



## Hena 1000

Rotary Vane Pump

# Operating Instructions

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# 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 refer 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](http://www.pfeiffer-vacuum.com).

### Applicable documents

Hena 1000	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](http://www.pfeiffer-vacuum.com)

## 1.2 Conventions

### Safety instructions

The safety instructions in Pfeiffer Vacuum operating manuals 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:

<b>DANGER</b>
<p><b>Immediate danger</b> Death or very severe injuries can occur.</p>
<b>WARNING</b>
<p><b>Possible danger</b> Injuries or severe property damages can occur.</p>
<b>CAUTION</b>
<p><b>Possible danger</b> Injuries or property damages can occur.</p>
<b>NOTE</b>
<p><b>Command or note</b> Command to perform an action or information about properties, the disregarding of which may result in damage to the product.</p>

## Pictograph definitions



Prohibition of an action or activity in connection with a source of danger, the disregarding of which may result in serious accidents.



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



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

## Instructions in the text

→ Work instruction: here you have to do something.

## Symbols used

The following symbols are used consistently throughout in all illustrations:

- ① Vacuum flange
- ② Exhaust flange
- ③ Gas ballast valve
- ⚡ Power connection

## 2 Safety

### 2.1 Safety precautions



#### NOTE

##### 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.



#### NOTE

##### 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 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 directive 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



### NOTE

#### CE 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.
- 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 deemed to be all use 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.
- The operation of the devices in potentially radioactive areas.

## 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.

- 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. Vacuum pumps should be transported or shipped in the original packing only.

#### **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.
- Store the pump in a cool, dry place; preferably at temperatures between -10 °C and +40 °C.
  - For a longer period of storage, seal the pump in a PE bag with drying agents enclosed.
  - For a period of storage longer than two years, it is recommended to 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

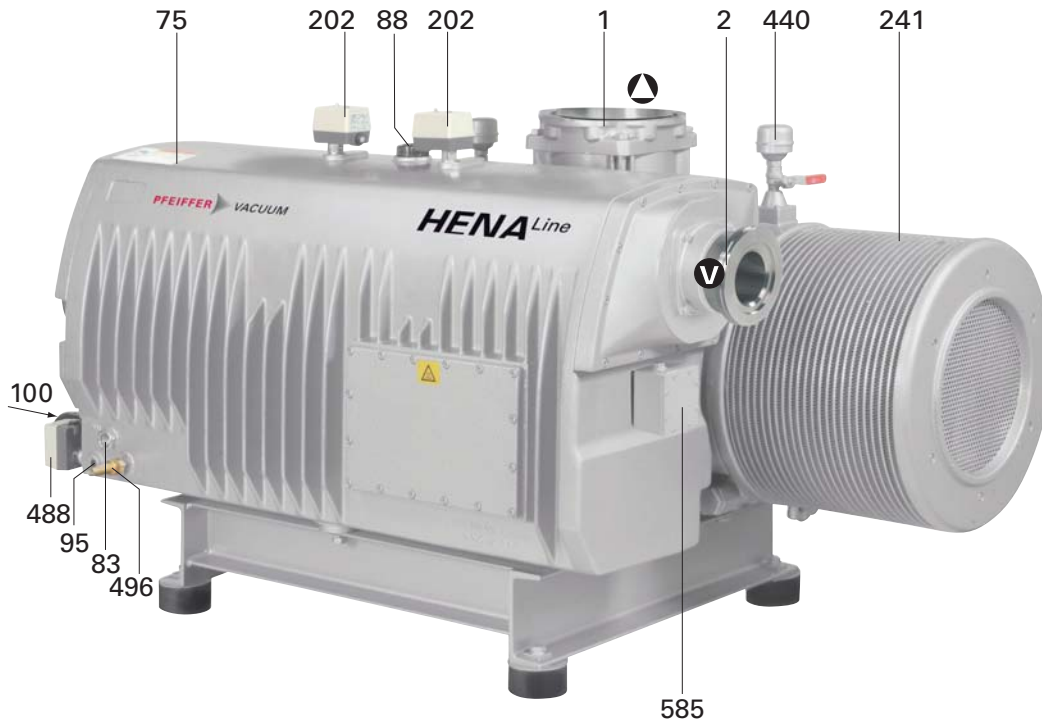
- Pump with drive unit
- Locking cap for vacuum flange
- Operating fluid P3 (for standard pump)
- Operating instructions

### Pump types

Pump type	Pump versions
Hena 1000	Standard version of pump <ul style="list-style-type: none"> <li>• Vacuum flange DN 160 ISO-K and exhaust flange DN 100 ISO-K (2x)</li> <li>• Operating fluid return unit via float valve</li> <li>• Pressure gauge (manometer) for pressure control in the operating fluid separator</li> <li>• Three-phase motors with 3 PTC motor protection</li> <li>• Gas ballast valve</li> <li>• Exhaust gas temperature monitoring</li> <li>• Operating fluid level switch in the separator</li> <li>• Operating fluid temperature switch in the separator</li> </ul>

## 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. The outlet is via an operating fluid separator (ONF) with integrated oil mist filter. In addition there is a filter in the operating fluid separator, which cleans the operating fluid (dependent on the pump model).



1	Vacuum flange	95	Operating fluid drain screw	241	Operating fluid cooler
2	Exhaust flange	100	Operating fluid filter	440	Gas ballast valve
75	Operating fluid separator	202	Exhaust gas temperature switch	496	Operating fluid level switch
83	Sight glass			488	Operating fluid temperature switch
88	Operating fluid filler screw			585	Float valve

Fig. 1: Hena 1000

### 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 195 directly to the intake side (vacuum flange 1). Operating fluid that is separated in front of the exhaust filters collects on the floor of the lower chamber of operating fluid separator 75.

### 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. 15, chap. ).
- 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.
- Sightglass and gas ballast valve must be visible and readily accessible.
  - Voltage and frequency information given on the motor rating plate must be visible.

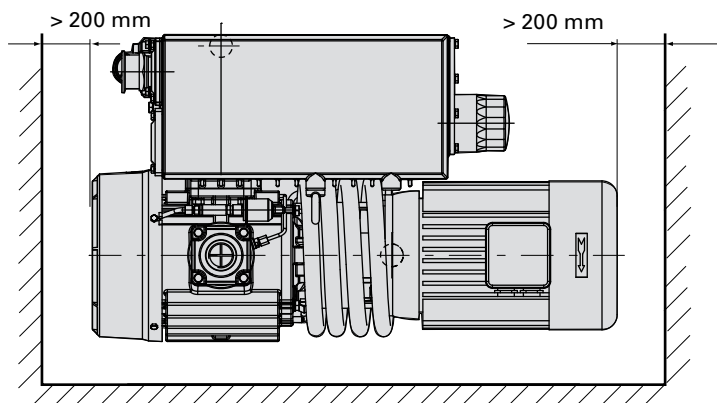


Fig. 2: Setting up the pump

## 5.2 Connecting the vacuum side

- Remove locking cap from the vacuum flange and insert centering ring.
- The connection between the pump and the recipient 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 mbar abs.) in the lines, observe all official accident prevention safety regulations.

- Connect both exhaust flanges.
  - 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 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 and 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.



### CAUTION

#### 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.



### 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

#### Inspection of the direction of rotation

With pumps with three-phase motors is it necessary to check the direction of rotation!



### 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 (if existing).
- 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

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.

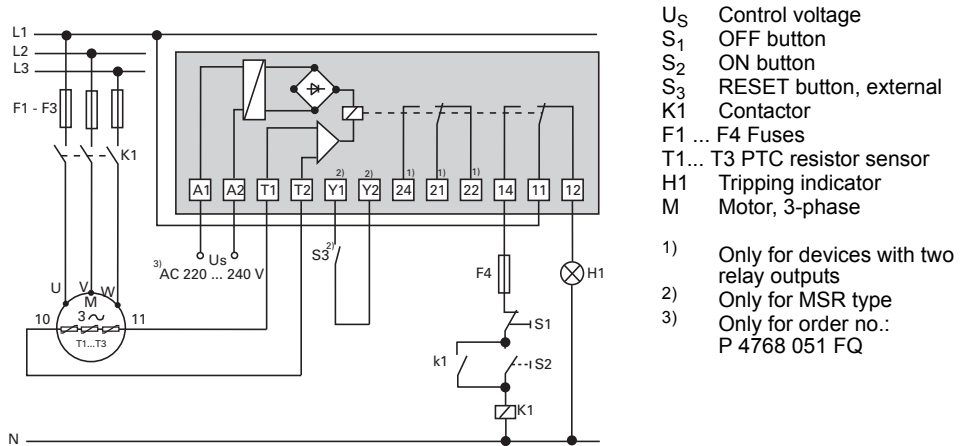


Fig. 3: Connection example for a three-phase AC motor with PTC resistor tripping device



NOTE

**Do not start with star/delta connection.**  
 → Always start motor directly.

**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  $\Delta$ . The voltage between the mains supply lines is called mains voltage. The mains current is the current which flows in the supply lines.

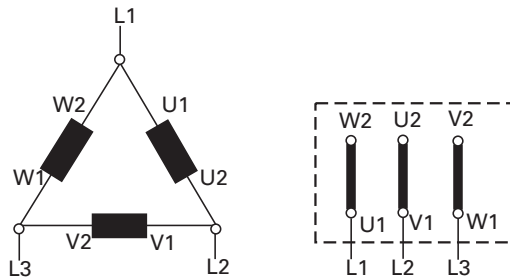


Fig. 4: Motor coil and connecting plate of Delta Connection (for low voltage)

**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  $Y$ .

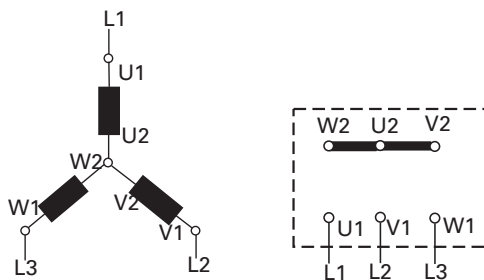


Fig. 5: Motor coil and connecting plate of Star Connection (for high voltage)

## 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



### NOTE

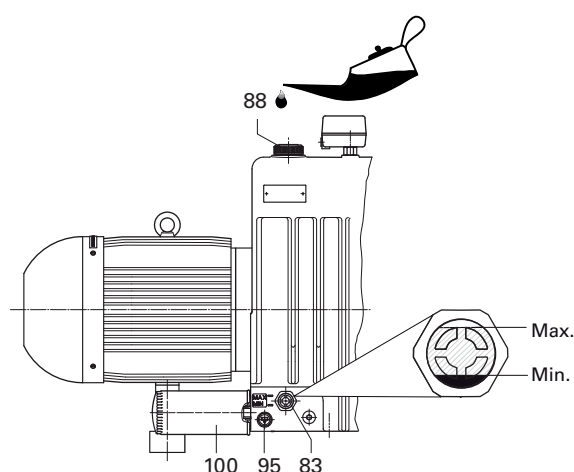
#### Use approved operating fluids only!

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. 30 l of operating fluid.



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

**Fig. 6: Filling up the operating fluid**

- Screw in operating fluid filler screw 88.
- Close intake port valve (if present) or cover intake flange with a rubber mat.
- 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 (2x) must be carried out, so that an alarm is released and the pump is switched off, if the gas temperature exceeds 90°C. The temperature switch is preset ex works.

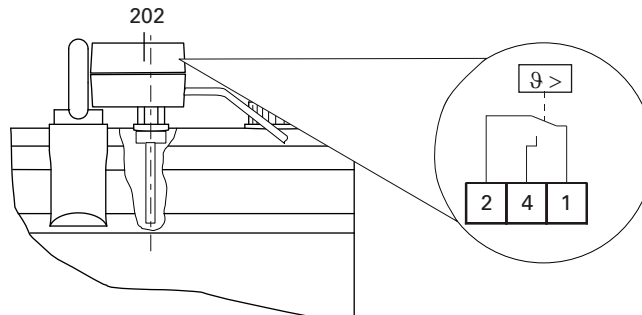


Fig. 7: Exhaust gas temperature monitoring

## 5.7 Operating fluid temperature monitoring (option)

A temperature switch 488, which is installed at the operating fluid separator (oil sump) is used for monitoring the operating fluid temperature.

Electrical connection of the temperature switch 488 must be carried out, so that an alarm is released and the pump is switched off, if the operating fluid temperature exceeds 100°C. The temperature switch is preset ex works.

## 5.8 Operating fluid level monitoring (option)

A level switch 496, which is installed at the operating fluid separator (oil sump) is used for monitoring the operating fluid level.

Electrical connection of the level switch 496 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.

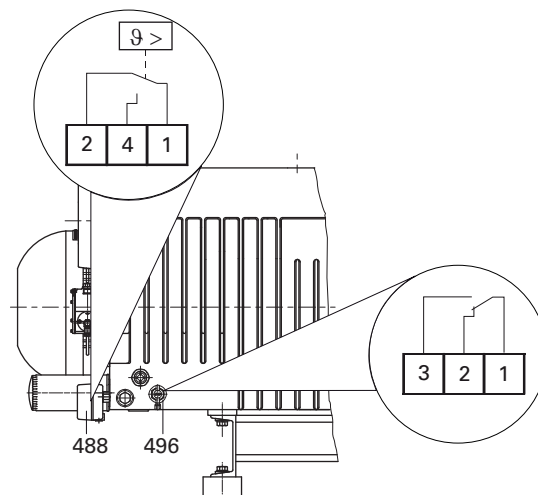


Fig. 8: Operating fluid temperature and operating fluid level monitoring



## 5.9 Connecting the heat exchanger (option)



### NOTE

#### 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.

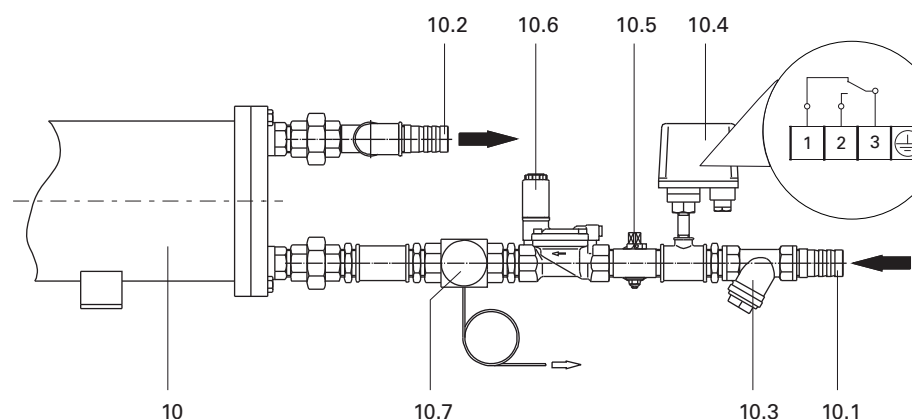
→ Switch off water cooling supply as well as a separately driven fan immediately when switching off the pump.

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 the cooling water flow can be adjusted between 0 (maximum flow) and position 5 (minimum flow).

A solenoid valve controls the cooling water inlet and stops the flow during operating interrupt of the pump.

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	10° dH
30 ... 40 °C	6° dH
60 ... 80 °C	3° dH
Max. potassium permanganate usage	10 mg/kg
pH value	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	2 ... 10 bar
Required pressure differential between inlet and outlet	> 0.3 bar

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**Requirements for the cooling water**

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Permitted cooling water temperature range	15 ... 40°C
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**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 screw 10.5 and fill the cooling system until cooling water comes out of the outlet.
- Close venting screw 10.5.
- Connect cooling water line at the outlet.
- Stop cooling water supply.

## 6 Operation

### 6.1 Before switching on

- Check the operating fluid level in the sightglass.
- 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 1.5 bar 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 and check the 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.



#### 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.

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

#### Permissible operating conditions

Type / Version	Intake pressure for continuous operation	Intake pressure for intermitted operation <sup>1</sup>
<b>Hena 1000</b> Operating fluid return via float valve	< 800 mbar unlimited	< 800 mbar unlimited from 1000 ... 800 mbar max. 10 min.

<sup>1</sup>. For interval evacuation and venting of a vessel, start the pump motor maximum once per minute only.

**Operating fluid return  
via float valve**

The pumps are fitted with an automated operating fluid return system via intake flange 1 as standard. If the fluid level in the operating fluid separator 75 reaches a definite level, the float valve returns collected operating fluid to the pump via oil return line 590 by means of differential pressure. As the float valve only opens temporarily there is no important decline of the ultimate pressure.



<b>NOTE</b>
The operating fluid return only works properly if the working pressure is < 800 mbar.

### 6.3 Pumping condensable vapours

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



CAUTION
<p><b>Bad final vacuum and damage to the pump!</b></p> <p>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.</p> <p>→ Only pump vapours when the pump is warm and the gas ballast valve is open.</p> <p>→ 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.</p>

#### 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.

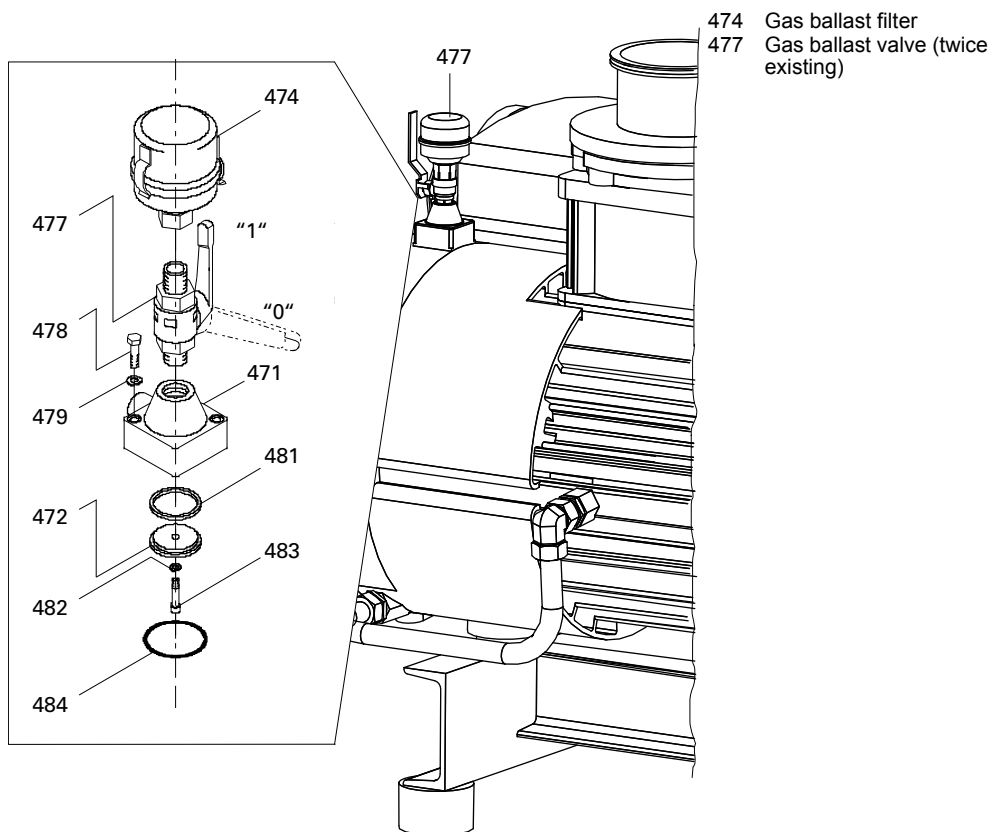


Fig. 9: Gas ballast valve for Hena 1000

## 6.4 Switching off the pump

The pump can be switched off in any pressure range.

Rotary vane pumps have an integrated safety valve on the intake side. If the differential pressure between the exhaust side and the intake side is  $\geq 250$  mbar, then the valve closes automatically and vents the pump when the pump is switched off.

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

### Venting the vacuum chamber



#### CAUTION

##### **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



#### CAUTION

##### **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, if necessary.
- 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 in order to repair defects.
- 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.



#### NOTE

##### **Service work should be carried out by qualified personnel 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](http://www.pfeiffer-vacuum.com).
- Please state all the information on the pump rating plate when ordering spare parts.

**Checklist for inspection, maintenance and overhaul**

Certain repair 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 intervals for inspection, maintenance, or overhaul are exceeded or inspection, maintenance, repair 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 valve			X		
Clean the fan cap of the motor		X			
Replace the radial shaft seals <sup>1</sup>				X (PV)	
Clean or replace discharge valves				X (PV)	
Replace vanes					X (PV)
Replace vacuum safety 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**

**NOTE**

**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 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 download it from the Internet.
- 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 dark yellow to red brown (equivalent to 4 ... 5 on the scale) change operating fluid.
- Switch off the pump.
- Unscrew operating fluid filler screw 88.
- Unscrew operating fluid drain screw 95.



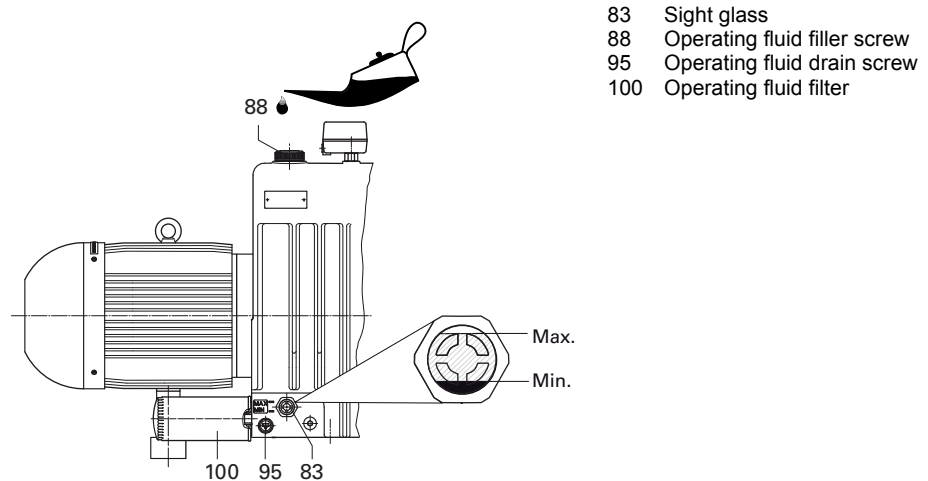


Fig. 10: Filling up the operating fluid

**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
- 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):

**Flushing**

- 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 back in.
- Fill up with operating fluid and check the filling level (see p. 15, chap. ).

**NOTE****Request safety data sheets for operating fluids and lubricants**

from Pfeiffer Vacuum or download them from the Internet.

- Dispose of operating fluid according to the local regulations.

## Changing the operating fluid filter

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

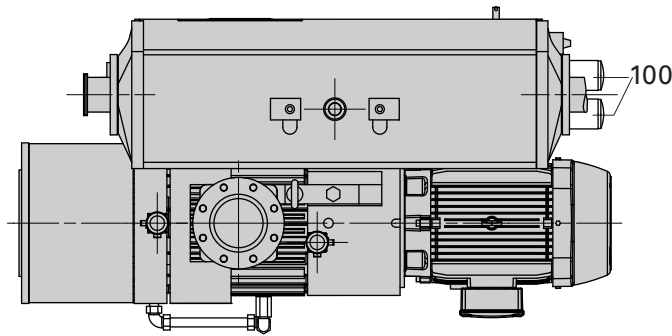


Fig. 11: Changing the operating fluid filter

## 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 for a filter replacement:

- Increased expulsion of operating fluid mist from the exhaust flange.
- Increased power consumption.
- Increased pressure in the operating fluid separator 75 (red area at the display of the pressure gauge).

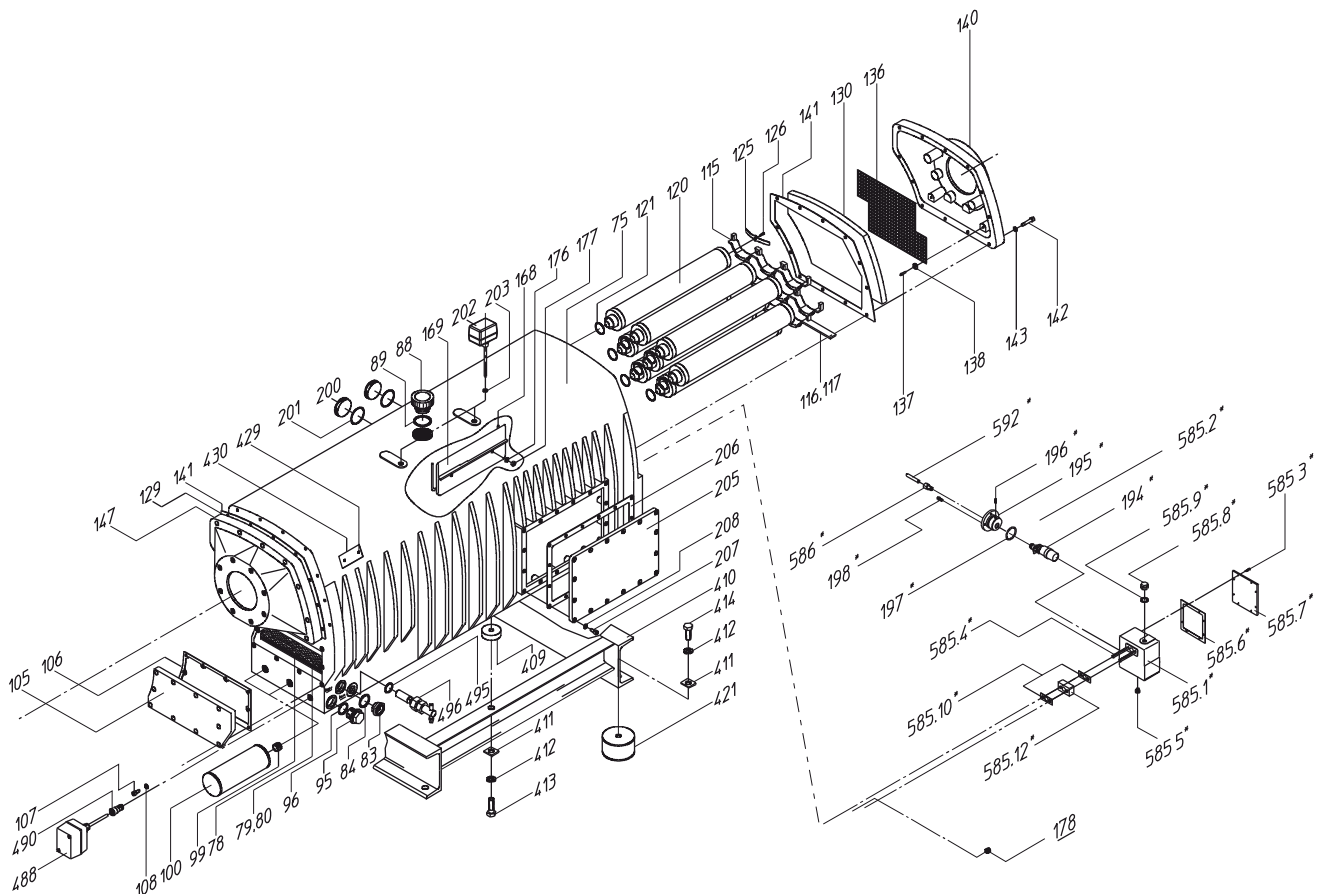


### WARNING

#### 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	116	Filter support	141	Flat seal
83	Sight glass	120	Exhaust filter	142	Cylinder head screws
84	Flat seal	121	O-ring	143	Spring washer
88	Operating fluid filler screw	125	Filter spring	194	Float valve
89	O-ring	126	Screws	195	Support for float valve
95	Operating fluid drain screw	130	Filter	196	Set screw
96	O-ring	136	Grid	197	O-ring
100	Operating fluid filter	137	Cylinder head screw	198	Cylinder head screws
105	Separator cover	138	Washer	205	Separator cover
115	Filter support	140	Exhaust cover plate		

**Fig. 12: Changing the exhaust filter**

## Dismantling

- Turn off the vacuum pump, vent to atmospheric pressure and allow to cool, if necessary.
- Dismantle both exhaust lines.
- Unscrew screws 142 from separator cover 140; take care with the spring washer 143!
- Remove separator cover 140.
- 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 float valve

The float valve (2x) must be checked and cleaned each time the operating fluid is changed.

- Drain off operating fluid.
- Undo the two fixing screws 198 on the float valve and remove the entire unit.
- 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.
- Refit float valve 194; pay attention to proper mounting orientation.

## 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 Changing the gas ballast filter

The gas ballast filter is used to keep the air free of particles before entering the suction chamber.



### CAUTION

#### 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.

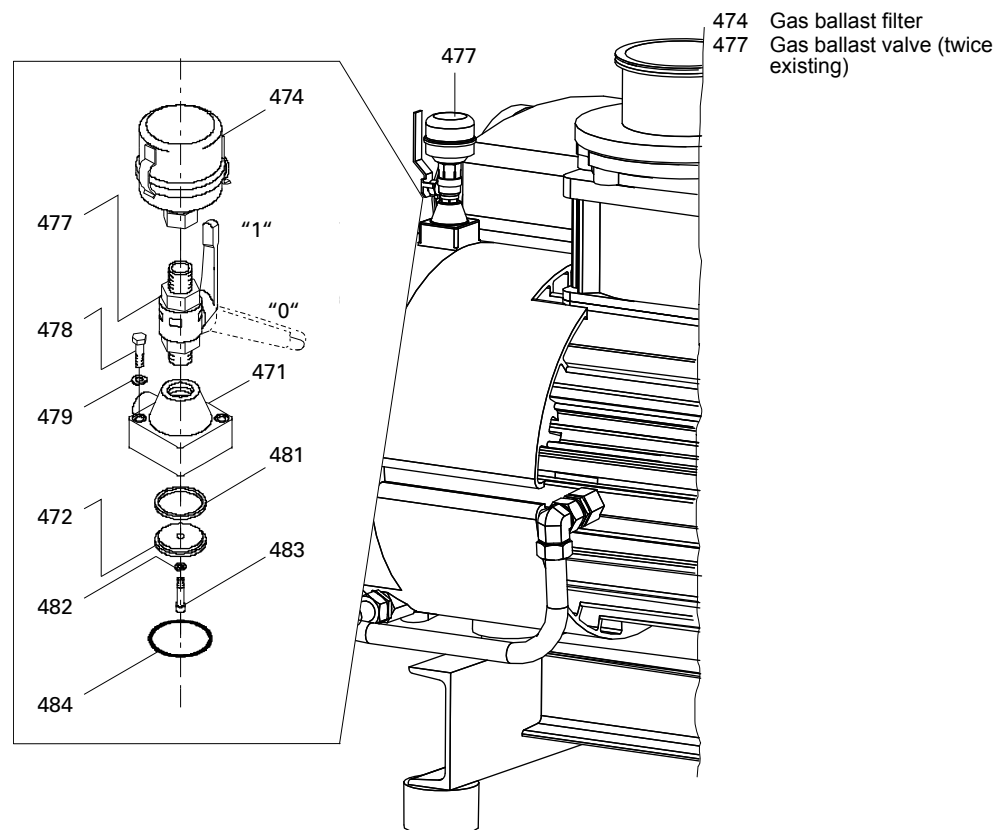


Fig. 13: Gas ballast valve for Hena 1000

- 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, ventilator cowl and motor cover 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. 24, 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



### NOTE

#### 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.



### CAUTION

#### 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.



### CAUTION

#### 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.

## 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.



### NOTE

#### 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



**NOTE**

**Service work should be carried out by qualified personal 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](http://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](http://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".<sup>1)</sup>
- 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.

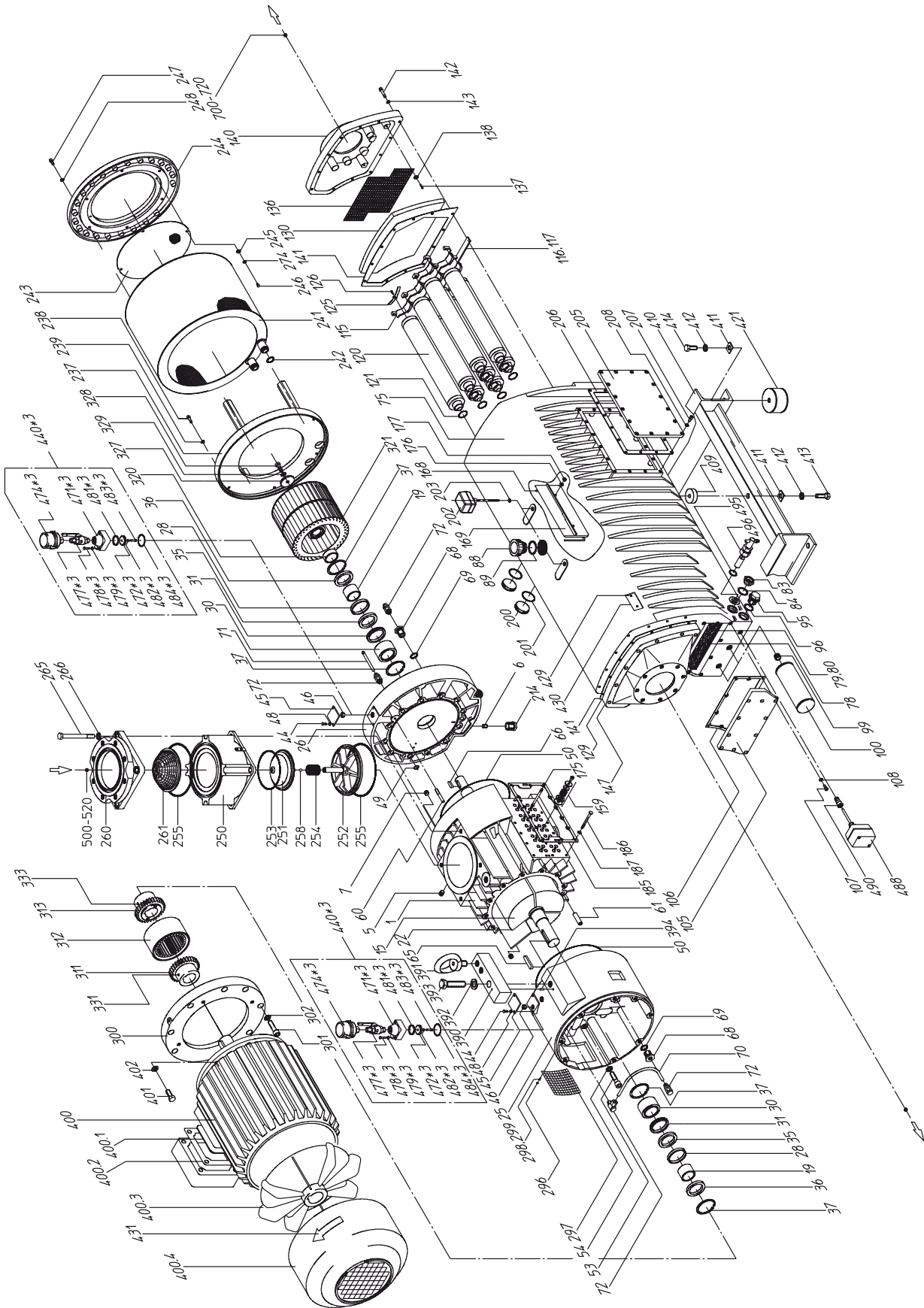
- Neutralise the pump by flushing it with nitrogen or dry air.
- Close all openings airtight.
- Seal the pump or unit in suitable protective film.
- Return the pump/unit only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

### **Service orders**

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

<sup>1)</sup> Forms under [www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)

# 11 Spare parts



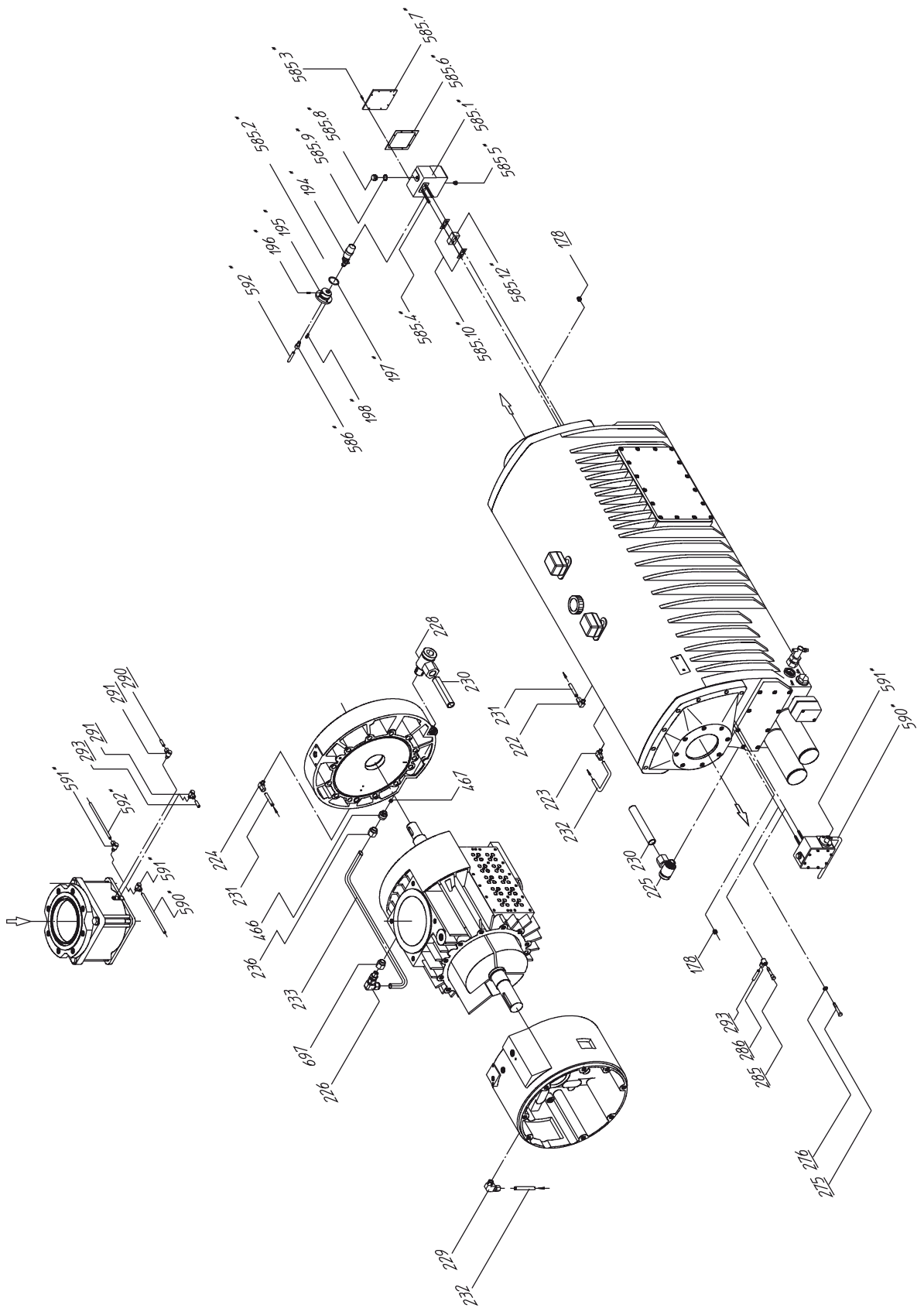


Fig. 14: Exploded view Hena 1000

19	Inner ring	96	O-ring	242	O-ring
22	Vane	100	Operating fluid filter	253	O-ring
30	Needle bearing	106	Flat seal	255	O-ring
35	Radial shaft seal	120	Exhaust filter	258	Ball
36	Radial shaft seal	121	O-ring	271	Sealing ring
49	O-ring	129	Filter	275	Oil return valve
50	O-ring	130	Filter	276	Sealing ring
60	Taper pin	141	Flat seal	312	Coupling sleeve
61	Cylinder pin	159	Exhaust valve	465	Sealing ring
69	O-ring	168	Cap gasket	495	Sealing ring
84	Flat seal	185	Flat seal	585.6	Cover seal
88	Operating fluid filler screw	197	O-ring	585.9	Sealing ring
89	Sealing ring	201	O-ring	585.10	Seal
95	Operating fluid drain screw	206	Flat seal	585	Sealing ring

## 11.1 Spare parts packages

Spare parts package	Pump type	No.	Parts according to the exploded view
Manometer	Hena 1000	PK 100 128	
Operating fluid filter	Hena 1000	P 0920 549 E	100
Set of seals	Hena 1000	PK E60 025 -T	84, 89, 96, 106, 121, 141, 201, 495, 35, 36, 185, 206, 49, 50, 69, 242, 465, 271, 276, 168, 253, 255, 258.
Maintenance kit	Hena 1000	PK E61 024 -T	100, 120, 121, 130, 129, 141, 89, 96, 206.
Overhaul kit	Hena 1000	PK E62 028 -T	Set of seals, 88, 100, 120, 129, 130, 19, 30, 60, 159, 275, 312, 261, 84, 89, 96, 106, 121, 141, 201, 495, 35, 36, 185, 206, 49, 50, 69, 242, 465, 271, 276, 168, 253, 255, 258.
Set of vanes	Hena 1000	PK E68 028 -T	22

## 12 Accessories

Benennung	Hena 1000
SAS 160, DN 160 ISO-K, polyester filter	PK Z60 514
Barretter actuation unit 3TF	P 4768 051 FQ
P3, mineral oil, 1 l	PK 001 106-T
P3, mineral oil, 5 l	PK 001 107-T
P3, mineral oil, 20 l	PK 001 108-T
P3, mineral oil, 50 l	PK 001 109-T
P3, mineral oil, 200 l	PK 001 110-T

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

# 13 Technical data

Parameter	Hena 1000
Flange (in)	DN 160 ISO-K
Flange (out)	DN 100 ISO-K ( 2 x )
Pumping speed at 50 Hz	1000 m <sup>3</sup> /h
Pumping speed at 60 Hz	1200 m <sup>3</sup> /h
Ultimate pressure with gas ballast	1.2 mbar
Ultimate pressure without gas ballast	1 mbar
Nominal rotation speed at 50 Hz	1000 rpm
Nominal rotation speed at 60 Hz	1200 rpm
Emission sound pressure level without gas ballast at 50 Hz	82 dB (A)
Relative humidity of air	95 %
Rated power 50 Hz	22 kW
Rated power 60 Hz	30 kW
Mains requirement: voltage 50 Hz	380-415/660-690 V
Mains requirement: voltage 60 Hz	220/380 V
Switch	No
Altitude of site, max	1000 m
Exhaust pressure, max.	1500 abs. mbar
Exhaust pressure, min.	1000 abs. mbar
Leak rate safety valve	0.08 mbar l/s
Ambient temperature	12-40 °C
Operating fluid filling	30 l
Weight	1190 kg

## 13.1 Dimensions

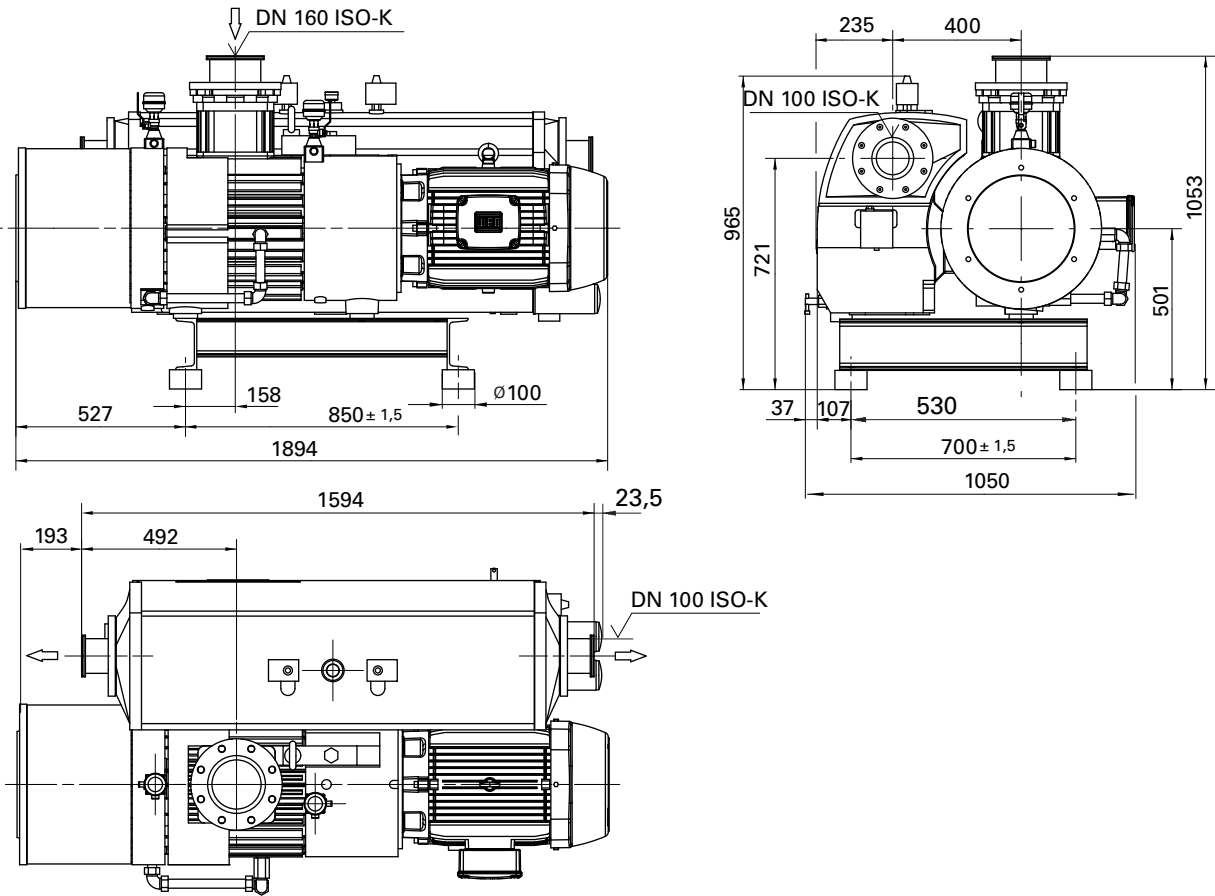


Fig. 15: Hena 1000



# Declaration of conformity

according to the EC directive:

- Machinery 2006/42/EC (Annex II, no. 1 A)

We hereby declare that the product cited below satisfies all relevant provisions of EC directive "Machinery" **2006/42/EC**.

In addition, the product cited below satisfies all relevant provisions of EC directive "Electromagnetic Compatibility" **2004/108/EC**.

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

**HenaLine™**

**Hena 1000**

Guidelines, harmonised standards and national standards and specifications which have been applied:

DIN EN ISO 12100 : 2011-03	DIN EN ISO 2151 : 2009	DIN EN 61000-6-3 : 2007
DIN EN 1012-1 : 2007	DIN EN ISO 13857 : 2008	DIN EN 61000-6-4 : 2007
DIN EN 1012-2 : 1996	DIN EN 61000-6-1 : 2007	
DIN EN ISO 14121-1 : 2007	DIN EN 61000-6-2 : 2006	

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Managing Director

(Dr. M. Wiemer)  
Managing Director

CE/2011

**Leading. Dependable.  
Customer Friendly**

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide. For German engineering art, competent advice and reliable services.

Ever since the invention of the turbopump, we've been setting standards in our industry. And this claim to leadership will continue to drive us in the future.

**You are looking for a  
perfect vacuum solution?  
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