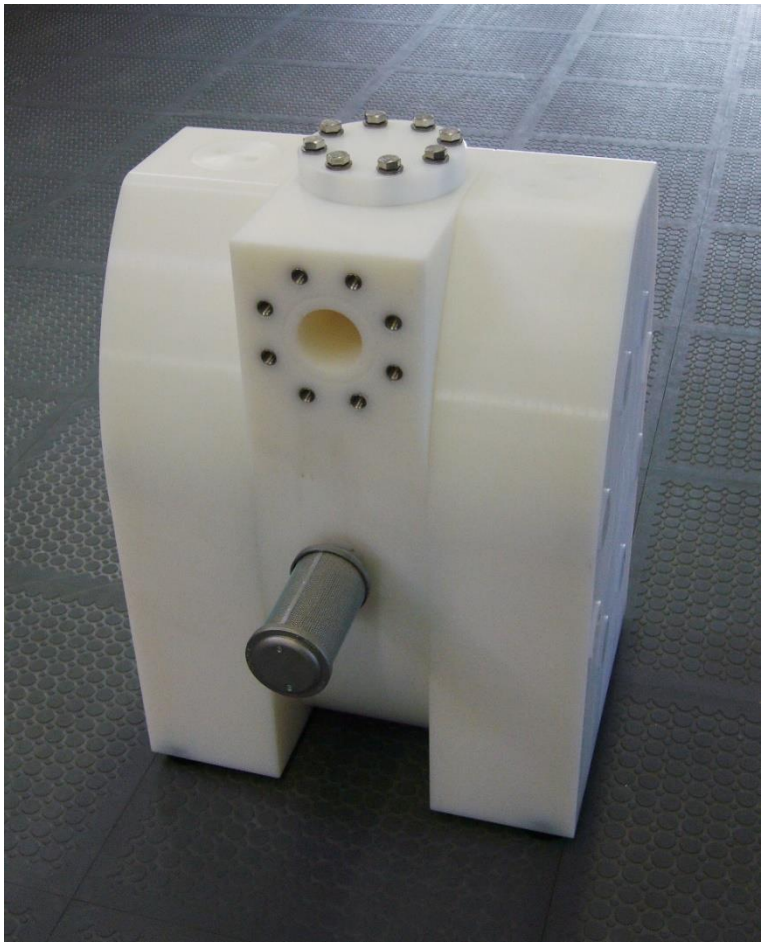
ALMATEC

Operating and Installation Instructions

E-Series
Pump Size E 80



Air-Operated Diaphragm Pumps made of Plastic

ought to be studied before installing the pump

Original Instruction

CE

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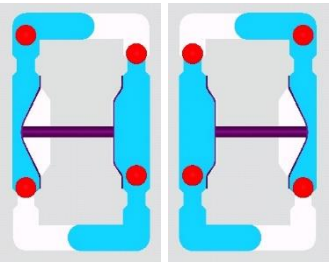
Introduction

ALMATEC air-operated diaphragm pumps are constructed according to the state of the art and they are reliable. Imminent danger by operating error or misuse can lead to damages of properties and/or persons. The pumps are to be applied for the intended use and in a safety-related proper condition only.

Each person working on the ALMATEC air-operated diaphragm pumps concerning installation, start-up, handling or maintenance has to read this manual completely and in an attentive way and has to follow all mentioned procedures and safety notes.

General description of the machine, appropriate use and residual dangers



The ALMATEC E-Series pumps are oscillating positive displacement pumps and are based on the functional principle of double diaphragm pumps. The basic configuration consists of two external side housings with a center housing between them. Each of the side housings contains a product chamber which is sealed against the center housing by a diaphragm. The two diaphragms are interconnected by a piston rod. Directed by an air control system, the diaphragms are alternately loaded with compressed air so that they move back and forth. In the first figure, the compressed air has forced the left-hand diaphragm towards the product chamber and displaced the liquid from that chamber through the open valve at the top to the discharge port. Liquid is simultaneously drawn in by the right-hand diaphragm, thus refilling the second product chamber. When the end of the stroke is reached, it reverses automatically and the cycle is repeated in the opposite direction. In the second figure, liquid is drawn in by the left-hand diaphragm and displaced by the right-hand diaphragm.

The appropriate use of an Almatec air-operated diaphragm pump of the E-Series refers to the liquid transport taking into account the operation parameter mentioned in this manual and in compliance of the given terms for commissioning, operation, assembly, disassembly and maintenance.

Even if all necessary safety measures described in this manual have been met, a residual danger exists by leakages or mechanical damages. At sealing areas or connections liquid can be released uncontrollably then.

Storage and long-term usage

In general the ALMATEC pump is delivered operational and packaged. If the unit is not installed right away, proper storage conditions are important for a trouble free operation later. The pump has to be protected from wetness, coldness, dirtying, UV-radiation and mechanical influences. The following storage conditions are recommended:
- Steady ventilated, dust and vibration free storage room
- Ambient temperature between 15°C (59°F) and 25°C (77°F) with a relative humidity below 65%
- Prevention of direct thermal influences (sun, heating)

Plastic materials are subject to aging processes depending on material, surrounding conditions and application parameters. Chemical contact and/or increased temperature can amend material characteristics on the long run, especially mechanical capabilities. For safety reasons, we do therefore recommend as part of every maintenance (resp. in case of no maintenance till then after two years and then every six month): A careful visual check of all pump parts for visible damages, a tactile check of all sealing surface (e.g. by moving a finger along the surface after cleaning), a shape-check of the housing parts (e.g. by laying a drawer on plain surfaces) and a movability check of all threads. Any eventually damaged part needs to be replaced!

Code system

PSG Germany GmbH is certified as a modern, quality-orientated enterprise acc. to DIN EN ISO 9001 and 14001. Before release for dispatch, any pump of the E-Series has to undergo an extended final control. The performance data registered during this are archived in our records and can be read back at any time.

As a general rule in the countries of the EU only such machines are allowed to take into operation, which are determined to meet the regulations of the EU machinery directive, the harmonized standards, European standards and the respective national standards. Hence the operator has to verify whether the ALMATEC pump manufactured and delivered properly according to the customers order meets the mentioned requirements.

Therefore make sure, before putting the pump into operation, that the pump and the used materials of construction are suitable for the provided application and the installation site. To check this, the exact pump code is required. This code, the serial number and the year of construction are noted on the identification plates on the pump itself.

Example to clarify the ALMATEC pump code:

E 80 E E E - TV

- **TV** – Optional equipment:
  - BS Optional equipment
  - C Stroke counting
  - D Diaphragm monitoring
  - TV Damper preparation (TVD without blind flange)
  - W ANSI flange
- **E** – Type and material of product valves:
  - E Ball valves, EPDM
  - N Ball valves, NBR
  - T Ball valves. PTFE
- **E** – Diaphragm material:
  - E EPDM
  - N NBR
  - T PTFE/EPDM-compound
- **E** – Housing material:
  - E PE
  - F PE-conductive
- **80** – Size and port dimension
- **E** – ALMATEC Pneumatic diaphragm pump, E-Series

The number in brackets, which is added to every part mentioned in the following explanations, refers to its position in the spare part list and the exploded view.

OPERATION IN EX-AREAS OR PUMPING FLAMMABLE LIQUIDS

X = CAUTION! = Special operating conditions apply!

For pumping flammable liquids or in Ex-areas, only pumps with housing parts and internals made of conductive plastic may be used. Air-operated diaphragm pumps of the E series with housing codes F (PE conductive) and U (PTFE conductive) meet this requirement. They must generally be grounded via a connection on the central housing [4]. The ground connection must have a minimum cross-section of 6 mm^2. All other housing parts are conductive and connected to each other .

ALMATEC air-operated diaphragm pumps made of electrically conductive PE/PTFE are suitable for use in potentially explosive atmospheres of category 2 and 3 ("Zone 1" and "Zone 2" respectively), atmosphere G/D, which are subject to the scope of EU Directive 2014/34/EU. Conductive diaphragms (material code 68, 70, 72) can be used without restriction for pumping liquids in all explosion groups. If non-conductive diaphragm materials are used (material code 67, 98), for explosion group IIB within the pump following protection measure (minimum one) must be taken for pump size E 80 as examples:

- exclusive use of water-miscible or conductive pump media or
- Avoidance of dry running through operational measures or
- inerting during dry running with nitrogen, water, carbon dioxide, etc. following the pumping operation.

Pipelines and product connections must be grounded separately. To avoid ignition hazards, the formation of dust deposits on the units must be prevented. Repairs in hazardous areas may only be carried out after careful examination of the feasibility and only with appropriate tools and by trained specialist personnel.

The ATEX marking according to Directive 2014/34/EU can be found in the enclosed Declaration of Conformity and the corresponding sticker on the pump or damper.

The interfaces for electrical accessories have been considered and do not represent a new potential ignition source.

The type of protection **"c = design safety"** was applied in accordance with guideline EN ISO 80079-37.

SPECIAL OPERATING CONDITIONS	E80
Permissible ambient temperature °C (°F)	-10 – 50 (14 – 122)
Permissible temperature compressed air °C (°F)	0 – 50 (32 – 122)
Maximum drive and operating pressure bar (psi)	7 (101,5)
Maximum operating temperature °C (°F) (X):	70 (158)

The ATEX marking for gases and dusts is defined as follows according to 2014/34/EU:

In order to enable the optimum and flexible design of an ATEX pump to the customer-specific application, a differentiation is made in the marking between the installation location of the pump (hazardous area outside the pump) and the inside of the pump (hazardous area inside the pump).

Equipment category G (gases, mists, vapors)

Installation site: Category G

Inside the pump: Category G

Conductive ALMATEC air-operated diaphragm pumps may generally be used in explosion group IIC at the installation site (potentially explosive area outside the pump), since the solid housings are made of dissipative materials and the entire pump is grounded.

ATTENTION! Inside the pump, the permitted explosion group varies depending on the diaphragm material used:

When using ***non-conductive diaphragms***, explosion group IIB applies inside the pump:

⟨Ex⟩ **II 2/2 G Ex h IIB/IIC T6…T4 Gb/Gb X** (inside the pump/installation site)

When using ***conductive diaphragms***, explosion group IIC applies inside the pump:

⟨Ex⟩ **II 2/2 G Ex h IIC/IIC T6…T4 Gb/Gb X** (inside the pump/installation site)

Equipment category D (dusts)

Installation site: Category D

Inside the pump: Category G

Conductive ALMATEC air-operated diaphragm pumps may generally be used in dust group IIIC at the installation site (potentially explosive area outside the pump; equipment category D).

ATTENTION! Inside the pump (equipment category G), the approved explosion group varies depending on the diaphragm material used:

When using ***non-conductive diaphragms***, explosion group IIB applies inside the pump:

⟨Ex⟩ **II 2/2 D Ex h IIB/IIIC T 70°C…130°C Gb/Db X** (inside the pump/installation site)

When using ***conductive diaphragms***, explosion group IIC applies inside the pump:

⟨Ex⟩ **II 2/2 D Ex h IIC/IIIC T 70°C…130°C Gb/Db X** (inside the pump/installation site)

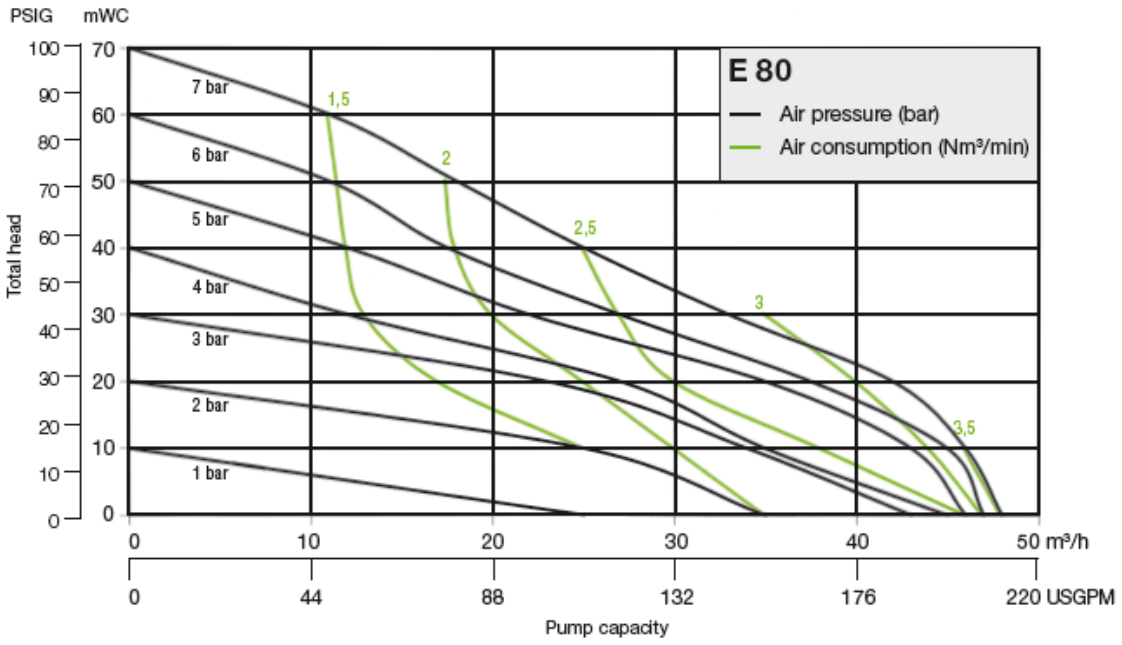
Technical Data and performance chart

Technical data		E 80
Dimensions, mm (inch):	length width height	700 (27.6) 627 (24.7) 844 (33.2)
Nominal port size Air connection	DIN / ANSI BSP	3” R 3/4“
Weight, kg (lb):		207 (456)
Max. particle size of solids for pumps with ball valves	mm (inch)	15 (0.6)
Suction lift dry, mWC (ft) Suction lift wet, mWC (ft)		3-4 (9.8-13.1) 9,5 (31.2)
Max. driving and operating pressure, bar (psig)		7 (100)
Max. operating temperature, °C (F)		70 (158)
Theoretical displacement volume per single stroke (l)		5,1
Sound power level L_{WA} [dB (A)]:** driving pressure 3 bar driving pressure 5 bar driving pressure 7 bar		 73,0-74,3 77,3-79,1 77,8-80,9
Sound pressure level L_{pf}, 1 m [dB (A)]:*** driving pressure 3 bar driving pressure 5 bar driving pressure 7 bar		 58,7-60,0 63,0-64,8 63,5-66,6

** determined in sound power level measurements according to EN ISO 3744 respectively EN ISO 9614 in laboratory and practise conditions

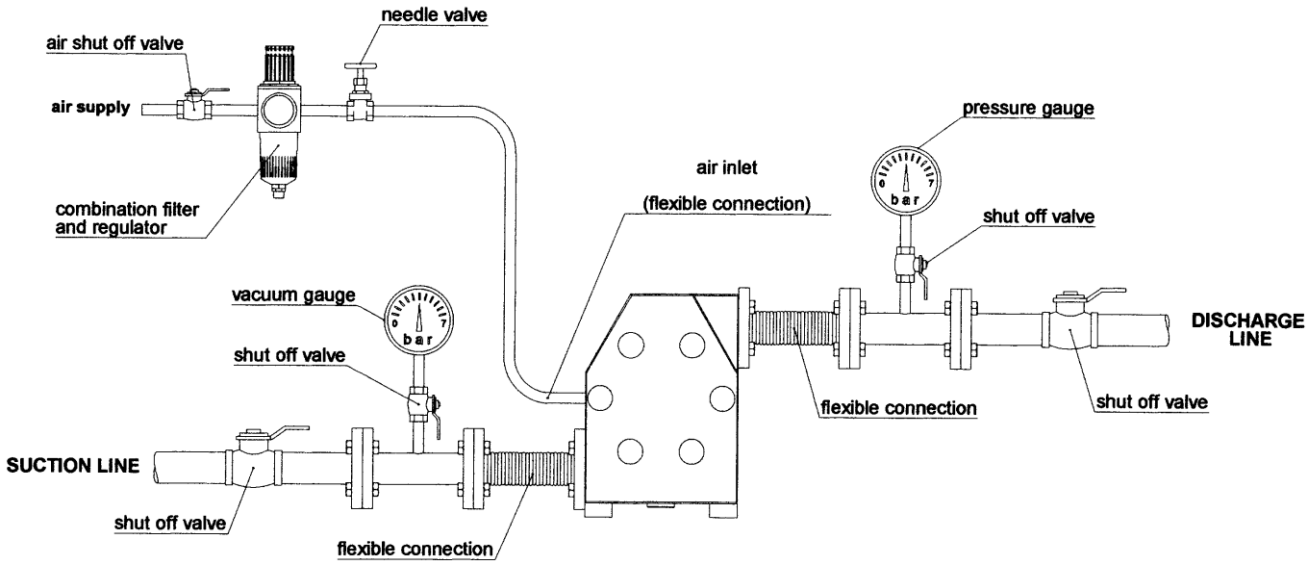
*** sound pressure levels as average location-independent values calculated norm-conformous from the location of the sound power levels listed above

These technical data refer to ALMATEC E-Series pumps without optional equipment.



Performance data are in accordance with DIN EN ISO 9906. The data refer to water (20°C) without using of a pulsation damper.

Recommended installation



Installation, operation and maintenance

UV-radiation can damage the housing parts of pumps made of PE. In general, the pump has to be connected load free. The flange connections (DIN or ANSI) of the product ports with the suction inlet horizontally at the bottom and the discharge outlet horizontally at the top are integrated into the center housing [2] (torque value 30 Nm). Neglecting this causes leakage and maybe even damages. To avoid vibrations, pulsation dampers and compensators are recommended. Before connecting the pump, take the yellow blind plugs out of the suction and discharge connections as well as the air inlet [19] in the center housing [2].

The operator is responsible for an adequately stability and an appropriate fixation of the piping according to the state of the art. To facilitate the installation and maintenance shut off valves should be installed right before and after the pump. The nominal width of the connection pipes has to be chosen in accordance to the connections of the pump. A smaller piping can cause cavitation (suction line) as well as a loss of performance (suction and discharge line). In case the pipe is too big, the dry suction capacity of the pump can decrease. Connect the suction line to the lower connection in the center housing [2]. Seal the suction line diligently; hosepipes should be suitably armoured. A suction line continuously rising will prevent the formation of air locks in the line which would affect the suction lift.

The air inlet [19] is located in the middle of the center housing [2]. Before installation make sure that the air supply pipe is free of solids. To supply the pump with driving air sufficiently, the pipe diameter should match the size of the air inlet. Take care that no dirt or particles can intrude into the pump during the connection, as these can accumulate inside the pump and can cause malfunctions. The integrated air control system *PERSWING P®* [22] is a precision-control that requires oil-free, dry and clean compressed air for optimal function. If humidity is expected, a water separator or air dryer has to be fitted to protect the pump from blocking by ice. The ideal condition is the dewpoint of air at -20°C (-4°F). In humid surroundings, icing from the outside may occur despite the driving air is dried. If so, a prolonged waste-air-exhaust (ca. 500 mm / 20 inch by pipe or hose) can be helpful. When installing the pump into boards or cabinets, it has to be ensured that cold air does not get caught behind the muffler. In applications with a tendency to freezing at the waste air exhaust, good experiences in practise have been achieved by pre-heating the driving air to increase the distance to the dew point of the air. Doing so, it has to be considered that the driving air temperature generally may not exceed 50°C (122°F) to avoid expansion and sticking effects on the air side. This max. air temperature is a well valid when using a compressor producing warm air which is e.g. often true for truck compressors.

The pressure of the driving air should be limited to the amount required to meet the performance needed. Excessive pressure increases both the air consumption and the wear of the pump. The pump is regulated by tuning the flow rate of the air. For a proper operation at the lower performance range the regulation via a needle valve is recommended. An empty pump has to be driven slowly (e.g. via a needle-valve). The pump starts automatically. Pumps of the E-Series are self-priming when dry, thus it is not necessary to fill the suction line of the pump. The suction lift capacity of a liquid-filled pump, however, is much higher. The pump is appropriate for running dry during slow operation. Dry running at high stroke frequency causes premature wear. The pumps can briefly (up to max. one hour) be operated against a closed discharge line. Throttling on

the suction side may damage the pump. When the pump operation has been stopped by a closed discharge, the pressure equilibrium of the diaphragms must be ensured. This can be achieved by keeping the pump connected to the air supply pressure; for longer stoppage, the pump must be released from the pressure within the system on both fluid side and air supply side.

Safety hints

- Before putting the pump into operation as well as after some hours of pumping, the housing bolts [15] have to be fixed according to the torque data of 50 Nm (37 ft lbs), as the elements of construction "settle". The valve stops discharge valve [6] and the plugs [7] have to be fixed too. Fixing all these parts is necessary as well after periods of stoppage, at temperature variations, after transport and dismantling the pump. In case of temperature varying between extremes or high temperature difference between the liquid and the surrounding, the housing bolts should be controlled more frequently (interval proposals are available on request).
- Installation, operation, and maintenance by qualified staff only.
- Before start-up of the pump anyone should acquaint oneself with the explanations of the chapter troubleshooting (see pages 12/13). Only by this the defect quickly can be realized and eliminated in case of trouble. Problems which cannot be solved or with an unknown reason should be passed on to the manufacturer.
- Before any maintenance and service procedures arising on the pump or on the optional equipments, the complete installation has to be turned off and protected against accidental turn on. This is possible by a lockable emergency stop for the air supply of the pump. Additional a danger sign against restart should be attached.
- Pressure tests of the plant a pump is included in may only be carried out with the pump disconnected from the pressure on both ports or by using the pressure the pump develops while operating. The load of a pressure in the plant may damage the pump.
- Pump must not be operated with a positive suction pressure.
- Depending on the conditions of operation, the liquid conveyed might escape from the pump through the muffler in case of a diaphragm rupture (in this case muffler has to be replaced). For further safety requirements the optional equipment diaphragm monitoring and barrier chamber system are recommended.
- In case of a diaphragm rupture, it might be possible fort he fluid pumped to intrude into the air side of the pump. In very adverse conditions - e.g. pressure within the fluid system during stopped air supply - the fluid might as well find its way into the air supply lines. To protect other devices like pulsation dampers or even pneumatic valves, it is recommended to protect the air supply line accordingly, e.g. via a non-return valve. This would as well avoid polluting the air supply line.
- The state of the muffler has to be inspected regularly, as a blocked muffler can be forced out of the pump. If this happens, damages of properties and/or persons cannot be excluded.
- If the product tends to settle, the pump has to be flushed regularly. For larger solids a filter has to be installed in the suction line.
- In case of delivery of hot liquids the wetted pump must not standstill for a longer time, because it could lead to temporary leaks in the valve area and to a blockade of the air control system.
- The relevant effective security advises have to be respected.
- Pools of liquid which appear in the near outer area of the pump have to be inspected on danger potential, if necessary safety measures are to be taken.
- Chemical and biological reactions in the product chamber of the pump (mixture of different substances) and the freezing of the liquid have to be avoided.
- Before starting to disassemble the pump, take care that the pump has been emptied and rinsed. Both ports piping are to be closed and drained if applicable. Further the pump has to be cut off from any energy on the air and product side. If the pump is being deported from the plant, a reference about the delivered liquid has to be attached.
- Please respect the relevant additional security advices, if the pump has been used for aggressive, dangerous or toxic liquids (e.g. suitable protective equipment according to the safety data sheet of the liquid). In case of a diaphragm rupture, it is possible that residues of the liquid remain behind the diaphragms, in the area of the air control system and at the muffler, despite of several flushing processes. Hence, appropriate safety equipment according to the safety data sheet of the liquid is indispensable.
- Additional advice for handling sensitive Fluids: With correct material choice, all wetted parts inside the pump are made from materials appropriate for your fluid - selected types as well for for food contact. A malfunction, however, might result in a contact of the fluid to components that are non-wetted during normal operation (e.g. inside the air section). Therefore, we recommend as usual for pumps, to discard the batch after a malfunction when handling

sensitive fluids. Please consider that a conformity for food-contact solely refers to wetted materials themselves, NOT to a “Hygienic Pump Construction”.

- Before putting the pump back into operation, the tightness of the pump has to be checked.
- Air-operated diaphragm pumps can lead to bruises when lifting, sinking or assembling them. Appropriate accessories and safety equipments are to be used. Big and heavy modules have to fixed and secured to lifting gears when transporting/replacing them.

- Especially when deliver critical liquids, wear parts, like diaphragms, should be replaced within a preventive maintenance.
- The use of non-original ALMATEC spare parts and structural changes lead to the lapse of the warranty immediately. When operating such a pump, damages of properties and/or persons cannot be excluded.
- The operation of the pump with nitrogen as driving gas is possible. In closed rooms sufficient ventilation must be provided.
- Possible electrical connections (e.g. when using optional equipment with controllers) may be executed by a qualified person only. The regulations of the respective manufacturers are to be followed.
- At any work arising it has to be made sure that no explosive atmosphere can appear. Appropriate safety equipment is recommended.
- Procedure for pump return: According to the requirements of our 14001-certification, every unit which is send to ALMATEC for diagnosis or maintenance reasons has to be accompanied by a filled out decontamination-sheet. Otherwise a processing is not possible. The decontamination-sheet is enclosed to this manual. Please pay attention to the further safety regulations.

Using as submersible pump

Consider the following advises when using an E-Series pump as a submersible pump: When immersing an air-operated diaphragm pump, it must generally be ensured that the waste air is deducted above the fluid level with a pipe or similar. The pump must be located vertically upright to guarantee proper function. Minute leakage on the air inlet or outlet can block the air valve. The pump must be disconnected from the pressure within the system during standstill. When choosing the pump type, it must be taken into consideration that all external parts - even those non-wetted during standard operation - like covers, shock absorbers, connections etc. must be resistant to the fluid pumped. Please consider as well that depending on the material, the pump must be weight down resp. fixed.

Additional temperature hints

The temperature and pressure limitations listed on page 5 are solely based on mechanical temperature limits of the housing material used. Depending on the fluid pumped, the maximum safe operating temperature of the housing material can be reduced significantly.

A general aspect of lower temperatures is, that below 0°C (32°F) cold-brittling of the elastomers used within the pumps can results in accelerated wear. Regarding the housing materials, please note that PE - other than PP - keeps its mechanical strengths at low temperatures. ALMATEC pumps of the E-Series can therefore be operated safely as well within low-temperature installations: However, with liquids below 0°C (32°F) accelerated wear of internal parts has to be accepted. Moreover, freezing, bogging or crystallisation of the fluid pumped must be avoided, especially within the pump. Emptying the pump via the drainage system (optional equipment code R) may be a useful tool to assist this.

Please consider, that viscosity and specific gravity of most fluids change with temperature (most often increasing at lower temperature). Depending on the application, this fact may not only result in result in a reduced flow rate, the pump may even be unable to prime the thicker and/or “heavier“ fluid any more.

In case of varying application temperatures, the housing bolt tension has to be controlled very thoroughly, as variations like these can change the effective tension of the housing bolts via the different thermal expansion characteristics of single.

Disassembly

When dismantling a pump the mentioned procedures and safety notes on the previous pages have to be considered generally. The general design of the ALMATEC E-Series is simple. Two tools are delivered along with every pump. The plastic one of these is designed for the mounting of the air-valve [22], the other one for the mounting of valve seat [10]. Further special tools are not required.

Take the caps out of the side housings [1] to get access to the housing bolts [15]. Unscrew the housing bolts [15] on one side using a socket wrench and remove the side housing [1]. Work carefully to ensure that the sealing surfaces in contact to the diaphragms are not damaged. Carefully draw the housing bolts [15] out of the pump. The center housing [2] and both side housings [1] are removeable now. Remove the sleeve [3] out from the side housing [1]. Take the O-rings sleeve [11] out of the center housing [2] and both side housings [1] for a possible renewal.

For further dismantling of the side housings [1], screw out the valve stop, discharge valve [6] with an appropriate wrench (figure 9.1). Alternatively, you can stick two housing bolts [15] into the holes in the valve stop [6] and loosen the valve stop with a third housing bolt [15] fixed in between the others. Take out the ball valve [9] and the O-ring, valve stop, discharge valve [12]. Use the metallic mounting tool to unscrew the valve seat [10] (figure 9.2/9.3).

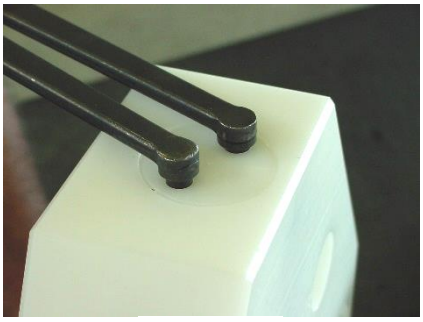


figure 9.1

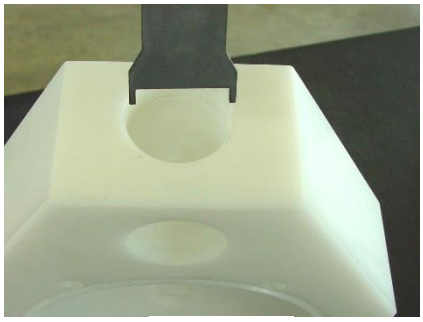


figure 9.2

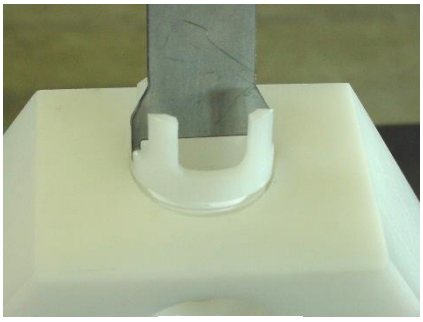


figure 9.3

The plug, side housing [7] can be unscrewed the same way as described for the valve stop [6]. Loosen the bolt, valve stop [5] with a screw-driver and remove lock bolt [4] and ball valve [9]. Turn the mounting tool and screw the valve seat [10] into the side housing [1] (figure 9.4). The valve seat [10] and the valve stop, discharge valve [4] can now be removed from inside the side housing.

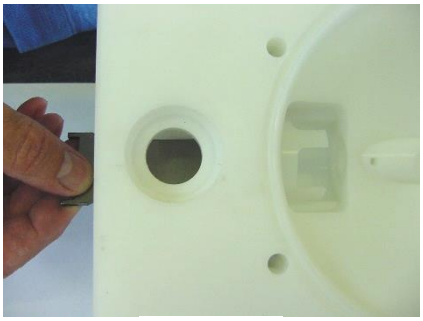


figure 9.4

figure 9.5

Screw one diaphragm [14] left-turning off the shaft [16] and pull the other diaphragm [14] out of the center housing [2] using the shaft[16]. Take set screws shaft [17] out of the diaphragms [14] (figure 9.5). Remove both parts of the shaft piston rings [18] from their grooves carefully (figure 9.6); do not damage the edges in the center housing, a re-assembly of the same piston rings is impossible, they have to be replaced.

Unscrew the muffler [21], the air inlet [19] and the air filter [20] out of the center housing [2]. To remove the *PERSWING P*® air control system, screw off both end caps using the plastic mounting tool delivered with the pump (figure 9.7). Take out main and pilot piston. Push out the air valve housing with the mounting tool turned around (figure 9.8).

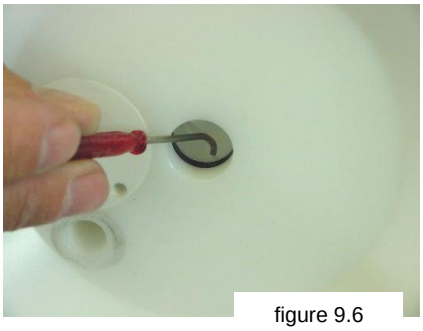


figure 9.6

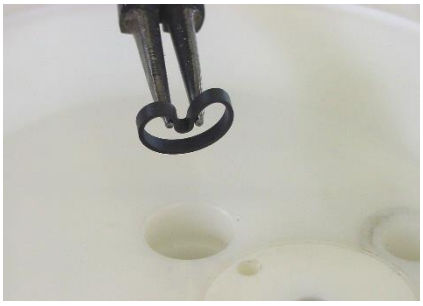
figure 9.7

figure 9.8

Assembly

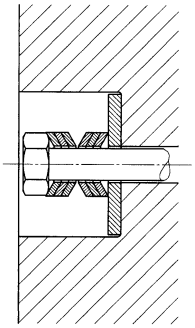
The re-assembly of the components is principally carried out vice-versa to the dismantling. Here are some additional references.

For the installation of the *PERSWING P*® air control system, first screw in one end cap flushly into the center housing [2]. Insert one of the six O-rings air-valve housing [24] into the end cap from the inside. Moisture the four O-rings [24] of the air-valve housing with a bit of water and push the housing into the center housing [2] using the mounting tool. Take care that it slips in softly. Do never insert the housing violently with a hammer. In case the housing cocks or hardly gets in, take it out again completely and start again. Insert the main piston and the pilot piston. Lay the sixth O-ring [24] on the edge of the air valve housing and screw in the second end cap.



To assemble new piston rings [18], carefully shape them like kidneys with locking ring pliers and insert the rings into the grooves in the center housing [2] (figure 10.1); completely press the rings into the grooves smoothly using some round tool.

Screw the set screws [17] into the diaphragms and tighten them. Fix the diaphragms [14] completely into the shaft [16] with the set screws [17]. Adjust the bores in the center housing [2] to the diaphragm on both sides (turn slightly backwards if necessary). The sealing surfaces of the diaphragms and the side housings [1] have to be absolutely clean and undamaged; mere small scratches can cause leaking (if necessary, smoothen the housing surfaces carefully with fine sandpaper).



When assembly the housing bolts pay attention to the correct arrangement of the spring washers. The pump sizes E 80 has 6 spring washers on both housing bolt sides. Figure 10.2 shows the arrangement. The arrangement represented in the drawing makes an improvement of power and way possible. Already used spring washers may not be installed again.

Cautiously push the O-rings, sleeve [11] into the side housings [1] and the center housing [2] (avoid bending the rings by all means! If necessary, moisture and softly twist the rings). Shove one diaphragm [14] into the center housing [2], lay the side housing [1] onto the diaphragm and fix its position with housing bolts [15]. After that, shove the other diaphragm [14] into the center housing [2] and carefully push the housing bolts [15] completely through the center housing [2] [slightly turning the bolts helps them to find their way]. Take care, that the diaphragms [14] are not damaged. Adjust the second side housing [1]. Fix the housing bolts [15] crosswise evenly according to the given torque values until the side housings [1] are situated on the center housing [2]. Any further tightening of the bolts does not improve sealing but can deform the housing! Before putting the pump back into operation, the tightness of the pump has to be checked.

Only use original ALMATEC spare parts for repairs and / or preventive maintenance work. If this is not observed, the CE and ATEX markings, the declaration of conformity (s) and the guarantee claim for the pump will expire.

All work on the pump may only be carried out with the appropriate tools and by trained specialist personnel.

Troubleshooting

Malfunction	Possible Reason	Solutions/Remarks
pump does not operate	air supply line blocked/closed	open air supply
	muffler blocked	clean/replace muffler
	working chambers blocked	remove blockage
	air control system defective	replace air valve system
	discharge line blocked/closed	clean/open line
pump operates unsteadily	piston rings worn	replace piston rings
	air control system worn	replace air control system
	diaphragm rupture	replace diaphragm, clean pump
	air control system soiled	clean/replace air control system
	check valve blocked	cleaning, removal of bulk particles
	icing	improve air processing
air within liquid	suction line leaky	seal suction line
	container with liquid empty	fill/new container
	diaphragm rupture	replace diaphragm
	cavitation	adapt suction lift, possibly install suction pressurised air chamber
insufficient discharge pressure	insufficient pressure/amount of driving air	increase air supply
	air supply line leaky	check/repair air supply
	air control system leaky	replace air control system
	check valve worn	check/replace check valve
	more air consuming components	increase pressure/amount of air
output decreases	air control system soiled	clean/replace air control system
	icing	improve air processing: dryer/filter
	air pressure drop	ensure sufficient supply of air
	suction line/inlet strainer soiled	cleaning
	discharge line/outlet strainer soiled	cleaning
	muffler blocked	replace the muffler
	check valve worn	replace valve
	change in viscosity	change back/adjust pump
	more air consuming components	increase pressure/amount of air
pump stops itself	icing of the air control system	improve air processing: dryer/heater etc.
	air pressure to low	increase air pressure
	air pressure drop	ensure sufficient air supply
	discharge line blocked	clean discharge line
	air filter blocked	clean air filter
	valve closed	open valve
	air control system defective	replace air control system
	wear/leaking of air control system	replace air control system
	diaphragm rupture	replace diaphragm, clean pump
	check valve blocked/worn	clean/replace check valve

Malfunction	Possible Reason	Solutions/Remarks
pumps operates, however suction capacity insufficient	pump operates too fast	start more slowly
	operation beyond physical limits	adjust installation
	cavitation	check, cool down
	operation beyond pump capacity	adjust installation resp. install bigger pump
	air cushion within suction/discharge line	bleed the line
	dry suction against discharge pressure	wet pump, start without pressure
	valve filter within suction line closed	open valve/clean filter
	valve filter within discharge line closed	open valve/clean filter
	container with liquid empty	fill/new container
	vacuum inside the container	bleed container
	wear of the check valves	replace valves
	suction line leaky	seal suction line
	suction line blocked	clean suction line
	air pressure cushion at discharge	bleed discharge line
	check valve blocked	clean/replace valve
insufficient suction capacity after pump repair	connections tighten incompletely	tighten/seal connections
	check valves inserted falsely	correct positioning of check valves
diaphragm overstrained	pressure within the plant/system	ensure that pressure is only developed by the pump itself, check plant/valves, replace diaphragms
	inadmissible vacuum	check suction line, open valve
	icing	improve air processing
leaking between housing parts	housing bolts loosened	tighten bolts, check pump
	O-rings sleeve damaged	replace O-rings
	diaphragms attacked chemically	replace diaphragms
	diaphragms overstrained	replace diaphragms
	tension installation/pipework	loosen, eliminate tension, use of a compensator
muffler grey	driving air too humid, icing	improve quality of driving air
muffler black	soiled, oily air	improve quality of driving air, install sensitive filter in suction line
pump is connected to air but does not operate	air control system blocked	clean/replace air control system
	bulk particles/dirt	clean pump, replace necessary parts, improve air quality
	chemical influence (O-rings swollen)	check, replace damaged parts
	valve closed in discharge line	open valve

Spare part list

Pump size				E 80 E..	E 80 F..
Item	**Pc.**	**Description**	**Material**	**Part Number**	**Part Number**
1	2	Side housing	PE/PE conductive	7 80 010 52	7 80 010 56
2	1	Center housing, DIN Center housing, ANSI	PE/PE conductive PE/PE conductive	7 80 011 52 7 80 411 52	7 80 011 56 7 80 411 56
2a	16	Thread bushing, center housing, DIN Thread bushing, center housing, ANSI	1.4305 1.4305	2 40 169 22 3 40 069 22	2 40 169 22 3 40 069 22
2b	2	O-ring, center housing, code .E. O-ring, center housing, code .T.	EPDM FEP/FKM	9 99 629 72 9 99 629 59	9 99 629 72 9 99 629 59
2c	1	Muffler cap	PE/PE conductive	2 80 046 52	2 80 046 56
3	4	Sleeve	PE/PE conductive	2 80 012 52	2 80 012 56
4	2	Lock bolt	PE/PE conductive	2 80 113 52	2 80 113 56
5	4	Bolt, valve stop	PE	2 40 014 52	2 40 014 52
6	2	Valve stop, discharge valve	PE/PE conductive	2 80 015 52	2 80 015 56
7	2	Plug, side housing	PE/PE conductive	2 80 017 52	2 80 017 56
7a	2	O-ring, plug side housing, code .E. O-ring, plug side housing, code .T.	EPDM FEP/FKM	9 99 635 72 9 99 635 59	9 99 635 72 9 99 635 59
9	4	Ball valve, code ..E Ball valve, code ..T Ball valve, code ..N	EPDM PTFE NBR	1 80 032 73 15-1080-55 1 80 032 71	1 80 032 73 15-1080-55 1 80 032 71
10	4	Valve seat	PE/PE conductive	2 80 018 52	2 80 018 56
11	8	O-ring, sleeve, code .E. O-ring, sleeve, code .T. O-ring, sleeve, code .N.	EPDM FEP/FKM NBR	9 99 635 72 9 99 635 59 9 99 635 71	9 99 635 72 9 99 635 59 9 99 635 71
12	2	O-ring, valve stop, discharge valve, code .E. O-ring, valve stop, discharge valve, code .T. O-ring, valve stop, discharge valve, code .N.	EPDM FEP/FKM NBR	9 99 629 72 9 99 629 59 9 99 629 71	9 99 629 72 9 99 629 59 9 99 629 71
13	4	Shock absorbers	NR	1 80 322 85	1 80 322 85
14	2	Diaphragm, code .E. Diaphragm, code .T. Diaphragm, code .N.	EPDM PTFE NBR	1 80 031 72 1 80 031 67 1 80 031 71	1 80 031 72 1 80 031 67 1 80 031 71
15	8	Housing bolt, cpl.	1.4301	2 80 020 22	2 80 020 22
16	1	Shaft	1.4301	2 80 030 22	2 80 030 22
17	2	Set screw, shaft	1.4305	9 24 224 22	9 24 224 22
18	2	Shaft piston ring, cpl.	PTFE	1 80 041 64	1 80 041 64
19	1	Air inlet	PETP	1 80 047 84	1 80 047 84
20	1	Air filter	PE	1 40 043 51	1 40 043 51
21	1	Muffler, cpl.	diverse	15-3510-99	15-3510-99
22	1	PERSWING P® air control system, cpl.	PETP	2 80 201 84	2 80 201 84
24	6	O-ring, air valve housing (included in item 22)	NBR	9 66 533 71	9 66 533 71

Optional Equipment Code TV/TVD

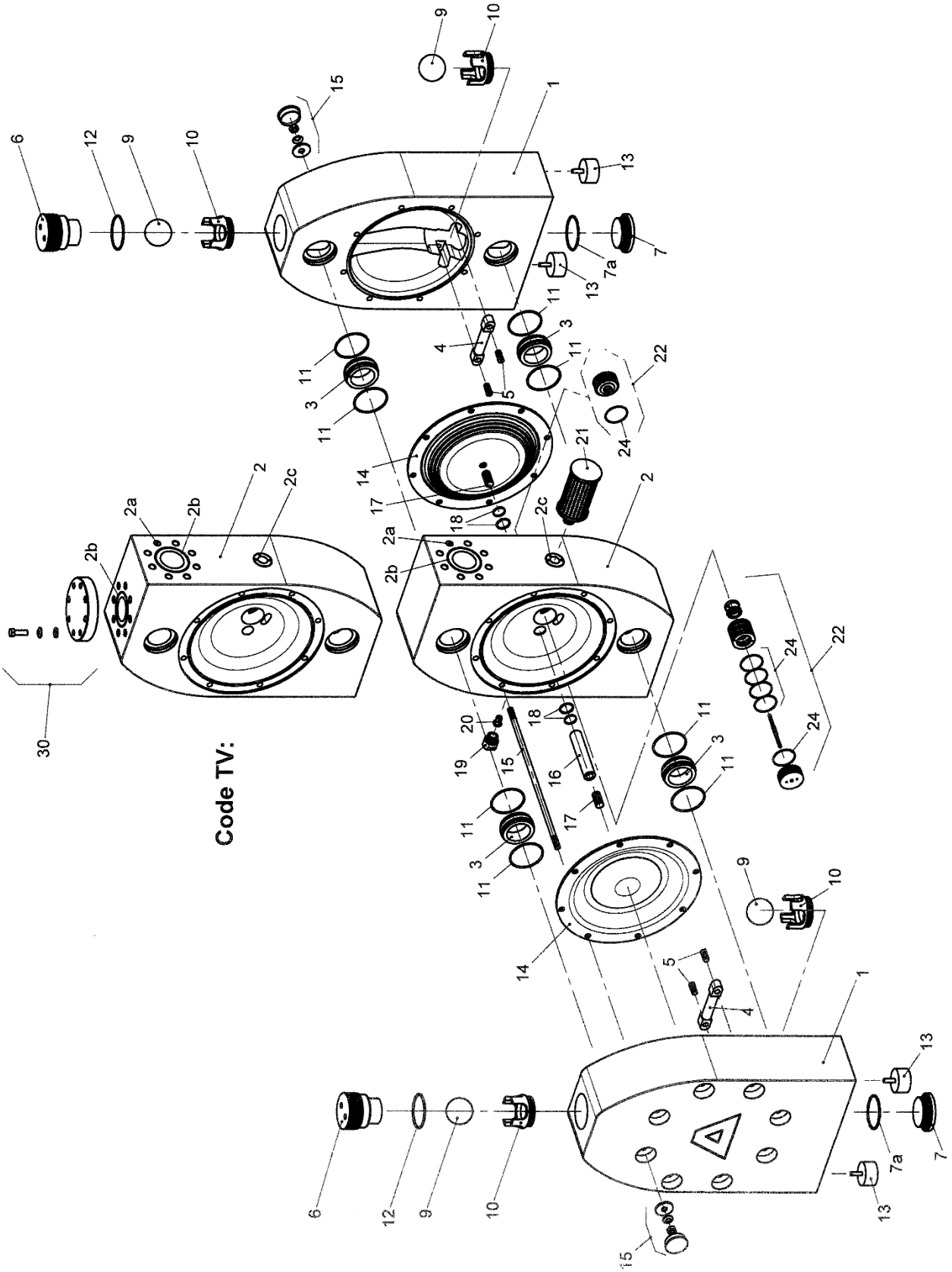
Item	**Pc.**	**Description**	**Material**	**Part Number**	**Part Number**
Code TV/TVD: Damper preparation					
2	1	Center housing, DIN Center housing, ANSI	PE/PE conductive	7 80 811 52 7 80 911 52	7 80 811 56 7 80 911 56
2a	24	Thread bushing, center housing, DIN Thread bushing, center housing, ANSI	1.4305 1.4305	2 40 169 22 3 40 069 22	2 40 169 22 3 40 069 22
2b	3	O-ring, center housing, code .E. O-ring, center housing, code .T.	EPDM FEP/FKM	9 99 629 72 9 99 629 59	9 99 629 72 9 99 629 59
30*	1	Blind flange	PE/PE conductive	2 80 067 52	2 80 067 56
-	8	Hexagon bolt DIN 933	1.4301	9 16 212 22	9 16 212 22
-	8	Washer DIN 125	1.4301	9 17 151 22	9 17 151 22
-	8	Spring washer DIN 2093	1.4301	9 16 154 22	9 16 154 22

* not for code TVD

More optional equipment on the pages 16-19.

When ordering please state the serial number of the pump.

Exploded view



Stroke counting (option code C 2, C 3, C 4)

A sensor [50] is installed in the center pump housing [2] to count the strokes. The diaphragm movement is scanned without contact by this sensor: a safe form of monitoring totally independent of external influences and the pump's mode of operation. The issued sensor pulses can be output to existing detectors or to a stroke counter (can also be supplied). When the preset value is reached, the stroke counter outputs a signal which can then be processed further, for instance in order to shut down the pump via a solenoid valve.

The stroke counting system is available in three variations:

- C 2 Stroke sensor (Namur), also for explosion-proof zone
- C 3 Stroke counting system complete with sensor and stroke counter
- C 4 Stroke counting system complete with sensor, stroke counter and controller for explosion-proof zone

In case only the sensor is included (code C 2), it has to be connected to an existing controller with Namur inlet. For applications an explosion-proof device is required for (code C 4) the intrinsically safe controller has to be installed between the sensor and the counter. The wiring diagram and technical data can be found on the electric units themselves. For further details, please refer to the data delivered by the manufacturers of the components. The controllers have to be installed in a suitable cabinet.

Spare part list Stroke Counting					**E 80**
Code	**Item**	**Pc.**	**Description**	**Material**	**Part-No.**
C2	2*	1	Center housing DIN for sensor, code E..	PE	7 80 111 52
	50	1	Stroke sensor, Namur	diverse	1 00 072 99
	-	1	O-ring, stroke sensor	NBR	9 25 535 71
C3			as C 2, but additional:		
	-	1	Clamp amplifier	diverse	1 00 171 99
	-	1	Stroke counter	diverse	1 00 071 99
C4			as C 2, but additional:		
	-	1	Controller	diverse	1 00 370 99
	-	1	Stroke counter	diverse	1 00 071 99
* Part-No. for center housings with ANSI connections on request					

Diaphragm monitoring (option code D 1, D 3)

Although ALMATEC diaphragms with integrated metal core are designed for an optimum service life, the diaphragm remains a wear part. If it breaks, liquid can leak into the center housing and possibly emerge through the muffler. This can be prevented simply and effectively with the ALMATEC diaphragm monitoring.

A capacitive diaphragm sensor is mounted in the muffler adapter [21a] of the pump, which registers any liquid approaching the sensor, no matter whether the liquid is conductive or not. Hence, a fast reaction to a damage of a diaphragm becomes possible. However, it has to be considered, that the diaphragm monitoring possibly cannot prevent that liquid can leave the pump via the muffler. For higher safety requirements the ALMATEC barrier chamber system (optional equipment code BS) is recommended. In case of humid surrounding air a false alert may occur despite operating the pump with dried compressed air.

The diaphragm monitoring system is available in two variations:

- D 1 Diaphragm sensor (Namur), also for explosion proof area
- D 3 Diaphragm monitoring system complete with sensor and controller

The diaphragm sensor can either be connected to an existing controller with Namur inlet (code D 1) or to the controller included (code D 3). The wiring diagram and technical data can be found on the controller itself. For further details, please refer to the data delivered by the manufacturers of the components. The controllers have to be installed in a suitable cabinet.

Spare part list diaphragm monitoring					**E 80**
Code	**Item**	**Pc.**	**Description**	**Material**	**Part-No.**
D1	21a	1	Adapter muffler for sensor	PETP	1 80 545 84
	51	1	Diaphragm sensor, Namur	diverse	1 00 773 99
D3	21a	1	Adapter muffler for sensor	PETP	1 80 545 84
	51	1	Diaphragm Sensor, Namur	diverse	1 00 773 99
	-	1	Controller	diverse	1 00 370 99

ALMATEC Pulsation Damper ET80-F for E-Series E 80 pump

The pump size E 80 of the E-Series can be equipped with an ALMATEC pulsation damper type ET80-F. The ALMATEC pulsation dampers series ET represents the latest generation of active pulsation dampers. They are specially designed to be used along with ALMATEC air-operated double diaphragm pumps of the E-Series. A general aspect to be considered is, that a pulsation damper decreases the total capacity of the system depending on the point of operation.

Before putting an ALMATEC pulsation damper into operation, make sure, that the materials of construction are resistant to the chemical to be pumped. To check this, the exact damper code is required. This code, the serial number and the year of construction are noted on the identification plates on the damper itself.

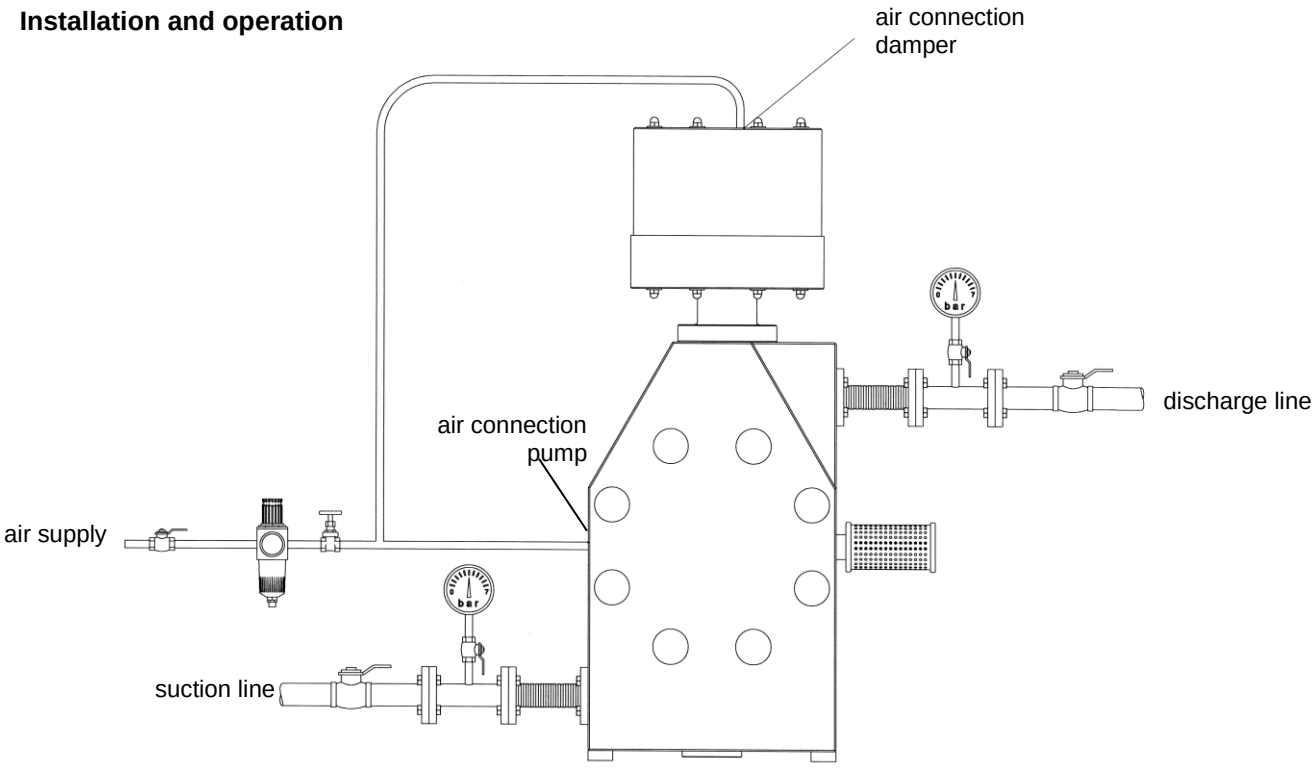
Example of the damper type code:

ET 80 E A E - F

		flange connection DIN / PN 10 or ANSI (Fw)
	Diaphragm material:	E EPDM N NBR T PTFE/EPDM-compound
	Material of damper head:	A PA F PE conductive
	Material of damper housing:	E PE F PE conductive
Size, nominal connection size:		DN 80
ALMATEC pulsation damper, ET series		

Air supply connection:	R 1/2“ BSP
Max. operating pressure:	7 bar (100 psig)
Max. operating temperature:	70°C (158°F)

Installation and operation



For inflammable liquids as well as for applications in explosion protected areas, only dampeners made of conductive plastic materials may be used.

In general, pump and dampener are dispatched completely mounted. Still, they can be packed in separate boxes, especially for the bigger sizes. If so, insert the flange O-ring [30] into the groove of the flange connection of the center housing and flange-mount the dampener with the attached screws and washers with a torque value of 30 Nm (22 ft lbs).

Before connecting the pump, take the yellow blind plugs out of air inlet which is located on the top of the dampener head [16]. For correct operation, the dampener absolutely needs an air-supply of its own, which has to be taken from the air-supply of the pump. Pump and pulsation dampener have to be connected to the same air pressure. No stop or regulating valve may be placed between pump and dampener. The driving air has to be oil-free, dry and clean. The dampener requires a minimum counter pressure of at least 1 bar for optimal function. Together with the pump an empty dampener has to be driven slowly. The dampeners are self-regulating for all changing operating conditions.

- Before putting the pulsation dampener into operation as well as after some hours of operating, the housing bolts [10] have to be tightened with a torque data of 30 Nm (22 ft lbs), as the elements of construction tend to "settle". Fixing the bolts is necessary as well after longer periods of stoppage, at extreme temperature variations, transport and after dismantling.
- Pressure tests of the plant a pump and a dampener are included in may only be carried out with the aggregate (pump and dampener) disconnected from the pressure on both ports or by using the pressure the aggregate develops while operating. The load of a pressure in the plant may damage the pump and the pulsation dampener.
- Before starting to disassemble the pump, take care that pump and dampener have been emptied and rinsed. Further both have to be cut off from any energy on the air and product side. If pump and dampener is being deported from the plant, a reference about the delivered liquid has to be attached.
- Please respect the relevant additional security advices, if the pump and the dampener have been used for aggressive, dangerous or toxic liquids.
- Before putting the pump and the dampener back into operation, the tightness of both has to be checked.
- According to the requirements of our 14001-certification, every unit which is send to ALMATEC for diagnosis or maintenance reasons has to be accompanied by a filled out decontamination-sheet. Otherwise a processing is not possible. The decontamination-sheet is enclosed to this manual. Please pay attention to the further safety regulations.
- For further warning instructions, please refer to pages 6-8.

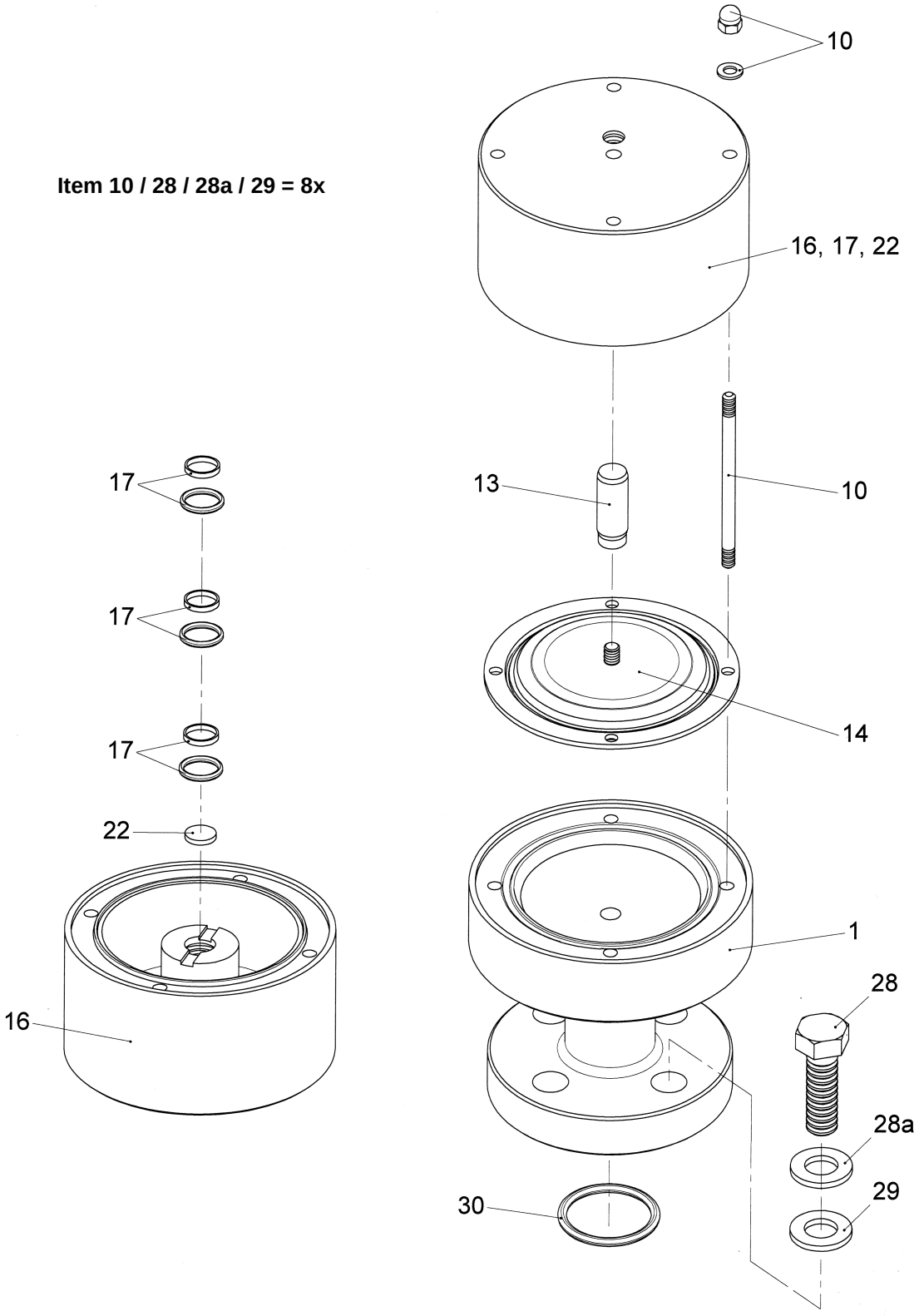
Disassembly instructions

Unscrew housing bolts [10] carefully. After that, all parts can be removed. Screw the diaphragm [14] off the actuator shaft [13]. A re-assembly of used piston rings [17] is impossible; they have to be replaced including the O-rings underneath. To assemble new piston rings [17] carefully shape them like kidneys with locking ring pliers and insert the rings into the grooves; completely press the rings into the grooves smoothly using some round tool.

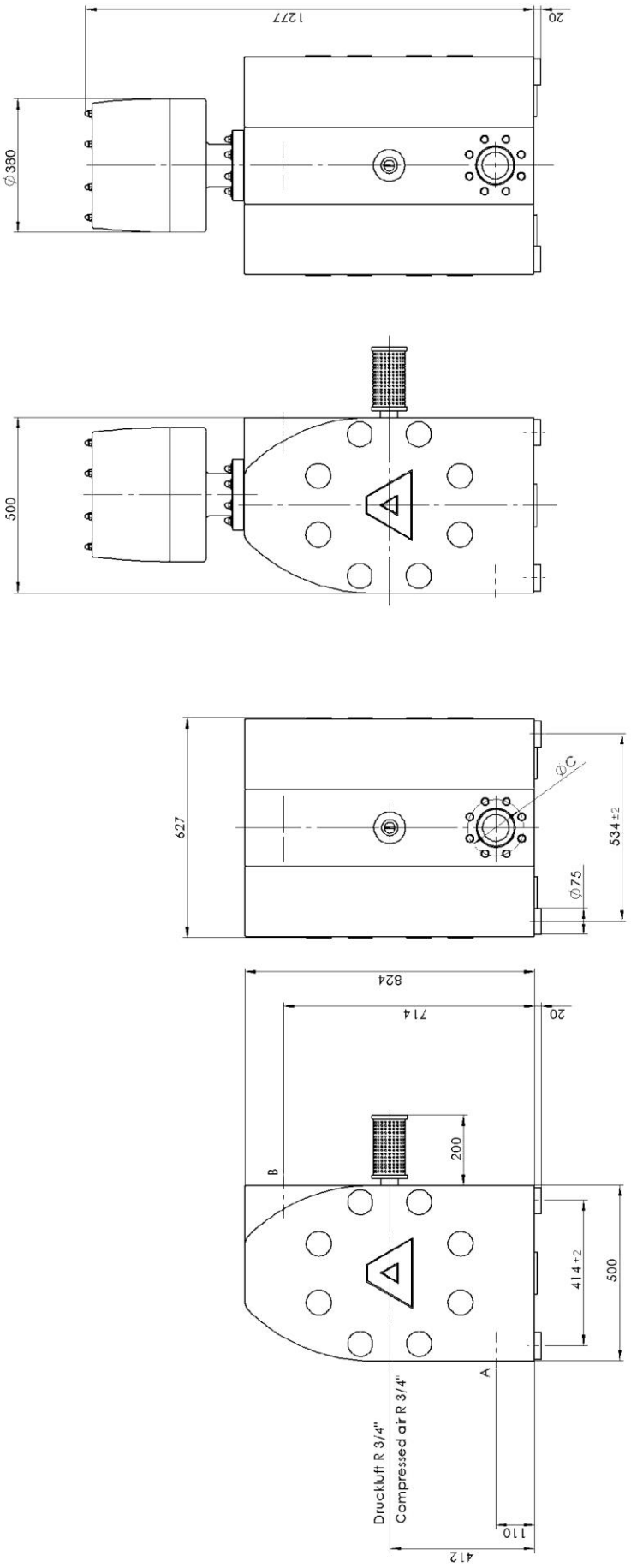
Spare part list				ET80-F (DIN)	ET80-Fw (ANSI)
Item	**Pc**	**Description**	**Material**	**Part-No.**	**Part-No.**
1	1	Damper housing, flange, code E.. Damper housing, flange, code F..	PE PE conductive	7 80 180 52 7 80 180 56	7 80 280 52 7 80 280 56
10	8	Housing bolt, cpl.	SS	2 80 083 22	2 80 083 22
13	1	Actuator shaft	SS	1 80 482 22	1 80 482 22
14	1	Diaphragm, code ..E Diaphragm, code ..T	EPDM PTFE	1 50 031 72 1 50 031 67	1 50 031 72 1 50 031 67
16	1	Damper head, code .A. Damper head, code .F.	PA PE conductive	2 80 081 53 2 80 081 56	2 80 081 53 2 80 081 56
17	3	Shaft piston ring, cpl.	PTFE	1 50 041 64	1 50 041 64
22	1	Muffler	PE	1 50 644 51	1 50 644 51
28	8	Hexagon bolt	SS	9 16 212 22	9 19 212 22
28a	8	Spring washer	SS	9 16 154 22	9 20 154 22
29	8	Washer	SS	9 17 151 22	9 21 151 22
30	1	Flange-O-ring, center housing, code ..E Flange-O-ring, center housing, code ..T Flange-O-ring, center housing, code ..N	EPDM FEP/FKM NBR	9 99 629 72 9 99 629 59 9 99 629 71	9 99 629 72 9 99 629 59 9 99 629 71

Exploded view damper

Item 10 / 28 / 28a / 29 = 8x



Dimensions pump and damper (standard without optional equipments, in mm)



A	Suction inlet DIN Suction inlet ANSI	DN 80 ANSI	8 x M 16 8 x ¾" UNC	
B	Discharge outlet DIN Discharge outlet ANSI	DN 80 ANSI	8 x M 16 8 x ¾" UNC	
C	DIN ANSI	Ø 160 mm Ø 168,1 mm (6,62 in.)		

Notes

Subject to change without notice, 2021/07

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