TYPE AODD PUMP

(COMPRESSED AIR-OPERATED DOUBLE DIAPHRAGM PUMPS)

< models PRO ONE xx >

INSTRUCTION MANUAL

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1 REVISION INDEX

Operating and maintenance manual for PRO ONE series AODD pumps

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Original instructions in English language

2 CONTENTS

3 INTRODUCTION

3.1 Preface

This manual is an integral part of the machine and contains information aimed at its safe use, maintenance, and repair. Therefore, the manual must always be available to operational personnel and maintenance staff.

Operational personnel and maintenance staff must have adequate technical training in accordance with the safety warnings.

The machine can only be used in compliance with these operating instructions. Any use not conforming to the operating instructions is prohibited and may be dangerous for people and other machines/plants.

3.2 Testing

Each machine has passed one or more tests before being packed and shipped. Testing reports for each individual machine are available upon request.

3.3 Warranty

The warranty is described in the General Terms of Sale available on the website www.pchem-industries.com Key points are highlighted below.

PCHEM provides a warranty for defects in materials or workmanship for a period of 12 (twelve) months from the delivery of the Products "Ex Works" (Seller's premises).

This warranty covers all defects that appear in the Product as a result of normal use, deriving exclusively for defects in materials or workmanship.

The warranty excludes labor for assembly and disassembly of PCHEM products from plants or machinery. This warranty does not extend to items damaged or modified after shipment from the factory.

No reimbursement is provided for machine downtime due to failure and subsequent repair. Any delays in repairs do not entitle to reimbursement or extension of this warranty.

The warranty does not cover parts classified as "wear parts" that are naturally subject to continuous wear (See section 9.3 on page 35).

The warranty voids in case of:

- Equipment used in a manner not conforming to the instructions in the operating manual.
- Equipment partially or fully disassembled during the warranty period by unauthorized personnel.
- Equipment repaired with non-original spare parts.
- Defects due to accidents, neglect, lack of maintenance, improper storage, transport damage, or other reasonably incorrect uses or actions.
- Failures due to exceptional events.
- Chemical and/or physical incompatibility of the pump materials with the transferred liquid.

3.4 Glossary

Air Side or Pneumatic Motor: All components that manage the pneumatic part of the pump, including the fastening elements.

Fluid Side: All pump components that are not part of the Air Side or Pneumatic Motor.

Parts in Contact with the Fluid: All fluid side components in contact with the liquid processed by the pump.

Self-Priming Pump: A pump capable of creating a vacuum at the suction port. The vacuum value is measured in bars or meters of liquid column (e.g., meters of water column).

Pressure Losses: Energy losses in a liquid are caused by resistances that oppose fluid motion. These resistances include internal friction within the liquid itself (known as viscosity), external friction between the liquid and the walls, and head. Pressure losses affect both the pump and the suction and discharge circuits to which the pump is connected. These losses are typically expressed in bars or meters of liquid column (e.g., meters of water column).

Self-Priming Pump: The pump sucks in the liquid to be processed by generating a vacuum on the suction line.

Below Suction Installation: Pump installed below the liquid storage tank.

Above Suction Installation: Pump installed above the liquid storage tank.

3.5 Warnings and Symbols

Obligation Symbol
Indicates the obligation to follow and comply with the described directives.

Eye Protection Use Symbol
Indicates the obligation to use eye protection.

Symbol of Obligation to Use Respiratory Protection Mask

The mask should be chosen based on the dust/gases potentially present in the work atmosphere that could harm personnel health.

Symbol of Obligation to Use Protective Gloves

Gloves should be chosen based on the temperatures, fluids, and all work circumstances that could harm personnel health.

Grounding Obligation Symbol

General Hazard Symbol
Indicates special attention to the described hazard.

Explosion Hazard Symbol

No Open Flames Symbol

Prohibition Symbol

4 MACHINE CHARACTERISTICS

4.1 Description

Air-operated double diaphragm pump suitable for liquid transfer. Constructed in accordance with the Machinery Directive 2006/42/EC.

4.2 Models

This instruction manual applies to the following pump models/series:

- Air-operated double diaphragm pumps Series PRO ONE.

4.3 Operating Principles

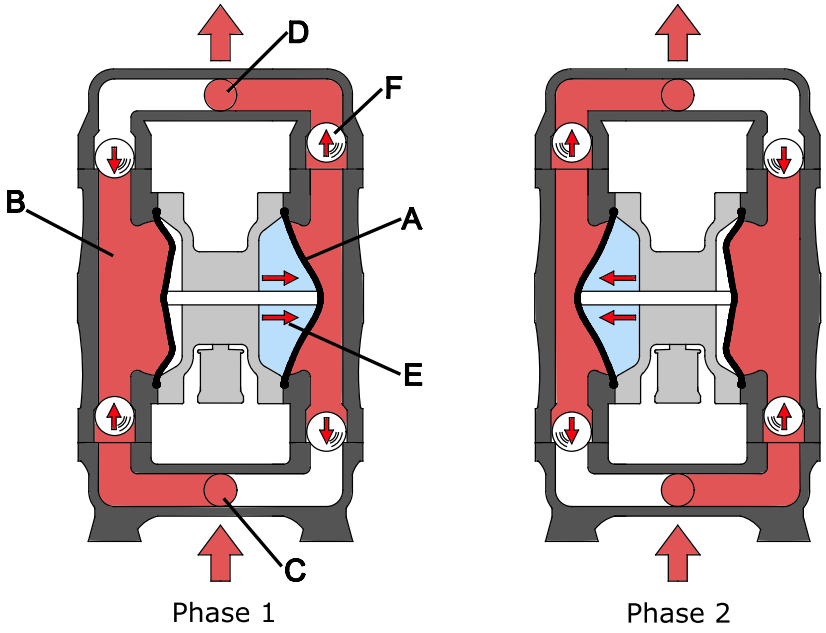


Image 1 - Operating Principle

Referring to Image 1, the pump operates based on the vacuum and pressure generated by the reciprocating linear motion of two diaphragms (A), which are mechanically connected by a metal shaft, within two sealed chambers (B).

During the diaphragm movement, the pump simultaneously draws liquid from the suction port (C) and expels liquid from the discharge port (D), thus creating a continuous transfer cycle. The diaphragms are driven by compressed air, which is automatically and alternately introduced and exhausted into the air chambers (E).

The liquid side of the pump contains four one-way valves, "Inlet and Outlet Valves" (F), which operate based on gravity and the pressure/vacuum generated by the diaphragm movement.

The pump's flow rate is proportional to the number of cycles performed. The number of cycles primarily depends on the pneumatic supply pressure and flow rate, the physical characteristics of the liquid being transferred, and the characteristics of the system.

4.4 Pump Coding and Material Configuration

Each pump model is identified by a specific code that provides information about the pump's configuration, including materials used for various components. The material selection depends on the type of fluid being transferred and the operating conditions.

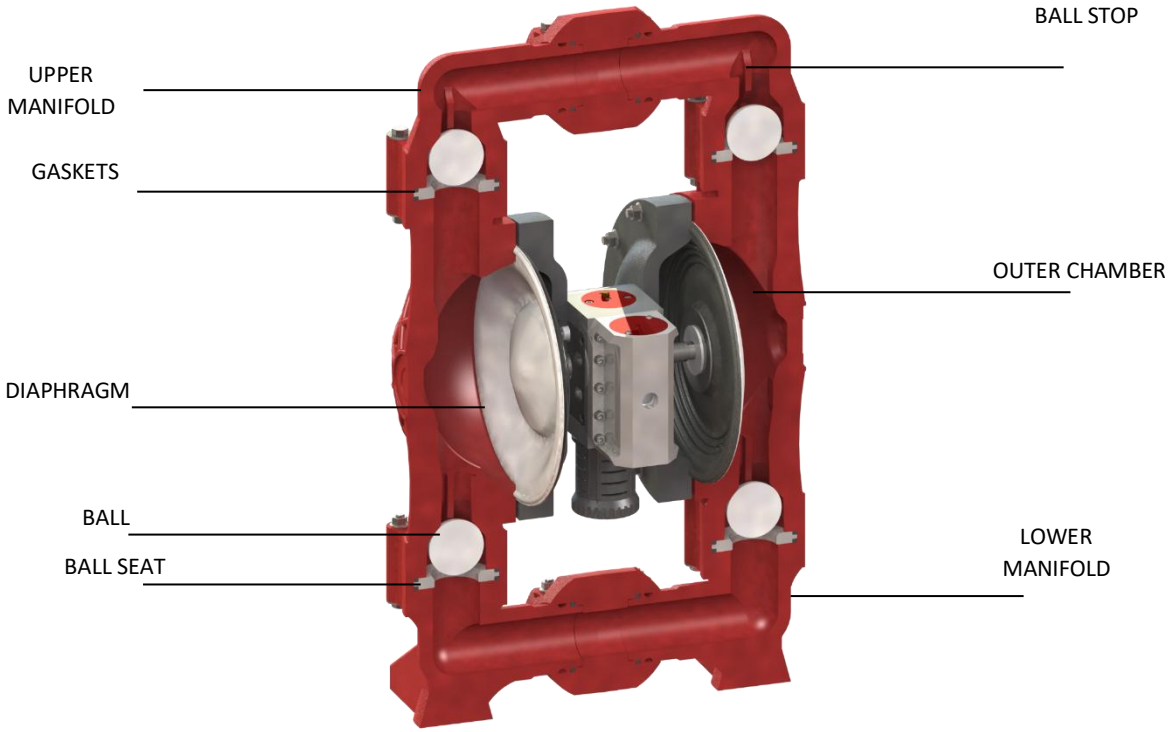


Image 2 – Pump Material Configuration

The described components are typically parts in contact with the transferred fluid. The components behind the diaphragms (air side or pneumatic motor) may come into contact with the transferred liquid in the event of damage or failure of fluid side parts, such as diaphragms.

4.5 Technical Characteristics of Pump Models

The technical characteristics, general measurements and flow rates, are detailed in the ATTACHMENT 1 (on page 43)

4.6 Identification Plate

The identification plate is mounted on the machine at the top of the pneumatic motor (see section MACHINE CHARACTERISTICS on page 9) and includes the following information:

Manufacturer's name, Maximum supply pressure, Product identification code, Type, Model, any configuration, Unique serial number, Year of manufacture, ATEX Marking Details (for ATEX models only)

The identification plate is an integral part of the machine:

- Never remove the plate from its original location chosen during design.
- Do not alter or counterfeit the technical data provided.
- Do not clean the plate with abrasive objects (e.g., steel brushes) to avoid damaging the data.

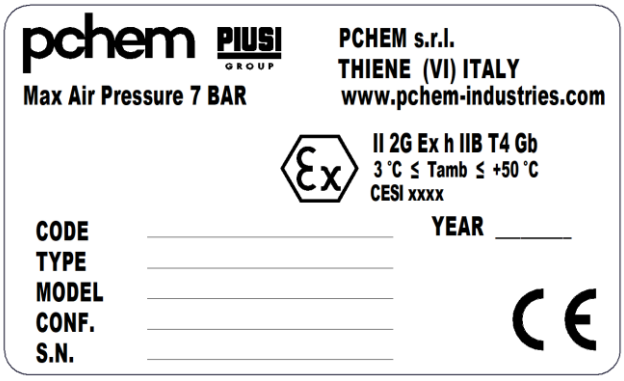


Image 3 – Sample Identification Plate

If the plate is damaged or illegible, contact the PCHEM manufacturer for replacement.

4.7 Machine Compliance

The Declaration of Conformity to the Machinery Directive 2006/42/EC is attached at the end of the manual.

Additional certifications or declarations can be provided upon request. For further information, please contact the distributor or the manufacturer PCHEM.

5 SAFETY

5.1 Intended Use

The pumps are designed for the safe transfer of fluids compatible with the materials used in the pump construction.

5.2 Unintended Use

Using the pumps for applications outside the specified Intended Use is considered improper use and therefore prohibited.

It is strictly prohibited to install the machine in explosive environments without ATEX certification.
Tampering with the pump or performing operations not covered in this manual is also strictly prohibited.
The machine must not be used in environments or conditions that do not comply with current regulations and laws.

The user must ensure the machine is used in accordance with its intended purpose.

The installation, inspection, use, and maintenance of the pump are permitted only by personnel who are properly trained and instructed in the use of air-operated process pumps.

5.3 PPE (Personal Protective Equipment)

For use during Transport, Installation, Operation, Maintenance, and Disposal.

Wear protective eyewear

Wear protective gloves

Any additional personal protective equipment must be used by the operator in compliance with current laws and regulations, depending on the environment, the type of machine installation, and the liquid being handled.

5.4 Main Checks by the User

The main checks that the user will have to carry out are indicated in the following sections.

5.4.1 Chemical Compatibility with Materials

The construction materials of the pump in contact with the processed liquid are specified for each model in the section MACHINE CHARACTERISTICS**Errore. L'origine riferimento non è stata trovata.** on page **Errore. Il segnalibro non è definito.**.

Before installation, the user must verify that the liquid(s) to be transferred are chemically compatible with the materials in contact with the pump (Fluid Side).
Note that any cleaning liquids used must also be chemically compatible with the materials of the Fluid Side.

A table indicating the chemical compatibility of commonly used industrial liquids with the materials used in PCHEM pumps is available on the PCHEM website. The table can be downloaded in PDF format from: http://www.pchem-industries.com/chemicalcomp.pdf

Note: The data in the table is sourced from selected references. However, PCHEM has not conducted direct verification tests and therefore does not assume responsibility for the accuracy of the information.

Additionally, each application exposes the pump to varying stresses, exposure times, chemical concentrations, and temperatures. These factors must be considered by the user to ensure chemical compatibility.

HALOGENATED SOLVENTS: Special attention must be given to halogenated solvents. These solvents, in contact with aluminum, can cause explosions.
Typical examples of halogenated solvents (H.H.C.) include Trichloroethane, Trichloroethylene, Methylene Chloride, Methyl Chloride, Carbon Tetrachloride, Chloroform, and Dichloroethylene.

5.4.2 Chemical Compatibility with the Work Environment

The work environment where the pump is installed must be chemically compatible with the pump's construction materials. Gases or vapors present in the work environment can damage the pump and create high-risk situations. If in doubt, contact the distributor or the manufacturer, PCHEM, before installation.

5.4.3 Temperature Limits

	Min [°C]	Max [°C]
Ambient Storage Temperature	-5	65
Ambient Operating Temperature	3	50
Transferred Liquid Temperature	3	50

For operational requirements at temperatures outside these ranges, please contact the manufacturer, PCHEM

5.4.4 Ambient Humidity Limits

High ambient humidity can cause ice formation on the pneumatic motor's air exhausts. Ice blockage in the air exhausts can lead to pump failure. The ambient humidity in the work environment should not exceed 70%.

5.4.5 Technical Specifications Limits

Refer to the section MACHINE CHARACTERISTICS on page 9 to ensure compliance with the pump's technical characteristics.

5.4.6 Use in the Pharmaceutical/Food Sector

Contact the manufacturer to confirm whether the pump is suitable for transferring pharmaceutical or food-grade liquids.

5.4.7 Use in Explosive Atmospheres (ATEX)

Refer to the Identification Plate to verify if the machine's certifications allow use in explosive atmospheres.

5.4.7.1 ATEX

ATEX-certified machines are designed and built for installation in explosive atmospheres, as defined by the ATEX Directive 2014/34/EU.

Refer to the Identification Plate to check the exact ATEX certification designation of the machine.

In the event of use in a potentially explosive atmosphere, the operator must be properly trained in the relevant safety standards.

The classification of the zone is the responsibility of the user, who must ensure that the installation area corresponds with the machine’s category.

Zone definitions:

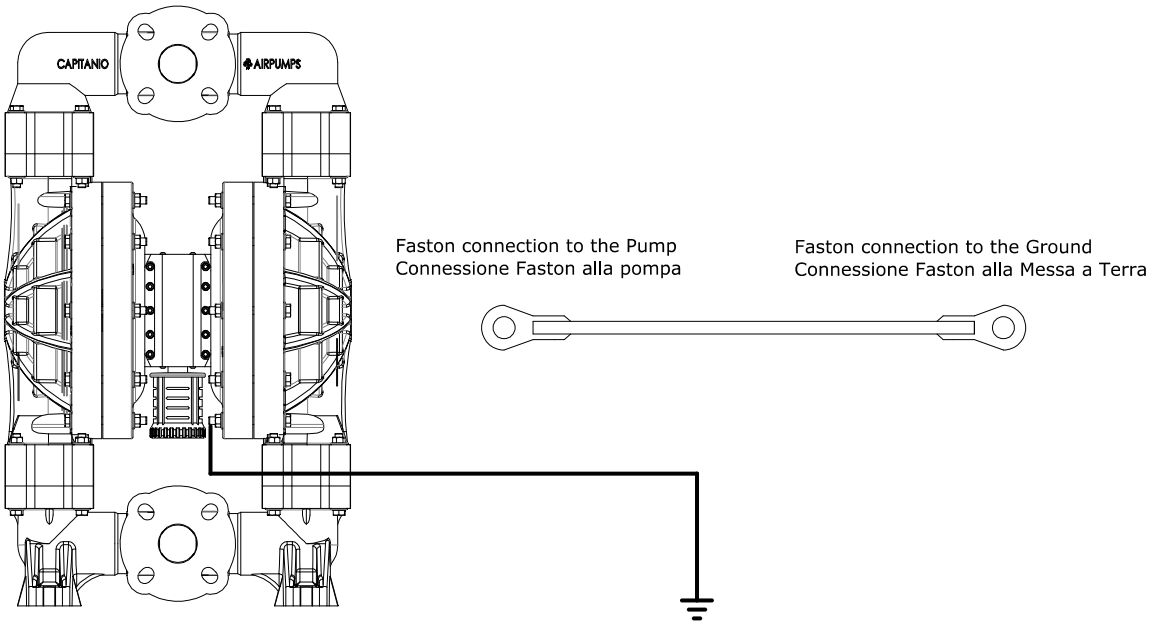
- **ZONE 0**: An area where an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapor, or mist is present continuously, for long periods, or frequently. Presence exceeds 1000 hours per year.
- **ZONE 1**: An An area where an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapor, or mist is likely to occur during normal operations. Presence is between 10-1000 hours per year.
- **ZONE 2**: An area where an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapor, or mist is not likely to occur during normal operations and, if it does occur, is only of short duration. Presence is less than 10 hours per year.

Installing this machine in zones not consistent with its category may increase the risk of explosions. For ATEX zone classification, the client must apply Title XI° of Legislative Decree 81/08 and the CEI EN 60079-10-1 technical standards.

5.4.7.2 Grounding

In the presence of an explosive atmosphere, electrostatic charges could cause hazardous situations. Ensure proper grounding of the machine.

Use a cable with a faston connector at the end (not provided) and connect it to the pump's grounding bolt.
If the pump is used with rubber anti-vibration feet, ensure they are conductive.



The use of flammable fluids might necessitate wearing antistatic clothing to prevent possible vapor ignition.

Installing this machine in a non-explosive environment does not pose any potential danger.

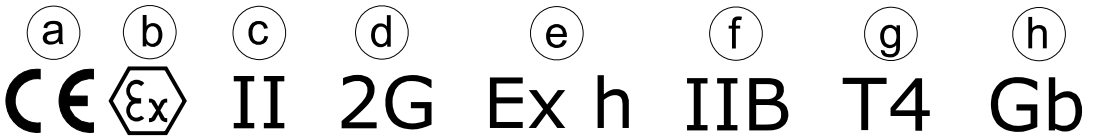
5.4.7.3 Conductivity of the Liquid and Processed Liquid Temperature

The passage of low conductivity (high resistivity) liquid (< 10^4 pS/m) inside the machine can cause the formation of potentially igniting electrostatic charges.

Users should be aware of this risk and, if necessary, add antistatic additives to the liquid or take safety measures to prevent vapor ignition from electrostatic discharges. Refer to the safety data sheet of the processed liquid.

Surface temperatures must be below the flash point of the processed liquid and must always comply with the temperature limits.

5.4.7.4 Marking



a. CE: Conforms to the ATEX Directive 2014/34/EU.

b. ATEX: Specific marking for explosion protection.

c. Group:

I - Includes equipment for use in underground mining operations and surface installations at risk of grisou and/or combustible dust release.

II - Includes equipment for use in other environments with potential explosive atmospheres.

d. Category:

3G - Suitable for use in Zone 2 with potentially explosive gases.

2G - Suitable for use in Zone 1 and 2 with potentially explosive gases.

1G - Suitable for use in Zone 0, 1, and 2 with potentially explosive gases.

e. H protection type: Generic protection for non-electrical devices.

f. IIB - Suitable for all gases in Group IIA and IIB if the protection level requires it, e.g., "ia" (see standard EN 60079-11).

g. Temperature Class: T4 - Maximum allowed surface temperature is 135°C

h. EPL (Equipment Protection Level)

Ga - Suitable for use in Zone 0

Gb - Suitable for use in Zone 1

Gc - Suitable for use in Zone 2

For more information, refer to the ATEX Directive 2014/34/EU and any subsequent updates.

5.4.7.5 Safety Instructions for Equipment Installed in Explosion Hazard Zones

DO NOT use spark-propagating tools, open flames, or smoke in explosion hazard zones (ATEX).

Prohibition to carry out any maintenance operation in the presence of a potentially explosive atmosphere.

Before performing any technical work in a classified explosion hazard zone, ensure that it has been cleared of flammable gas, vapor, and mist sources.

If the area cannot be cleared, ensure no ignition sources are introduced that could trigger the ATEX mixture. Use antistatic clothing to dissipate charges to the ground. If tools are needed, they must be spark-resistant, made from non-igniting materials.

Ignition sources include flames, sparks, hot surfaces, electrostatic discharges, and electrical components.

Organizational measures provided by the Employer (user) for explosion prevention and protection (Legislative Decree 81/08, Title XI) include:

- Developing written instructions, as specified in the explosion protection document.
- Training workers in explosion protection.
- Adequate worker qualifications.
- Implementing a work authorization system for hazardous activities, if specified in the explosion protection document.
- Performing maintenance.
- Conducting inspections and monitoring.
- Marking potentially explosive zones, if necessary.

5.4.7.6 Other Requirements for Use in ATEX Environments

- Any accessories installed on the device must be ATEX marked and belong to the pump's certification category.
- The device must not be exposed to lightning.
- The device must not be directly exposed to sunlight.

5.4.8 Viscosity

Viscosity is a physical quantity that measures a fluid's resistance to flow.

The viscosity of the processed liquid inversely affects the pump's performance: as viscosity increases, the pump's processing capacity decreases, consequently reducing the flow rate and cycle number, potentially leading to a complete pump blockage.

Directly proportional to increasing viscosity are:

- The force required by the pump to process the liquid.
- The distributed pressure losses in the suction and discharge circuits.

Special attention must be given to the design of the pump's suction conduit if the self-priming capability is to be utilized, such as in an above-ground installation.

The pump's suction capacity varies based on size and material configuration, ranging approximately between 0.1 and 0.5 bar absolute.

For air-operated double diaphragm pumps, a reference viscosity limit is around 10,000 to 15,000 Centipoise (CPS).

As non-binding example, based on the manufacturer's experience, the following theoretical maximum viscosity limits for pumping are provided for reference.

Size	**Theoretical Maximum Viscosity Limit [CPS]**
PRO ONE 8 [3/8”]	300
PRO ONE 15 [½”]	2’500 (35'000*)
PRO ONE 20 [3/4”]	4’000
PRO ONE 25 [1”]	6’000
PRO ONE 40 [1” ½”]	12’000 (90'000*)
PRO ONE 50 [2”]	15’000

For operations with different viscosities, contact the manufacturer PCHEM.

*Values in parentheses relate to specific applications conducted by PCHEM with pumps installed under head and free discharge where the pumps managed to transfer the liquid.

5.4.9 Crystallization/Solidification

Some liquids tend to solidify under certain working conditions (e.g., temperature or air contact). If the machine is used with such liquids, all necessary precautions must be taken to prevent the liquid from crystallizing/solidifying inside the machine. Otherwise, the machine will stop working, and all fluid-contact components may need replacement.

5.4.10 Cavitation

Cavitation is a phenomenon where vapor zones form within a fluid and then implode. This occurs due to local pressure drops, reaching the liquid's vapor pressure, causing phase change to gas and forming bubbles (cavities) containing vapor. The user must verify the properties of the transferred liquid and the pump installation conditions to prevent cavitation.

5.4.11 Reasonably Foreseeable Misuse

In addition to the restrictions described in previous chapters, the following uses of the pump are prohibited:

- Using it as a vacuum generator.
- Operating "dry," i.e., running the pump without liquid to transfer.
- Using it as an intercept valve, check valve, shut-off valve, or dosing valve.
- Using it with liquids containing solid particles in suspension that can damage fluid-contacting components (e.g., metal chips).
- Using it as a device for supplying respiratory mixtures.
- Using it as a device to pressurize and/or maintain pressure in a downstream circuit.

5.5 Residual Risks

5.5.1 Liquid Leakage from the Pump

In the event of wear, aging, or failure of fluid-side components, loosened fittings due to vibrations, thermal fluctuations, or accidental damages, the pumped liquid, even under pressure, may leak from the pump. Additionally, in case of membrane failure or loosening, the liquid can reach the air side of the pump and leak through the air exhausts and the pneumatic air inlet.

The user must take all necessary measures to prevent this potential issue from causing undesirable effects.
Such as, providing a liquid containment basin, installing fixed guards, isolating the pump with shut-off valves in the hydraulic discharge and suction lines.

It is also recommended to design and implement a regular maintenance program to minimize this risk. See the MAINTENANCE AND SPARE PARTS on page 34.

5.5.2 Compressed Air Leakage from the Pump's Central Body

Vibrations, thermal fluctuations, and accidental impacts can loosen the closure screws of the pump's pneumatic motor components, causing compressed air leaks.

The user must take all necessary measures to prevent this potential issue from causing undesirable effects.

It is also recommended to design and implement a regular maintenance program to minimize this risk. See the MAINTENANCE AND SPARE PARTS on page 34.

5.6 Noise

The noise level for each model is indicated in the MACHINE CHARACTERISTICS on page 9. For specific noise requirements, contact the manufacturer PCHEM.

6 STORAGE, UNPACKING, AND TRANSPORT

Equip yourself with the personal protective equipment as described in section 5.3on page 12.

6.1 Storage

- The pump must be stored in an indoor environment and carefully covered with waterproof material to protect it from weather elements, dust, insects, rodents, etc.
- Take all necessary measures to avoid risks such as impacts, tampering, or mistreatment.
- Refer to the Storage section on page 21 for storage temperature information.

6.2 Unpacking

During the unpacking of the pump, proceed as follows:

- Check that the packaging is not damaged due to transportation. If it is, the pump may be damaged and cannot be used. Before performing any other operations, contact the retailer or the manufacturer PCHEM.
- Carefully remove the pump from the packaging.
- Visually inspect the pump. If there are any cracks, deformations, breaks, or any other signs of damage, do not perform any other operations and contact the retailer or the manufacturer PCHEM.
- For packaging disposal, refer to the DISPOSAL section on page 43.

6.3 Transport and Handling

Transport can be manually carried out by a single person for a maximum weight of 25 kg (20 kg for women). For weights exceeding this, appropriate transport and lifting equipment such as forklifts, pallet jacks, cranes, etc., must be used, lifting the pump from the upper manifold as shown in Image 4.

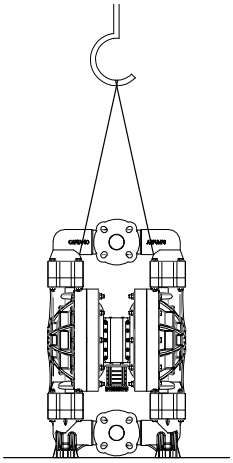


Image 4 –Lifting

The weight of each pump model is indicated in the MACHINE CHARACTERISTICS on page 9.

Lift the pump only through structural parts such as the fluid side.

Move the pump while keeping it at a minimal height from the ground and place it at the installation site.

It is prohibited to maneuver, move, or lift the machine if it is connected to the pneumatic and/or hydraulic network and/or contains liquid.

It is prohibited to maneuver, move, or lift the machine if it contains the processed liquid.

It is prohibited to maneuver, move, or lift the machine in the presence of a potentially explosive atmosphere.

6.4 Bolt Tightening Verification

Perform the operations described in section 9.10 Torque of Bolts on page 40.

7 INSTALLATION

Equip yourself with the personal protective equipment as described in section 5.3 on page 12.

Ensure the pump is stable.

Under no circumstances should the external components of the pump and/or the air side come into contact with the pumped liquid or be exposed to splashes/sprays of any type of fluid. Even neutral liquids like water could infiltrate the internal components and the pneumatic motor, causing damage.

The pump must not be operated unless it is correctly installed.

The pump must not be operated without being connected to the hydraulic system and/or without liquid to transfer.

Do not use the pump without the protections provided and indicated by the manufacturer in this manual.

Do not connect to the pneumatic and hydraulic network unless safety devices as required by current regulations are present.

Do not handle, move, or lift the pump while it is in operation and/or connected to the hydraulic and/or pneumatic system.

The pump does not exceed a surface temperature of 70 °C, therefore the danger of burns is only present if the installation site limits the operator's mobility. In this case, it is recommended to report the risk of contact with hot surfaces.

7.1 Positioning

To ensure proper functioning, the pump must be installed on a flat and horizontal base, as shown in Image 5.

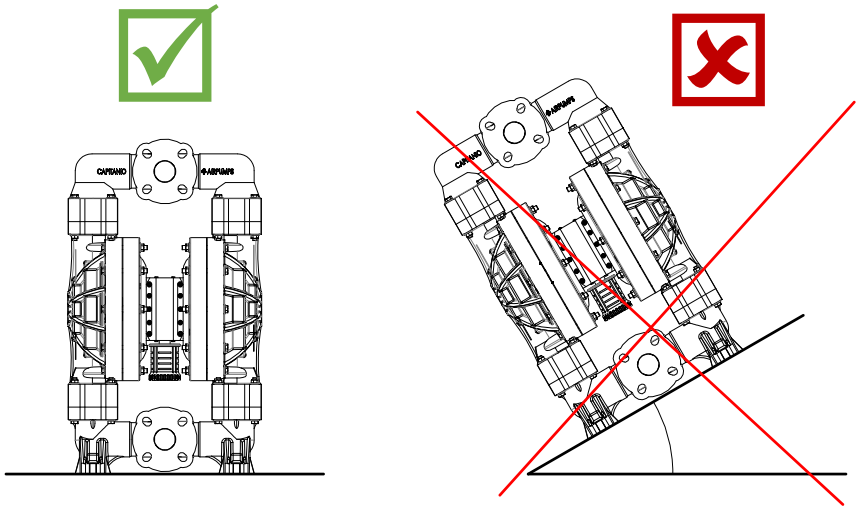


Image 5 - Installation on a flat surface

The pump has support feet with mounting holes (see MACHINE CHARACTERISTICS on page 9)

Secure the pump to the base using all the provided holes and anti-loosening fasteners.

The pump must be installed in a vertical position.

The pump must be stable.

Ensure an adequate location, protected from accidental impacts, or provide protective cover.

The base must support the weight of the pump and its associated accessories.

For other types of mounting requirements, contact the manufacturer PCHEM.

It is recommended to install anti-vibration feet between the pump's support feet and the base to dampen vibrations produced during regular operation.

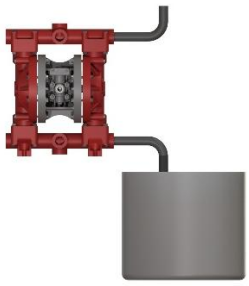
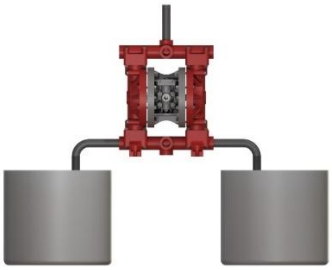
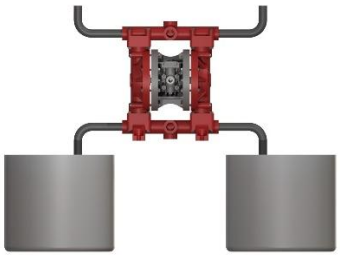
7.2 Types of Installation

Depending on the configuration, the pump can be installed in the following ways:

- The viscosity of the liquid to be processed is a factor that can determine the type of installation. See the Viscosity section on page 18.
- The suction capacity of the pump is described in the MACHINE CHARACTERISTICS on page 9.

7.2.1 Above Head Installation - Self-Priming

Above head installation is possible thanks to the pump's self-priming capability. The pump creates a vacuum in the suction pipe, drawing in the liquid. The suction capacity depends on the nature of the liquid and the geometry of the conduit.

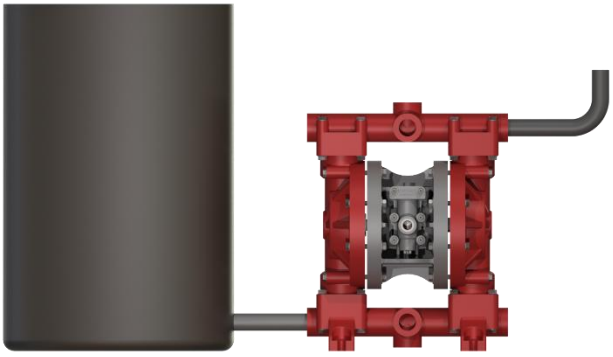
		
SINGLE SUCTION SINGLE DISCHARGE	**DOUBLE SUCTION SINGLE DISCHARGE**	**DOUBLE SUCTION DOUBLE DISCHARGE**
		
FROM DRUM / TRUNK		

- For sizes smaller than ½”, above head installation is not recommended.
- Double suction pump configurations significantly reduce the vacuum generated by the pump.
- For drum and tank installations, provide a pressure access hole for atmospheric pressure in the liquid.

The pump does not function as a shut-off valve and/or check valve. Due to the principle of communicating vessels, the liquid can flow through the pump even if stopped or not supplied with compressed air pressure.

7.2.2 Below Head Installation

The pump is primed by the fluid column present in the suction container.



The pump does not function as a shut-off valve and/or check valve. The liquid can flow through the pump due to its own energy, even if stopped or not supplied with compressed air pressure.

Ensure that the liquid pressure generated by the upstream head does not exceed the maximum pressure allowed by the pump, which is equal to the maximum pneumatic supply pressure.

7.3 Connection to the Hydraulic System

The hydraulic system of the pump must be properly designed according to the application and the model of the pump to be installed. An incorrect hydraulic system can cause malfunctions and high-risk safety situations.

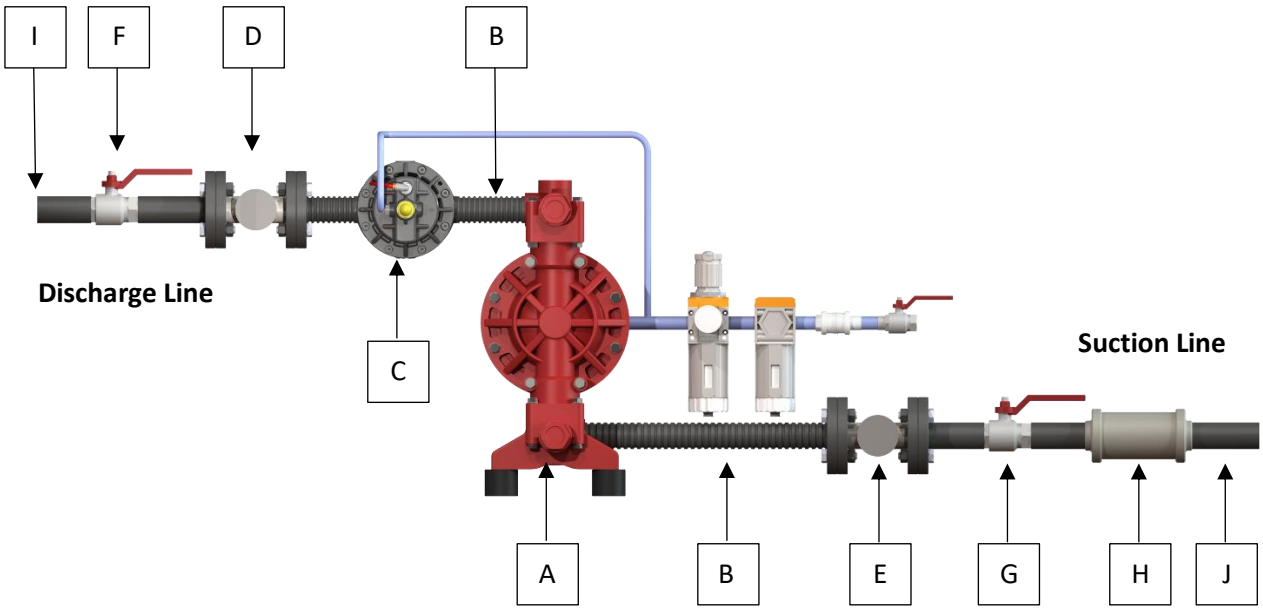


Image 6 - Connection to the Hydraulic System

A) Pump
B) Flexible Joint
C) Dynamic Pulsation Dampener
D) Pressure Gauge
E) Vacuum Gauge
F) Two-Way Shut-Off Valve on Discharge Side
G) Two-Way Shut-Off Valve on Suction Side
H) Suction Filter
I) Discharge Pipe
J) Suction Pipe

Referring to the MACHINE CHARACTERISTICS section on page 9 and Image 6 on page 27:

- Install the components indicated in Image 6
- Connect the discharge line to the pump's discharge port.
- Connect the suction line to the pump's suction port.

Notes:

- For pumps with multi-port manifolds, only one port should be used.
- For pumps with double suction and/or double discharge configurations, connect the discharge and suction lines to the designated ports.

The pipes must withstand the pressure of the liquid delivered by the pump. See the MACHINE CHARACTERISTICS on page 9.

Ensure all joints are perfectly sealed.

The weight of the pipes must not burden the pump and its suction and discharge connections.

The pipes should be at least as large in diameter as the pump's discharge connection to reduce pressure losses due to fluid friction along the pipes.

Design the discharge pipe to be as short and direct as possible, minimizing the use of valves, bends, and fittings.

Filter the liquid to be transferred or install suction filters to prevent solids or impurities from entering the pump and circuit. Refer to H) Image 6.

Install a two-way shut-off valve in the suction line and in the discharge line to isolate the pump from the system. Refer to F) G) Image 6.

Install flexible joints between the pipes and the pump's suction and discharge connections. Refer to B) Image 6.

Closing the two-way shut-off valve on the discharge side refer to F) Image 6 does not stop the pump.

The pump does not function as a shut-off valve and/or check valve. The liquid can flow through the pump due to its own energy, even if stopped or not supplied with compressed air pressure.

The pressure of the liquid entering the pump, and any back pressure from the discharge line, must not exceed the maximum pressure allowed by the pump, which is equal to the maximum pneumatic supply pressure.

- It is recommended to install a Dynamic Pulsation Dampener to reduce liquid pulsation and vibrations in the discharge line.
- Even with the complete closure of the Two-Way Shut-Off Valve on Discharge Side refer to F) Image 6 the pump may continue to cycle due to internal leakages. This effect is related to the construction of the pump's fluid side and is not considered a defect.
- The pump has a 1:1 air supply pressure to fluid discharge pressure ratio. This means the pump imparts a pressure on the processed liquid equivalent to the pump's air supply pressure.
    - If the incoming liquid pressure exceeds atmospheric pressure, the pump will be bypassed by the liquid.
    - The pump does not impart a pressure differential but an equivalent pressure to the pneumatic supply pressure.
- Conical fittings are not recommended as improper tightening could damage the suction and discharge connections. The tightening torques for threaded connections are indicated in the exploded views. See section 9.11 on page 40.

7.4 Connection to the Pneumatic System

The pneumatic supply system for the pump must be correctly designed according to the application and the pump model to be installed. An incorrectly designed pneumatic system can cause malfunctions and high-risk safety situations.

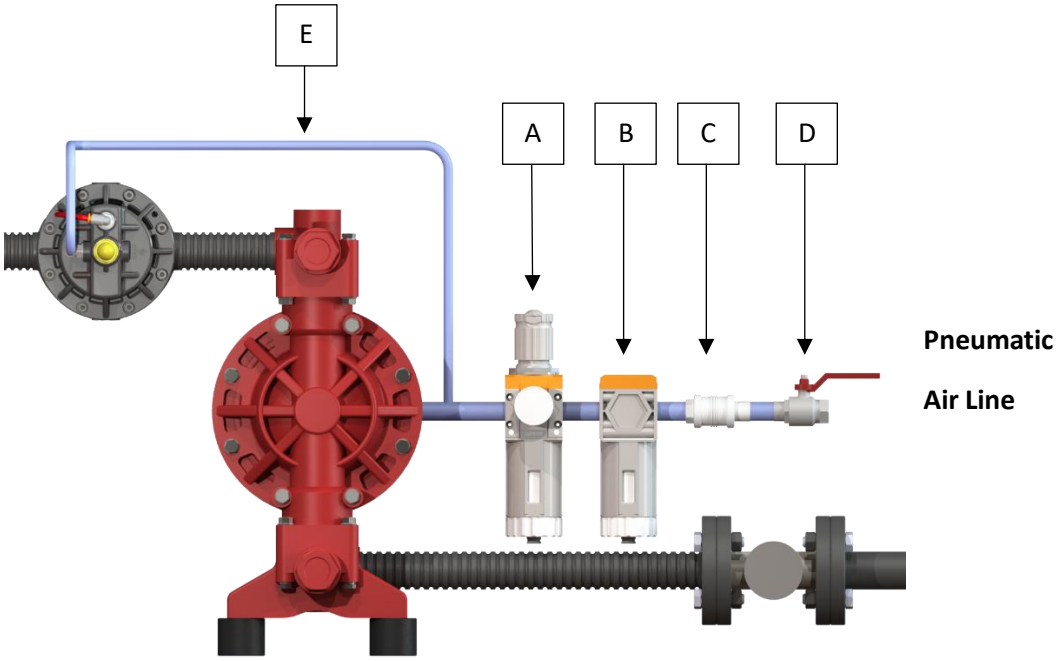


Image 7 - Connection to the Pneumatic System

A) Pressure Regulator with 0-8 bar Gauge
B) Filter: Filtration grade ≤ 15µm
C) 3-Way Quick Exhaust Valve
D) 2-Way Flow Valve
E) Pneumatic Line for Optional Pulsation Dampener

For pumps configured for "external control", the pump must be connected via two pneumatic supply tubes, to be connected to their respective ports. The pneumatic pressure must be alternately supplied and vented from the two ports (e.g., with a 5/2 valve) at a maximum frequency of 3 cycles per second.

Referring to the MACHINE CHARACTERISTICS on page 9 and Image 7 on page 30:

1. There should be no air flow in the pneumatic line.
2. The maximum pneumatic supply pressure, the position, and the size of the pneumatic supply port are indicated in the MACHINE CHARACTERISTICS on page 9.
3. Install the pneumatic components indicated in Image 7, sized according to the pneumatic supply port of the pump indicated in the MACHINE CHARACTERISTICS on page 9.
4. Close the pressure regulator A), close the quick exhaust valve C), and close the two-way flow valve D). The gauge should indicate zero pressure.

The pump requires dry compressed air. All pneumatic components inside the pump are pre-lubricated with special greases by the manufacturer PCHME, which are also available as spare parts.

Install a condensate separator upstream of the pump's pneumatic supply line to prevent the presence of water and oil in the compressed air.

Moisture in the air could freeze the pump's air exhaust mufflers, causing the pump to lock up. This condition must not occur. See section 10.3 on page 42.

Ensure all joints are perfectly sealed.

- During operation, the pump exhausts compressed air into the atmosphere through muffled air exhausts (see MACHINE CHARACTERISTICS on page 9) pre-filtered and silenced by the pump itself.
    - The pump cannot be installed in airtight enclosures. If this is necessary, contact the manufacturer PCHEM.
    - The mufflers must remain clean, intact, and unobstructed.
- The pipes and pneumatic components must withstand the pneumatic supply pressure of the pump. See the MACHINE CHARACTERISTICS on page 9.
- The minimum internal diameter of the tubes for proper pneumatic supply is indicated in the table below:

Pump Size	**3/8”**	**½”**	**¾”**	**1”**	**1“ ½”**	**2”**	**3”**
Min. Recommended Inner Diameter [mm]	6	6	8	8	16	16	16

8 OPERATION

Carefully read the sections on SAFETY and INSTALLATION.

Wear the personal protective equipment as described in section 5.3 on page 12.

8.1 Starting

- Open the 2-Way Flow Valve Ref. D) and open the 3-Way Quick Exhaust Valve Ref. C) (Image 6 on page 27) to allow air flow.
- Using Pressure Regulator with 0-8 bar Gauge Ref. A) (Image 6 on page 27) gradually increase the supply pressure until the pump starts.
- Wait for the pump to engage, i.e., verify the beginning of liquid transfer. If this does not occur, gradually increase the supply pressure.
- Adjust the supply pressure to the desired level.
- The pump has a 1:1 air supply pressure to fluid discharge pressure ratio. This means the pump imparts a pressure on the processed liquid equal to the pump's supply pressure.

8.2 Stopping

- Close the Pressure Regulator with 0-8 bar Gauge Ref. A) (Image 6 on page 27) to completely cut off the pneumatic supply. The gauge should indicate zero pressure.

Closing the Two-Way Shut-Off Valve on Discharge Side Ref. F) (Image 6 on page 27) installed in the hydraulic circuit's discharge line does not stop the pump.

Closing the Two-Way Shut-Off Valve on Discharge Side Ref. F) (Image 6 on page 27) completely, will stop the liquid flow, but the entire pump will remain pressurized, i.e., compressed air will remain in the pump's pneumatic motor and liquid will remain under pressure in the pump's fluid chambers. The pump will resume liquid discharge upon opening, even partially, of the valve. The pump will not suffer any damage or malfunction; however, this condition should be clearly indicated with signs or other necessary measures so that all authorized personnel (especially maintenance staff) working with the pump or the associated system are aware.

Any fluid dried in the discharge line can cause the pump to stop. This is NOT a stopping condition as pneumatic and hydraulic pressure are still present inside the pump.

8.3 Emergency Stop

Interrupt the pneumatic supply to the pump using the 3-Way Quick Exhaust Valve Ref. C) (Image 7 on page 30).

After performing the emergency stop, carry out the normal stopping procedures as described in section 8.2.

8.4 Flow Rate Adjustment

The flow rate delivered by the pump is proportional to the number of pump cycles. Flow rate adjustment can be done in various ways:

- By adjusting the pneumatic supply pressure of the pump using the Pressure Regulator with 0-8 bar Gauge Ref. A) (Image 6 on page 27)
- By throttling the liquid discharge with the Two-Way Shut-Off Valve on Discharge Side Ref. F) (Image 6 on page 27)
- By combining the methods described above.

By varying the pneumatic supply pressure from the minimum to the maximum value, the number of cycles and, consequently, the liquid flow rate delivered by the pump will vary proportionally.

9 MAINTENANCE AND SPARE PARTS

9.1 Introduction

Over time, the pump will inevitably require maintenance, which involves periodic or occasional actions to keep the machine efficient and in good condition.

Before performing any maintenance, consider the following precautions:

Maintenance must be carried out by specialized, professionally qualified personnel (as required by applicable laws and regulations) who possess technical and regulatory knowledge for proper execution.

Any maintenance and/or cleaning operations, even simple ones, must be carried out only after stopping the pump, physically disconnecting the pneumatic supply tube, and disconnecting the pump from the hydraulic circuit to prevent accidental start-up by others. Additionally, any remaining liquid in the pump's fluid side must be drained.

Anyone causing, directly or indirectly, damage to people, property, or animals by failing to follow the instructions in this manual and/or by improper or non-compliant use of the machine must assume full responsibility.

Disassembly or modification, even partial, of any pump component during the warranty period, without specific authorization from the manufacturer PCHEM, will void the warranty, making it impossible to identify the cause of any malfunction.

The breakage or excessive wear of any pump component can compromise the integrity of other parts of the system, the work environment, or create high-risk and/or dangerous situations. Residual risks are described in the section on Residual Risks on page 20.
If any signs of wear, breakage, or damage are visually detected, disconnect the pump from the pneumatic and hydraulic networks, avoid further operations, and contact the distributor or manufacturer PCHEM.

Only use genuine PCHEM spare parts. Using non-original parts will void the warranty and can cause irreparable damage to the pump, creating high-risk and/or dangerous situations.

Wear personal protective equipment as described in section 5.3 on page 12.

9.2 Regular and Extraordinary Maintenance

Maintenance interventions can be of two types:

- **Regular Maintenance**: All operations performed periodically or occasionally to keep the machines described in this manual efficient and in good condition.
- **Extraordinary Maintenance**: All operations performed periodically or occasionally. For extraordinary maintenance, it is recommended to always contact the manufacturer PCHEM.

9.3 Concept of Wear Parts

Wear over time is a natural characteristic of any pump component.

“Wear over time parts" refer to all components that reasonably wear out due to normal pump operation. Estimating their lifespan is practically impossible as it depends on various factors such as the liquid transferred, operating speed, working environment, etc.

Wear parts are detailed in the following sections of this chapter.

PCHEM invests significant resources in ongoing research into materials and design solutions to increase the lifespan and efficiency of components.

9.4 Preventive Maintenance

A preventive maintenance plan is cost-effective for the user, minimizing the risk of sudden production stops or poorly executed maintenance.

9.4.1 Maintenance of Components in Contact with Transferred Liquid

Wear of fluid-side components mainly depends on the properties of the transferred liquid, working environment, and the system in which the machine is installed. It is impossible for PCHEM to predict the number of cycles or hours of component lifespan in contact with the processed liquid.

Therefore, the user must define a preventive maintenance plan to replace the most wear-prone components before they fail. This plan can be adjusted over time based on the observed wear of components during maintenance.

9.4.2 Example of Preventive Maintenance

As an example, based on the manufacturer's experience, the following preventive maintenance schedule is suggested for a PRO ONE 25 pump used for transferring water at 20°C with a discharge pressure of 1 bar, and supplied at 4 bar:

Time interval	**Intervention**
Every 2000 hours Or Every 12 months	Replace diaphragms Replace external clamping discs (not applicable if using diaphragms with integrated clamping discs) Replace inlet and outlet valves Replace fluid-side gaskets Replace air exhaust muffler
Every 4000 hours Or Every 24 months	Replace pneumatic motor power valve Replace pneumatic motor pilot valve Replace pneumatic motor sliding bushes Replace pneumatic motor gaskets Replace diaphragms shaft

For static plastic parts in contact with the transferred liquid, replacement is recommended after 48 months.

9.5 End-of-Day or End-of-Shift Maintenance

- Perform a thorough external cleaning of the pump. Use a vacuum cleaner with a thin nozzle if necessary to remove residues and impurities from all parts of the pump; use short bursts of compressed air to reach difficult areas if needed. Before using compressed air, wear a respiratory mask and protective goggles, and ensure that people nearby are kept away. Do not use water sprays or metallic objects, especially sharp or pointed ones, to avoid damaging surfaces or components.
- Check that the pump's air exhausts are not obstructed. Clean them thoroughly using a vacuum cleaner or short bursts of compressed air. If cleaning is not possible, replace the components.
- Visually inspect the pneumatic and hydraulic connections to the pump. If any scratches, cracks, kinks, or other damage or wear are noted, promptly call a specialized technician for repair or replacement of the affected components.
- If the pump transfers liquids that can crystallize, solidify, or leave solid residues (e.g., deposits, filaments), perform a cleaning of the fluid side of the pump. Two methods can be used, and the user should choose the most appropriate:

    - Transfer a cleaning liquid through the pump until it is thoroughly cleaned. Note that the cleaning liquid must follow the safety guidelines described in SAFETY on page 12.
    - Disassemble the fluid side of the pump and clean each component individually. This type of maintenance during the warranty period must be authorized by PCHEM.

- Ensure the hygiene conditions of the workplace and, consequently, of the pump in compliance with applicable laws and regulations.
- Check the torque of the bolts. Perform the operations described in section 9.10 Torque of Bolts on page 40.
- Isolate the pump from the hydraulic circuit by closing the Two-Way Shut-Off Valve on Discharge Side F) and the Two-Way Shut-Off Valve on Suction Side G) described in the Connection to the Hydraulic System on page 27.
- Isolate the pump from the pneumatic circuit by shutting off the pneumatic supply to the pump using the 3-Way Quick Exhaust Valve. See the Connection to the Pneumatic System on page 30.

9.6 Extended Shutdown or Exclusion from Service

In case of extended shutdown or exclusion from service, disconnect the pump from the pneumatic and hydraulic networks.

- Perform all operations described in section 9.5 End-of-Day or End-of-Shift Maintenance.
- Perform all operations described in the Storage section on Storage on page 21.
- Upon re-commissioning, conduct a thorough preliminary inspection to check its integrity and treat it as if it were a new installation. See sections 6-7-8.

9.7 Maintenance of Pneumatic Motor Components

In case of wear or breakage of a pneumatic motor component, the pump may:

- Not deliver liquid / Not operate
- Decrease pumping performance
- Leak air

The pneumatic motor parts most prone to wear are:

- Power valve and Pilot valve
- Gaskets
- Sliding bushes
- Diaphragm shaft
- Air exhaust

For spare parts and exploded views, see section 9.11 on page 40.

Whenever disassembling air-side components, the air-side gaskets must be replaced and lubrication restored

9.8 Maintenance of Fluid Side Components

In case of wear or breakage of any fluid-side parts, the pump may:

- Not deliver liquid / Not operate
- Decrease pumping performance
- Leak liquid

Below are the fluid-side pump parts most prone to wear and the main consequences of wear, breakage, or damage.

Diaphragms Diaphragm Clamping Discs	- Liquid leakage outside the pump. - Liquid leakage from the pump's air exhausts / pneumatic supply. - Liquid reaching the pneumatic motor components, potentially making them unusable. - Compressed air leakage from the fluid side. - Presence of compressed air pressure in the hydraulic circuit.
Inlet and Outlet Valves Fluid-Side Gaskets Fluid-Side Structure	- Liquid leakage outside the pump. - Irregular pumping. - Failure to suction liquid. - Liquid return in the suction pipe.

Whenever disassembling fluid-side components, replace the fluid-side gaskets

Whenever disassembling the diaphragms, replace the external clamping discs

For spare parts and exploded views, see section 9.11 on page 40.

9.9 Lubrication

The components of the Pneumatic Motor are lubricated by the manufacturer PCHEM with special and appropriate lubricants.

After any maintenance operation on the components, the lubricant must be restored.

Ensure that the air supply to the pump is dry. See the Connection to the Pneumatic System on page 30.

Incorrect lubricants can cause irreparable damage to the pump and create high-risk and/or dangerous situations. A classic example of an incorrect lubricant is vaseline oil.

Use only genuine PCHEM lubricants available as part of the spare parts kit.

After any maintenance of the pneumatic motor components, restore the lubricant.

9.10 Torque of Bolts

Transport, handling, vibrations due to normal operation, and thermal excursions may, over time, loosen the torque of the pump bolts, especially in pumps with plastic components.

Use a torque wrench to check the torque of all visible bolts from both the air side and fluid side. Also, check the bolts anchoring the pump to bases or supports.

The torque specifications for threaded connections are indicated in the exploded views. See section 9.11 on page 40.

For torque checking operations only:

- Do not remove any bolts or fastening elements.
- Do not remove any pump components.
- It is not necessary to check the torque of internal pump components.

9.11 Spare Parts and Exploded Views

For spare parts and exploded views, refer to the attachment ATTACHMENT 1 (on page 43)

10 POTENTIAL FAILURES OR ANOMALIES

10.1 The pump does not cycle, does not deliver flow, and no air leaks are heard

- Ensure that all INSTALLATION procedures described in section 7 on page 23.
- Ensure that all OPERATION procedures described in section 8 on page 32, have been performed correctly, including:
    - Checking the condition of the pneumatic supply line.
    - Verifying the connection and condition of the hydraulic system.
- Verify that the discharge piping is not obstructed and that no circuit shut-off valves are present.
- **The pump may have sucked in impurities or solid particles that hinder the movement of the inlet and outlet valves.**
- Presence of dried liquid inside the pump.
- Check the suction filter on the pump.
- Ensure that the pump's air exhausts are not obstructed.
- Possible presence of impurities from the pneumatic supply blocking the movement of the motor components.
- Verify that the pressure drop on the discharge side does not exceed the maximum performance limits of the pump.
- Ensure there are no constrictions or shut-off valves in the pneumatic and hydraulic lines.
- If the pump still does not cycle, does not deliver flow, and no air leaks are heard, contact the distributor or manufacturer PCHEM.

10.2 The pump cycles but does not deliver flow

- Ensure that all INSTALLATION procedures described in section 7 on page 23 have been performed correctly.
- Ensure that all OPERATION procedures described in section 8 on page 32 have been performed correctly, including:
    - Checking the condition of the pneumatic supply line.
    - Verifying the connection and condition of the hydraulic system.
- **Verify that there is liquid to be transferred.**
- **The pump may have ingested impurities or solid particles that hinder the movement of the inlet and outlet valves.**
- **Possible wear of the inlet and outlet valves.**

10.3 Presence of ice near the air exhausts of the pneumatic motor

The presence of condensation or ice on the surfaces of the pump near the air exhaust is a phenomenon caused by the temperature drop due to the expansion of compressed air into the atmosphere, encountering ambient humidity.

This phenomenon should not be considered a defect of the pump.

If ice blocks the air passages, the pump may become blocked, creating a hazardous situation.

The presence of ice near the air exhausts of the motor indicates excessive ambient humidity or excessive humidity in the pneumatic supply line to the pump.

- The pump must be supplied with dry air. See section 7.4 on page 30. The condensate separator in the pneumatic supply line may be damaged; replace or repair it if necessary.
- The pump cannot operate with exhaust mufflers obstructed by ice. Install the pump in a less humid environment.
- Consult the manufacturer PCHEM to configure the pump with special mufflers or with ducted air exhaust.

10.4 Continuous air leakage from the pneumatic motor of the pump

- One or more screws securing the pneumatic motor may have loosened due to vibrations. Check the correct tightening. See Section 9.10 on page 40.
- One or more seals of the pneumatic motor may be worn and need replacement.
- One or more components of the pneumatic motor may be worn and need replacement.

10.5 Presence of air in the hydraulic circuit

- Check that the suction and discharge pipes are perfectly sealed.
- One or more screws securing the pneumatic motor may have loosened due to vibrations. Check the correct tightening. See section 9.10 on page 40.
- Possible rupture of diaphragms and/or sealing disks.
- Possible cavitation phenomenon.

10.6 Presence of liquid on the pneumatic motor

- Possible rupture of diaphragms and/or sealing disks.
- Possible cavitation phenomenon.

10.7 Leakage of liquid from the pump

- Verify proper connection to the hydraulic system. See section 7.3 on page 27.
- Verify proper connection to the pneumatic system. See section 7.4 on page 30.
- One or more screws may have loosened due to vibrations. Check the correct tightening. See section 9.10 on page 40.
  Possible rupture or damage of one of the fluid side components.
  Possible chemical incompatibility of the transferred liquid with the pump.

10.8 Other anomalies or malfunctions

Contact the technical support of the distributor or manufacturer PCHEM.

11 DISPOSAL

If you need to dismantle the machine, you must separate its components by material type and dispose of them in accordance with current laws and regulations. Contact specialized waste disposal companies that will handle the disposal in compliance with relevant laws and regulations.

Ensure the use of personal protective equipment as described in section 5.3 on page 12.

11.1 Packaging Disposal

The packaging may include the following materials, depending on the model, number of units, and shipment characteristics:

Paper and cardboard, adhesive tape, metal staples, plastic bags.

The supporting pallet, if any, may be made of plastic or wood.

11.2 Machine Disposal

The machine may be made of the following materials:

- Metals (stainless steel, carbon steel, brass, aluminum)
- Plastics (PTFE, PP, PVDF, POM, PET, PA, PE, ABS, SANTOPRENE, POLYURETHANE)
- Elastomers (NBR, FPM, EPDM, SILICONE)

See the pump configuration materials described in section 4.4 on page 10.

12 ATTACHMENTS

1) ATTACHMENT 1

Technical Specifications, Exploded Views, Screw Torque Values, Spare Parts.

13 CE DECLARATION OF CONFORMITY

Original version in English language

CE DECLARATION OF CONFORMITY

of a machine (2006/42/CE, Annex. II, part. 1, let. A)

The manufacturer/Authorized person to draft the technical documentation:

PCHEM S.R.L.
Via Brigata Mazzini, 35/A 36016 - Thiene (VI)

Declares under its own and sole responsibility that the machine:

Type: AODD Pump
Model : Pro One xx
Function : Pump designed for transfer of fluid
Serial number: From xxxxx to xxxx

complies with the legal provisions indicated in the directive:

- 2006/42/EC (Machine)

and the following harmonized standards, applied standards and/or technical specifications:

EN ISO 12100:2010
EN 809:1998+A1:2009

Luogo: Thiene (VI)

Data: xx/xx/20xx

Otto Varini

Il legale rappresentante

14 ATEX 2G DECLARATION OF CONFORMITY

EU DECLARATION OF CONFORMITY EU

(2014/34/UE, Annex X)

The manufacturer:

PCHEM S.R.L.

Via Brigata Mazzini, 35/A - 36016 - Thiene (VI) Italia

Declares under its own and sole responsibility that the machine:

Type	**AODD PUMP (in Metal or Conductive Plastic)**
Model	**Pro One xx**
Serial Number	**From xx0001 to xx9999**
Use	**Liquid transfer**
Year of manufacture	**20xx**

Complies with all requirements of the following EU directives:

- **ATEX 2014/34/UE**

And the following harmonized standards, applied standards and/or technical specifications:

- EN 1127-1:2019
- EN ISO 80079-36:2016
- EN ISO 80079-37:2016

Notified body data: name, identification number and address

- Name: CESI
- Identification number: 0722
- Address: Via Rubattino,134 – 20134-Milano
- Identification n. : xxxxxxxx

This equipment is classified as follows:

II 2G Ex h IIB T4 Gb

3 °C ≤ Tamb ≤ +50 °C

Authorized person to compile the Technical File

Otto Varini

Thiene (VI) ITALY

Date: **xx.xx.20xx**

Otto Varini

Legale Rappresentante – Otto Varini

Original Version in English

15 ATEX 3G DECLARATION OF CONFORMITY

EU DECLARATION OF CONFORMITY

(2014/34/UE, Annex X)

The manufacturer:

PCHEM S.R.L.

Via Brigata Mazzini, 35/A - 36016 - Thiene (VI) Italia

Declares under its own and sole responsibility that the machine:

Type	**AODD PUMP (in Metal or Conductive Plastic)**
Model	**Pro One xx**
Serial Number	**From xxxxxx to xxxxxx**
Use	**Liquid transfer**
Year of manufacture	**xxxx**

Complies with all requirements of the following EU directives:

- **ATEX 2014/34/UE**

And the following harmonized standards, applied standards and/or technical specifications:

- EN 1127-1:2019
- EN ISO 80079-36:2016
- EN ISO 80079-37:2016

This equipment is classified as follows:

II 3G Ex h IIB T4 Gc

3 °C ≤ Tamb ≤ +50 °C

Authorized person to compile the Technical File

Otto Varini

Thiene (VI) ITALY

Date: xx.xx.20xx

Otto Varini

Legale Rappresentante – Otto Varini

Original Version in English