



# OPERATING INSTRUCTIONS

EN

Translation of the Original

## MVP 020-3 DC

Diaphragm Pump

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## Dear Customer,

Thank you for choosing a Pfeiffer Vacuum product. Your new diaphragm pump is designed to support you with its performance, perfect operation and without impacting 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. From this extensive, practical experience we have gained a large volume of information that can contribute to efficient deployment and to your personal safety.

In the knowledge that our product must avoid consuming work output, we trust that our product can offer you a solution that supports you in the effective and trouble-free implementation 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](mailto: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

This operating instructions is a customer document of Pfeiffer Vacuum. The operating instructions describe the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in this operating instructions refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

### 1.1.1 Applicable documents

Designation	Document
Declaration of conformity	A component of these operating instructions

### 1.1.2 Variants

These operating instructions apply to diaphragm pumps with the following part numbers:

Part number	Designation
PK T01 198	MVP 020-3 DC

## 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.

	<b>Rating plate</b> The rating plate is located on the cover of the electronics.
	<b>Warning of hot surfaces</b> The label warns of hot surfaces during operation or immediately after switching off the vacuum pump.
	<b>Closure seal</b> The diaphragm heads are sealed at the factory. Damaging or removing a closure seal results in loss of the warranty.

Tbl. 1: Stickers on the product

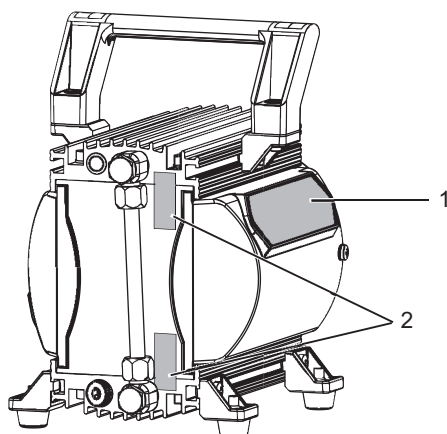


Fig. 1: Position of the labels on the product

- |  |                |
|--|----------------|
| 1 Rating plate of the diaphragm pump<br>Incl. hot surface warning sign | 2 Closure seal |
|--|----------------|

## 1.3.4 Abbreviations

Abbreviation	Meaning in this document
DC	Direct current
DN	Nominal diameter (from the French: diamètre nominal)
f	Rotation speed value of a vacuum pump (frequency, in rpm or Hz)
LED	Light emitting diode
MVP	Diaphragm vacuum pump
PE	Earthed conductor (protective earth)
PTFE	Polytetrafluoroethylene
PWM	Pulse width modulation (Type of modulation in which one technical variable (e.g. The electrical voltage) changes between 2 values.)



Abbreviation	Meaning in this document
T	Temperature (in °C), property abbreviation of the vacuum pump
TC	Turbopump electronic drive unit (turbo controller)
TPS	Voltage supply (turbo power supply)

**Tbl. 2:      Abbreviations used in this document**

## 2 Safety

### 2.1 General safety information

The following 4 risk levels and 1 information level are taken into account in this document.

#### **DANGER**

##### **Immediately pending danger**

Indicates an immediately pending danger that will result in death or serious injury if not observed.

- ▶ Instructions to avoid the danger situation

#### **WARNING**

##### **Potential pending danger**

Indicates a pending danger that could result in death or serious injury if not observed.

- ▶ Instructions to avoid the danger situation

#### **CAUTION**

##### **Potential pending danger**

Indicates a pending danger that could result in minor injuries if not observed.

- ▶ Instructions to avoid the danger situation

#### **NOTICE**

##### **Danger of damage to property**

Is used to highlight actions that are not associated with personal injury.

- ▶ Instructions to avoid damage to property



Notes, tips or examples indicate important information about the product or about 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 installation**

#### **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.

**NOTICE****Vacuum pump damage caused by overpressure**

Mixing up the connections causes overpressure overload. The vacuum 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 vacuum pump to the vacuum equipment.
- ▶ Before commissioning, make completely sure that the pressure side pressure is below the permissible limit.

**NOTICE****Property damage due to incorrect polarity**

Incorrect or excessive supply voltage will destroy the motor.

- ▶ Always observe the motor rating plate specifications.
- ▶ When connecting the supply cable, observe the colored marking on the corresponding wires.
- ▶ Always provide a suitable mains fuse.

**Risks during operation****⚠ 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****Risk of explosion from reactive, explosive or other hazardous gas / air mixtures.**

Uncontrolled inlet of gas at the flushing gas nozzle leads to sparks generated mechanically following diaphragm rupture, hot surfaces or to explosive gas / air mixtures in the vacuum system caused by static electricity.

- ▶ If necessary, use inert gas for supplying the flushing gas in order to avoid a potential ignition.

**⚠ 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****Risk of poisoning due to toxic process gases escaping**

For intake pressures > 500 hPa, process gas may escape from the flushing gas nozzle.

- ▶ If necessary, use an extraction line.

### **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.

### **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 in event of malfunctions**

### **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.

### **NOTICE**

#### **Property damage from incorrect installation**

Change in dead volume due to incorrect installation of the original spacer disks impairs the final vacuum or leads to bearing damage.

- ▶ During disassembly, keep the existing spacer disks separate per installation location.
- ▶ Reinstall the same number of original spacer disks per diaphragm head.

### **NOTICE**

#### **Property damage from electrostatic discharge**

Neglecting the electrostatic hazard for electronic components results in their damage or destruction

- ▶ Implement ESD safety measures at the workstation.
- ▶ Observe EN 61340 "Protection of electronic devices from electrostatic phenomena".

#### **Risks during disposal**

### **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.

## 2.3 Safety precautions

### DANGER

#### Danger to life from electric shock

Power supply packs that are not specified or are not approved will lead to severe injury to death.

- ▶ Make sure that the power supply pack meets the requirements for double isolation between mains input voltage and output voltage, in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Make sure that the power supply pack meets the requirements in accordance with IEC 61010-1 IEC 60950-1 and IEC 62368-1.
- ▶ Where possible, use original power supply packs or only power supply packs that correspond with the applicable safety regulations.



#### 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

- ▶ Prevent process gases and their reaction and ancillary products that are harmful to health and the environment from escaping, or dispose of these according to the applicable regulations.
- ▶ Avoid contact with process gases that are harmful to health and if required, wear personal protective clothing.
- ▶ Check the media compatibility of parts carrying media.
- ▶ 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.
- ▶ Never disconnect plug connections during operation.
- ▶ 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 degree prior to installation or operation in other environments.
- ▶ Provide suitable touch protection, if the surface temperature exceeds 70°C.
- ▶ Keep lines and cables away from hot surfaces.
- ▶ Before returning the vacuum pump, observe the notes in the chapter Service solutions.

## 2.4 Limits of use of the product

Installation location	Interiors, protected against the accumulation of dust and weather influences, in a non-explosive, dry environment
Protection degree IEC 60529	IP 20
Protection degree UL 50E	NEMA type 1
Installation altitude	max. 2000 m above sea level <sup>1)</sup>
Ambient temperature	+10 °C to +40 °C

1) at an installation location higher than 1000 meters above sea level, there is a risk of insufficient cooling. If necessary, take measures according to Directive DIN EN 61010.

Relative air humidity	80% at $T \leq 31\text{ °C}$ , to max. 50% at $T \leq 40\text{ °C}$
Degree of contamination	2

**Tbl. 3: Limits of use of the product**

Operations condition, status	Intake pressure	Permissible intake temperature of medium to be pumped
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. 4: Intake temperature limits of use**

## 2.5 Proper use

- ▶ Use the vacuum pump for vacuum generation only.
- ▶ 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

Improper use of the product invalidates all warranty and liability claims. Any use that is counter to the purpose of the product, whether intentional or unintentional, is regarded as improper use; in particular:

- Pumping of corrosive media
- Pumping of explosive media
- Pumping radioactive or volatile media
- Pumping of gases that contain impurities such as particles, dust, or condensate
- Pumping of 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
- Use of the vacuum pump outside the specified area of application
- Using the vacuum pump below ground
- Using the vacuum pump to generate pressure
- Using the vacuum pump in systems in which sporadic loads and vibrations or periodic forces act on the unit
- Using the vacuum pump 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
- Connecting to sockets without earthing contact
- Using pipes to lift the vacuum pump
- Use of accessories or spare parts that are not listed in these instructions
- Using the vacuum 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 degree limits

## 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 diaphragm pump is a dry compressing vacuum pump with 3 pumping stages. This vacuum 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 directly connected to the drive motor.



**Fig. 2: Diaphragm pump design**

- |  |   |
|--|---|
| 1 Handle   | 6 Connecting socket (control signals)<br>(for Binder bayonet connectors, 2-pin, Ø12 mm) |
| 2 Vacuum connection, thread 1/8"                   | 7 Connecting socket (voltage supply)<br>(for Hirschmann line socket G20KW3F, 2-pin)     |
| 3 Banjo bolt                                       | 8 Exhaust   |
| 4 Interhead connection                             | 9 Cover fixing screw  |
| 5 Locking screw<br>(optional: flushing gas nozzle) |   |

### 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.
- ▶ Learn about certifications through test seals on the product or at [www.certipedia.com](http://www.certipedia.com) with company ID no. 000021320.

### 3.3 Shipment

- Vacuum pump with drive
- Operating instructions
- Blind plug on the vacuum connection



## 4 Transportation and Storage

### 4.1 Transporting the vacuum 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.



#### **Packing**

We recommend keeping the transport packaging and original protective cover.

#### **General information regarding safe transport**

1. Observe the weight specified on packaging.
2. Use a transport aid if necessary (trolley, lift truck).
3. Transport the product in its original packaging.
4. Always place the product on an adequately sized, level surface.

#### **Transporting the vacuum pump without its packaging**

1. Unpack the vacuum pump.
2. To protect the inside of the pump, leave both protective caps on the connections during transport.
3. For lifting, use the handle provided for this purpose, located on the top of the pump.
4. Lift the vacuum pump out of the transport packaging.
5. Make sure that no forces are acting on the piping system.
6. Always place the vacuum pump on an adequately sized, level surface.

### 4.2 Storing the vacuum pump



#### **Packing**

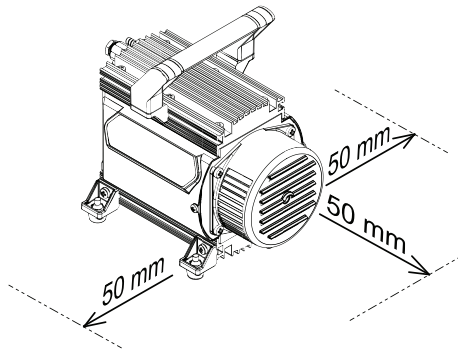
We recommend storing the product in its original packaging.

#### **Procedure**

1. Seal the vacuum connection with the blind plug.
2. Store the vacuum pump only in dry, dust-free rooms, within the specified ambient conditions.
3. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.

## 5 Installation

### 5.1 Installing the vacuum pump



**Fig. 3: Minimum distances**

#### Procedure

1. Place the vacuum pump on a flat, horizontal surface.
2. For stationary installation, screw the vacuum pump directly to the base if necessary.
  - For this purpose, dismantle the rubber feet.
3. When installing the pump in a closed housing, ensure adequate air circulation.
  - The vacuum pump does not have a fan.
4. Make sure that minimum distances to adjacent components, e.g., walls, housings, etc., are observed.
5. Keep the specifications on the motor rating plate visible and freely accessible.

### 5.2 Connecting the vacuum side

#### NOTICE

##### Property damage from contaminated gases

Pumping gases that contain contamination 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 diaphragm pumps.

- Information and ordering options for approved [accessories](#) can be found online.
- Described accessories are not included in the shipment.



##### Preventing throttling losses

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



##### Condensate separator

Pfeiffer Vacuum recommends the installation of a condensate separator in case vapors are formed from moisture during evacuation.

#### Procedure

1. Remove the blind plug from the vacuum connection.
2. Establish the shortest possible connection between vacuum pump and vacuum chamber.
3. Choose a minimum vacuum line diameter equal to the nominal diameter of the vacuum connection.

4. Depending on the pump type, use PVC or metallic hoses with flange connections from the [Pfeiffer Vacuum component shop](#).
5. Connect the vacuum pump to the vacuum system using the vacuum connection.

### 5.3 Connecting the exhaust side

#### **WARNING**

##### **Danger to life from poisoning where toxic process gases leak with no exhaust line**

During normal operation, the vacuum pump expels exhaust gases and vapors 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.

#### **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.



#### **Condensate separator**

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

#### **Procedure**

1. Choose a minimum exhaust line diameter equal to the nominal diameter of the connection flange.
2. Depending on the pump type, use PVC or metallic hoses with flange connections from the [Pfeiffer Vacuum component shop](#).
3. Option: In case of higher gas throughputs, mount an exhaust line.
4. Route the piping downwards from the vacuum pump, to prevent condensate return.
5. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.

### 5.4 Establishing control signal connections

#### **NOTICE**

##### **Property damage from electrostatic discharge**

Neglecting the electrostatic hazard for electronic components results in their damage or destruction

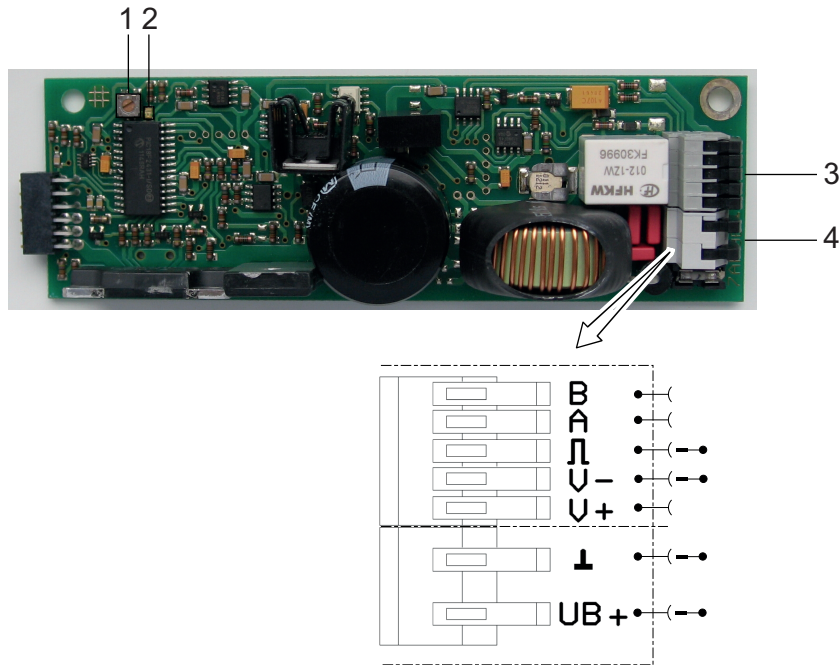
- ▶ Implement ESD safety measures at the workstation.
- ▶ Observe EN 61340 "Protection of electronic devices from electrostatic phenomena".

#### **Required tool**

- Phillips head (crosshead) screwdriver, **size 2**

#### **Removing the cover**

1. Loosen the fixing screw on the cover.
2. Remove the cover to the extent necessary without damaging the cable.
3. Finally, slide the cover back on completely.
4. Fasten the cover with the fixing screw.



**Fig. 4:** Circuit board with terminals

- |                              |   |
|------------------------------|---|
| 1 Trimmer                    | 3 Terminal block ST1B (control signals) |
| 2 LED for error code display | 4 Terminal block ST1A (voltage supply)  |

Rotation speed set value	Terminal block ST1B				
	V+	V-	PWM	A	B
External through PWM signal	-	black	red	-	-
External through analog voltage	red	black	-	-	-
Internal via trimmer	-	-	-	-	-
Cable cross-section = 0.25 mm <sup>2</sup>					

**Tbl. 5:** Overview of connections on terminal block ST1B

### 5.4.1 Establishing connections to the rotation speed setting



#### Trimmer priority

The trimmer has priority over the control signals.

#### Required tool

- Slot screwdriver

#### Connecting the external PWM signal

1. Turn the trimmer to the left stop.
2. Connect the corresponding terminals of terminal block ST1B.
  - The control cable (red/black) is firmly connected to the connecting socket on the diaphragm pump.
3. For a user-specific rotation speed preset, use the control cable to apply an electrically isolated PWM signal to terminal block ST1B.
  - 5 V to 24 V (mandatory), boundary frequency: > 100 Hz, < 1.5 kHz

#### Connecting analog voltage

1. Turn the trimmer to the left stop.
2. Connect the corresponding terminals of terminal block ST1B.
  - The control cable (red/black) is firmly connected to the connecting socket on the diaphragm pump.

### Establishing a connection for the trimmer

1. Make sure that no control signal is connected at the terminals of terminal block ST1B.
2. Connect the supply voltage at the corresponding terminals of terminal block ST1A.

## 5.4.2 Establishing a connection for interval operation

### Required cables (accessories)

- Control cable, TC 110/120 - diaphragm pump, 0.5 m
- Connection cable TPS - MVP



Fig. 5: Connection to TC and TPS

### Procedure

1. Establish the voltage supply.
2. Establish the control signal connection.

## 5.5 Connecting the voltage supply

### NOTICE

#### Property damage due to incorrect polarity

Incorrect or excessive supply voltage will destroy the motor.

- ▶ Always observe the motor rating plate specifications.
- ▶ When connecting the supply cable, observe the colored marking on the corresponding wires.
- ▶ Always provide a suitable mains fuse.

### NOTICE

#### Property damage from electrostatic discharge

Neglecting the electrostatic hazard for electronic components results in their damage or destruction

- ▶ Implement ESD safety measures at the workstation.
- ▶ Observe EN 61340 "Protection of electronic devices from electrostatic phenomena".

### Required cable (accessories)

- Connection cable TPS - MVP

### Procedure

- ▶ Connect the +24 V DC voltage supply (in accordance with rating plate) to the corresponding connecting socket.

## 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.

#### **NOTICE**

##### **Vacuum pump damage caused by overpressure**

Mixing up the connections causes overpressure overload. The vacuum 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 vacuum pump to the vacuum equipment.
- ▶ Before commissioning, make completely sure that the pressure side pressure is below the permissible limit.

#### **Procedure**

1. Compare the frequency specifications on the rating plate with the available supply voltage.
2. Check the exhaust connection for free passage (max. permissible pressure: 1100 hPa absolute).
3. Actuate the shut-off units so that the shut-off units open before or at the same time as the vacuum pump starts up.

### 6.2 Switching on the vacuum pump

When pumping down dry gases, no special precautions are required.

Pfeiffer Vacuum supplies the diaphragm pump ex factory for operation without control signal and with the trimmer turned to the right stop. The diaphragm pump starts directly and rotates at max. rotation speed.

#### **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.



#### **Warm-up time of the vacuum pump**

The warm-up time depends on the ambient temperature and takes at least 30 minutes.

#### **Prerequisite**

- required cable connections are established

#### **Switching on the vacuum pump**

1. Switch the voltage supply on.
2. If required, switch the vacuum pump on in each pressure range.
3. Allow the vacuum pump to warm up prior to process start, with the vacuum connection closed.

The vacuum pump achieves the specified throughput and final pressure values once the operating temperature has been reached.

## 6.3 Adjusting rotation speed

When operating the vacuum pump, there are 3 different control options, each of which can lead to a smooth circular runout of the vacuum pump at motor rotation speed > 400 rpm. The motor rotation speed of the vacuum pump increases linearly in each case up to max. rotation speed.

The higher the motor rotation speed, the higher the pumping speed. The lower the rotation speed, the longer the service life of the diaphragms and valves. In the low rotation speed range between approx. 600 and 1000 rpm, the diaphragm pump achieves the best final vacuum.

### Prerequisites

- Trimmer turned to left stop
- Control cable connected on terminal block ST1B (except with setting via trimmer)

### Setting the rotation speed externally through the PWM signal

- ▶ For a user-specific rotation speed, specify the control cable to apply an electrically isolated PWM signal to terminal block ST1B.
  - 5 V – 24 V (mandatory), boundary frequency: > 100 Hz, < 1.5 kHz

### Setting the rotation speed externally through analog voltage

- ▶ Specify an analog voltage in the range of 0.8 V to 10 V.

### Setting the rotation speed via the trimmer

- ▶ Rotate the trimmer clockwise to increase the motor rotation speed.
- ▶ Rotate the trimmer anti-clockwise to reduce the motor rotation speed.

## 6.4 Operating the diaphragm pump in interval operation

The interval operation increases the service life of the diaphragm pump with low gas throughputs of < 0.18 hPa l/s. The turbopump electronic drive unit switches the diaphragm pump on and off depending on the rated input of the turbopump. The rated input of the turbopump depends on the fore-vacuum pressure and gas throughput.



### It is not possible to control the rotation speed

Rotation speed control is not possible in this operating mode.

### Procedure

1. Apply a galvanically isolated PWM signal to the control signal input.
  - 0 V = pump "off", 24 V = pump "on" (max. rotation speed)
2. For low gas throughput, reduce the relative duty cycle to about 1 to 60% by comparing the rated input with an upper and lower threshold value.
3. From approx. 0.018 hPa l/s, make sure that the buffer volume in the fore-vacuum line is 0.5 liters in order to avoid switching on too frequently.

## 6.5 Pumping condensable vapors

Vapors or moisture from pumped media impair the throughput after condensation in the vacuum pump. Using the optional flushing gas nozzle improves the discharge of condensate, and the pump achieves the specified final vacuum more quickly.

### WARNING

#### Risk of explosion from reactive, explosive or other hazardous gas / air mixtures.

Uncontrolled inlet of gas at the flushing gas nozzle leads to sparks generated mechanically following diaphragm rupture, hot surfaces or to explosive gas / air mixtures in the vacuum system caused by static electricity.

- ▶ If necessary, use inert gas for supplying the flushing gas in order to avoid a potential ignition.

### CAUTION

#### Risk of poisoning due to toxic process gases escaping

For intake pressures > 500 hPa, process gas may escape from the flushing gas nozzle.

- ▶ If necessary, use an extraction line.



#### Maximum inlet pressure

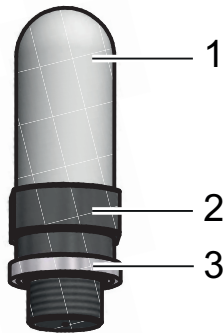
The maximum permissible inlet pressure at the flushing gas nozzle is 1,200 hPa absolute.

#### Accessories required

- Flushing gas nozzle with filter (order number PK 050 304 -U)

#### Required tools

- Allen key, **WAF 5**
- Open-end wrench, **WAF 14**



**Fig. 6: Flushing gas nozzle with filter**

- |  |                   |
|--|-------------------|
| 1 Filter (1/8" thread)   | 3 VS sealing ring |
| 2 Nozzle adapter for inert gas connection (1/8" thread, nozzle Ø 0.2 mm) |                   |

#### Mounting the flushing gas nozzle

1. Unscrew and remove the sealing screw from the vacuum pump.
2. Screw the flushing gas nozzle into the vacuum pump.
3. Manually unscrew and remove the filter from the nozzle adapter to connect an inert gas line.

## 6.6 Switching off the vacuum pump

#### Procedure

1. Allow the vacuum pump to run on for 5 to 10 minutes with the vacuum connection open to allow any condensate that may be present to be removed from the vacuum pump.
2. If required, switch the vacuum pump off in each pressure range.
3. Disconnect the voltage supply on the power supply pack.



## 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**

##### **Damage caused by unsuitable cleaning agents**

Unsuitable cleaning agents damage pump parts.

- ▶ Use only approved cleaning agents to clean pump parts.
- ▶ Use only a clean dry cloth to clean the diaphragms and valves.
- ▶ Do not use any alcohol or other cleaning agents to clean the diaphragms and valves.

#### **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.

Valves and diaphragms are wear parts.

Component	Operating hours
Diaphragms	15 000
Valves	15 000
Motor bearing	40 000

**Tbl. 6: Typical service life with normal use**

#### **Prerequisites**

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

#### **Required materials**

- Cloth (clean, lint-free)
- Water or mild soap solution

**Servicing the vacuum pump**

1. Disconnect the vacuum pump from the voltage supply.
2. Secure the motor against reactivation.
3. Remove any external contamination on the vacuum pump with cloth slightly moistened with water or a mild soap solution.
4. Allow all cleaned parts to dry well.
5. For maintenance work, only dismantle the vacuum pump to the extend needed.
6. Clean the suction chamber, diaphragms, and valves with a dry cloth.
7. Examine the diaphragms and valves for cracks at the latest when the pressure values achieved decrease.

**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.

**Maintenance level 2**

We recommend that Pfeiffer Vacuum Service carry out maintenance work at level 2. If the specified intervals 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 wherever parts other than original spare parts are used.

Action	Inspection	Maintenance level 1	Maintenance level 3	Required material
Interval	as required; at least once every six months	as required; at least every 2 years	as required; at least every 4 years	
Check silencer for contamination <sup>2)</sup>	■			
Test vacuum pump optically and acoustically	■			
Read out and analyze pump data		■		
Clean the vacuum pump		■		
Change the diaphragms and valves		■		Overhaul kit
Change silencer <sup>3)</sup>		■		Silencer
Perform a functional test		■		
Incoming inspection with vibration measurement			■	
Disassemble vacuum pump completely			■	
Clean vacuum pump completely			■	
Change gas ballast filter <sup>4)</sup>			■	Filter
Replace all wear parts			■	Diaphragms, valves, sealing rings, silencers

**Tbl. 7: Maintenance intervals**

2) if present

3) if present

4) if present

## 7.3 Change the diaphragms and valves

### NOTICE

#### Property damage from incorrect installation

Change in dead volume due to incorrect installation of the original spacer disks impairs the final vacuum or leads to bearing damage.

- ▶ During disassembly, keep the existing spacer disks separate per installation location.
- ▶ Reinstall the same number of original spacer disks per diaphragm head.

### 7.3.1 Dismantle the pump head and valves



#### Avoid interchanging components

Always dismantle and mount only the pump head on one pump side in order to avoid interchanging the components.

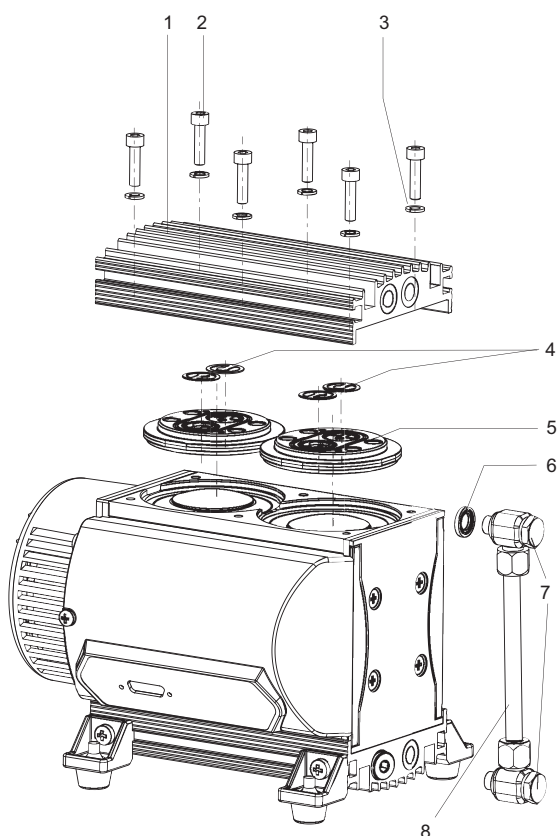
The procedures are identical for both pump heads.

#### Prerequisites

- Handle dismantled
- Diaphragm pump supported

#### Required tools

- Open-end wrench, **WAF 15**
- Open-end wrench, **WAF 16**
- Allen key, **WAF 4**



**Fig. 7: Pump head and valves**

- |                       |                     |
|-----------------------|---------------------|
| 1 Housing cover 1     | 5 Head cover (2×)   |
| 2 Cylinder screw (6×) | 6 Sealing ring (2×) |
| 3 Lock washer (6×)    | 7 Banjo bolt (2×)   |
| 4 Valve (4×)          | 8 Hose connection   |

### Procedure

1. Loosen the screw fitting.
2. Turn the elbow fitting max. 1/4 revolution anti-clockwise, until the hose connection can be loosened.
3. Loosen the screw fitting.
4. Dismantle the hose connection.
5. Unscrew the cylinder screws on the housing cover.
6. Remove the housing cover.
7. Remove the head cover each with both valves.
  - If the valves stick to the housing cover, carefully release the valves; otherwise, remove the valves from the head covers.

## 7.3.2 Dismantling the diaphragms

### Prerequisite

- Pump head and valves dismantled

### Required tool

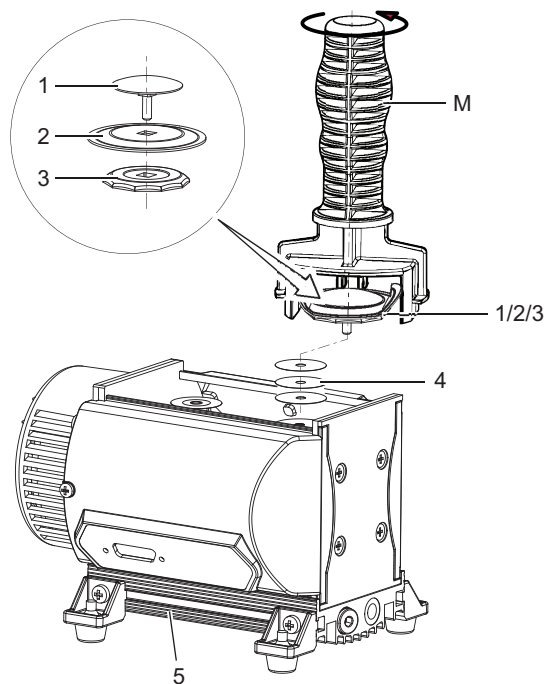
- Diaphragm key **WAF 46**

### Spare parts required

- Inspection set, including diaphragm key

### Required consumable materials

- Clean, dry cloth
- Alcohol or cleaning solvent, if necessary



**Fig. 8: Replacing the diaphragms**

- |                     |                 |
|---------------------|-----------------|
| 1 Clamping washer   | 4 Spacer disks  |
| 2 Diaphragm         | 5 Pump head 2   |
| 3 Supporting washer | M Diaphragm key |

### Dismantling the diaphragms

1. Carefully bend the diaphragm up on the side and while it is bent, attach the diaphragm key to the supporting washer.
  - Do not use a sharp-edged tool.
2. Unscrew the supporting washer, diaphragm, and clamping washer.

3. Pay attention to the spacer disks under the diaphragm.
  - Reuse the original spacer disks for each installation location when remounting.
4. Remove the supporting washer and the diaphragm from the square of the clamping washer connecting screw.
  - If the diaphragm is stuck to the supporting washer, use alcohol or cleaning solvent to release it.

### 7.3.3 Installing the diaphragm

#### Required tools

- Diaphragm key **WAF 46**

#### Spare parts required

- Overhaul kit incl. diaphragm key

#### Required consumables

- Clean, dry cloth
- Alcohol or cleaning solvent, if necessary

#### Installing the diaphragm

1. Clean all parts with a dry, clean cloth.
2. Replace the wearing parts (valves and diaphragms) as per the spare part package.
3. Place the diaphragm (blue side up) and the supporting washer on the square of the clamping washer connecting screw.
  - Pay attention to the seating of the diaphragm in the square of the connecting screw.
4. Place the original spacer disks on the respective connection rod.
5. Tighten the supporting washer with the diaphragm key on the connection rod.

### 7.3.4 Installing the pump head and valves



#### Avoid interchanging components

Always dismantle and mount only the pump head on one pump side in order to avoid interchanging the components.

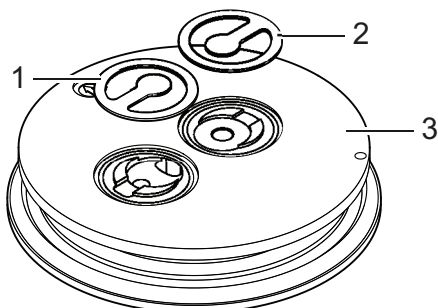
The procedures are identical for both pump heads.

#### Prerequisite

- Diaphragms installed

#### Required tools

- Open-end wrench, **WAF 15**
- Open-end wrench, **WAF 16**
- Allen key, **WAF 4**
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )



**Fig. 9:** Correct mounting orientation of the valves in the head cover

- |                  |              |
|------------------|--------------|
| 1 Valve (inlet)  | 3 Head cover |
| 2 Valve (outlet) |              |

**Procedure**

1. Insert the valves into the head cover.
  - Make sure that the valves have the correct mounting orientation.
2. Mount the housing cover.
3. First, screw on the cylinder screws of the housing cover loosely by hand, alternating screws in a diagonal pattern.
4. Then tighten the cylinder screws of the housing cover, alternating screws in a diagonal pattern.
  - Tightening torque: **max. 6.0 ±1 Nm**
5. Mount the hose connection and the banjo bolts.

## 7.4 Checking the final pressure

The leakage rate of the vacuum pump ensures that the specified final pressure is reached and prevents the formation of potentially explosive mixtures in the interior of the vacuum pump

After the diaphragm or valve is replaced, the vacuum pump reaches the specified final pressure value only after a run-in period of several hours.

**Test values**

Observe the separate test specification.

- with gas ballast: < 3 hPa
- without gas ballast: < 2.0 hPa

**Procedure**

1. Measure the final pressure of the vacuum pump.
  - after work on the system, e.g., maintenance
  - before the vacuum pump is reinserted
2. Compare the measured final pressure with the test values and the specifications in the technical data.

**Prerequisites**

- Vacuum pump mounted
- Vacuum pump correctly installed electrically

**Required aids**

- Vacuum chamber (3 liter)
- Pressure gauge
- Flushing gas nozzle (optional)

**Measure the final pressure**

1. Connect a vacuum chamber (volume approx. 3 l) to a vacuum connection.
2. Also connect a pressure gauge (e.g. Pirani gauge) to the vacuum chamber on the vacuum side.
3. Operate the vacuum pump with open flushing gas nozzle (if available) for at least 2 hours.
4. If unusual noises develop, immediately switch off the vacuum pump and check the position of the clamping washers.
5. Measure the final pressure.

**Comparing the ultimate pressure with the test value**

1. Compare the measured ultimate pressure with the test value.
2. If the values differ significantly from the specified values after replacing the diaphragm and valve, and if there are no changes after a run-in period, perform the following steps:
  - Check the compression couplings of the connection hoses to the pump heads.
  - Check the valve seats and the suction chambers.
  - Repeat the ultimate pressure measurement.

## 8 Decommissioning

Before shutting down the vacuum pump, observe the following instructions to adequately protect the interior of the vacuum pump (suction chamber) from corrosion:

### **Procedure for temporary vacuum pump shutdowns**

1. Allow the vacuum pump to run on for 5 to 10 minutes with the vacuum connection open to allow any condensate that may be present to be removed from the vacuum pump.
2. If media has entered the vacuum pump that may attack the pump materials or lead to deposits, clean the inside of the pump heads.

### **Procedure for longer vacuum pump shutdowns**

1. Disconnect the vacuum pump from the vacuum system.
2. Remove the vacuum pump from the vacuum system if necessary.
3. Seal the vacuum connection with the original sealing plugs.
4. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
5. 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.

## 9 Recycling and disposal

### **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.



#### **Environmental protection**

You **must** dispose of the product and its components in accordance with all applicable regulations for protecting people, the environment and nature.

- Help to reduce the wastage of natural resources.
- Prevent contamination.



#### **Environmental protection**

The product and its components **must be disposed of in accordance with the applicable regulations relating to environmental protection and human health**, with a view to reducing natural resource wastage and preventing pollution.

### 9.1 General disposal information

Pfeiffer Vacuum products contain materials that you must recycle.

- ▶ Dispose of our products according to the following:
  - Iron
  - Aluminium
  - Copper
  - Synthetic
  - Electronic components
  - Oil and fat, solvent-free
- ▶ Observe the special precautionary measures when disposing of:
  - Fluoroelastomers (FKM)
  - Potentially contaminated components that come into contact with media

### 9.2 Dispose of diaphragm pumps

Pfeiffer Vacuum diaphragm pumps contain materials that you must recycle.

1. Disconnect the electronic drive unit.
2. Dismantle the motor.
3. Decontaminate the components that come into contact with process gases.
4. Separate the components into recyclable materials.
5. Recycle the non-contaminated components.
6. Dispose of the product or components in a safe manner according to locally applicable regulations.



## 10 Malfunctions

### ⚠ 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"> <li>No supply voltage or voltage does not correspond to the motor data</li> </ul>	<ul style="list-style-type: none"> <li>Check the supply voltage.</li> </ul>
	<ul style="list-style-type: none"> <li>Pump temperature too low</li> </ul>	<ul style="list-style-type: none"> <li>Heat the vacuum pump to a temperature of &gt; 12 °C.</li> </ul>
	<ul style="list-style-type: none"> <li>Thermal protection of the motor has triggered</li> </ul>	<ul style="list-style-type: none"> <li>Identify and eliminate the cause and allow vacuum pump to cool if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Diaphragms or valves dirty</li> </ul>	<ul style="list-style-type: none"> <li>Clean the vacuum pump.</li> </ul>
	<ul style="list-style-type: none"> <li>Overpressure in the exhaust lead</li> </ul>	<ul style="list-style-type: none"> <li>If required, check and clean the exhaust line.</li> </ul>
Vacuum pump switches off after a while after being started	<ul style="list-style-type: none"> <li>Thermal protection of the motor has triggered</li> </ul>	<ul style="list-style-type: none"> <li>Identify and eliminate the cause and allow vacuum pump to cool if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Exhaust pressure too high</li> </ul>	<ul style="list-style-type: none"> <li>Check exhaust line outlet opening and exhaust side accessories.</li> </ul>
Vacuum pump does not reach the specified ultimate pressure	<ul style="list-style-type: none"> <li>Condensate in the vacuum pump</li> </ul>	<ul style="list-style-type: none"> <li>Operate the vacuum pump at atmospheric pressure for a longer period.</li> </ul>
	<ul style="list-style-type: none"> <li>Flushing gas nozzle open</li> </ul>	<ul style="list-style-type: none"> <li>Close the flushing gas nozzle</li> </ul>
	<ul style="list-style-type: none"> <li>Soiled valves or diaphragms</li> </ul>	<ul style="list-style-type: none"> <li>If necessary, clean or replace the valves and diaphragms.</li> </ul>
	<ul style="list-style-type: none"> <li>Leak in system</li> </ul>	<ul style="list-style-type: none"> <li>Locate and eliminate the leak.</li> </ul>
Pumping speed of vacuum pump too low	<ul style="list-style-type: none"> <li>The intake line is not suitably dimensioned</li> </ul>	<ul style="list-style-type: none"> <li>Make sure that connections are short and cross sections adequately dimensioned.</li> </ul>
	<ul style="list-style-type: none"> <li>Exhaust pressure too high</li> </ul>	<ul style="list-style-type: none"> <li>Check exhaust line outlet opening and exhaust side accessories.</li> </ul>

Problem	Possible causes	Remedy
Unusual noises during operation	<ul style="list-style-type: none"> <li>Defective valves or diaphragms</li> </ul>	<ul style="list-style-type: none"> <li>If necessary, clean or replace the valves and diaphragms.</li> </ul>
	<ul style="list-style-type: none"> <li>Soiled suction chamber</li> </ul>	<ul style="list-style-type: none"> <li>Clean suction chamber.</li> </ul>
	<ul style="list-style-type: none"> <li>Valves dirty or defective</li> </ul>	<ul style="list-style-type: none"> <li>If necessary, clean or replace the valves and diaphragms.</li> </ul>
	<ul style="list-style-type: none"> <li>Connection rod or motor bearing defective</li> </ul>	<ul style="list-style-type: none"> <li>Contact <a href="#">Pfeiffer Vacuum Service</a>.</li> </ul>

Tbl. 8: Troubleshooting on diaphragm pumps

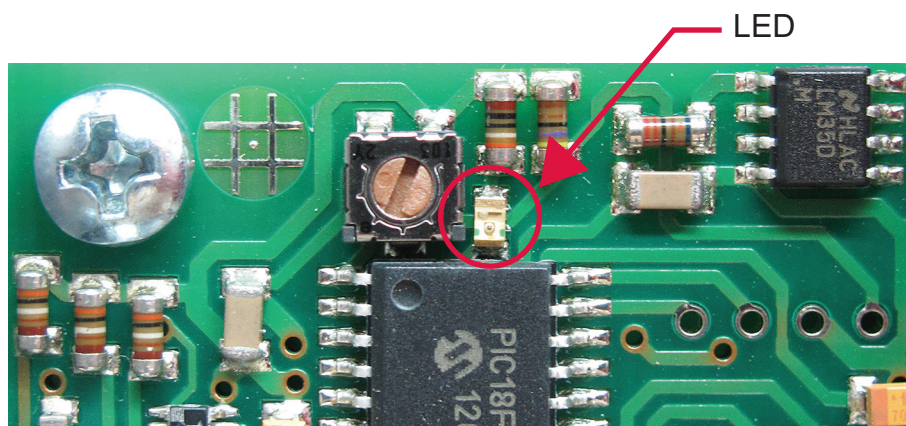


Fig. 10: LED on the circuit board

LED flashing	Meaning
1×	Supply voltage < 16 V
2×	Supply voltage > 36 V
3×	Electronics excess temperature
4×	Pump blocked, no rotation possible
5×	Error speed monitoring
6×	-
7×	Electronics error

Tbl. 9: LED display of error codes

# 11 Service solutions by Pfeiffer Vacuum

## We offer first-class service

High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

We are always focused on perfecting our core competence – servicing of vacuum components. Once you have purchased a product from Pfeiffer Vacuum, our service is far from over. This is often exactly where service begins. Obviously, in proven Pfeiffer Vacuum quality.

Our professional sales and service employees are available to provide you with reliable assistance, worldwide. Pfeiffer Vacuum offers an entire range of services, from original replacement parts to service contracts.

## Make use of Pfeiffer Vacuum service

Whether preventive, on-site service carried out by our field service, fast replacement with mint condition replacement products, or repair carried out in a Service Center near you – you have various options for maintaining your equipment availability. You can find more detailed information and addresses on our homepage, in the Pfeiffer Vacuum Service section.

**You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.**

**For fast and smooth service process handling, we recommend the following:**



1. Download the up-to-date form templates.
  - Explanations of service requests
  - Service requests
  - Contamination declaration



- a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
- b) If necessary, drain operating fluid/lubricant.
- c) If necessary, drain coolant.
2. Complete the service request and contamination declaration.



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

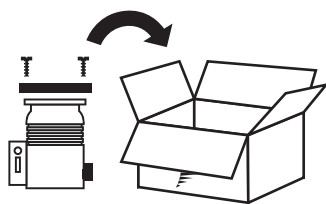


4. You will receive an acknowledgment from Pfeiffer Vacuum.

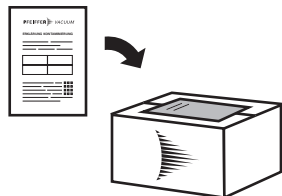
PFEIFFER VACUUM

## Submission of contaminated products

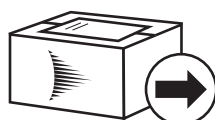
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination costs** may be incurred.



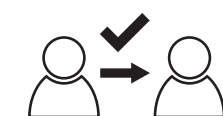
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
  - a) Neutralize the product with nitrogen or dry air.
  - b) Seal all openings with blind flanges, so that they are airtight.
  - c) Shrink-wrap the product in suitable protective foil.
  - d) Package the product in suitable, stable transport containers only.
  - e) Maintain applicable transport conditions.



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



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



8. You will receive an acknowledgment/quotation, from Pfeiffer Vacuum.

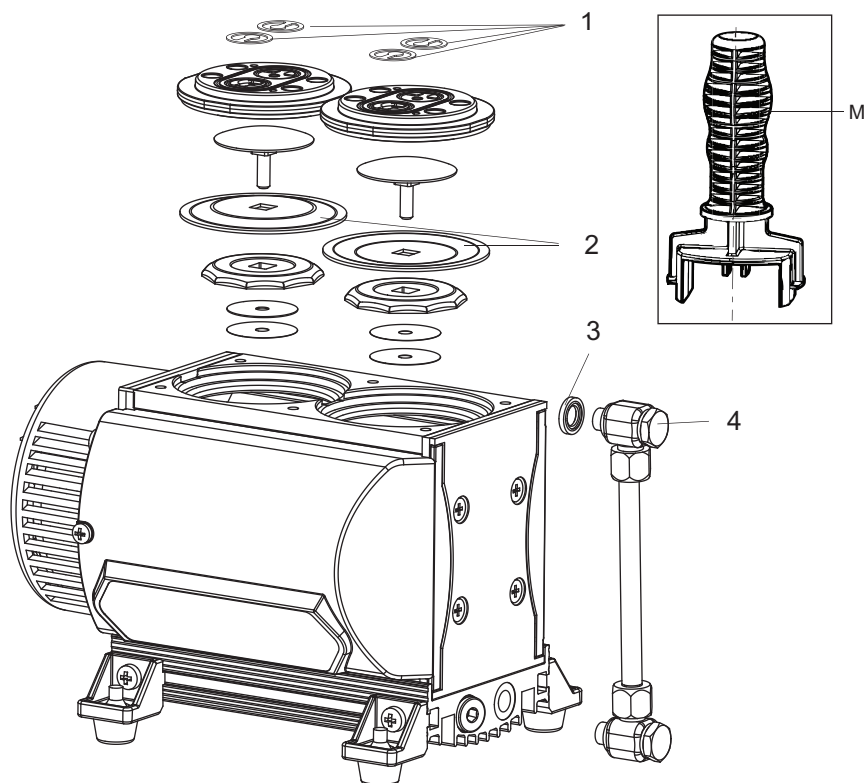
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Our sales and delivery conditions and repair and maintenance conditions for vacuum devices and components apply to all service orders.

## 12 Spare part packages

### Ordering spare part packages

- ▶ Have the vacuum pump part number to hand, along with other details from the rating plate if necessary.
- ▶ Install original spare parts only.
- ▶ When ordering the inspection set, observe the respective part number of the diaphragm pump.



**Fig. 11: Spare parts**

- |                |                 |
|----------------|-----------------|
| 1 Valves       | 4 Banjo bolt    |
| 2 Diaphragms   | M Diaphragm key |
| 3 Sealing ring |                 |

Spare part package	Order number	comprising the following parts
Inspection set, including diaphragm key	PU E22 034 -T	Pos. 1 (8×) Pos. 2 (4×) Pos. M
Sealing ring	P 3529 133 -P	Pos. 3
Banjo bolt	P 0995 943	Pos. 4
Diaphragm key	P 0995 941	Pos. M

**Tbl. 10: Spare part packages**

Spare part package	Part number	comprising the following parts
Filter	P 0105 405	Flushing gas nozzle filter

**Tbl. 11: Spart part package flushing gas nozzle**

## 13 Accessories

### 13.1 Accessory information

**Power supply packs**

Power supply packs for fastening to the wall and standard rails or for rack assembly serve the voltage supply.

**Cable and adapter**

Mains, interface, connection, and extension cables provide a secure and suitable connection. Different lengths on request

**Hose connections**

Hose connections with adapters for connecting to a turbopump

**Screwing flange**

Screwing flange, including seal for the intake side of the vacuum pump

**Flushing gas connection**

Avoids moisture accumulating in the vacuum pump

### 13.2 Ordering accessories

Selection field	Part number
TPS 180, power supply pack for wall/standard rail installation	PM 061 341 -T
Wall rail fitting for TPS 110/180/310/400	PM 061 392 -T
Connection cable TPS - MVP	PM 061 441 -T
Control cable, TC 110/120 - diaphragm pump, 0.5 m	PM 061 433 -X
Hose DN 6; (ø 8/6 mm) polyethylene	P 0991 939
Hose connection DN 6 x 400 mm with straight connector 1/8" thread and 1/4" thread including seal	P 0920 739 E
Hose connection DN 6 x 1000 mm with straight connector 1/8" thread and 1/4" thread including seal	P 0920 817 E
Push-in fitting 1/8" thread including seal for hose connection (8/6 mm)	P 4131 029 G
Screwing flange DN 16 ISO-KF / 1/8" thread incl. seal	PK 050 108 -T
Flushing gas nozzle with filter for MVP 020-3 / MVP 030-3	PK 050 304 -U

**Tbl. 12: Accessories**

## 14 Technical data and dimensions

### 14.1 General

Basis for the technical data of Pfeiffer Vacuum diaphragm pumps:

- Specifications according to PNEUROP committee PN5
- ISO 21360:2012: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"

The following harmonized standards are fulfilled:

- IEC 61010-1
- UL 61010-1
- CSA 61010-1

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

1 Pa = 1 N/m<sup>2</sup>

**Tbl. 13: Conversion table: Pressure units**

	mbar l/s	Pa m <sup>3</sup> /s	sccm	Torr l/s	atm cm <sup>3</sup> /s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m <sup>3</sup> /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 <sup>3</sup> /s	1.01	0.101	59.8	0.76	1

**Tbl. 14: Conversion table: Units for gas throughput**

### 14.2 Technical data

<b>Type designation</b>	<b>MVP 020-3 DC</b>
<b>Part number</b>	<b>PK T01 198</b>
Number of pumping stages	4
Connection flange (in)	G 1/8"
Connection flange (out)	1/8" thread
Pumping speed category	1.2 m <sup>3</sup> /h
Final pressure without gas ballast	2 hPa
Final pressure with gas ballast	3 hPa
Gas ballast	Available as an accessory
Intake pressure max.	1100 hPa
Exhaust pressure, max.	1100 hPa
Integral leakage rate	$1 \cdot 10^{-2}$ Pa m <sup>3</sup> /s
Operating voltage: DC	24 V
Input voltage: tolerance	±10 %
Rated current consumption	3.5 A
Current, max.	5.5 A

<b>Type designation</b>	<b>MVP 020-3 DC</b>
<b>Part number</b>	<b>PK T01 198</b>
Rotation speed	300 – 1 500 rpm
Sound pressure level	45 dB(A)
Motor type	DC motor
Cooling method	Convection cooled
Operating altitude, max.	2000 m
Protection degree	IP20, NEMA Type 1 (acc. to UL 50E)
Ambient temperature	10 – 40 °C
Temperature: Storage	-10 – 60 °C
Degree of pollution	2
Weight	4.3 kg

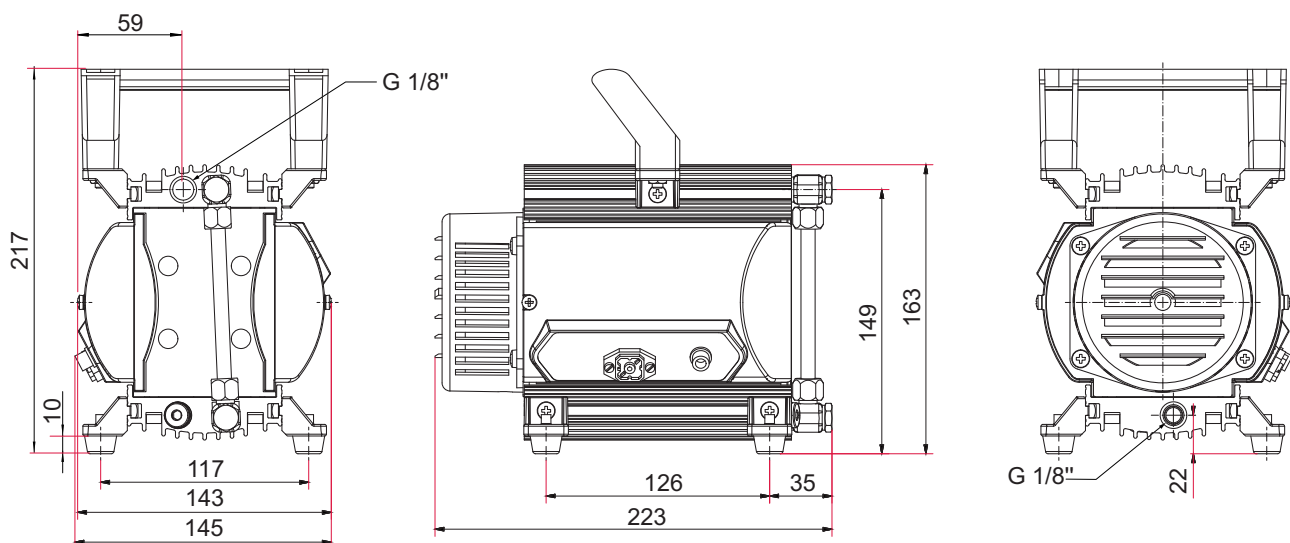
**Tbl. 15: Technical data, MVP 020-3 DC**

### 14.3 Substances in contact with the media

<b>Pump parts</b>	<b>Substances in contact with the media</b>
Housing cover	Aluminum alloy (AlMgSi)
Head cover	Aluminum alloy (AlMgSi)
Diaphragm clamping disk	Aluminum alloy (AlMgSi)
Diaphragm	FPM, PTFE-coated
Valves	FPM
Inlet	Aluminum alloy (AlMgSi)
Outlet	Aluminum / silicone rubber
Threaded hose couplings	Anodized aluminum
Hose	Polyethylene (PE), highly crosslinked

**Tbl. 16: Materials that make contact with the process media**

### 14.4 Dimensions



**Fig. 12: Dimensions MVP 020-3 DC**  
Dimensions in mm



# Declaration of conformity

Declaration for product(s) of the type:

**Diaphragm Pump**

MVP 020-3 DC

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

DIN EN IEC 63000:2019

DIN EN 1012-2:2011

DIN EN 61010-1:2011

DIN EN 61326-1:2013

IEC 61010-1:2010 (Ed. 3)

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

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Signature:



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(Daniel Sälzer)  
Managing Director

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

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Asslar, 2019-08-27



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

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