

Operation Manual (EN)
Translation of the german original manual

Diaphragm pumps

Models:

▶ **2019C-02**
(230V / 50Hz)

▶ **2019B-01**
(115V / 60Hz)

▶ **2019C-50**
(230V / 50Hz)



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Gardner Denver Thomas GmbH

Am Vogelherd 20
98693 Ilmenau
Germany
T +49 3677 604 0
F +49 3677 604 131
welch.emea@gardnerdenver.com
www.welchvacuum.com

Customer Support +49 3677 604 0

For USA, Canada and other Americas

Gardner Denver Thomas, Inc.

1601 Feehanville Drive
Suite 550
Mt. Prospect, IL 60056
USA
T +1 847 676-8800
F +1 847 677-8606
welch.na@gardnerdenver.com
www.welchvacuum.com

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Important Information

1 Important Information

1.1 General Information

The **Diaphragm Pumps** conform to the following directives:

2006 / 42 / EC	Machinery Directive
2014 / 30 / EU	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!

1.2 Target Groups

This Operating Manual is intended for the personnel planning, operating and maintaining Diaphragm Pumps.

This group of people includes:

- Designers and fitters of vacuum apparatus
- Employees working on commercial laboratory and industrial vacuum technology applications
- 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 Pumps must be appropriate for the conditions of use. The user bears the sole responsibility for this.
- The Diaphragm Pumps 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.

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 device (thermal)
- "Hot Surface" label on the pump - warning notice 

The Diaphragm Pumps must not be operated without these elements.

1.6 Meaning of the Warning notes

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

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

1.7 Product Standards, Safety Regulations

Diaphragm Pumps meet the following product standards:

DIN EN ISO 12100:2011-03	Safety of machinery - General principles for design - Risk assessment and risk reduction
DIN EN ISO 13857:2008-06	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
DIN EN 1012-2:2011-12	Compressors and Vacuum pumps - Safety requirements - Part 2: Vacuum pumps
DIN EN ISO 2151:2009-01	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2)
DIN EN 60204-1:2014-10	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
DIN EN 61000-6-2:2011-06 DIN EN 61000-6-4:2011-09	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments Part 6-4: Generic standards - Emission standard for industrial environments
DIN EN 61010-1/A1:2015-04	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
DIN EN 50110-1:2014-02	Operation of electrical installations
Directive 2012/19/EU	Electrical and electronics - old devices (WEEE)
Directive 2011/65/EU	Dangerous materials in electrical and electronics devices (RoHS II)
China – RoHS II	Environment protection law - China 2016-01

The following additional safety regulations apply in the FR Germany:

BGV A3	Electrical equipment and operating materials
VBG 5	Power-driven machines
BGR 120	Guidelines for laboratories
BGI 798	Hazard assessment in the laboratory
BGG 919 (VBG 16)	Accident prevention regulations for "compressors"
BGR 189 (BGR 195;192;197)	Use of protective working clothes

Observe the standards and regulations applying in your country when you use the Diaphragm Pumps.

Basic Safety Instructions

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 Pumps 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 Pumps 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 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 laboratory hoses for connecting 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

	ACHTUNG !
<p>The operating company bears the responsibility for the use of the Diaphragm Pumps. 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.</p>	

The local regulations apply in foreign countries.

Combustible, aggressive and explosive Gases

Don't pump combustible, especially aggressive or explosive gases or vapors or operate this pump in an atmosphere containing combustible or explosive gases or vapors.

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.

The Diaphragm Pumps are not certified according to ATEX guidelines 2014/34/EU.

The Diaphragm Pumps are not recommended for pumping acidic, basic or organic vapors.

Poisonous Gases

Use a suitable 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 pumps.

Fulfil the requirements, for example:

- German Hazardous Substances Regulation (GefStoffV) of 01. December 2010
- Regulation 2016/1179/EU
(Classification, Packaging and Labelling of hazardous substances),
- Manufacturer's safety data sheets on hazardous substances.

2.5 High Temperatures

The Diaphragm Pumps 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 electric motor has a thermal overload protection.

Description

3 Description

3.1 Design

3.1.1 Connections - Suction- / Pressure side

<p>Vacuum connection Suction side (1)</p> <p>Exhaust connection Pressure side (2)</p>  <p>(3)</p>	<p>► Suction side - Connection:</p> <p>Hose nozzle DN 8 (1)</p> <p>► Pressure side - Connection:</p> <p>Exhaust silencer (2) or hose nozzle DN 8</p> <p>► Suction side - Connection:</p> <p>Vacuum Regulator - Kit (3) with separator and display</p> <p>With the help of suction-side mounted Regulator-Kit it is possible to regulate the final pressure of the pump. You can see the actual pressure at the manometer.</p>
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3.1.2 Connecting to the electricity supply

The Diaphragm Pumps are supplied with complete electrical wiring. It is connected via a mains connection cable and a power plug. Mains connection cable and plug must comply with the requirements of the line disconnection devices (current, output). Motor is provided with a thermal overload protection ex works, protecting the vacuum pump from damage or destruction, respectively.

	<p>WARNING !</p>
<p>Should the user change the electrical connection, for example for fitting into a system, then this may only be performed by a electrical specialist under observance of the accident prevention regulations.</p>	

3.1.3 Display - Vacuum Regulator

The Vacuum Regulator shows pressures at below atmospheric pressure. The reference point for the gauge is atmospheric pressure.

	WARNUNG !
<p>Please keep in mind that the barometric pressure changes from day to day. This also changes the displayed pressure values because of latent air pressure fluctuations.</p>	

3.2 Protection measures against liquids in the pump

3.2.1 Condensate separator (Suction side)

If the possibility of penetration of larger liquid quantities, we recommend the additional installation of a larger collection vessel (eg. Woulff bottle).

3.2.2 Cold trap (Suction side)

The installation of an appropriate cold trap is required when a larger amount of steam (water, solvent) is obtained which exceeds the tolerance of the vapor pump. The refrigerant used is usually dry ice or dry ice mixture with an acetone or alcohol.

Maintenance:

The refrigerant must have the highest possible level in the cold trap. The rise in pressure in the connected vacuum apparatus indicates that the cold trap is saturated.

For cleaning remove the cold trap and defrost. The condensate must be disposed of properly. The cold trap is, if applicable, clean with a detergent and dry.

3.3 Areas of Application

The Diaphragm Pumps are intended to:

- Pumping and compressing neutral and aggressive gases and vapours.
- Generating a vacuum down to a minimum ultimate pressure of 200 mbar.
- Use in physical and chemical laboratories in trade and industry.
- Use for vacuum filtration, vacuum drying, glove boxes, vacuum ovens and other vacuum technology applications.

Description

3.4 Materials of the medium-affecting pump parts

Component	Materials
Seal	EPDM
Hose nozzle	PVDF
Piston cup seal	PTFE - Compound
Pump head	Aluminium with corrosion protection
Separator vessel	Plastic

3.5 Scope of Delivery

The scope of delivery is specified in the supply contract.

3.6 Accessories

Figure	Designation / Usage	Order no.
	Inline filter, hydrophobic Pore size: 0.22 µm To protect the pump against fine dust and aerosols. Installation in the suction line, <i>as shown</i> .	112555-04
	Vacuum hose red, rubber 18 / 8 x 5 mm For vacuum applications between pump and apparatus.	828310-4
	PVC-Fabric hose 8 x 3 mm For compressor- and vacuum applications as exhaust air- and suction line.	828346
	Hose clamp Clamping range 8 – 16 mm For fixing and sealing of PVC fabric hose.	826011-9

4 Technical Data

Parameter	Unit	2019B-01	2019C-02
Pumping speed 50/60 Hz at atmospheric pressure	m ³ / h	1.9 / 2.3	
	l / min	31 / 37	
Ultimate pressure	mbar	200	
Suction connection	-	Hose nozzle DN 8 for hose inside diameter 8 mm	
Pressure connection		Hose nozzle DN 8 for hose inside diameter 8 mm and Exhaust silencer	
Ambient temperature	°C	+ 10 to + 40	
Max. Operating gas temperature		+ 60	
Voltage / Frequency	V / Hz	115 / 60	230 / 50
Type of protection DIN EN 60529	-	IP 20	
Weight	kg	5.6	6.1 6.5
Dimensions (W/D/H)	mm	224 / 127 / 224	264 / 127 / 224
Order No. for:			
- Diaphragm pump <i>inclusive mains connection cable with plug US</i>		2019B-01	-
- Diaphragm pump <i>inclusive mains connection cable with plug CEE</i>	-	-	2019C-02
- Diaphragm pump <i>inclusive mains connection cable with plug CEE and vacuum regulator - Kit</i>	-	-	2019C-50

The information presented in this material is based on technical data and test results of nominal units. It is believed to be accurate and reliable and is offered as an aid to help in the selection of products. It is the responsibility of the user to determine the suitability of the product for the intended use and the user assumes all risk and liability whatsoever in connection therewith. Gardner Denver Thomas GmbH does not warrant, guarantee or assume any obligation or liability in connection with this information.

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 (model, electrical supply data),
- Completeness of the delivery.

Please inform us 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 the manufacturing firm.

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

5.2 Setting up and connecting

5.2.1 Setting up

- Set the pump on a flat and horizontal surface.
- Remove the protective caps on the suction and pressure ports.
- Note that the cooling of the pump is guaranteed, *see chapter 2.3*.
- Note that on the installation location no moisture acts on the pump.

5.2.2 Connecting

5.2.2.1 Electrical Connection

- Before the electrical connection of the pump review the specifications on the nameplate with the existing electrical connection conditions, *see chapter 2.2*.

	CAUTION !
The electric motor has a thermal overload protection. After triggering the protective fuse after a certain cooling occurs an auto restart (Reset) the motor.	

5.2.2.2 Vacuum connection (Suction side)

- The vacuum connection (suction port) consists of a hose nozzle DN 8.
Suitable vacuum lines are available:
 - Thick-walled rubber vacuum hose 8 x 5 mm hose nozzle DN 8.
 - PVC fabric hose and hose clamp 8 x 3 mm clamping range 8 - 16 mm.
- Make sure that the vacuum line is kept as short as possible from the pump to the apparatus.

5.2.2.3 Exhaust connection (Pressure side)

The exhaust connection (pressure port) also consists of a hose nozzle DN 8.

- Thick-walled rubber vacuum hose 8 x 5 mm hose nozzle DN 8.
- PVC fabric hose and hose clamp 8 x 3 mm clamping range 8 - 16 mm.

5.3 Operation

	CAUTION !
Observe the basic safety instructions when using the Diaphragm Pump, chapter 2.	

5.3.1 Start-up

- Make sure that when you start the pump, which may arise in the connection lines condensates, cannot penetrate into the pump.
▶ Action: additional suction side condensate separator
- Always try to avoid aspiration of foreign body particles!
▶ Action: suction side inline filter
- The Diaphragm pump is switched on the power switch.
- It is recommended to let the pump run for a few minutes before use. The warm-up improves the eligibility of the pump.

5.3.2 Decommissioning

- If vacuum applications with special steam load, the pump needs to run after the process with an open vacuum port about 2 minutes and rinsed with atmospheric air. This measure is used to cleaning the pump chamber and minimizes the corrosive attack wetted material pump parts.
- The Diaphragm pump is switched off using the power 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 2012/19/EU guideline and the specific national regulations. Contaminated Diaphragm Pumps must be decontaminated according to the laws.	

Maintenance and Servicing

6 Maintenance and Servicing

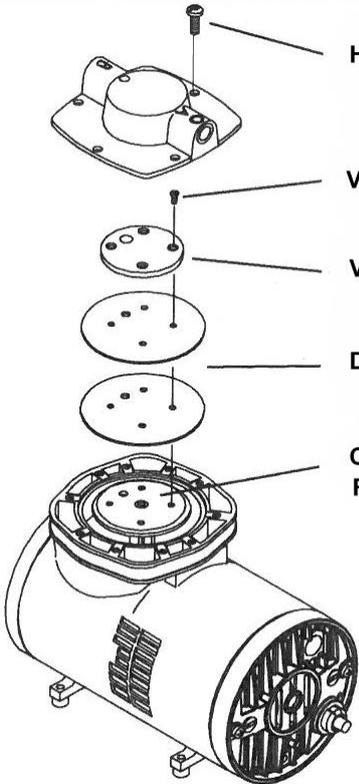
Diaphragm Pumps are 100% oil-free.
All bearings are sealed and permanently lubricated.

6.1 Maintenance Performed by the User

	WARNING !
<p>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.</p> <p>Beware of the pump parts being possibly contaminated by hazardous substances. Wear protective clothing if there is contamination.</p> <p>Renew defective parts, if necessary! Do not clean with compressed air!</p>	

- Check the pump daily for unusual running noises and heat building up on the surface of the pump.
- Check the electrical and vacuum connections daily.

6.1.1 Diaphragm replacement

<p>Disassembling the diaphragms:</p> <ul style="list-style-type: none">• Disconnect power.• Note: Observe the position of the air intake port (B) and exhaust port (A) before disassembly.• Remove the six screws from head (with handle) and place the head with the screws aside.• Remove the four screws from valve plate and remove them.• Now remove the diaphragm with the PTFE diaphragm liner and discard it. <p>Reassembling the diaphragms:</p> <ul style="list-style-type: none">• Wipe top of connecting rod clean with a soft clean cloth.• Place new diaphragm with PTFE-diaphragm liner on top of connecting rod. Line up the holes in the diaphragm and liner with the screw holes in connecting rod.• Screw the four screws crosswise with a torque of 3 - 4 Nm.	
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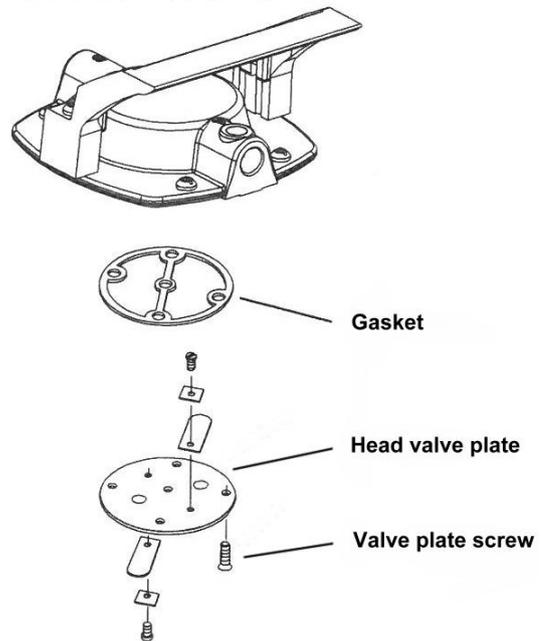


WARNING !

To prevent damage to the pump, never apply any sealant or lubrication to the gasket.

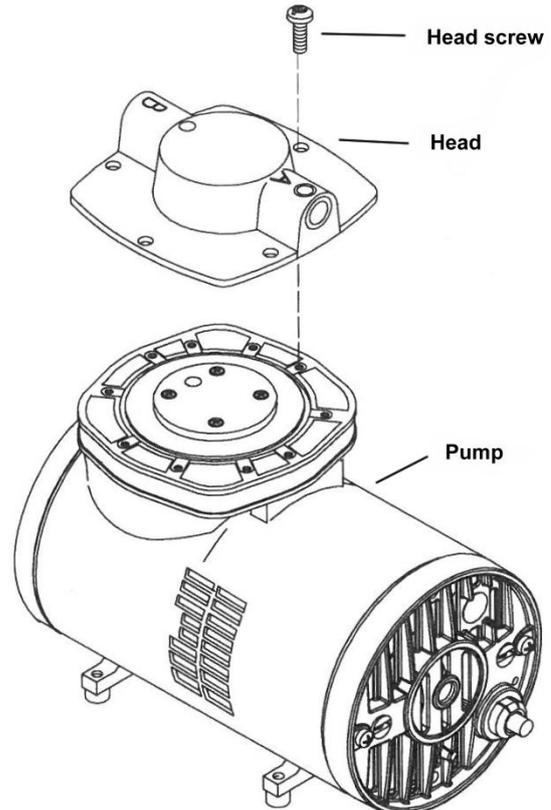
Valve plate replacement:

- Wipe inside of head clean. Install new gasket if needed, be sure to remove any excess gasket.
- Replace valve plate in head. Chamfer side of valve plate should face you. Insert four new screws.
- Screw the four screws crosswise with a torque of 3 - 4 Nm.



Reassembling the pump:

- Place the head (with handle) on the pump casing, observing the position of the air intake port (B) and exhaust port (A).
- **Note:** Make sure the diaphragm is seated properly in the well of the pump casing and head. Do not pinch the diaphragm or liner.
- Insert the screws on the head (with handle). Do not completely tighten the screws yet.
- Now screw the four screws crosswise with a torque of 5 - 6 Nm.



Maintenance and Servicing

6.2 Maintenance by the Manufacturer

Repairs and maintenance going beyond the extent of the work described *in chapter 6.1* 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.	

6.3 Damage Report

You find the form of the damage report to the Download on our web page in the menu "service" and "Downloads". www.welchvacuum.com

If you should not have an entrance to the Internet, you can request the form also gladly with us, under phone +49 3677 604 0.

	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 manufacturing firm.

Trouble	Cause	Remedy	
		by:	with:
Pump does not start	No power supply	Qualified electrician	Check electrical installation
	Motor defective	Service workshop	Exchange
Pump does not generate a vacuum or overpressure	Connected apparatus and/or connecting elements leaking	User or Service workshop	Identify and seal the leak, replace the seals and/or hoses if necessary.
	Pump leaking		Exchange the hoses and/or fittings if necessary.
	Pump dirty		General maintenance / Cleaning
	Valve plate or diaphragm defective		Exchange, see chapter 6.1.1
	Valve plate dirty		Cleaning condensates and foreign objects out of the valves.
	Seals / diaphragms dirty		Cleaning or exchange
	Loose screws		User
	Separator container is full	Empty the separate container	
Running noise	Pump dirty	User or Service workshop	General maintenance / Cleaning
	Valve plate, diaphragm, seals defective or dirty	User	Exchange or cleaning
	loose screws or connectors		Tighten the screws and / or connectors
Cable	defective and/or brittle	Qualified electrician	Exchange of the cable

Spare Parts Overview

8 Spare Parts Overview

The Spare parts- and Kit lists contain all the parts and all the information necessary for ordering. When ordering, please quote the description, quantity, serial number and order number!

	CAUTION !
<p>We are not liable for any damage caused by the installation of any parts not supplied by the manufacturer.</p>	

8.1 Kit – Order numbers

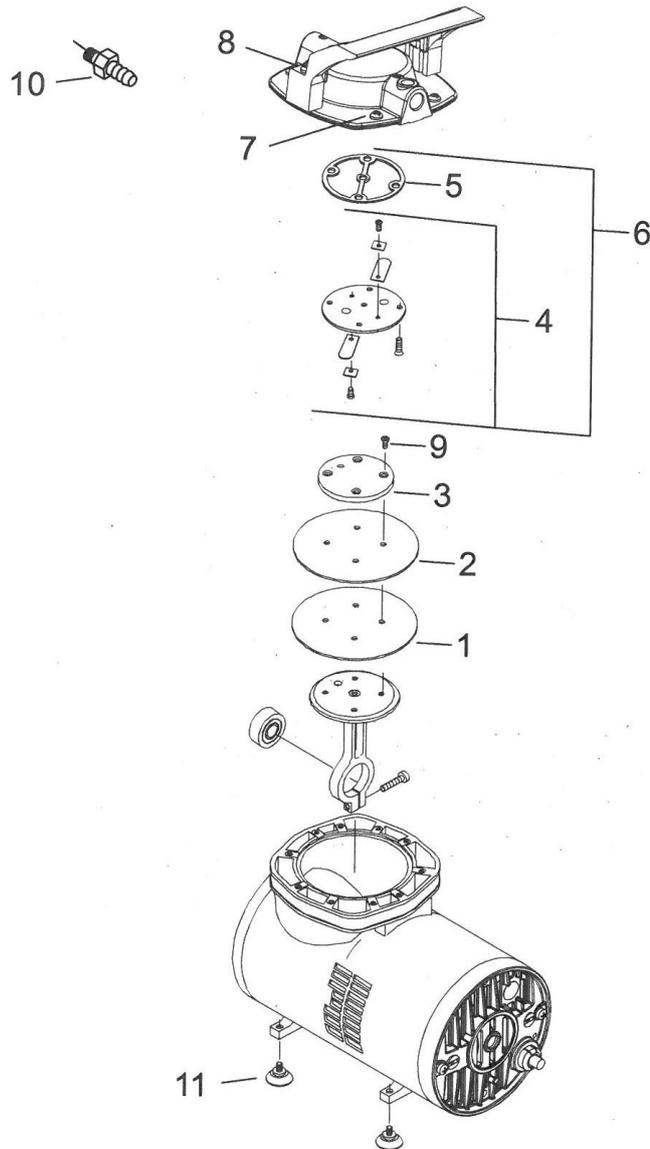
Diaphragm pumps Models:	Diaphragm Replacement Kit	Pump head and Rebuild Kit	Foot Kit
	Order no.	Order no.	Order no.
2019B-01 2019C-02 2019C-50	2019K-01	2019K-03	2019K-04

8.2 Diaphragm pump with vacuum regulator kit - 2019C-50



Item	Description	Piece	Order no.
-	Vacuum Regulator Kit, consisting of:	1	404022
A	- Manometer 1/8" (mbar/kPa) brass	1	U726024
B	- Extension PP, G1/4" – G1/4"	1	400779-6
C	- Reducing nipple PVDF, G 1/8" – G 1/4"	1	450527
D	- Grub screw	1	U624327
E	- Regulator	1	U662455-50
F	- Regulator - Rotation upper part	1	U641230
G	- Hose nozzle PP, DN 6 – G 1/4"	1	710631-01
H	- Plastic separator (38/69)	1	U61-4613
J	- Gasket washer FKM (40/30/3)	1	828875-5

8.3 Spare parts view / Parts list



Item	Spare parts description	2019K-01	2019K-03	2500K-04
1	Diaphragm, Buna N	1	1	-
2	PTFE Diaphragm liner	1	1	-
3	Diaphragm hold down plate	-	1	-
4	Valve platte Assembly	-	*	-
5	O-Ring Gasket, Head	1	*	-
6	* Pump head includes item 4 and 5	-	1	-
7	Haed screws	-	4	-
8	Handle screws	-	2	-
9	Diaphragm hold down plate screws	4	4	-
10	Hose nozzle DN 8 PVDF 1/8" NPT x 1/4" ID Hose	-	2	-
11	Rubber suction cup feet	-	-	4