

OPERATING INSTRUCTIONS

EN

Translation of the Original

MVP 160-3 Diaphragm vacuum pump

PFEIFFER  **VACUUM**

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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 a 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 Related documents

Designation	Document
Declaration of conformity	A component of these instructions

Current documents are available from the [Pfeiffer Vacuum Download Center](#).

1.1.2 Variants

This operating manual applies to pumps with the following part numbers:

Part number	Designation
PK T01 400	MVP 160-3

1.2 Target group

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

- transport,
- 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 Pictographs

Pictographs used in the document indicate useful information.






Note



Tip




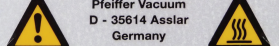


1.3.2 Symbols used

-  Vacuum connection
-  Power connection
-  Pressure connection (exhaust)

Tbl. 1: Symbols used

1.3.3 Product sticker

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

 <p>The rating plate contains the following information: PFEIFFER VACUUM Mod.: MVP 160-3 2017 / 10  Mod.Nr.: PK T01 400 S (N₂) max. 9.6/10.4 m³/h 230 V 50/60 Hz 2.8 A Pw: 390 W M: 25 kg Ser. -Nr.: 2743691103   Pfeiffer Vacuum D - 35614 Asslar Germany</p>	<p>Rating plate The rating plate is located on the housing panel.</p>
	<p>General warning signs The label provides a general warning of potential hazards, in this case in relation to the hot surfaces warning.</p>
	<p>Warning of hot surfaces The label warns of hot surfaces during operation or immediately after switching off the pump.</p>

1.3.4 Instructions in the text

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by a individual 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 numbering indicates an action with multiple action steps required.

1. Action step 1
2. Action step 2
3. ...

2 Safety

2.1 General safety instructions

This document includes the following four risk levels and one information level.

DANGER

Imminent danger

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

- ▶ Instructions on avoiding the hazardous situation

WARNING

Possibly imminent danger

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

- ▶ Instructions on avoiding the hazardous situation

CAUTION

Possibly imminent danger

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

- ▶ Instructions on avoiding the hazardous situation

NOTICE

Danger of property damage

Notice is used to address practices not related to physical injury.

- ▶ Instructions on avoiding property damage



Notes, tips or examples identify important information on the product or on this document.

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 EN ISO 12100 Section 5. As far as applicable, all unit life cycle phases have been considered.

Risks during transport

WARNING

Danger of serious injury due to falling objects

Due to falling objects there is a risk of injuries to limbs through to broken bones.

- ▶ Take particular care and pay special attention when transporting products manually.
- ▶ Do not stack the products.
- ▶ Wear protective equipment, e.g. safety shoes.

NOTICE

Damage caused during transport

Transport in unsuitable packaging or failure to install all transport locks can damage the product.

- ▶ Observe the transport instructions.
- ▶ Always transport the pump in its original packaging.
- ▶ Transport the pump using only the transport handles provided.
- ▶ Always use dense and impact-proof packaging for the pump.
- ▶ Seal inlet and outlet ports (for example using transport caps).
- ▶ Reattach transport locks prior to every transport.

Risks during storage

NOTICE

Damage caused by improper storage
 Improper storage damages the pump.

- ▶ Store the pump in a cool, dry, dust-free place, where it is protected against impacts.
- ▶ Seal inlet and outlet ports (for example using transport caps).
- ▶ Maintain the permissible storage temperature. (See technical data)

Risks during installation

⚠ DANGER

Danger to life from improperly earthed unit
 An improperly earthed unit is a potential threat to life in the event of a fault.

- ▶ Conduct the electrical connection in accordance with locally applicable regulations.
- ▶ Make sure that the local mains voltage and frequency match rating plate specifications.
- ▶ Use only a 3-pin mains cable and extension cables with properly connected protective earthing (earthed conductor).
- ▶ Plug the mains plug into a socket with earthing contact only.
 - Protection must not be impaired by an extension with no earthed conductor.
- ▶ Always connect the mains cable prior to all other cables, to ensure continuous protective earthing.
 - In reverse: always disconnect all other cables prior to disconnecting the mains cable.

⚠ CAUTION

Risk of injury from bursting due to high pressure in the exhaust line
 Faulty or insufficient exhaust lines cause hazardous situations, e.g. increase in exhaust pressure. There is a risk of bursting. It is not possible to rule out the risk of injuries due to broken pieces flying around, high escaping pressure and damage to the equipment.

- ▶ Lay the exhaust line without shut-off units.
- ▶ Observe the permissible pressures and pressure differentials of the product.
- ▶ Check the exhaust line regularly for correct function.

NOTICE

Pump damage caused by overpressure
 Mixing up the connections causes overpressure overload. The pump can be started only against max. 1 bar differential pressure between inlet and outlet, otherwise the motor jams and sustains damage.

- ▶ Make sure that the distributor is installed correctly on the diaphragm heads, before connecting the pump to the vacuum equipment.
- ▶ Before commissioning, make completely sure that the pressure side pressure is below the permissible limit.

Risks during operation

⚠ WARNING

Danger of poisoning due to emission of toxic process gases from the exhaust
 During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Observe the relevant regulations for handling toxic substances.
- ▶ Safely purge toxic process gases via an exhaust line.
- ▶ Use suitable filter equipment to separate toxic substances.

⚠ WARNING**Risk of burns on hot surfaces**

During pump operation, exposed surfaces reach high temperatures. There is a risk of burning.

- ▶ Allow the pump to cool down before carrying out any work.
- ▶ Wear protective gloves (in accordance with EN 420).

NOTICE**Damage caused by water hammer**

The sudden ingress of condensate can cause water hammer, as the pump cannot pump the additionally formed steam down quickly enough. Water hammer destroys the pump.

- ▶ Install a capacitor between the vacuum system and pump.
 - This intercepts the fluid upstream of the pump.

NOTICE**Damage caused by fluids and dust**

Fluids and dust damage diaphragms and valves.

- ▶ Prevent ingress of particles and dusts to the pump.
- ▶ Install a suitable filter upstream of the pump if necessary.
- ▶ Avoid condensation in the pump and water hammer.
- ▶ Observe the intended use.

NOTICE**Damage caused by silencer contamination**

After a long period of operation at high intake pressures or with dust-laden gases, the silencer can become congested. If the silencer becomes contaminated, an internal overpressure builds that damages bearings, diaphragms, and valves.

- ▶ Replace a contaminated silencer.
- ▶ Make sure that the exhaust line is unobstructed.
- ▶ Ideally, use a hose nozzle as an outlet.

Risks during maintenance**⚠ CAUTION****Risk of injury on hot surfaces, due to the vacuum or on sharp edges due to improperly performed maintenance work**

Improper handling of the pump before maintenance work causes hazardous situations involving a risk of injury. There is a risk of burning injuries on hot surfaces. There is a risk of injury due to the vacuum when switching off. There is a risk of cutting injuries due to the access to sharp-edged, rotating parts when removing the pump.

- ▶ Ensure that the pump has come to a complete standstill before performing any work on the pump.
- ▶ Switch off the pump correctly.
- ▶ Vent the pump to atmospheric pressure.
- ▶ Secure the pump against being switched back on.
- ▶ Allow the pump to cool down.
- ▶ Seal open connections with the original protective covers immediately after removing the pump.

NOTICE**Damage caused by pointed or sharp-edged tools**

Sharp-edged tools damage pump parts during maintenance.

- ▶ Never disconnect pump parts such as diaphragm heads using pointed or sharp-edged tools.
- ▶ Never use pointed or sharp-edged tools to lift diaphragms.
- ▶ If necessary, use a rubber mallet to loosen parts.

NOTICE

Damage caused by unsuitable cleaning agents

Unsuitable cleaning agents damage pump parts.

- ▶ Use only approved cleaning agents to clean pump parts.
- ▶ Never use soluble detergents.

NOTICE

Damage caused by unsuitable auxiliary tool

Using unsuitable tools damage the diaphragm and associated components.

- ▶ Never use the diaphragm key with auxiliary tools (for example pliers or an Allen key without torque limitation).

2.3 Safety precautions

The product is designed according to the latest technology and recognized safety engineering rules. Nevertheless, improper use can result in danger to operator all third party life and limb, and product damage and additional property damage.



Information requirement on possible hazards

The owner or operator of the product is required to make all operating personnel aware of hazards arising from the use of this product.

Every person who is involved in the installation, operation or maintenance of the product must have read and understood the safety-relevant parts of this documentation.



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

General safety precautions for working with the pump

- ▶ 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.
- ▶ Observe statutory and local regulations regarding solvents handling.
- ▶ Never operate an open or faulty unit.
- ▶ Before carrying out any maintenance, first allow the unit to cool and disconnect it from the vacuum equipment.
- ▶ Disconnect the pump from the mains prior to every intervention, and wait an additional five seconds until the capacitors have discharged.
- ▶ Implement suitable safety precautions where unintentional pump venting can cause hazards.
 - Power failures can cause unintentional venting.

2.4 Proper use

- You may use the pump exclusively for vacuum generation.
- You may not operate the pump with accessories not recommended by Pfeiffer Vacuum.

- Always observe installation, commissioning, operating, and maintenance instructions.

2.5 Foreseeable improper use

Improper use 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 corrosive media
- pumping explosive media
- pumping corrosive, explosive, radioactive, or volatile media
- pumping gases that introduce an ignition source to the suction chamber
- pumping gases that contain impurities such as particles, dust, or condensate
- pumping fluids
- pumping FPM-solubilizing media
- pumping vapors from combustible liquids
- pumping pressurized media (> atmospheric pressure)
- pumping media that can condense or cause adhering deposits to form in the suction chamber
- using the pump outside the specified area of application
- using the pump below ground
- using the pump to generate pressure
- using the pump in systems in which sporadic loads and vibrations or periodic forces act on the unit
- using the pump in strong electrical, magnetic, or electromagnetic fields
- connecting to pumps and equipment that are not intended for this purpose according to their operating instructions
- connecting to equipment with exposed live parts
- connecting to sockets without earthing contact
- using lubricants not specified by Pfeiffer Vacuum
- using pipes to lift the pump
- using accessories or spare parts not listed in this manual
- using the pump as a climbing aid
- using the connection lines between the diaphragm heads as carrying handles
- using the pump in ambient conditions that do not meet the specified IP protection class limits

3 Transporting the pump

⚠ WARNING

Danger of serious injury due to falling objects

Due to falling objects there is a risk of injuries to limbs through to broken bones.

- ▶ Take particular care and pay special attention when transporting products manually.
- ▶ Do not stack the products.
- ▶ Wear protective equipment, e.g. safety shoes.

NOTICE

Damage caused during transport

Transport in unsuitable packaging or failure to install all transport locks can damage the product.

- ▶ Observe the transport instructions.
- ▶ Always transport the pump in its original packaging.
- ▶ Transport the pump using only the transport handles provided.
- ▶ Always use dense and impact-proof packaging for the pump.
- ▶ Seal inlet and outlet ports (for example using transport caps).
- ▶ Reattach transport locks prior to every transport.

Instructions for safe transport

1. Observe weight specified on the rating plate.
2. Where possible, always transport or ship the pump in its original packaging.
3. Always carry the pump with both hands.
4. Remove the protective cover only immediately prior to installation.

4 Storing the pump

NOTICE

Damage caused by improper storage

Improper storage damages the pump.

- ▶ Store the pump in a cool, dry, dust-free place, where it is protected against impacts.
- ▶ Seal inlet and outlet ports (for example using transport caps).
- ▶ Maintain the permissible storage temperature. (See technical data)

5 Product description

5.1 Identifying the product

You will need all the data from the rating plate to safely identify the product when communicating with Pfeiffer Vacuum.

Recording rating plate data

1. Read the data on the product rating plate.
2. Record this data.
3. Always have all rating plate specifications to hand.

5.2 Shipment

- MVP 160-3 diaphragm vacuum pump
- Operating manual (German/English)

5.3 Pump design and function

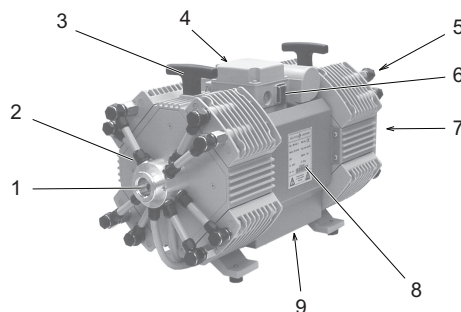


Fig. 1: MVP 160-3

- | | |
|---|---------------------------------------|
| 1 Vacuum connection (inlet, DN 25 ISO-KF) | 6 Mains switch |
| 2 Distributor, intake side | 7 Pressure connection (with silencer) |
| 3 Handle (2x) | 8 Rating plate on housing panel |
| 4 Mains plug | 9 Motor fan |
| 5 Distributor, pressure side | |

The diaphragm vacuum pump is a three stage, dry compressing pump. This means that the supplied medium does not come into contact with any lubricant.

The pump is a positive displacement pump with a periodic change in suction chamber size, produced by the movement of the diaphragm. The gas flow causes the valves to open and close automatically.

The pump units are connected directly to the drive motor (AC motor).

The pump is equipped with a pressure side silencer as standard.

6 Installation

6.1 Installing the pump

Notes on installing the pump

1. Place the pump on a **flat, horizontal surface**.
2. Make sure that the pump is **stable and secure**, with no additional mechanical contact other than the pump feet.
3. Make sure that the system to be evacuated and all hose connections are **mechanically stable**.
4. **Never install the pump on a soft surface (such as foam)**, as this impairs air supply to the fan.
5. Ensure **adequate air supply** if you install the pump in an enclosed housing or at a high ambient temperature. Provide external forced ventilation if necessary.
 - **Minimum 5 cm** between fan (on pump underside) and adjacent parts (for example housing, walls, etc.)
6. If you install the pump at an **installation altitude of > 1000 m AMSL**, you must implement **measures in accordance with DIN VDE 0530** to ensure an adequate cooling air supply.
7. **Anchor** the pump to the supporting surface in the event of stationary installation.
8. Use **elastic hose pieces or bellows** for anchoring.
 - This prevents mechanical forces resulting from rigid connection lines.
9. Maintain **ambient conditions**.
10. Before switching on, allow the pump to **acclimatize**.
 - If the pump is brought into the operating area from a cold environment, condensation can form.

6.2 Connecting the pumping stages

NOTICE

Pump damage caused by overpressure

Mixing up the connections causes overpressure overload. The pump can be started only against max. 1 bar differential pressure between inlet and outlet, otherwise the motor jams and sustains damage.

- ▶ Make sure that the distributor is installed correctly on the diaphragm heads, before connecting the pump to the vacuum equipment.
- ▶ Before commissioning, make completely sure that the pressure side pressure is below the permissible limit.

The intake connections of the pumps are marked "IN" and the outlets "EX" on the individual diaphragm heads.

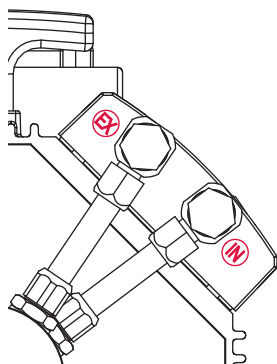


Fig. 2: IN and EX connections on diaphragm heads

IN Intake connection

EX Outlet

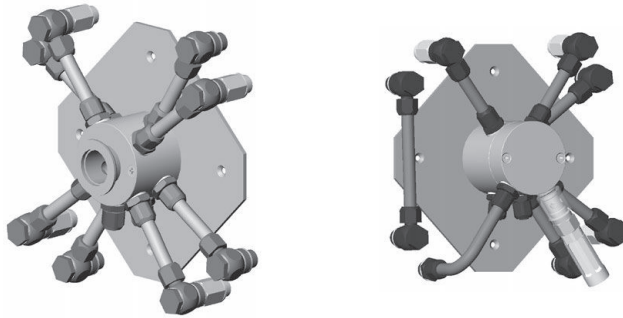


Fig. 3: Distributor: Intake side distributor (left) and pressure side distributor (right)

6.3 Connecting the vacuum side



Preventing pressure losses

Using the shortest possible vacuum connection lines with large nominal diameter prevents pressure losses.



Condensate separator

We recommend using a condensate separator in cases where the system to be evacuated contains fluid, resulting in steam being generated during evacuation.

Connecting the vacuum side

1. Remove the locking cap from the vacuum connection.
2. Install the connection between pump and vacuum system so that it is as short as possible.
3. Install a condensate separator upstream of the pump.
4. Connect the pump to the vacuum system using the vacuum connection.

6.4 Connecting the exhaust side



Condensate separator

We recommend using a condensate separator in cases where the system to be evacuated contains fluid, resulting in steam being generated during evacuation.

Connecting the exhaust side

1. Observe the official accident prevention regulations.
 - This applies in particular where you install a shut-off unit for internal operating reasons, meaning that overpressure can build in the line.
2. Remove protective caps.
3. Install the line downward from the pump, so that condensation does not flow back into the pump.
4. Connect pump and vacuum chambers with the shortest possible connection, with a minimum nominal diameter equal to that of the vacuum connection.
5. Make sure that no piping system forces are acting on the pump.
6. Support or hang the pipes.
7. Only use the silencer at low gas throughput, and check it regularly to ensure that it is unobstructed.

6.5 Establishing an electrical connection

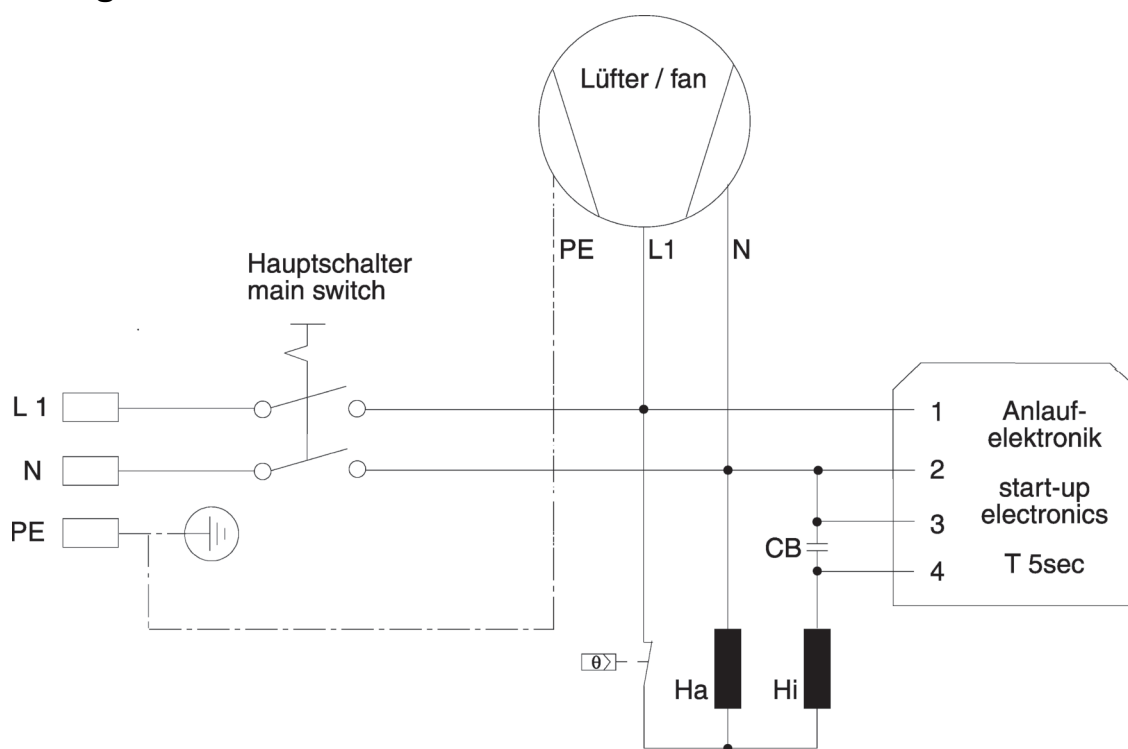


Fig. 4: Connection diagram: MVP 160-3 with single phase AC motor

7 Operation

7.1 Switching on and operating the pump

⚠ WARNING

Danger of poisoning due to emission of toxic process gases from the exhaust

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Observe the relevant regulations for handling toxic substances.
- ▶ Safely purge toxic process gases via an exhaust line.
- ▶ Use suitable filter equipment to separate toxic substances.

⚠ CAUTION

Risk of injury from bursting due to high pressure in the exhaust line

Faulty or insufficient exhaust lines cause hazardous situations, e.g. increase in exhaust pressure. There is a risk of bursting. It is not possible to rule out the risk of injuries due to broken pieces flying around, high escaping pressure and damage to the equipment.

- ▶ Lay the exhaust line without shut-off units.
- ▶ Observe the permissible pressures and pressure differentials of the product.
- ▶ Check the exhaust line regularly for correct function.

NOTICE

Damage caused by water hammer

The sudden ingress of condensate can cause water hammer, as the pump cannot pump the additionally formed steam down quickly enough. Water hammer destroys the pump.

- ▶ Install a capacitor between the vacuum system and pump.
 - This intercepts the fluid upstream of the pump.

NOTICE

Damage caused by fluids and dust

Fluids and dust damage diaphragms and valves.


- ▶ Prevent ingress of particles and dusts to the pump.
- ▶ Install a suitable filter upstream of the pump if necessary.
- ▶ Avoid condensation in the pump and water hammer.
- ▶ Observe the intended use.

NOTICE

Damage caused by silencer contamination

After a long period of operation at high intake pressures or with dust-laden gases, the silencer can become congested. If the silencer becomes contaminated, an internal overpressure builds that damages bearings, diaphragms, and valves.

- ▶ Replace a contaminated silencer.
- ▶ Make sure that the exhaust line is unobstructed.
- ▶ Ideally, use a hose nozzle as an outlet.

 **Achieving throughput and ultimate pressure**

The pump achieves the specified throughput and ultimate pressure values once the operating temperature has been reached (after approx. 15 minutes).

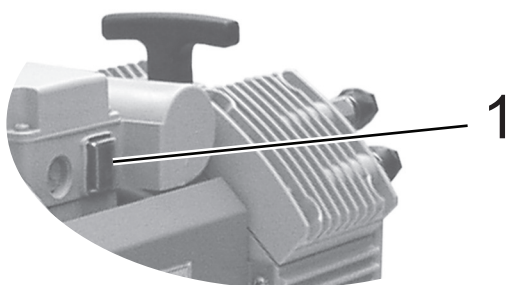


Fig. 5: Mains switch

- 1 Mains switch

Switching on and operating the pump

You can switch on the pump at any time.

1. Press the mains switch.

7.2 Switching off the pump

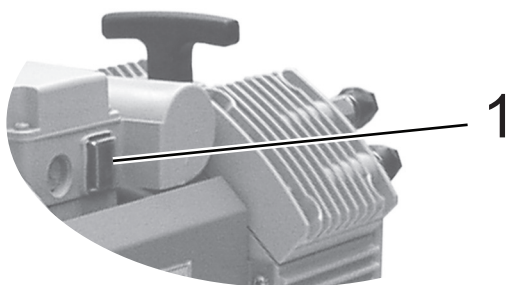


Fig. 6: Mains switch

- 1 Mains switch

Switching off the pump

You can switch off the pump at any time.

1. Allow the pump to run on for a few more minutes with the intake port open.
2. Press the mains switch.
3. Clean and check the diaphragm heads when working with pump media that are corrosive to pump materials or can cause formation of deposits.

8 Decommissioning the pump for long periods

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

Decommissioning the pump for long periods

1. Switch pump off.
2. Vent pump and allow to cool.
3. Disconnect pump from vacuum equipment.
4. Clean suction chamber.
5. Seal flanges and any other openings.
6. Store the pump in dry, dust-free areas, within the specified ambient conditions:
 - In areas with damp or aggressive atmospheres, we recommend packaging the pump in a plastic bag with a drying agent, and sealing it so that it is airtight.
 - For storage durations longer than 2 years, we recommend you carry out maintenance and a lubricant change prior to recommissioning.

9 Maintenance

9.1 General

CAUTION

Risk of injury on hot surfaces, due to the vacuum or on sharp edges due to improperly performed maintenance work

Improper handling of the pump before maintenance work causes hazardous situations involving a risk of injury. There is a risk of burning injuries on hot surfaces. There is a risk of injury due to the vacuum when switching off. There is a risk of cutting injuries due to the access to sharp-edged, rotating parts when removing the pump.

- ▶ Ensure that the pump has come to a complete standstill before performing any work on the pump.
- ▶ Switch off the pump correctly.
- ▶ Vent the pump to atmospheric pressure.
- ▶ Secure the pump against being switched back on.
- ▶ Allow the pump to cool down.
- ▶ Seal open connections with the original protective covers immediately after removing the pump.

NOTICE

Damage caused by pointed or sharp-edged tools

Sharp-edged tools damage pump parts during maintenance.

- ▶ Never disconnect pump parts such as diaphragm heads using pointed or sharp-edged tools.
- ▶ Never use pointed or sharp-edged tools to lift diaphragms.
- ▶ If necessary, use a rubber mallet to loosen parts.

9.2 Maintenance intervals



Dismantle the pump only to the extent necessary

Dismantle the pump only to the extent required for maintenance.
Use only genuine parts as listed in the spare parts list.

Valves and diaphragms are wear parts.

Component	Operating hours
Diaphragm	15,000
Valves	15,000
Motor bearing	40,000
Motor capacitors	10,000-40,000

Tbl. 2: Typical life with normal use

You must check wear parts by the time the achieved pressure values drop off at the latest.

Checking wear parts

1. Clean suction chamber
2. Clean diaphragms
3. Clean valves
4. Check and clean diaphragm heads at regular intervals (depending on the individual case)
5. Inspect diaphragms and valves for cracks.
6. Replace defective parts.

9.3 Dismantling the distributor

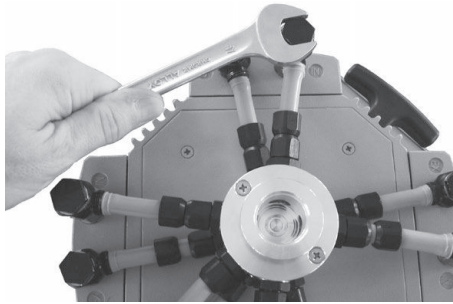


Fig. 7: Unscrewing screw couplings from diaphragm head

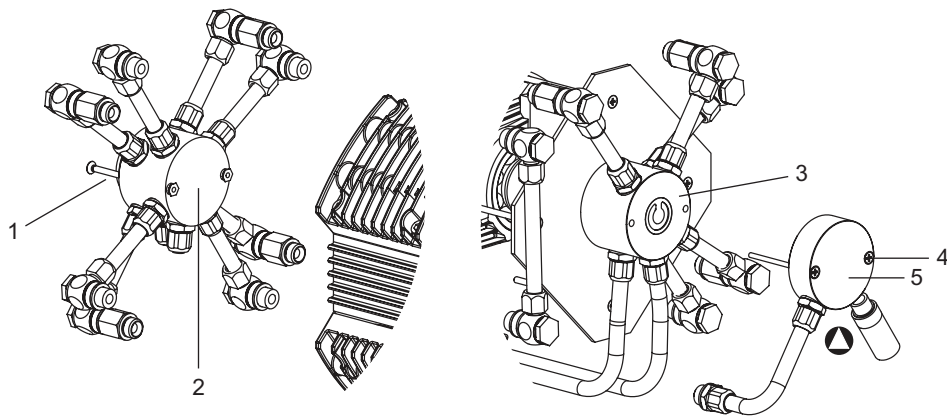


Fig. 8: Dismantling both distributors

- | | |
|-----------------------------|----------------------|
| 1 Countersunk screws | 4 Countersunk screws |
| 2 Intake side distributor | 5 Cover plate |
| 3 Pressure side distributor | |



It is not necessary to remove the connection hoses from the distributor screw couplings.

Dismantling the distributor

Tools required

- Open-end wrench (17 WAF)
 - Crosshead screwdriver
1. Unscrew the screw couplings from all diaphragm heads using the open-end wrench.
 2. Unscrew the countersunk screws using the crosshead screwdriver.
 3. Remove the entire intake side distributor, including all fittings.
 4. Unscrew the countersunk screws using the crosshead screwdriver.
 5. Remove the entire pressure side distributor and cover panel, including all fittings.

9.4 Disassembling the diaphragm head

NOTICE

Damage caused by pointed or sharp-edged tools

Sharp-edged tools damage pump parts during maintenance.

- ▶ Never disconnect pump parts such as diaphragm heads using pointed or sharp-edged tools.
- ▶ Never use pointed or sharp-edged tools to lift diaphragms.
- ▶ If necessary, use a rubber mallet to loosen parts.

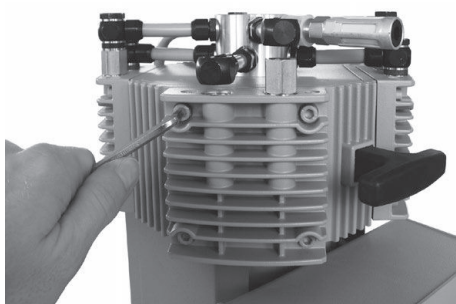


Fig. 9: Disconnecting diaphragm head

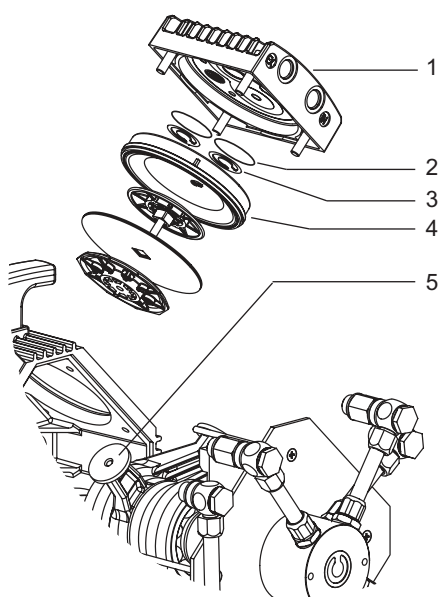


Fig. 10: Disassembling the diaphragm head

- | | |
|------------------|------------------|
| 1 Diaphragm head | 4 Head cover |
| 2 O-rings | 5 Connection rod |
| 3 Valves | |

Disassembling the diaphragm head

Tools required

- Allen key (5 WAF)
 - Rubber mallet
1. Use the Allen key to unscrew the four cheesehead screws from the diaphragm head.
 2. Remove top of housing (diaphragm head and head cover).
 - Do not allow the head cover to fall out of the diaphragm head when doing so.
 3. Remove the head cover from the diaphragm had in order to check the valves.
 4. Note the position of the valves and O-rings, and remove them.

5. Move the connection rod by rotating the eccentric bushing (on the front of the connection rod) to a position where the diaphragm rests centrally and flush on the supporting surface in the housing opening.

9.5 Checking and replacing parts

Checking and replacing parts

1. Check all parts for damage and contamination.
2. Clean contaminated parts.
3. Replace damaged valves.
4. Replace damaged diaphragms.

9.6 Cleaning contaminated parts

NOTICE

Damage caused by unsuitable cleaning agents

Unsuitable cleaning agents damage pump parts.

- ▶ Use only approved cleaning agents to clean pump parts.
- ▶ Never use soluble detergents.

Cleaning contaminated parts

Consumables required

- Industrial alcohol
1. Clean contaminated parts with industrial alcohol.
 2. Allow parts to dry well.

9.7 Replacing the diaphragm

NOTICE

Damage caused by unsuitable auxiliary tool

Using unsuitable tools damage the diaphragm and associated components.

- ▶ Never use the diaphragm key with auxiliary tools (for example pliers or an Allen key without torque limitation).



Spacer disks

Take care with any spacer disks that may be between the diaphragm support disk and connection rod. Keep the spacer disks for each cylinder separate, and reinstall the same number of original spacer disks.

Too few spacer disks: Pump does not attain final vacuum.

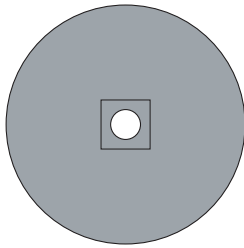
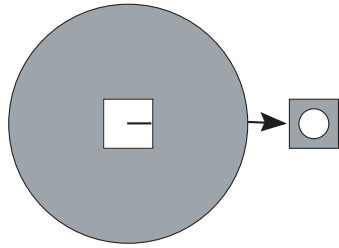
Too many spacer disks: Pump bangs (noise development).



Double diaphragm

You have to position the double diaphragms with the printed sides facing outwards.

Depending on the pump design, two diaphragm attachments may be possible when replacing the diaphragm:

Attachment with countersunk screw	Form-fitted attachment
	
Design with bore	Design with square hole

Tbl. 3: Diaphragm attachments



Fig. 11: Diaphragm key (accessory)

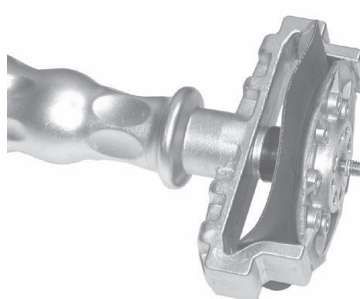
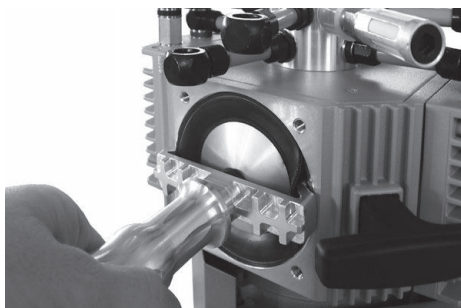


Fig. 12: Diaphragm key with inlaid diaphragm parts

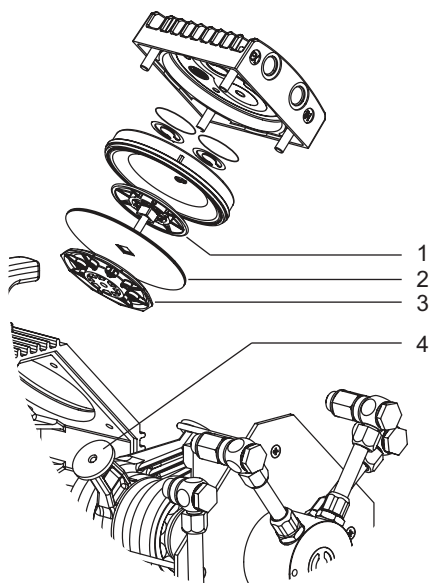


Fig. 13: Diaphragm and associated parts

- 1 Diaphragm clamping disk
- 2 Diaphragm

- 3 Diaphragm support disk
- 4 Connection rod

Replacing the diaphragm

Tools required

- Diaphragm key (accessory)
- Torque wrench (hex, size 6)

Consumables required

- Gasoline or petroleum
1. **Diaphragm with square hole:** Remove the pre-punched interior of the new diaphragm.
 2. Carefully lift the side of the diaphragm.
 3. Using the diaphragm key, reach under the diaphragm and grasp the diaphragm support disk.
 4. Disconnect the diaphragm support disk using the diaphragm key.
 5. Unscrew the diaphragm support disk together with the diaphragm and diaphragm clamping disk.
 6. If necessary, disconnect the old diaphragm from the diaphragm support disk using gasoline or petroleum.
 7. Insert the new diaphragm between diaphragm clamping disk and diaphragm support disk.
 - When doing so, make sure that the square connecting bolt of the diaphragm clamping disk is positioned correctly in the diaphragm support disk guide.
 8. Lift the side of the diaphragm and insert it carefully in the diaphragm key with the diaphragm clamping disk and diaphragm support disk.
 - When doing so, do not kink the diaphragm excessively.
 9. Bolt all parts together with the spacer disks and connection rod.
 10. Attach the torque wrench to the diaphragm key
 11. Tighten the screw fitting with the torque wrench.
 - Tightening torque = **6 Nm**

9.8 Replacing the valves

The valves are located in the diaphragm heads and below the pressure side distributor cover plate.

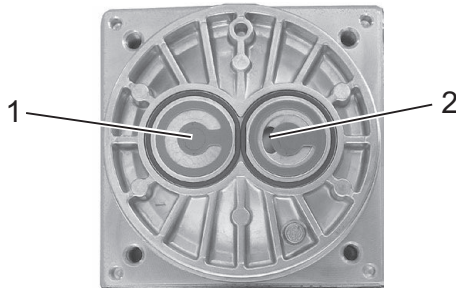


Fig. 14: Correct positioning of valves in diaphragm head

- 1 Outlet side with round central opening below valve
- 2 Inlet side with kidney-shaped opening next to valve

The valve crosspiece lies opposite the kidney-shaped opening.

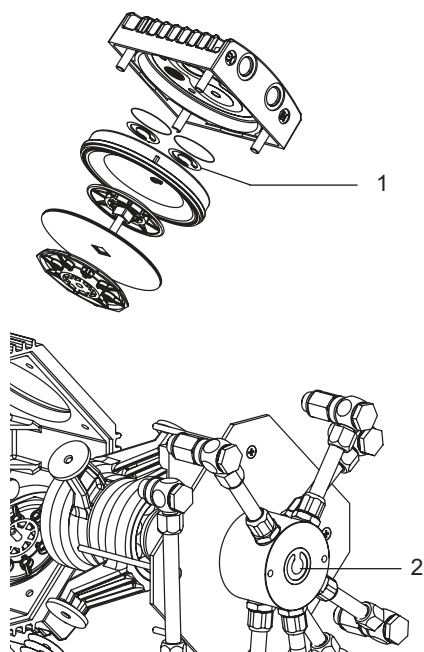


Fig. 15: Valves

- 1 Valves in diaphragm head
- 2 Valve in pressure side distributor

Replacing the valves in the diaphragm head

1. When replacing valves (1), make sure they are positioned correctly.
2. Insert valves (1) in the diaphragm head.

Replacing the valve in the pressure side distributor

1. When replacing valve (2), make sure it is positioned correctly.
2. Insert valve (2) in the pressure side distributor.

9.9 Installing the diaphragm head

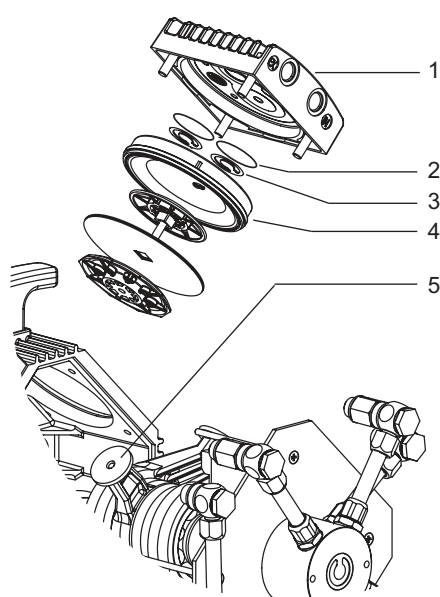


Fig. 16: Installing the diaphragm head

- | | |
|------------------|------------------|
| 1 Diaphragm head | 4 Head cover |
| 2 O-rings | 5 Connection rod |
| 3 Valves | |

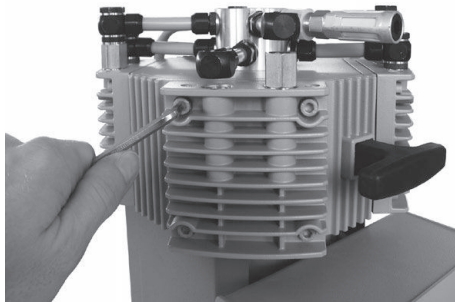


Fig. 17: Secure diaphragm head

Installing the diaphragm head

Tools required

- Allen key (5 WAF)
 - Torque wrench
1. Move the connection rod by rotating the eccentric bushing (on the front of the connection rod) to a position where the diaphragm rests centrally and flush on the supporting surface in the housing opening.
 2. Make sure that valves and O-rings are positioned correctly.
 3. Assemble head cover and diaphragm head.
 4. Place top of housing (diaphragm head and head cover) on pump housing.
 - When doing so, the diaphragm must lie centrally for even clamping between the pump housing and head cover.
 5. Use the Allen key to tighten the four cheesehead screws on the diaphragm head.
 6. First, use the Allen key to lightly tighten the four cheesehead screws.
 7. Then, use the torque wrench to firmly tighten the four cheesehead screws diagonally. (Do not tighten up to the stop.)
 - Tightening torque = 12 Nm

9.10 Installing the distributor

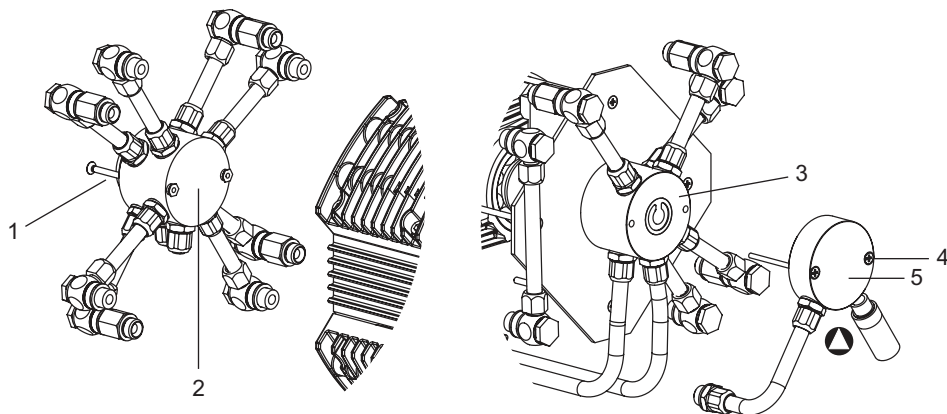


Fig. 18: Install both distributors

- | | |
|-----------------------------|----------------------|
| 1 Countersunk screws | 4 Countersunk screws |
| 2 Intake side distributor | 5 Cover plate |
| 3 Pressure side distributor | |

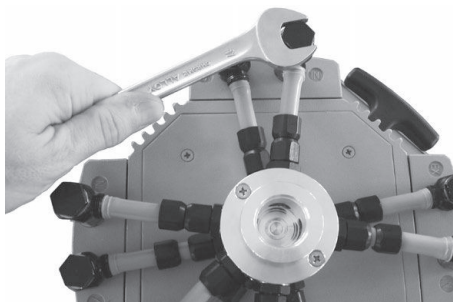


Fig. 19: Screw couplings on diaphragm head

Installing the distributor

Tools required

- Open-end wrench (17 WAF)
 - Crosshead screwdriver
1. Hold the pressure side distributor, including cover plate and all fittings, in position on the pump.
 2. Secure the countersunk screws using the crosshead screwdriver.
 3. Hold the intake side distributor, including all fittings, in position on the pump.
 4. Secure the countersunk screws using the crosshead screwdriver.
 5. Secure the screw couplings to all diaphragm heads using the open-end wrench.

9.11 Checking pump function

After working on the pump, you must check the final vacuum. Only where the pump reaches the specified final vacuum can a low pump leakage rate, and thus the prevention of potentially explosive mixtures in the pump interior, be ensured.

Checking function of individual diaphragm heads

Tools required

- Standard vacuum gage
1. Measure the intake port pressure in every stage:
 - Using the standard vacuum gage, you must be able to measure < 110 hPa pressure values at the intake port.
 2. If this pressure value is not reached, check the suction chamber.
 3. When doing so, check that valves and diaphragms are correctly seated (centrally to housing hole).

Checking final vacuum

If, following diaphragm valve replacement, the pump achieves the specified final vacuum value only after being run in for several hours, or unusual noise can be heard, proceed as follows:

1. switch off pump immediately in the event of unusual noise.
2. carry out troubleshooting.

10 Troubleshooting

Problem	Possible causes	Remedy
Pump not achieving ultimate pressure. (no throughput)	Deposits in the pump	Clean and check diaphragm heads
	Condensate in the pump	Operate pump for a longer period of time under atmospheric pressure
	In-process steam formation	Check process parameters
	Valves/diaphragms soiled/faulty	Clean/replace valves/diaphragms
	Small flange connection centering ring inserted incorrectly	Check connection
	Long, thin vacuum line	Choose a line with a larger cross section.
	Leak in system	Fix leak Check pump directly, connect measurement instrument directly to pump inlet
Unusual noises during operation	Valves/diaphragms faulty	Replace valves/diaphragms
	Dirt in suction chamber	Cleaning the suction chamber
	Silencer loose or missing	Check or replace silencer
	Motor fan defective	Replace motor fan
	Connection rod or motor bearing defective	Contact Pfeiffer Vacuum Service
Pump does not start up.	No mains voltage	Check mains voltage
		Check mains fuse
		Insert mains plug
	Phase failure	Check fuse
	Thermal winding protection has triggered. (Motor overloaded)	Allow motor to cool down and switch mains switch off and on again.
	Ambient temperature too low	Warm up pump
	Valves/diaphragms soiled/faulty	Clean/replace valves/diaphragms
	Overpressure in exhaust line	Open exhaust line
Pump switches off.	Diaphragm bonded	Clean pump
	Mains voltage incorrect	Correct according to rating plate
Motor contactor tripped.	Pump overheated	Switch off pump or disconnect mains plug. Allow pump to cool down. Determine and eliminate cause of overheating.
Pump blocked or connection rod stiff		Contact Pfeiffer Vacuum Service

Tbl. 4: Troubleshooting

11 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.

Our intention is always to optimize our core expertise, servicing vacuum components. After the purchase of a product from Pfeiffer Vacuum, our service is still far from over. Often that's precisely where it starts. Naturally with proven Pfeiffer Vacuum quality.

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](#).

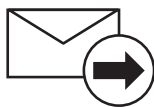
For quick and smooth handling of the service process, we recommend the following steps:



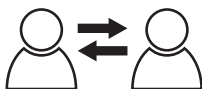
1. Download the current form templates.
 - [Declaration of Service Request](#)
 - [Service Request](#)
 - [Declaration of Contamination](#)



- a. Dismantle all accessories (all parts that are not original parts).
 - 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](#).

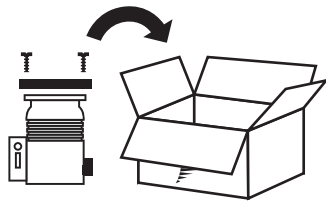


4. You will receive a response from Pfeiffer Vacuum.

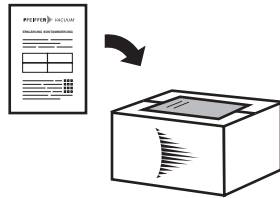
PFEIFFER VACUUM

Sending of contaminated products

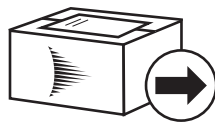
No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. If products are contaminated or if the declaration of contamination is missing, Pfeiffer Vacuum performs decontamination at the **shipper's expense**.



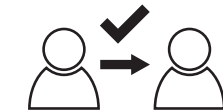
5. Prepare the product for transport in accordance with the details in the declaration of contamination.
 - a) Neutralize the pump with nitrogen or dry air.
 - b) Close all openings airtight.
 - c) Seal the product in appropriate protective film.
 - d) Only pack the product in suitable, stable transport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

12 Spare parts

Description	order number
Overhaul kit with valve seal and diaphragms	PU E22 002 -T
Silencer (G 1/4")	P0 920 792 E
Fan (220–240 V)	P0 920 416 E

Tbl. 5: MVP 160-3 spare parts list

13 Accessories

Description	order number
Diaphragm key (66 WAF)	PK 050 172
Relay box, shielded, for backing pumps, 1-phase 7A for TC 110/120 and TCP 350, plug M8	PM 071 282 -X
Relay box, shielded, for backing pumps, 1-phase 7 A for TC 400/1200, TM 700 and TCP 350, M12	PM 071 284 -X
Mains cable 115 / 230 V without plug, right angle IEC 320/C13 socket, 3 m	PK 050 111
Mains cable 230 V with safety plug CEE 7, right angle IEC 320/C13 socket, 2 m	PK 050 109

Tbl. 6: Accessories

14 Technical data and dimensions

14.1 Technical data

Connection flange (inlet)	DN 25 ISO-KF
Connection flange (outlet)	G ¼" + silencer
Rated volume flow rate at 50 Hz	9.6 m³/h
Rated volume flow rate at 60 Hz	10.4 m³/h
Final pressure without gas ballast	≤ 2 hPa
Max. counter-pressure	1100 hPa
Leakage rate	≤ 2x10 ⁻³ Pa m³/s
Ambient temperature	12 – 40 °C
Temperature: Storage	-10 – 60 °C
Sound pressure level	52 dB(A)
Motor rating/power	390 W
Rotation speed at 50 Hz	1500 rpm
Rotation speed at 60 Hz	1800 rpm
Motor protection	Thermal winding protection (self holding)
Grid connection: Voltage, max.	230 V
Grid connection: Voltage (range)	±10 %
Rated current (50 Hz)	2.8 A
Rated current (60 Hz)	2.7 A
Protection system, class, category	IP20
Installation altitude, max.	2000 m
Weight	25 kg

Tbl. 7: Technical data

Pump parts	Substances in contact with the media
Housing cover	Aluminum alloy (AlSi12)
Head cover	Aluminum alloy (AlSi12)
Diaphragm clamping disk	Aluminum alloy (AlSi12)
Diaphragm	Elastomer (FPM)
Valves	Elastomer (FPM)
O-rings	Elastomer (FPM)
Vacuum connection	Stainless steel
Silencer	Aluminum alloy/PA/PE
Overpressure valve	Silicone
Hoses	Polyethylene (PE)
Compression couplings	Anodized aluminum (AlCuMgPb)
Sealing rings	Elastomer (FPM)

Tbl. 8: Substances in contact with the media

Operations condition, status	Intake pressure	Permissible gas temperature range
Continuous operation	> 100 hPa (high gas load)	+10°C to +40°C
Continuous operation	< 100 hPa (low gas load)	0°C to +60°C *
Short-term (< 5 minutes)	< 100 hPa (low gas load)	-10°C to +80°C *

Tbl. 9: Intake gas temperature

14.2 Dimensions

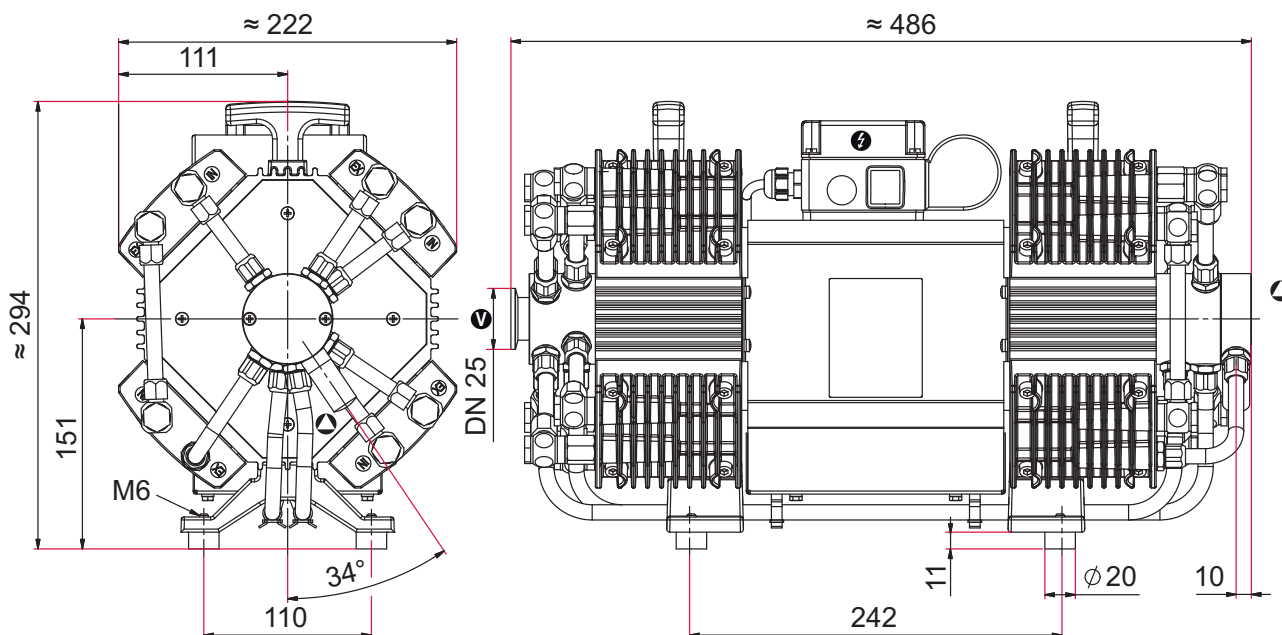


Fig. 20: Dimensions in mm

14.3

MVP 160-3 (50 Hz)

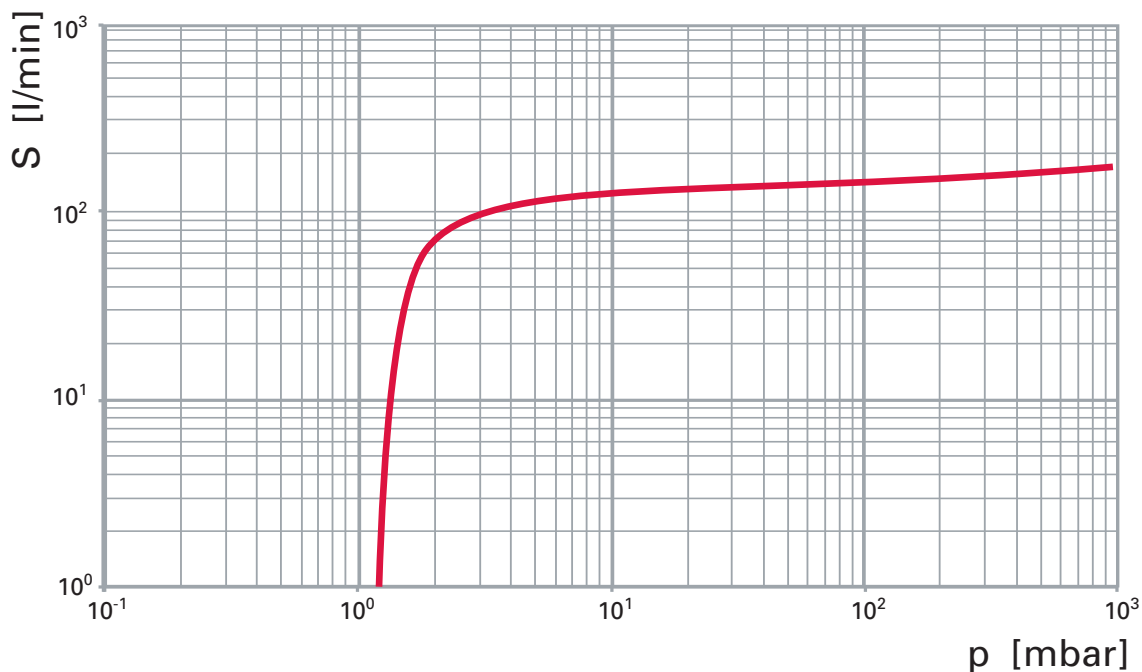


Fig. 21: Air pumping speed at 50 Hz

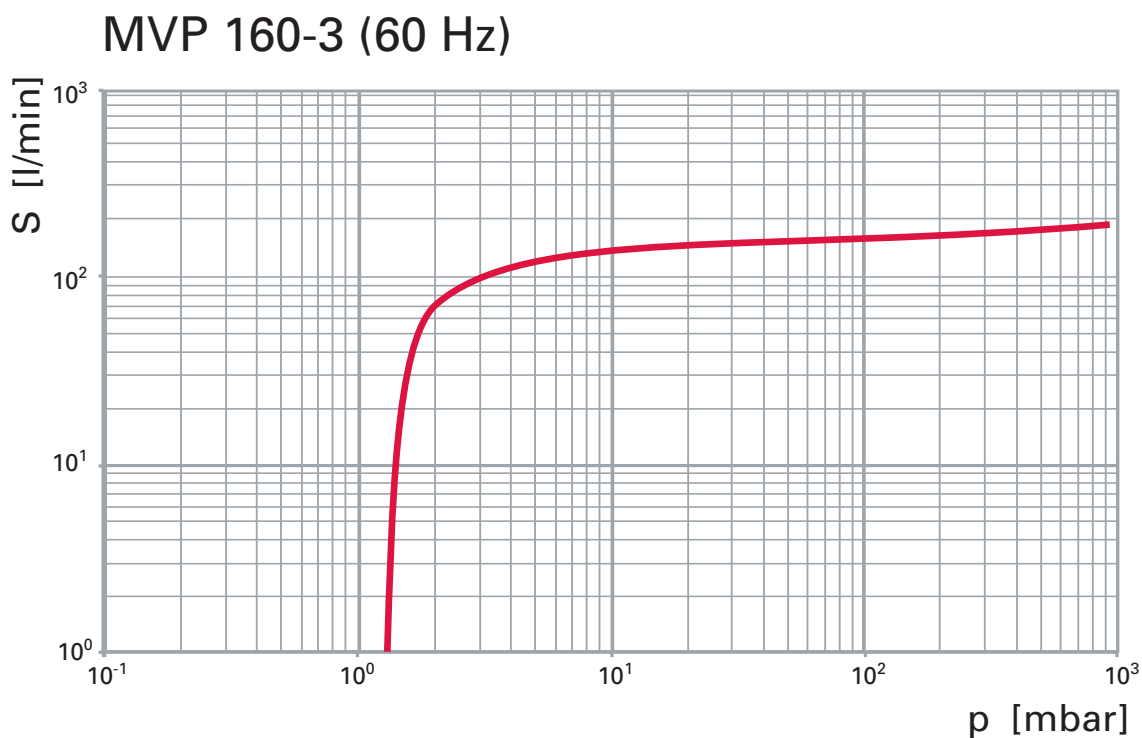


Fig. 22: Air pumping speed at 60 Hz



Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions of the following **EU Directives**:

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

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

Diaphragm vacuum pump

MVP 160-3

Harmonized standards and applied national standards and specifications:

EN ISO 12100:2011

EN 61010-1:2011

IEC 61010-1:2010 (edition 3)

EN 1012-2:2011

EN 61326-1:2013

EN 50581:2013

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Aßlar
Germany

(Dr. Ulrich von Hülsen)
Managing Director

Aßlar, 8/28/2017

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From a single component to complex systems:

We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE

Benefit from our know-how and our portfolio of training opportunities!

We support you with your plant layout and provide first-class on-site service worldwide.

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perfect vacuum solution?
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info@pfeiffer-vacuum.de

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