Operation Manual

ILMVAC

Diaphragm pumps 1-headed

Types **MP 301 E**

MPC 301 E

Fisher Scientific
Part of Thermo Fisher Scientific

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We are constantly working on the further development of all our product types.

We reserve the right to make changes and amendments.

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Contents

1 Important Information

1.1 General Information

The ILMVAC Diaphragm Pumps conform to the following directives:

- 2006/95/EC Low Voltage Directive
- 2006/42/EC Machinery Directive
- 2004/108/EC Electromagnetic Compatibility Directive

The CE sign is located on the rating plate. Observe the binding national and local regulations when fitting the pump into installations.
Our products are sold worldwide and can therefore be equipped with the typical national plugs and for the various voltages. You will find more information about the available pump designs under http://www.ilmvac.de.

1.2 Target Groups

This Operating Manual is intended for the personnel planning, operating and maintaining ILMVAC Diaphragm Pumps.
This group of people includes:

- Designers and fitters of vacuum apparatus,
- Employees working on commercial laboratory and industrial vacuum technology applications and
- Service personnel for diaphragm pumps

The personnel operating and maintaining the diaphragm pumps must have the technical competence required to perform the work that has to be done. The user must authorize the operating personnel to do the work that has to be done. The personnel must have read and understood the complete Operating Manual before using the diaphragm pumps.
The Operating Manual must be kept at the place of use and be available to the personnel when required.

1.3 Intended Use

- The layout of the diaphragm pump must be appropriate for the conditions of use. The user bears the sole responsibility for this.
- The diaphragm pump may only be operated under the conditions stated
  - in the "Technical Data" section,
  - on the type plate, and
  - in the technical specification for the order concerned.
- Diaphragm pumps are approved for extracting, pumping and compressing gases and vapours. If these gases and vapours are toxic or explosive, then the user must observe the currently valid safety regulations for this application. Special types of diaphragm pumps are available for aggressive and explosive gases.

1.4 Use for an Unauthorized Purpose

It is forbidden to use the pump for applications deviating from the technical data stated on the type plate or the conditions stated in the supply contract, or to operate it with missing or defective protective devices.

1.5 Safety Devices

Measures such as the following are for the safety of the operating personnel:

- electrical connection with a protective conductor (operating mode S1) and an earthing plug,
- Motor protection switch (thermal) and
- “Hot Surface" label on the pump body (warning notice).

The diaphragm pump must not be operated without these elements.

1.6 Meaning of the Warning notes

Take note of the warning notices. They are in the following box:

	**CAUTION ! / WARNING !**
Hazard which may lead to serious injuries or material damage.	

1.7 Product Standards, Safety Regulations

ILMVAC Diaphragm Pumps meet the following product standards:

DIN EN 292-1, DIN EN 292-2	Safety of machines, basic terminology
DIN EN 1012-2	Compressors and vacuum pumps
DIN EN 60204-1	Electrical equipment of machines
EN 50110-1 (DIN VDE 0105-100)	Operation of electrical installations
EN 61010-1	Safety for laboratory devices
EN 50081-1-2	Electromagnetic compatibility (EMC) Generic specification - Interference resistance for residential, business and industrial areas, and small businesses
EN 50082-1-2	Electromagnetic compatibility (EMC) Generic specification - Interference emission for residential, business and industrial areas, and small businesses
EN 55014	Radio disturbance characteristics of electrical equipment and systems
EN 61000-3-2/3	Electromagnetic compatibility (EMC)
Directive 2006/42/EC	Law and Administration Regulations relating to Machinery
Directive 2002/95/EC	RoHS Restriction of use of certain hazardous substances

The following additional safety regulations apply in the FR Germany:

BGV A2	Electrical equipment and operating materials
VBG 5	Power-driven machines
BGR 120	Guidelines for laboratories
BGI 798	BG hazard assessment in the laboratory

Observe the standards and regulations applying in your country when you use the diaphragm pumps.

2 Basic Safety Instructions

2.1 General Information

Warning notices must be observed. Disregarding them may lead to damage to health and property.
The diaphragm pumps must be operated by personnel who can detect impending dangers and take action to prevent them from materialising.
The manufacturer or authorized authorised workshops will only service or maintain the diaphragm pump if it is accompanied by a fully completed damage report. Precise information about the contamination (also negative information if necessary) and thorough cleaning of the diaphragm pump are legally binding parts of the contract.
Contaminated diaphragm pumps and their individual parts must be disposed of in accordance with the legal regulations.
The local regulations apply in foreign countries.

2.2 Electricity

The diaphragm pumps of operation mode S1 are supplied. When the location of operation mode S1 devices is changed, please note that the testing must be repeated in accordance with DIN EN 0105, DIN EN 0702 and BGV A2.
The local regulations apply in foreign countries.

Please note the following when connecting to the electrical power supply system:

- The electrical power supply system must have a protective connector according to DIN VDE 0100-410 (IEC 60364-4-41).
- The protective connector must not have any breaks.
- The connecting cable must not be damaged.

2.3 Mechanical Systems

Improper use can lead to injuries or material damage. Observe the following instructions:

- Only operate the diaphragm pumps with hoses of the specified dimensions.
- The maximum permissible pressure of 1 bar at the suction connection must not be exceeded.
- Hazardous substances must be separated out as far as this is technically possible before they reach the pump.
- External mechanical stresses and vibrations must not be transmitted to the pump. Only use flexible NW 8 laboratory hoses for connecting diaphragm pumps.
- The overpressure generated at the pressure port must not exceed 1 bar.
- The pump must not be used to suck up fluids. Lay the exhaust pipe so that it slopes downwards, so allowing condensate to flow out of the pump. Collect the condensate and dispose of it in an environmentally compatible manner.
- Prevent dyes exuding.
- Maintain a space of least 20 mm between the pump and adjacent parts in order to enable the pump to cool.

	**CAUTION !**
Solid particles in the pumping medium impair the pumping action and can lead to damage. Prevent solid particles penetrating into the pump.	

2.4 Hazardous Substances

The operating company bears the responsibility for the use of the diaphragm pump.

Hazardous substances in the gases to be pumped can cause personal injuries and property damage. Pay attention to the warning notices for handling hazardous substances.

The local regulations apply in foreign countries.

Combustible Gases

Examine before switching on whether that can form gas combustible gas/air mixtures which can be promoted! Consider the regulations of the guideline 1999/92/EC.

Explosive gases

The diaphragm pumps is not certified according to ATEX guidelines 94/9/EC.

Aggressive gases

The **MPC** series is designed for extracting contaminated gases!

The use of diaphragm pumps of the series **MP** of ILMVAC GmbH cannot be recommended for such cases of application!

Especially aggressive gases have to be explicitly checked for material resistance as described *in chapter 3.4* and, if necessary, modified.

Poisonous gases

Use a separator when pumping poisonous or harmful gases. Prevent such substances from leaking out of the appliance or pump. Treat these substances according to the applicable environmental protection regulations.

Test the strength and leak-tightness of the connecting lines and the connected apparatus. Prevent environmental poisons, e.g. mercury, getting into the diaphragm pumps.

Fulfil the requirements, for example:

- German Hazardous Substances Regulation (GefStoffV) of 23. December 2004
- Regulations 2006/121/EC (classification, packaging and identification of hazardous substances),
- Manufacturer's safety data sheets on hazardous substances.

2.5 High Temperatures

The diaphragm pump may heat up as a result of the temperature of the gas being pumped and through compression heat.
Prevent the following maximum permissible temperatures from being exceeded.

- + 40 °C for the environment, and
- + 60 °C for the gas to be pumped.

The motor for single phase alternating current is protected against overload by an integrated motor protection switch.

3 Description

3.1 Design

The one-stage diaphragm pump consists of a pump body and a drive motor.

The pump casing contains the drive unit and one pump heads.
The pump head contains a diaphragm and the work valves.

The pump heads are driven via an eccentric shaft with a connecting rod.

Fig. 1 Diaphragm pump MP 301 E

3.2 Principle of Operation

Motor, eccentric shaft and connecting rod set the diaphragms in stroke movement. This changes the size of the space between the diaphragms and pump head (pump chamber).

Increasing the size of the pump chamber opens the inlet valve while the outlet valve is closed (intake process).

Decreasing the size of the pump chamber ejects the gas through the outlet valve.

The valves are actuated by the gas being pumped. A large proportion of fluid in the diaphragm pump minimizes the pumping efficiency.

3.3 Areas of Application

ILMVAC Diaphragm Pumps are intended to:

- Pumping and compressing neutral and aggressive gases and vapours.
- Generating a vacuum down to an ultimate pressure < 75 mbar.
- Use in physical and chemical laboratories in trade and industry.
- Use for vacuum filtration, vacuum distillation and vacuum drying, and other vacuum technology applications.

3.3.1 Materials of the medium-affecting pump parts

Component	Standard design MP type	Chemical model MPC type (resistant to aggressive gases)
Connection head / Pump head	Aluminium	PTFE with carbon-fibre reinforcing
Seal	EPDM	EPDM
Screw fitting	PA / PP	PVDF / PP
Valves	PEEK	PEEK
Diaphragm	fabric reinforced with a PTFE layer	fabric reinforced with a PTFE layer
Connecting elements	PP	PP
Hose	PTFE	PTFE

Notes:

PTFE with carbon-fibre reinforcement, electrically conductive (with manufacturer's certificate of electrical conductivity).

Material resistance to aggressive media see:

“Kunststoff Kautschuk Produkte“, Jahreshandbuch der Verarbeiter 2000/2001 ("Plastic, Rubber Products“, Annual Handbook of the Processor 2000/2001), Publisher Hoppenstedt Darmstadt, Vienna, Zurich.

3.4 Scope of Delivery

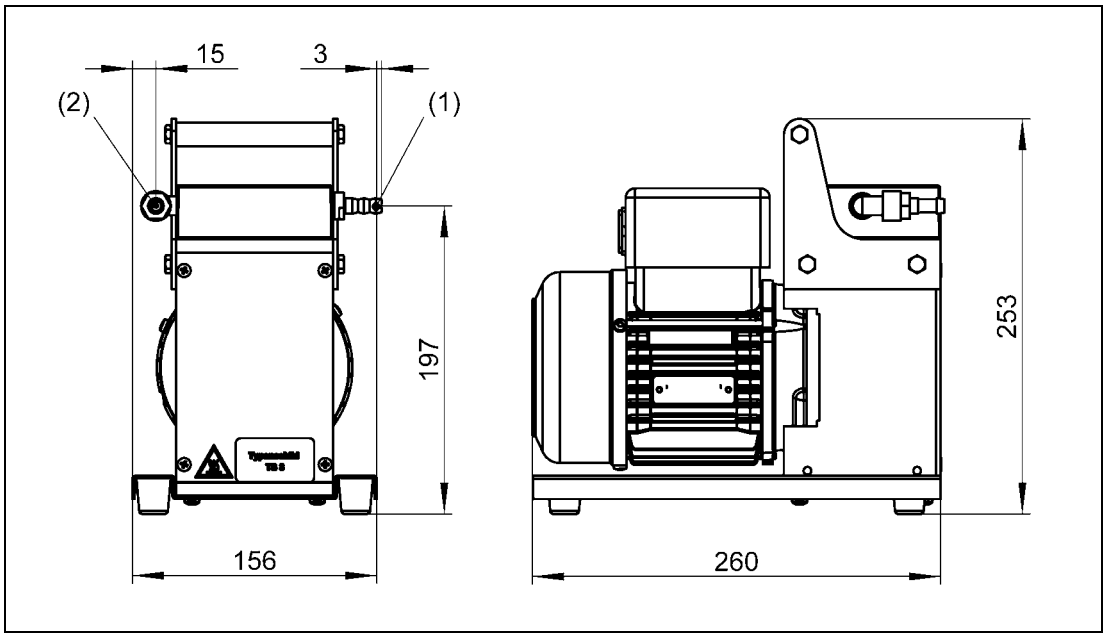
The scope of delivery is specified in the supply contract.

3.5 Accessories

Figure	Designation	Order no.
	**Vacuum Control Box VCB 424 cv** For measuring and regulation of vacuum.	600037

4 Technical Data

4.1 Dimensions



(1)	**Suction connection**	Hose nozzle DN 8
(2)	**Pressure connection**	Hose nozzle DN 8 / muffler

Fig. 2 Dimensions

4.2 Intake Pressure / Pumping Speed – Diagram

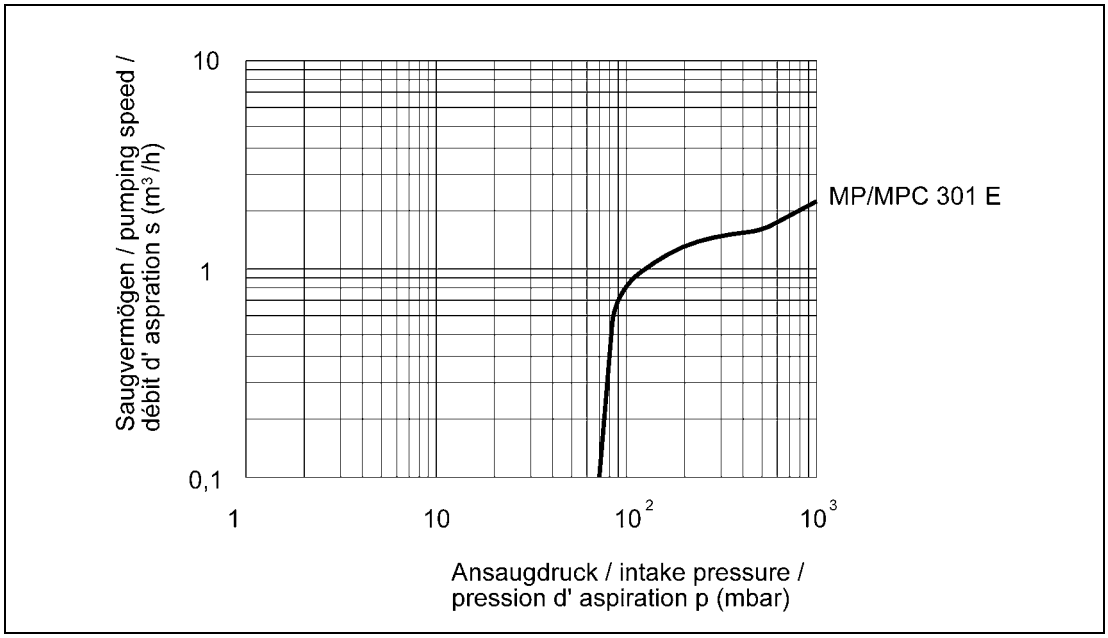


Fig. 3 Intake Pressure, Pumping Speed

4.3 Device Data

Parameter	Unit	MP 301 E	MPC 301 E
Pumping speed 50/60 Hz DIN 28432	m^3 / h	2.3 / 2.5	
	l / min	38 / 41	
Ultimate pressure	mbar	< 75	
Max. inlet pressure	bar	1	
Max. outlet pressure	bar	1	
Suction connection	-	Hose nozzle for hose inside diameter 8 mm	
Pressure connection		Hose nozzle for hose inside diameter 8 mm (or muffler)	
Ambient temperature	°C	+ 10 to + 40	
Max. operating gas temperature	°C	+ 60	
Bearing	-	maintenance-free	
Reference surface sound pressure level DIN 45635 part 13	dB (A)	< 45	
Voltage / Frequency (different data upon customer request)	V, Hz	230, 50/60 (115, 50/60) (generally with motor protection switch, switch and plug IEC)	
Power	W	180	
Operating mode	-	S 1	
Type of protection (Motor) DIN EN 60529	-	IP 54	
Class of insulation DIN EN 600034-1	-	F (160°C)	
Weight	kg	8.9	
Dimensions (W/D/H)	mm	162 / 260 / 252	
Order numbers for :	-		
- Mains connection cable IEC with plug CEE (D)		825885	
- Mains connection cable IEC with plug BS (UK)		825878	
- Mains connection cable IEC with plug type 12 (CH)		825877	
- Mains connection cable IEC with plug NEMA 1-15 (US)		825903	
Order numbers for :			
- Diaphragm pump 230 V **without** mains connection cable		4000732	4000742
- Diaphragm pump 115 V **without** mains connection cable		4000732-01	4000742-01

5 Installation and Operation

5.1 Unpacking

Carefully unpack the diaphragm pump.

Check the pump for:

- Transport damage,
- Conformity with the specifications of the supply contract (type, electrical supply data),
- Completeness of the delivery.

Please inform Ilmvac GmbH without delay if there are discrepancies between the delivery and the contractually agreed scope of delivery, or if damage is detected.

Please take note of the general terms of business of ILMVAC GmbH.

In case of a claim under warranty, the device must be returned in packaging that is suitable for protecting it during transport.

5.2 Installation and Connection

1. Set the diaphragm pump on a flat and horizontal surface.
2. Remove the protective caps on the suction port.
3. Prepare the connections.
4. Connect the DN 8 vacuum line to the suction connection.
5. Connect the diaphragm pump to the electrical supply.
6. If the exhaust pipe is to be connected, fit the supplied hose nipple. The sound absorber is to be mounted when the exhaust pipe is free.

	**CAUTION !**
The muffler used in the chemical area has only a limited chemical durability.	

5.3 Operation

	**CAUTION !**
Observe the basic safety instructions when using the pump.	

The diaphragm pump is switched on and off at the operating switch.

5.4 Storage

The pumps are to be stored in a low-dust, interior room within the temperature range from + 5 to + 40 °C and at a relative air humidity < 90%.

Leave the protective elements on the suction and pressure ports. Another equally good protection may be used.

5.5 Scrap Disposal

	**CAUTION !**
The diaphragm pumps must be disposed of in accordance with the 2002/96/EC guideline and the specific national regulations. **Contaminated diaphragm pumps must be decontaminated according to the laws.**	

6 Maintenance and Servicing

6.1 General Requirements

- Check the pump daily for unusual running noises and heat building up on the surface of the pump.
- We recommend changing the diaphragm after 10,000 operating hours. The user may specify that the exchange be made earlier, depending upon the application process.
- Check the electrical and vacuum connections daily.

6.2 Maintenance Performed by the User

WARNING !

Only perform the work that is described here, and that which is permitted to be done by the user.
All other maintenance and service work may only be performed by the manufacturer or a dealer authorized by him.
Beware of the pump parts being possibly contaminated by hazardous substances. Wear protective clothing if there is contamination.

Scope of permissible work:

- Open and remove the pump heads
- Inspect the pump chambers, diaphragms and valves
- Deposits in the inside of the pump must be cleaned out
- If necessary change the diaphragms, valves and seals.

Tools required:

- Order no. 826801 Pin type face wrench, adjustable, size 3
- Order no. 826801-6 Allan key, size 4

6.2.1 Disassembly

1. Disconnect the power supply and ensure that it cannot be switched on again.
2. Remove four machine screws **(1)** from each connection head with an Allan key, size 4.
3. Lift off the connection head **(2)** and the pump head **(5)**. The valves **(3)**, o-rings **(4)** and diaphragm **(7)** are now freely exposed.
4. Loosen the diaphragm **(7)** at the strain washer **(6)** by turning the size 3 pin type face wrench anticlockwise.
5. Clean the valves **(3)**, the pump head **(5)** and the diaphragm **(7)** with a soft cloth and acetone.
6. Check that the drive is in good working order.

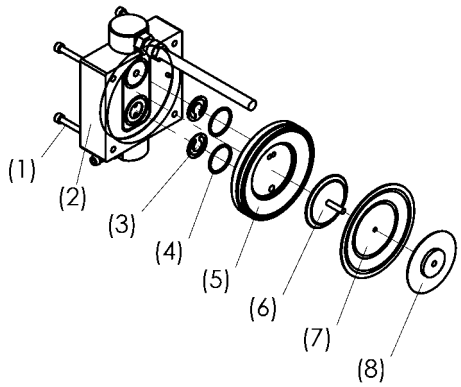


Fig. 4 Disassembly, assembly

	WARNING !
Renew defective parts, if necessary ! Wear protective gloves! **Parts must be renewed at the intervals stated in this Operating Manual or as specified by the user internally.** **Do not clean with compressed air !**	

6.2.2 Assembly *(Fig. 4)*

1. Use the size 3 pin-type face wrench to tighten the pressure disc **(8)**, the diaphragm **(7)** and the strain washer **(6)** with the correct torque of 2 - 4 Nm.
2. Bring the connecting rod *(see fig. 5)* and the diaphragm **(7)** into the central position.
3. Replace the pump head **(5)**.
4. Insert the valves **(3)** and the o-rings **(4)**.
   Ensure that they are lying completely flat. Do not insert the burred side facing the sealing surface. Align the connection head flush with the pin.
5. Tighten the four machine screws **(1)** symmetrically with a torque of 3 to 4 Nm.

6.2.3 Test

- Connect a vacuum measuring device to the suction connector and measure the ultimate pressure.
  If the device is working properly, then the figure stated in the technical data must be attained within a maximum of one minute.
- The pump must not make any abnormal noises.
- Moving parts must not touch each other.

6.3 Maintenance by the Manufacturer

Repairs and maintenance going beyond the extent of the work described *in chapter 6.2* or reconditioning or modification may only be performed by the manufacturer or authorized workshops.

	**WARNING !**
The user shall be liable for the consequences of an incorrect damage report or a contaminated pump. The statements in the damage report are legally binding.	

6.4 Damage Report

You find the form of the damage report to the Download on our web page http://www.ilmvac.de and/or. http://www.ilmvac.com in the menu "service" and "Downloads".

If you should not have an entrance to the Internet, you can request the form also gladly with us, company Ilmvac GmbH.

	**WARNING !**
Incomplete or incorrectly completed damage reports may endanger the service personnel! **Give full information in the damage report, in particular regarding a possible contaminating.**	

7 Troubleshooting

During the warranty period, intervention in the diaphragm pumps and accessory components may only be made by ILMVAC GmbH.

Trouble	Cause	Action
Diaphragm pump does not start	No power supply to the motor	Electrical system to be checked by a qualified electrician.
	Motor defective	Exchange by service shop.
	Pump body defective	Exchange or repair by service shop.
The diaphragm pump does not generate a vacuum or only an inadequate one	Connected apparatus leaks, connecting elements leak	Identify and seal the leak, replace the seals and hoses if necessary.
	Diaphragm pump leaks (pipes or hoses)	Check the hose connections between the pump heads, replace the hoses and screwed clamping rings if necessary.
	Pump head leaks	Repair by service shop.
	Diaphragm defective	Repair by the service workshop or the user.
	Valves are dirty	Clean condensates and foreign objects out of the valves. Cleaning by the service workshop or the user.
	Valves defective	Replace valves Repair by the service workshop or the user.
	Diaphragm pump is dirty	Cleaning by the service workshop or the user.

8 Spare Parts Overview

The spare parts lists contain all the spare parts and all the information necessary for ordering.

When ordering, please quote the description, quantity, serial number and order number!

	**CAUTION !**
Ilmvac is not liable for any damage caused by the installation of any parts not supplied by the manufacturer.	

8.1 Maintenance kit

Designation	Order no.
Maintenance kit	402046

The maintenance kit consists of:

Designation	Piece	Order no.
O-ring ø 25 x 2	2	829250-1
Valve	2	400656
Diaphragm	1	400732

Caution, the number of supplied construction units in the maintenance set corresponds to the maximum need of the series!

8.2 Exploded view

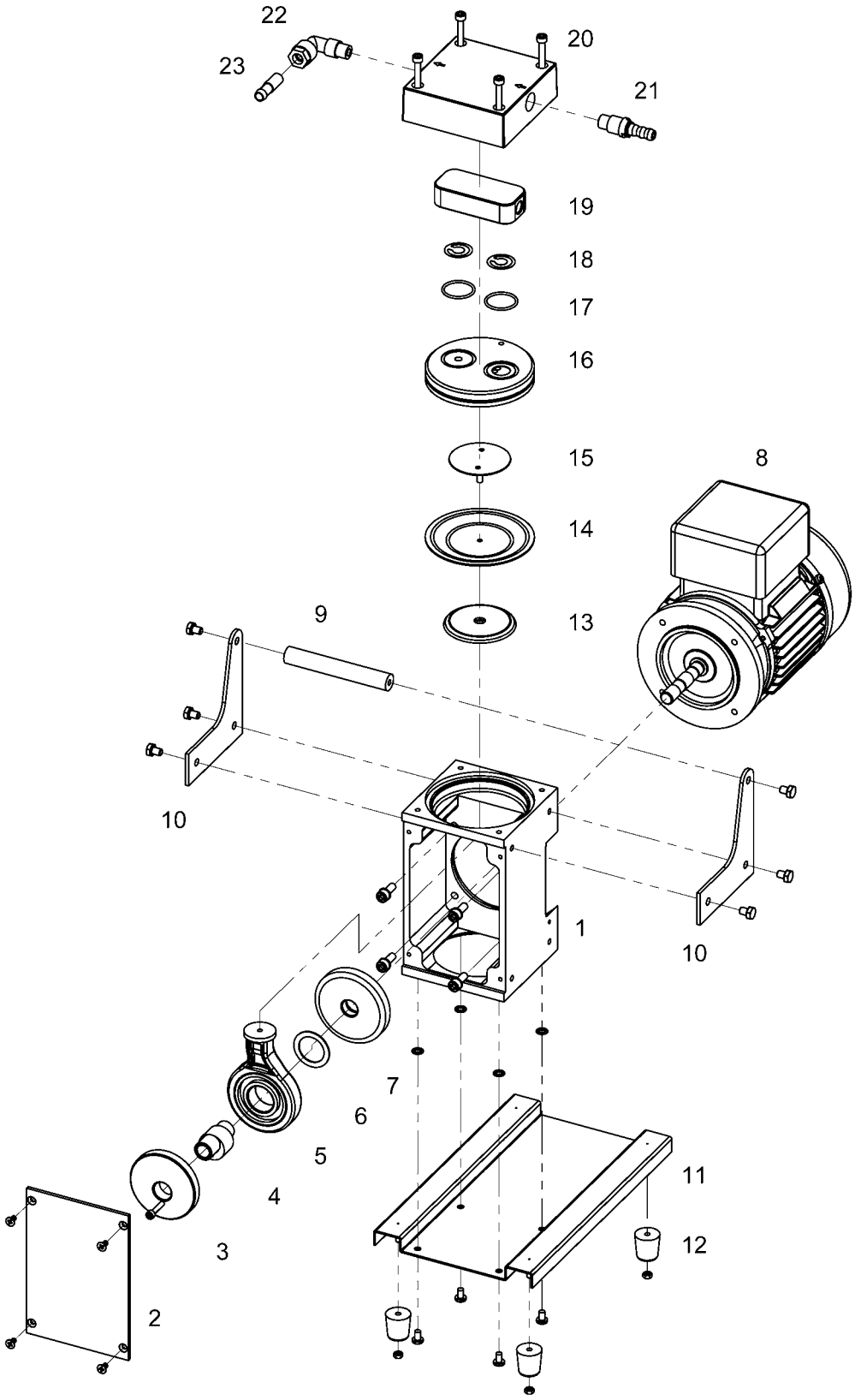


Fig. 5 Exploded view MPC 301 E

8.2.1 Part list diaphragm pumps MP 301 E

Item no.	Designation	Piece	MP 301 E 230 V (Order no. 4000732)	MP 301 E 115 V (Order no. 4000732-01)
			Order no.	Order no.
-	Basic pump complete *) *(consisting of position: 1 – 8)*	1	400733-16	400733-17
1	Casing	1	400640	400640
2	Cover plate	1	400641	400641
-	Drive complete *(consisting of position: 3 – 7)*	1	400843-02	400843-02
3	Centrifugal mass	1	400649	400649
4	Eccentric	1	400648-01	400648-01
5	Piston rod with ball bearing	1	400647-01	400647-01
6	Close tolerance spacer 25 x 35 x 1	1	824957-1	824957-1
7	Mass balance	1	400678-2	400678-2
8	Motor …V; 50/60 Hz; 0.18 kW	1	826420	826422-1
9	Handle	1	400964	400964
10	Handle bracket	2	400963	400963
11	Pump bracket	1	400962	400962
12	Rubber pad	4	829150	829150
13	Pressure washer	1	400680	400680
14	Diaphragm	1	400732	400732
15	Tightening washer	1	400617	400617
16	Pump head	1	400643-01	400643-01
17	O-ring EPDM, ø 25 x 2	2	829250-1	829250-1
18	Valve	4	400656	400656
19	Aluminium insert	2	400902-01	400902-01
20	Connection head	2	400901	400901
21	Hose nozzle PP, DN 8 - M12 x 1	1	710798-04	710798-04
22	Threaded elbow joint 10 - PP, M12 x 1	1	829972	829972
23	Hose sleeve	1	829924-1	829924-1
24	Muffler A 10 *(provided)*	1	400941	400941

*) The “basic pump” module (items 1 – 8) can only be supplied complete under order number 400733-16 or 400733-17

8.2.2 Part list diaphragm pumps MPC 301 E

Item no.	Designation	Piece	MPC 301 E 230 V (Order no. 4000742)	MPC 301 E 115 V (Order no. 4000742-01)
			Order no.	Order no.
-	Basic pump complete *) *(consisting of position: 1 – 8)*	1	400733-16	400733-17
1	Casing	1	400640	400640
2	Cover plate	1	400641	400641
-	Drive complete *(consisting of position: 3 – 7)*	1	400843-02	400843-02
3	Centrifugal mass	1	400649	400649
4	Eccentric	1	400648-01	400648-01
5	Piston rod with ball bearing	1	400647-01	400647-01
6	Close tolerance spacer 25 x 35 x 1	1	824957-1	824957-1
7	Mass balance	1	400678-2	400678-2
8	Motor …V; 50/60 Hz; 0.18 kW	1	826420	826422-1
9	Handle	1	400964	400964
10	Handle bracket	2	400963	400963
11	Pump bracket	1	400962	400962
12	Rubber pad	4	829150	829150
13	Pressure washer	1	400680	400680
14	Diaphragm	1	400732	400732
15	Tightening washer	1	400707	400707
16	Pump head	1	400705-02	400705-02
17	O-ring EPDM, ø 25 x 2	2	829250-1	829250-1
18	Valve	4	400656	400656
19	PTFE insert	1	400902	400902
20	Connection head	2	400901	400901
21	Hose nozzle PP, DN 8 - M12 x 1	1	710798-04	710798-04
22	Threaded elbow joint 10 - PP, M12 x 1	1	829972	829972
23	Hose sleeve	1	829924-1	829924-1
24	Muffler A 10 *(provided)*	1	400941	400941

*) The “basic pump” module (items 1 – 8) can only be supplied complete under order number 400733-16 or 400733-17