

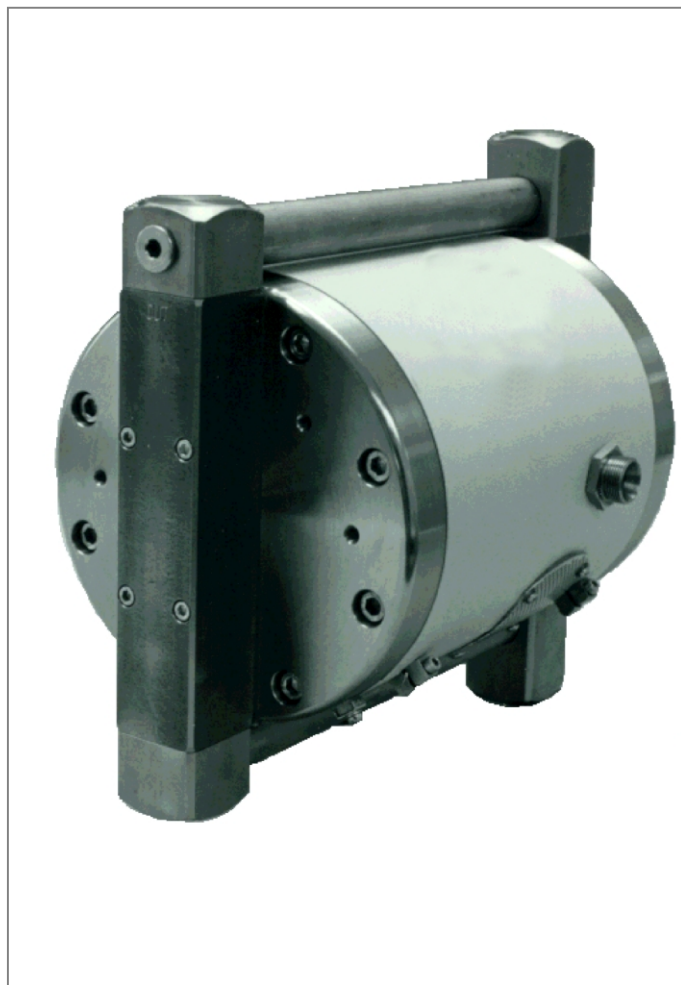
# USER INFORMATION

# 6000300E

PLEASE KEEP SAFE FOR FUTURE USE

Rev. C

B.6.50.80-GB



Diaphragm pump REGULUS<sup>®</sup> 3:1

## GRACO N.V.

Industrieterrein "Oude Bunders"

Loc. 2206 - Slakweidestraat 31

3630 Maasmechelen - Belgium

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The original manufacturer's nameplate is on the diaphragm pump.

Please compare the data and supplement if possible.



[Translation of nameplate]

**AIR OPERATED  
DIAPHRAGM PUMP**

Model 003.175-DP  
Production no.  
Year of construction  
Material  
volume flow max.: 114 l/min.  
Temperature max.: 80 °C  
Excess pressure max.: 18 bar  
Air inlet  
pressure max.: 6 bar  
Transmission ratio: 3:1

**Read and observe the operating and safety instructions before commissioning!**

In this manual important information is marked with the following symbols:



Information which affects your safety.



Information important to functional running.

**Please pass on all safety information to other users.**

**DIAPHRAGM PUMP 003.175-DP****CONTENTS OF USER INFORMATION****Page****OPERATING INSTRUCTIONS**

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We reserve the right to make amendments

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Proc. 11.12.98 Voigt	<b>USER INFORMATION</b> <b>- OPERATING INSTRUCTIONS -</b>	Issued 10.99
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### LIST OF REPLACEMENT PARTS

#### REPLACEMENT DIAPHRAGM PUMPS, REPLACEMENT ACCESSORIES (Extract from sales catalogue)

Includes:

TEST CERTIFICATE (final inspection)

EC DECLARATION OF CONFORMITY

BRIEF USER INSTRUCTIONS (can be adhered to pump)

BRIEF OPERATING INSTRUCTIONS, WARNING SIGNS

### CORRECT USE

The diaphragm pumps 003.175-DP are exclusively manufactured for the usual applications in surfacing technology (to convey coatings or auxiliary agents or for spraying) or similar work.

Any other purpose above and beyond this is considered incorrect use. We are not responsible for any damage or injury resulting from this; the user bears the sole responsibility in such cases.

Correct use includes observing the operating, maintenance and inspection conditions and regulations laid down by us.

003.175-DP diaphragm pumps may only be used, maintained and repaired by personnel familiar with, and trained to recognise the inherent dangers.

The relevant accident prevention regulations as well as safety and medical rules must be observed.

Unilateral changes to the appliance will cause us to waive our responsibility for any damage or injury caused.

The user is responsible for the correct installation of the appliance.

## FUNCTIONAL DIAGRAM

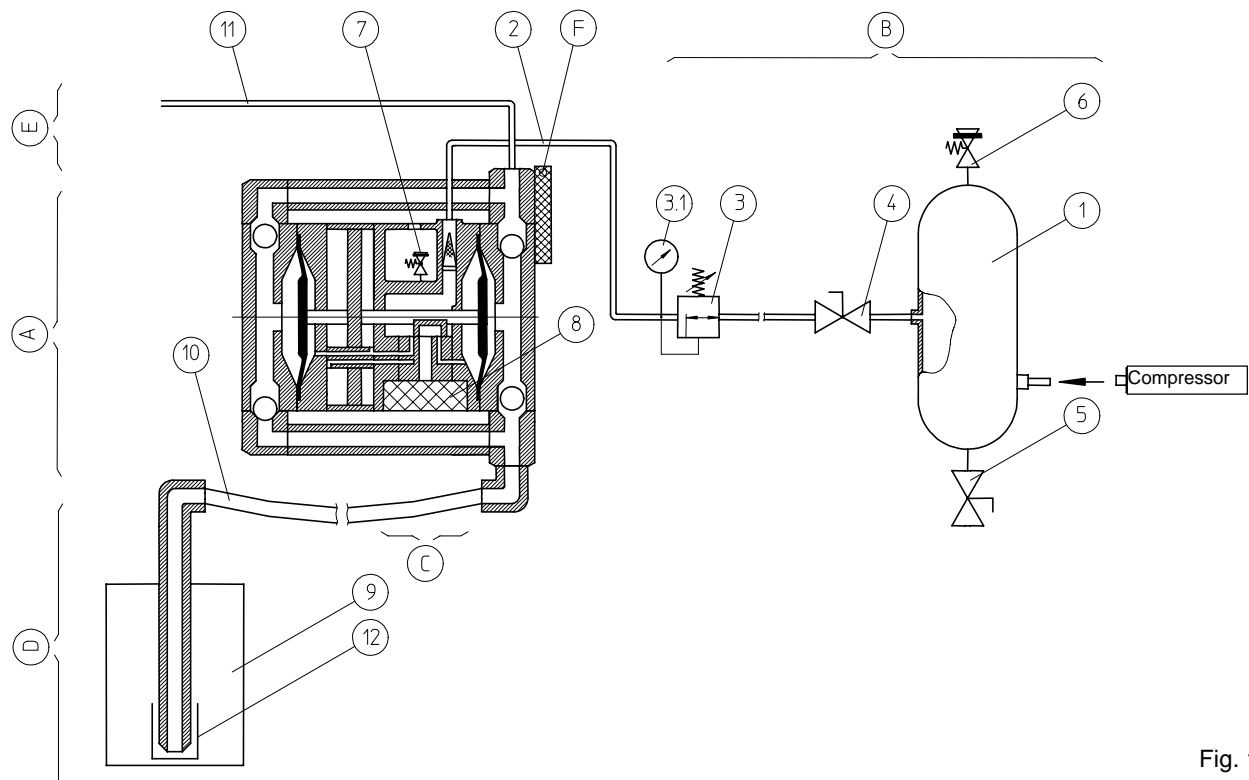


Fig. 1

- |                                   |                               |                        |
|-----------------------------------|-------------------------------|------------------------|
| (A) DIAPHRAGM PUMP                | (1) Pressure tank             | (7) Safety valve       |
| (B) COMPRESSED AIR SUPPLY         | (2) Pipeline or hose          | (8) Sound absorber     |
| (C) EXHAUST AIR SOUND SUPPRESSION | (3) Pressure regulation valve | (9) Vessel             |
| (D) MATERIAL SUCTION DEVICE       | (4) Ball cock                 | (10) Suction pipeline  |
| (E) MATERIAL PRESSURE SYSTEM      | (5) Ball cock                 | (11) Pressure pipeline |
| (F) SUPPORT                       | (6) Safety valve              | (12) Sieve             |

## DESCRIPTION OF FUNCTIONS

The compressed air is supplied to the diaphragm pump (A) from a pressure tank (1) via a pipe or hose (2) and a pressure control valve (3). The air supply from the pressure tank to the diaphragm pump can be interrupted by the ball cock (4).

The other ball cock (5) is used for manually releasing condensation (an automatic steam trap would be preferable here).

The safety valve (6) protects the pressure tank against inadmissible rises in air pressure (e.g. in the event of heating).

There is also a safety valve (7) on the diaphragm pump because as a rule the compressed air supply (B) is not installed for the diaphragm pump only, and because it is obligatory.

During operation, compressed air escapes into the atmosphere from the propulsion mechanism of the diaphragm pump via the integrated sound absorber ⑧. This unburdens it.

The material (coating or auxiliary agents) is sucked out of a material receptacle ⑨ via the suction line ⑩ by the diaphragm pump and fed on under pressure via the pipe or hose line ⑪ to the withdrawal point.

A sieve (dirt trap) ⑫ protects the diaphragm pump against foreign bodies which have unintentionally entered the material.

## COMPONENT PARTS OF APPLIANCE - IMPORTANT INFORMATION

The following must be fulfilled if the appliance is to be considered ready for operation:

### Ⓐ THE DIAPHRAGM PUMP

For the description of the functions of the diaphragm pump see "Technical Description of Product B. 6.50.80-P".

### Ⓑ THE COMPRESSED AIR SUPPLY

The compressed air supply consists of the compressor, the pressure tank with steam trap, possibly a compressed air drier and pipeline. The compressed air supply is generally already available to the user.

- If a compressed air supply must be installed the relevant accident prevention regulations, safety rules and user information, in particular information from the compressor manufacturer, must be applied.

There must be a flexible connection between the diaphragm pump and the compressed air line (avoids fractures caused by vibrations). A hose line is most suitable

- nominal diameter 13 or bigger
- operational pressure = max. mains pressure, preferably • 16 bar
- air and local temperature -20 to 50 °C
- free of materials detrimental to paint such as silicone

In areas with a danger of explosion the compressed air line and the hose line must be electrically conductive (to avoid electrostatic charging).

- leakage resistance < 10<sup>6</sup> Ω to earth.

The pressure control valve is in most cases directly fitted to the diaphragm pump.

- efficient rate of flow  
at 6 bar and 25 m/s > 114 m³/h
- air inlet pressure 16 bar
- air and local temperature 0° C to 50 °C

It goes without saying that the pressure control valve can be situated between the hose line and the compressed air line.

The manometer connected 3.1 in function diagram enables exact setting and control of the air pressure required.

- display range 0 to 16 bar
- air and local temperature 0 to 50 °C
- damped construction

A shutoff mechanism (e.g. ball cock) should be fitted between the pressure control valve and the hose line in all cases, or between the hose line and the compressed air line. This enables a quick and safe diaphragm pump switch-off before operating pauses, maintenance work and in cases of breakdown.

There is no change to the value set on the pressure control valve:

- Nominal pressure 16 bar
- Material CuZn, nickel-plated



For ball cocks the following must be observed: stopcock transverse to flow direction = pipe is closed off

Do not use PTFE or hemp to seal connections (causes pressure control valve malfunction due to residue from compressed air supply).

There are no special requirements as regards the quality of the compressed air supplied to the diaphragm pump.

- condensation and residue oil from the compressor are trapped  
(pressure tank, compressed air filter)
- oiling of compressed air not necessary
- temperature of compressed air 10°C to 50 °C

In painting processes the compressed air must be free of substances which could lead to the formation of craters (oil, silicone).

- This also applies to component parts of the compressed air supply.

### © EXHAUST AIR SOUND ABSORBER

The sound emissions of a compressed air powered diaphragm pump is damaging to hearing in the absence of a sound absorber [ $> 100 \text{ dB(A)}$ ]. Every diaphragm pump is therefore fitted with an integrated sound absorber.

As there is a connection between sound absorption and the formation of ice on the diaphragm pump control system, the sound level cannot be reduced with a sound absorber as much as would be desired [not  $\leq 70$  db(A)].

See "Technical Description of Product B.6.50.80-P-GB", page 04 for more detailed information on the sound level.

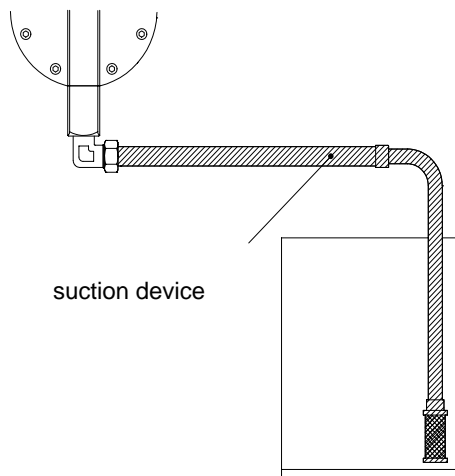


The diaphragm pump may not be used without the sound absorbing components.

- The decision to wear ear protection depends on the operating pressure and the resulting sound level.

#### D MATERIAL SUCTION SYSTEM

ALL METAL PARTS IN CONTACT WITH THE SUCTION AREA MATERIAL ARE MADE OF AUSTENITIC STAINLESS STEEL.



The cross section of the suction line is so measured that material with a kinematic viscosity of up to 750 mm<sup>2</sup>/s(cSt) can be sucked without difficulty by the diaphragm pump. Higher viscosity can result in difficulties ranging from a reduction in the suction performance to interrupted suction, identifiable by an increasingly greater fall in pressure during the change of direction (pulsating pressure).

- Measures for improvement are:  
keeping the suction line as short as possible or a short

suction hose with a Fig. 2r cross section.

Suction system characteristics are:

- Electrically conductive, maximum permissible resistance  $3 \cdot 10^4 \Omega/\text{m}$  (tested to ISO 8031) and leakage resistance to earth  $< 10^6 \Omega$ .  
Suitable for use in hazardous locations.
- The individual parts of the suction system are designed to withstand an excess pressure of 12 bar (- Suitable for suction heights of up to 8.5 m).
- The suction hose and the suction sieve are resistant to the usual solvents in the surface coating and silicone-free.
- Minimum nominal diameter 25



- Temperature of material 10 °C to 85 °C
- Sieve mesh size 1.8

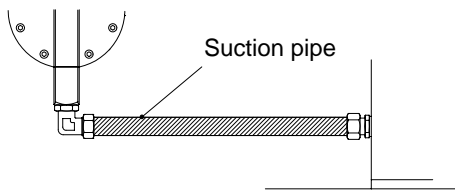


Fig. 3

For a fixed installation the connections diaphragm pump → material loop pipe or diaphragm pump → pressure tank must be flexible (avoids fracture caused by vibrational stresses). The characteristics of the suction pipe are the same as those for the suction equipment.



The diaphragm pump may not be pressurised from the suction side.

- This could destroy important functional components.

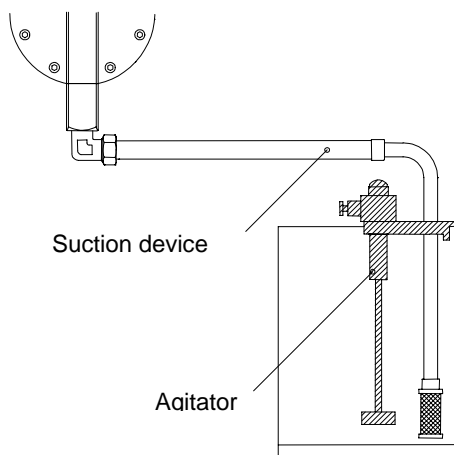


Fig. 4

The viscosity of thixotropic materials is reduced when stirred; this can have the effect that the suction performance of the diaphragm pump is improved (amongst others).

The agitator is fixed to the pipe of the suction device. The clamp (bracket) must be fixed to the vessel rim. This ensures that the agitator propeller is in the right position in relation to the vessel wall, the base and the suction pipe, and that frictional contact is impossible.

Immersed agitator parts (shaft and propeller) are made of austenitic stainless steel (1.4305).

The agitator is pneumatically driven, max. allowable input pressure 6 bar. Rotational speeds can be adjusted using the butterfly valve connected. The user should determine the optimal rotational speed for the material used.

- The agitator propeller is surrounded by an external protection ring
- Techn. Product Description B.18.10.05-P

## ⑤ MATERIAL PRESSURE SYSTEM

The material pressure system is normally composed of a hose and/or pipeline.

For surface coating, the hose must have the following characteristics:

- Electrically conductive, max. permissible resistance  $3 \times 10^4 \Omega/\text{m}$  (tested to ISO 8031).
- The inside pipeline coating must be resistant to normal solvents, the outer coating resistant under certain conditions.

- Free from materials detrimental to paint use such as silicone.
- Operational temperature -40 °C to 90 °C or higher.
- Meets the requirements of all relevant standards (design, identification).
- The internal hose fittings must be of austenitic stainless steel, outer fittings of galvanised and yellow chromated steel.
- Operating pressure > max. allowable excess pressure of diaphragm pump
- Connection thread normally G1.

In most cases the material pressure connection is joined to the diaphragm pump by a pipeline  
The connection must be flexible (avoids fracture caused by vibration stresses).

The characteristics of the flexible pressure line:

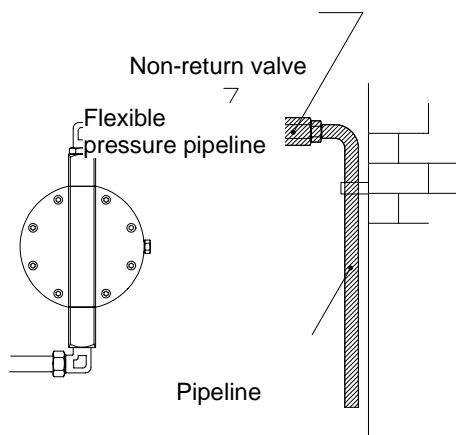


Fig. 5

- Minimum nominal diameter 25
- Operating pressure > max. allowable diaphragm pump excess pressure
- Operating pressure > max. allowable diaphragm pump excess pressure
- Operational temperature 10 to 90 °C
- For areas subject to danger of explosion:  
Electrically conductive, leakage resistance to earth <  $10^6 \Omega$ .
- The following applies to the surface coating :  
resistant to normal solvents and free from materials detrimental to paint use such as silicone.



In an expanded material pressure system and in cases where the pressure system is influenced by heat (sunrays, heating, etc.) it is necessary to fit a suitable non-return valve in the pressure pipeline (to prevent damage caused by heat expansion).

All metal parts of the pressure and suction accessories supplied by us which come in contact with the material are of austenitic stainless steel. They are suitable for use with water lacquer.

## **(F) APPLIANCE SUPPORT**

A wall fixing and a frame support the 003.175-DP diaphragm pump.

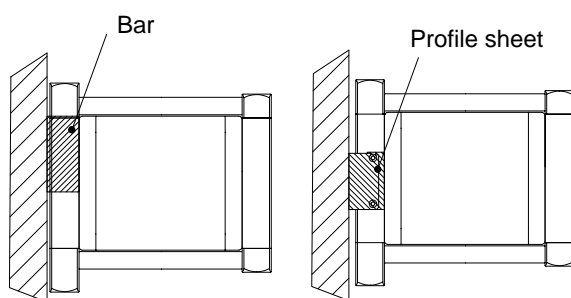


Fig. 6

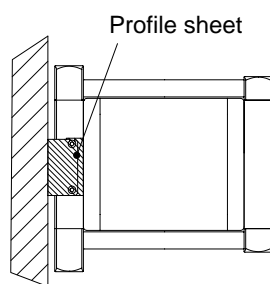


Fig. 7

2 bars are used as wall fixings. This type of fixing is provided for flat walls such as machine walls.

A wall fixing made of 2 bars and profile sheets is recommended for uneven walls (brickwork).

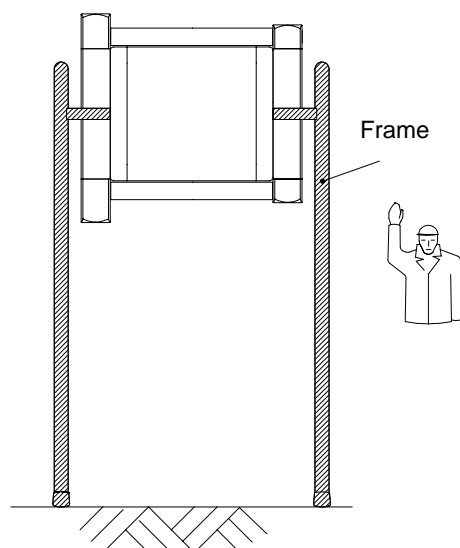


Fig. 8

The frame is used to support the diaphragm pump on an even floor. The bearing surface should be as even as possible and level (slope < 3°).

All setup positions have the suction connection of the diaphragm pump facing downward, and the pressure connection facing upward. A connection facing in any other direction will impair the pump function.

Screws and dowels of all fixtures supplied by us conform to technical product description

B.17.90.01-P .

## TOOL LIST


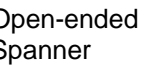


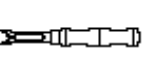
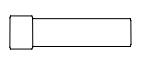
					
Allen Screw DIN 911	Open-ended Spanner DIN 895	Flat-nosed pliers DIN 5248	Pliers DIN 5256 C	Gripper Article No. 70630 002002	Assembly bolt Article No. 70640 001002
SW 4, SW 5, SW 6, SW 8	SW 8, SW 13, SW 19, SW 32	Length 140	for retaining ring Ø 12 - 25	Special tool	Special tool

Table 1

### Open-ended Spanner DIN 895

SW 32 Compressed air hose line (compressed air accessories)

SW 41 Screw fitting for suction and pressure connections

## INSTALLATION

### INSTALLATION AND SECURING

Diaphragm pumps may only be mounted in a horizontal position (as drawing). Any other position can lead to malfunctioning.

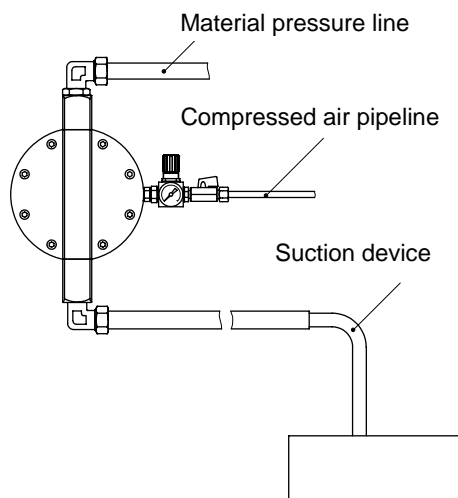


Fig. 9

The following criteria must be met for a safe fixing:

- bearing surface and / or wall even and load bearing.
- dowels and fixing screws must be of sufficient size (Techn. Product Description B.17.90.01-P).

Do not mount in closed rooms (cabinets)  
(- malfunction due to icing of control system).

When installing in hazardous locations, zone 1, you should observe the guidelines for explosion prevention (EX-RL) ZH 1/10 (chapter E2), as regards assembly materials.



The diaphragm pumps must not be installed in zone 0 (receptacles).

### VENTILATION OF WORK AREA

must be provided.

### EARTHING



The appliances must be earthed in hazardous locations.

The following applies in relation to the guideline under "Static Electricity" ZH 1/200:

The earthing must be mechanically so resistant and corrosion-proof as to withstand all conditions to which it may be subjected in operation. The earth conductors should be connected to all appliance components and to the earth by soldering, welding or protected screw fittings. Chains may not be used. When making connections, in particular to pipelines, it should be ensured that the earth conductor is not interrupted by non-conductive parts or during repair work.

The earth connection should be tested for functionality under operational conditions by an expert.

- The earth connection points on all devices are marked:



Movable, conducting vessels or appliances which could store an electric charge should also be earthed. This is usually achieved with a flexible connection that is secured, for example, with a clip.

- Chains may not be used.

## COMPRESSED AIR SUPPLY

The compressor and compressed air storage receptacle (pressure tank) must be of sufficient size

- Check thoroughly

- see also page 5, "Quality of Compressed Air"

## CONNECTIONS

Compressed air pipeline ↔ diaphragm pump

Suction pipeline ↔ diaphragm pump

Pressure pipeline ↔ diaphragm pump

These should be flexible and, in hazardous locations, electrically conductive.

- see pages 4, 7 and 8

## COMPRESSED AIR PIPELINE

If a compressed air line must be laid it must have a gradient of 3 to 5 mm per m down to the compressed air tank or the water trap.

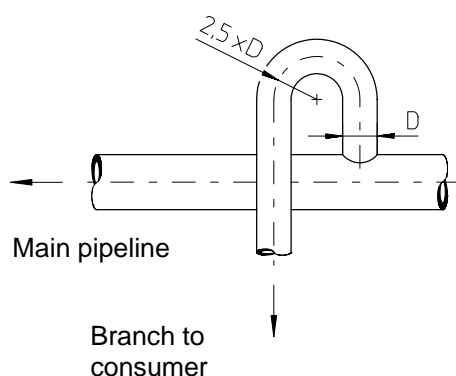


Fig. 10

If a branch line has to be made from an existing compressed air line, this should be carried out above the level of the pipe axis.

In the case of bends in metal air pipes these should be selected with a bend radius of the pipe axis not smaller than  $2.5 \times$  the pipe outside diameter.

- Plastic pipelines in hazardous locations must have a conducting resistance to earth of  $< 10^6 \Omega$ .

## COMPRESSED AIR CONTROL VALVE (PRESSURE CONTROL VALVE), MANOMETER AND BALL COCK

- see pages 4 and 5

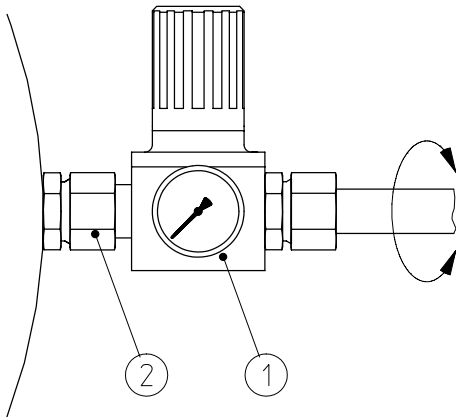


Fig. 11

If the pressure control valve ① is fitted to the diaphragm pump it can be adjusted for easier reading of the manometer.

- loosen union nut ②
- adjust pressure control valve
- tighten union nut

## MATERIAL SUCTION DEVICE

- See pages 6 and 7

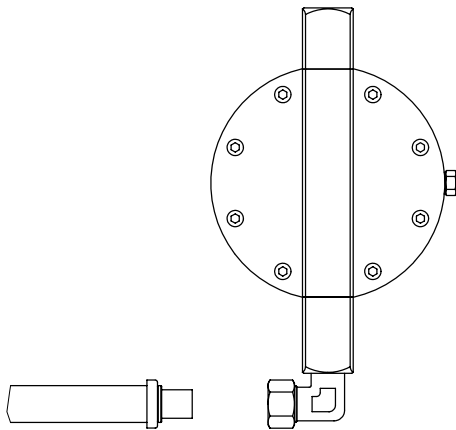


Fig. 12

Connection of the suction device to the diaphragm pump takes place using a normal cutting ring threaded joint or using the pivotable angled cutting ring threaded joint (Article No. 77741 131003).

## MATERIAL PRESSURE SYSTEM

- See pages 7 and 8

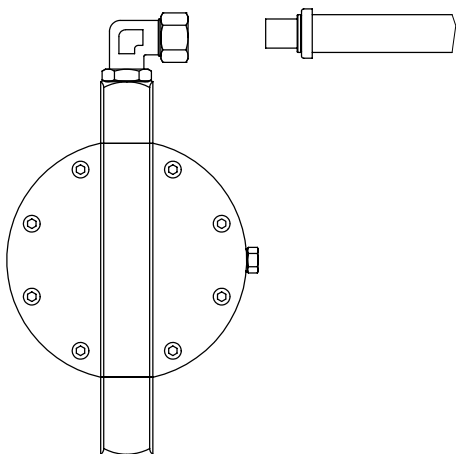


Fig. 13

The pressure pipeline is connected using a cutting ring threaded joint.

## GENERAL ASSEMBLY INSTRUCTIONS

- Keep to recommended torque.
- Grease thread lightly.
- Do not use PTFE tape or hemp.
- Components not supplied by us must be so dimensioned as to correspond to the given dimensions of the diaphragm pump. - Note manufacturer's instructions.
- Observe manufacturer's assembly instructions when using cutting rings or double conical rings.



If liquids are to be pumped which contain chlorinated hydrocarbons (carbon hydrides), e.g. trichloroethane or dichloromethane, the parts in contact with the material in the suction and pressure system must not be made of aluminium or have a zinc-plated surface.  
- there can be metal organic reactions which are explosive and extremely caustic.

## COMMISSIONING

### FLUSHING DIAPHRAGM PUMP

As every diaphragm pump is tested in the works after assembly using an anti-corrosion liquid it is necessary to thoroughly flush out the rest of this liquid (and any other contaminants which have entered during installation) with detergent (flushing agent).

- please see "Commissioning diaphragm pump/plant" ,

The detergent should be subsequently removed as completely as possible from the system. This can be accomplished with air suction.

- Set air inlet pressure < 0.5 bar.



Any detergent used must be compatible with materials to be used later; we recommend consulting your material supplier.

### COMMISSIONING DIAPHRAGM PUMP / PLANT

As the diaphragm pump works automatically with back pressure it can only be commissioned (material transport) if material is extracted / let out of the pressure system.

Open compressed air supply to pressure control valve.

- Open stop cock in compressed air line.

- stop cock handle parallel to compressed air pipe

- Open pressure control valve.

## AERATING (BLEEDING) OF APPLIANCE/PLANT

Any air remaining in the diaphragm pump or the system must be removed completely.

Ensure that the material supply (suction pipe) is immersed in the material. Open the pressure control valve until the diaphragm pump slowly starts.

- Operate the diaphragm pump with < 2 bar material pressure until no more air is pumped.

## PREPARING FOR SPRAYING

Raise the material excess pressure slowly to the maximum value.

Operate the diaphragm pump at this pressure for a short time. Then set the required operating pressure.

- Diaphragm pump / plant is ready for operation.

## LOW LOCAL TEMPERATURE

If commissioning or operation is carried out at a local temperature around 10 °C the compressed air should be supplied with anti-freezer from a dosing apparatus (compressed air oiler).

We recommend ethylene glycol, diluted, with high-pressure additives, 1000 ml , article no. 75682 114002).

## IMPORTANT INFORMATION CONCERNING COMMISSIONING AND OPERATION



The diaphragm pump should only be dry operated for short periods of time under supervision and with low air inlet pressure.

Dry operation after the material has passed through must be strictly avoided. It will damage or destroy important component parts.



Continuous operation with high stroke frequency leads to extensive icing of control system (increased pulsation until diaphragm pump shutdown) (see technical product description B. 6.50.80-P-GB, page 03) and leads to a decrease in service life.



Do not remove and replace the suction pipe or hose during operation.

- If air gets into the system this may e.g. lead to poor painting.





Never immerse a running propeller into a filled container.

- Increase the agitator propeller rotation slowly.



Personal safety equipment (breathing apparatus, goggles, gloves, etc.) must be worn when working with material that is dangerous to health.



Never point the spraying equipment at people or animals.

## OPERATION

The diaphragm pumps run automatically, i.e. during operational shutdown (no material drawn out of pressure system) pumping will stop.

It is therefore recommended that the pump be disconnected from the air supply overnight or at the weekend and, if possible, material pressure be reduced by withdrawal (after the air is disconnected.) This can be achieved by using a spray device for example.

Before long-term shutdown, e.g. company holidays, pumps carrying paint should be flushed. In order to avoid the hardening of paint residue the detergent should remain in the pump during shutdown.

We recommend an alkyl sulfon acidic detergent for long-term shutdowns, e.g. "ASE".



Consult the material supplier concerning the compatibility of the detergent.



NITRO thinners or cleanser should not be used as detergent.

## MAINTENANCE AND INSPECTION, REPAIR

### MAINTENANCE AND INSPECTION

003.175-DP DIAPHRAGM PUMPS REQUIRE LITTLE MAINTENANCE.

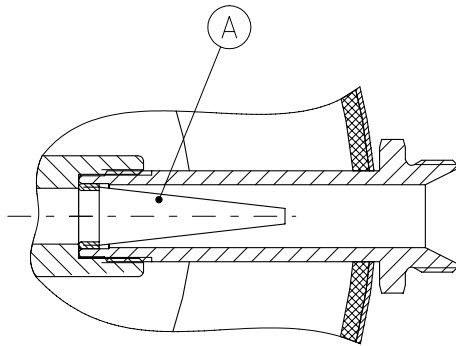


Fig. 14

To avoid increased wear and tear of control components through contaminated air a filter (A) is fitted to the compressed air connection of the diaphragm pump. If the stroke frequency decreases over time this should be cleaned.

- to clean, simply unscrew compressed air connection with filter.



The pump diaphragms become fatigued due to flexing work, and are subject to natural wear. We recommend carrying out a safety inspection or if necessary exchanging the diaphragm at regular intervals to prevent diaphragm breakage.

- Always replace both diaphragms.
- If there is no automatic drainage of water from the compressed air supply, condensation water should be let out daily from the pressure tank, filter and filter regulator.
- When using anti-freezer (operating at 10 °C) replenish after use.
- The diaphragm safety valve must be checked for functionality once a year. This entails exceeding the maximum permissible operating pressure slightly (opening pressure up to 1.1 times the maximum permissible operating pressure).
- The service life of the hose lines is adversely affected, and thus shortened, by surrounding influences (oxygen in air, temperature, light, etc.), even if correctly. It is recommended that they undergo regular visual checks and occasional checking of performance. As a precaution the hose lines should be replaced at intervals set by the operator (- after 2 to 3 years).



Do not carry out any dismantling work on a diaphragm pump that is under pressure.

Regularly watch the diaphragm pump during operation!

Abnormalities such as:

- major pressure fluctuations
- changes in running sound
- irregular running

are normally signs that the diaphragm and control components are in an advanced state of wear.

A timely renewal prevents consequential damage.

- Always replace both diaphragms.

(see breakdown effect analysis, page 22)

## REPAIR



Repairs must be carried out by qualified personnel (experts). (VBG 87).

Only our (the manufacturer's) replacement parts may be used.

Our replacement obligation for the pumps and equipment no longer applies if replacement parts other than ours are used (Produkthaftungsgesetz/Product Liability Law of 15 Dec 1989)

After dismantling, all parts which are to be reused should be cleaned thoroughly.

Do not damage sealing surfaces; therefore do not throw parts around or knock them.



Do not use any tension tools.



Check all PE sealing rings thoroughly for damage, replace if necessary. Always replace any FPM O-rings which have been dismantled.



Apply lubricant to all threads and fits with lubricant before assembling (lightly grease), and on no account use grease containing silicone.



Compressed air supply to diaphragm pump must be interrupted and the pump made free from pressure before any dismantling work.



When traces of wear can be seen on running or sealing surfaces the components affected must be exchanged.

## REPLACING THE DIAPHRAGMS

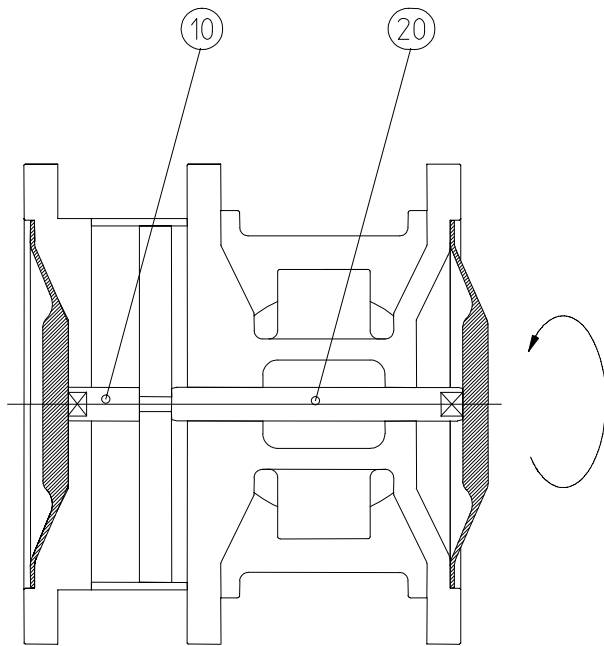


Fig. 15

- Remove both housing covers by first removing the appropriate cheese head screws (valve housing, connection parts and casing do not need to be removed).
- Loosen the diaphragms by hand one after the other and unscrew.

If one of the pins ⑩ or ⑳ rotates during this movement feed an open-ended spanner SW13 under the diaphragm and hold it against the rotation. Before this, push the linkage for the diaphragm to be removed across.

- Check the pin connections for tight fit using two spanners.
- Tighten the new diaphragm lightly only by hand.

Do not use any tools such as pliers to do this.

Replacement diaphragms should be stored in dry, cool, dust-free and dark places, and not longer than 8 months to avoid material ageing.

## REPLACEMENT OF CONTROLS

- Remove front valve housing with connection pieces.
- Remove casing.
- Unscrew cheese head screws ①.
- Remove plate ② with seal ③.
- Lift out close sliding seat ④ using two screwdrivers.
- Remove flat slide ⑤.
- Remove safety rings ⑥.
- Screw cheese head screw ① into its stop ⑦, then pull it out.
- Remove safety ring ⑧ and press the bush ⑨ out from inside.
- Push out the drive pin ⑩.

- If pin ⑪ is to be removed, first pull out safety rings ⑫ with flat-nosed pliers.
- After replacement of wearing parts reassemble in reverse order
- You will require the gripper (Article No. 70630 002002) to insert the safety rings ⑫ (special tools, see tool list).



To avoid damage to the O-ring, always assemble the pin ⑫ first, then slide the bushes ⑨ open from the outside.

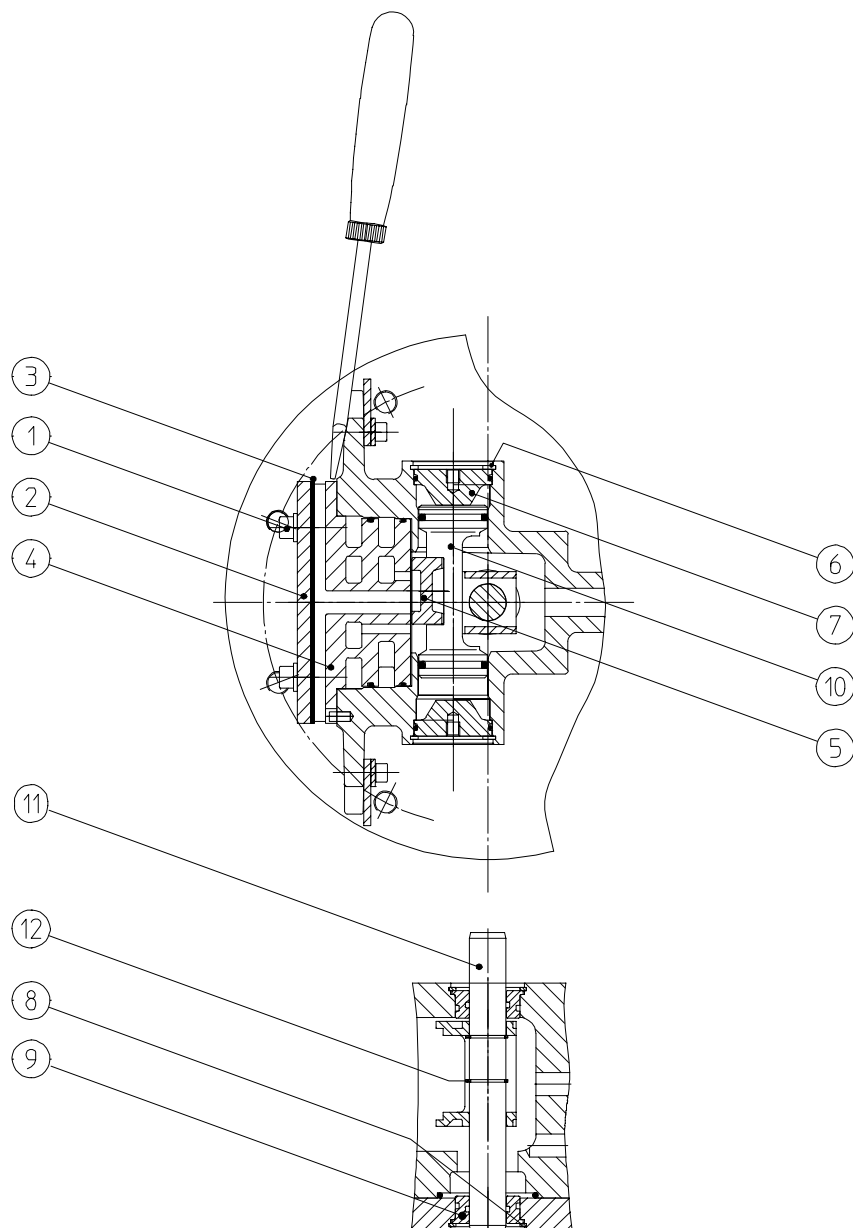


Fig. 16

## REPLACING THE VALVES

- Screw out the cheese head screws ① and remove the connection pieces ②.
- Remove pressure spring ④ and ball bearing traveller ⑤ from the valve area.
- Prise the ball ⑥ out of the valve seat with the help of a small screwdriver.
- Feed the pin (special tool) with the thinner shaft through the free valve seat and carefully knock out the valve parts opposite with light taps.
- Hold one hand against the parts to be removed to prevent them falling out.
- After removing the spring ⑦, the ball bearing traveller ⑧, the ball ⑨ and the valve seat ⑩, feed the pin with the thicker neck through the valve housing and press out the valve seat ⑫ with the bush sleeve ⑪.
- After replacement of wearing parts re-assembly takes place in reverse order.
- If the PE sealing rings show signs of damage, these must also be renewed. If new sealing rings are used they must be placed in the appropriate seat before replacing the valve seat ⑫ and the bush sleeve ⑪.
- Take care that the bent ends of pressure springs ④ and ⑦ are mated to the ball guide feet ⑤ and ⑧.

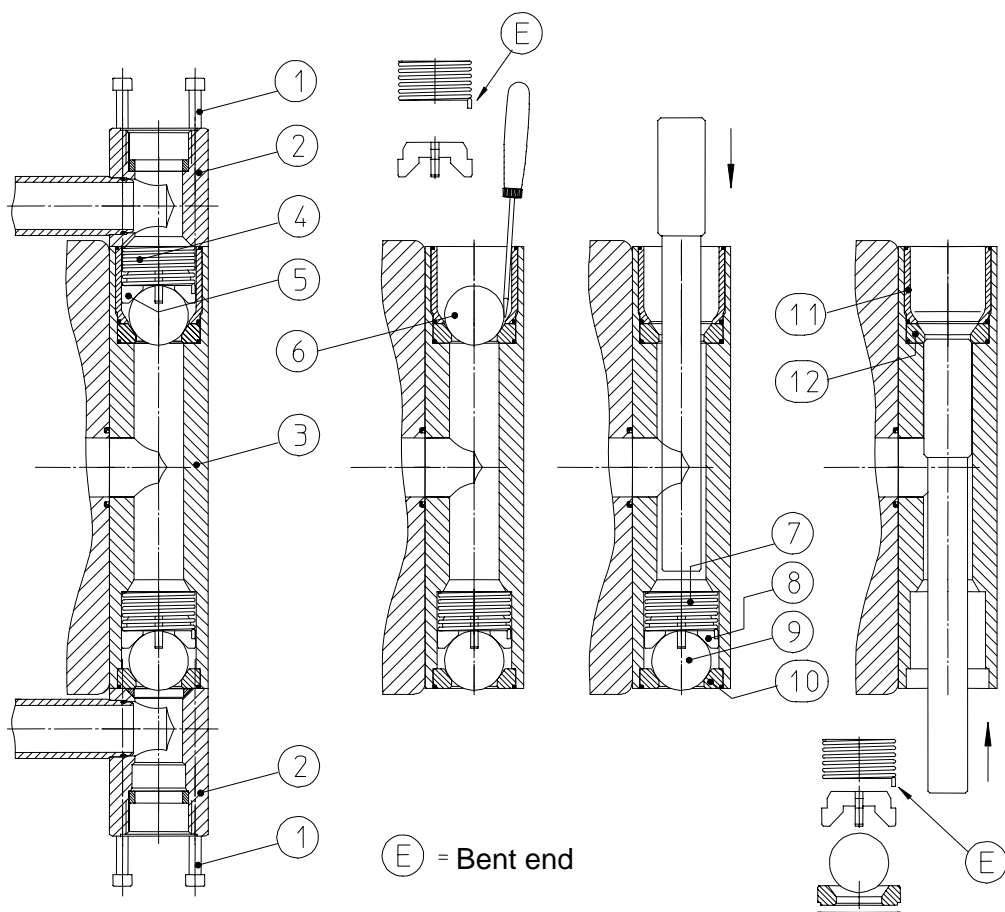


Fig. 17

## TORQUE MOMENTS



All screw connections must be tightened so that they comply with the following torque moments.

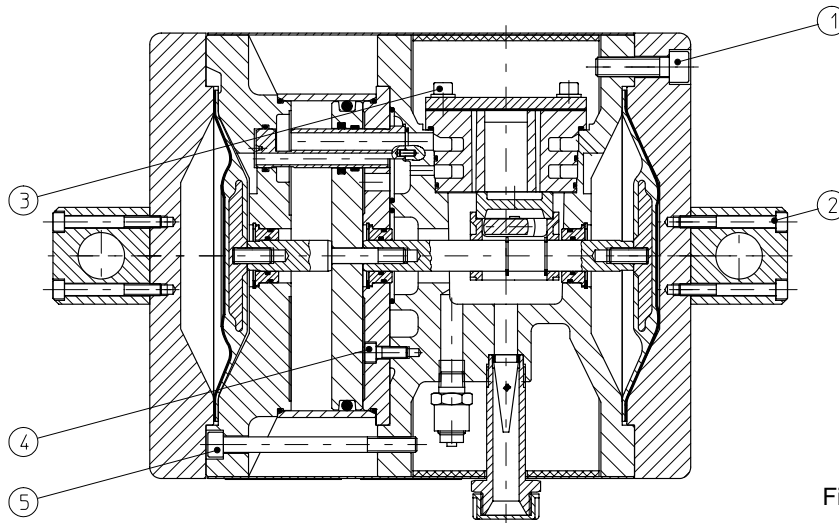


Fig. 18

Position	1	2	3	4	5
Thread	M 10	M 6			M8
Torque Moment	12 Nm	10 Nm	6 Nm	8 Nm	15 Nm

Table 2

All screw material: 8.8/galvanised

## DECOMMISSIONING

### SHORT TERM

- Cut off the compressed air supply
- Relieve the diaphragm pump of pressure by removing material.

### LONGER TERM, PRIOR TO WORKS HOLIDAYS

- Flush out diaphragm pump thoroughly
- Leave detergent in the diaphragm pump
- Interrupt the compressed air supply
- Relieve the diaphragm pump of pressure by removing detergent

### LONG TERM

- Flush out diaphragm pump thoroughly
- Pump detergent out of the diaphragm pump
- Briefly run the diaphragm pump empty at the lowest air pressure level
- Interrupt the compressed air supply to the diaphragm pump (by unscrewing)

## SOLVING BREAKDOWNS

Component group	Nature of defect	Defect symptoms	Possible cause	Countermeasure
<b>Compressed air supply</b>	Pump does not start	Heavy leakage	Defective fitting	Replace defective fitting
		Narrowing of cross section	Hose line pinched Dirty fittings	Check lines
<b>Diaphragm pump</b>	Running irregular, Stroke frequency dropping, comes to standstill	Flat slide defective	Wear	Renew worn parts, check compressed air sieve
		Icing	Compressed air too moist, stroke frequency too high, local temperature too low	Remove ice, change operating conditions
	Air escapes continually from air exit aperture	Flat slide or close sliding seat defective	Foreign body has gained access	Renew defective part, check compressed air filter
	Comes to standstill during operation	Diaphragm broken	Load limit exceeded serviceable life exceeded	Renew both diaphragms, clean diaphragm pump
	Pump does not stop when material pressure feed blocked	Suction or pressure valve defective	Wear, foreign body has gained access	Renew defective part, check sieves at suction device
	Does not start	Material in diaphragm pump has hardened	Insufficiently flushed before long-term standstill	Clean diaphragm pump
<b>Material suction device</b>	Pump does not start, pressure fluctuations	Sieve blocked, max. suction exceeded, hose or seal defective	Material contaminated pump set up incorrectly incorrect use	Clean sieve, observe Tech. Data, renew defective parts
<b>Material pressure system</b>	Pump does not start, stops during operation	Hose line clamped / folded spray pistol blocked	Incorrect use, material contaminated	Check hose line



## NOTES

### SELF MONITORING



If the 003.175-DP diaphragm pump is operated without monitoring, dangerous situations should be avoided by using automatic self regulation.

A stop valve, is particularly suitable for this purpose as it cuts off the compressed air supply to the diaphragm pump if the set limit is exceeded (e.g. due to excessive stroke frequency in case of a line breakage).

### USER INFORMATION

The user information (operating instructions) contains all necessary information about 003.175-DP diaphragm pumps, in accordance with the sales catalogue 02.5080.

The technical product description B .6.50.80-P-GB and the replacement parts list are part of every operating manual. For reasons of organisation they are produced as separate documents.

Compressed-air driven double action diaphragm pumps are recommended for coating and process materials

### DESCRIPTION OF DIAPHRAGM PUMP

The diaphragm pump consists of a diaphragm housing **1** with the compressed-air control **2**, the cylinder unit **3**, the diaphragms **4** and **5**, the lids **6** and **7**, with the valves **8** and **9**, the suction connection **bl** and the pressure connection **bm**.

The diaphragms divide the operational chambers into an air chamber (housing side) and a material chamber (lid side). The pins **bn** and **bo** connect the diaphragms with each other. The ring piston **bp** of cylinder unit **3** is located between the pins. During operation the air chambers of the diaphragms and of the cylinder unit are filled with air alternately by the flat slide **bq**, which is driven by the pin, causing the diaphragms to perform suction and pressure strokes. The ball valves **8** and **9** are spring-loaded. A safety valve **br** protects the diaphragm pump and the pressure system in cases where the air inlet pressure exceeds its maximum permissible value.

A filter **bs** in the air inlet ensures that no contamination enter into the pump control system from the compressed air system.

The integrated silencer **bt** makes separate sound absorbers unnecessary .

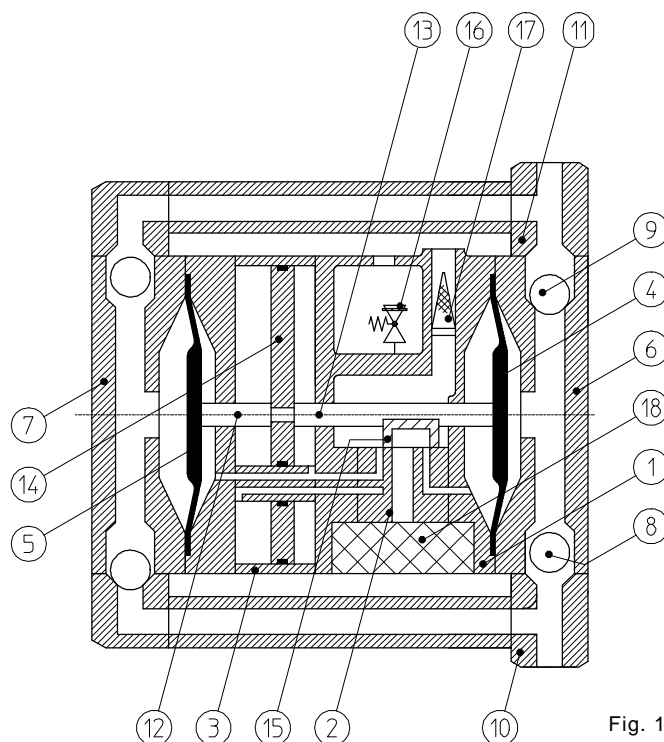
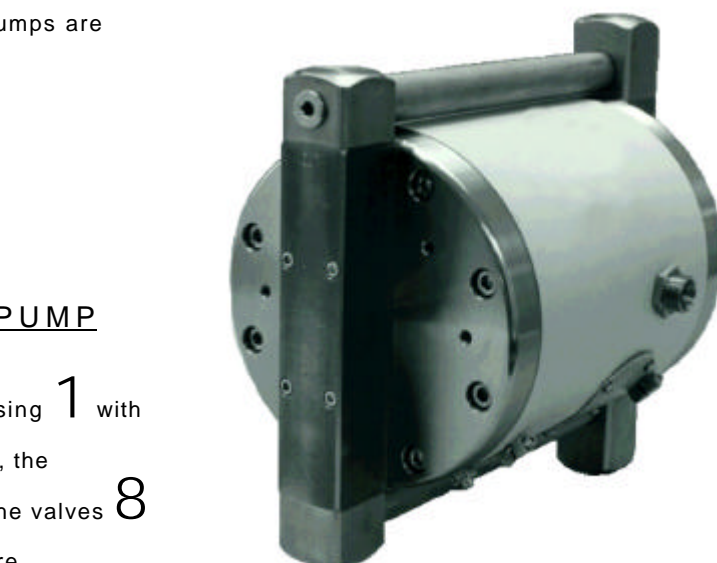


Fig. 1

We reserve the right to make amendments

Continued on pages 02 to

Proc. 14.09.99 Hilse	USER INFORMATION - TECH. PRODUCT DESCRIPTION -	Issued 06.00
Checked 19.10.99 Kuhn		B.6.50.80-P-GB

## SUITABILITY, MATERIAL

TASK BEHAVIOUR	SUITABILITY
<u>Transport task</u>	
Transporting	++
gentle transport	Δ
Metering	Δ
<u>Suction behaviour</u>	
self-priming	++
<u>Tendency to</u>	
harden, adhere	Δ
Precipitate	Δ
Foam	+
Coagulate	-
Crystallise	-
<b>MATERIAL</b>	
<u>Solids content</u>	
None	++
low to 1%	+
medium 1 to 10%	+Δ
over 10%	Δ?
over 50%	-
<u>Gas content</u>	
very low	++
Low	+
High	Δ
<u>Kinematic viscosity</u> in mm/s	
up to 500	++
500 to 750	+
over 750	Δ to ?
<u>Behaviour</u>	
Neutral	++
Corrosive	++
Abrasive	Δ
Acidic	Δ
Toxic	++
Flammable, danger classes	++ <sup>1.)</sup>
AI, AII, AIII	

TRANSPORT OF	SUITABILITY
Oil, diesel fuel, heating oils,	++
Emulsions	
Paint containing solvent	++
Water laquers	++
Dispersions	++
Latex	++
Print colours	Δ?
Hardening agent	++
Solvent	+?
Alcohol	Δ
Water, waste water	+
Soap, cleanser	+?
Cream of clay, chalk mud	Δ?
Glasing	+Δ
Natural and synthetic resins	+
on a water basis	
and solvent basis	
Wood preservatives	++
Fibre material, cellulose	-
Mud, mash, paste	-
Adhesive	?

++ highly suitable

+ suitable

Δ suitable under certain conditions

- not suitable

? needs to be tested

<sup>1.)</sup> Open system, earthed, constantly monitored, air supply cut off when not in operation.



Materials containing chlorinated hydrocarbon (halogenated chlorinated hydrocarbon e.g. trichloethene or methylene chloride) react with aluminium or galvanised parts causing metallo-organic compounds.

These compounds are explosive and extremely acidic.

- Please consult us concerning strongly abrasive or aggressive (caustic) materials.

## TECHNICAL DATA

### KEY TO DESIGNATION

DIAPHRAGM PUMP 003 . 175 - D P W

Pressure transmission

003 = 3:1

Material flow volume

in cm<sup>3</sup> / stroke

e. g. 175 = 175 cm<sup>3</sup>/stroke

Additional detail

e. g. W = Wall version

M = MACHINE VERSION

S = FRAME VERSION

Drive: pneumatic

Action: double-action oscillating

### PRODUCT RANGE

Diaphragm pump	Version	Article No.
003.175-DP	NIRO (1.4571)	79082 151003

Detailed information about basic versions, basic devices, complete devices, accessories and article numbers can be found in sales catalogue 02.5080

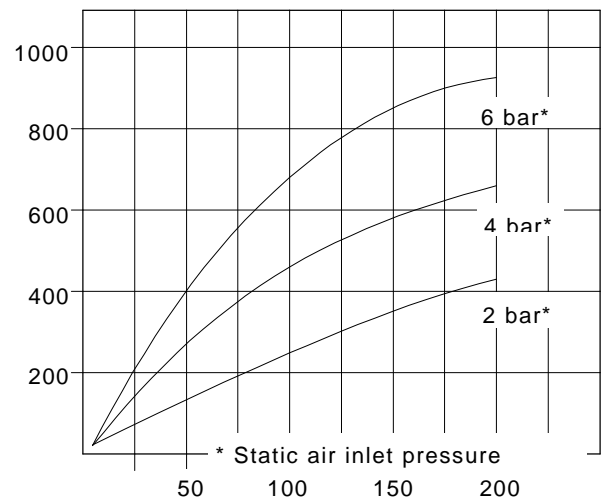
### DATA

Legend:

v = Flow velocity

DH = Double stroke

Max. allowable stroke frequency in DH/min			
Continuous operation		Intermittent operation	
- Full load	- Part load	- Full load	- Part load
60	75	90	110



Stroke frequency in DH/min

Fig. 2

Min. allowable stroke frequency at continuous operation: 1 DH in 10 min. (increased pulsation)

v = 0.4 m/s		v = 0.7 m/s		v = 1.5 m/s	
Stroke frequency in DH/min	Volume flow in l/min	Stroke frequency in DH/min	Volume flow in l/min	Stroke frequency in DH/min	Volume flow in l/min
30	10.5	50	17.5	110	38.5

Max. material volume flow (analogous to DIN 24374 T1)	114 l/min
Material volume	350 Cm <sup>3</sup> /DH
Min. air inlet pressure	0.5 Bar
Max. perm. air inlet pressure	6.0 Bar
Transmission ratio	3:1
Max perm. excess oper. press.	18 Bar
Operational temperature	10-80 °C
Suction height (pump empty)	2.5 M
Suction height (device full)	6.7 M

When using in paint workshop only silicone-free process material (compressed air) and accessories must be used.

## SOUND EMISSION

As the working place cannot be anticipated the highest possible sound level is shown.

### Measurement spacing

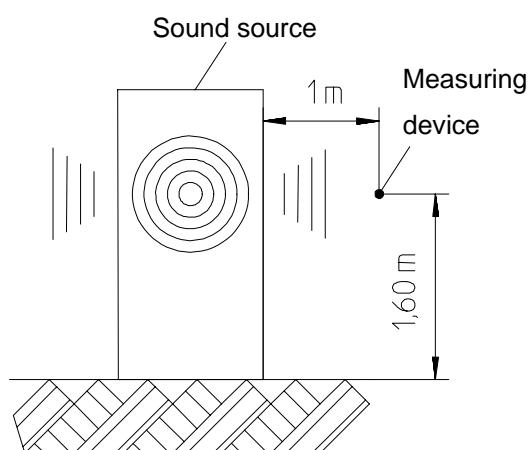


Fig. 3

	Air inlet overpressure in bar		
	2	4	6
Sound pressure level in dB(A) at 50 DH/min	72	76	80

A warning plate is attached to the diaphragm pump.

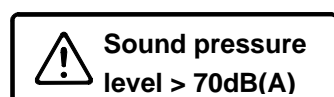


Fig. 4

CONSTRUCTION MATERIALS

OF SURFACE AREAS IN CONTACT WITH FLUID MATERIAL

Pos.	Designation	Material <sup>1)</sup>	Pos.	Designation	Material
1	Valve housing	1.4571	9	Ball	POM
2	Cover	1.4571	10	Fixing screw	A4
3	Moulded membrane	PTFE/NBR	11	Sealing ring	POM
4	Connector	1.4571	12	Sealing ring	PE-HD
5	Pipe	1.4571	13	Bush	POM
6	Pressure spring	1.4310	14	Profile sealing ring	PE-HD
7	Ball guide	POM	15	Profile ring	POM
8	Valve seat	1.4571	16	O-ring	FPM

1) Material information is valid for version NIRO/1.4571.

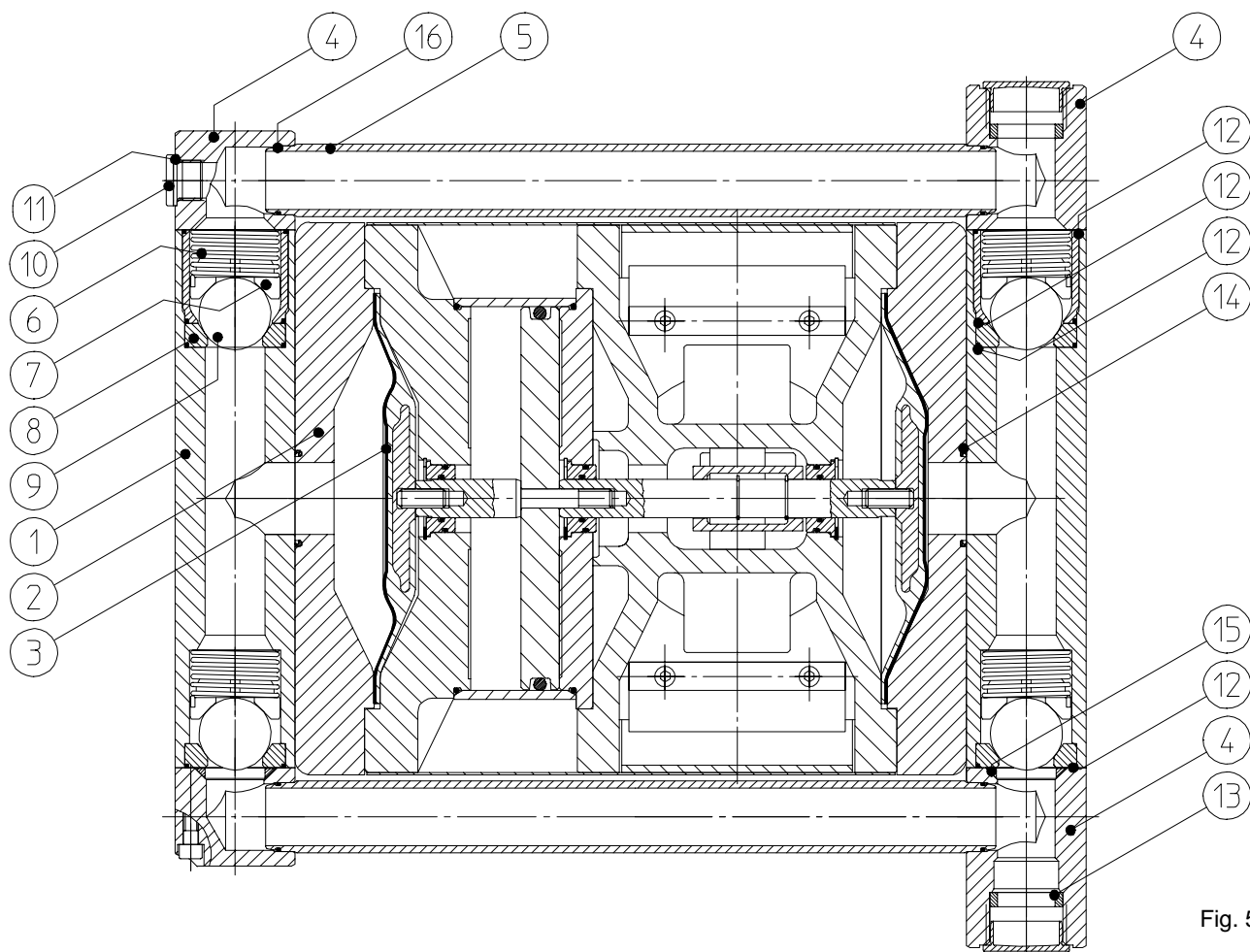


Fig. 5

## DIMENSIONS, SCREW CONNECTION THREADS, NOMINAL DIAMETER OF CONNECTIONS, MOUNTING POSITION

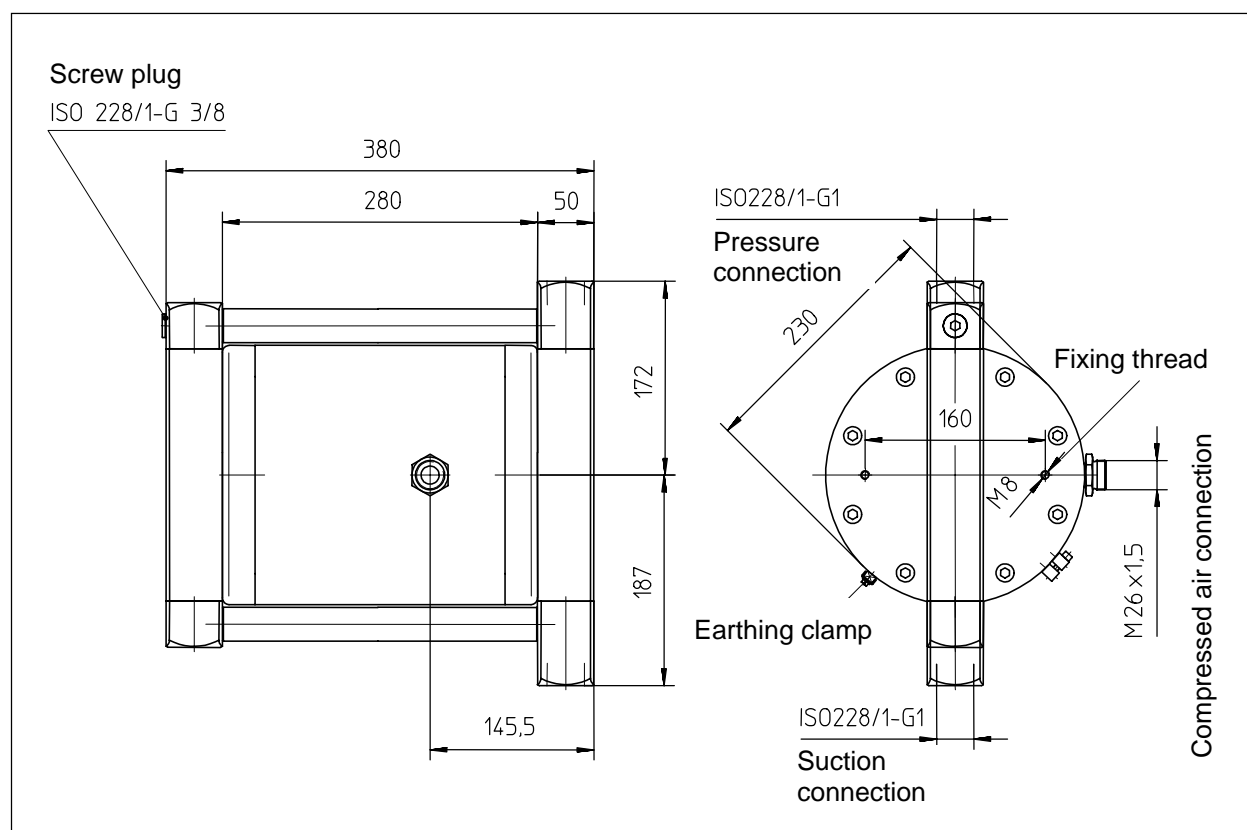


Fig. 6

Compressed air pipe	$DN_L = 13$
Material pressure pipe	$DN_D = 25$
Material suction pipe	$DN_S = 25$

Elastic connections

Diaphragm pump - compressed air network

Diaphragm pump - material container / line necessary.

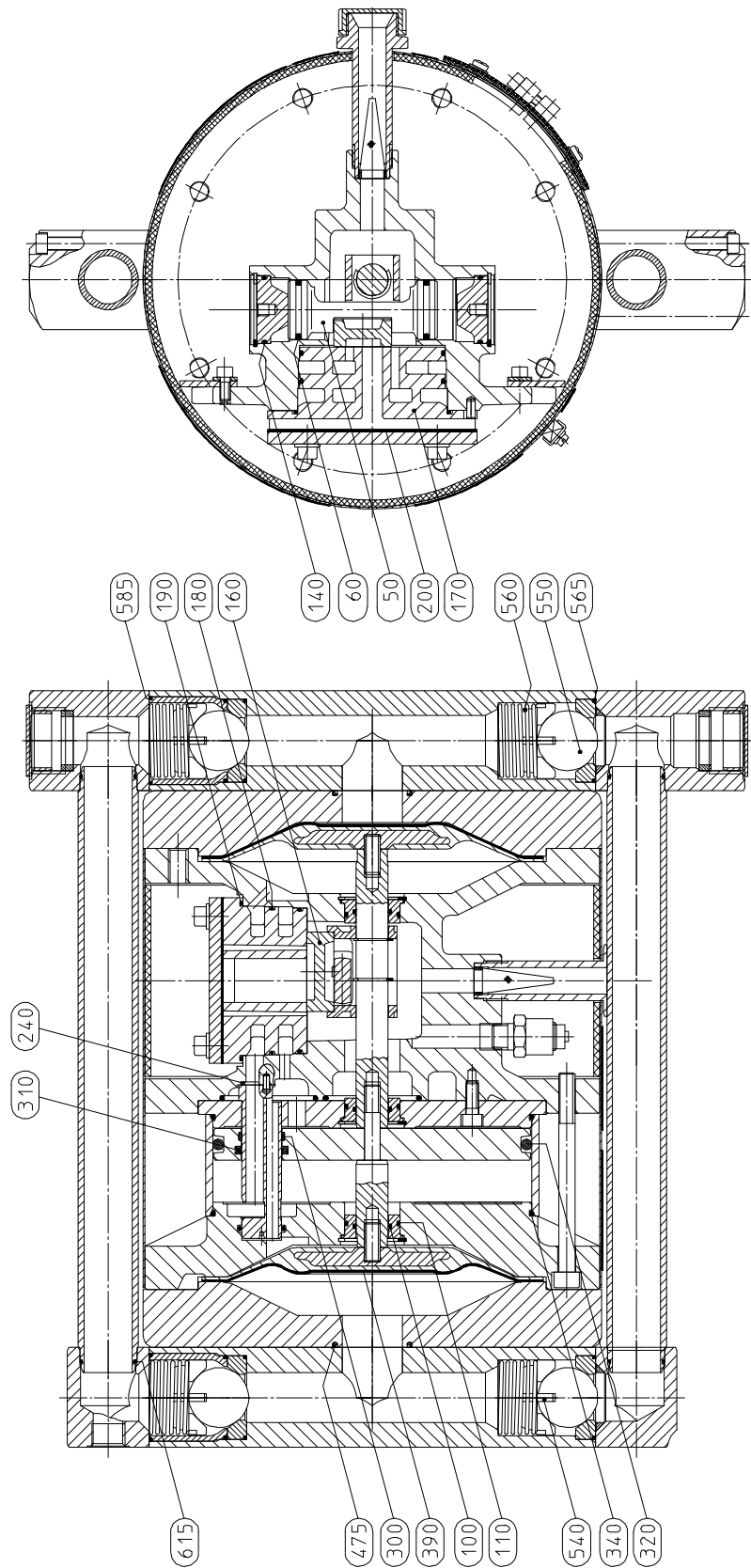
The diaphragm pumps can only be operated in a horizontal position as perfect ventilation of the pump cannot otherwise be guaranteed.

- suction side connection down; - pressure side connection up

## FOOTNOTE

Relevant documentation      Sales catalogue 02.5080

DIAPHRAGM PUMP 003.175



We reserve the right to make amendments

Continued on pages 02 to

Proc. 22.11.00 Hilse	USER INFORMATION - REPLACEMENT PARTS LIST (SETS) -	Issued 11.00
Checked 22.11.00 Kuhn		B.6.50.80-EO



# DIAPHRAGM PUMP 003.175-DP

Replacement part set, diaphragm			Article No. 79978 045001	
Pos.	Number	Designation		
390	2	Moulded diaphragm	D 170	
615	4	O-ring	25 x 2.5 B	

Replacement part set, seals - controls			Article No.. 79978 016001	
Pos.	Number	Designation		
50	1	Drive pin	D 30 x L 75	
60	2	O-ring	26 x 2.5 B	
100	3	O-ring	16 x 2 B	
110	3	O-ring	23 x 2 B	
140	2	O-ring	30 x 2 B	
160	1	Flat slide	39.5 x 29	
170	1	Close sliding seat AE		
180	2	O-ring	67 x 2 N	
190	1	O-ring	73 x 2 N	
200	1	Flat packing	105 x 83 x 0.75	

Replacement part set, valves			Article No. 79978 046001	
Pos.	Number	Designation		
530	4	Spring	35,2 x 1,8 x 30	
540	4	Ball guide		
550	4	Ball	30 mm	
560	4	Valve seat	D 23	

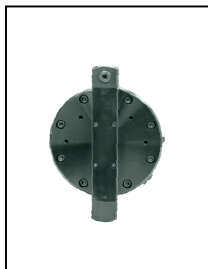
Replacement part set, pneumatic cylinder			Article No. 79978 039001	
Pos.	Number	Designation		
240	1	O-ring	10 x 2 B	
300	1	Drive band	4 x 1,55 x 64	
310	1	X-ring	20.22 x 3.55	
320	1	O-ring	145 x 6 B	
340	2	O-ring	150 x 3 B	

Replacement part set, sealing rings			Article No. 79978 047001	
Pos.	Number	Designation		
475	2	Profile sealing ring	35 x 40 x 3.2	
565	6	Sealing ring	39 x 42 x 1.6	
585	2	Sealing ring	41 x 44 x 1.6	

## REPLACEMENT DIAPHRAGM PUMPS

## REPLACEMENT ACCESSORIES

Diaphragm pumps in basic version

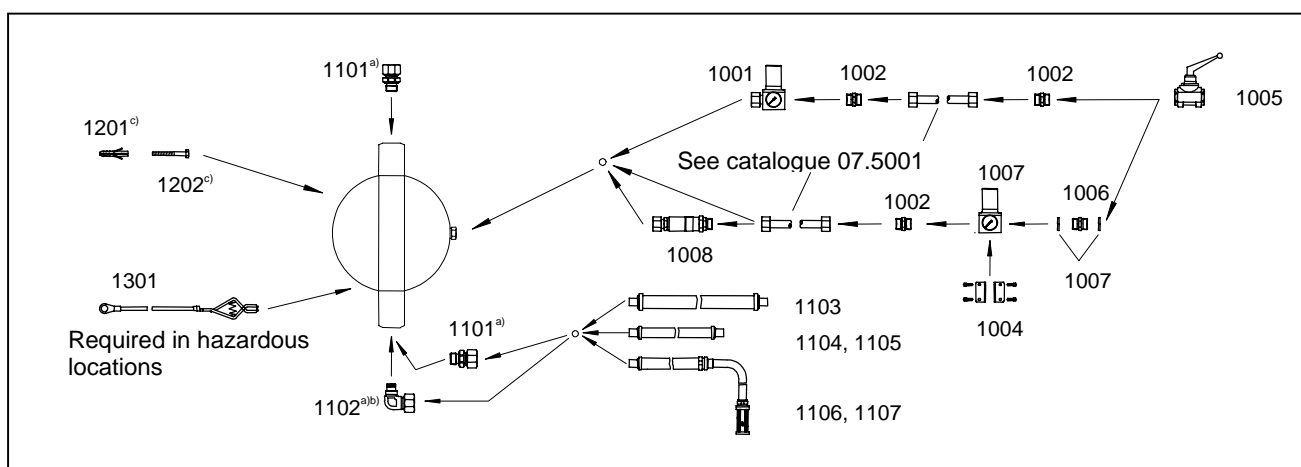


Diaphragm pump 003.175-DP

- without add-on parts

Pos.	Material	Weight in kg	Article No.
003	NIRO (1.4571)	40	79082 151003

### Accessories



	Pos	Designation	Material	Notes	Article No.
Compr. air conn.	1001	Compr. air conn.	-	M26x1,5 – G ½	77522 036003
	1002	Union red.	CrSt	M26x1.5 – R ½ taper..	76639 215001
	1003	Compr. air conn.	-	G ½	77522 036002
	1004	Bracket set	-	to regulator G ½	75650 008002
	1005	Ball cock	CuZn	PN 50 G ½	75601 012004
	1006	Union	CrSt	12 – G ½	76640006002
	1007	Sealing ring	Al	A21 x 26	74188 017070
	1008	Stop valve	-	M26x1.5 PN12	78594 001004
Suction and compr. air conn.	1101	Screwed joint	NIRO	GE 28 – ZLR ED	75204 010005
	1102	Coupling	NIRO	G1 – D28	77741 131003
	1103	Suction hose	NIRO	DN32 2xD28 1000long	77848 035007
	1104	Suction hose	NIRO	DN25 2xD28 1000long	77848 035003
	1105	Suction hose	NIRO	DN25 2xD28 1600long	77848 035004
	1106	Suction hose	NIRO	30l – Vessel	78848 020008
	1107	Suction hose	NIRO	200l – Vessel	77848 020009
Bracket	1201	Dowel	-	D drill 10 L50	75690 001006
	1202	Screw	-	8 x 90	74060 036003
Earthing	1301	Earthing cable	-	Length 8m	73483 001011

a) Replacement sealing ring, article-No. 75188 097003 for pos. 1101 and 1102

b) Replacement O-ring, article-No. 74186 033020 for Pos. 1102

c) For pos. 102, 103, 202, see appropriate sales catalogue 02.5080

Order Example

Please lay out each order as follows:

Designation	Pos. No.	Article No.
Diaphragm pump 003.175-DP	003	79082 151003

## **GRACO STANDARD-WARRANTY**

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve month from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the repaired return of equipment claimed to be defective to an authorized Graco distributor for verification of claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

**THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

**GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO.**

These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

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The parties acknowledge that they have required that the present document, as well as all documents, notices and legal proceedings entered into, given or instituted pursuant hereto or relating directly or indirectly hereto, be drawn up in English.

**GRACO N.V.**

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