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Original operating instructions · English

Operating Instructions L-BV7

Elmo Rietschle
A Gardner Denver Product

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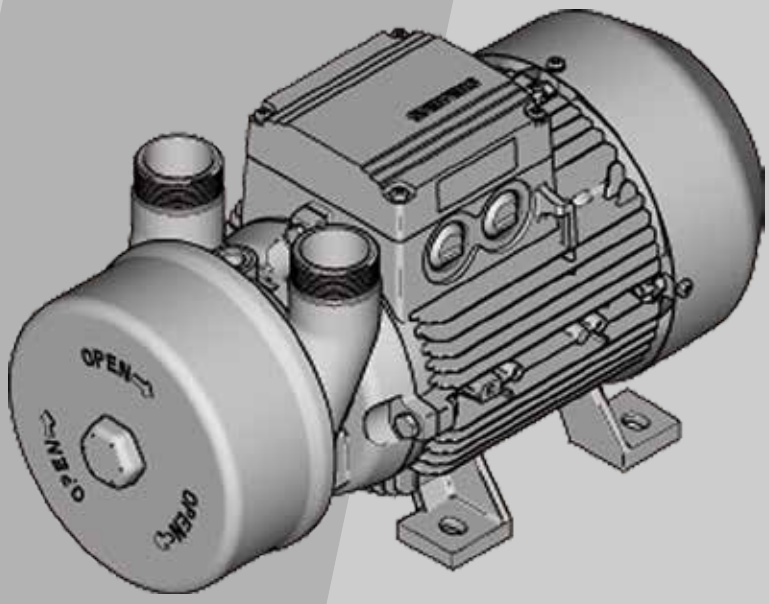

2BV7060
2BV7061
2BV7070
2BV7071

L-Serie
L-Series
Flüssig-
keitsring
Liquid Ring

Contents

1 Glossary

In these instructions the following technical terms with the specified meaning are used:

Designation:	**Definition:**
Vacuum pump	Machine for generating a vacuum.
Compressor	Machine for generating a gauge pressure.
Machine	Here: Vacuum pump or compressor. Unit for extracting, transporting and compressing gases and/or vapors, as well as for generating vacuum and gauge pressure. Here the drive is not considered part of the machine.
Pump-motor unit	Unit consisting of a machine and a drive motor.
Machine set	Two or more machines that are interconnected with couplings and mounted on a common base frame.
Driving side; D side	Side of the machine on which the drive is connected.
Non-driving side; N side	Side of the machine on which no drive is connected.
Inlet pressure	Pressure of the pumped gases/vapors on the inlet connection of the machine.
Discharge pressure; Compression pressure	Pressure of the pumped gases/vapors at the discharge connection of the machine.
Test pressure	Pressure to which the machine is subjected when testing for leaks.
Qualified personnel	Persons who, based on their training, experience and instruction, as well as their knowledge of the pertinent standards, regulations, accident protection regulations and operating conditions, are capable of carrying out certain tasks (e.g. start-up, operation, maintenance, repair) and can recognize and avoid possible dangers in the process. The required knowledge includes a knowledge of first aid and of the on-site emergency equipment. These persons must be authorized by the person responsible for system safety to perform the required tasks.

2 Safety

2.1 Definitions

To point out dangers and important information, the following signal words and symbols are used in these operating instructions:

2.1.1 Safety alert symbol

} The **safety alert symbol** is located in the safety precautions in the highlighted heading field on the left next to the signal word (DANGER, WARNING, CAUTION).

Safety precautions **with** a safety alert symbol indicate a danger of **injuries**.

Be sure to follow these safety precautions to protect against **injuries or death**!

Safety precautions **without** a safety alert symbol indicate a danger of **damage**.

2.1.2 Signal words

DANGER **WARNING** **CAUTION** **NOTICE** **NOTE**	The **signal words** are located in the safety precautions in the highlighted heading field. They follow a certain hierarchy and indicate (in conjunction with the safety alert symbol, see Chapter 2.1.1) the **seriousness of the danger** and the **type of warning.** See the following explanations:

} DANGER

Danger of injuries.

Indicates an imminently hazardous situation,
that **will** result in **death or serious injury**
if the corresponding measures are not taken.

} WARNING

Danger of injuries.

Indicates a potentially hazardous situation,
that **could** result in **death or serious injury**
if the corresponding measures are not taken.

} CAUTION

Danger of injuries.

Indicates a potentially hazardous situation,
that may result in **minor or moderate injury**
if the corresponding measures are not taken.

CAUTION

Danger of damage.

Indicates a potentially hazardous situation
that may result in **property damage**
if the corresponding measures are not taken.

NOTICE

Indicates a possible **disadvantage**,
i.e. undesirable conditions or consequences can occur
if the corresponding measures are not taken.

NOTE

Indicates a possible **advantage**
if the corresponding measures are taken;
tip.

2.1.3 Graphic symbols

The **graphic symbol** is located in safety precautions in the left-hand field.

There are several types of graphic symbols:

Hazard alerting symbols
... for general dangers: 
... for special dangers: 

Prohibition symbols
... for general prohibitions: 
... for special prohibitions: 

Mandatory action symbols
... for general instructions: 
... for special instructions: 

Information


2.2 General safety precautions

} WARNING

Improper use of the unit can result in serious or even fatal injuries!

These operating instructions

- must have been read completely and understood before beginning any work with or at the pump-motor unit,
- must be strictly observed,
- must be available at the operating location of the pump-motor unit.

} WARNING

Improper use of the unit can result in serious or even fatal injuries!

Only operate the pump-motor unit

- for the purposes indicated under "Intended Use"!
- with the fluids indicated under 'Intended Use'!
- with the values indicated under 'Technical Data'!

} WARNING

Improper use of the unit can result in serious or even fatal injuries!

Transport and handling as well as assembly and disassembly of the unit may be carried out by trained and responsible personnel only!

} WARNING

When working on the unit, there is a danger of injury, e.g. in the form of cuts/cutting off, crushing and burns!

During transport/handling as well as assembly and disassembly always wear personal protective equipment (safety helmet, protective gloves, safety boots)!

} WARNING

Hair and clothing can be pulled into the unit or caught and wound up moving parts!

Do not wear long, loose hair or wide, loose clothes!

Use a hair net!

} DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

} DANGER

Electrical danger!

Work on electrical installations may be carried out by trained and authorized electricians only!

DANGER

Electrical danger!

Do not open the motor terminal box unless absence of electricity has been ensured!

WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Before beginning work on the unit or system:

- Interrupt supply of operating liquid.
- Bleed lines and vacuum pump/compressor (depressurize).

WARNING

Danger from rotating external fan of unit!

Only operate the unit with the fan guard mounted!

It is prohibited to remove the fan guard!

WARNING

Danger from rotating impeller of unit!

Only operate the unit with the vacuum pump/compressor housing mounted!

Do not remove the vacuum pump/compressor housing until after the unit has been shut down and the impeller has come to a complete stop!

Consider that the impeller has a certain run-out!

WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Only operate the unit with the pipes/hoses connected to the intake and discharge connection, as well as to the operating-liquid port!

WARNING

Danger from rotating impeller of unit!

Only operate the unit with the pipes/hoses connected to the intake and discharge connection, as well as to the operating-liquid port!

WARNING

Danger in the form of cuts or cutting off extremities on the impeller of the pump-motor unit!

Do not reach into the unit through open connections!

Do not insert objects into the unit through the openings!

WARNING

Danger due to gauge pressure and vacuum!

Check the lines and containers used for sufficient strength!

WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Check the connections of the pipe/hose connections for leaks!

} WARNING

Danger of burns and scalding from hot surfaces of the pump-motor unit and from hot fluids!

Do not touch during operation! Allow to cool after shut-down!

} CAUTION

Danger of unit tipping over!

Secure the pump-motor unit on the installation surface before putting into operation!

2.3 Residual risks

} WARNING

Danger zone:

Shaft exposed in gap between drive motor and vacuum pump/compressor.

Hazard:

Possible entanglement of long, loose hair!

Protective measures:

Wear hair net!

} WARNING

Danger zone:

Fan guard

Hazard:

Long, loose hair can be drawn into external fan through fan guard grate, even with fan guard mounted!

Protective measures:

Wear hair net!

} WARNING

Danger zone:

Hot surface.

Hazard:

Burns/scalding possible.

Protective measures:

Do not touch!

Wear protective gloves!

3 Intended Use

These operating instructions

- apply to liquid-ring vacuum pumps/compressors of the L-BV7 series, types 2BV7060, 2BV7061, 2BV7070 and 2BV7071,
- contains instructions bearing on transport and handling, installation, commissioning, operation, shut-down, storage, servicing and disposal of the L-BV7,
- must be completely read and understood by all operating and servicing personnel before beginning to work with or on the L-BV7,
- must be strictly observed,
- must be available at the site of operation of the L-BV7.

About the operating and servicing personnel of the L-BV7:

- These persons must be trained and authorized for the work to be carried out.
- Work on electrical installations may be carried out by trained and authorized electricians only.
- If necessary, the training/instruction on using the L-BV7 can be carried out by the manufacturer/suppler on order of the owner.

The L-BV7

- are pump-motor units for generating vacuum or gauge pressure.
- are used to extract, transport and compress the following
  pumped gases/vapors:
  - all dry and humid gases, which are not explosive or flammable,
  - preferably air or air/vapor mixtures.
  - In case of corrosive or toxic gases/vapors contact service.
- are designed for operation with the following
  operating liquids:
  - Water with a pH of 6 to 9, free of solid materials (such as sand).
  - If the pH values or operating liquids differ, it is necessary to contact service.
- are intended for industrial applications.
- are designed for continuous operation.

When operating the L-BV7, the limits listed in Chapter 4, "Technical Data", Pg. 11 ff. must always be complied with.

Foreseeable Misuse

It is prohibited

- to use the L-BV7 in applications other than industrial applications
  unless the necessary protection is provided on the system,
  e.g. guards suitable for children's fingers,
- to use the device in rooms in which explosive gases can occur if the L-BV7 is not expressly intended for this purpose;
- to extract, to deliver and to compress explosive, flammable, corrosive or toxic fluids
  unless the L-BV7 is specifically designed for this purpose,
- to operate the L-BV7 with values other than those specified in Chapter 4, "Technical Data", Pg. 11 ff.

Any unauthorized modifications of the L-BV7 are prohibited for safety reasons.
any maintenance and repair work, such as replacing worn or defective components, may only be carried out by companies authorized by the manufacturer (please contact service).

4 Technical Data

4.1 Mechanical data

Dimensions

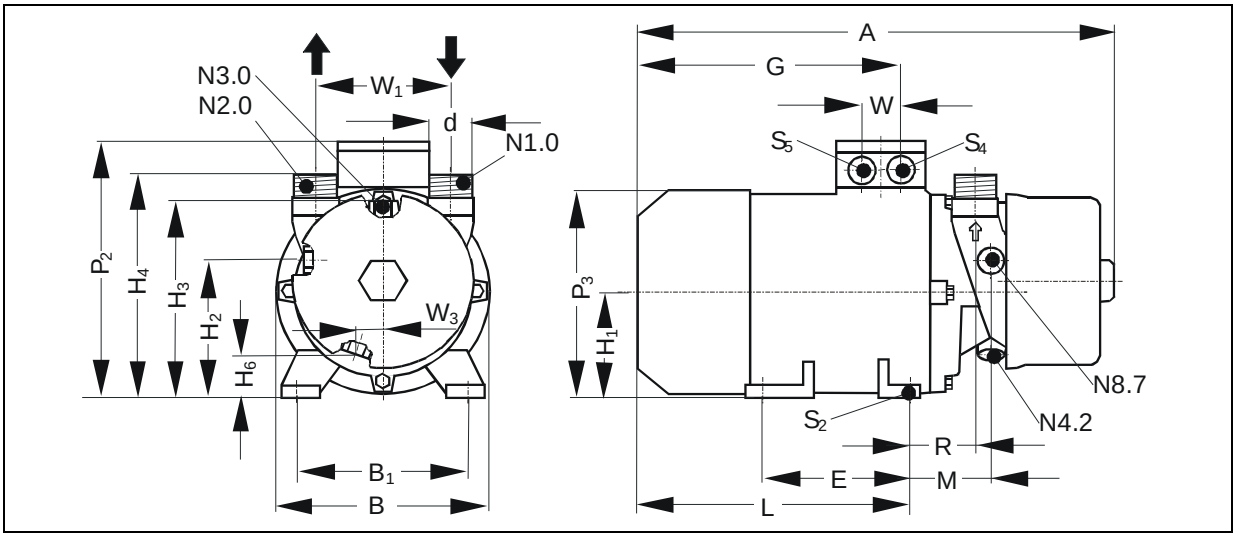

Fig. 1: Dimensions

N1.0 Inlet connection
N2.0 Discharge connection
N3.0 Operating-liquid port
N4.2 Emptying or drain opening
N8.7 Connection for cavitation protection

Specification in mm								
Type	**2BV7060**		**2BV7061**	**2BV7070**			**2BV7071**	
	...-1/...-2	**...-3**		**...-1**	**...-2**	**...-3**	**...-1**	**...-2/...-3**
A	335	372	394	438	473	482	488	511
B	162	180	180	202	204	266	227	266
B_1	125	140	140	160	160	216	190	216
E	100	100	100	140	140	140	140	140
G	186	218	218	231	266	266	252	266
H_1	80	90	90	100	100	132	112	132
H_2	107	117	117	134	134	166	146	166
H_3	156	166	166	194	194	227	206	227
H_4	180	190	190	222	222	260	234	260
H_6	26	36	36	34	34	66	46	66
L	184	225	225	249	284	284	263	284
M	72	68	68	89	89	99	96	99
P_2	200	218	218	235	235	300	261	300
P_3	161	180	180	201	202	265	225	265
R	59	55	55	71	71	81	78	81
S_2	10	10	10	12	12	12	12	12

Specification in mm								
Type	**2BV7060**		**2BV7061**	**2BV7070**			**2BV7071**	
	...-1/...-2	**...-3**		**...-1**	**...-2**	**...-3**	**...-1**	**...-2/...-3**
S_4	M25 x 1.5			M32 x 1.5				
S_5	M16 x 1.5			M32 x 1.5				
W	32	32	32	42	42	42	42	42
W_1	110	110	110	120	120	120	120	120
W_3	23	23	23	28	28	28	28	28
d	G 1	G 1	G 1	G 1½	G 1½	G 1½	G 1½	G 1½
N3.0, 4.2, 8.7	G ¼							

Specifications in inches								
Type	**2BV7060**		**2BV7061**	**2BV7070**			**2BV7071**	
	...-1/...-2	**...-3**		**...-1**	**...-2**	**...-3**	**...-1**	**...-2/...-3**
A	13.2	14.6	15.5	17.2	18.6	19.0	19.2	20.1
B	6.38	7.09	7.09	7.95	8.03	10.5	8.94	10.5
B_1	4.92	5.51	5.51	6.30	6.30	8.50	7.48	8.50
E	3.94	3.94	3.94	5.51	5.51	5.51	5.51	5.51
G	7.32	8.58	8.58	9.09	10.5	10.5	9.92	10.5
H_1	3.15	3.54	3.54	3.94	3.94	5.20	4.41	5.20
H_2	4.21	4.61	4.61	5.28	5.28	6.54	5.75	6.54
H_3	6.14	6.54	6.54	7.64	7..4	8.94	8.11	8.94
H_4	7.09	7.48	7.48	8.74	8.74	10.2	9.21	10.2
H_6	1.02	1.42	1.42	1.34	1.34	2.60	1.81	2.60
L	7.24	8.86	8.86	9.80	11.2	11.2	10.4	11.2
M	2.83	2.68	2.68	3.50	3.50	3.90	3.78	3.90
P_2	7.87	8.58	8.58	9.25	9.25	11.8	10.3	11.8
P_3	6.34	7.09	7.09	7.91	7.95	10.4	8.86	10.4
R	2.32	2.17	2.17	2.80	2.80	3.19	3.07	3.19
S_2	0.394	0.394	0.394	0.472	0.472	0.472	0.472	0.472
S_4	M25 x 1.5			M32 x 1.5				
S_5	M16 x 1.5			M32 x 1.5				
W	1.26	1.26	1.26	1.65	1.65	1.65	1.65	1.65
W_1	4.33	4.33	4.33	4.72	4.72	4.72	4.72	4.72

Specifications in inches								
Type	**2BV7060**		**2BV7061**	**2BV7070**			**2BV7071**	
	...-1/...-2	**...-3**		**...-1**	**...-2**	**...-3**	**...-1**	**...-2/...-3**
W_3	0.906	0.906	0.906	1.10	1.10	1.10	1.10	1.10
d	G 1	G 1	G 1	G 1½	G 1½	G 1½	G 1½	G 1½
N3.0, 4.2, 8.7	G ¼							

Weight

Type	Weight	
	[kg]	[lbs]
2BV7060-1A.0.	approx. 16	approx. 35.3
2BV7060-2A.0.	approx. 17	approx. 37.5
2BV7060-3A.0.	approx. 18	approx. 39.7
2BV7061-1A.0.	approx. 22	approx. 48.5
2BV7070-1A.0.	approx. 31	approx. 68.3
2BV7070-2A.0.	approx. 35	approx. 77.2
2BV7070-3A.0.	approx. 48	approx. 106
2BV7071-1A.0.	approx. 39	approx. 86
2BV7071-2A.0.	approx. 50	approx. 110
2BV7071-3A.0.	approx. 56	approx. 123

Minimum distances for heat dissipation

Type	Minimum distance from fan guard to adjacent surface	
	[mm]	[inches]
2BV7060	34	1.34
2BV7061	34	1.34
2BV7070	53	2.09
2BV7071	53	2.09

Noise level

Measuring-surface sound pressure level as per EN ISO 3744, measured at distance of 1 m [3.28 ft] with medium throttling (100 mbar abs. [1.45 psia]) and connected lines, tolerance □糧糧 dB (A).

Type	1-m measuring-surface sound pressure level L [dB (A)]	
	at 50 Hz:	at 60 Hz:
2BV7060	70	70
2BV7061		70
2BV7070		72
2BV7071		76

Limit speeds for supply by converter

Type	n [rpm]
2BV706	4,800
2BV707	4,000

4.2 Electrical data

See drive motor rating plate.

4.3 Operating conditions

Temperatures

Temperature of pumped gases/vapors:	max. +80 °C [max. +176 °F] At higher fluid temperatures, measures must be taken on the system to prevent burns, e.g. mount separating safety device (cover).
Operating-liquid temperature:	max. +80 °C [max. +176 °F] min. +5 °C [min. +41 °F] Nominal value: +15 °C [+59 °F]
Ambient temperature:	max. +40 °C [+104 °F] min. +5 °C [+41 °F]

Pressures

Min. inlet pressure:	Dependent on the operating liquid temperature (see Fig. 2, Pg. 14) When this temperature is dropped below, the hose of the liquid separator (accessory) must be connected to the connection for cavitation protection (Fig. 7, Pg. 22, Item 4).
Max. discharge pressure during vacuum-pump operation:	1.1 bar abs. [16.0 psia]
Max. permissible pressure in pump-motor unit:	8 bar abs. [116 psia] If higher pressures can occur in the system, then corresponding protective devices must be provided.

Max. discharge pressure $p_{2\,max}$ during compressor operation (at inlet pressure p_1 = 1 bar abs. [14.5 psia]):

Type	$p_{2\,max}$			
	[bar abs.]		[psia]	
	at 50 Hz:	at 60 Hz:	at 50 Hz:	at 60 Hz:
2BV7060	2	2	29.0	29.0
2BV7061	2	2	29.0	29.0
2BV7070	3	2.5	43.5	36.3
2BV7071	3.5	2.5	50.8	36.3

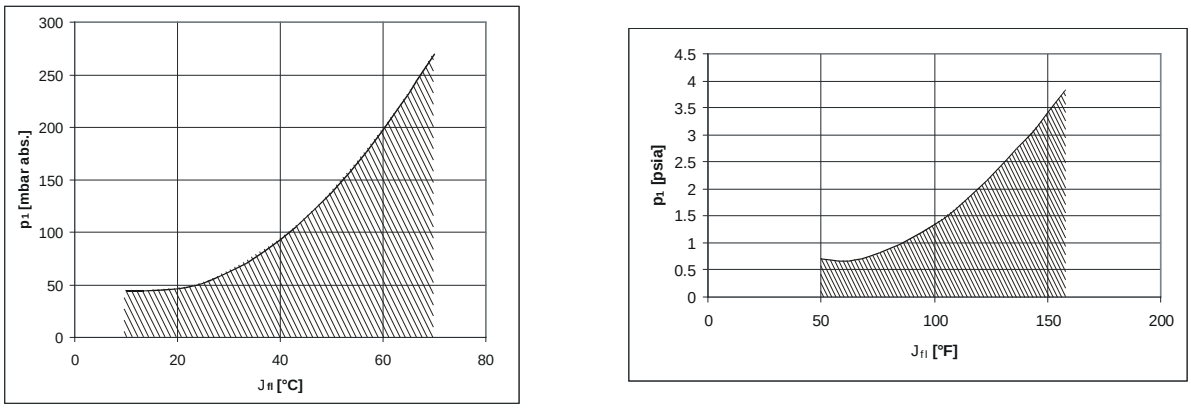

Fig. 2: Minimum inlet pressure/cavitation limit

J_{fl} [°C, °F] = Temperature of operating liquid
p_1 [mbar abs., psia] = Inlet pressure abs.

The minimum permissible inlet pressure of the pump-motor unit is dependent on the temperature of the operating liquid.
During operation without cavitation protection, the minimum inlet pressure must be set above the shaded area.

Nominal operating-liquid flow rate

(with dry air extraction and with water at 15°C [59 °F] as operating liquid)

Type	Flow rate			
	[m³/h]		[ft³/h]	
	at 50 Hz:	at 60 Hz:	at 50 Hz:	at 60 Hz:
2BV7060	0.20	0.20	7.06	7.06
2BV7061	0.23	0.23	8.12	8.12
2BV7070	0.28	0.34	9.89	12.0
2BV7071	0.45	0.55	15.9	19.4

Operating-liquid filling amount for priming

Type	Filling amount		
	[l]	[gal (US)]	[gal (UK)]
2BV7060	0.40	0.106	0.088
2BV7061	0.55	0.145	0.121
2BV7070	0.80	0.211	0.176
2BV7071	1.10	0.291	0.242

5 Description of Vacuum Pump/Compressor

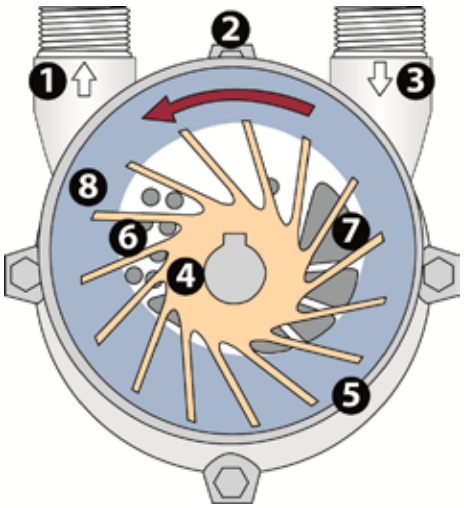

Fig. 3: Design and operation of liquid-ring vacuum pumps/compressors (cross-section of operating chamber)

1 Discharge connection
2 Operating-liquid port
3 Inlet connection
4 Impeller
5 Housing
6 Discharge port
7 Inlet port
8 Operating liquid

5.1 Design

The L-BV7 are liquid-ring vacuum pumps compressors. They consist of the vacuum pump/the compressor itself and an electric motor. For the detailed design, see Fig. 3, Pg. 15.

The pumped gases/vapors are sucked via the inlet connection (3) into the pump-motor unit and pushed out via the discharge connection (1).

The impeller (4) with the blades is located in the cylindrical housing (5). The impeller is arranged eccentrically relative to the housing. In addition, the housing also contains the operating liquid (8). This liquid is fed in via the operating-liquid port (2) and output together with the pumped gases/vapors via the discharge connection (1).

5.2 Operating method

When the impeller turns, the operating liquid is put into motion and accelerated. This forms a liquid ring that also rotates. Due to centrifugal force, this ring is arranged concentrically to the housing and eccentrically to the impeller.

During a complete rotation of the impeller, the following occurs:

- The impeller cells are completely filled with operating liquid at the lower vertex.
- During the first half rotation, the liquid ring lifts off the impeller hub. The space in the cells increases so that the pumped gases/vapors are sucked in through the inlet port (7).
- The space in the cells is largest at the upper vertex, as these are virtually free of operating liquid.
- During the second half rotation, the liquid ring approaches the hub again. The space in the cells decreases so that the pumped gases/vapors are compressed and pushed out through the discharge port (6).

5.3 Operating modes

The pump-motor unit can function in several different operating modes.
These differ in how the pump-motor unit is supplied with operating liquid:

- Self-priming operation
- Operation with operating-liquid feed:
  - Non-automatic operation
  - Automatic operation

5.3.1 Self-priming operation

In this operating mode the pump-motor unit automatically sucks in the operating liquid.
The operating-liquid flow rate is automatically adjusted.

See Fig. 8, Pg. 27.

5.3.2 Operation with operating-liquid feed

In this operating mode the pump-motor unit DOES NOT automatically suck in the operating liquid.
A certain volume flow ("nominal operating-liquid flow rate") or pre-pressure must be set for the operating liquid.

Here the following additional distinctions are made:

Non-automatic operation

In this case the operating liquid feed is switched on and off manually with a stop valve.

See Fig. 11, Pg. 29.

Automatic operation

In this case the operating liquid feed is switched on and off by a solenoid valve. The solenoid valve is dependent on the motor operating mode:

- Motor/pump-motor unit switched on: Valve open.
- Motor/pump-motor unit switched off: Valve closed.

See Fig. 12, Pg. 29.

NOTICE

The following is dependent on the operating mode:

- when and how the pump-motor unit must be filled with operating liquid the first time,
- how the pump-motor unit is put into operation.

The specifications for this are contained in Chapter 7, "Installation", Pg. 19ff., and Chapter 8, "Commissioning", Pg. 25ff.

6 Transport and Handling

} WARNING

Danger from tipping or falling loads!

Prior to transport and handling make sure that all components are securely assembled and secure or remove all components the fasteners of which have been loosened!

} CAUTION

Tipping or falling can lead to crushing, broken bones etc.!

Sharp edges can cause cuts!

Wear personal safety equipment (protective helmet, protective gloves, safety shoes) during transport!

Packing:

On delivery the pump-motor unit is bolted to a pallet and covered with a cardboard box.
To unpack, remove the cardboard box and unscrew the securing bolts on the feet of the pump-motor unit.

Manual handling:

} WARNING

Danger from lifting heavy loads!

Manual handling of the unit is only permitted within the following limits:

- max. 30 kg [max. 66 lbs] for men
- max. 10 kg [max. 22 lbs] for women
- max. 5 kg [max. 11 lbs] for pregnant women

For the weight of the pump-motor unit, see Chapter 4.1, "Mechanical data", Section "Weight", Pg. 13.

For weights above the given values use suitable lifting appliances and handling equipment!

Handling by means of lifting equipment:

} WARNING

Danger from tipping or falling loads!

When transporting with lifting equipment, observe the following basic rules:

- The lifting capacity of lifting equipment and lifting gear must be at least equal to the unit's weight.

  For the weight of the pump-motor unit, see Chapter 4.1, "Mechanical data", Section "Weight", Pg. 13.

- The pump-motor unit must be secured so that it cannot tip or fall.

- Do not stand or walk under suspended loads!

Transport and handling by means of a crane and strap belts is advisable.

Fig. 4: Attachment points

Attach the strap belts as shown in Fig. 4, Pg. 18:

- Use two strap belts, of which one is routed under the vacuum pump/compressor housing, and one under the fan guard.
- The strap belts should be seated securely in the undercuts so that the unit cannot slip out.
- The belts must be sufficiently long (spread angle smaller than 90°).
- Make sure that no damage is caused to any attached fittings.

} WARNING

Danger from tipping loads!

Be sure to observe the routing of the strap belts as shown in Fig. 4, S. 18, even if the motor is provided with attachment points such as transport eyes or eye bolts.

These are solely designed for the separate transport of the motor, however not for the different weight distribution that results for the mounted vacuum pump/mounted compressor, so that the unit could tip!

7 Installation

7.1 Installation

} CAUTION

Danger of crushing from unit tipping over!

In the unmounted state, the unit can easily tip due to its weight distribution!

Wear gloves and safety shoes! Handle the unit with the appropriate care!

} CAUTION

Danger of tripping and falling!

Make sure the unit does not present a danger of tripping!

} WARNING

Electrical danger!

The pump-motor unit must be installed so that the electrical device cannot be damaged by external influences!

In particular, the feed pipes must be securely routed, e.g. in cable ducts or in the floor.

} CAUTION

Danger of injuries from flying parts!

Select installation so that parts that are thrown out through the grate if the external fan breaks cannot hit persons!

CAUTION

Danger of damage to the pump-motor unit due to overheating!

When installing the unit, make sure that heat dissipation and cooling are not obstructed. The minimum distances specified in Chapter 4.1, "Mechanical data", Section "Minimum distances for heat dissipation", Pg. 13 must be complied with.

Discharge air of other units may not be directly sucked in again!

For the space requirement and arrangement of the holes for installing and securing the pump-motor unit, please see Fig. 1, Pg. 11.
For minimum clearances for heat dissipation and cooling, see Chapter 4.1, "Mechanical data", Section "Minimum distances for heat dissipation", Pg. 13.

The pump-motor unit must be installed as follows:

- on level surfaces,
- with shaft in horizontal position,
- on stationary (fixed) surfaces or structures,
- at a maximum height of 1000 m [3280 ft] above sea level.

Observe the following when installing the pump-motor unit:

- The **load bearing capacity** of the base plate or the foundation must be designed for at least the weight of the unit.

- The **vibration behavior at the operating location** must be taken into account.
  The total vibrations of the unit are dependent on the following factors:
  - the characteristic vibrations of the unit,
  - the alignment and installation,
  - the condition (vibration behavior) of the load-bearing surface,
  - the influences by vibrations of other parts and system components (external vibrations).

  The maximum permissible value for vibrations is v_{eff} = 4.5 mm/s.
  To ensure proper operation and a long

service life of the unit, this value may not be exceeded.
Generally, this value can be adhered to without a special foundation or a special base plate.
The points on the unit for measuring the vibration speed are shown in Fig. 5, Pg. 20.

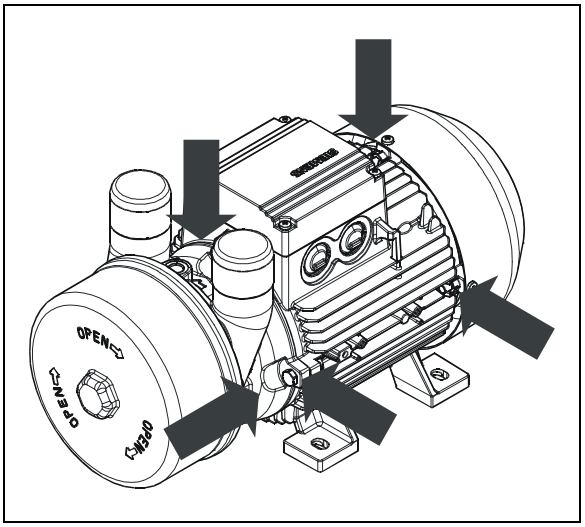

Fig. 5: Points for measuring the vibration speed

Different installation, e.g. with the shaft in the vertical position, requires consultation with service.

Bolt the feet of the unit to the supporting surface with suitable securing elements, as shown in Fig. 6, Pg. 20.

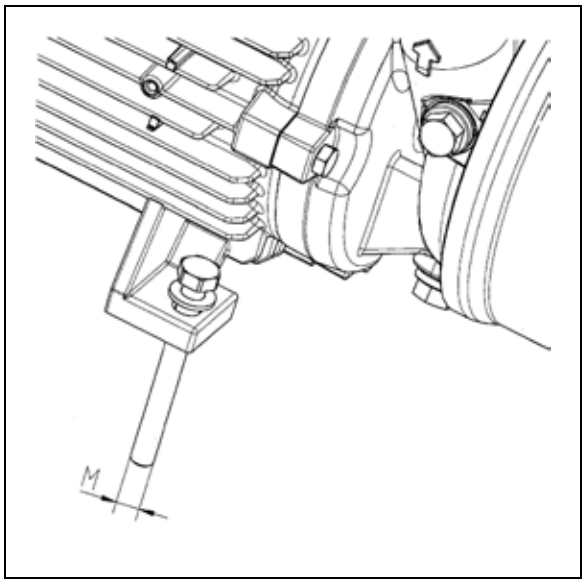

Fig. 6: Securing elements for bolting feet to supporting surface

2BV706: M = 4 x M8-6.8
2BV707: M = 4 x M10-6.8

7.2 Electrical connection (motor)

The electrical connection must be carried out as follows:

- according to the applicable national and local laws and regulations,
- according to the applicable system-dependent prescriptions and requirements,
- according to the applicable regulations of the utility company.

} DANGER

Electrical danger!

Malpractice can result in severe injuries and material damage!

} DANGER

Electrical danger!

The electrical connection may be carried out by trained and authorized electricians only!

} DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

} WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Before beginning work on the unit or system:

- Interrupt supply of operating liquid.
- Bleed lines and vacuum pump/compressor (depressurize).

CAUTION

Incorrect connection of the motor can lead to serious damage to the unit!

Observe the **motor rating plate**.
It is imperative that the operating conditions correspond to the data given on the rating plate!

Deviations permissible without reduction in performance:

- ±5 % voltage deviation
- ±2 % frequency deviation

Make the connection in accordance with the **circuit diagram in the terminal box**.
Connect the protective conductor.

- Use suitable cable lugs when doing so.
- The electrical connection must be permanently safe.
- Tightening torques for terminal plate connections:

Thread		M4	M5
Tightening torque	**[Nm]**	0.8 ... 1.2	1.8 ... 2.5
	[ft lbs]	0.590 ... 0.885	1.33 ... 1.84

} WARNING

Electrical danger!

Clearance between bare live parts and between bare live parts and ground:

at least **5.5 mm [0.217"]** (at a nominal voltage of $V_n \leq 690V$)

Make sure there are no protruding pieces of wire!

WARNING

Electrical danger!

The terminal box must be free from

- foreign bodies,
- dirt,
- humidity.

Terminal box cover and cable entries must be tightly closed so as to make them dustproof and waterproof.

Check for tightness at regular intervals.

For **motor overload protection**:

- Use motor circuit breakers.
- Set the motor circuit breakers to the nominal current specified on the rating plate.

For **supply by converter**:

- High-frequency current and voltage harmonics in the motor supply cables can lead to emitted electromagnetic interference.
- Use shielded supply cables, whereby the shield must be installed on both sides.
- Limit speed: see Chapter 4.2, "Electrical data", Pg. 13.

CAUTION

If the unit is run dry, the mechanical seal will be destroyed in a matter of seconds!

DO NOT switch on as long as the unit is not filled with operating liquid!

7.3 Connecting pipes/hoses (vacuum pump/compressor)

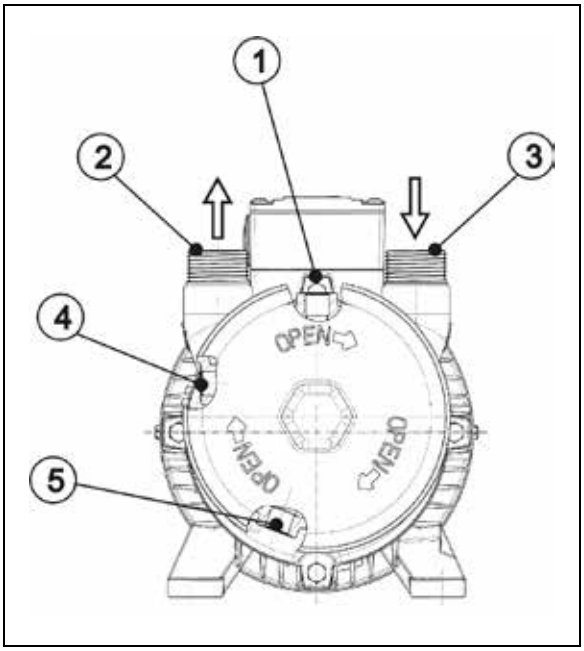

Fig. 7: Pipe/hose connection of vacuum pump/compressor

1 Operating-liquid port G ¼"
2 Discharge connection
3 Inlet connection
4 Connection for cavitation protection G ¼"
5 Drain opening G ¼"

To prevent foreign bodies from entering the unit, all connections are sealed off when delivered.
Do not remove the sealing plugs until immediately before connecting the pipes/hoses.

For the arrangement of the pipe/hose connection, see Fig. 7, Pg. 22.

The **pumped gases/vapors** are sucked in via the inlet connection (see Chapter 7.3.1, Pg. 23) and discharged via the discharge connection (see Chapter 7.3.2, Pg. 23).
For operation the unit must be continuously supplied with **operating liquid**.
This is fed in via the operating-liquid port (see Chapter 7.3.3, Pg. 23) and discharged together with the pumped gases/vapors through the discharge connection.

Fill with operating liquid:

When and how the pump-motor unit must be filled with operating liquid the first time is dependent on the operating mode:

- For self-priming operation:
  During installation.
- For operation with operating-liquid feed:
  After completing installation.

For **self-priming operation** you now pour operating liquid into the working space of the pump-motor unit before you connect the pipes/hoses to the unit.
To do this, pour operating liquid into the open inlet connection, discharge connection or operating-liquid port.
For proper filling quantities, see Chapter 4.3, "Operating conditions", Section "Operating-liquid filling amount for priming", Pg. 14.

Then attach the pipes/hoses to the unit as described in the following.

WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

During operation, connected pipes and vessels are pressurized or vacuumized!

Make sure that all connections are sufficiently tight! Use only pipes and vessels of sufficient strength!

NOTICE

Attach pipes/hoses free of mechanical tensions.

Support the weight of the pipes/hoses.

7.3.1 Inlet connection

The inlet connection (Fig. 7, Pg. 22, Item 3) is marked with an arrow pointing downward (↓). Connect the inlet pipe here. The pumped gases/vapors are sucked in via this.

CAUTION

The tightening torque for pipe connections on intake and discharge connections may not exceed **100 Nm [73.8 ft lbs]**!

7.3.2 Discharge connection

The discharge connection (Fig. 7, Pg. 22, Item 2) is marked with an arrow pointing upward (↑).
Connect the discharge pipe here. Both the pumped gases/vapors and the operating liquid are discharged via this pipe.

CAUTION

The tightening torque for pipe connections on intake and discharge connections may not exceed **100 Nm [73.8 ft lbs]**!

7.3.3 Operating-liquid port

The operating-liquid port (Fig. 7, Pg. 22, Item 1) is located between the discharge and inlet connection.

Connect the feed pipe for the operating liquid here.

7.3.4 Notes

NOTICE

For **operating liquid with impurities**:

- Install a filter, screen or separator in the supply line if necessary.

NOTICE

In case of **operating liquid with a high lime content**:

- Soften operating liquid

OR

- Decalcify pump-motor unit regularly (see Chapter 11.1, "Maintenance", Pg. 33).

NOTICE

To prevent installation residues (e.g. welding spatter) from entering the unit,
a start-up screen should be installed in the inlet pipe for the first 100 operating hours.

7.4 Accessories

The following accessories are available according to our catalogue:

- Liquid separator
- Non-return valve
- Connecting and counter flange
- Gas ejector.

See Chapter 13, "Accessories", Pg. 40.

8 Commissioning

} WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Danger due to rotating parts!

The pump-motor unit may only be put into operation when the following conditions are met:

- Fan guard and vacuum pump/compressor housing are mounted.
- The lines to the discharge connection, inlet connection and operating-liquid port are attached.
- The lines and connections have been tested for strength and leaks.

CAUTION

If the unit is run dry, the mechanical seal will be destroyed in a matter of seconds!

DO NOT switch on as long as the unit is not filled with operating liquid!

8.1 Preparation and start-up

CAUTION

If the pumped gases/vapors discharged on the pressure side are passed on,
then it must be ensured that the maximum discharge pressure of 1.1 bar abs. [16.0 psia] is not exceeded!

NOTICE

Maximum permissible quantity of water entrained via the inlet connection:
See Fig. 13, Pg. 29.

If a shut-off device is installed in the discharge pipe:
Make sure that the unit CANNOT be operated with the shut-off device closed.

Fill with operating liquid:

When and how the pump-motor unit must be filled with operating liquid the first time is dependent on the operating mode:

- For self-priming operation:
  During installation.
- For operation with operating-liquid feed:
  After completing installation.

For **operation with operating-liquid feed**, you now fill the working area of the unit with operating liquid.
To do this, open the respective stop valve for approx. 20 sec.:

- For non-automatic operation:
  Stop valve (Fig. 11, Pg. 29, Item 4).
- For automatic operation:
  Stop valve in the bypass pipe (Fig. 12, Pg. 29, Item 4a).

Then proceed with commissioning as described in the following.

Check connections of the pipes/hoses for leaks.

Check direction of rotation:

- The direction of flow of the pumped gases/vapors is marked with arrows on the intake and discharge connection.
- The intended direction of shaft rotation is marked with an arrow on the motor mounting adapter between the intake and discharge connection, as well as with an arrow on the fan guard.
- The pump-motor unit may not be allowed to run dry!
  Have you filled it with operating liquid beforehand (during or after installation)?

  See sections "Fill with operating liquid", Pg. 23 and Pg. 25.
- Briefly switch on pump-motor unit.
- Compare the actual direction of rotation of the external fan with the intended direction of shaft rotation as indicated with the arrows.
- Switch off pump-motor unit again.
- If necessary, reverse the direction of rotation of the motor.

} DANGER

Electrical danger!

The electrical connection may be carried out by trained and authorized electricians only!

} DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

} WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Before beginning work on the unit or system:

- Interrupt supply of operating liquid.
- Bleed lines and vacuum pump/compressor (depressurize).

The further procedure is again dependent on the unit operating mode:

8.2 Self-priming operation

See Fig. 8, Pg. 27.

Here the following must be watched:

- The pump-motor unit must be pre-throttled on the inlet side. This means a vacuum of **at least 900 mbar abs.** [**13.1 psia]** must be present in the inlet pipe (Item B) at switch-on.
- During switch-on, the liquid level in the feed pipe (Item A) and in the reservoir (Item C) respectively must be at the same level as the center of the unit shaft (Item 1).
- During operation the liquid level in the reservoir (Item C) may not drop below **approx. 1 m [3.28 ft] below** the center of the unit shaft (Item 1).

Starting the pump-motor unit:

- Switch on the unit.
- The operating liquid is sucked in.

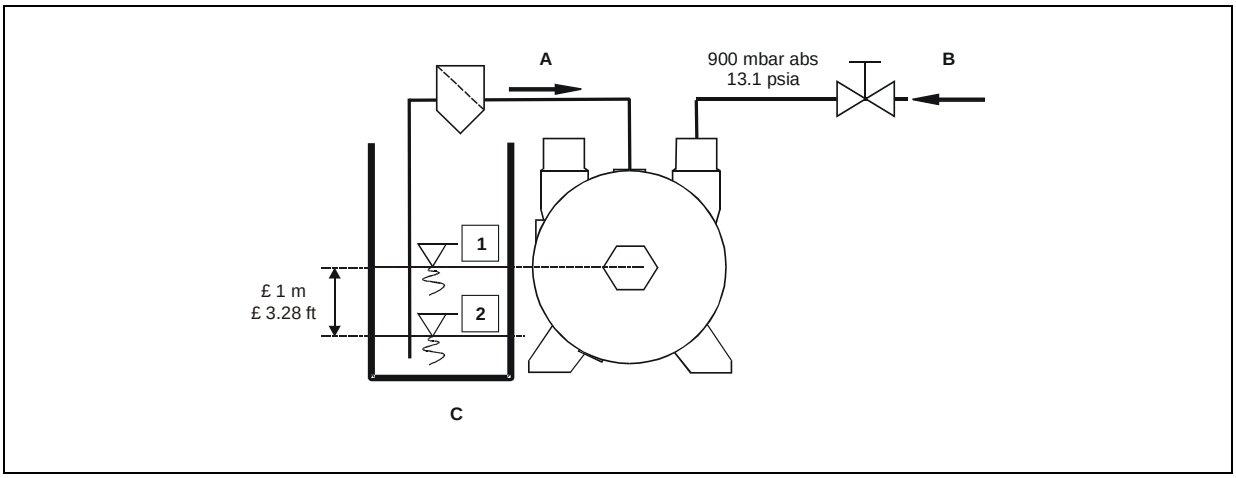

Fig. 8: Self-priming operation

A Feed pipe for operating liquid
B Inlet pipe
C Reservoir for operating liquid

1 Required liquid level when switching on
2 Min. liquid level during operation

8.3 Operation with operating-liquid feed

See Fig. 9, Pg. 28; and Fig. 10, Pg. 28, as well as Fig. 11, Pg. 29 and Fig. 12, Pg. 29.

Proceed as follows here:

Method A:

1) Set pre-pressure of operating liquid (Fig. 9, Pg. 28):

- Set a pre-pressure p_A in the feed pipe for the operating liquid (Item A) around approx. **1 bar [14.5 psi] above** the inlet pressure p_B in the inlet pipe (Item B).

2) Start up the unit:

For non-automatic operation (Fig. 11, Pg. 29):
- Open the stop valve (Item 4) manually. The operating liquid is fed in.
- Switch on the unit.

For automatic operation (Fig. 12, Pg. 29):
- Switch on the unit.
- The solenoid valve (Item 4) opens and the operating liquid is fed in.

Method B:

1) Start up the unit:

For non-automatic operation (Fig. 11, Pg. 29):
- Open the stop valve (Item 4) manually. The operating liquid is fed in.
- Switch on the unit.

For automatic operation (Fig. 12, Pg. 29):
- Switch on the unit.
- The solenoid valve (Item 4) opens and the operating liquid is fed in.

2) Check the operating-liquid flow rate:

- with the flow meter (Fig. 11, Pg. 29, and Fig. 12, Pg. 29, Item 2)

OR
- by measuring the volume of operating liquid per unit of time that exits at the discharge connection with a graduated vessel (Fig. 10, Pg. 28)

3) Set/correct the operating-liquid flow rate:

- via the control valve (Fig. 11, Pg. 29, and Fig. 12, Pg. 29, Item 3)
- Nominal operating-liquid flow rate: For nominal values, see Chapter 4.3, "Operating conditions", Section "Nominal operating-liquid flow rate", Pg. 14.

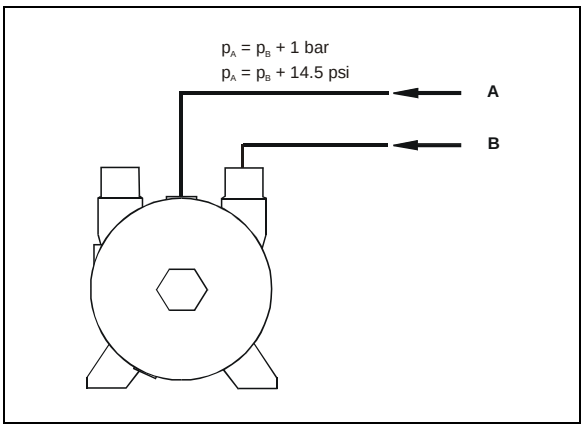

Fig. 9: Setting the operating-liquid flow rate: Setting pre-pressure

A Feed pipe for operating liquid
B Inlet pipe

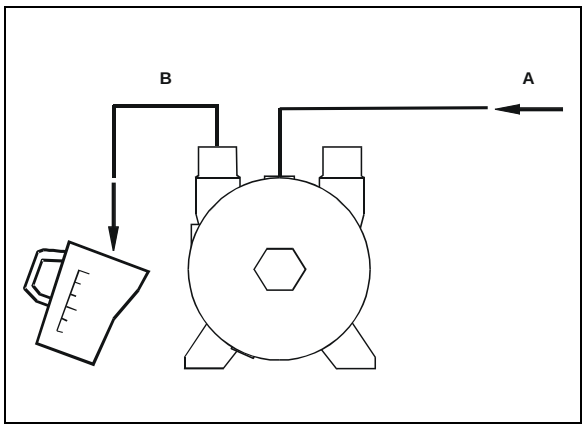

Fig. 10: Setting the operating-liquid flow rate: Measuring the volume with a graduated vessel

A Feed pipe for operating liquid
B Drain pipe for operating liquid

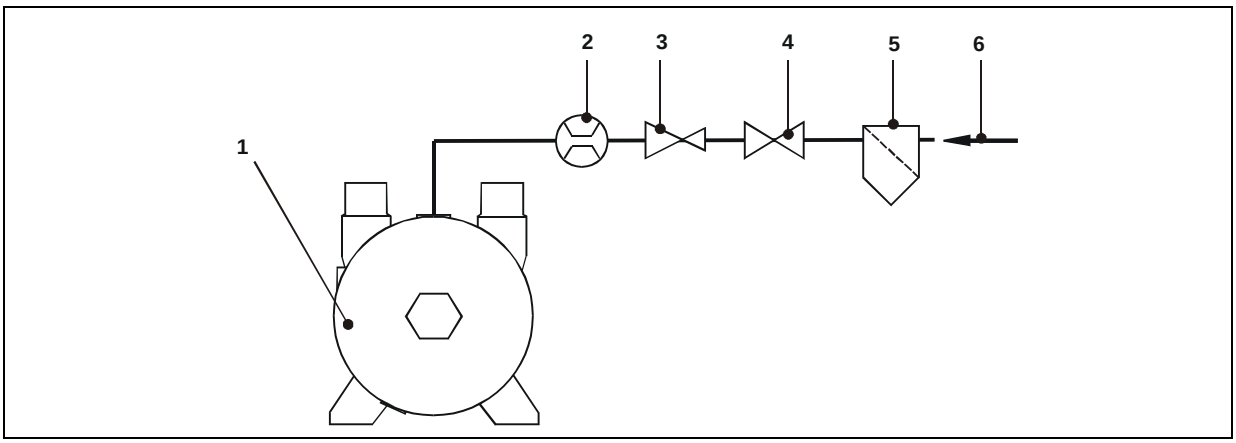

Fig. 11: Operation with operating-liquid feed: Non-automatic operation

1 Pump-motor unit
2 Flow meter
3 Control valve
4 Stop valve
5 Filter
6 Feed pipe for operating liquid

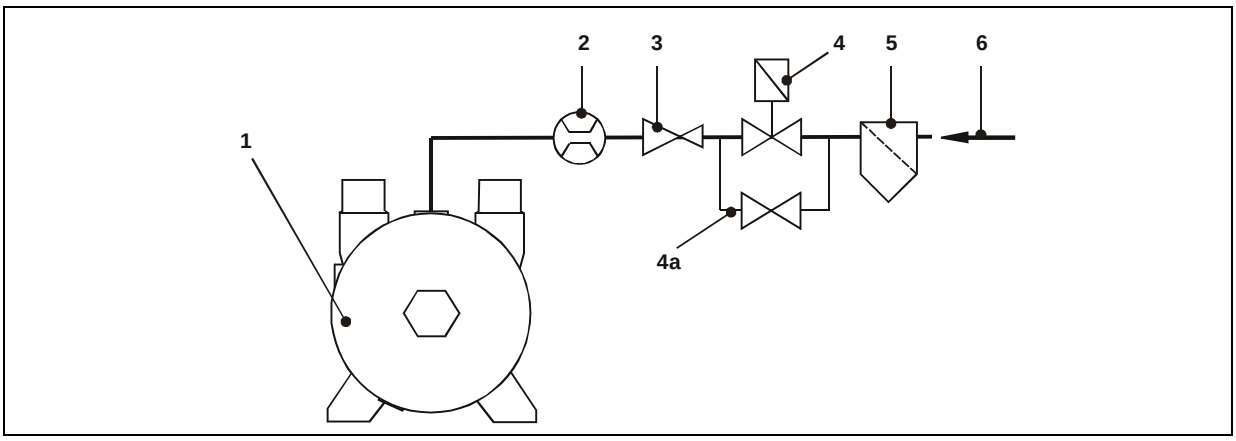

Fig. 12: Operation with operating-liquid feed: Automatic operation

1 Pump-motor unit
2 Flow meter
3 Control valve
4 Solenoid valve, connected to motor
4a Bypass with stop valve (for priming)
5 Filter
6 Feed pipe for operating liquid

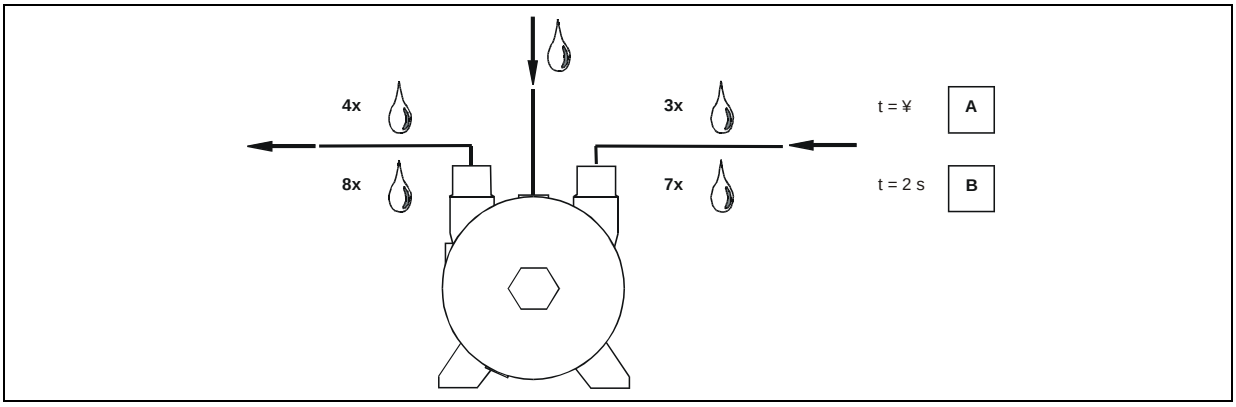

Fig. 13: Maximum permissible quantity of water entrained via the inlet connection

A During continuous operation: 3x quantity of operating-liquid flow rate
B Briefly (up to 2 sec.): 7x quantity of operating-liquid flow rate

9 Operation

} WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Danger due to rotating parts!

The pump-motor unit may only be put into operation when the following conditions are met:

- Fan guard and vacuum pump/compressor housing are mounted.
- The lines to the discharge connection, inlet connection and operating-liquid port are attached.
- The lines and connections have been tested for strength and leaks.

CAUTION

If the unit is run dry, the mechanical seal will be destroyed in a matter of seconds!

DO NOT switch on as long as the unit is not filled with operating liquid!

} WARNING

Danger of burns and scalding from hot surfaces of the pump-motor unit and from hot fluids!

Do not touch during operation! Allow to cool after shut-down!

NOTICE

Maximum permissible quantity of water entrained via the inlet connection:
See Fig. 13, Pg. 29.

9.1 Self-priming operation

Follow the instructions contained in Chapter 8.2, "Self-priming operation", Pg. 27 for this operating mode.

9.2 Operation with operating-liquid feed

Start-up

For non-automatic operation (Fig. 11, Pg. 29):

- Open the stop valve (Item 4) manually. The operating liquid is fed in.
- Switch on the unit.

For automatic operation (Fig. 12, Pg. 29):

- Switch on the unit.
- The solenoid valve (Item 4) opens and the operating liquid is fed in.

Shut down:

For non-automatic operation (Fig. 11, Pg. 29):

- Switch off the pump-motor unit.
- Close the stop valve (Item 4) manually. Feeding of the operating liquid is cut off.
- The following applies for the control valve (Item 3) for setting the operating-liquid flow rate:
  In case of an interruption in operation, the valve setting (i.e. the valve position or the open valve cross-section) is not changed.

For automatic operation (Fig. 12, Pg. 29):

- Switch off the pump-motor unit.
- The solenoid valve (Item 4) closes, and feeding of the operating liquid is cut off.
- The following applies for the control valve (Item 3) for setting the operating-liquid flow rate:
  In case of an interruption in operation, the valve setting (i.e. the valve position or the open valve cross-section) is not changed.

10 Shut-Down and Longer Standstills

10.1 Draining

} DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

} WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Before beginning work on the unit or system:

- Interrupt supply of operating liquid.
- Bleed lines and vacuum pump/compressor (depressurize).

- Switch off the pump-motor unit.
- The above safety precautions apply when working on the unit or system.
- Provide suitable catch containers below the vacuum pump/compressor housing.
- Open the screw plug (Fig. 7, Pg. 22, Item 5).
- Allow the liquid to drain out.
- Close the screw plug again, tightening torque T_t = 2 ... 3 Nm [1.48 ... 2.21 ft lbs].

10.2 Preparing for longer standstill

Before a longer standstill (from approx. 4 weeks) or when there is danger of frost, proceed as follows:

- Drain pump-motor unit as described in Chapter 10.1, "Draining", Pg. 31.
- Remove the pipe/hose from the intake or discharge connection.
- Pour ½ l [0.132 gal (US); 0.110 gal (UK)] of preservative (rust protection oil, e.g. Mobilarma 247 form Mobil Oil) into the open intake or discharge connection.
- Close the intake and discharge connection, as well as the operating-liquid port and remount the disconnected pipes/hoses.
- Guide a M6 or M8 bolt (depending on the type) with a sufficient shank length through the center opening into the fan guard and screw into the shaft end on the external fan side (see Fig. 14, Pg. 31).
- Turn the shaft by hand using the bolt.
- Remove the M6 or M8 bolt again.
- You have two options for the standstill: Either the pump-motor unit remains connected in the system, or the unit is removed for storage.

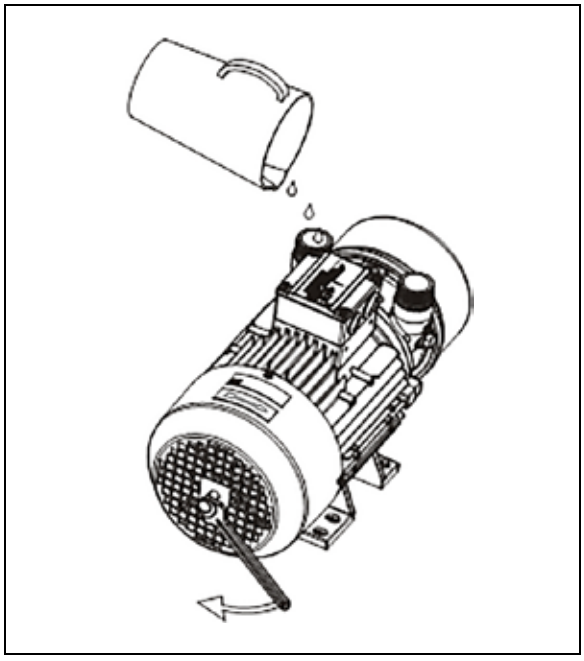

Fig. 14: Pour in preservative and turn shaft

10.3 Storage conditions

This chapter applies in the following cases:

- new pump-motor units,
- pump-motor unit that are already installed in a system and were prepared for a longer standstill, as described in Chapter 10.2, "Preparing for longer standstill", Pg. 31.

To prevent standstill damage during storage, the environment must provide the following conditions:

- dry,
- dust-free,
- low-vibration (effective value of vibration speed $v_{eff} \leq 0.2$ mm/s [0.008"/sec]).

Take the following measures for **commissioning following a longer standstill**:

- Measure the insulation resistance of the motor.
  In case of values ≤ 1kΩ per volt of nominal voltage, dry winding.

- Drain off preservative, as described in Chapter 10.1, "Draining", Pg. 31.
  Subsequent cleaning of the pump-motor unit is not required.
  Dispose of preservative in accordance with the manufacturer's specifications.

- For new pump-motor units:
  Install pump-motor unit as described in Chapter 7, "Installation", Pg. 19.
  Commission the pump-motor unit as described in Chapter 8, "Commissioning", Pg. 25.

  For pump-motor unit that are already installed in a system:
  Commission the pump-motor unit as described in Chapter 8, "Commissioning", Pg. 25.

} DANGER

Electrical danger!

Work on electrical installations may be carried out by trained and authorized electricians only!

11 Servicing

DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

WARNING

Danger due to gauge pressure and vacuum!

Danger due to escaping fluid!

Before beginning work on the unit or system:

- Interrupt supply of operating liquid.
- Bleed lines and vacuum pump/compressor (depressurize).

WARNING

Danger from rotating external fan of unit!

It is prohibited to remove the fan guard!

WARNING

Danger from rotating impeller of unit!

Do not remove the vacuum pump/compressor housing until after the unit has been shut down and the impeller has come to a complete stop!

Consider that the impeller has a certain run-out!

WARNING

Danger of burns and scalding from hot surfaces of the pump-motor unit and from hot fluids!

Do not touch during operation! Allow to cool after shut-down!

WARNING

When working on the unit, there is a danger of injury, e.g. in the form of cuts/cutting off, crushing and burns!

During transport/handling as well as assembly and disassembly always wear personal protective equipment (safety helmet, protective gloves, safety boots)!

11.1 Maintenance

The pump-motor unit is largely maintenance-free.

However, if dirt or solid matter (e.g. sand) or lime deposits get into the unit through the operating liquid and/or the pumped gases/vapors, then it is necessary to clean the unit at regular intervals to prevent the impeller from jamming up and to avoid wearing of the impeller and the vacuum pump/compressor housing.

Refer to the following table:

Contamination/Problem	Remedy
Dirt collects in the motor cooling fins.	· Clean the motor cooling fins at regular intervals.
Fine-grain dirt (e.g. sand) get into the vacuum pump/compressor with the operating liquid or pumped gases/vapors.	Install a liquid separator, filter or screen in the feed pipe. OR Regularly dismantle and clean the vacuum pump/compressor housing as follows: · Shut unit down. · Drain the pump-motor unit as described in Chapter 10.1, "Draining", Pg. 31. · Unscrew the housing with a 36 mm [$^3/_8$"] wrench (in direction of arrow shown on housing) (see Fig. 15, Pg. 35). · Remove the housing. · Dirt has collected in the housing. Rinse out the housing. · Screw on the housing again (opposite direction of arrow shown on housing) and tighten with a tightening torque of 50 Nm [36.9 ft lbs]. · When commissioning the pump-motor unit, proceed as described in Chapter 8, "Commissioning", Pg. 25.
Impeller is jammed.	· Shut unit down. · Guide a M6 or M8 bolt (depending on the type) with a sufficient shank length through the center opening into the fan guard and screw into the shaft end on the external fan side (see Fig. 16, Pg. 35). · Free the shaft using the bolt. · Remove the bolt again.
Extremely hard water used as operating liquid Lime content > 15°dH).	Soften operating liquid. OR Decalcify the pump-motor unit at intervals of 3 months as follows (also see Fig. 16, Pg. 35): · Wear personal protective equipment (protective gloves and safety goggles), · Shut unit down. · Drain the pump-motor unit as described in Chapter 10.1, "Draining", Pg. 31. · Remove pipes/hoses. · Fill the unit with decalcifying liquid through one of the connection openings. Use **10% solution of acetic acid** or another **commercially available decalcifying agent**. · Allow the decalcifying liquid to soak for at least 30 minutes. · Turn the shaft occasionally during this time. To do this, guide a M6 or M8 bolt (depending on the type) with a sufficient shank length through the center opening into the fan guard and screw into the shaft end on the external fan side (see Fig. 16, Pg. 35). · Turn the shaft using the bolt. · Remove the bolt again. · Drain the decalcifying liquid out of the unit. To do this, proceed as described in Chapter 10.1, "Draining", Pg. 31. · Mount pipes/hoses. · When commissioning the pump-motor unit, proceed as described in Chapter 8, "Commissioning", Pg. 25. · The decalcifying liquid can be disposed of in the sewer system.

Contamination/Problem	Remedy
Dirt gets into the air passages (fan guard, external fan, cooling fins) of the motor.	Clean the motor air passages regularly. To do so, proceed as follows: · Carry out protective measures for the use of compressed air: Wear personal protective equipment (protective gloves and safety goggles), secure surroundings. Remove objects lying around. · Blow in compressed air through the fan guard grate. · It is prohibited to remove the fan guard!

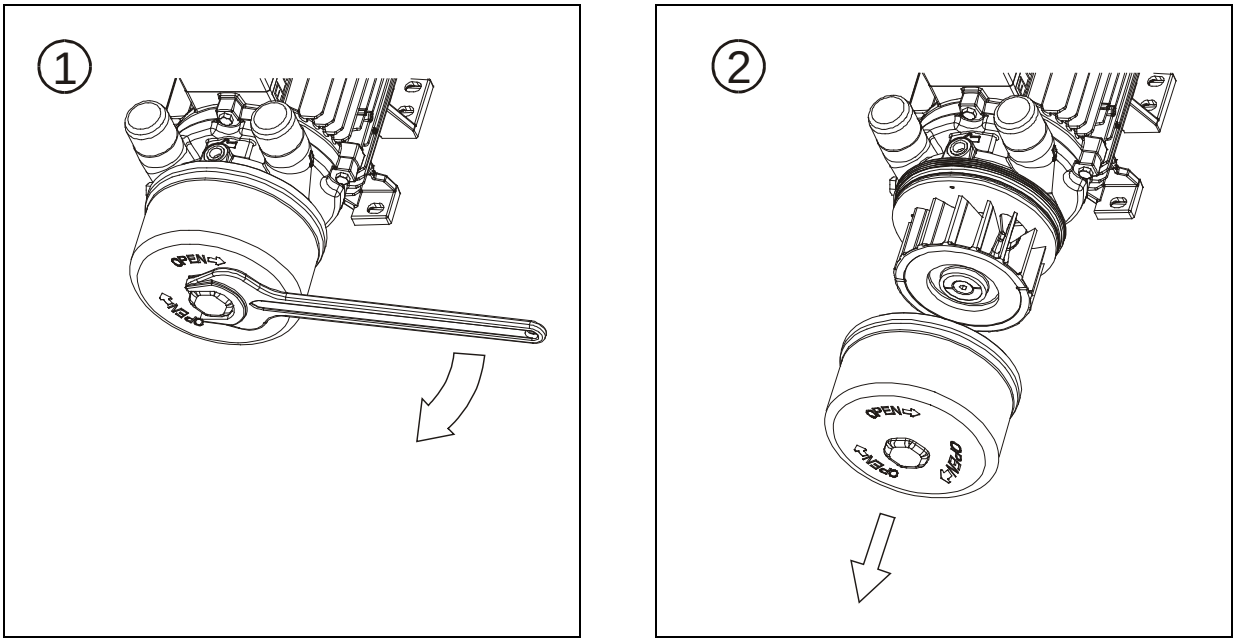

Fig. 15: Removing vacuum pump/compressor housing
Carry out with 36 mm [$^3/_8$"] open-end wrench.

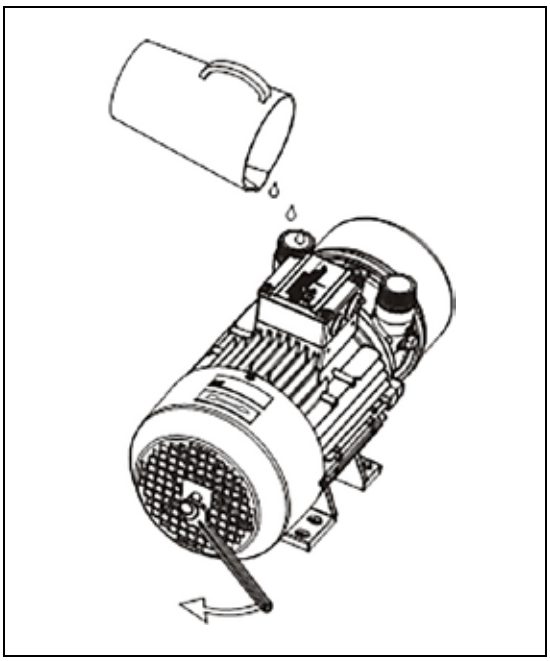

Fig. 16: Pouring in decalcifying agent and freeing shaft by turning

11.2 Repairs/troubleshooting

Fault	Cause	Remedy	Carried out by
Motor does not start, no motor noise.	At least two power supply leads interrupted.	Check fuses, terminals and cables for open circuit. Eliminate open circuit.	Electrician
Motor does not start, humming noise..	One power supply lead interrupted.	Check fuses, terminals and cables for open circuit. Eliminate open circuit.	Electrician
	Impeller is jammed.	Free shaft by turning. See Chapter 11.1, "Maintenance", Pg. 33.	Operator
		Decalcify vacuum pump/compressor. See Chapter 11.1, "Maintenance", Pg. 33.	Operator
		Drain and clean vacuum pump/compressor if necessary. See Chapter 11.1, "Maintenance", Pg. 33.	Operator
		Check and correct impeller gap setting if necessary.	Service
	Impeller defective.	Replace impeller.	Service
	Motor bearings defective.	Replace motor bearings.	Service
Protective motor switch trips when motor is switched on.	Winding short-circuit.	Have winding checked.	Electrician
	Motor overloaded.	Throttle operating-liquid flow rate. See Chapter 8.2, "Self-priming operation", Pg. 27 or 8.3, "Operation with operating-liquid feed", Pg. 28.	Operator
	Counter-pressure at discharge connection too high.	Reduce counter-pressure.	Operator
	Share of liquid also fed too high.	Reduce share of liquid also fed.	Operator
	Impeller is jammed.	See "Motor does not start, humming noise."	Service
Power consumption too high.	Lime or other deposits.	Decalcify vacuum pump/compressor. See Chapter 11.1, "Maintenance", Pg. 33.	Operator
		Clean vacuum pump/compressor. See Chapter 11.1, "Maintenance", Pg. 33.	Operator
Unit does not generate vacuum.	No operating liquid.	Ensure proper operating-liquid flow rate. See Chapter 8.2, "Self-priming operation", Pg. 27 or Chapter 8.3, "Operation with operating-liquid feed", Pg. 28.	Operator
	Severe leak in the system.	Seal leak in the system.	Operator
	Wrong direction of rotation.	Reverse direction of rotation by interchanging two connecting leads.	Electrician

Fault	Cause	Remedy	Carried out by
Unit generates insufficient vacuum.	Unit too small.	Use larger unit.	Operator
	Operating-liquid flow too low.	Increase operating-liquid flow rate to up to 2x the nominal flow rate. See Chapter 8.2, "Self-priming operation", Pg. 27 or Chapter 8.3, "Operation with operating-liquid feed", Pg. 28.	Operator
	Operating liquid too warm (nominal temperature: 15°C [59 °F]).	Cool or increase operating-liquid flow, See Chapter 8.2, "Self-priming operation", Pg. 27 or 8.3, "Operation with operating-liquid feed", Pg. 28.	Operator
	Erosion.	Inspect impeller. To do so, proceed as follows: · Shut unit down. · Drain the pump-motor unit as described in Chapter 10.1, "Draining", Pg. 31. · Unscrew the housing with a 36 mm [$^{3}/_{8}$"] wrench (in direction of arrow shown on housing) (see Fig. 15, Pg. 35). · Remove the housing. · Examine the impeller for erosion. · Have the impeller replaced by Service if necessary. · Screw on the housing again (opposite direction of arrow shown on housing) and tighten with a tightening torque of 50 Nm [36.9 ft lbs]. · When commissioning the pump-motor unit, proceed as described in Chapter 8, "Commissioning", Pg. 25.	Operator
		Replace affected components.	Service
	Slight leak in the system.	Seal leak in the system.	Operator
	Mechanical seal leaky.	Replace mechanical seal.	Service
Abnormal screeching noise.	Cavitation of vacuum pump/compressor.	Connect cavitation-protection hose of liquid separator (see Chapter 13.5, "Cavitation protection", Pg. 45) or clean cavitation-protection equipment.	Operator
	Operating-liquid flow rate too high.	Check operating-liquid flow rate and reduce if necessary. See Chapter 8.3, "Operation with operating-liquid feed", Pg. 28.	Operator
Unit leaky.	Seals defective.	Check seals.	Service

11.3 Spare parts

11.3.1 Ordering spare parts

Spare parts order as per Spare part list.

11.3.2 Ordering standardized parts

Commercially available standardized parts can be purchased on the open market.
When doing so, observe the information in the parts list exactly, especially the design, dimensions, property class etc.

11.4 Service/After-sales service

Our Service is available for work (in particular the installation of spare parts, as well as maintenance and repair work), not described in these operating instructions (see front page of these operating instructions).

Observe the following when **returning** pump-motor unit:

- Before shipping:
  - Drain the pump-motor unit so that it is residue-free,
    as described in Chapter 10.1, "Draining", Pg. 31.
  - Clean the unit on the inside and outside,
    as described in Chapter 11.1, "Maintenance", Pg. 33.
- The pump-motor unit must be delivered complete, i.e. not dismantled.
- Only the original packing should be used for shipment.
- A declaration of clearance must be included with the shipment,
  as described in Chapter 11.5, "Decontamination and Declaration of Clearance", Pg. 38.
- The original rating plate of the pump-motor unit must be properly mounted, intact and legible.
  All warranty claims are voided for pump-motor units delivered for a damage expertise without the original rating plate or with a destroyed original rating plate.

11.5 Decontamination and Declaration of Clearance

} WARNING

Danger from flammable, caustic or toxic substances!

To protect the environment and persons, the following applies:

Pump-motor unit which have come into contact with **dangerous substances** must always be decontaminated before being passed on to a workshop!

A so-called **Declaration of Clearance** must be included with each pump-motor unit that is given to a workshop for inspection, maintenance or repair.

The declaration of clearance

- is provided as a pre-printed form for photocopying on Pg. 47,
- is legally binding,
- must be filled out and signed by authorized, qualified personnel,
- must be issued for each unit sent in (i.e. a separate declaration for each unit),
- must be attached outside on the packing of the unit,
- should be sent to as a copy by fax the workshop conducting the work prior to shipment.

This ensures

- that the unit has not come into contact with dangerous substances,
- that a unit that has come into contact with dangerous substances has been sufficiently decontaminated,
- that the inspection, maintenance or repair personnel can take the required protective measures if necessary.

NOTICE

The inspection/maintenance/ repair of the unit at the workshop will not be begun
until the declaration of clearance has been received!

If the declaration of clearance is not included with the shipment, delays may result!

12 Disposal

Have the entire pump-motor unit scrapped by a suitable disposal company. No special measures are required when doing so.

For additional information on disposing of the unit, ask service.

13 Accessories

13.1 Flanges

The pipes on the intake and discharge side are connected to intake and discharge connections via the flanges.

See Fig. 17, Pg. 40.

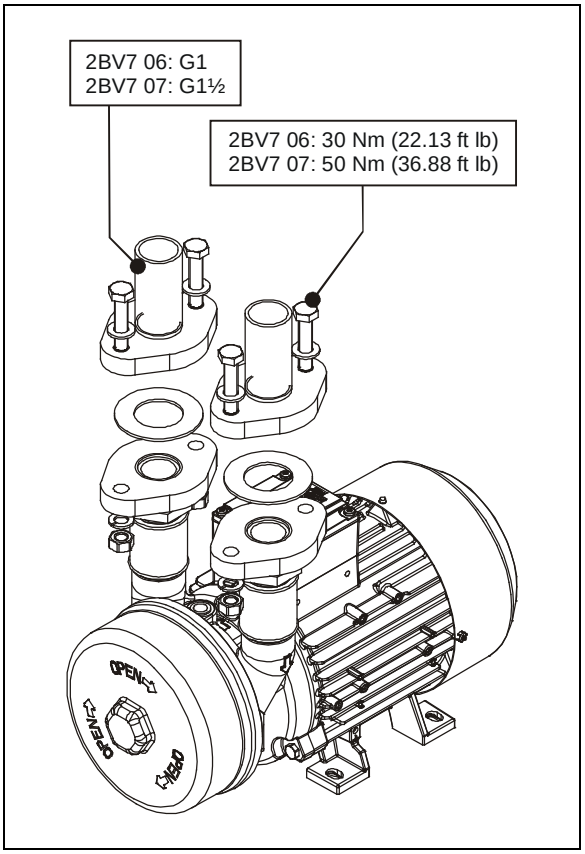

Fig. 17: Flanges

Mounting

The flanges are mounted when connecting the pipes/hoses, as described in Chapter 7.3, "Connecting pipes/hoses (vacuum pump/compressor)", Pg. 22.

Proceed as follows:

- Screwing flanges onto intake and discharge connections.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.
- Screw intake and discharge connections onto flanges.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.

13.2 Non-return valve

The non-return valve is basically a valve with a plate seat. Its function is to prevent the pumped gases/vapors as well as the operating liquid from flowing back out of the pump in case the operation of the pump-motor unit is interrupted. It is mounted on the inlet connection of the unit for this purpose.

See Fig. 18, Pg. 40.

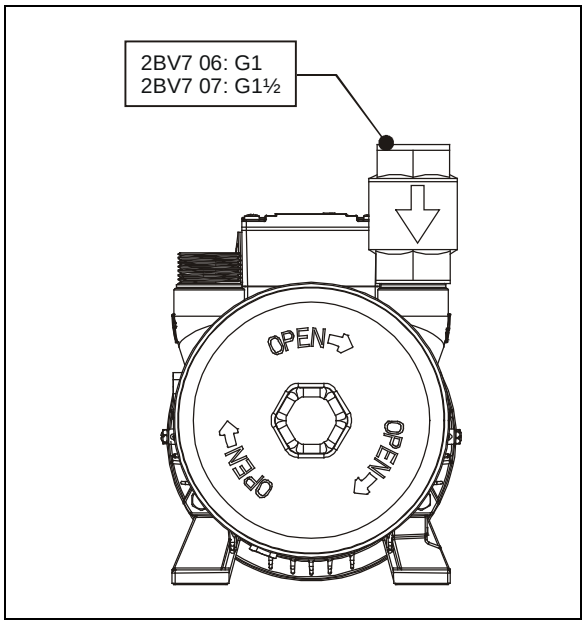

Fig. 18: Non-return valve

Mounting

The non-return valve is mounted when connecting the pipes/hoses, as described in Chapter 7.3, "Connecting pipes/hoses (vacuum pump/compressor)", Pg. 22.

Proceed as follows:

- Screw on the non-return valve **with the arrow pointing downward** on the inlet connection.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.
- Screw the inlet pipe onto the non-return valve.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.

13.3 Gas ejector

The gas ejector is used when an **inlet pressure of the unit** in the range **from 40 mbar [0.580 psi] to 10 mbar [0.145 psi]** is to be achieved.
The gas ejector compresses the pumped gases/vapors sucked in to the inlet pressure of the pump-motor unit.
Ambient air at 20°C [68 °F] and 1013 mbar [14.7 psi] is used as a propellant. This air may **not contain any liquid droplets**.

See Fig. 19, Pg. 41.

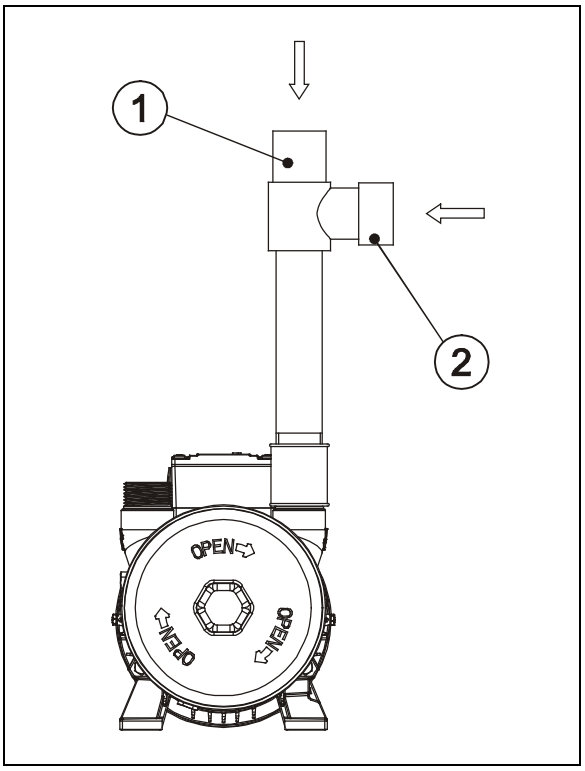

Fig. 19: Gas ejector

Mounting

The gas ejector is mounted when connecting the pipes/hoses, as described in Chapter 7.3, "Connecting pipes/hoses (vacuum pump/compressor)", Pg. 22.

Proceed as follows:

- Screw the gas ejector onto the inlet connection.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.
- Screw the inlet pipe onto the gas ejector.
  Use commercially available liquid sealant (e.g. Loctite) when doing so.
  Tightening torque: dependent on the sealant.
- With soiled ambient air:
  Screw a propellant line onto the gas ejector.

When evacuating containers, the gas ejector operates as a throttle in the range from 1000 mbar [14.5 psi] to approx. 100 mbar [1.45 psi]. To achieve fast venting times here, the gas ejector can be bypassed with a bypass pipe. The bypass pipe must be closed if the gas ejector is to be effective. The best point for switching over to operation with the gas ejector is at approx. 40 mbar [0.580 psi].

13.4 Liquid separator

The liquid separator is mounted on the discharge connection. Its functions consists of separating the discharged operating liquid form the pumped gases/vapors. Part of this separated operating liquid can be fed back to the pump-motor unit via the operating-liquid port. The rest is drained off and replaced with fresh operating liquid.

Operation with a liquid separator and operating water return is the operating mode recommended for the pump-motor unit.

The procedure for mounting the liquid separator on the pump-motor unit is shown in Fig. 20, Pg. 43, and Fig. 21, Pg. 44. Here the following applies:

1) Remove the plug at the top and bottom on the liquid separator.

2) Screw the hose nipple into the holes on the liquid separator. Use commercially available liquid sealant (e.g. Loctite) when doing so.
   - Top hole:
     Angled hose nipple.
   - Bottom hole:
     Straight hose nipple.

   For **2BV7060** and **2BV7061**:
   The premounted reducer on the liquid separator **is** required. Therefore:
   - Remove the reducer from the liquid separator.
   - Seal off thread. Use commercially available liquid sealant (e.g. Loctite) when doing so.
   - Screw the reducer into the liquid separator again.

   For **2BV7070** and **2BV7071**:
   The premounted reducer on the liquid separator is **not** required. Therefore:
   - Remove the reducer from the liquid separator and dispose of it.

3) Screw the hose nipple into the hole provided on the pump-motor unit. Use commercially available liquid sealant (e.g. Loctite) when doing so.
   - Operating-liquid port:
     Angled hose nipple, directed toward the front.
   - Connection for cavitation protection:
     Angled hose nipple, directed upward.

4) Mount the "T" hose nipple on the angled hose nipple on the operating-liquid port with the hose clamp.

5) Place the liquid separator on the discharge connection and tighten it by hand. Use commercially available liquid sealant (e.g. Loctite) when doing so.

6) Mount the hose for returning the operating liquid (see arrow) with hose clamps.
   - On the liquid separator:
     Mount the hose on the lower hose nipple.
   - On the pump-motor unit:
     Mount the hose on the side connection of the "T" hose nipple (operating-liquid port).

7) Mount the cavitation-protection hose (see arrow) with hose clamps.
   - On the liquid separator:
     Mount the hose on the upper hose nipple.
   - On the pump-motor unit:
     Mount the hose on the hose nipple of the cavitation protection connection.

8) Side view of the mounted liquid separator.
   A = Connection for feed pipe for fresh operating liquid.
   B = Connection for draining off separated operating liquid.

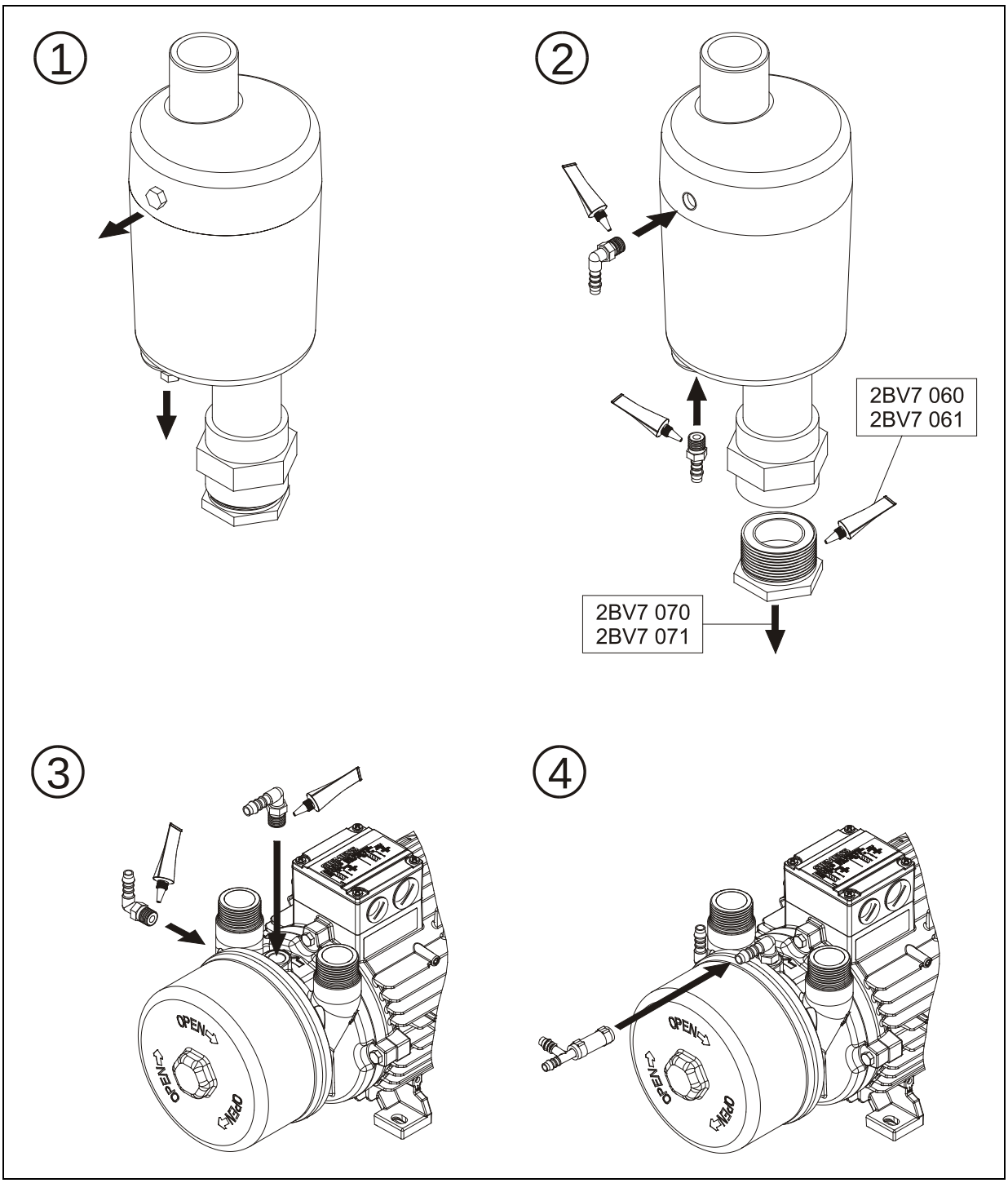

Fig. 20: Mounting liquid separator, Part 1 of 2

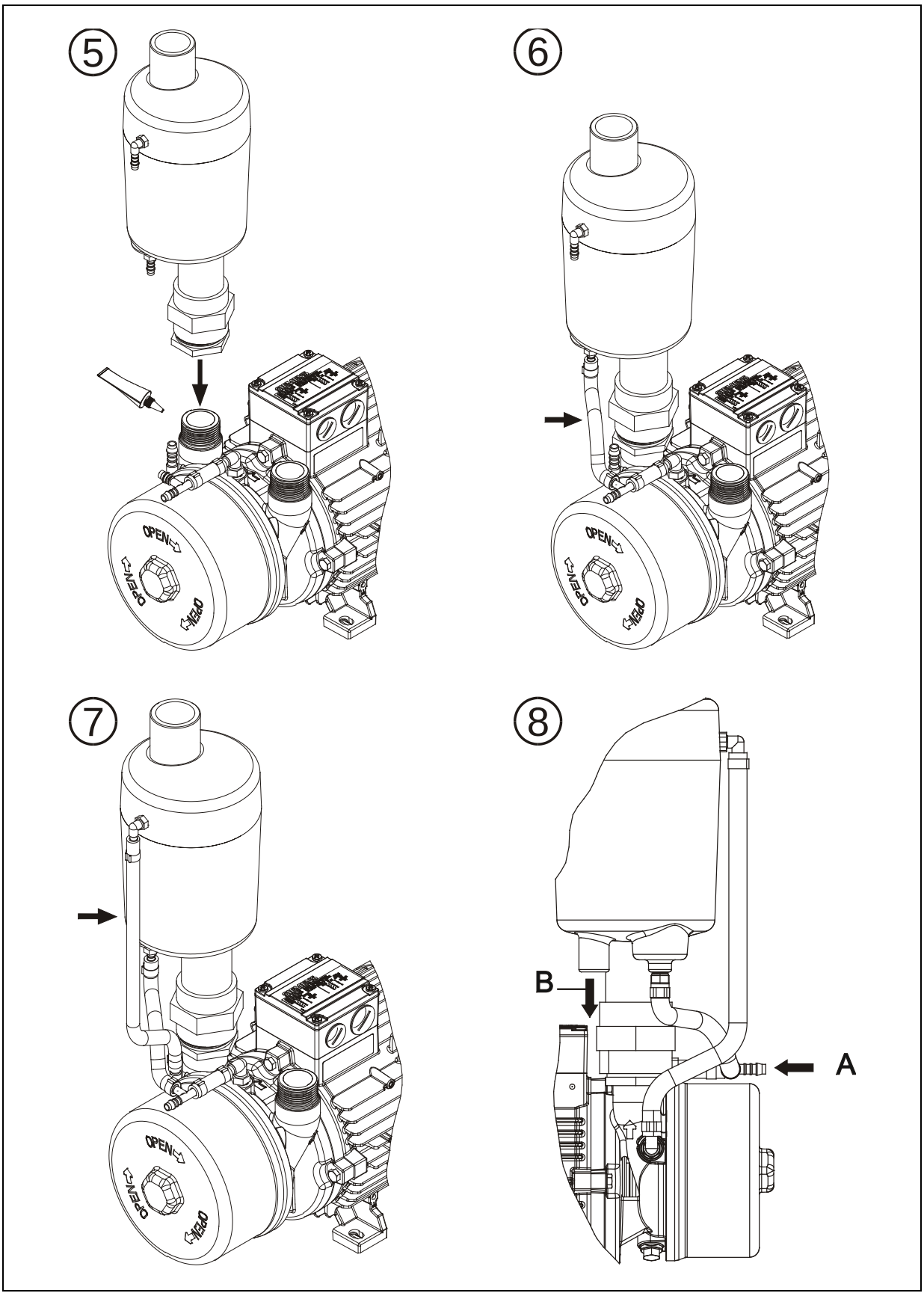

Fig. 21: Mounting liquid separator, Part 2 of 2

13.5 Cavitation protection

Cavitation is understood to be the production and sudden implosion of gas bubbles in the liquid being fed. If the pressure in the vacuum pump/compressor drops below the evaporation pressure of the liquid (on the intake side or in constricted areas), gas bubbles form. When the pressure increases above the evaporation pressure again (on the discharge side or at points with a larger cross-section), these gas bubbles collapse while forming high pressure peaks, which may lead to particles being torn out of the housing wall and impeller. Noise is radiated. Material destruction of the pump-motor unit is possible. To prevent this, measures should be taken for **cavitation protection**.

To protect the unit from cavitation, connect the cavitation-protection hose of the liquid separator to the connection for cavitation protection (Fig. 7, Pg. 22, Item 4).

EU declaration of conformity

Manufacturer:	Gardner Denver Deutschland GmbH Industriestraße 26 97616 Bad Neustadt Germany
Representative for the compilation of technical documents:	Holger Krause Industriestraße 26 97616 Bad Neustadt Germany
Designation of the machine:	Compressor/Vacuum Pump
	Series L-BV7
	Types 2BV7060 2BV7061 2BV7070 2BV7071

The machine described above meets the following applicable Community harmonisation legislation:

2006/42/EC	European Parliament and Council Directive 2006/42/EC from 17th May 2006 on machinery and amending Directive 95/16/EC.
2004/108/EC	Directive 2004/108/EC of the European Parliament and Council from 15th December 2004 for the application of the legal regulations of the EU member states concerning electrical devices and repealing Directive 89/336/EEC

Harmonised standards applied:

EN 1012-1:2010	Compressors and vacuum pumps - Safety requirements - Part 1: Compressors
EN 1012-2:1996 +A1:2009	Compressors and vacuum pumps - Safety requirements - Part 2: Vacuum pumps
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines Part 1: General requirements IEC 60204-1:2005 (amended)
EN 60034-1:2010/ AC: 2010	Rotating electrical machines - Part 1: Rating and performance IEC 60034-1:2010 (amended)

Bad Neustadt, 16.04.2015

(Place and date of issue)

Andreas Bernklau, Product management/Authorised signatory

(Name and function)

Thomas Küpper, Development

(Name and function)

664.48060.40.000

Statement on health safety and on the protection of the environment

- For the safety of our employees and to comply with statutory requirements on handling substances harmful to the health and the environment, this statement must be enclosed, fully completed, with **each** unit/system sent.
- **Without the fully completed statement, repair/disposal is not possible and delays are unavoidable!**
- The statement is to be completed and signed by suitably qualified, authorised personnel at the operating organisation.
- In the case of shipment to Germany, the statement is to be completed in German or English.
- The statement is to be attached to the outside of the packing on shipment.
- If necessary, the carrier is to be informed.

1. **Product designation (type):** ----------
2. **Serial number (no. BN):** ----------
3. **Reason for sending:** ----------
4. **The unit/system**
   ☐ has **not** come into contact with hazardous substances. There will be **no** hazards for personnel or the environment during repair/disposal. Continue with "6. Legally binding statement“
   ☐ has come into contact with hazardous substances. Continue with "5. Information on the contamination“
5. **Information on the contamination** (if necessary provide more information on an additional sheet)
   The unit/system was used in the following application:

   ----
   and has come into contact with the following classifiable substances or substances presenting a hazard to health/environment:

Trade name:	Chemical designation:	Hazardous substance class:	Properties (e.g. toxic, inflammable, caustic, radioactive):

   ☐ The unit/system has been emptied in accordance with the operating instructions, flushed and cleaned externally.
   ☐ Safety data sheets in accordance with the applicable regulations are enclosed (..... sheet).
   ☐ The following safety precautions are necessary for handling (e.g. personal protective equipment):

   ----
6. **Legally binding statement**
   I herewith guarantee that the details specified are true and complete and that I, as signatory, am in a position to judge that this is so.
   We are aware that we are liable to the contractor for any damages arising from incomplete or incorrect specifications. We are obliged to indemnify the contractor against claims for damages by third parties arising from incomplete or incorrect specifications. We are aware that, irrespective of this statement, we are directly liable to third parties - in particular including the contractor's employees tasked with repair/disposal.

Company/institute: ----------

Name, position: ---------- Phone: ----------

Street: ---------- Fax: ----------

Post code, city: ----------

Country: ---------- Stamp:

Date, signature: ----------

P.O. box 1510
97605 Bad Neustadt
Phone: +49 7622 392 0
Fax: +49 7622 392 300
E-mail: er.de@gardnerdenver.com
Internet: www.gd-elmorietschle.com
610.00250.40.905
10.2009
English

Elmo Rietschle

www.gd-elmorietschle.de
er.de@gardnerdenver.com

Gardner Denver
Deutschland GmbH
Industriestraße 26
97616 Bad Neustadt · Deutschland
Tel. +49 9771 6888-0
Fax +49 9771 6888-4000

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