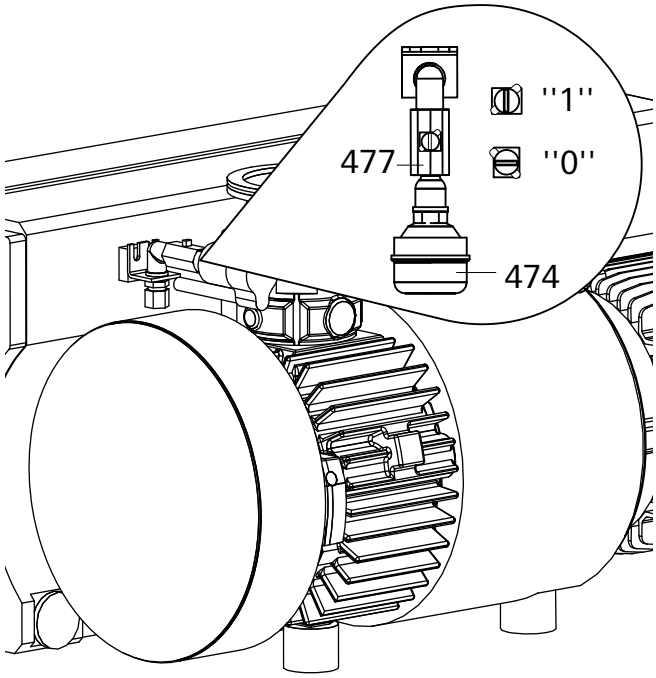


Fig. 13: Gas ballast valve 477 with gas ballast filter 474

6.4 Topping up the operating fluid

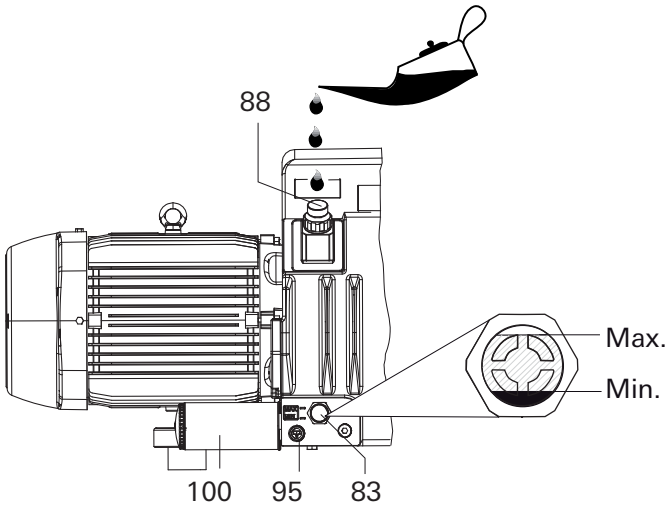
If the operating fluid has reached its minimum filling level, the operating fluid must be topped up.

Filling up the operating fluid

➔ Switch off the pump.

➔ Unscrew operating fluid filler screw 88.

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



83 Sight glass
88 Operating fluid filler screw
95 Operating fluid drain screw
100 Operating fluid filter

Fig. 14: Filling up the operating fluid

➔ Screw in operating fluid filler screw 88.

6.5 Switching off

The pump can be switched off in any pressure range.

HenaLine rotary vane pumps have an integrated non-return valve on the suction side. This closes automatically when the pump is switched off and therefore prevents the return flow of gas and processing materials into the suction pipe.

➔ Switch the pump off at the mains switch or disconnect from the mains in a secure manner.

Vacuum chamber venting

NOTICE

Danger of backflow of operating fluid into the intake line!

Contamination of the connected vacuum system!

➔ Vent the vacuum chamber within 30 s, regardless of the chamber size.

➔ For a longer venting process, use an additional shut-off valve and shut off the intake line after switching off the pump.

Maintaining the vacuum in the chamber

NOTICE

Danger of backflow of operating fluid into the intake line!

Contamination of the connected vacuum system!

➔ Because the safety valve of the pump is not suitable for longer-term sealing, install an additional shut-off valve in the intake line.

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

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; at least once every 6 months	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 the saturation of the exhaust air filter (internal oil mist filter)	X				
Change operating fluid		X			
Change operating fluid filter		X			
Change the exhaust air filter			X		
Cleaning the pump and renew the O-rings			X		
Clean gas ballast filter		X			
Clean the fan cap of the motor		X			
Replace the radial shaft seals[1]				X (PV)	
Clean or replace discharge valves				X (PV)	
Replace vanes					X (PV)
Replace the non return valve					X (PV)
Check or change coupling					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.

1. Where unusually high levels of operating fluid are being lost it is necessary to carry out a check of the radial shaft seals. If operating fluid leaks out from under the pump between the pump casing and the motor or fan, the radial shaft seals should be replaced. In this case please get in touch with your local Pfeiffer Vacuum Service.

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.

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

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.

Draining the operating fluid

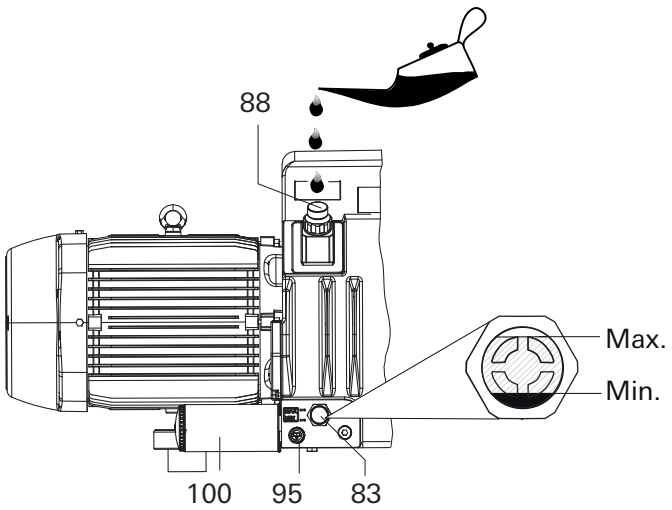
➔ Turn off the vacuum pump and vent to atmospheric pressure.

➔ Unscrew operating fluid filler screw 88.

➔ Unscrew operating fluid drain screw 95.

➔ Drain the operating fluid while still quite hot;

– to empty the pump fully, tip it forward slightly.



83 Sight glass
88 Operating fluid filler screw
95 Operating fluid drain screw
100 Operating fluid filter

Fig. 15: Filling up the operating fluid

➔ Screw in operating fluid drain screw 95; pay attention to O-ring.

➔ Screw in operating fluid filler screw 88.

➔ Allow pump to run for a maximum of 5 seconds with the vacuum flange open.

➔ Drain off remaining operating fluid.

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

➔ Fill up with operating fluid and check the filling level *(see p. 17, chap. 5.5)*.

Determining the level of deterioration

➔ The level of deterioration of operating fluid P3 can be determined for clean processes with the colour scale (in accordance with DIN 51578); supplementary sheet PK 0219 BN on request or at **www.pfeiffer-vacuum.com**.

➔ Suck off operating fluid from the pump through the operating fluid filler opening.

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

➔ Where discolouration is red brown (equivalent to 5 on the scale) change operating fluid at the latest.

Flushing and cleaning

If the interior of the pump is heavily contaminated with process residues, we recommend performing several changes of operating fluid to flush away the contamination:

➔ 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.
➔ If the operating fluid is heavily contaminated, replace the operating fluid filter 100 and exhaust filter 120.
➔ Screw the operating fluid drain screw back in.
➔ Fill up with operating fluid and check the filling level *(see p. 17, chap. 5.5)*.
➔ Screw in operating fluid filler screw 88.

Changing the operating fluid filter

Operating fluid filter 100 should be replaced at every operating fluid change but at least once every six months. It is also necessary to replace the filter when the pump is on operating temperature and the filter housing is cold.

➔ Allow the pump to warm up for a minimum of 15 minutes before replacing the filter.
➔ Switch off the pump.
➔ Drain off operating fluid.
➔ Unscrew operating fluid filter with a spanner and replace.
➔ Oil the sealed surface of the replacement filter before fitting.
➔ Screw in the filter manually; do not use tools.

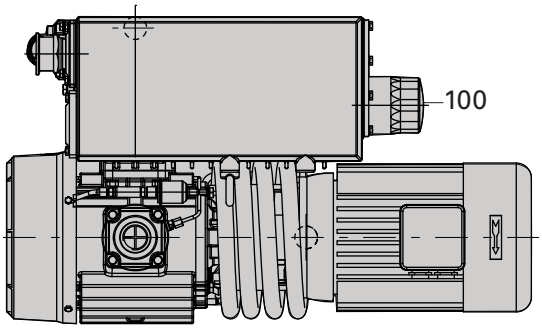


Fig. 16: Changing the operating fluid filter 100

7.3 Changing the exhaust filter in the operating fluid separator

Exhaust filters 120 in operating fluid separator 75 should be replaced, depending on the application and level of contamination, however at least once every year. It is recommended to replace also the respective O-rings 121.

During operation, the exhaust filters become saturated with oil. It is therefore normal for the operating fluid fill level to sink slightly after the filters are changed.

Indications that a filter change is required:

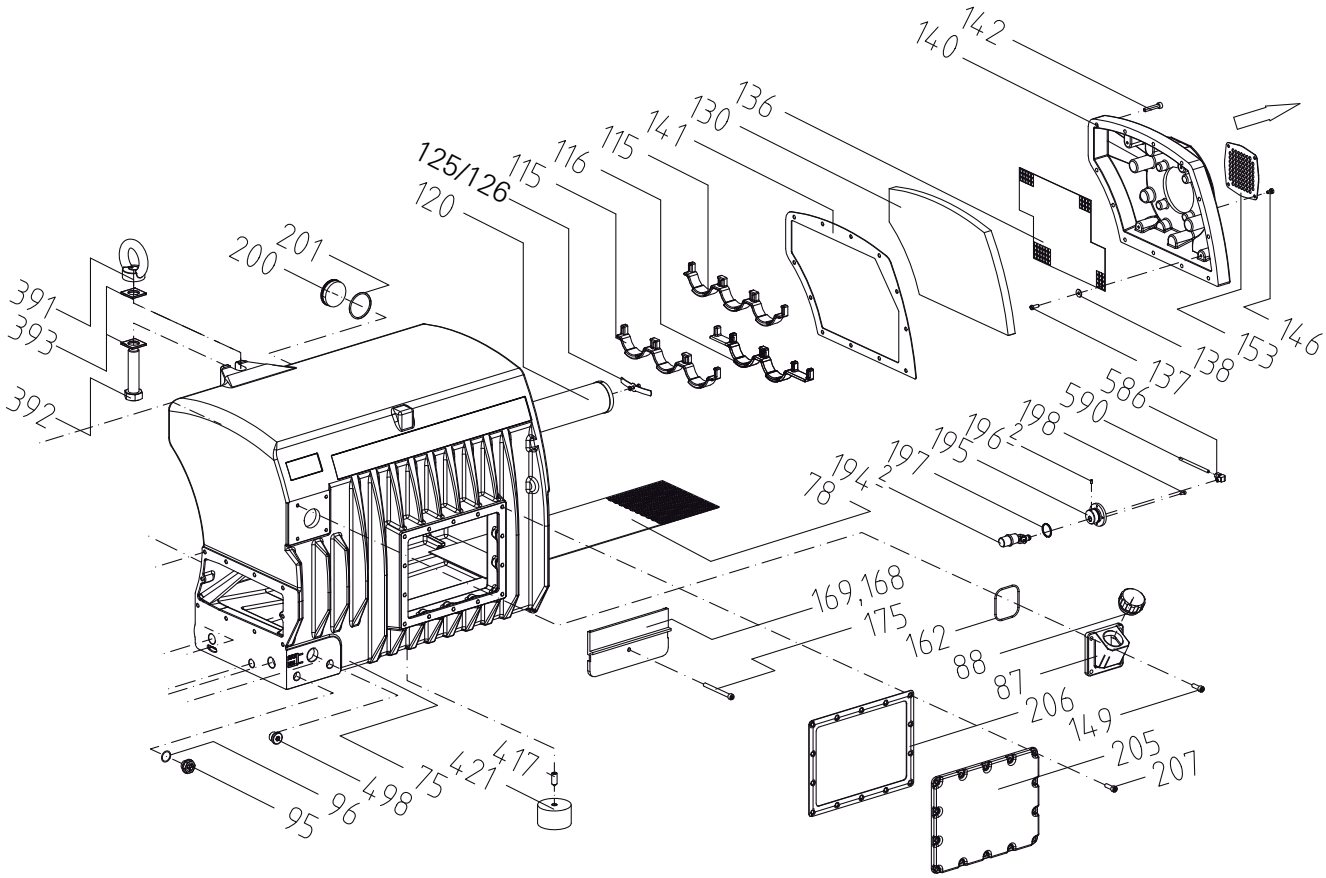
– High current drain by the motor.
– Increased presence of operating fluid vapor in gas outlet.
– Increased pressure in operating fluid separator 75 (manometer display in red range). To perform continuous monitoring of the filter resistance, you can install a manometer (see accessories) instead of the operating fluid filler screw 88.

WARNING

Exhaust air filter may contain toxic substances from the pumped media!

Danger of poisoning from the emission of harmful substances (radioactive, toxic, etc.) from the filter and the operating fluid.

➔ Wear suitable protective clothing and respirators.
➔ Dispose of consumables supplies according to the local regulations



75	Operating fluid separator	121	O-ring	141	Flat seal
83	Sight glass	125	Filter spring	142	Cylinder head screw
84	Flat seal	126	Screw	143	Spring washer
88	Operating fluid filler screw	128	Lock washer	146	Hexagon head screw
89	O-ring	130	Filter	194	Float valve
95	Operating fluid drain screw	136	Grid	195	Support for float valve
96	O-ring	137	Cylinder head screw	196	Set screw
115	Filter support	138	Washer	197	O-ring
116	Filter support	139	Lock washer	198	Cylinder head screw
120	Exhaust filter	140	Exhaust cover plate		

Fig. 17: Changing the exhaust filter

Dismantling

➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.
➔ Remove exhaust line.
➔ Unscrew screws 142 from separator cover 140; take care with the spring washer 143!
➔ Remove separator cover 140, observe the flat gasket 141.
➔ Remove grid 136 and filter 130.
➔ Slacken screws 126 and release tension on filter spring 125; do not remove screws.
➔ Remove filter spring.
➔ Remove filter supports 115/116.
➔ Remove used exhaust filter 120 from operating fluid separator; be careful of O-rings 121.

Assembling

➔ Insert new exhaust filters with new O-rings 121 and filter supports 115/116, observe direction of arrow on the exhaust filters.

➔ Tension filter springs 125.

➔ Replace grid 136 and filter 130 and insert into the guide rail of the separator box;

– Push filter material onto the floor and make sure it is in contact with all sides of the separator box.

➔ Install separator cover 140, ensure that flat seal 141 is clean and undamaged; exchange if necessary.

7.4 Cleaning the operating fluid return line

To ensure proper functioning, the operating fluid return line 590 and the float valve should be cleaned whenever the exhaust filter and the operating fluid is replaced.

This ensures that the vacuum pump achieves the specified ultimate pressure and no operating fluid leaks out at the exhaust flange.

Dismantling

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

➔ Remove separator cover 140 above the float valve 194 (fig. see above).

➔ Using a spray bottle, evacuate operating fluid from the float chamber.

Operating fluid leaks out

When the banjo fitting is released, a small amount of operating fluid leaks out.

➔ Have a cleaning cloth to hand.

➔ Pay attention to the sealing rings of the banjo fitting.

➔ Loosen operating fluid return line 590 at the elbow union 586.

➔ Unscrew both screws 198 on the float valve and press off via tapped holes.

➔ Remove level switch support 195, pay attention to the O-ring 197.

➔ Undo set screw 196 and remove float valve 194; check for functioning and clean with compressed air if necessary.

➔ Check O-ring 197 and replace if necessary.

Assembly

Before installation of the level switch support 195, it must be ensured that the floater can be **easily moved by its own weight** and the axial sealing surface of the floater is clean.

➔ **Assembling** is carried out in reverse order.

➔ Refit float valve 194; pay attention to proper mounting orientation.

➔ Operate the pump and check the integrity of the operating fluid return by monitoring the final pressure.

7.5 Cleaning the operating fluid separator

➔ Disassemble separator cover 105/205.

➔ Remove demister 79.

➔ Clean the inside of the separator 75, the demister 79 and the exhaust valves 159 with an appropriate cleaning agent.

➔ Exchange the exhaust filters 120, the filter 130 and the operating fluid filter 100; check the respective sealings and exchange if necessary.

7.6 Cleaning the intake filter

The intake filter, located in the upper part of the intake flange must be cleaned when the intake throughput reduces.

➔ Unscrew screws 265 from the vacuum flange and dismantle flange

➔ Remove intake sieve 261 from the intake port and clean it.

➔ When cleaning the sieve it is recommended to clean the vacuum safety valve at the same time and check it for wear and tear.

7.7 Cleaning the gas ballast valve

The greater the contamination, the lower the filter air throughput and the greater the risk of condensation and corrosion within the pump.

477 Gas ballast valve
474 Gas ballast filter

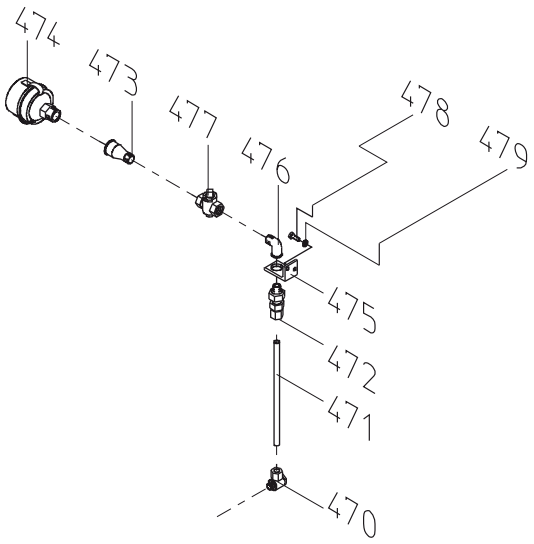


Fig. 18: Gas ballast valve for Hena 401/631

➔ Check gas ballast valve and line for free flow.

➔ If no further air is sucked in, dismount gas ballast filter 474 and blow out with compressed air.

7.8 Cleaning the fan covers and radiator

Contamination prevents the flow of cool air and can lead to the vacuum pump overheating.

➔ Check cooler and cooling ribs as well as the intake channels of cooler and motor for dirt on a regular basis; clean, if necessary.

8 Decommissioning

8.1 Shutting down for longer periods

Before shutting down the pump, observe the following procedure and adequately protect the pump system against corrosion:

➔ Switch off the pump.
➔ Change the operating fluid *(see p. 27, chap. 7.2)*.
➔ Start the pump and allow the pump to warm up with closed vacuum flange and with open gas ballast valve.
➔ Close gas ballast valve.
➔ Blow compressed air through the cooling water system and completely empty cooling water channels to avoid rust and frost damage.

8.2 Re-starting

NOTICE

Re-starting

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

➔ Replace the operating fluid.
➔ Replace the radial shaft sealing rings and further elastomer parts.
➔ Replace bearings at pumps with anti-friction bearings.
➔ Follow the maintenance instructions and inform Pfeiffer Vacuum.

NOTICE

Danger of damaging the vanes when starting!

After a longer downtime it may happen that the vanes stick to the pump system.

➔ Disassemble the fan cover and turn the fan by hand.

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
	Pump temperature too low	Warm up pump to > 12 °C
	Thermal protection switch has responded	Detect and fix cause of overheating; allow pump to cool off if necessary.
	Pump system dirty	Clean pump; contact Pfeiffer Vacuum Service if necessary.
	Pump system damaged	Clean and overhaul pump; contact Pfeiffer Vacuum Service 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 motor 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
Pump does not attain ultimate pressure	Measurement reading is false	Check gauge, check ultimate pressure without installation connected.
	Pump or connected accessories are dirty	Clean pump and check components for contamination.
	Operating fluid dirty	Operate pump for a longer period with gas ballast valve open or change operating fluid
	Leak in system	Repair leak
	Operating fluid filling level too low	Top off operating fluid
	Pump 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
Loss of operating fluid	Operating fluid separator leaky	Check tightness; replace gasket if necessary
	Radial shaft seal rings leaky	Replace seal ring and check bushing
	Operational loss of operating fluid	Check the oil return unit
Unusual operating noises	Silencer dirty	Clean or replace the silencer.
	Damage to the pump system	Clean and overhaul pump; contact Pfeiffer Vacuum Service if necessary.
	Motor bearing defective	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

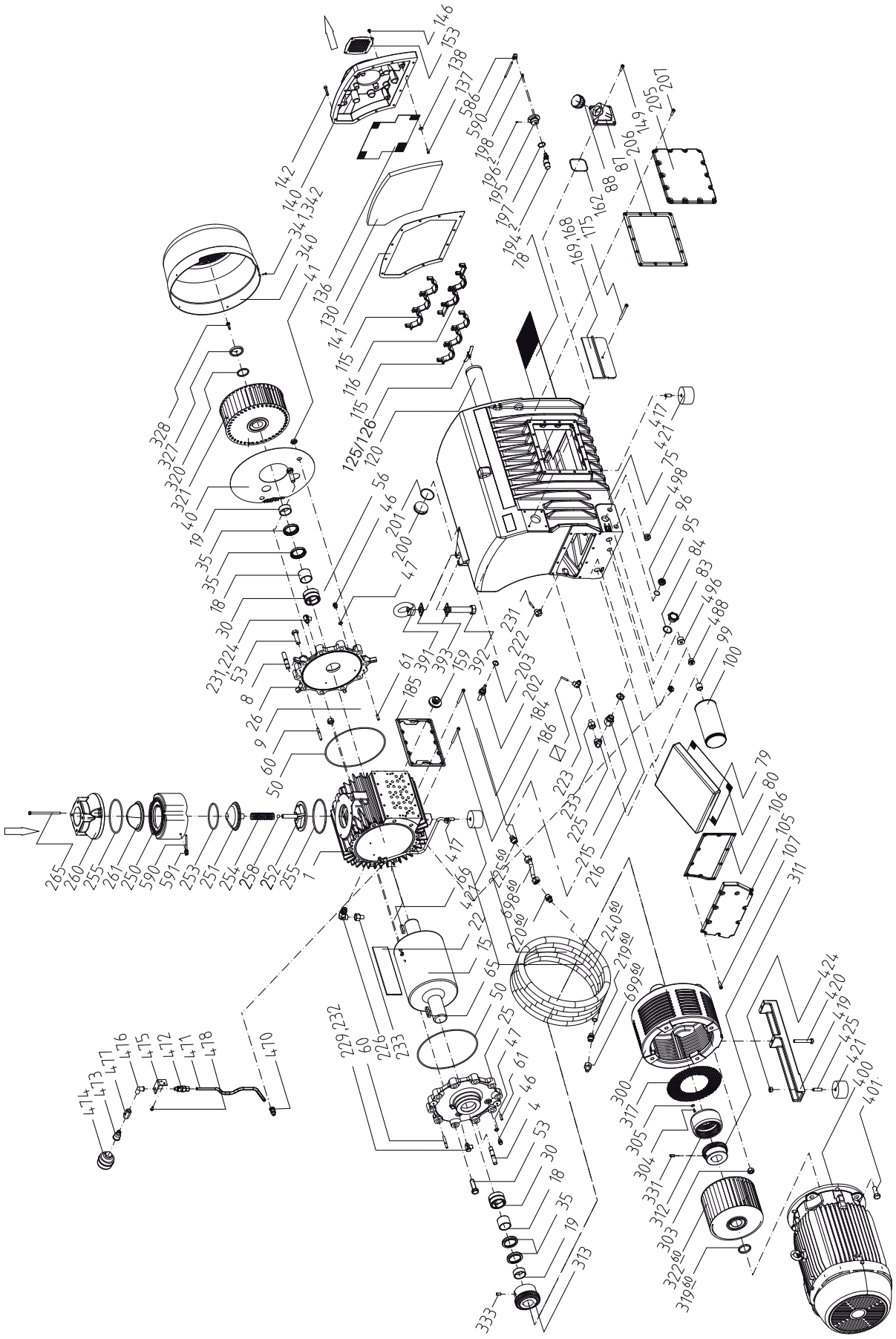


Fig. 19: Exploded view Hena 401

18	Inner ring	89	Sealing ring	197	O-ring
19	Inner ring	95	Operating fluid drain screw	201	O-ring
22	Vane	96	O-ring	206	Flat seal
30	Needle bearing without inner ring	100	Operating fluid filter	216	Sealing ring
		106	Flat seal	253	O-ring
35	Radial shaft seal	120	Exhaust filter	255	O-ring
47	Sealing ring	121	O-ring	258	Ball
50	O-ring	130	Filter	261	Intake sieve
60	Taper pin	141	Flat seal	271	Sealing ring
61	Cylinder pin	154	Cover seal	276	Sealing ring
84	Flat seal	159	Exhaust valve	312	Coupling sleeve
88	Operating fluid filler screw	168	Cap gasket	585	Cover seal
		185	Flat seal	585	Sealing ring

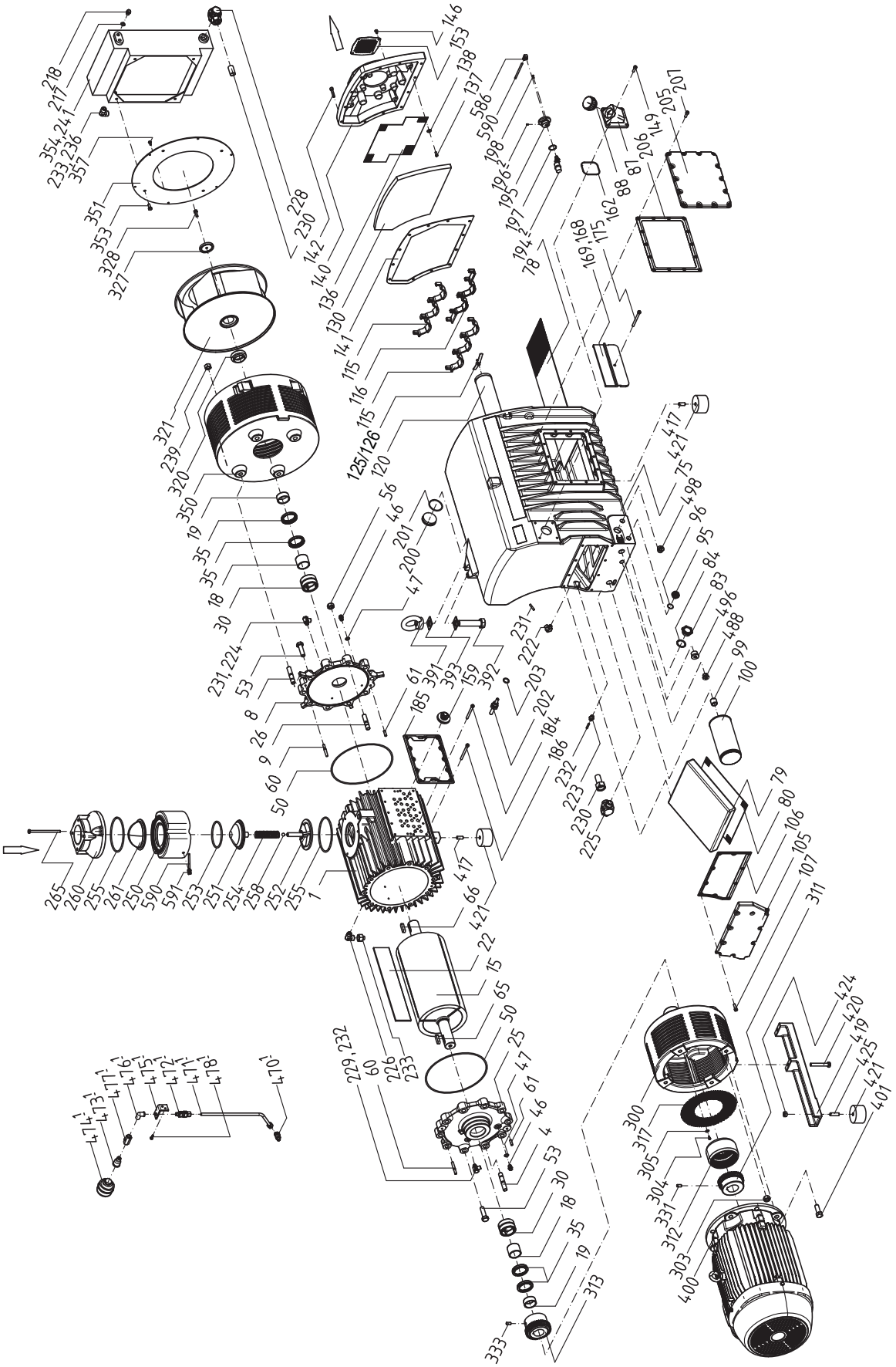


Fig. 20: Exploded view Hena 631

18 Inner ring
19 Inner ring
22 Vane
30 Needle bearing without inner ring
35 Radial shaft seal
47 Sealing ring
50 O-ring
60 Taper pin
61 Cylinder pin
84 Flat seal
88 Operating fluid filler screw
89 Sealing ring
95 Operating fluid drain screw
96 O-ring
100 Operating fluid filter
106 Flat seal
120 Exhaust filter
121 O-ring
130 Filter
141 Flat seal
154 Cover seal
159 Exhaust valve
168 Cap gasket
185 Flat seal
197 O-ring
201 O-ring
206 Flat seal
216 Sealing ring
217 Sealing ring (only for Hena 630)
241 Sealing ring operating fluid cooler (only for Hena 630)
253 O-ring
255 O-ring
258 Ball
261 Intake sieve
271 Sealing ring
276 Sealing ring
312 Coupling sleeve
585 Cover seal
585 Sealing ring

11.1 Spare parts packages

Spare parts package	Pump type	No.	Parts according to the exploded view
Set of seals	Hena 400/630	PK E60 024 -T	185, 206, 141, 106, 84, 89, 168, 271, 276, 47, 216, 96, 121, 201, 50, 255, 253, 35, 258, 217, 154.
Maintenance kit	Hena 400/630	PK E61 023 -T	100, 120, 121, 130, 141, 89, 96, 206.
Overhaul kit	Hena 400	PK E62 026 -T	Set of seals, 60, 61, 19, 30, 312, 100, 120, 261, 130, 159, 88, 95, 18, 275, 185, 206, 141, 106, 84, 89, 168, 271, 276, 47, 216, 96, 121, 201, 50, 255, 253, 35, 258, 217, 154.
	Hena 630	PK E62 027 -T	Set of seals, 60, 61, 19, 30, 312, 100, 120, 261, 130, 159, 88, 95, 18, 275, 185, 206, 141, 106, 84, 89, 168, 271, 276, 47, 216, 96, 121, 201, 50, 255, 253, 35, 258, 217, 154
Set of vanes	Hena 400	PK E68 026 -T	22
	Hena 630	PK E68 027 -T	22
Operating fluid filter	Hena 400/630	P 0920 549 E	100

12 Accessories

Designation	Hena 401	Hena 631
SAS 100 dust separator, DN 100 ISO-K, polyester filter	PK Z60 512	PK Z60 512
KAS 100, condensate separator for pumping speeds up to 760 m^3/h	PK Z10 012	PK Z10 012
FAK 100, activated carbon filter	PK Z30 012	PK Z30 012
Operating fluid level monitoring	PK 100 116	PK 100 116
Operating fluid temperature switch	PK 100 125	PK 100 125
Flange DN 100 ISO-K - G 3"	PK 100 061	PK 100 061
PTC-resistor tripping device	P 4768 051 FQ	P 4768 051 FQ
Pressure gauge 0–1 bar, G 1½"	PK 100 128	PK 100 128
P3, mineral oil, 1 l	PK 001 106 -T	PK 001 106 -T
P3, mineral oil, 5 l	PK 001 107 -T	PK 001 107 -T
P3, mineral oil, 20 l	PK 001 108 -T	PK 001 108 -T

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

13 Technical data and dimensions

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

Parameter	Hena 401	Hena 631
Flange (in)	Female thread G 3"	Female thread G 3"
Flange (out)	Female thread G 3"	Female thread G 3"
Pumping speed at 50 Hz	400 m^3/h	630 m^3/h
Pumping speed at 60 Hz	480 m^3/h	760 m^3/h
Ultimate pressure with gas ballast	≤0.7 hPa	≤0.7 hPa
Ultimate pressure without gas ballast	≤0,3 hPa	≤0.3 hPa
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, max.	Atmospheric pressure	Atmospheric pressure
Rotation speed at 50 Hz	1500 min^{-1}	1500 min^{-1}
Rotation speed at 60 Hz	1800 min^{-1}	1800 min^{-1}
Leak rate safety valve	$\leq 8 \cdot 10^{-3}$ Pa m^3/s	$\leq 8 \cdot 10^{-3}$ Pa m^3/s
Emission sound pressure level without gas ballast at 50 Hz	≤77 dB (A)	≤77 dB (A)
Emission sound pressure level without gas ballast at 60 Hz	≤79 dB (A)	≤77 dB (A)
Ambient temperature	12-40 °C	12-40 °C
Protection category	IP55	IP55
Rated power 50 Hz	13.5 kW	15 kW
Rated power 60 Hz	15 kW	18.5 kW
Switch	No	No
Mains cable	No	No
Shipping and storage temperature	-25-+55 °C	-25-+55 °C
Operating fluid	P3	P3
Operating fluid filling	12 l	15 l
Gas ballast	Yes	Yes
Weight	535 kg	670 kg
Cooling method, standard	Air	Air

13.3 Dimensions

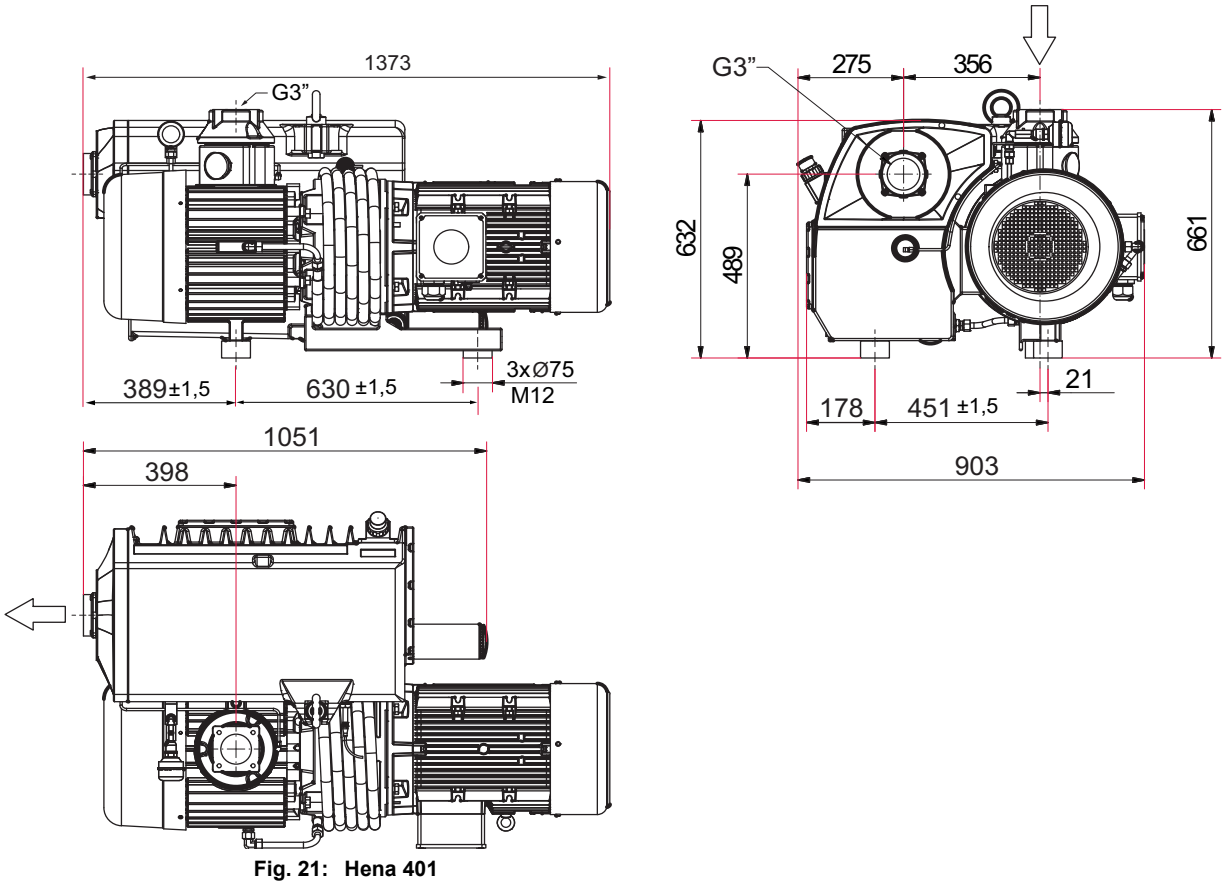


Fig. 21: Hena 401

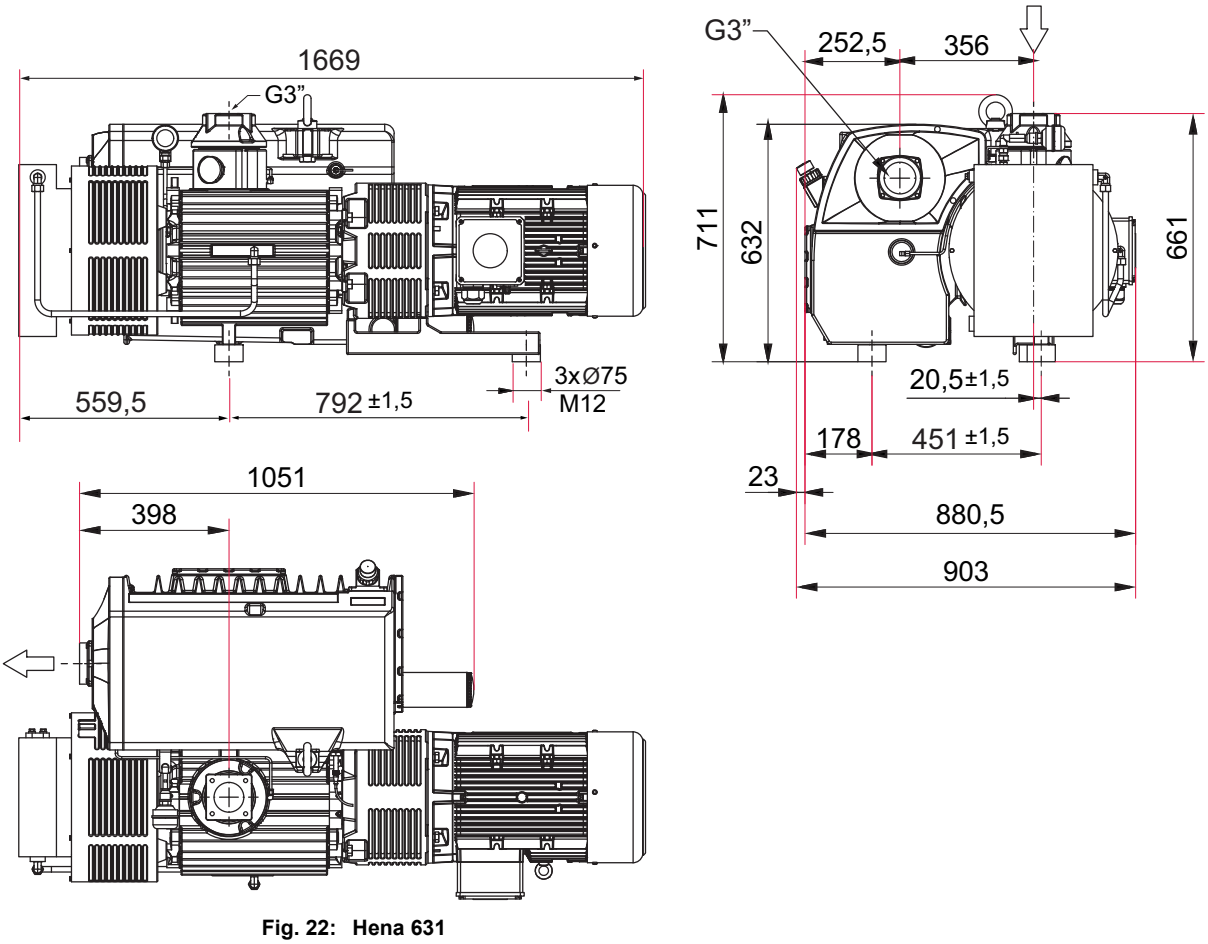


Fig. 22: Hena 631

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.

HenaLine™
Hena 401/631

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

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

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2016-04-14

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