

Bellows pump series MP[®]-F

MP-F05, MP-F05/R,

MP-F10, MP-F10/R

(Valid as of Serial No. 21123397, 02.2022)

Instruction Manual

Version 1.07.02



**Dear customer,**

Thank you for buying our product. In this manual you will find all necessary information about this M&C product. The information in the manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. You will find all the addresses in the appendix of this instruction manual.

For additional information about our products, please go to M&C's website www.mc-techgroup.com. There you can find the data sheets and manuals of our products in German and English.

Disclaimer

This instruction manual does not claim to be complete and it may be subject to technical modifications.

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MP® is a registered trade mark.

With the release of this version all older manual versions will no longer be valid.

The German instruction manual is the original instruction manual. In case of arbitration only the German wording shall be valid and binding.

Version: 1.07.02

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1 General information

The product described in this instruction manual has been built and tested in our production facility.

All M&C products are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this instruction manual need to be followed. This instruction manual includes all information regarding proper transportation, storage, installation, operation, and maintenance of this product by qualified personnel.

Follow all instructions and warnings closely.

Read this manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor.

2 Declaration of conformity



The product described in this operating manual complies with the following directive:

Machinery Directive

The requirements of the directive 2006/42/EC are met.

Declaration of conformity

The EU Declaration of conformity can be downloaded from the **M&C** homepage or directly requested from **M&C**.

3 Warranty

In case of a device failure, please contact immediately M&C or your M&C authorized distributor.

We have a warranty period of 12 months from the delivery date. The warranty covers only appropriately used products and does not cover the consumable parts. Please find the complete warranty conditions in our terms and conditions.

The warranty includes a free-of-charge repair in our production facility or the free replacement of the device. If you return a device to M&C, please be sure that it is properly packaged and shipped with protective packaging. The repaired or replaced device will be shipped free of delivery charges to the point of use.

4 Warning signs and definitions



Danger

The 'Danger' warning sign indicates that death, serious injury and/or significant material damage will be the consequence, if the appropriate precautions should not be taken.



Warning

The 'Warning' warning sign indicates that death, serious injury or damage to property may occur, if the relevant precautionary measures are not observed.



Caution

The 'Caution' warning sign indicates that slight personal injury can occur, if the appropriate safety precautions are not observed.

Caution

'Caution' indicates that damage to property can occur, if the appropriate safety precautions are not observed.



Note

'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.

Qualified Personnel

'Qualified personnel' are experts who are familiar with the installation, mounting, commissioning and operation of these types of products.



High voltages!

Protect yourself and others against damage which might be caused by high voltages.



Toxic!

Acute toxicity (oral, dermal, inhalation)! Toxic when in contact with skin, swallowed or inhaled.



Corrosive!

These substances destroy living tissue and equipment upon contact. Do not breathe vapors; avoid contact with skin and eyes.



Hot surface!

Contact may cause burn! Do not touch!



Caution, risk of being crushed due to rotating parts.

Do not open the device. Use personal protective equipment (PPE).



Wear protective gloves!

Working with chemicals, sharp objects or extremely high temperatures requires wearing protective gloves.



Wear safety glasses!

Protect your eyes while working with chemicals or pointed objects. Wear safety glasses to avoid getting something in your eyes.



Wear protective clothes!

Working with chemicals, pointed objects or extremely high temperatures requires wearing protective clothes.



Wear safety footwear!



Use safety helmet and full protective goggles

5 Correct operation

Follow these basic safety precautions during installation, commissioning and operation of the device:

- Read this instruction manual before commissioning and operating the product. Please make sure to follow all warnings and safety instructions.
- Installation and commissioning of electrical devices must be carried out only by qualified skilled personnel in compliance with the current regulations.
- The installation and commissioning of the device must conform to the requirements of VDE 0100 'Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V' and must be in compliance with all relevant regulations and standards.
- Before connecting the device, please make sure to compare the supply voltage with the specified voltage on the product label.
- Protection against contact to components carrying high voltages: Disconnect the power supply before opening the device for access. Make sure that all external power supplies are disconnected.
- Operate the device only in the permitted temperature and pressure ranges. For details please refer to the technical data sheet or instruction manual.
- Install the device only in protected areas, sheltered from sun, rain and moisture.
- Do not use the bellows pumps MP-F05, MP-F05/R, MP-F10, MP-F10/R in hazardous areas.
- If an operation involves sample gases, which are toxic and hazardous to the health, protective measures need to be taken against any accidental leakage, e.g. unexpected damage of the pump bellows, the related tubing or tube connections.
- To troubleshoot failing or decreasing pump performance, we recommend installing a flow monitoring device downstream from the pump.
- The pump is only designed for sample gases, which are not contaminated with particles. It might be necessary to install a suitable particle filter upstream of the pump.
- The pump is not designed for liquid. To protect the pump against condensate, a cooler might be necessary to be installed upstream of the pump.
- Only gas or gas mixtures can be used, which do not react with each other or with materials of the pump components.
- Installation, maintenance, inspections, and any repairs of the devices must be carried out only by qualified skilled personnel in compliance with the current regulations.
- In processes where condensate is to be expected in the event of a malfunction or other conditions, turn the pump head downwards and mount the pump at the highest point. If this mounting is not possible, the outlet tubing must be installed with a downward slope (see Figure 8) to the downstream components.

6 Wrong operation



Warning

Please make sure to install and operate the pump for the intended use described in this instruction manual only.



Warning

The pump can only be operated within the parameters stated in the technical data of chapter 8 Technical data.



Warning

The pump is not designed for liquids or particles.

Even condensation in the pump is not permitted and can lead to a defect.

The pump head can be electrostatically charged by particles, liquids and drops of condensate.

If in case of a malfunction moisture or condensation is to be expected, the pump head must be turned downwards for normal operation and the sample gas outlet must be installed with a downward slope to the downstream components.



Warning

The materials of the pump, which are in contact with the sample gas, need to be suitable for the used sample gas.



Warning

In order to operate the pump, it needs to be securely installed.



Warning

Install the pump only in protected areas, sheltered from rain and moisture.

Please make sure to provide sufficient ventilation.



Warning

Do not exceed the permitted maximum pressure within the pump (gauge pressure).

Do not close the sample gas output. A sufficient sample gas flow needs to be provided to prevent the pump pressure from exceeding the permitted maximum pressure value.

A sufficient sample gas flow also prevents the temperature of the pump head to increase over the permitted temperature range.



Warning

If components downstream from the pump can block or reduce the sample gas flow, appropriate measure, e.g. a pressure valve, needs to be installed to prevent the process pressure from exceeding the maximum permitted pressure value.

7 Application



Note

As of February 2022 (starting with serial number 21123397), the MP-F series pump has a new, more powerful motor.

When replacing an older pump (serial numbers up to 21123396), note that the motor protection must be set according to the technical data applicable from February 2022 (from serial number 21123397). See chapter 8 Technical data.

The bellows pump **MP-F...** is suitable for 100 % oil-free operation of corrosive gases. The construction and performance of the pump is especially tailored to the requirements of the analysis technique. The pump is gas tight and its operation is maintenance-free.

All sample contacting parts of the bellows pump **MP-F** are corrosion resistant. To connect the pump head to the tubing, the upper part of the pump head is also available in stainless steel (optional).

The pump operates absolutely lubricant free, this prevents the sample gases from any contamination. Due to a special bellows and valve system, the pump operates maintenance-free and has a long service life. The straightforward valve design ensures low maintenance costs.

The pump is available in 230 V or 115 V and in two different pump capacities. These are the minimum pump capacities the pump is able to achieve:

- MP-F05 pump capacity at least 5 NI/min (approx. 320 NI/h)
- MP-F10 pump capacity at least 10 NI/min (approx. 600 NI/h)

liter capacity with a counter pressure of ± 50 mbar on the vacuum and pressure side.

- Option: integrated needle valve to adjust the flow rate in the pump head of the MP F.../R

and/or

- Option: stainless steel pump head with NPT – thread.

The sample gas line can be connected to the top or the side of the pump head. The pump head also can be rotated and mounted in 90° steps.



Warning

Bellows pumps series MP-F are not suitable for liquids or particles. These pumps only operate dry and particle-free gases.

7.1 MP-F05/R and MP-F10/R with integrated needle

To ensure that the needle valve works properly, the output of the pump needs to be operated with at least 0.1 bar counter pressure.

To adjust the pump capacity, a needle valve used as an internal pump bypass is integrated into the pump head. The optimized shape of the needle valve makes it possible to adjust the pump capacity over a wide range. All parts of the valve, which are in contact with the sample gas, are made of PTFE and PVDF. There are no O-rings in the needle valve.

To open the needle valve completely, turn out the valve until it stays at 35 mm (lowest pump capacity).

To close the needle valve completely, turn in the valve, until it stays at 25 mm (highest pump capacity)

After adjusting the needle valve, the locknut (see position ①) needs to be fastening hand-tight with a wrench. This ensures that the needle valve is gas tight and avoids accidental misalignment of the valve.

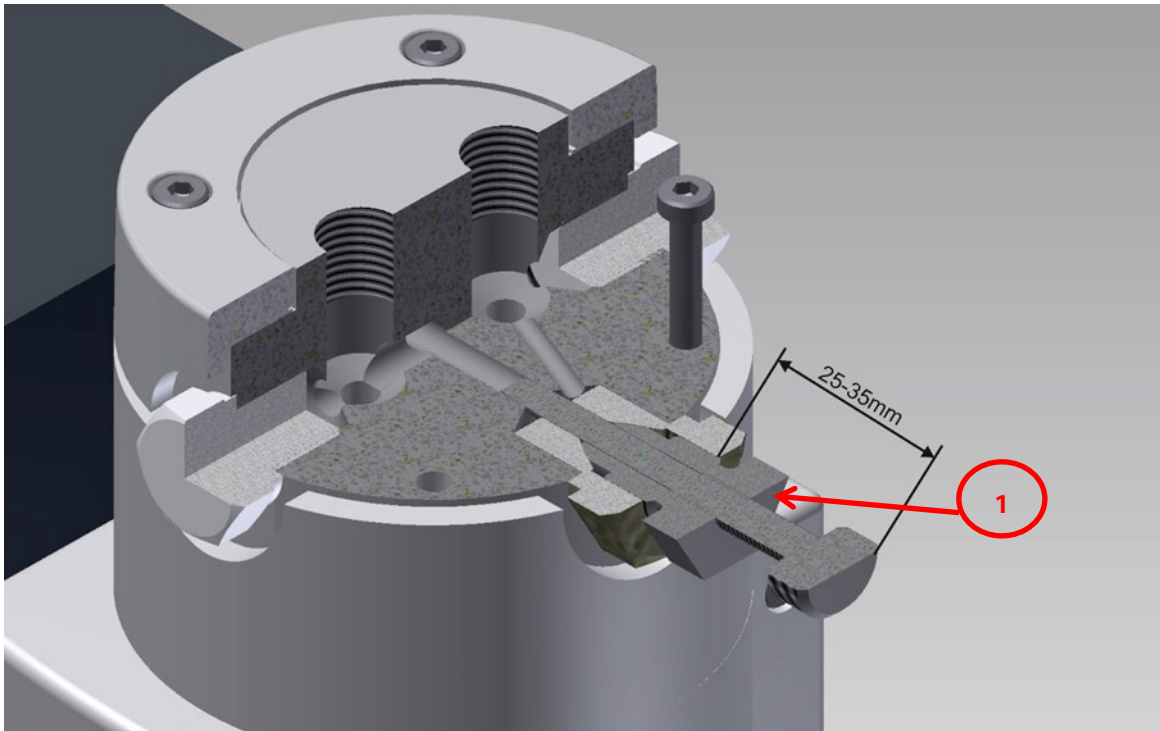


Figure 1 Needle valve in a half-section view with one quarter removed

Service life and reliability of the pump is increased by using a bypass needle valve. This needle valve protects the pump from unnecessary high loads or overload.

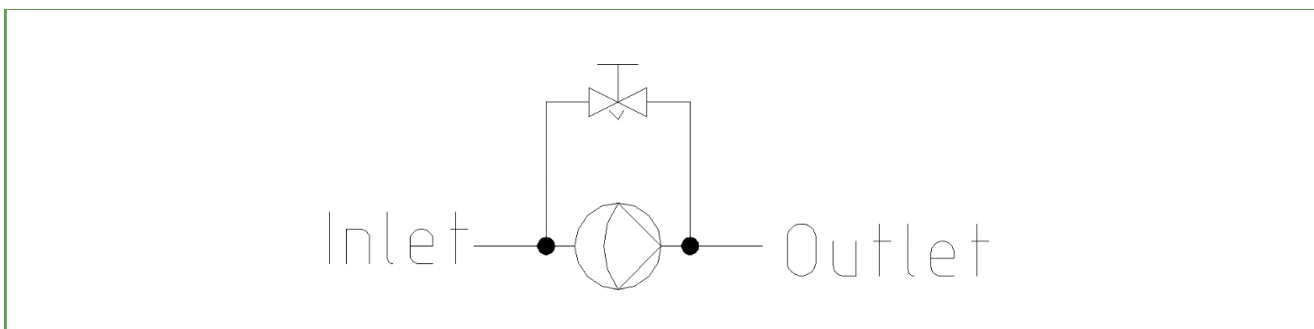


Figure 2 Pump with bypass needle valve

8 Technical data

Bellows Pump	MP-F05/230 V		MP-F05/115 V		MP-F10/230 V		MP-F10/115 V	
Part No.	05P1000		05P1000a		05P1005		02P1005a	
Part No. with needle valve MP-F../R	05P1010		05P1010a		05P1015		05P1015a	
Voltage	230 V 50/60 Hz		115 V 50/60 Hz		230 V 50/60 Hz		115 V 50/60 Hz	
Voltage tolerance	In accordance with IEC 60034-1 Voltage $\pm 5\%$ Frequency $\pm 2\%$							
Degree of protection	IP 54 - DIN 40050							
Pump capacity	At least 320 NI/h (approx. 5 l/min) Liter capacity with a counter pressure of ± 50 mbar on the vacuum and pressure side				At least 600 NI/h (approx. 10 l/min) Liter capacity with a counter pressure of ± 50 mbar on the vacuum and pressure side			
Operating pressure	Max. 0.4 to 2.5 bar abs.				Max. 0.3 to 3.2 bar abs.			
Gas temperature	-30 to +100 °C [-22 °F to 212 °F] for dry sample gas							
Ambient temperature	+10 °C to +50 °C / 0 °C to +50 °C for dry sample gas [+50 °F to +122 °F / +32 °F to +122 °F for dry sample gas] installation altitude of < 1000 m [\approx < 3281 ft.] above sea level							
Storage temperature	-20 to +60 °C [-4 to +140 °F]							
Sample gas connections	G 1/4" i DIN ISO 228/1							
Gas tightness of pump head	< 6×10^{-3} mbar l/s							
Power consumption	65 W							
Cos ϕ at specified frequency	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
	0.92	0.99	0.94	0.99	0.92	0.99	0.94	0.99
Current consumption at specified frequency	0.62 A	0.55 A	1.24 A	1.1 A	0.62 A	0.55 A	1.24 A	1.1 A
Cable glands	M20 x 1.5							
Terminal range	6.5 – 10 mm		7.5 – 10 mm		6.5 – 10 mm		7.5 – 10 mm	
Electrical equipment standard	EN 60204-1							
Material of sample gas contacting parts	PTFE, PFA, FEP (+PVDF for type /R)							
Weight	4.7 kg [\approx 10.4 lbs]		4.7 kg [\approx 10.4 lbs]		4.7 kg [\approx 10.4 lbs]		4.7 kg [\approx 10.4 lbs]	
Options								
05P1050	Mounting bracket with 4 anti-vibration pads for bellows pump MP-F							
90P8100	Mounting bracket for wall mounting							
05P1060	Extra charge for upper pump head of bellows pump MP-F out of stainless steel							
05P1070	Extra charge for upper pump head of bellows pump MP-F../R out of stainless steel with needle valve out of PVDF							

Material abbreviations according to ISO 1629 and 1043.1

8.1 Pump capacities

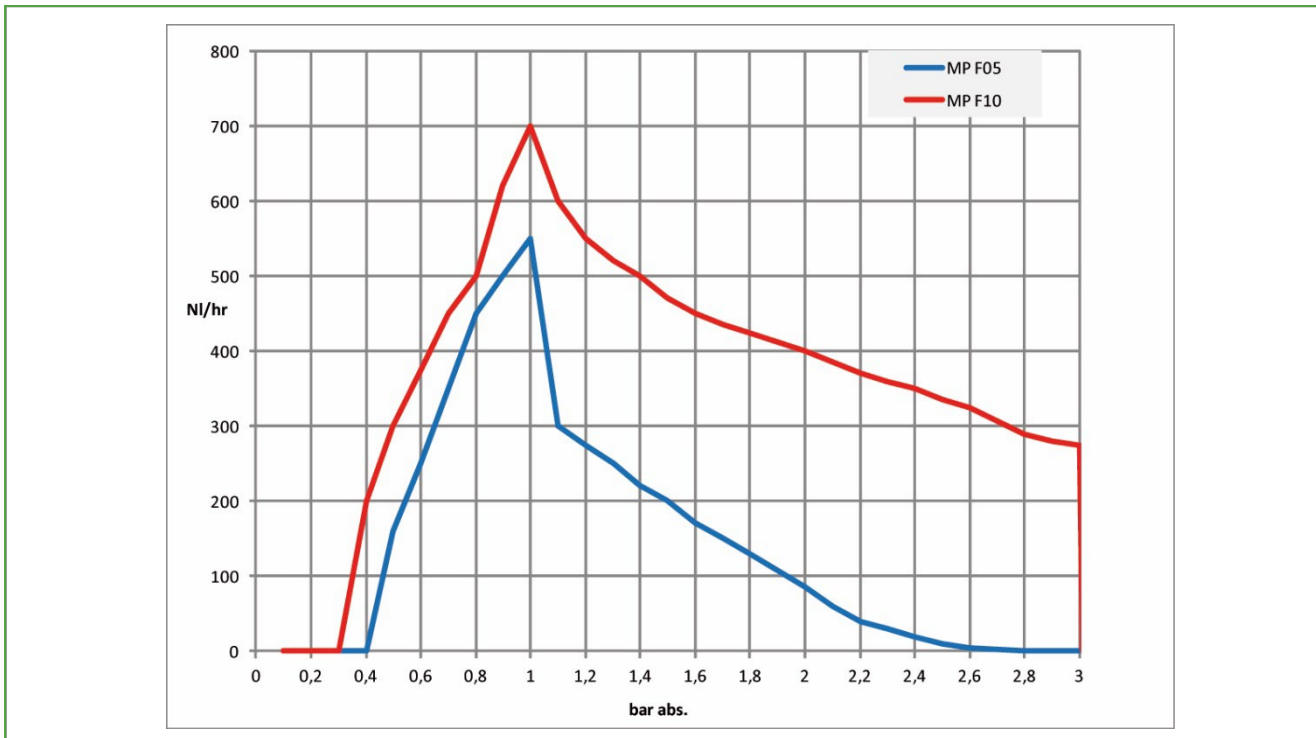


Figure 3 Pump capacity MP-F05 and MP-F10

8.2 Dimensions

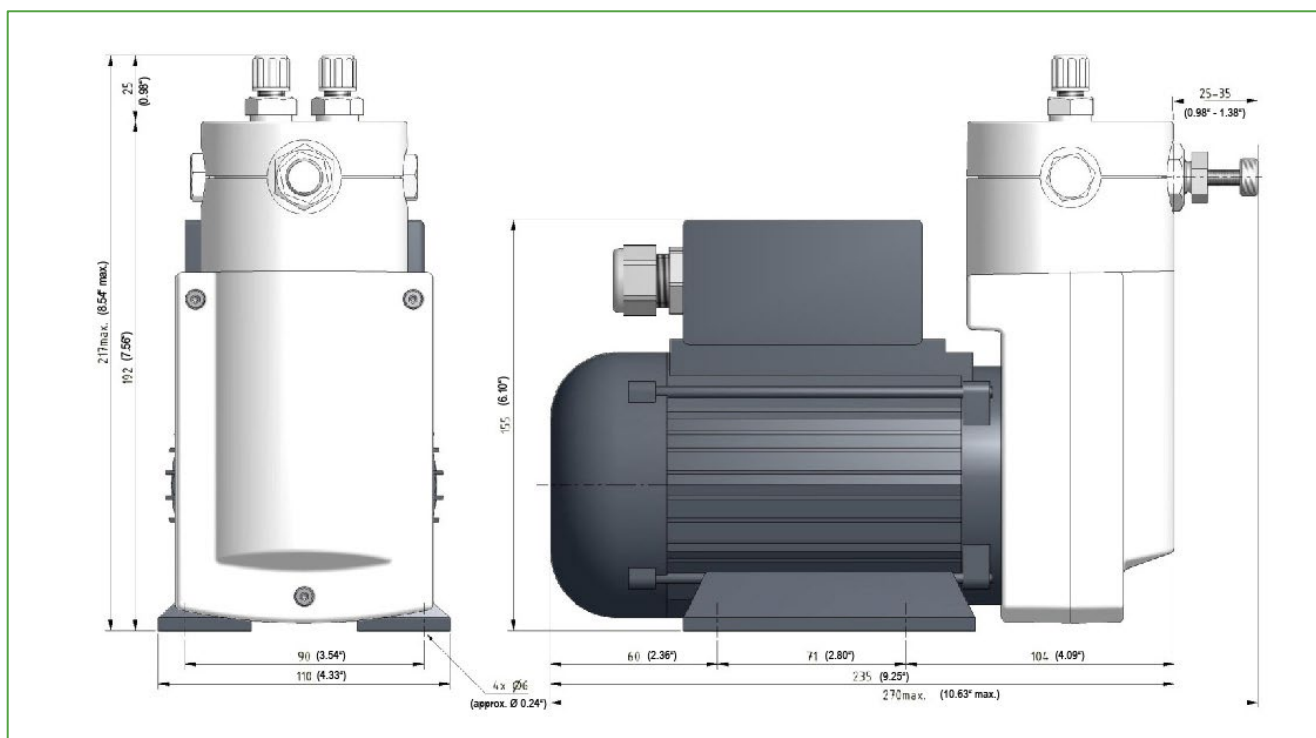


Figure 4 Dimensions MP-F./R

9 Receiving and storing the bellows pump

1. Please remove the bellows pump carefully from the packaging. Check the scope of the delivery specified on the delivery note. Please make sure that you have received all items stated on the delivery note.
2. Please check the unit for any transport damage after receipt and report any complaints to the transport company immediately.



Note

The bellows pump should be stored in a protected, frost-free room!

10 Installation instructions

All relevant regulations regarding accident prevention and safety need to be met during installation and operation of the pump.



Warning

High voltage!

Working without disconnecting the power supply may cause an electrical shock.



Disconnect power supply before any assembly, maintenance or repair work. Secure the pump against accidental restart!



Warning

Protect yourself and others against contact to parts of the pump, e.g. electrical connections, which may be still connected to a power supply. Protect yourself and others against contact to moving parts of the pump. Protect the pump against entering of water and particles.



Make sure to comply with the current safety regulations regarding the sample gas used in the pump.



Note

Install the pump in well ventilated rooms and away from heat sources to prevent any heat accumulation.

For outdoor installation, install the pump in a protective housing. The housing needs to provide protection against frost in winter, and ventilation in summer. Avoid exposure to direct sunlight.



Warning

Pumps contain mechanically moving parts that can cause vibrations. In order to avoid damage to the pump and peripheral components / facilities and to minimize acoustic noise, appropriate vibration isolation must be provided. M&C offers e.g. vibration control air springs to decouple the vibration source from the vibration-free environment.

Especially the connections of the sample gas lines to the pump head need to be decoupled.

The components, which will be connected to the pump, need to meet the requirements of the pneumatic data of the pump. For details please refer to the technical data sheet or manual.



Warning

Make sure to comply with the current safety regulations when connecting the pump to the power supply.

Make sure to comply with the current safety regulations regarding the sample gas used in the pump.



Aggressive condensate possible.
Chemical burns possible due to aggressive media!



For general electrical and mechanical work on the pump, wear personal protective equipment (PPE) in accordance with the risk assessment.

Condensate accumulated inside the pump head destroys the pump.

Condensate can form, for example, if the pressure dew point is exceeded or if there is a malfunction in the sampling process. If condensate is to be expected, then the following measures must be taken:



Warning

- Turn the pump head downwards so that the gas connections point downwards.
- Mount the pump at the highest point in the system. If this is not possible, route the outlet tubing away from the pump at an incline (see Figure 8).

These measures allow condensate formed in the pump outlet to flow out of the pump head and be safely drained.



Note

To immediately detect pump malfunctions, we recommend installing a flow monitoring device downstream from the pump.

10.1 Mounting bracket (Part-No. 90P8100)

The pump can be mounted on a stainless steel mounting bracket. The mounting bracket is designed for various pump models. The following figure shows the hole pattern for the MP-F pump (right hand side) and the hole pattern for wall mounting (left). In all positions (pump head to the left, right and to the front) it is possible to rotate the pump head 180° downwards.

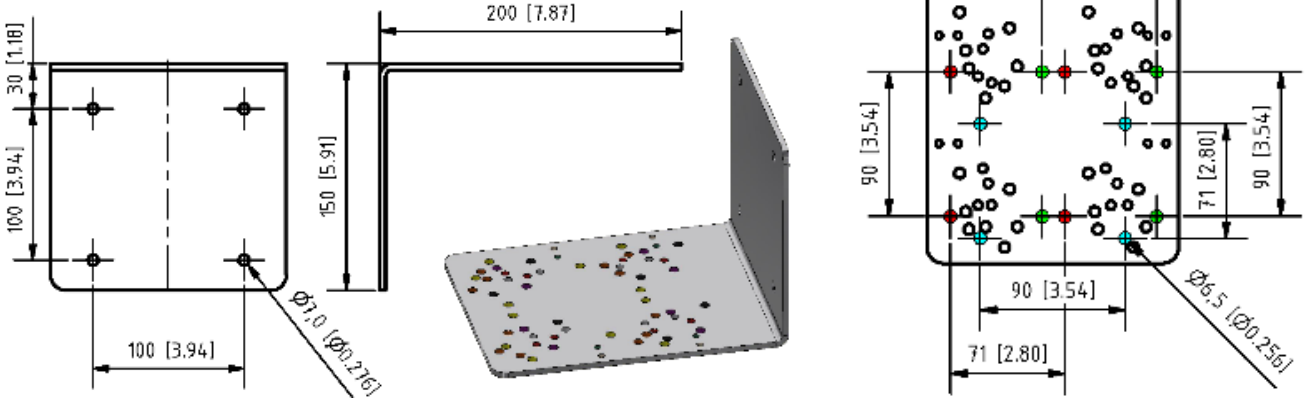


Figure 5 Mounting bracket hole pattern for wall-mount (left) and pump (right)

10.2 Mounting the pump

Condensate accumulated inside the pump head destroys the pump.

Condensate can form, for example, if the pressure dew point is exceeded or if there is a malfunction in the sampling process. If condensate is to be expected, then the following measures must be taken:



Warning

- Turn the pump head downwards so that the gas connections point downwards.
- Mount the pump at the highest point in the system. If this is not possible, route the outlet tubing away from the pump at an incline (see Figure 8).

These measures allow condensate formed in the pump outlet to flow out of the pump head and be safely drained.

The mounting site needs to comply with the following requirements:

- Ambient temperature range during operation: +10 to +50 °C/0 to +50 °C for dry sample gas [+50 to +122 °F/+32 to +122 °F for dry sample gas].
- The pump is rated IP55 (protection class) and it needs to be protected against water and dust ingress.
- During operation, the pump needs to have an adequate supply of cooling air for heat dissipation.
- If possible, install the pump at the highest elevation point of your system, to make sure that no condensate and no dust will ingress the pump.
- Mount the pump through the four 6 mm holes located in the base of the pump. If vibrations are likely to occur at this location, use vibration control air springs to decouple the vibration source. Screw the pump tightly to the ground. For dimensions, please see Figure 4. For sufficient supply of cooling air, the pump needs to be mounted at least 25 mm apart from the wall.

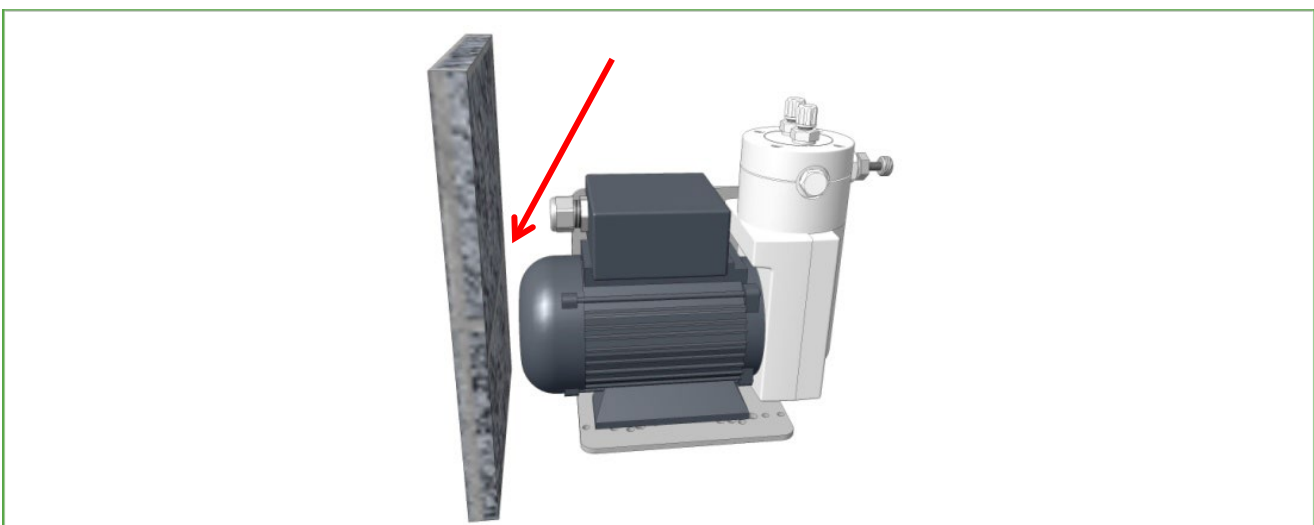


Figure 6 Installing the MP-F..

10.3 Rotating the pump head

The position of the pump head compared to the motor base can be changed. The pump head can be rotated in 90° steps. Please follow these steps to rotate the pump head:

1. Please unscrew and remove the three lid screws.
2. Remove lid.
3. Unscrew and remove the four flange screws with the lock washers shown in Figure 7.
4. Now you can change the position of the pump head in 90° steps.
5. After rotating the pump head to the selected position, please insert the four flange screws with the lock washers back again and tighten them.
6. Put the lid back on and secure the lid by tightening the three lid screws.

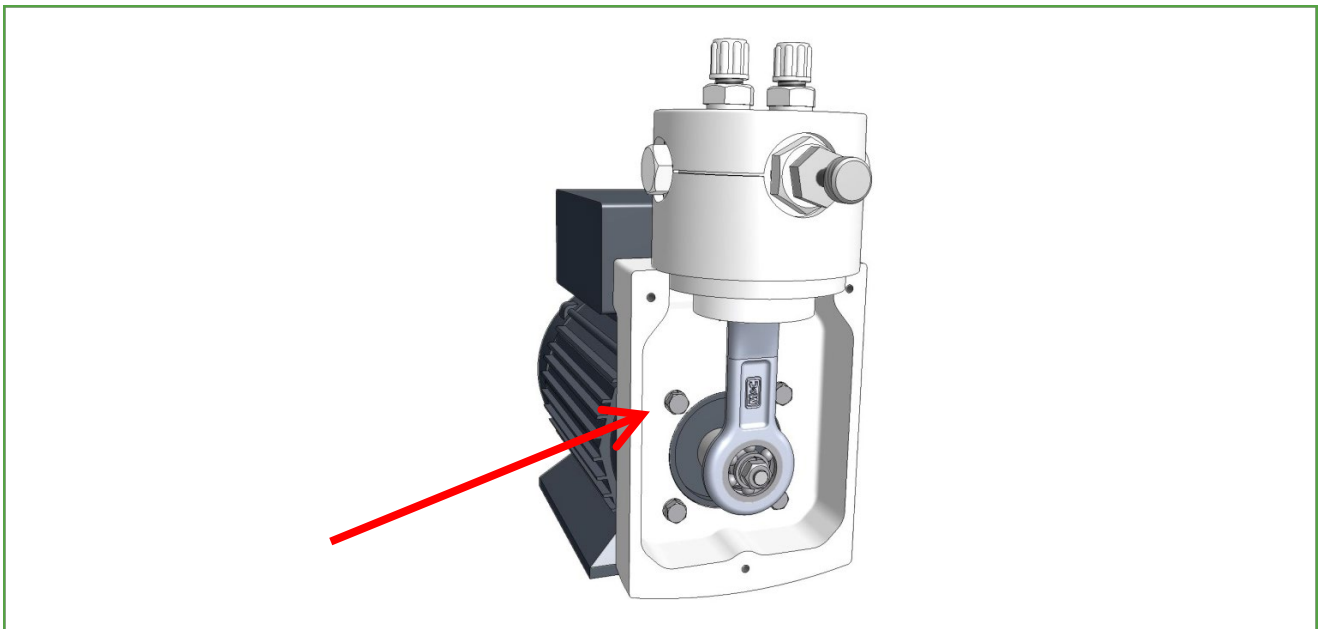


Figure 7 Rotating the pump head

10.4 Routing the gas outlet tubing with a downward slope

If there is a risk that condensate may form in the outlet of the pump, e.g. by exceeding the pressure dew point or in the event of a malfunction during the extraction process, proceed as follows:

1. Turn the pump head downwards so that the gas connections point downwards.
2. Mount the pump at the highest point in the system. If this is not possible, then lay the sample gas outlet tubing with a downward slope to the downstream components to safely guide the condensate produced away from the pump.

The following figure shows a pump with a rotated pump head and with a sample gas outlet tubing that is installed with a downward slope to the downstream components.

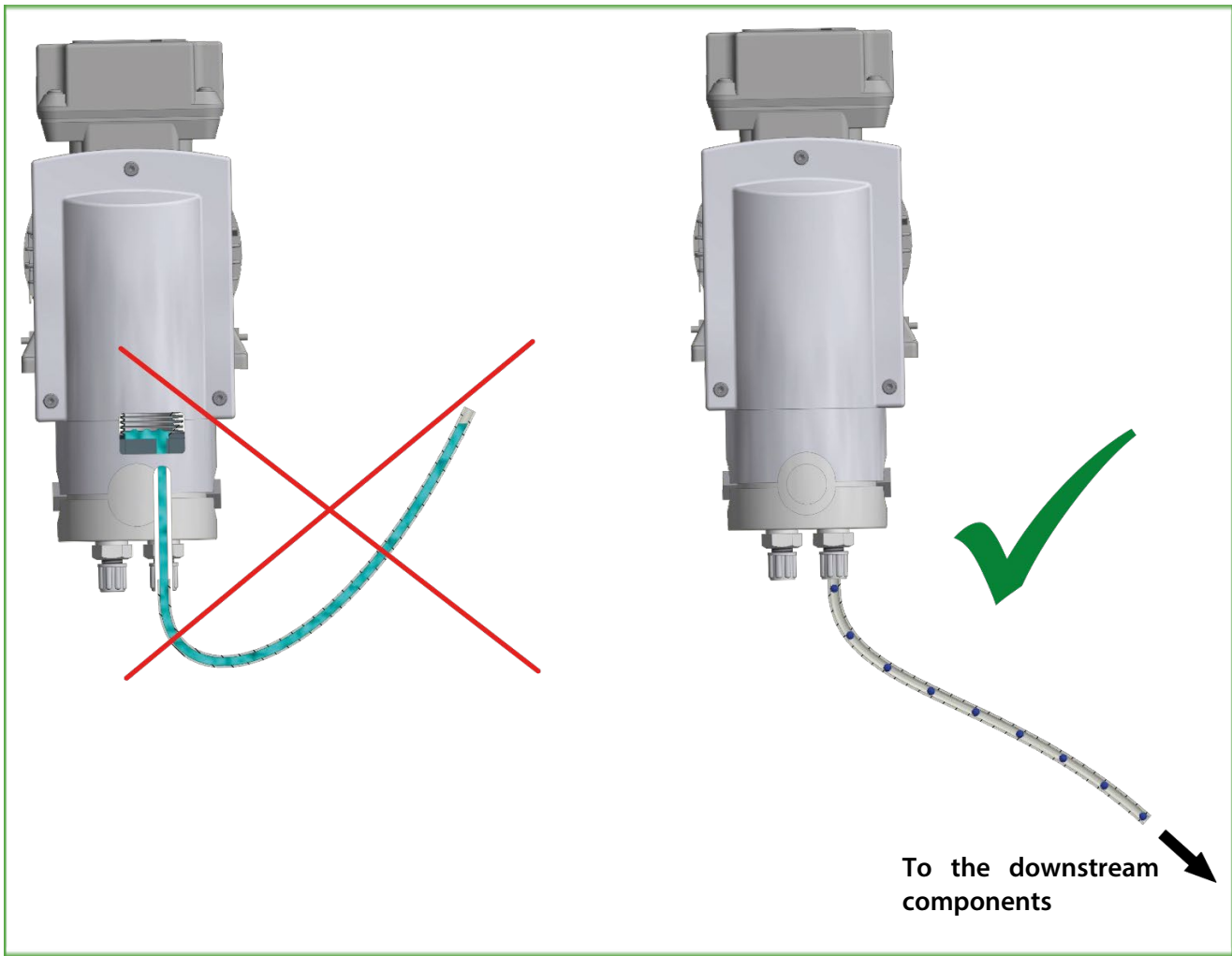


Figure 8 Pump head facing down: install outlet tubing with a downward slope

10.5 Electrical connections



Note

As of February 2022 (starting with serial number 21123397), the MP-F series pump has a new, more powerful motor.

When replacing an older pump (serial numbers up to 21123396), note that the motor protection must be set according to the technical data applicable from February 2022 (from serial number 21123397). See chapter 8 Technical data.

Be sure to observe all relevant safety regulations during the electrical installation of the pump. The main power supply must be turned off before connecting the pump.



Danger

Do not operate bellows pumps MP F.. in explosive environments!



Warning



Incorrect voltage can destroy the device.

When connecting the equipment, please ensure that the supply voltage is identical with the information provided on the model type plate. The supply voltage is only allowed to deviate max. $\pm 5\%$ and frequency $\pm 2\%$ from the indication on the model type plate.

Exceeding the tolerance increases the heating and influences the electromagnetic compatibility (EMC).

The air-cooled motor is designed for an ambient range $+10$ to $+50$ °C/ 0 to $+50$ °C for dry sample gas [$+50$ to $+122$ °F/ $+32$ to $+122$ °F for dry sample gas] and an installation altitude of < 1000 m [$\approx < 3281$ ft.] above sea level.



Note

The installation and commissioning of the device must conform to the requirements of VDE 0100 'Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V' and must be in compliance with all relevant regulations and standards!

230 V 50 Hz: The current supply circuit of pump type MP-F... has to be provided with a motor circuit breaker 0.62 A corresponding to the rated current (overcurrent protection).

230 V 60 Hz: The current supply circuit of pump type MP-F... has to be provided with a motor circuit breaker 0.55 A corresponding to the rated current (overcurrent protection).

115 V 60 Hz: The current supply circuit of pump type MP-F... has to be provided with a motor circuit breaker 1.1 A corresponding to the rated current (overcurrent protection).

115 V 50 Hz: The current supply circuit of pump type MP-F... has to be provided with a motor circuit breaker 1.24 A corresponding to the rated current (overcurrent protection).

- Install a device to disconnect the pump motor from all poles of the main power supply according to EN 60335-1.
- The pump needs to be installed in such a way, that contact to parts carrying live voltage (e.g. electrical connections) is impossible.

For wiring the cables and wires, please follow these steps:

1. Unscrew and remove the lid of the connection box.
2. **230 V:** Feed connection cable ($\varnothing \geq 0.75 \text{ mm}^2 \text{ Cu}$) through cable gland (clamping range 6.5 – 10 mm) and connect it with ring cable lugs according to Figure 9 or the connection diagram in the junction box lid. Secure cable with the clamping bracket.
3. **115 V:** Feed connection cable ($\varnothing \geq 0.75 \text{ mm}^2 \text{ Cu}$) through cable gland (clamping range 7.5 – 10 mm) and connect it with ring cable lugs according to Figure 10 or the connection diagram in the junction box lid. Secure cable with the clamping bracket.
4. Keep the inside of the junction box clean.
5. Close lid of the junction box. Please make sure that the lid does close correctly, and the sealing of the box is still in good condition.

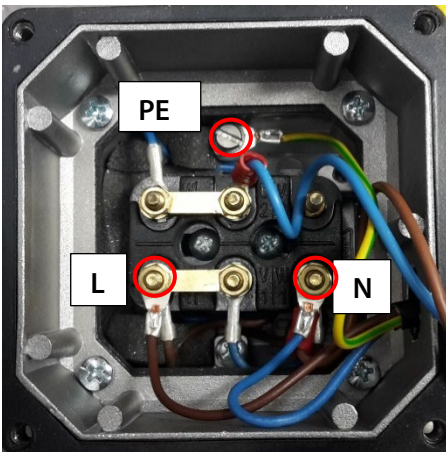


Figure 9 Electrical connection MP-F.. 230 V

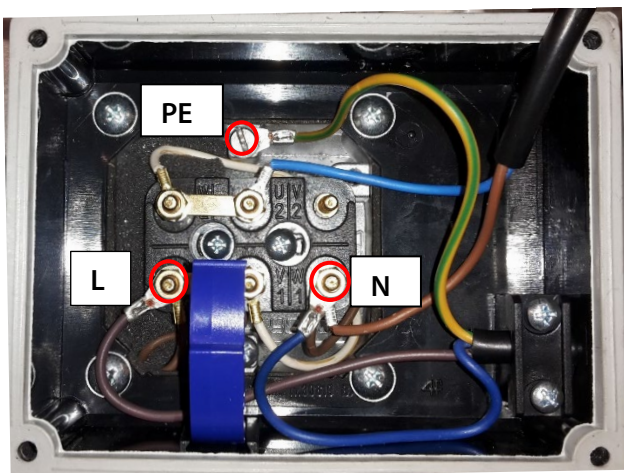


Figure 10 Electrical connection MP-F.. 115 V

10.6 Pneumatic connection

1. Remove protective plugs from the gas connection threads (thread size G 1/4").
2. It is possible to screw the tube connection fittings into the pump head either from the top or side. To screw in the tube connection fittings from the side, please remove protective plugs from the gas connection threads on the side and screw them into the threads on the top.
3. Accessory parts like tube connection fittings are screwed into the connection threads with sealing tape (when using straight M&C connectors, no sealing tape is necessary). Connection fittings for DN 4/6 or DN 6/8 are optional and available at M&C.

The tube connection for M&C fittings is described below.



Figure 11 Pneumatic connection

1. Connect suction and pressure line.



The operating direction is marked with an arrow on the pump head. In Figure 11 the pressure side is on the left and the suction side is on the right.

To connect the suction and pressure line, please loosen the union nut of the compression ring fitting counterclockwise. Be sure to remove the union nut carefully from the fitting. There is a loose clamp ring inside the union nut.

2. Slide the nut over the connecting tube.
3. Slide the clamp ring with the thicker bulge facing the nut, over the connecting tube.
4. Slide the connecting tube on the support nipple of the fitting.
5. Hand-tighten the nut. The connecting tube is now slip-proof and pressure-tight mounted to the tube connection fitting.
6. Suction and pressure lines need to be installed in such a way that the pump is protected against ingress of condensate or dust.



Because of compression of sample gases, it is possible that condensate builds up in the pressure line. This pressure must be reduced. For example, reduce the pressure with a valve in the pressure line upstream of the pump or with the integrated needle valve.

11 Preparations for commissioning

Before initial startup, all plant- and process-specific safety measures must be observed. It is mandatory for the operator to complete the enclosed risk assessment of the product.

The gas exposure risk must be assessed by the operator with regard to the hazards posed by process and calibration gas and the setup at the installation site (e.g. tubing, system cabinet/container/plant). If the risk assessment reveals increased exposure hazards, further measures are required.

A visible label must be attached to the installation site in accordance with the risk assessment provided by the operator.

12 Start up

Before commissioning, be sure to comply with all applicable facility- and process-specific safety measures.

Make sure to operate the pump for the intended use described in chapter 5 only.

Before commissioning, be sure to comply with all applicable safety regulations and measures of the involved sample gases. The materials of the pump, which are in contact with the sample gas, need to be suitable for the used sample gas. Before operating the pump, make sure that the materials of the pump head, bellows and valves (for pump materials: see chapter 8 Technical data) are suitable for the used sample gas.

Follow these instructions before initial start-up:

- Ensure that the pump is securely tightened to the surface.
- Only sample gas which withstands the pressure and temperature within the pump and does not built-up condensate is suitable for operation.
- Make sure that the pump does not start-up against pressure or vacuum.
- Before start-up and restarting, atmospheric pressure must be present in the suction and pressure lines. Even when the power has been cut off for only a short period, the suction and pressure lines need to have atmospheric pressure. After a pump standstill, the pressure in the sample gas lines needs to be set back to atmospheric pressure.
- Never exceed the maximum permitted operating pressure (for details see chapter 8 Technical data).
- Only insert a sample gas flow controller or restriction device into the suction line. This protects the pump bellows from damage and prevents the pressure from exceeding the maximum permitted operating value.
- Monitor the pressure, when a sample gas flow controller or restriction device is inserted in the suction line. This prevents the pressure to exceed the maximum permitted operating pressure.
- Monitor the pressure if necessary.
- If there is a chance that components installed downstream of the pump may block or reduce the sample gas flow, it is necessary to install e.g. a pressure relief valve. This prevents the pressure to exceed the maximum permitted operating value.
- The bellows, valve plates and O-rings are the only consumable parts of the pump. Wear is usually indicated by a drastic reduction in the pneumatic performance. Valve plates must be replaced when they have reached a total thickness of < 1.6 mm [\approx 0.063"] including spacers. New O-rings ensure the tightness of the pump.

When replacing parts, please have a look at chapter 16 Maintenance.

13 Operating the pump

The following ambient conditions are necessary for operating the pump:

- Ambient temperature range during operation: +10 to +50 °C/0 to +50 °C for dry sample gas [+50 to +122 °F/+32 to +122 °F for dry sample gas].
- Operate the pump only in well ventilated rooms, and away from heat sources to prevent any heat accumulation.
- Please check immediately for damage when the motor makes unusual running noises. Damaged ball bearings could be the cause of these running noises.

14 Decommissioning

Before switching off the pump (decommissioning), the pump needs to be purged with inert gas or air.



The room or area where the pump is installed in must be kept frost-free at all times! The ambient temperature range is +10 to +50 °C/0 to +50 °C for dry sample gas [+50 to +122 °F/+32 to +122 °F for dry sample gas] even after decommissioning the pump.



Aggressive condensate possible.

Chemical burns possible due to aggressive media!



For general electrical and mechanical work on the pump, wear personal protective equipment (PPE) in accordance with the risk assessment.

15 Disassembly



Note

Before switching off the pump (decommissioning), the pump needs to be purged with inert gas or air, and it needs to be dried.



Aggressive condensate possible.

Chemical burns possible due to aggressive media!



For general electrical and mechanical work on the pump, wear personal protective equipment (PPE) in accordance with the risk assessment.

Before disassembling the pump, follow these warnings and safety instructions:



Warning

High voltage!

Working without disconnecting the power supply may cause an electrical shock. Disconnect power supply before any assembly, maintenance, or disassembly.



Secure the pump against accidental restart.



Danger

There may be harmful sample gases in the pump. Prevent potentially harmful gases from escaping the open sample gas lines during disassembly.



You can disassemble the pump now.

16 Maintenance

It is necessary to schedule maintenance work at least twice a year.

The intervals between servicing are dependent on the process and system conditions in your facility. The facility QA/QC plan should address the frequency for maintenance and should be updated based on your operations.



Danger



Follow all safety notes and descriptions stated in this manual.

There may be harmful sample gases in the pump. Prevent potentially harmful gases from escaping the open sample gas lines during maintenance. Purge the pump with inert gas or air before servicing.



Warning



High voltage!

Working without disconnecting the power supply may cause an electrical shock. Disconnect power supply before any assembly, maintenance or disassembly.

Secure the pump against accidental restart.



Aggressive condensate possible.

Chemical burns possible due to aggressive media!



For general electrical and mechanical work on the pump, wear personal protective equipment (PPE) in accordance with the risk assessment.

The four hexagon socket screws see Figure 12 part G, need to be retightened to a value of 4 N m [\approx 2.95 lbf. ft] by using a torque wrench. Start to retighten one screw. Tighten the opposite screw to the same amount, then select the adjacent pair. Repeat in the same sequence to reach the value of 4 N m [\approx 2.95 lbf. ft].

The bellows, valve plates and O-rings are the only consumable parts of the pump. Valve plates must be replaced when they have reached a total thickness of < 1.6 mm [\approx 0.063"] including spacers. It is recommended to replace the O-rings to ensure the tightness of the pump.

Please refer to the spare parts list in chapter 19 for our recommended spare parts.

Inspect the following pump components	Action
Pump	Check pump for external damage and any leakage in regular intervals, at least two times per year.
Capacitor	Check the conditions of the adhesive covers of the vents in regular intervals. Replace capacitor with damaged adhesive cover.
Bellows, valve plates and O-rings	Replace at least when performance of the pump decreases. Valve plates must be replaced when they have reached a total thickness of < 1.6 mm [\approx 0.063"] including spacers. It is recommended to replace the O-rings to ensure the tightness of the pump.
Connecting rod bearings	Need to be replaced after 20 000 operating hours or 24 months of operation, whichever occurs first.
Motor bearings	Need to be replaced after 20 000 operating hours or 24 months of operation, whichever occurs first.
Fittings, connections, inlets	Check in suitable intervals. Replace when damaged with original parts in perfect condition.
Equipotential bonding	Check equipotential bonding between pump enclosure and motor. The equipotential bonding needs to be lower than 0.3 Ohm. Use lock washers for the screws.
Additional components, accessories	During maintenance, any upstream filters, separators, or coolers must be checked for proper functioning.

**Note**

If there are any damage to the connection rod, e.g. a loose threaded pin M 8 or loose ball bearings, the complete unit with connection rod and bearings need to be replaced (see chapter 19 for more details)

The eccentric is glued to the motor shaft by using Loctite 270. This connection is additionally secured by a set screw.

16.1 Replacing the valve plates



Note

If you replace the valve plates, we also recommend replacing the O-rings C at the same time. New O-rings ensure the tightness of the pump.

For replacing the valve plates, the sample gas fittings don't need to be dismantled.

To replace the valve plates, proceed as follows:

1. Unscrew the crankcase cover. To do this, loosen the 3 hexagon socket screws F (3 mm spanner).
2. Loosen the four hex socket screws G (3 mm spanner).
3. Remove pressure ring H.
4. Remove upper pump head A.

Caution

Turn the pump head A to the right only. This prevents the bellows from detaching from the connecting rod. Then pull the pump head A out upwards.

O-rings C and valve plates B are freely accessible now.

5. The valve plates and O-rings can now be cleaned or replaced.
6. Clean valve seats and pump head with an adequate solvent (e.g. alcohol) and use oil-free compressed air to remove dust particles from the parts.

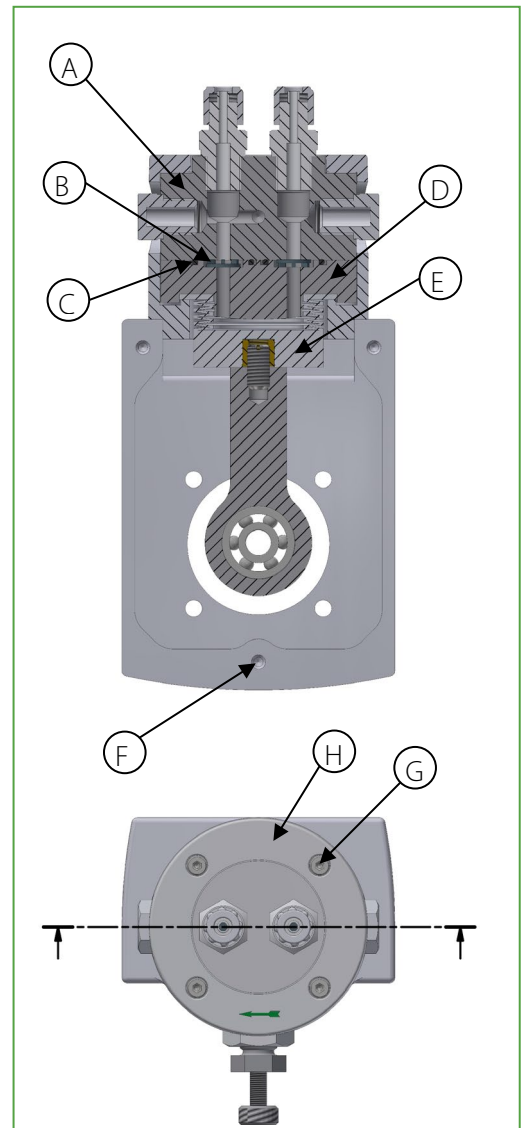


Figure 12 Sectional drawing MP-F..

After replacing or cleaning the valve plates and O-rings, follow these steps to reassemble the pump:

1. Insert O-rings C into the grooves, and place valve plates B back into the cleaned valve seats. Make sure that the valve plates are in the correct position.



Note

On the pressure side (on the left), the smooth side of Valve B is facing downwards, and on the suction side (on the right) the smooth side of Valve B is facing upwards. The operating direction is marked with an arrow (from right to left) on the pump head.

2. Install the upper pump head A and then the pressure ring H again. Align both so that the screws fit into the threads in the housing.
3. Check that the bellows are seated correctly. The bellows must be attached to the connecting rod.
4. Fasten the pressure ring H with the four hexagon socket screws G. First tighten the screws by hand. Start lightly to tighten one screw. Tighten the opposite screw to the same amount, then select the adjacent pair. Repeat in the same sequence, going for a hand-tight setting.
5. Then tighten the four hexagon socket screws alternately in the same sequence with a torque to a value of 4 N m [\approx 2.95 lbf. ft].
6. Screw the crankcase cover back on again. Tighten the three hexagon socket screws F (wrench 3 mm) by hand.

16.2 Replacing the bellows



Note

If you replace the bellows, we also recommend replacing the O-rings C at the same time. New O-rings ensure the tightness of the pump.

To replace the bellows, proceed as follows:

1. Unscrew the crankcase cover. To do this, loosen the 3 hexagon socket screws F (3 mm spanner).
2. Loosen the four hex socket screws G (3 mm spanner).
3. Remove pressure ring H.
4. Remove upper pump head A.

Caution

Turn the pump head A to the right only. This prevents the bellows from detaching from the connecting rod. Then pull the pump head A out upwards.

5. Remove lower pump head D. For easier removal of the lower pump head D, please close one of the boreholes in the valve seat with your fingers and blow pressured air into the other borehole. This will loosen the lower pump head D.
6. Unscrew the bellows E from the connection rod. Please make sure to leave any spacers which might be there, on the threaded pin.
7. Screw new bellows hand-tight onto the connection rod.

After replacing the bellows and the O-rings, please follow these steps to reassemble the pump:

1. Put lower pump head D back into place.
2. Insert new O-rings C into the grooves, and place valve plates B back into the cleaned valve seats. Make sure that the valve plates are in the correct position.



Note

On the pressure side (on the left), the smooth side of Valve B is facing downwards, and on the suction side (on the right) the smooth side of Valve B is facing upwards. The operating direction is marked with an arrow (from right to left) on the pump head.



3. Install the upper pump head A and then the pressure ring H again. Align both so that the screws fit into the threads in the housing.
4. Check that the bellows are seated correctly. The bellows must be attached to the connecting rod.
5. Fasten the pressure ring H with the four hexagon socket screws G. First tighten the screws by hand. Start lightly to tighten one screw. Tighten the opposite screw to the same amount, then select the adjacent pair. Repeat in the same sequence, going for a hand-tight setting.
6. Then tighten the four hexagon socket screws alternately in the same sequence with a torque to a value of 4 N m [\approx 2.95 lbf ft]
7. Screw the crankcase cover back on again. Tighten the three hexagon socket screws F (wrench 3 mm) by hand.

16.3 Cleaning instructions

- When changing valve plates, bellows and O-rings, inspect all parts for contamination before assembling the pump head and clean them if necessary.
- Only use adequate solvents (e.g. alcohol) to prevent corrosion of the plastic parts (PTFE, PFA, FEP). If available, use oil-free compressed air to remove dust particles from the parts.

17 Trouble shooting



Warning



High voltage!

Working without disconnecting the power supply may cause an electrical shock. Disconnect power supply before any assembly, maintenance or disassembly.

Secure the pump against accidental restart.

Problem/Indication	Possible cause	Check/Action
Pump produces no flow	No main supply	Check power supply; Check power cable for correct fit.
	Connections or lines are blocked.	Remove blockage.
	An external valve is closed or a filter is blocked.	Open valve or clean contaminated/blocked filter
	Liquid (condensate) has collected in the pump head.	Operate pump with air for a few minutes. Install the pump at the highest elevation point of your system.
Flow, pressure or vacuum too low	Bellows, valves and/or O-rings are damaged or worn out	Change bellows, valves and/or O-rings. Valve plates must be replaced when they have reached a total thickness of < 1.6 mm [≈ 0.063 "] including spacers. It is recommended to replace the O-rings to ensure the tightness of the pump.
	The pump is not designed for these operating parameters.	Compare the actual operating parameters: pressure, vacuum and capacity with the data in chapter '8 Technical data'.
	There is overpressure on the pressure side and at the same time vacuum on the suction side.	Check the pump with pressure less suction side and compare values with parameter characteristic graph. If ok: check system parameters; not ok: see "Bellows or valves are damaged or worn out".
	Pneumatic lines or connecting parts have a too small cross-section.	To measure the performance values, uncouple the pump from the system; even a line with a too small cross-section or e. g. a valve installed in the system can change the measured value considerably.
	A leak at the connectors, lines or pump head. Bellows or valve plate is damaged, or pump head is contaminated.	Seal the leak, tighten the screws, replace damaged parts, clean or replace contaminated parts.

18 Proper disposal of the device

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

19 Spare parts list

The replacement interval for spare parts and consumables depends on the specific operating condition of the bellows pump. The quantities recommended in the following table are based on experience. Your replacement intervals will be based on your operating conditions.

Bellows pump MP-F05, MP-F10, MP-F05/R, MP-F10/R					
(C) Consumable parts					
(R) Recommended spare parts					
(S) Spare parts					
			Recommended quantity being in operation [years]		
Part No.	Description	C/R/S	1	2	3
95P0010	Bellows MP-F, PTFE	C	-	-	1
90P1110	Valve plate MP-F	C	2	4	6
95P0035	1 x O-ring FEP 18x2 MP-F	C	2	4	6
95P0030	Lower pump head MP-F, material: PTFE	S	-	-	-
95P0025	Upper pump head MP-F, material: PTFE	S	-	-	-
95P0037	Spare parts kit for bellows pump with 2 x valve plates MP-F, 2 x O-rings FEP 18 x 2 MP-F and 1 x bellows MP-F.	S	-	-	-
95P0039	Spare screws set for mounting the pump head with 4 x spring washers M4 and 4 x Allen socket head screws M4 x 55	S	-	-	-
95P0040	Connection rod with eccentric and ball bearing for MP-F05	S	-	-	-
95P0045	Connection rod with eccentric and ball bearing for MP-F10	S	-	-	-
95P0026	Pump head MP-F above with borehole for needle valve, material: PTFE	S	-	-	-
90P6030	Needle valve for MP-F../R, Sealing ring and needle, material: PTFE	S	-	-	-
90P6015	Spare needle for MP-F../R, material: PTFE	S	-	-	-
90P6020	Sealing ring for needle valve in MP-F../R, material: PTFE	S	-	-	-
90P6025	Adapter for needle valve in MP-F/R, material: PTFE	S	-	-	-

PVDF male connectors with G-thread (ISO 1010031)					
C) Consumable parts					
(R) Recommended spare parts					
(S) Spare parts					
			Recommended amount based on number of years of operation [years]		
Part No.	Description	C/R/S	1	2	3
05V1060	Straight male connector DN 4/6-G1/4" material: PVDF	S	-	-	-
05V1065	Straight male connector DN 6/8-G1/4" material: PVDF	S	-	-	-
05V6600	Ferrule DN 4/6, PVDF	S	1	2	3
05V6602	Ferrule DN 6/8, PVDF	S	1	2	3
05V6605	Union nut DN 4/6, PVDF	S	1	2	3
05V6607	Union nut DN 6/8, PVDF	S	1	2	3

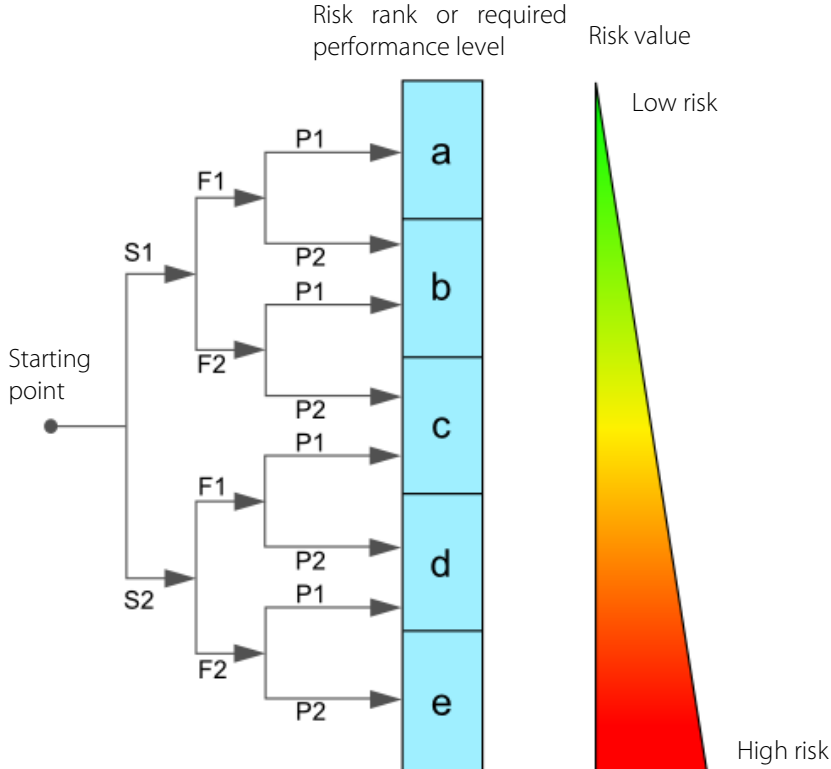
20 Risk assessment

The risk assessment provided in this chapter is intended for all work activities on the product. The hazards can occur in the work steps of assembly, commissioning, maintenance, disassembly and in the event of a product fault. During normal operation, the product is protected by a system cabinet or appropriate covers.

Only qualified personnel is permitted to perform the work. The following minimum knowledge is required for the work:

- Employee instruction provided in process engineering
- Employee instruction provided in electrical engineering
- Detailed knowledge of the instruction manual and the applicable safety regulations

The product complies with the current regulations according to state-of-the-art science and technology. Nevertheless, not all sources of danger can be eliminated while observing technical protective measures. Therefore, the following risk assessment and the description of exposure hazards refer to the work steps mentioned above.



Severity of injury:

S1 = 1 = minor (reversible injury)
S2 = 2 = serious (irreversible injury, death)

Frequency and duration:

F1 = 1 = infrequent or short exposure to hazard
F2 = 2 = frequent (more than once per hour/shift)

Possibility of preventing or limiting the damage

P1 = 1 = possible
P2 = 2 = hardly possible

Figure 13 Overview risk assessment



Aggressive condensate possible

Risk rank group A

Chemical burns due to aggressive media possible!
This applies to all liquids in vessels and in the product.
In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.



Caution risk of being crushed by rotating parts

Risk rank - group A

The product contains rotating parts. Do not open covers until the device has been switched off.



Caution hot surfaces

Risk rank - group A

The temperature inside the product can be higher than $> 60\text{ }^{\circ}\text{C}$.

The hot parts are shielded by mechanical devices. Before opening the products, they must be disconnected from the power supply and a cooling time of more than > 20 minutes must be observed. In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.



Caution electric shock

Risk rank group C

When installing high-power systems with nominal voltages of up to 1000 V, the requirements of VDE 0100 and their relevant standards and regulations must be observed!

This also applies to any connected alarm and control circuits. Before opening the products, they must always be disconnected from the power supply.



Gas hazard

Risk rank group A-B-C

The hazard potential mainly depends on the gas to be extracted.

If toxic gases, oxygen displacing or explosive gases are conveyed with the product, an additional risk assessment by the operator is mandatory.

In principle, the gas paths must be purged with inert gas or air before opening the gas-carrying parts.

The escape of potentially harmful gas from the open process connections must be prevented.

The relevant safety regulations must be observed for the media to be conveyed. If necessary, flush the gas-carrying parts with a suitable inert gas. In the event of a gas leakage, the product may only be opened with suitable PPE or with a monitoring system.

Furthermore, the work safety regulations of the operator must be observed.



Caution crushing hazard

Risk rank - group A

The work must be performed by trained personnel only.

This applies to products weighing less than $< 40\text{ kg}$ [$\approx 88.2\text{ lbs}$]:

The product can be transported by 1 to 2 person(s). The instructions for appropriate personal protective equipment (PPE) must be observed.

The weight specifications are contained in the technical data of this product.

Furthermore, the work safety regulations of the operator must be observed.

21 Appendix



Further product documentation can be seen and downloaded from our home page:
www.mc-techgroup.com