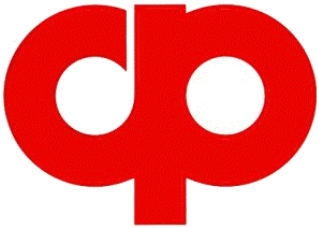

POMPE CUCCHI
s.r.l.

Serie N

GEAR METERING PUMP

OPERATING AND MAINTENANCE MANUAL

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CONTENTS

1. GENERAL INFORMATION

1.1 SUPPLY CONDITIONS

According to Customer's requirements, the pump can be provided both as bare shaft pump and as pump unit. By pump unit it is meant the pump aligned with the engine, including driving elements, baseplate and any auxiliary machinery. The pumping group is supplied with safety coupling guard.

1.2 MANUFACTURER

The pump Manufacturer is POMPE CUCCHI S.R.L.. You can apply for assistance by sending a request to the following address:

Via dei Pioppi 39 - 20090 OPERA (MI) ITALY
Tel. +39.02.57.60.62.87 (Hunting Line)
Fax +39.02.57.60.22.57
E-mail : sales@pompecucchi.it

1.3 USER MANUAL CONTENT

This user manual provides all the necessary information to ensure a safe and correct use of the machine. It was written – when applicable – according to point 5.5 of Standard EN 292 part 2-1992 - Machinery Safety; according to point 7 of Standard UNI EN 809-2000 Pumps and Pump Units for Liquids - Common Safety Requirements - and according to point 1.7.4 of Directive 98/37/EC 1998 (ex 89/392 EC). In this manual it is constantly referred to safety instructions. Such instructions are identified by the following symbols:

	It represents the safety instructions contained in this manual, whose non-observance may compromise safety.
	It is shown when electrical safety is essential to worker protection.
	It indicates the safety instructions which should be taken into account for the safe operation of either the pump, the pump unit or the pump or pump unit protection.

1.4 NAME, TYPE

The standard pump construction is made of AISI 316L stainless steel with graphite supports and mechanical seal in ceramic/graphite/viton. The complete series includes several models which vary in size, materials and mechanical seals. Furthermore, the Manufacturer can also provide models with preheating chambers, double mechanical seals, magnetic drive, sanitary fittings, etc. The pump identification is obtained by an alphanumeric code, an example of which is shown below:

- 0NAX010/D0HF0C0: N type pump, A class, construction in AISI 316L stainless steel, rated flow 10 l/min. at 1500 rpm (cubic capacity 7.8 cm3/revolution), gears in AISI 316L, graphite bushes, dual mechanical seal, equipped with preheating chamber.

1.5 NOISE EMISSIONS

- Reference standard: CEN/TC 197/SC3 N 21 E -fig.8- ISO 3744 on 6 positions
- Measured values:
  1 - Equivalent weighted continuous acoustic pressure level Leq = 75 dB(A);
  2 - Maximum weighted instantaneous acoustic pressure C (peak level) Lpc < 78 dB(C).
- Test conditions: When measuring noise, the pumped liquid (ref. to a liquid with 1 cP viscosity) must be introduced into the testing system at a speed of less than 0.8 m/s into pipes. It must however reach laminar flow regime (thus the speed must be related to the viscosity) and the conditions outlined in this manual must be respected.

1.6 APPLICATION FIELDS AND LIMITS. ALLOWED AND NOT ALLOWED USES

Each machine shall be used according to the type of application, operating conditions and liquid characteristics provided in contract specifications. Each variation which alters the intended use of the pump is forbidden and the User is fully responsible for it (e.g. the use of a liquid which is corrosive to pump materials rather than the recommended fluid, etc.). For variations in use within the application limits (e.g. fluid viscosity variations) it is advised to contact the Manufacturer in advance.

In any case, the use of "KK" or alike plastic gears to allow the pump to operate also with poorly lubricating fluids, requires greater attention to avoid excessive or unexpected pressure loads.

It is absolutely forbidden to use the machine in hazardous environments (explosive atmosphere, etc…), the use of hazardous substances (e.g. fluids with dangerous gases), in critical conditions (e.g. abnormal temperatures, etc…), which are not supplied with the pump.

For pumps and pump units intended to be used in potentially explosive environments, please read carefully "Additional instructions for the operation and management of pumps and pump units intended to be used in potentially explosive atmospheres (Directive 94/9/EC)".

Pompe Cucchi S.r.l. declines every responsibility for the consequences arising from an improper use of the machine which does not comply with what prescribed in this manual or specifically requested when ordering.

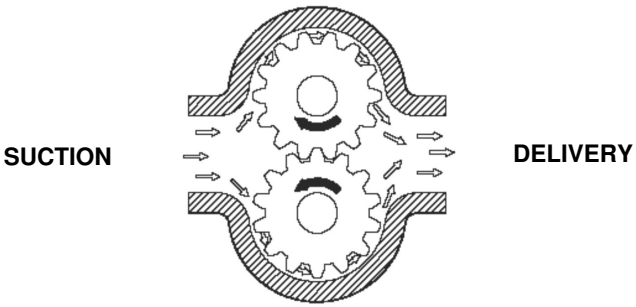
2. TRANSPORT, HANDLING, PACKAGING, STORAGE

Pompe Cucchi sells “ex works”. Consequently, transport from the manufacturing shop to the named place of destination is carried out by the Customer under his own responsibility. For each transport a suitable standard packaging is ensured or established based on Customer requirements who, in any case, must give information about the type of shipment to be performed (by land, air, “overseas“).
In case of long stationary periods under critical environmental conditions (such as: high humidity and/or salinity, etc.) the supply shall be stored in a protected environment.

3. DESCRIPTION OF THE PUMP AND THE PUMP UNIT

3.1 GENERAL DESCRIPTION OF THE MACHINE

Essentially the pump consists of two driven pinions which mesh one another inside a billet machined main body, thus creating a flow of liquid between the inlet and the outlet.



The fluid containment inside the pump is ensured by a suitable seal part as defined in the order.
The pump is attached to the electric motor, EC approved, by flexible or magnetic coupling.
The access to the coupling and the projecting segments of motor-side and pump-side shafts is prevented by a safety coupling guard.
The pump unit can be equipped with a mechanical speed reducer or an hydraulic speed variator for the adjustment of the rotation speed, EC approved. The assembly rests on a strong metal baseplate.

3.2 WARNINGS

Standard construction pumps, as an indication, require a NPSH of approx. 0.4 bar. Always calculate the maximum available suction lift, in relation to fluid characteristics, suction circuit and operating conditions. Ensure that gears do not operate when dry. Before starting the pump for the first time or after long stationary periods, it is advisable to fill the gear spaces with oil or liquid being pumped through one of the nozzles and rotate the driving shaft by operating manually with a screwdriver on the motor cooling fan. This also makes it possible to check for even and smooth movement of rotary components and excessive friction. It is recommended that an overland cut-out set at approx. 10% above the motor current be installed in the control circuit.
In our pumps the direction of rotation is clearly shown by an arrow marking the right direction.

The pump operating temperature in normal working conditions is about 80°C. In special pump versions, working temperatures of 180°C and more may be achieved. To protect personnel from dangers due to the temperatures reached during the operation of the machine, in the event of accidental contact (burn), the User must reduce the external pump temperature by means of insulation plates, coatings, screens, barriers, etc. As limit reference temperature for the contact surface it is advisable to take 55°C. Below this value, for hot smooth surfaces in bare metal, there is no burn threshold. For a detailed knowledge of this problem in relation to different particular cases, the User can read the standard UNI EN 563 Ed.'94, where burn thresholds are specified for several types of surface according to the "surface temperature - contact time" parameters.

Liquids to be pumped must not contain abrasive or solid suspension as this will greatly reduce the pump life. At this purpose we recommend the installation of a properly sized filter on the suction line if solids may be present.
When pumps are installed in parallel, the suction lines should be adequately separated to prevent unnecessary turbulence.

3.3 PROTECTION DEVICE

The coupling guard installed by the Manufacturer is made of a strong metal plate, fastened to the baseplate by screws, duly shaped to prevent fingers from coming into contact with moving parts. It can be removed only by using a proper tool.

3.4 ADDITIONAL DESCRIPTION OF ACCESSORIES

3.4.1 Seal parts

The pump is usually supplied equipped with mechanical seal. If the Customer requires a particular type of seal, Pompe Cucchi S.r.l. installs the desired seal after verifying if its dimensions are compatible with those of the pump. In case the Customer requires only the seal mark, the Company leaves the Manufacturer to select the type of seal, by giving information about the pumped liquid.
Among the seals used we can mention the following:

- Single mechanical seal
- Double tandem mechanical seals with tank and pressureless flowing liquid
- Double opposed mechanical seals with external pressurized flowing liquid

These last must be installed when the pumped product has characteristics which prevent it from being used as flowing source or for greater safety (visual inspection).

The tank for tandem mechanical seals is not pressurized and it is used to avoid dry operation of the external seal and visually detect any possible leakage of the internal mechanical seal.
For magnetic drive pumps sealing is only ensured by static gaskets, since the pump shaft is completely enclosed within the pump body.

4. INSTALLATION, ASSEMBLY

4.1 SPECIAL ASSEMBLY TOOLS

To assemble the pump you do not need special tools, except for seal extractors (see Maintenance).

4.2 INSTALLATION SITE INFORMATION

4.2.1 Space requirements for operation and installation

The space destined by the Customer to the installation of the machine should be enough to gain access to, install and maintain the pump unit.

4.2.2 Inspection before starting installation

Before installation, the Customer must ensure that the environmental conditions of the selected site comply with requirements specified under the contract.
In particular, unless expressly required and accepted in the order, the installation site should not be exposed to the following environmental conditions:

- abnormal temperature;
- high humidity;
- corrosive atmosphere;
- explosion and/or fire hazard areas;
- dust, sandstorms;
- earthquakes and other similar external conditions;
- high level of vibrations;
- high altitude;
- flood hazard areas.

4.2.3 Baseplate, foundation plate details

The metal base plate shall be of sufficient size and strength to support induced stress.

When the pump unit is installed, it shall be firmly fixed in place by fastening bolts or by using other securing methods.
Ground fastening bolts or other securing methods shall be of sufficient strength to prevent the pump unit from moving accidentally.

4.2.4 Alignment requirements

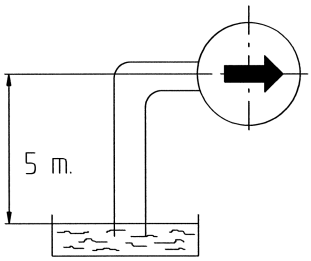
The alignment operation must not submit the pump unit to axial and radial stress, therefore the offset must always be lower than the tolerance limits expected fot the coupling.

Great care shall be taken to align pump units equipped with magnetic drive coupling.

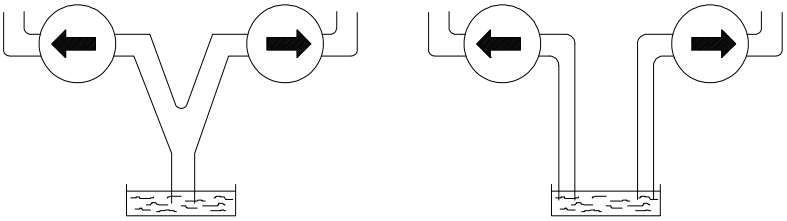
4.2.5 Suction lift

The suction lift, that is the vertical distance between the pump inlet mid-point and the free surface of the tank to which the pump is attached, must not exceed 5 m to allow pump priming and avoid cavitation phenomena.

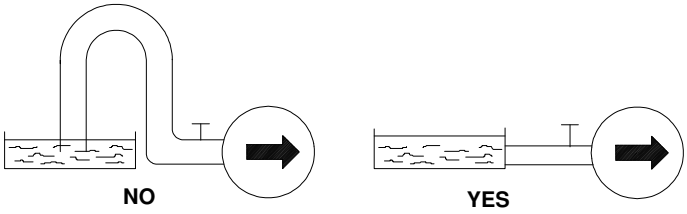
Otherwise, contact our Technical Department.



Each pump must have its own suction pipe; the installation of two or more pumps with a common suction pipe length causes the pump to work less efficiently.
The length of the suction pipe must be reduced as much as possible to minimize pressure losses in such segment; higher pressure losses in the discharge line do not adversely affect the correct operation of the pump (if they do not exceed the delivery limits stamped on rating plate).



Furthermore, it is necessary to check that siphons are not created in the suction pipe, since the formation of air pockets generates vibrations and stresses which are not compatible with the correct operation of the pump and may obstruct the pump priming at startup.



In case of installation below head, the pump does not ensure to be able to intercept the flow of fluid as a shut-off cock or a proper stop valve.

4.3 INITIAL INSTALLATION

According to the conditions of supply, the pump can be delivered as follows:

4.3.1 Complete pump unit

In this case the Customer must fasten the baseplate to a solid support in order to ensure the correct axis alignment in all operating conditions.

We recommend the use of vibration dampers below the pump base and vibration damping sections on pipes near pump inlets.

Once the pump unit has been positioned, proceed as described below:

a) connect suction and discharge pipes respectively to the pump inlet and outlet;
b) power the motor, by carefully controlling the compatibility of motor voltage and frequency with those of the system;
c) open the intake and discharge pipe valves, if any;
d) run the motor for a while to verify that the pump rotates in the direction indicated by the arrow stamped on the pump.

4.3.2 Bare shaft pump

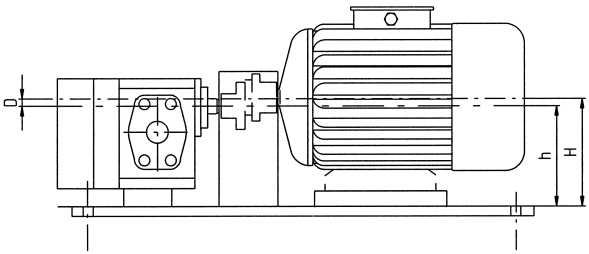
In this case, before following the steps described at Paragraph 4.3.1, choose the type of motor and align it to the pump on a baseplate.

The motor must be selected by the Customer depending on the type of operation for which it is specifically requested (continuous operation, discontinuous operation, repeated startups, indoor or outdoor installation, explosive atmosphere, critical environmental conditions, altitude, etc.) with power compatible with that required by the pump.

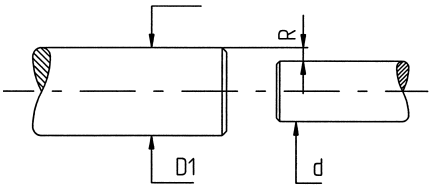
The alignment is performed by flexible or magnetic coupling on a baseplate.

To align the *flexible coupling* make the following basic operations:

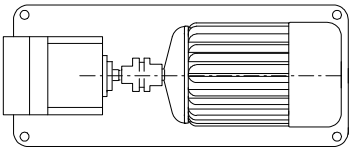
a) accurately measure the height of the pump axis (h) and the height of the motor axis (**H**);
b) calculate the difference **D = h – H**;



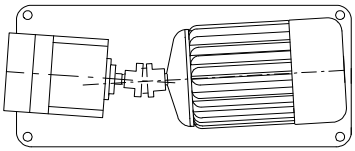
c) prepare some aluminium (or steel) shims with height **D**;
d) place motor and pump on a single plane (verify their flatness), by placing shims where necessary (or under the motor feet or the pump feet);
e) verify that the axes of the two shafts coincide, by measuring the two diameters by difference, that is, by accurately measuring **R, D1 = 2R + d**. If this equality is not verified, properly place calibrated shims so as to align perfectly the pump unit;



f) check that the pump axis and the motor axis are perfectly coaxial, since an offset would cause a radial force whose strength may reduce the life of the pump or motor.



YES



NO

g) leave an axial clearance of approximately 2 - 3 mm between the 2 couplings, so as to avoid stresses induced by axial forces and thermal expansions.

In case of connection by *magnetic coupling*, proceed as follows:

a), b), c), d) proceed as in the case of the flexible coupling;

e) verify the coaxiality between the inner magnet cover and the outer magnet cover, by accurately measuring **R**, difference between the outer cover diameter d and the external outer magnet diameter **D1**. This measurement should be made on at least 4 points at 90°; if different values are found in various measurement points, properly place calibrated shims so as to perfectly align the pump unit;

f) the non-perfect coaxiality causes differences in the air gap which induce variations of the magnetic pull force on the inner magnet with consequent radial forces on the shaft and wear of bushes;

g) it is also essential to avoid generating axial stress on the inner magnet, which would cause the consequent premature deterioration of bushes, by leaving the outer magnet free to position itself axially. After positioning the pump and the motor, it is therefore necessary to unscrew the coupling fastening grub screw on the motor shaft and retighten it after the magnet has moved to its balance position.
Verify that the end of the motor shaft is at a distance of at least 2 - 3 mm (axially) from the inner magnet cover.
It is advisable to mark by two dowel pins the position of the pump on the baseplate, so as to make the assembly easier after maintenance operations.

When centering the outer magnet, pay particular attention to the effects of the magnetic pull force; in particular pay attention to your fingers (always use safety gloves) and not to damage magnets with accidental shocks.

We recommend to use tools in non-magnetic material.

The User shall place a rigid coupling guard on the flexible or magnetic coupling: it shall be machined so as to prevent access to moving parts.
Such coupling guard shall be firmly secured to the baseplate.

4.4 DRIVE UNIT AND ACCESSORY ASSEMBLY

4.4.1 Motor

The Company installs EC approved electric motors, of power compatible with that required by the pump, selected according to the desired operating conditions and environmental characteristics. In particular if the pump unit is required to operate in explosive atmosphere, the motor is chosen in explosion-proof execution **(we remind that, to be used within the European Union, also the execution of the pump and the relevant fittings must comply with directive 94/9/EC).**

4.4.2 Installation of safety and control devices

If specifically requested in the order form, the Company provides the pump with the relief valve, which must be calibrated to protect the pump from damage. Once it has been properly calibrated, the valve must not be tampered with in any way, since volumetric pumps can reach quickly, with the delivery closed, extremely high pressure values, with consequent very serious danger.

Any pressure adjustment shall be compulsorily made with the pump stopped and depressurized.

The User shall install a pressure gauge in the pump outlet, upstream of the relief valve; it is advisable to install a vacuum gauge near the pump inlet.

In case also a safety valve is installed on the system, make sure that its calibration pressure differs considerably from the one of the relief valve not to generate dangerous resonance phenomena (pipe and/or valve break).

4.5 ELECTRICAL CONNECTIONS, CONNECTION CABLES

The machine shall be connected to the external ground protection system by the appropriate terminal, which must be identified by the PE letter. Connection cables shall be properly sized and insulated. Before energizing the machine, always verify that the mains voltage and frequency are compatible with those of the motor.

4.6 PIPING

4.6.1 General

Pipes shall have a suitable diameter to allow a regular flow with low pressure losses. Therefore, we recommend to use, at least for the suction line, pipes with inner diameter equal to or greater than that of the pump inlet, mostly when the viscosity level becomes considerable. To minimize pressure losses in the circuit, we recommend to avoid, as much as possible, abrupt variations of section and direction (curves) along the pipe run, particularly in the suction line.

4.6.2 Forces and moments which operate on suction and delivery flanges.

As general rule it would be necessary to interpose flexible vibration damping sections between the pump and the system piping; therefore, we recommend to verify that the flanges of the connection pipes are always placed, in free position, with the planes parallel to those of the flanges of the suction and delivery nozzles to avoid that, after fastening them, forces and moments of excessive value are generated.

In any case, the User shall make sure that the loads induced on the pump flanges, under the most critical operating conditions, do not exceed the values prescribed by Standards UNI EN ISO 14847.

4.6.3 Fastening screw torques

The fastening torque for the screws of our pumps shall be:

- for M6 screws 11-12 Nm
- for M8 screws 20-22 Nm
- for M10 screws 38-40 Nm

For more detailed information, contact our Technical Department.

5. COMMISSIONING, OPERATION, SHUTDOWN

5.1 DOCUMENTATION

Operating and maintenance manual

5.2 PUMP PREPARATION FOR STARTUP

5.2.1 Filling / discharge

To prevent gears from running dry, before starting the pump for the first time or after long stationary periods it is advisable to fill the gear spaces with oil or liquid being pumped through one of the nozzles and rotate the driving shaft by operating manually with a screwdriver on the motor cooling fan. This also makes it possible to check for even and smooth movement of rotary components and excessive friction.

The pump discharge, if it is about toxic, harmful or, in any case, dangerous fluid, shall be carried out with the greatest care. In particular, the pump body shall be emptied with appropriate operating manoeuvres. Later the pump (except for the NAX2.5 model) shall be submitted to a CIP cycle washing ensured by an internal drain line which, by creating a vacuum, after partially closing the intake valve, in the bearing area and the seal chamber, removes completely any traces of conveyed liquid.

5.2.2 Electrical connections

It is necessary to choose wires which satisfy the operating conditions required by the Customer (e.g. voltage, current, electric shock protection, bundle of cables) and can support external influences (e.g. ambient temperature, presence of water or corrosive substances, mechanical stresses, fire hazards). Moreover, we remind that wires must be properly sized to ensure the voltage drop from the power supply inlet to the point of load application does not exceed 4%.

5.2.3 Verifying the direction of rotation

Open the intake and discharge valves. To verify the direction of rotation run the motor for a while only to check that the pump rotates in the direction marked by the arrows.

5.3 SAFETY DEVICES

5.3.1 Mechanical safety devices (guards for rotating parts)

The hazardous area, represented by the projecting sections of pump side and motor side shafts and the coupling, shall be protected against accidental contact using a duly shaped strong metal coupling guard which must be firmly secured to the baseplate.

5.3.2 Acoustic insulation

Sound emission values are specified in this manual. The User should always verify if the regulations of his own country prescribe, in relation to the frequency of exposure to emission values, the use of **individual protection devices**. If it is, he must comply with the requirements contained in the above-mentioned regulations to protect the operator's health and safety.

5.3.3 Splash-proof cover

In the event the liquid being pumped is dangerous, the operator must be in any case protected against the risk of any accidental contact with jets of liquid by wearing appropriate **individual protection devices**.

5.3.4 Regulation on the electric components

We remind that in accordance with Standard EN 60204-1 Ed1998-04, as power disconnecting switch, a plug/socket combination is allowed for a machine with rated power **equal to or lower than 16 A** and a total power **equal to or lower than 3 kW.**

5.4 STARTING THE PUMP

5.4.1 Initial commissioning

- Ensure that the pump unit is properly earthed.
- In case the pump is equipped with preheating chamber, it is necessary to operate this last up to reach the normal operating temperature and gradually start the liquid pumping up to reach the operating conditions in thermal equilibrium.
- Verify that suction pipes are properly joined one another to avoid air infiltrations which would prevent the pump from priming.
- Check that siphons are not created in the suction pipes so that pump can completely remove the air. In this case, if the air is not completely removed then the flow rate may decrease and the noise level may increase although the pump has taken in the liquid, with consequent premature deterioration of bearing bushes and moving parts.
- Where applicable, verify that the pipes for the external flow of mechanical seals are properly connected.
- Verify the proper operation of the relief valve; to do so it is necessary to gradually increase pressure, by acting on the valve located on the discharge pipe, up to reach the expected calibration value. Now, after a further rotation of the valve, the discharge pressure shall remain lower than the calibration value. Otherwise, **after stopping the machine and depressurizing the pump,** it is necessary to disassemble the valve cap, remove the gasket below, loosen the nut and rotate counterclockwise the spring pre-load adjusting screw (clockwise to increase the pre-load). Retighten the lock nut, interpose the gasket and rescrew the protection cap. **The adjusting screw is not equipped with retainer, therefore it is necessary to pay attention, when unscrewing it, not to cause a leakage of the fluid being pumped.**

5.4.2 Startup after shutdowns

The most common case in which the pump may stop working - apart from the power supply failure (black out) – is when the electric motor overcharge protection comes into operation. In this case, before starting the pump examine the causes which triggered the activation of the protection and remove them.

In magnetic drive pumps, it may happen that, once the maximum transmissible torque value has been exceeded, the pump stops while the motor is idling. In this case, it is necessary to stop immediately the motor, wait until the inner magnet cover (which became hot as a result of eddy currents) is cooled and restart the motor after troubleshooting.

5.4.3 Pump system requirements

In volumetric pumps, pressure is not related to flow rate and/or rotation speed; therefore, avoid installing shut-off valves on the discharge pipe and, in any case, between the pump and the stop valve a relief valve must always be installed.

5.4.4 Startup/shutdown frequency

Pumps which are expressly requested by the Customer to start frequently and repeatedly do not show any problems for this kind of operation.

5.4.5 Operation and startup with closed valve

It is forbidden to start the pump with the discharge valve closed: such mistake would cause an abrupt pressure rise above the limit values with consequent seizing.

5.5 SHUTDOWN

5.5.1 Decommissioning

In case of decommissioning of the pump unit, it is necessary to disconnect the power supply to make unexpected and accidental startups impossible.

5.5.2 Emptying

A pump or a pump unit which operates with a flammable, toxic, corrosive or, in any way, hazardous fluid, or with a liquid at a temperature higher than 55°C, shall be equipped with a device such as a connection pipe, **to be provided by the User**, to collect and dispose the liquid drained or coming from any possible leakage from the shaft seal or discharged by a pressure relief valve.

6. MAINTENANCE AND INSPECTION

6.1 USE PRECAUTIONS

Before performing any maintenance operation, please observe the following safety precautions:

- **Never** execute maintenance operations with the pump running.
- Cut the power supply to the pump unit.
- Wear gloves, glasses and protective suits adequate to the characteristics of the liquid being pumped.

- Wait until the pump is cooled.
- **Never** open the pump unit and/or the relief valve when the pump is pressurized.
- Close suction and discharge pipe valves, if any.

- Disconnect the pump from suction and discharge pipes, by paying attention to put a collecting basin for the pipe liquid.
- In case externally flowed mechanical seals are used, disconnect the relevant pipes.
- Cut the power supply to the motor and disconnect the earth cable.
- Unscrew anchoring screws and remove the pump unit complete with its baseplate.
- Disassemble the protection coupling guard and disconnect the pump from the motor.

- **If necessary, pay particular attention to the effects of the magnetic pull force; in particular pay attention to your fingers (always wear safety gloves) and not to damage magnets by accidental shocks. We recommend to use tools in non-magnetic material.**
- Disconnect the pump from the baseplate.

- Place a collecting basin for the pump liquid.
- Perform the maintenance operation.

- Align carefully pump and motor and fasten the pump to the baseplate.
- Connect the pump to the motor and assemble the protection coupling guard.
- Secure the baseplate by anchoring screws.
- Connect the pump to suction and discharge pipes.

- Reconnect the power supply to the motor and the earth cable.
- Open suction and discharge pipe valves, if any.
- Reconnect the power supply to the pump unit.

6.2 WEARABLE MATERIALS

The normal wear parts, included as spares in the 2-year warranty are the following:
- bearing bushes;
- seal parts (mechanical seal, gaskets);
- gears;
- shafts.

6.3 SURVEILLANCE DURING OPERATION

The pump unit does not need the presence of an Operator during the work cycle. It is up to the User to provide or not a periodic surveillance depending on the importance and seriousness of the operation. The relevant checks shall be aimed to detect abnormal noise, vibration, temperature levels and/or some dripping from the mechanical seals, variations of pressure and/or flow rate, etc.

6.4 PREVENTIVE MAINTENANCE

It is always advisable, for a reliable and cost-effective operation, to adopt a policy of preventive maintenance. The service time specified for wearable component parts in this manual can be used as reference for the first period of operation. Later the user will be able to improve the MTBM (Mean Time Between Maintenance) as a result of the acquired experience.

6.5 PUMP DISASSEMBLY AND REASSEMBLY

6.5.1 Tools

No special tools are requested, except for seal extractors.

6.5.2 Disassembly/reassembly procedure

Before disassembling the pump, it is necessary to perform the operations mentioned at point 6.1 "USE PRECAUTIONS".
Refer to the drawings and nomenclature attached at the end of the manual.

1) Single seal (see Figure 1)

a) Access to the mechanical seal

After removing the feather key ㉓ from its seat, loosen the hexagonal head screws ⑯ of the seal cover ① and extract it, by paying attention not to damage the seal static part ⑩, housed in the cover. It is thus possible to check the state of wear and tear of the seal contact surfaces. On reassembly, pay attention not to pinch the sealing O-ring ㉖ housed in the cover.

b) Replacing static seal

To remove the static part of the seal ⑩ from the seal cover ①, it is necessary to extract, by using special pliers, the seeger ring ⑬ housed in the cover, remove the ball bearing ⑭ and exert a pressure upon the external side of the seal. After placing the seal cover on a plane and greasing the walls to make assembly easier, insert the new static seal with the relevant O-ring; use a pad interposed with a soft bearing to exert the force perpendicularly to the cover.

c) Replacing dynamic seal

To remove the dynamic part of the seal ⑪ it is advisable to use an iron wire bent at 90° at one end to hook the first or the second coil of the seal spring ⑫. Exert a traction force parallel to the shaft ⑤, by paying attention not to scratch this last. After greasing the shaft to make assembly easier, insert the new mechanical seal by rotating the spring in the direction opposite to that of the coil; use a pad interposed with soft bearing to press the seal up to make the spring ⑫ rest on the projection (or on the seeger ㉕B) provided on the shaft.

2) Double back-to-back seals (see Figure 2)

a) Access to the external mechanical seal

After removing the feather key ㉓ from its seat, loosen the hexagonal head screws ⑯ of the external seal cover ㉞ and remove this last, by paying attention not to damage the static part of the external seal ⑩, housed in the cover. It is thus possible to check the state of wear and tear of the external seal contact surfaces. On reassembly, pay attention not to pinch the sealing O-ring ㉖ housed in the cover.

b) Replacing static seals

To remove the static part of the external seal ⑩ from the seal cover ㉞, it is necessary to extract, by using special pliers, the seeger ring ⑬ housed in the cover, remove the ball bearing ⑭ and exert a pressure upon the external side of the seal. After placing the seal cover on a plane and greasing the walls to make assembly easier, insert the new static seal with the relevant O-ring; use a pad interposed with a soft bearing to exert the force perpendicularly to the cover.

To gain access to the static part of the internal seal, proceed as described at points *c)*, *e)*. By acting from the back of the front body insert the point of a screwdriver in the existing cavity between the tang of the static part of the internal mechanical seal ㊲ and the bush which houses this last ㉝ (the bush is forced into the body and cannot be disassembled); with small blows on the surrounding area, it is possible to remove the fixed seat of the mechanical seal ㊲.

On assembly, after reassembling gears and shafts as described at point *e)*, place the pump on a plane, grease the bush walls ㉝ to make assembly easier, insert the new static seal with the relevant O-ring by using a pad interposed with a soft bearing to exert the force perpendicularly to the cover.

c) Replacing dynamic seals

To remove the dynamic part of the external seal ⑪ it is advisable to hold the spring ⑫ and, with a rotation movement in the same direction as that of its coil, exert a traction force parallel to the shaft ⑤D, by paying attention not to scratch this last. After greasing the shaft to make assembly easier, insert the new mechanical seal by rotating the spring in the direction opposite to that of the coil; use a pad interposed with a soft bearing to press the seal up to make the spring rest on the stop ring ㉟ fixed on the shaft.

To replace the dynamic part of the internal seal ㊳, it is necessary to disassemble the ring ㉟, fixed on the shaft by means of threaded grub screws ㊱. **We recommend to mark accurately the ring position on the shaft before disassembly, so as to ensure the correct seal pre-load later.** To remove the dynamic part of the internal seal ㊳ it is advisable to use an iron wire bent at 90° at one end to hook the first or the second coil of the seal spring ㊴. Exert a traction force parallel to the shaft ⑤D, by paying attention not to scratch this last. Make sure that grub screws ㊱ did not scratch the shaft ⑤D.

After greasing the shaft to make assembly easier, insert the new mechanical seal by rotating the spring in the direction opposite to that of the coil; use a pad interposed with a soft bearing to press the seal up to make it match the fixed part ㊲. Secure the ring ㉟ in the original position and lock it on the shaft ⑤D by using grub screws ㊱.

During operation, pay attention not to invert seals and relevant springs.

3) Double tandem mechanical seals (see Figure 3)

a) Access to the external mechanical seal

Place a basin of suitable size and capacity under the seal cover ㉞ and, by loosening the grub screw ㊹, empty the tank ㊸.

After removing the feather key ㉓ from its seat, loosen the hexagonal head screws ⑯ of the external seal cover ㉞ and extract this last, by paying attention not to damage the static part of the external seal ⑩, housed in the cover. It is thus possible to verify the state of wear and tear of the external seal contact surfaces. On reassembly, pay attention not to pinch the sealing O-ring ㊺ housed in the cover. Retighten the grub screw ㊹ and fill the tank ㊸ with the recommended fluid.

b) Replacing static seals

To remove the static part of the external seal ⑩ from the seal cover ㉞, it is necessary to extract, by using special pliers, the seeger ring ⑬ housed in the cover, remove the ball bearing ⑭ and exert a pressure upon the external side of the seal. After placing the seal cover on a plane and greasing the walls to make assembly easier, insert the new static seal with the relevant O-ring; use a pad interposed with a soft bearing to exert the force perpendicularly to the cover.

To gain access to the static part of the internal seal, proceed as described at point *c)*, without disassembling the dynamic part of the internal seal ㊳. By exerting a pressure on the external side of the seal, remove the fixed seat of the internal mechanical seal ㊲ from the flange ㊷. After placing this last on a plane and greasing the walls to make assembly easier, insert the new static seal with the relevant O-ring; use a pad interposed with a soft bearing to exert the force perpendicularly to the cover. On reassembly, pay attention not to pinch the sealing O-ring ㉖ housed in the flange ㊷.

c) Replacing dynamic seals

To remove the dynamic part of the external seal ⑪ it is advisable to hold the spring ⑫ and, with a rotation movement in the same direction as that of its coil, exert a traction force parallel to the shaft ⑤D, by paying attention not to scratch this last. After greasing the shaft to make assembly easier, insert the new mechanical seal by rotating the spring in the direction opposite to that of the coil; use a pad interposed with a soft bearing to press the seal up to make the spring rest on the external stop ring ㉟ fixed on the shaft.

To replace the dynamic part of the internal seal ㊳, it is necessary to disassemble the external ring ㉟, secured on the shaft by means of threaded grub screws ㊱. **We recommend to mark accurately the ring position on the shaft before disassembly, so as to ensure the correct seal pre-load later.** Loosen the hexagonal head screws ㊺ and disassemble the flange ㊷ (with the static part of the internal mechanical seal) and the O-ring ㉖. To extract the dynamic part of the internal seal ㊳ it is advisable to use an iron wire bent at 90° at one end to hook the first or the second coil of the seal spring ㊴. Exert a traction force parallel to the shaft ⑤D, by paying attention not to scratch this last. Ensure that grub screws ㊱ did not scratch the shaft ⑤D.

After greasing the shaft to make assembly easier, insert the new mechanical seal by rotating the spring in the direction opposite to that of the coil; use a pad interposed with a soft bearing to press the seal up to make the spring ㊴ rest on the internal ring ㉟ (or on the seeger) fixed on the shaft.

4) Magnetic drive coupling (see Figure 4)

a) Access to inner magnet

Place a basin of suitable size and capacity under the inner magnet cover; loosen the hexagonal head screws ㊼ and disassemble the cover ㊶ and the O-ring ㊽. Unscrew the screw ㊻, remove the washer ㊺ and disassemble the inner magnet ㊷. On reassembly, pay attention not to pinch the sealing O-ring ㉖ housed on the centering ring ㊵. **We recommend the use of tools in non-magnetic material.**

d) Replacing bearing bushes

Proceed as described at points *a), b), c), e).* To replace the graphite bearing bushes ⑨, it is necessary to break them with a chisel or other convenient tool, by paying great attention not to damage the seat diameter of bushes and their base plane. Before inserting new bushes, clean very carefully bush seats with alcohol in order to remove all impurities and dry well. Fit new bushes by spreading a layer of glue of “LOCTITE 648” type over their outer diameters, by paying attention that the cut bush and the integer bush match perfectly. First introduce the integer bush and then the other, by letting glue dry for about 10÷15 minutes. When the operation is over, set to zero the bush shims with the relevant housing covers. If a surfacing feed is not available, you can choose a base plane abraded with fine emery cloth with P80 type grain for rough grinding and 400 type grain for finishing, by making a circular motion. For assembly, follow the instructions at points *e), c), b), a).*

e) Replacing gears and shafts

Proceed as described at points *a), b), c).* Loosen the hexagonal head screws ⑮ which fasten the rear cover ④ and remove this last, by keeping into account that the operation may become difficult for the accuracy of shafts and dowel pins ⑰. For pumps of size greater than that of NEX400, loosen the hexagonal head screws on the front cover.

Draw a reference mark on the main body ③ to avoid reversing base planes on reassembly and remove it together with the 2 teflon flat gaskets ㉔; the operation may become difficult for the accuracy of shafts and dowel pins ⑰. Remove the driven shaft ⑥ and then the driving shaft ⑤ (in some cases it is necessary first to disassemble the gears ⑦ and ⑧, and then extract the feather key ㉒ and remove the driving shaft from the front side).

Disassemble the locking spring clips ㉕A, if any, and extract the gears ⑦ and ⑧ from shafts; on reassembly, pay attention not to modify the position of the helical gearing, not to reverse the direction of the axial thrust. On reassembly, reverse the procedure, by taking as reference the position of covers and flat gaskets with respect to the main body, the position of dowel pins and internal drain line holes. Tighten the screws ⑯ which fasten covers in a cross-wise way, by rotating at the same time the motor shaft, so as to avoid differentiated pressures on gears which may increase friction; for tightening torques please refer to point **4.6.3**. Then, proceed as described at points *c), a)*.

7. FAULTS: CAUSES AND SOLUTIONS

Here below the most common causes of malfunctions in the operation of pumps are shortly listed together with the possible solutions.

FAULT	ORIGIN	CAUSE	SOLUTION
The pump does not start	Electrical	The motor is not powered	Verify electrical connections and thermal protections
	Electrical	Incorrect supply voltage	Verify rating and type of (star - delta) motor connection
	Electrical	Excessive power consumption	Reduce the inverter start ramp
	Mechanical	Mechanical lock of motor and/or pump shafts	Verify that shafts rotate freely
	Mechanical	Magnetic coupling detachment	Verify that the pump shaft rotates freely
The pump does not suck liquid at startup	Electrical	Direction of rotation reversed	Reverse electric motor connections
	Hydraulic	Valves on suction and/or discharge pipes closed	Open valves
	Hydraulic	Suction filter clogged	Disassemble and clean the filter
	Hydraulic	Presence of air in the suction pipe	Drain pipes. Remove siphons. Tighten fittings and flanges
	Hydraulic	High pressure losses in the suction line	Increase the pipe diameter. Remove abrupt variations of section and direction
	Hydraulic	Fluid too viscous	Preheat the fluid. Decrease the speed of rotation.
Pressure and/or flow rate pulses in the discharge line	Electrical	Overvoltage and/or overcurrent	Stabilize the mains voltage
	Electrical	Feedback electric circuit too sensitive	Stabilize the electric circuit
	Hydraulic	Feedback hydraulic circuit too sensitive	Increase the inertia of the hydraulic circuit
	Hydraulic	Presence of air in pipes	Drain pipes. Remove siphons. Tighten fittings and flanges
	Hydraulic	Intermittent opening of the relief valve	Increase the valve operating pressure
	Hydraulic	Foot valve not working properly or of the type with plate and spring	Replace with free ball foot valve

FAULT	ORIGIN	CAUSE	SOLUTION
The pump is noisy and vibrates	Hydraulic	Presence of air in pipes	Drain pipes. Remove siphons. Tighten fittings and flanges
	Hydraulic	Cavitation	Decrease pressure losses in the suction line. Reduce the speed of rotation. Change fluid temperature
	Mechanical	Ball bearing and/or bush failure	Replace ball bearing and/or bushes
The flow rate does not increase as the speed of rotation increases	Hydraulic	Pump saturation	Decrease pressure losses in pipes. Reduce fluid viscosity
	Hydraulic	Excessive speed of rotation in relation to the fluid viscosity	Decrease the speed of rotation or increase the fluid temperature
	Hydraulic	Relief valve opening	Increase relief valve spring pre-load
	Hydraulic	Cavitation	Decrease pressure losses in the suction line. Change fluid temperature. Decrease speed of rotation.
Progressive reduction of the discharge flow rate and/or pressure, with constant speed of rotation	Hydraulic	Relief valve opening	Increase relief valve spring pre-load
	Mechanical	Friction increase by thermal effect	Cool the fluid
	Mechanical	Deterioration bush shims	Replace bushes
	Hydraulic	Decrease in viscosity due to the temperature increase	Decrease the fluid temperature

8. WARRANTY CONDITIONS

Pompe Cucchi S.r.l. guarantees that pumps and pump units are free from defects in material, construction, workmanship and assembly for a period of 12 (twelve) months from the delivery date (specified on the D.D.T.).

Purchaser's warranty covers only free replacement of components whose defectiveness is proven. Such warranty excludes the purchaser's right to claim for rescission of contract, price reduction or further damages.

Warranty is void in case of misuse or improper use of the pump by the User. The pump shall be used according to what expressly requested in the order or based on the instructions contained in this manual.

Any damages resulting from shocks and/or tampering are not covered by this warranty.

Warranty does not apply to normal wear parts and damages due to negligence and poor maintenance.

For the application of the warranty it is necessary that:

- the Customer informs immediately Pompe Cucchi S.r.l. about the pump defect causing the trouble;
- the pump was not tampered with;
- the pump is returned to Pompe Cucchi s.r.l. clean, after removing any trace of the process fluid and in a proper packaging;
- a short description of the fault is provided in writing together with the operating parameters of the pump or the pump unit;
- if required, a chemical analysis or a sample of the process fluid is provided.

Pumps which have not been emptied of the process fluid or installations outside the pump unit will not be taken into account.

In the event Pompe Cucchi S.r.l. acknowledges the defect under warranty, no charge will be made to the Customer both for the replaced material and the workmanship.

The forwarding charges from the Customer to Pompe Cucchi S.r.l. remain to the Sender's (Customer) account.

9. ALLEGATI/ANNEXES

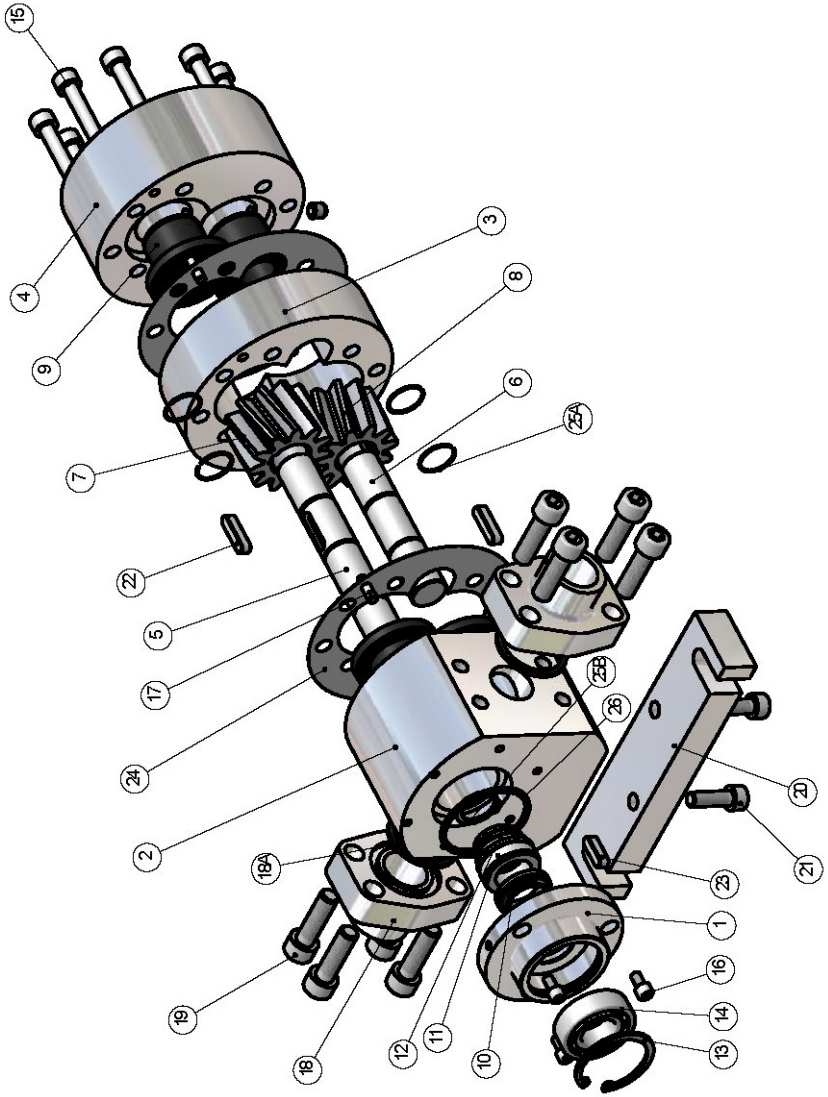


Figura 1 - Tenuta Singola
Figure 1 - Single Seal

Parts list			
ITEM	**Q.TY**	**DESCRIZIONE**	**DESCRIPTION**
①	1	Premitenuta	Seal cover
②	1	Coperchio anteriore	Front cover
③	1	Corpo centrale	Main body
④	1	Coperchio posteriore	Back cover
⑤	1	Albero conduttore	Driving shaft
⑥	1	Albero condotto	Driven shaft
⑦	1	Ingranaggio conduttore	Driving gear
⑧	1	Ingranaggio condotto	Driven gear
⑨	4	Boccola	Bush
⑩	1	Anello stazionario (ten. mecc.)	Stationary ring (mech. seal)
⑪	1	Anello rotante (ten. mecc.)	Rotating ring (mech. seal)
⑫	1	Molla (ten. mecc.)	Spring (mech. seal)
⑬	1	Anello elastico per fori	Internal retaining ring
⑭	1	Cuscinetto a sfere	Ball bearing
⑮	8	Vite T.C.E.I	Socket screw
⑯	3	Vite T.C.E.I	Socket screw
⑰	4	Spina di riferimento	Dowel pin
⑱	2	Flangia S.A.E. (weld-on)	S.A.E. flange (weld-on)
⑲	8	Vite T.C.E.I	Socket screw
⑳	1	Piede	Foot
㉑	2	Vite T.C.E.I	Socket screw
㉒	2	Linguetta	Feather key
㉓	1	Linguetta	Feather key
㉔	2	Guarnizione	Gasket
㉖	1	O-Ring	O-Ring
⑱A	2	O-Ring	O-Ring
㉕A	4	Molletta	Spring clip
㉕B	1	Anello elastico per alberi	External retaining ring

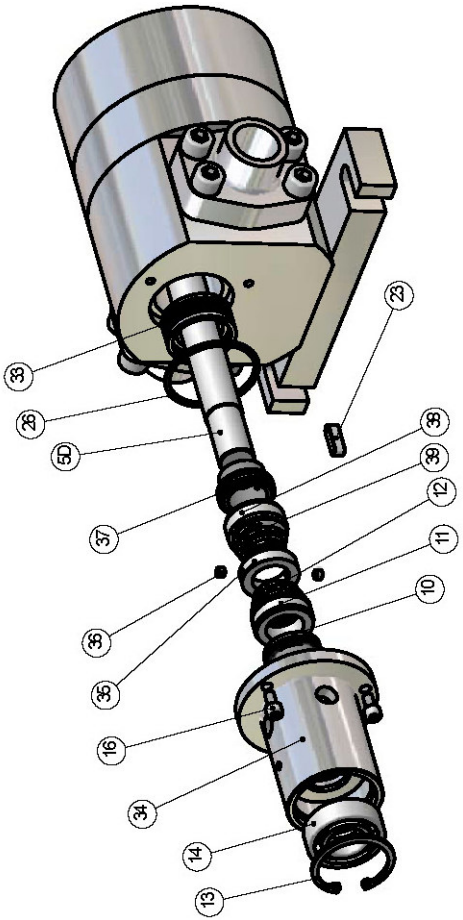


Figura 2 - Tenuta Doppia Back-to-Back
Figure 2 - Double Back-to-Back Seals

Parts list			
ITEM	**Q.TY**	**DESCRIZIONE**	**DESCRIPTION**
⑩	1	Anello stazionario (ten. mecc. est.)	Stationary ring (ext. mech. seal)
⑪	1	Anello rotante (ten. mecc. est.)	Rotating ring (ext. mech. seal)
⑫	1	Molla (ten. mecc. est.)	Spring (ext. mech. seal)
⑬	1	Anello elastico per fori	Internal retaining ring
⑭	1	Cuscinetto a sfere	Ball bearing
⑯	3	Vite T.C.E.I	Socket screw
㉓	1	Linguetta	Feather key
㉖	1	O-Ring	O-Ring
㉝	1	Bussola per sede interna	Inner seat bush
㉞	1	Premitenuta	Seal cover
㉟	1	Anello	Ring
㊱	2	Grano	Grub screw
㊲	1	Anello stazionario (ten. mecc. int.)	Stationary ring (int. mech. seal)
㊳	1	Anello rotante (ten. mecc. int.)	Rotating ring (int. mech. seal)
㊴	1	Molla (ten. mecc. int.)	Spring (int. mech. seal)
⑤D	1	Albero conduttore	Driving shaft

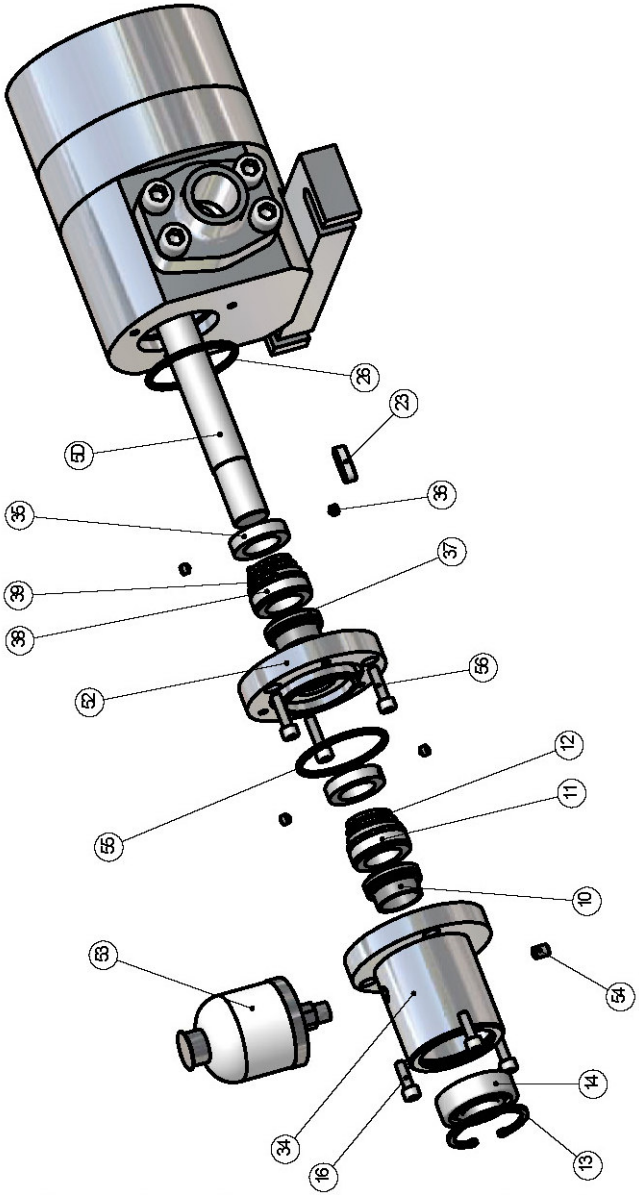


Figura 3 - Tenuta Doppia in Tandem
Figure 3 - Double Tandem Seals

Parts list			
ITEM	**Q.TY**	**DESCRIZIONE**	**DESCRIPTION**
⑩	1	Anello stazionario (ten. mecc. est.)	Stationary ring (ext. mech. seal)
⑪	1	Anello rotante (ten. mecc. est.)	Rotating ring (ext. mech. seal)
⑫	1	Molla (ten. mecc. est.)	Spring (ext. mech. seal)
⑬	1	Anello elastico per fori	Internal retaining ring
⑭	1	Cuscinetto a sfere	Ball bearing
⑯	3	Vite T.C.E.I	Socket screw
㉓	1	Linguetta	Feather key
㉖	1	O-Ring	O-Ring
㉞	1	Premitenuta	Seal cover
㉟	2	Anello	Ring
㊱	4	Grano	Grub screw
㊲	1	Anello stazionario (ten. mecc. int.)	Stationary ring (int. mech. seal)
㊳	1	Anello rotante (ten. mecc. int.)	Rotating ring (int. mech. seal)
㊴	1	Molla (ten. mecc. int.)	Spring (int. mech. seal)
㊷	1	Flangia per sede interna	Inner seat flange
㊸	1	Serbatoio	Tank
㊹	1	Grano	Grub screw
㊺	1	O-Ring	O-Ring
㊻	3	Vite T.C.E.I	Socket screw
⑤D	1	Albero conduttore	Driving shaft

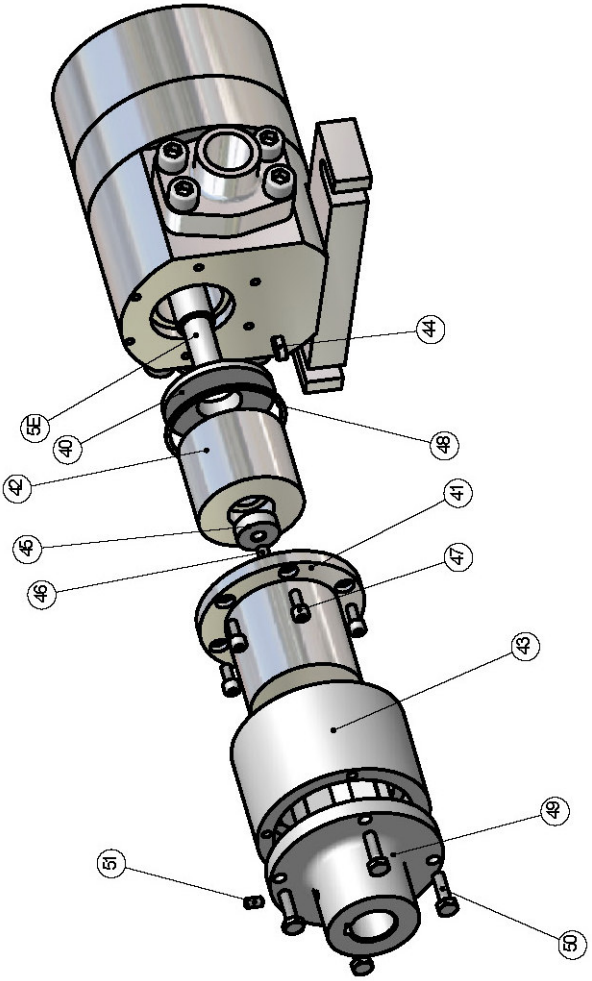


Figura 4 - Giunto a Trascinamento Magnetico
Figure 4 - Magnetic Drive Coupling

Parts list			
ITEM	**Q.TY**	**DESCRIZIONE**	**DESCRIPTION**
㊵	1	Anello di centraggio	Centering ring
㊶	1	Campana magnete interno	Inner magnet cover
㊷	1	Magnete interno	Inner magnet
㊸	1	Magnete esterno	Outer magnet
㊹	1	Linguetta	Feather key
㊺	1	Rondella	Washer
㊻	1	Vite T.E.	Hexagonal head screw
㊼	6	Vite T.C.E.I	Socket screw
㊽	1	O-Ring	O-Ring
㊾	1	Giunto	Coupling
㊿	4	Vite T.E.	Hexagonal head screw
(51)	1	Grano	Grub screw
⑤E	1	Albero conduttore	Driving shaft

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DICHIARAZIONE DI CONFORMITA'

La POMPE CUCCHI s.r.l. dichiara, sotto la propria esclusiva responsabilità, che i gruppi di pompaggio serie B, F, FM, FT, MX, N, WPP, WPL, CP, CPP, CMP, CM, DMP, AM5 sono conformi a quanto prescritto dalle seguenti Direttive:
98/37/CE, 93/68/CE, 73/23/CE, 89/336/CE.

DECLARATION OF CONFORMITY

POMPE CUCCHI s.r.l. declares, under its own responsability, that pumping sets series B, F, FM, FT, MX, N, WPP, WPL, CP, CPP, CMP, CM, DMP, AM5 are in accordance with the following Directives:
98/37/EC, 93/68/EC, 73/23/EC, 89/336/EC.

Date
30/09/2005

POMPE CUCCHI s.r.l.
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PER FORNITURA DI POMPE AD ASSE NUDO

La POMPE CUCCHI s.r.l. dichiara, sotto la propria esclusiva responsabilità, che le pompe serie B, F, FM, FT, MX, N, WPP, WPL, CP, CPP, CMP, CM, DMP, AM5 sono conformi per progetto a quanto prescritto dalla Direttiva 98/37/CE.
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DECLARATION OF INCORPORATION
FOR SUPPLY OF BARE SHAFT PUMPS

POMPE CUCCHI s.r.l. declares, under its own responsability, that pumps series B, F, FM, FT, MX, N, WPP, WPL, CP, CPP, CMP, CM, DMP, AM5 have been designed in accordance with the 98/37/EC Directive.
They cannot be put into operation before the pumping sets have been correctly assembled and declared in accordance with the following Directives:
98/37/EC, 93/68/EC, 73/23/EC, 89/336/EC.

Date
30/09/2005

POMPE CUCCHI s.r.l.
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