

Analytical Diaphragm Pump Series MP[®]

MP48/R and MP48S/R

Instruction Manual
Version 1.02.00



MP48/R



MP48S/R

**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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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.

MP® is a registered trademark.

Version: 1.02.00

List of content

1	General information	5
2	Declaration of conformity	5
3	Safety instructions	6
4	Warranty	6
5	Warning signs and definitions	7
6	Introduction	9
6.1	Proper use.....	9
6.2	Improper use.....	9
7	Area of application	10
8	Ambient conditions	12
8.1	Safety.....	12
9	Technical data	13
9.1	Dimensions	14
10	Design and function	15
11	Transport, receipt of goods and storage	17
12	Installation instructions	18
12.1	Mounting bracket (Part-No. 90P8100).....	18
12.2	Mounting the pump	19
12.3	MP48/R: Aligning the compressor housing.....	21
12.4	Electrical connection.....	23
12.4.1	Attaching connection cables.....	24
12.4.2	Connecting the pump	24
12.5	Pneumatic connection	25
12.5.1	Connecting the pump	26
12.5.2	Optional tube fittings.....	27
13	Preparations for commissioning	27
14	Start up	27
15	Operation	28
15.1	Switching pump on and off.....	29
15.2	Setting the flow	29
16	Closing down	30
17	Maintenance	30
17.1	Maintenance schedule.....	31
17.2	Cleaning the pump.....	31
17.3	Replacing diaphragm and valve plates	32
17.3.1	Removing pump head.....	33
17.3.2	Replacing diaphragm	34
17.3.3	Replacing valve plate and sealing.....	35
17.3.4	Assembling the pump head.....	36
17.3.5	Final steps	36
17.4	Replacing the throttle valve.....	37
18	Trouble shooting	38
18.1	Trouble shooting is not succesful	39
19	Returns	39
20	Proper disposal of the device	39
21	Spare parts list	40
22	Risk assessment	40
23	Appendix	43

List of illustrations

Figure 1	Pump capacity MP48/R and MP48S/R	11
Figure 2	Dimensions of the MP48/R in mm/Inches	14
Figure 3	Dimensions of the MP48S/R in mm/Inches.....	14
Figure 4	Design of the MP48/R.....	15
Figure 5	Design of the MP48S/R.....	15
Figure 6	Function of the MP48/R and MP48S/R	16
Figure 7	Mounting bracket hole pattern for wall-mount.....	18
Figure 8	Mounting bracket hole pattern for MP48/R.....	19
Figure 9	Mounting bracket hole pattern for MP48S/R.....	19
Figure 10	MP48/R: Compressor housing.....	21
Figure 11	MP48/R: Mounting positions of the compressor housing.....	22
Figure 12	Electrical connection MP48S/R.....	25
Figure 13	Electrical connection MP48/R	25
Figure 14	Marking on the pump head to indicate flow direction.....	26
Figure 15	Self-locking adjusting screw X for setting the flow rate.....	29
Figure 16	Exploded view pump head MP48/R	32
Figure 17	Mark the position of the pump head with a felt-tip pen.....	33
Figure 18	Remove housing cover, move connection rod in upper position	34
Figure 19	Throttle valve	37
Figure 20	Overview risk assessment	41

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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

EU/EC Directives/Standards

For the purposes of the Machinery Directive 2006/42/EC, pumps are "partly completed machinery", and are therefore to be regarded as not ready for use. Partly completed machinery may not be commissioned until such time as it has been determined that the machine in which the partly completed machinery is to be assembled is in conformity with the provisions of the Machinery Directive 2006/42/EC. The following essential requirements of Annex I of Directive 2006/42/EC (general principles) are applied and observed:

General Principles No. 1

No. 1.1.2./1.1.3./1.3.1./1.3.3./1.3.4./1.4.1./1.5.1./1.5.2./1.5.8./1.5.9./1.7.4./1.7.4.1./1.7.4.3.

As these partly completed machinery are OEM-models the power supplies and the equipment for disconnecting and switching-off the partly completed machinery respectively have to be considered when mounting as well as over-current and overload protective gear.

In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.



The pumps conform to the Directive 2011/65/EU.

The following harmonized standards have been used:

- EN 60204-1
- EN 60034-1
- EN 61000-6-1/2/3/4
- DIN EN 50581



3 SAFETY INSTRUCTIONS

Follow these 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 devices only in protected areas, sheltered from sun, rain and moisture.

Do not use the **MP48/R** and **MP48S/R** in hazardous areas.

Installation, maintenance, inspections and any repairs of the devices must be carried out only by qualified skilled personnel in compliance with the current regulations.

4 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. See also chapter 18 for returning the device.

5 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, pointed 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.



Use foot protection.



Use safety helmet and full protective goggles

6 INTRODUCTION



Note

As of April 2023, the **MP48/R** pump has a new motor with a higher energy efficiency rating. Please note that the new **MP48/R** has a new part number **2P4801(A)**. The new pumps are supplied with the following voltages and frequencies: **230 V/50 Hz** and **115 V/60 Hz**.

When replacing an older pump (part number 02P4800(A)), note that the new pumps are not suitable for the 50 to 60 Hz frequency range. For more details see chapter 9 Technical data.

The **MP48/R** and **MP48S/R** diaphragm pumps are suitable for 100% oil-free delivery of corrosive gases. Its performance and design are specially adapted to the requirements of the analysis technology. The pumps are gas-tight and they operate maintenance-free. **MP48/R** and **MP48S/R** only differ in the motor used. The **MP48/R** has an IP54 motor and the **MP48S/R** has an IP20 motor. The pump head is identical for both pumps.

6.1 PROPER USE

The **MP48/R** and **MP48S/R** are exclusively intended for transferring gases and vapors.

Install and operate the pumps only under the operating parameters and conditions described in chapter 9.

The pumps may only be operated when fully assembled.

Ensure that the installation site is dry and that the pump is protected from the sun, rain, spray, splash water, pot water and other contaminants.

Regularly check the tightness of the connections between the piping of the application and the pump (or the casing of the pump), leaking connections may release dangerous gases and vapors from the pumping system.

Before pumping a medium, check whether the medium can be pumped without danger in the specific application. Before using a medium, check the compatibility of the materials of the pump head, diaphragm and valves with the medium.

Only pump gases that remain stable under the pressures and temperatures occurring in the pump.

6.2 IMPROPER USE

The **MP48/R** and **MP48S/R** must not be operated in explosive atmospheres.

The **MP48/R** and **MP48S/R** diaphragm pumps are not suitable for pumping:

- dusts
- liquids
- aerosol
- biological and microbiological substances
- fuel
- explosives and flammable materials
- fibers
- oxidizing agents
- food products

The pumps must not be used for creating vacuum and overpressure at the same time. Overpressure must not be applied to the suction side of the pump.

7 AREA OF APPLICATION



Note

As of April 2023, the **MP48/R** pump has a new motor with a higher energy efficiency rating. Please note that the new **MP48/R** has a new part number **2P4801(A)**. The new pumps are supplied with the following voltages and frequencies: **230 V/50 Hz** and **115 V/60 Hz**.

When replacing an older pump (part number 02P4800(A)), note that the new pumps are not suitable for the 50 to 60 Hz frequency range. For more details see chapter 9 Technical data.

MP48/R and **MP48S/R** only differ in the motor used. The **MP48/R** has an IP54 motor and the **MP48S/R** has an IP20 motor. The pump head is identical for both pumps.

All parts of the diaphragm pumps that come into contact with the medium are made of PTFE or FFPM. The pumped gas remains analytically pure due to the absolutely lubricant-free operation of the pumps. A special diaphragm and valve system ensures freedom from maintenance and a long service life.

The pumps are available for 230 V or 115 V mains supply. For applications with higher power requirements, the **MP48/R** and **MP48S/R** pumps are optimally designed with a flow rate of 16 NI/min.

The diaphragm pumps are supplied as standard with an integrated throttle valve in the pump head for flow adjustment.

- Pumping of gases and vapors with a media temperature of 0 to + 60 °C [32 to 140 °F]
- Maximum permissible operating overpressure, ultimate vacuum, flow rate: see technical data.
- Before use in unknown pumping media, the compatibility of the materials of the pump head, diaphragm and valves with the medium must be checked.



Note

The diaphragm pump series **MP48/R** and **MP48S/R** are not allowed for liquid medium.

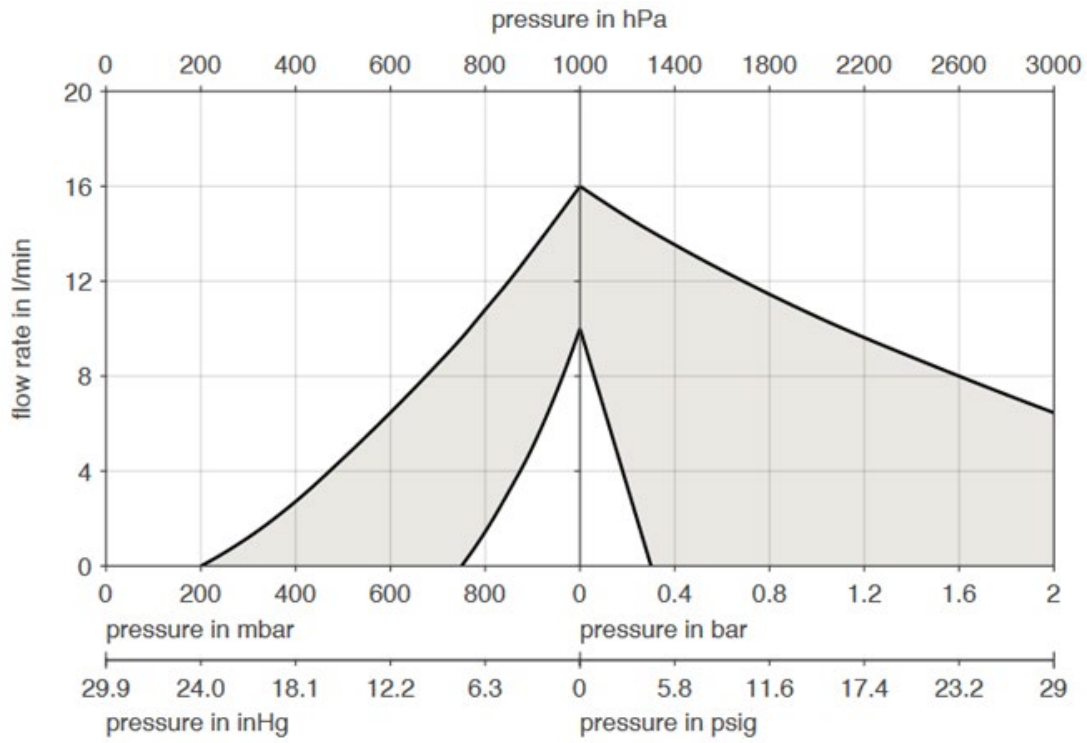


Figure 1 Pump capacity MP48/R and MP48S/R

8 AMBIENT CONDITIONS

The following ambient conditions must be complied with during operation:

- Ambient temperature range during operation: +5 to +60 °C [41 to 140 °F], 0 °C [32 °F] if not condensing (frost-free).
- The pumps must be protected from the effects of water and dust.
- During operation, a sufficient supply of cooling air must be ensured.

8.1 SAFETY

The **MP48/R** pump is designed with **IP54** protection. The pump is dust-protected and protected against splash water according to VDE 0710 DIN 40050. The motor is designed in protection class **IP55** and is dust-protected and protected against water jets according to VDE 0710 DIN 40050.

The pump and the motor of the **MP48S/R** are designed with **IP20** protection. There is no protection against water.



Warning

Aggressive media

Aggressive media lead to burns during decommissioning.

- Flush the pump under atmospheric pressure conditions with inert gas. If there is no danger of explosion, flushing can also be carried out with air.

Aggressive media residues possible.

- Wear protective goggles and appropriate protective clothing when dismantling, repairing, or cleaning the pump.

Note that the pumps are only to be used for their intended purpose.



Note

The components to be connected to the pumps must be designed for the pneumatic data of the pumps.

Observe the corresponding safety regulations when connecting the pumps to the electrical network.

The corresponding safety regulations must be observed for the media to be pumped.

9 TECHNICAL DATA

Diaphragm pump	MP48/R/230 V	MP48/R/115 V	MP48S/R/230 V	MP48S/R/115 V
Part No.	02P4801	02P4801A	02P4810	02P4810A
Power supply	230 V	115 V	230 V	115 V
Degree of protection motor	IP 55 - EN 60529		IP 20 - EN 60529	
Degree of protection pump	IP 54 - EN 60529		IP 20 - EN 60529	
Capacity max.	10 to 16 NI/min \pm 10 % at atmospheric pressure			
Operating pressure	3 bar abs.			
Ambient temperature	5 to +60 °C [41 to 140 °F], 0 °C [32 °F] if not condensing (frost-free)			
Sample temperature	0 to +60 °C [32 to 140 °F]			
Storage temperature	5 to +40 °C [41 to 104 °F]			
Transport temperature	-10 bis 60 °C [14 to 140 °F]			
Permitted humidity (non-condensing)	30 to 85 %		80 % for temperatures up to 31 °C [87.8 °F], decreasing linearly to 50 % at 40 °C [104 °F].	
Max. altitude of installation site	1000 m [\approx 3281 ft] above sea level			
Frequency	50 Hz	60 Hz	50 Hz	60 Hz
Current consumption	1.35 A	1.7 A	0.7	
Power P1 consumption	185 W	195 W	100 W	100 W
Gas connections	G 1/4" female, DIN ISO 228/1*			
Electrical standard	EN 61010 part 1			
Material of sample contacting parts	PTFE modified, PTFE, FFPM			
Operation mode	100 % continuous duty, start of the pump only without pressure			
Weight	7.3 kg [\approx 16.1 lbs]		5.8 kg [\approx 12.8 lbs]	

*The dimensions and designation of the screw-in threads correspond to the respective applicable standard. The tolerances of the thread standards are matched to metal threads and cannot be applied to plastic threads.

Material mark according to ISO 1629 and 1043.1

Please note: NI/h and NI/min refer to the German standard DIN 1343 and are based on these standard conditions: 0 °C [32 °F], 1013 mbar.

9.1 DIMENSIONS

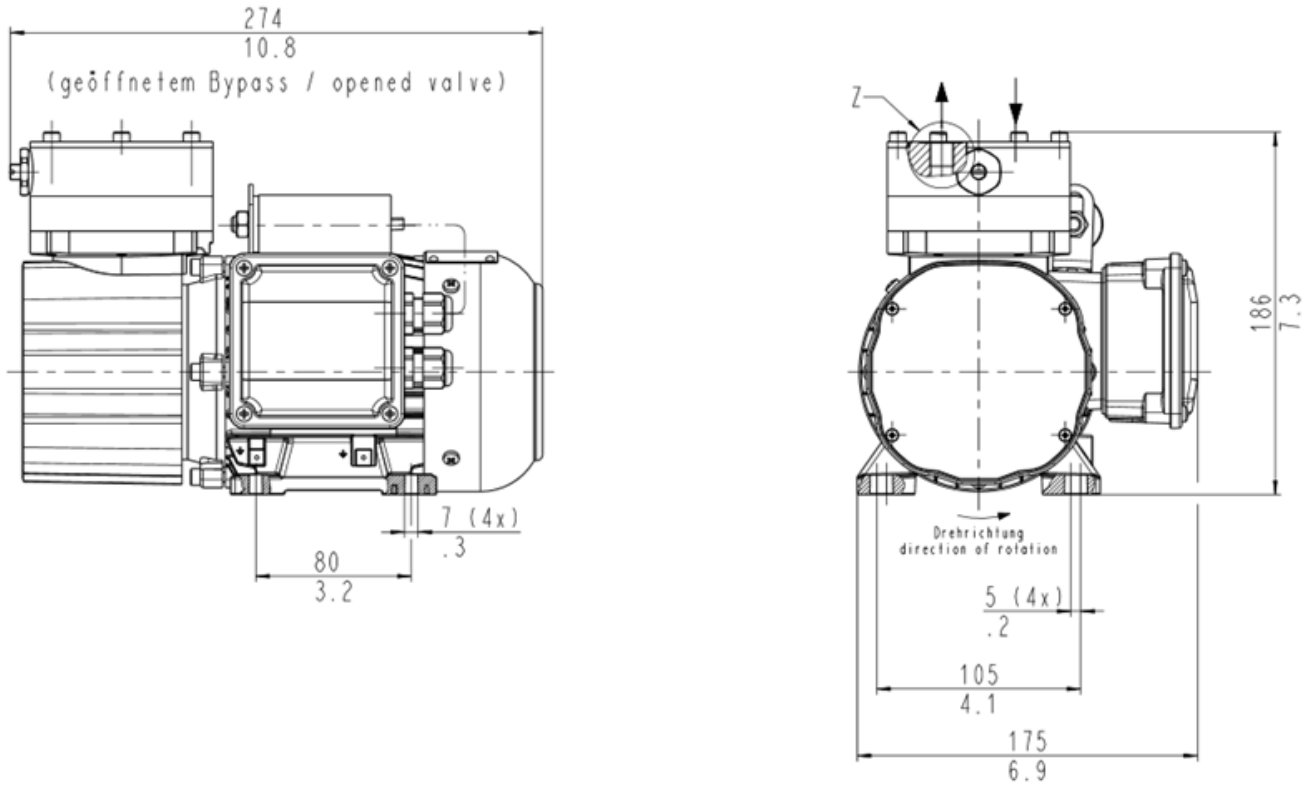


Figure 2 Dimensions of the MP48/R in mm/Inches

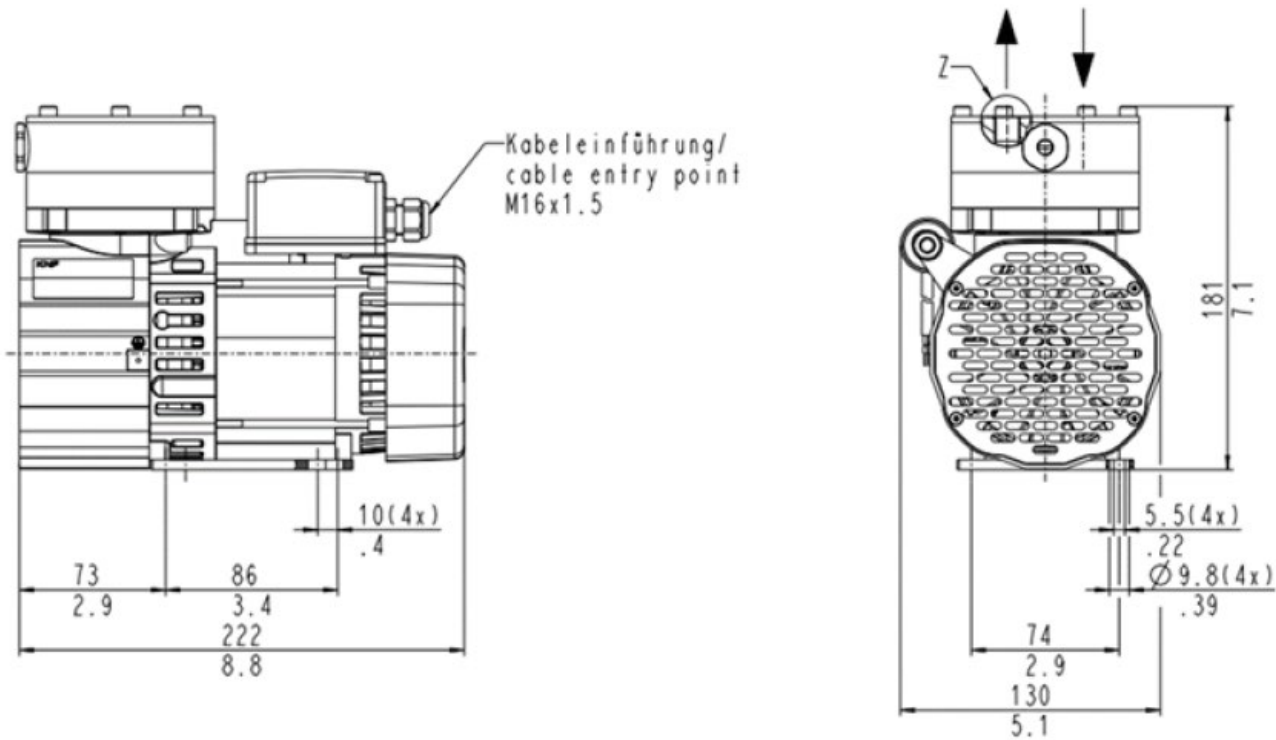
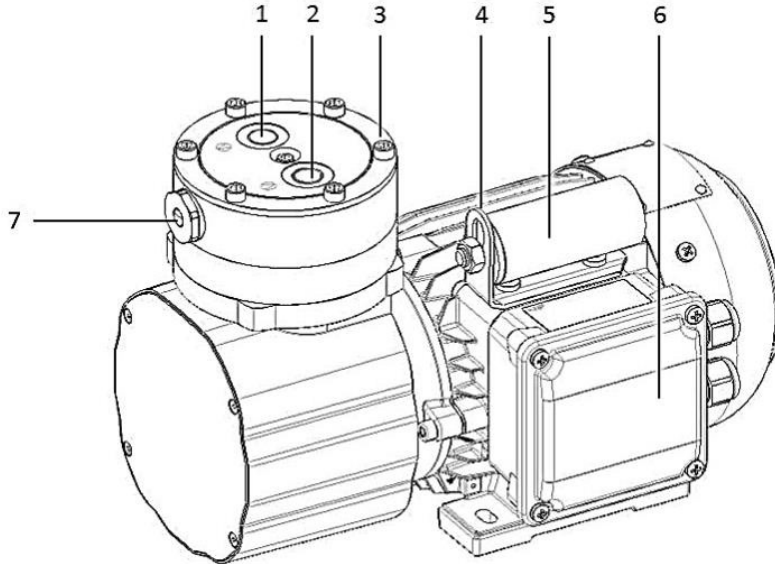


Figure 3 Dimensions of the MP48S/R in mm/Inches

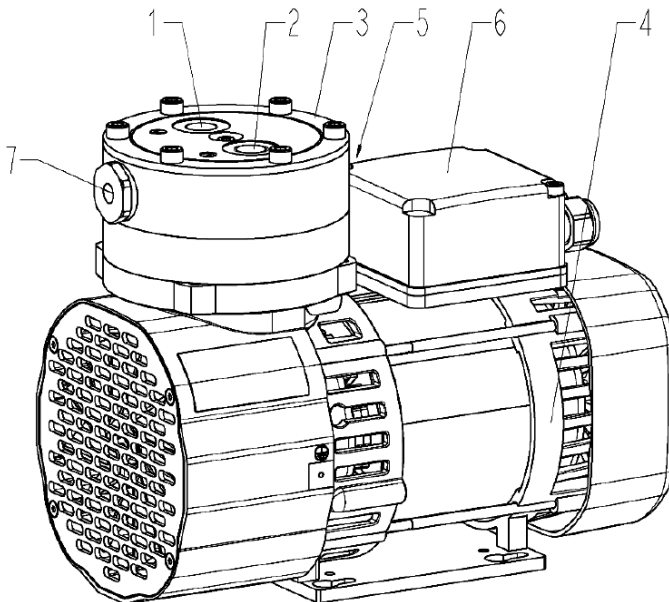
10 DESIGN AND FUNCTION

To adjust the flow rate, a throttle valve (Figure 4/7) is installed in the pump head as an internal pump by-pass. All wetted parts are made of modified PTFE, PTFE and FFPM.



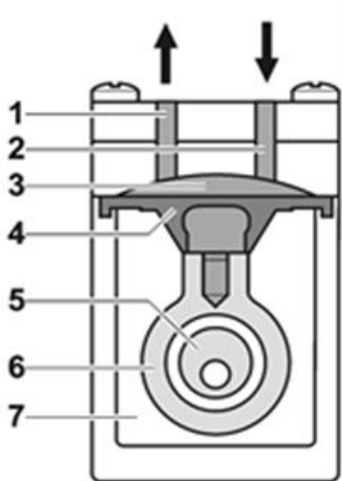
1 Pneumatic pump outlet	2 Pneumatic pump inlet	3 Pump head
4 Motor	5 Capacitor	6 Electrical terminal box
7 Adjusting screw for flow		

Figure 4 Design of the MP48/R



1 Pneumatic pump outlet	2 Pneumatic pump inlet	3 Pump head
4 Motor	5 Capacitor	6 Electrical terminal box
7 Adjusting screw for flow		

Figure 5 Design of the MP48S/R



1 Outlet valve	2 Inlet valve	3 Transfer chamber	4 Diaphragm
5 Eccentric	6 Connection rod	7 Pump drive	

Figure 6 Function of the MP48/R and MP48S/R

The elastic diaphragm (Figure 6/4) is moved up and down by the eccentric (Figure 6/5) and the connection rod (Figure 6/6). In the downward stroke it aspirates the gas to be transferred via the inlet valve (Figure 6/2). In the upward stroke, the diaphragm presses the medium out of the pump head via the outlet valve (Figure 6/1). The transfer chamber (Figure 6/3) is hermetically separated from the pump drive (Figure 6/7) by the diaphragm.

11 TRANSPORT, RECEIPT OF GOODS AND STORAGE



Caution

Personal injury and/or damage to property because of false or improper transportation of the pump.

Due to false or improper transportation the pump can fall down, become damaged and injure people.

- If necessary, use suitable aids (eyebolt, harness, lifting device, etc.).
- Wear proper personal protective equipment (e.g., safety gloves, safety shoes).



Caution

Danger of injury due to sharp edges on the package

When handling or opening the package there is the possibility of injury by cutting at sharp edges.

- Wear proper personal protective equipment (e.g., safety gloves, safety shoes).

- Check the goods for possible transport damage. Document any transport damage that has occurred in writing and with pictures. Inform your transport insurer immediately of any damage.
- Transport the pump in its original packaging to the installation site.
- Carefully remove the diaphragm pump and any special accessories from the shipping packaging immediately after arrival and check the scope of delivery according to the delivery note.
- Keep the original packaging of the pump (e.g., for later storage).



Note

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

12 INSTALLATION INSTRUCTIONS

When installing the pump make certain that accident prevention regulations and safety instructions including those for subsequent operation are observed. The safety instructions in chapter 3 must be observed.



Observe the relevant safety regulations for the pumped media.
To avoid disturbing heat accumulation, the pump should be installed away from heat sources and freely ventilated.

When installed outdoors, the pump must be installed in a protective housing, frost-free in winter and sufficiently ventilated in summer. Direct sunlight should be avoided.



Pumps contain mechanical moving parts that can cause vibrations. In order to avoid damage to the pump and peripheral components/equipment, as well as to limit the acoustic noise development to a minimum, a suitable vibration decoupling must be provided. M&C can supply anti-vibration pad for this purpose.

This also applies explicitly to the connection of the sample gas lines to the pump head.

12.1 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 figures show the hole patterns used for wall mounting the MP48/R and MP48S/R pumps.



MP48/R: In all positions (pump head to the left, right and to the front) it is possible to rotate the pump head 180° down-wards.

MP48S/R: The pump head can not be rotated.

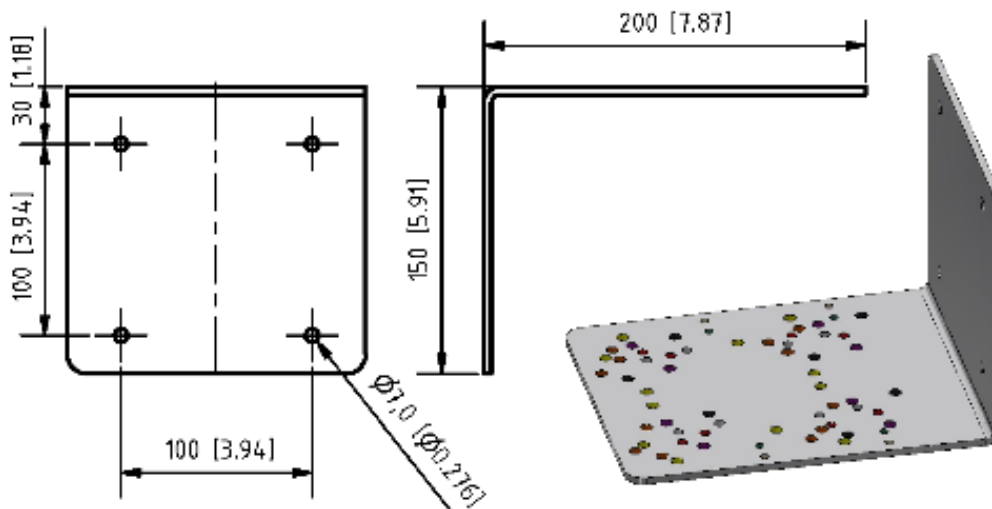


Figure 7 Mounting bracket hole pattern for wall-mount

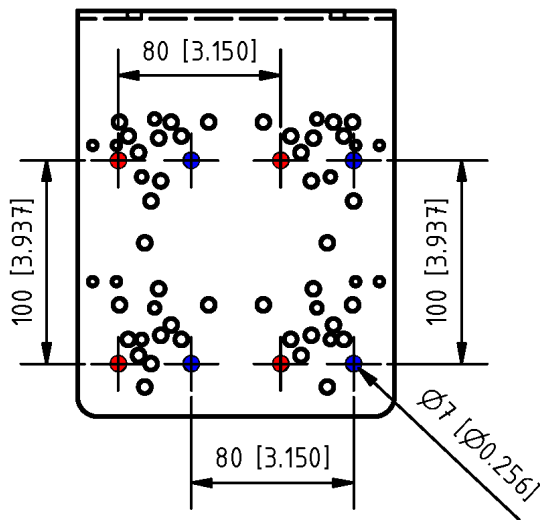


Figure 8 Mounting bracket hole pattern for MP48/R

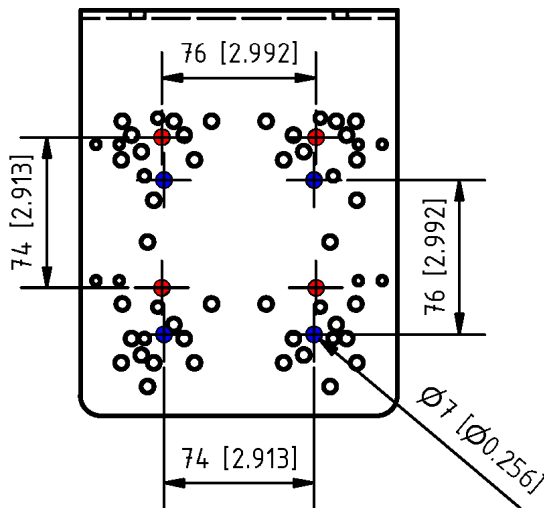


Figure 9 Mounting bracket hole pattern for MP48S/R

12.2 MOUNTING THE PUMP

Only install and operate the pumps under the pneumatic operating parameters and conditions described in chapter 9. Observe the safety instructions in chapter 3.



Note

Before installation, store the pump at the installation location to bring it up to ambient temperature.

Refer to Figure 2 and Figure 3 for mounting dimensions.



Warning

Danger of burns from hot surfaces

Hot surfaces may be caused by overheating of the pump.



- Install the pump so that the motor fan can intake sufficient cooling air.

Mount the pumps in such a way that their fan blade can draw in sufficient cooling air.

Mount the pumps at the highest point in the system and/or with the pump head facing downward to prevent condensate from accumulating in the pump head - this will increase the operating time.

When installing, make sure that there are no combustible or thermally malleable objects placed in the immediate ambient of the hot pump parts (head, motor).

Make sure that the installation location is dry, and the pump is protected against sun, rain, splash, hose and drip water as well as other pollutions.

Make sure, that the installation location is accessible for maintenance and service.

Note IP protection classes of the pump motor: the IP protection class of the pump motor of the **MP48/R** is **IP54** and the **MP48S/R** is **IP20**.

The IP protection class of the pump motor is indicated on the type plate.

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

- 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.

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



Note

MP48/R: Pump head can be rotated 180°.

If condensate is to be expected, then turn the pump head of the MP48/R downwards so that the gas connections point downwards. It is only possible to rotate the pump head of the MP48/R.

Protect the pump from dust.

Protect the pump from vibrations and jolts.



Personal injury and/or damage to property because of vibration

In conjunction with adjacent components, vibration of the pump may result in crushing and/or damage to these components.

- Make sure that vibrations of the pump do not result in hazards associated with adjacent components.

Protect the pump against contact and intrusion of foreign matter.

12.3 MP48/R: ALIGNING THE COMPRESSOR HOUSING

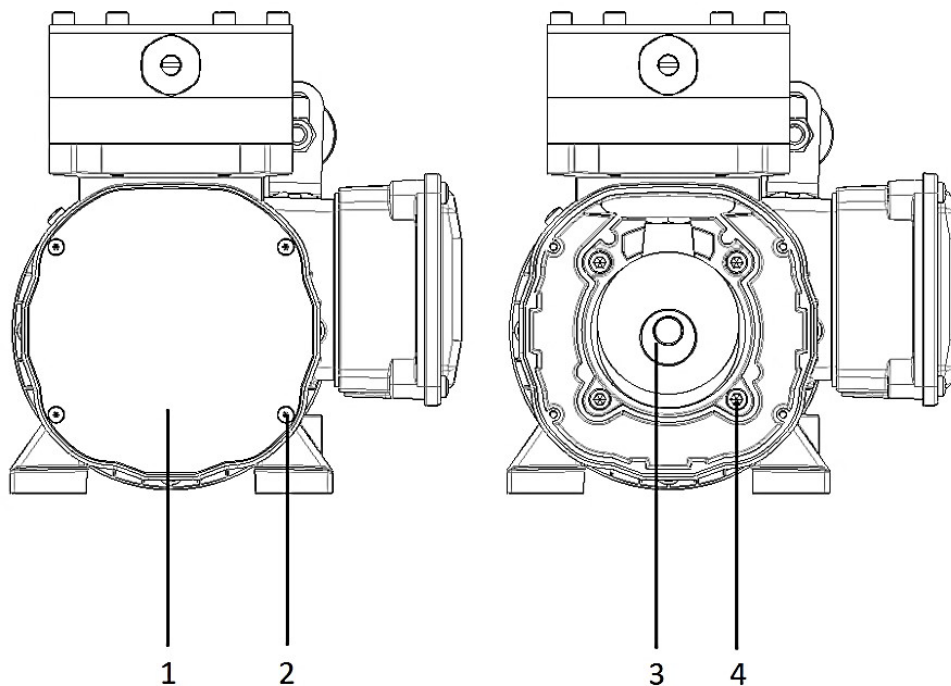
The compressor housing can only be aligned on the MP48/R diaphragm pump. Alignment is not possible with the MP/S/R.

Required tools:

Quantity	Tool	Size
1	Allen key	2
1	Allen key	4

If the pump is used to transfer moist gases, condensation may form in the pump head during operation. Among other things, this reduces the pump capacity.

To ensure optimum suction performance, it is advisable to align the pump head downwards so that the condensation can simply run out of the pump head. To do this, the compressor housing and pump head (depending on the installation situation) can be rotated and assembled in 90° increments.



1 Housing cover	2 Allen screw
3 Eccentric	4 Motor mounting screw

Figure 10 MP48/R: Compressor housing

Follow these steps to rotate the compressor housing:

1. Undo and remove the four Allen screws (Figure 10/2) from the housing cover (Figure 10/1).
2. Remove the housing cover (Figure 10/1). The eccentric crank assembly (Figure 10/3) and the four motor mounting screws (Figure 10/4) are visible.
3. Undo and remove the four motor mounting screws (Figure 10/4).
4. Rotate the housing to the required position. The compressor housing can be rotated completely around its own axis in 90° increments in relation to the motor (see Figure 11).

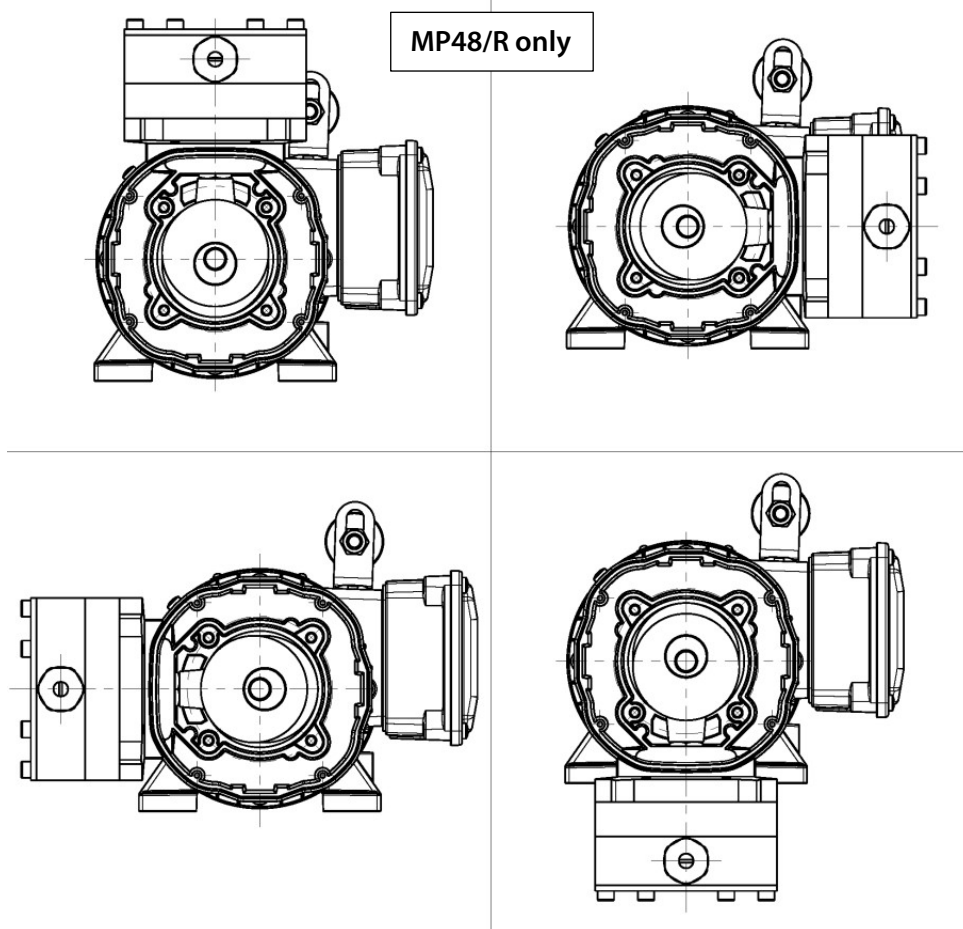


Figure 11 MP48/R: Mounting positions of the compressor housing

5. Reinsert and tighten the four motor mounting screws (Figure 10/4) (tightening torque: 6 Nm).
6. Replace the housing cover (Figure 10/1) and tighten with the four Allen screws (Figure 10/2) (tightening torque: 15 Ncm).

12.4 ELECTRICAL CONNECTION

During electrical installation work, the relevant safety regulations must be observed. Before connecting the pump, ensure that the electrical supply is de-energized.



Extreme danger from electrical shock

- Only have the pump connected by an authorized specialist.
- Only have the pump connected when the power supply is disconnected.



Incorrect mains voltage can destroy the device.

When connecting, ensure that the mains voltage is correct according to the information on the type plate! The supply voltage may deviate by max. +6 % or - 10 % from the specifications on the type plate.



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

An easily accessible main switch with appropriate labeling must be provided externally, according to EN 60204-1.

- Observe the relevant standards, directives, regulations and technical standards when making the electrical connection.
- The supply circuit of the pump types **MP48/R** and **MP48S/R (230 V)** must be equipped with a motor protection switch 0.63 - 1 A corresponding to the rated current; (overcurrent protection).
- The supply circuit of the pump type **MP48/R** and **MP48S/R (115 V)** must be equipped with a motor circuit breaker 1 - 1.6 A corresponding to the rated current (overcurrent protection).
- Protect the pump motors according to EN 60204-1 (overcurrent protection, overload protection).
- The max. current consumption of the pump is listed on the pump type plate.
- It is recommended to install an additional EMERGENCY STOP device.
- Install the pumps in such a way that contact with the live parts (electrical connection) is impossible.

12.4.1 ATTACHING CONNECTION CABLES

Fasten the connection cables in such a way that:

- the cables do not come into contact with moving or hot parts.
- the cables do not chafe or become damaged on sharp corners or edges.
- no tensile or compressive forces are applied to the connection point of the cables (strain relief).

The pumps are protected against overload by a thermoswitch (capacitor motor) as standard.

12.4.2 CONNECTING THE PUMP



Note

As of April 2023, the **MP48/R** pump has a new motor with a higher energy efficiency rating. Please note that the new **MP48/R** has a new part number **2P4801(A)**. The new pumps are supplied with the following voltages and frequencies: **230 V/50 Hz** and **115 V/60 Hz**.

When replacing an older pump (part number 02P4800(A)), note that the new pumps are not suitable for the 50 to 60 Hz frequency range. For more details see chapter 9 Technical data.


1. Compare the supply voltage data with the data on the motor type plate. Refer to the pump type plate for the maximum current consumption of the pump.




Note

Permitted deviation of the supply voltage see chapter 9 Technical data.

2. Open terminal box cover.
3. insert the cable for the mains connection through the M16 cable gland, clamping range 4 to 10 mm, into the terminal box.

MP48S/R: Connect the wires to the L1, N and PE  terminals of the MP48S/R pump motor.

MP48/R: Use the appropriate M4 ring cable lugs to connect the wires to terminals L1, N and PE  of the MP48/R pump motor.

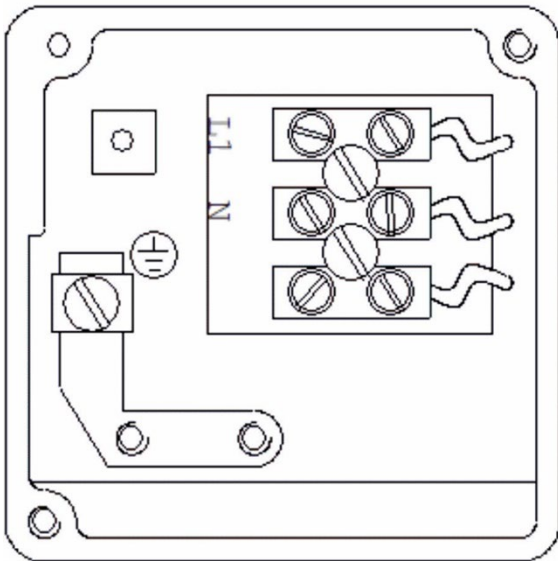


Figure 12 Electrical connection MP48S/R

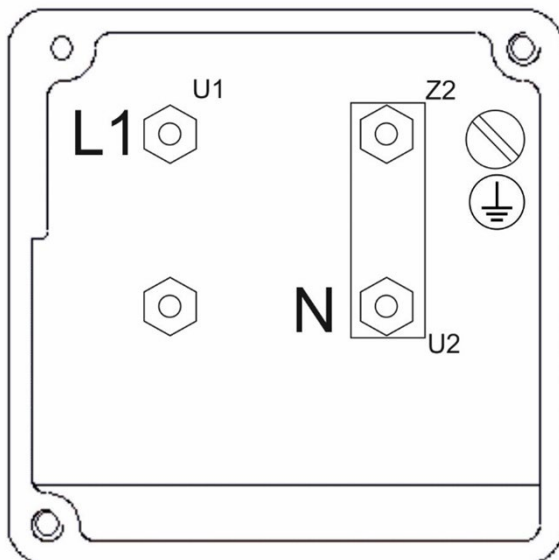


Figure 13 Electrical connection MP48/R

4. Close the terminal cover box.

12.5 PNEUMATIC CONNECTION



Caution

Personal injury or damages to property by ejected protective plugs

If the protective plug at the pressure side of the pump has not been removed, it could be ejected because of the overpressure during operation.

- Remove the protective plug during installation.

- Only connect components to the pump that are designed for the pneumatic data and thermal requirements of the pump (see chapter 9 Technical data).

- Protect compressors with a pressure relief device between the compressor discharge port and the first shut-off valve.
- If the pump is used as a vacuum pump, safely discharge the pump output at the pneumatic outlet of the pump.
- M&C recommends to mechanically decouple the pump from the piping system, e.g., by using flexible tubes or hoses. In this way, possible vibrations and noise from the pump can be avoided being transmitted to the system.

12.5.1 CONNECTING THE PUMP

The pneumatic connection to the diaphragm pump is located on the top of the pump head. Standard connections with G1/4" female thread are available for this purpose.

A marking on the pump head indicates the flow direction.

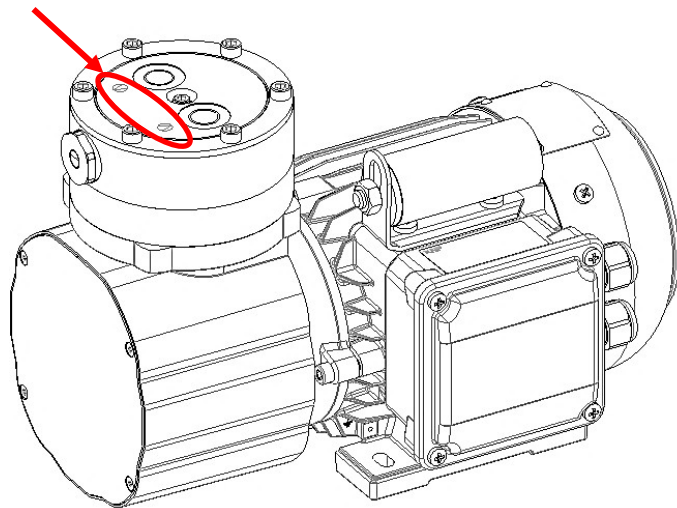


Figure 14 Marking on the pump head to indicate flow direction

Caution

Mixing up the suction and pressure sides can lead to breakage of connected components on the suction and pressure sides.

1. Remove the protective plugs from the port threads (thread size G 1/4" female).
2. Connect the suction and pressure lines.



Note

Accessories such as tube fittings are screwed into the connection threads with sealing tape (no sealing tape is required when using M&C fittings).

3. Lay the suction and discharge lines in a downward slope so that no condensate can get into the pump.

12.5.2 OPTIONAL TUBE FITTINGS



Note

Do not mix up tube connections for sample gas inlet and outlet; the connections are marked accordingly. After connecting all lines, check for leaks.

The tightness of the connection can only be guaranteed if the connection hose has a straight end edge (use a hose cutter).

Connect the optionally available tube fittings as follows:

1. Loosen the union nut of the compression fitting by turning it counterclockwise, carefully remove the nut from the fitting body. Be careful not to lose the compression ring that is loose in the nut.
2. Slide the union nut over the connecting tube.
3. Slide the clamping ring, with the thicker bead facing the nut, onto the connecting tube.
4. Push the tube onto the support nipple in the fitting body; tighten the union nut hand-tight.

The tube is now mounted in a non-slip and pressure-tight manner.

Connection fittings for DN 4/6 or DN 6/8 are optionally available at M&C.

13 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.

14 START UP



Danger of burns from hot pump parts or hot medium

During or after operation of the pump, some pump parts may be hot.

- Allow the pump to cool after operation.
- Take safety precautions against the contact of hot parts/media.

Injury of the eyes

During excessive approach to the inlet or outlet of the pump, the eyes could be injured by the upcoming vacuum or overpressure.

- Do not look into the pump's inlet or outlet during the operation.

- Only operate the pumps under the operating parameters and conditions described in chapter 9 Technical data.
- Ensure that the pumps are used as intended (see chapter 6.1).
- Exclude unintended use of the pumps (see chapter 6.2).
- Observe the safety instructions (see chapter 3).
- The pumps are built-in devices. Before commissioning, make sure that the machines or systems in which the pumps are installed comply with the relevant regulations.

15 OPERATION



Warning

Automatic starting can cause personal injury and pump damage

When the operation of the pump is interrupted by the thermal switch (capacitor motor), the pump will restart automatically after cooling down.

- Take all necessary care to prevent this leading to a dangerous situation.

Pump standstill

When the pump is at a standstill, establish normal atmospheric pressure in the lines.

The pump must **not** start up against pressure and/or vacuum when switched on (see chapter 9). This also applies in operating following a brief power failure.

Vapors as media

The life of the diaphragm is prolonged the formation of condensate is avoided. Therefore, the following precautions should be taken:

- Run the pump for a few minutes to warm it up before handling saturated or nearly saturated vapors.

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:

- 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.

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

MP48/R: Pump head can be rotated 180°.

If condensate is to be expected, then turn the pump head of the MP48/R downwards so that the gas connections point downwards. It is only possible to rotate the pump head of the MP48/R.



Note

- M&C recommends: When transferring aggressive media, flush the pump prior to switch off (see chapter 17.2) to increase the service life of the diaphragm.

15.1 SWITCHING PUMP ON AND OFF

Switch on pump

The pump must **not** start up against pressure and/or vacuum when switched on (see chapter 9). This also applies during operation after a brief power interruption.

Switch off pump

M&C recommends: When transferring aggressive media, flush the pump prior to switch off (see chapter 17.2) to increase the service life of the diaphragm.

Open pressure and suction lines to normal atmospheric pressure. (Relieve the pump pneumatically.)

15.2 SETTING THE FLOW

Excessive pressure will destroy the pump and the downstream analyzers.

Unnecessarily high pressure increases the risk of exceeding the pressure dew point (condensate accumulation in the pump head) and can reduce the service life of the pump. Downstream analyzers may be destroyed if the pressure set at the pump throttle valve exceeds the maximum operating pressure of the analyzer.

Caution

- Set the required pressure for the analysis system.
- Check the pressure.

Required tool:

Quantity	Tool	Size
1	Standard screw driver	6.5 mm

The diaphragm pump is designed so that the flow rate can be adjusted to suit the analysis system it is supplying. If it is necessary to adjust the flow, proceed as follows (see Figure 15):

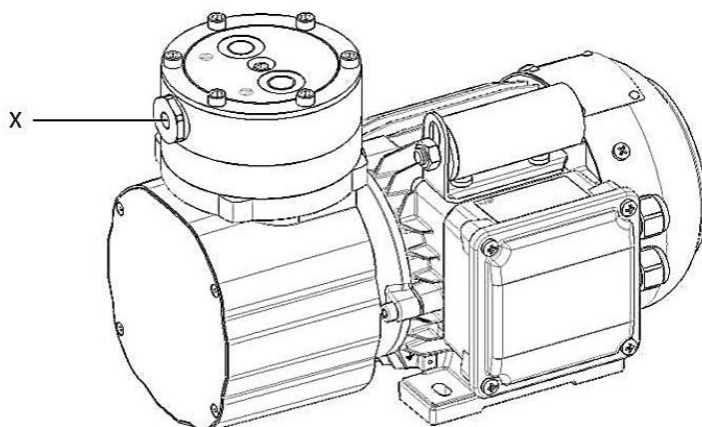


Figure 15 Self-locking adjusting screw X for setting the flow rate

To reduce the flow

Turn the adjusting screw X anti-clockwise.

To increase the flow

Turn the adjusting screw X clockwise.



When the valve is closed as well as completely opened the resistance to turning increases noticeably – to avoid damage do not turn beyond this point. The corresponding end position is reached.

16 CLOSING DOWN



The installation site of the diaphragm pump must remain frost-free even during the time when the unit is switched off.

- When shutting down (switching off the pump), restore normal atmospheric pressure in the lines. (Relieve the pump pneumatically).
- Before recommissioning, observe the relevant standards, directives, regulations and technical standards for the electrical connection.
- Check the pump regularly for external damage or leakage.



Aggressive media

Aggressive media lead to burns during decommissioning.

- Flush the pump under atmospheric pressure conditions with inert gas. If there is no danger of explosion, flushing can also be carried out with air.



Aggressive media residues possible.

- Wear protective goggles and appropriate protective clothing when dismantling, repairing, or cleaning the pump.

17 MAINTENANCE



Health hazard due to dangerous substances in the pump

Depending on the substance transferred, caustic burns or poisoning are possible.

- Wear protective clothing if necessary, e.g., protective gloves.
- Clean pump with suitable measures

**Warning**

Risk of injury due to failure to use original parts.

The function of the pump and its safety are at risk if original parts are not used.

The validity of the CE conformity expires if original parts are not used.

- Only use original parts from M&C.

Before carrying out maintenance work, the plant- and process-specific safety measures must be observed.

17.1 MAINTENANCE SCHEDULE

- Check the pump regularly for external damage or leakage.
- Check the pump regularly for noticeable changes in noise and vibration.
- Replace diaphragm and valve plates/seals at the latest when the pump performance decreases.
- Check the gas connections regularly for external damage or leakage.

17.2 CLEANING THE PUMP

**Note**

When cleaning, make sure that no liquids enter the inside of the housing.

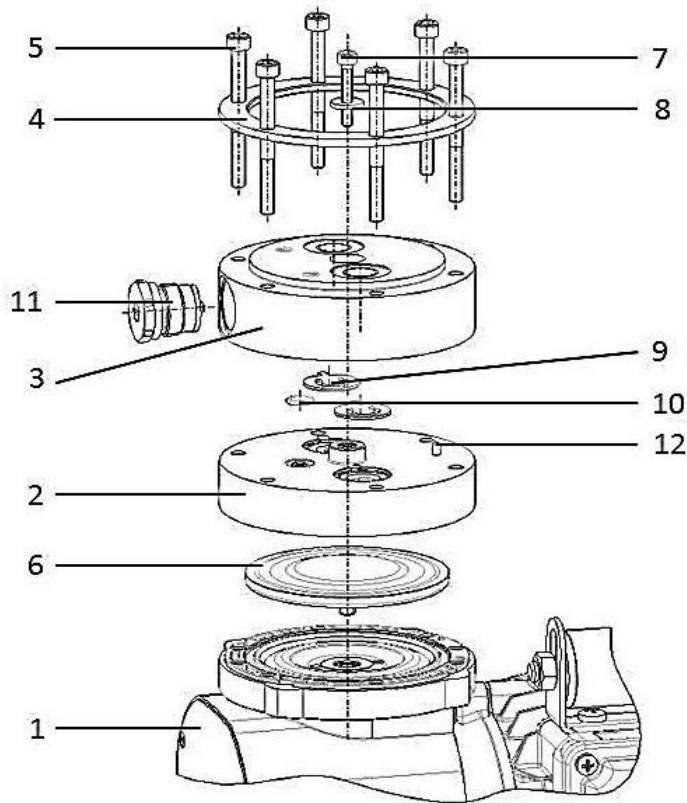
Flushing the pump

When transferring aggressive media, flush the pump under atmospheric conditions some minutes with air (or, if necessary, for safety reasons, with an inert gas) prior to switch-off to increase the service life of the diaphragm.

Cleaning the pump

- Only use solvents for cleaning if the head materials cannot be attacked (check the resistance of the material!).
- If compressed air is available, blow out the components.

17.3 REPLACING DIAPHRAGM AND VALVE PLATES



1 Housing	2 Intermediate plate	3 Head plate
4 Pressure plate	5 Screws	6 Diaphragm
7 Center screw	8 Shim	9 Valve plate/sealing
10 O-ring	11 Throttle valve	12 Guide pin

Figure 16 Exploded view pump head MP48/R

Required spare parts:

Spare parts (see chapter 20)	Position numbering as in Figure 16	Quantity
Zone diaphragm	(6)	1
Valve plates/sealings	(9)	2
O-ring	(10)	1

Required tools:

Quantity	Tool	Size
1	Allen key	3 mm
1	Allen key	4 mm
1	Felt-tip pen	



Note

Always change zone diaphragms, valve plates and O-rings together to maintain pump performance.



Health hazard due to dangerous substances in the pump!

Depending on the substance transferred, caustic burns or poisoning are possible.

- Wear protective clothing, if necessary, e.g., protective gloves.
- Clean pump with suitable measures.

17.3.1 REMOVING PUMP HEAD

1. Mark the position between the housing (Figure 16/1), intermediate plate (Figure 16/2), head plate (Figure 16/3) and pressure plate (Figure 16/4) with a continuous felt-tip pen stroke to ensure correct assembly.

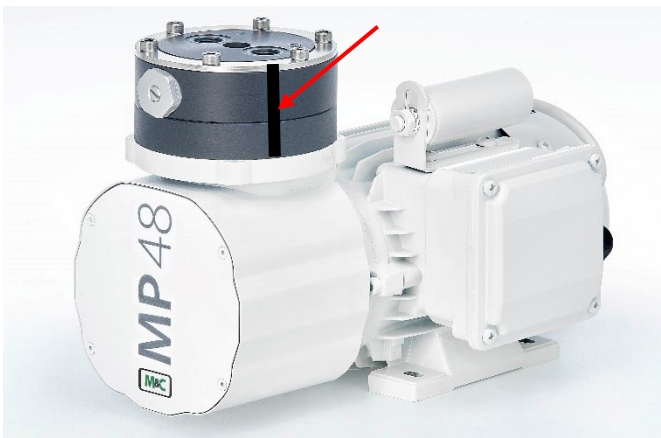


Figure 17 Mark the position of the pump head with a felt-tip pen

2. Loosen the six screws (Figure 16/5) and remove the pressure plate (Figure 16/4), head plate (Figure 16/3) and intermediate plate (Figure 16/2) together from the pump housing.

17.3.2 REPLACING DIAPHRAGM

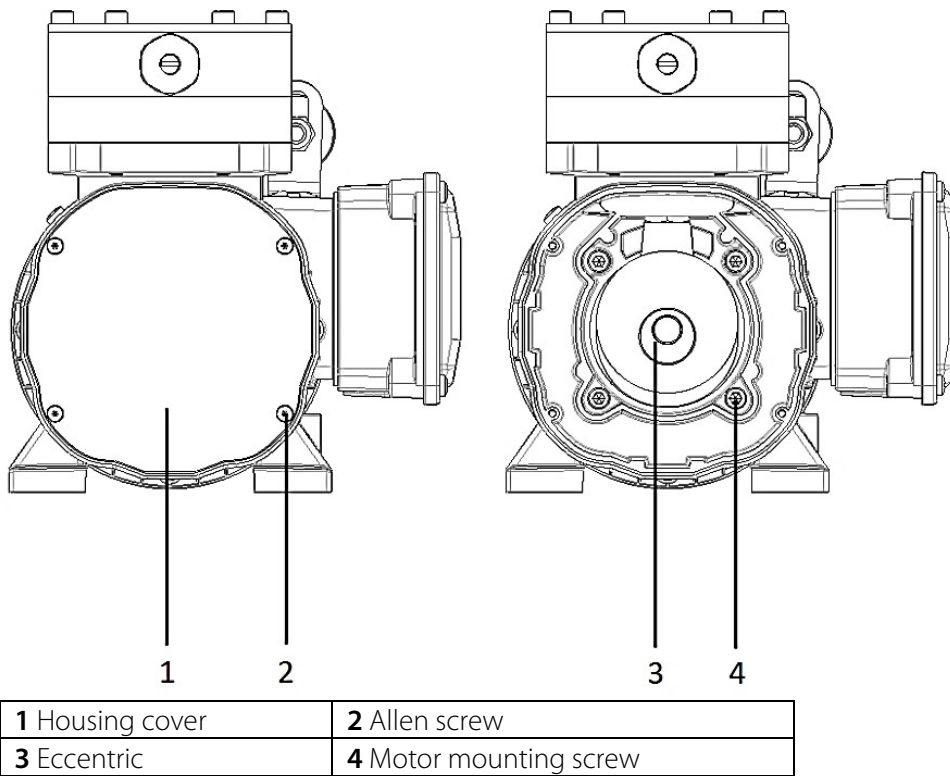


Figure 18 Remove housing cover, move connection rod in upper position

1. Loosen and remove the four Allen screws (Figure 18/2) of the housing cover (Figure 18/1).
2. Remove housing cover (Figure 18/1).
3. Move the connecting rod (connecting part between drive shaft and diaphragm) to the upper reversal point.
4. Hold the diaphragm (Figure 16/6) at the side edges and unscrew counterclockwise.
5. Check all parts for contamination and clean if necessary (see chapter 17.2).
6. Screw the new diaphragm (Figure 16/6) clockwise onto the support cup and tighten it hand tight.



Note

If the zone diaphragm is tightened too much, there is a risk that the PTFE coating will detach.

17.3.3 REPLACING VALVE PLATE AND SEALING

1. Remove the pressure plate (Figure 16/4) from the pump head using the six screws (Figure 16/5).
2. Loosen the screw (Figure 16/7) and remove it together with the washer (Figure 16/8).
3. Separate the head cover (Figure 16/3) from the intermediate plate (Figure 16/2).

**Note**

Carefully lay down the head cover so that its sealing edge is not damaged.

4. Remove the valve plates/sealings (Figure 16/9) from the intermediate plate (Figure 16/2).
5. Remove the O-ring (Figure 16/10) from the intermediate plate.
6. Check valve seats, intermediate plate (Figure 16/2), head cover (Figure 16/3) and, if necessary, O-ring groove for contamination and damage. Clean parts if necessary. Contact M&C if uneven, scratched, or corroded. Order and replace damaged parts.
7. Insert valve plate/sealing.

**Note**

Valve plates/sealings for discharge and suction side are identical; top and bottom of valve plates/seals are identical.

8. Insert new valve plates/sealings (Figure 16/9) into the valve seats of the intermediate plate (Figure 16/2).
9. Ensure that the valve plates/sealings (Figure 16/9) are centered in the valve seats of the intermediate plate (Figure 16/2) by moving the valve plates/sealings (Figure 16/9) slightly horizontally.
10. Install the new O-ring (Figure 16/10).
11. Place the head cover (Figure 16/3) on the intermediate plate (Figure 16/2) according to the dowel pin (Figure 16/12) and the felt-tip mark.
12. Check the centering of the head cover (Figure 16/3) by moving it slightly sideways.
13. Connect the head cover (Figure 16/3) and the intermediate plate (Figure 16/2) by tightening the screw (Figure 16/7) with the washer (Figure 16/8) underneath (tightening torque: 100 Ncm).
14. Place the pressure plate (Figure 16/4) with the six screws (Figure 16/5) on the head cover (Figure 16/3) and the intermediate plate (Figure 16/2) according to the felt-tip markings.
15. Dispose of the replaced diaphragm, valve plates/seals and, if necessary, O-ring properly.

17.3.4 ASSEMBLING THE PUMP HEAD

1. Place the pump head on the housing according to the felt-tip mark.
2. Screw in the screws (Figure 16/5) and tighten them lightly crosswise.
3. Check the smooth running of the pump by turning the counterweight.
4. Tighten the screws (Figure 16/5) crosswise (tightening torque: 450 Ncm).
5. Put on the housing cover (Figure 18/1) and tighten it with the four Allen screws (Figure 18/2) (tightening torque: 15 Ncm).

17.3.5 FINAL STEPS

1. Reconnect suction and pressure line to the pump.
2. Reconnect the pump to the electricity supply.



Note

If you have any questions about servicing call our technical adviser. You will find the contact information on www.mc-techgroup.com.

17.4 REPLACING THE THROTTLE VALVE

Required tool:

Quantity	Tool	Size
1	Standard screw driver	22 mm

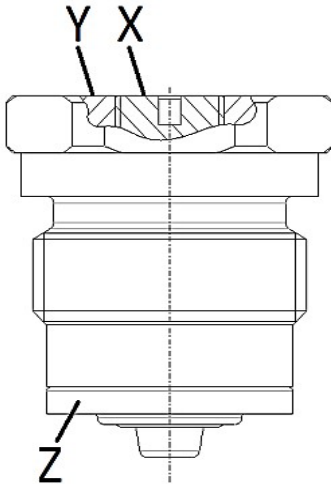


Figure 19 Throttle valve

1. Unscrew the throttle valve (Figure 16/11) from the head with a wrench by turning it counterclockwise.
2. Screw the new throttle valve (Figure 16/11) into the head and tighten it (tightening torque: 450 Ncm).



Note

The throttle valve (Figure 16/11) has a defined factory setting.

Therefore, no changes may be made to the throttle valve before it is mounted on the head.

Should deviations or discrepancies nevertheless occur, the following must be observed according to Figure 19:

1. Threaded part (Y) and adjusting screw (X) must be flush for assembly.
2. Valve diaphragm (Z) must be completely screwed in and must not be tightened.
3. Set the delivery rate according to chapter 15.2.

18 TROUBLE SHOOTING



Danger



Extreme danger from electrical shock!

- Disconnect the pump power supply before working on the pump.
- Make sure the pump is de-energized and secure.

Problem/Indication	Possible cause	Check/Action
Pump does not transfer	Thermal switch or triggering device for PTC sensors of the motor has operated following to over-heating.	<ul style="list-style-type: none"> • Disconnect pump from mains. • Allow pump to cool. • Trace cause of over-heating and eliminate it.
	No voltage in power source.	<ul style="list-style-type: none"> • Check room fuse and switch on if necessary.
	Connections or lines are blocked.	<ul style="list-style-type: none"> • Check connections and lines. • Remove blockage.
	External valve is closed or filter is clogged.	<ul style="list-style-type: none"> • Check external valves and filters.
	Condensate has collected in pump head.	<ul style="list-style-type: none"> • Flush pump (see chapter 17.2). • Install pump at highest point in system.
	Diaphragm or valve plates/sealings are worn out.	<ul style="list-style-type: none"> • Replace diaphragm and valve plates/sealings (see chapter 17.3).
Flow rate, pressure or vacuum too low	Condensate has collected in pump head.	<ul style="list-style-type: none"> • Flush pump (see chapter 17.2). • Install pump at highest point in system.
	There is gauge pressure on pressure side and at the same time vacuum or a pressure above atmospheric pressure on suction side.	<ul style="list-style-type: none"> • Change the pressure conditions.
	Pneumatic lines or connection parts have an insufficient cross section or are throttled.	<ul style="list-style-type: none"> • Disconnect pump from system to determine output values. Eliminate throttling (e.g. valve) if necessary. • Use lines or connection parts with larger cross section if necessary.
	Leaks occur on connections, lines or pump head.	<ul style="list-style-type: none"> • Eliminate leaks.
	Connections or lines completely or partially jammed.	<ul style="list-style-type: none"> • Check connections and lines. • Remove the jamming parts and particles.
	Head parts are soiled.	<ul style="list-style-type: none"> • Clean head components.
	Diaphragm or valve plates/sealings are worn.	<ul style="list-style-type: none"> • Replace diaphragm and valve plates/sealings (see chapter 17.3).

18.1 TROUBLE SHOOTING IS NOT SUCCESSFUL

If you are unable to determine any of the specified causes, send the pump to M&C customer service (contact information: see www.mc-techgroup.com).



Flush the pump to free the pump head of dangerous or aggressive gases (see chapter 17.2).

1. Remove the pump.
2. Clean the pump (see chapter 17.2).
3. Send the pump, together with completed RMA Service Receipt to M&C stating the nature of the transferred medium.

19 Returns

If you send your diaphragm pump to M&C Customer Service for repair, then we require a fully completed RMA Service Receipt. You can find the RMA Service Receipt on our website www.mc-techgroup.com under Service & Support → Returns.

There you enter information about the pumped medium, especially about aggressive pumped media.

If hazardous or highly aggressive gases have been pumped with the pump, the pump must be cleaned before shipment.

20 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.

21 SPARE PARTS LIST

Wear, tear and replacement part requirements depend on specific operating conditions. The recommended quantities are based on experience and they are not binding.

Diaphragm pumps MP48/R and MP48S/R

(C) Consumable parts (R) Recommended spare parts (S) Spare parts

Part No.	Description	C/R/S	Recommended quantity being in operation [years]		
			1	2	3
90P8030	O-ring 5, 5 x 2, Material: FFPM	R	1	2	3
90P8020	Replacement throttle valve, material: FFPM	R	1	2	3
90P8010	Valve plate and sealing, 1 piece, material: FFPM, (2 pieces are necessary)	R	2	4	6
90P8000	Zone diaphragm, material: PTFE coated	S	-	-	1

PVDF Male connectors with G-thread (ISO 1010031)

05V1060	Straight male connector for flexible tube DN 4/6-G 1/4", material: PVDF	S	-	-	2
05V1065	Straight male connector for flexible tube DN 6/8-G 1/4", material: PVDF	S	-	-	2
05V4060	Male elbow connector for flexible tube DN 4/6-G 1/4", material: PVDF	S	-	-	2
05V4065	Male elbow connector for flexible tube DN 6/8-G 1/4", material: PVDF	S	-	-	2
05V6600	Verrule DN 4/6, material: PVDF	S	2	2	4
05V6602	Verrule DN 6/8, material: PVDF	S	2	2	4
05V6605	Union nut DN 4/6, material: PVDF	S	2	2	4
05V6607	Union nut DN 6/8, material: PVDF	S	2	2	4

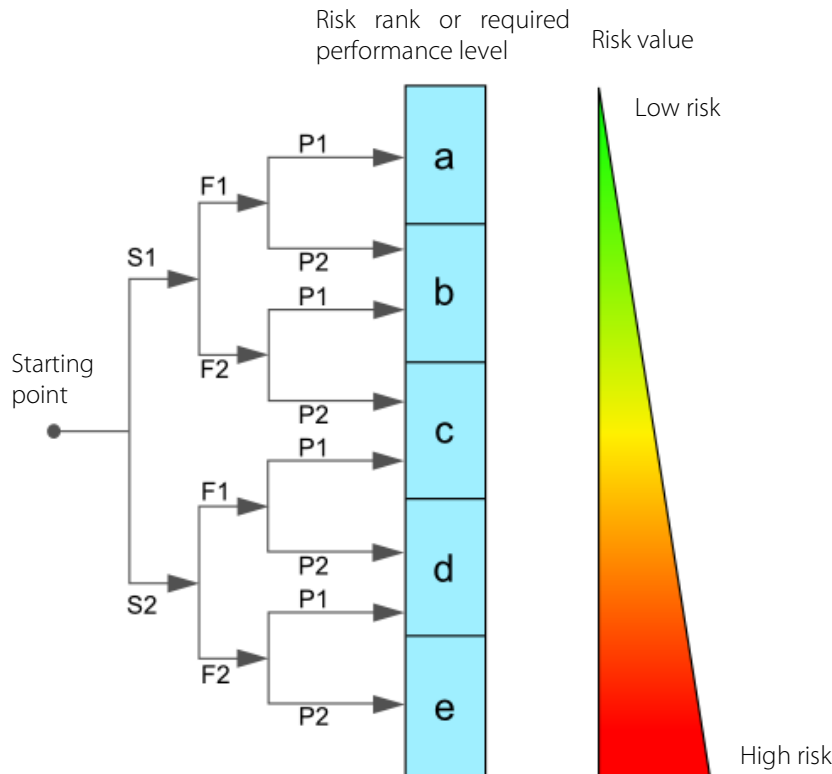
22 Risk assessment

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 20 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.

23 APPENDIX



Further product documentation can be seen and downloaded from our home page:

www.mc-techgroup.com