



OPERATING INSTRUCTIONS

EN

Translation of the Original

HENA 201 | 251 | 301 | 301 S

Rotary vane pump

PFEIFFER  **VACUUM**

Dear Customer,

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

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

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

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

Disclaimer of liability

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

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

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We reserve the right to make changes to the technical data and information in this document.

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1 About this manual



IMPORTANT

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

1.1 Validity

These operating instructions are for customers of Pfeiffer Vacuum. They describe the function of the designated product and provide the most important information for safe usage of the product. The descriptions comply with applicable directives. All information provided in these operating instructions refer to the current development status of the product. The documentation remains valid as long as the customer does not modify the product in any way.

1.1.1 Applicable documents

Document	Number
Declaration of conformity	A component of these instructions

You can find this document in the [Pfeiffer Vacuum Download Center](#).

1.1.2 Variants

These instructions apply to HenaLine vacuum pumps.

Pump type	Pump version
Hena 201	Standard version of rotary vane pump
Hena 251	Standard version of rotary vane pump
Hena 301	Standard version of rotary vane pump
	Rotary vane pump with water cooling
Hena 301 S	Rotary vane pump with limited intake pressure

1.2 Target group

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

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

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

1.3 Conventions

1.3.1 Instructions in the text

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

Individual action step

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

- ▶ This is an individual action step.

Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

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

1.3.2 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

1.3.3 Stickers on the product

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

<p>PFEIFFER VACUUM D-35614 Asslar Mod. Hena 201 P/N PK D03 455 A S/N xxxxxxxxx Oil P3 6.5 l S (N₂) max. 360.0 m³/h n max. 1800 1/min Mass 227.0 kg Made in Switzerland 2019/08</p>	<p>Rating plate (example) Rating plate of the rotary vane vacuum pump Motor rating plate (not shown)</p>
	<p>Warning hot surface This sticker warns of injuries caused by high temperatures in case of touching without protection during operation.</p>
	<p>Operating instructions note This sticker indicates that this operating instructions must be read before performing any tasks.</p>
	<p>Arrow indicating direction of rotation The direction of rotation arrow indicates the required motor rotation direction.</p>

Tbl. 1: Stickers on the product

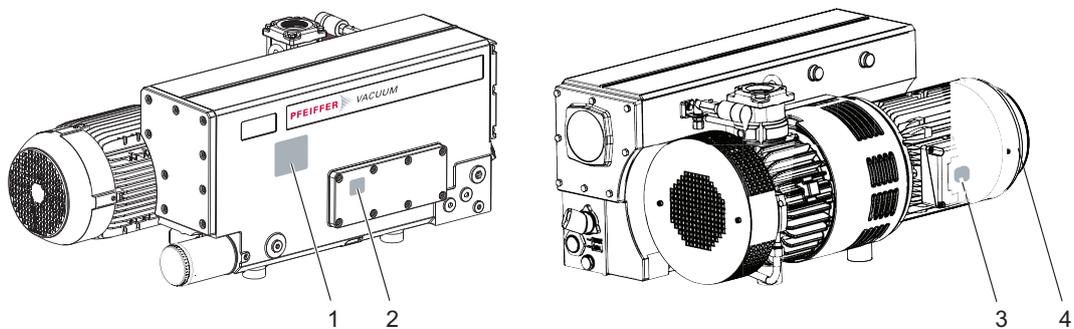


Fig. 1: Position of the stickers on the product

- | | |
|---|---|
| <ol style="list-style-type: none"> 1 Rating plate of the rotary vane vacuum pump 2 Hot surface warning sign | <ol style="list-style-type: none"> 3 Operating instructions note 4 Arrow indicating direction of rotation |
|---|---|

1.3.4 Abbreviations

Abbreviation	Meaning in this document
BA	Operating instructions
ID	Internal diameter
IE3	Efficiency of the electric motors (premium efficiency class)
N.N.	Mean sea level
PE	Earthed conductor (protective earth)
PTC	Temperature-dependent resistor (positive temperature coefficient)
PVC	Polyvinyl chloride (PVC)
WAF	width across flats
RSSR	Radial shaft seal ring
MM	Maintenance manual

Tbl. 2: Abbreviations used in this document

1.4 Trademark proof

- Loctite® is a trademark of HENKEL IP & HOLDING GMBH.

2 Safety

2.1 General safety instructions

This document includes the following 4 risk levels and 1 information level.

⚠ DANGER	
<p>Imminent danger Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</p> <ul style="list-style-type: none"> ▶ Instructions on avoiding the hazardous situation 	
⚠ WARNING	
<p>Possibly imminent danger Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p> <ul style="list-style-type: none"> ▶ Instructions on avoiding the hazardous situation 	
⚠ CAUTION	
<p>Possibly imminent danger Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p> <ul style="list-style-type: none"> ▶ Instructions on avoiding the hazardous situation 	
NOTICE	
<p>Danger of property damage Notice is used to address practices not related to physical injury.</p> <ul style="list-style-type: none"> ▶ Instructions on avoiding property damage 	
<div style="border: 1px solid black; padding: 5px; display: inline-block;">  </div>	<p>Notes, tips or examples indicate important information on the product or on this document.</p>

2.2 Safety instructions

All safety instructions in this document are based on the results of the risk assessment carried out in accordance with Machinery Directive 2006/42/EC Annex I and DIN EN ISO 12100 Section 5. Where applicable, all life cycle phases of the product were taken into account.

Risks during transport

⚠ WARNING
<p>Risk of serious injury from swinging, toppling or falling objects During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.</p> <ul style="list-style-type: none"> ▶ Secure the danger zone if necessary. ▶ Pay attention to the center of gravity of the load during transport. ▶ Ensure even movements and moderate speeds. ▶ Observe safe handling of the transport devices. ▶ Avoid sloping attachment aids. ▶ Never stack products. ▶ Wear protective equipment, e.g. safety shoes.

Risks during installation

⚠ DANGER**Danger to life from electric shock**

Contact with exposed and live elements generate an electric shock. Incorrect connection of the mains supply leads to the risk of live housing parts that can be touched. There is a risk to life.

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

⚠ CAUTION**Danger of injury from moving parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

Risks during operation

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

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

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

⚠ WARNING**Risk of burns from ejected hot oil mist**

During operation, hot pressurized oil mist escapes from the operating fluid separator.

- ▶ Only operate the vacuum pump with the filler screw securely fitted.
- ▶ Open the locking screws on the separator only while the vacuum pump is switched off.

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

After a power failure or a standstill as a result of overheating, the motor restarts automatically.

There is a risk of minor injuries to fingers and hands (e.g. hematoma) from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

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

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g. increased exhaust pressure.

There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

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

⚠ CAUTION

Danger of burns on hot surfaces

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C.

- ▶ Provide suitable touch protection.

Risks during maintenance, decommissioning and malfunctions

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

⚠ WARNING

Danger to life from electric shock in the event of a fault

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

- ▶ Always keep the mains connection freely accessible so you can disconnect it at any time.

⚠ WARNING

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

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

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

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

⚠ CAUTION

Risk of injury from suction of body parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically.

There is a risk of minor injuries to fingers and hands (e.g. hematoma) from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

⚠ CAUTION**Scalding from hot operating fluid**

Danger of burns when draining operating fluid if it comes into contact with the skin.

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

⚠ CAUTION**Danger of burns on hot surfaces**

In the event of a fault, the surface temperature of the vacuum pump can increase to above 105 °C.

- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Wear personal protective equipment if necessary.

⚠ CAUTION**Danger of injury from moving parts**

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

2.3 Safety precautions

**Duty to provide information on potential dangers**

The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.

Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety-related parts of this document.

**Infringement of conformity due to modifications to the product**

The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

General safety precautions when handling the product

- ▶ Observe all applicable safety and accident prevention regulations.
- ▶ Check that all safety measures are observed at regular intervals.
- ▶ Do not expose body parts to the vacuum.
- ▶ Always ensure a secure connection to the earthed conductor (PE).
- ▶ Never disconnect plug connections during operation.
- ▶ Observe the above shutdown procedures.
- ▶ Keep lines and cables away from hot surfaces (> 70 °C).
- ▶ Never fill or operate the unit with cleaning agents or cleaning agent residues.
- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Observe the unit protection class prior to installation or operation in other environments.
- ▶ Provide suitable touch protection, if the surface temperature exceeds 70 °C.

2.4 Limits of use of the product

Parameter	Hena 201, Hena 251, Hena 301	Hena 301 S
Installation location	<ul style="list-style-type: none"> Indoors, protected from dust deposits Outdoors, protected from direct weather influences 	<ul style="list-style-type: none"> Indoors, protected from dust deposits Outdoors, protected from direct weather influences
Installation altitude	max. 1000 m above sea level	max. 1000 m above sea level
Orientation	horizontal	horizontal
permissible angle of inclination	$\pm 1^\circ$	$\pm 1^\circ$
Ambient temperature	+12 °C to +40 °C	+12 °C to +40 °C
Relative air humidity	max. 85 %	max. 85 %
Pumped medium intake temperature, max.	+80 °C	+80 °C
Permissible operating pressure range during continuous operation	< 800 hPa	≤ 100 hPa
Exhaust pressure	Atmospheric pressure	Atmospheric pressure

Tbl. 3: Limits of use of the product

2.5 Proper use

- ▶ Use the vacuum pump for vacuum generation only.
- ▶ When pumping media with an oxygen concentration level of $\geq 21\%$, only use perfluorinated, synthetic oils (F4, F5, A113) as operating fluid.
- ▶ Adhere to the installation, commissioning, operating, and maintenance instructions.
- ▶ Do not use any accessory parts other than those recommended by Pfeiffer Vacuum.

2.6 Foreseeable improper use

Misuse of the product invalidates all warranty and liability claims. Improper use is any, even unintended, use, which is contrary to the product purpose; and in particular:

- Pumping of corrosive media
- Pumping radioactive media
- Pumping of gases that introduce an ignition source to the suction chamber
- Pumping of gases that contain impurities such as particles, dust, or condensate
- Pumping explosive media
- Pumping of media with a propensity to sublimation
- Pumping of fluids
- Use of the vacuum pump in potentially explosive atmospheres
- Use of the vacuum pump outside the specified area of application
- Use for pressure generation
- Use in strong electrical, magnetic, or electromagnetic fields
- Connection to vacuum pumps or equipment which are not suitable for this purpose according to their operating instructions
- Connection to devices with exposed live parts
- Use of accessories or spare parts not listed in these operating instructions
- Use of operating fluids other than those specified by Pfeiffer Vacuum
- Use of D1 or mineral oil as operating fluid with an oxygen concentration level of $> 21\%$

Mineral oils are combustible and ignite in high temperatures and when they come into contact with pure oxygen. This oils oxidize heavily and thus lose their lubricating capacity.

2.7 Personnel qualification

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

Training people

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

2.7.1 Ensuring personnel qualification**Specialist for mechanical work**

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

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

Specialist for electrotechnical work

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

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

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

Trained individuals

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

2.7.2 Personnel qualification for maintenance and repair**Advanced training courses**

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

Adequately trained individuals are:

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

2.7.3 Advanced training with Pfeiffer Vacuum

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

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

3 Product description

3.1 Function

The rotary vane pumps of the HenaLine are single-stage, oil-sealed rotary positive displacement pumps with air cooling and circulatory lubrication. A non-return valve in the vacuum connection closes the intake line automatically when the rotary vane pump is switched off and prevents an operating fluid return flow. The integrated oil mist filter cleans the conveyed gas and prevents the operating fluid mist from being emitted at the exhaust. An operating fluid filter is also installed for cleaning the operating fluid.

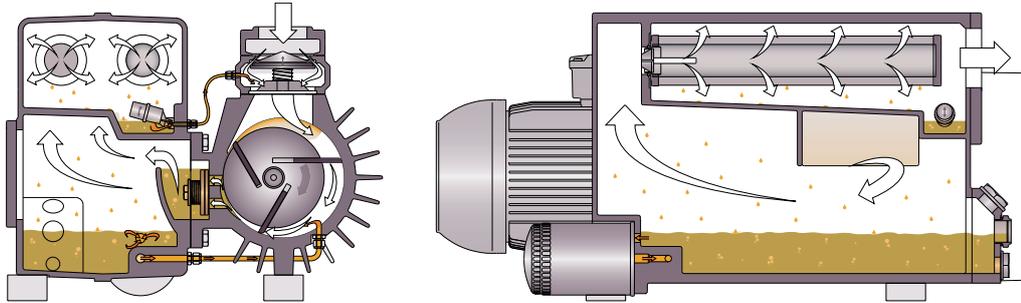


Fig. 2: Operating principle

The pumping system is made up of the housing, the eccentrically mounted rotor, and the centrifugally sliding vanes, which divide the suction chamber into multiple chambers. The volume of each chamber changes periodically as the rotor rotates. This causes the gas to be continuously drawn in at the vacuum connection and compressed in the suction chamber by the rotation of the rotor until the exhaust valve opens against the atmospheric pressure and the gas leaves the suction chamber.

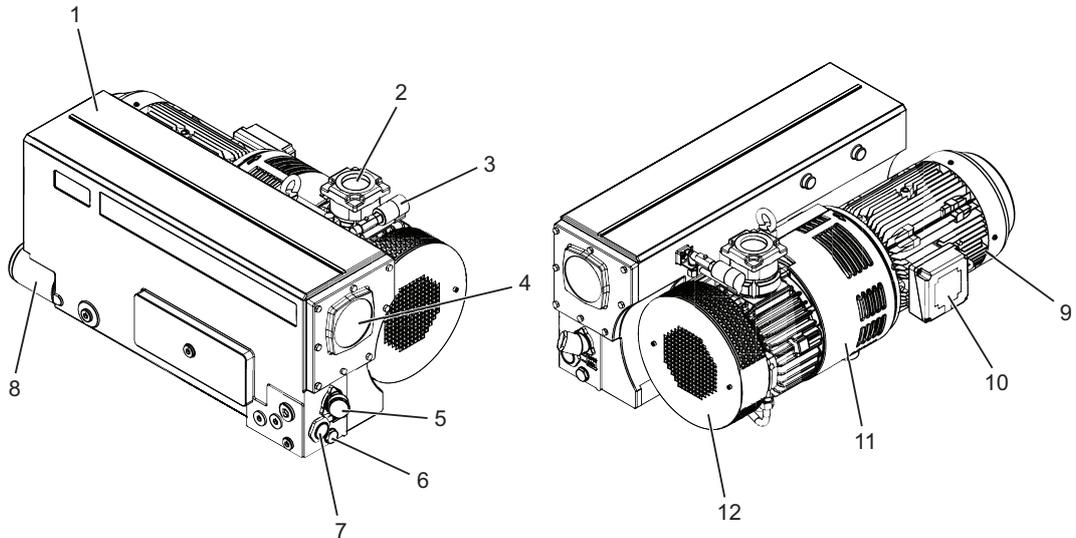


Fig. 3: Structure of the rotary vane pump

- | | |
|-------------------------------|--|
| 1 Operating fluid separator | 7 Sight glass |
| 2 Vacuum connection | 8 Operating fluid filter |
| 3 Gas ballast valve | 9 Motor |
| 4 Exhaust connection | 10 Motor terminal box |
| 5 Filler screw with manometer | 11 Intermediate flange |
| 6 Drain screw | 12 Axial fan with oil / air heat exchanger |

3.1.1 Operating fluid

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

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

3.1.2 Operating fluid return via the float valve



Function of the operating fluid return

The operating fluid return functions only at an operating pressure of < 800 hPa.

The vacuum pumps are equipped with an operating fluid return as standard. If the operating fluid collected in the operating fluid separator reaches a certain level, a float valve opens and the ejected operating fluid is returned to the intake port of the vacuum pump.

3.1.3 Cooling

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

In case of thermally unfavorable ambient conditions, Pfeiffer Vacuum recommends the use of a pump version with oil/water heat exchanger. The oil/water heater is installed at the factory. The oil/water heat exchanger cannot be retrofitted.

- Air cooling (standard)
- Oil/water heat exchanger (optional)

3.1.4 Gas ballast

An integrated gas ballast system serves the controlled supply of ambient air or inert gas into the suction chamber. Gas ballast supports the reduction of condensate accumulating in the pumping system.

3.2 Identifying the product

- ▶ To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.
- ▶ Observe the motor-specific data on the motor rating plate attached separately.

3.3 Product features

Pump type	Characteristics
Hena 201	<ul style="list-style-type: none"> • Nominal pumping speed 200 – 240 m³/h
Hena 251	<ul style="list-style-type: none"> • Nominal pumping speed 250 – 300 m³/h
Hena 301	<ul style="list-style-type: none"> • Nominal pumping speed 300 – 360 m³/h • Oil/water heat exchanger (optional)
Hena 301 S	<ul style="list-style-type: none"> • Nominal pumping speed 300 – 360 m³/h • Limited intake pressure • 3 exhaust filters • max. continuous intake pressure ≤ 100 hPa

Tbl. 4: Features of the rotary vane pumps

3.4 Scope of delivery

- Rotary vane vacuum pump with motor
- Operating fluid
- Locking caps for vacuum and exhaust connection
- Operating instructions

4 Transportation and Storage

4.1 Transporting the vacuum pump

⚠ WARNING

Risk of serious injury from swinging, toppling or falling objects

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

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

NOTICE

Equipment damage from operating fluid leaking into the pumping system.

If the vacuum pump is tipped, the operating fluid will overflow into the pumping system, resulting in the vane breaking when the vacuum pump is switched on.

- ▶ Always transport the vacuum pump horizontally or without operating fluid filling.
- ▶ Fill in the operating fluid only at the final installation location.



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

General information regarding safe transport

1. Observe the weight specified on packaging.
2. Use personal protective equipment, e.g. safety shoes.
3. Use transport equipment (e.g. fork lift truck or lift truck).
4. Where possible, always transport or ship the product in the original packaging.
5. Be mindful of transport damage.
6. Always place the product on an adequately sized, level surface.

Transporting the vacuum pump with its packaging

1. Observe safe handling of manually operated transport devices.
2. Note the center of gravity of the load.
3. Use a fork lift truck or pallet truck to transport the vacuum pump on a pallet in its packaging.
4. Ensure harmonious movements and moderate speeds.
5. To protect the inside of the pump, leave both protective caps on the connections during transport.

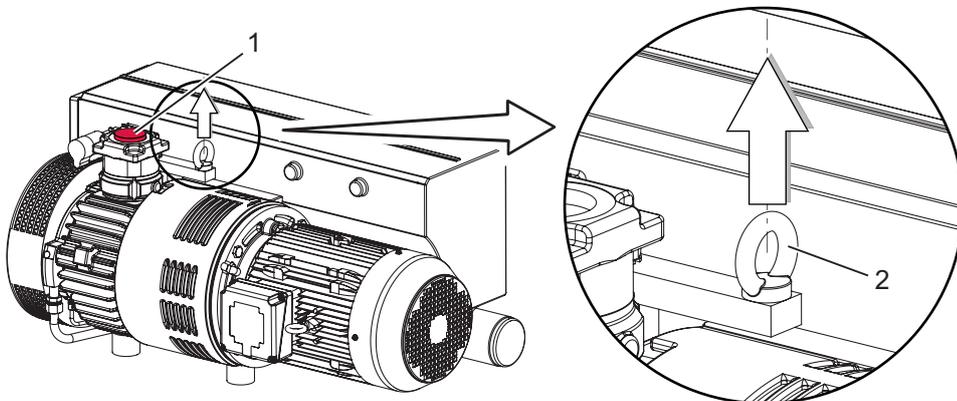


Fig. 4: Transporting the vacuum pump

1 Protective cap

2 Crane lug

Transporting the vacuum pump without its packaging

1. Unpack the vacuum pump.
2. To protect the inside of the pump, leave the protective caps on the connections during transport.
3. For lifting, use the crane lug provided for this purpose, located on the top of the pump.
4. Lift the vacuum pump out of the transport packaging.
5. Always place the vacuum pump on an adequately sized, level surface.

4.2 Storing the vacuum pump

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

Procedure

1. Seal the vacuum and exhaust connection.
2. Make sure that the gas ballast valve is closed.
3. Store the vacuum pump only in dry, dust-free rooms, within the specified ambient conditions.
4. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
5. Change the operating fluid if the storage period is longer than 2 years.

5 Installation

5.1 Installing the vacuum pump

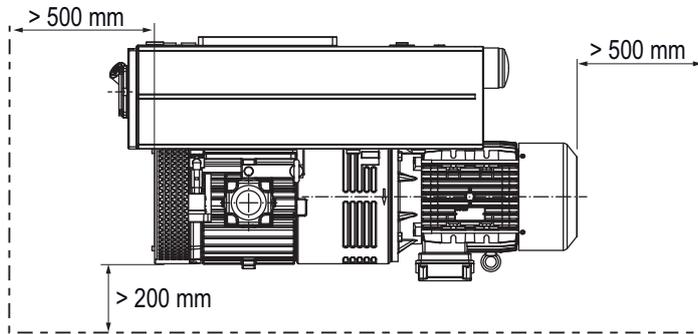


Fig. 5: Minimum distances to the lateral limitations (top view)

Procedure

1. Place the vacuum pump on a flat, horizontal surface, to safeguard the operating fluid supply.
2. Observe the permissible angle of inclination of $\pm 1^\circ$.
3. Screw the vacuum pump onto the rubber-metal buffers on the mounting surface.
4. When installing the pump in a closed housing, ensure adequate air circulation.
5. Keep the sight glass and gas ballast valve visible and freely accessible.
6. Keep the voltage and frequency specifications on the motor rating plate visible and freely accessible.

5.2 Connecting the vacuum side

NOTICE

Property damage from contaminated gases

Pumping down gases that contain impurities (condensate, particles) damages the vacuum pump.

- ▶ Use suitable filters or separators from the Pfeiffer Vacuum range of accessories, to protect the vacuum pump.



Installation and operation of accessories

Pfeiffer Vacuum offers a series of special, compatible accessories for its rotary vane pumps.

- You can find information and ordering options for approved [accessories](#) online.
- Described accessories are not included in the shipment.

Required consumables

- Screw lock, e.g. Loctite 245 or Loctite 577

Procedure

1. Remove the protective cap from the vacuum connection.
2. Establish the shortest possible pipeline between vacuum pump and vacuum chamber.
3. Choose a minimum diameter equal to the nominal diameter of the vacuum connection.
4. Clean the connection threads.
5. For sealing, apply screw lock to the thread turns.
6. Install the piping with pipe components and fasteners from the [Pfeiffer Vacuum Components Shop](#).
7. Use screw lock for the thread.
8. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
9. Use a separator or filter from the Pfeiffer Vacuum line of [accessories](#) if necessary.

As an alternative, screwing flanges DN 63/100 ISO-K / G 2" are available from Pfeiffer Vacuum [Accessories](#).

5.3 Connecting the exhaust side

CAUTION

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

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

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



Installation and operation of accessories

Pfeiffer Vacuum offers a series of special, compatible accessories for its rotary vane pumps.

- You can find information and ordering options for approved [accessories](#) online.
- Described accessories are not included in the shipment.



Condensate separator

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

Required consumables

- Screw lock, e.g. Loctite 245 or Loctite 577

Procedure

1. Remove the protective cap from the exhaust connection.
2. Choose a minimum diameter equal to the nominal diameter of the exhaust connection.
3. Route the piping downwards from the vacuum pump, to prevent condensate return.
4. Clean the connection threads.
5. Install the piping with pipe components and fasteners from the [Pfeiffer Vacuum Components Shop](#).
6. Use screw lock for the thread.
7. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.
8. Use a separator or filter from the Pfeiffer Vacuum line of [accessories](#) if necessary.

As an alternative, screwing flanges DN 63/100 ISO-K / G 2" are available from Pfeiffer Vacuum [Accessories](#).

5.4 Filling the operating fluid

NOTICE

Risk of damage due to the use of non-approved operating fluid

Product-specific performance data are not achieved. All liability and warranty claims against Pfeiffer Vacuum are also excluded.

- ▶ Only use approved operating fluids.
- ▶ Only use other application-specific operating fluids after consultation with Pfeiffer Vacuum.

The type of operating fluid specified, as well as the filling quantity for the entire rotary vane vacuum pump, are shown on the rating plate. Only the operating fluid used during initial installation is permissible.

Approved operating fluid

- P3 (standard operating fluid)
- D1 for special applications (such as higher operating temperatures)

Read the operating fluid type on the rating plate

- ▶ Refer to the rating plate of the vacuum pump for type and quantity of intended operating fluid.

Required consumables

- Operating fluid of the vacuum pump

Required aids

- Funnel (optional)

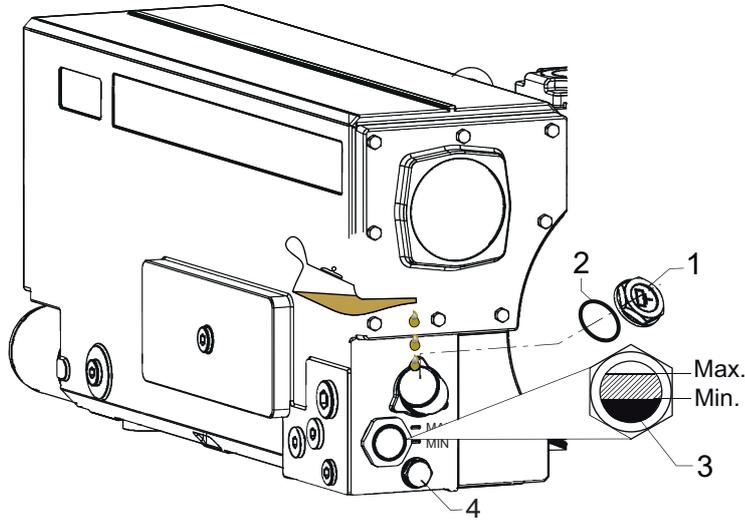


Fig. 6: Filling the operating fluid

- | | |
|----------------|---------------|
| 1 Filler screw | 3 Sight glass |
| 2 O-ring | 4 Drain screw |

Filling the operating fluid

1. Unscrew the filler screw.
2. Fill the operating fluid according to the sight glass:
3. Screw in the filler screw again.
 - Be careful with the O-ring.
4. Seal the vacuum connection.
5. Start the vacuum pump.
6. Operate the vacuum pump for approx. 5 minutes.
7. Switch off the vacuum pump.
8. Wait approx. 1 minute until the operating fluid has accumulated in the operating fluid separator.
9. Check the fill level.
 - The correct fill level is between the Min/Max markings or within the ring mark on the sight glass.
10. If necessary, fill more operating fluid in case the fill level is incorrect.

5.5 Connect the oil/water heat exchanger

NOTICE

Vacuum pump damage caused by different cooling characteristics

For applications with short switching cycles or increased ambient temperature, there is a risk of damaging the rotor after switching off temporarily.

- ▶ Always switch the oil / water cooling off together with the vacuum pump.
- ▶ For checking the cooling water flow, use a solenoid valve that only opens when the vacuum pump is switched on.

Parameter	Cooling water
Appearance	<ul style="list-style-type: none"> ● filtered ● mechanically clear ● visually clear ● no turbidity ● no sediment ● free from grease and oil
pH value	7 to 9
Carbonate hardness, max.	10 °dH 12.53 °e 17.8 °fH 178 ppm CaCO ₃
Chloride content, max.	100 mg/l
Sulfate content, max.	240 mg/l
Carbonic acid content, max.	not detectable
Ammonia content, max.	not detectable
Electrical conductivity, max.	500 µS/cm
Particle size, max.	150 µm
Cooling water temperature	see "Technical data"
Cooling water flow	see "Technical data"
Feed line overpressure, max.	6000 hPa

Tbl. 5: Requirements on the cooling water composition

Required material

- Cooling water hose, ID 19 mm
- Hose clamps

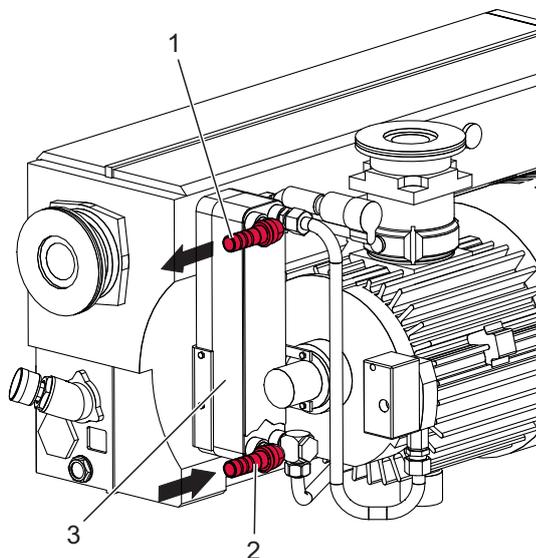


Fig. 7: Cooling water connection

- | | |
|------------------------|----------------------------|
| 1 Cooling water outlet | 3 Oil/water heat exchanger |
| 2 Cooling water inlet | |

Making the cooling water connection

1. Connect the cooling water lines:
 - Cooling water inlet
 - Cooling water outlet
2. Ensure that the cooling water outlet is unpressurized.
3. Use a dirt trap in the inlet.

4. Open the cooling water flow and fill the cooling system until cooling water escapes at the cooling water outlet.
5. Set the cooling water flow on-site (see technical data).

5.6 Establishing mains connection

⚠ DANGER

Danger to life from electric shock

Contact with exposed and live elements generate an electric shock. Incorrect connection of the mains supply leads to the risk of live housing parts that can be touched. There is a risk to life.

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

NOTICE

Risk of damage from excess voltage

Incorrect or excessive mains voltage will destroy the motor.

- ▶ Always observe the motor rating plate specifications.
- ▶ Route the mains connection in accordance with locally applicable provisions.
- ▶ Always provide a suitable mains fuse to protect the motor and supply cable in the event of a fault.
 - Pfeiffer Vacuum recommends the circuit breaker type "K" with slow tripping characteristic.

NOTICE

Property damage from high starting torque

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

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

5.6.1 Connect three phase motor with 12-pin terminal board

There are 3 different circuit configurations:

- Double star circuit for low voltage
- Delta connection for medium voltage
- Star circuit for high voltage

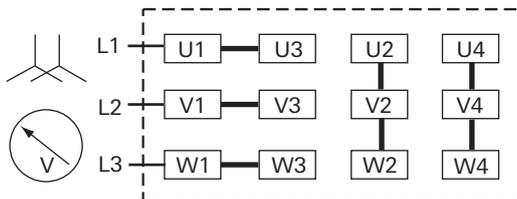


Fig. 8: Double star circuit

Connect the three phase motor with double star circuit

- ▶ Connect the three phase motor according to the connection diagram.

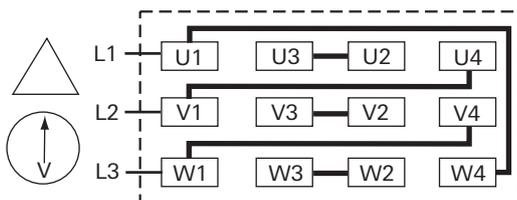


Fig. 9: Delta connection

Connect the three phase motor with delta connection

▶ Connect the three phase motor according to the connection diagram.

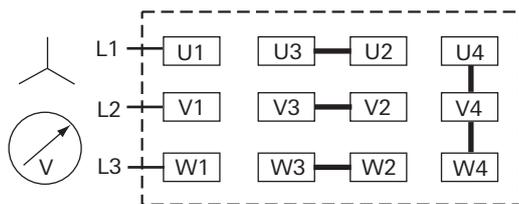


Fig. 10: Star circuit

Connect the three phase motor with star circuit

▶ Connect the three phase motor according to the connection diagram.

5.6.2 Connect three phase motor with 6-pin terminal board

There are 2 different circuit configurations:

- Delta connection for low voltage
- Star circuit for high voltage

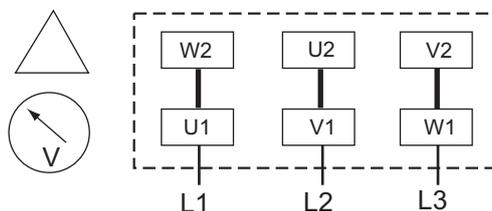


Fig. 11: Delta connection

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

Star circuit

Connect the three phase motor with delta connection

▶ Connect the three phase motor according to the connection diagram.

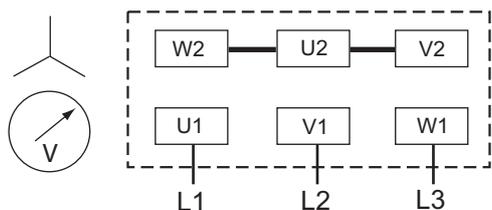


Fig. 12: Star circuit

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

Connect the three phase motor with star circuit

▶ Connect the three phase motor according to the connection diagram.

5.6.3 Frequency inverter for vacuum pumps with 3-phase motor

Rotary vane pumps with variable rotation speed can be operated within a mains frequency range of 35 to 60 Hz. Start-up is ramped (maximum run-up time: 30 s). Shutdown can take place immediately.

5.6.4 Checking the direction of rotation

NOTICE
<p>Equipment damage from incorrect direction of rotation</p> <p>The direction of rotation must be checked on vacuum pumps with three phase motors. If the vacuum pump has an incorrect direction of rotation, damage may be caused to the pumping system after a short time.</p> <ul style="list-style-type: none"> ▶ Determine the intended direction of rotation based on the arrow sticker. ▶ Fill in the operating fluid only after that.

Procedure

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

5.6.5 Setting the motor protection switch

Motor protection switches are current-dependent protective devices for the drive motors. Protection switches with slow tripping characteristics are suitable.

An increase of 1.5 times the rated current over a 2 minute period is permissible for the drive motors (in accordance with EN 60034-1), without tripping the motor protection switch.

Procedure

1. Take the settings for the motor protection switch from the following table.
2. Take into consideration that certain operating conditions (for example, cold vacuum pump start) can cause short-term increases in current consumption.
3. Set the desired value on the contactor.

Voltage [V]	Frequency [Hz]	Motor rating [kW]	I _N [A]	I _{max} [A]
190 – 200	50	5.5	24.2	204
220 – 230	50	5.5	20.9	176
380 – 400	50	5.5	12.1	102
208	60	6.6	25.6	213
220	60	6.6	24.2	201
230	60	6.6	24.2	201
440	60	6.6	12.1	101
460	60	6.6	12.1	101

Tbl. 6: Motor protection switch setting values for Hena 201 (from index "A")

Voltage [V]	Frequency [Hz]	Motor rating [kW]	I _N [A]	I _{max} [A]
190 – 200	50	7.5	32.6	297
220 – 230	50	7.5	28.2	257
380 – 400	50	7.5	16.3	149
208	60	9.2	33.0	314
220	60	9.2	32.2	306
230	60	9.2	32.0	304
440	60	9.2	16.1	153
460	60	9.2	16.0	152
400	50	8.3	16.7	122
690	50	8.3	9.6	71

Tbl. 7: Motor protection switch setting values for Hena 251 | Hena 301 (from index "A")

5.6.6 Connecting the PTC thermistor tripping unit

Pfeiffer Vacuum recommends connecting motors with PTC in the stator winding to a PTC resistor tripping device for protection against overload. Tripping units store the shut-down.

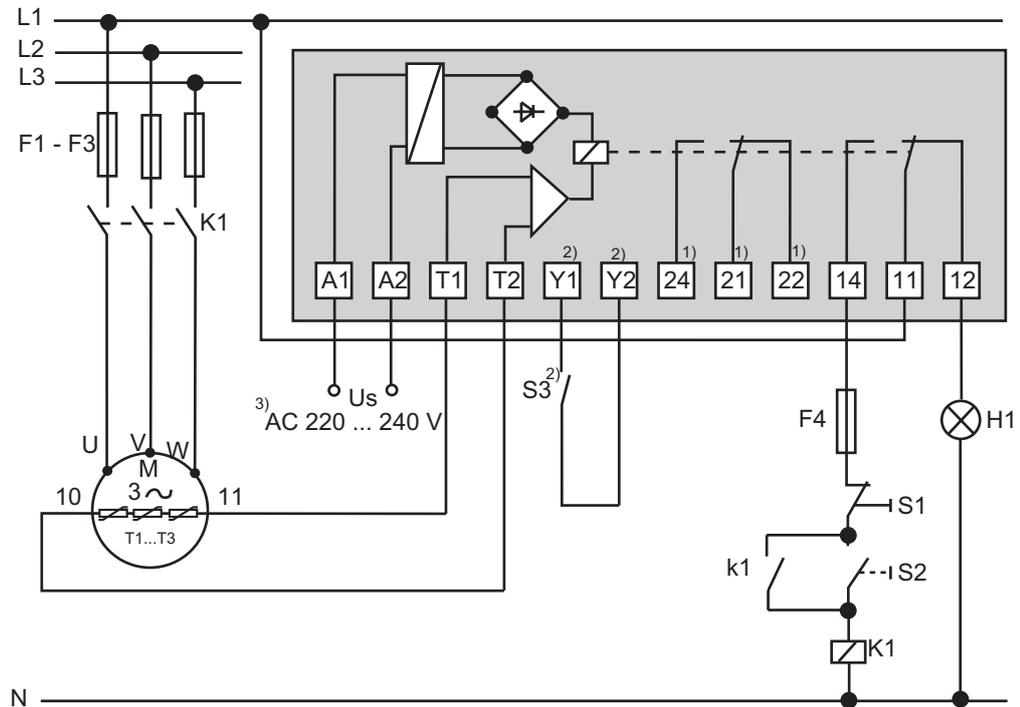


Fig. 13: Connection example with PTC thermistor tripping unit

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

Procedure

- ▶ After shut-down, switch the tripping unit back on manually via the installed RESET button or the external RESET S3.
 - Switching on mains detected as automatic RESET.

6 Operation

6.1 Putting the vacuum pump into operation

WARNING

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

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

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

CAUTION

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

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

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

Before switching on

1. Check the operating fluid in the sight glass.
2. Compare the voltage and frequency specifications on the motor rating plate with the available mains voltage and frequency.
3. Protect the vacuum pump from sucking in contamination using suitable measures.
4. Check the operating fluid at regular intervals.
5. Check the exhaust connection for free passage (max. permissible pressure: atmospheric pressure).
6. Actuate the shut-off units so that the shut-off units open before or at the same time as the pump starts up.
7. Open the cooling water supply.

6.2 Switching on the vacuum pump

WARNING

Risk of burns from ejected hot oil mist

During operation, hot pressurized oil mist escapes from the operating fluid separator.

- ▶ Only operate the vacuum pump with the filler screw securely fitted.
- ▶ Open the locking screws on the separator only while the vacuum pump is switched off.

CAUTION

Risk of injury from suction of body parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically.

There is a risk of minor injuries to fingers and hands (e.g. hematoma) from direct contact with the vacuum flange.

- ▶ Maintain sufficient distance to the vacuum flange during all work.
- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against re-start.

⚠ CAUTION**Danger of burns on hot surfaces**

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above 70 °C.

- ▶ Provide suitable touch protection.

NOTICE**Risk of damage to the drive from increased motor current consumption**

At an intake pressure of approximately 300 hPa and under unfavorable operating conditions (such as for example exhaust side counterpressure), the power input exceeds the rated current.

- ▶ Limit the maximum power input of 1.5 times the rated current to max. 2 minutes (in accordance with EN 60034-1).

**Cycle operation**

Cycle operation with maximum 10 cycles per hour is possible.

Longer operating phases and short downtimes permit a functionally safe operating condition of the vacuum pump.

Operating Conditions

- The optimal operating condition of the vacuum pump is continuous operation.
- When pumping down dry gases, no special precautions are required.
- The lowest possible ultimate pressures can be achieved with the gas ballast valve closed.

Switching on the vacuum pump

1. If required, switch the vacuum pump on in each pressure range.
2. Close the vacuum connection and gas ballast valve.
3. Allow the vacuum pump to warm up prior to process start, with the vacuum connection closed, for approx. 30 minutes.

Inspect operating fluid level

1. Regularly check the operating fluid level while the vacuum pump is running and at operating temperature.
2. Make sure that the fill level is within the markings of the sight glass.
3. Check the operating fluid fill level daily during continuous operation, and every time the vacuum pump is switched on.

6.3 Operating the rotary vane pump with gas ballast

NOTICE**Risk of damage from condensation in vacuum pump**

During operation without gas ballast, condensation may form as a result of the vapor compatibility of the vacuum pump being exceeded.

- ▶ Pump condensable vapors only when the vacuum pump is warm and the gas ballast valve open.
- ▶ Allow the vacuum pump to run on after process end for another 30 minutes with the gas ballast valve open.
 - This cleans the operating fluid and protects the vacuum pump against corrosion.

**No intermediate settings possible**

An intermediate setting between open and closed is not possible.

The gas ballast valve supplies air to the working chamber of the vacuum pump periodically at the beginning of the compression phase. When pumping down vapors, this air prevents condensation within certain limits in the vacuum pump.

Required tool

- Flat-tip screwdriver

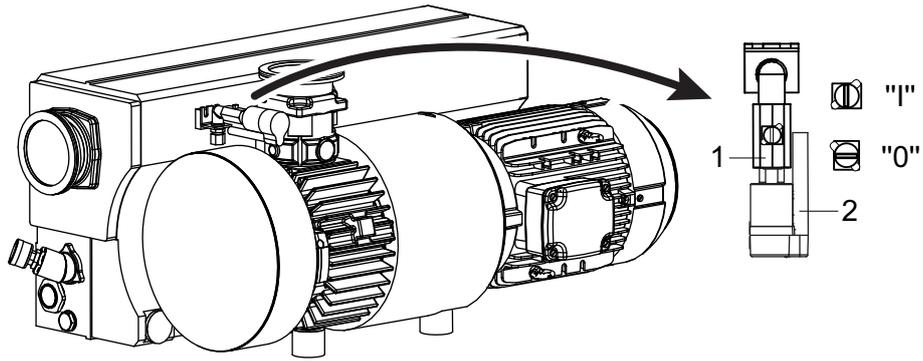


Fig. 14: Gas ballast valve

- 1 Gas ballast valve
- 2 Gas ballast filter

Behavior with process gases with condensable vapors

- ▶ Operate the vacuum pump with gas ballast, i.e. with the gas ballast valve open.

Open gas ballast valve

- ▶ To open, turn the screw on the gas ballast valve to the "I" position.

Close gas ballast valve

- ▶ To close, turn the screw on the gas ballast valve to the position "0".

6.4 Refilling operating fluid

Required consumables

- Operating fluid of the vacuum pump

Required aids

- Funnel (optional)



Refill during operation

Operating fluid can be refilled during operation in the final vacuum.

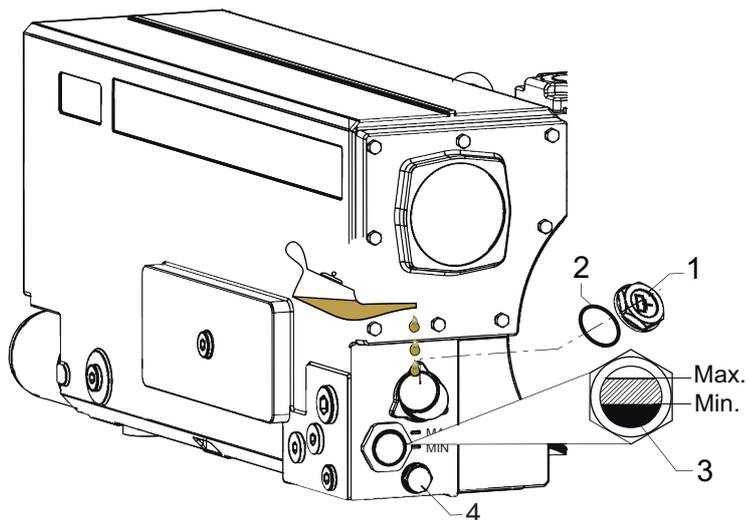


Fig. 15: Refilling operating fluid

- 1 Filler screw
- 2 O-ring
- 3 Sight glass
- 4 Drain screw

Procedure

1. Unscrew the filler screw.
2. With the vacuum pump at operating temperature, refill with operating fluid up to the top marking before the minimum fill level is reached.
3. Screw in the filler screw again.
 - Be careful with the O-ring.

6.5 Switching off the vacuum pump

NOTICE

Contamination from operating fluid backflow

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

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

NOTICE

Contamination from operating fluid backflow

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

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

Rotary vane vacuum pumps of the HenaLine have an integrated non-return valve on the suction side. The non-return valve closes automatically when the vacuum pump is switched off, preventing the return flow of gas and processing materials into the intake line.

Procedure

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

7 Maintenance

7.1 Maintenance instructions

WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

CAUTION

Danger of injury from moving parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

NOTICE

Danger of property damage from improper maintenance

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

- ▶ We recommend taking advantage of our service training offering.
- ▶ When ordering spare parts, specify the information on the nameplate.

The following section describes the tasks for cleaning and maintaining the vacuum pump. More advanced works are described in the service instructions.

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump cooled

Preparing maintenance

- ▶ Safely disconnect the drive motor from the mains.
- ▶ Secure the motor against switching back on.
- ▶ For maintenance work, only dismantle the vacuum pump to the extent needed.
- ▶ Dispose of used operating fluid according to applicable regulations in each case.
- ▶ When using synthetic operating fluid, please observe the associated application instructions.
- ▶ Only clean the pump parts using industrial alcohol, isopropanol or similar media.

7.2 Checklist for inspection and maintenance



Notes on maintenance intervals

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

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

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

We recommend Pfeiffer Vacuum Service for carrying out maintenance work of **Maintenance Level 2** and **Maintenance Level 3** (revision). If the required intervals listed below are exceeded, or if maintenance work is carried out improperly, no warranty or liability claims are accepted on the part of Pfeiffer Vacuum. This also applies if original spare parts are not used.

Action described in document	Inspection BA	Maintenance BA		Inspection MM	Required material
		≤ every six months	≤ 1 years		
Interval	daily			≤ 4 years	
Inspection					
Visual and acoustic pump check <ul style="list-style-type: none"> • Check operating fluid fill level • Check operating fluid color (contamination) • Check saturation of the exhaust filters • Check vacuum pump for leaks 	■				
Check accessories (in accordance with respective operating instructions)	■				
Maintenance level 1 – operating fluid replacement					
<ul style="list-style-type: none"> • Clean the outside of the pump housing • Clean motor fan cap • Changing the operating fluid • Changing the operating fluid filter • Dismantle and clean the filter of the gas ballast valve 		■			Operating fluid Operating fluid filter
Maintenance level 2 – maintenance					
<ul style="list-style-type: none"> • Change the exhaust filter • Clean the operating fluid separator and change the seals • Changing the operating fluid filter 			■		Operating fluid Maintenance kit
Maintenance level 3 – overhaul					
Dismantle and clean vacuum pump, replace seals and all wear parts: <ul style="list-style-type: none"> • Storage • Replace the radial shaft seal ring ¹⁾ • Clean or replace the exhaust valves • Check the coupling and replace the sleeve 				■	Overhaul kit (without vane) Operating fluid
<ul style="list-style-type: none"> • Vane 				■ as required	Set of vanes

Tbl. 8: Maintenance intervals

1) In event of noticeably high loss of operating fluid from operating fluid escaping between the pump housing and motor or fan, the radial shaft seal rings have to be replaced.

7.3 Changing the operating fluid

WARNING

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

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

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

CAUTION

Scalding from hot operating fluid

Danger of burns when draining operating fluid if it comes into contact with the skin.

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



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

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



Operating fluid type

Fundamentally, when filling, refilling, or changing operating fluid, you must always use the operating fluid type specified on the rating plate. Should process conditions change, you can convert to a different operating fluid type.



Safety data sheets

You can obtain the safety data sheets for operating fluids from Pfeiffer Vacuum on request, or from the [Pfeiffer Vacuum Download Center](#).

The usable life of operating fluid is dependent on the area of application of the rotary vane vacuum pumps.

Instructions for when operating fluid should be changed

- The vacuum pump does not reach the specified ultimate pressure.
- Operating fluid is perceptibly polluted, milky, or cloudy when viewed through the sight glass.
- It is possible to detect thermal aging of the operating fluid from its color identification number (applies to mineral oils only).

7.3.1 Determine degree of aging of P3 operating fluid

WARNING

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

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

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

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

Prerequisites

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

Required aids

- Test tube
- Pipette with flexible hose

Determine degree of aging of P3 operating fluid

1. Unscrew the filler screw.
2. Use the pipette to extract a sample of the operating fluid from the filling port.
3. Pour the sample into a test tube.
4. Check the sample in bright light.
5. If it is a reddish-brown color at the latest (corresponding with color identification number 5), change the operating fluid.
6. Screw in the filler screw.

7.3.2 Changing the operating fluid**⚠ WARNING****Health hazard and risk of environmental damage from toxic contaminated operating fluid**

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

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

⚠ CAUTION**Scalding from hot operating fluid**

Danger of burns when draining operating fluid if it comes into contact with the skin.

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

**Cleaning by changing the operating fluid**

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

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump has cooled so that it can be touched
- Operating fluid still warm

Required consumables

- Operating fluid of the vacuum pump

Required tools

- Open-end wrench, **WAF 27**
- Open-end wrench, **WAF 38**

Required aids

- Collection receptacle (> 7 l)

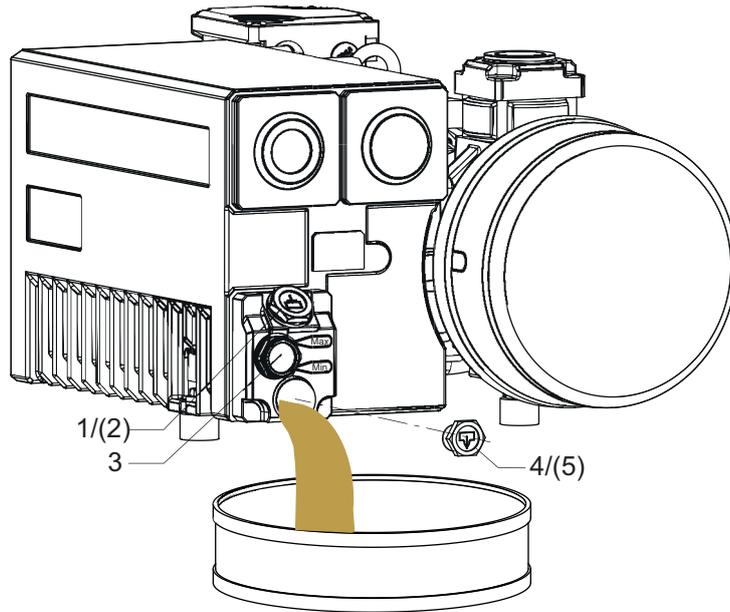


Fig. 16: Draining the operating fluid

- | | |
|----------------|---------------|
| 1 Filler screw | 4 Drain screw |
| 2 O-ring | 5 O-ring |
| 3 Sight glass | |

Draining the operating fluid

1. Unscrew the filler screw.
 - Be careful with the O-ring.
2. Place a collection vessel below the drain hole.
3. Unscrew the drain screw.
 - Be careful with the O-ring.
4. Allow operating fluid to drain into collection vessel.

Filling fresh operating fluid

1. Screw in the drain screw.
 - Be careful with the O-ring.
2. Fill new operating fluid.
3. Check level.
4. Screw in the filler screw.
 - Be careful with the O-ring.

7.3.3 Rinsing and cleaning the rotary vane vacuum pump



Cleaning by changing the operating fluid

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

Prerequisites

- Fresh operating fluid filled

Required aids

- Collection receptacle (> 7 l)

Change operating fluid for cleaning

1. Operate the vacuum pump with the gas ballast open, until it is warm.
2. Perform an operating fluid change.
3. Check the pollution level and repeat the changing of the operating fluid if necessary.
4. In case of highly contaminated operating fluid, replace the operating fluid filter and the exhaust filter.

7.3.4 Changing the operating fluid filter

The operating fluid filter must be changed:

- in event of saturation
 - You can recognize a saturated operating fluid filter by the fact that the filter housing is cool on the outside while the rotary vane pump is running at operating temperature.
- with each operating fluid change
- at least once every six months

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Operating fluid drained

Required tool

- Strap wrench

Required aids

- Collection receptacle (> 1 l)

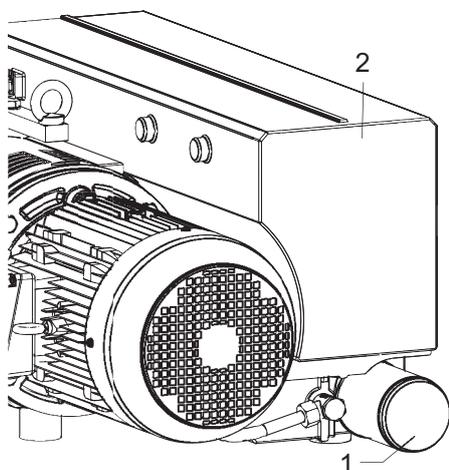


Fig. 17: Changing the operating fluid filter

- 1 Operating fluid filter 2 Operating fluid separator

Procedure

1. Place a collection receptacle below the operating fluid filter.
2. Unscrew the operating fluid filter using a strap wrench.
 - Pay attention to escaping operating fluid.
3. Apply oil to the sealing surface of the operating fluid filter.
4. Screw the operating fluid filter on finger-tight.

7.4 Change the exhaust filter in the operating fluid separator

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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



Change the exhaust filter annually

Pfeiffer Vacuum recommends replacing the exhaust filter in the operating fluid separator annually, depending on the work process and the contamination incurred during the process.

Signs for saturation of the exhaust filter:

- higher current consumption of the motor
- increased emission of operating fluid mist at the gas outlet
- increased pressure in the operating fluid separator (pressure gage display in the red area).

7.4.1 Dismantling the exhaust filters

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump cooled

Required tools

- Socket key, **WAF 13**
- Allen key, **WAF 6**

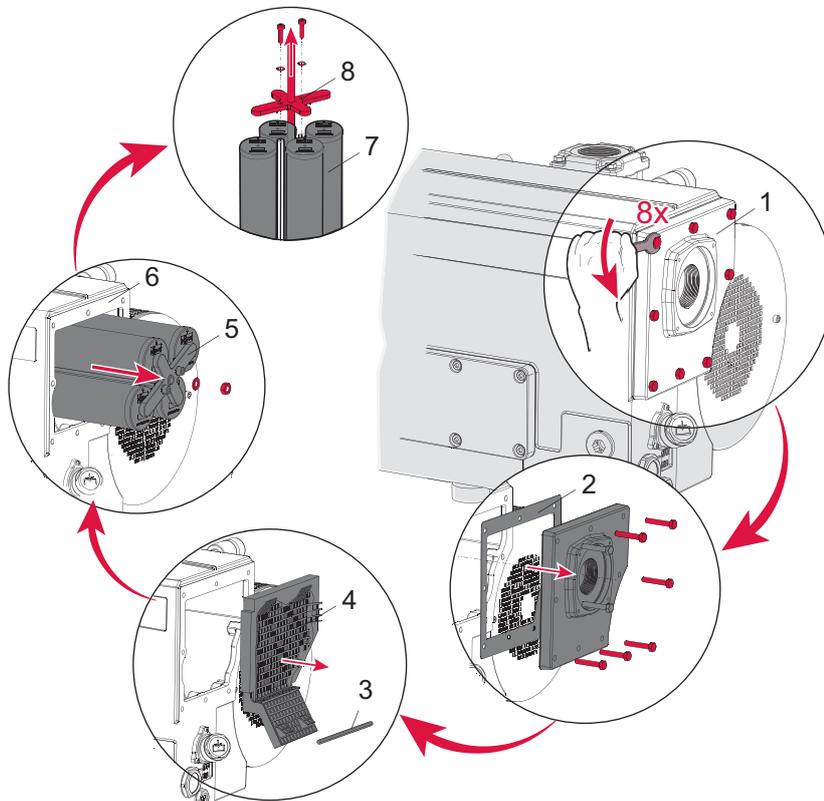


Fig. 18: Dismantling the exhaust filters

- | | |
|-------------------------|-----------------------------|
| 1 Separator cover plate | 5 Filter unit |
| 2 Flat seal | 6 Operating fluid separator |
| 3 Fixing bolts | 7 Exhaust filter |
| 4 Filter material | 8 Clamping plate |

Procedure

1. Remove the exhaust line.
2. Remove the separator cover plate.
 - Pay attention to the flat seal.
3. Remove the fixing bolts inside the operating fluid separator.
4. Remove the filter material.
5. Loosen the nut from the threaded rod of the filter unit.

6. Pull the filter unit completely out of the operating fluid separator.
7. Dismantle the clamping plate.
8. Replace the exhaust filters.

7.4.2 Mounting the exhaust filters

Prerequisites

- Vacuum pump switched off
- Vacuum pump vented to atmospheric pressure
- Vacuum pump cooled

Required consumables

- Maintenance kit – Maintenance level 2

Required tools

- Socket key, **WAF 13**
- Allen key, **WAF 6**
- Calibrated torque wrench (tightening factor ≤ 2.5)

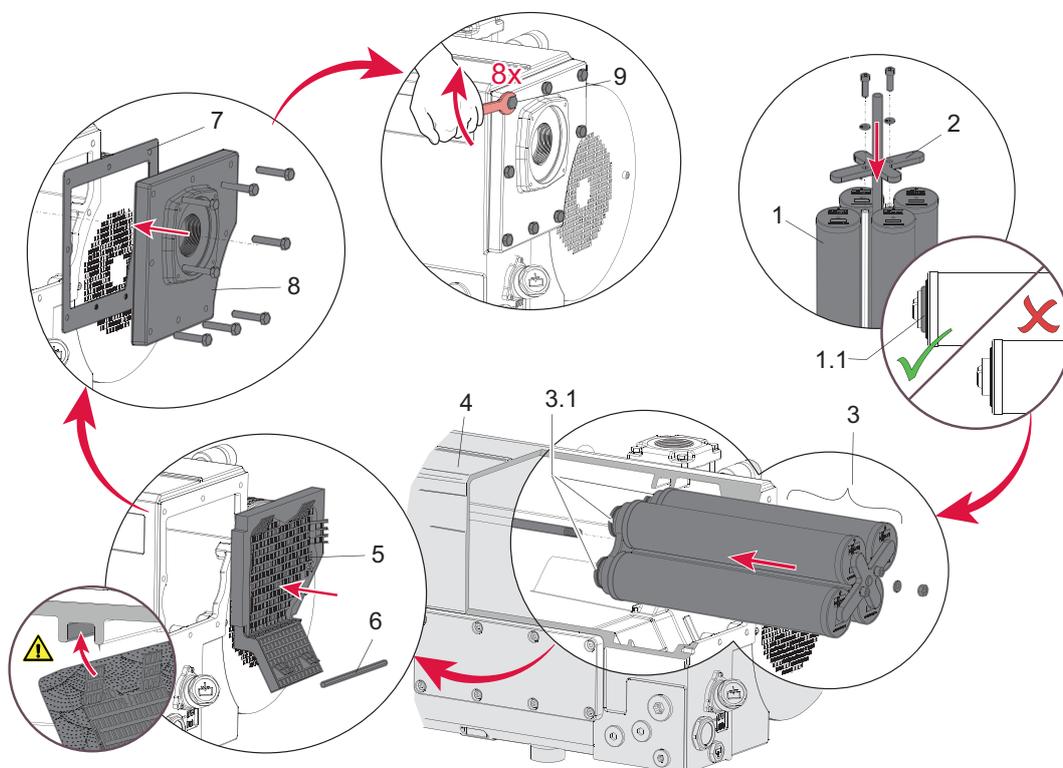


Fig. 19: Mounting the exhaust filters

- | | |
|-----------------------------|-------------------------|
| 1 Exhaust filter | 5 Filter material |
| 1.1 O-ring | 6 Fixing bolts |
| 2 Clamping plate | 7 Flat seal |
| 3 Filter unit | 8 Separator cover plate |
| 3.1 O-ring | 9 Screws |
| 4 Operating fluid separator | |

Procedure

1. Place the new O-ring on the front side of the exhaust filters.
2. Mount the exhaust filters using the clamping plate.
 - The installation orientation is identifiable by an arrow on the filter.
 - The arrow must point upwards (↑).
3. Place the new O-ring on the front side of the filter unit.
4. Insert the pre-assembled filter unit into the operating fluid separator.
5. Insert the new filter material into the housing groove of the operating fluid separator and fix it with the fixing bolts at the same time.

6. Fit the separator cover plate with new flat seal.
7. Tighten the screws on the separator cover plate evenly.
 - Tightening torque: **21 Nm**.

During operation, the new exhaust filter becomes saturated with oil. It is therefore normal for the operating fluid fill level to drop slightly after the filters were changed.

7.5 Cleaning the intake strainer

The intake strainer in the vacuum connection upper section must be cleaned:

- when the throughput decreases
- if there is visible contamination

Required tool

- Hexagonal wrench, **WAF 13**

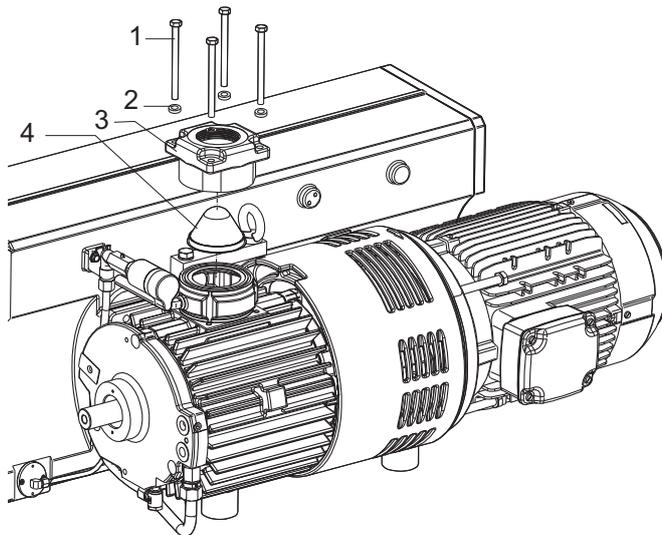


Fig. 20: Dismantling / assembling the intake strainer

- | | |
|--------------------|---------------------|
| 1 Cheesehead screw | 3 Vacuum connection |
| 2 Washer | 4 Intake strainer |

Dismantling the intake strainer

1. Dismantle the operating fluid return line from the vacuum connection.
2. Unscrew the cheesehead screws.
3. Remove the vacuum connection.
 - Pay attention to the washers.
4. Remove the intake strainer from the intake duct.
5. Dismantle the part of the non-return valve resting in the intake duct.

Clean all parts and examine for wear

1. Clean all parts.
2. Examine all parts for wear.

Assembling the intake strainer

1. Mount the parts of the non-return valve.
2. Insert the intake strainer into the intake duct.
3. Fit the vacuum connection.
 - Pay attention to the washers.
4. Screw on the cylinder screws.
5. Mount the operating fluid return line to the vacuum connection.

7.6 Cleaning the gas ballast filter

The gas ballast filter is soiled if the vacuum pump takes in ambient air containing dust during gas ballast operation.

As the soiling increases, the throughput of the gas ballast filter decreases. The risk of condensation and corrosion in the vacuum pump increases.

Required consumables

- Compressed air

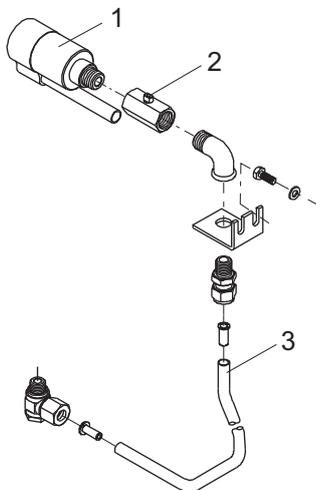


Fig. 21: Cleaning the gas ballast filter

- | | |
|----------------------|--------------------|
| 1 Gas ballast filter | 3 Gas ballast line |
| 2 Gas ballast valve | |

Removing and cleaning the gas ballast filter

1. Dismantle the gas ballast filter.
2. Clean the gas ballast filter using compressed air.
3. Replace the gas ballast filter in the event of major contamination or damage.
4. Check and clean the gas ballast line using compressed air if the gas ballast line is clogged.

7.7 Changing the operating fluid type



Possibilities for changing the operating fluid type

The operating fluid type can be changed between mineral operating fluid – **P3** – and synthetic operating fluid – **D1** – only.

It is not possible to change from **P3/D1** to **F4/F5** or vice versa.

Required consumables

- 3 times the filling quantity of the new operating fluid

Changing the operating fluid type

1. Change the operating fluid with the new operating fluid **twice** in order to rinse the vacuum pump.
2. Change the exhaust filters in the operating fluid separator.
3. Change the operating fluid filter.
4. Fill the vacuum pump with operating fluid to one third full.
5. Note the currently used operating fluid type at a suitable location on the vacuum pump, e.g. on the rating plate.

8 Decommissioning

8.1 Shutting down for longer periods

Before shutting down the vacuum pump, observe the following instructions to adequately protect the interior of the vacuum pump (pumping system) against corrosion:

1. Switch off the vacuum pump.
2. Vent the vacuum pump.
3. Allow the vacuum pump to cool down.
4. Remove the vacuum pump from the vacuum system if necessary.
5. Change the operating fluid.
6. Start the vacuum pump and bring it to operating temperature in order to wet the inside of the vacuum pump with fresh operating fluid.
7. Seal the connections with the original protective caps.
8. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
9. Pack the vacuum pump together with a drying agent in a plastic bag, and seal the vacuum pump airtight if it is to be stored in rooms with damp or aggressive atmospheres.
10. For longer storage periods (> 2 years), Pfeiffer Vacuum recommends changing the operating fluid again prior to recommissioning.

8.2 Recommissioning

NOTICE

Risk of damage to vacuum pump as a result of operating fluid aging

The operating fluid usability is limited (max. 2 years). Prior to recommissioning, following a shutdown of **2 years or more**, carry out the following work.

- ▶ Change the operating fluid.
- ▶ Change the radial shaft seal rings and other elastomer parts if required.
- ▶ Observe the maintenance instructions – consult Pfeiffer Vacuum if necessary.

8.3 Disposing of the vacuum pump

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

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

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

Procedure

- ▶ Dispose safely of all substances according to local regulations.

9 Malfunctions

⚠ CAUTION

Danger of injury from moving parts

After a power failure or a standstill as a result of overheating, the motor restarts automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.

- ▶ Safely disconnect motor from the mains.
- ▶ Secure the motor against reactivation.
- ▶ Dismantle the vacuum pump for inspection, away from the system if necessary.

⚠ CAUTION

Danger of burns on hot surfaces

In the event of a fault, the surface temperature of the vacuum pump can increase to above 105 °C.

- ▶ Allow the vacuum pump to cool down before carrying out any work.
- ▶ Wear personal protective equipment if necessary.

NOTICE

Danger of property damage from improper maintenance

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

- ▶ We recommend taking advantage of our service training offering.
- ▶ When ordering spare parts, specify the information on the nameplate.

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

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

Problem	Possible causes	Remedy
Vacuum pump does not reach the specified ultimate pressure	<ul style="list-style-type: none"> Measurement result distorted 	<ul style="list-style-type: none"> Check the measurement instrument. Check the ultimate pressure without system connected.
	<ul style="list-style-type: none"> Vacuum pump or connected accessory contaminated 	<ul style="list-style-type: none"> Clean the vacuum pump. Check the components for contamination.
	<ul style="list-style-type: none"> Operating fluid contaminated 	<ul style="list-style-type: none"> Operate the vacuum pump with the gas ballast valve open over a longer period. Change the operating fluid.
	<ul style="list-style-type: none"> Operating fluid level too low 	<ul style="list-style-type: none"> Top up the operating fluid.
	<ul style="list-style-type: none"> Leak in system 	<ul style="list-style-type: none"> Locate and eliminate the leak.
	<ul style="list-style-type: none"> Vacuum pump is damaged 	<ul style="list-style-type: none"> Contact Pfeiffer Vacuum Service.
Pumping speed of vacuum pump too low	<ul style="list-style-type: none"> The intake line is not suitably dimensioned 	<ul style="list-style-type: none"> Make sure that connections are short and cross sections adequately dimensioned.
	<ul style="list-style-type: none"> Exhaust pressure too high 	<ul style="list-style-type: none"> Check exhaust line outlet openings and exhaust side accessories.
Loss of operating fluid	<ul style="list-style-type: none"> Operating fluid separator leaking 	<ul style="list-style-type: none"> Check for leaks. Replace the seal as required.
	<ul style="list-style-type: none"> Radial shaft seal rings (RSSR) leaking 	<ol style="list-style-type: none"> Check the RSSR. Replace the RSSR if required. Check and also replace the associated bushing if necessary.
	<ul style="list-style-type: none"> Operational loss of operating fluid 	<ul style="list-style-type: none"> Check the oil return.
Unusual noises during operation	<ul style="list-style-type: none"> Pumping system is contaminated or damaged 	<ul style="list-style-type: none"> Clean and maintain the vacuum pump. Contact Pfeiffer Vacuum Service.
	<ul style="list-style-type: none"> Motor bearing is faulty 	<ul style="list-style-type: none"> Change the motor. Contact Pfeiffer Vacuum Service.

Tbl. 9: Troubleshooting for rotary vane pumps

10 Service solutions from Pfeiffer Vacuum

We offer first class service

Long vacuum component service life, coupled with low downtimes, are clear expectations that you have of us. We satisfy your needs with capable products and outstanding service.

We are consistently striving to perfect our core competence, service for vacuum components. And our service is far from over once you've purchased a product from Pfeiffer Vacuum. It often enough really just begins then. In proven Pfeiffer Vacuum quality, of course.

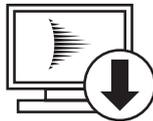
Our professional sales engineers and service technicians stand ready to provide hands-on support to you worldwide. Pfeiffer Vacuum offers a complete portfolio of service offerings, ranging from genuine spare parts right through to service agreements.

Take advantage of Pfeiffer Vacuum Service

Whether for preventative on-site service from our field service, fast replacement with as-new replacement products or repair in a Service Center close to you; you have various options for upholding your equipment availability. Detailed information and addresses can be found on our website in the Pfeiffer Vacuum Service section.

Advice on the optimum solution is available from your Pfeiffer Vacuum contact partner.

For quick and smooth handling of the service process, we recommend the following steps:



1. Download the current form templates.
 - [Declaration of Service Request](#)
 - [Service Request](#)
 - [Declaration of Contamination](#)



- a) Dismantle all accessories and keep them (all external mounted parts as valve, inlet screen, etc.).
 - b) Drain the operating fluid/lubricant as necessary.
 - c) Drain the cooling medium as necessary.
2. Fill out the service request and the declaration of contamination.



3. Send the forms via email, fax or post to your local Service Center.

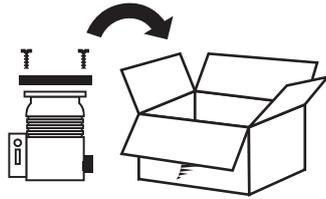


4. You will receive a response from Pfeiffer Vacuum.

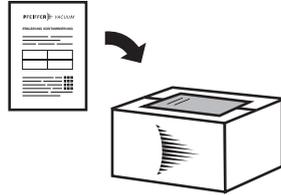
PFEIFFER VACUUM

Sending of contaminated products

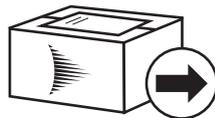
No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. If products are contaminated or if the declaration of contamination is missing, Pfeiffer Vacuum will contact the customer before starting maintenance. In addition, depending on the product and the level of contamination **additional decontamination costs** may be required.



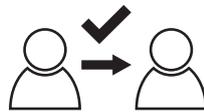
5. Prepare the product for transport in accordance with the details in the declaration of contamination.
 - a) Neutralize the product with nitrogen or dry air.
 - b) Close all openings with airtight blank flanges.
 - c) Seal the product in appropriate protective film.
 - d) Only pack the product in suitable, stable transport containers.
 - e) Observe the applicable transport conditions.



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



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



8. You will receive a confirmation message/a quotation from Pfeiffer Vacuum.

PFEIFFER VACUUM

For all service orders, our General Terms and Conditions of Sales and Supply and General Terms and Conditions of Repair and Maintenance apply to vacuum equipment and components.

11 Spare parts

11.1 Ordering spare parts packs

Procedure

1. Have the vacuum pump part number to hand, along with other details from the rating plate.
2. Use only original spare parts.

Spare parts package	Order no.
Set of seals	PK E60 022 -T
Maintenance kit	PK E61 022 -T
Overhaul kit without vane	PK E62 024 -T
Set of vanes	PK E68 024 -T
Coupling set	PK E63 000 -T
Operating fluid filter	P 0920 591 E
Gas ballast filter	PK 100 171 -U
Manometer, 0 – 1 bar	PK 100 127

Tbl. 10: Spare parts packages Hena 201

Spare parts package	Order no.
Set of seals	PK E60 023 -T
Maintenance kit	PK E61 022 -T
Overhaul kit without vane	PK E62 025 -T
Set of vanes	PK E68 025 -T
Coupling set	PK E63 000 -T
Operating fluid filter	P 0920 591 E
Gas ballast filter	PK 100 171 -U
Manometer, 0 – 1 bar	PK 100 127

Tbl. 11: Spare parts packages Hena 251 | Hena 301 | Hena 301 S

11.2 Operating fluids – Maintenance level 1

Select the respective operating fluid type and quantity under consideration of the details on the rating plate.

Description	Order number
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
D1, synthetic diester based oil, 1 l	PK 005 875 -T
D1, synthetic diester based oil, 5 l	PK 005 876 -T

Tbl. 12: Consumables

11.3 Maintenance kit – maintenance level 2

The maintenance kit contains:

- Filler and drain screw seals for one operating fluid change
- Seals of the separator cover plate for cleaning the oil chamber
- Exhaust filter

- Operating fluid filter
- Filter material

11.4 Overhaul kit – maintenance level 3

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

- Set of seals with all seals relevant for the function
- Bearing
- Intake strainer
- Operating fluid and exhaust filters
- Wearing parts of the valves
- Coupling sleeve

11.5 Set of seals

The set of seals contains:

- all seals from the main- and sub-assemblies,
- Radial shaft seal rings (RSSR)

11.6 Set of vanes

The set of vanes contains:

- Vane

11.7 Coupling set

The coupling set contains:

- two coupling halves
- Coupling sleeve

12 Accessories



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

12.1 Accessory information

Operating fluid level switch

Monitors operating fluid level

Operating fluid temperature switch

Monitors operating fluid temperature

Condensate separator

Protects the pump from liquids from inlet line or backflow from exhaust line

Dust separators

Protects the pump from particles out of processes

Magnetized gas ballast valve

Solenoid valve for remote control of gas ballast

PTC resistor tripping device

Monitors the motor winding temperature

12.2 Ordering accessories

Description	Order number
Operating Fluid Level Switch	PK 100 116
Operating Fluid Temperature Switch	PK 100 125
KAS 63, Condensate Separator	PK Z10 010
FAK 063, Activated Carbon Filter	PK Z30 010
SAS 63, DN 63 ISO-K	PK Z60 511
Screw-in flange DN 100 ISO-K / G 2"	PK 100 058
Screw-in flange DN 63 ISO-K / G 2"	PK 100 059
Magnetic Gas Ballast Valve 24 V DC	PK 100 145 -U
PTC Resistor Tripping Device 220 – 240 V AC	P 4768 052 FQ
PTC Resistor Tripping Device 24 V AC/DC	P 4768 052 FE

Tbl. 13: Accessories

Description	Order number
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
D1, synthetic diester based oil, 1 l	PK 005 875 -T
D1, synthetic diester based oil, 5 l	PK 005 876 -T

Tbl. 14: Consumables

13 Technical data and dimensions

13.1 General

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

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

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

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

Tbl. 15: Conversion table: Pressure units

	mbar l/s	Pa m ³ /s	sccm	Torr l/s	atm cm ³ /s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m ³ /s	10	1	592	7.5	9.87
sccm	$1.69 \cdot 10^{-2}$	$1.69 \cdot 10^{-3}$	1	$1.27 \cdot 10^{-2}$	$1.67 \cdot 10^{-2}$
Torr l/s	1.33	0.133	78.9	1	1.32
atm cm ³ /s	1.01	0.101	59.8	0.76	1

Tbl. 16: Conversion table: Units for gas throughput

13.2 Technical data

Classification	Hena 201	Hena 251
Order number	PK D03 400	PK D03 432
Connection: Atmospheric side	Female thread G 2"	Female thread G 2"
Connection: Vacuum side	Female thread G 2"	Female thread G 2"
Nominal pumping speed at 50 Hz	200 m ³ /h	250 m ³ /h
Nominal pumping speed at 60 Hz	240 m ³ /h	300 m ³ /h
Ultimate pressure with gas ballast	$\leq 7 \cdot 10^{-1}$ hPa	$\leq 7 \cdot 10^{-1}$ hPa
Ultimate pressure without gas ballast	$\leq 3 \cdot 10^{-1}$ hPa	$\leq 3 \cdot 10^{-1}$ hPa
Continuous inlet pressure, max.	800 hPa	800 hPa
Leak rate safety valve	$\leq 8 \cdot 10^{-3}$ Pa m ³ /s	$\leq 8 \cdot 10^{-3}$ Pa m ³ /s
Exhaust pressure, max.	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure
Water vapor capacity 50 Hz	4000 g/h	4500 g/h
Water vapor capacity 60 Hz	4600 g/h	5200 g/h
Water vapor tolerance at 50 Hz	40 hPa	40 hPa
Water vapor tolerance at 60 Hz	40 hPa	40 hPa

Classification	Hena 201	Hena 251
Emission sound pressure level without gas ballast at 50 Hz	≤ 72 dB(A)	≤ 72 dB(A)
Emission sound pressure level without gas ballast at 60 Hz	≤ 74 dB(A)	≤ 74 dB(A)
Cooling method, standard	Air	Air
Continuous gas temperature, max.	80 °C	80 °C
Operating fluid filling	6.5 l	6.5 l
Ambient temperature	12 – 40 °C	12 – 40 °C
Transport and storage temperature	-25 – 55 °C	-25 – 55 °C
Motor version	3-ph motor	3-ph motor
Mains requirement: voltage 50 Hz	190–200/220–230/380–400 V	190–200/220–230/380–400 V
Mains requirement: voltage 60 Hz	208/220/230/440/460 V	208/220/230/440/460 V
Mains requirement: voltage (range)	±5 %	±5 %
Rated power 50 Hz	5.5 kW	7.5 kW
Rated power 60 Hz	6.6 kW	9.2 kW
Rotation speed at 50 Hz	1500 rpm	1500 rpm
Rotation speed at 60 Hz	1800 rpm	1800 rpm
Protection category	IP55	IP55
Motor protection	PTC	PTC
Switch included	No	No
Mains cable included	No	No
Weight	182 kg	227 kg

Tbl. 17: Technical data Hena 201 | Hena 251

Classification	Hena 301	Hena 301 S	Hena 301
Order number	PK D03 450	PK D03 455	PK D03 461
Connection: Atmospheric side	Female thread G 2"	Female thread G 2"	Female thread G 2"
Connection: Vacuum side	Female thread G 2"	Female thread G 2"	Female thread G 2"
Nominal pumping speed at 50 Hz	300 m ³ /h	300 m ³ /h	300 m ³ /h
Nominal pumping speed at 60 Hz	360 m ³ /h	360 m ³ /h	360 m ³ /h
Ultimate pressure with gas ballast	≤ 7 · 10 ⁻¹ hPa	≤ 7 · 10 ⁻¹ hPa	≤ 7 · 10 ⁻¹ hPa
Ultimate pressure without gas ballast	≤ 3 · 10 ⁻¹ hPa	≤ 3 · 10 ⁻¹ hPa	≤ 3 · 10 ⁻¹ hPa
Continuous inlet pressure, max.	800 hPa	100 hPa	800 hPa
Leak rate safety valve	≤ 8 · 10 ⁻³ Pa m ³ /s	≤ 8 · 10 ⁻³ Pa m ³ /s	≤ 8 · 10 ⁻³ Pa m ³ /s
Exhaust pressure, max.	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure
Exhaust pressure, min.	Atmospheric pressure	Atmospheric pressure	Atmospheric pressure
Water vapor capacity 50 Hz	5000 g/h	5000 g/h	5000 g/h
Water vapor capacity 60 Hz	5800 g/h	5800 g/h	5800 g/h
Water vapor tolerance at 50 Hz	40 hPa	40 hPa	40 hPa

Classification	Hena 301	Hena 301 S	Hena 301
Water vapor tolerance at 60 Hz	40 hPa	40 hPa	40 hPa
Emission sound pressure level without gas ballast at 50 Hz	≤ 74 dB(A)	≤ 74 dB(A)	≤ 74 dB(A)
Emission sound pressure level without gas ballast at 60 Hz	≤ 76 dB(A)	≤ 76 dB(A)	≤ 76 dB(A)
Cooling method, standard	Air	Air	Water
Cooling water pressure	–	–	2 000 – 6 000 hPa
Cooling water flow	–	–	150 l/h
Cooling water temperature	–	–	5 – 35 °C
Continuous gas temperature, max.	80 °C	80 °C	80 °C
Operating fluid filling	6.5 l	6.5 l	6.5 l
Ambient temperature	12 – 40 °C	12 – 40 °C	12 – 40 °C
Transport and storage temperature	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C
Motor version	3-ph motor	3-ph motor	3-ph motor
Mains requirement: voltage 50 Hz	190–200/220–230/380–400 V	190–200/220–230/380–400 V	190–200/220–230/380–400 V
Mains requirement: voltage 60 Hz	208/220/230/440/460 V	208/220/230/440/460 V	208/220/230/440/460 V
Mains requirement: voltage (range)	±5 %	±5 %	±5 %
Rated power 50 Hz	7.5 kW	7.5 kW	7.5 kW
Rated power 60 Hz	9.2 kW	9.2 kW	9.2 kW
Rotation speed at 50 Hz	1500 rpm	1500 rpm	1500 rpm
Rotation speed at 60 Hz	1800 rpm	1800 rpm	1800 rpm
Protection category	IP55	IP55	IP55
Motor protection	PTC	PTC	PTC
Gas ballast	Yes	Yes	Yes
Switch included	No	No	No
Mains cable included	No	No	No
Weight	227 kg	227 kg	227 kg

Tbl. 18: Technical data Hena 301 | Hena 301 S

13.3 Dimensions

Dimensions in mm

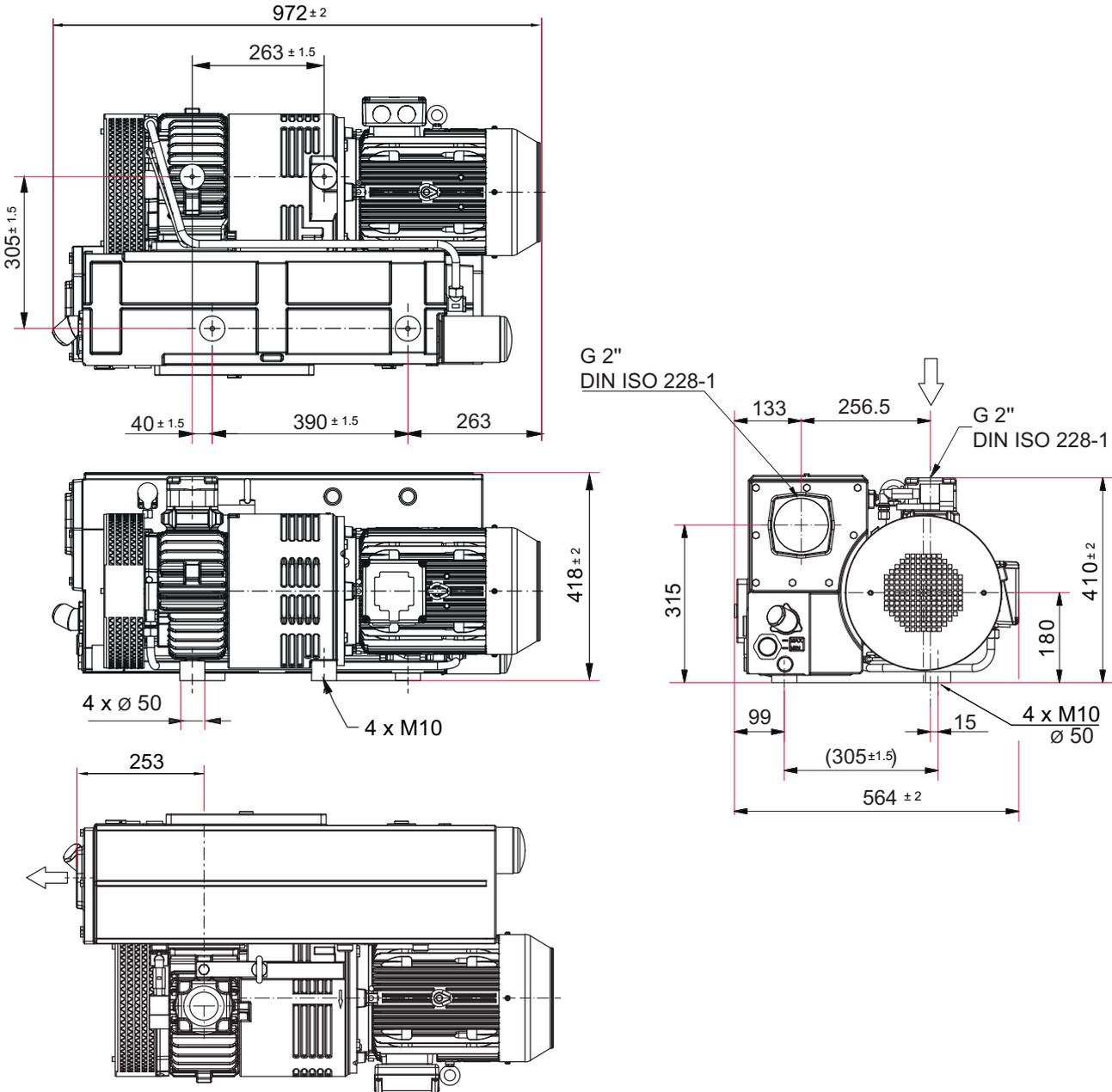


Fig. 22: Dimensions Hena 201 | Three phase motor IE3

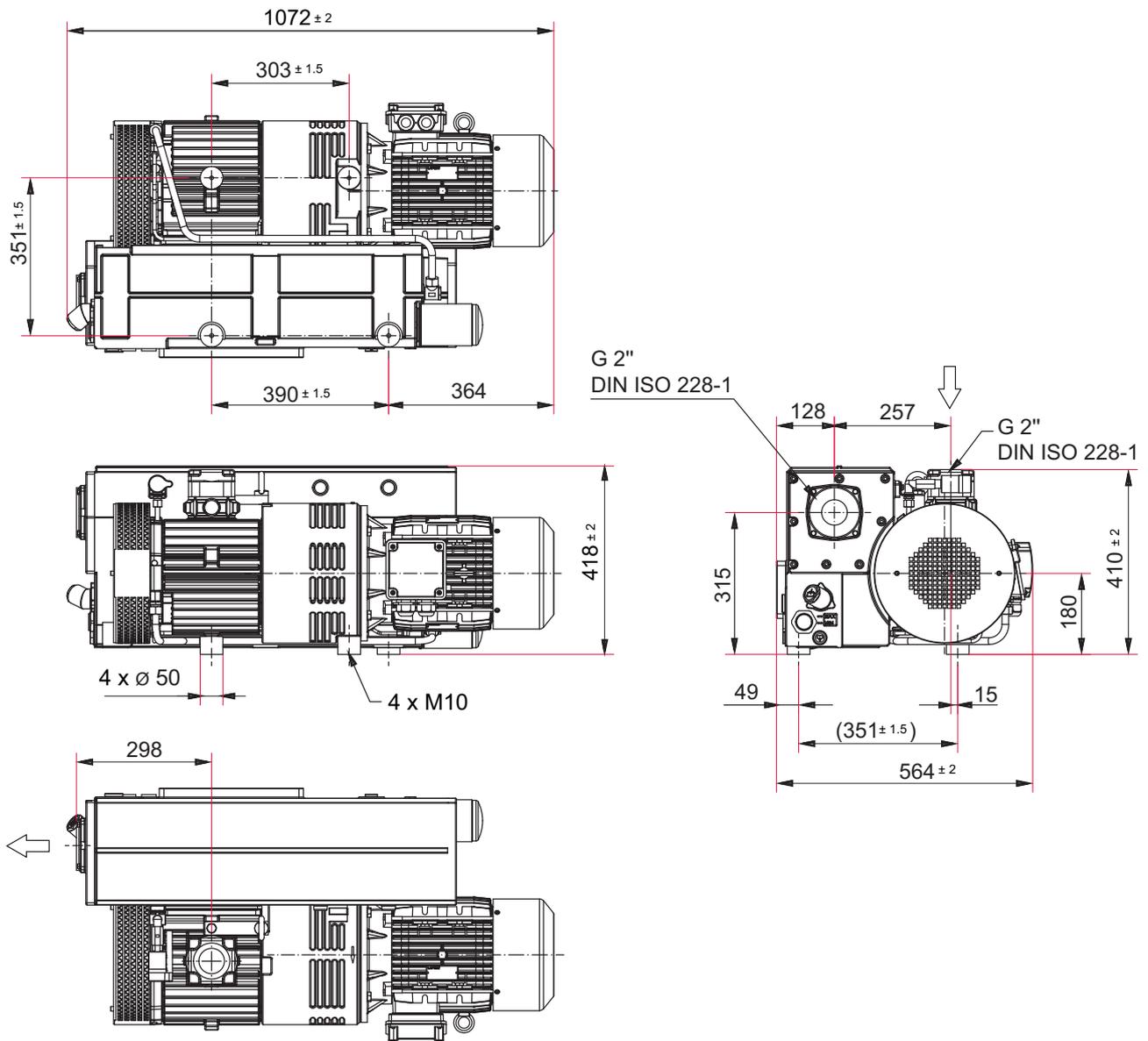


Fig. 23: Dimensions Hena 251 | Three phase motor IE3

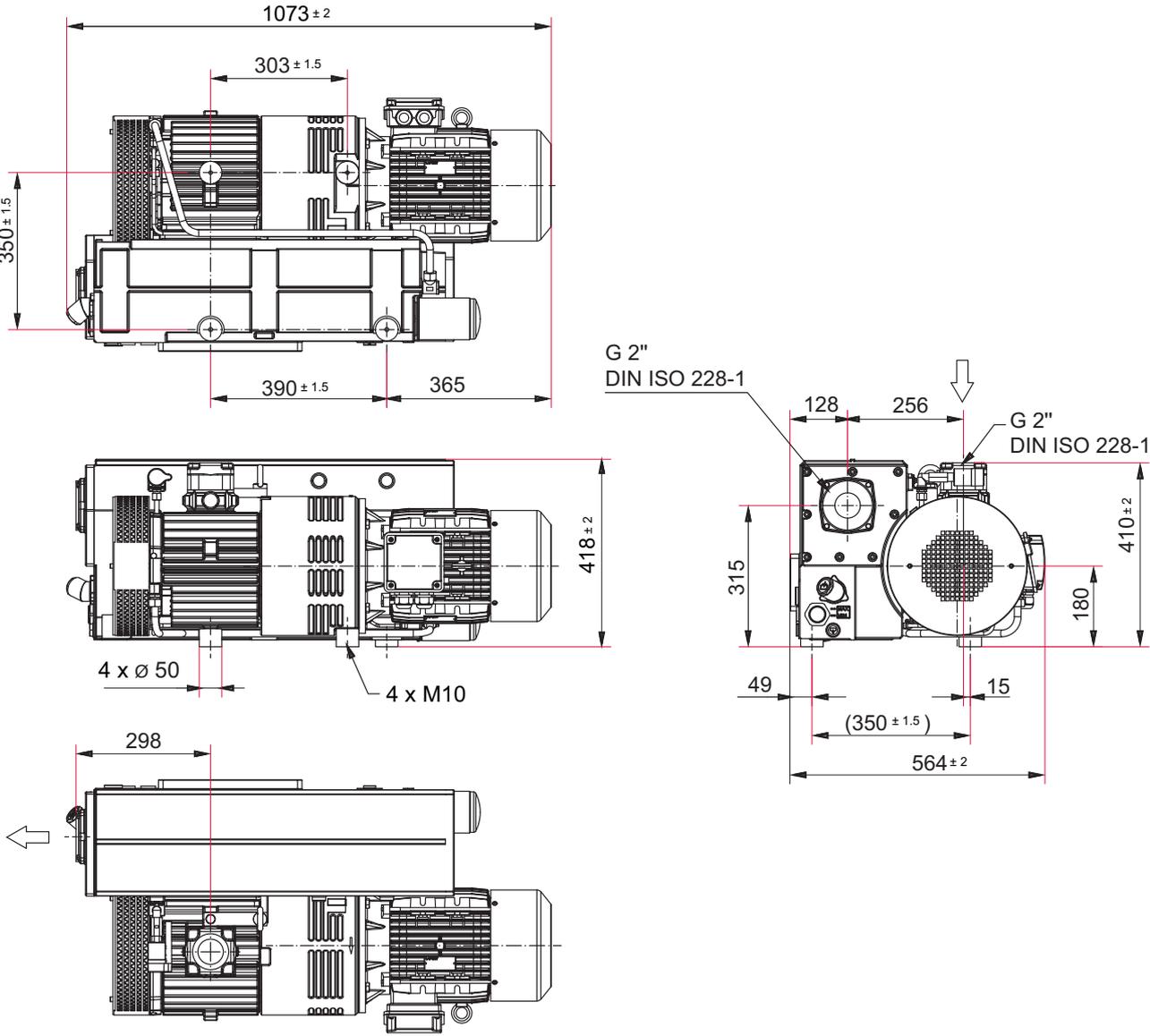


Fig. 24: Dimensions Hena 301 | Three phase motor IE3

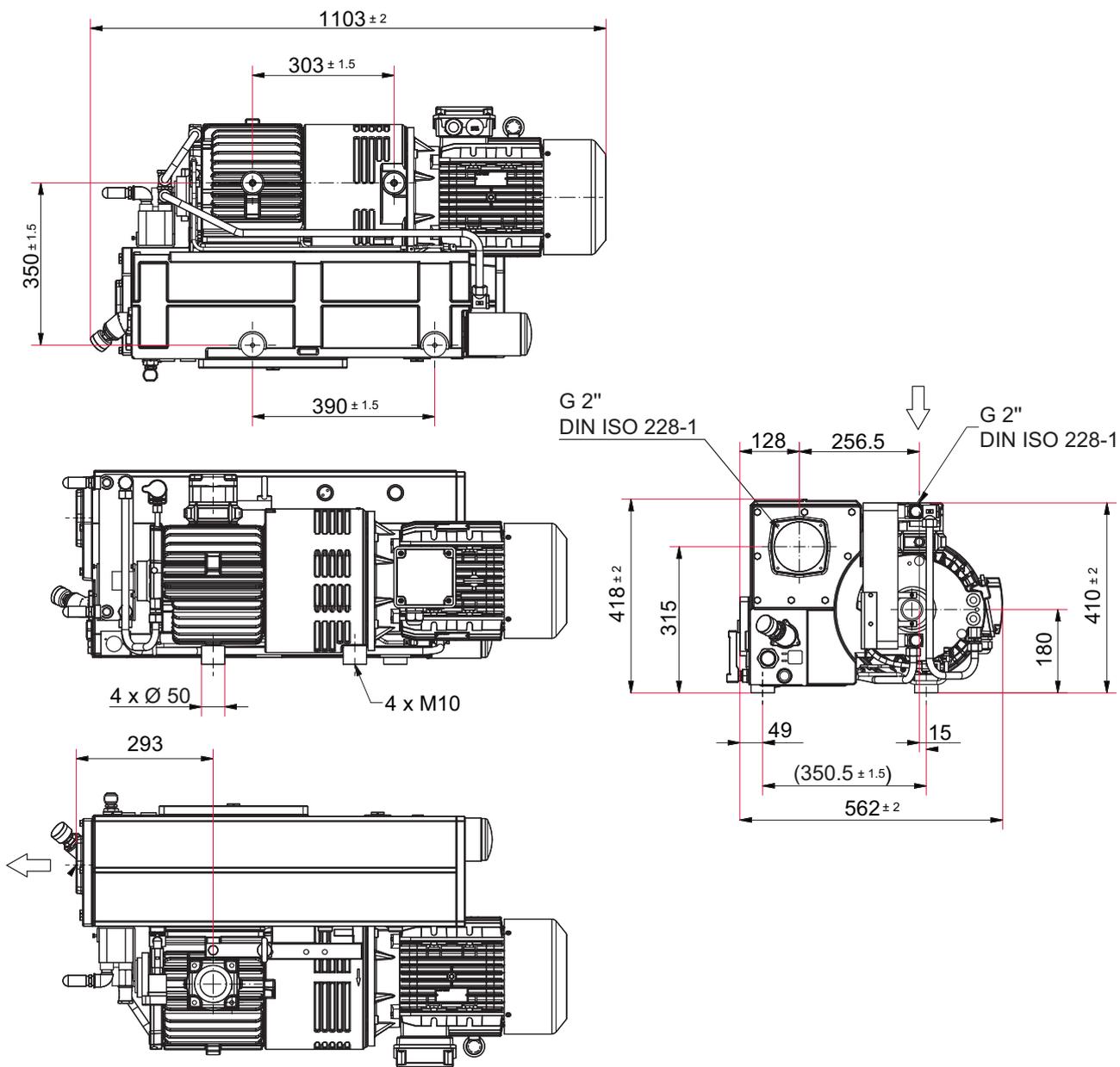


Fig. 25: Dimensions Hena 301 | Three phase motor IE3 and oil/water heat exchanger

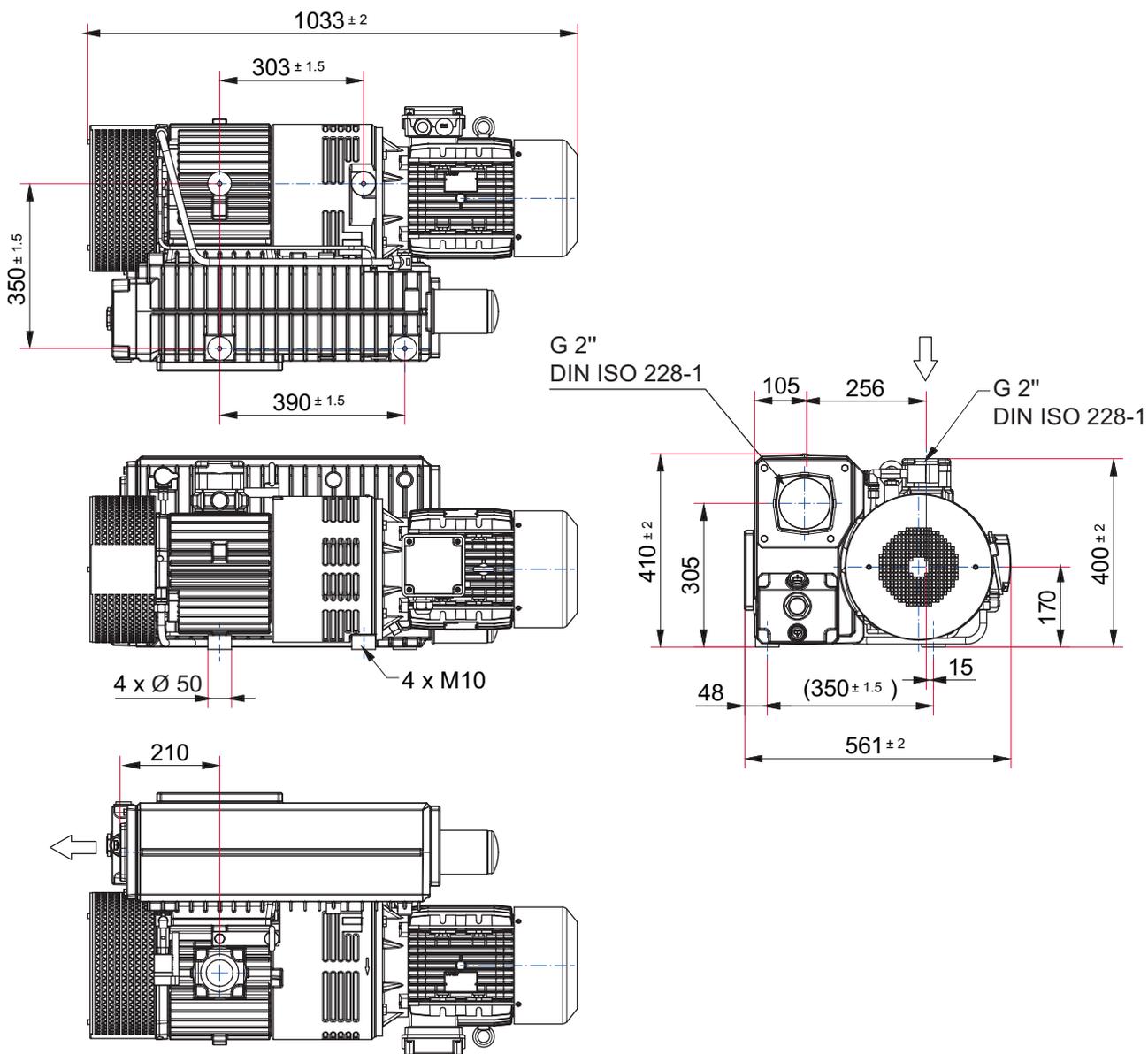


Fig. 26: Dimensions Hena 301 S | Three phase motor IE3

Declaration of conformity

Declaration for product(s) of the type:

Rotary vane pump

Hena 201
Hena 251
Hena 301
Hena 301 S

We hereby declare that the listed product satisfies all relevant provisions of the following **European Directives**.

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

Electromagnetic compatibility 2014/30/EU

Restriction of the use of certain hazardous substances 2011/65/EU

Restriction of the use of certain hazardous substances, delegated directive 2015/863/EU

Harmonized standards and applied national standards and specifications:

DIN EN ISO 12100: 2011-03

DIN EN 60204-1: 2019-06

DIN EN ISO 13857: 2008-06

DIN EN 61000-6-2: 2006-03

DIN EN 1012-1: 2011-02

DIN EN 61000-6-4: 2011-09

DIN EN 1012-2 : 2011-12

DIN EN ISO 2151 : 2009-01

DIN EN 13849-1: 2016-06

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

Signature:



Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Asslar, 2019-10-18





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

www.pfeiffer-vacuum.com

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