

pompetravaini

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ITEM 64P1



OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB...

MC... - TC...

TMA



OPERATING MANUAL

INSTALLATION, START-UP AND MAINTENANCE FOR CENTRIFUGAL AND SELF-PRIMING PUMPS

This manual applies to the listed below centrifugal pump series and/or affiliated series:

AT - TBH - TBA - TBK - TBAK

MC - MEC - TCK

TCH / MCU-CH

TCA - TCT - TCD

TMA

All pumps are manufactured by:

POMPETRAVAINI s.p.A.

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Distributor:

WARRANTY: All products manufactured by POMPETRAVAINI are guaranteed to meet the conditions listed on the general terms and conditions of sale and/or conditions listed on the Order Confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual will void the manufacturer's warranty. Guarantee will be preserved only if the pump maintenance is carried out by Pompetravaini or an authorized service. Any modification introduced to the pump without the authorization of Pompetravaini will lead to the loss of the guarantee. If it is strictly necessary to dismantle the pump, please consult Disassembling Instructions on our website "www.pompetravaini.it".



This manual is valid only for the listed pump series. This manual IS NOT for the total installation. Instruction and maintenance manual for the installation must be obtained from the engineer that designed the installation. Furthermore the installation manual will take precedence over the pump manual.



The liquids handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their possible disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for pumps subjected to the ATEX 94/9/CE directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 94/9/CE directive it is available a dedicated integrative manual.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

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KEY TO SYMBOLS

 Indications for the pump preservation	 Signals for the operator's safety. DANGER: indicates imminent conditions of danger of serious harm or death. CAUTION: indicates a possible danger of minor harm.
 Warnings for the environment safeguard	 Magnetic dangers for the operator's safety.
 Warnings for the ATEX Directive 94/9/CE	 Electric dangers for the operator's safety.

1 - GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- pump safe application and operation
- pump installation and maintenance instructions
- pump start-up, operation and stopping procedures.

The pump user must complete the section at the end of this manual where the design conditions for the pump are recorded. The manual must be filed in a safe place and be accessible to the operator and to the maintenance personnel. The qualified personnel responsible for the operation or maintenance of the pump should read CAREFULLY the whole manual before operating or working on the pump. Qualified personnel are those with experience, knowledge and have a good familiarity with the working safety regulations. They usually have knowledge of basic first aid.

The pump is to be used only for the applications specified on the confirming order for which POMPETRAVAINI has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore the pump CANNOT be used for applications other than those specified on the order.

In the event the pump is to be used for different applications, please contact the sales office or representative of the manufacturer. POMPETRAVAINI declines to assume any responsibility if the pump is used for different applications without prior written consent confirmation.

Pumps are for industrial and continual use in installations fit for the purpose by authorized and trained personnel. The use in unfit or unprotected installations, without proper precautions preventing the contact with untrained personnel or children, is strictly forbidden

If the constructive details functioning data of the pump in use aren't available they could be requested to POMPETRAVAINI specifying the pump type and serial number that are printed on the pump nameplate. Always refer to this for further requests of information or replacement components.

The user is responsible for the verification of the ambient conditions where the pump will be stored or installed.

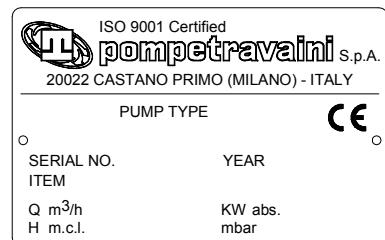
Extreme low or high temperatures may severely damage the pump unless proper precautions are taken.

POMPETRAVAINI does not guarantee repairs or alterations done by user or other unauthorised personnel.

Special designs and constructions may vary from the information given in this manual. Please contact POMPETRAVAINI should you have any difficulty.

NOTE: Drawings appearing in this manual are only schematics and not to be used for construction.

For more specific information contact the Engineering Department of POMPETRAVAINI or the authorised local representative.



2 - SAFETY INSTRUCTIONS



CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS.

Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.

- ALWAYS apply the pump for the conditions outlined on the confirming order.
- Be ALWAYS informed on locations of first aid sites inside the company and carefully read safety and medical first aid prescriptions in force.
- ALWAYS have a fire extinguisher in the vicinity of the pump installation.
- Any work on the pump must ALWAYS be carried out by at least 2 qualified people and expressly authorized.
- Electrical connections on the motor or accessories must ALWAYS be carried out by authorised personnel and in accordance to the local codes.
- When approaching the pump ALWAYS be properly dressed (avoid use of clothes with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done. Also refrain from wearing long and loose hair.
- DO NOT attempt to remove the safety guards when the pump is operating.
- After completion of the work ALWAYS re-install the safety guards previously removed.
- DO NOT operate the pump in the wrong direction of rotation.
- NEVER put hands or fingers in the pump openings or holes.
- ALWAYS disconnect the power to the motor prior to working or removing the pump from the installation.
- Make sure you have taken the necessary steps to prevent a possible inadvertent return of tension.
- Ensure the proper isolation of the components and ground connection before inserting the tension.
- ALWAYS stop the pump prior to touching it for whatever the reason. Wait for the complete pump stopping and make sure that all the installation control devices are properly set in order to avoid any return flow.

- Pump and piping connected to the pump must NEVER be under pressure when maintenance or repair is carried out.
 - NEVER work on the pump when it is hot.
 - NEVER touch pump or piping having temperatures higher than 70°C or lower than -10°C.
 - ALWAYS be careful when handling pumps that convey acids or hazardous fluids.
 - NEVER step on pump and/or piping connected to the pump.
 - ALWAYS make sure that the pump is permanently fixed and steady to the installation (i.e. during removal, handling, installation, etc.)



CAUTION!

Pumps type TCK, TBK and TBAK create a high magnetic field. Personnel should take proper precautions if they are wearing pace-makers or if they are using instrumentation sensitive to magnetic fields.



The listed below minimum distances must be kept:

- When the magnetic rotor parts are disassembled:
users of pace-maker = 2 meters floppy disk; magnetic cards, etc. = 1 meter
 - When the magnetic rotor is mounted in the pump:
users of pace-maker = 1 meter floppy disk; magnetic cards, etc. = 0,5 meter



DANGER!

Possible contact with hazardous media and hazardous substances There are certain components in the pump which may be dangerous to people coming in their contact even during normal operation procedures and/or maintenance, see table 1.



CAUTION!

Danger due to smokes or vapours. In case smokes or vapours are released by the pump do not inhale and immediately stop the pump for inspection.

Tab. 1

MATERIAL	USE	MAJOR RISKS
Oil and grease	General lubrication, ball bearings	Skin and eye rash
Plastic & elastomer components	O-Ring, V-Ring, splash ring, coupling dowels	Smoke & vapours in case of overheating
Teflon & Kevlar fibbers	Packing rings	Release of dangerous powder, release of smoke if overheated
Paints & varnishes	Pump outside surface	Release of powder and smoke if working the painted areas. Flammable
Protective liquid	Pump inside surface	Skin and eye rash

3 - IN CASE OF EMERGENCY

In the event of pump break-down and/or loss of pumped fluid, immediately disconnect the electrical power to the motor (see chapter 11) and contact the responsible personnel in charge of the installation, which should intervene with at least two people paying particular attention to the fact that the pump may be handling dangerous fluids, hazardous to the health and environmentally unsafe.

After the causes for the emergency have been addressed and resolved, it will be necessary to follow the starting procedures (see chapter 10) for the start-up of the pump/motor assembly.

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or come in contact with the human body, immediately follow the instructions given in the company's internal medical safety procedures.

The instructions given in this manual refer to the listed below single stage and multistage centrifugal pumps, horizontal or vertical mounted.

NOTE: Capacities and pressures are approximated and refer to the maximum attainable values for pumps applied in standard conditions at room temperature.

TCH / MCU-CH	Single stage centrifugal pumps for clean liquids designed to DIN 24256/ISO 2858 and 5199 standards - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 16 bar - Flanges PN 16
TCA	Single stage centrifugal pumps for abrasive liquids to DIN 24256/ISO 2858 and 5199 standards - Design with fully open impeller - Capacity to 100 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCT	Single stage centrifugal pumps for very dirty liquids derived from DIN 24256/ISO 2858 standards - Design with open vortex impeller - Capacity to 250 m ³ /h, Max. pressure 7 bar - Flanges PN 16
TCD	Single stage centrifugal pumps for Thermal fluids (Oils) to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 350 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCS	Single stage centrifugal pumps with inspection opening for clean and dirty liquids - Design with closed and open impeller - Capacity to 550 m ³ /h, Max. pressure 4 bar - Flanges PN 10
MEC	Semi-axial centrifugal pumps for large flows of clean and dirty liquids - Design with open impeller - Capacity to 2100 m ³ /h, Max. pressure 4 bar - Flanges PN 10
TCN	Single stage centrifugal pumps for clean and dirty liquids - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 6 bar - Flanges PN 10
TCK	Magnetic drive single stage centrifugal pumps for toxic and contaminated liquids - Designed to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 300 m ³ /h, Max. pressure 16 bar - Flanges PN 16
MILLS	Pumps derived from the series TCH with special mixing impeller
AT	Self-priming multistage centrifugal pumps with dual lateral channel. Low NPSH requirements. Capacity to 31 m ³ /h, Max. pressure 7 bar - Flanges PN 40
TBH	Self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBK	Magnetic drive self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBA	Self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBAK	Magnetic drive self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TMA	Multistage centrifugal pumps for clean liquids, medium and high pressures - Capacity to 45 m ³ /h, Max. pressure 40 bar - Flange inlet PN 16, flange outlet PN 40

The flanges standard (NP 16 or NP 40) does not refer to the maximum pump performance but it indicates the maximum pressure the pump can be subjected to.

For information regarding temperature and pressure LIMITATIONS applicable to the varying designs, types and materials of construction please contact POMPETRAVAINI or your closest authorised representative.

The maximum operating pressure is normally the sum of the suction and discharge pressures.

4.1 - PUMP MODEL NUMBERS AND MATERIALS OF CONSTRUCTION TABLES

Pump nameplate affixed to each pump contains model number, serial number and year of manufacture. Interpretation of pump model number may be attained with the aid of the following table. The pump model is such that it gives information pertaining to the pump type and design.

Listed below are some examples of pump nomenclatures:

Pumps series MC... - TC... = TCH V 50 - 200 A / 1 - C / A3 - M / T	
TCH ⇒ Pump type	1 ⇒ Constructive project number
V ⇒ Vertical mounting	C ⇒ Shaft seal type
50 ⇒ Diameter discharge flange	A3 ⇒ Materials of construction (see table)
200 ⇒ Impeller nominal diameter	M ⇒ Monoblock design with flanged motor
A ⇒ Hydraulic project modification	T ⇒ Special design

Pumps series AT – TB...	=	TBH 315 A / 1 - C / A3 - M / T - V - Z
TBH ⇒ Pump type		A3 ⇒ Materials of construction (see table)
31x ⇒ Pump size		M ⇒ Monoblock design with flanged motor
xx5 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Pumps series TMA	=	TMA 32 - 7 A / 1 - C / A3 - M / T - V - Z
TMA ⇒ Pump type		A3 ⇒ Materials of construction (see table)
32 ⇒ Pump size		M ⇒ Monoblock design with flanged motor
7 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Generic materials for STANDARD CONSTRUCTION: pumps **MC... - TC...**

Description	GS	RA	A3	HC	DU
Casing	Ductile iron			Hastelloy C	ASTM-CN7M
Cover casing					
Impeller	Cast iron	Stainless steel AISI 316 ASTM-CF8M			Incoloy 825
Shaft					
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **AT - TB...**

Description	GH	RA	A3	B2	GP
Casing	Ductile iron			Bronze	Ductile iron
Element					Cast iron
Impeller	Brass	Stainless steel AISI 316 ASTM-CF8M			Brass
Shaft	Stain. steel AISI 420				Stain. steel AISI 420
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **TMA**

Description	F	RA	A3
Casing	Ductile iron		
Stage casing			
Impeller	Cast iron	Stainless steel AISI 316 - ASTM-CF8M	
Shaft	Stainless steel AISI 420		
Bearing frame		Cast iron	

For detailed information on materials of construction, (standard or special) for pumps TCD, TCK, MEC, TBK and TBAK please contact POMPETRAVAINI or your local representative.

In case the metallic pump wetted parts come into contact with aggressive liquids it is recommended to stick to the following limitations:

- pH limit for Cast Iron and Ductile Iron ≥ 6
- pH limit for Stainless Steel ≥ 2,5

The above values are approximate and refer to ambient temperature. It is recommended to contact POMPETRAVAINI for doubts, particular conditions or in case different materials are used.

5 – UNPACKING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt verify that the material received is in exact compliance with that listed on the packing slip.

When unpacking follow the instructions listed below:

- Check that no visible damage exists on the crate that could have occurred during transport
- Carefully remove the packaging material
- Check that pump/or accessories such as tanks, piping, valves, etc. are free from visible markings such as dents, scratches and damage which may have occurred during transportation
- In the event of damage, report this immediately to the transport company and to POMPETRAVAINI's customer service department.

DANGER!

Danger due to cut, prick or abrasion Take immediate actions to dispose of possible packaging parts that may generate injuries or risks (for example edges, nails, splinters, etc.)



We remind that the single stage centrifugal pumps supports contain lubricating oil.

Organize the right management of materials subjected to controlled and differentiate disposal (for example plastic, cartoon, polystyrene materials, etc.) according to the laws into force and to a safe local environment management. according to the laws into force and to a safe local environment management.

If the pump will be stored, as foreseen in our Operating Manuals, we recommend a proper care to avoid oil dropping on the ground.

The pump must ALWAYS be moved and transported in the horizontal position.

Before transportation check on the nameplate, in the transportation and technical documents for:

- total weight
- centre of gravity
- maximum outside dimensions
- lifting points location.

DANGER!

Danger due to overturning or crushing For a safe lifting it is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts with correct movements, to prevent material damages and/or personal injuries.

The fig. 1 shows several additional examples of lifting.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 2).

Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage.

The fig. 3 shows several additional examples of lifting to be avoided.

CAUTION!

Possible contact with fluids or harmful substances. Before removal after a period of operation, the pump, together with auxiliary piping and jacketing, must be drained and decontaminated from the handled media.

Every hole and opening communicating with the inside of the pump must be properly plugged.

For removing the pump from the installation see chapter 17. Operate provided with apposite protective devices.

6 - STORAGE INSTRUCTIONS

After receipt and inspection the unit, if not immediately installed, the unit must be repackaged and stored in the best way.

For a proper storage proceed as follows:

- store the pump in a location which is closed, clean, dry and free of vibrations
- do not store in areas with less than 5°C temperature (for lower temperature it is necessary to completely drain the pump of any liquids which are subject to freezing)

POSSIBILITY OF FREEZING!

Where the ambient temperature is less than 5°C it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

It is possible to use as antifreeze a mixture of surface-active glycol or other suitable products making sure they are compatible with both pump gaskets and elastomer.

- fill the pump with a rust-preventative liquid that is compatible with the pump gaskets and elastomer. Rotate the shaft by hand to impregnate all internal surfaces. Drain the excessive liquid from the pump and associated piping (see chapter 11).

Please note that the pumps with cast iron internal parts have been treated at the factory, prior to shipment, with a rust-preventative liquid: this liquid is capable of protecting the pump against rust for a period of 3 to 6 months.

A further solution, for long term storage, is to fill the pump with the rust inhibitor, rotate the pump shaft by hand to eliminate any air pockets (the liquid must be suitable with gasket, elastomer and pump materials).

- plug all openings that connect the pump internals to the atmosphere
- protect all machined external surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up or seizing
- keep the pump in a dry and clean place not subjected to vibrations caused by other sources
- any pump accessories should be subjected to similar procedure.

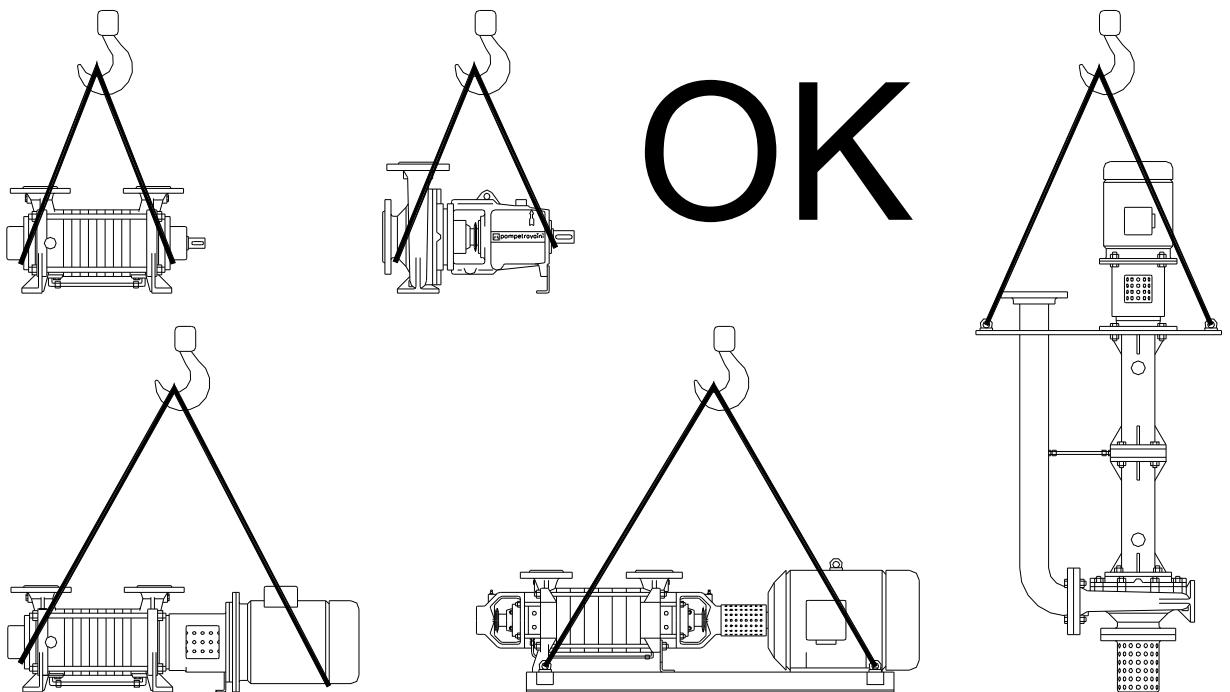


Fig. 1

Fig. 2

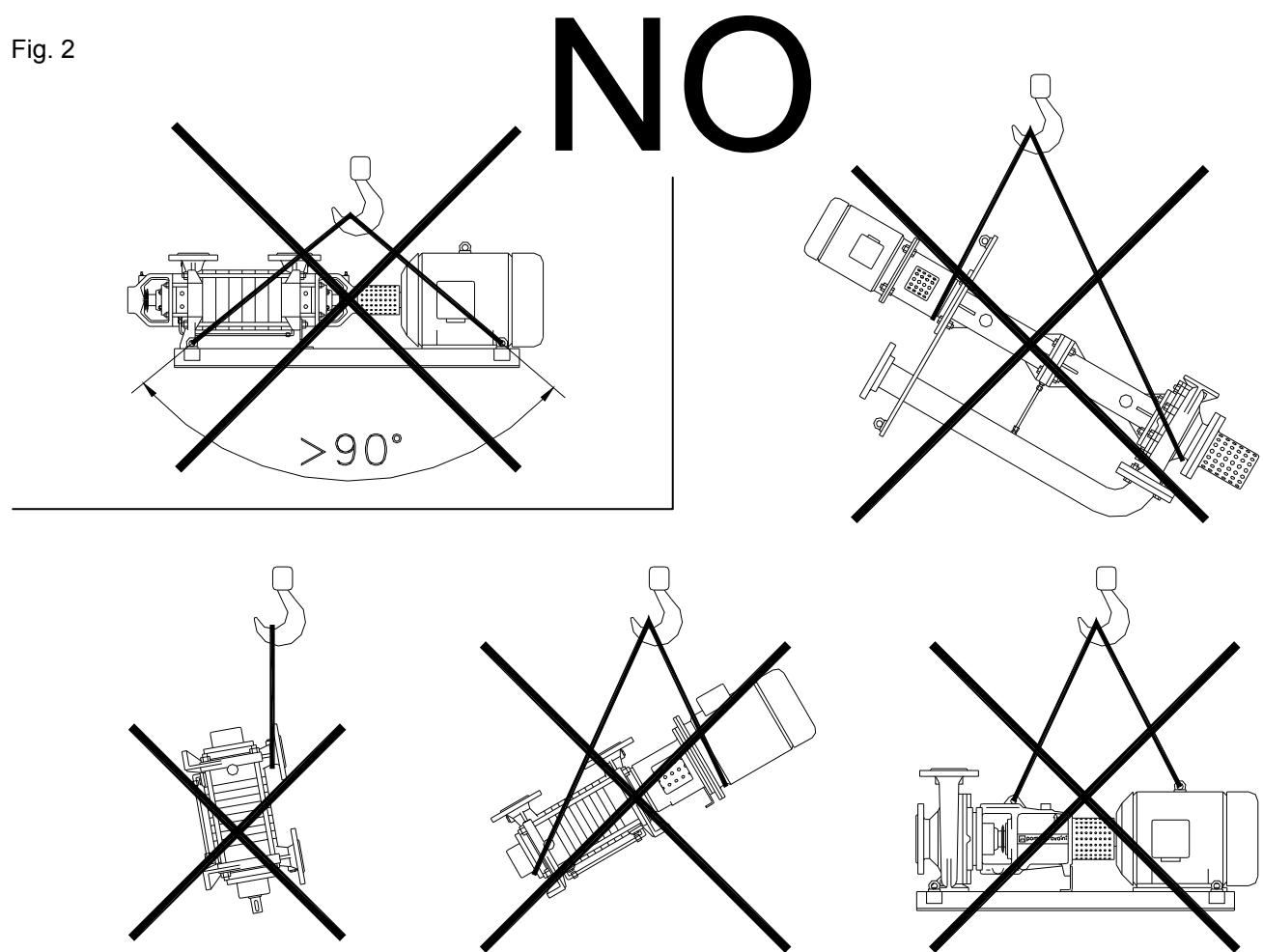


Fig. 3

CAUTION!

Avoid installing the unit in narrow areas and lacking of ventilation where unfavourable conditions for the personnel may take place. Allow the personnel a good visibility of the pump assembly by providing a proper lighting.



A proper pump installation must not transmit vibrations to ambient in the permanent presence of personnel.

Information to determine the piping sizes and floor space requirements can be obtained from dimension drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of all connections for flushing, cooling, heating, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to following chapters 7.1 - 7.2 - 7.3.

Proper lifting devices should be available for installation and repair operations.

Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made.

It is important to have proper room around the unit for ventilation of motor. Avoid installing the unit in hidden locations, dusty and lacking of ventilation.

Pump/motor assembly should not be installed in narrow areas, dusty, toxic and explosive ambient. In the event this is not possible it is recommended to ventilate the areas to help cooling the motor (minimum 0,6 metres of empty room around). All components used in the installation should comply with the safety codes. The installation must not transmit vibrations to the pump.

Select a mounting pad that will minimise vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams.

It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 4).

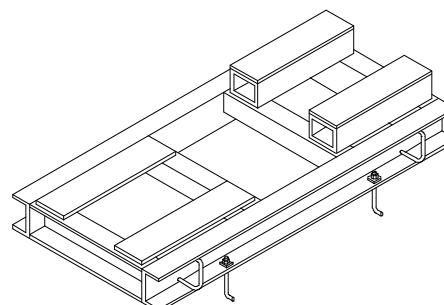
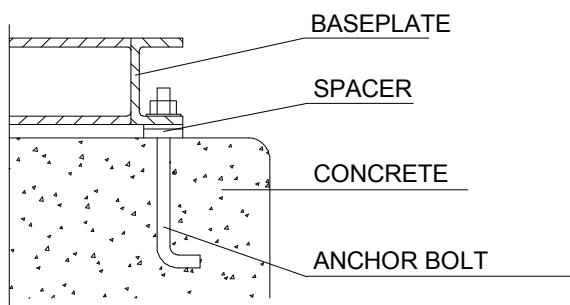


Fig. 4

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

7.1 - INSTALLATION OF PUMP/MOTOR ASSEMBLY

Place the pump assembly on the foundation pad aligning the anchoring bolts.

If necessary use metal spacers to level the unit and check the flange connection for good horizontal and vertical planes.

Tighten the foundation bolts.

Check again the level of the assembly and proceed with the pump/motor alignment verification as discussed in paragraph 8.2.

In cases where the pump is installed on a baseplate separated from that of the motor (due to expected piping forces, moments or as it often is in cases of large units) it is recommended to first install the pump and then proceed with the motor installation and alignment.

7.2 - SUCTION AND DISCHARGE PIPING

Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction (see fig. 5) and discharge flanges, the service liquid line and all other service connections.

CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Pay maximum attention to the proper connection of the system pipelines to the respective pump's connections.

Operate only provided with apposite protective devices.

To prevent the introduction of any limb in the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up.

Inlet and discharge piping should be of same size as the pump flanges, where possible increase the pipe size but NEVER decrease the size.

In general the liquid velocity in the suction piping should not exceed 2 m/s and in the discharge piping should be less than 3 m/s. Higher liquid velocities will result in higher pressure drops which could create cavitation in the suction piping and excessive pressure losses in the discharge piping, which would negatively affect the system performance and the pump.

Where possible, avoid using piping turns and especially short radius elbows.

When using larger pipe sizes than the nominal, the reduction from a larger diameter to a small diameter should be gradual and with conical configuration, the length of the conical area should be 5 to 7 times the difference in size of the two diameters.



Piping should always be supported to neutralise any forces, moments, piping weights, thermal expansions, etc. which could create pump/motor misalignment, deflections and overloading to foundation bolts.

Pipe joints should be by means of flanges with flange gaskets of proper size and material.

Flange gaskets should be properly centred between the flange bolts so that there is no interference with the flow of the liquid.

There should not be any tensions, deformations or misalignment of the piping when loosening the bolts holding the flanges together.

Any thermal shocks and/or excessive vibrations should be controlled by means of expansion joints, flexibles, etc. having same size as the piping.

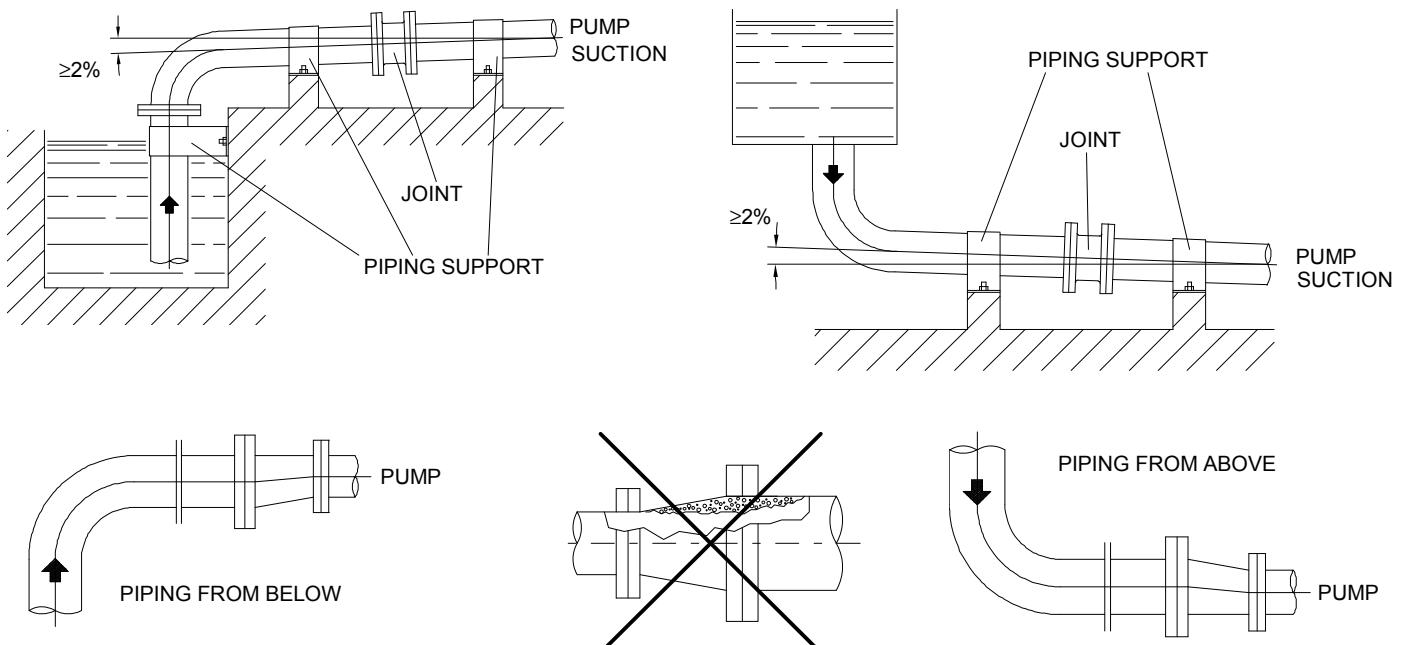


Fig. 5

7.2.1 - Suction piping (see fig. 5 and 6)

To prevent loosing pump priming absolutely avoid formation of air pockets in the suction piping. This piping therefore should have a slope toward the reservoir in the case of suction lift installation, and toward the pump in the case of the flooded suction installation.

Isolating valve should only be on the fully open or fully closed positions and NEVER as a flow regulator. The valve should be installed with the stem in the horizontal position relative to the flow in the piping and at a distance from the pump suction flange of at least 10 times the pipe size.

Depending upon the application, a non return valve or a foot valve should be fitted in the suction piping, a strainer or filter will prevent solids from entering the pump and a pressure or vacuum gauge will enable reading the pump inlet pressure.

All components listed above will create pressure drops which must be taken into consideration in the design stage.

Where more than one pump is installed, every pump should have its own separate suction piping; if a stand-by pump is installed the two inlets can be connected to a common manifold with a single suction piping.



For pumps series TBA, in case of negative suction (from well) and only if NOT provided with check valve or foot valve, contrary to what above indicated it should be necessary that the suction piping will have a slope toward the pump.

7.2.2 - Discharge piping (see fig. 6)

Right after the pump discharge flange install a non return valve will stop dangerous water hammer which could seriously damage the pump discharge casing, a flow regulating valve (Globe or Needle valve), a pressure gauge can be connected to the threaded connection under the pump discharge flange, a vent valve should be fitted in this piping to fill pump and piping for initial start-up.

7.2.3 - Piping cleaning



CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Operate only provided with apposite protective devices.

Before installation start-up clean piping and any reservoirs removing loose materials and foreign particles.

Particular attention for cleaning should be for installations where welding of piping and components has taken place.

7.2.4 - Pressure testing



DANGER!

Danger due to fluids in pressure. Carry out sealing tests provided with apposite protective devices.

When the installation has been completed it is necessary to test the piping for both static pressure and vacuum.

Testing should be carried out in accordance to the applicable standards for the piping function and the operating pressures.

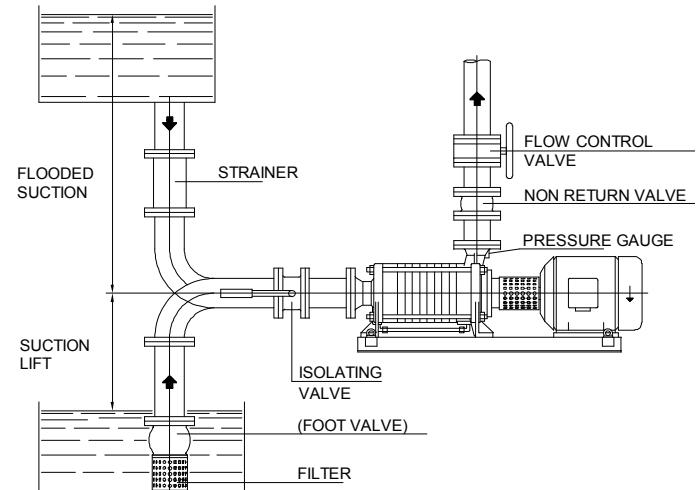
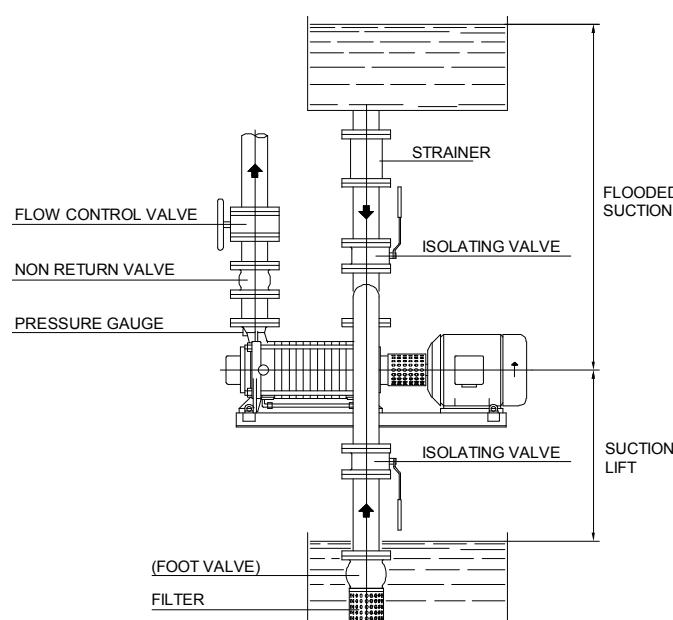
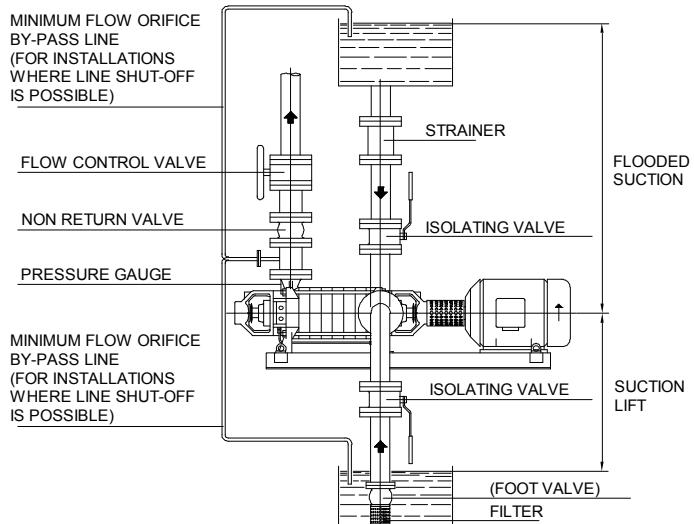
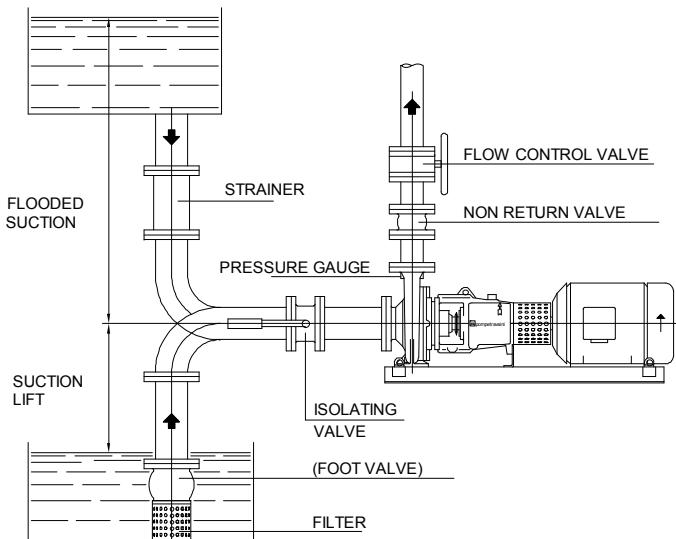
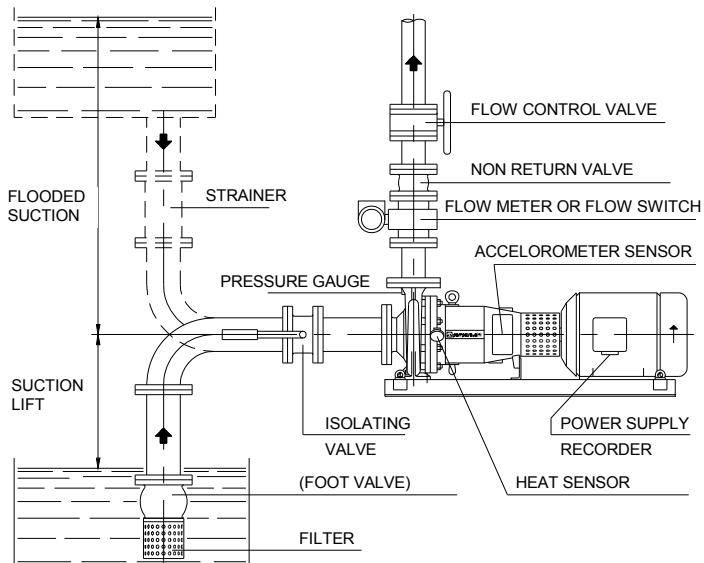
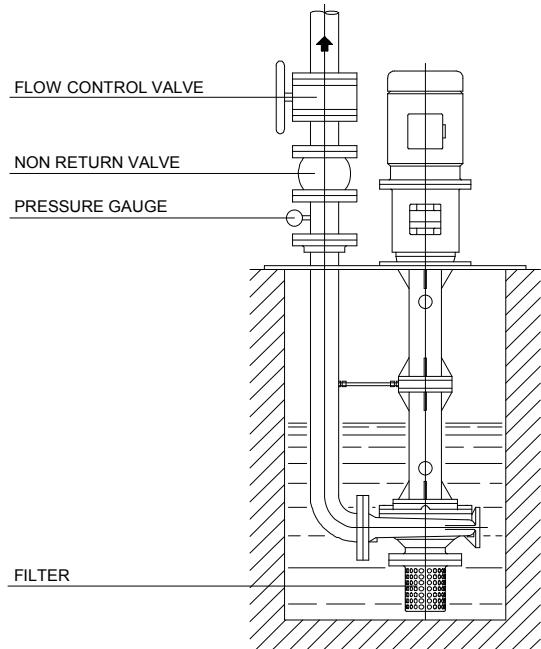


Fig. 6A



Pump series TCK



Pump series MC... - TC... - VERTICAL construction

Fig. 6B

7.3 - ACCESSORIES AND AUXILIARY CONNECTIONS

Depending on the application accessories may be installed to test the pump performance (instrumentation to measure pressure, temperature, capacity, etc.) and/or for necessary operations (cooling, heating, flushing of seals, etc.). When accessories are required the following should be considered:

- a) Pressure and vacuum gauges must be properly anchored and connected at the measuring points located at pump flanges or near the flanges, using approx. 8 mm. diameter tubing with "pig tail" configuration to alleviate pressure fluctuations.
For safety purposes, isolating and vent valves should be fitted before these instruments (see fig. 7).
- b) Temperature gauges should be installed with thermowells selected for the specific purpose and fitted in strategic locations where the reading is required (see fig. 8).
- c) Every pump is fitted with draining connections at the pump casing. If required, pump drain and mechanical seals leakages can be piped to a container located nearby on the floor or (if available) to the drain catch basin for the total installation.
The pump draining piping should be fitted with an isolating valve and both should be suitable for the pumps maximum operating pressure.
- d) Cooling, heating, flushing of mechanical seals and other piping must be connected only to the designated connections located on the pump (see fig. 9-10-11-12 and chapter 15 for more details).
All tubing and connections must be a minimum of same size as the connection on the pump.
Insulation, if required, must be limited to the pump body, leaving all other components such as bearing frame and motor uncovered for heat dissipation.
- e) Controlling the minimum capacity.

When the pump operates near the shut-off with almost no flow, almost all the motor power is transformed into thermal energy which is absorbed by the pumped liquid.

If the capacity is less than the minimum recommended (10-15% of pump capacity at its best efficiency point) not only will there be excessive load on the pump support and bearings but the liquid could evaporate resulting in damage to the impellers and wear rings with possibility of the pump seizing.

To prevent these problems it is recommended the installation of a minimum flow valve in the discharge piping, right after the pump but before the flow regulating valve.

In the event the flow regulating valve being excessively throttled or even completely closed, there will always be the required minimum liquid flow recirculated from the pump discharge to the suction piping of the pump.

The other device which may be fitted in this by-pass line (from pump discharge, before flow regulating valve, to pump suction) is a calibrated orifice sized for the minimum liquid flow required by the pump.

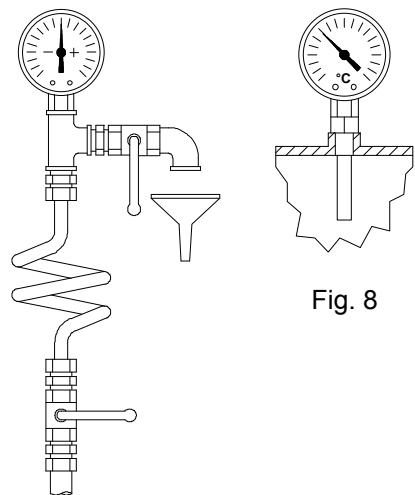


Fig. 8

Fig. 7

- f) Pumps with magnetic drives (series TBK, TBAK, TCK), should be fitted with a temperature sensor to monitor and register the temperature in the area of the magnetic coupling. Pumps are fitted with a threaded connection for this purpose.
- g) To prevent pumps running dry it is recommended to install, in the pump discharge line, a flow meter to check that there is a constant liquid circulation in the piping.
- h) Fitting of a power meter will help analyzing the operation of the pumps. Knowing the minimum and maximum power absorbed by the operating pumps will help identifying problems that may be caused by dry running, siphoning, etc.
- i) Accelerometers fitted on the bearing housing near the bearings, will help with the reading of the vibrations. An analysis of the vibration diagram, direct or indirect, would provide a diagnostic to prevent mechanical breakdowns, such as hydraulic cavitation.
- j) It is recommended to start the magnetic pumps and all other pumps with more than 4 KW motor drive, with Soft-Starters or Delta-Star connections. Further information may be found in chapter 9 and in paragraph 19.1 of chapter 19.

LEGEND for figures 9-10-11-12

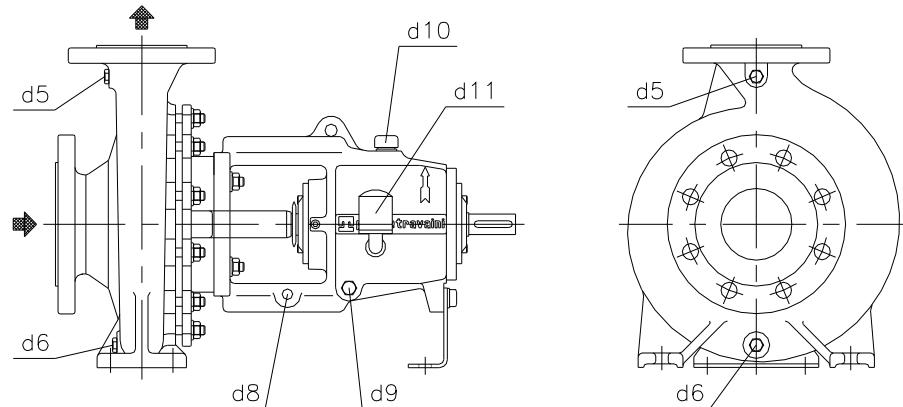
- d1.1 Threaded connection - "double tandem" mechanical seal flushing inlet from outside
- d1.2 Threaded connection - "double tandem" mechanical seal flushing outlet
- d2.1 Threaded connection - mechanical seal chamber cooling/heating liquid inlet
- d2.2 Threaded connection - mechanical seal chamber cooling/heating liquid outlet
- d3.1 Threaded connection - flushing liquid inlet from outside for "double back to back" mechanical seal or for single mechanical seal construction
- d3.2 Threaded connection - "double back to back" mechanical seal flushing liquid outlet
- d4.1 Threaded connection - casing cooling/heating chamber liquid inlet
- d4.2 Threaded connection - casing cooling/heating chamber liquid outlet
- d5 Plugged connection - for manometer
- d6 Plugged connection - for pump casing drain
- d7.1 Threaded connection - packing seal flushing liquid inlet from outside
- d7.2 Threaded connection - packing seal flushing liquid outlet from outside
- d8 Threaded connection - for seal leakages recovery
- d9 Plugged connection - bearings oil drain from housing (on request only)
- d10 Plug with dipstick for bearings oil filling into housing
- d11 Constant level oil filler (on request only) or Oil level gauge (standard)
- d12 Threaded connection - mechanical seal flushing liquid inlet from outside (on request only)
- d13 Grease nipple
- d14 Plugged connection - air-hole mechanical seal chamber
- d15 Plugged connection - sludge discharge from mechanical seal chamber (only for TCD/2-SP)
- d16 Threaded connection - tank liquid discharge (only for TCD/2-SP)
- d17 Threaded connection - for tank (only for TCD/2-SP)
- d18 Threaded connection - to check oil leaks from bearing (only for TCD/2-SP)
- d19 Threaded connection - thermometric probe
- d20 Plugged connection - filling
- d21.1 Threaded connection – "Quench" liquid inlet
- d21.2 Threaded connection – "Quench" liquid outlet

Plugged connection = Plug to be removed in case of use

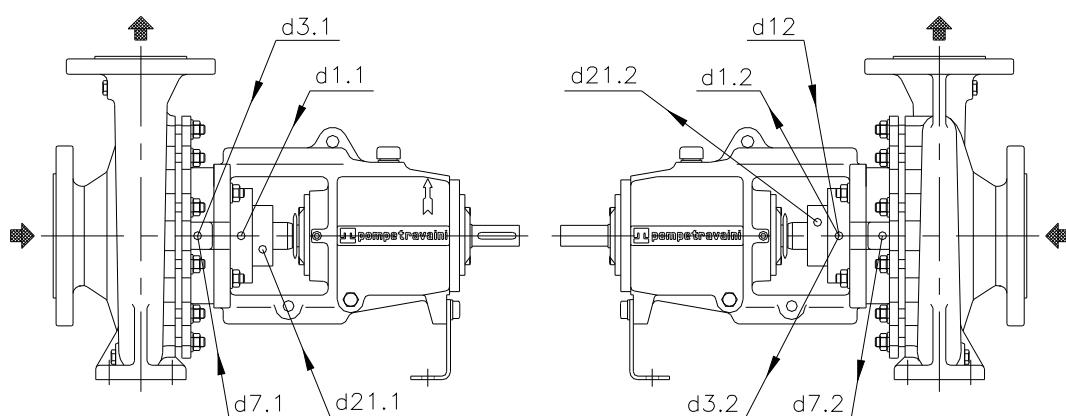
Threaded connection = Before connecting remove the plastic protection plug

For each pump specific connections dimension please consult our website "www.pompetravaini.it".

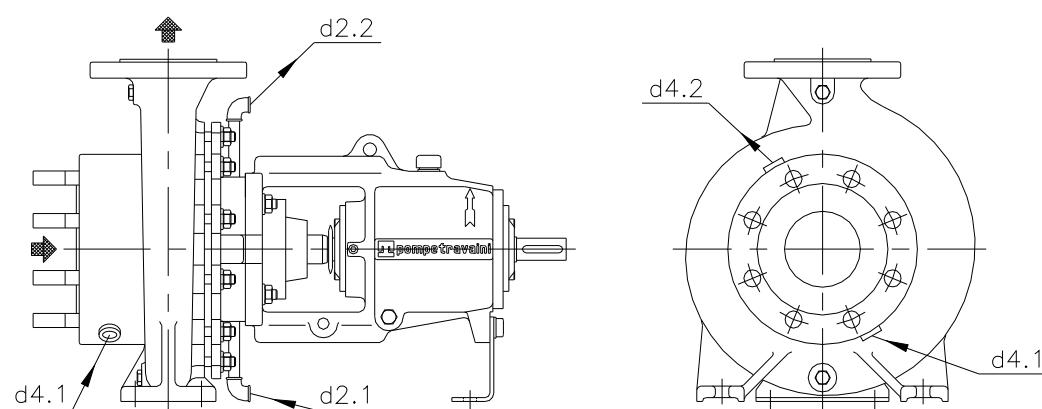
Fig. 9 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
Standard connections and hook-ups

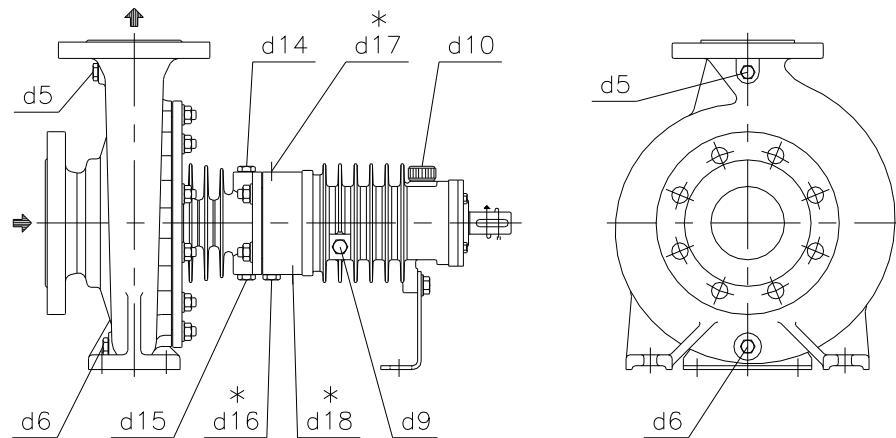


Pumps series MC... - TC...
Connections for designs /C - /R - /RR - /R2 - /B

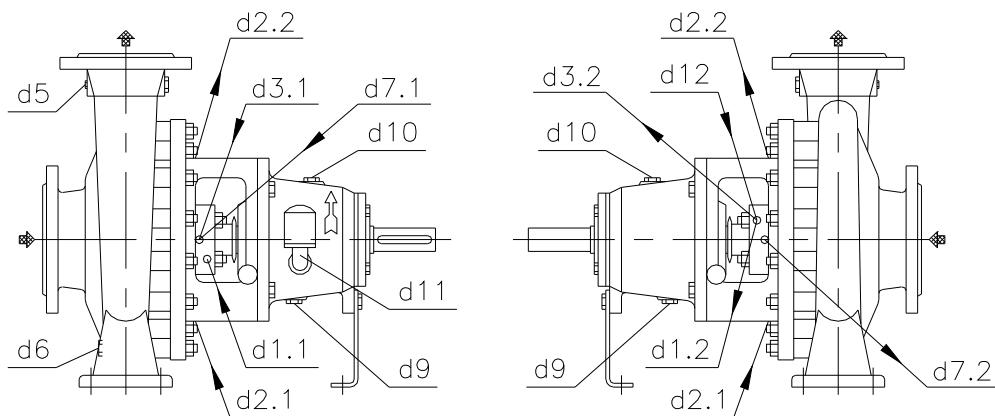


Pumps series MC... - TC...
Connections for designs /T - /U2

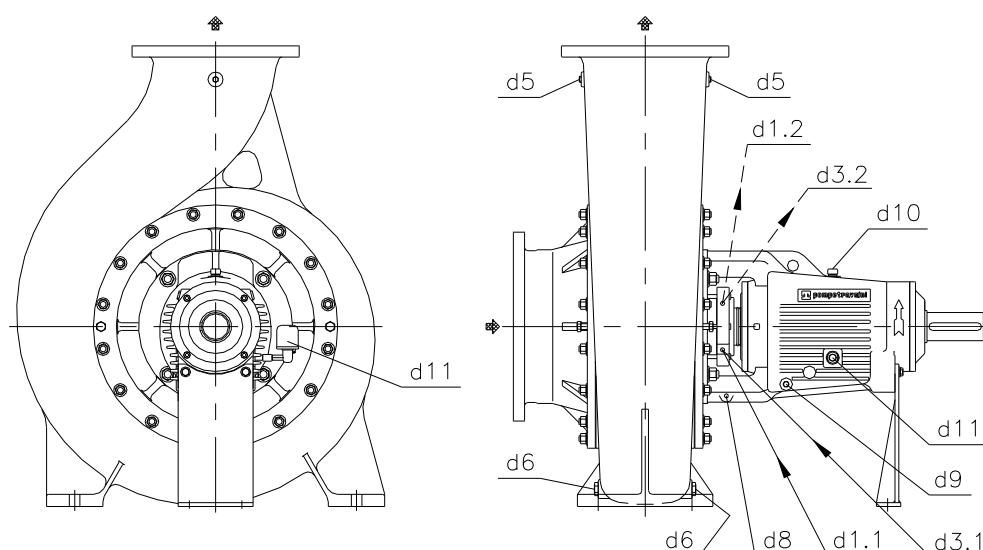
Fig. 10A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TCD
Standard hook-ups and connections - (* Only for TCD/2-SP)

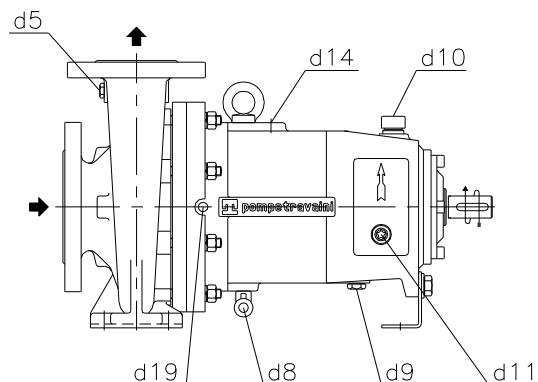


Pumps series MCU-CH n.s. group 3 and 4
Standard hook-ups and connections

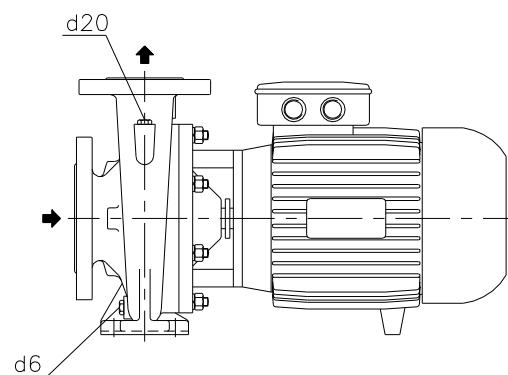


Pumps series TCH and TCN group 5
Standard hook-ups and connections for Double back to back mechanical Seals

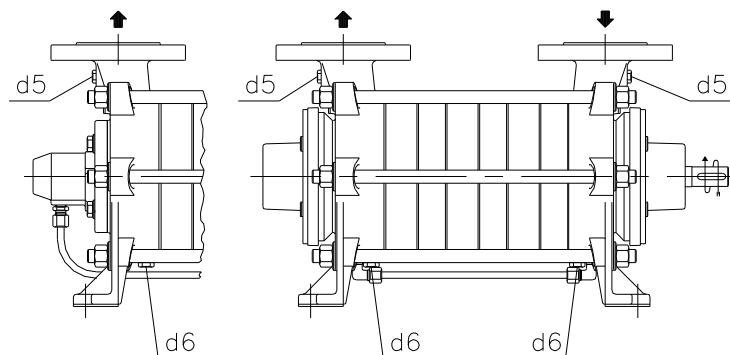
Fig. 10B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



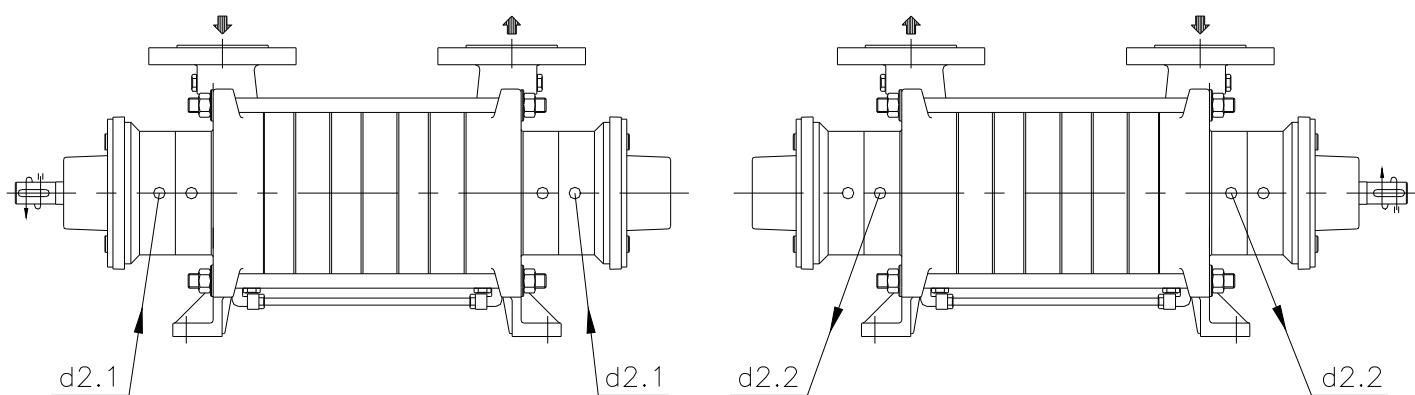
Pump series TCK
Standard connections and hook-ups
NOTE: d19 = on both side for gr. 2



Pump series MCM
Standard connections and hook-ups

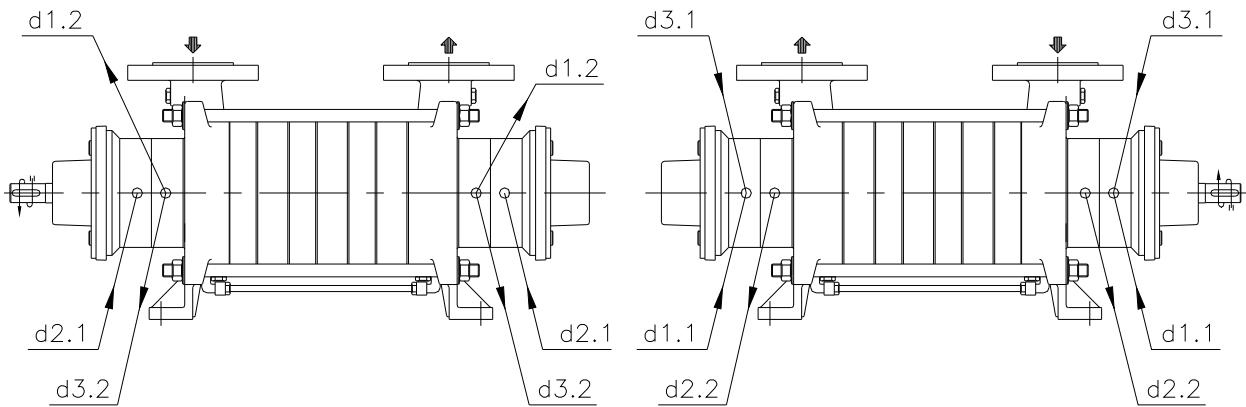


Pumps series TBH/C - TBH/KC - AT/KC - TBA/C
Standard hook-ups and connections

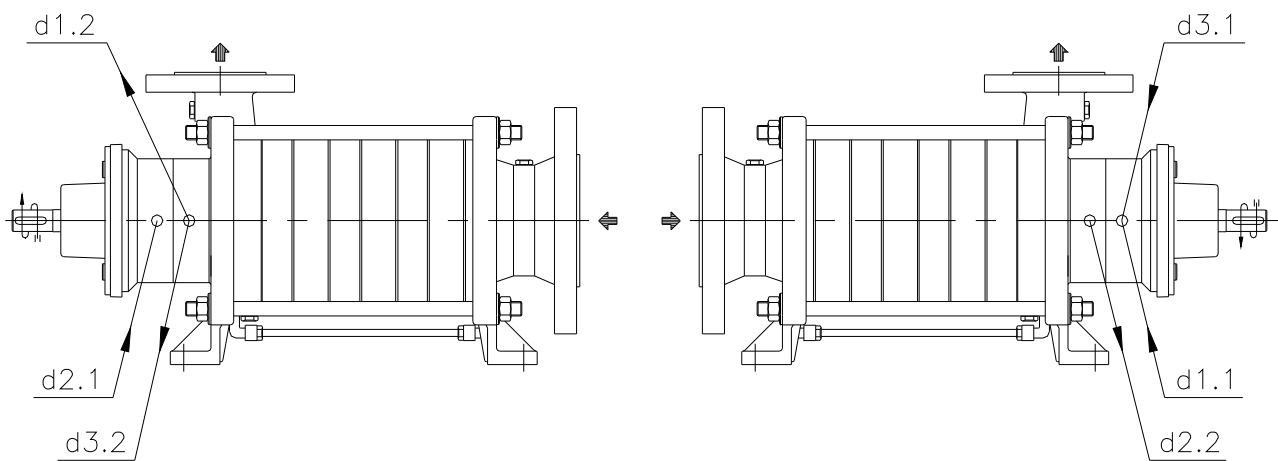


Pumps series TBH/CT - AT/CT
Connections for cooling or heating

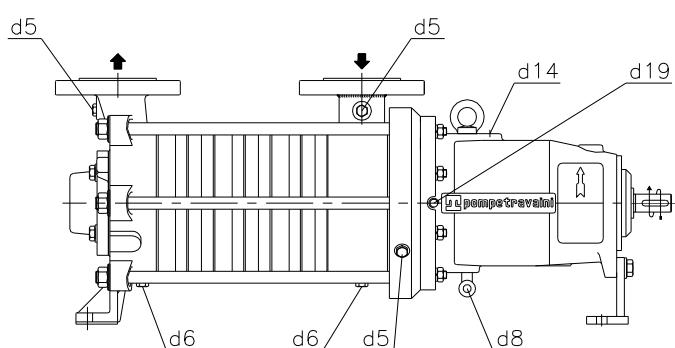
Fig. 11A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



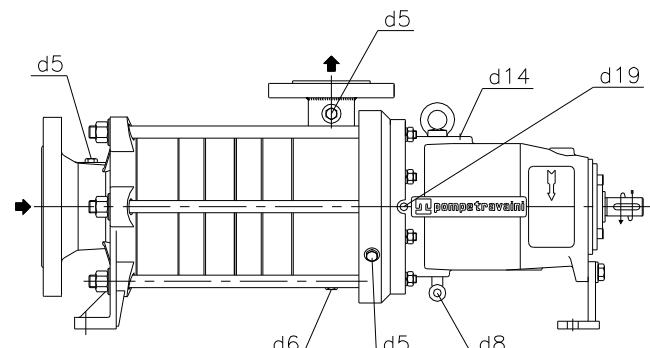
Pumps series TBH/KC-2T - AT/KC-2T
Connections for mechanical seals flushing, cooling or heating



Pumps series TBA/C-2T
Connections for mechanical seals flushing, cooling or heating

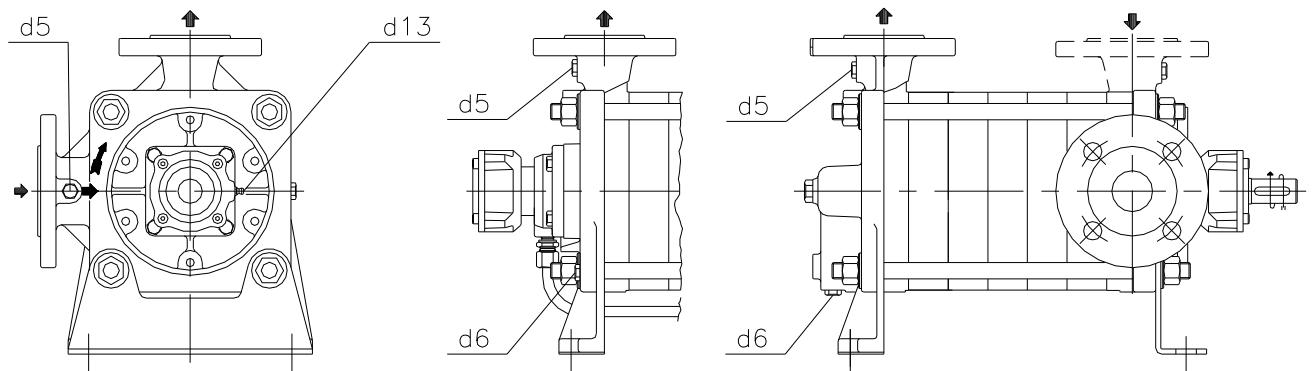


Pump series TBK
Standard connections and hook-ups

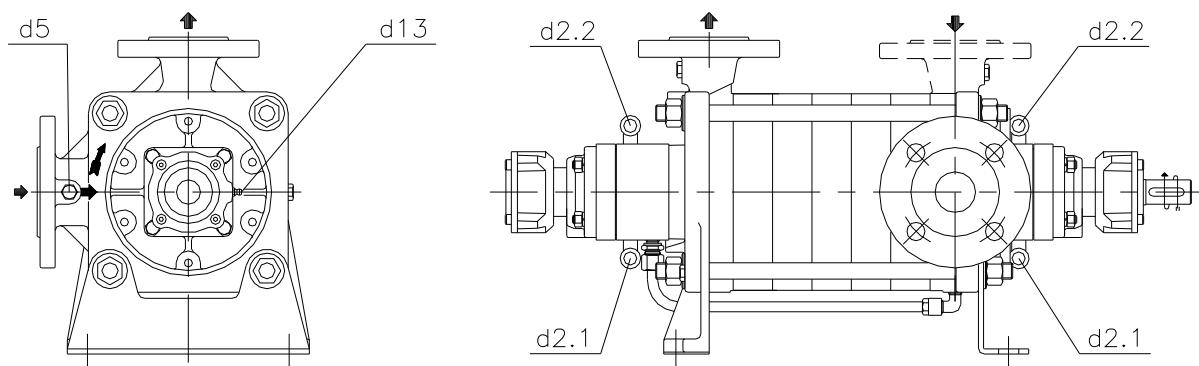


Pump series TBAK
Standard connections and hook-ups

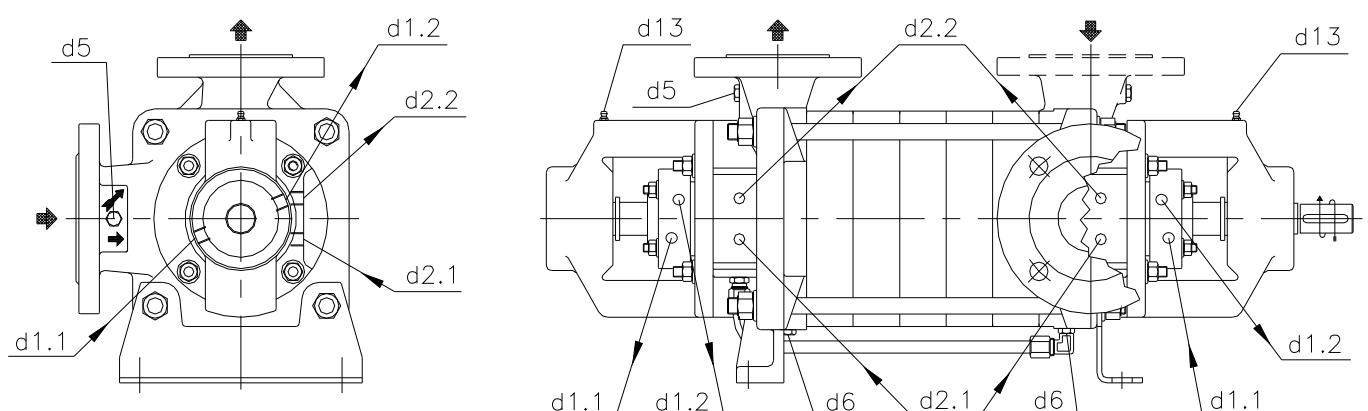
Fig. 11B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TMA 31 and 32/C and /R
Standard hook-ups and connections

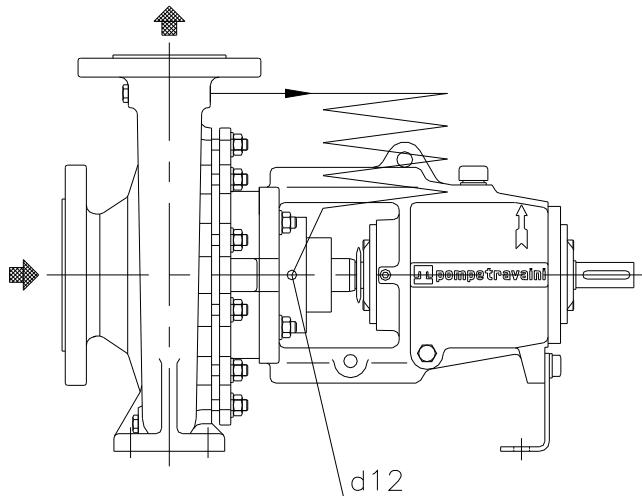


Pumps series TMA 31 and 32/T
Connections for cooling or heating



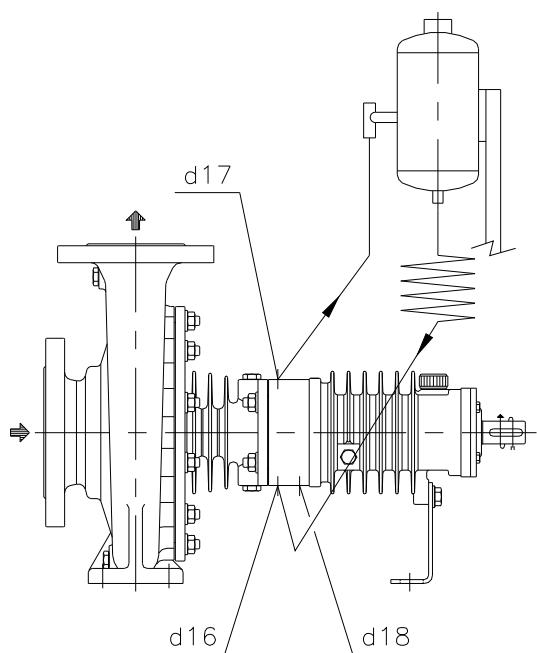
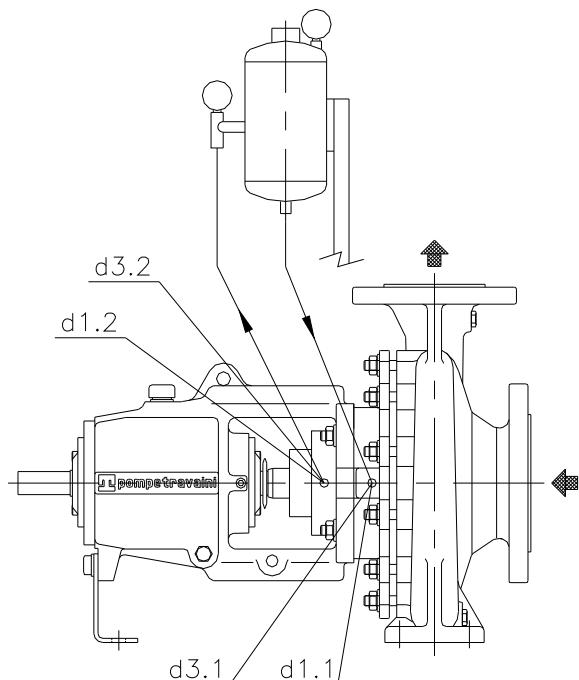
Pumps series TMA 40 and 50/B - /R - /R2
Connections for mechanical seals flushing, cooling or heating

Fig. 12 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
(API Plan 11) Recycle directly from pump casing or via cooling

Pumps series MC... - TC...
Single or Double mechanical seal flushing with Seal Tank



Pumps series TCD/SP
Mechanical seal flushing with Seal Tank

DANGER!

 Danger of collision, harm and crushing! Do not start up the pump without the needful guards on both coupling and motor. The coupling procedures must be carried out when the pump is stopped, after having activated the safety procedures to prevent an accidental start-up (also see chapter 2). Operate provided with apposite protective devices (helmet, glasses, gloves, etc.).

8.1 - MONOBLOCK PUMP/MOTOR AND PUMP/MOTOR ASSEMBLY MOUNTED ON A BASEPLATE

If the pump has been furnished with bare shaft end (i. e. without motor) it is required to procure a proper baseplate on which to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid "U" shaped channel (fig. 15 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit.

Selection of motor must consider the following data at running condition:

- maximum power absorbed by the pump over the total operating range
pump operating speed (RPM)
- available power and network frequency (hertz, voltage, poles, etc.)
- motor enclosure type (CVE, ATEX, etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

Flexible couplings are selected considering:

- nominal motor horse power
- motor operating speed
- coupling guard must meet safety standards
 - possible pump damaging.

 Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 8.3 steps 1, 2, 4, 5, 6.

Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 8.3 steps 7, 1, 8, 5, 9, 10, 11.

For pump driven with V-BELT, please consult POMPETRAVAINI for possible information.

8.2 - ALIGNMENT PROCEDURE FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE

The pump/motor assembly is properly aligned by POMPETRAVAINI prior to shipment.

It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK DESIGN see paragraph 7.3 steps 3, 4, 5, 6.

For alignment procedure of BASEPLATE DESIGN see paragraph 7.3 steps 7, 5, 9, 10, 11.

PLEASE NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by POMPETRAVAINI as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

8.3 - ALIGNMENT INSTRUCTIONS

Alignment should be done at ambient temperature.

Do not try to force the fitting of the coupling onto the shaft. First remove the elastomeric dowels and then heat up the half coupling up to 150°C (do not use microwave ovens).

Should the pump operate at high temperatures which could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures.

The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper keyway slots and fit the coupling halves in line with the shaft ends. The use of a rubber hammer and even pre-heating of the metal half couplings may be required (see fig. 13). Lightly tighten the set screws. For monoblock versions make sure to tighten the connecting screws between lantern and motor as explained hereinafter.

Verify that both pump and motor shafts rotate freely.

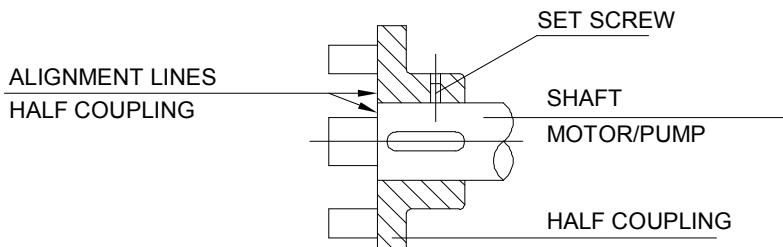


Fig. 13

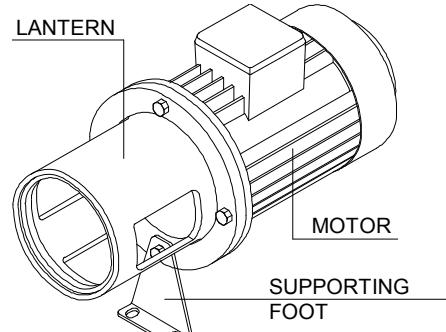


Fig. 14

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 15) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 14). When tightening the connecting screws between lantern and motor make sure not to force the two half-couplings until they touch each other. If this occurs remove the motor, axially move the half-coupling on the shaft and repeat the fixing procedure.

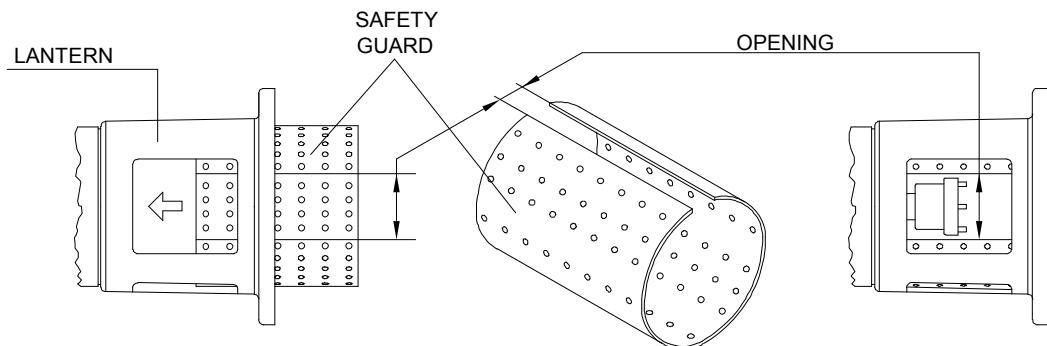


Fig. 15 - PREPARATION TO ASSEMBLY ON MONOBLOCK DESIGN

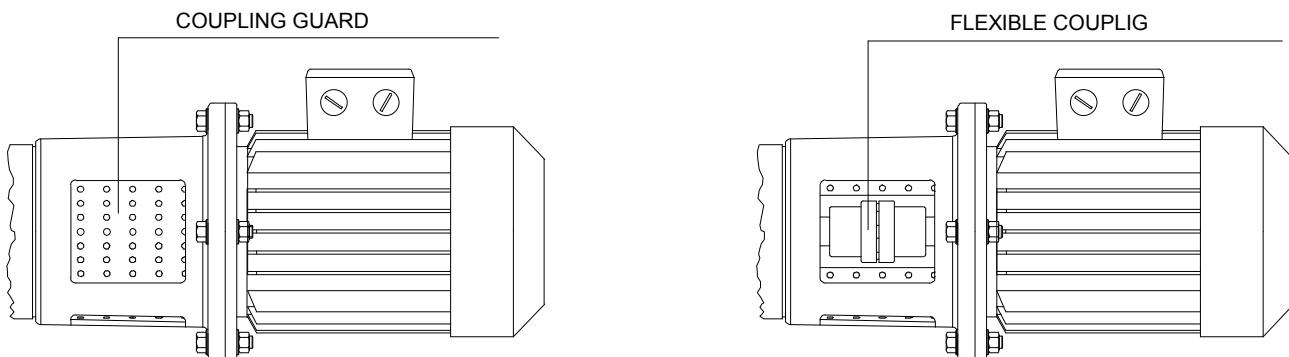


Fig. 16 - CHECKING ALIGNMENT ON MONOBLOCK DESIGN

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 16).

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a proper spacer check the distance between the two coupling halves. The gap value "S" should be as listed on table 2 or as given by the coupling manufacturer. In the event an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap "S" (see fig. 20). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

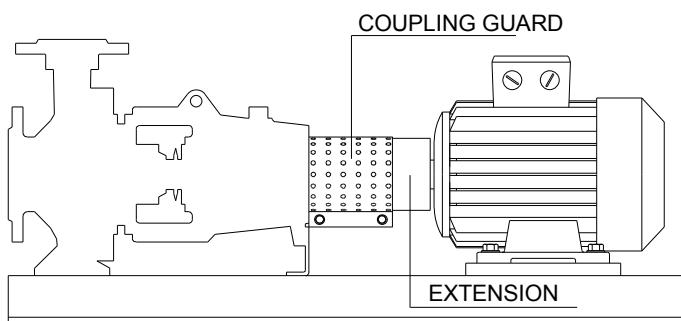


Fig. 17 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 17 and 18).

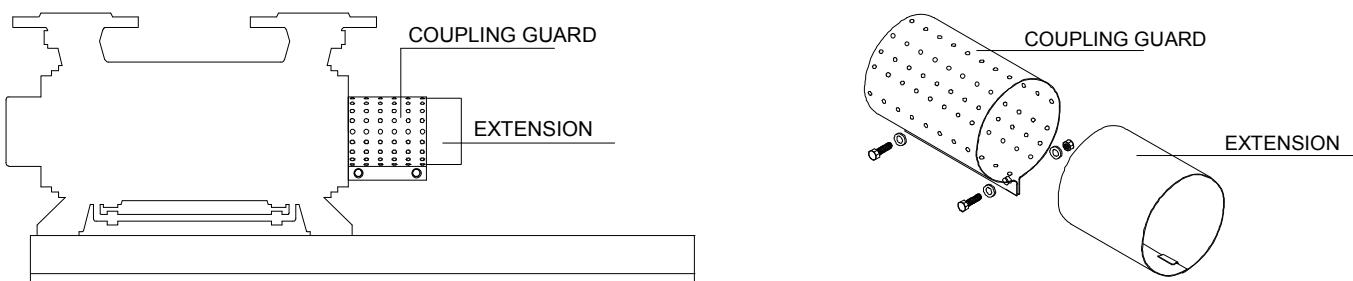


Fig. 18 - MOUNTING THE UNITS ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2 mm. gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 19).

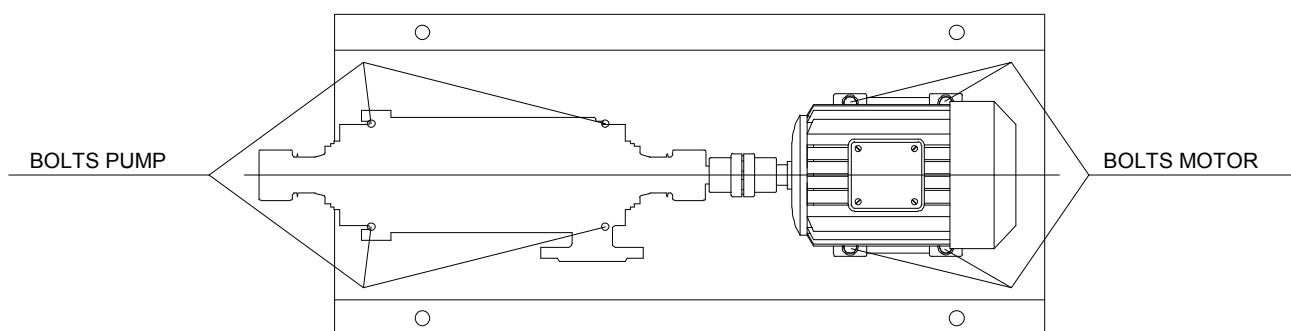


Fig. 19

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 21).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

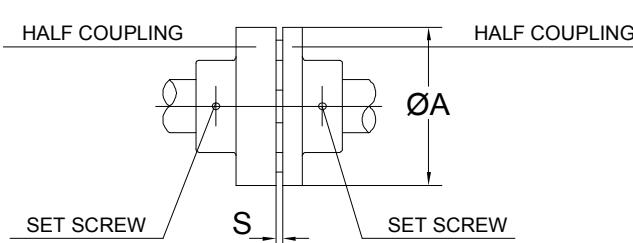


Fig. 20

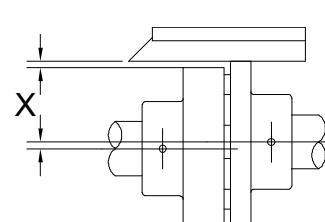


Fig. 21

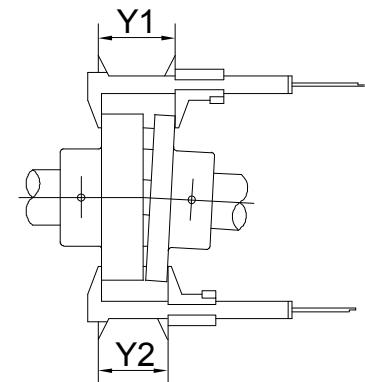


Fig. 22

If the maximum value of "X" is higher than that listed in the tab. 2 (for the given coupling size) it will be required to correct the alignment by using decimal shims under the pump or motor feet (NOTE: the optimal values have to be considered half of the reported data).

When the measured values fall within the tolerances the pump and motor anchoring bolts can be tightened.

10 - Angular misalignment can be measured with a Calliper. Measure the outside coupling dimension at several points (see fig. 22).

Find the minimum and maximum width of the coupling, the difference between these two readings "Y" ($Y_1 - Y_2$) should not exceed the value listed in tab. 2 for the given coupling size (NOTE: the optimal values have to be considered half of the reported data). Should this value be greater it will be necessary to correct the alignment by re-shimming the pump and/or motor.

Following this operation it is recommended to check once more the value "X" to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Tab. 2

COUPLING "Ø A" mm	GAP "S" mm	PARALLEL "X" mm	ANGULAR "Y" mm
60 ÷ 80	2 to 2,5	0,10	0,20
100 ÷ 130		0,15	0,25
150 ÷ 260	3 to 3,5		
290	4 to 5	0,30	
330	5 to 7		0,30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor and guard should not be greater than 2 to 3 mm. (see fig. 23).

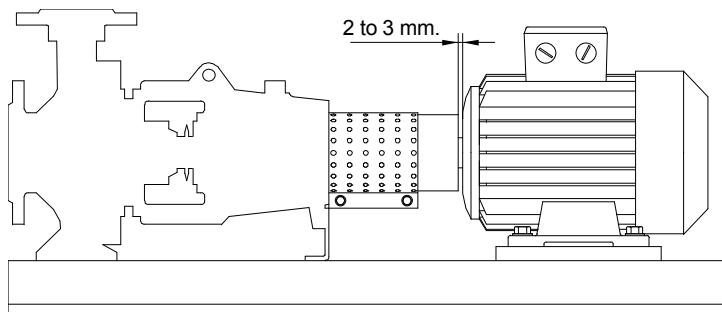


Fig. 23

8.4 - COUPLING PUMP SERIES "TCHM" AND "TCTM"

These pumps do not require a coupling between the pump and the motor shaft; they have been engineered with a supporting flange and shaft having bore and keyway ready to engage the motor shaft and key.

- Check the tolerances of pump shaft bore with its keyway and motor shaft with key. The motor shaft must engage the pump shaft perfectly without interference. In the event there is interference, even if minimal, it is required to rework the motor shaft because a forced fitting would be detrimental to the pump operation.
- Attach the electric motor to the pump flange making sure that the two shafts line-up and the key engages the keyway. Bolt the assembly with the supplied fasteners and install the supporting foot if it applies to the specific pump (see fig 23A).

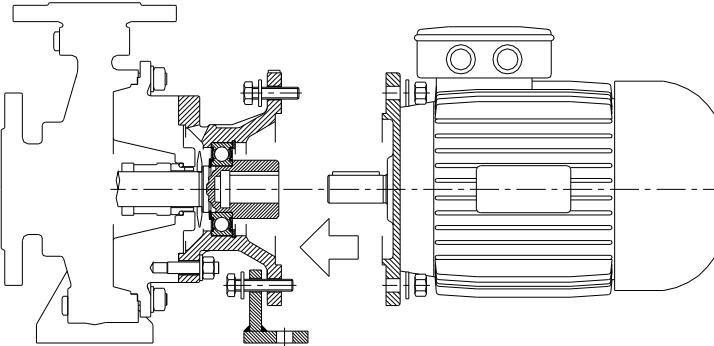


Fig. 23A

9 - ELECTRICAL CONNECTIONS

DANGER!

Electric danger. Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code. Always ground the motor verifying it is properly wired. It is advisable to have an electrical switch near the pump for emergency situations.

FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN CHAPTER 2.

BEFORE DOING ANY WORK TO THE INSTALLATION DISCONNECT ALL POWER SUPPLIES



All electric motors and possible connected accessories must be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate.

It is recommended that motors over 4 kW be wired for Star-Delta start-up, to avoid electrical overloads to the motor and mechanical overloads to the pump.



It is advisable to have an electrical switch near the pump for emergency situations. Be sure to replace all safety guards before switching on the electrical power.

Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor.

Motor connection should be as indicated on the motor tag (frequency, voltage, poles and max consumption) and as discussed in the motor instruction manual.

Pump series TCK, TBK and TBAK (and all motors over 4 kW) should always be preferably wired for Star-Delta start or "soft-start".

If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter).

Please be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage.

Electrical instrumentation such as solenoid valves, level switches, temperature switches, flow switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers.

10 - CHECK LIST PRIOR TO START-UP



If the installed pump is designated to be used in environments subjected to the application of the ATEX 99/92/CE directive but does not show the wording "ATEX" on the name plate, and the integrative ATEX manual hasn't been received or undelivered, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.



CAUTION!

All questions listed below must have POSITIVE answers prior to proceeding to the pump start-up (the following list may not be complete for special installations which may require further precautions as the cases dictate).

- Is this manual entirely read and understood?
- Are all the safety protections in order?
- Are the electrical connections properly wired, grounded and protected?
- Is the position of the pump switch-off button evident, accessible and clear?
- The piping system has been flushed of any foreign particles, welding impurities, etc.?
- Have all piping and pump obstruction been removed?
- All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?
- Pump and motor are properly lubricated, if required?
- Pump/motor alignment has been checked?
- If mechanical seal requires flushing has this been connected?
- All valves in the installation are in the correct position?
- Has this pump's direction of rotation been checked by jogging the motor?
- Are pump and installation ready for start-up?

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free it up by applying a torque to the pump coupling with a pipe wrench.

To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand.

In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.



The selected solvent or lubricating fluid must be compatible with the pump, seals and gasket materials.

New pumps from the factory and pumps coming from long term storage are likely impregnated with a rust preventative liquid; before the start-up, these pumps should be subjected to fresh water rinsing for approximately 15 minutes.

The obtained liquid-water mixture must be collected and, according to the environmental disposal regulations, treated as special liquid.



Dispose the waste liquids according to the current regulations protecting the environment.



CHECK PUMP-MOTOR COUPLING ALIGNMENT!

This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See chapter 8.2.

11.1 - START-UP

Never run the pump when it is dry!

Before starting-up verify that all auxiliary supplies are in place, ready to be used and, where necessary, they have been correctly opened. (Example: seal or packing flushing, pressurising buffer liquid to "back to back" double mechanical seals, etc.). Make sure the pump and motor bearings have been properly lubricated and oil levels are correct.

If necessary oil topping should be done through the proper connections (see fig. 20-21-22-23) and with recommended lubricants (see chapter 13). If the liquid to be handled is at dangerous high temperatures it is required to insulate the pump and the piping to prevent direct contact, the pump should also be protected against thermal shocks by insulation, preheating, etc.

Prior to starting, the suction piping and the pump must be filled with the liquid to be lifted; for this purpose there are three types of installations to be identified:



CAUTION!

Possible contact with hazardous media, cold or warm, and pump surfaces, cold or warm. During the following operations it is particularly important to avoid contact and/or inhale of possible spilled liquid (vapour): therefore all safety precautions must be taken. Operate only provided with apposite protective devices.

For this purpose there are three types of installations to be identified:

11.1.1 - Submersed pump (vertical design)

Pump filling is not applicable.

11.1.2 - Pump with flooded suction

Close the valve at pump discharge side, fully open the valve at pump suction side and the vent valve including any breather valve on the stuffing box.



Pump series TCD are fitted with a vent cock (see fig. 10B) which should be open to prevent forming air pockets in the mechanical seal chamber.



CAUTION!

Possible contact with warm media and warm surfaces. Be sure to do this only when the spilled thermal oil is at ambient temperature. Operate only provided with apposite protective devices.

When the thermal fluid exits the air cock without any air or gas bubbles, even after turning the pump rotor it means that the whole pump is full of liquid, therefore close the air cock.

11.1.3 - Pump with suction lift (from well)

In this case the pump must be primed: fully open the isolating valve in suction piping.

If the pump is self-priming and it has been previously filled with liquid, there will be no problems, because the pump will be able to prime itself and lift the liquid as soon as it starts operating.

If the pump is not self-priming, but the suction piping is fitted with a foot valve, the suction piping and the pump can be filled with liquid by opening the valve at the discharge side (provided the discharge piping is full of liquid) or fill the pump body as well as suction piping, with the liquid to be pumped, through the vent valve.

For non self-priming pumps with the suction piping not having a foot valve, the suction piping and the pump can be filled with liquid by hooking-up the vent valve to a vacuum line and keeping closed the valve at the discharge side of the pump: when the liquid exits the vent valve it means that the pump and suction piping are completely full of liquid.

At this point close the vent valve and the vacuum line.

Check the position and/or control the opening of the minimum flow valve, flushing lines and/or auxiliary supply lines.

After the pump and its suction line is full of liquid the pump should be started. In this regard there are two possible cases:

11.1.4 – Start-up a pump without back pressure at discharge side

For centrifugal pumps type MC... - TC... - TMA motor must be started with discharge valve closed.

When the motor has reached full speed, the discharge valve can be opened until the required differential pressure is reached (CAUTION: do not operate the pump with closed discharge piping for an extended period of time, to avoid overheating problems previously discussed).

For self-priming pumps type AT - TBH - TBA all valves in suction and discharge piping must be fully open before starting the motor. After the motor has been started the discharge valve can be throttled to build up the expected pressure.

(It is possible to start these pumps with the discharge valve at the closed position but, in this case, there will be maximum power consumption at start-up).

11.1.5 – Start-up a pump with back pressure at discharge side

In this case a non-return valve must always be installed in the discharge piping.

The unit is started with the discharge valve partially open and after the pump pressure exceeds the back pressure in the discharge line then is time to adjust the discharge flow regulating valve to attain the operating pressure.

For the Starting Torque of the pump see chapter 19.1.

11.2 - OPERATION

After starting the pump the following should be checked:

- The differential pressure and the capacity are as expected (if required, adjust the flow regulating valve at the pump discharge side but NEVER throttle the valve at the suction side).
- The motor amperage does not exceed the value shown on the motor nameplate.
- The pump/motor assembly does not have unusual vibrations and noises.
- The seal arrangement works as it should:
 - if the sealing is by packing there should be continuous dripping from the stuffing box (see chapter 14).
 - if the sealing is by mechanical seal there should not be any leakage (see chapter 15).
 - the bearing housings temperature, when operating regularly, must be lower than 85°C.



CAUTION!

Never run the pump dry.



CAUTION!

Possible contact with high temperature surfaces. Operate only provided with apposite protective devices.

If at start-up there are suspicions of abnormal operation it is recommended to stop the unit and investigate the causes (see chapter 16).

11.3 - SHUT DOWN

DANGER!



Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Operate only provided with apposite protective devices.

The centrifugal pumps can be shut down by switching off the power to the motor, with open or closed flow regulating valve: however if there are no provisions against liquid hammer it is recommended to close the flow regulating valve at pump discharge prior to stopping the pump.

Avoid the use of instantaneous shut-off valves, such as solenoid valves. These can cause severe pump damage.

If the piping has not been fitted with non-return valves it is required to close the shut-off valves in sequence to prevent emptying the piping.

Close first the isolating valve at discharge and then at suction side.

If the non return valve is not fitted, or the isolating valve at the discharge side is not completely closed, it may happen that during the shut-down the pump shaft will rotate in the opposite direction than is normal because of a return flow: in such cases absolutely avoid restarting the pump until the pump shaft has stopped rotating.

Following pump shut down it is required to close any auxiliary lines such as flushing, heating, etc.

After the first start-stop and if necessary, check pump/motor alignment and make sure that no external forces or moment rest on pump or piping.

In the event the pump is shut down for an extended period of time it is recommended to completely drain the pump to prevent the possibility of freezing in the winter time and/or the possibility of corrosion due to stagnant liquid left in the pump (see chapter 6).

12 - OPERATING CHECK LIST

Periodically check the good working condition of the pump by reading the instruments such as gauges, amp meters, flow meters, etc., the pump should constantly be performing as the installation requires.

The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections.

It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see chapters 13 - 14 - 15 - 16) at least once a year, even if no abnormalities have been noticed.



If during operation the pump seems to run irregularly, because of noise or vibrations, it is necessary to stop the unit and investigate the causes of the malfunctioning (see chapter 16).

When the pump is fitted with auxiliary supply lines such as cooling, heating or flushing it is recommended to periodically check their flow, temperature and pressure.

If the magnetic driven pump is fitted with a temperature sensor, the temperature in the area of the magnetic coupling should be approximately 3 to 5°C above the temperature of the product being pumped in standard conditions (water at ambient temperature). Higher values could indicate operation at low flow, obstruction of internal flushing connections or mechanical damage of the magnetic coupling.

Please contact POMPETRAVAINI if there are doubts regarding abnormal temperature rises.

13 - LUBRICATION INSTRUCTIONS

Pumps often operate in severe conditions and the bearings are subject to relevant radial and axial forces. For a good pump operation it is therefore very important to keep the pump bearings well lubricated and clean.

DANGER!

 Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.

FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

Bearings and lubricants must be free of any foreign particles such as dirt, dust, etc. which could cause the bearings to seize.

See "Disassembly and assembly instructions" for bearing sizes, quantity and type of lubricants.

13.1 - GREASE LUBRICATED BALL BEARINGS

TMA pumps series, flanges size 40 and 50, have ball bearings that, during assembly, are already lubricated with high quality grease with working temperature limits -30 °C +140°C.

The bearings used in a pump normal operating conditions must be carefully cleaned and newly greased after approximately 2000/2500 working hours using a good lubricating grease quality (check the "Disassembly & assembly instructions" for the lubricating grease replacement).



Dispose the exhausted grease following the current regulations and the right measures to protect the environment.

The sealed pre-greased never need lubrication, but must anyway controlled after 2000/2500 working hours.

It is important to remember not to over lubricate the bearings, excessive grease will lead to overheating of bearings.

AT - TBH - TBA - TCK - TBK - TBAK pump series are fitted with self lubricated ball bearings which do not require re-grease in normal operating conditions (series TCK, TBK e TBAK may also be fitted with oil lubrication as described in the paragraph listed below).

It is necessary to carry out the greasing and maintenance operations as per the above description for the pumps with roller bearing fitted on the drive end.

Bearing temperature should not exceed 85°C in normal conditions and ambient temperatures.

Overheating could be caused by excessive grease, coupling misalignment, excessive vibrations and /or bearing wear (see chapter 16).

13.2 - OIL LUBRICATED BALL BEARINGS

Pump series TC... - MC... are fitted with oil lubricated ball bearings. The series TCK – TBK and TBAK can also be with grease lubricated bearings.

It is good practice to replace the lubricating oil used at time of testing.

Oil should also be changed after the first 50 to 100 hours of operation.



Dispose the exhausted oil following the current regulations and the right measures to protect the environment.

The lubricating oil, poured through the hole which is also the dipstick seat or vent plug located at the top of the bearing frame should, as a maximum, cover the bearing balls of the lower crown (the oil dipstick or the oil level gauge show the correct quantity, see fig. 25).

The installation of a constant level oil-filler (as option) consents a correct lubricating oil level in the avoiding recurrent fillings.

For the first filling proceed as follows:

- remove vent plug of the bearing frame
- upset the oil-cruet

- pour oil into the bearing frame through the hole of plug till you can see oil in the oil-filler elbow
- fill the oil-filler pouring oil directly into the oil-cruet and NOT into the elbow (see fig. 24)
- replace the cruet in normal position
- let oil flow into bearing frame
- repeat operation till the oil level in the cruet cease to decrease.

The following fillings should be done pouring oil directly into the cruet and NOT into the elbow of the oil-filler or bearing frame plug (see fig. 24).

If there are no particular dangers of oil contamination (dust, water) and the temperature in the bearing frame oil bath does not exceed 60°C, oil should be changed every 4000 to 6000 hours of service.

For higher operating temperatures and contaminated oil the frequency of oil changes should be increased.

Bearing temperature should not exceed 85°C in normal conditions of operations and ambient temperatures.

Overheating could be caused by too much oil, coupling misalignment, excessive vibrations and/or bearing wear. It is recommended to periodically check the oil pH which will indicate the oil stability and the oxidation grade (consult the supplier for the acceptable values).

Satisfactory oils are those with a viscosity at 40°C between 46 and 100 centistokes.

Oils with high viscosity (100 centistokes) are recommended for applications with high operating temperatures.

Pumps of series TCD can use oils with viscosity up to 220 centistokes.

Pumps are provided with oil OLEODIN 100 for standard applications at ambient temperatures from -5 to +40 °C

Some oil types are:

OLEODIN 100

AGIP BLASIA 68

CASTROL HYSPIN VG 46

CASTROL HYSPIN AWS 68

ESSO TERESSO 68

ESSO NURAY 100

SHELL TELLUS OIL T68

IP HYDRUS 68

Avoid to mix oils having different features and brands.

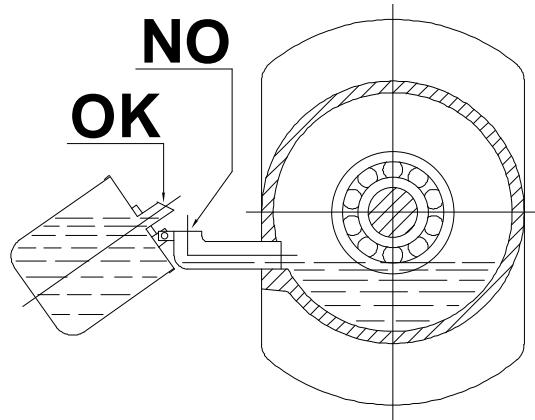


Fig. 24

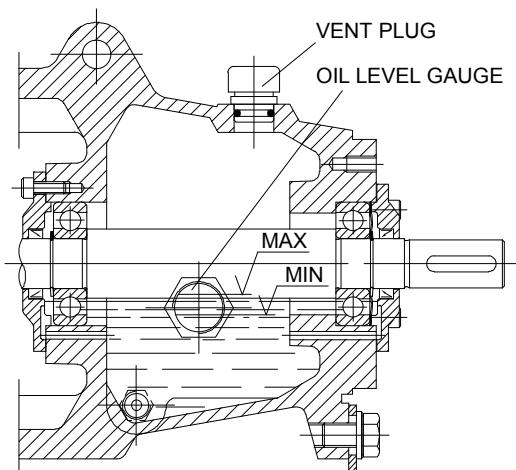
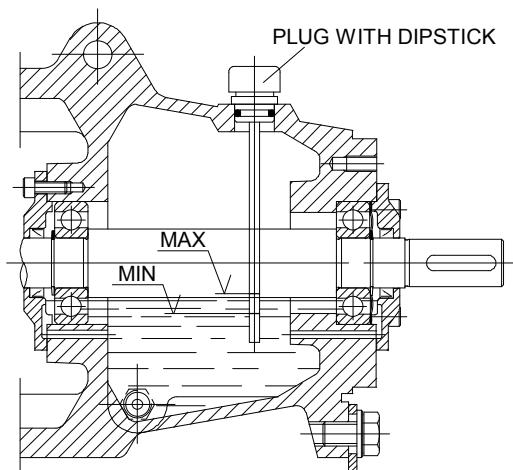


Fig. 25

DANGER!

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Pumps fitted with packed stuffing boxes require packing flushing either from an external source or directly from the pumped media through pump internal passages.

This liquid is necessary to remove the friction heat generated between the shaft and the packing.

The dripping quantity is a function of the pump size and of the pressure in the stuffing box housing.

In any event the liquid drops coming out of the stuffing box should not exceed a temperature of 60 - 70°C in relation to handling a liquid at ambient temperature.

14.1 - ADJUSTING THE PACKING

All adjustment operations must be performed with the **PUMP NOT RUNNING** following the safety measures given in chapter 2. After completion of the work **ALWAYS** re-install the safety guards previously removed.

At first start up loosen the nuts of the packing gland allowing a steady flow of liquid to drain out (see fig. 26).

After obtaining a steady flow of leakage gradually tighten the gland nuts until attaining a steady dripping within the limit of the above recommended temperature.

A few hours time span may be required to establish a steady dripping at low temperatures.

Packing adjustment is required when the liquid leakage increases.

When adjustment is no longer possible, the packing material should be replaced with new one.

Follow the "Disassembly and Assembly Instructions" to replace the packing materials.

In the event the pump remains out of service for more than 2 months it is recommended to replace the packing rings, prior to start-up.

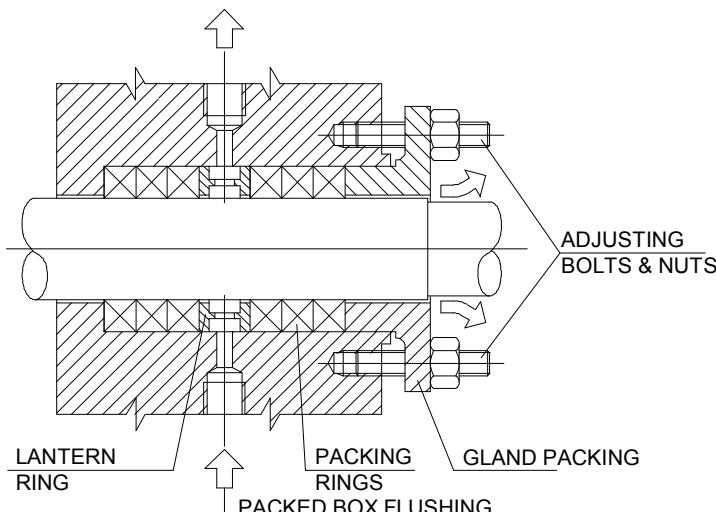


Fig. 26

15 - MECHANICAL SEALS**DANGER!**

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Purpose of mechanical seals is to retain handled product inside the pump in the area where the shaft exits the pump casing. Mechanical Seals can be of many different materials, types and configurations (see fig. 28-29-30 for some examples). To assure maximum reliability and safe operation Pompetravaini evaluates seal choices at time of pump selection in connection with customer's requirements, application and liquid details.

In the case of self lubricated single mechanical seals (API Plan 01, 02 or 11, see fig. 28) flushing and /or pressure system are not required, pump has been engineered to provide proper seal lubrication with pump operating pressure.

In the event the application requires increased safety margin against possibilities of product leaking through a single type mechanical seal, it is possible to install two mechanical seals working simultaneously thus creating a safety barrier from the pumped liquid.

There are two possible types of double mechanical seals: Back-to-Back (also known as "Opposite" type) API Plan 54, see fig. 29 and in Series (also known as "Tandem" type) API Plan 52, see fig. 30.

Double mechanical seals Back-to-Back are generally selected where pumped liquid is absolutely not allowed to leak from the pump. Double mechanical seals in Series are chosen where the pumped liquid may escape the pump toward the pump exterior but it is controlled and contained in the closed seal loop but never to escape to the atmosphere.

Double mechanical seal installations require a flushing (buffer) liquid from an external source that is compatible with the pumped product as well as the working conditions. Flushing liquid system is such as to guarantee adequate buffer liquid pressure and temperature to the mechanical seals: seal flushing system with proper instrumentation and controls is of paramount importance for a successful pump installation, it must be installed by qualified personnel familiar with every details of the application and with system set-up.

All flushing systems MUST use tubing with diameters equal or larger than the connections provided on the pump, buffer liquid must be compatible with the pumped product. Pressure on the buffer liquid should always be constant and/or high enough to cover the entire pump performance.

In the case of 'once through' seal flushing (buffer liquid not recycled), it is very important the regulation and control of pressure in the seal housing. In the double seal case it is recommended to adjust the buffer liquid pressure with a flow regulating valve installed after the seal housing while reading pressure on a gauge installed between the seal housing and the valve. Avoid controlling buffer liquid pressure before the seal housing, reading the pressure before the seal housing is NOT recommended as it could lead to wrong conclusions which could be cause for serious damages. With an adequate seal tank in the system (see fig. 33) a closed loop seal flushing, containing possible leakages is provided. Adequate controls and/or instrumentation will provide pressure and liquid level controls in the tank to indicate the conditions of the sealing system. Increase of liquid level (or pressure) is indication of product leaking through the pump seal. Decrease of liquid level (or pressure) is indication of buffer liquid leaking inside the pump or to the atmosphere through the outside seal, in which case the leakage is also visible.

The liquid to be used in the seal tank must offer full compatibility with the pumped liquid in the event the seal at pump side will leak, (for example when the two liquids will mix there must not be any dangerous chemical reactions) as well the liquid must offer good lubricating characteristics and good heat dissipation. Some good examples of suitable buffer liquids are water, vaseline oils or vegetable oils.

Pressure in the seal tank is often kept with pressurised Ozone or Nitrogen bottle. Cooling of the buffer liquid in the loop (picks up friction heat from the seal faces) is achieved with fresh liquid through the cooling coil fitted inside the seal tank. Seal tank is provided with Inlet & Outlet connections for sealing liquid. DO NOT reverse these two connections; the liquid circulates by natural heat convection (warm liquid moves upward and cold liquid downward), reversing the connections would prevent the start of such natural phenomenon. The buffer liquid outlet connection going to pump seal housing is at bottom of tank while the return connection is approximately at the middle of the tank.

Checking of proper liquid circulation is done while pump is in service; the piping at seal housing connection should be colder by 3 to 5°C than the outlet tubing exiting the seal housing going to the tank. If this is not the case simply change the tubing on the seal housing (connect tubing from inlet to the outlet and vice versa) do not change the connections on the tank. Sometimes this adjustment is required because the rotation of the mechanical seal (and at times peculiar seal design) generates an hydraulic pressure that could be opposite and higher than the natural. Only in 'field' check one can be assured of the correct liquid circulation. Monitoring the pressure in the seal tank with pressure switches or pressure gauges and/or controlling the liquid level in the tank allow the verification of possible seal leakages and prompt corrective actions can be taken when required.

Use good quality gauges to monitor the pressure, with good dial and scale graduation adequate for good reading in the anticipated pressure range. As a minimum use liquid filled gauges with dial size of minimum 60 mm and 2.5 accuracy. Additional data and information may be requested from Pompetravaini or its local representative if required.



Incorrect pressure of seal housing could cause severe damage to the rotating parts. To minimise seal system malfunctions avoid pressure fluctuations in the seal loop as well as in the pump operating pressure.

Seal housing with double mechanical seals back-to-back type, must always have a pressure such that the inside seal (closer to pump impeller) will not be pushed out of its seat by the total pump pressure (suction plus pump operating pressures) even when pump is in stand-by mode. Flushing liquid therefore must be at least 0.5 bar over the maximum pump discharge pressure throughout its performance.

A lower pressure, even if for a moment, will cause the stationary part of internal seal to come out of its seat and the pumped liquid will mix with the flushing liquid due to the higher pressure inside the pump, see fig. 27.

In the case of double seals in series (Tandem) the pressure of the flushing liquid should be as low as possible but high enough to provide good flow in the circuit. High pressures (over 0.3 bar over the atmospheric pressure) may push the stationary seat of mechanical seal at product side (closer to pump impeller), out of its seat (especially when pump is at rest without pressure), therefore flushing liquid would mix with the product inside the pump following seal system damage.

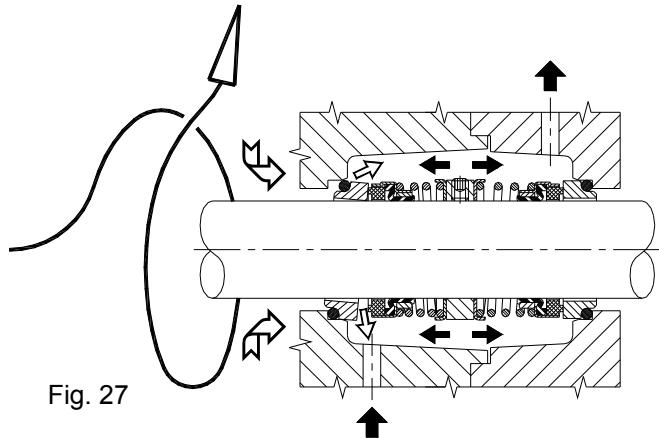


Fig. 27



Incorrect pressure in sealing system is the most common cause for seal system failure, therefore a continued monitoring with prompt corrective actions are necessary.

See fig. 20-21-22-23 and operating manual for centrifugal pumps for locations of liquid flushing connections. Required flow and pressure for buffer liquid are listed in tab. 3 and/or contact Pompetravaini and/or seal supplier. See tab. 4 for liquid flow required to cool or heat the seal housings. For a longer seal life cooling is recommended when pumping liquids over 90°C. Tab. 4 also lists cooling or heating liquid flow for pumps of "U2" design that include jacketed pump casing.

Standard mechanical seals supplied with our pumps meet ISO 3069/UNI EN 12756 standards, see pump "Disassembly and Assembly Instructions" for overall dimensions. Special or non-standard seals can be installed after proper

evaluation by our technical department. Mechanical seals do not require maintenance until losses of liquid are visible (for seal replacement see "Disassembly and Assembly Instructions"). Losses of few drops of liquid in several minutes is normally considered acceptable and it is not an indication of seal failure.

Seal leakage or even seal failure should be properly corrected considering the impact on environment, toxicity and safety issues.



CAUTION!

Pay attention to possible leakage of pumped liquid from mechanical seal which, by its characteristics, could be harmful to the environment.

Mechanical seals should NEVER run dry, without flushing liquid (internal or external). This could cause severe damage to the seal faces, O-Rings and elastomer. It is recommended to check the wear on seal faces every 4000 working hours. This is an acceptable normal working time for mechanical seals, over this time there could be losses due to wear and tear that require seal replacement.

MECHANICAL SEALS WITH QUENCH

There are two types of Quench/Barrier, available upon request: API Plan 61 and 62.

System Plan 61 (see fig. 31) includes a bushing on the back of the seal at atmospheric pressure side (single or double) to hold the bulk of the liquid in the event of accidental failures. The bushing requires a minimum clearance over the shaft therefore the liquid is NOT sealed completely but most of it will be retained in case of a sudden seal breakage. Drain and vent connections are threaded. This arrangement does not allow a continuous flushing because the above mentioned clearances would cause considerable losses of liquid over the shaft toward the outside. This system is chosen for avoid emergencies or to limit losses of liquid.

System Plan 62 (see fig. 32) requires (contrary to Plan 61) a constant flushing because the auxiliary seal is of the contact type and CANNOT work without a liquid that removes the generated heat of friction. The auxiliary seal is usually a lip seal (radial seal ring) not to be confused with the traditional mechanical seal. Losses of several liquid drops should be tolerated and with time its reliability will decrease. This system is often used where there is the need to wash the back of the mechanical seal on the atmospheric side preventing crystallization or coking of handled product. It is a less effective alternative to the double mechanical seals in series. Pressure of buffer liquid must follow same rules as for the double seals in series, therefore max pressure can be 0.3 bar over the atmospheric pressure and temperature can be max 60°C.

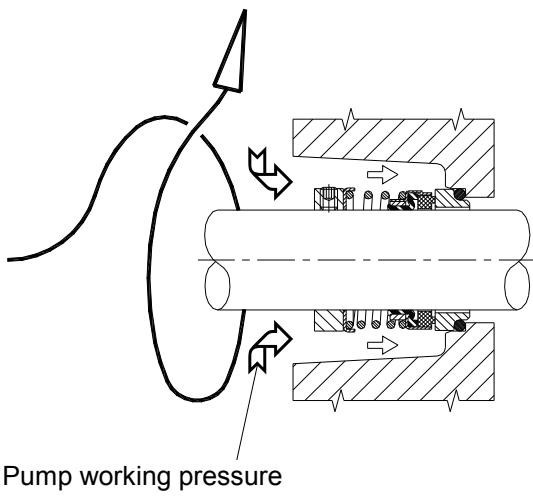


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

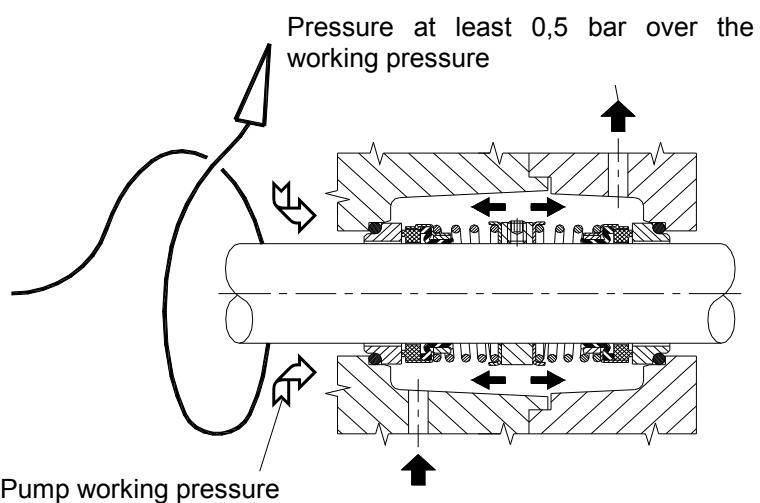


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54

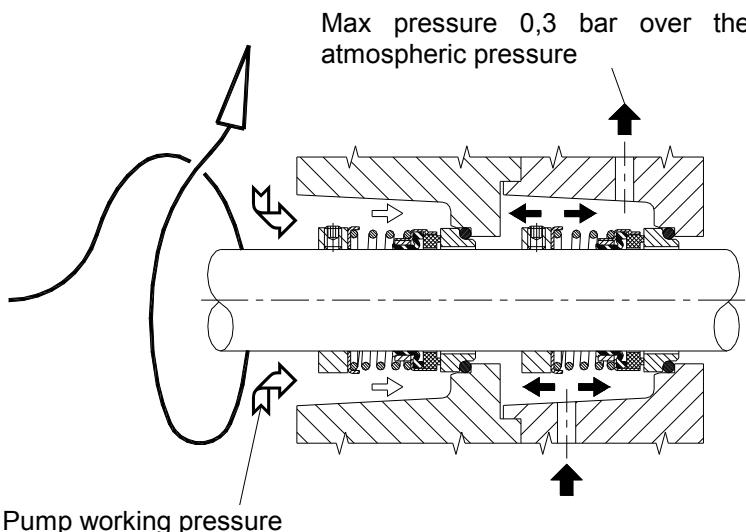


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

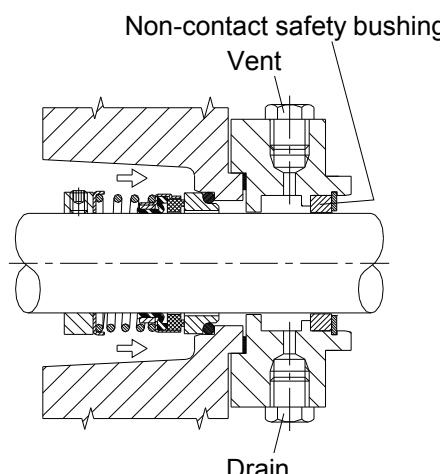


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

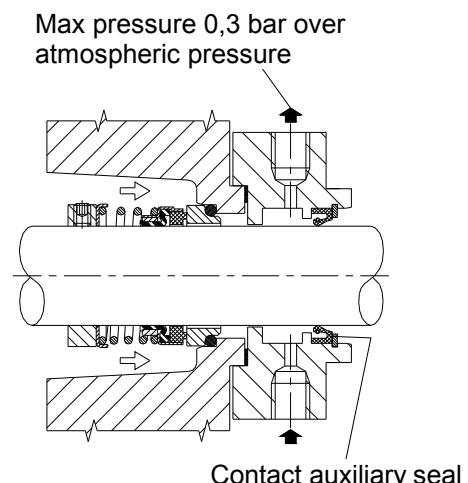


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

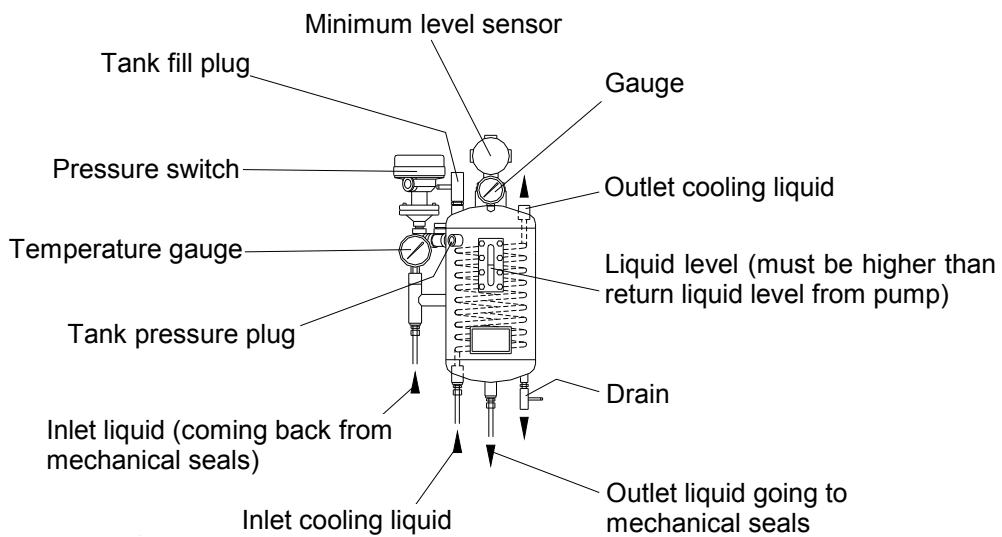
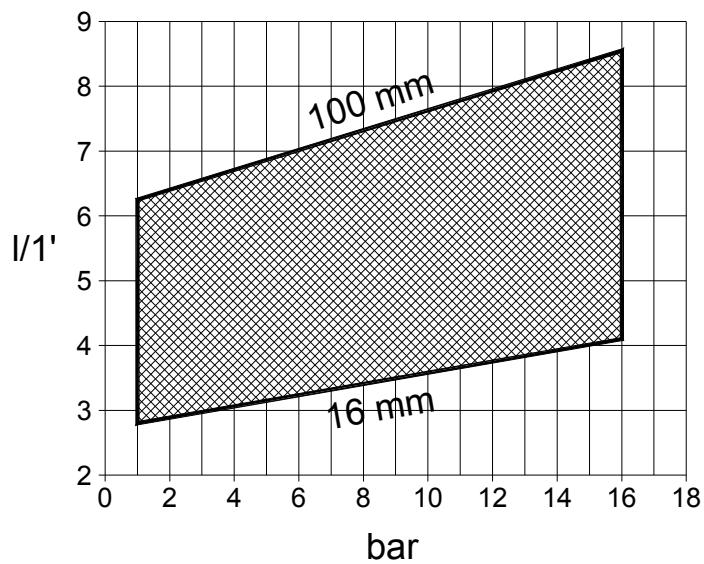


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

NOTE: Tank installation must be at least 1 m above the rotating pump shaft



Tab. 3 - REQUIRED LIQUID FLOW TO FLUSH MECHANICAL SEALS FROM OUTSIDE SOURCE

mm = installed shaft seal diameter
 bar = maximum pump working pressure (total of inlet pressure and pump generated pressure as measured at pump discharge flange)
 I/1' = required liquid flow (lit/min) for single seals or double in series type seals (tolerance +/-25% depending upon temperatures)
 NOTE: DOUBLE quantity of liquid flow for double mechanical seals back-to-back type.

CAUTION: Flushing liquid PRESSURE for back-to-back double seals must be min 0.5 bar over the max pump working pressure, while NOT more than 0.3 bar over the atmospheric pressure in case of double seals in series (TANDEM).

Tab. 4 - LIQUID FLOW FOR COOLING OR HEATING JACKETED SEAL HOUSING (maximum pressure for liquid circuit is 3.5 bar, referred to water and ambient temperature. In case of heating circuit the allowed maximum temperature is 135°C).
 Flow tolerance +/-25%.

CAUTION: Flow for cooling or heating of jacketed pump casings, design "U2" pump series MC... - TC... (see fig. 34) can vary depending upon temperatures for cooling or heating the casing, ALWAYS limiting the maximum pressure of 3.5 bar and temperature of 135°C of the pump casing jacket.

PUMP SERIES	FLOW MINIMUM I/1'	FLOW MAXIMUM I/1'
AT - TB... TC... group 1 - 2 TMA	3	8
MC... group 3 - 4 - 5 TC... group 3 - 4 - 5 MEC	5	12

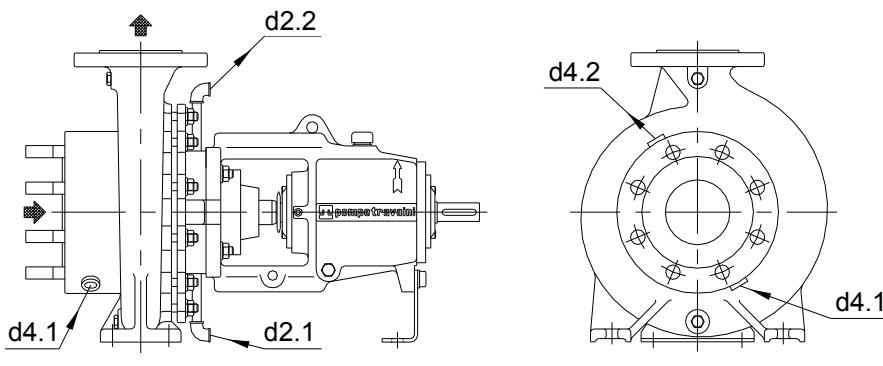


Fig. 34

- d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
- d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
- d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
- d4.2 Threaded connection - Outlet cooling/heating liquid pump jacketed casing

16 - TROUBLE SHOOTING CHART - PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart (tab. 5) or should there be any doubts, do not hesitate to contact POMPETRAVAINI or your local representative.

Tab. 5 - LIST OF PROBLEMS

PROBLEM	LIST OF POSSIBLE CAUSES
Lack of, or no flow and/or pressure	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 17 - 25 - 40
Excessive flow and/or pressure	15 - 16 - 17 - 18
High power consumption	10 - 15 - 16 - 18 - 19 - 20 - 21 - 22 - 23
Excessive vibration and noise	8 - 18 - 19 - 20 - 23 - 24 - 25 - 26 - 27 - 28 - 36 - 37 - 40
Bearing overheating	19 - 20 - 28 - 29 - 30 - 36 - 38 - 39 - 42
Sealing malfunction	28 - 31 - 32 - 33 - 34 - 35 - 40 - 41

	CAUSES	SOLUTIONS
1	Pump is not primed	Repeat the priming procedure
2	Rotational speed is not adequate	Increase the motor speed in relation to the working conditions - Replace impeller with one having larger diameter.
3	Installation requires higher pressure than expected	Increase operating speed, if possible, (see point 2) or replace impeller with one of larger diameter - Change the pump or increase the number of stages in case of multistage pumps - Reduce the system pressure
4	Wrong direction of rotation	Change the motor direction of rotation
5	There are air pockets in the suction line	Modify the layout of suction piping
6	Air enters the suction line	Check the piping sealing areas
7	The pumped liquid is emulsified with air	Install a reservoir or tank before the pump to de-aerate the liquid
8	The suction lift or/and suction pressure is more than anticipated and therefore the pump cavitates	Reset the suction lift to the original value - Increase the piping diameter - Check the suction piping, the foot valve or non return valve, the filter - Open completely the isolating valve in the suction piping - Decrease the friction losses
9	The wear ring and/or impeller neck and/or the impeller and/or the diffusers are worn out or damaged	Overhaul the pump replacing and/or repairing the damaged components
10	Viscosity, density, or specific weight of liquid have higher values than expected	Re-establish the characteristics of the liquid as originally expected (if necessary contact POMPETRAVAINI)
11	Suction piping is not sufficiently submersed in the liquid, creating vortex	Increase the depth of piping or foot valve in the liquid
12	Impeller is plugged with scale deposit and/or foreign materials	Take out the impeller, clean it, free the vanes and cavities of any materials - Soften the pumped liquid
13	There is entrained air in the system	Adjust the packed stuffing box or repair/replace the mechanical seal
14	Piping is plugged	Clean piping and valves - clean the filters
15	Velocity is too high	If possible, decrease the pump rotational speed
16	The required pressure of system is lower than anticipated	Adjust the flow regulating valve in discharge piping - Decrease the impeller diameter (contact POMPETRAVAINI) - Decrease the number of stages in case of multistage pumps
17	Pump is not suitable for the application	Contact POMPETRAVAINI
18	Inlet pressure is too high	Reduce the pressure, but without adjusting the isolating valve at the suction side

19	Pump/motor coupling is misaligned	Realign the coupling
20	Bearings are defective or worn out	Replace bearings
21	The power supply voltage is wrong - Motor does not operate properly	Change the motor - Correct the power supply
22	The packing is too tight	Loosen the nuts of the packing gland
23	Pump seizing is experienced	Stop the pump and look for any rotor obstructions
24	The pump and/or piping are loose	Torque the bolts as required
25	Pump is worn out or damaged with excessive internal clearances	Overhaul the pump
26	The coupling rubber inserts are worn	Replace the coupling inserts
27	The impeller is out of balance due to wear, deposits and encrustation	Disassemble, clean, balance and/or replace the impeller - Soften the liquid
28	Forces, moments and piping misalignment are loading the pump	Realign and support the piping
29	Oil level in bearing frame is low, oil quality is inadequate or there is lack of grease	Replace oil or grease to the normal level using proper quality lubricants
30	The power absorbed is too high	Decrease the power consumption by identifying the cause
31	Pump is running dry	Reinstate the correct working conditions
32	Pumped liquid or the flushing liquid to the seals is dirty and/or not adequate	Install a filter in the flushing lines - Change flushing fluid
33	There are excessive shaft vibrations and deflections	Identify the causes and reinstate the correct working conditions (refer to more specific points in the table)
34	The pumped liquid is not adequate for the seals	Contact POMPETRAVAINI
35	The shaft sleeve is worn out	Replace the sleeve with a new one
36	The pumped flow is less than the minimum required	Increase the flow - Adjust the by-pass recirculation valve or line
37	Baseplate or pump foundation is not adequate	Change or reinforce the baseplate and/or foundation following the recommended procedures
38	Too much grease in the bearings	Remove excessive grease and check the bearings
39	There is water in the bearing frame	Change bearings and replace all the lubricant
40	Incorrect assembly after pump repair	Overhaul pump and assembly following correct procedures
41	The mechanical seals are damaged	Remove the mechanical seals, overhaul or change them
42	The axial forces are too strong	Check the impeller

Should the pump require repairs it is recommended to be familiar with the procedures outlined in the "Disassembly and Assembly Instructions".

DANGER!

Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.



FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

In any case, before working on the pump it is important to:

- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cables from the motor
- close the pump inlet and outlet isolating valves
- let the pump cool down to ambient temperature if is pumping hot liquids
- adopt safety measures if the pump has been handling dangerous liquids
- drain the pump body of the pumped liquid, through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:

- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one
- if required, remove motor by removing the bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from installation without damaging other system components.

Before returning the pump to POMPETRAVAINI or an authorized service decontaminate the pump and ask for the "handled media" examination form.



In case of pump removal from the installation dispose the unit by following the current regulations and the right measures to protect the environment.

When the pump has been repaired must repeat the steps from "Assembly and Alignment" procedures and after (see the applicable chapters starting from chapter 7).

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimise unnecessary down times in the event of pump failure or routine maintenance.

For better parts management, the VDMA 24296 standards suggest to stock the number of parts in function of the number of pumps being used by the plant (see following table).

Components	Spare parts	Identical pumps number (stand-by pumps included)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Number of spare parts								
Suction and discharge elements	1	1	2 1	2	2	3	30%	
Impellers								
Radial seal rings	2	2		3	3	4	50%	
Ball or roller bearings								
Shaft complete with keys, nuts, shoulder rings, etc.	1	1	2	2	3	3	30%	
Bushes				3	3	4	50%	
Shaft protection sleeves	2	2						
Neck rings	1	1		2	2	3	30%	
Packing rings	16	16	24	24	24	32	40%	
Gaskets for pump casing (Set)	4	6	8	8	9	12	150%	
Other gaskets (Set)						10	100%	
Mechanical seals	Rotating part		4	5	6	7	90%	
	Stationary part		6	8	8	10	150%	
	Rotating part gasket							
	Stationary part gasket							
	Springs	1	1	1	1	2	2	20%
Bearing housing groups complete with shaft, bearings, covers, seal rings, etc.	---	---	---	---	---	1	2	
Coupling inserts (Set)	2	3	4	5	6	7	75%	

On the pump nameplate there are printed pump model, year of manufacture and pump serial number.

When ordering spare parts always provide this information.

Pump type, parts item number (VDMA) and description per the pump sectional drawing and parts list is useful information which helps to supply correct spare parts for your pump.

We recommend the use of original spares: in case this is not respected, POMPETRAVAINI declines any responsibility for possible damages and not correct running caused by not original spare parts.

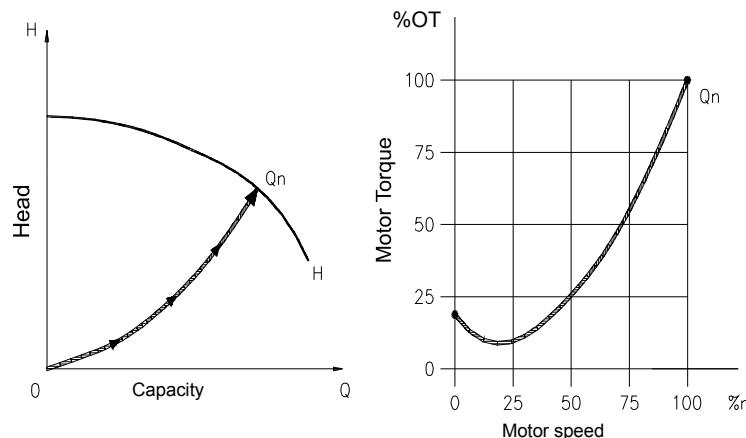
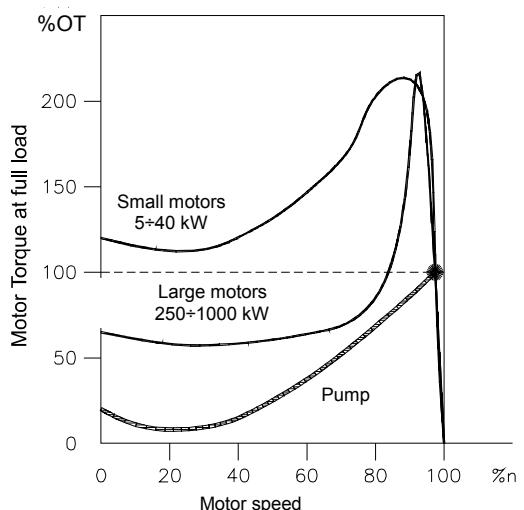
19.1 - STARTING TORQUE

Starting torque of a centrifugal pump is very low. Usually standard electric motors may be safely used to drive this pump. Pump operational speed (any speed) is reached only if motor torque is greater than pump operating torque. See side figure.

Operating Torque (**Nm**) is given by

$$\text{Operating Torque} = 9549 \times \text{kW} (\text{absorbed at operating speed}) / \text{RPM (nominal)}$$

According to the centrifugal pump starting, there could be three principal cases each with his characteristic curve of starting (see examples below).



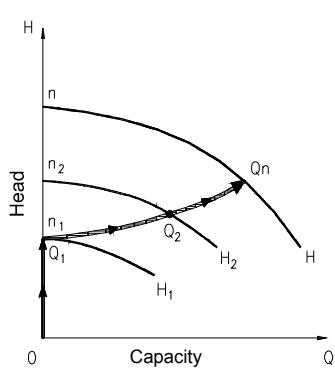
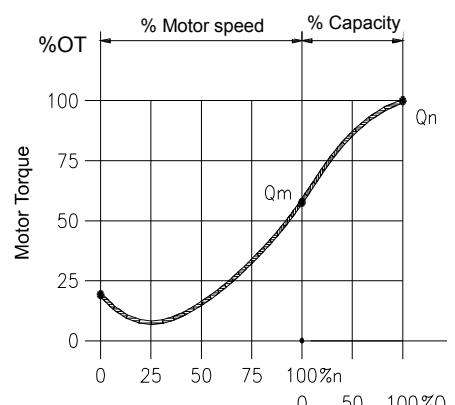
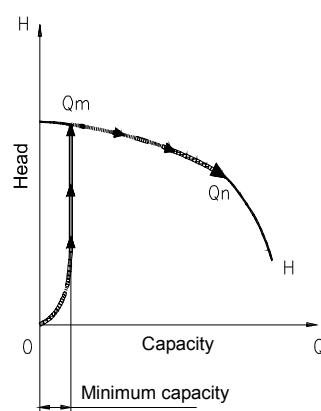
1) Starting with open valve on discharge

During this starting it can be assumed the curve of Operating Torque in function of the round number similar to a parable that starts from about the 20% of the value of Operating Torque to the value of nominal capacity **Qn**.

2) Starting with partially closed valve on discharge

This type of starting requires a particular observation: first the pump must reach a value of minimum capacity **Qm** (correspondent to the partialized capacity of the valve) such to guarantee a correct operation without problems of liquid evaporation or excessive radial loads on the shaft; then the pump, by totally opening the valve, will reach the value of nominal capacity **Qn** and therefore the value of maximum operating torque.

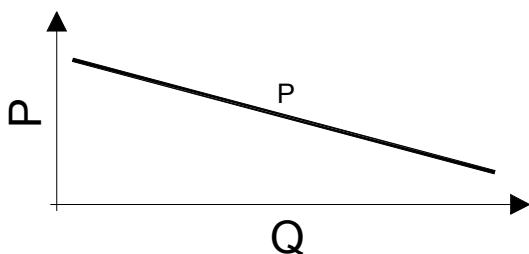
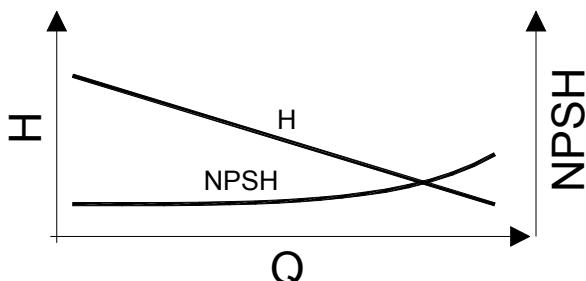
NOTE: In this case it is esteemed an absorbed power at the value of **Qm** corresponding to about 60% of **Qn**.



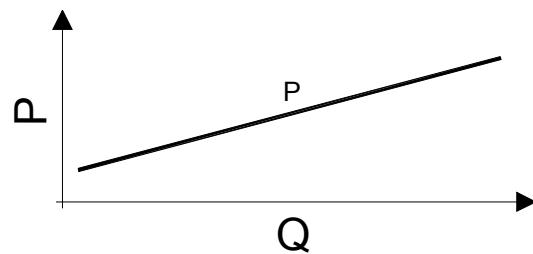
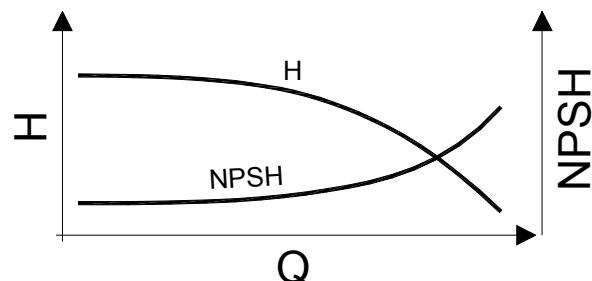
3) Starting with completely open valve and with non return valve on discharge

During the starting the non return valve will remain closed up to the attainment of the pressure value **H1** (correspondent to the pre-load pressure of the same valve) and therefore void capacity. This value is reached at speed **n1** (in this example esteemed about 60% of the nominal speed). The continuous motor acceleration will reach the attainment of the value of nominal capacity **Qn** after having passed through **n2**, **Q2**, **H2**.

19.2 - TYPICAL PERFORMANCE CURVES



Typical performance curves
for pumps series AT - TB...



Typical performance curves
for pumps series TC... - MC... - TMA

Where:

- H = Head
- NPSH = Net Positive Suction Head
- P = Absorbed power
- Q = Capacity

19.3 - UNITS CONVERSION TABLE

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Discharge and Delivery	Litres/sec	Litres/min	60	m ³ /h	Litres/sec	0.2778
	Litres/sec	m ³ /h	3.6	m ³ /h	Litres/min	16.67
	Litres/sec	C.F.M.	2.12	m ³ /h	C.F.M.	0.589
	Litres/min	Litres/sec	0.01667	C.F.M.	Litres/sec	0.4719
	Litres/min	m ³ /h	0.06	C.F.M.	Litres/min	28.32
	Litres/min	C.F.M.	0.0353	C.F.M.	m ³ /h	1.698

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Capacity	Litres	m ³	0.001	U.S. Gal	Litres	3.785
	Litres	Ft ³	0.0353	U.S. Gal	m ³	0.003785
	Litres	U.S. Gal	0.02641	U.S. Gal	Ft ³	0.0133
	Litres	Imp. Gal	0.219	U.S. Gal	Imp. Gal	0.0832
	m ³	Litres	0.001	Imp. Gal	Litres	4.545
	m ³	Ft ³	35.3	Imp. Gal	m ³	0.004545
	m ³	U.S. Gal	264.17	Imp. Gal	Ft ³	0.16
	m ³	Imp. Gal	219.96	Imp. Gal	U.S. Gal	1.2
	Ft ³	Litres	28.32			
	Ft ³	m ³	0.0283			

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Linear measure	cm	inches	0.3937	inches	cm	2.54
	cm	m	0.01	feet	m	0.3048
	m	feet	3.28084			
	m	cm	100			

19.4 NOISE LEVEL AND VIBRATIONS

Noise level (sound pressure level L_p at 1 meter distance neglecting motor, with pump installed in the system and sound power level L_w) for pump operating at BEP and motor at 50 Hz operating speed.

The values can change depending on the installed motor. Contact POMPETRAVINI for further information.

The class of the vibration level (values rms mm/s) shows the limit values for the continuous working of the pump if properly installed. For higher values to proceed with maintenance following the table below.

NOTE: Pumps not included in the following tables have to be seen as a particular construction.

Contact POMPETRAVINI in order to know the data.

	Continuous working	Preventive maintenance	Extraordinary maintenance
Class V1	< 3,5	> 3,5 < 7	> 7
Class V2	< 4,5	> 4,5 < 7	> 7

PUMP MODEL	Noise level L_p (L_w)	Vibration level
TMA	dB(A) poles	class poles
31 – 3		
31 – 4		
31 – 5		
31 – 6		
31 – 7		
31 – 8		
31 – 9		
31 – 10		
31 – 11		
31 – 12		
31 – 13		
31 – 14		
31 – 15		
32 – 3		
32 – 4		
32 – 5		
32 – 6		
32 – 7		
32 – 8		
32 – 9		
32 – 10		
32 – 11		
32 – 12		
32 – 13		
32 – 14		
32 – 15		
40 – 3		
40 – 4		
40 – 5		
40 – 6		
40 – 7		
40 – 8		
40 – 9		
40 – 10		
40 – 11		
40 – 12		
40 – 13		
40 – 14		
40 – 15		
50 – 3		
50 – 4		
50 – 5		
50 – 6		
50 – 7		
50 – 8		
50 – 9		
50 – 10		
50 – 11		
50 – 12		

PUMP MODEL	Noise level L_p (L_w)				Vibration level			
TC...	dB(A) poles				class poles			
	8	6	4	2	8	6	4	2
25 – 125					V1			
25 – 160					V1			
25 – 200					V1			
32 – 125					V1			
32 – 160					V1			
32 – 200					V1			
40 – 125					V1			
40 – 160					V1			
40 – 200					V1			
40 – 250					V1			
50 – 125					V1			
50 – 160					V1			
50 – 200					V1			
50 – 250					V1			
50 – 315			74 (86)		V1			
65 – 125			73 (85)		V1			
65 – 160			73 (85)		V1			
65 – 200			73 (85)		V1			
65 – 250			74 (86)		V1			
65 – 315			75 (88)		V1			
80 – 160			73 (85)		V1			
80 – 200			74 (86)		V1			
80 – 250			75 (87)		V1			
80 – 315			77 (90)		V1	V2		
100 – 200			75 (87)		V1	V2		
100 – 250			76 (89)		V1	V2		
100 – 315			78 (91)		V1	V2		
100 – 400					V1			
125 – 250					V2			
125 – 315					V2			
125 – 400					V2			
150 – 250					V2			
150 – 315					V2			
150 – 400					V2			
200 – 315					V2			
200 – 400					V2			
250 – 315					V2			
300 – 350					V2			
300 – 450					V2			
250 – 450					V2			
300 – 550	79 (94)	---	---		V2	---	---	

PUMP MODEL TBA	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
202 ♦	< 73 (85)	
203 ♦		
204 ♦		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
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311		
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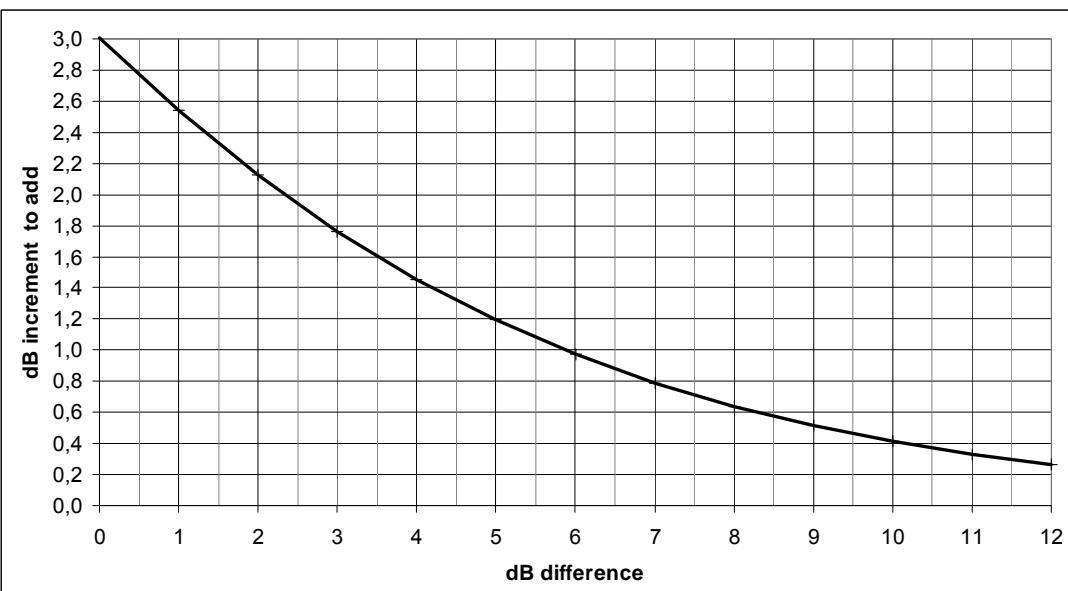
♦ = WARNING: 2 poles motors

PUMP MODEL TBH	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
201		
202		
203		
204		
205		
206		
207		
208		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
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In order to have approximate values of the noise level for the pump-motor assembly the sound power level of the motor and the pump can be added. The following table shows some values of the motor noise level. The addition has to be calculated using the diagram below.

In order to get the total sound power level it is necessary to calculate the difference between the pump and motor noise level; by that value calculate, from the following diagram, the increment that will have to be added to the higher value of the power sound level. Ex: motor 80 dB and pump 75 dB, level difference 5 dB, increment 1.2 dB, total power sound level 81.2 dB. Taking into account that the noise level depends on several factors, contact POMPETRAVAINI to know more accurate values.

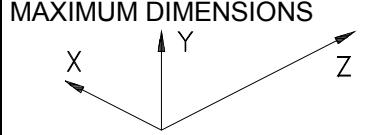
POWER kW	Noise level L_p (L_w)				Noise level L_p (L_w) ATEX			
	dB(A)				dB(A)			
	8 poles	6 poles	4 poles	2 poles	8 poles	6 poles	4 poles	2 poles
0,75	55 (63)	50 (58)	48 (56)	59 (67)	54 (62)	48 (56)	53 (61)	64 (72)
1,1	55 (63)	50 (58)	54 (62)	60 (68)	54 (62)	48 (56)	56 (64)	64 (72)
1,5	57 (65)	53 (61)	54 (62)	63 (71)	56 (64)	57 (65)	56 (64)	71 (79)
2,2	57 (65)	55 (61)	55 (63)	63 (71)	60 (68)	59 (67)	57 (65)	71 (79)
3	58 (66)	57 (65)	55 (63)	67 (75)	60 (68)	62 (70)	57 (65)	74 (82)
4	60 (68)	57 (65)	58 (66)	69 (77)	64 (72)	62 (70)	62 (70)	74 (82)
5,5	60 (68)	57 (65)	61 (69)	72 (81)	64 (72)	62 (70)	66 (74)	75 (83)
7,5	60 (68)	63 (71)	61 (69)	72 (81)	64 (72)	66 (74)	69 (77)	77 (85)
11	63 (71)	64 (72)	68 (78)	74 (82)	66 (75)	66 (74)	71 (79)	77 (86)
15	65 (73)	64 (72)	68 (78)	74 (82)	67 (77)	69 (78)	71 (79)	78 (86)
18,5	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	78 (86)
22	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	76 (85)
30	69 (80)	68 (78)	73 (84)	82 (93)	70 (81)	72 (83)	72 (82)	78 (88)
37	67 (75)	70 (81)	75 (86)	82 (93)	62 (74)	72 (83)	75 (86)	78 (88)
45	67 (77)	72 (84)	75 (86)	82 (93)	62 (74)	67 (79)	75 (86)	80 (90)
55	67 (77)	72 (84)	78 (86)	84 (98)	63 (77)	67 (79)	77 (88)	80 (91)
75	67 (77)	77 (87)	73 (82)	79 (89)	65 (77)	67 (81)	72 (84)	77 (89)
90	67 (77)	77 (88)	73 (82)	79 (89)	65 (79)	71 (85)	72 (84)	77 (89)
110	73 (85)	77 (88)	79 (92)	84 (97)	65 (79)	72 (86)	73 (86)	77 (91)
132	76 (88)	77 (88)	79 (92)	84 (97)		72 (86)	77 (86)	85 (99)
160		78 (89)	79 (92)	84 (97)			77 (91)	85 (99)
200			79 (92)	84 (97)			77 (91)	85 (99)
250			83 (95)	84 (97)				



NOTES

PUMP model	Serial Number	Computer Number	Year of manuf.
.....

LIQUID handled	Capacitym ³ /h	Suction Pressurem	Discharge Press.m	Temperature°C
<input type="checkbox"/> Lethal <input type="checkbox"/> Toxic <input type="checkbox"/> Noxious <input type="checkbox"/> Corrosive <input type="checkbox"/> Irritant <input type="checkbox"/> Malodorous <input type="checkbox"/>				
<input type="checkbox"/> Clean <input type="checkbox"/> Dirty <input type="checkbox"/> With suspended parts	Spec. Gravity.....	Viscosity.....	PH.....	

TOTAL WEIGHTKGs.	MAXIMUM DIMENSIONS 	X =cm Y =cm Z =cm	NOISE (measured at 1 m) Pressure =dB(A) Power =dB(A)
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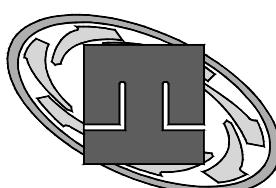
INSTALLATION		SERVICE	
<input type="checkbox"/> Inside <input type="checkbox"/> Explosive area	<input type="checkbox"/> Outside <input type="checkbox"/>	<input type="checkbox"/> Continuous <input type="checkbox"/>	<input type="checkbox"/> Intermittent <input type="checkbox"/>

MOTOR type / Frame	No Poles	No RevolutionsRPM	Absorbed powerAmp	Installed PowerkW /HP
FrequencyHz	SupplyVolt	Enclosure IP.....	Insulation class	Absorbed PowerkW /HP

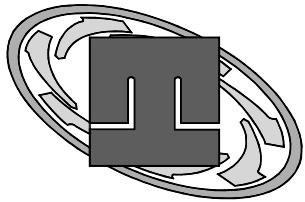
COMMENTS

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Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



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(Rev. 2.2_05-2012)

ITEM 63P6



OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB...

MC... - TC...

TMA



OPERATING MANUAL

INSTALLATION, START-UP AND MAINTENANCE FOR CENTRIFUGAL AND SELF-PRIMING PUMPS

This manual applies to the listed below centrifugal pump series and/or affiliated series:

AT - TBH - TBA - TBK - TBAK

MC - MEC - TCK

TCH / MCU-CH

TCA - TCT - TCD

TMA

All pumps are manufactured by:

POMPETRAVAINI s.p.A.

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Distributor:

WARRANTY: All products manufactured by POMPETRAVAINI are guaranteed to meet the conditions listed on the general terms and conditions of sale and/or conditions listed on the Order Confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual will void the manufacturer's warranty. Guarantee will be preserved only if the pump maintenance is carried out by Pompetravaini or an authorized service. Any modification introduced to the pump without the authorization of Pompetravaini will lead to the loss of the guarantee. If it is strictly necessary to dismantle the pump, please consult Disassembling Instructions on our website "www.pompetravaini.it".



This manual is valid only for the listed pump series. This manual IS NOT for the total installation. Instruction and maintenance manual for the installation must be obtained from the engineer that designed the installation. Furthermore the installation manual will take precedence over the pump manual.



The liquids handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their possible disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for pumps subjected to the ATEX 94/9/CE directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 94/9/CE directive it is available a dedicated integrative manual.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

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KEY TO SYMBOLS

 Indications for the pump preservation	 Signals for the operator's safety. DANGER: indicates imminent conditions of danger of serious harm or death. CAUTION: indicates a possible danger of minor harm.
 Warnings for the environment safeguard	 Magnetic dangers for the operator's safety.
 Warnings for the ATEX Directive 94/9/CE	 Electric dangers for the operator's safety.

1 - GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- pump safe application and operation
- pump installation and maintenance instructions
- pump start-up, operation and stopping procedures.

The pump user must complete the section at the end of this manual where the design conditions for the pump are recorded. The manual must be filed in a safe place and be accessible to the operator and to the maintenance personnel. The qualified personnel responsible for the operation or maintenance of the pump should read CAREFULLY the whole manual before operating or working on the pump. Qualified personnel are those with experience, knowledge and have a good familiarity with the working safety regulations. They usually have knowledge of basic first aid.

The pump is to be used only for the applications specified on the confirming order for which POMPETRAVAINI has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore the pump CANNOT be used for applications other than those specified on the order.

In the event the pump is to be used for different applications, please contact the sales office or representative of the manufacturer. POMPETRAVAINI declines to assume any responsibility if the pump is used for different applications without prior written consent confirmation.

Pumps are for industrial and continual use in installations fit for the purpose by authorized and trained personnel. The use in unfit or unprotected installations, without proper precautions preventing the contact with untrained personnel or children, is strictly forbidden

If the constructive details functioning data of the pump in use aren't available they could be requested to POMPETRAVAINI specifying the pump type and serial number that are printed on the pump nameplate. Always refer to this for further requests of information or replacement components.

The user is responsible for the verification of the ambient conditions where the pump will be stored or installed.

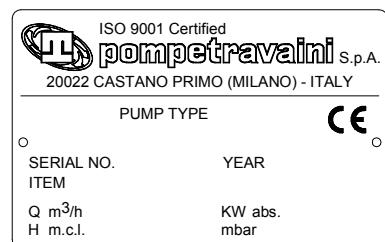
Extreme low or high temperatures may severely damage the pump unless proper precautions are taken.

POMPETRAVAINI does not guarantee repairs or alterations done by user or other unauthorised personnel.

Special designs and constructions may vary from the information given in this manual. Please contact POMPETRAVAINI should you have any difficulty.

NOTE: Drawings appearing in this manual are only schematics and not to be used for construction.

For more specific information contact the Engineering Department of POMPETRAVAINI or the authorised local representative.



2 - SAFETY INSTRUCTIONS



CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS.

Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.

- ALWAYS apply the pump for the conditions outlined on the confirming order.
- Be ALWAYS informed on locations of first aid sites inside the company and carefully read safety and medical first aid prescriptions in force.
- ALWAYS have a fire extinguisher in the vicinity of the pump installation.
- Any work on the pump must ALWAYS be carried out by at least 2 qualified people and expressly authorized.
- Electrical connections on the motor or accessories must ALWAYS be carried out by authorised personnel and in accordance to the local codes.
- When approaching the pump ALWAYS be properly dressed (avoid use of clothes with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done. Also refrain from wearing long and loose hair.
- DO NOT attempt to remove the safety guards when the pump is operating.
- After completion of the work ALWAYS re-install the safety guards previously removed.
- DO NOT operate the pump in the wrong direction of rotation.
- NEVER put hands or fingers in the pump openings or holes.
- ALWAYS disconnect the power to the motor prior to working or removing the pump from the installation.
- Make sure you have taken the necessary steps to prevent a possible inadvertent return of tension.
- Ensure the proper isolation of the components and ground connection before inserting the tension.
- ALWAYS stop the pump prior to touching it for whatever the reason. Wait for the complete pump stopping and make sure that all the installation control devices are properly set in order to avoid any return flow.

- Pump and piping connected to the pump must NEVER be under pressure when maintenance or repair is carried out.
 - NEVER work on the pump when it is hot.
 - NEVER touch pump or piping having temperatures higher than 70°C or lower than -10°C.
 - ALWAYS be careful when handling pumps that convey acids or hazardous fluids.
 - NEVER step on pump and/or piping connected to the pump.
 - ALWAYS make sure that the pump is permanently fixed and steady to the installation (i.e. during removal, handling, installation, etc.)



CAUTION!

Pumps type TCK, TBK and TBAK create a high magnetic field. Personnel should take proper precautions if they are wearing pace-makers or if they are using instrumentation sensitive to magnetic fields.



The listed below minimum distances must be kept:

- When the magnetic rotor parts are disassembled:
users of pace-maker = 2 meters floppy disk; magnetic cards, etc. = 1 meter
 - When the magnetic rotor is mounted in the pump:
users of pace-maker = 1 meter floppy disk; magnetic cards, etc. = 0,5 meter



DANGER!

Possible contact with hazardous media and hazardous substances There are certain components in the pump which may be dangerous to people coming in their contact even during normal operation procedures and/or maintenance, see table 1.



CAUTION!

Danger due to smokes or vapours. In case smokes or vapours are released by the pump do not inhale and immediately stop the pump for inspection.

Tab. 1

MATERIAL	USE	MAJOR RISKS
Oil and grease	General lubrication, ball bearings	Skin and eye rash
Plastic & elastomer components	O-Ring, V-Ring, splash ring, coupling dowels	Smoke & vapours in case of overheating
Teflon & Kevlar fibbers	Packing rings	Release of dangerous powder, release of smoke if overheated
Paints & varnishes	Pump outside surface	Release of powder and smoke if working the painted areas. Flammable
Protective liquid	Pump inside surface	Skin and eye rash

3 - IN CASE OF EMERGENCY

In the event of pump break-down and/or loss of pumped fluid, immediately disconnect the electrical power to the motor (see chapter 11) and contact the responsible personnel in charge of the installation, which should intervene with at least two people paying particular attention to the fact that the pump may be handling dangerous fluids, hazardous to the health and environmentally unsafe.

After the causes for the emergency have been addressed and resolved, it will be necessary to follow the starting procedures (see chapter 10) for the start-up of the pump/motor assembly.

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or come in contact with the human body, immediately follow the instructions given in the company's internal medical safety procedures.

The instructions given in this manual refer to the listed below single stage and multistage centrifugal pumps, horizontal or vertical mounted.

NOTE: Capacities and pressures are approximated and refer to the maximum attainable values for pumps applied in standard conditions at room temperature.

TCH / MCU-CH	Single stage centrifugal pumps for clean liquids designed to DIN 24256/ISO 2858 and 5199 standards - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 16 bar - Flanges PN 16
TCA	Single stage centrifugal pumps for abrasive liquids to DIN 24256/ISO 2858 and 5199 standards - Design with fully open impeller - Capacity to 100 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCT	Single stage centrifugal pumps for very dirty liquids derived from DIN 24256/ISO 2858 standards - Design with open vortex impeller - Capacity to 250 m ³ /h, Max. pressure 7 bar - Flanges PN 16
TCD	Single stage centrifugal pumps for Thermal fluids (Oils) to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 350 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCS	Single stage centrifugal pumps with inspection opening for clean and dirty liquids - Design with closed and open impeller - Capacity to 550 m ³ /h, Max. pressure 4 bar - Flanges PN 10
MEC	Semi-axial centrifugal pumps for large flows of clean and dirty liquids - Design with open impeller - Capacity to 2100 m ³ /h, Max. pressure 4 bar - Flanges PN 10
TCN	Single stage centrifugal pumps for clean and dirty liquids - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 6 bar - Flanges PN 10
TCK	Magnetic drive single stage centrifugal pumps for toxic and contaminated liquids - Designed to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 300 m ³ /h, Max. pressure 16 bar - Flanges PN 16
MILLS	Pumps derived from the series TCH with special mixing impeller
AT	Self-priming multistage centrifugal pumps with dual lateral channel. Low NPSH requirements. Capacity to 31 m ³ /h, Max. pressure 7 bar - Flanges PN 40
TBH	Self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBK	Magnetic drive self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBA	Self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBAK	Magnetic drive self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TMA	Multistage centrifugal pumps for clean liquids, medium and high pressures - Capacity to 45 m ³ /h, Max. pressure 40 bar - Flange inlet PN 16, flange outlet PN 40

The flanges standard (NP 16 or NP 40) does not refer to the maximum pump performance but it indicates the maximum pressure the pump can be subjected to.

For information regarding temperature and pressure LIMITATIONS applicable to the varying designs, types and materials of construction please contact POMPETRAVAINI or your closest authorised representative.

The maximum operating pressure is normally the sum of the suction and discharge pressures.

4.1 - PUMP MODEL NUMBERS AND MATERIALS OF CONSTRUCTION TABLES

Pump nameplate affixed to each pump contains model number, serial number and year of manufacture. Interpretation of pump model number may be attained with the aid of the following table. The pump model is such that it gives information pertaining to the pump type and design.

Listed below are some examples of pump nomenclatures:

Pumps series MC... - TC... = TCH V 50 - 200 A / 1 - C / A3 - M / T	
TCH ⇒ Pump type	1 ⇒ Constructive project number
V ⇒ Vertical mounting	C ⇒ Shaft seal type
50 ⇒ Diameter discharge flange	A3 ⇒ Materials of construction (see table)
200 ⇒ Impeller nominal diameter	M ⇒ Monoblock design with flanged motor
A ⇒ Hydraulic project modification	T ⇒ Special design

Pumps series AT – TB...	=	TBH 315 A / 1 - C / A3 - M / T - V - Z
TBH ⇒ Pump type		A3 ⇒ Materials of construction (see table)
31x ⇒ Pump size		M ⇒ Monoblock design with flanged motor
xx5 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Pumps series TMA	=	TMA 32 - 7 A / 1 - C / A3 - M / T - V - Z
TMA ⇒ Pump type		A3 ⇒ Materials of construction (see table)
32 ⇒ Pump size		M ⇒ Monoblock design with flanged motor
7 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Generic materials for STANDARD CONSTRUCTION: pumps **MC... - TC...**

Description	GS	RA	A3	HC	DU
Casing	Ductile iron			Hastelloy C	ASTM-CN7M
Cover casing					
Impeller	Cast iron	Stainless steel AISI 316 ASTM-CF8M			Incoloy 825
Shaft					
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **AT - TB...**

Description	GH	RA	A3	B2	GP
Casing	Ductile iron			Bronze	Ductile iron
Element					Cast iron
Impeller	Brass	Stainless steel AISI 316 ASTM-CF8M			Brass
Shaft	Stain. steel AISI 420				Stain. steel AISI 420
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **TMA**

Description	F	RA	A3
Casing	Ductile iron		
Stage casing			
Impeller	Cast iron	Stainless steel AISI 316 - ASTM-CF8M	
Shaft	Stainless steel AISI 420		
Bearing frame		Cast iron	

For detailed information on materials of construction, (standard or special) for pumps TCD, TCK, MEC, TBK and TBAK please contact POMPETRAVAINI or your local representative.

In case the metallic pump wetted parts come into contact with aggressive liquids it is recommended to stick to the following limitations:

- pH limit for Cast Iron and Ductile Iron ≥ 6
- pH limit for Stainless Steel ≥ 2,5

The above values are approximate and refer to ambient temperature. It is recommended to contact POMPETRAVAINI for doubts, particular conditions or in case different materials are used.

5 – UNPACKING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt verify that the material received is in exact compliance with that listed on the packing slip.

When unpacking follow the instructions listed below:

- Check that no visible damage exists on the crate that could have occurred during transport
- Carefully remove the packaging material
- Check that pump/or accessories such as tanks, piping, valves, etc. are free from visible markings such as dents, scratches and damage which may have occurred during transportation
- In the event of damage, report this immediately to the transport company and to POMPETRAVAINI's customer service department.

DANGER!

Danger due to cut, prick or abrasion Take immediate actions to dispose of possible packaging parts that may generate injuries or risks (for example edges, nails, splinters, etc.)



We remind that the single stage centrifugal pumps supports contain lubricating oil.

Organize the right management of materials subjected to controlled and differentiate disposal (for example plastic, cartoon, polystyrene materials, etc.) according to the laws into force and to a safe local environment management. according to the laws into force and to a safe local environment management.

If the pump will be stored, as foreseen in our Operating Manuals, we recommend a proper care to avoid oil dropping on the ground.

The pump must ALWAYS be moved and transported in the horizontal position.

Before transportation check on the nameplate, in the transportation and technical documents for:

- total weight
- centre of gravity
- maximum outside dimensions
- lifting points location.

DANGER!

Danger due to overturning or crushing For a safe lifting it is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts with correct movements, to prevent material damages and/or personal injuries.

The fig. 1 shows several additional examples of lifting.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 2).

Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage.

The fig. 3 shows several additional examples of lifting to be avoided.

CAUTION!

Possible contact with fluids or harmful substances. Before removal after a period of operation, the pump, together with auxiliary piping and jacketing, must be drained and decontaminated from the handled media.

Every hole and opening communicating with the inside of the pump must be properly plugged.

For removing the pump from the installation see chapter 17. Operate provided with apposite protective devices.

6 - STORAGE INSTRUCTIONS

After receipt and inspection the unit, if not immediately installed, the unit must be repackaged and stored in the best way.

For a proper storage proceed as follows:

- store the pump in a location which is closed, clean, dry and free of vibrations
- do not store in areas with less than 5°C temperature (for lower temperature it is necessary to completely drain the pump of any liquids which are subject to freezing)

POSSIBILITY OF FREEZING!

Where the ambient temperature is less than 5°C it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

It is possible to use as antifreeze a mixture of surface-active glycol or other suitable products making sure they are compatible with both pump gaskets and elastomer.

- fill the pump with a rust-preventative liquid that is compatible with the pump gaskets and elastomer. Rotate the shaft by hand to impregnate all internal surfaces. Drain the excessive liquid from the pump and associated piping (see chapter 11).

Please note that the pumps with cast iron internal parts have been treated at the factory, prior to shipment, with a rust-preventative liquid: this liquid is capable of protecting the pump against rust for a period of 3 to 6 months.

A further solution, for long term storage, is to fill the pump with the rust inhibitor, rotate the pump shaft by hand to eliminate any air pockets (the liquid must be suitable with gasket, elastomer and pump materials).

- plug all openings that connect the pump internals to the atmosphere
- protect all machined external surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up or seizing
- keep the pump in a dry and clean place not subjected to vibrations caused by other sources
- any pump accessories should be subjected to similar procedure.

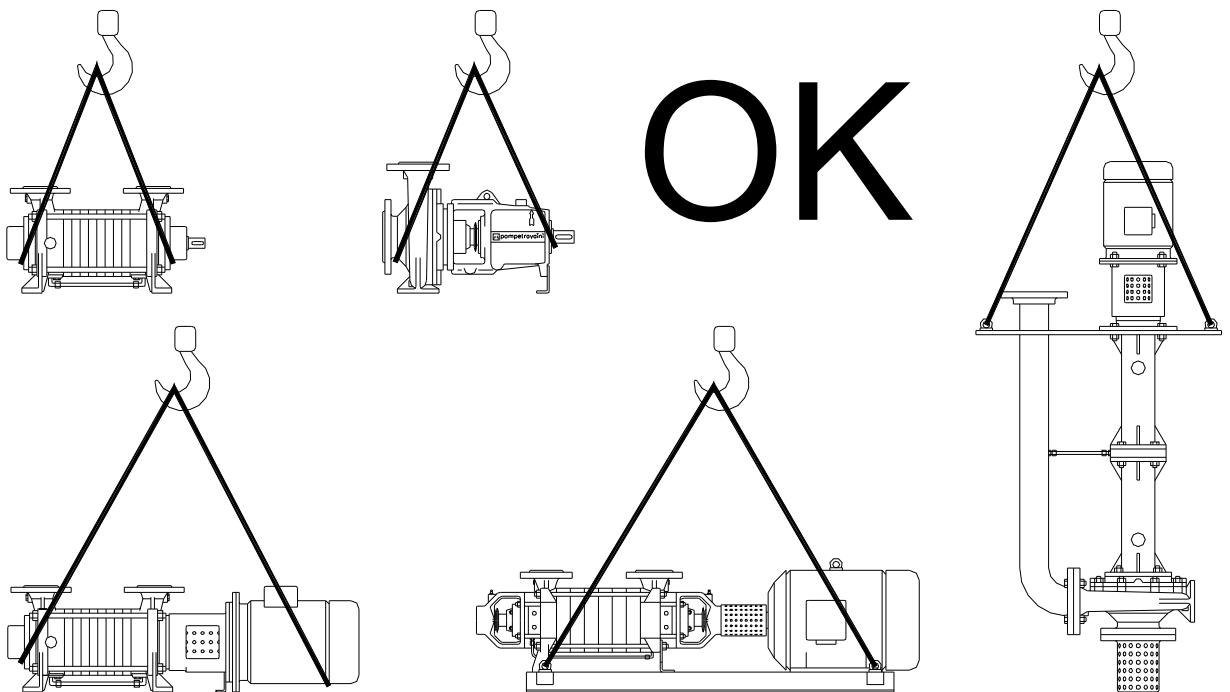


Fig. 1

Fig. 2

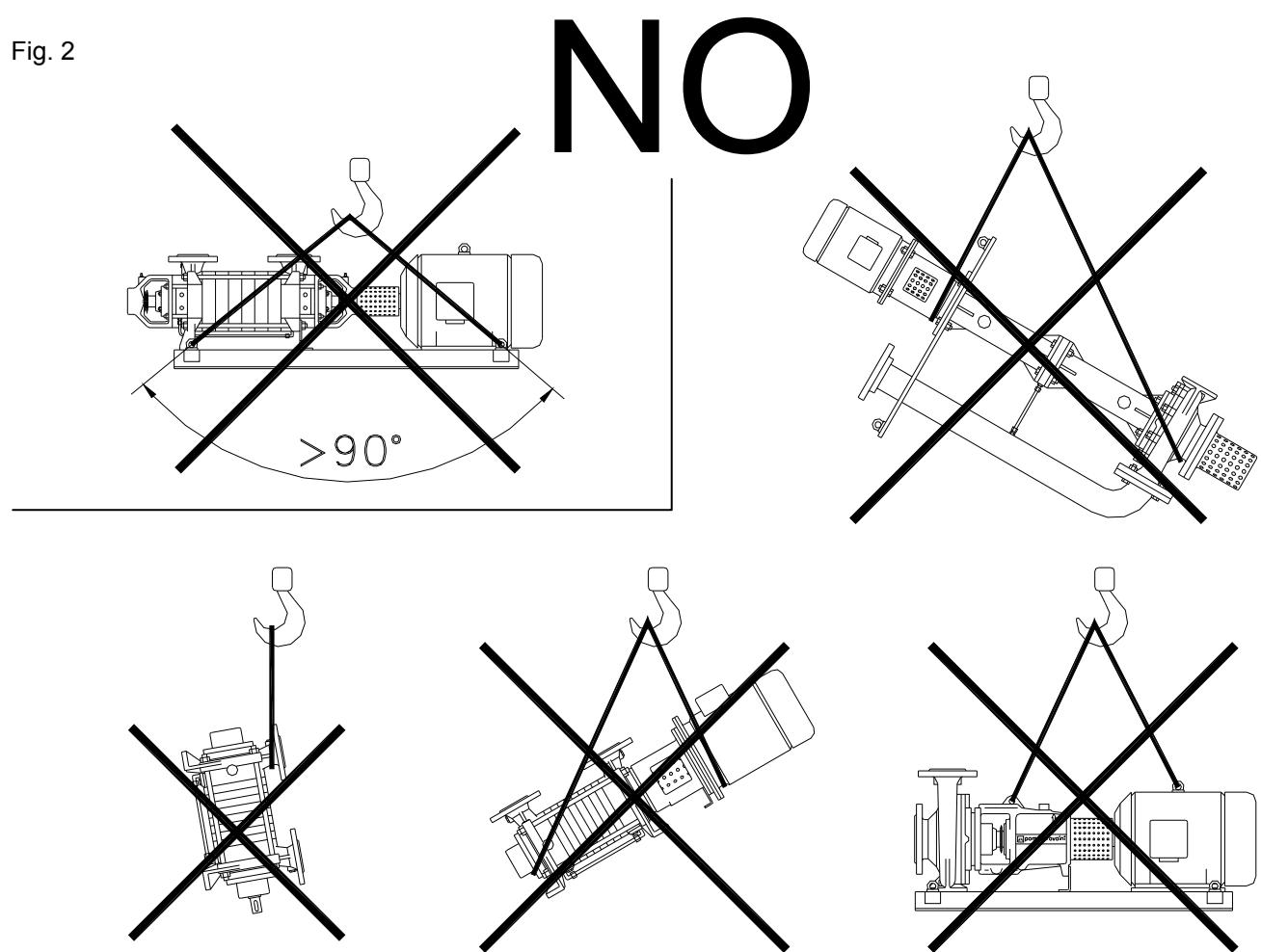


Fig. 3

CAUTION!

Avoid installing the unit in narrow areas and lacking of ventilation where unfavourable conditions for the personnel may take place. Allow the personnel a good visibility of the pump assembly by providing a proper lighting.



A proper pump installation must not transmit vibrations to ambient in the permanent presence of personnel.

Information to determine the piping sizes and floor space requirements can be obtained from dimension drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of all connections for flushing, cooling, heating, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to following chapters 7.1 - 7.2 - 7.3.

Proper lifting devices should be available for installation and repair operations.

Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made.

It is important to have proper room around the unit for ventilation of motor. Avoid installing the unit in hidden locations, dusty and lacking of ventilation.

Pump/motor assembly should not be installed in narrow areas, dusty, toxic and explosive ambient. In the event this is not possible it is recommended to ventilate the areas to help cooling the motor (minimum 0,6 metres of empty room around). All components used in the installation should comply with the safety codes. The installation must not transmit vibrations to the pump.

Select a mounting pad that will minimise vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams.

It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 4).

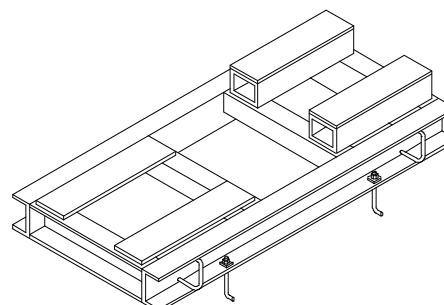
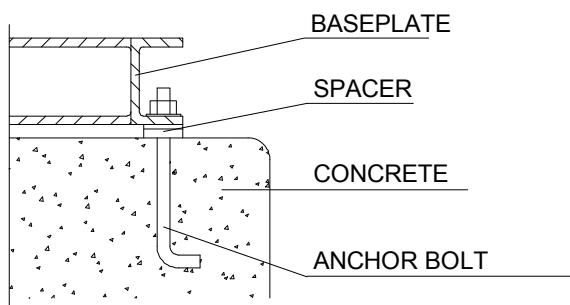


Fig. 4

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

7.1 - INSTALLATION OF PUMP/MOTOR ASSEMBLY

Place the pump assembly on the foundation pad aligning the anchoring bolts.

If necessary use metal spacers to level the unit and check the flange connection for good horizontal and vertical planes.

Tighten the foundation bolts.

Check again the level of the assembly and proceed with the pump/motor alignment verification as discussed in paragraph 8.2.

In cases where the pump is installed on a baseplate separated from that of the motor (due to expected piping forces, moments or as it often is in cases of large units) it is recommended to first install the pump and then proceed with the motor installation and alignment.

7.2 - SUCTION AND DISCHARGE PIPING

Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction (see fig. 5) and discharge flanges, the service liquid line and all other service connections.

CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Pay maximum attention to the proper connection of the system pipelines to the respective pump's connections.

Operate only provided with apposite protective devices.

To prevent the introduction of any limb in the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up.

Inlet and discharge piping should be of same size as the pump flanges, where possible increase the pipe size but NEVER decrease the size.

In general the liquid velocity in the suction piping should not exceed 2 m/s and in the discharge piping should be less than 3 m/s. Higher liquid velocities will result in higher pressure drops which could create cavitation in the suction piping and excessive pressure losses in the discharge piping, which would negatively affect the system performance and the pump.

Where possible, avoid using piping turns and especially short radius elbows.

When using larger pipe sizes than the nominal, the reduction from a larger diameter to a small diameter should be gradual and with conical configuration, the length of the conical area should be 5 to 7 times the difference in size of the two diameters.



Piping should always be supported to neutralise any forces, moments, piping weights, thermal expansions, etc. which could create pump/motor misalignment, deflections and overloading to foundation bolts.

Pipe joints should be by means of flanges with flange gaskets of proper size and material.

Flange gaskets should be properly centred between the flange bolts so that there is no interference with the flow of the liquid.

There should not be any tensions, deformations or misalignment of the piping when loosening the bolts holding the flanges together.

Any thermal shocks and/or excessive vibrations should be controlled by means of expansion joints, flexibles, etc. having same size as the piping.

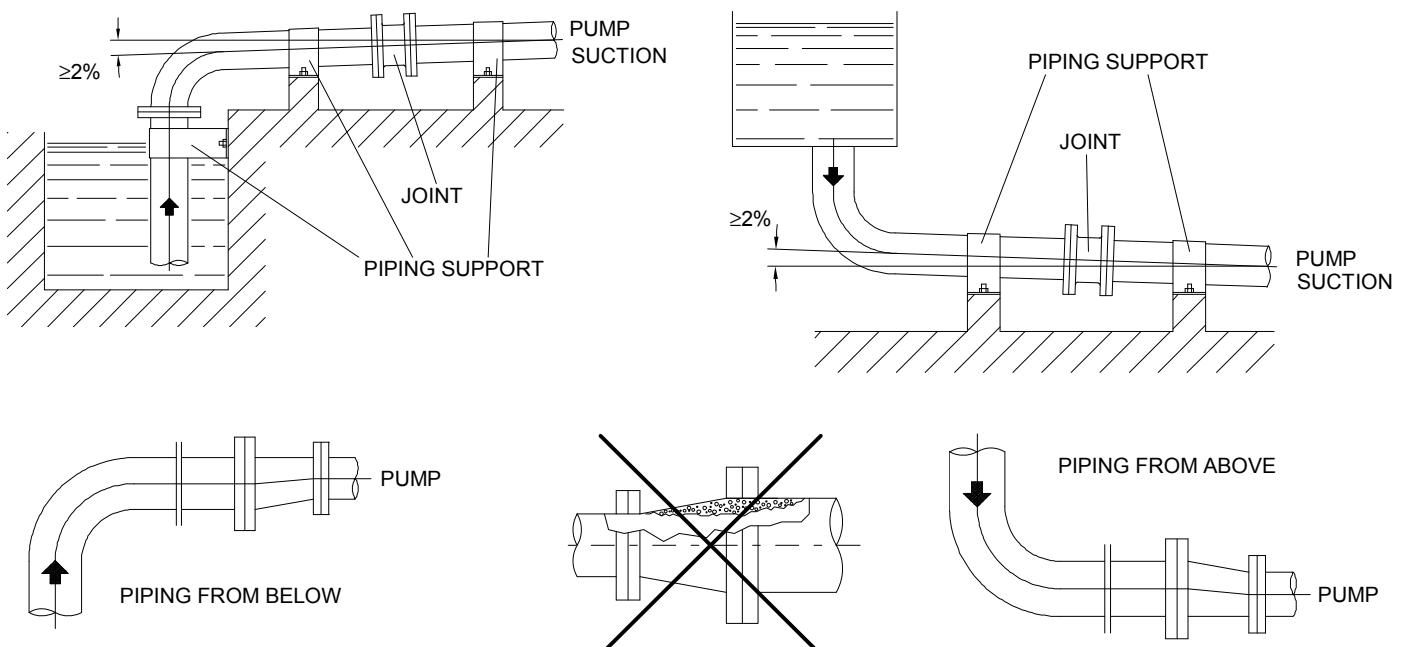


Fig. 5

7.2.1 - Suction piping (see fig. 5 and 6)

To prevent loosing pump priming absolutely avoid formation of air pockets in the suction piping. This piping therefore should have a slope toward the reservoir in the case of suction lift installation, and toward the pump in the case of the flooded suction installation.

Isolating valve should only be on the fully open or fully closed positions and NEVER as a flow regulator. The valve should be installed with the stem in the horizontal position relative to the flow in the piping and at a distance from the pump suction flange of at least 10 times the pipe size.

Depending upon the application, a non return valve or a foot valve should be fitted in the suction piping, a strainer or filter will prevent solids from entering the pump and a pressure or vacuum gauge will enable reading the pump inlet pressure.

All components listed above will create pressure drops which must be taken into consideration in the design stage.

Where more than one pump is installed, every pump should have its own separate suction piping; if a stand-by pump is installed the two inlets can be connected to a common manifold with a single suction piping.



For pumps series TBA, in case of negative suction (from well) and only if NOT provided with check valve or foot valve, contrary to what above indicated it should be necessary that the suction piping will have a slope toward the pump.

7.2.2 - Discharge piping (see fig. 6)

Right after the pump discharge flange install a non return valve will stop dangerous water hammer which could seriously damage the pump discharge casing, a flow regulating valve (Globe or Needle valve), a pressure gauge can be connected to the threaded connection under the pump discharge flange, a vent valve should be fitted in this piping to fill pump and piping for initial start-up.

7.2.3 - Piping cleaning



CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Operate only provided with apposite protective devices.

Before installation start-up clean piping and any reservoirs removing loose materials and foreign particles.

Particular attention for cleaning should be for installations where welding of piping and components has taken place.

7.2.4 - Pressure testing

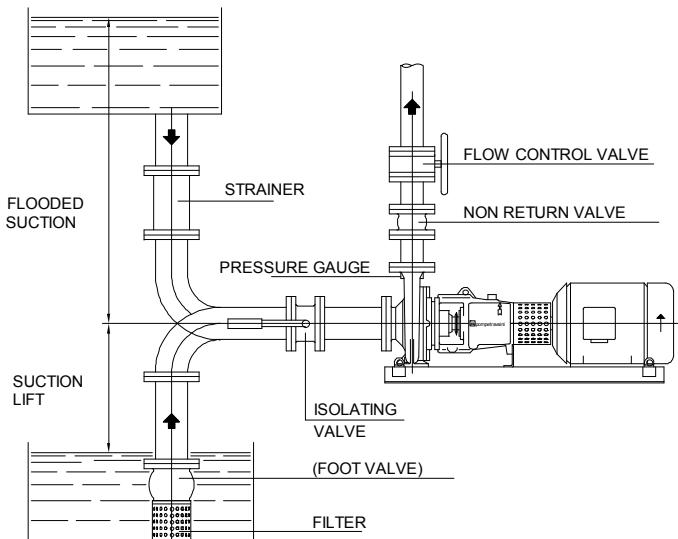


DANGER!

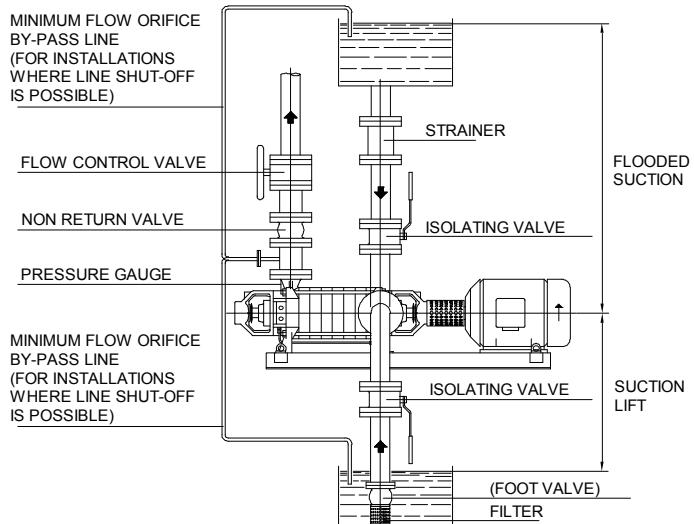
Danger due to fluids in pressure. Carry out sealing tests provided with apposite protective devices.

When the installation has been completed it is necessary to test the piping for both static pressure and vacuum.

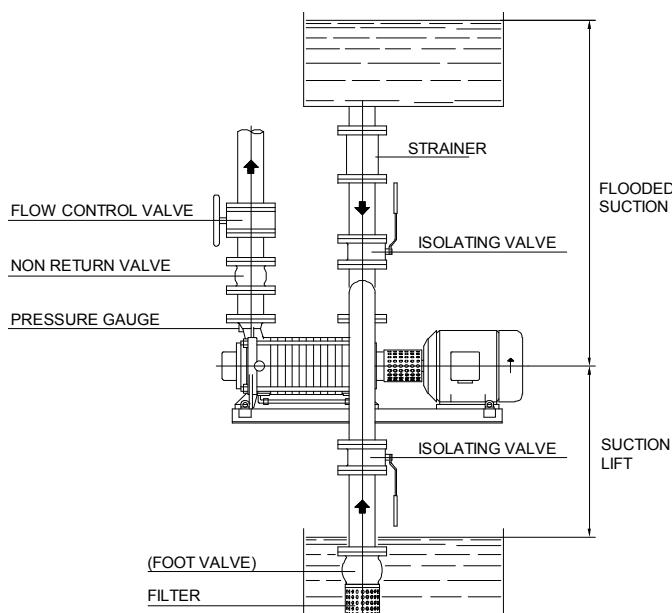
Testing should be carried out in accordance to the applicable standards for the piping function and the operating pressures.



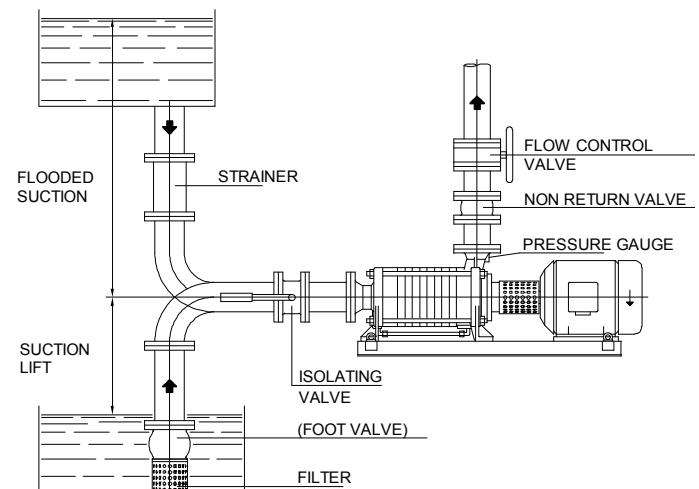
Pump series MC... - TC...- MILLS



Pumps series TMA

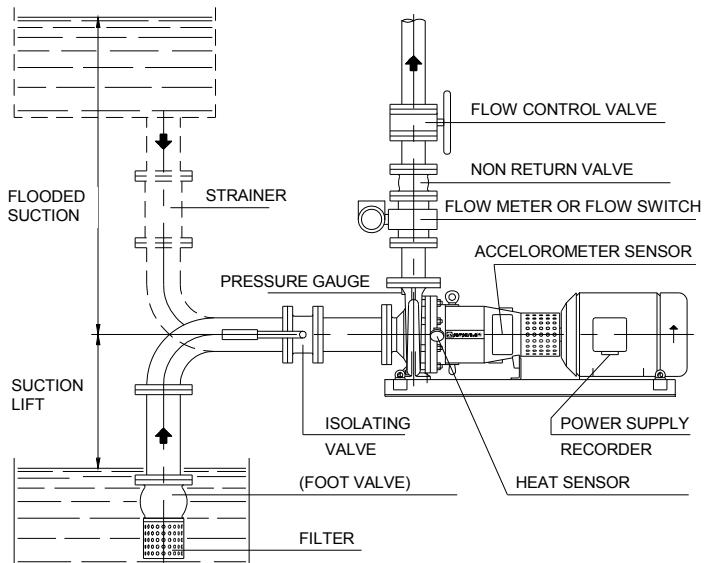


Pump series AT - TBH - TBK

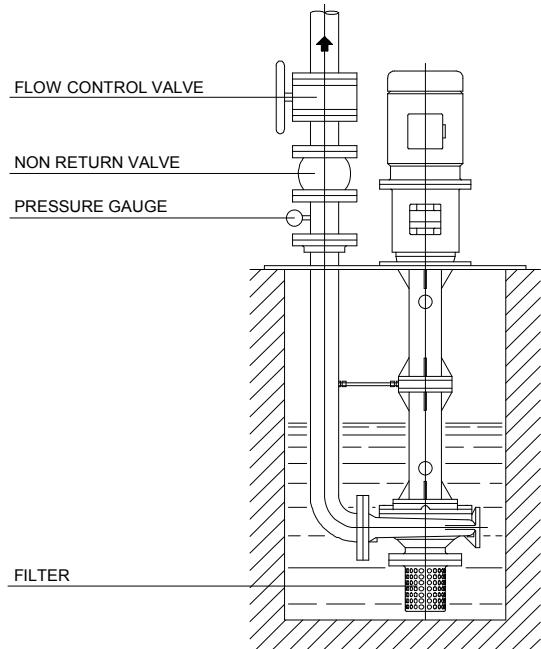


Pump series TBA - TBAK

Fig. 6A



Pump series TCK



Pump series MC... - TC... - VERTICAL construction

Fig. 6B

7.3 - ACCESSORIES AND AUXILIARY CONNECTIONS

Depending on the application accessories may be installed to test the pump performance (instrumentation to measure pressure, temperature, capacity, etc.) and/or for necessary operations (cooling, heating, flushing of seals, etc.). When accessories are required the following should be considered:

- a) Pressure and vacuum gauges must be properly anchored and connected at the measuring points located at pump flanges or near the flanges, using approx. 8 mm. diameter tubing with "pig tail" configuration to alleviate pressure fluctuations.
For safety purposes, isolating and vent valves should be fitted before these instruments (see fig. 7).
- b) Temperature gauges should be installed with thermowells selected for the specific purpose and fitted in strategic locations where the reading is required (see fig. 8).
- c) Every pump is fitted with draining connections at the pump casing. If required, pump drain and mechanical seals leakages can be piped to a container located nearby on the floor or (if available) to the drain catch basin for the total installation.
The pump draining piping should be fitted with an isolating valve and both should be suitable for the pumps maximum operating pressure.
- d) Cooling, heating, flushing of mechanical seals and other piping must be connected only to the designated connections located on the pump (see fig. 9-10-11-12 and chapter 15 for more details).
All tubing and connections must be a minimum of same size as the connection on the pump.
Insulation, if required, must be limited to the pump body, leaving all other components such as bearing frame and motor uncovered for heat dissipation.
- e) Controlling the minimum capacity.

When the pump operates near the shut-off with almost no flow, almost all the motor power is transformed into thermal energy which is absorbed by the pumped liquid.

If the capacity is less than the minimum recommended (10-15% of pump capacity at its best efficiency point) not only will there be excessive load on the pump support and bearings but the liquid could evaporate resulting in damage to the impellers and wear rings with possibility of the pump seizing.

To prevent these problems it is recommended the installation of a minimum flow valve in the discharge piping, right after the pump but before the flow regulating valve.

In the event the flow regulating valve being excessively throttled or even completely closed, there will always be the required minimum liquid flow recirculated from the pump discharge to the suction piping of the pump.

The other device which may be fitted in this by-pass line (from pump discharge, before flow regulating valve, to pump suction) is a calibrated orifice sized for the minimum liquid flow required by the pump.

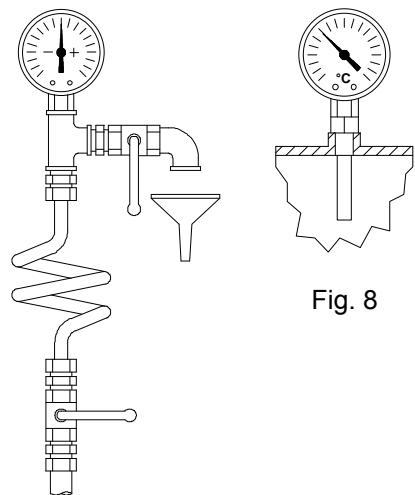


Fig. 8

Fig. 7

- f) Pumps with magnetic drives (series TBK, TBAK, TCK), should be fitted with a temperature sensor to monitor and register the temperature in the area of the magnetic coupling. Pumps are fitted with a threaded connection for this purpose.
- g) To prevent pumps running dry it is recommended to install, in the pump discharge line, a flow meter to check that there is a constant liquid circulation in the piping.
- h) Fitting of a power meter will help analyzing the operation of the pumps. Knowing the minimum and maximum power absorbed by the operating pumps will help identifying problems that may be caused by dry running, siphoning, etc.
- i) Accelerometers fitted on the bearing housing near the bearings, will help with the reading of the vibrations. An analysis of the vibration diagram, direct or indirect, would provide a diagnostic to prevent mechanical breakdowns, such as hydraulic cavitation.
- j) It is recommended to start the magnetic pumps and all other pumps with more than 4 KW motor drive, with Soft-Starters or Delta-Star connections. Further information may be found in chapter 9 and in paragraph 19.1 of chapter 19.

LEGEND for figures 9-10-11-12

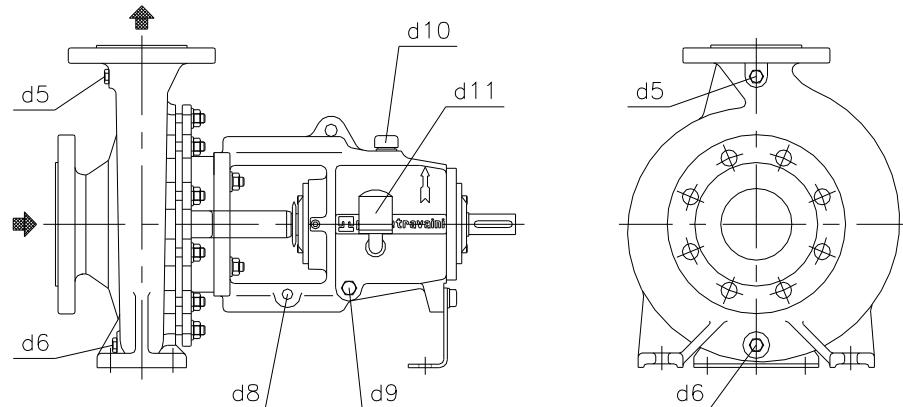
- d1.1 Threaded connection - "double tandem" mechanical seal flushing inlet from outside
- d1.2 Threaded connection - "double tandem" mechanical seal flushing outlet
- d2.1 Threaded connection - mechanical seal chamber cooling/heating liquid inlet
- d2.2 Threaded connection - mechanical seal chamber cooling/heating liquid outlet
- d3.1 Threaded connection - flushing liquid inlet from outside for "double back to back" mechanical seal or for single mechanical seal construction
- d3.2 Threaded connection - "double back to back" mechanical seal flushing liquid outlet
- d4.1 Threaded connection - casing cooling/heating chamber liquid inlet
- d4.2 Threaded connection - casing cooling/heating chamber liquid outlet
- d5 Plugged connection - for manometer
- d6 Plugged connection - for pump casing drain
- d7.1 Threaded connection - packing seal flushing liquid inlet from outside
- d7.2 Threaded connection - packing seal flushing liquid outlet from outside
- d8 Threaded connection - for seal leakages recovery
- d9 Plugged connection - bearings oil drain from housing (on request only)
- d10 Plug with dipstick for bearings oil filling into housing
- d11 Constant level oil filler (on request only) or Oil level gauge (standard)
- d12 Threaded connection - mechanical seal flushing liquid inlet from outside (on request only)
- d13 Grease nipple
- d14 Plugged connection - air-hole mechanical seal chamber
- d15 Plugged connection - sludge discharge from mechanical seal chamber (only for TCD/2-SP)
- d16 Threaded connection - tank liquid discharge (only for TCD/2-SP)
- d17 Threaded connection - for tank (only for TCD/2-SP)
- d18 Threaded connection - to check oil leaks from bearing (only for TCD/2-SP)
- d19 Threaded connection - thermometric probe
- d20 Plugged connection - filling
- d21.1 Threaded connection – "Quench" liquid inlet
- d21.2 Threaded connection – "Quench" liquid outlet

Plugged connection = Plug to be removed in case of use

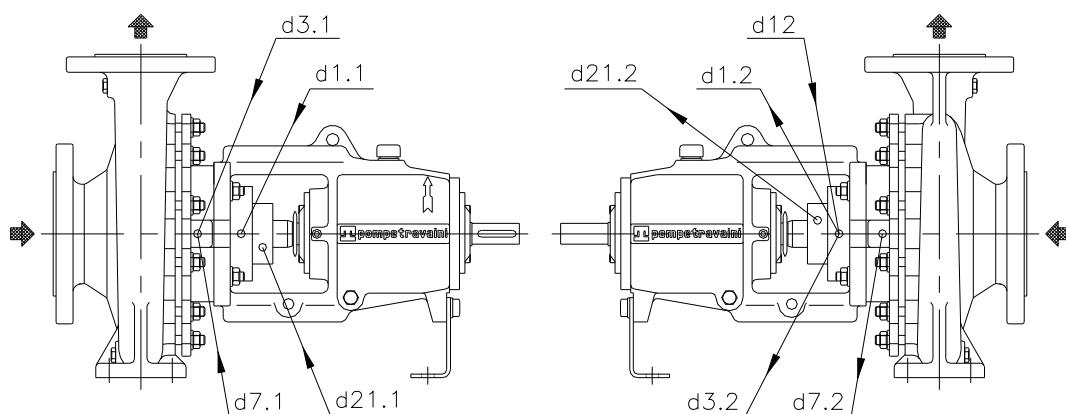
Threaded connection = Before connecting remove the plastic protection plug

For each pump specific connections dimension please consult our website "www.pompetravaini.it".

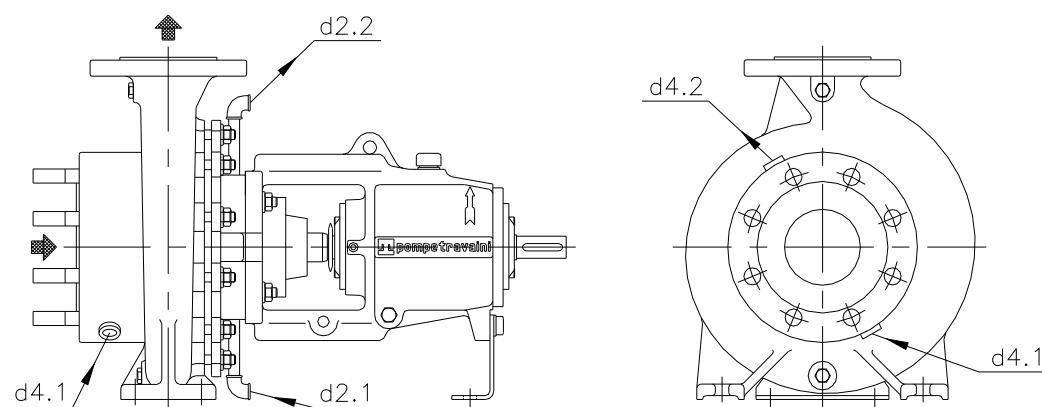
Fig. 9 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
Standard connections and hook-ups

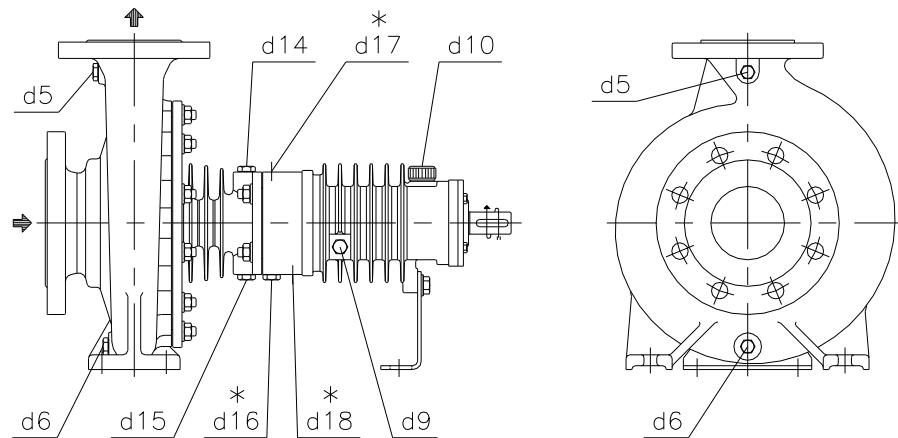


Pumps series MC... - TC...
Connections for designs /C - /R - /RR - /R2 - /B

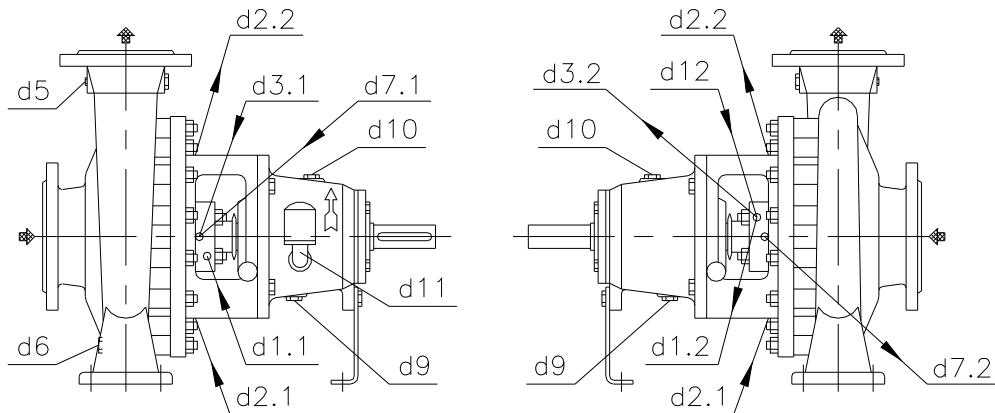


Pumps series MC... - TC...
Connections for designs /T - /U2

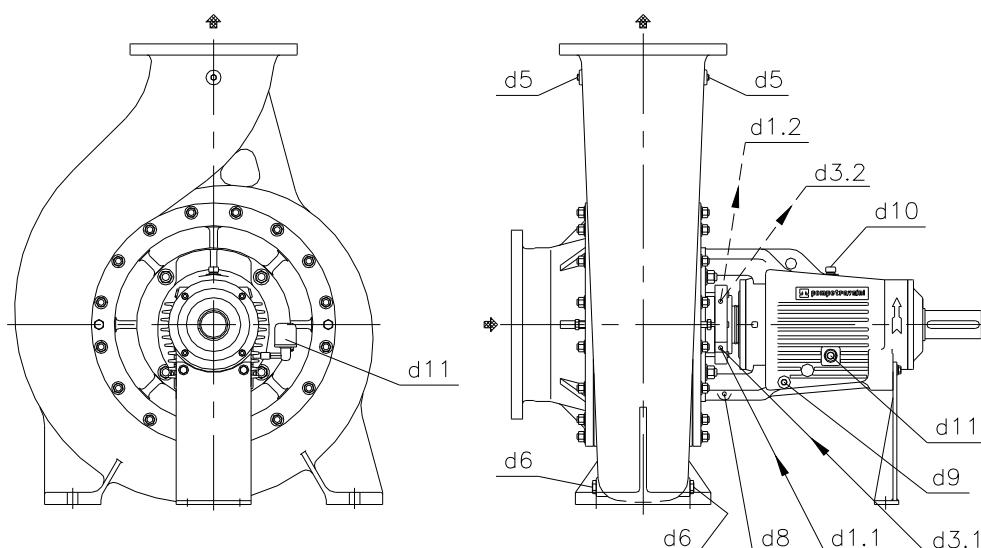
Fig. 10A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TCD
Standard hook-ups and connections - (* Only for TCD/2-SP)

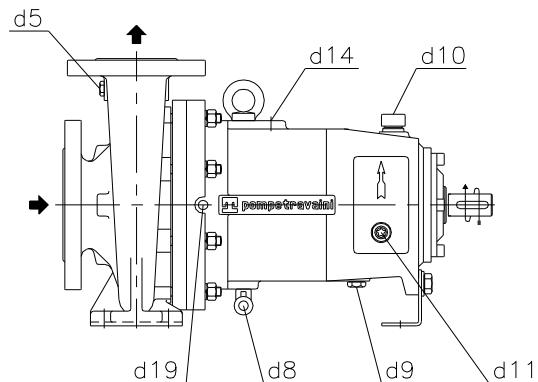


Pumps series MCU-CH n.s. group 3 and 4
Standard hook-ups and connections

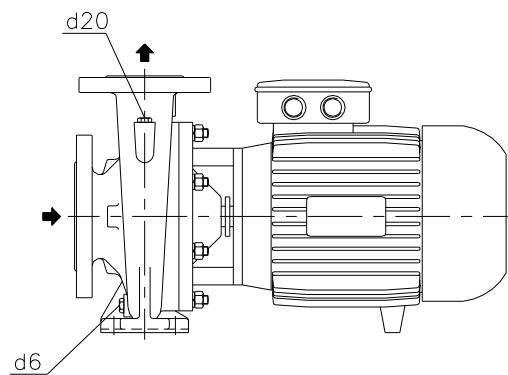


Pumps series TCH and TCN group 5
Standard hook-ups and connections for Double back to back mechanical Seals

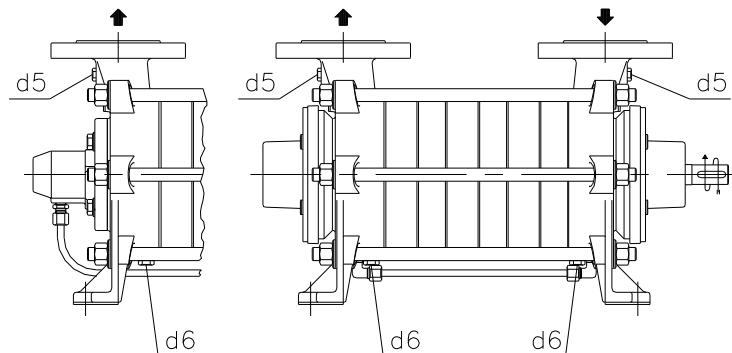
Fig. 10B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



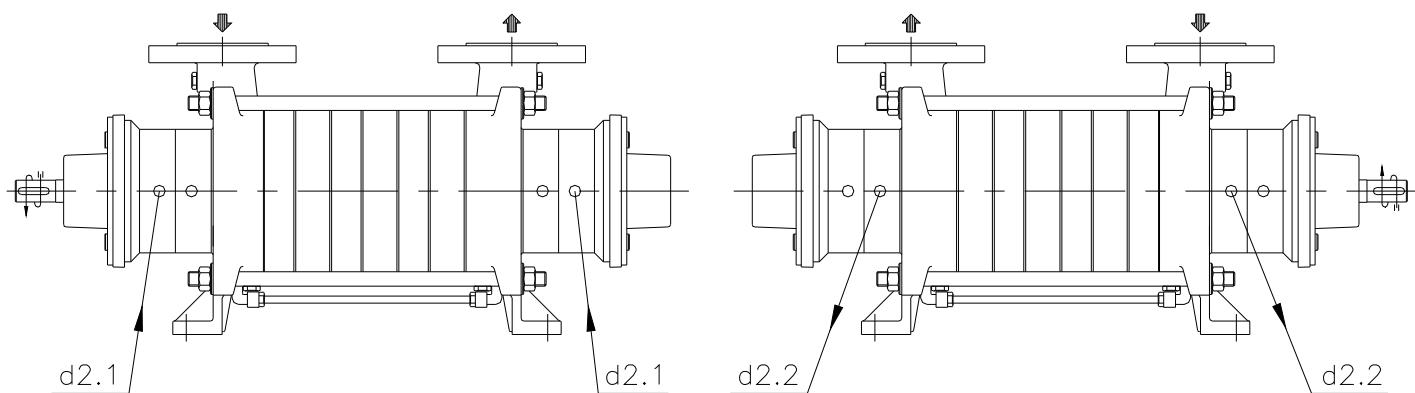
Pump series TCK
Standard connections and hook-ups
NOTE: d19 = on both side for gr. 2



Pump series MCM
Standard connections and hook-ups

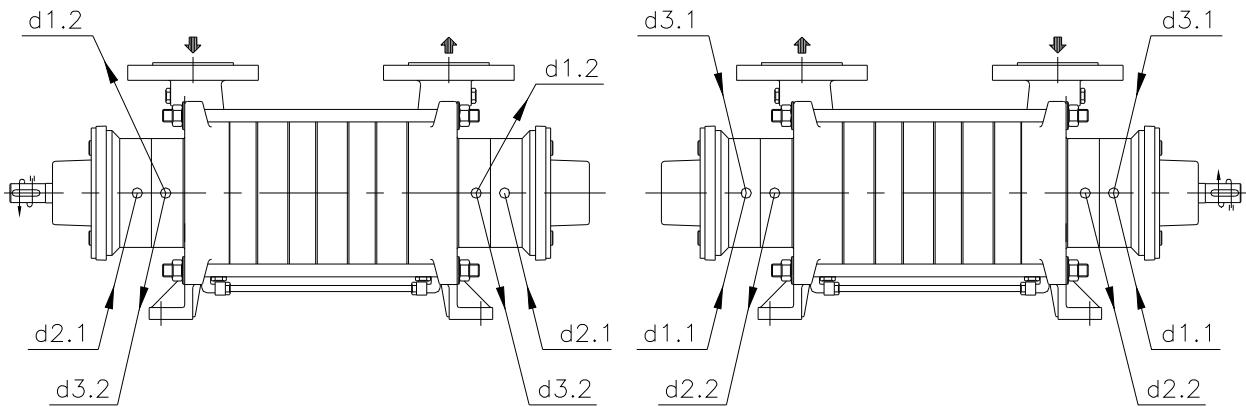


Pumps series TBH/C - TBH/KC - AT/KC - TBA/C
Standard hook-ups and connections

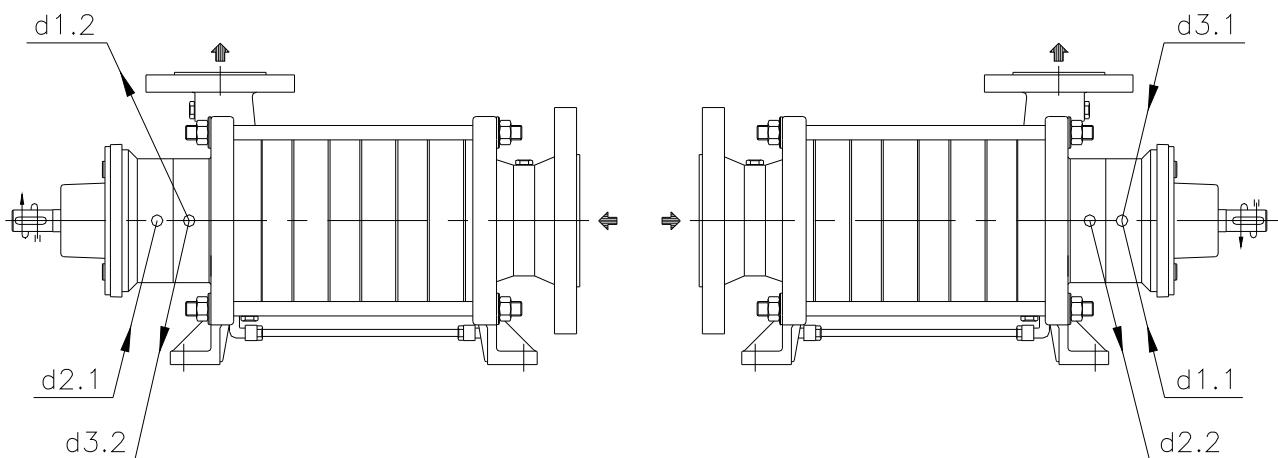


Pumps series TBH/CT - AT/CT
Connections for cooling or heating

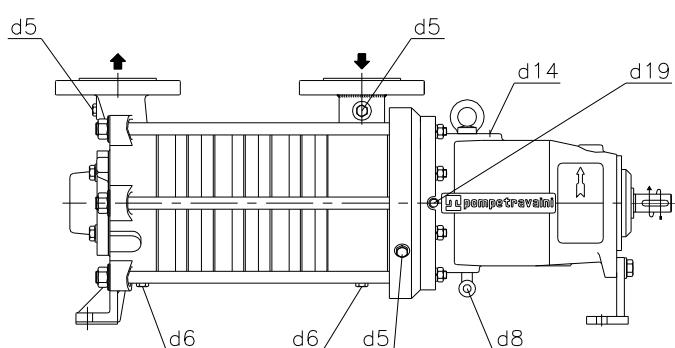
Fig. 11A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



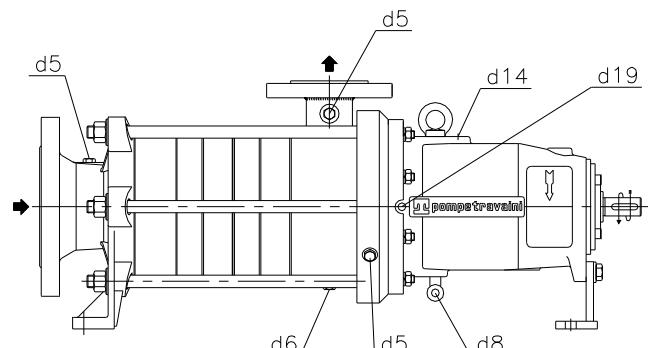
Pumps series TBH/KC-2T - AT/KC-2T
Connections for mechanical seals flushing, cooling or heating



Pumps series TBA/C-2T
Connections for mechanical seals flushing, cooling or heating

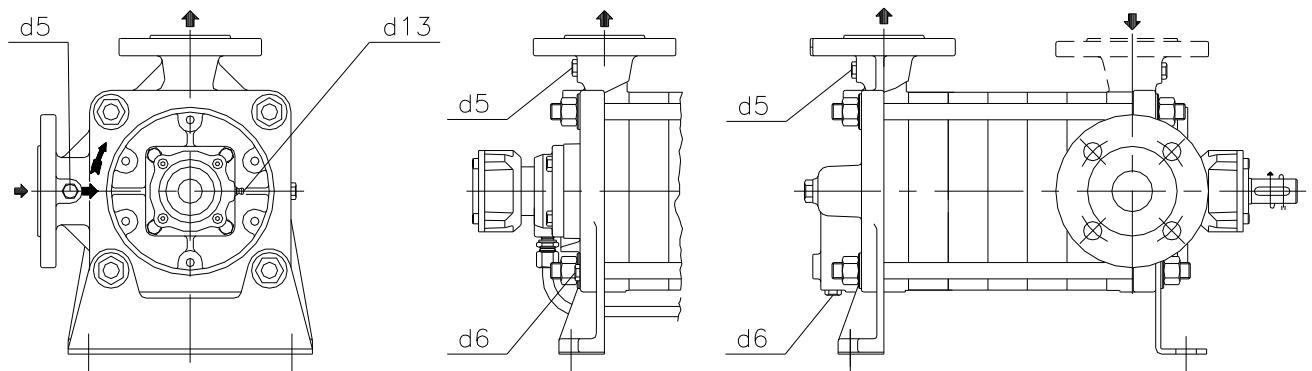


Pump series TBK
Standard connections and hook-ups

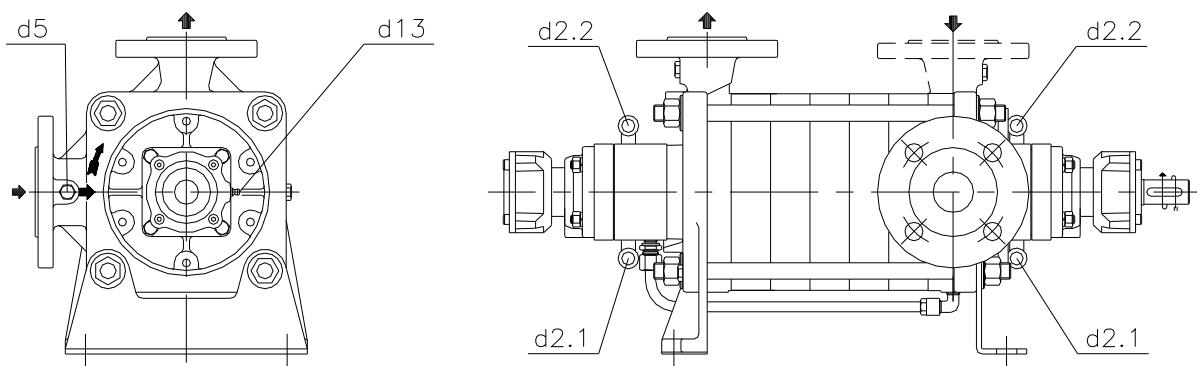


Pump series TBAK
Standard connections and hook-ups

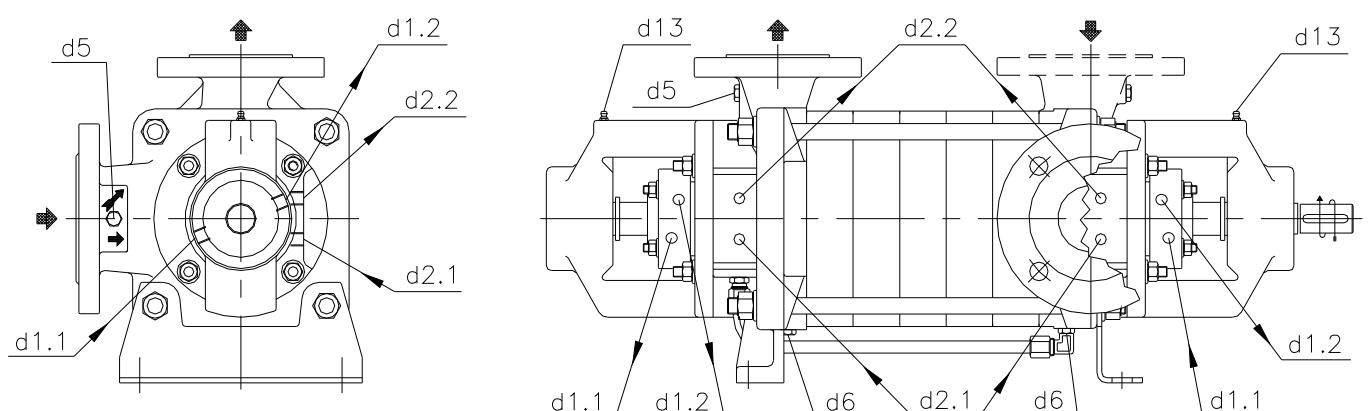
Fig. 11B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TMA 31 and 32/C and /R
Standard hook-ups and connections

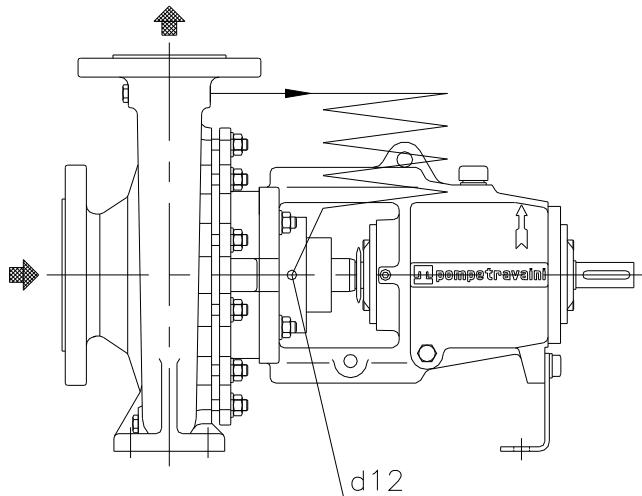


Pumps series TMA 31 and 32/T
Connections for cooling or heating



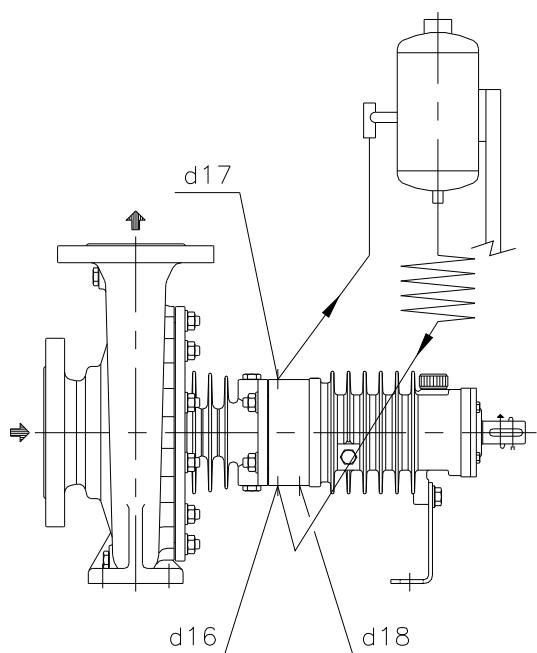
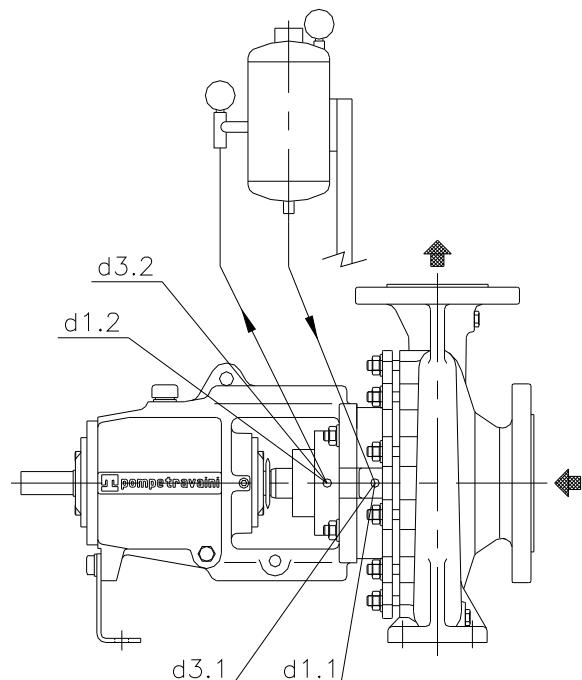
Pumps series TMA 40 and 50/B - /R - /R2
Connections for mechanical seals flushing, cooling or heating

Fig. 12 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
(API Plan 11) Recycle directly from pump casing or via cooling

Pumps series MC... - TC...
Single or Double mechanical seal flushing with Seal Tank



Pumps series TCD/SP
Mechanical seal flushing with Seal Tank

DANGER!

 Danger of collision, harm and crushing! Do not start up the pump without the needful guards on both coupling and motor. The coupling procedures must be carried out when the pump is stopped, after having activated the safety procedures to prevent an accidental start-up (also see chapter 2). Operate provided with apposite protective devices (helmet, glasses, gloves, etc.).

8.1 - MONOBLOCK PUMP/MOTOR AND PUMP/MOTOR ASSEMBLY MOUNTED ON A BASEPLATE

If the pump has been furnished with bare shaft end (i. e. without motor) it is required to procure a proper baseplate on which to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid "U" shaped channel (fig. 15 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit.

Selection of motor must consider the following data at running condition:

- maximum power absorbed by the pump over the total operating range
pump operating speed (RPM)
- available power and network frequency (hertz, voltage, poles, etc.)
- motor enclosure type (CVE, ATEX, etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

Flexible couplings are selected considering:

- nominal motor horse power
- motor operating speed
- coupling guard must meet safety standards
 - possible pump damaging.

 Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 8.3 steps 1, 2, 4, 5, 6.

Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 8.3 steps 7, 1, 8, 5, 9, 10, 11.

For pump driven with V-BELT, please consult POMPETRAVAINI for possible information.

8.2 - ALIGNMENT PROCEDURE FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE

The pump/motor assembly is properly aligned by POMPETRAVAINI prior to shipment.

It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK DESIGN see paragraph 7.3 steps 3, 4, 5, 6.

For alignment procedure of BASEPLATE DESIGN see paragraph 7.3 steps 7, 5, 9, 10, 11.

PLEASE NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by POMPETRAVAINI as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

8.3 - ALIGNMENT INSTRUCTIONS

Alignment should be done at ambient temperature.

Do not try to force the fitting of the coupling onto the shaft. First remove the elastomeric dowels and then heat up the half coupling up to 150°C (do not use microwave ovens).

Should the pump operate at high temperatures which could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures.

The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper keyway slots and fit the coupling halves in line with the shaft ends. The use of a rubber hammer and even pre-heating of the metal half couplings may be required (see fig. 13). Lightly tighten the set screws. For monoblock versions make sure to tighten the connecting screws between lantern and motor as explained hereinafter.

Verify that both pump and motor shafts rotate freely.

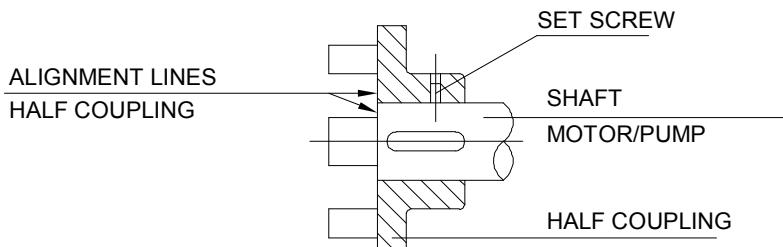


Fig. 13

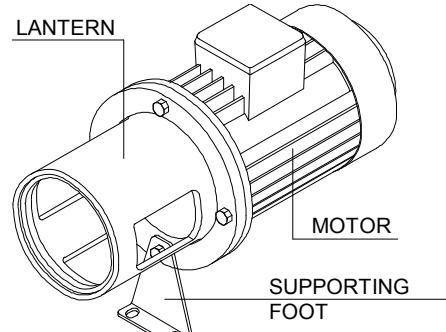


Fig. 14

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 15) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 14). When tightening the connecting screws between lantern and motor make sure not to force the two half-couplings until they touch each other. If this occurs remove the motor, axially move the half-coupling on the shaft and repeat the fixing procedure.

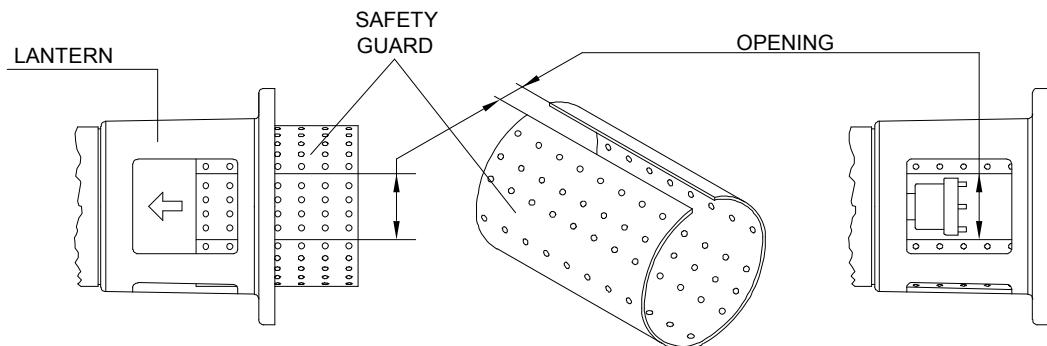


Fig. 15 - PREPARATION TO ASSEMBLY ON MONOBLOCK DESIGN

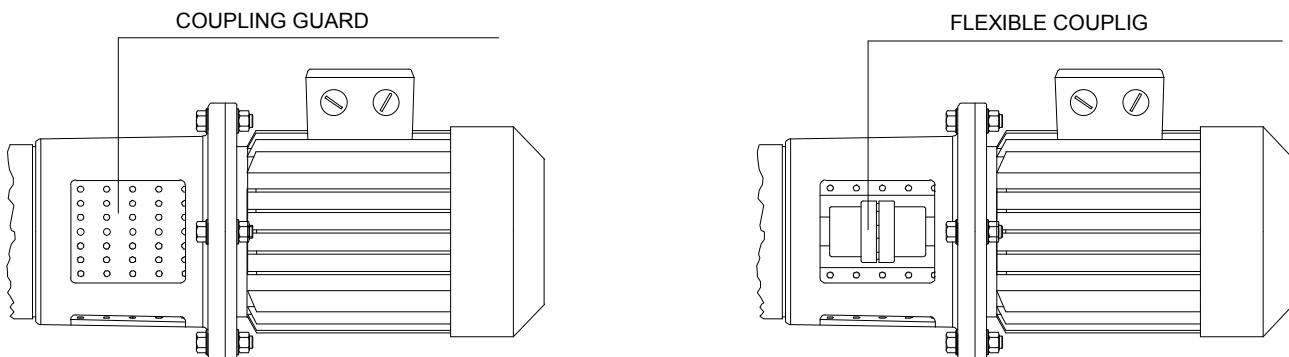


Fig. 16 - CHECKING ALIGNMENT ON MONOBLOCK DESIGN

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 16).

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a proper spacer check the distance between the two coupling halves. The gap value "S" should be as listed on table 2 or as given by the coupling manufacturer. In the event an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap "S" (see fig. 20). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

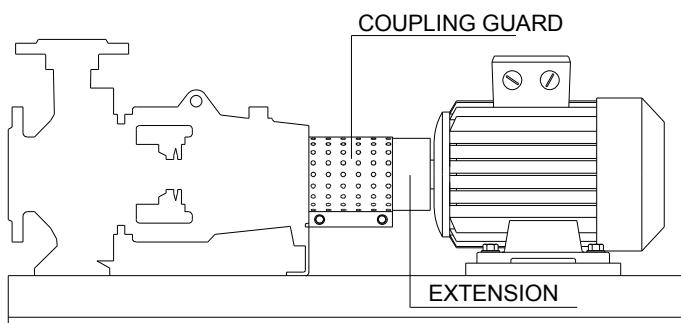


Fig. 17 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 17 and 18).

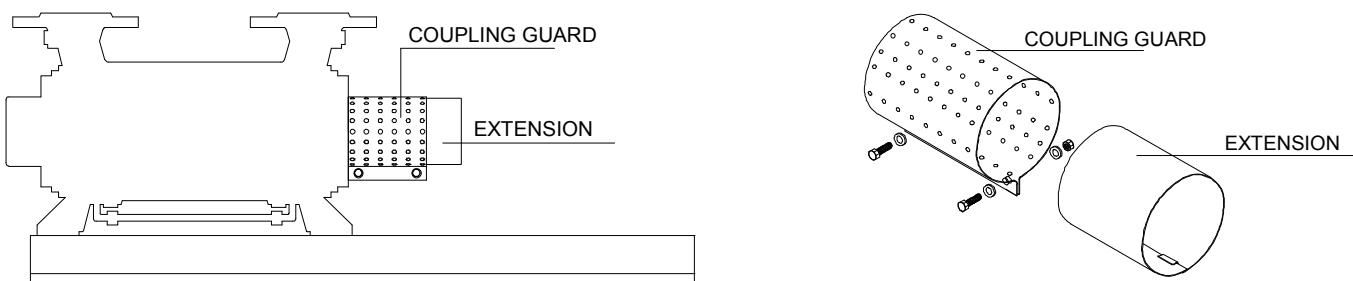


Fig. 18 - MOUNTING THE UNITS ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2 mm. gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 19).

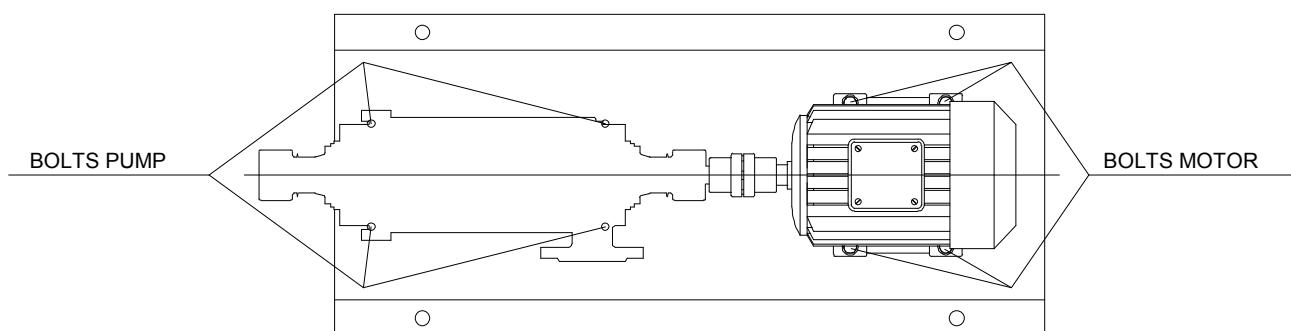


Fig. 19

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 21).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

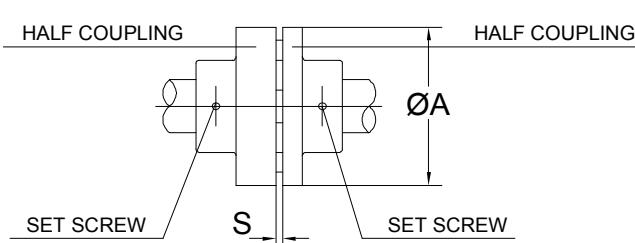


Fig. 20

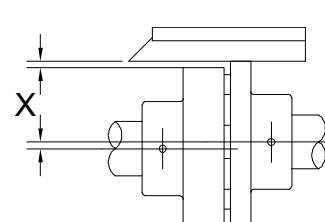


Fig. 21

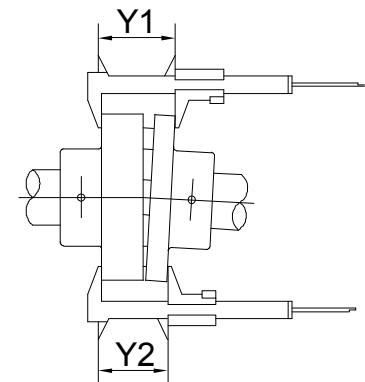


Fig. 22

If the maximum value of "X" is higher than that listed in the tab. 2 (for the given coupling size) it will be required to correct the alignment by using decimal shims under the pump or motor feet (NOTE: the optimal values have to be considered half of the reported data).

When the measured values fall within the tolerances the pump and motor anchoring bolts can be tightened.

10 - Angular misalignment can be measured with a Calliper. Measure the outside coupling dimension at several points (see fig. 22).

Find the minimum and maximum width of the coupling, the difference between these two readings "Y" ($Y_1 - Y_2$) should not exceed the value listed in tab. 2 for the given coupling size (NOTE: the optimal values have to be considered half of the reported data). Should this value be greater it will be necessary to correct the alignment by re-shimming the pump and/or motor.

Following this operation it is recommended to check once more the value "X" to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Tab. 2

COUPLING "Ø A" mm	GAP "S" mm	PARALLEL "X" mm	ANGULAR "Y" mm
60 ÷ 80	2 to 2,5	0,10	0,20
100 ÷ 130		0,15	0,25
150 ÷ 260	3 to 3,5		
290	4 to 5	0,30	
330	5 to 7		0,30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor and guard should not be greater than 2 to 3 mm. (see fig. 23).

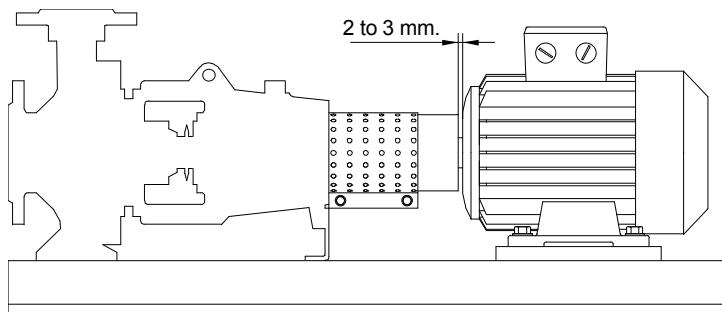


Fig. 23

8.4 - COUPLING PUMP SERIES "TCHM" AND "TCTM"

These pumps do not require a coupling between the pump and the motor shaft; they have been engineered with a supporting flange and shaft having bore and keyway ready to engage the motor shaft and key.

- Check the tolerances of pump shaft bore with its keyway and motor shaft with key. The motor shaft must engage the pump shaft perfectly without interference. In the event there is interference, even if minimal, it is required to rework the motor shaft because a forced fitting would be detrimental to the pump operation.
- Attach the electric motor to the pump flange making sure that the two shafts line-up and the key engages the keyway. Bolt the assembly with the supplied fasteners and install the supporting foot if it applies to the specific pump (see fig 23A).

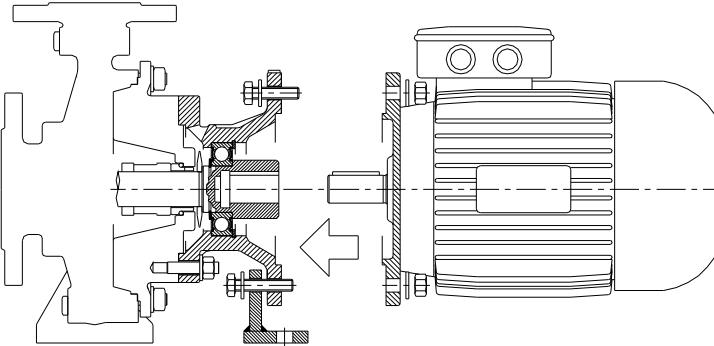


Fig. 23A

9 - ELECTRICAL CONNECTIONS

DANGER!

Electric danger. Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code. Always ground the motor verifying it is properly wired. It is advisable to have an electrical switch near the pump for emergency situations.

FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN CHAPTER 2.

BEFORE DOING ANY WORK TO THE INSTALLATION DISCONNECT ALL POWER SUPPLIES



All electric motors and possible connected accessories must be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate.

It is recommended that motors over 4 kW be wired for Star-Delta start-up, to avoid electrical overloads to the motor and mechanical overloads to the pump.



It is advisable to have an electrical switch near the pump for emergency situations. Be sure to replace all safety guards before switching on the electrical power.

Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor.

Motor connection should be as indicated on the motor tag (frequency, voltage, poles and max consumption) and as discussed in the motor instruction manual.

Pump series TCK, TBK and TBAK (and all motors over 4 kW) should always be preferably wired for Star-Delta start or "soft-start".

If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter).

Please be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage.

Electrical instrumentation such as solenoid valves, level switches, temperature switches, flow switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers.

10 - CHECK LIST PRIOR TO START-UP



If the installed pump is designated to be used in environments subjected to the application of the ATEX 99/92/CE directive but does not show the wording "ATEX" on the name plate, and the integrative ATEX manual hasn't been received or undelivered, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.



CAUTION!

All questions listed below must have POSITIVE answers prior to proceeding to the pump start-up (the following list may not be complete for special installations which may require further precautions as the cases dictate).

- Is this manual entirely read and understood?
- Are all the safety protections in order?
- Are the electrical connections properly wired, grounded and protected?
- Is the position of the pump switch-off button evident, accessible and clear?
- The piping system has been flushed of any foreign particles, welding impurities, etc.?
- Have all piping and pump obstruction been removed?
- All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?
- Pump and motor are properly lubricated, if required?
- Pump/motor alignment has been checked?
- If mechanical seal requires flushing has this been connected?
- All valves in the installation are in the correct position?
- Has this pump's direction of rotation been checked by jogging the motor?
- Are pump and installation ready for start-up?

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free it up by applying a torque to the pump coupling with a pipe wrench.

To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand.

In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.



The selected solvent or lubricating fluid must be compatible with the pump, seals and gasket materials.

New pumps from the factory and pumps coming from long term storage are likely impregnated with a rust preventative liquid; before the start-up, these pumps should be subjected to fresh water rinsing for approximately 15 minutes.

The obtained liquid-water mixture must be collected and, according to the environmental disposal regulations, treated as special liquid.



Dispose the waste liquids according to the current regulations protecting the environment.



CHECK PUMP-MOTOR COUPLING ALIGNMENT!

This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See chapter 8.2.

11.1 - START-UP

Never run the pump when it is dry!

Before starting-up verify that all auxiliary supplies are in place, ready to be used and, where necessary, they have been correctly opened. (Example: seal or packing flushing, pressurising buffer liquid to "back to back" double mechanical seals, etc.). Make sure the pump and motor bearings have been properly lubricated and oil levels are correct.

If necessary oil topping should be done through the proper connections (see fig. 20-21-22-23) and with recommended lubricants (see chapter 13). If the liquid to be handled is at dangerous high temperatures it is required to insulate the pump and the piping to prevent direct contact, the pump should also be protected against thermal shocks by insulation, preheating, etc.

Prior to starting, the suction piping and the pump must be filled with the liquid to be lifted; for this purpose there are three types of installations to be identified:



CAUTION!

Possible contact with hazardous media, cold or warm, and pump surfaces, cold or warm. During the following operations it is particularly important to avoid contact and/or inhale of possible spilled liquid (vapour): therefore all safety precautions must be taken. Operate only provided with apposite protective devices.

For this purpose there are three types of installations to be identified:

11.1.1 - Submersed pump (vertical design)

Pump filling is not applicable.

11.1.2 - Pump with flooded suction

Close the valve at pump discharge side, fully open the valve at pump suction side and the vent valve including any breather valve on the stuffing box.



Pump series TCD are fitted with a vent cock (see fig. 10B) which should be open to prevent forming air pockets in the mechanical seal chamber.



CAUTION!

Possible contact with warm media and warm surfaces. Be sure to do this only when the spilled thermal oil is at ambient temperature. Operate only provided with apposite protective devices.

When the thermal fluid exits the air cock without any air or gas bubbles, even after turning the pump rotor it means that the whole pump is full of liquid, therefore close the air cock.

11.1.3 - Pump with suction lift (from well)

In this case the pump must be primed: fully open the isolating valve in suction piping.

If the pump is self-priming and it has been previously filled with liquid, there will be no problems, because the pump will be able to prime itself and lift the liquid as soon as it starts operating.

If the pump is not self-priming, but the suction piping is fitted with a foot valve, the suction piping and the pump can be filled with liquid by opening the valve at the discharge side (provided the discharge piping is full of liquid) or fill the pump body as well as suction piping, with the liquid to be pumped, through the vent valve.

For non self-priming pumps with the suction piping not having a foot valve, the suction piping and the pump can be filled with liquid by hooking-up the vent valve to a vacuum line and keeping closed the valve at the discharge side of the pump: when the liquid exits the vent valve it means that the pump and suction piping are completely full of liquid.

At this point close the vent valve and the vacuum line.

Check the position and/or control the opening of the minimum flow valve, flushing lines and/or auxiliary supply lines.

After the pump and its suction line is full of liquid the pump should be started. In this regard there are two possible cases:

11.1.4 – Start-up a pump without back pressure at discharge side

For centrifugal pumps type MC... - TC... - TMA motor must be started with discharge valve closed.

When the motor has reached full speed, the discharge valve can be opened until the required differential pressure is reached (CAUTION: do not operate the pump with closed discharge piping for an extended period of time, to avoid overheating problems previously discussed).

For self-priming pumps type AT - TBH - TBA all valves in suction and discharge piping must be fully open before starting the motor. After the motor has been started the discharge valve can be throttled to build up the expected pressure.

(It is possible to start these pumps with the discharge valve at the closed position but, in this case, there will be maximum power consumption at start-up).

11.1.5 – Start-up a pump with back pressure at discharge side

In this case a non-return valve must always be installed in the discharge piping.

The unit is started with the discharge valve partially open and after the pump pressure exceeds the back pressure in the discharge line then is time to adjust the discharge flow regulating valve to attain the operating pressure.

For the Starting Torque of the pump see chapter 19.1.

11.2 - OPERATION

After starting the pump the following should be checked:

- The differential pressure and the capacity are as expected (if required, adjust the flow regulating valve at the pump discharge side but NEVER throttle the valve at the suction side).
- The motor amperage does not exceed the value shown on the motor nameplate.
- The pump/motor assembly does not have unusual vibrations and noises.
- The seal arrangement works as it should:
 - if the sealing is by packing there should be continuous dripping from the stuffing box (see chapter 14).
 - if the sealing is by mechanical seal there should not be any leakage (see chapter 15).
 - the bearing housings temperature, when operating regularly, must be lower than 85°C.



CAUTION!

Never run the pump dry.



CAUTION!

Possible contact with high temperature surfaces. Operate only provided with apposite protective devices.

If at start-up there are suspicions of abnormal operation it is recommended to stop the unit and investigate the causes (see chapter 16).

11.3 - SHUT DOWN

DANGER!



Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Operate only provided with apposite protective devices.

The centrifugal pumps can be shut down by switching off the power to the motor, with open or closed flow regulating valve: however if there are no provisions against liquid hammer it is recommended to close the flow regulating valve at pump discharge prior to stopping the pump.

Avoid the use of instantaneous shut-off valves, such as solenoid valves. These can cause severe pump damage.

If the piping has not been fitted with non-return valves it is required to close the shut-off valves in sequence to prevent emptying the piping.

Close first the isolating valve at discharge and then at suction side.

If the non return valve is not fitted, or the isolating valve at the discharge side is not completely closed, it may happen that during the shut-down the pump shaft will rotate in the opposite direction than is normal because of a return flow: in such cases absolutely avoid restarting the pump until the pump shaft has stopped rotating.

Following pump shut down it is required to close any auxiliary lines such as flushing, heating, etc.

After the first start-stop and if necessary, check pump/motor alignment and make sure that no external forces or moment rest on pump or piping.

In the event the pump is shut down for an extended period of time it is recommended to completely drain the pump to prevent the possibility of freezing in the winter time and/or the possibility of corrosion due to stagnant liquid left in the pump (see chapter 6).

12 - OPERATING CHECK LIST

Periodically check the good working condition of the pump by reading the instruments such as gauges, amp meters, flow meters, etc., the pump should constantly be performing as the installation requires.

The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections.

It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see chapters 13 - 14 - 15 - 16) at least once a year, even if no abnormalities have been noticed.



If during operation the pump seems to run irregularly, because of noise or vibrations, it is necessary to stop the unit and investigate the causes of the malfunctioning (see chapter 16).

When the pump is fitted with auxiliary supply lines such as cooling, heating or flushing it is recommended to periodically check their flow, temperature and pressure.

If the magnetic driven pump is fitted with a temperature sensor, the temperature in the area of the magnetic coupling should be approximately 3 to 5°C above the temperature of the product being pumped in standard conditions (water at ambient temperature). Higher values could indicate operation at low flow, obstruction of internal flushing connections or mechanical damage of the magnetic coupling.

Please contact POMPETRAVAINI if there are doubts regarding abnormal temperature rises.

13 - LUBRICATION INSTRUCTIONS

Pumps often operate in severe conditions and the bearings are subject to relevant radial and axial forces. For a good pump operation it is therefore very important to keep the pump bearings well lubricated and clean.

DANGER!

 Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.

FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

Bearings and lubricants must be free of any foreign particles such as dirt, dust, etc. which could cause the bearings to seize.

See "Disassembly and assembly instructions" for bearing sizes, quantity and type of lubricants.

13.1 - GREASE LUBRICATED BALL BEARINGS

TMA pumps series, flanges size 40 and 50, have ball bearings that, during assembly, are already lubricated with high quality grease with working temperature limits -30 °C +140°C.

The bearings used in a pump normal operating conditions must be carefully cleaned and newly greased after approximately 2000/2500 working hours using a good lubricating grease quality (check the "Disassembly & assembly instructions" for the lubricating grease replacement).



Dispose the exhausted grease following the current regulations and the right measures to protect the environment.

The sealed pre-greased never need lubrication, but must anyway controlled after 2000/2500 working hours.

It is important to remember not to over lubricate the bearings, excessive grease will lead to overheating of bearings.

AT - TBH - TBA - TCK - TBK - TBAK pump series are fitted with self lubricated ball bearings which do not require re-grease in normal operating conditions (series TCK, TBK e TBAK may also be fitted with oil lubrication as described in the paragraph listed below).

It is necessary to carry out the greasing and maintenance operations as per the above description for the pumps with roller bearing fitted on the drive end.

Bearing temperature should not exceed 85°C in normal conditions and ambient temperatures.

Overheating could be caused by excessive grease, coupling misalignment, excessive vibrations and /or bearing wear (see chapter 16).

13.2 - OIL LUBRICATED BALL BEARINGS

Pump series TC... - MC... are fitted with oil lubricated ball bearings. The series TCK – TBK and TBAK can also be with grease lubricated bearings.

It is good practice to replace the lubricating oil used at time of testing.

Oil should also be changed after the first 50 to 100 hours of operation.



Dispose the exhausted oil following the current regulations and the right measures to protect the environment.

The lubricating oil, poured through the hole which is also the dipstick seat or vent plug located at the top of the bearing frame should, as a maximum, cover the bearing balls of the lower crown (the oil dipstick or the oil level gauge show the correct quantity, see fig. 25).

The installation of a constant level oil-filler (as option) consents a correct lubricating oil level in the avoiding recurrent fillings.

For the first filling proceed as follows:

- remove vent plug of the bearing frame
- upset the oil-cruet

- pour oil into the bearing frame through the hole of plug till you can see oil in the oil-filler elbow
- fill the oil-filler pouring oil directly into the oil-cruet and NOT into the elbow (see fig. 24)
- replace the cruet in normal position
- let oil flow into bearing frame
- repeat operation till the oil level in the cruet cease to decrease.

The following fillings should be done pouring oil directly into the cruet and NOT into the elbow of the oil-filler or bearing frame plug (see fig. 24).

If there are no particular dangers of oil contamination (dust, water) and the temperature in the bearing frame oil bath does not exceed 60°C, oil should be changed every 4000 to 6000 hours of service.

For higher operating temperatures and contaminated oil the frequency of oil changes should be increased.

Bearing temperature should not exceed 85°C in normal conditions of operations and ambient temperatures.

Overheating could be caused by too much oil, coupling misalignment, excessive vibrations and/or bearing wear. It is recommended to periodically check the oil pH which will indicate the oil stability and the oxidation grade (consult the supplier for the acceptable values).

Satisfactory oils are those with a viscosity at 40°C between 46 and 100 centistokes.

Oils with high viscosity (100 centistokes) are recommended for applications with high operating temperatures.

Pumps of series TCD can use oils with viscosity up to 220 centistokes.

Pumps are provided with oil OLEODIN 100 for standard applications at ambient temperatures from -5 to +40 °C

Some oil types are:

OLEODIN 100

AGIP BLASIA 68

CASTROL HYSPIN VG 46

CASTROL HYSPIN AWS 68

ESSO TERESSO 68

ESSO NURAY 100

SHELL TELLUS OIL T68

IP HYDRUS 68

Avoid to mix oils having different features and brands.

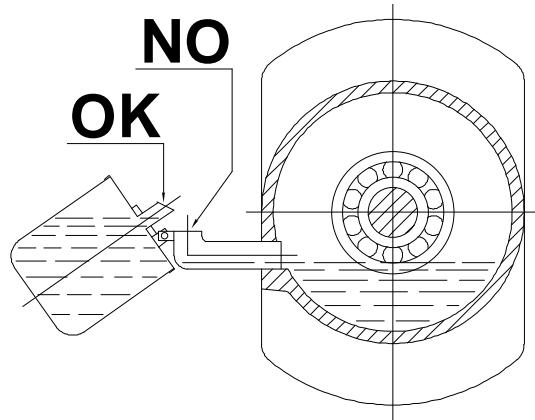


Fig. 24

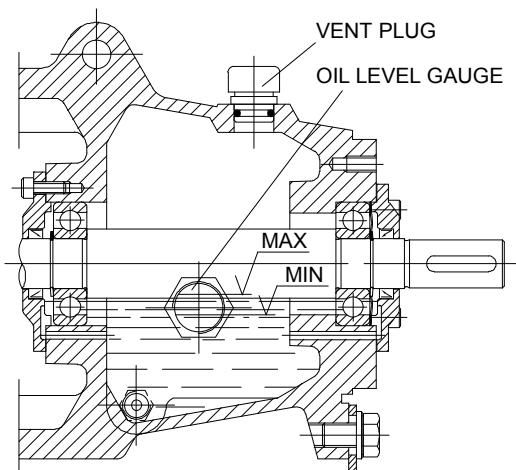
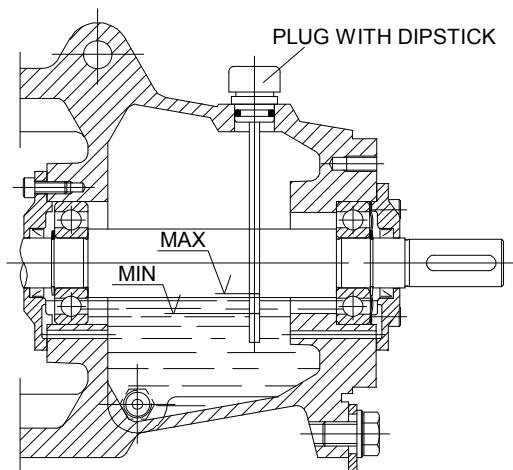


Fig. 25

DANGER!

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Pumps fitted with packed stuffing boxes require packing flushing either from an external source or directly from the pumped media through pump internal passages.

This liquid is necessary to remove the friction heat generated between the shaft and the packing.

The dripping quantity is a function of the pump size and of the pressure in the stuffing box housing.

In any event the liquid drops coming out of the stuffing box should not exceed a temperature of 60 - 70°C in relation to handling a liquid at ambient temperature.

14.1 - ADJUSTING THE PACKING

All adjustment operations must be performed with the **PUMP NOT RUNNING** following the safety measures given in chapter 2. After completion of the work **ALWAYS** re-install the safety guards previously removed.

At first start up loosen the nuts of the packing gland allowing a steady flow of liquid to drain out (see fig. 26).

After obtaining a steady flow of leakage gradually tighten the gland nuts until attaining a steady dripping within the limit of the above recommended temperature.

A few hours time span may be required to establish a steady dripping at low temperatures.

Packing adjustment is required when the liquid leakage increases.

When adjustment is no longer possible, the packing material should be replaced with new one.

Follow the "Disassembly and Assembly Instructions" to replace the packing materials.

In the event the pump remains out of service for more than 2 months it is recommended to replace the packing rings, prior to start-up.

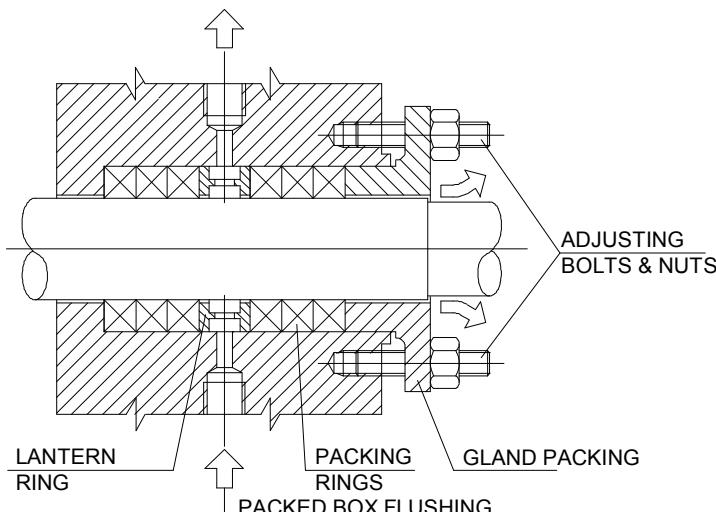


Fig. 26

15 - MECHANICAL SEALS**DANGER!**

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Purpose of mechanical seals is to retain handled product inside the pump in the area where the shaft exits the pump casing. Mechanical Seals can be of many different materials, types and configurations (see fig. 28-29-30 for some examples). To assure maximum reliability and safe operation Pompetravaini evaluates seal choices at time of pump selection in connection with customer's requirements, application and liquid details.

In the case of self lubricated single mechanical seals (API Plan 01, 02 or 11, see fig. 28) flushing and /or pressure system are not required, pump has been engineered to provide proper seal lubrication with pump operating pressure.

In the event the application requires increased safety margin against possibilities of product leaking through a single type mechanical seal, it is possible to install two mechanical seals working simultaneously thus creating a safety barrier from the pumped liquid.

There are two possible types of double mechanical seals: Back-to-Back (also known as "Opposite" type) API Plan 54, see fig. 29 and in Series (also known as "Tandem" type) API Plan 52, see fig. 30.

Double mechanical seals Back-to-Back are generally selected where pumped liquid is absolutely not allowed to leak from the pump. Double mechanical seals in Series are chosen where the pumped liquid may escape the pump toward the pump exterior but it is controlled and contained in the closed seal loop but never to escape to the atmosphere.

Double mechanical seal installations require a flushing (buffer) liquid from an external source that is compatible with the pumped product as well as the working conditions. Flushing liquid system is such as to guarantee adequate buffer liquid pressure and temperature to the mechanical seals: seal flushing system with proper instrumentation and controls is of paramount importance for a successful pump installation, it must be installed by qualified personnel familiar with every details of the application and with system set-up.

All flushing systems MUST use tubing with diameters equal or larger than the connections provided on the pump, buffer liquid must be compatible with the pumped product. Pressure on the buffer liquid should always be constant and/or high enough to cover the entire pump performance.

In the case of 'once through' seal flushing (buffer liquid not recycled), it is very important the regulation and control of pressure in the seal housing. In the double seal case it is recommended to adjust the buffer liquid pressure with a flow regulating valve installed after the seal housing while reading pressure on a gauge installed between the seal housing and the valve. Avoid controlling buffer liquid pressure before the seal housing, reading the pressure before the seal housing is NOT recommended as it could lead to wrong conclusions which could be cause for serious damages. With an adequate seal tank in the system (see fig. 33) a closed loop seal flushing, containing possible leakages is provided. Adequate controls and/or instrumentation will provide pressure and liquid level controls in the tank to indicate the conditions of the sealing system. Increase of liquid level (or pressure) is indication of product leaking through the pump seal. Decrease of liquid level (or pressure) is indication of buffer liquid leaking inside the pump or to the atmosphere through the outside seal, in which case the leakage is also visible.

The liquid to be used in the seal tank must offer full compatibility with the pumped liquid in the event the seal at pump side will leak, (for example when the two liquids will mix there must not be any dangerous chemical reactions) as well the liquid must offer good lubricating characteristics and good heat dissipation. Some good examples of suitable buffer liquids are water, vaseline oils or vegetable oils.

Pressure in the seal tank is often kept with pressurised Ozone or Nitrogen bottle. Cooling of the buffer liquid in the loop (picks up friction heat from the seal faces) is achieved with fresh liquid through the cooling coil fitted inside the seal tank. Seal tank is provided with Inlet & Outlet connections for sealing liquid. DO NOT reverse these two connections; the liquid circulates by natural heat convection (warm liquid moves upward and cold liquid downward), reversing the connections would prevent the start of such natural phenomenon. The buffer liquid outlet connection going to pump seal housing is at bottom of tank while the return connection is approximately at the middle of the tank.

Checking of proper liquid circulation is done while pump is in service; the piping at seal housing connection should be colder by 3 to 5°C than the outlet tubing exiting the seal housing going to the tank. If this is not the case simply change the tubing on the seal housing (connect tubing from inlet to the outlet and vice versa) do not change the connections on the tank. Sometimes this adjustment is required because the rotation of the mechanical seal (and at times peculiar seal design) generates an hydraulic pressure that could be opposite and higher than the natural. Only in 'field' check one can be assured of the correct liquid circulation. Monitoring the pressure in the seal tank with pressure switches or pressure gauges and/or controlling the liquid level in the tank allow the verification of possible seal leakages and prompt corrective actions can be taken when required.

Use good quality gauges to monitor the pressure, with good dial and scale graduation adequate for good reading in the anticipated pressure range. As a minimum use liquid filled gauges with dial size of minimum 60 mm and 2.5 accuracy. Additional data and information may be requested from Pompetravaini or its local representative if required.



Incorrect pressure of seal housing could cause severe damage to the rotating parts. To minimise seal system malfunctions avoid pressure fluctuations in the seal loop as well as in the pump operating pressure.

Seal housing with double mechanical seals back-to-back type, must always have a pressure such that the inside seal (closer to pump impeller) will not be pushed out of its seat by the total pump pressure (suction plus pump operating pressures) even when pump is in stand-by mode. Flushing liquid therefore must be at least 0.5 bar over the maximum pump discharge pressure throughout its performance.

A lower pressure, even if for a moment, will cause the stationary part of internal seal to come out of its seat and the pumped liquid will mix with the flushing liquid due to the higher pressure inside the pump, see fig. 27.

In the case of double seals in series (Tandem) the pressure of the flushing liquid should be as low as possible but high enough to provide good flow in the circuit. High pressures (over 0.3 bar over the atmospheric pressure) may push the stationary seat of mechanical seal at product side (closer to pump impeller), out of its seat (especially when pump is at rest without pressure), therefore flushing liquid would mix with the product inside the pump following seal system damage.

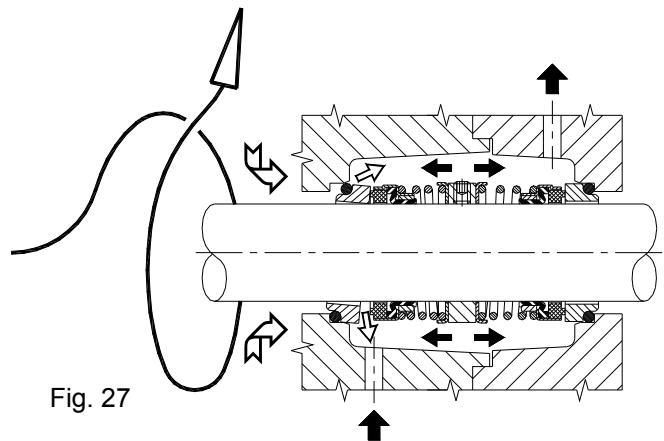


Fig. 27



Incorrect pressure in sealing system is the most common cause for seal system failure, therefore a continued monitoring with prompt corrective actions are necessary.

See fig. 20-21-22-23 and operating manual for centrifugal pumps for locations of liquid flushing connections. Required flow and pressure for buffer liquid are listed in tab. 3 and/or contact Pompetravaini and/or seal supplier. See tab. 4 for liquid flow required to cool or heat the seal housings. For a longer seal life cooling is recommended when pumping liquids over 90°C. Tab. 4 also lists cooling or heating liquid flow for pumps of "U2" design that include jacketed pump casing.

Standard mechanical seals supplied with our pumps meet ISO 3069/UNI EN 12756 standards, see pump "Disassembly and Assembly Instructions" for overall dimensions. Special or non-standard seals can be installed after proper

evaluation by our technical department. Mechanical seals do not require maintenance until losses of liquid are visible (for seal replacement see "Disassembly and Assembly Instructions"). Losses of few drops of liquid in several minutes is normally considered acceptable and it is not an indication of seal failure.

Seal leakage or even seal failure should be properly corrected considering the impact on environment, toxicity and safety issues.



CAUTION!

Pay attention to possible leakage of pumped liquid from mechanical seal which, by its characteristics, could be harmful to the environment.

Mechanical seals should NEVER run dry, without flushing liquid (internal or external). This could cause severe damage to the seal faces, O-Rings and elastomer. It is recommended to check the wear on seal faces every 4000 working hours. This is an acceptable normal working time for mechanical seals, over this time there could be losses due to wear and tear that require seal replacement.

MECHANICAL SEALS WITH QUENCH

There are two types of Quench/Barrier, available upon request: API Plan 61 and 62.

System Plan 61 (see fig. 31) includes a bushing on the back of the seal at atmospheric pressure side (single or double) to hold the bulk of the liquid in the event of accidental failures. The bushing requires a minimum clearance over the shaft therefore the liquid is NOT sealed completely but most of it will be retained in case of a sudden seal breakage. Drain and vent connections are threaded. This arrangement does not allow a continuous flushing because the above mentioned clearances would cause considerable losses of liquid over the shaft toward the outside. This system is chosen for avoid emergencies or to limit losses of liquid.

System Plan 62 (see fig. 32) requires (contrary to Plan 61) a constant flushing because the auxiliary seal is of the contact type and CANNOT work without a liquid that removes the generated heat of friction. The auxiliary seal is usually a lip seal (radial seal ring) not to be confused with the traditional mechanical seal. Losses of several liquid drops should be tolerated and with time its reliability will decrease. This system is often used where there is the need to wash the back of the mechanical seal on the atmospheric side preventing crystallization or coking of handled product. It is a less effective alternative to the double mechanical seals in series. Pressure of buffer liquid must follow same rules as for the double seals in series, therefore max pressure can be 0.3 bar over the atmospheric pressure and temperature can be max 60°C.

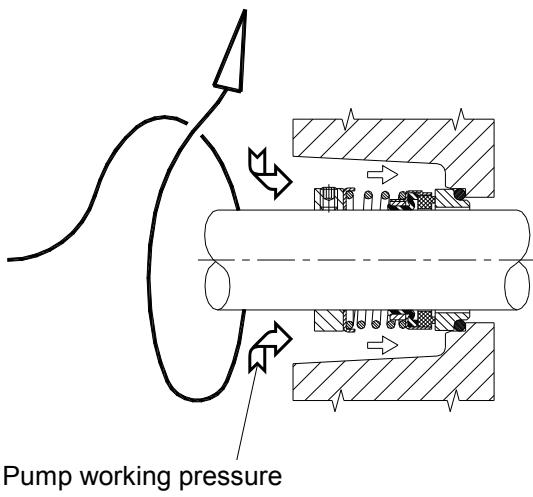


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

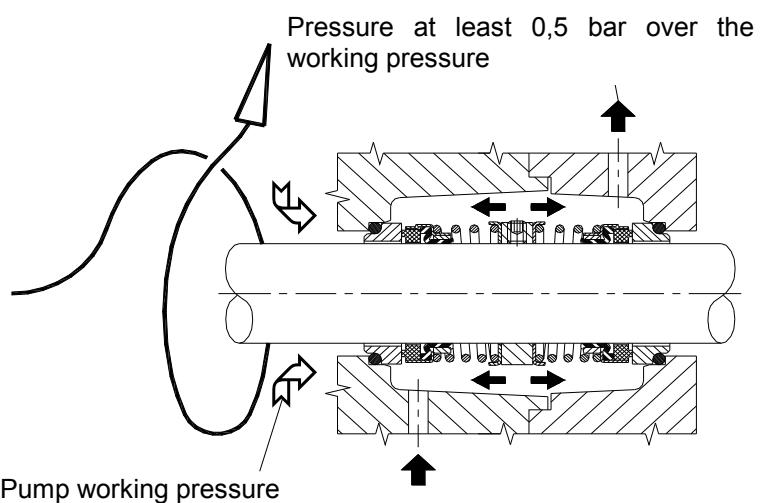


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54

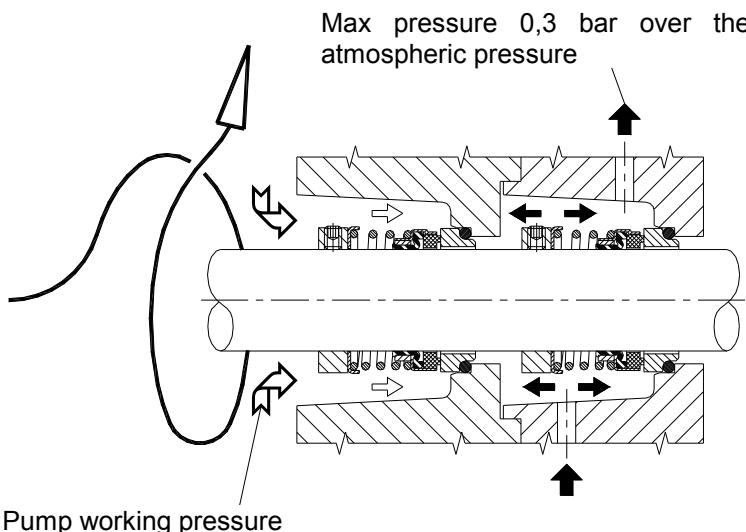


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

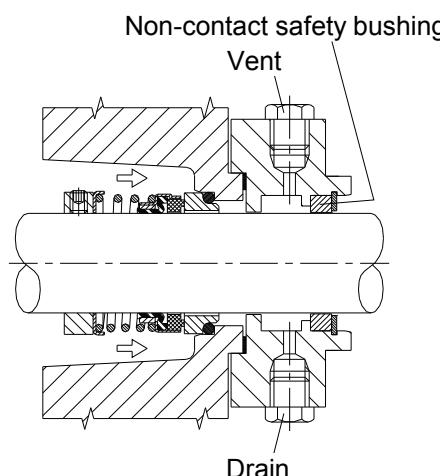


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

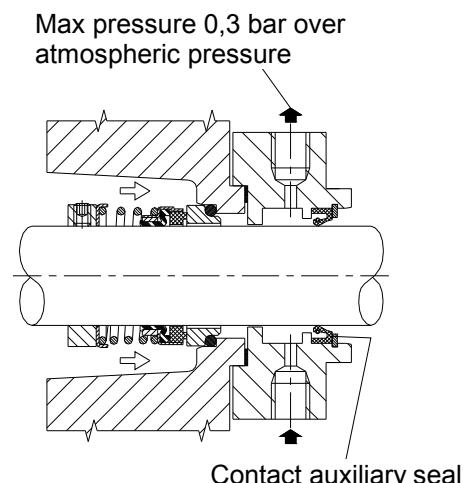


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

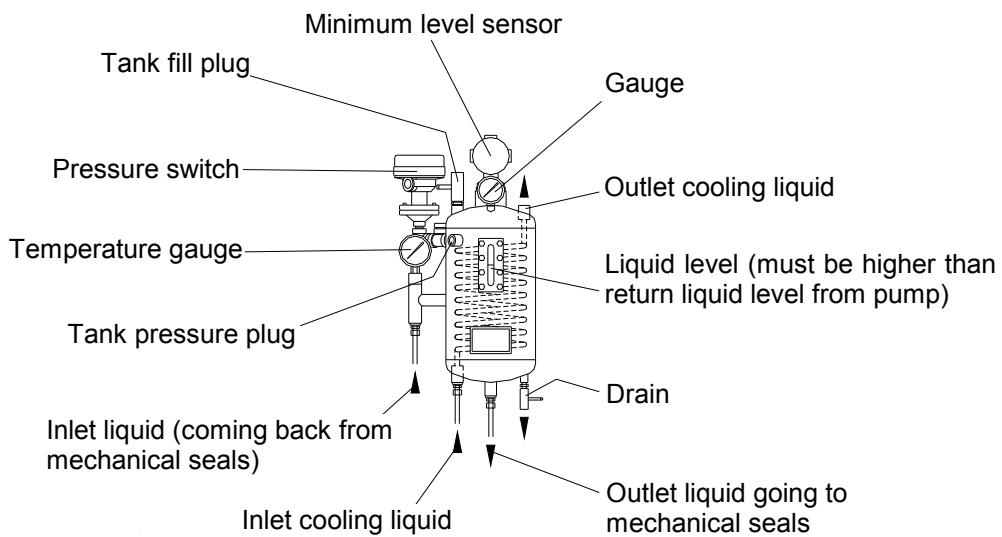
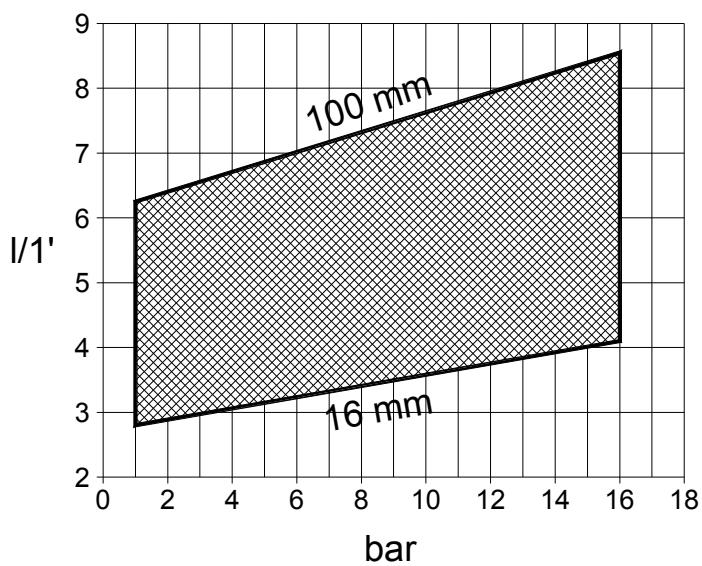


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

NOTE: Tank installation must be at least 1 m above the rotating pump shaft



Tab. 3 - REQUIRED LIQUID FLOW TO FLUSH MECHANICAL SEALS FROM OUTSIDE SOURCE

mm = installed shaft seal diameter
 bar = maximum pump working pressure (total of inlet pressure and pump generated pressure as measured at pump discharge flange)
 I/1' = required liquid flow (lit/min) for single seals or double in series type seals (tolerance +/-25% depending upon temperatures)
 NOTE: DOUBLE quantity of liquid flow for double mechanical seals back-to-back type.

CAUTION: Flushing liquid PRESSURE for back-to-back double seals must be min 0.5 bar over the max pump working pressure, while NOT more than 0.3 bar over the atmospheric pressure in case of double seals in series (TANDEM).

Tab. 4 - LIQUID FLOW FOR COOLING OR HEATING JACKETED SEAL HOUSING (maximum pressure for liquid circuit is 3.5 bar, referred to water and ambient temperature. In case of heating circuit the allowed maximum temperature is 135°C).
 Flow tolerance +/-25%.

CAUTION: Flow for cooling or heating of jacketed pump casings, design "U2" pump series MC... - TC... (see fig. 34) can vary depending upon temperatures for cooling or heating the casing, ALWAYS limiting the maximum pressure of 3.5 bar and temperature of 135°C of the pump casing jacket.

PUMP SERIES	FLOW MINIMUM I/1'	FLOW MAXIMUM I/1'
AT - TB... TC... group 1 - 2 TMA	3	8
MC... group 3 - 4 - 5 TC... group 3 - 4 - 5 MEC	5	12

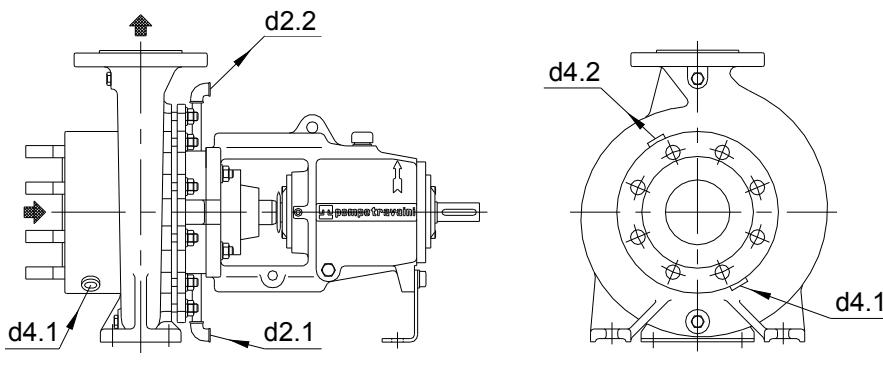


Fig. 34

- d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
- d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
- d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
- d4.2 Threaded connection - Outlet cooling/heating liquid pump jacketed casing

16 - TROUBLE SHOOTING CHART - PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart (tab. 5) or should there be any doubts, do not hesitate to contact POMPETRAVAINI or your local representative.

Tab. 5 - LIST OF PROBLEMS

PROBLEM	LIST OF POSSIBLE CAUSES
Lack of, or no flow and/or pressure	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 17 - 25 - 40
Excessive flow and/or pressure	15 - 16 - 17 - 18
High power consumption	10 - 15 - 16 - 18 - 19 - 20 - 21 - 22 - 23
Excessive vibration and noise	8 - 18 - 19 - 20 - 23 - 24 - 25 - 26 - 27 - 28 - 36 - 37 - 40
Bearing overheating	19 - 20 - 28 - 29 - 30 - 36 - 38 - 39 - 42
Sealing malfunction	28 - 31 - 32 - 33 - 34 - 35 - 40 - 41

	CAUSES	SOLUTIONS
1	Pump is not primed	Repeat the priming procedure
2	Rotational speed is not adequate	Increase the motor speed in relation to the working conditions - Replace impeller with one having larger diameter.
3	Installation requires higher pressure than expected	Increase operating speed, if possible, (see point 2) or replace impeller with one of larger diameter - Change the pump or increase the number of stages in case of multistage pumps - Reduce the system pressure
4	Wrong direction of rotation	Change the motor direction of rotation
5	There are air pockets in the suction line	Modify the layout of suction piping
6	Air enters the suction line	Check the piping sealing areas
7	The pumped liquid is emulsified with air	Install a reservoir or tank before the pump to de-aerate the liquid
8	The suction lift or/and suction pressure is more than anticipated and therefore the pump cavitates	Reset the suction lift to the original value - Increase the piping diameter - Check the suction piping, the foot valve or non return valve, the filter - Open completely the isolating valve in the suction piping - Decrease the friction losses
9	The wear ring and/or impeller neck and/or the impeller and/or the diffusers are worn out or damaged	Overhaul the pump replacing and/or repairing the damaged components
10	Viscosity, density, or specific weight of liquid have higher values than expected	Re-establish the characteristics of the liquid as originally expected (if necessary contact POMPETRAVAINI)
11	Suction piping is not sufficiently submersed in the liquid, creating vortex	Increase the depth of piping or foot valve in the liquid
12	Impeller is plugged with scale deposit and/or foreign materials	Take out the impeller, clean it, free the vanes and cavities of any materials - Soften the pumped liquid
13	There is entrained air in the system	Adjust the packed stuffing box or repair/replace the mechanical seal
14	Piping is plugged	Clean piping and valves - clean the filters
15	Velocity is too high	If possible, decrease the pump rotational speed
16	The required pressure of system is lower than anticipated	Adjust the flow regulating valve in discharge piping - Decrease the impeller diameter (contact POMPETRAVAINI) - Decrease the number of stages in case of multistage pumps
17	Pump is not suitable for the application	Contact POMPETRAVAINI
18	Inlet pressure is too high	Reduce the pressure, but without adjusting the isolating valve at the suction side

19	Pump/motor coupling is misaligned	Realign the coupling
20	Bearings are defective or worn out	Replace bearings
21	The power supply voltage is wrong - Motor does not operate properly	Change the motor - Correct the power supply
22	The packing is too tight	Loosen the nuts of the packing gland
23	Pump seizing is experienced	Stop the pump and look for any rotor obstructions
24	The pump and/or piping are loose	Torque the bolts as required
25	Pump is worn out or damaged with excessive internal clearances	Overhaul the pump
26	The coupling rubber inserts are worn	Replace the coupling inserts
27	The impeller is out of balance due to wear, deposits and encrustation	Disassemble, clean, balance and/or replace the impeller - Soften the liquid
28	Forces, moments and piping misalignment are loading the pump	Realign and support the piping
29	Oil level in bearing frame is low, oil quality is inadequate or there is lack of grease	Replace oil or grease to the normal level using proper quality lubricants
30	The power absorbed is too high	Decrease the power consumption by identifying the cause
31	Pump is running dry	Reinstate the correct working conditions
32	Pumped liquid or the flushing liquid to the seals is dirty and/or not adequate	Install a filter in the flushing lines - Change flushing fluid
33	There are excessive shaft vibrations and deflections	Identify the causes and reinstate the correct working conditions (refer to more specific points in the table)
34	The pumped liquid is not adequate for the seals	Contact POMPETRAVAINI
35	The shaft sleeve is worn out	Replace the sleeve with a new one
36	The pumped flow is less than the minimum required	Increase the flow - Adjust the by-pass recirculation valve or line
37	Baseplate or pump foundation is not adequate	Change or reinforce the baseplate and/or foundation following the recommended procedures
38	Too much grease in the bearings	Remove excessive grease and check the bearings
39	There is water in the bearing frame	Change bearings and replace all the lubricant
40	Incorrect assembly after pump repair	Overhaul pump and assembly following correct procedures
41	The mechanical seals are damaged	Remove the mechanical seals, overhaul or change them
42	The axial forces are too strong	Check the impeller

Should the pump require repairs it is recommended to be familiar with the procedures outlined in the "Disassembly and Assembly Instructions".

DANGER!

Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.



FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

In any case, before working on the pump it is important to:

- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cables from the motor
- close the pump inlet and outlet isolating valves
- let the pump cool down to ambient temperature if is pumping hot liquids
- adopt safety measures if the pump has been handling dangerous liquids
- drain the pump body of the pumped liquid, through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:

- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one
- if required, remove motor by removing the bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from installation without damaging other system components.

Before returning the pump to POMPETRAVAINI or an authorized service decontaminate the pump and ask for the "handled media" examination form.



In case of pump removal from the installation dispose the unit by following the current regulations and the right measures to protect the environment.

When the pump has been repaired must repeat the steps from "Assembly and Alignment" procedures and after (see the applicable chapters starting from chapter 7).

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimise unnecessary down times in the event of pump failure or routine maintenance.

For better parts management, the VDMA 24296 standards suggest to stock the number of parts in function of the number of pumps being used by the plant (see following table).

Components	Spare parts	Identical pumps number (stand-by pumps included)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Number of spare parts								
Suction and discharge elements	1	1	2 1	2	2	3	30%	
Impellers								
Radial seal rings	2	2		3	3	4	50%	
Ball or roller bearings								
Shaft complete with keys, nuts, shoulder rings, etc.	1	1	2	2	3	3	30%	
Bushes				3	3	4	50%	
Shaft protection sleeves	2	2						
Neck rings	1	1		2	2	3	30%	
Packing rings	16	16	24	24	24	32	40%	
Gaskets for pump casing (Set)	4	6	8	8	9	12	150%	
Other gaskets (Set)						10	100%	
Mechanical seals	Rotating part		4	5	6	7	90%	
	Stationary part		6	8	8	10	150%	
	Rotating part gasket							
	Stationary part gasket							
	Springs	1	1	1	1	2	2	20%
Bearing housing groups complete with shaft, bearings, covers, seal rings, etc.	---	---	---	---	---	1	2	
Coupling inserts (Set)	2	3	4	5	6	7	75%	

On the pump nameplate there are printed pump model, year of manufacture and pump serial number.

When ordering spare parts always provide this information.

Pump type, parts item number (VDMA) and description per the pump sectional drawing and parts list is useful information which helps to supply correct spare parts for your pump.

We recommend the use of original spares: in case this is not respected, POMPETRAVAINI declines any responsibility for possible damages and not correct running caused by not original spare parts.

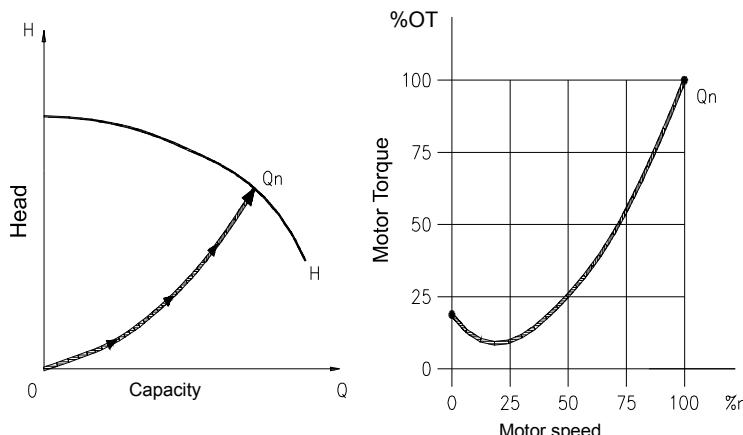
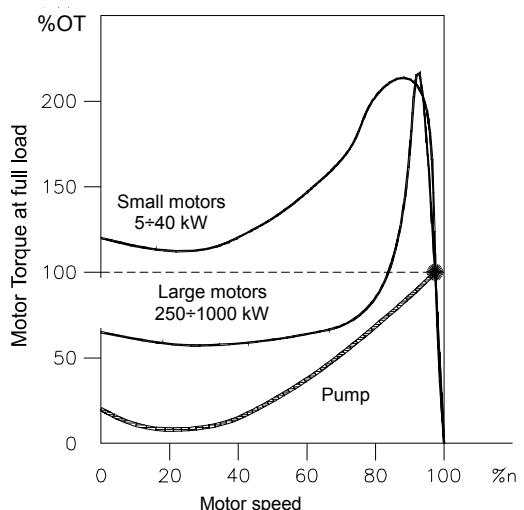
19.1 - STARTING TORQUE

Starting torque of a centrifugal pump is very low. Usually standard electric motors may be safely used to drive this pump. Pump operational speed (any speed) is reached only if motor torque is greater than pump operating torque. See side figure.

Operating Torque (**Nm**) is given by

$$\text{Operating Torque} = 9549 \times \text{kW} (\text{absorbed at operating speed}) / \text{RPM (nominal)}$$

According to the centrifugal pump starting, there could be three principal cases each with his characteristic curve of starting (see examples below).



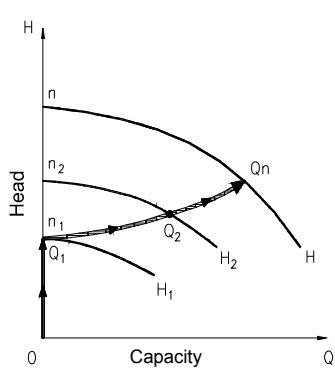
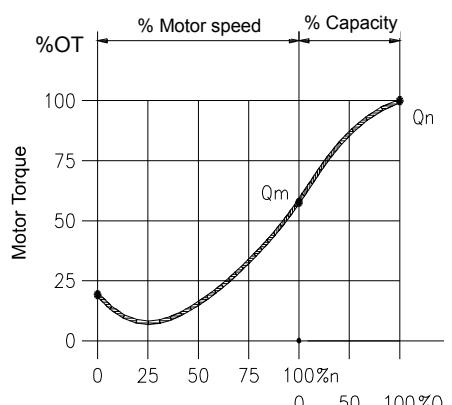
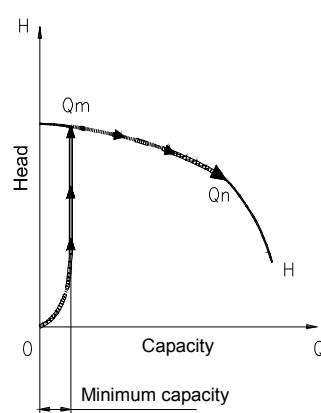
1) Starting with open valve on discharge

During this starting it can be assumed the curve of Operating Torque in function of the round number similar to a parable that starts from about the 20% of the value of Operating Torque to the value of nominal capacity **Qn**.

2) Starting with partially closed valve on discharge

This type of starting requires a particular observation: first the pump must reach a value of minimum capacity **Qm** (correspondent to the partialized capacity of the valve) such to guarantee a correct operation without problems of liquid evaporation or excessive radial loads on the shaft; then the pump, by totally opening the valve, will reach the value of nominal capacity **Qn** and therefore the value of maximum operating torque.

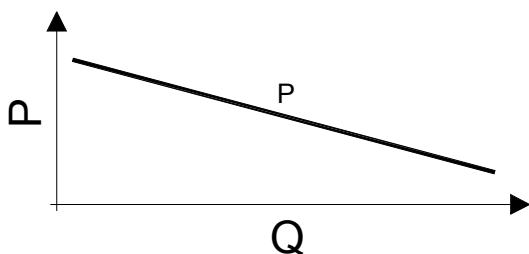
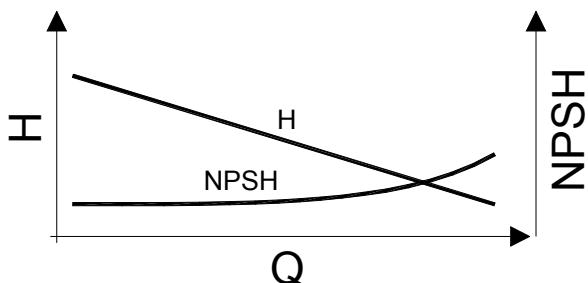
NOTE: In this case it is esteemed an absorbed power at the value of **Qm** corresponding to about 60% of **Qn**.



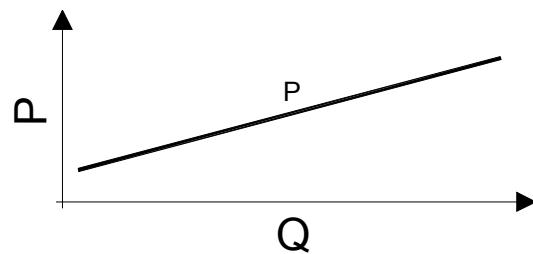
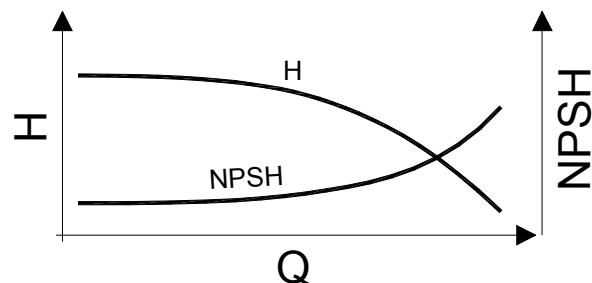
3) Starting with completely open valve and with non return valve on discharge

During the starting the non return valve will remain closed up to the attainment of the pressure value **H1** (correspondent to the pre-load pressure of the same valve) and therefore void capacity. This value is reached at speed **n1** (in this example esteemed about 60% of the nominal speed). The continuous motor acceleration will reach the attainment of the value of nominal capacity **Qn** after having passed through **n2**, **Q2**, **H2**.

19.2 - TYPICAL PERFORMANCE CURVES



Typical performance curves
for pumps series AT - TB...



Typical performance curves
for pumps series TC... - MC... - TMA

Where:

- H = Head
- NPSH = Net Positive Suction Head
- P = Absorbed power
- Q = Capacity

19.3 - UNITS CONVERSION TABLE

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Discharge and Delivery	Litres/sec	Litres/min	60	m ³ /h	Litres/sec	0.2778
	Litres/sec	m ³ /h	3.6	m ³ /h	Litres/min	16.67
	Litres/sec	C.F.M.	2.12	m ³ /h	C.F.M.	0.589
	Litres/min	Litres/sec	0.01667	C.F.M.	Litres/sec	0.4719
	Litres/min	m ³ /h	0.06	C.F.M.	Litres/min	28.32
	Litres/min	C.F.M.	0.0353	C.F.M.	m ³ /h	1.698

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Capacity	Litres	m ³	0.001	U.S. Gal	Litres	3.785
	Litres	Ft ³	0.0353	U.S. Gal	m ³	0.003785
	Litres	U.S. Gal	0.02641	U.S. Gal	Ft ³	0.0133
	Litres	Imp. Gal	0.219	U.S. Gal	Imp. Gal	0.0832
	m ³	Litres	0.001	Imp. Gal	Litres	4.545
	m ³	Ft ³	35.3	Imp. Gal	m ³	0.004545
	m ³	U.S. Gal	264.17	Imp. Gal	Ft ³	0.16
	m ³	Imp. Gal	219.96	Imp. Gal	U.S. Gal	1.2
	Ft ³	Litres	28.32			
	Ft ³	m ³	0.0283			

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Linear measure	cm	inches	0.3937	inches	cm	2.54
	cm	m	0.01	feet	m	0.3048
	m	feet	3.28084			
	m	cm	100			

19.4 NOISE LEVEL AND VIBRATIONS

Noise level (sound pressure level L_p at 1 meter distance neglecting motor, with pump installed in the system and sound power level L_w) for pump operating at BEP and motor at 50 Hz operating speed.

The values can change depending on the installed motor. Contact POMPETRAVINI for further information.

The class of the vibration level (values rms mm/s) shows the limit values for the continuous working of the pump if properly installed. For higher values to proceed with maintenance following the table below.

NOTE: Pumps not included in the following tables have to be seen as a particular construction.

Contact POMPETRAVINI in order to know the data.

	Continuous working	Preventive maintenance	Extraordinary maintenance
Class V1	< 3,5	> 3,5 < 7	> 7
Class V2	< 4,5	> 4,5 < 7	> 7

PUMP MODEL	Noise level L_p (L_w)	Vibration level
TMA	dB(A) poles	class poles
31 – 3		
31 – 4		
31 – 5		
31 – 6		
31 – 7		
31 – 8		
31 – 9		
31 – 10		
31 – 11		
31 – 12		
31 – 13		
31 – 14		
31 – 15		
32 – 3		
32 – 4		
32 – 5		
32 – 6		
32 – 7		
32 – 8		
32 – 9		
32 – 10		
32 – 11		
32 – 12		
32 – 13		
32 – 14		
32 – 15		
40 – 3		
40 – 4		
40 – 5		
40 – 6		
40 – 7		
40 – 8		
40 – 9		
40 – 10		
40 – 11		
40 – 12		
40 – 13		
40 – 14		
40 – 15		
50 – 3		
50 – 4		
50 – 5		
50 – 6		
50 – 7		
50 – 8		
50 – 9		
50 – 10		
50 – 11		
50 – 12		

PUMP MODEL	Noise level L_p (L_w)				Vibration level			
TC...	dB(A) poles				class poles			
	8	6	4	2	8	6	4	2
25 – 125					V1			
25 – 160					V1			
25 – 200					V1			
32 – 125					V1			
32 – 160					V1			
32 – 200					V1			
40 – 125					V1			
40 – 160					V1			
40 – 200					V1			
40 – 250					V1			
50 – 125					V1			
50 – 160					V1			
50 – 200					V1			
50 – 250					V1			
50 – 315					74 (86)	V1		
65 – 125					73 (85)	V1		
65 – 160					73 (85)	V1		
65 – 200					73 (85)	V1		
65 – 250					74 (86)	V1		
65 – 315					75 (88)	V1		
80 – 160					73 (85)	V1		
80 – 200					74 (86)	V1		
80 – 250					75 (87)	V1		
80 – 315					77 (90)	V1	V2	
100 – 200					75 (87)	V1	V2	
100 – 250					76 (89)	V1	V2	
100 – 315					78 (91)	V1	V2	
100 – 400					---	V1	---	
125 – 250					---	V2	---	
125 – 315					---	V2	---	
125 – 400					---	V2	---	
150 – 250					---	V2	---	
150 – 315					---	V2	---	
150 – 400					---	V2	---	
200 – 315					---	V2	---	
200 – 400					---	V2	---	
250 – 315					---	V2	---	
300 – 350					---	V2	---	
300 – 450					---	V2	---	
250 – 450					---	V2	---	
300 – 550	79 (94)	---	---		V2	---	---	

PUMP MODEL TBA	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
202 ♦	< 73 (85)	
203 ♦		
204 ♦		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
307		
308		
311		
312		
313		
314		
315		
316		
317		
318		
401		
402		
403		
404		
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658		

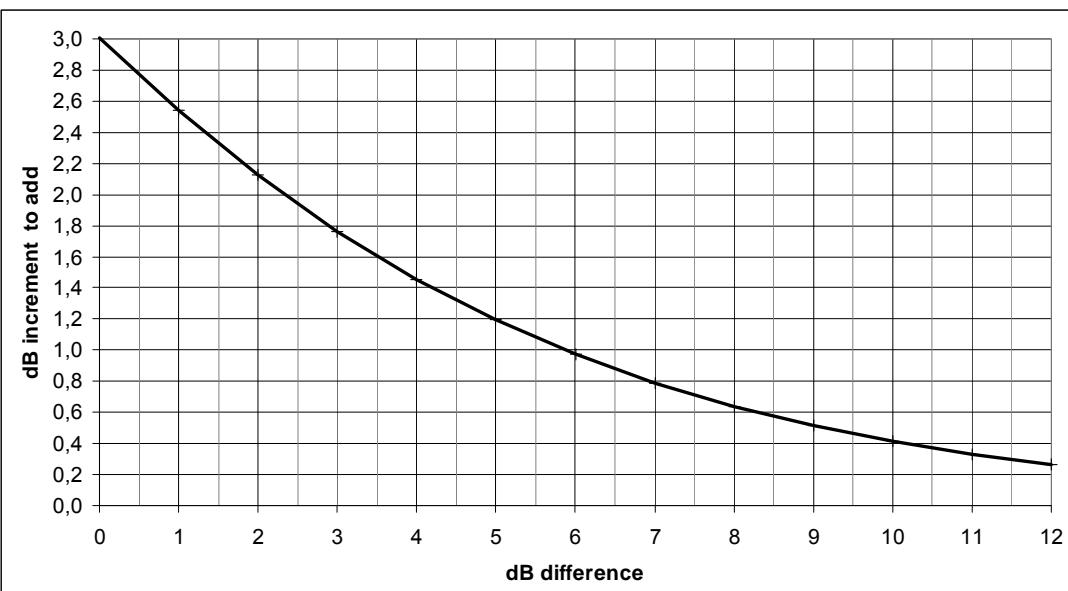
♦ = WARNING: 2 poles motors

PUMP MODEL TBH	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
201		
202		
203		
204		
205		
206		
207		
208		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
307		
308		
311		
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314		
315		
316		
317		
318		
401		
402		
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658		

In order to have approximate values of the noise level for the pump-motor assembly the sound power level of the motor and the pump can be added. The following table shows some values of the motor noise level. The addition has to be calculated using the diagram below.

In order to get the total sound power level it is necessary to calculate the difference between the pump and motor noise level; by that value calculate, from the following diagram, the increment that will have to be added to the higher value of the power sound level. Ex: motor 80 dB and pump 75 dB, level difference 5 dB, increment 1.2 dB, total power sound level 81.2 dB. Taking into account that the noise level depends on several factors, contact POMPETRAVAINI to know more accurate values.

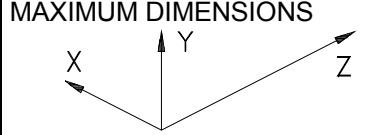
POWER kW	Noise level L_p (L_w)				Noise level L_p (L_w) ATEX			
	dB(A)				dB(A)			
	8 poles	6 poles	4 poles	2 poles	8 poles	6 poles	4 poles	2 poles
0,75	55 (63)	50 (58)	48 (56)	59 (67)	54 (62)	48 (56)	53 (61)	64 (72)
1,1	55 (63)	50 (58)	54 (62)	60 (68)	54 (62)	48 (56)	56 (64)	64 (72)
1,5	57 (65)	53 (61)	54 (62)	63 (71)	56 (64)	57 (65)	56 (64)	71 (79)
2,2	57 (65)	55 (61)	55 (63)	63 (71)	60 (68)	59 (67)	57 (65)	71 (79)
3	58 (66)	57 (65)	55 (63)	67 (75)	60 (68)	62 (70)	57 (65)	74 (82)
4	60 (68)	57 (65)	58 (66)	69 (77)	64 (72)	62 (70)	62 (70)	74 (82)
5,5	60 (68)	57 (65)	61 (69)	72 (81)	64 (72)	62 (70)	66 (74)	75 (83)
7,5	60 (68)	63 (71)	61 (69)	72 (81)	64 (72)	66 (74)	69 (77)	77 (85)
11	63 (71)	64 (72)	68 (78)	74 (82)	66 (75)	66 (74)	71 (79)	77 (86)
15	65 (73)	64 (72)	68 (78)	74 (82)	67 (77)	69 (78)	71 (79)	78 (86)
18,5	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	78 (86)
22	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	76 (85)
30	69 (80)	68 (78)	73 (84)	82 (93)	70 (81)	72 (83)	72 (82)	78 (88)
37	67 (75)	70 (81)	75 (86)	82 (93)	62 (74)	72 (83)	75 (86)	78 (88)
45	67 (77)	72 (84)	75 (86)	82 (93)	62 (74)	67 (79)	75 (86)	80 (90)
55	67 (77)	72 (84)	78 (86)	84 (98)	63 (77)	67 (79)	77 (88)	80 (91)
75	67 (77)	77 (87)	73 (82)	79 (89)	65 (77)	67 (81)	72 (84)	77 (89)
90	67 (77)	77 (88)	73 (82)	79 (89)	65 (79)	71 (85)	72 (84)	77 (89)
110	73 (85)	77 (88)	79 (92)	84 (97)	65 (79)	72 (86)	73 (86)	77 (91)
132	76 (88)	77 (88)	79 (92)	84 (97)		72 (86)	77 (86)	85 (99)
160		78 (89)	79 (92)	84 (97)			77 (91)	85 (99)
200			79 (92)	84 (97)			77 (91)	85 (99)
250			83 (95)	84 (97)				



NOTES

PUMP model	Serial Number	Computer Number	Year of manuf.
.....

LIQUID handled	Capacitym ³ /h	Suction Pressurem	Discharge Press.m	Temperature°C
<input type="checkbox"/> Lethal <input type="checkbox"/> Toxic <input type="checkbox"/> Noxious <input type="checkbox"/> Corrosive <input type="checkbox"/> Irritant <input type="checkbox"/> Malodorous <input type="checkbox"/>				
<input type="checkbox"/> Clean <input type="checkbox"/> Dirty <input type="checkbox"/> With suspended parts	Spec. Gravity.....	Viscosity.....	PH.....	

TOTAL WEIGHTKGs.	MAXIMUM DIMENSIONS 	X =cm Y =cm Z =cm	NOISE (measured at 1 m) Pressure =dB(A) Power =dB(A)
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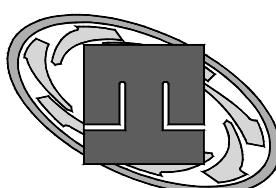
INSTALLATION		SERVICE	
<input type="checkbox"/> Inside	<input type="checkbox"/> Outside	<input type="checkbox"/> Continuous	<input type="checkbox"/> Intermittent

MOTOR type / Frame	No Poles	No RevolutionsRPM	Absorbed powerAmp	Installed PowerkW /HP
FrequencyHz	SupplyVolt	Enclosure IP.....	Insulation class	Absorbed PowerkW /HP

COMMENTS

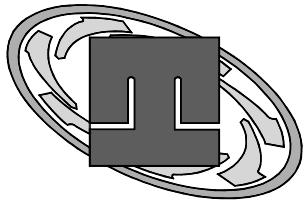
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Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



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pompetravaini

(Rev. 2.2_05-2012)

ITEM 63P5



OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB...

MC... - TC...

TMA



OPERATING MANUAL

INSTALLATION, START-UP AND MAINTENANCE FOR CENTRIFUGAL AND SELF-PRIMING PUMPS

This manual applies to the listed below centrifugal pump series and/or affiliated series:

AT - TBH - TBA - TBK - TBAK

MC - MEC - TCK

TCH / MCU-CH

TCA - TCT - TCD

TMA

All pumps are manufactured by:

POMPETRAVAINI s.p.A.

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Distributor:

WARRANTY: All products manufactured by POMPETRAVAINI are guaranteed to meet the conditions listed on the general terms and conditions of sale and/or conditions listed on the Order Confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual will void the manufacturer's warranty. Guarantee will be preserved only if the pump maintenance is carried out by Pompetravaini or an authorized service. Any modification introduced to the pump without the authorization of Pompetravaini will lead to the loss of the guarantee. If it is strictly necessary to dismantle the pump, please consult Disassembling Instructions on our website "www.pompetravaini.it".



This manual is valid only for the listed pump series. This manual IS NOT for the total installation. Instruction and maintenance manual for the installation must be obtained from the engineer that designed the installation. Furthermore the installation manual will take precedence over the pump manual.



The liquids handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their possible disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for pumps subjected to the ATEX 94/9/CE directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 94/9/CE directive it is available a dedicated integrative manual.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

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KEY TO SYMBOLS

 Indications for the pump preservation	 Signals for the operator's safety. DANGER: indicates imminent conditions of danger of serious harm or death. CAUTION: indicates a possible danger of minor harm.
 Warnings for the environment safeguard	 Magnetic dangers for the operator's safety.
 Warnings for the ATEX Directive 94/9/CE	 Electric dangers for the operator's safety.

1 - GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- pump safe application and operation
- pump installation and maintenance instructions
- pump start-up, operation and stopping procedures.

The pump user must complete the section at the end of this manual where the design conditions for the pump are recorded. The manual must be filed in a safe place and be accessible to the operator and to the maintenance personnel. The qualified personnel responsible for the operation or maintenance of the pump should read CAREFULLY the whole manual before operating or working on the pump. Qualified personnel are those with experience, knowledge and have a good familiarity with the working safety regulations. They usually have knowledge of basic first aid.

The pump is to be used only for the applications specified on the confirming order for which POMPETRAVAINI has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore the pump CANNOT be used for applications other than those specified on the order.

In the event the pump is to be used for different applications, please contact the sales office or representative of the manufacturer. POMPETRAVAINI declines to assume any responsibility if the pump is used for different applications without prior written consent confirmation.

Pumps are for industrial and continual use in installations fit for the purpose by authorized and trained personnel. The use in unfit or unprotected installations, without proper precautions preventing the contact with untrained personnel or children, is strictly forbidden

If the constructive details functioning data of the pump in use aren't available they could be requested to POMPETRAVAINI specifying the pump type and serial number that are printed on the pump nameplate. Always refer to this for further requests of information or replacement components.

The user is responsible for the verification of the ambient conditions where the pump will be stored or installed.

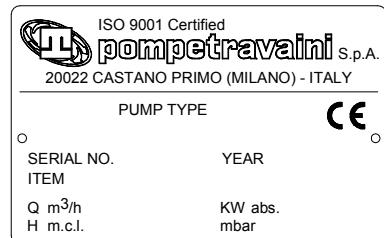
Extreme low or high temperatures may severely damage the pump unless proper precautions are taken.

POMPETRAVAINI does not guarantee repairs or alterations done by user or other unauthorised personnel.

Special designs and constructions may vary from the information given in this manual. Please contact POMPETRAVAINI should you have any difficulty.

NOTE: Drawings appearing in this manual are only schematics and not to be used for construction.

For more specific information contact the Engineering Department of POMPETRAVAINI or the authorised local representative.



2 - SAFETY INSTRUCTIONS



CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS.

Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.

- ALWAYS apply the pump for the conditions outlined on the confirming order.
- Be ALWAYS informed on locations of first aid sites inside the company and carefully read safety and medical first aid prescriptions in force.
- ALWAYS have a fire extinguisher in the vicinity of the pump installation.
- Any work on the pump must ALWAYS be carried out by at least 2 qualified people and expressly authorized.
- Electrical connections on the motor or accessories must ALWAYS be carried out by authorised personnel and in accordance to the local codes.
- When approaching the pump ALWAYS be properly dressed (avoid use of clothes with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done. Also refrain from wearing long and loose hair.
- DO NOT attempt to remove the safety guards when the pump is operating.
- After completion of the work ALWAYS re-install the safety guards previously removed.
- DO NOT operate the pump in the wrong direction of rotation.
- NEVER put hands or fingers in the pump openings or holes.
- ALWAYS disconnect the power to the motor prior to working or removing the pump from the installation.
- Make sure you have taken the necessary steps to prevent a possible inadvertent return of tension.
- Ensure the proper isolation of the components and ground connection before inserting the tension.
- ALWAYS stop the pump prior to touching it for whatever the reason. Wait for the complete pump stopping and make sure that all the installation control devices are properly set in order to avoid any return flow.

- Pump and piping connected to the pump must NEVER be under pressure when maintenance or repair is carried out.
 - NEVER work on the pump when it is hot.
 - NEVER touch pump or piping having temperatures higher than 70°C or lower than -10°C.
 - ALWAYS be careful when handling pumps that convey acids or hazardous fluids.
 - NEVER step on pump and/or piping connected to the pump.
 - ALWAYS make sure that the pump is permanently fixed and steady to the installation (i.e. during removal, handling, installation, etc.)



CAUTION!

Pumps type TCK, TBK and TBAK create a high magnetic field. Personnel should take proper precautions if they are wearing pace-makers or if they are using instrumentation sensitive to magnetic fields.



The listed below minimum distances must be kept:

- When the magnetic rotor parts are disassembled:
users of pace-maker = 2 meters floppy disk; magnetic cards, etc. = 1 meter
 - When the magnetic rotor is mounted in the pump:
users of pace-maker = 1 meter floppy disk; magnetic cards, etc. = 0,5 meter



DANGER!

Possible contact with hazardous media and hazardous substances There are certain components in the pump which may be dangerous to people coming in their contact even during normal operation procedures and/or maintenance, see table 1.



CAUTION!

Danger due to smokes or vapours. In case smokes or vapours are released by the pump do not inhale and immediately stop the pump for inspection.

Tab. 1

MATERIAL	USE	MAJOR RISKS
Oil and grease	General lubrication, ball bearings	Skin and eye rash
Plastic & elastomer components	O-Ring, V-Ring, splash ring, coupling dowels	Smoke & vapours in case of overheating
Teflon & Kevlar fibbers	Packing rings	Release of dangerous powder, release of smoke if overheated
Paints & varnishes	Pump outside surface	Release of powder and smoke if working the painted areas. Flammable
Protective liquid	Pump inside surface	Skin and eye rash

3 - IN CASE OF EMERGENCY

In the event of pump break-down and/or loss of pumped fluid, immediately disconnect the electrical power to the motor (see chapter 11) and contact the responsible personnel in charge of the installation, which should intervene with at least two people paying particular attention to the fact that the pump may be handling dangerous fluids, hazardous to the health and environmentally unsafe.

After the causes for the emergency have been addressed and resolved, it will be necessary to follow the starting procedures (see chapter 10) for the start-up of the pump/motor assembly.

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or come in contact with the human body, immediately follow the instructions given in the company's internal medical safety procedures.

The instructions given in this manual refer to the listed below single stage and multistage centrifugal pumps, horizontal or vertical mounted.

NOTE: Capacities and pressures are approximated and refer to the maximum attainable values for pumps applied in standard conditions at room temperature.

TCH / MCU-CH	Single stage centrifugal pumps for clean liquids designed to DIN 24256/ISO 2858 and 5199 standards - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 16 bar - Flanges PN 16
TCA	Single stage centrifugal pumps for abrasive liquids to DIN 24256/ISO 2858 and 5199 standards - Design with fully open impeller - Capacity to 100 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCT	Single stage centrifugal pumps for very dirty liquids derived from DIN 24256/ISO 2858 standards - Design with open vortex impeller - Capacity to 250 m ³ /h, Max. pressure 7 bar - Flanges PN 16
TCD	Single stage centrifugal pumps for Thermal fluids (Oils) to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 350 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCS	Single stage centrifugal pumps with inspection opening for clean and dirty liquids - Design with closed and open impeller - Capacity to 550 m ³ /h, Max. pressure 4 bar - Flanges PN 10
MEC	Semi-axial centrifugal pumps for large flows of clean and dirty liquids - Design with open impeller - Capacity to 2100 m ³ /h, Max. pressure 4 bar - Flanges PN 10
TCN	Single stage centrifugal pumps for clean and dirty liquids - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 6 bar - Flanges PN 10
TCK	Magnetic drive single stage centrifugal pumps for toxic and contaminated liquids - Designed to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 300 m ³ /h, Max. pressure 16 bar - Flanges PN 16
MILLS	Pumps derived from the series TCH with special mixing impeller
AT	Self-priming multistage centrifugal pumps with dual lateral channel. Low NPSH requirements. Capacity to 31 m ³ /h, Max. pressure 7 bar - Flanges PN 40
TBH	Self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBK	Magnetic drive self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBA	Self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBAK	Magnetic drive self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TMA	Multistage centrifugal pumps for clean liquids, medium and high pressures - Capacity to 45 m ³ /h, Max. pressure 40 bar - Flange inlet PN 16, flange outlet PN 40

The flanges standard (NP 16 or NP 40) does not refer to the maximum pump performance but it indicates the maximum pressure the pump can be subjected to.

For information regarding temperature and pressure LIMITATIONS applicable to the varying designs, types and materials of construction please contact POMPETRAVAINI or your closest authorised representative.

The maximum operating pressure is normally the sum of the suction and discharge pressures.

4.1 - PUMP MODEL NUMBERS AND MATERIALS OF CONSTRUCTION TABLES

Pump nameplate affixed to each pump contains model number, serial number and year of manufacture. Interpretation of pump model number may be attained with the aid of the following table. The pump model is such that it gives information pertaining to the pump type and design.

Listed below are some examples of pump nomenclatures:

Pumps series MC... - TC... = TCH V 50 - 200 A / 1 - C / A3 - M / T	
TCH ⇒ Pump type	1 ⇒ Constructive project number
V ⇒ Vertical mounting	C ⇒ Shaft seal type
50 ⇒ Diameter discharge flange	A3 ⇒ Materials of construction (see table)
200 ⇒ Impeller nominal diameter	M ⇒ Monoblock design with flanged motor
A ⇒ Hydraulic project modification	T ⇒ Special design

Pumps series AT – TB...	=	TBH 315 A / 1 - C / A3 - M / T - V - Z
TBH ⇒ Pump type		A3 ⇒ Materials of construction (see table)
31x ⇒ Pump size		M ⇒ Monoblock design with flanged motor
xx5 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Pumps series TMA	=	TMA 32 - 7 A / 1 - C / A3 - M / T - V - Z
TMA ⇒ Pump type		A3 ⇒ Materials of construction (see table)
32 ⇒ Pump size		M ⇒ Monoblock design with flanged motor
7 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Generic materials for STANDARD CONSTRUCTION: pumps **MC... - TC...**

Description	GS	RA	A3	HC	DU
Casing	Ductile iron			Hastelloy C	ASTM-CN7M
Cover casing					
Impeller	Cast iron	Stainless steel AISI 316 ASTM-CF8M			Incoloy 825
Shaft					
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **AT - TB...**

Description	GH	RA	A3	B2	GP
Casing	Ductile iron			Bronze	Ductile iron
Element					Cast iron
Impeller	Brass	Stainless steel AISI 316 ASTM-CF8M			Brass
Shaft	Stain. steel AISI 420				Stain. steel AISI 420
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **TMA**

Description	F	RA	A3
Casing	Ductile iron		
Stage casing			
Impeller	Cast iron	Stainless steel AISI 316 - ASTM-CF8M	
Shaft	Stainless steel AISI 420		
Bearing frame		Cast iron	

For detailed information on materials of construction, (standard or special) for pumps TCD, TCK, MEC, TBK and TBAK please contact POMPETRAVAINI or your local representative.

In case the metallic pump wetted parts come into contact with aggressive liquids it is recommended to stick to the following limitations:

- pH limit for Cast Iron and Ductile Iron ≥ 6
- pH limit for Stainless Steel ≥ 2,5

The above values are approximate and refer to ambient temperature. It is recommended to contact POMPETRAVAINI for doubts, particular conditions or in case different materials are used.

5 – UNPACKING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt verify that the material received is in exact compliance with that listed on the packing slip.

When unpacking follow the instructions listed below:

- Check that no visible damage exists on the crate that could have occurred during transport
- Carefully remove the packaging material
- Check that pump/or accessories such as tanks, piping, valves, etc. are free from visible markings such as dents, scratches and damage which may have occurred during transportation
- In the event of damage, report this immediately to the transport company and to POMPETRAVAINI's customer service department.

DANGER!

Danger due to cut, prick or abrasion Take immediate actions to dispose of possible packaging parts that may generate injuries or risks (for example edges, nails, splinters, etc.)



We remind that the single stage centrifugal pumps supports contain lubricating oil.

Organize the right management of materials subjected to controlled and differentiate disposal (for example plastic, cartoon, polystyrene materials, etc.) according to the laws into force and to a safe local environment management. according to the laws into force and to a safe local environment management.

If the pump will be stored, as foreseen in our Operating Manuals, we recommend a proper care to avoid oil dropping on the ground.

The pump must ALWAYS be moved and transported in the horizontal position.

Before transportation check on the nameplate, in the transportation and technical documents for:

- total weight
- centre of gravity
- maximum outside dimensions
- lifting points location.

DANGER!

Danger due to overturning or crushing For a safe lifting it is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts with correct movements, to prevent material damages and/or personal injuries.

The fig. 1 shows several additional examples of lifting.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 2).

Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage.

The fig. 3 shows several additional examples of lifting to be avoided.

CAUTION!

Possible contact with fluids or harmful substances. Before removal after a period of operation, the pump, together with auxiliary piping and jacketing, must be drained and decontaminated from the handled media.

Every hole and opening communicating with the inside of the pump must be properly plugged.

For removing the pump from the installation see chapter 17. Operate provided with apposite protective devices.

6 - STORAGE INSTRUCTIONS

After receipt and inspection the unit, if not immediately installed, the unit must be repackaged and stored in the best way.

For a proper storage proceed as follows:

- store the pump in a location which is closed, clean, dry and free of vibrations
- do not store in areas with less than 5°C temperature (for lower temperature it is necessary to completely drain the pump of any liquids which are subject to freezing)

POSSIBILITY OF FREEZING!

Where the ambient temperature is less than 5°C it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

It is possible to use as antifreeze a mixture of surface-active glycol or other suitable products making sure they are compatible with both pump gaskets and elastomer.

- fill the pump with a rust-preventative liquid that is compatible with the pump gaskets and elastomer. Rotate the shaft by hand to impregnate all internal surfaces. Drain the excessive liquid from the pump and associated piping (see chapter 11).

Please note that the pumps with cast iron internal parts have been treated at the factory, prior to shipment, with a rust-preventative liquid: this liquid is capable of protecting the pump against rust for a period of 3 to 6 months.

A further solution, for long term storage, is to fill the pump with the rust inhibitor, rotate the pump shaft by hand to eliminate any air pockets (the liquid must be suitable with gasket, elastomer and pump materials).

- plug all openings that connect the pump internals to the atmosphere
- protect all machined external surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up or seizing
- keep the pump in a dry and clean place not subjected to vibrations caused by other sources
- any pump accessories should be subjected to similar procedure.

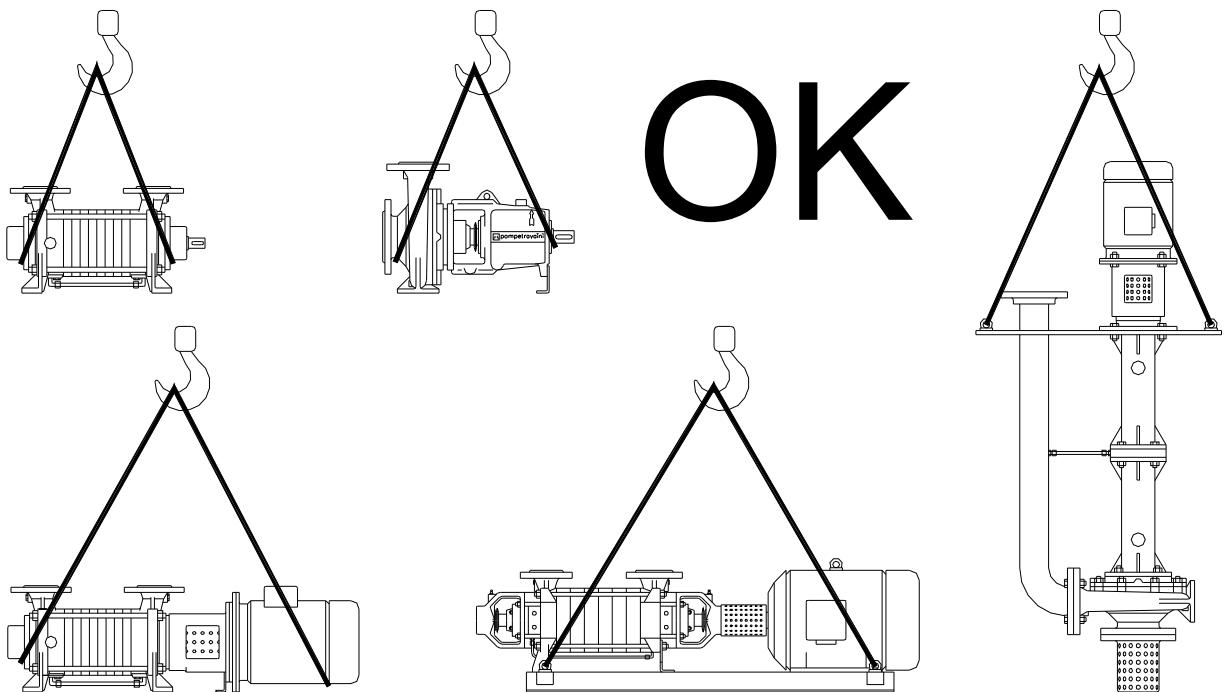


Fig. 1

Fig. 2

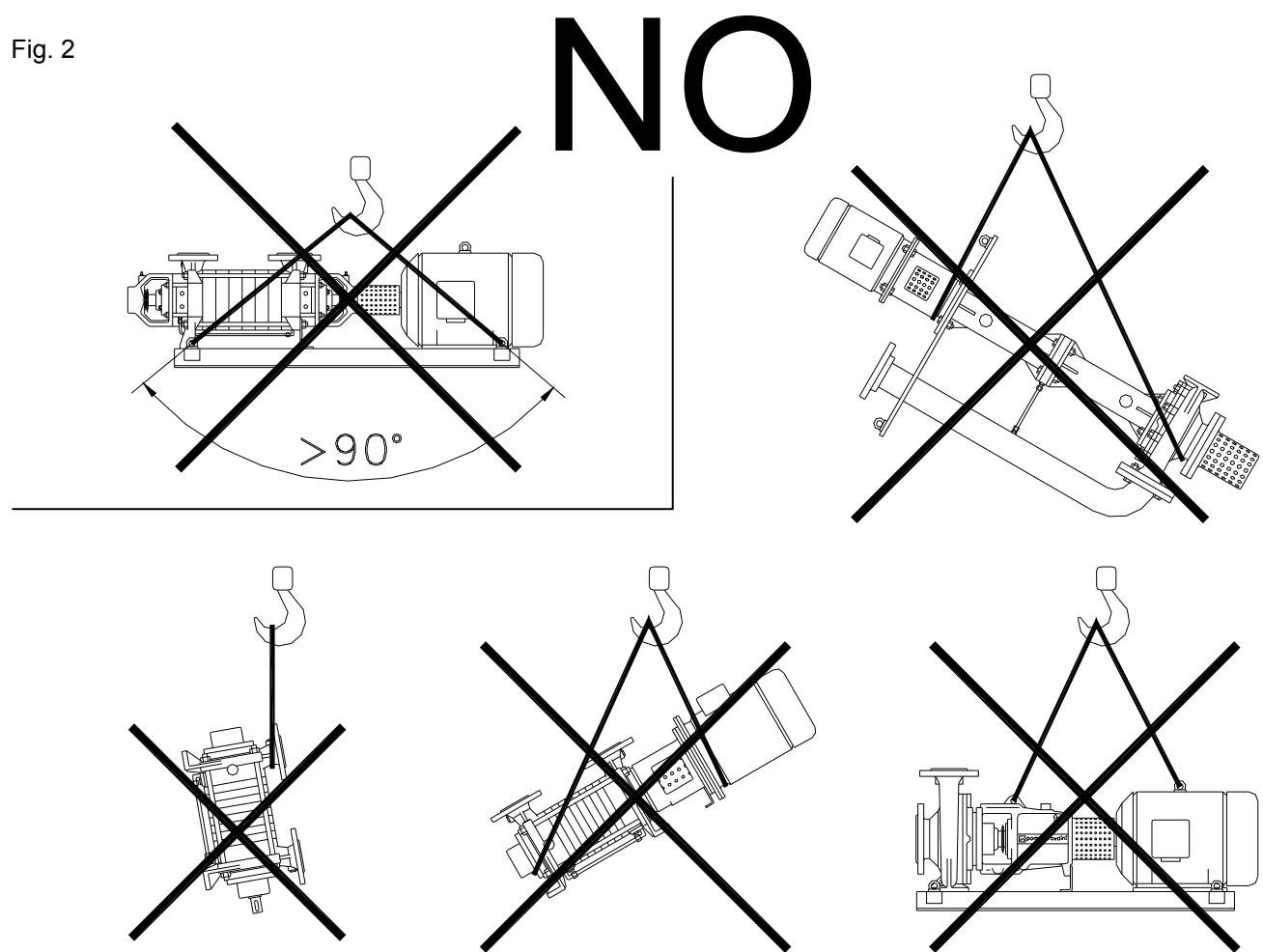


Fig. 3

CAUTION!

Avoid installing the unit in narrow areas and lacking of ventilation where unfavourable conditions for the personnel may take place. Allow the personnel a good visibility of the pump assembly by providing a proper lighting.



A proper pump installation must not transmit vibrations to ambient in the permanent presence of personnel.

Information to determine the piping sizes and floor space requirements can be obtained from dimension drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of all connections for flushing, cooling, heating, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to following chapters 7.1 - 7.2 - 7.3.

Proper lifting devices should be available for installation and repair operations.

Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made.

It is important to have proper room around the unit for ventilation of motor. Avoid installing the unit in hidden locations, dusty and lacking of ventilation.

Pump/motor assembly should not be installed in narrow areas, dusty, toxic and explosive ambient. In the event this is not possible it is recommended to ventilate the areas to help cooling the motor (minimum 0,6 metres of empty room around). All components used in the installation should comply with the safety codes. The installation must not transmit vibrations to the pump.

Select a mounting pad that will minimise vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams.

It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 4).

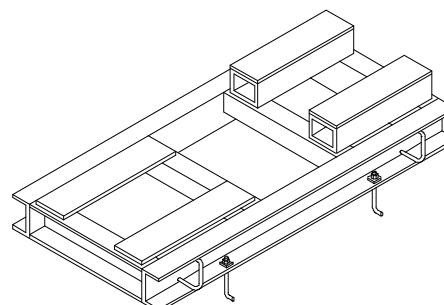
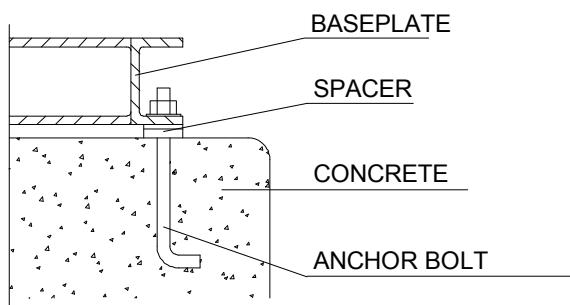


Fig. 4

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

7.1 - INSTALLATION OF PUMP/MOTOR ASSEMBLY

Place the pump assembly on the foundation pad aligning the anchoring bolts.

If necessary use metal spacers to level the unit and check the flange connection for good horizontal and vertical planes.

Tighten the foundation bolts.

Check again the level of the assembly and proceed with the pump/motor alignment verification as discussed in paragraph 8.2.

In cases where the pump is installed on a baseplate separated from that of the motor (due to expected piping forces, moments or as it often is in cases of large units) it is recommended to first install the pump and then proceed with the motor installation and alignment.

7.2 - SUCTION AND DISCHARGE PIPING

Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction (see fig. 5) and discharge flanges, the service liquid line and all other service connections.

CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Pay maximum attention to the proper connection of the system pipelines to the respective pump's connections.

Operate only provided with apposite protective devices.

To prevent the introduction of any limb in the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up.

Inlet and discharge piping should be of same size as the pump flanges, where possible increase the pipe size but NEVER decrease the size.

In general the liquid velocity in the suction piping should not exceed 2 m/s and in the discharge piping should be less than 3 m/s. Higher liquid velocities will result in higher pressure drops which could create cavitation in the suction piping and excessive pressure losses in the discharge piping, which would negatively affect the system performance and the pump.

Where possible, avoid using piping turns and especially short radius elbows.

When using larger pipe sizes than the nominal, the reduction from a larger diameter to a small diameter should be gradual and with conical configuration, the length of the conical area should be 5 to 7 times the difference in size of the two diameters.



Piping should always be supported to neutralise any forces, moments, piping weights, thermal expansions, etc. which could create pump/motor misalignment, deflections and overloading to foundation bolts.

Pipe joints should be by means of flanges with flange gaskets of proper size and material.

Flange gaskets should be properly centred between the flange bolts so that there is no interference with the flow of the liquid.

There should not be any tensions, deformations or misalignment of the piping when loosening the bolts holding the flanges together.

Any thermal shocks and/or excessive vibrations should be controlled by means of expansion joints, flexibles, etc. having same size as the piping.

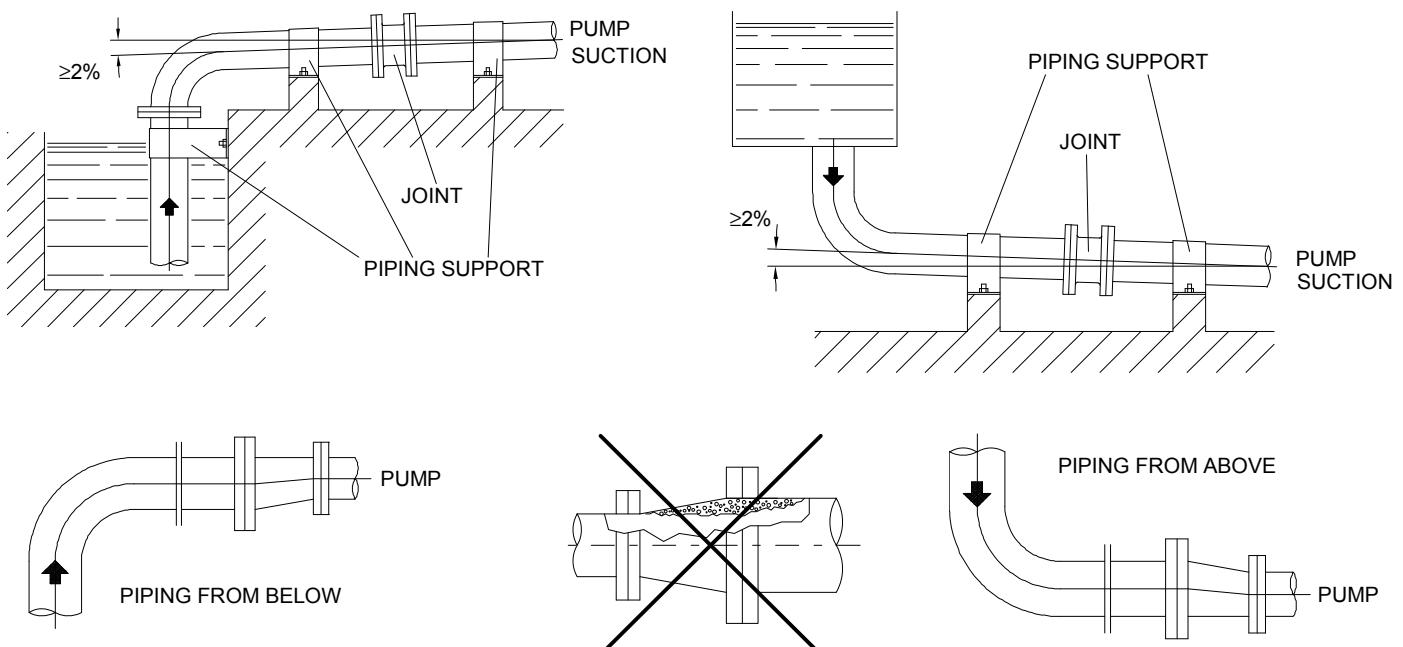


Fig. 5

7.2.1 - Suction piping (see fig. 5 and 6)

To prevent loosing pump priming absolutely avoid formation of air pockets in the suction piping. This piping therefore should have a slope toward the reservoir in the case of suction lift installation, and toward the pump in the case of the flooded suction installation.

Isolating valve should only be on the fully open or fully closed positions and NEVER as a flow regulator. The valve should be installed with the stem in the horizontal position relative to the flow in the piping and at a distance from the pump suction flange of at least 10 times the pipe size.

Depending upon the application, a non return valve or a foot valve should be fitted in the suction piping, a strainer or filter will prevent solids from entering the pump and a pressure or vacuum gauge will enable reading the pump inlet pressure.

All components listed above will create pressure drops which must be taken into consideration in the design stage.

Where more than one pump is installed, every pump should have its own separate suction piping; if a stand-by pump is installed the two inlets can be connected to a common manifold with a single suction piping.



For pumps series TBA, in case of negative suction (from well) and only if NOT provided with check valve or foot valve, contrary to what above indicated it should be necessary that the suction piping will have a slope toward the pump.

7.2.2 - Discharge piping (see fig. 6)

Right after the pump discharge flange install a non return valve will stop dangerous water hammer which could seriously damage the pump discharge casing, a flow regulating valve (Globe or Needle valve), a pressure gauge can be connected to the threaded connection under the pump discharge flange, a vent valve should be fitted in this piping to fill pump and piping for initial start-up.

7.2.3 - Piping cleaning



CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Operate only provided with apposite protective devices.

Before installation start-up clean piping and any reservoirs removing loose materials and foreign particles.

Particular attention for cleaning should be for installations where welding of piping and components has taken place.

7.2.4 - Pressure testing

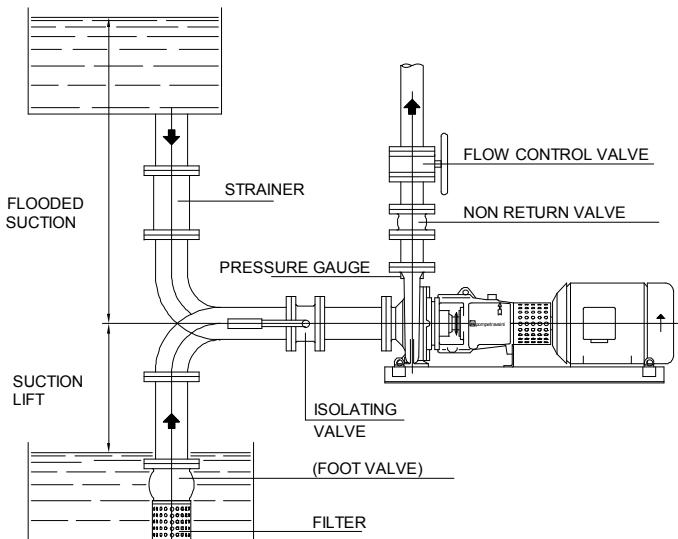


DANGER!

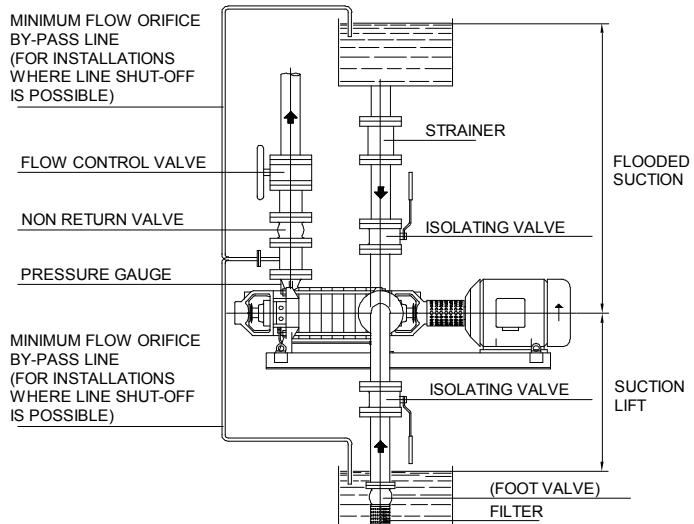
Danger due to fluids in pressure. Carry out sealing tests provided with apposite protective devices.

When the installation has been completed it is necessary to test the piping for both static pressure and vacuum.

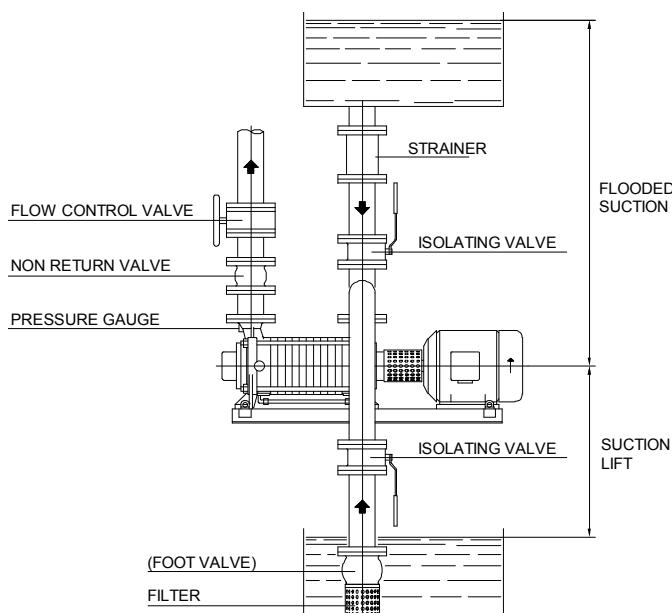
Testing should be carried out in accordance to the applicable standards for the piping function and the operating pressures.



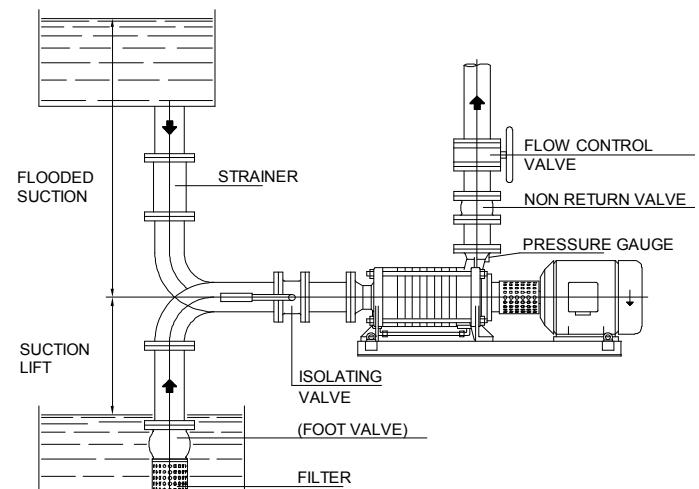
Pump series MC... - TC...- MILLS



Pumps series TMA

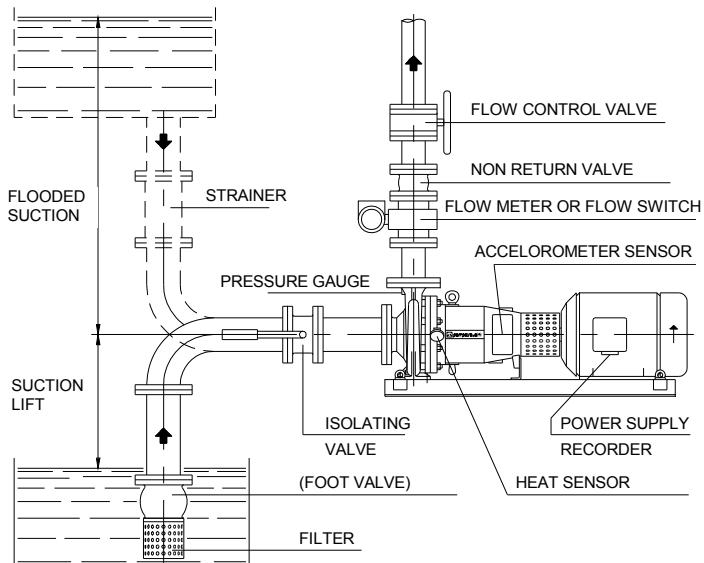


Pump series AT - TBH - TBK

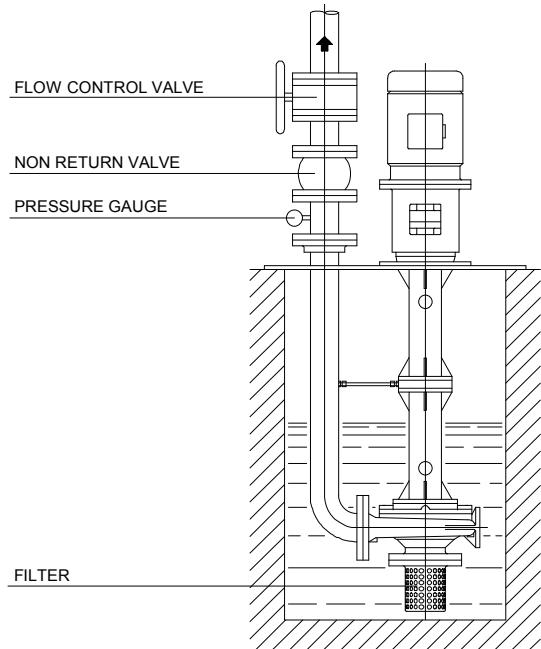


Pump series TBA - TBAK

Fig. 6A



Pump series TCK



Pump series MC... - TC... - VERTICAL construction

Fig. 6B

7.3 - ACCESSORIES AND AUXILIARY CONNECTIONS

Depending on the application accessories may be installed to test the pump performance (instrumentation to measure pressure, temperature, capacity, etc.) and/or for necessary operations (cooling, heating, flushing of seals, etc.). When accessories are required the following should be considered:

- a) Pressure and vacuum gauges must be properly anchored and connected at the measuring points located at pump flanges or near the flanges, using approx. 8 mm. diameter tubing with "pig tail" configuration to alleviate pressure fluctuations.
For safety purposes, isolating and vent valves should be fitted before these instruments (see fig. 7).
- b) Temperature gauges should be installed with thermowells selected for the specific purpose and fitted in strategic locations where the reading is required (see fig. 8).
- c) Every pump is fitted with draining connections at the pump casing. If required, pump drain and mechanical seals leakages can be piped to a container located nearby on the floor or (if available) to the drain catch basin for the total installation.
The pump draining piping should be fitted with an isolating valve and both should be suitable for the pumps maximum operating pressure.
- d) Cooling, heating, flushing of mechanical seals and other piping must be connected only to the designated connections located on the pump (see fig. 9-10-11-12 and chapter 15 for more details).
All tubing and connections must be a minimum of same size as the connection on the pump.
Insulation, if required, must be limited to the pump body, leaving all other components such as bearing frame and motor uncovered for heat dissipation.
- e) Controlling the minimum capacity.

When the pump operates near the shut-off with almost no flow, almost all the motor power is transformed into thermal energy which is absorbed by the pumped liquid.

If the capacity is less than the minimum recommended (10-15% of pump capacity at its best efficiency point) not only will there be excessive load on the pump support and bearings but the liquid could evaporate resulting in damage to the impellers and wear rings with possibility of the pump seizing.

To prevent these problems it is recommended the installation of a minimum flow valve in the discharge piping, right after the pump but before the flow regulating valve.

In the event the flow regulating valve being excessively throttled or even completely closed, there will always be the required minimum liquid flow recirculated from the pump discharge to the suction piping of the pump.

The other device which may be fitted in this by-pass line (from pump discharge, before flow regulating valve, to pump suction) is a calibrated orifice sized for the minimum liquid flow required by the pump.

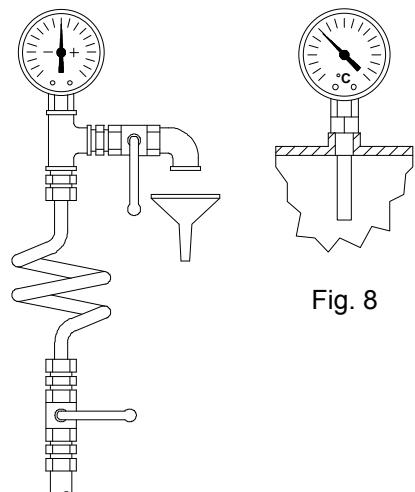


Fig. 8

Fig. 7

- f) Pumps with magnetic drives (series TBK, TBAK, TCK), should be fitted with a temperature sensor to monitor and register the temperature in the area of the magnetic coupling. Pumps are fitted with a threaded connection for this purpose.
- g) To prevent pumps running dry it is recommended to install, in the pump discharge line, a flow meter to check that there is a constant liquid circulation in the piping.
- h) Fitting of a power meter will help analyzing the operation of the pumps. Knowing the minimum and maximum power absorbed by the operating pumps will help identifying problems that may be caused by dry running, siphoning, etc.
- i) Accelerometers fitted on the bearing housing near the bearings, will help with the reading of the vibrations. An analysis of the vibration diagram, direct or indirect, would provide a diagnostic to prevent mechanical breakdowns, such as hydraulic cavitation.
- j) It is recommended to start the magnetic pumps and all other pumps with more than 4 KW motor drive, with Soft-Starters or Delta-Star connections. Further information may be found in chapter 9 and in paragraph 19.1 of chapter 19.

LEGEND for figures 9-10-11-12

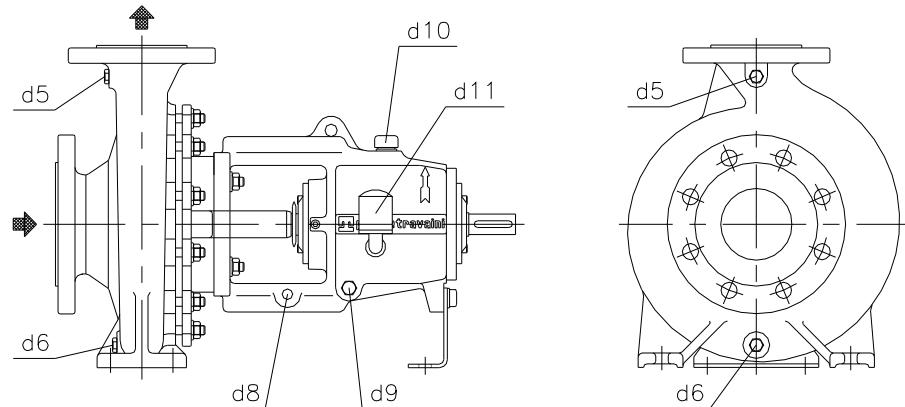
- d1.1 Threaded connection - "double tandem" mechanical seal flushing inlet from outside
- d1.2 Threaded connection - "double tandem" mechanical seal flushing outlet
- d2.1 Threaded connection - mechanical seal chamber cooling/heating liquid inlet
- d2.2 Threaded connection - mechanical seal chamber cooling/heating liquid outlet
- d3.1 Threaded connection - flushing liquid inlet from outside for "double back to back" mechanical seal or for single mechanical seal construction
- d3.2 Threaded connection - "double back to back" mechanical seal flushing liquid outlet
- d4.1 Threaded connection - casing cooling/heating chamber liquid inlet
- d4.2 Threaded connection - casing cooling/heating chamber liquid outlet
- d5 Plugged connection - for manometer
- d6 Plugged connection - for pump casing drain
- d7.1 Threaded connection - packing seal flushing liquid inlet from outside
- d7.2 Threaded connection - packing seal flushing liquid outlet from outside
- d8 Threaded connection - for seal leakages recovery
- d9 Plugged connection - bearings oil drain from housing (on request only)
- d10 Plug with dipstick for bearings oil filling into housing
- d11 Constant level oil filler (on request only) or Oil level gauge (standard)
- d12 Threaded connection - mechanical seal flushing liquid inlet from outside (on request only)
- d13 Grease nipple
- d14 Plugged connection - air-hole mechanical seal chamber
- d15 Plugged connection - sludge discharge from mechanical seal chamber (only for TCD/2-SP)
- d16 Threaded connection - tank liquid discharge (only for TCD/2-SP)
- d17 Threaded connection - for tank (only for TCD/2-SP)
- d18 Threaded connection - to check oil leaks from bearing (only for TCD/2-SP)
- d19 Threaded connection - thermometric probe
- d20 Plugged connection - filling
- d21.1 Threaded connection – "Quench" liquid inlet
- d21.2 Threaded connection – "Quench" liquid outlet

Plugged connection = Plug to be removed in case of use

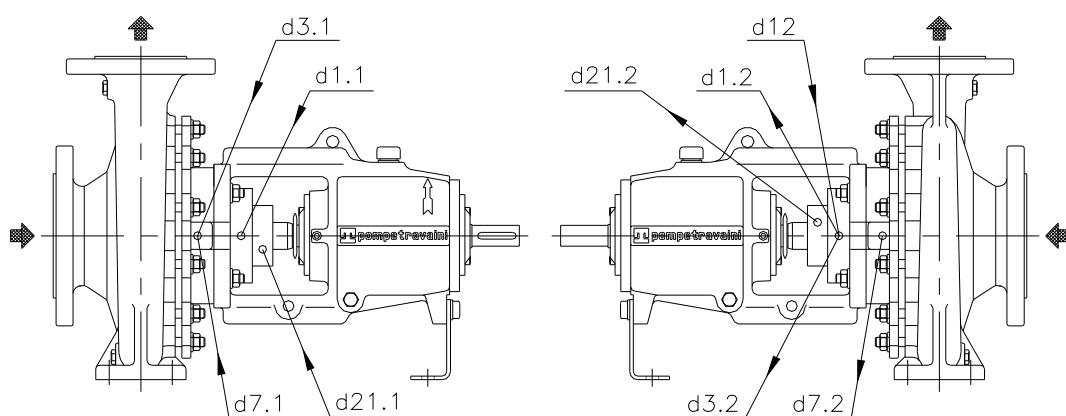
Threaded connection = Before connecting remove the plastic protection plug

For each pump specific connections dimension please consult our website "www.pompetravaini.it".

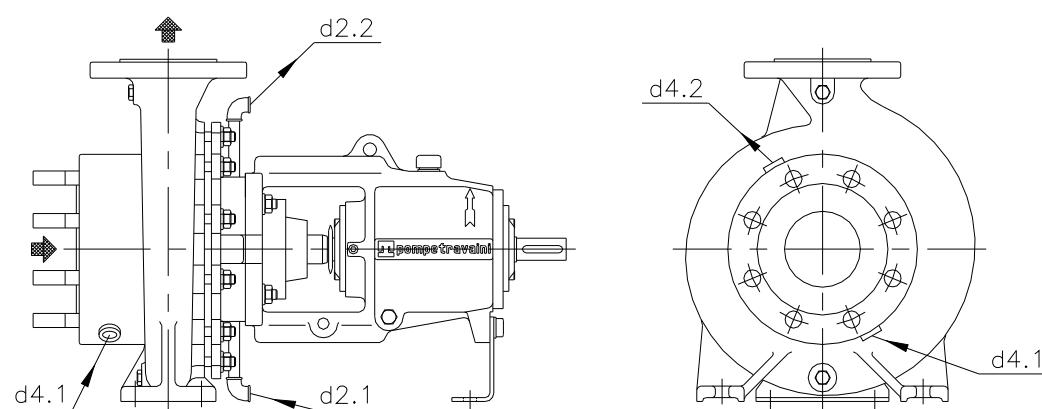
Fig. 9 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
Standard connections and hook-ups

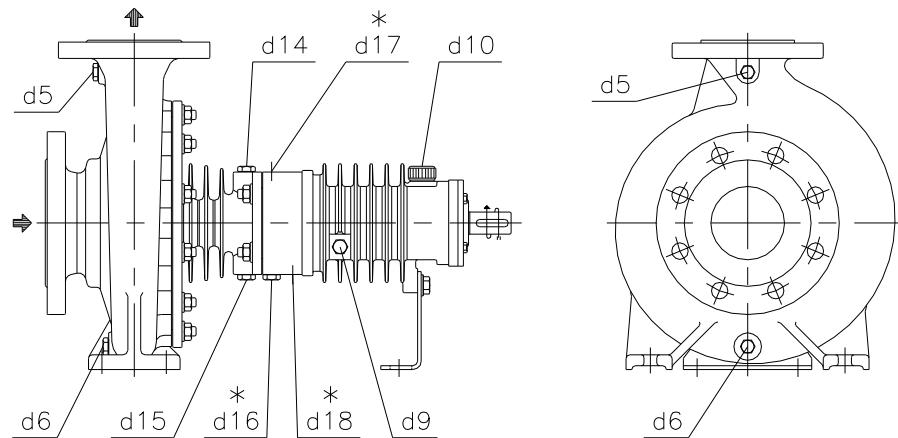


Pumps series MC... - TC...
Connections for designs /C - /R - /RR - /R2 - /B

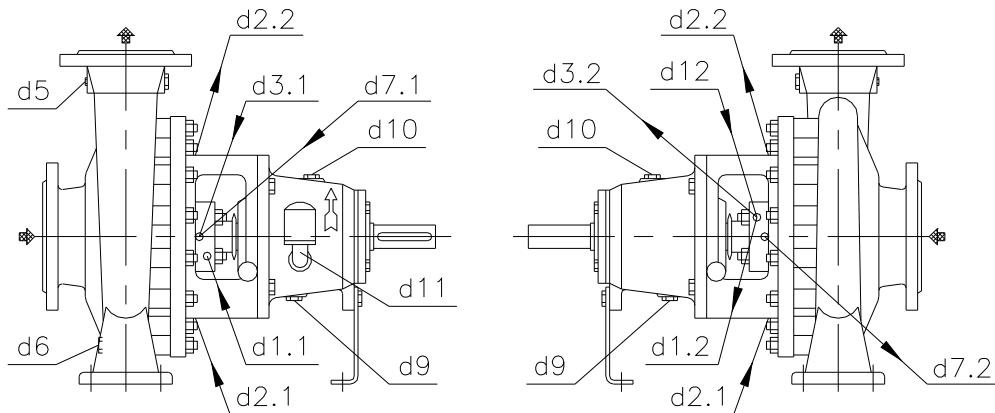


Pumps series MC... - TC...
Connections for designs /T - /U2

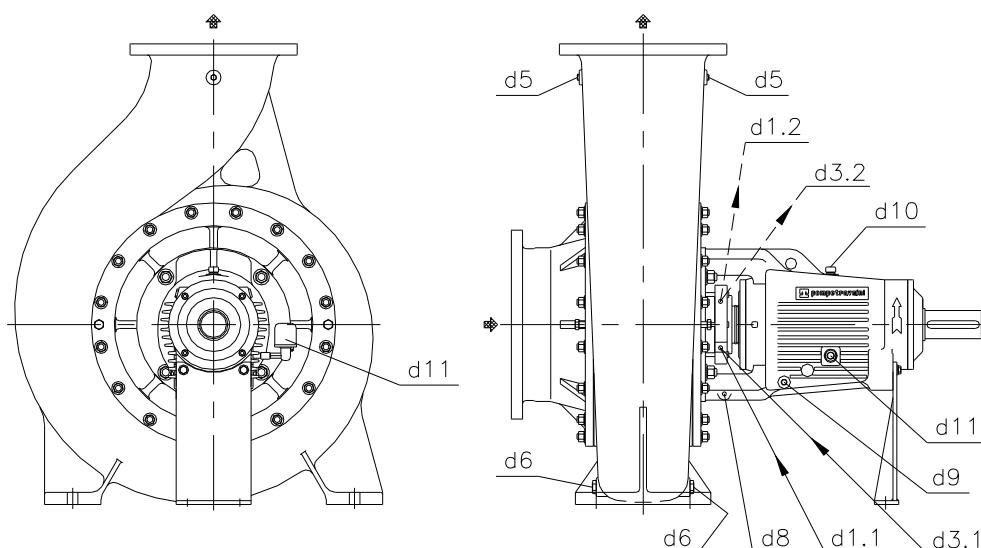
Fig. 10A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TCD
Standard hook-ups and connections - (* Only for TCD/2-SP)

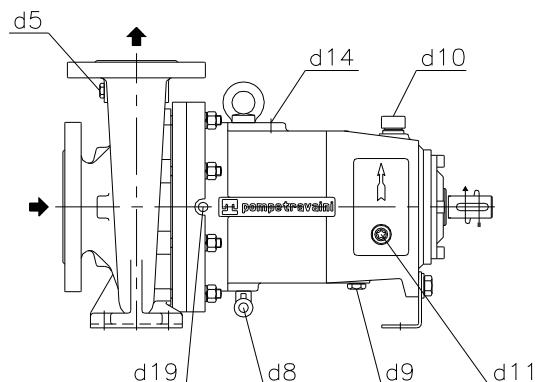


Pumps series MCU-CH n.s. group 3 and 4
Standard hook-ups and connections

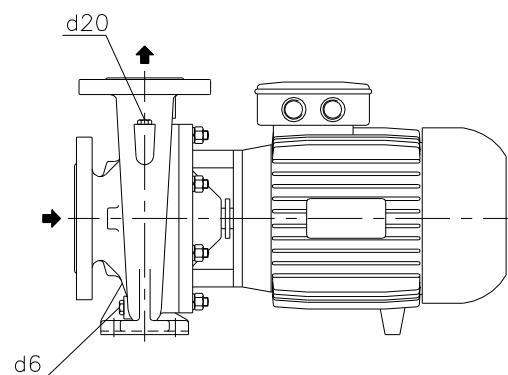


Pumps series TCH and TCN group 5
Standard hook-ups and connections for Double back to back mechanical Seals

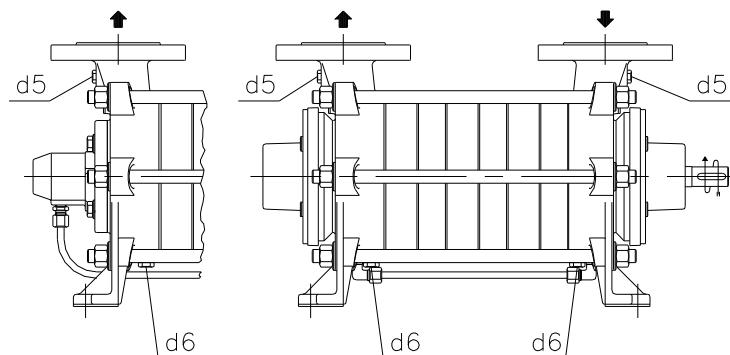
Fig. 10B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



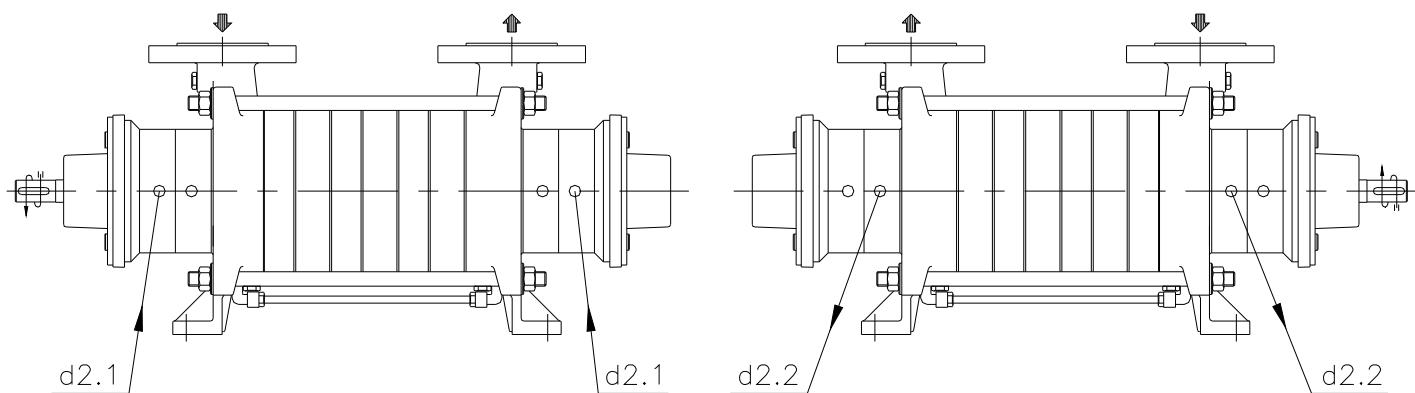
Pump series TCK
Standard connections and hook-ups
NOTE: d19 = on both side for gr. 2



Pump series MCM
Standard connections and hook-ups

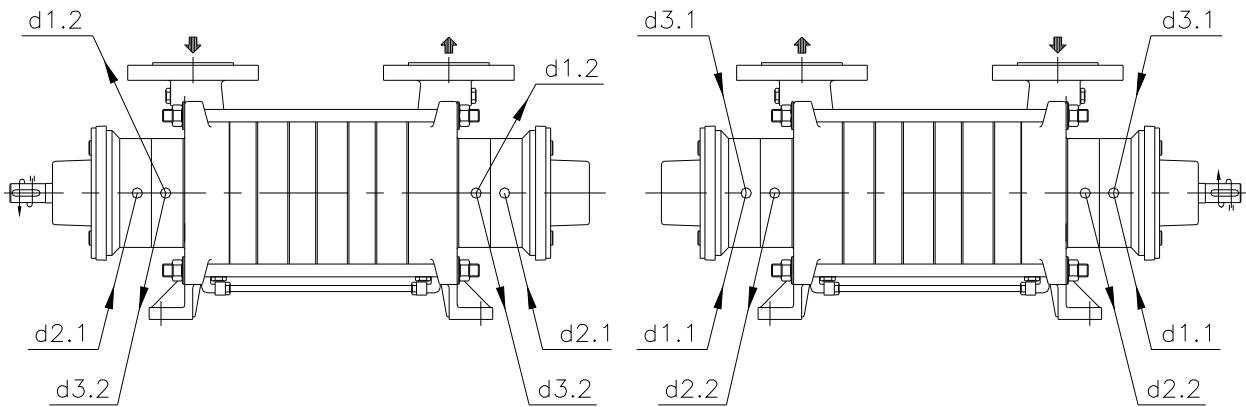


Pumps series TBH/C - TBH/KC - AT/KC - TBA/C
Standard hook-ups and connections

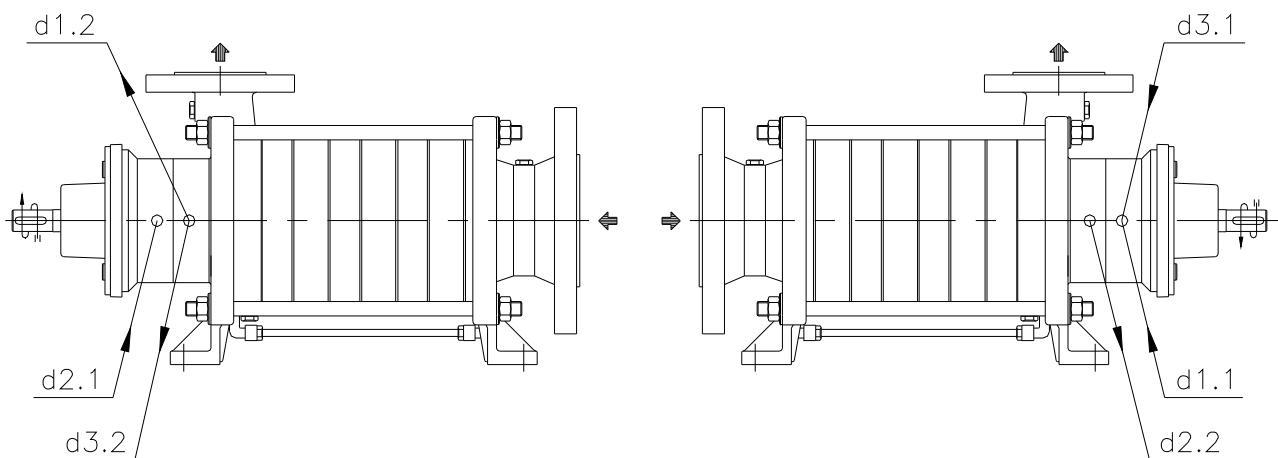


Pumps series TBH/CT - AT/CT
Connections for cooling or heating

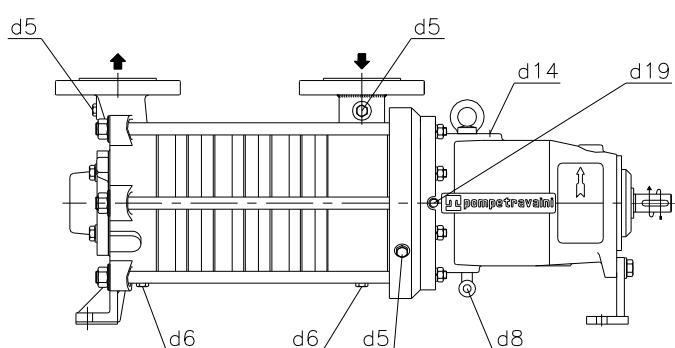
Fig. 11A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



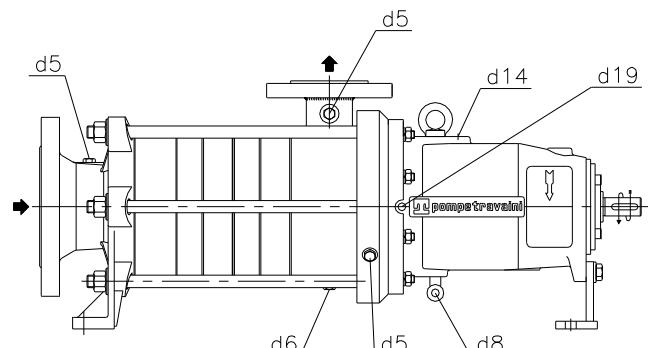
Pumps series TBH/KC-2T - AT/KC-2T
Connections for mechanical seals flushing, cooling or heating



Pumps series TBA/C-2T
Connections for mechanical seals flushing, cooling or heating

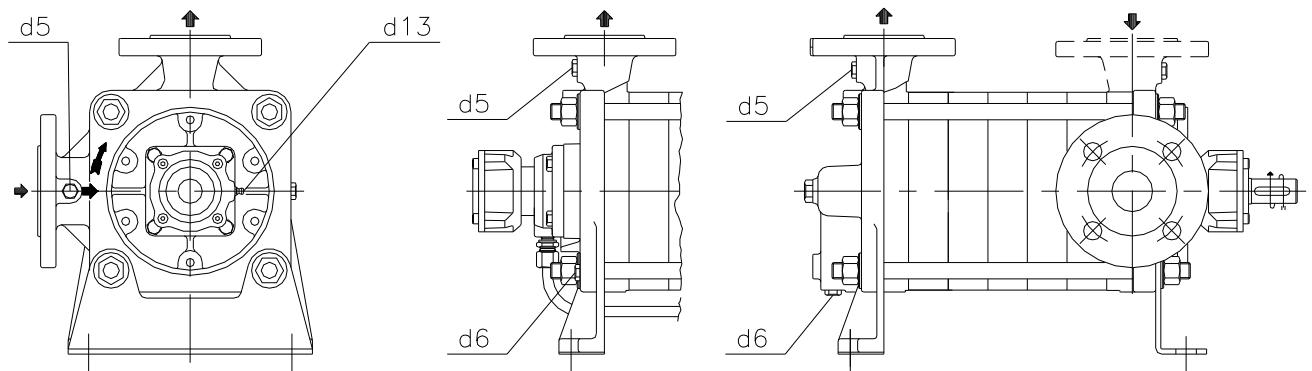


Pump series TBK
Standard connections and hook-ups

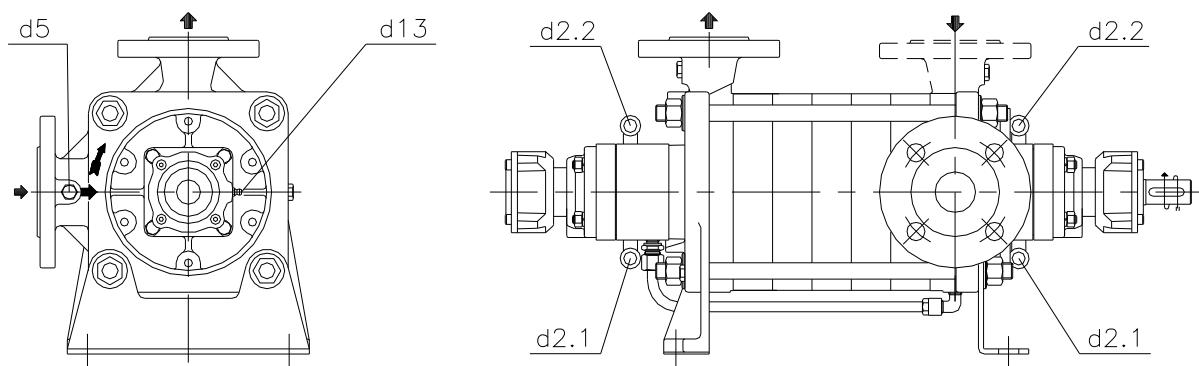


Pump series TBAK
Standard connections and hook-ups

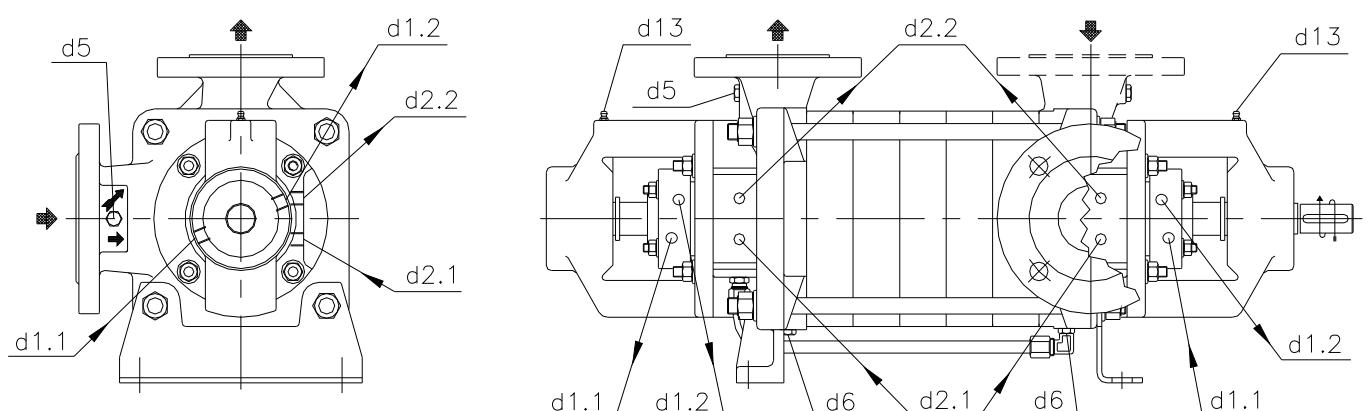
Fig. 11B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TMA 31 and 32/C and /R
Standard hook-ups and connections

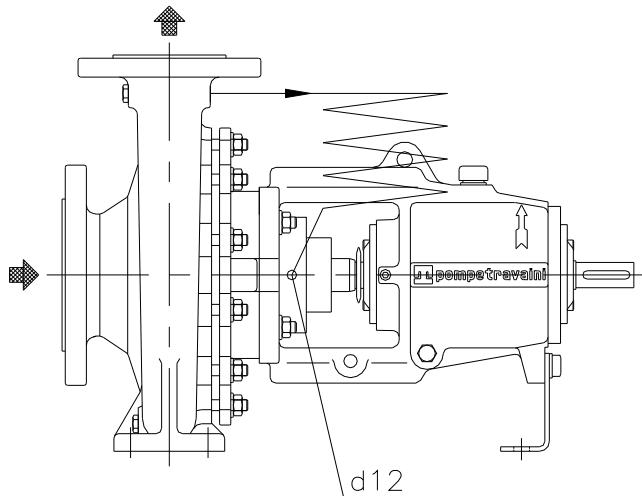


Pumps series TMA 31 and 32/T
Connections for cooling or heating



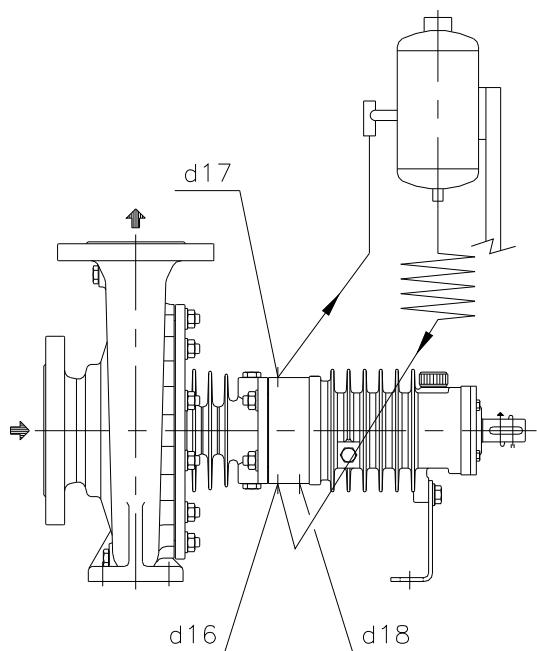
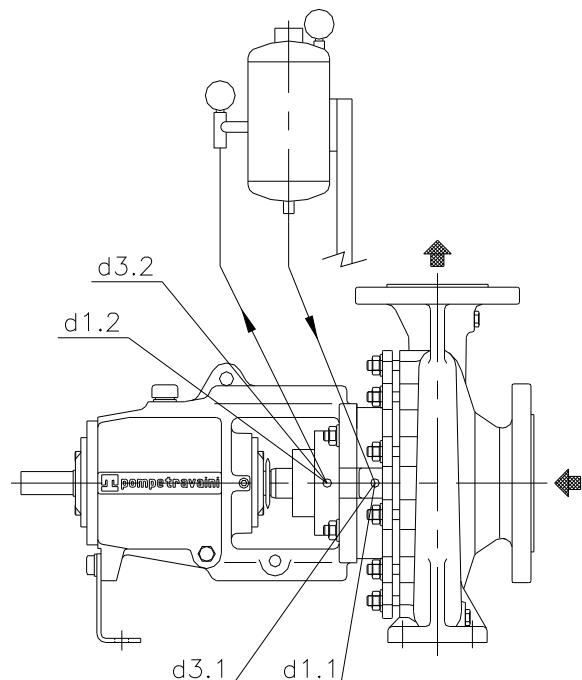
Pumps series TMA 40 and 50/B - /R - /R2
Connections for mechanical seals flushing, cooling or heating

Fig. 12 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
(API Plan 11) Recycle directly from pump casing or via cooling

Pumps series MC... - TC...
Single or Double mechanical seal flushing with Seal Tank



Pumps series TCD/SP
Mechanical seal flushing with Seal Tank

DANGER!

 Danger of collision, harm and crushing! Do not start up the pump without the needful guards on both coupling and motor. The coupling procedures must be carried out when the pump is stopped, after having activated the safety procedures to prevent an accidental start-up (also see chapter 2). Operate provided with apposite protective devices (helmet, glasses, gloves, etc.).

8.1 - MONOBLOCK PUMP/MOTOR AND PUMP/MOTOR ASSEMBLY MOUNTED ON A BASEPLATE

If the pump has been furnished with bare shaft end (i. e. without motor) it is required to procure a proper baseplate on which to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid "U" shaped channel (fig. 15 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit.

Selection of motor must consider the following data at running condition:

- maximum power absorbed by the pump over the total operating range
pump operating speed (RPM)
- available power and network frequency (hertz, voltage, poles, etc.)
- motor enclosure type (CVE, ATEX, etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

Flexible couplings are selected considering:

- nominal motor horse power
- motor operating speed
- coupling guard must meet safety standards
 - possible pump damaging.

 Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 8.3 steps 1, 2, 4, 5, 6.

Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 8.3 steps 7, 1, 8, 5, 9, 10, 11.

For pump driven with V-BELT, please consult POMPETRAVAINI for possible information.

8.2 - ALIGNMENT PROCEDURE FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE

The pump/motor assembly is properly aligned by POMPETRAVAINI prior to shipment.

It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK DESIGN see paragraph 7.3 steps 3, 4, 5, 6.

For alignment procedure of BASEPLATE DESIGN see paragraph 7.3 steps 7, 5, 9, 10, 11.

PLEASE NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by POMPETRAVAINI as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

8.3 - ALIGNMENT INSTRUCTIONS

Alignment should be done at ambient temperature.

Do not try to force the fitting of the coupling onto the shaft. First remove the elastomeric dowels and then heat up the half coupling up to 150°C (do not use microwave ovens).

Should the pump operate at high temperatures which could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures.

The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper keyway slots and fit the coupling halves in line with the shaft ends. The use of a rubber hammer and even pre-heating of the metal half couplings may be required (see fig. 13). Lightly tighten the set screws. For monoblock versions make sure to tighten the connecting screws between lantern and motor as explained hereinafter.

Verify that both pump and motor shafts rotate freely.

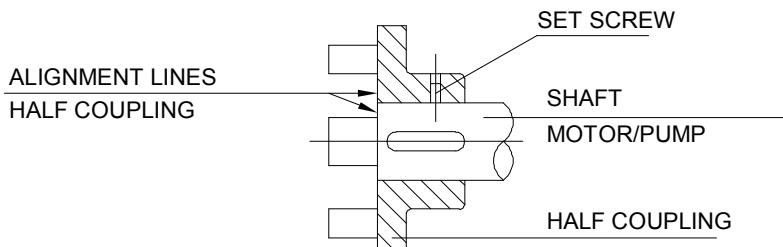


Fig. 13

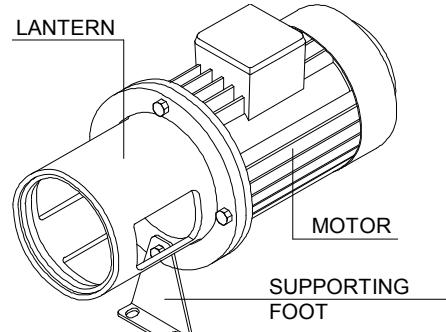


Fig. 14

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 15) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 14). When tightening the connecting screws between lantern and motor make sure not to force the two half-couplings until they touch each other. If this occurs remove the motor, axially move the half-coupling on the shaft and repeat the fixing procedure.

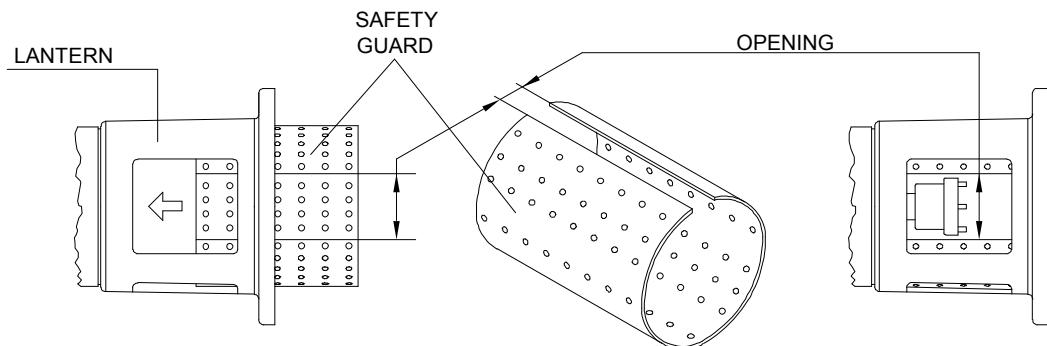


Fig. 15 - PREPARATION TO ASSEMBLY ON MONOBLOCK DESIGN

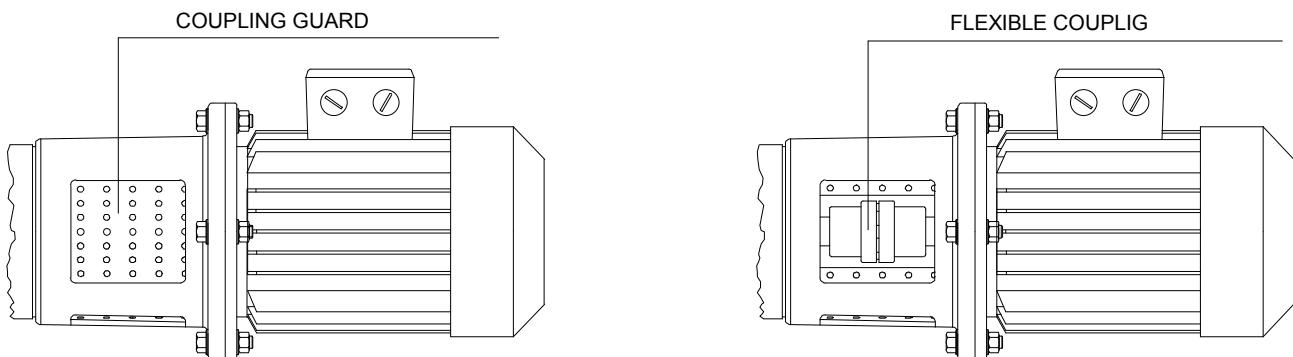


Fig. 16 - CHECKING ALIGNMENT ON MONOBLOCK DESIGN

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 16).

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a proper spacer check the distance between the two coupling halves. The gap value "S" should be as listed on table 2 or as given by the coupling manufacturer. In the event an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap "S" (see fig. 20). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

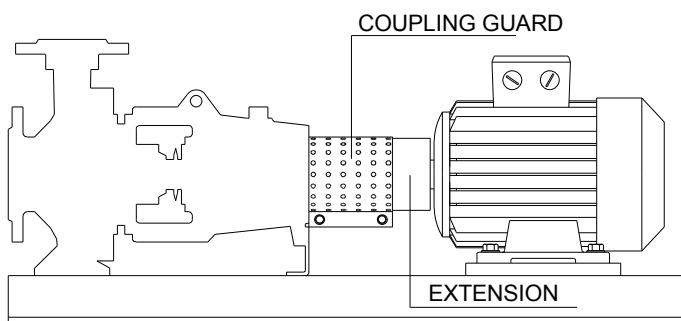


Fig. 17 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 17 and 18).

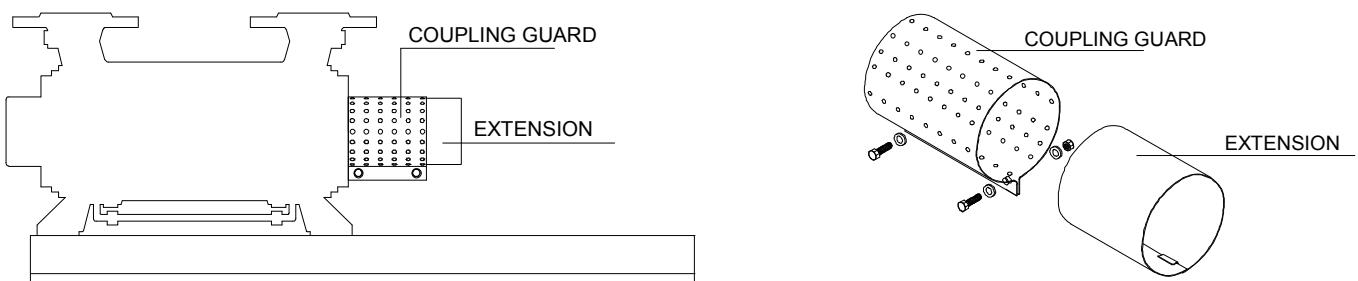


Fig. 18 - MOUNTING THE UNITS ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2 mm. gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 19).

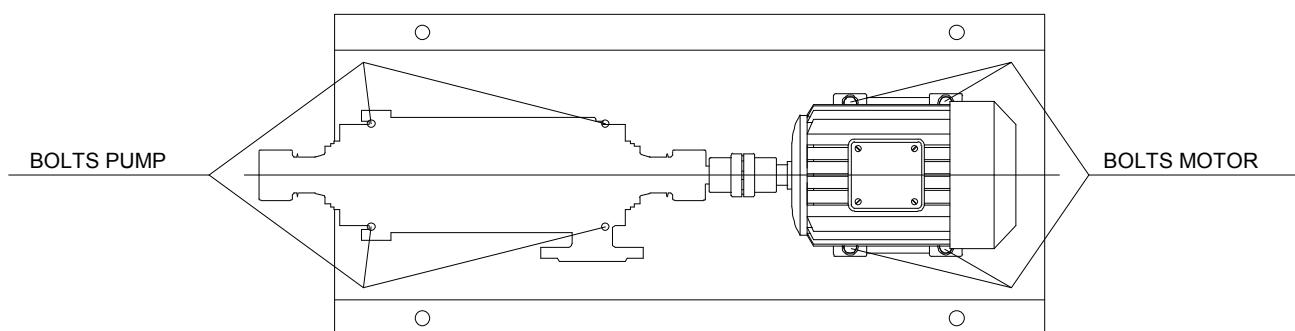


Fig. 19

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 21).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

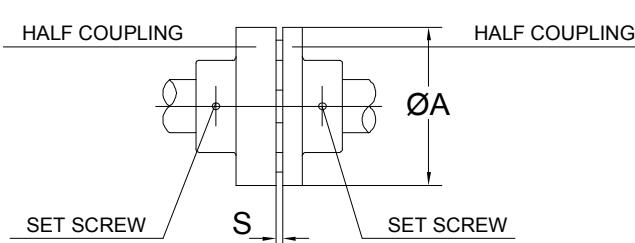


Fig. 20

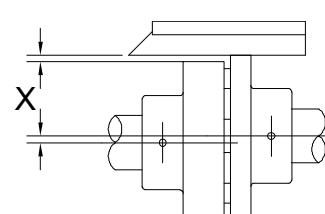


Fig. 21

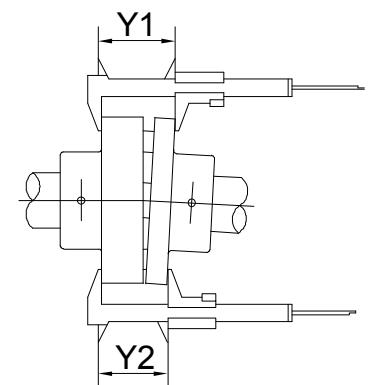


Fig. 22

If the maximum value of "X" is higher than that listed in the tab. 2 (for the given coupling size) it will be required to correct the alignment by using decimal shims under the pump or motor feet (NOTE: the optimal values have to be considered half of the reported data).

When the measured values fall within the tolerances the pump and motor anchoring bolts can be tightened.

10 - Angular misalignment can be measured with a Calliper. Measure the outside coupling dimension at several points (see fig. 22).

Find the minimum and maximum width of the coupling, the difference between these two readings "Y" ($Y_1 - Y_2$) should not exceed the value listed in tab. 2 for the given coupling size (NOTE: the optimal values have to be considered half of the reported data). Should this value be greater it will be necessary to correct the alignment by re-shimming the pump and/or motor.

Following this operation it is recommended to check once more the value "X" to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Tab. 2

COUPLING "Ø A" mm	GAP "S" mm	PARALLEL "X" mm	ANGULAR "Y" mm
60 ÷ 80	2 to 2,5	0,10	0,20
100 ÷ 130		0,15	0,25
150 ÷ 260	3 to 3,5		
290	4 to 5	0,30	
330	5 to 7		0,30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor and guard should not be greater than 2 to 3 mm. (see fig. 23).

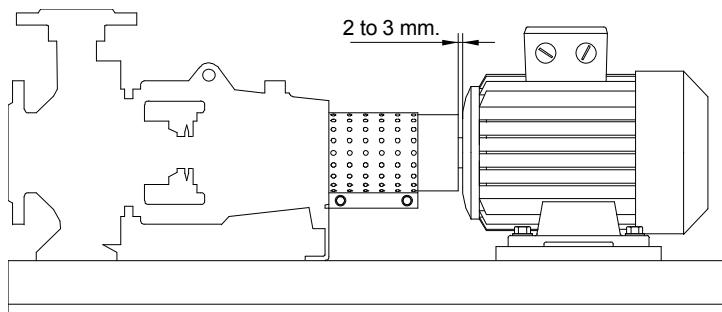


Fig. 23

8.4 - COUPLING PUMP SERIES "TCHM" AND "TCTM"

These pumps do not require a coupling between the pump and the motor shaft; they have been engineered with a supporting flange and shaft having bore and keyway ready to engage the motor shaft and key.

- Check the tolerances of pump shaft bore with its keyway and motor shaft with key. The motor shaft must engage the pump shaft perfectly without interference. In the event there is interference, even if minimal, it is required to rework the motor shaft because a forced fitting would be detrimental to the pump operation.
- Attach the electric motor to the pump flange making sure that the two shafts line-up and the key engages the keyway. Bolt the assembly with the supplied fasteners and install the supporting foot if it applies to the specific pump (see fig 23A).

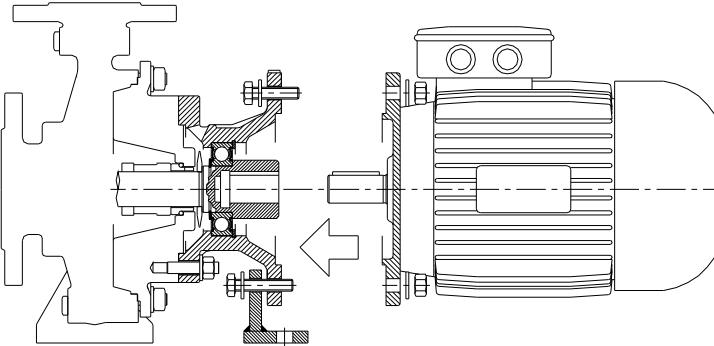


Fig. 23A

9 - ELECTRICAL CONNECTIONS

DANGER!

 Electric danger. Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code. Always ground the motor verifying it is properly wired. It is advisable to have an electrical switch near the pump for emergency situations.

 FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN CHAPTER 2.

BEFORE DOING ANY WORK TO THE INSTALLATION DISCONNECT ALL POWER SUPPLIES

 All electric motors and possible connected accessories must be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate.

It is recommended that motors over 4 kW be wired for Star-Delta start-up, to avoid electrical overloads to the motor and mechanical overloads to the pump.



It is advisable to have an electrical switch near the pump for emergency situations. Be sure to replace all safety guards before switching on the electrical power.

Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor.

Motor connection should be as indicated on the motor tag (frequency, voltage, poles and max consumption) and as discussed in the motor instruction manual.

Pump series TCK, TBK and TBAK (and all motors over 4 kW) should always be preferably wired for Star-Delta start or "soft-start".

If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter).

Please be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage.

Electrical instrumentation such as solenoid valves, level switches, temperature switches, flow switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers.

10 - CHECK LIST PRIOR TO START-UP



If the installed pump is designated to be used in environments subjected to the application of the ATEX 99/92/CE directive but does not show the wording "ATEX" on the name plate, and the integrative ATEX manual hasn't been received or undelivered, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.



CAUTION!

All questions listed below must have POSITIVE answers prior to proceeding to the pump start-up (the following list may not be complete for special installations which may require further precautions as the cases dictate).

- Is this manual entirely read and understood?
- Are all the safety protections in order?
- Are the electrical connections properly wired, grounded and protected?
- Is the position of the pump switch-off button evident, accessible and clear?
- The piping system has been flushed of any foreign particles, welding impurities, etc.?
- Have all piping and pump obstruction been removed?
- All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?
- Pump and motor are properly lubricated, if required?
- Pump/motor alignment has been checked?
- If mechanical seal requires flushing has this been connected?
- All valves in the installation are in the correct position?
- Has this pump's direction of rotation been checked by jogging the motor?
- Are pump and installation ready for start-up?

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free it up by applying a torque to the pump coupling with a pipe wrench.

To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand.

In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.



The selected solvent or lubricating fluid must be compatible with the pump, seals and gasket materials.

New pumps from the factory and pumps coming from long term storage are likely impregnated with a rust preventative liquid; before the start-up, these pumps should be subjected to fresh water rinsing for approximately 15 minutes.

The obtained liquid-water mixture must be collected and, according to the environmental disposal regulations, treated as special liquid.



Dispose the waste liquids according to the current regulations protecting the environment.



CHECK PUMP-MOTOR COUPLING ALIGNMENT!

This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See chapter 8.2.

11.1 - START-UP

Never run the pump when it is dry!

Before starting-up verify that all auxiliary supplies are in place, ready to be used and, where necessary, they have been correctly opened. (Example: seal or packing flushing, pressurising buffer liquid to "back to back" double mechanical seals, etc.). Make sure the pump and motor bearings have been properly lubricated and oil levels are correct.

If necessary oil topping should be done through the proper connections (see fig. 20-21-22-23) and with recommended lubricants (see chapter 13). If the liquid to be handled is at dangerous high temperatures it is required to insulate the pump and the piping to prevent direct contact, the pump should also be protected against thermal shocks by insulation, preheating, etc.

Prior to starting, the suction piping and the pump must be filled with the liquid to be lifted; for this purpose there are three types of installations to be identified:



CAUTION!

Possible contact with hazardous media, cold or warm, and pump surfaces, cold or warm. During the following operations it is particularly important to avoid contact and/or inhale of possible spilled liquid (vapour): therefore all safety precautions must be taken. Operate only provided with apposite protective devices.

For this purpose there are three types of installations to be identified:

11.1.1 - Submersed pump (vertical design)

Pump filling is not applicable.

11.1.2 - Pump with flooded suction

Close the valve at pump discharge side, fully open the valve at pump suction side and the vent valve including any breather valve on the stuffing box.



Pump series TCD are fitted with a vent cock (see fig. 10B) which should be open to prevent forming air pockets in the mechanical seal chamber.



CAUTION!

Possible contact with warm media and warm surfaces. Be sure to do this only when the spilled thermal oil is at ambient temperature. Operate only provided with apposite protective devices.

When the thermal fluid exits the air cock without any air or gas bubbles, even after turning the pump rotor it means that the whole pump is full of liquid, therefore close the air cock.

11.1.3 - Pump with suction lift (from well)

In this case the pump must be primed: fully open the isolating valve in suction piping.

If the pump is self-priming and it has been previously filled with liquid, there will be no problems, because the pump will be able to prime itself and lift the liquid as soon as it starts operating.

If the pump is not self-priming, but the suction piping is fitted with a foot valve, the suction piping and the pump can be filled with liquid by opening the valve at the discharge side (provided the discharge piping is full of liquid) or fill the pump body as well as suction piping, with the liquid to be pumped, through the vent valve.

For non self-priming pumps with the suction piping not having a foot valve, the suction piping and the pump can be filled with liquid by hooking-up the vent valve to a vacuum line and keeping closed the valve at the discharge side of the pump: when the liquid exits the vent valve it means that the pump and suction piping are completely full of liquid.

At this point close the vent valve and the vacuum line.

Check the position and/or control the opening of the minimum flow valve, flushing lines and/or auxiliary supply lines.

After the pump and its suction line is full of liquid the pump should be started. In this regard there are two possible cases:

11.1.4 – Start-up a pump without back pressure at discharge side

For centrifugal pumps type MC... - TC... - TMA motor must be started with discharge valve closed.

When the motor has reached full speed, the discharge valve can be opened until the required differential pressure is reached (CAUTION: do not operate the pump with closed discharge piping for an extended period of time, to avoid overheating problems previously discussed).

For self-priming pumps type AT - TBH - TBA all valves in suction and discharge piping must be fully open before starting the motor. After the motor has been started the discharge valve can be throttled to build up the expected pressure.

(It is possible to start these pumps with the discharge valve at the closed position but, in this case, there will be maximum power consumption at start-up).

11.1.5 – Start-up a pump with back pressure at discharge side

In this case a non-return valve must always be installed in the discharge piping.

The unit is started with the discharge valve partially open and after the pump pressure exceeds the back pressure in the discharge line then is time to adjust the discharge flow regulating valve to attain the operating pressure.

For the Starting Torque of the pump see chapter 19.1.

11.2 - OPERATION

After starting the pump the following should be checked:

- The differential pressure and the capacity are as expected (if required, adjust the flow regulating valve at the pump discharge side but NEVER throttle the valve at the suction side).
- The motor amperage does not exceed the value shown on the motor nameplate.
- The pump/motor assembly does not have unusual vibrations and noises.
- The seal arrangement works as it should:
 - if the sealing is by packing there should be continuous dripping from the stuffing box (see chapter 14).
 - if the sealing is by mechanical seal there should not be any leakage (see chapter 15).
 - the bearing housings temperature, when operating regularly, must be lower than 85°C.



CAUTION!

Never run the pump dry.



CAUTION!

Possible contact with high temperature surfaces. Operate only provided with apposite protective devices.

If at start-up there are suspicions of abnormal operation it is recommended to stop the unit and investigate the causes (see chapter 16).

11.3 - SHUT DOWN

DANGER!



Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Operate only provided with apposite protective devices.

The centrifugal pumps can be shut down by switching off the power to the motor, with open or closed flow regulating valve: however if there are no provisions against liquid hammer it is recommended to close the flow regulating valve at pump discharge prior to stopping the pump.

Avoid the use of instantaneous shut-off valves, such as solenoid valves. These can cause severe pump damage.

If the piping has not been fitted with non-return valves it is required to close the shut-off valves in sequence to prevent emptying the piping.

Close first the isolating valve at discharge and then at suction side.

If the non return valve is not fitted, or the isolating valve at the discharge side is not completely closed, it may happen that during the shut-down the pump shaft will rotate in the opposite direction than is normal because of a return flow: in such cases absolutely avoid restarting the pump until the pump shaft has stopped rotating.

Following pump shut down it is required to close any auxiliary lines such as flushing, heating, etc.

After the first start-stop and if necessary, check pump/motor alignment and make sure that no external forces or moment rest on pump or piping.

In the event the pump is shut down for an extended period of time it is recommended to completely drain the pump to prevent the possibility of freezing in the winter time and/or the possibility of corrosion due to stagnant liquid left in the pump (see chapter 6).

12 - OPERATING CHECK LIST

Periodically check the good working condition of the pump by reading the instruments such as gauges, amp meters, flow meters, etc., the pump should constantly be performing as the installation requires.

The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections.

It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see chapters 13 - 14 - 15 - 16) at least once a year, even if no abnormalities have been noticed.



If during operation the pump seems to run irregularly, because of noise or vibrations, it is necessary to stop the unit and investigate the causes of the malfunctioning (see chapter 16).

When the pump is fitted with auxiliary supply lines such as cooling, heating or flushing it is recommended to periodically check their flow, temperature and pressure.

If the magnetic driven pump is fitted with a temperature sensor, the temperature in the area of the magnetic coupling should be approximately 3 to 5°C above the temperature of the product being pumped in standard conditions (water at ambient temperature). Higher values could indicate operation at low flow, obstruction of internal flushing connections or mechanical damage of the magnetic coupling.

Please contact POMPETRAVAINI if there are doubts regarding abnormal temperature rises.

13 - LUBRICATION INSTRUCTIONS

Pumps often operate in severe conditions and the bearings are subject to relevant radial and axial forces. For a good pump operation it is therefore very important to keep the pump bearings well lubricated and clean.

DANGER!

 Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.

FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

Bearings and lubricants must be free of any foreign particles such as dirt, dust, etc. which could cause the bearings to seize.

See "Disassembly and assembly instructions" for bearing sizes, quantity and type of lubricants.

13.1 - GREASE LUBRICATED BALL BEARINGS

TMA pumps series, flanges size 40 and 50, have ball bearings that, during assembly, are already lubricated with high quality grease with working temperature limits -30 °C +140°C.

The bearings used in a pump normal operating conditions must be carefully cleaned and newly greased after approximately 2000/2500 working hours using a good lubricating grease quality (check the "Disassembly & assembly instructions" for the lubricating grease replacement).



Dispose the exhausted grease following the current regulations and the right measures to protect the environment.

The sealed pre-greased never need lubrication, but must anyway controlled after 2000/2500 working hours.

It is important to remember not to over lubricate the bearings, excessive grease will lead to overheating of bearings.

AT - TBH - TBA - TCK - TBK - TBAK pump series are fitted with self lubricated ball bearings which do not require re-grease in normal operating conditions (series TCK, TBK e TBAK may also be fitted with oil lubrication as described in the paragraph listed below).

It is necessary to carry out the greasing and maintenance operations as per the above description for the pumps with roller bearing fitted on the drive end.

Bearing temperature should not exceed 85°C in normal conditions and ambient temperatures.

Overheating could be caused by excessive grease, coupling misalignment, excessive vibrations and /or bearing wear (see chapter 16).

13.2 - OIL LUBRICATED BALL BEARINGS

Pump series TC... - MC... are fitted with oil lubricated ball bearings. The series TCK – TBK and TBAK can also be with grease lubricated bearings.

It is good practice to replace the lubricating oil used at time of testing.

Oil should also be changed after the first 50 to 100 hours of operation.



Dispose the exhausted oil following the current regulations and the right measures to protect the environment.

The lubricating oil, poured through the hole which is also the dipstick seat or vent plug located at the top of the bearing frame should, as a maximum, cover the bearing balls of the lower crown (the oil dipstick or the oil level gauge show the correct quantity, see fig. 25).

The installation of a constant level oil-filler (as option) consents a correct lubricating oil level in the avoiding recurrent fillings.

For the first filling proceed as follows:

- remove vent plug of the bearing frame
- upset the oil-cruet

- pour oil into the bearing frame through the hole of plug till you can see oil in the oil-filler elbow
- fill the oil-filler pouring oil directly into the oil-cruet and NOT into the elbow (see fig. 24)
- replace the cruet in normal position
- let oil flow into bearing frame
- repeat operation till the oil level in the cruet cease to decrease.

The following fillings should be done pouring oil directly into the cruet and NOT into the elbow of the oil-filler or bearing frame plug (see fig. 24).

If there are no particular dangers of oil contamination (dust, water) and the temperature in the bearing frame oil bath does not exceed 60°C, oil should be changed every 4000 to 6000 hours of service.

For higher operating temperatures and contaminated oil the frequency of oil changes should be increased.

Bearing temperature should not exceed 85°C in normal conditions of operations and ambient temperatures.

Overheating could be caused by too much oil, coupling misalignment, excessive vibrations and/or bearing wear. It is recommended to periodically check the oil pH which will indicate the oil stability and the oxidation grade (consult the supplier for the acceptable values).

Satisfactory oils are those with a viscosity at 40°C between 46 and 100 centistokes.

Oils with high viscosity (100 centistokes) are recommended for applications with high operating temperatures.

Pumps of series TCD can use oils with viscosity up to 220 centistokes.

Pumps are provided with oil OLEODIN 100 for standard applications at ambient temperatures from -5 to +40 °C

Some oil types are:

OLEODIN 100

AGIP BLASIA 68

CASTROL HYSPIN VG 46

CASTROL HYSPIN AWS 68

ESSO TERESSO 68

ESSO NURAY 100

SHELL TELLUS OIL T68

IP HYDRUS 68

Avoid to mix oils having different features and brands.

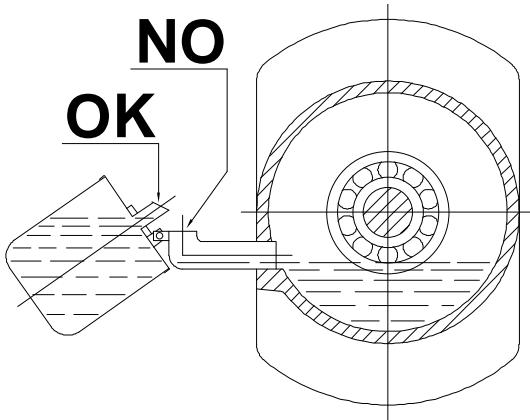


Fig. 24

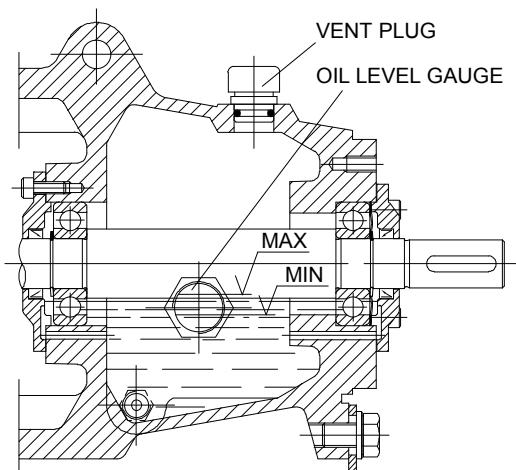
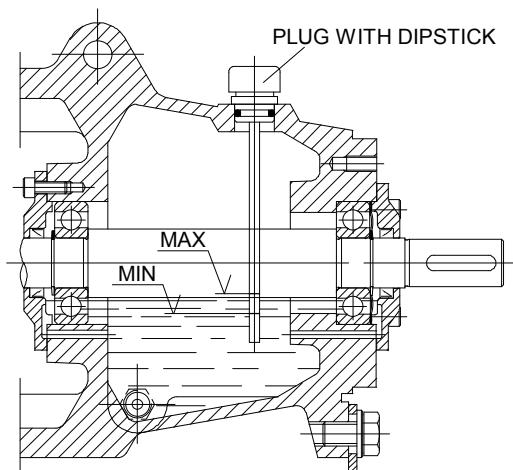


Fig. 25

DANGER!

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Pumps fitted with packed stuffing boxes require packing flushing either from an external source or directly from the pumped media through pump internal passages.

This liquid is necessary to remove the friction heat generated between the shaft and the packing.

The dripping quantity is a function of the pump size and of the pressure in the stuffing box housing.

In any event the liquid drops coming out of the stuffing box should not exceed a temperature of 60 - 70°C in relation to handling a liquid at ambient temperature.

14.1 - ADJUSTING THE PACKING

All adjustment operations must be performed with the **PUMP NOT RUNNING** following the safety measures given in chapter 2. After completion of the work **ALWAYS** re-install the safety guards previously removed.

At first start up loosen the nuts of the packing gland allowing a steady flow of liquid to drain out (see fig. 26).

After obtaining a steady flow of leakage gradually tighten the gland nuts until attaining a steady dripping within the limit of the above recommended temperature.

A few hours time span may be required to establish a steady dripping at low temperatures.

Packing adjustment is required when the liquid leakage increases.

When adjustment is no longer possible, the packing material should be replaced with new one.

Follow the "Disassembly and Assembly Instructions" to replace the packing materials.

In the event the pump remains out of service for more than 2 months it is recommended to replace the packing rings, prior to start-up.

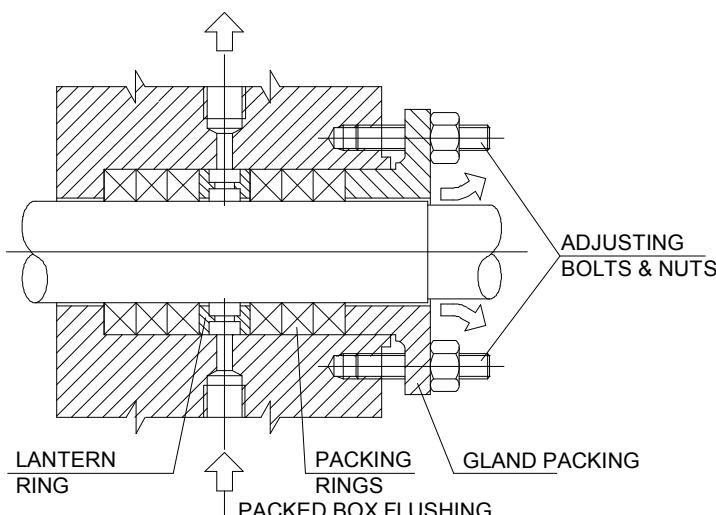


Fig. 26

15 - MECHANICAL SEALS**DANGER!**

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Purpose of mechanical seals is to retain handled product inside the pump in the area where the shaft exits the pump casing. Mechanical Seals can be of many different materials, types and configurations (see fig. 28-29-30 for some examples). To assure maximum reliability and safe operation Pompetravaini evaluates seal choices at time of pump selection in connection with customer's requirements, application and liquid details.

In the case of self lubricated single mechanical seals (API Plan 01, 02 or 11, see fig. 28) flushing and /or pressure system are not required, pump has been engineered to provide proper seal lubrication with pump operating pressure.

In the event the application requires increased safety margin against possibilities of product leaking through a single type mechanical seal, it is possible to install two mechanical seals working simultaneously thus creating a safety barrier from the pumped liquid.

There are two possible types of double mechanical seals: Back-to-Back (also known as "Opposite" type) API Plan 54, see fig. 29 and in Series (also known as "Tandem" type) API Plan 52, see fig. 30.

Double mechanical seals Back-to-Back are generally selected where pumped liquid is absolutely not allowed to leak from the pump. Double mechanical seals in Series are chosen where the pumped liquid may escape the pump toward the pump exterior but it is controlled and contained in the closed seal loop but never to escape to the atmosphere.

Double mechanical seal installations require a flushing (buffer) liquid from an external source that is compatible with the pumped product as well as the working conditions. Flushing liquid system is such as to guarantee adequate buffer liquid pressure and temperature to the mechanical seals: seal flushing system with proper instrumentation and controls is of paramount importance for a successful pump installation, it must be installed by qualified personnel familiar with every details of the application and with system set-up.

All flushing systems MUST use tubing with diameters equal or larger than the connections provided on the pump, buffer liquid must be compatible with the pumped product. Pressure on the buffer liquid should always be constant and/or high enough to cover the entire pump performance.

In the case of 'once through' seal flushing (buffer liquid not recycled), it is very important the regulation and control of pressure in the seal housing. In the double seal case it is recommended to adjust the buffer liquid pressure with a flow regulating valve installed after the seal housing while reading pressure on a gauge installed between the seal housing and the valve. Avoid controlling buffer liquid pressure before the seal housing, reading the pressure before the seal housing is NOT recommended as it could lead to wrong conclusions which could be cause for serious damages. With an adequate seal tank in the system (see fig. 33) a closed loop seal flushing, containing possible leakages is provided. Adequate controls and/or instrumentation will provide pressure and liquid level controls in the tank to indicate the conditions of the sealing system. Increase of liquid level (or pressure) is indication of product leaking through the pump seal. Decrease of liquid level (or pressure) is indication of buffer liquid leaking inside the pump or to the atmosphere through the outside seal, in which case the leakage is also visible.

The liquid to be used in the seal tank must offer full compatibility with the pumped liquid in the event the seal at pump side will leak, (for example when the two liquids will mix there must not be any dangerous chemical reactions) as well the liquid must offer good lubricating characteristics and good heat dissipation. Some good examples of suitable buffer liquids are water, vaseline oils or vegetable oils.

Pressure in the seal tank is often kept with pressurised Ozone or Nitrogen bottle. Cooling of the buffer liquid in the loop (picks up friction heat from the seal faces) is achieved with fresh liquid through the cooling coil fitted inside the seal tank. Seal tank is provided with Inlet & Outlet connections for sealing liquid. DO NOT reverse these two connections; the liquid circulates by natural heat convection (warm liquid moves upward and cold liquid downward), reversing the connections would prevent the start of such natural phenomenon. The buffer liquid outlet connection going to pump seal housing is at bottom of tank while the return connection is approximately at the middle of the tank.

Checking of proper liquid circulation is done while pump is in service; the piping at seal housing connection should be colder by 3 to 5°C than the outlet tubing exiting the seal housing going to the tank. If this is not the case simply change the tubing on the seal housing (connect tubing from inlet to the outlet and vice versa) do not change the connections on the tank. Sometimes this adjustment is required because the rotation of the mechanical seal (and at times peculiar seal design) generates an hydraulic pressure that could be opposite and higher than the natural. Only in 'field' check one can be assured of the correct liquid circulation. Monitoring the pressure in the seal tank with pressure switches or pressure gauges and/or controlling the liquid level in the tank allow the verification of possible seal leakages and prompt corrective actions can be taken when required.

Use good quality gauges to monitor the pressure, with good dial and scale graduation adequate for good reading in the anticipated pressure range. As a minimum use liquid filled gauges with dial size of minimum 60 mm and 2.5 accuracy. Additional data and information may be requested from Pompetravaini or its local representative if required.



Incorrect pressure of seal housing could cause severe damage to the rotating parts. To minimise seal system malfunctions avoid pressure fluctuations in the seal loop as well as in the pump operating pressure.

Seal housing with double mechanical seals back-to-back type, must always have a pressure such that the inside seal (closer to pump impeller) will not be pushed out of its seat by the total pump pressure (suction plus pump operating pressures) even when pump is in stand-by mode. Flushing liquid therefore must be at least 0.5 bar over the maximum pump discharge pressure throughout its performance.

A lower pressure, even if for a moment, will cause the stationary part of internal seal to come out of its seat and the pumped liquid will mix with the flushing liquid due to the higher pressure inside the pump, see fig. 27.

In the case of double seals in series (Tandem) the pressure of the flushing liquid should be as low as possible but high enough to provide good flow in the circuit. High pressures (over 0.3 bar over the atmospheric pressure) may push the stationary seat of mechanical seal at product side (closer to pump impeller), out of its seat (especially when pump is at rest without pressure), therefore flushing liquid would mix with the product inside the pump following seal system damage.

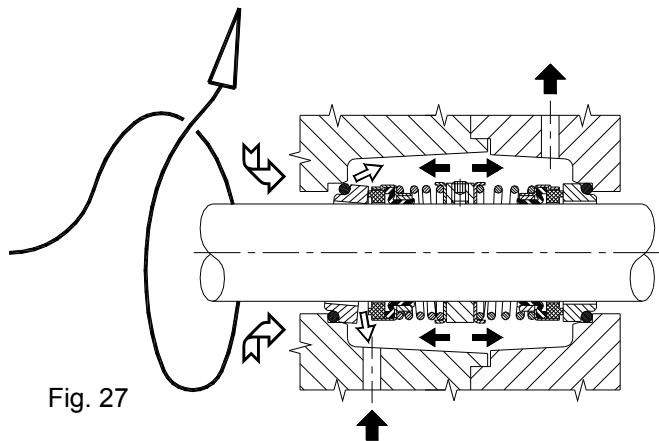


Fig. 27



Incorrect pressure in sealing system is the most common cause for seal system failure, therefore a continued monitoring with prompt corrective actions are necessary.

See fig. 20-21-22-23 and operating manual for centrifugal pumps for locations of liquid flushing connections. Required flow and pressure for buffer liquid are listed in tab. 3 and/or contact Pompetravaini and/or seal supplier. See tab. 4 for liquid flow required to cool or heat the seal housings. For a longer seal life cooling is recommended when pumping liquids over 90°C. Tab. 4 also lists cooling or heating liquid flow for pumps of "U2" design that include jacketed pump casing.

Standard mechanical seals supplied with our pumps meet ISO 3069/UNI EN 12756 standards, see pump "Disassembly and Assembly Instructions" for overall dimensions. Special or non-standard seals can be installed after proper

evaluation by our technical department. Mechanical seals do not require maintenance until losses of liquid are visible (for seal replacement see "Disassembly and Assembly Instructions"). Losses of few drops of liquid in several minutes is normally considered acceptable and it is not an indication of seal failure.

Seal leakage or even seal failure should be properly corrected considering the impact on environment, toxicity and safety issues.



CAUTION!

Pay attention to possible leakage of pumped liquid from mechanical seal which, by its characteristics, could be harmful to the environment.

Mechanical seals should NEVER run dry, without flushing liquid (internal or external). This could cause severe damage to the seal faces, O-Rings and elastomer. It is recommended to check the wear on seal faces every 4000 working hours. This is an acceptable normal working time for mechanical seals, over this time there could be losses due to wear and tear that require seal replacement.

MECHANICAL SEALS WITH QUENCH

There are two types of Quench/Barrier, available upon request: API Plan 61 and 62.

System Plan 61 (see fig. 31) includes a bushing on the back of the seal at atmospheric pressure side (single or double) to hold the bulk of the liquid in the event of accidental failures. The bushing requires a minimum clearance over the shaft therefore the liquid is NOT sealed completely but most of it will be retained in case of a sudden seal breakage. Drain and vent connections are threaded. This arrangement does not allow a continuous flushing because the above mentioned clearances would cause considerable losses of liquid over the shaft toward the outside. This system is chosen for avoid emergencies or to limit losses of liquid.

System Plan 62 (see fig. 32) requires (contrary to Plan 61) a constant flushing because the auxiliary seal is of the contact type and CANNOT work without a liquid that removes the generated heat of friction. The auxiliary seal is usually a lip seal (radial seal ring) not to be confused with the traditional mechanical seal. Losses of several liquid drops should be tolerated and with time its reliability will decrease. This system is often used where there is the need to wash the back of the mechanical seal on the atmospheric side preventing crystallization or coking of handled product. It is a less effective alternative to the double mechanical seals in series. Pressure of buffer liquid must follow same rules as for the double seals in series, therefore max pressure can be 0.3 bar over the atmospheric pressure and temperature can be max 60°C.

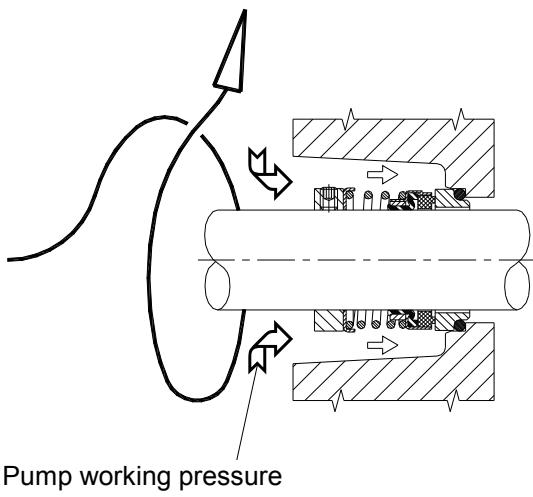


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

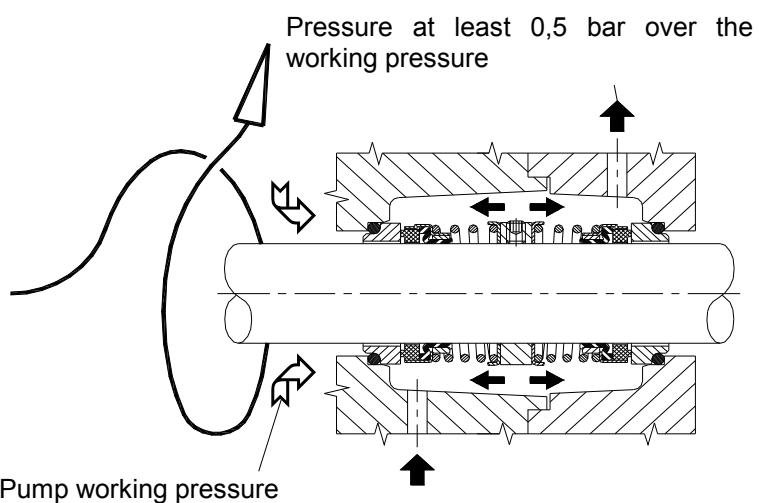


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54

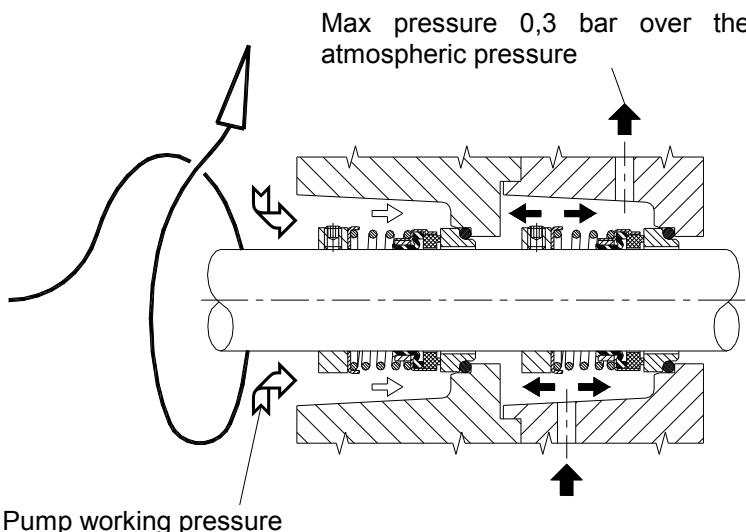


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

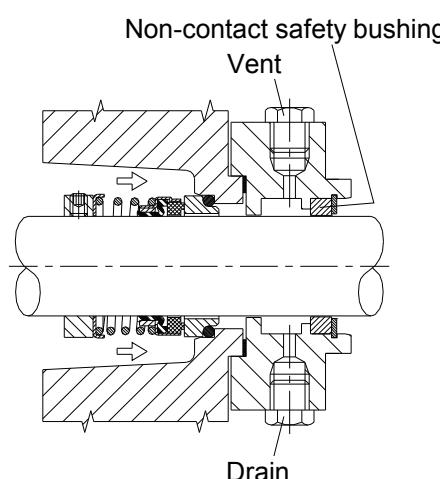


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

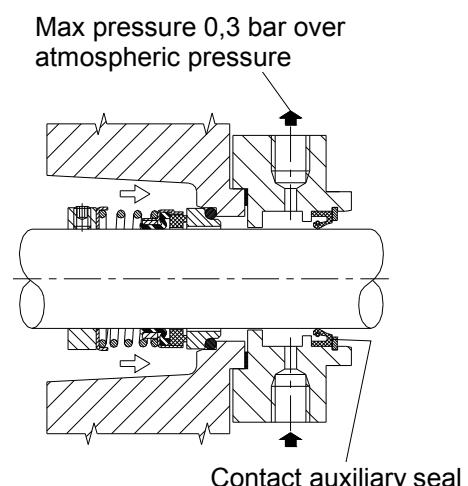


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

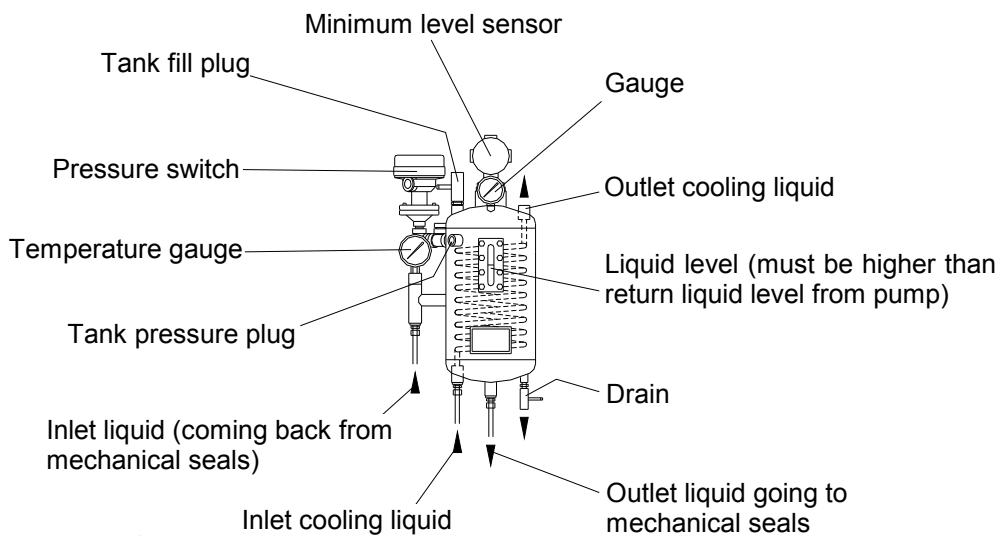
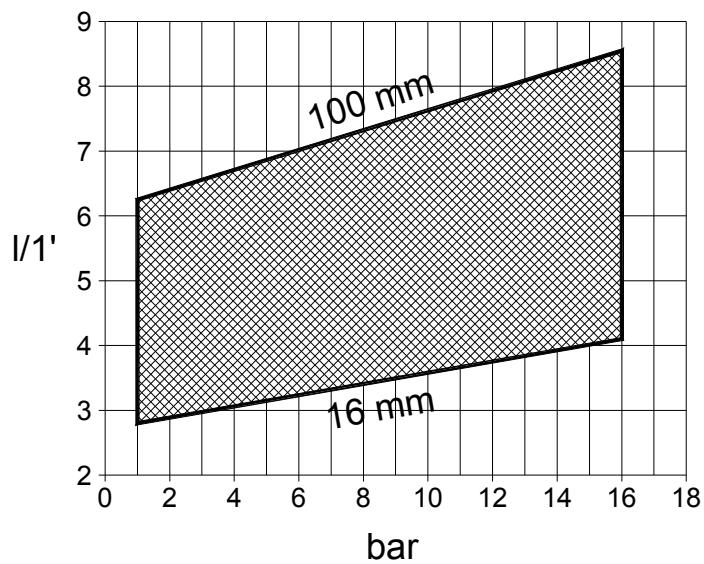


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

NOTE: Tank installation must be at least 1 m above the rotating pump shaft



Tab. 3 - REQUIRED LIQUID FLOW TO FLUSH MECHANICAL SEALS FROM OUTSIDE SOURCE

mm = installed shaft seal diameter
 bar = maximum pump working pressure (total of inlet pressure and pump generated pressure as measured at pump discharge flange)
 I/1' = required liquid flow (lit/min) for single seals or double in series type seals (tolerance +/-25% depending upon temperatures)
 NOTE: DOUBLE quantity of liquid flow for double mechanical seals back-to-back type.

CAUTION: Flushing liquid PRESSURE for back-to-back double seals must be min 0.5 bar over the max pump working pressure, while NOT more than 0.3 bar over the atmospheric pressure in case of double seals in series (TANDEM).

Tab. 4 - LIQUID FLOW FOR COOLING OR HEATING JACKETED SEAL HOUSING (maximum pressure for liquid circuit is 3.5 bar, referred to water and ambient temperature. In case of heating circuit the allowed maximum temperature is 135°C).
 Flow tolerance +/-25%.

CAUTION: Flow for cooling or heating of jacketed pump casings, design "U2" pump series MC... - TC... (see fig. 34) can vary depending upon temperatures for cooling or heating the casing, ALWAYS limiting the maximum pressure of 3.5 bar and temperature of 135°C of the pump casing jacket.

PUMP SERIES	FLOW MINIMUM I/1'	FLOW MAXIMUM I/1'
AT - TB... TC... group 1 - 2 TMA	3	8
MC... group 3 - 4 - 5 TC... group 3 - 4 - 5 MEC	5	12

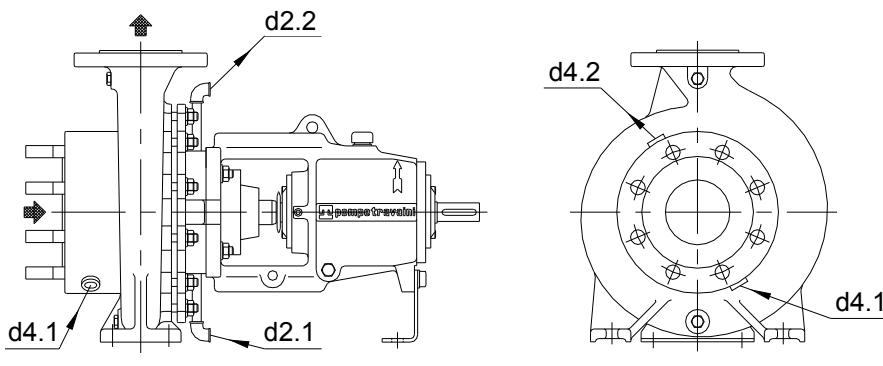


Fig. 34

- d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
- d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
- d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
- d4.2 Threaded connection - Outlet cooling/heating liquid pump jacketed casing

16 - TROUBLE SHOOTING CHART - PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart (tab. 5) or should there be any doubts, do not hesitate to contact POMPETRAVAINI or your local representative.

Tab. 5 - LIST OF PROBLEMS

PROBLEM	LIST OF POSSIBLE CAUSES
Lack of, or no flow and/or pressure	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 17 - 25 - 40
Excessive flow and/or pressure	15 - 16 - 17 - 18
High power consumption	10 - 15 - 16 - 18 - 19 - 20 - 21 - 22 - 23
Excessive vibration and noise	8 - 18 - 19 - 20 - 23 - 24 - 25 - 26 - 27 - 28 - 36 - 37 - 40
Bearing overheating	19 - 20 - 28 - 29 - 30 - 36 - 38 - 39 - 42
Sealing malfunction	28 - 31 - 32 - 33 - 34 - 35 - 40 - 41

	CAUSES	SOLUTIONS
1	Pump is not primed	Repeat the priming procedure
2	Rotational speed is not adequate	Increase the motor speed in relation to the working conditions - Replace impeller with one having larger diameter.
3	Installation requires higher pressure than expected	Increase operating speed, if possible, (see point 2) or replace impeller with one of larger diameter - Change the pump or increase the number of stages in case of multistage pumps - Reduce the system pressure
4	Wrong direction of rotation	Change the motor direction of rotation
5	There are air pockets in the suction line	Modify the layout of suction piping
6	Air enters the suction line	Check the piping sealing areas
7	The pumped liquid is emulsified with air	Install a reservoir or tank before the pump to de-aerate the liquid
8	The suction lift or/and suction pressure is more than anticipated and therefore the pump cavitates	Reset the suction lift to the original value - Increase the piping diameter - Check the suction piping, the foot valve or non return valve, the filter - Open completely the isolating valve in the suction piping - Decrease the friction losses
9	The wear ring and/or impeller neck and/or the impeller and/or the diffusers are worn out or damaged	Overhaul the pump replacing and/or repairing the damaged components
10	Viscosity, density, or specific weight of liquid have higher values than expected	Re-establish the characteristics of the liquid as originally expected (if necessary contact POMPETRAVAINI)
11	Suction piping is not sufficiently submersed in the liquid, creating vortex	Increase the depth of piping or foot valve in the liquid
12	Impeller is plugged with scale deposit and/or foreign materials	Take out the impeller, clean it, free the vanes and cavities of any materials - Soften the pumped liquid
13	There is entrained air in the system	Adjust the packed stuffing box or repair/replace the mechanical seal
14	Piping is plugged	Clean piping and valves - clean the filters
15	Velocity is too high	If possible, decrease the pump rotational speed
16	The required pressure of system is lower than anticipated	Adjust the flow regulating valve in discharge piping - Decrease the impeller diameter (contact POMPETRAVAINI) - Decrease the number of stages in case of multistage pumps
17	Pump is not suitable for the application	Contact POMPETRAVAINI
18	Inlet pressure is too high	Reduce the pressure, but without adjusting the isolating valve at the suction side

19	Pump/motor coupling is misaligned	Realign the coupling
20	Bearings are defective or worn out	Replace bearings
21	The power supply voltage is wrong - Motor does not operate properly	Change the motor - Correct the power supply
22	The packing is too tight	Loosen the nuts of the packing gland
23	Pump seizing is experienced	Stop the pump and look for any rotor obstructions
24	The pump and/or piping are loose	Torque the bolts as required
25	Pump is worn out or damaged with excessive internal clearances	Overhaul the pump
26	The coupling rubber inserts are worn	Replace the coupling inserts
27	The impeller is out of balance due to wear, deposits and encrustation	Disassemble, clean, balance and/or replace the impeller - Soften the liquid
28	Forces, moments and piping misalignment are loading the pump	Realign and support the piping
29	Oil level in bearing frame is low, oil quality is inadequate or there is lack of grease	Replace oil or grease to the normal level using proper quality lubricants
30	The power absorbed is too high	Decrease the power consumption by identifying the cause
31	Pump is running dry	Reinstate the correct working conditions
32	Pumped liquid or the flushing liquid to the seals is dirty and/or not adequate	Install a filter in the flushing lines - Change flushing fluid
33	There are excessive shaft vibrations and deflections	Identify the causes and reinstate the correct working conditions (refer to more specific points in the table)
34	The pumped liquid is not adequate for the seals	Contact POMPETRAVAINI
35	The shaft sleeve is worn out	Replace the sleeve with a new one
36	The pumped flow is less than the minimum required	Increase the flow - Adjust the by-pass recirculation valve or line
37	Baseplate or pump foundation is not adequate	Change or reinforce the baseplate and/or foundation following the recommended procedures
38	Too much grease in the bearings	Remove excessive grease and check the bearings
39	There is water in the bearing frame	Change bearings and replace all the lubricant
40	Incorrect assembly after pump repair	Overhaul pump and assembly following correct procedures
41	The mechanical seals are damaged	Remove the mechanical seals, overhaul or change them
42	The axial forces are too strong	Check the impeller

Should the pump require repairs it is recommended to be familiar with the procedures outlined in the "Disassembly and Assembly Instructions".

DANGER!

Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.



FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

In any case, before working on the pump it is important to:

- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cables from the motor
- close the pump inlet and outlet isolating valves
- let the pump cool down to ambient temperature if is pumping hot liquids
- adopt safety measures if the pump has been handling dangerous liquids
- drain the pump body of the pumped liquid, through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:

- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one
- if required, remove motor by removing the bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from installation without damaging other system components.

Before returning the pump to POMPETRAVAINI or an authorized service decontaminate the pump and ask for the "handled media" examination form.



In case of pump removal from the installation dispose the unit by following the current regulations and the right measures to protect the environment.

When the pump has been repaired must repeat the steps from "Assembly and Alignment" procedures and after (see the applicable chapters starting from chapter 7).

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimise unnecessary down times in the event of pump failure or routine maintenance.

For better parts management, the VDMA 24296 standards suggest to stock the number of parts in function of the number of pumps being used by the plant (see following table).

Components	Spare parts	Identical pumps number (stand-by pumps included)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Number of spare parts								
Suction and discharge elements	1	1	2 1	2	2	3	30%	
Impellers								
Radial seal rings	2	2		3	3	4	50%	
Ball or roller bearings								
Shaft complete with keys, nuts, shoulder rings, etc.	1	1	2	2	3	3	30%	
Bushes				3	3	4	50%	
Shaft protection sleeves	2	2						
Neck rings	1	1		2	2	3	30%	
Packing rings	16	16	24	24	24	32	40%	
Gaskets for pump casing (Set)	4	6	8	8	9	12	150%	
Other gaskets (Set)						10	100%	
Mechanical seals	Rotating part		4	5	6	7	90%	
	Stationary part		6	8	8	10	150%	
	Rotating part gasket							
	Stationary part gasket							
	Springs	1	1	1	1	2	2	20%
Bearing housing groups complete with shaft, bearings, covers, seal rings, etc.	---	---	---	---	---	1	2	
Coupling inserts (Set)	2	3	4	5	6	7	75%	

On the pump nameplate there are printed pump model, year of manufacture and pump serial number.

When ordering spare parts always provide this information.

Pump type, parts item number (VDMA) and description per the pump sectional drawing and parts list is useful information which helps to supply correct spare parts for your pump.

We recommend the use of original spares: in case this is not respected, POMPETRAVAINI declines any responsibility for possible damages and not correct running caused by not original spare parts.

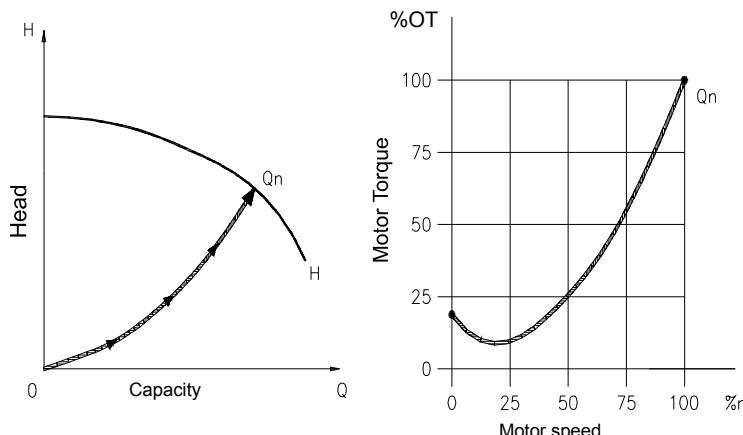
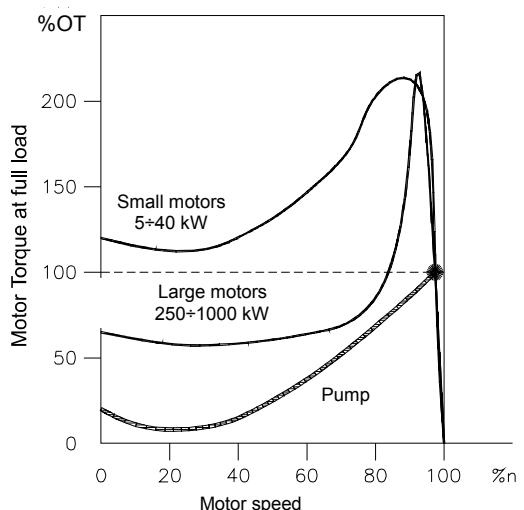
19.1 - STARTING TORQUE

Starting torque of a centrifugal pump is very low. Usually standard electric motors may be safely used to drive this pump. Pump operational speed (any speed) is reached only if motor torque is greater than pump operating torque. See side figure.

Operating Torque (**Nm**) is given by

$$\text{Operating Torque} = 9549 \times \text{kW} (\text{absorbed at operating speed}) / \text{RPM (nominal)}$$

According to the centrifugal pump starting, there could be three principal cases each with his characteristic curve of starting (see examples below).



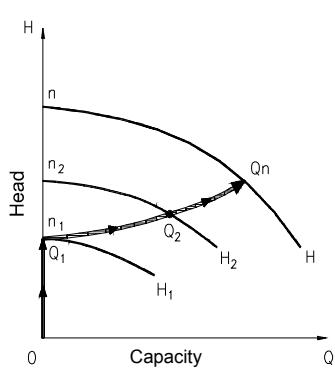
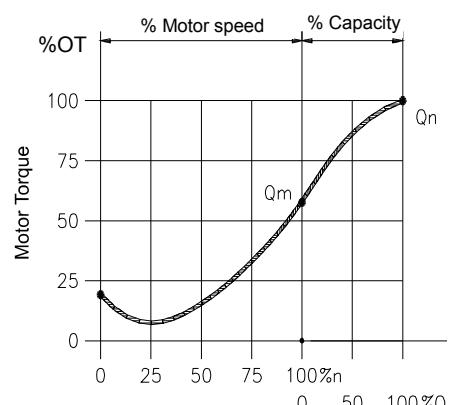
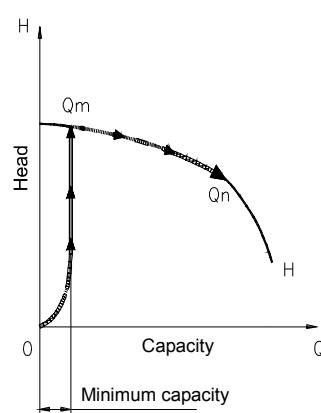
1) Starting with open valve on discharge

During this starting it can be assumed the curve of Operating Torque in function of the round number similar to a parable that starts from about the 20% of the value of Operating Torque to the value of nominal capacity **Qn**.

2) Starting with partially closed valve on discharge

This type of starting requires a particular observation: first the pump must reach a value of minimum capacity **Qm** (correspondent to the partialized capacity of the valve) such to guarantee a correct operation without problems of liquid evaporation or excessive radial loads on the shaft; then the pump, by totally opening the valve, will reach the value of nominal capacity **Qn** and therefore the value of maximum operating torque.

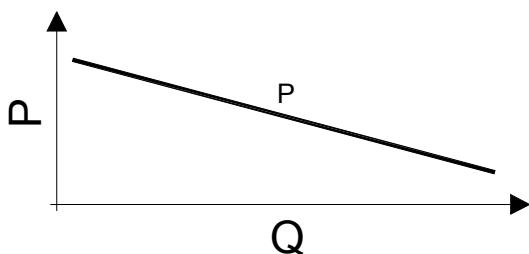
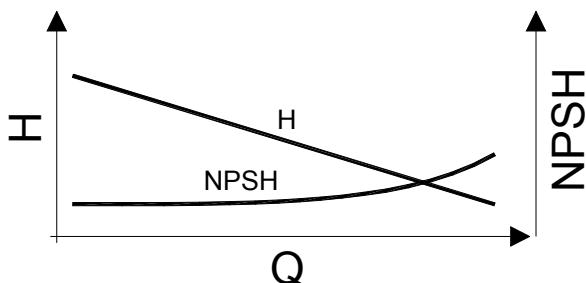
NOTE: In this case it is esteemed an absorbed power at the value of **Qm** corresponding to about 60% of **Qn**.



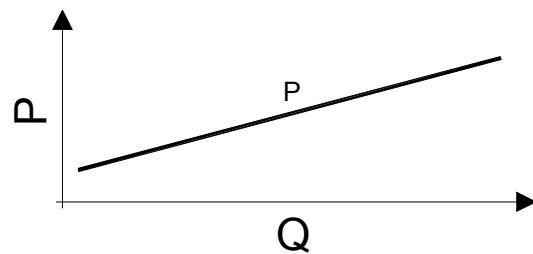
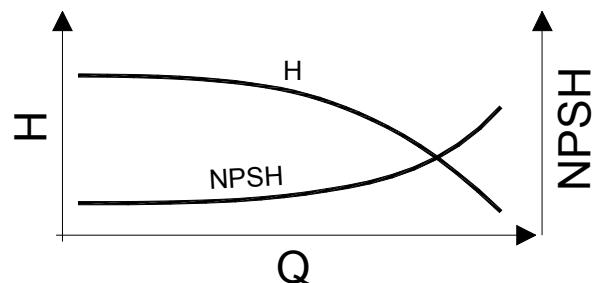
3) Starting with completely open valve and with non return valve on discharge

During the starting the non return valve will remain closed up to the attainment of the pressure value **H1** (correspondent to the pre-load pressure of the same valve) and therefore void capacity. This value is reached at speed **n1** (in this example esteemed about 60% of the nominal speed). The continuous motor acceleration will reach the attainment of the value of nominal capacity **Qn** after having passed through **n2**, **Q2**, **H2**.

19.2 - TYPICAL PERFORMANCE CURVES



Typical performance curves
for pumps series AT - TB...



Typical performance curves
for pumps series TC... - MC... - TMA

Where:

- H = Head
- NPSH = Net Positive Suction Head
- P = Absorbed power
- Q = Capacity

19.3 - UNITS CONVERSION TABLE

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Discharge and Delivery	Litres/sec	Litres/min	60	m ³ /h	Litres/sec	0.2778
	Litres/sec	m ³ /h	3.6	m ³ /h	Litres/min	16.67
	Litres/sec	C.F.M.	2.12	m ³ /h	C.F.M.	0.589
	Litres/min	Litres/sec	0.01667	C.F.M.	Litres/sec	0.4719
	Litres/min	m ³ /h	0.06	C.F.M.	Litres/min	28.32
	Litres/min	C.F.M.	0.0353	C.F.M.	m ³ /h	1.698

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Capacity	Litres	m ³	0.001	U.S. Gal	Litres	3.785
	Litres	Ft ³	0.0353	U.S. Gal	m ³	0.003785
	Litres	U.S. Gal	0.02641	U.S. Gal	Ft ³	0.0133
	Litres	Imp. Gal	0.219	U.S. Gal	Imp. Gal	0.0832
	m ³	Litres	0.001	Imp. Gal	Litres	4.545
	m ³	Ft ³	35.3	Imp. Gal	m ³	0.004545
	m ³	U.S. Gal	264.17	Imp. Gal	Ft ³	0.16
	m ³	Imp. Gal	219.96	Imp. Gal	U.S. Gal	1.2
	Ft ³	Litres	28.32			
	Ft ³	m ³	0.0283			

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Linear measure	cm	inches	0.3937	inches	cm	2.54
	cm	m	0.01	feet	m	0.3048
	m	feet	3.28084			
	m	cm	100			

19.4 NOISE LEVEL AND VIBRATIONS

Noise level (sound pressure level L_p at 1 meter distance neglecting motor, with pump installed in the system and sound power level L_w) for pump operating at BEP and motor at 50 Hz operating speed.

The values can change depending on the installed motor. Contact POMPETRAVINI for further information.

The class of the vibration level (values rms mm/s) shows the limit values for the continuous working of the pump if properly installed. For higher values to proceed with maintenance following the table below.

NOTE: Pumps not included in the following tables have to be seen as a particular construction.

Contact POMPETRAVINI in order to know the data.

	Continuous working	Preventive maintenance	Extraordinary maintenance
Class V1	< 3,5	> 3,5 < 7	> 7
Class V2	< 4,5	> 4,5 < 7	> 7

PUMP MODEL	Noise level L_p (L_w)	Vibration level
TMA	dB(A) poles	class poles
	31 – 3	
	31 – 4	
	31 – 5	
	31 – 6	
	31 – 7	
	31 – 8	
	31 – 9	
	31 – 10	
	31 – 11	
	31 – 12	
	31 – 13	
	31 – 14	
	31 – 15	
	32 – 3	
	32 – 4	
	32 – 5	
	32 – 6	
	32 – 7	
	32 – 8	
	32 – 9	
	32 – 10	
	32 – 11	
	32 – 12	
	32 – 13	
	32 – 14	
	32 – 15	
	40 – 3	
	40 – 4	
	40 – 5	
	40 – 6	
	40 – 7	
	40 – 8	
	40 – 9	
	40 – 10	
	40 – 11	
	40 – 12	
	40 – 13	
	40 – 14	
	40 – 15	
	50 – 3	
	50 – 4	
	50 – 5	
	50 – 6	
	50 – 7	
	50 – 8	
	50 – 9	
	50 – 10	
	50 – 11	
	50 – 12	

PUMP MODEL	Noise level L_p (L_w)				Vibration level			
TC...	dB(A) poles				class poles			
	8	6	4	2	8	6	4	2
25 – 125					V1			
25 – 160					V1			
25 – 200					V1			
32 – 125					V1			
32 – 160					V1			
32 – 200					V1			
40 – 125					V1			
40 – 160					V1			
40 – 200					V1			
40 – 250					V1			
50 – 125					V1			
50 – 160					V1			
50 – 200					V1			
50 – 250					V1			
50 – 315			74 (86)		V1			
65 – 125			73 (85)		V1			
65 – 160			73 (85)		V1			
65 – 200			73 (85)		V1			
65 – 250			74 (86)		V1			
65 – 315			75 (88)		V1			
80 – 160			73 (85)		V1			
80 – 200			74 (86)		V1			
80 – 250			75 (87)		V1			
80 – 315			77 (90)		V1	V2		
100 – 200			75 (87)		V1	V2		
100 – 250			76 (89)		V1	V2		
100 – 315			78 (91)		V1	V2		
100 – 400					V1			
125 – 250					V2			
125 – 315					V2			
125 – 400					V2			
150 – 250					V2			
150 – 315					V2			
150 – 400					V2			
200 – 315					V2			
200 – 400					V2			
250 – 315					V2			
300 – 350					V2			
300 – 450					V2			
250 – 450					V2			
300 – 550	79 (94)	---	---		V2	---	---	

PUMP MODEL TBA	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
202 ♦	< 73 (85)	
203 ♦		
204 ♦		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
307		
308		
311		
312		
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314		
315		
316		
317		
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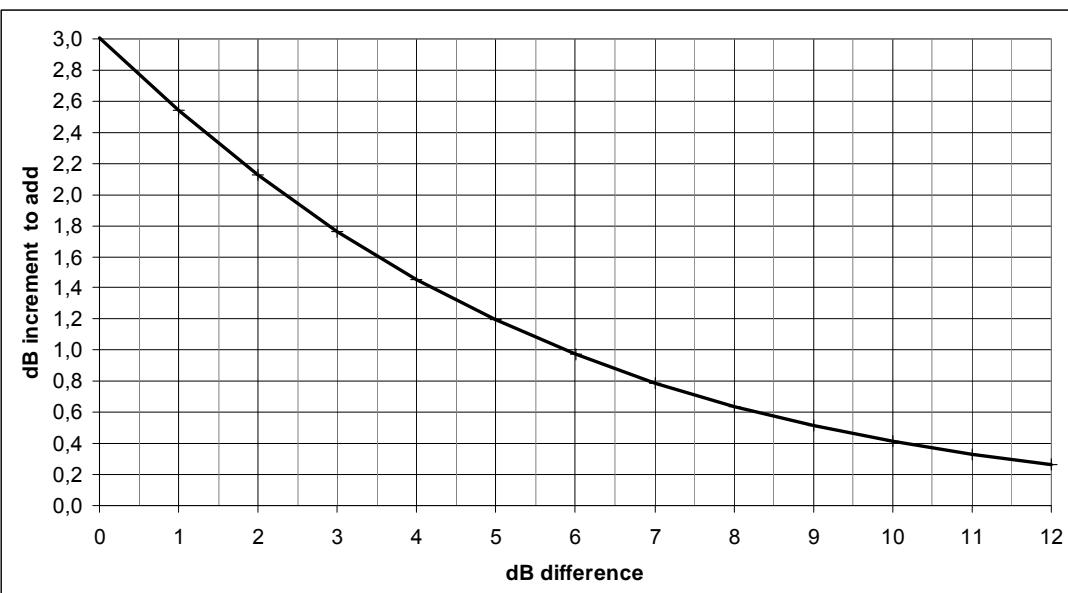
♦ = WARNING: 2 poles motors

PUMP MODEL TBH	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
201		
202		
203		
204		
205		
206		
207		
208		
291		
292		
293		
294		
295		
296		
297		
298		
301		
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In order to have approximate values of the noise level for the pump-motor assembly the sound power level of the motor and the pump can be added. The following table shows some values of the motor noise level. The addition has to be calculated using the diagram below.

In order to get the total sound power level it is necessary to calculate the difference between the pump and motor noise level; by that value calculate, from the following diagram, the increment that will have to be added to the higher value of the power sound level. Ex: motor 80 dB and pump 75 dB, level difference 5 dB, increment 1.2 dB, total power sound level 81.2 dB. Taking into account that the noise level depends on several factors, contact POMPETRAVAINI to know more accurate values.

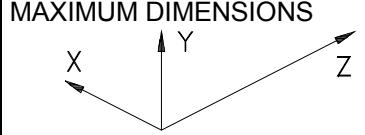
POWER kW	Noise level L_p (L_w)				Noise level L_p (L_w) ATEX			
	dB(A)				dB(A)			
	8 poles	6 poles	4 poles	2 poles	8 poles	6 poles	4 poles	2 poles
0,75	55 (63)	50 (58)	48 (56)	59 (67)	54 (62)	48 (56)	53 (61)	64 (72)
1,1	55 (63)	50 (58)	54 (62)	60 (68)	54 (62)	48 (56)	56 (64)	64 (72)
1,5	57 (65)	53 (61)	54 (62)	63 (71)	56 (64)	57 (65)	56 (64)	71 (79)
2,2	57 (65)	55 (61)	55 (63)	63 (71)	60 (68)	59 (67)	57 (65)	71 (79)
3	58 (66)	57 (65)	55 (63)	67 (75)	60 (68)	62 (70)	57 (65)	74 (82)
4	60 (68)	57 (65)	58 (66)	69 (77)	64 (72)	62 (70)	62 (70)	74 (82)
5,5	60 (68)	57 (65)	61 (69)	72 (81)	64 (72)	62 (70)	66 (74)	75 (83)
7,5	60 (68)	63 (71)	61 (69)	72 (81)	64 (72)	66 (74)	69 (77)	77 (85)
11	63 (71)	64 (72)	68 (78)	74 (82)	66 (75)	66 (74)	71 (79)	77 (86)
15	65 (73)	64 (72)	68 (78)	74 (82)	67 (77)	69 (78)	71 (79)	78 (86)
18,5	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	78 (86)
22	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	76 (85)
30	69 (80)	68 (78)	73 (84)	82 (93)	70 (81)	72 (83)	72 (82)	78 (88)
37	67 (75)	70 (81)	75 (86)	82 (93)	62 (74)	72 (83)	75 (86)	78 (88)
45	67 (77)	72 (84)	75 (86)	82 (93)	62 (74)	67 (79)	75 (86)	80 (90)
55	67 (77)	72 (84)	78 (86)	84 (98)	63 (77)	67 (79)	77 (88)	80 (91)
75	67 (77)	77 (87)	73 (82)	79 (89)	65 (77)	67 (81)	72 (84)	77 (89)
90	67 (77)	77 (88)	73 (82)	79 (89)	65 (79)	71 (85)	72 (84)	77 (89)
110	73 (85)	77 (88)	79 (92)	84 (97)	65 (79)	72 (86)	73 (86)	77 (91)
132	76 (88)	77 (88)	79 (92)	84 (97)		72 (86)	77 (86)	85 (99)
160		78 (89)	79 (92)	84 (97)			77 (91)	85 (99)
200			79 (92)	84 (97)			77 (91)	85 (99)
250			83 (95)	84 (97)				



NOTES

PUMP model	Serial Number	Computer Number	Year of manuf.
.....

LIQUID handled	Capacitym ³ /h	Suction Pressurem	Discharge Press.m	Temperature°C
<input type="checkbox"/> Lethal <input type="checkbox"/> Toxic <input type="checkbox"/> Noxious <input type="checkbox"/> Corrosive <input type="checkbox"/> Irritant <input type="checkbox"/> Malodorous <input type="checkbox"/>				
<input type="checkbox"/> Clean <input type="checkbox"/> Dirty <input type="checkbox"/> With suspended parts	Spec. Gravity.....	Viscosity.....	PH.....	

TOTAL WEIGHTKGs.	MAXIMUM DIMENSIONS 	X =cm Y =cm Z =cm	NOISE (measured at 1 m) Pressure =dB(A) Power =dB(A)
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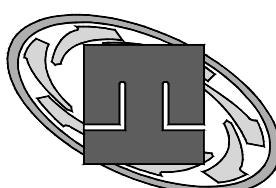
INSTALLATION		SERVICE	
<input type="checkbox"/> Inside <input type="checkbox"/> Explosive area	<input type="checkbox"/> Outside <input type="checkbox"/>	<input type="checkbox"/> Continuous <input type="checkbox"/>	<input type="checkbox"/> Intermittent <input type="checkbox"/>

MOTOR type / Frame	No Poles	No RevolutionsRPM	Absorbed powerAmp	Installed PowerkW /HP
FrequencyHz	SupplyVolt	Enclosure IP.....	Insulation class	Absorbed PowerkW /HP

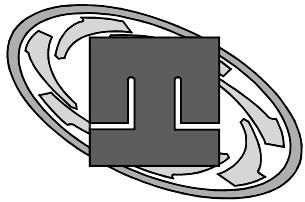
COMMENTS

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Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



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ITEM 62P1



OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB...

MC... - TC...

TMA



OPERATING MANUAL

INSTALLATION, START-UP AND MAINTENANCE FOR CENTRIFUGAL AND SELF-PRIMING PUMPS

This manual applies to the listed below centrifugal pump series and/or affiliated series:

AT - TBH - TBA - TBK - TBAK

MC - MEC - TCK

TCH / MCU-CH

TCA - TCT - TCD

TMA

All pumps are manufactured by:

POMPETRAVAINI s.p.A.

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Distributor:

WARRANTY: All products manufactured by POMPETRAVAINI are guaranteed to meet the conditions listed on the general terms and conditions of sale and/or conditions listed on the Order Confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual will void the manufacturer's warranty. Guarantee will be preserved only if the pump maintenance is carried out by Pompetravaini or an authorized service. Any modification introduced to the pump without the authorization of Pompetravaini will lead to the loss of the guarantee. If it is strictly necessary to dismantle the pump, please consult Disassembling Instructions on our website "www.pompetravaini.it".



This manual is valid only for the listed pump series. This manual IS NOT for the total installation. Instruction and maintenance manual for the installation must be obtained from the engineer that designed the installation. Furthermore the installation manual will take precedence over the pump manual.



The liquids handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their possible disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for pumps subjected to the ATEX 94/9/CE directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 94/9/CE directive it is available a dedicated integrative manual.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

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KEY TO SYMBOLS

 Indications for the pump preservation	 Signals for the operator's safety. DANGER: indicates imminent conditions of danger of serious harm or death. CAUTION: indicates a possible danger of minor harm.
 Warnings for the environment safeguard	 Magnetic dangers for the operator's safety.
 Warnings for the ATEX Directive 94/9/CE	 Electric dangers for the operator's safety.

1 - GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- pump safe application and operation
 - pump installation and maintenance instructions
 - pump start-up, operation and stopping procedures.

The pump user must complete the section at the end of this manual where the design conditions for the pump are recorded. The manual must be filed in a safe place and be accessible to the operator and to the maintenance personnel. The qualified personnel responsible for the operation or maintenance of the pump should read CAREFULLY the whole manual before operating or working on the pump. Qualified personnel are those with experience, knowledge and have a good familiarity with the working safety regulations. They usually have knowledge of basic first aid.

The pump is to be used only for the applications specified on the confirming order for which POMPETRAVAINI has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore the pump CANNOT be used for applications other than those specified on the order.



In the event the pump is to be used for different applications, please contact the sales office or representative of the manufacturer. POMPETRAVAINI declines to assume any responsibility if the pump is used for different applications without prior written consent confirmation.

Pumps are for industrial and continual use in installations fit for the purpose by authorized and trained personnel. The use in unfit or unprotected installations, without proper precautions preventing the contact with untrained personnel or children, is strictly forbidden

If the constructive details functioning data of the pump in use aren't available they could be requested to POMPETRAVAINI specifying the pump type and serial number that are printed on the pump nameplate. Always refer to this for further requests of information or replacement components.

The user is responsible for the verification of the ambient conditions where the pump will be stored or installed.

Extreme low or high temperatures may severely damage the pump unless proper precautions are taken.

POMPETRAVAINI does not guarantee repairs or alterations done by user or other unauthorised personnel.

POMPETRAVAINI does not guarantee repairs or alterations done by user or other unauthorised personnel.
Special designs and constructions may vary from the information given in this manual. Please contact
POMPETRAVAINI should you have any difficulty.

NOTE: Drawings appearing in this manual are only schematics and not to be used for construction.

Drawings appearing in this manual are only schematics and not to be used for construction.
For more specific information contact the Engineering Department of POMPETRAVAINI or the authorised local representative.

2 - SAFETY INSTRUCTIONS



CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS

Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.

- Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.
 - ALWAYS apply the pump for the conditions outlined on the confirming order.
 - Be ALWAYS informed on locations of first aid sites inside the company and carefully read safety and medical first aid prescriptions in force.
 - ALWAYS have a fire extinguisher in the vicinity of the pump installation.
 - Any work on the pump must ALWAYS be carried out by at least 2 qualified people and expressly authorized.
 - Electrical connections on the motor or accessories must ALWAYS be carried out by authorised personnel and in accordance to the local codes.
 - When approaching the pump ALWAYS be properly dressed (avoid use of clothes with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done. Also refrain from wearing long and loose hair.
 - DO NOT attempt to remove the safety guards when the pump is operating.
 - After completion of the work ALWAYS re-install the safety guards previously removed.
 - DO NOT operate the pump in the wrong direction of rotation.
 - NEVER put hands or fingers in the pump openings or holes.
 - ALWAYS disconnect the power to the motor prior to working or removing the pump from the installation.
 - Make sure you have taken the necessary steps to prevent a possible inadvertent return of tension.
 - Ensure the proper isolation of the components and ground connection before inserting the tension.
 - ALWAYS stop the pump prior to touching it for whatever the reason. Wait for the complete pump stopping and make sure that all the installation control devices are properly set in order to avoid any return flow.

- Pump and piping connected to the pump must NEVER be under pressure when maintenance or repair is carried out.
 - NEVER work on the pump when it is hot.
 - NEVER touch pump or piping having temperatures higher than 70°C or lower than -10°C.
 - ALWAYS be careful when handling pumps that convey acids or hazardous fluids.
 - NEVER step on pump and/or piping connected to the pump.
 - ALWAYS make sure that the pump is permanently fixed and steady to the installation (i.e. during removal, handling, installation, etc.)



CAUTION!

Pumps type TCK, TBK and TBAK create a high magnetic field. Personnel should take proper precautions if they are wearing pace-makers or if they are using instrumentation sensitive to magnetic fields.



The listed below minimum distances must be kept:

- When the magnetic rotor parts are disassembled:
users of pace-maker = 2 meters floppy disk; magnetic cards, etc. = 1 meter
 - When the magnetic rotor is mounted in the pump:
users of pace-maker = 1 meter floppy disk; magnetic cards, etc. = 0,5 meter



DANGER!

Possible contact with hazardous media and hazardous substances There are certain components in the pump which may be dangerous to people coming in their contact even during normal operation procedures and/or maintenance, see table 1.



CAUTION!

Danger due to smokes or vapours. In case smokes or vapours are released by the pump do not inhale and immediately stop the pump for inspection.

Tab. 1

MATERIAL	USE	MAJOR RISKS
Oil and grease	General lubrication, ball bearings	Skin and eye rash
Plastic & elastomer components	O-Ring, V-Ring, splash ring, coupling dowels	Smoke & vapours in case of overheating
Teflon & Kevlar fibbers	Packing rings	Release of dangerous powder, release of smoke if overheated
Paints & varnishes	Pump outside surface	Release of powder and smoke if working the painted areas. Flammable
Protective liquid	Pump inside surface	Skin and eye rash

3 - IN CASE OF EMERGENCY

In the event of pump break-down and/or loss of pumped fluid, immediately disconnect the electrical power to the motor (see chapter 11) and contact the responsible personnel in charge of the installation, which should intervene with at least two people paying particular attention to the fact that the pump may be handling dangerous fluids, hazardous to the health and environmentally unsafe.

After the causes for the emergency have been addressed and resolved, it will be necessary to follow the starting procedures (see chapter 10) for the start-up of the pump/motor assembly.

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or come in contact with the human body, immediately follow the instructions given in the company's internal medical safety procedures.

The instructions given in this manual refer to the listed below single stage and multistage centrifugal pumps, horizontal or vertical mounted.

NOTE: Capacities and pressures are approximated and refer to the maximum attainable values for pumps applied in standard conditions at room temperature.

TCH / MCU-CH	Single stage centrifugal pumps for clean liquids designed to DIN 24256/ISO 2858 and 5199 standards - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 16 bar - Flanges PN 16
TCA	Single stage centrifugal pumps for abrasive liquids to DIN 24256/ISO 2858 and 5199 standards - Design with fully open impeller - Capacity to 100 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCT	Single stage centrifugal pumps for very dirty liquids derived from DIN 24256/ISO 2858 standards - Design with open vortex impeller - Capacity to 250 m ³ /h, Max. pressure 7 bar - Flanges PN 16
TCD	Single stage centrifugal pumps for Thermal fluids (Oils) to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 350 m ³ /h, Max. pressure 10 bar - Flanges PN 16
TCS	Single stage centrifugal pumps with inspection opening for clean and dirty liquids - Design with closed and open impeller - Capacity to 550 m ³ /h, Max. pressure 4 bar - Flanges PN 10
MEC	Semi-axial centrifugal pumps for large flows of clean and dirty liquids - Design with open impeller - Capacity to 2100 m ³ /h, Max. pressure 4 bar - Flanges PN 10
TCN	Single stage centrifugal pumps for clean and dirty liquids - Design with closed impeller - Capacity to 2000 m ³ /h, Max. pressure 6 bar - Flanges PN 10
TCK	Magnetic drive single stage centrifugal pumps for toxic and contaminated liquids - Designed to DIN 24256/ISO 2858 standards - Design with closed impeller - Capacity to 300 m ³ /h, Max. pressure 16 bar - Flanges PN 16
MILLS	Pumps derived from the series TCH with special mixing impeller
AT	Self-priming multistage centrifugal pumps with dual lateral channel. Low NPSH requirements. Capacity to 31 m ³ /h, Max. pressure 7 bar - Flanges PN 40
TBH	Self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBK	Magnetic drive self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBA	Self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TBAK	Magnetic drive self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m ³ /h, Max. pressure 35 bar - Flanges PN 40
TMA	Multistage centrifugal pumps for clean liquids, medium and high pressures - Capacity to 45 m ³ /h, Max. pressure 40 bar - Flange inlet PN 16, flange outlet PN 40

The flanges standard (NP 16 or NP 40) does not refer to the maximum pump performance but it indicates the maximum pressure the pump can be subjected to.

For information regarding temperature and pressure LIMITATIONS applicable to the varying designs, types and materials of construction please contact POMPETRAVAINI or your closest authorised representative.

The maximum operating pressure is normally the sum of the suction and discharge pressures.

4.1 - PUMP MODEL NUMBERS AND MATERIALS OF CONSTRUCTION TABLES

Pump nameplate affixed to each pump contains model number, serial number and year of manufacture. Interpretation of pump model number may be attained with the aid of the following table. The pump model is such that it gives information pertaining to the pump type and design.

Listed below are some examples of pump nomenclatures:

Pumps series MC... - TC... = TCH V 50 - 200 A / 1 - C / A3 - M / T	
TCH ⇒ Pump type	1 ⇒ Constructive project number
V ⇒ Vertical mounting	C ⇒ Shaft seal type
50 ⇒ Diameter discharge flange	A3 ⇒ Materials of construction (see table)
200 ⇒ Impeller nominal diameter	M ⇒ Monoblock design with flanged motor
A ⇒ Hydraulic project modification	T ⇒ Special design

Pumps series AT – TB...	=	TBH 315 A / 1 - C / A3 - M / T - V - Z
TBH ⇒ Pump type		A3 ⇒ Materials of construction (see table)
31x ⇒ Pump size		M ⇒ Monoblock design with flanged motor
xx5 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Pumps series TMA	=	TMA 32 - 7 A / 1 - C / A3 - M / T - V - Z
TMA ⇒ Pump type		A3 ⇒ Materials of construction (see table)
32 ⇒ Pump size		M ⇒ Monoblock design with flanged motor
7 ⇒ Number of stages		T ⇒ Seal chamber cooling design
A ⇒ Hydraulic project modification		V ⇒ Vertical mounting
1 ⇒ Constructive project number		Z ⇒ Special design
C ⇒ Shaft seal type		

Generic materials for STANDARD CONSTRUCTION: pumps **MC... - TC...**

Description	GS	RA	A3	HC	DU
Casing	Ductile iron			Hastelloy C	ASTM-CN7M
Cover casing					
Impeller	Cast iron	Stainless steel AISI 316 ASTM-CF8M			Incoloy 825
Shaft					
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **AT - TB...**

Description	GH	RA	A3	B2	GP
Casing	Ductile iron			Bronze	Ductile iron
Element					Cast iron
Impeller	Brass	Stainless steel AISI 316 ASTM-CF8M			Brass
Shaft	Stain. steel AISI 420				Stain. steel AISI 420
Bearing frame		Cast iron			

Generic materials for STANDARD CONSTRUCTION: pumps **TMA**

Description	F	RA	A3
Casing	Ductile iron		
Stage casing			
Impeller	Cast iron	Stainless steel AISI 316 - ASTM-CF8M	
Shaft	Stainless steel AISI 420		
Bearing frame		Cast iron	

For detailed information on materials of construction, (standard or special) for pumps TCD, TCK, MEC, TBK and TBAK please contact POMPETRAVAINI or your local representative.

In case the metallic pump wetted parts come into contact with aggressive liquids it is recommended to stick to the following limitations:

- pH limit for Cast Iron and Ductile Iron ≥ 6
- pH limit for Stainless Steel ≥ 2,5

The above values are approximate and refer to ambient temperature. It is recommended to contact POMPETRAVAINI for doubts, particular conditions or in case different materials are used.

5 – UNPACKING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt verify that the material received is in exact compliance with that listed on the packing slip.

When unpacking follow the instructions listed below:

- Check that no visible damage exists on the crate that could have occurred during transport
- Carefully remove the packaging material
- Check that pump/or accessories such as tanks, piping, valves, etc. are free from visible markings such as dents, scratches and damage which may have occurred during transportation
- In the event of damage, report this immediately to the transport company and to POMPETRAVAINI's customer service department.

DANGER!

Danger due to cut, prick or abrasion Take immediate actions to dispose of possible packaging parts that may generate injuries or risks (for example edges, nails, splinters, etc.)



We remind that the single stage centrifugal pumps supports contain lubricating oil.

Organize the right management of materials subjected to controlled and differentiate disposal (for example plastic, cartoon, polystyrene materials, etc.) according to the laws into force and to a safe local environment management. according to the laws into force and to a safe local environment management.

If the pump will be stored, as foreseen in our Operating Manuals, we recommend a proper care to avoid oil dropping on the ground.

The pump must ALWAYS be moved and transported in the horizontal position.

Before transportation check on the nameplate, in the transportation and technical documents for:

- total weight
- centre of gravity
- maximum outside dimensions
- lifting points location.

DANGER!

Danger due to overturning or crushing For a safe lifting it is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts with correct movements, to prevent material damages and/or personal injuries.

The fig. 1 shows several additional examples of lifting.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 2).

Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage.

The fig. 3 shows several additional examples of lifting to be avoided.

CAUTION!

Possible contact with fluids or harmful substances. Before removal after a period of operation, the pump, together with auxiliary piping and jacketing, must be drained and decontaminated from the handled media.

Every hole and opening communicating with the inside of the pump must be properly plugged.

For removing the pump from the installation see chapter 17. Operate provided with apposite protective devices.

6 - STORAGE INSTRUCTIONS

After receipt and inspection the unit, if not immediately installed, the unit must be repackaged and stored in the best way.

For a proper storage proceed as follows:

- store the pump in a location which is closed, clean, dry and free of vibrations
- do not store in areas with less than 5°C temperature (for lower temperature it is necessary to completely drain the pump of any liquids which are subject to freezing)

POSSIBILITY OF FREEZING!

Where the ambient temperature is less than 5°C it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

It is possible to use as antifreeze a mixture of surface-active glycol or other suitable products making sure they are compatible with both pump gaskets and elastomer.

- fill the pump with a rust-preventative liquid that is compatible with the pump gaskets and elastomer. Rotate the shaft by hand to impregnate all internal surfaces. Drain the excessive liquid from the pump and associated piping (see chapter 11).

Please note that the pumps with cast iron internal parts have been treated at the factory, prior to shipment, with a rust-preventative liquid: this liquid is capable of protecting the pump against rust for a period of 3 to 6 months.

A further solution, for long term storage, is to fill the pump with the rust inhibitor, rotate the pump shaft by hand to eliminate any air pockets (the liquid must be suitable with gasket, elastomer and pump materials).

- plug all openings that connect the pump internals to the atmosphere
- protect all machined external surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up or seizing
- keep the pump in a dry and clean place not subjected to vibrations caused by other sources
- any pump accessories should be subjected to similar procedure.

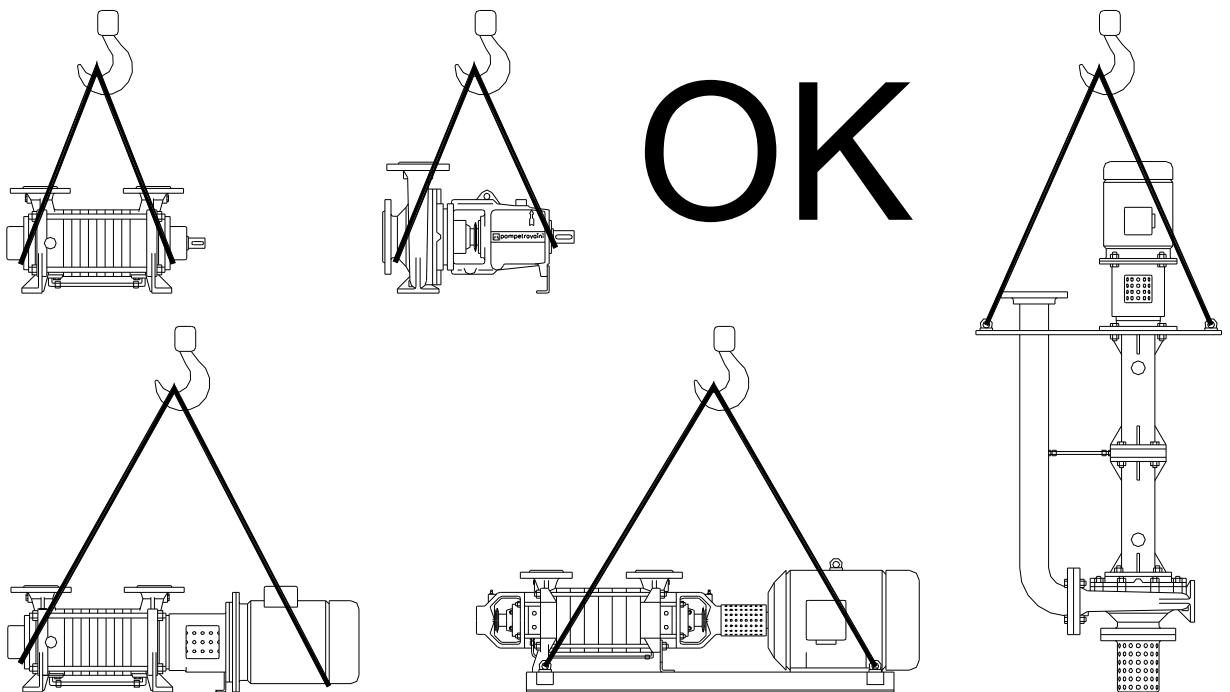


Fig. 1

Fig. 2

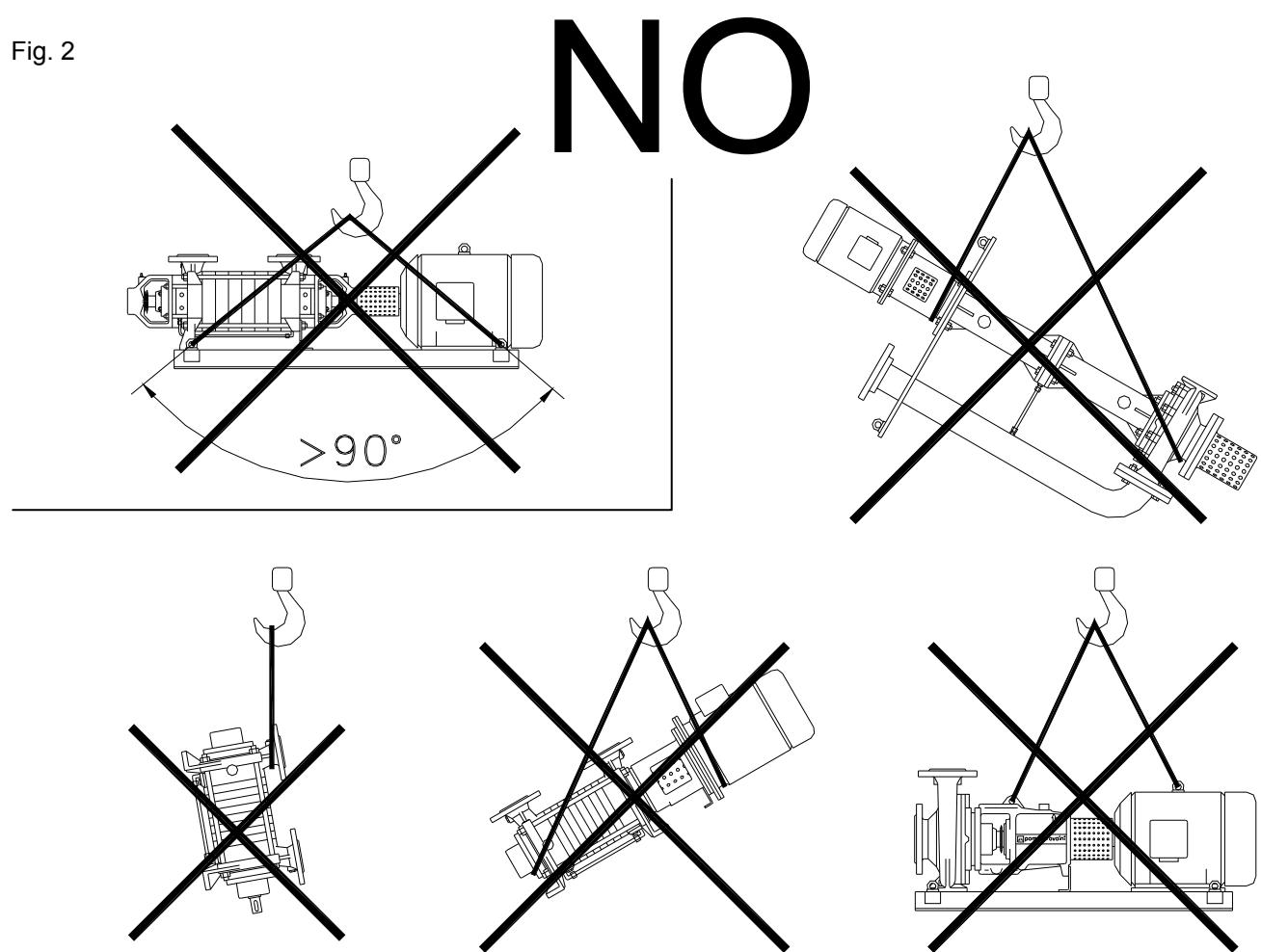


Fig. 3

CAUTION!

Avoid installing the unit in narrow areas and lacking of ventilation where unfavourable conditions for the personnel may take place. Allow the personnel a good visibility of the pump assembly by providing a proper lighting.



A proper pump installation must not transmit vibrations to ambient in the permanent presence of personnel.

Information to determine the piping sizes and floor space requirements can be obtained from dimension drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of all connections for flushing, cooling, heating, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to following chapters 7.1 - 7.2 - 7.3.

Proper lifting devices should be available for installation and repair operations.

Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made.

It is important to have proper room around the unit for ventilation of motor. Avoid installing the unit in hidden locations, dusty and lacking of ventilation.

Pump/motor assembly should not be installed in narrow areas, dusty, toxic and explosive ambient. In the event this is not possible it is recommended to ventilate the areas to help cooling the motor (minimum 0,6 metres of empty room around). All components used in the installation should comply with the safety codes. The installation must not transmit vibrations to the pump.

Select a mounting pad that will minimise vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams.

It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 4).

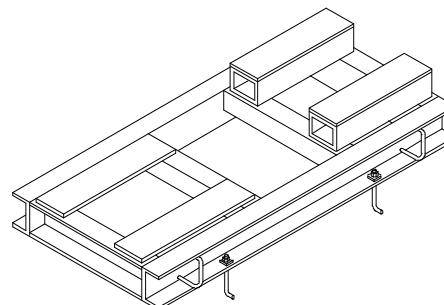
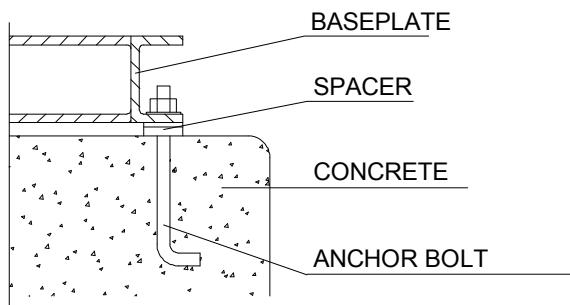


Fig. 4

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

7.1 - INSTALLATION OF PUMP/MOTOR ASSEMBLY

Place the pump assembly on the foundation pad aligning the anchoring bolts.

If necessary use metal spacers to level the unit and check the flange connection for good horizontal and vertical planes.

Tighten the foundation bolts.

Check again the level of the assembly and proceed with the pump/motor alignment verification as discussed in paragraph 8.2.

In cases where the pump is installed on a baseplate separated from that of the motor (due to expected piping forces, moments or as it often is in cases of large units) it is recommended to first install the pump and then proceed with the motor installation and alignment.

7.2 - SUCTION AND DISCHARGE PIPING

Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction (see fig. 5) and discharge flanges, the service liquid line and all other service connections.

CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Pay maximum attention to the proper connection of the system pipelines to the respective pump's connections.

Operate only provided with apposite protective devices.

To prevent the introduction of any limb in the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up.

Inlet and discharge piping should be of same size as the pump flanges, where possible increase the pipe size but NEVER decrease the size.

In general the liquid velocity in the suction piping should not exceed 2 m/s and in the discharge piping should be less than 3 m/s. Higher liquid velocities will result in higher pressure drops which could create cavitation in the suction piping and excessive pressure losses in the discharge piping, which would negatively affect the system performance and the pump.

Where possible, avoid using piping turns and especially short radius elbows.

When using larger pipe sizes than the nominal, the reduction from a larger diameter to a small diameter should be gradual and with conical configuration, the length of the conical area should be 5 to 7 times the difference in size of the two diameters.



Piping should always be supported to neutralise any forces, moments, piping weights, thermal expansions, etc. which could create pump/motor misalignment, deflections and overloading to foundation bolts.

Pipe joints should be by means of flanges with flange gaskets of proper size and material.

Flange gaskets should be properly centred between the flange bolts so that there is no interference with the flow of the liquid.

There should not be any tensions, deformations or misalignment of the piping when loosening the bolts holding the flanges together.

Any thermal shocks and/or excessive vibrations should be controlled by means of expansion joints, flexibles, etc. having same size as the piping.

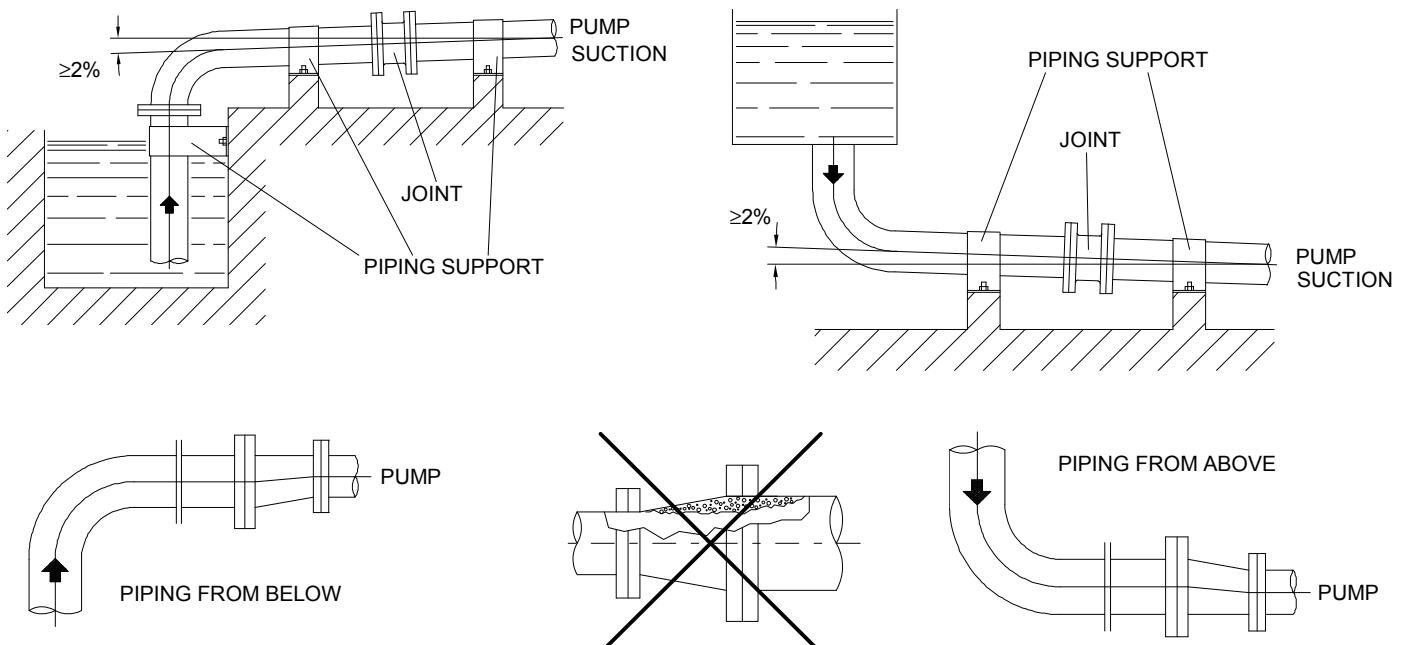


Fig. 5

7.2.1 - Suction piping (see fig. 5 and 6)

To prevent loosing pump priming absolutely avoid formation of air pockets in the suction piping. This piping therefore should have a slope toward the reservoir in the case of suction lift installation, and toward the pump in the case of the flooded suction installation.

Isolating valve should only be on the fully open or fully closed positions and NEVER as a flow regulator. The valve should be installed with the stem in the horizontal position relative to the flow in the piping and at a distance from the pump suction flange of at least 10 times the pipe size.

Depending upon the application, a non return valve or a foot valve should be fitted in the suction piping, a strainer or filter will prevent solids from entering the pump and a pressure or vacuum gauge will enable reading the pump inlet pressure.

All components listed above will create pressure drops which must be taken into consideration in the design stage.

Where more than one pump is installed, every pump should have its own separate suction piping; if a stand-by pump is installed the two inlets can be connected to a common manifold with a single suction piping.



For pumps series TBA, in case of negative suction (from well) and only if NOT provided with check valve or foot valve, contrary to what above indicated it should be necessary that the suction piping will have a slope toward the pump.

7.2.2 - Discharge piping (see fig. 6)

Right after the pump discharge flange install a non return valve will stop dangerous water hammer which could seriously damage the pump discharge casing, a flow regulating valve (Globe or Needle valve), a pressure gauge can be connected to the threaded connection under the pump discharge flange, a vent valve should be fitted in this piping to fill pump and piping for initial start-up.

7.2.3 - Piping cleaning



CAUTION!

Possible contact with hazardous media and hazardous substances, cold or warm. Operate only provided with apposite protective devices.

Before installation start-up clean piping and any reservoirs removing loose materials and foreign particles.

Particular attention for cleaning should be for installations where welding of piping and components has taken place.

7.2.4 - Pressure testing



DANGER!

Danger due to fluids in pressure. Carry out sealing tests provided with apposite protective devices.

When the installation has been completed it is necessary to test the piping for both static pressure and vacuum.

Testing should be carried out in accordance to the applicable standards for the piping function and the operating pressures.

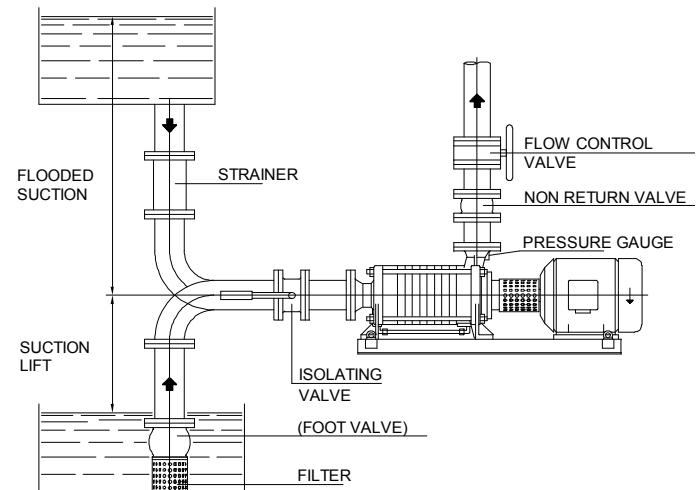
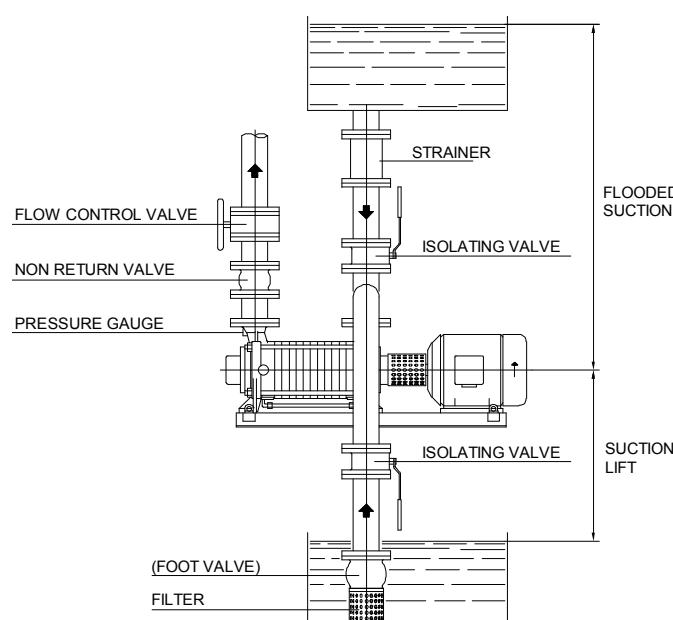
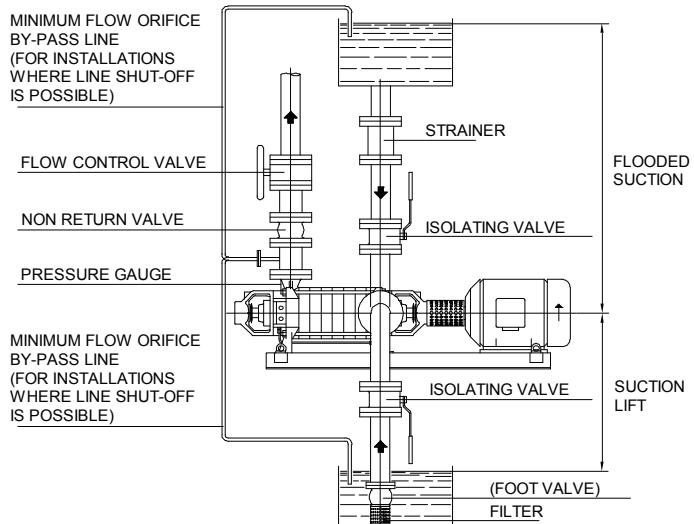
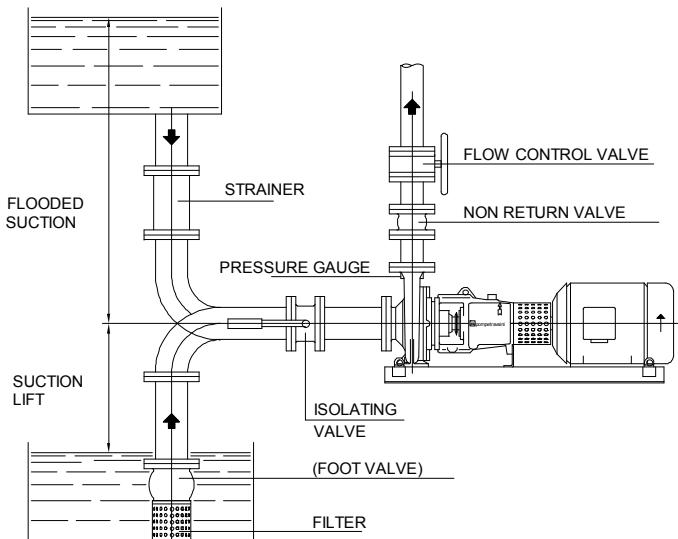
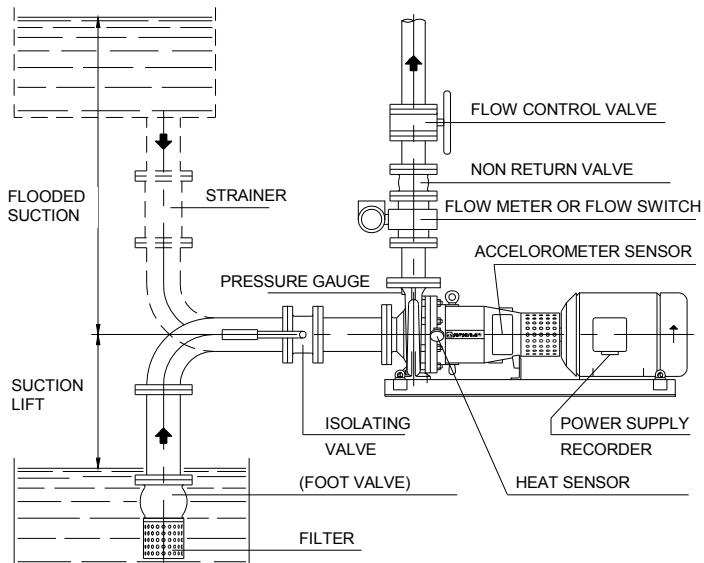
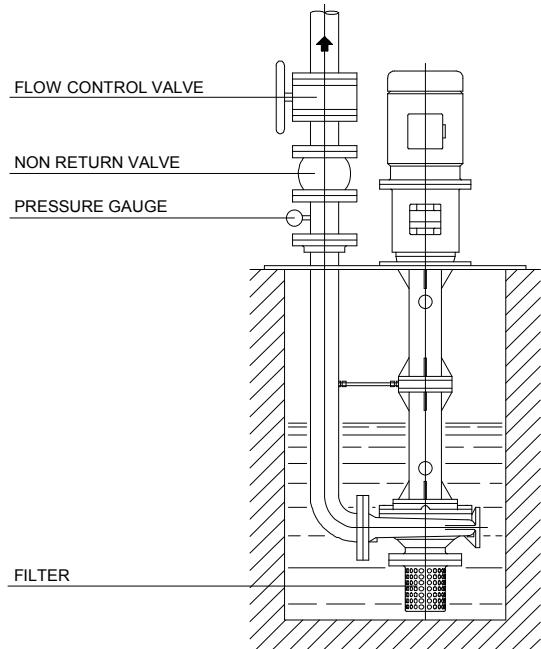


Fig. 6A



Pump series TCK



Pump series MC... - TC... - VERTICAL construction

Fig. 6B

7.3 - ACCESSORIES AND AUXILIARY CONNECTIONS

Depending on the application accessories may be installed to test the pump performance (instrumentation to measure pressure, temperature, capacity, etc.) and/or for necessary operations (cooling, heating, flushing of seals, etc.). When accessories are required the following should be considered:

- a) Pressure and vacuum gauges must be properly anchored and connected at the measuring points located at pump flanges or near the flanges, using approx. 8 mm. diameter tubing with "pig tail" configuration to alleviate pressure fluctuations.
For safety purposes, isolating and vent valves should be fitted before these instruments (see fig. 7).
- b) Temperature gauges should be installed with thermowells selected for the specific purpose and fitted in strategic locations where the reading is required (see fig. 8).
- c) Every pump is fitted with draining connections at the pump casing. If required, pump drain and mechanical seals leakages can be piped to a container located nearby on the floor or (if available) to the drain catch basin for the total installation.
The pump draining piping should be fitted with an isolating valve and both should be suitable for the pumps maximum operating pressure.
- d) Cooling, heating, flushing of mechanical seals and other piping must be connected only to the designated connections located on the pump (see fig. 9-10-11-12 and chapter 15 for more details).
All tubing and connections must be a minimum of same size as the connection on the pump.
Insulation, if required, must be limited to the pump body, leaving all other components such as bearing frame and motor uncovered for heat dissipation.
- e) Controlling the minimum capacity.

When the pump operates near the shut-off with almost no flow, almost all the motor power is transformed into thermal energy which is absorbed by the pumped liquid.

If the capacity is less than the minimum recommended (10-15% of pump capacity at its best efficiency point) not only will there be excessive load on the pump support and bearings but the liquid could evaporate resulting in damage to the impellers and wear rings with possibility of the pump seizing.

To prevent these problems it is recommended the installation of a minimum flow valve in the discharge piping, right after the pump but before the flow regulating valve.

In the event the flow regulating valve being excessively throttled or even completely closed, there will always be the required minimum liquid flow recirculated from the pump discharge to the suction piping of the pump.

The other device which may be fitted in this by-pass line (from pump discharge, before flow regulating valve, to pump suction) is a calibrated orifice sized for the minimum liquid flow required by the pump.

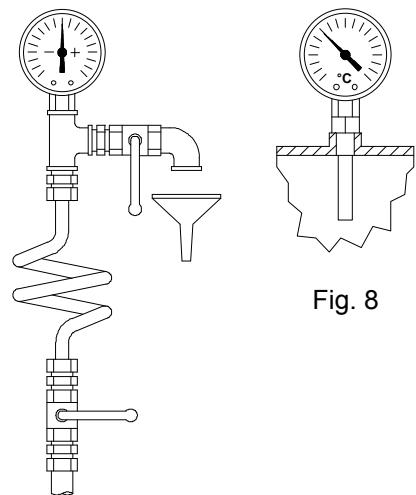


Fig. 8

Fig. 7

- f) Pumps with magnetic drives (series TBK, TBAK, TCK), should be fitted with a temperature sensor to monitor and register the temperature in the area of the magnetic coupling. Pumps are fitted with a threaded connection for this purpose.
- g) To prevent pumps running dry it is recommended to install, in the pump discharge line, a flow meter to check that there is a constant liquid circulation in the piping.
- h) Fitting of a power meter will help analyzing the operation of the pumps. Knowing the minimum and maximum power absorbed by the operating pumps will help identifying problems that may be caused by dry running, siphoning, etc.
- i) Accelerometers fitted on the bearing housing near the bearings, will help with the reading of the vibrations. An analysis of the vibration diagram, direct or indirect, would provide a diagnostic to prevent mechanical breakdowns, such as hydraulic cavitation.
- j) It is recommended to start the magnetic pumps and all other pumps with more than 4 KW motor drive, with Soft-Starters or Delta-Star connections. Further information may be found in chapter 9 and in paragraph 19.1 of chapter 19.

LEGEND for figures 9-10-11-12

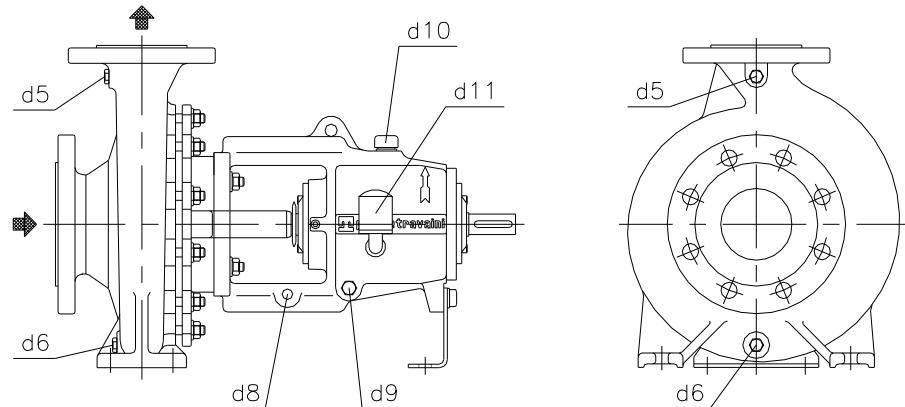
- d1.1 Threaded connection - "double tandem" mechanical seal flushing inlet from outside
- d1.2 Threaded connection - "double tandem" mechanical seal flushing outlet
- d2.1 Threaded connection - mechanical seal chamber cooling/heating liquid inlet
- d2.2 Threaded connection - mechanical seal chamber cooling/heating liquid outlet
- d3.1 Threaded connection - flushing liquid inlet from outside for "double back to back" mechanical seal or for single mechanical seal construction
- d3.2 Threaded connection - "double back to back" mechanical seal flushing liquid outlet
- d4.1 Threaded connection - casing cooling/heating chamber liquid inlet
- d4.2 Threaded connection - casing cooling/heating chamber liquid outlet
- d5 Plugged connection - for manometer
- d6 Plugged connection - for pump casing drain
- d7.1 Threaded connection - packing seal flushing liquid inlet from outside
- d7.2 Threaded connection - packing seal flushing liquid outlet from outside
- d8 Threaded connection - for seal leakages recovery
- d9 Plugged connection - bearings oil drain from housing (on request only)
- d10 Plug with dipstick for bearings oil filling into housing
- d11 Constant level oil filler (on request only) or Oil level gauge (standard)
- d12 Threaded connection - mechanical seal flushing liquid inlet from outside (on request only)
- d13 Grease nipple
- d14 Plugged connection - air-hole mechanical seal chamber
- d15 Plugged connection - sludge discharge from mechanical seal chamber (only for TCD/2-SP)
- d16 Threaded connection - tank liquid discharge (only for TCD/2-SP)
- d17 Threaded connection - for tank (only for TCD/2-SP)
- d18 Threaded connection - to check oil leaks from bearing (only for TCD/2-SP)
- d19 Threaded connection - thermometric probe
- d20 Plugged connection - filling
- d21.1 Threaded connection – "Quench" liquid inlet
- d21.2 Threaded connection – "Quench" liquid outlet

Plugged connection = Plug to be removed in case of use

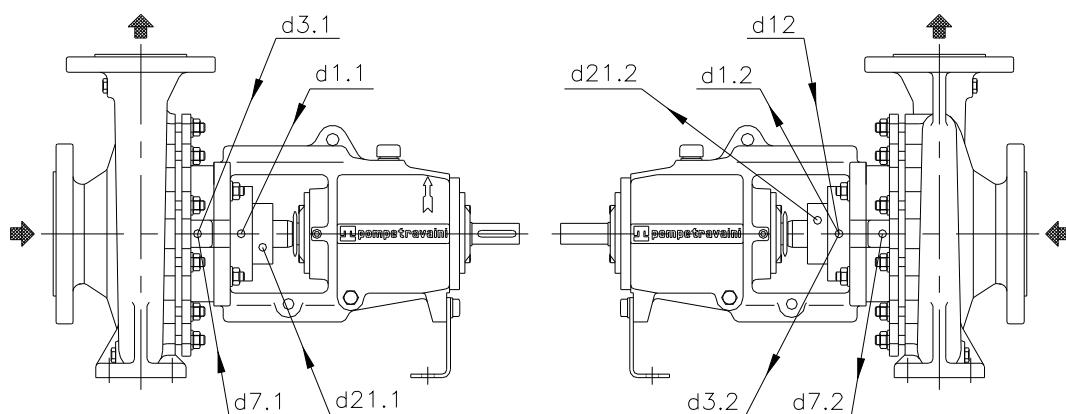
Threaded connection = Before connecting remove the plastic protection plug

For each pump specific connections dimension please consult our website "www.pompetravaini.it".

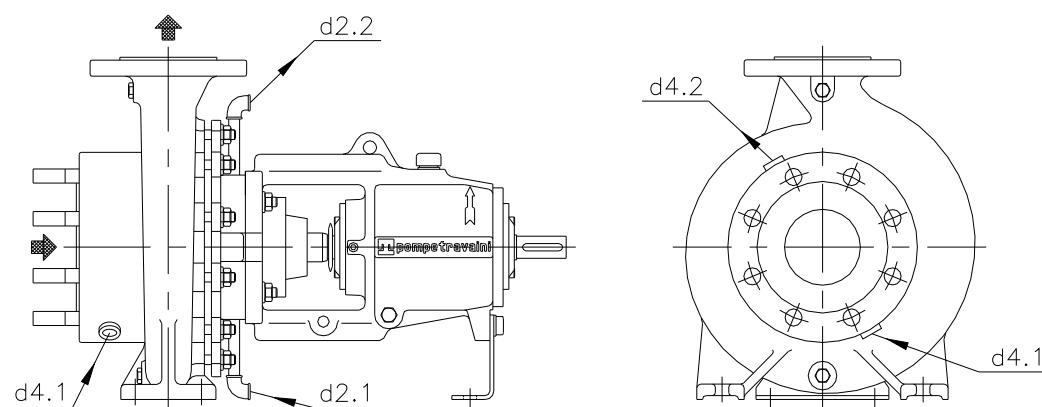
Fig. 9 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
Standard connections and hook-ups

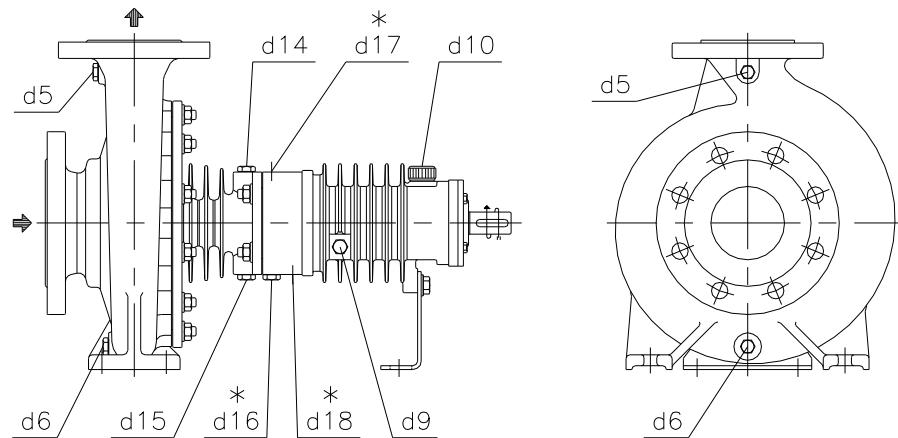


Pumps series MC... - TC...
Connections for designs /C - /R - /RR - /R2 - /B

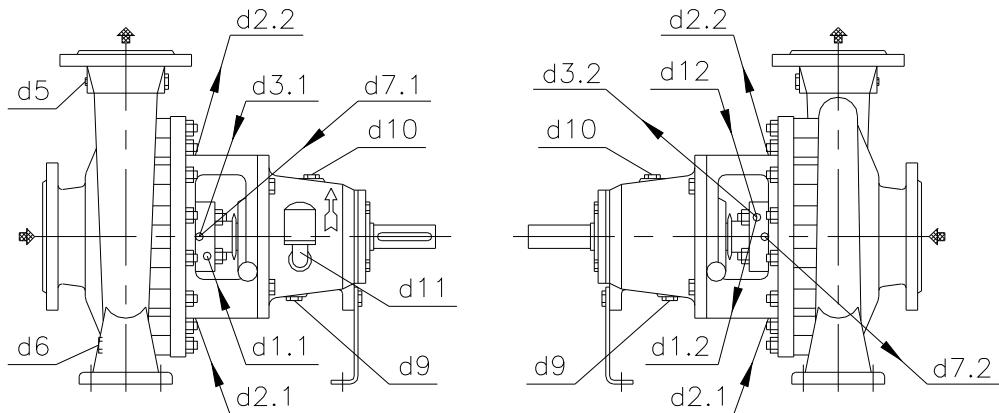


Pumps series MC... - TC...
Connections for designs /T - /U2

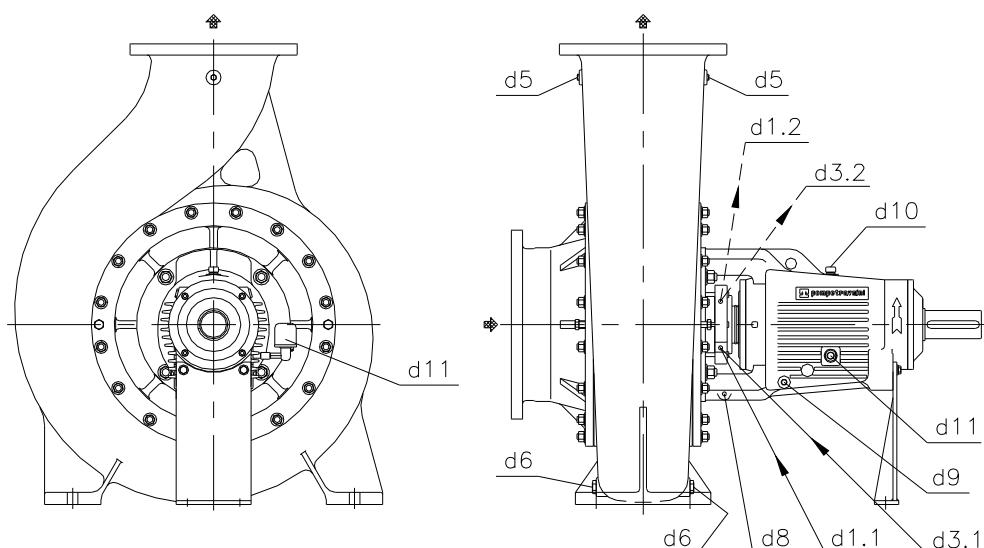
Fig. 10A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TCD
Standard hook-ups and connections - (* Only for TCD/2-SP)

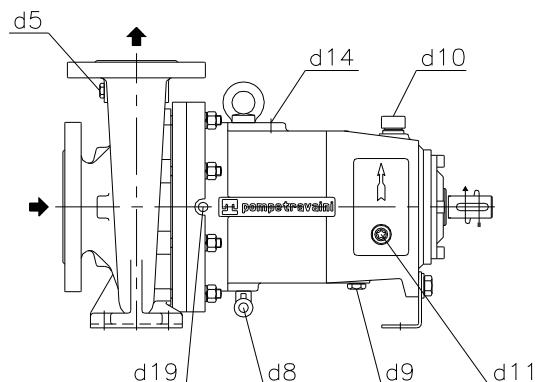


Pumps series MCU-CH n.s. group 3 and 4
Standard hook-ups and connections

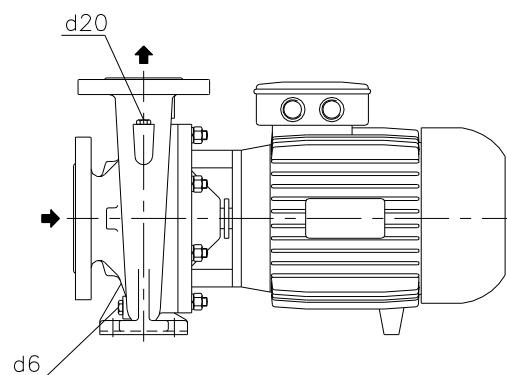


Pumps series TCH and TCN group 5
Standard hook-ups and connections for Double back to back mechanical Seals

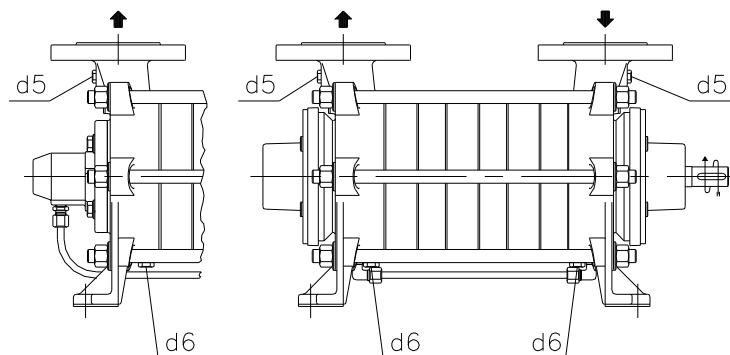
Fig. 10B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



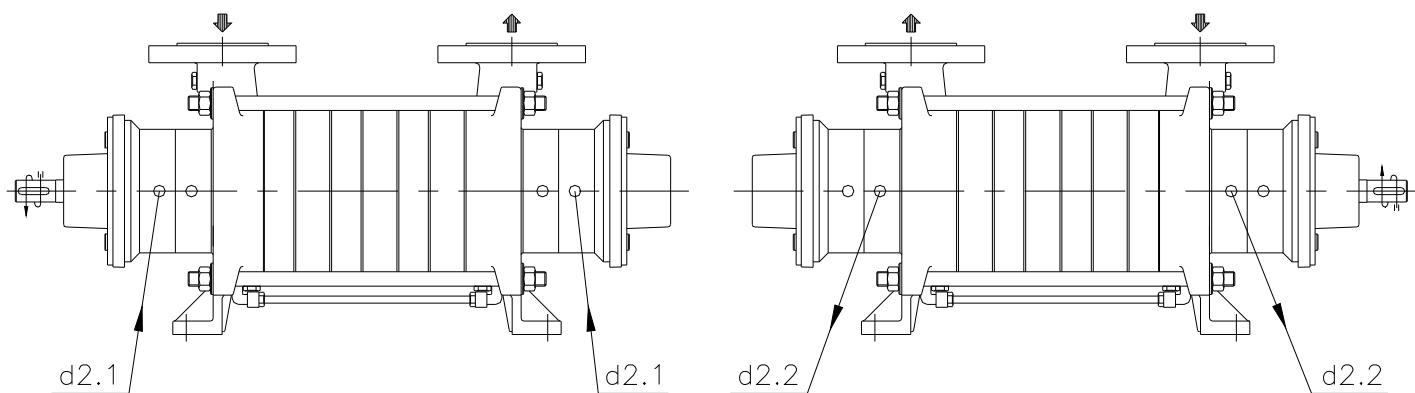
Pump series TCK
Standard connections and hook-ups
NOTE: d19 = on both side for gr. 2



Pump series MCM
Standard connections and hook-ups

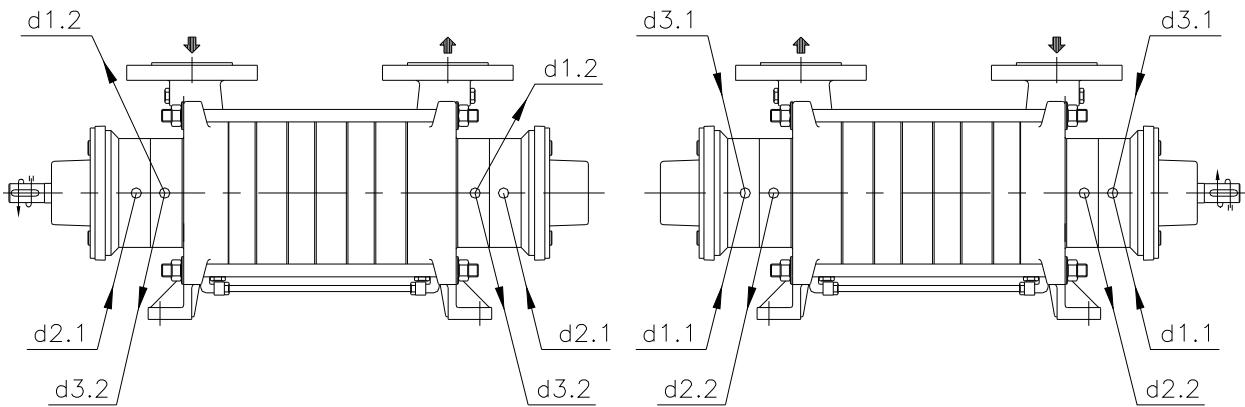


Pumps series TBH/C - TBH/KC - AT/KC - TBA/C
Standard hook-ups and connections

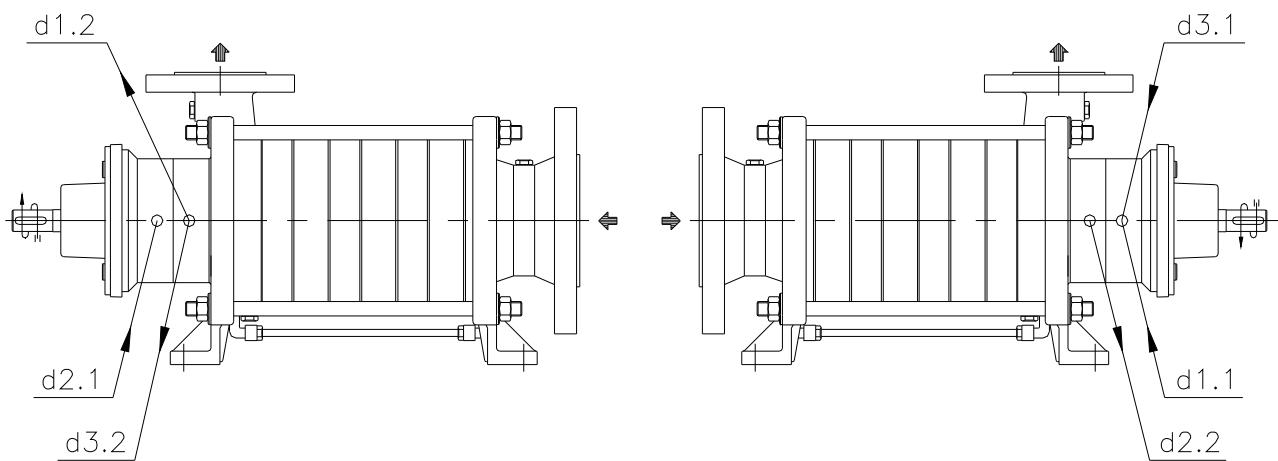


Pumps series TBH/CT - AT/CT
Connections for cooling or heating

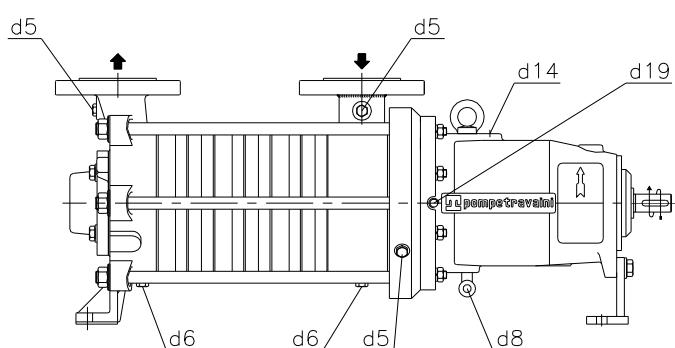
Fig. 11A - CONNECTIONS AND HOOK-UPS FOR FLUSHING



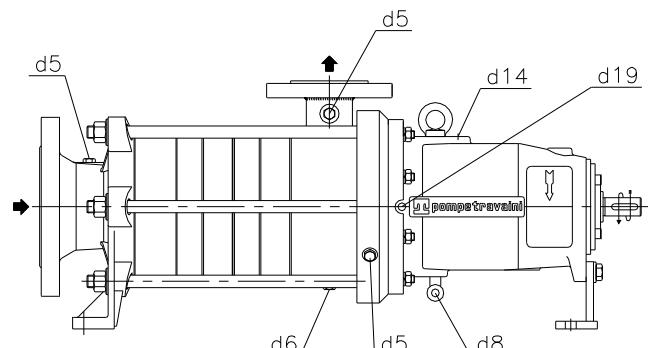
Pumps series TBH/KC-2T - AT/KC-2T
Connections for mechanical seals flushing, cooling or heating



Pumps series TBA/C-2T
Connections for mechanical seals flushing, cooling or heating

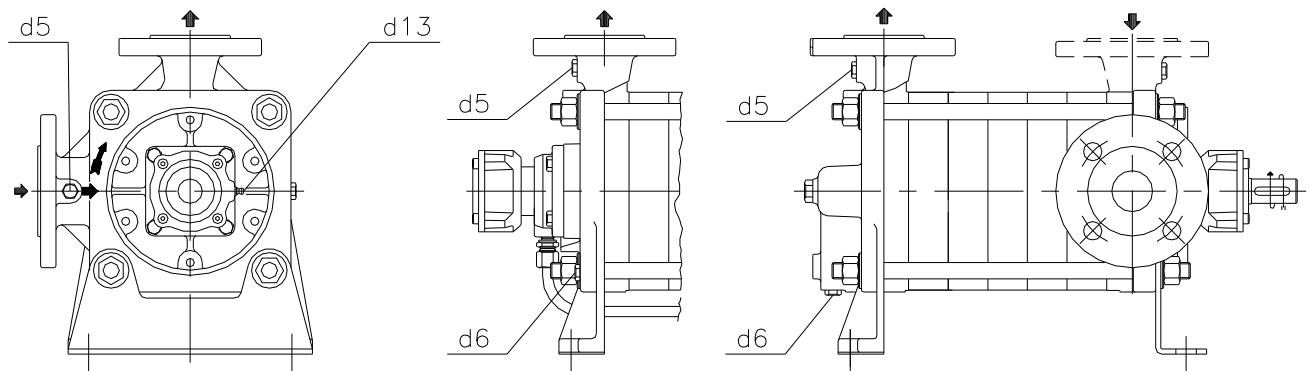


Pump series TBK
Standard connections and hook-ups

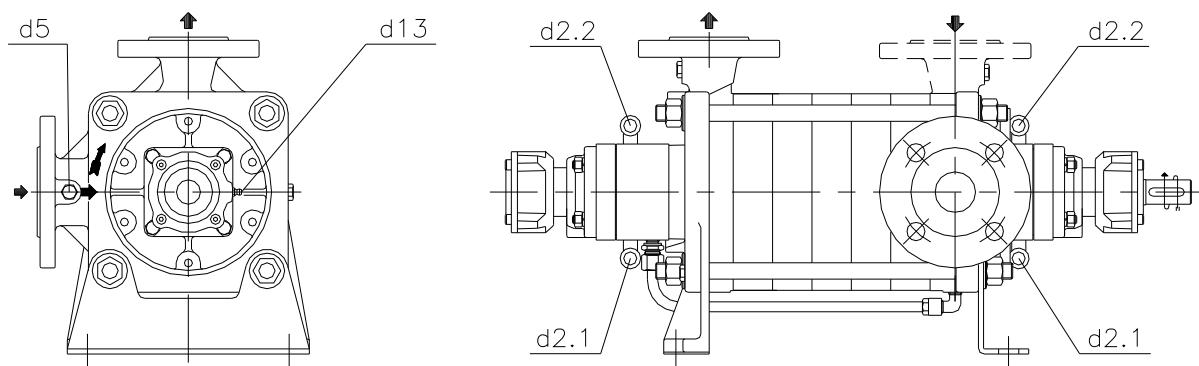


Pump series TBAK
Standard connections and hook-ups

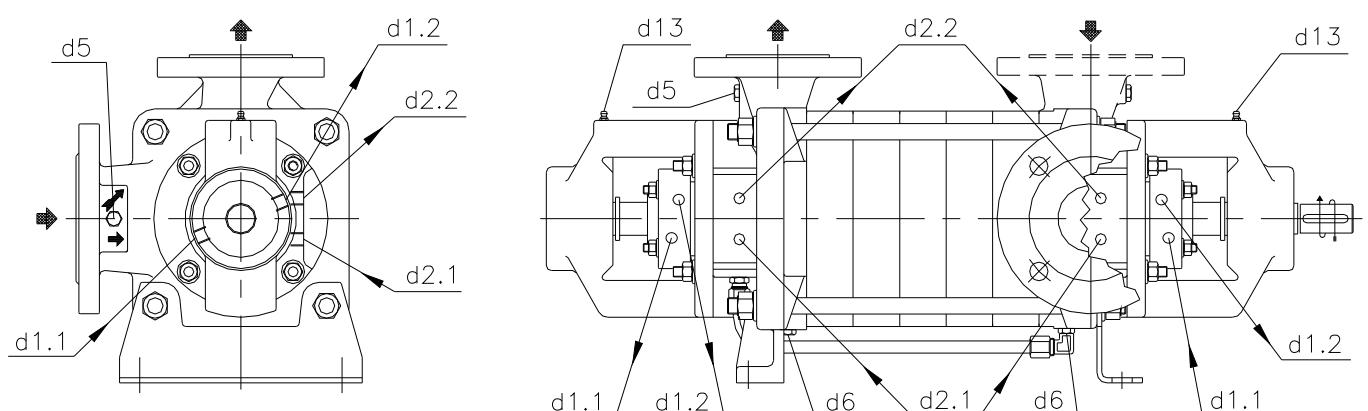
Fig. 11B - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series TMA 31 and 32/C and /R
Standard hook-ups and connections

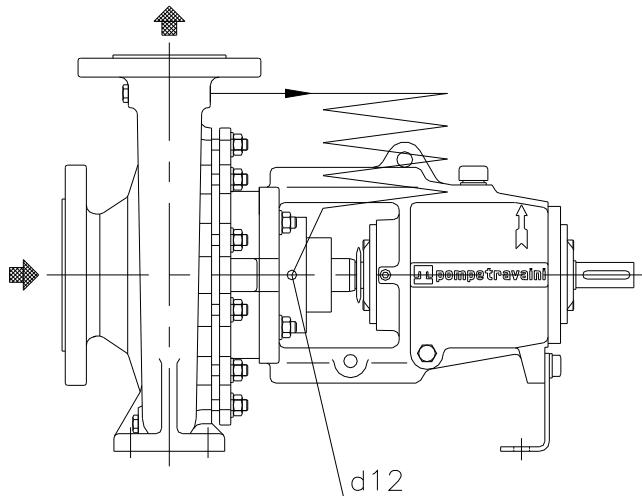


Pumps series TMA 31 and 32/T
Connections for cooling or heating



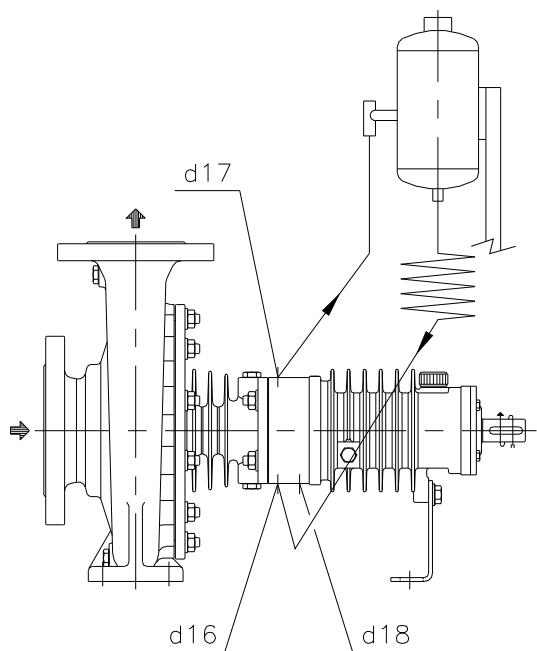
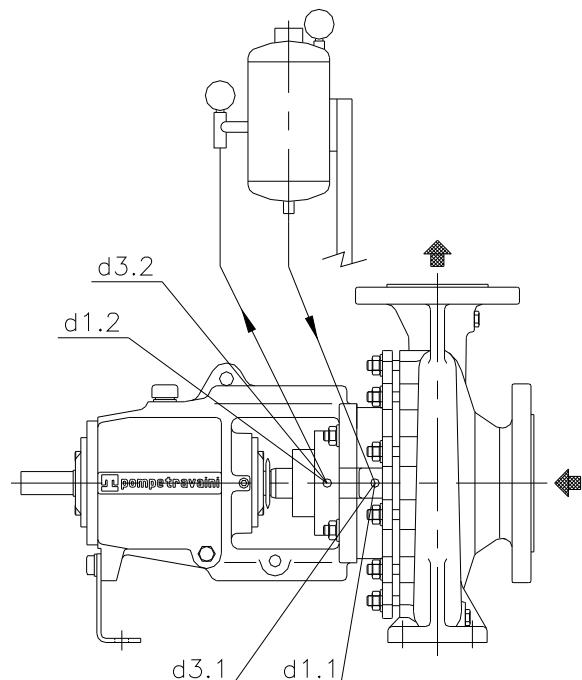
Pumps series TMA 40 and 50/B - /R - /R2
Connections for mechanical seals flushing, cooling or heating

Fig. 12 - CONNECTIONS AND HOOK-UPS FOR FLUSHING



Pumps series MC... - TC...
(API Plan 11) Recycle directly from pump casing or via cooling

Pumps series MC... - TC...
Single or Double mechanical seal flushing with Seal Tank



Pumps series TCD/SP
Mechanical seal flushing with Seal Tank

DANGER!

 Danger of collision, harm and crushing! Do not start up the pump without the needful guards on both coupling and motor. The coupling procedures must be carried out when the pump is stopped, after having activated the safety procedures to prevent an accidental start-up (also see chapter 2). Operate provided with apposite protective devices (helmet, glasses, gloves, etc.).

8.1 - MONOBLOCK PUMP/MOTOR AND PUMP/MOTOR ASSEMBLY MOUNTED ON A BASEPLATE

If the pump has been furnished with bare shaft end (i. e. without motor) it is required to procure a proper baseplate on which to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid "U" shaped channel (fig. 15 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit.

Selection of motor must consider the following data at running condition:

- maximum power absorbed by the pump over the total operating range
pump operating speed (RPM)
- available power and network frequency (hertz, voltage, poles, etc.)
- motor enclosure type (CVE, ATEX, etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

Flexible couplings are selected considering:

- nominal motor horse power
- motor operating speed
- coupling guard must meet safety standards
 - possible pump damaging.

 Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 8.3 steps 1, 2, 4, 5, 6.

Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 8.3 steps 7, 1, 8, 5, 9, 10, 11.

For pump driven with V-BELT, please consult POMPETRAVAINI for possible information.

8.2 - ALIGNMENT PROCEDURE FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE

The pump/motor assembly is properly aligned by POMPETRAVAINI prior to shipment.

It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK DESIGN see paragraph 7.3 steps 3, 4, 5, 6.

For alignment procedure of BASEPLATE DESIGN see paragraph 7.3 steps 7, 5, 9, 10, 11.

PLEASE NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by POMPETRAVAINI as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

8.3 - ALIGNMENT INSTRUCTIONS

Alignment should be done at ambient temperature.

Do not try to force the fitting of the coupling onto the shaft. First remove the elastomeric dowels and then heat up the half coupling up to 150°C (do not use microwave ovens).

Should the pump operate at high temperatures which could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures.

The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper keyway slots and fit the coupling halves in line with the shaft ends. The use of a rubber hammer and even pre-heating of the metal half couplings may be required (see fig. 13). Lightly tighten the set screws. For monoblock versions make sure to tighten the connecting screws between lantern and motor as explained hereinafter.

Verify that both pump and motor shafts rotate freely.

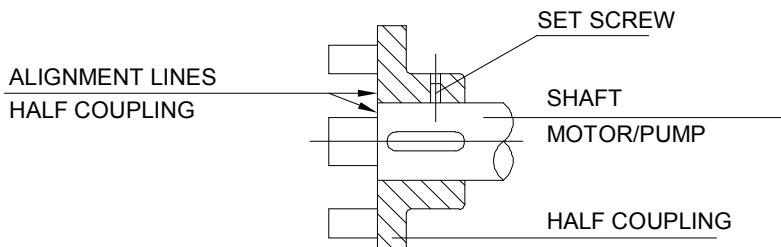


Fig. 13

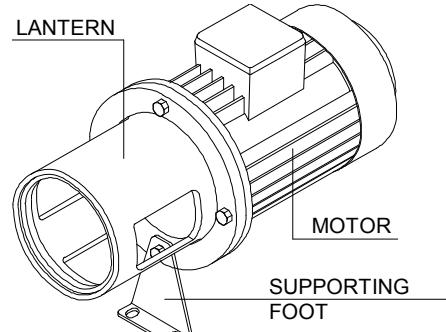


Fig. 14

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 15) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 14). When tightening the connecting screws between lantern and motor make sure not to force the two half-couplings until they touch each other. If this occurs remove the motor, axially move the half-coupling on the shaft and repeat the fixing procedure.

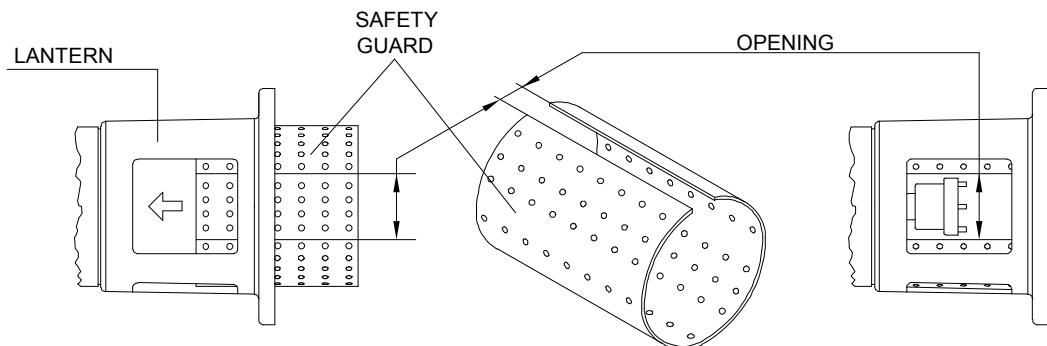


Fig. 15 - PREPARATION TO ASSEMBLY ON MONOBLOCK DESIGN

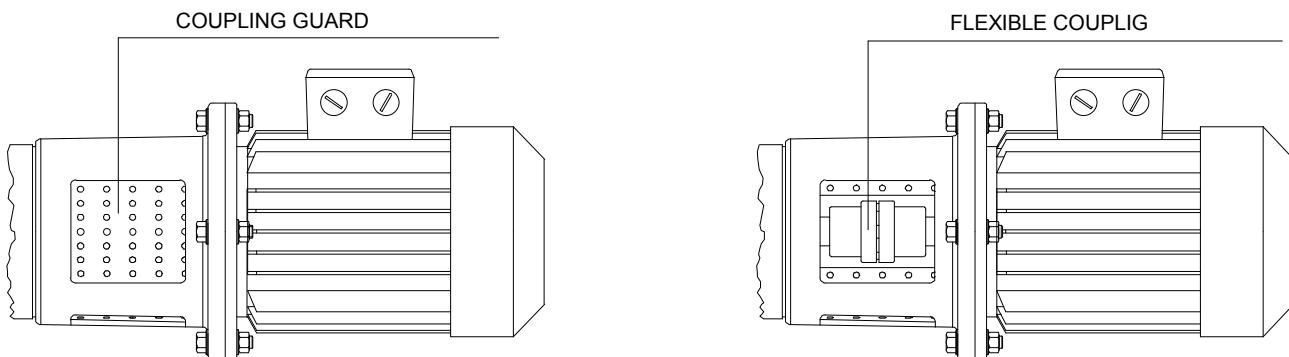


Fig. 16 - CHECKING ALIGNMENT ON MONOBLOCK DESIGN

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 16).

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a proper spacer check the distance between the two coupling halves. The gap value "S" should be as listed on table 2 or as given by the coupling manufacturer. In the event an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap "S" (see fig. 20). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

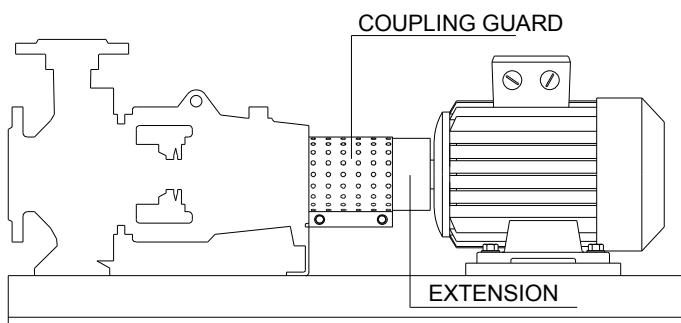


Fig. 17 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 17 and 18).

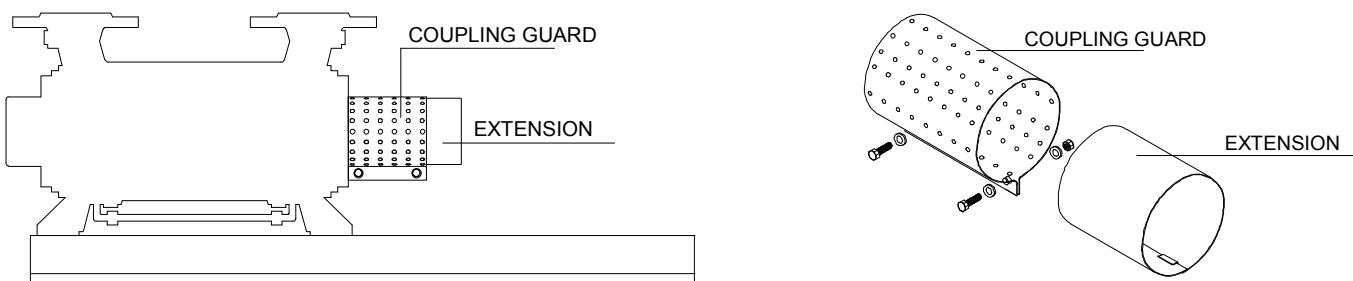


Fig. 18 - MOUNTING THE UNITS ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2 mm. gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 19).

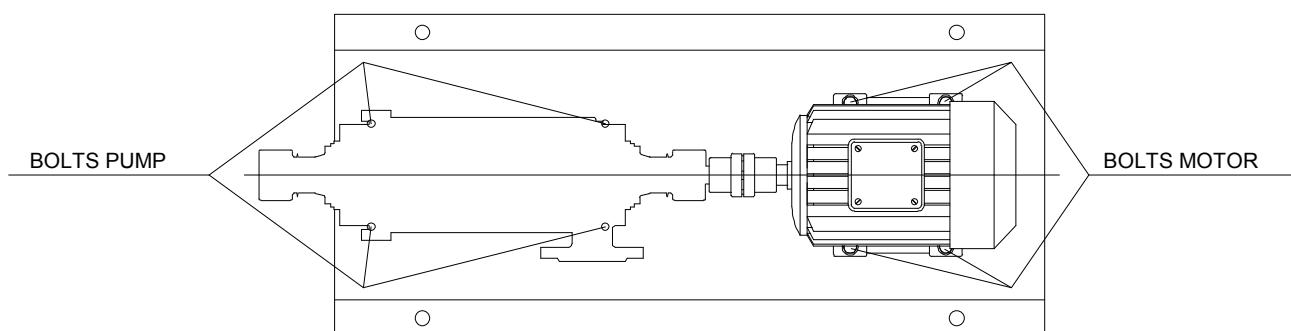


Fig. 19

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 21).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

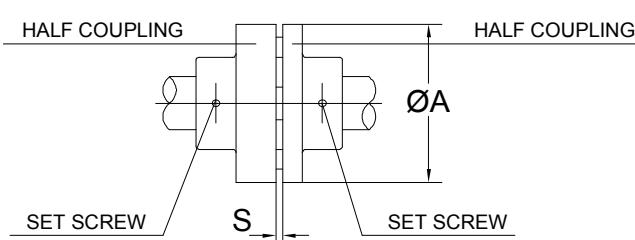


Fig. 20

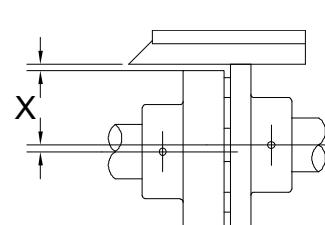


Fig. 21

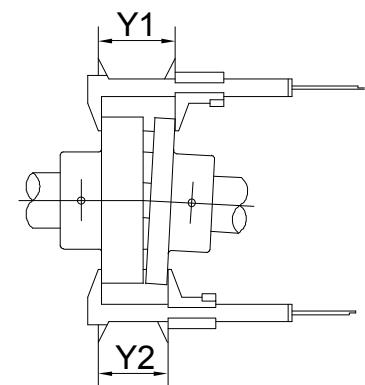


Fig. 22

If the maximum value of "X" is higher than that listed in the tab. 2 (for the given coupling size) it will be required to correct the alignment by using decimal shims under the pump or motor feet (NOTE: the optimal values have to be considered half of the reported data).

When the measured values fall within the tolerances the pump and motor anchoring bolts can be tightened.

10 - Angular misalignment can be measured with a Calliper. Measure the outside coupling dimension at several points (see fig. 22).

Find the minimum and maximum width of the coupling, the difference between these two readings "Y" ($Y_1 - Y_2$) should not exceed the value listed in tab. 2 for the given coupling size (NOTE: the optimal values have to be considered half of the reported data). Should this value be greater it will be necessary to correct the alignment by re-shimming the pump and/or motor.

Following this operation it is recommended to check once more the value "X" to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Tab. 2

COUPLING "Ø A" mm	GAP "S" mm	PARALLEL "X" mm	ANGULAR "Y" mm
60 ÷ 80	2 to 2,5	0,10	0,20
100 ÷ 130		0,15	0,25
150 ÷ 260	3 to 3,5		
290	4 to 5	0,30	
330	5 to 7		0,30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor and guard should not be greater than 2 to 3 mm. (see fig. 23).

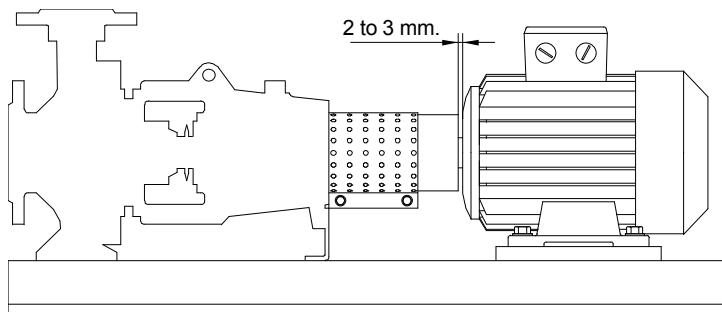


Fig. 23

8.4 - COUPLING PUMP SERIES "TCHM" AND "TCTM"

These pumps do not require a coupling between the pump and the motor shaft; they have been engineered with a supporting flange and shaft having bore and keyway ready to engage the motor shaft and key.

- Check the tolerances of pump shaft bore with its keyway and motor shaft with key. The motor shaft must engage the pump shaft perfectly without interference. In the event there is interference, even if minimal, it is required to rework the motor shaft because a forced fitting would be detrimental to the pump operation.
- Attach the electric motor to the pump flange making sure that the two shafts line-up and the key engages the keyway. Bolt the assembly with the supplied fasteners and install the supporting foot if it applies to the specific pump (see fig 23A).

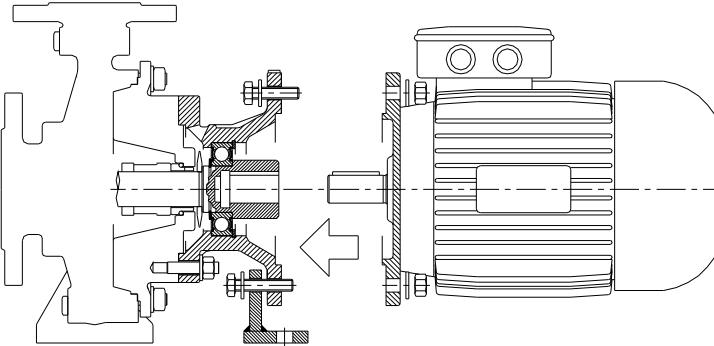


Fig. 23A

9 - ELECTRICAL CONNECTIONS

DANGER!

Electric danger. Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code. Always ground the motor verifying it is properly wired. It is advisable to have an electrical switch near the pump for emergency situations.

FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN CHAPTER 2.

BEFORE DOING ANY WORK TO THE INSTALLATION DISCONNECT ALL POWER SUPPLIES



All electric motors and possible connected accessories must be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate.

It is recommended that motors over 4 kW be wired for Star-Delta start-up, to avoid electrical overloads to the motor and mechanical overloads to the pump.



It is advisable to have an electrical switch near the pump for emergency situations. Be sure to replace all safety guards before switching on the electrical power.

Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor.

Motor connection should be as indicated on the motor tag (frequency, voltage, poles and max consumption) and as discussed in the motor instruction manual.

Pump series TCK, TBK and TBAK (and all motors over 4 kW) should always be preferably wired for Star-Delta start or "soft-start".

If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter).

Please be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage.

Electrical instrumentation such as solenoid valves, level switches, temperature switches, flow switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers.

10 - CHECK LIST PRIOR TO START-UP



If the installed pump is designated to be used in environments subjected to the application of the ATEX 99/92/CE directive but does not show the wording "ATEX" on the name plate, and the integrative ATEX manual hasn't been received or undelivered, it strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.



CAUTION!

All questions listed below must have POSITIVE answers prior to proceeding to the pump start-up (the following list may not be complete for special installations which may require further precautions as the cases dictate).

- Is this manual entirely read and understood?
- Are all the safety protections in order?
- Are the electrical connections properly wired, grounded and protected?
- Is the position of the pump switch-off button evident, accessible and clear?
- The piping system has been flushed of any foreign particles, welding impurities, etc.?
- Have all piping and pump obstruction been removed?
- All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?
- Pump and motor are properly lubricated, if required?
- Pump/motor alignment has been checked?
- If mechanical seal requires flushing has this been connected?
- All valves in the installation are in the correct position?
- Has this pump's direction of rotation been checked by jogging the motor?
- Are pump and installation ready for start-up?

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free it up by applying a torque to the pump coupling with a pipe wrench.

To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand.

In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.



The selected solvent or lubricating fluid must be compatible with the pump, seals and gasket materials.

New pumps from the factory and pumps coming from long term storage are likely impregnated with a rust preventative liquid; before the start-up, these pumps should be subjected to fresh water rinsing for approximately 15 minutes.

The obtained liquid-water mixture must be collected and, according to the environmental disposal regulations, treated as special liquid.



Dispose the waste liquids according to the current regulations protecting the environment.



CHECK PUMP-MOTOR COUPLING ALIGNMENT!

This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See chapter 8.2.

11.1 - START-UP

Never run the pump when it is dry!

Before starting-up verify that all auxiliary supplies are in place, ready to be used and, where necessary, they have been correctly opened. (Example: seal or packing flushing, pressurising buffer liquid to "back to back" double mechanical seals, etc.). Make sure the pump and motor bearings have been properly lubricated and oil levels are correct.

If necessary oil topping should be done through the proper connections (see fig. 20-21-22-23) and with recommended lubricants (see chapter 13). If the liquid to be handled is at dangerous high temperatures it is required to insulate the pump and the piping to prevent direct contact, the pump should also be protected against thermal shocks by insulation, preheating, etc.

Prior to starting, the suction piping and the pump must be filled with the liquid to be lifted; for this purpose there are three types of installations to be identified:



CAUTION!

Possible contact with hazardous media, cold or warm, and pump surfaces, cold or warm. During the following operations it is particularly important to avoid contact and/or inhale of possible spilled liquid (vapour): therefore all safety precautions must be taken. Operate only provided with apposite protective devices.

For this purpose there are three types of installations to be identified:

11.1.1 - Submersed pump (vertical design)

Pump filling is not applicable.

11.1.2 - Pump with flooded suction

Close the valve at pump discharge side, fully open the valve at pump suction side and the vent valve including any breather valve on the stuffing box.



Pump series TCD are fitted with a vent cock (see fig. 10B) which should be open to prevent forming air pockets in the mechanical seal chamber.



CAUTION!

Possible contact with warm media and warm surfaces. Be sure to do this only when the spilled thermal oil is at ambient temperature. Operate only provided with apposite protective devices.

When the thermal fluid exits the air cock without any air or gas bubbles, even after turning the pump rotor it means that the whole pump is full of liquid, therefore close the air cock.

11.1.3 - Pump with suction lift (from well)

In this case the pump must be primed: fully open the isolating valve in suction piping.

If the pump is self-priming and it has been previously filled with liquid, there will be no problems, because the pump will be able to prime itself and lift the liquid as soon as it starts operating.

If the pump is not self-priming, but the suction piping is fitted with a foot valve, the suction piping and the pump can be filled with liquid by opening the valve at the discharge side (provided the discharge piping is full of liquid) or fill the pump body as well as suction piping, with the liquid to be pumped, through the vent valve.

For non self-priming pumps with the suction piping not having a foot valve, the suction piping and the pump can be filled with liquid by hooking-up the vent valve to a vacuum line and keeping closed the valve at the discharge side of the pump: when the liquid exits the vent valve it means that the pump and suction piping are completely full of liquid.

At this point close the vent valve and the vacuum line.

Check the position and/or control the opening of the minimum flow valve, flushing lines and/or auxiliary supply lines.

After the pump and its suction line is full of liquid the pump should be started. In this regard there are two possible cases:

11.1.4 – Start-up a pump without back pressure at discharge side

For centrifugal pumps type MC... - TC... - TMA motor must be started with discharge valve closed.

When the motor has reached full speed, the discharge valve can be opened until the required differential pressure is reached (CAUTION: do not operate the pump with closed discharge piping for an extended period of time, to avoid overheating problems previously discussed).

For self-priming pumps type AT - TBH - TBA all valves in suction and discharge piping must be fully open before starting the motor. After the motor has been started the discharge valve can be throttled to build up the expected pressure.

(It is possible to start these pumps with the discharge valve at the closed position but, in this case, there will be maximum power consumption at start-up).

11.1.5 – Start-up a pump with back pressure at discharge side

In this case a non-return valve must always be installed in the discharge piping.

The unit is started with the discharge valve partially open and after the pump pressure exceeds the back pressure in the discharge line then is time to adjust the discharge flow regulating valve to attain the operating pressure.

For the Starting Torque of the pump see chapter 19.1.

11.2 - OPERATION

After starting the pump the following should be checked:

- The differential pressure and the capacity are as expected (if required, adjust the flow regulating valve at the pump discharge side but NEVER throttle the valve at the suction side).
- The motor amperage does not exceed the value shown on the motor nameplate.
- The pump/motor assembly does not have unusual vibrations and noises.
- The seal arrangement works as it should:
 - if the sealing is by packing there should be continuous dripping from the stuffing box (see chapter 14).
 - if the sealing is by mechanical seal there should not be any leakage (see chapter 15).
 - the bearing housings temperature, when operating regularly, must be lower than 85°C.



CAUTION!

Never run the pump dry.



CAUTION!

Possible contact with high temperature surfaces. Operate only provided with apposite protective devices.

If at start-up there are suspicions of abnormal operation it is recommended to stop the unit and investigate the causes (see chapter 16).

11.3 - SHUT DOWN

DANGER!



Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Operate only provided with apposite protective devices.

The centrifugal pumps can be shut down by switching off the power to the motor, with open or closed flow regulating valve: however if there are no provisions against liquid hammer it is recommended to close the flow regulating valve at pump discharge prior to stopping the pump.

Avoid the use of instantaneous shut-off valves, such as solenoid valves. These can cause severe pump damage.

If the piping has not been fitted with non-return valves it is required to close the shut-off valves in sequence to prevent emptying the piping.

Close first the isolating valve at discharge and then at suction side.

If the non return valve is not fitted, or the isolating valve at the discharge side is not completely closed, it may happen that during the shut-down the pump shaft will rotate in the opposite direction than is normal because of a return flow: in such cases absolutely avoid restarting the pump until the pump shaft has stopped rotating.

Following pump shut down it is required to close any auxiliary lines such as flushing, heating, etc.

After the first start-stop and if necessary, check pump/motor alignment and make sure that no external forces or moment rest on pump or piping.

In the event the pump is shut down for an extended period of time it is recommended to completely drain the pump to prevent the possibility of freezing in the winter time and/or the possibility of corrosion due to stagnant liquid left in the pump (see chapter 6).

12 - OPERATING CHECK LIST

Periodically check the good working condition of the pump by reading the instruments such as gauges, amp meters, flow meters, etc., the pump should constantly be performing as the installation requires.

The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections.

It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see chapters 13 - 14 - 15 - 16) at least once a year, even if no abnormalities have been noticed.



If during operation the pump seems to run irregularly, because of noise or vibrations, it is necessary to stop the unit and investigate the causes of the malfunctioning (see chapter 16).

When the pump is fitted with auxiliary supply lines such as cooling, heating or flushing it is recommended to periodically check their flow, temperature and pressure.

If the magnetic driven pump is fitted with a temperature sensor, the temperature in the area of the magnetic coupling should be approximately 3 to 5°C above the temperature of the product being pumped in standard conditions (water at ambient temperature). Higher values could indicate operation at low flow, obstruction of internal flushing connections or mechanical damage of the magnetic coupling.

Please contact POMPETRAVAINI if there are doubts regarding abnormal temperature rises.

13 - LUBRICATION INSTRUCTIONS

Pumps often operate in severe conditions and the bearings are subject to relevant radial and axial forces. For a good pump operation it is therefore very important to keep the pump bearings well lubricated and clean.

DANGER!

 Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.

FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

Bearings and lubricants must be free of any foreign particles such as dirt, dust, etc. which could cause the bearings to seize.

See "Disassembly and assembly instructions" for bearing sizes, quantity and type of lubricants.

13.1 - GREASE LUBRICATED BALL BEARINGS

TMA pumps series, flanges size 40 and 50, have ball bearings that, during assembly, are already lubricated with high quality grease with working temperature limits -30 °C +140°C.

The bearings used in a pump normal operating conditions must be carefully cleaned and newly greased after approximately 2000/2500 working hours using a good lubricating grease quality (check the "Disassembly & assembly instructions" for the lubricating grease replacement).



Dispose the exhausted grease following the current regulations and the right measures to protect the environment.

The sealed pre-greased never need lubrication, but must anyway controlled after 2000/2500 working hours.

It is important to remember not to over lubricate the bearings, excessive grease will lead to overheating of bearings.

AT - TBH - TBA - TCK - TBK - TBAK pump series are fitted with self lubricated ball bearings which do not require re-grease in normal operating conditions (series TCK, TBK e TBAK may also be fitted with oil lubrication as described in the paragraph listed below).

It is necessary to carry out the greasing and maintenance operations as per the above description for the pumps with roller bearing fitted on the drive end.

Bearing temperature should not exceed 85°C in normal conditions and ambient temperatures.

Overheating could be caused by excessive grease, coupling misalignment, excessive vibrations and /or bearing wear (see chapter 16).

13.2 - OIL LUBRICATED BALL BEARINGS

Pump series TC... - MC... are fitted with oil lubricated ball bearings. The series TCK – TBK and TBAK can also be with grease lubricated bearings.

It is good practice to replace the lubricating oil used at time of testing.

Oil should also be changed after the first 50 to 100 hours of operation.



Dispose the exhausted oil following the current regulations and the right measures to protect the environment.

The lubricating oil, poured through the hole which is also the dipstick seat or vent plug located at the top of the bearing frame should, as a maximum, cover the bearing balls of the lower crown (the oil dipstick or the oil level gauge show the correct quantity, see fig. 25).

The installation of a constant level oil-filler (as option) consents a correct lubricating oil level in the avoiding recurrent fillings.

For the first filling proceed as follows:

- remove vent plug of the bearing frame
- upset the oil-cruet

- pour oil into the bearing frame through the hole of plug till you can see oil in the oil-filler elbow
- fill the oil-filler pouring oil directly into the oil-cruet and NOT into the elbow (see fig. 24)
- replace the cruet in normal position
- let oil flow into bearing frame
- repeat operation till the oil level in the cruet cease to decrease.

The following fillings should be done pouring oil directly into the cruet and NOT into the elbow of the oil-filler or bearing frame plug (see fig. 24).

If there are no particular dangers of oil contamination (dust, water) and the temperature in the bearing frame oil bath does not exceed 60°C, oil should be changed every 4000 to 6000 hours of service.

For higher operating temperatures and contaminated oil the frequency of oil changes should be increased.

Bearing temperature should not exceed 85°C in normal conditions of operations and ambient temperatures.

Overheating could be caused by too much oil, coupling misalignment, excessive vibrations and/or bearing wear. It is recommended to periodically check the oil pH which will indicate the oil stability and the oxidation grade (consult the supplier for the acceptable values).

Satisfactory oils are those with a viscosity at 40°C between 46 and 100 centistokes.

Oils with high viscosity (100 centistokes) are recommended for applications with high operating temperatures.

Pumps of series TCD can use oils with viscosity up to 220 centistokes.

Pumps are provided with oil OLEODIN 100 for standard applications at ambient temperatures from -5 to +40 °C

Some oil types are:

OLEODIN 100

AGIP BLASIA 68

CASTROL HYSPIN VG 46

CASTROL HYSPIN AWS 68

ESSO TERESSO 68

ESSO NURAY 100

SHELL TELLUS OIL T68

IP HYDRUS 68

Avoid to mix oils having different features and brands.

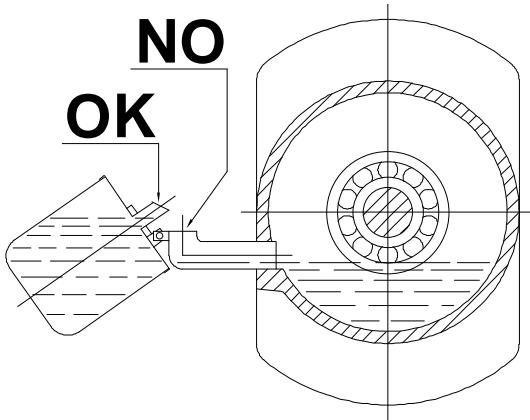


Fig. 24

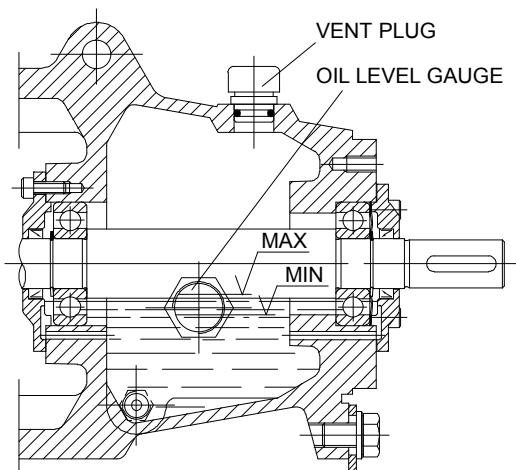
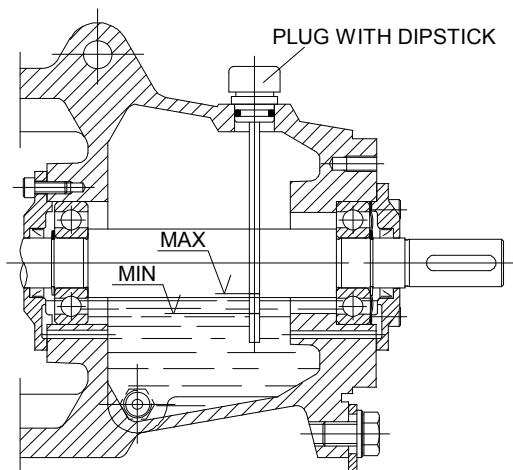


Fig. 25

DANGER!

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Pumps fitted with packed stuffing boxes require packing flushing either from an external source or directly from the pumped media through pump internal passages.

This liquid is necessary to remove the friction heat generated between the shaft and the packing.

The dripping quantity is a function of the pump size and of the pressure in the stuffing box housing.

In any event the liquid drops coming out of the stuffing box should not exceed a temperature of 60 - 70°C in relation to handling a liquid at ambient temperature.

14.1 - ADJUSTING THE PACKING

All adjustment operations must be performed with the PUMP NOT RUNNING following the safety measures given in chapter 2. After completion of the work **ALWAYS** re-install the safety guards previously removed.

At first start up loosen the nuts of the packing gland allowing a steady flow of liquid to drain out (see fig. 26).

After obtaining a steady flow of leakage gradually tighten the gland nuts until attaining a steady dripping within the limit of the above recommended temperature.

A few hours time span may be required to establish a steady dripping at low temperatures.

Packing adjustment is required when the liquid leakage increases.

When adjustment is no longer possible, the packing material should be replaced with new one.

Follow the "Disassembly and Assembly Instructions" to replace the packing materials.

In the event the pump remains out of service for more than 2 months it is recommended to replace the packing rings, prior to start-up.

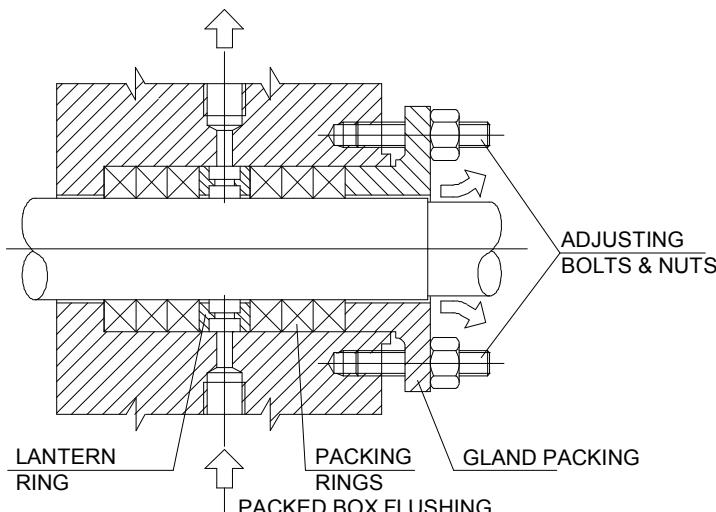


Fig. 26

15 - MECHANICAL SEALS**DANGER!**

 Danger due to collision, crushing or abrasions. Possible contact with hazardous fluids, cold or warm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Remove protections only in case of maintenance. Operate only provided with apposite protective devices.

Purpose of mechanical seals is to retain handled product inside the pump in the area where the shaft exits the pump casing. Mechanical Seals can be of many different materials, types and configurations (see fig. 28-29-30 for some examples). To assure maximum reliability and safe operation Pompetravaini evaluates seal choices at time of pump selection in connection with customer's requirements, application and liquid details.

In the case of self lubricated single mechanical seals (API Plan 01, 02 or 11, see fig. 28) flushing and /or pressure system are not required, pump has been engineered to provide proper seal lubrication with pump operating pressure.

In the event the application requires increased safety margin against possibilities of product leaking through a single type mechanical seal, it is possible to install two mechanical seals working simultaneously thus creating a safety barrier from the pumped liquid.

There are two possible types of double mechanical seals: Back-to-Back (also known as "Opposite" type) API Plan 54, see fig. 29 and in Series (also known as "Tandem" type) API Plan 52, see fig. 30.

Double mechanical seals Back-to-Back are generally selected where pumped liquid is absolutely not allowed to leak from the pump. Double mechanical seals in Series are chosen where the pumped liquid may escape the pump toward the pump exterior but it is controlled and contained in the closed seal loop but never to escape to the atmosphere.

Double mechanical seal installations require a flushing (buffer) liquid from an external source that is compatible with the pumped product as well as the working conditions. Flushing liquid system is such as to guarantee adequate buffer liquid pressure and temperature to the mechanical seals: seal flushing system with proper instrumentation and controls is of paramount importance for a successful pump installation, it must be installed by qualified personnel familiar with every details of the application and with system set-up.

All flushing systems MUST use tubing with diameters equal or larger than the connections provided on the pump, buffer liquid must be compatible with the pumped product. Pressure on the buffer liquid should always be constant and/or high enough to cover the entire pump performance.

In the case of 'once through' seal flushing (buffer liquid not recycled), it is very important the regulation and control of pressure in the seal housing. In the double seal case it is recommended to adjust the buffer liquid pressure with a flow regulating valve installed after the seal housing while reading pressure on a gauge installed between the seal housing and the valve. Avoid controlling buffer liquid pressure before the seal housing, reading the pressure before the seal housing is NOT recommended as it could lead to wrong conclusions which could be cause for serious damages. With an adequate seal tank in the system (see fig. 33) a closed loop seal flushing, containing possible leakages is provided. Adequate controls and/or instrumentation will provide pressure and liquid level controls in the tank to indicate the conditions of the sealing system. Increase of liquid level (or pressure) is indication of product leaking through the pump seal. Decrease of liquid level (or pressure) is indication of buffer liquid leaking inside the pump or to the atmosphere through the outside seal, in which case the leakage is also visible.

The liquid to be used in the seal tank must offer full compatibility with the pumped liquid in the event the seal at pump side will leak, (for example when the two liquids will mix there must not be any dangerous chemical reactions) as well the liquid must offer good lubricating characteristics and good heat dissipation. Some good examples of suitable buffer liquids are water, vaseline oils or vegetable oils.

Pressure in the seal tank is often kept with pressurised Ozone or Nitrogen bottle. Cooling of the buffer liquid in the loop (picks up friction heat from the seal faces) is achieved with fresh liquid through the cooling coil fitted inside the seal tank. Seal tank is provided with Inlet & Outlet connections for sealing liquid. DO NOT reverse these two connections; the liquid circulates by natural heat convection (warm liquid moves upward and cold liquid downward), reversing the connections would prevent the start of such natural phenomenon. The buffer liquid outlet connection going to pump seal housing is at bottom of tank while the return connection is approximately at the middle of the tank.

Checking of proper liquid circulation is done while pump is in service; the piping at seal housing connection should be colder by 3 to 5°C than the outlet tubing exiting the seal housing going to the tank. If this is not the case simply change the tubing on the seal housing (connect tubing from inlet to the outlet and vice versa) do not change the connections on the tank. Sometimes this adjustment is required because the rotation of the mechanical seal (and at times peculiar seal design) generates an hydraulic pressure that could be opposite and higher than the natural. Only in 'field' check one can be assured of the correct liquid circulation. Monitoring the pressure in the seal tank with pressure switches or pressure gauges and/or controlling the liquid level in the tank allow the verification of possible seal leakages and prompt corrective actions can be taken when required.

Use good quality gauges to monitor the pressure, with good dial and scale graduation adequate for good reading in the anticipated pressure range. As a minimum use liquid filled gauges with dial size of minimum 60 mm and 2.5 accuracy. Additional data and information may be requested from Pompetravaini or its local representative if required.



Incorrect pressure of seal housing could cause severe damage to the rotating parts. To minimise seal system malfunctions avoid pressure fluctuations in the seal loop as well as in the pump operating pressure.

Seal housing with double mechanical seals back-to-back type, must always have a pressure such that the inside seal (closer to pump impeller) will not be pushed out of its seat by the total pump pressure (suction plus pump operating pressures) even when pump is in stand-by mode. Flushing liquid therefore must be at least 0.5 bar over the maximum pump discharge pressure throughout its performance.

A lower pressure, even if for a moment, will cause the stationary part of internal seal to come out of its seat and the pumped liquid will mix with the flushing liquid due to the higher pressure inside the pump, see fig. 27.

In the case of double seals in series (Tandem) the pressure of the flushing liquid should be as low as possible but high enough to provide good flow in the circuit. High pressures (over 0.3 bar over the atmospheric pressure) may push the stationary seat of mechanical seal at product side (closer to pump impeller), out of its seat (especially when pump is at rest without pressure), therefore flushing liquid would mix with the product inside the pump following seal system damage.

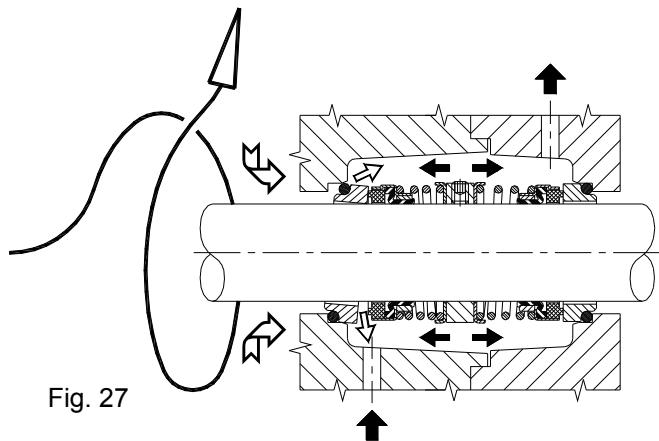


Fig. 27



Incorrect pressure in sealing system is the most common cause for seal system failure, therefore a continued monitoring with prompt corrective actions are necessary.

See fig. 20-21-22-23 and operating manual for centrifugal pumps for locations of liquid flushing connections. Required flow and pressure for buffer liquid are listed in tab. 3 and/or contact Pompetravaini and/or seal supplier. See tab. 4 for liquid flow required to cool or heat the seal housings. For a longer seal life cooling is recommended when pumping liquids over 90°C. Tab. 4 also lists cooling or heating liquid flow for pumps of "U2" design that include jacketed pump casing.

Standard mechanical seals supplied with our pumps meet ISO 3069/UNI EN 12756 standards, see pump "Disassembly and Assembly Instructions" for overall dimensions. Special or non-standard seals can be installed after proper

evaluation by our technical department. Mechanical seals do not require maintenance until losses of liquid are visible (for seal replacement see "Disassembly and Assembly Instructions"). Losses of few drops of liquid in several minutes is normally considered acceptable and it is not an indication of seal failure.

Seal leakage or even seal failure should be properly corrected considering the impact on environment, toxicity and safety issues.



CAUTION!

Pay attention to possible leakage of pumped liquid from mechanical seal which, by its characteristics, could be harmful to the environment.

Mechanical seals should NEVER run dry, without flushing liquid (internal or external). This could cause severe damage to the seal faces, O-Rings and elastomer. It is recommended to check the wear on seal faces every 4000 working hours. This is an acceptable normal working time for mechanical seals, over this time there could be losses due to wear and tear that require seal replacement.

MECHANICAL SEALS WITH QUENCH

There are two types of Quench/Barrier, available upon request: API Plan 61 and 62.

System Plan 61 (see fig. 31) includes a bushing on the back of the seal at atmospheric pressure side (single or double) to hold the bulk of the liquid in the event of accidental failures. The bushing requires a minimum clearance over the shaft therefore the liquid is NOT sealed completely but most of it will be retained in case of a sudden seal breakage. Drain and vent connections are threaded. This arrangement does not allow a continuous flushing because the above mentioned clearances would cause considerable losses of liquid over the shaft toward the outside. This system is chosen for avoid emergencies or to limit losses of liquid.

System Plan 62 (see fig. 32) requires (contrary to Plan 61) a constant flushing because the auxiliary seal is of the contact type and CANNOT work without a liquid that removes the generated heat of friction. The auxiliary seal is usually a lip seal (radial seal ring) not to be confused with the traditional mechanical seal. Losses of several liquid drops should be tolerated and with time its reliability will decrease. This system is often used where there is the need to wash the back of the mechanical seal on the atmospheric side preventing crystallization or coking of handled product. It is a less effective alternative to the double mechanical seals in series. Pressure of buffer liquid must follow same rules as for the double seals in series, therefore max pressure can be 0.3 bar over the atmospheric pressure and temperature can be max 60°C.

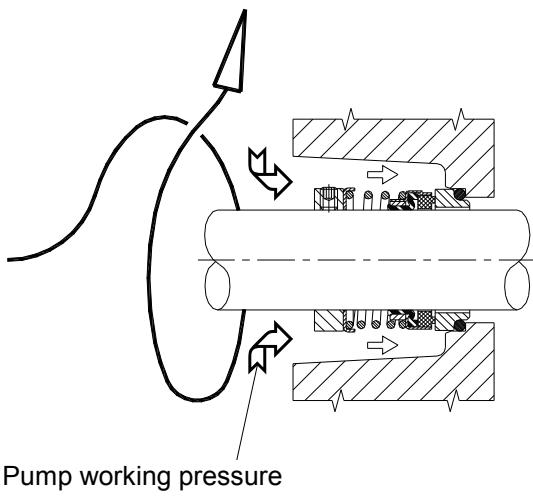


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

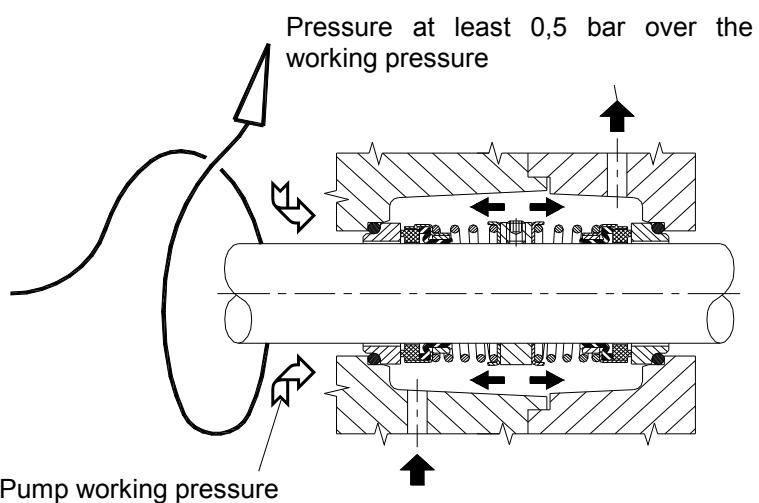


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54

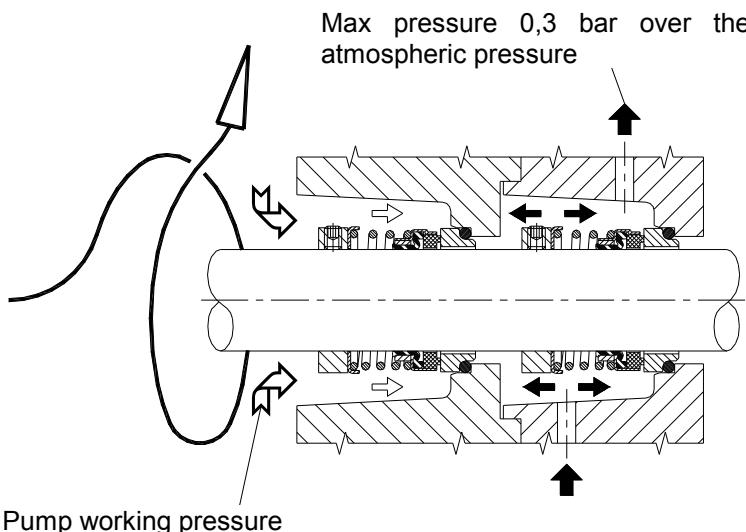


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

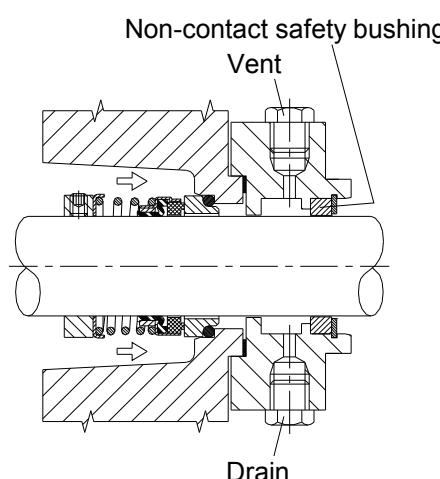


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

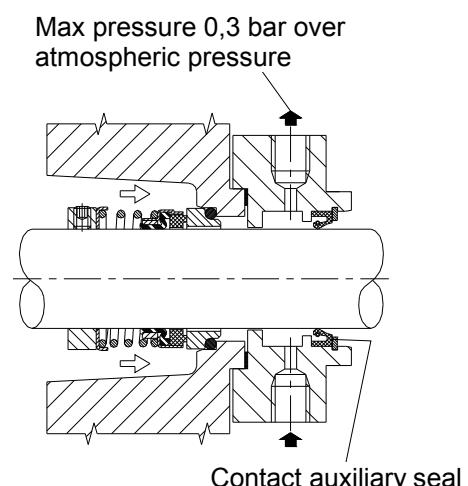


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

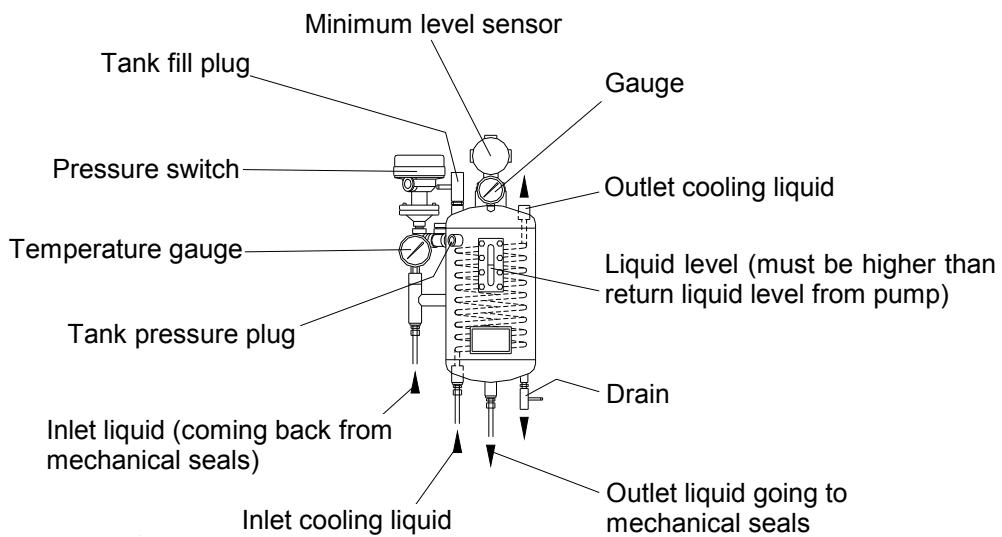
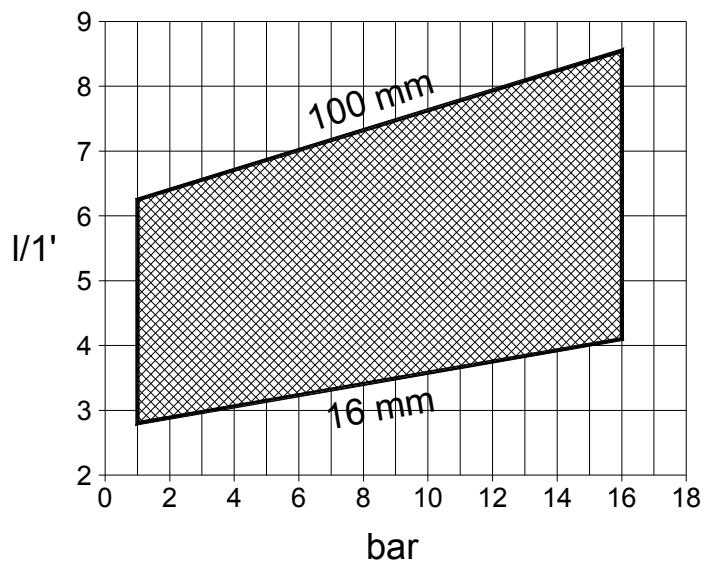


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

NOTE: Tank installation must be at least 1 m above the rotating pump shaft



Tab. 3 - REQUIRED LIQUID FLOW TO FLUSH MECHANICAL SEALS FROM OUTSIDE SOURCE

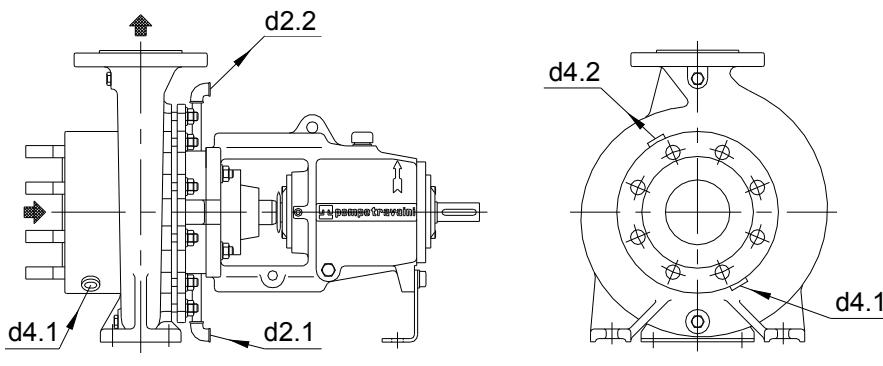
mm = installed shaft seal diameter
 bar = maximum pump working pressure (total of inlet pressure and pump generated pressure as measured at pump discharge flange)
 I/1' = required liquid flow (lit/min) for single seals or double in series type seals (tolerance +/-25% depending upon temperatures)
 NOTE: DOUBLE quantity of liquid flow for double mechanical seals back-to-back type.

CAUTION: Flushing liquid PRESSURE for back-to-back double seals must be min 0.5 bar over the max pump working pressure, while NOT more than 0.3 bar over the atmospheric pressure in case of double seals in series (TANDEM).

Tab. 4 - LIQUID FLOW FOR COOLING OR HEATING JACKETED SEAL HOUSING (maximum pressure for liquid circuit is 3.5 bar, referred to water and ambient temperature. In case of heating circuit the allowed maximum temperature is 135°C).
 Flow tolerance +/-25%.

CAUTION: Flow for cooling or heating of jacketed pump casings, design "U2" pump series MC... - TC... (see fig. 34) can vary depending upon temperatures for cooling or heating the casing, ALWAYS limiting the maximum pressure of 3.5 bar and temperature of 135°C of the pump casing jacket.

PUMP SERIES	FLOW MINIMUM I/1'	FLOW MAXIMUM I/1'
AT - TB... TC... group 1 - 2 TMA	3	8
MC... group 3 - 4 - 5 TC... group 3 - 4 - 5 MEC	5	12



- Fig. 34**
- d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
 - d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
 - d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
 - d4.2 Threaded connection - Outlet cooling/heating liquid pump jacketed casing

16 - TROUBLE SHOOTING CHART - PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart (tab. 5) or should there be any doubts, do not hesitate to contact POMPETRAVAINI or your local representative.

Tab. 5 - **LIST OF PROBLEMS**

PROBLEM	LIST OF POSSIBLE CAUSES
Lack of, or no flow and/or pressure	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 17 - 25 - 40
Excessive flow and/or pressure	15 - 16 - 17 - 18
High power consumption	10 - 15 - 16 - 18 - 19 - 20 - 21 - 22 - 23
Excessive vibration and noise	8 - 18 - 19 - 20 - 23 - 24 - 25 - 26 - 27 - 28 - 36 - 37 - 40
Bearing overheating	19 - 20 - 28 - 29 - 30 - 36 - 38 - 39 - 42
Sealing malfunction	28 - 31 - 32 - 33 - 34 - 35 - 40 - 41

	CAUSES	SOLUTIONS
1	Pump is not primed	Repeat the priming procedure
2	Rotational speed is not adequate	Increase the motor speed in relation to the working conditions - Replace impeller with one having larger diameter.
3	Installation requires higher pressure than expected	Increase operating speed, if possible, (see point 2) or replace impeller with one of larger diameter - Change the pump or increase the number of stages in case of multistage pumps - Reduce the system pressure
4	Wrong direction of rotation	Change the motor direction of rotation
5	There are air pockets in the suction line	Modify the layout of suction piping
6	Air enters the suction line	Check the piping sealing areas
7	The pumped liquid is emulsified with air	Install a reservoir or tank before the pump to de-aerate the liquid
8	The suction lift or/and suction pressure is more than anticipated and therefore the pump cavitates	Reset the suction lift to the original value - Increase the piping diameter - Check the suction piping, the foot valve or non return valve, the filter - Open completely the isolating valve in the suction piping - Decrease the friction losses
9	The wear ring and/or impeller neck and/or the impeller and/or the diffusers are worn out or damaged	Overhaul the pump replacing and/or repairing the damaged components
10	Viscosity, density, or specific weight of liquid have higher values than expected	Re-establish the characteristics of the liquid as originally expected (if necessary contact POMPETRAVAINI)
11	Suction piping is not sufficiently submersed in the liquid, creating vortex	Increase the depth of piping or foot valve in the liquid
12	Impeller is plugged with scale deposit and/or foreign materials	Take out the impeller, clean it, free the vanes and cavities of any materials - Soften the pumped liquid
13	There is entrained air in the system	Adjust the packed stuffing box or repair/replace the mechanical seal
14	Piping is plugged	Clean piping and valves - clean the filters
15	Velocity is too high	If possible, decrease the pump rotational speed
16	The required pressure of system is lower than anticipated	Adjust the flow regulating valve in discharge piping - Decrease the impeller diameter (contact POMPETRAVAINI) - Decrease the number of stages in case of multistage pumps
17	Pump is not suitable for the application	Contact POMPETRAVAINI
18	Inlet pressure is too high	Reduce the pressure, but without adjusting the isolating valve at the suction side

19	Pump/motor coupling is misaligned	Realign the coupling
20	Bearings are defective or worn out	Replace bearings
21	The power supply voltage is wrong - Motor does not operate properly	Change the motor - Correct the power supply
22	The packing is too tight	Loosen the nuts of the packing gland
23	Pump seizing is experienced	Stop the pump and look for any rotor obstructions
24	The pump and/or piping are loose	Torque the bolts as required
25	Pump is worn out or damaged with excessive internal clearances	Overhaul the pump
26	The coupling rubber inserts are worn	Replace the coupling inserts
27	The impeller is out of balance due to wear, deposits and encrustation	Disassemble, clean, balance and/or replace the impeller - Soften the liquid
28	Forces, moments and piping misalignment are loading the pump	Realign and support the piping
29	Oil level in bearing frame is low, oil quality is inadequate or there is lack of grease	Replace oil or grease to the normal level using proper quality lubricants
30	The power absorbed is too high	Decrease the power consumption by identifying the cause
31	Pump is running dry	Reinstate the correct working conditions
32	Pumped liquid or the flushing liquid to the seals is dirty and/or not adequate	Install a filter in the flushing lines - Change flushing fluid
33	There are excessive shaft vibrations and deflections	Identify the causes and reinstate the correct working conditions (refer to more specific points in the table)
34	The pumped liquid is not adequate for the seals	Contact POMPETRAVAINI
35	The shaft sleeve is worn out	Replace the sleeve with a new one
36	The pumped flow is less than the minimum required	Increase the flow - Adjust the by-pass recirculation valve or line
37	Baseplate or pump foundation is not adequate	Change or reinforce the baseplate and/or foundation following the recommended procedures
38	Too much grease in the bearings	Remove excessive grease and check the bearings
39	There is water in the bearing frame	Change bearings and replace all the lubricant
40	Incorrect assembly after pump repair	Overhaul pump and assembly following correct procedures
41	The mechanical seals are damaged	Remove the mechanical seals, overhaul or change them
42	The axial forces are too strong	Check the impeller

Should the pump require repairs it is recommended to be familiar with the procedures outlined in the "Disassembly and Assembly Instructions".

DANGER!

Danger due to collision, crushing or harm. Wait for the complete pump stopping before handling the unit. If the pump still contains some fluid it may suddenly start to rotate once again. Take precautionary measures by draining the pump or closing the pipes by mean of a valve. Possible contact with high temperature surfaces, wait for the pump cooling. Maintenance must be absolutely carried out when the pump is at a standstill, disconnecting the power supply and any other connection. Please make sure that the power supply is restored only by the operator making the maintenance. It is necessary the presence of at least two operators and a foreman must be aware there is a maintenance in progress. Operate only provided with apposite protective devices.



FOLLOW THE SAFETY STANDARDS LISTED IN CHAPTER 2.

In any case, before working on the pump it is important to:

- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cables from the motor
- close the pump inlet and outlet isolating valves
- let the pump cool down to ambient temperature if is pumping hot liquids
- adopt safety measures if the pump has been handling dangerous liquids
- drain the pump body of the pumped liquid, through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:

- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one
- if required, remove motor by removing the bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from installation without damaging other system components.

Before returning the pump to POMPETRAVAINI or an authorized service decontaminate the pump and ask for the "handled media" examination form.



In case of pump removal from the installation dispose the unit by following the current regulations and the right measures to protect the environment.

When the pump has been repaired must repeat the steps from "Assembly and Alignment" procedures and after (see the applicable chapters starting from chapter 7).

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimise unnecessary down times in the event of pump failure or routine maintenance.

For better parts management, the VDMA 24296 standards suggest to stock the number of parts in function of the number of pumps being used by the plant (see following table).

Components	Spare parts	Identical pumps number (stand-by pumps included)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Number of spare parts								
Suction and discharge elements	1	1	2 1	2	2	3	30%	
Impellers								
Radial seal rings	2	2		3	3	4	50%	
Ball or roller bearings								
Shaft complete with keys, nuts, shoulder rings, etc.	1	1	2	2	3	3	30%	
Bushes				3	3	4	50%	
Shaft protection sleeves	2	2						
Neck rings	1	1		2	2	3	30%	
Packing rings	16	16	24	24	24	32	40%	
Gaskets for pump casing (Set)	4	6	8	8	9	12	150%	
Other gaskets (Set)						10	100%	
Mechanical seals	Rotating part		4	5	6	7	90%	
	Stationary part		6	8	8	10	150%	
	Rotating part gasket							
	Stationary part gasket							
	Springs	1	1	1	1	2	2	20%
Bearing housing groups complete with shaft, bearings, covers, seal rings, etc.	---	---	---	---	---	1	2	
Coupling inserts (Set)	2	3	4	5	6	7	75%	

On the pump nameplate there are printed pump model, year of manufacture and pump serial number.

When ordering spare parts always provide this information.

Pump type, parts item number (VDMA) and description per the pump sectional drawing and parts list is useful information which helps to supply correct spare parts for your pump.

We recommend the use of original spares: in case this is not respected, POMPETRAVAINI declines any responsibility for possible damages and not correct running caused by not original spare parts.

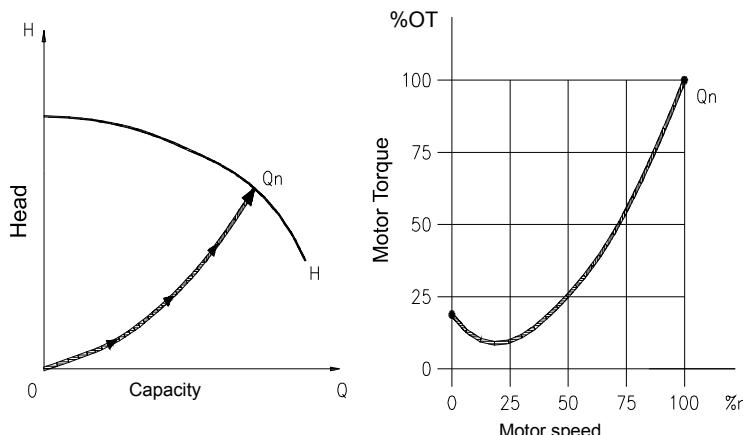
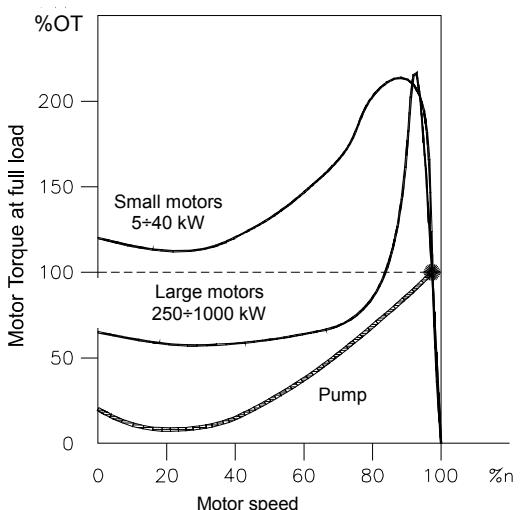
19.1 - STARTING TORQUE

Starting torque of a centrifugal pump is very low. Usually standard electric motors may be safely used to drive this pump. Pump operational speed (any speed) is reached only if motor torque is greater than pump operating torque. See side figure.

Operating Torque (**Nm**) is given by

$$\text{Operating Torque} = 9549 \times \text{kW} (\text{absorbed at operating speed}) / \text{RPM (nominal)}$$

According to the centrifugal pump starting, there could be three principal cases each with his characteristic curve of starting (see examples below).



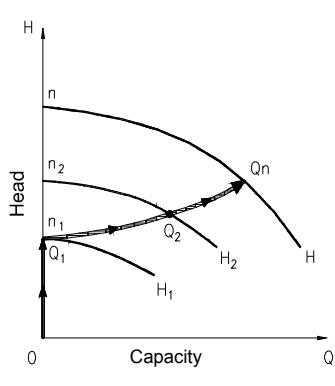
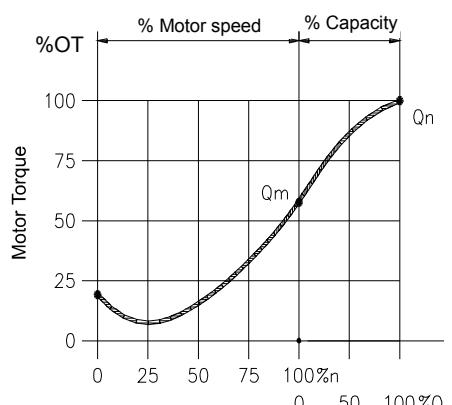
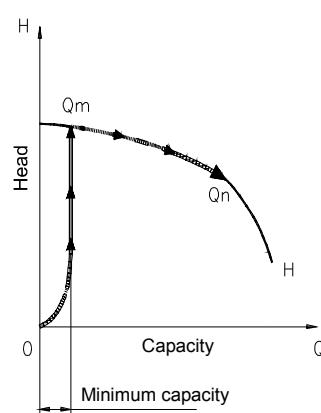
1) Starting with open valve on discharge

During this starting it can be assumed the curve of Operating Torque in function of the round number similar to a parable that starts from about the 20% of the value of Operating Torque to the value of nominal capacity **Qn**.

2) Starting with partially closed valve on discharge

This type of starting requires a particular observation: first the pump must reach a value of minimum capacity **Qm** (correspondent to the partialized capacity of the valve) such to guarantee a correct operation without problems of liquid evaporation or excessive radial loads on the shaft; then the pump, by totally opening the valve, will reach the value of nominal capacity **Qn** and therefore the value of maximum operating torque.

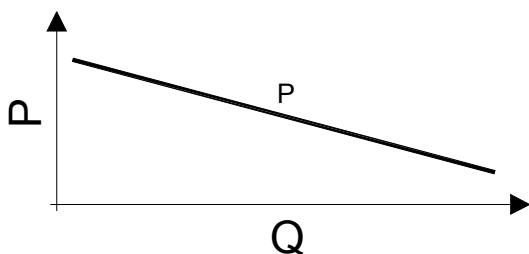
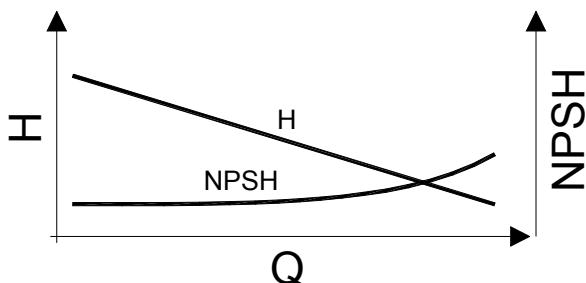
NOTE: In this case it is esteemed an absorbed power at the value of **Qm** corresponding to about 60% of **Qn**.



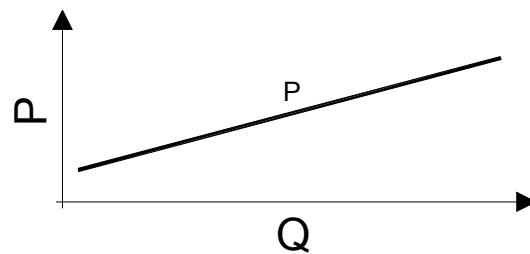
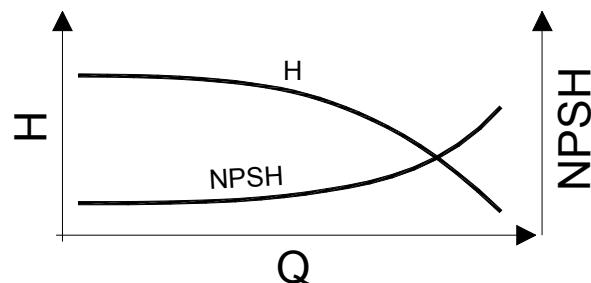
3) Starting with completely open valve and with non return valve on discharge

During the starting the non return valve will remain closed up to the attainment of the pressure value **H1** (correspondent to the pre-load pressure of the same valve) and therefore void capacity. This value is reached at speed **n1** (in this example esteemed about 60% of the nominal speed). The continuous motor acceleration will reach the attainment of the value of nominal capacity **Qn** after having passed through **n2**, **Q2**, **H2**.

19.2 - TYPICAL PERFORMANCE CURVES



Typical performance curves
for pumps series AT - TB...



Typical performance curves
for pumps series TC... - MC... - TMA

Where:

- H = Head
- NPSH = Net Positive Suction Head
- P = Absorbed power
- Q = Capacity

19.3 - UNITS CONVERSION TABLE

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Discharge and Delivery	Litres/sec	Litres/min	60	m ³ /h	Litres/sec	0.2778
	Litres/sec	m ³ /h	3.6	m ³ /h	Litres/min	16.67
	Litres/sec	C.F.M.	2.12	m ³ /h	C.F.M.	0.589
	Litres/min	Litres/sec	0.01667	C.F.M.	Litres/sec	0.4719
	Litres/min	m ³ /h	0.06	C.F.M.	Litres/min	28.32
	Litres/min	C.F.M.	0.0353	C.F.M.	m ³ /h	1.698

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Capacity	Litres	m ³	0.001	U.S. Gal	Litres	3.785
	Litres	Ft ³	0.0353	U.S. Gal	m ³	0.003785
	Litres	U.S. Gal	0.02641	U.S. Gal	Ft ³	0.0133
	Litres	Imp. Gal	0.219	U.S. Gal	Imp. Gal	0.0832
	m ³	Litres	0.001	Imp. Gal	Litres	4.545
	m ³	Ft ³	35.3	Imp. Gal	m ³	0.004545
	m ³	U.S. Gal	264.17	Imp. Gal	Ft ³	0.16
	m ³	Imp. Gal	219.96	Imp. Gal	U.S. Gal	1.2
	Ft ³	Litres	28.32			
	Ft ³	m ³	0.0283			

	To convert	To obtain	Multiply by	To convert	To obtain	Multiply by
Linear measure	cm	inches	0.3937	inches	cm	2.54
	cm	m	0.01	feet	m	0.3048
	m	feet	3.28084			
	m	cm	100			

19.4 NOISE LEVEL AND VIBRATIONS

Noise level (sound pressure level L_p at 1 meter distance neglecting motor, with pump installed in the system and sound power level L_w) for pump operating at BEP and motor at 50 Hz operating speed.

The values can change depending on the installed motor. Contact POMPETRAVINI for further information.

The class of the vibration level (values rms mm/s) shows the limit values for the continuous working of the pump if properly installed. For higher values to proceed with maintenance following the table below.

NOTE: Pumps not included in the following tables have to be seen as a particular construction.

Contact POMPETRAVINI in order to know the data.

	Continuous working	Preventive maintenance	Extraordinary maintenance
Class V1	< 3,5	> 3,5 < 7	> 7
Class V2	< 4,5	> 4,5 < 7	> 7

PUMP MODEL	Noise level L_p (L_w)	Vibration level
TMA	dB(A) poles	class poles
31 – 3		
31 – 4		
31 – 5		
31 – 6		
31 – 7		
31 – 8		
31 – 9		
31 – 10		
31 – 11		
31 – 12		
31 – 13		
31 – 14		
31 – 15		
32 – 3		
32 – 4		
32 – 5		
32 – 6		
32 – 7		
32 – 8		
32 – 9		
32 – 10		
32 – 11		
32 – 12		
32 – 13		
32 – 14		
32 – 15		
40 – 3		
40 – 4		
40 – 5		
40 – 6		
40 – 7		
40 – 8		
40 – 9		
40 – 10		
40 – 11		
40 – 12		
40 – 13		
40 – 14		
40 – 15		
50 – 3		
50 – 4		
50 – 5		
50 – 6		
50 – 7		
50 – 8		
50 – 9		
50 – 10		
50 – 11		
50 – 12		

PUMP MODEL	Noise level L_p (L_w)				Vibration level			
TC...	dB(A) poles				class poles			
	8	6	4	2	8	6	4	2
25 – 125					V1			
25 – 160					V1			
25 – 200					V1			
32 – 125					V1			
32 – 160					V1			
32 – 200					V1			
40 – 125					V1			
40 – 160					V1			
40 – 200					V1			
40 – 250					V1			
50 – 125					V1			
50 – 160					V1			
50 – 200					V1			
50 – 250					V1			
50 – 315					74 (86)	V1		
65 – 125					73 (85)	V1		
65 – 160					73 (85)	V1		
65 – 200					73 (85)	V1		
65 – 250					74 (86)	V1		
65 – 315					75 (88)	V1		
80 – 160					73 (85)	V1		
80 – 200					74 (86)	V1		
80 – 250					75 (87)	V1		
80 – 315					77 (90)	V1	V2	
100 – 200					75 (87)	V1	V2	
100 – 250					76 (89)	V1	V2	
100 – 315					78 (91)	V1	V2	
100 – 400					---	V1	---	
125 – 250					---	V2	---	
125 – 315					---	V2	---	
125 – 400					---	V2	---	
150 – 250					---	V2	---	
150 – 315					---	V2	---	
150 – 400					---	V2	---	
200 – 315					---	V2	---	
200 – 400					---	V2	---	
250 – 315					---	V2	---	
300 – 350					---	V2	---	
300 – 450					---	V2	---	
250 – 450					---	V2	---	
300 – 550	79 (94)	---	---		V2	---	---	

PUMP MODEL TBA	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
202 ♦	< 73 (85)	
203 ♦		
204 ♦		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
307		
308		
311		
312		
313		
314		
315		
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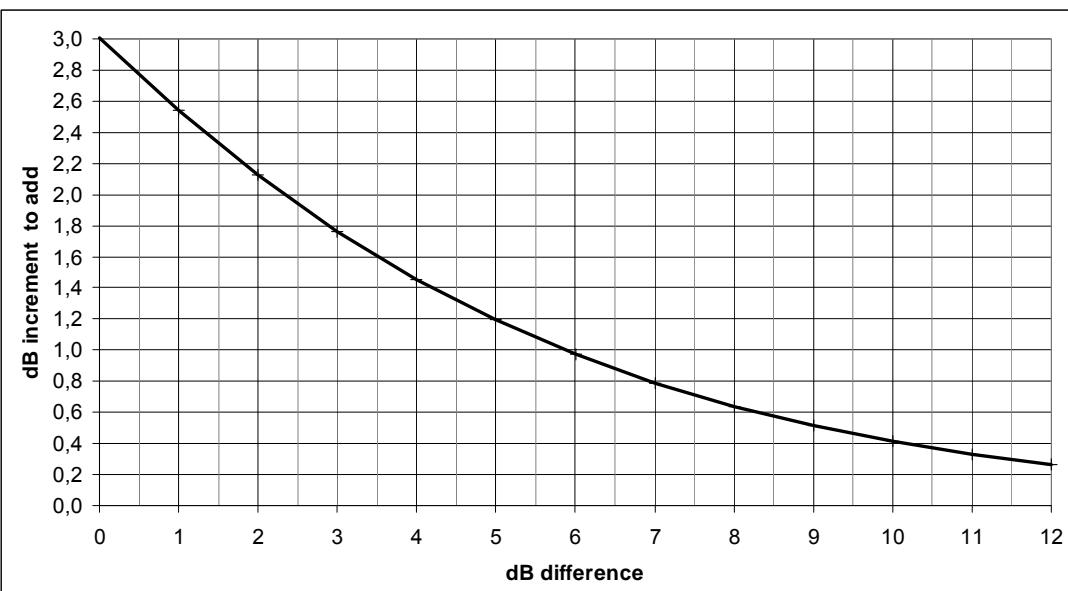
♦ = WARNING: 2 poles motors

PUMP MODEL TBH	Noise level $L_p (L_W)$ dB(A) 4 poles	Vibration level class 4 poles
201		
202		
203		
204		
205		
206		
207		
208		
291		
292		
293		
294		
295		
296		
297		
298		
301		
302		
303		
304		
305		
306		
307		
308		
311		
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316		
317		
318		
401		
402		
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658		

In order to have approximate values of the noise level for the pump-motor assembly the sound power level of the motor and the pump can be added. The following table shows some values of the motor noise level. The addition has to be calculated using the diagram below.

In order to get the total sound power level it is necessary to calculate the difference between the pump and motor noise level; by that value calculate, from the following diagram, the increment that will have to be added to the higher value of the power sound level. Ex: motor 80 dB and pump 75 dB, level difference 5 dB, increment 1.2 dB, total power sound level 81.2 dB. Taking into account that the noise level depends on several factors, contact POMPETRAVAINI to know more accurate values.

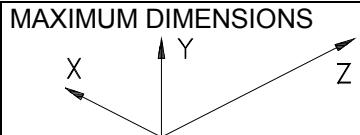
POWER kW	Noise level L_p (L_w)				Noise level L_p (L_w) ATEX			
	dB(A)				dB(A)			
	8 poles	6 poles	4 poles	2 poles	8 poles	6 poles	4 poles	2 poles
0,75	55 (63)	50 (58)	48 (56)	59 (67)	54 (62)	48 (56)	53 (61)	64 (72)
1,1	55 (63)	50 (58)	54 (62)	60 (68)	54 (62)	48 (56)	56 (64)	64 (72)
1,5	57 (65)	53 (61)	54 (62)	63 (71)	56 (64)	57 (65)	56 (64)	71 (79)
2,2	57 (65)	55 (61)	55 (63)	63 (71)	60 (68)	59 (67)	57 (65)	71 (79)
3	58 (66)	57 (65)	55 (63)	67 (75)	60 (68)	62 (70)	57 (65)	74 (82)
4	60 (68)	57 (65)	58 (66)	69 (77)	64 (72)	62 (70)	62 (70)	74 (82)
5,5	60 (68)	57 (65)	61 (69)	72 (81)	64 (72)	62 (70)	66 (74)	75 (83)
7,5	60 (68)	63 (71)	61 (69)	72 (81)	64 (72)	66 (74)	69 (77)	77 (85)
11	63 (71)	64 (72)	68 (78)	74 (82)	66 (75)	66 (74)	71 (79)	77 (86)
15	65 (73)	64 (72)	68 (78)	74 (82)	67 (77)	69 (78)	71 (79)	78 (86)
18,5	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	78 (86)
22	67 (75)	66 (74)	68 (78)	74 (82)	70 (81)	71 (81)	72 (81)	76 (85)
30	69 (80)	68 (78)	73 (84)	82 (93)	70 (81)	72 (83)	72 (82)	78 (88)
37	67 (75)	70 (81)	75 (86)	82 (93)	62 (74)	72 (83)	75 (86)	78 (88)
45	67 (77)	72 (84)	75 (86)	82 (93)	62 (74)	67 (79)	75 (86)	80 (90)
55	67 (77)	72 (84)	78 (86)	84 (98)	63 (77)	67 (79)	77 (88)	80 (91)
75	67 (77)	77 (87)	73 (82)	79 (89)	65 (77)	67 (81)	72 (84)	77 (89)
90	67 (77)	77 (88)	73 (82)	79 (89)	65 (79)	71 (85)	72 (84)	77 (89)
110	73 (85)	77 (88)	79 (92)	84 (97)	65 (79)	72 (86)	73 (86)	77 (91)
132	76 (88)	77 (88)	79 (92)	84 (97)		72 (86)	77 (86)	85 (99)
160		78 (89)	79 (92)	84 (97)			77 (91)	85 (99)
200			79 (92)	84 (97)			77 (91)	85 (99)
250			83 (95)	84 (97)				



NOTES

PUMP model	Serial Number	Computer Number	Year of manuf.
.....

LIQUID handled	Capacitym ³ /h	Suction Pressurem	Discharge Press.m	Temperature°C
<input type="checkbox"/> Lethal <input type="checkbox"/> Toxic <input type="checkbox"/> Noxious <input type="checkbox"/> Corrosive <input type="checkbox"/> Irritant <input type="checkbox"/> Malodorous <input type="checkbox"/>				
<input type="checkbox"/> Clean <input type="checkbox"/> Dirty <input type="checkbox"/> With suspended parts	Spec. Gravity.....	Viscosity.....	PH.....	

TOTAL WEIGHTKGs.	MAXIMUM DIMENSIONS 	X =cm Y =cm Z =cm	NOISE (measured at 1 m) Pressure =dB(A) Power =dB(A)
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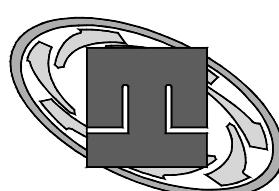
INSTALLATION		SERVICE	
<input type="checkbox"/> Inside	<input type="checkbox"/> Outside	<input type="checkbox"/> Continuous	<input type="checkbox"/> Intermittent

MOTOR type / Frame	No Poles	No RevolutionsRPM	Absorbed powerAmp	Installed PowerkW /HP
FrequencyHz	SupplyVolt	Enclosure IP.....	Insulation class	Absorbed PowerkW /HP

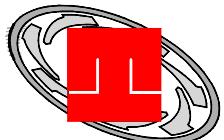
COMMENTS

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Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



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www.pompetravaini.it



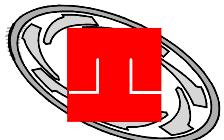
pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Operating manual



pompetravaini S.p.A.

<http://www.pompetravaini.it>

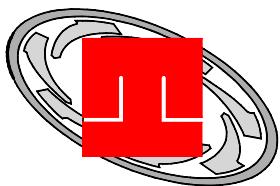
ISO 9001



Instructions

I	Dichiarazione CE di Conformità	NL	EG Verklaring van Overeenstemming
GB	EC Declaration of Conformity	DK	CE Overensstemmelseserklæring
F	Déclaration CE de Conformité	S	CE Försäkran om överensstämmelse
D	CE Konformitätserklärung	FIN	EU Vaatimustenmukaisuusvakuutus
E	Certificado de Conformidad CE	PL	CE Certyfikat zgodności

I La Ditta
 GB The Company
 F La Société
 D Die Firma
 E La Empresa
 NL Fabrikant
 DK Firmaet
 S Företag
 FIN Yritys



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 FIN tämän kirjeen allekirjoitus vakuuttaa että kone täyttää Direktiivien edellyttämät vaatimukset
 PL sygnatariusz niniejszego dokumentu zaświadczenie, że urządzenie spełnia wymogi opisane w Dyrektywie

Direttiva Macchine / Machinery Directive 2006/42/CE Compatibilità elettromagnetica / EMC Directive 2004/108/CE

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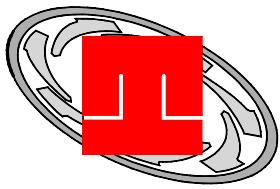
POMPETRAVAINI S.P.A.		12/09/2012
		001243
Nº conf.	1204402	del 01/06/12 Cod. TCHG2A02118
S/N DI099	Centrifugal pump - Pompa Centrifuga	
	TCH 40-250/1-C/GS	Kg 0335
Liquido		
	WATER	
Q m3/h 30	kW abs 11,5	rpm 2900
H m.c.l. 70	mbar	MADE IN ITALY

I II Presidente e responsabile tecnico
 GB *The President and Technical Manager*
 F Le Président et le Directeur Technique
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Sig. Carlo Travaini

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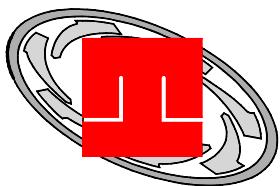
POMPETRAVAINI S.P.A.	12/09/2012
	001243
<hr/>	
Nº conf. 1204401 del 01/06/12 Cod.TCTG1A01004	
S/N DI098 Centrifugal pump - Pompa Centrifuga	
TCT 32-160/1-B/RA-L3	Kg 0220
<hr/>	
Liquido	
WASTE WATER/DET.SLURRY+5/10%SO	
Q m3/h 6	kW abs 7
H m.c.l. 35	mbar
	rpm 2900
	MADE IN ITALY

I II Presidente e responsabile tecnico
 GB *The President and Technical Manager*
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Direttiva Macchine / Machinery Directive 2006/42/CE Compatibilità elettromagnetica / EMC Directive 2004/108/CE

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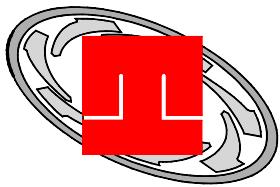
POMPETRAVAINI S.P.A.	12/09/2012
	001243
<hr/>	
Nº conf. 1204400 del 01/06/12 Cod.TCTG1A01003	
S/N DI097 Centrifugal pump - Pompa Centrifuga	
TCT 32-160/1-B/RA-L3	Kg 0250
Liquido	
WATER/DETERG.SLURRY	
Q m3/h 6	kW abs 14
H m.c.l. 30	mbar
rpm 2900	
MADE IN ITALY	

- I II Presidente e responsabile tecnico
 GB *The President and Technical Manager*
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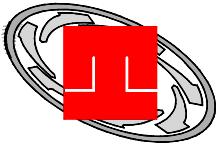
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POMPETRAVAINI S.P.A.	12/09/2012
	001243
<hr/>	
Nº conf. 1204399 del 01/06/12 Cod.TCTG3A00010	
S/N DI096 Centrifugal pump - Pompa Centrifuga	
TCT 50-315/1X-B/RA-L3	Kg 0425
Liquido	
SLURRY	
Q m3/h 10	kW abs 17
H m.c.l. 27,3	mbar
	rpm 1480
	MADE IN ITALY

I II Presidente e responsabile tecnico
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Sig. Carlo Travaini



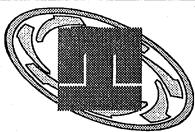
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ISO 9001



EC Declaration of Conformity



CERTIFICATO VISIVO E DIMENSIONALE
VISUAL AND DIMENSIONAL CERTIFICATE
CERTIFICADO VISUAL Y DIMENSIONAL
UNI EN 10204/92 - 3.1B -

DT

T.R. N° : 24351

Pag. : 1 di 1
of

Conferma
Confirmation 1204399

Ordine
Order 121241

Cliente
Customer BALLESTRA S.P.A.

Specifiche
Specific

Procedura
Procedure

Matricola S/N	Codice componente Part number	Descrizione componente Part description	Materiale Material	Item Item
DI096	TCTG3A00010	TCT 50-315/1X-B/RA-L3	AISI 316	62P1

Risultati controllo visivo:
Results visual control :

Resultados control visual:

- Conforme alla specifica/conferma Non Conforme alla specifica
Conform to specification/confirmation Not Conform to specification
Conforme con la especificación / conferma No conforme con la especificación

Scarto
Rejection

Risultati controllo dimensionale:
Results dimensional control:

Resultados control dimensional:

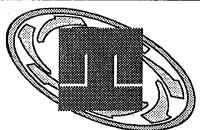
- Conforme alla specifica
Conform to specification
Conforme con la especificación

- Non Conforme alla specifica
Not Conform to specification
No conforme con la especificación

Scarto
Rejection

Note
Notes

Operatore Operator --	Data Date	Responsabile A.Q. QA Mngr Ing. Luca Porta	Data Date 17/09/2012
Valutatore Evaluator	Data Date	Ispettore Cliente Customer inspector	Data Date



CERTIFICATO VISIVO E DIMENSIONALE
VISUAL AND DIMENSIONAL CERTIFICATE
CERTIFICADO VISUAL Y DIMENSIONAL
UNI EN 10204/92 - 3.1B -

DT

T.R. N° : 24352
Pag. : 1 di 1
of

Conferma Confirmation	1204400	Ordine Order	121241	Cliente Customer	BALLESTRA S.P.A.
Specifiche Specific	Procedura Procedure				

Matricola S/N	Codice componente Part number	Descrizione componente Part description	Materiale Material	Item Item
DI097	TCTG1A01003	TCT 32-160/1-B/RA-L3	AISI 316	63P5

Risultati controllo visivo:

Results visual control :

Resultados control visual:

- Conforme alla specifica/conferma Non Conforme alla specifica
Conform to specification/confirmation *Not Conform to specification* Scarto
Conforme con la especificación / conferma *No conforme con la especificación* *Rejection*

Risultati controllo dimensionale:

Results dimensional control:

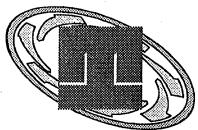
Resultados control dimensional:

- Conforme alla specifica Non Conforme alla specifica
Conform to specification *Not Conform to specification* Scarto
Conforme con la especificación *No conforme con la especificación* *Rejection*

Note
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Operatore Operator	Data Date	Responsabile A.Q. QA Mngr	Data Date
--		Ing. Luca Porta	17/09/2012

Valutatore Evaluator	Data Date	Ispettore Cliente Customer inspector	Data Date



CERTIFICATO VISIVO E DIMENSIONALE
VISUAL AND DIMENSIONAL CERTIFICATE
CERTIFICADO VISUAL Y DIMENSIONAL
 UNI EN 10204/92 - 3.1B -

DT

T.R. N° : 24353

Pag. : 1 di 1
ofConferma
Confirmation 1204401Ordine
Order 121241Cliente
Customer BALLESTRA S.p.A.Specifiche
SpecificProcedura
Procedure

Matricola S/N	Codice componente Part number	Descrizione componente Part description	Materiale Material	Item Item
DI098	TCTG1A01004	TCT 32-160/1-B/RA-L3	AISI 316	63P6

Risultati controllo visivo:

Results visual control :

Resultados control visual:

 Conforme alla specifica/conferma

Conform to specification/confirmation

Conforme con la especificación / conferma

 Non Conforme alla specifica

Not Conform to specification

No conforme con la especificación

 Scarto

Rejection

Risultati controllo dimensionale:

Results dimensional control:

Resultados control dimensional:

 Conforme alla specifica

Conform to specification

Conforme con la especificación

 Non Conforme alla specifica

Not Conform to specification

No conforme con la especificación

 Scarto

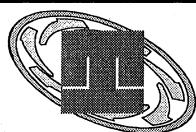
Rejection

Note

Notes

Operatore Operator	Data Date	Responsabile A.Q. QA Mngr	Data Date
--		Ing. Luca Porta	17/09/2012

Valutatore Evaluator	Data Date	Ispettore Cliente Customer inspector	Data Date



CERTIFICATO VISIVO E DIMENSIONALE
VISUAL AND DIMENSIONAL CERTIFICATE
CERTIFICADO VISUAL Y DIMENSIONAL
 UNI EN 10204/92 - 3.1B -

DT

T.R. N° : 24354

Pag. : 1 di 1
ofConferma
Confirmation 1204402Ordine
Order 121241Cliente
Customer BALLESTRA S.P.A.Specifiche
SpecificProcedura
Procedure

Matricola S/N	Codice componente Part number	Descrizione componente Part description	Materiale Material	Item Item
DI099	TCHG2A02118	TCH 40-250/1-C/GS	AISI 316	64P1

Risultati controllo visivo:

Conforme alla specifica/conferma Non Conforme alla specifica
Conform to specification/confirmation *Not Conform to specification*

Scarto
Rejection

Results visual control :

Conforme con la especificación / conferma *No conforme con la especificación*

Risultati controllo dimensionale:

Conforme alla specifica Non Conforme alla specifica
Conform to specification *Not Conform to specification*

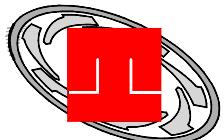
Scarto
Rejection

Results dimensional control:

Conforme con la especificación *No conforme con la especificación*

Resultados control visual:
Resultados control dimensional:
Notes

Operatore Operator	Data Date	Responsabile A.Q. QA Mngr	Ing. Luca Porta	Data Date
Valutatore Evaluator	Data Date	Ispettore Cliente Customer inspector		Data Date



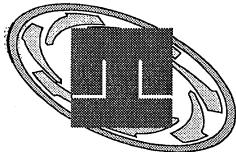
pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Visual and dimensional certificate



ATTESTATO DI RUMOROSITÀ
NOISE TEST REPORT
RELEVE DE CONTRÔLE DU NIVEAU DU BRUIT
SCHALLEISTUNGSPEGEL WERKSZEUGNIS
UNI EN 10204/92 - 2.2 -

NA

Nº: 24300

Conferma :
Confirmation - Code usine - Auftragbestätigung
 1204399

Ordine :
Order - Commande - Bestellung
 121241

Cliente:
Customer - Client - Kunde
 BALLESTRA S.P.A.

Tipo pompa:
Pump Type - Pompe type - Pumpentyp
 TCT 50-315/1X-B/RA-L3

Item:
Item
 62P1

Matricola:- Serial/N - N. N Série -
Kenn-Nummer
 DI096

Codice :
Code - Code
 TCTG3A00010

Specifiche :
Specific - Spécification - Spezifikation

Procedura :
Procedure - Procédure - Verfahren
 UNI EN ISO 3746

Con la presente, si certifica che il livello di pressione sonora (SPL) con ponderazione "A", misurato ad 1 m. di distanza dalla pompa, non è superiore a:

We certify that the sound pressure level (SPL) weighted "A", measured at 1 m. of distance from the pump, does not exceed:

Nous certifions déclare que le niveau de pression sonore avec pondération "A", mesuré à 1 m. de distance de la pompe, n'est pas supérieur à :

Win eRklären, daß die Schalleistungspegel mit „A“ Wiegung und in 1 Meter Abstand von Pumpe gemessen, nicht über ist.

Pump: dB(A)

Lp: <70

Lw:

Motor: dB(A)

Lp: 68

Per il rilevamento è stato utilizzato il fonometro digitale:

The measurement has been made by the digital sound level meter:

L'essai a été effectué en utilisant un sonomètre digital:

Die Abmessung würde mit digital Phonometer aufgenommen:

Costruttore - Manufacturer – Constructeur- Hersteller

Tipo - Type – Types- Typ :

Matricola - Serial No. - N. Série – Kenn-Nummer:

Classe di precisione - Accuracy rating - Degré de précision – Genauigkeits- Klasse:

LARSON DAVIS

MOD. 2800

0441

1

Note:
Notes - Remarques - Bemerkungen

Operatore:
Operator - Opérateur - Bediener
 --

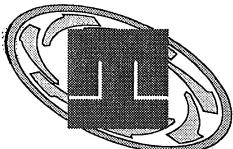
Data :
Date - Date- Datum

Responsabile A.Q.
QA Mngr - AQ Mngr - QV Mngr
 Ing. Luca Porta

Data :
Date - Date- Datum
 14/09/2012

Ispettore Cliente
Customer Inspector - Inspecteur - Kundes Inspektor

Data :
Date - Date-Datum



ATTESTATO DI RUMOROSITA'
NOISE TEST REPORT
RELEVE DE CONTRÔLE DU NIVEAU DU BRUIT
SCHALLEISTUNGSPEGEL WERKSZEUGNIS
UNI EN 10204/92 - 2.2 -

NA

Nº: 24303

Conferma :
Confirmation - Code usine - Auftragbestätigung
 1204400

Ordine :
Order - Commande - Bestellung
 121241

Cliente:
Customer- Client - Kunde
 BALLESTRA S.P.A.

Tipo pompa:
Pump Type- Pompe type- Pumpentyp
 TCT 32-160/1-B/RA-L3

Item:
Item
 63P5

Matricola:- *Serial/N - N. N Sérié -*
Kenn-Nummer
 DI097

Codice :
Code - Code
 TCTG1A01003

Specifiche :
Specific - Spécification - Spezifikation

Procedura :
Procedure - Procédure- Verfahren
 UNI EN ISO 3746

Con la presente, si certifica che il livello di pressione sonora (SPL) con ponderazione "A", misurato ad 1 m. di distanza dalla pompa, non è superiore a:

We certify that the sound pressure level (SPL) weighted "A", measured at 1 m. of distance from the pump, does not exceed:

Nous certifions déclare que le niveau de pression sonore avec pondération "A", mesuré à 1 m. de distance de la pompe, n'est pas supérieur à :

Win eRklären, daß die Schalleistungspegel mit „A“ Wiegung und in 1 Meter Abstand von Pumpe gemessen, nicht über ist.

Pump: dB(A)

Lp: <70

Lw:

Motor: dB(A)

Lp: 74

Per il rilevamento è stato utilizzato il fonometro digitale:

The measurement has been made by the digital sound level meter:

L'essai a été effectué en utilisant un sonomètre digital:

Die Abmessung würde mit digital Phonometer aufgenommen:

Costruttore - *Manufacturer – Constructeur- Hersteller*

Tipo - *Type – Types- Typ :*

Matricola - *Serial No. - N. Série – Kenn-Nummer:*

Classe di precisione - *Accuracy rating - Degré de précision – Genauigkeits- Klasse:* 1

LARSON DAVIS

MOD. 2800

0441

Note:
Notes – Remarques - Bemerkungen

Operatore:
Operator - Opérateur - Bediener
 --

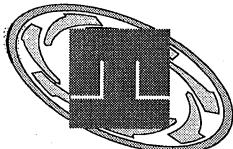
Data :
Date – Date- Datum

Responsabile A.Q.
QA Mngr- AQ Mngr- QV Mngr
 Ing. Luca Porta

Data :
Date – Date- Datum
 14/09/2012

Ispettore Cliente
Customer Inspector – Kundes Inspektor

Data :
Date – Date-Datum



ATTESTATO DI RUMOROSITÀ
NOISE TEST REPORT
RELEVE DE CONTRÔLE DU NIVEAU DU BRUIT
SCHALLEISTUNGSPPEGEL WERKSZEUGNIS
UNI EN 10204/92 - 2.2 -

NA

Nº: 24308

Conferma :
Confirmation - Code usine - Auftragbestätigung
 1204401

Ordine :
Order - Commande - Bestellung
 121241

Cliente:
Customer- Client - Kunde
 BALLESTRA S.P.A.

Tipo pompa:
Pump Type- Pompe type- Pumpentyp
 TCT 32-160/1-B/RA-L3

Item:
Item
 63P6

Matricola:- *Serial/N - N. N Série - Kenn-Nummer*
 DI098

Codice :
Code - Code
 TCTG1A01004

Specifiche :
Specific - Spécification - Spezifikation

Procedura :
Procedure - Procédure- Verfahren
 UNI EN ISO 3746

Con la presente, si certifica che il livello di pressione sonora (SPL) con ponderazione "A", misurato ad 1 m. di distanza dalla pompa, non è superiore a:

We certify that the sound pressure level (SPL) weighted "A", measured at 1 m. of distance from the pump, does not exceed:

Nous certifions déclare que le niveau de pression sonore avec pondération "A", mesuré à 1 m. de distance de la pompe, n'est pas supérieur à :

Win eRklären, daß die Schalleistungspegel mit „A“ Wiegung und in 1 Meter Abstand von Pumpe gemessen, nicht über ist.

Pump: dB(A)

Lp: <70

Lw:

Motor: dB(A)

Lp: 74

Per il rilevamento è stato utilizzato il fonometro digitale:

The measurement has been made by the digital sound level meter:

L'essai a été effectué en utilisant un sonomètre digital:

Die Abmessung würde mit digital Phonometer aufgenommen:

Costruttore - *Manufacturer – Constructeur- Hersteller*

Tipo - *Type – Types- Typ* :

Matricola - *Serial No. - N. Série – Kenn-Nummer*:

Classe di precisione - *Accuracy rating - Degré de précision – Genauigkeits- Klasse:*

LARSON DAVIS

MOD. 2800

0441

1

Note:
Notes – Remarques - Bemerkungen

Operatore:
Operator - Opérateur - Bediener

--

Data :
Date – Date- Datum

Responsabile A.Q.
QA Mngt - AQ-Mngr- QV Mngr

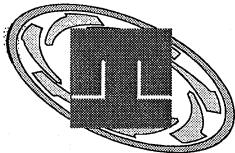
Ing. Luca Porta

Data :
Date – Date- Datum

14/09/2012

Ispettore Cliente
Customer inspector – Inspecteur – Kundes Inspektor

Data :
Date – Date-Datum



ATTESTATO DI RUMOROSITA'
NOISE TEST REPORT
RELEVE DE CONTRÔLE DU NIVEAU DU BRUIT
SCHALLEISTUNGSPEGEL WERKSZEUGNIS
UNI EN 10204/92 - 2.2 -

NA

Nº: 24312

Conferma :
Confirmation - Code usine - Auftragbestätigung
 1204402

Ordine :
Order - Commande - Bestellung
 121241

Cliente:
Customer - Client - Kunde
 BALLESTRA S.P.A.

Tipo pompa:
Pump Type - Pompe type - Pumpentyp
 TCH 40-250/1-C/GS

Item:
Item
 64P1

Matricola:- *Serial/N - N. N Série - Kenn-Nummer*
 DI099

Codice :
Code - Code
 TCHG2A02118

Specifiche :
Specific - Spécification - Spezifikation

Procedura :
Procedure - Procédure - Verfahren
 UNI EN ISO 3746

Con la presente, si certifica che il livello di pressione sonora (SPL) con ponderazione "A", misurato ad 1 m. di distanza dalla pompa, non è superiore a:

We certify that the sound pressure level (SPL) weighted "A", measured at 1 m. of distance from the pump, does not exceed:

Nous certifions déclare que le niveau de pression sonore avec pondération "A", mesuré à 1 m. de distance de la pompe, n'est pas supérieur à :

Win eRklären, daß die Schalleistungspegel mit „A“ Wiegung und in 1 Meter Abstand von Pumpe gemessen, nicht über ist.

Pump: dB(A)

Lp: <70

Lw:

Motor: dB(A)

Lp: 74

Per il rilevamento è stato utilizzato il fonometro digitale:

The measurement has been made by the digital sound level meter:

L'essai a été effectué en utilisant un sonomètre digital:

Die Abmessung würde mit digital Phonometer aufgenommen:

Costruttore - Manufacturer – Constructeur- Hersteller

Tipo - Type – Types- Typ :

Matricola - Serial No. - N. Série – Kenn-Nummer:

Classe di precisione - Accuracy rating - Degré de précision – Genauigkeits- Klasse: 1

LARSON DAVIS

MOD. 2800

0441

1

Note:
Notes - Remarques - Bemerkungen

Operatore:
Operator - Opérateur - Bediener
 --

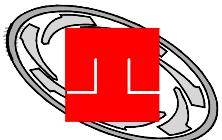
Data :
Date - Date- Datum

Responsabile A.Q.
QA Mngr - AQ Mngr - QV Mngr
 Ing. Luca Porta

Data :
Date - Date- Datum
 14/09/2012

Ispettore Cliente
Customer Inspector - Inspecteur - Kundes Inspektor

Data :
Date - Date-Datum



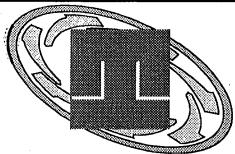
pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Noise test report



ATTESTATO DI VIBRAZIONI

VIBRATION TEST REPORT

UNI EN 10204/92 - 2.2 -

VA

Nº
data

24297

Conferma :
Confirmation :
1204399Ordine :
Order :
121241Cliente:
Customer:
BALLESTRA S.P.A.Tipo pompa:
Pump Type:
TCT 50-315/1X-B/RA-L3Item:
Item:
62P1Matricola:
S/N:
DI096Codice :
Code :
TCTG3A00010Specifiche :
Specific :Procedura :
Procedure :
UNI ISO 10816

Con la presente, si certifica che il livello di vibrazioni, misurato sulla sede dei cuscinetti, non è superiore a

<3,5 mm/s .

Per il rilevamento è stato utilizzato l'analizzatore di vibrazioni:

Costruttore: **LARSON DAVIS**

Tipo: **2800**

Matricola: **0441**

We certify that the vibration level, measured on the bearing seat, does not exceed:

<3,5 mm/s .

The measurement has been made by the digital vibration analyzer.

Manufacturer: **LARSON DAVIS**

Type: **2800**

Serial No: **0441**

Note:
Notes

Operatore :
Operator :
--

Data :
Date :

Responsabile A.Q.
QA Mngt
Ing. Luca Porta

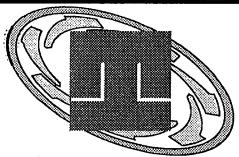
Data :
Date :
14/09/2012

Valutatore :
Evaluator :

Data :
Date :

Ispettore Cliente
Customer Inspector

Data :
Date :



ATTESTATO DI VIBRAZIONI

VIBRATION TEST REPORT

UNI EN 10204/92 - 2.2 -

VA

N°
data

24302

Conferma :
Confirmation :
1204400Ordine :
Order :
121241Cliente:
Customer:
BALLESTRA S.P.A.Tipo pompa:
Pump Type:
TCT 32-160/1-B/RA-L3Item:
Item:
63P5Matricola:
S/N:
DI097Codice :
Code :
TCTG1A01003Specifiche :
Specific :Procedura :
Procedure :
UNI ISO 10816

Con la presente, si certifica che il livello di vibrazioni, misurato sulla sede dei cuscinetti, non è superiore a

<3,5 mm/s .

Per il rilevamento è stato utilizzato l'analizzatore di vibrazioni:

Costruttore: **LARSON DAVIS**

Tipo: **2800**

Matricola: **0441**

We certify that the vibration level, measured on the bearing seat, does not exceed:

<3,5 mm/s .

The measurement has been made by the digital vibration analyzer.

Manufacturer: **LARSON DAVIS**

Type: **2800**

Serial No: **0441**

Note:
Notes

Operatore :
Operator :
--

Data :
Date :

Responsabile A.Q.
QA Mngt
Ing. Luca Porta

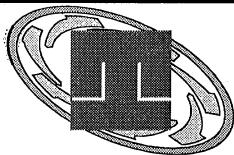
Data :
Date :
14/09/2012

Valutatore :
Evaluator :

Data :
Date :

Ispettore Cliente
Customer Inspector

Data :
Date :



ATTESTATO DI VIBRAZIONI

VIBRATION TEST REPORT

UNI EN 10204/92 - 2.2 -

VA

N°
data

24306

Conferma :
Confirmation :
1204401Ordine :
Order :
121241Cliente:
Customer:
BALLESTRA S.P.A.Tipo pompa:
Pump Type:
TCT 32-160/1-B/RA-L3Item:
Item:
63P6Matricola:
S/N:
DI098Codice :
Code :
TCTG1A01004Specifiche :
Specific :Procedura :
Procedure :
UNI ISO 10816

Con la presente, si certifica che il livello di vibrazioni, misurato sulla sede dei cuscinetti, non è superiore a

<3,5 mm/s .

Per il rilevamento è stato utilizzato l'analizzatore di vibrazioni:

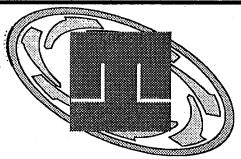
Costruttore: **LARSON DAVIS**Tipo: **2800**Matricola: **0441**

We certify that the vibration level, measured on the bearing seat, does not exceed:

<3,5 mm/s .

The measurement has been made by the digital vibration analyzer.

Manufacturer: **LARSON DAVIS**Type: **2800**Serial No: **0441**Note:
NotesOperatore :
Operator :
--Data :
Date :Responsabile A.Q.
QA Mgr
Ing. Luca PortaData :
Date :
14/09/2012Valutatore :
Evaluator :Data :
Date :Ispettore Cliente
Customer InspectorData :
Date :



ATTESTATO DI VIBRAZIONI

VIBRATION TEST REPORT

UNI EN 10204/92 - 2.2 -

VA

N°
data

24311

Conferma :
Confirmation :
1204402Ordine :
Order :
121241Cliente:
Customer:
BALLESTRA S.P.A.Tipo pompa:
Pump Type:
TCH 40-250/1-C/GSItem:
Item:
64P1Matricola:
S/N:
DI099Codice :
Code :
TCHG2A02118Specifiche :
Specific :Procedura :
Procedure :
UNI ISO 10816

Con la presente, si certifica che il livello di vibrazioni, misurato sulla sede dei cuscinetti, non è superiore a

<3,5 mm/s .

Per il rilevamento è stato utilizzato l'analizzatore di vibrazioni:

Costruttore: **LARSON DAVIS**

Tipo: **2800**

Matricola: **0441**

We certify that the vibration level, measured on the bearing seat, does not exceed:

<3,5 mm/s .

The measurement has been made by the digital vibration analyzer.

Manufacturer: **LARSON DAVIS**

Type: **2800**

Serial No: **0441**

Note:
Notes

Operatore :
Operator :
--

Data :
Date :

Responsabile A.Q.
QA Mngr
Ing. Luca Porta

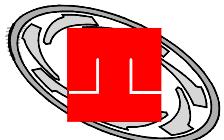
Data :
Date :
14/09/2012

Valutatore :
Evaluator :

Data :
Date :

Ispettore Cliente
Customer Inspector

Data :
Date :



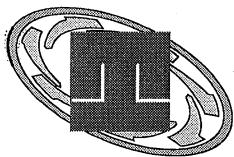
pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Vibration test report



ATTESTATO DI EQUILIBRATURA

BALANCE TEST REPORT

RELEVE DE CONTRÔLE D'EQUILIBRAGE

UNI EN 10204/92 - 2.2 -

Sistema qualità.mdb - Versione 10.6 - Luglio 2012 PL.AQ

BA

Nº: 24299

Conferma :
Confirmation - Code usine

1204399

Ordine :
Order - Commande

121241

Cliente:
Customer- Client

BALLESTRA S.P.A.

Tipo pompa:
Pump Type- Pompe type

TCT 50-315/1X-B/RA-L3

Item:
Item

62P1

Matricola:
Serial/N - N. Série

DI096

Codice :
Code - Code:

TCTG3A00010

Specifiche :
Specific - Spécifications:

ISO 1940 - G 6.3

Procedura :
Procedure - Procédure:

Con la presente, si garantisce che le giranti forniteVi sono state sottoposte a processo di equilibratura in accordo alle norme **ISO 1940/1 edizione 1986**.

La classe di qualità di riferimento, a cui le stesse risultano pienamente conformi, è la **G 6.3**.

We state that all the impellers we supply are balanced according to ISO 1940/1 standard edition 1986.

The quality class is G 6.3.

Nous garantissons que toutes les turbines fournies sont équilibrées selon les normes **ISO 1940/1 édition 1986**.

Le système de contrôle- qualité referant est le **G 6.3**.

Note:
Notes - RemarquesOperatore:
Operator - Opérateur -

--

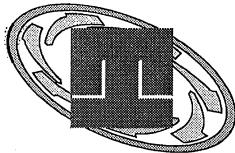
Data :
Date - DateResponsabile A.Q.
QA Mgr

Ing. Luca Porta

Data :
Date - Date

14/09/2012

Ispettore Cliente
Customer Inspector – Inspecteur clientData :
Date - Date



ATTESTATO DI EQUILIBRATURA

BALANCE TEST REPORT

RELEVE DE CONTRÔLE D'EQUILIBRAGE

UNI EN 10204/92 - 2.2 -

Sistema qualità.mdb - Versione 10.6 - Luglio 2012 PL.AC

BA

N°: 24301

Conferma :
Confirmation - Code usine
1204400Ordine :
Order - Commande
121241Cliente:
Customer- Client
BALLESTRA S.P.A.Tipo pompa:
Pump Type- Pompe type
TCT 32-160/1-B/RA-L3Item:
Item
63P5Matricola:
Serial/N - N. Série
DI097Codice :
Code - Code:
TCTG1A01003Specifiche :
Specific - Spécifications:
ISO 1940 - G 6.3Procedura :
Procedure - Procédure:

Con la presente, si garantisce che le giranti forniteVi sono state sottoposte a processo di equilibratura in accordo alle norme **ISO 1940/1 edizione 1986**.

La classe di qualità di riferimento, a cui le stesse risultano pienamente conformi, è la **G 6.3**.

We state that all the impellers we supply are balanced according to ISO 1940/1 standard edition 1986.

The quality class is G 6.3.

Nous garantissons que toutes les turbines fournies sont équilibrées selon les normes **ISO 1940/1 édition 1986**.

Le système de contrôle- qualité referant est le **G 6.3**.

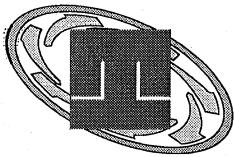
Note:
Notes - RemarquesOperatore:
Operator - Opérateur -
--Data :
Date - DateResponsabile A.Q.
QA Manager

Ing. Luca Porta

Data :
Date - Date

14/09/2012

Ispettore Cliente
Customer Inspector – Inspecteur clientData :
Date - Date



ATTESTATO DI EQUILIBRATURA

BALANCE TEST REPORT

RELEVE DE CONTRÔLE D'EQUILIBRAGE

UNI EN 10204/92 - 2.2 -

Sistema qualità.mdb - Versione 10.6 - Luglio 2012 PL.AQ

BA

N°: 24305

Conferma :
Confirmation - Code usine

1204401

Ordine :
Order - Commande

121241

Cliente:
Customer- Client

BALLESTRA S.P.A.

Tipo pompa:
Pump Type- Pompe type

TCT 32-160/1-B/RA-L3

Item:
Item

63P6

Matricola:
Serial/N - N. Série

DI098

Codice :
Code - Code:

TCTG1A01004

Specifiche :
Specific - Spécifications:

ISO 1940 - G 6.3

Procedura :
Procedure - Procédure:

Con la presente, si garantisce che le giranti forniteVi sono state sottoposte a processo di equilibratura in accordo alle norme **ISO 1940/1 edizione 1986**.

La classe di qualità di riferimento, a cui le stesse risultano pienamente conformi, è la **G 6.3**.

We state that all the impellers we supply are balanced according to ISO 1940/1 standard edition 1986.

The quality class is G 6.3.

Nous garantissons que toutes les turbines fournies sont équilibrées selon les normes **ISO 1940/1 édition 1986**.

Le système de contrôle- qualité referant est le **G 6.3**.

Note:
Notes - RemarquesOperatore:
Operator - Opérateur -

--

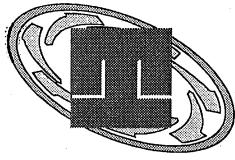
Data :
Date - DateResponsabile AIQ.
QA Mngt

Ing. Luca Porta

Data :
Date - Date

14/09/2012

Ispettore Cliente
Customer inspector – Inspecteur clientData :
Date - Date



ATTESTATO DI EQUILIBRATURA

BALANCE TEST REPORT

RELEVE DE CONTRÔLE D'EQUILIBRAGE

UNI EN 10204/92 - 2.2 -

Sistema qualità.mdb - Versione 10.6 - Luglio 2012 PL.AQ

BA

N°: 24310

Conferma :
Confirmation - Code usine
1204402Ordine :
Order - Commande
121241Cliente:
Customer- Client
BALLESTRA S.P.A.Tipo pompa:
Pump Type- Pompe type

TCH 40-250/1-C/GS

Item:
Item

64P1

Matricola:
Serial/N - N. Série

DI099

Codice :
Code - Code:

TCHG2A02118

Specifiche :
Specific - Spécifications:

ISO 1940 - G 6.3

Procedura :
Procedure - Procédure:

Con la presente, si garantisce che le giranti forniteVi sono state sottoposte a processo di equilibratura in accordo alle norme **ISO 1940/1 edizione 1986**.

La classe di qualità di riferimento, a cui le stesse risultano pienamente conformi, è la **G 6.3**.

We state that all the impellers we supply are balanced according to ISO 1940/1 standard edition 1986.

The quality class is G 6.3.

Nous garantissons que toutes les turbines fournies sont équilibrées selon les normes **ISO 1940/1 édition 1986**.

Le système de contrôle- qualité referant est le **G 6.3**.

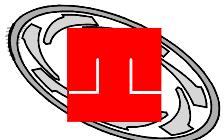
Note:
Notes - RemarquesOperatore:
Operator - Opérateur -
--Data :
Date - DateResponsabile A.Q.
QA Mngr

Ing. Luca Porta

Data :
Date - Date

14/09/2012

Ispettore Cliente
Customer Inspector – Inspecteur clientData :
Date - Date



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ISO 9001



Balance test report

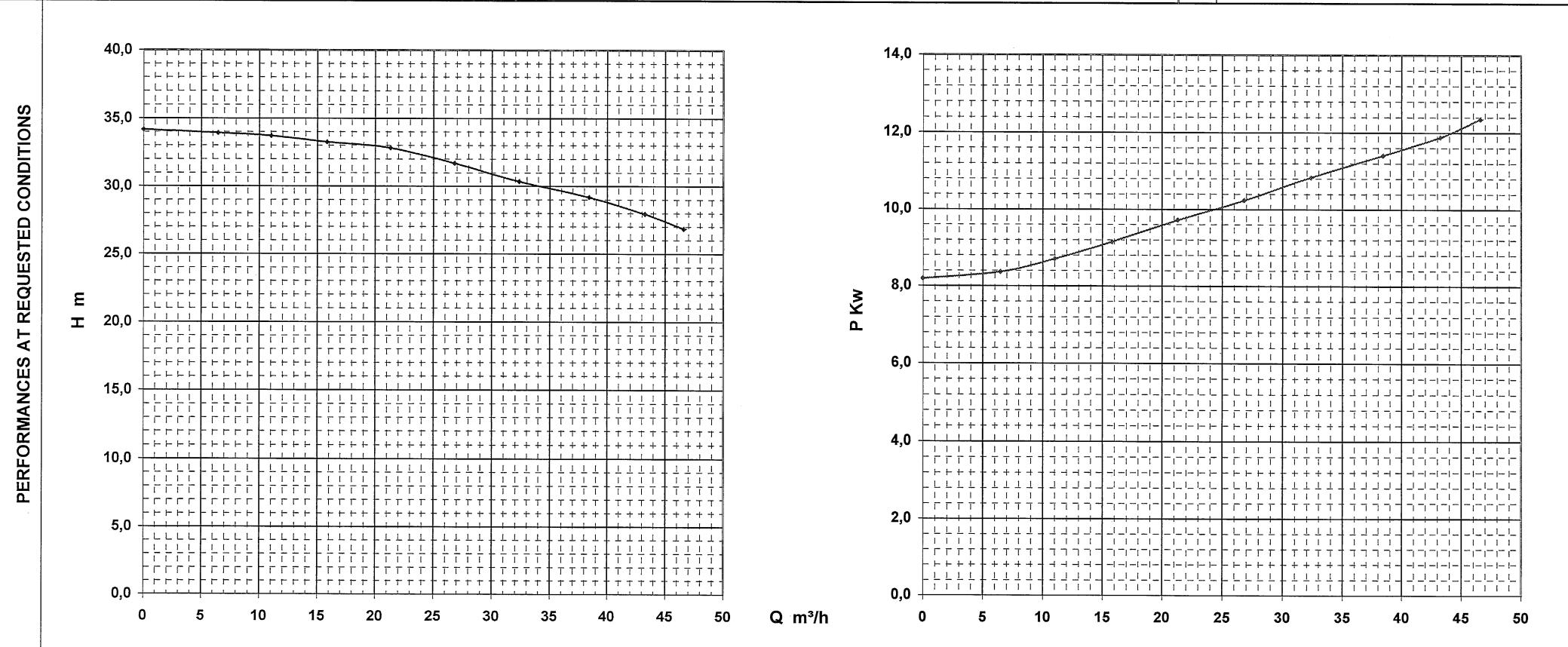


TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 50-315/1X-B/RA-L3CUSTOMER BALLESTRA S.P.A.SERIAL N° DI096ORDER CONF. 1204399 DATE 06/01/12ITEM 62P1ORDER N° 121241 DATE 30/05/2012IMPELLER DIAM. 285 mm

REQUESTED DATA	CAPACITY	<u>10</u> m ³ /h	LIQUID	<u>SLURRY</u>	TEST CONDITIONS TESTING BENCH 3	Liquid	<u>water</u>	H Suc. Man.	<u>0</u> m	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9092/2000 (only for l. bench 3)	MOTOR DATA	Manuf.	<u>BROOK</u>	Serial	<u>RK410014</u>
	TOTAL HEAD	<u>27,3</u> m	SPEC. WEIGHT	<u>1,1</u> kg/dm ³		Liquid Temp.	<u>21,8</u> C°	H Disch. Man.	<u>1,3</u> m			Power	<u>30/22</u> Hp/kW	Pole/Freq.	<u>04-50</u>
	ABS. POWER	<u>17</u> kW	VISCOSITY	<u>500</u>		Air Temp.	<u>25,6</u> C°	Suction Man.	<u>0-2 abs.</u>			Voltage	<u>415</u> V	Current	<u>38,8</u> A
	SPEED	<u>1480</u> r.p.m.	TEMPERATURE	<u>60/85</u> C°		Atm. Press.	<u>1013</u> mbar	Disch. Man.	<u>0-10 rel.</u>			Cos φ	<u>0,86</u>	Efficiency	<u>91,6</u>
	EFFICIENCY	<u>4,8</u> %	pH			Suc. Pipe Diam.	<u>80</u> mm	Flowmeter	<u>DN100</u>			Power Abs.	<u>watt.2</u>	serial	<u>WF 4822280002</u>
						Disch. Pipe Diam.	<u>50</u> mm								



NOTES [Commessa: C2F11A]

TEST ENGINEER Davide PaolangeloDATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 11.35



TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 32-160/1-B/RA-L3

CUSTOMER BALLESTRA S.P.A.

SERIAL N° DI097

ORDER CONF. 1204400 DATE 06/01/12

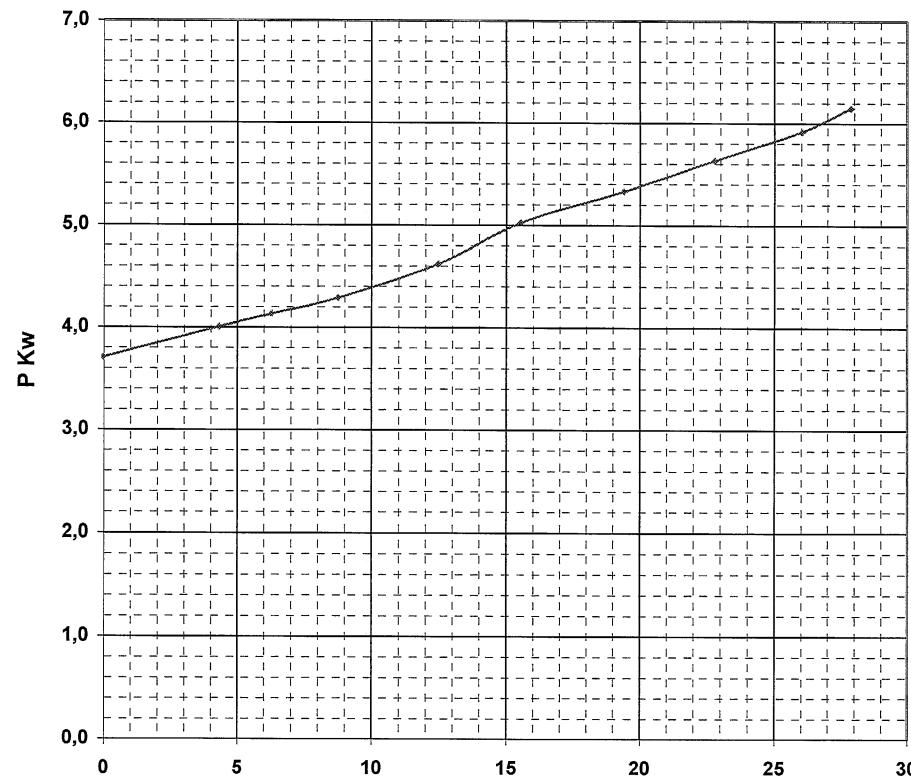
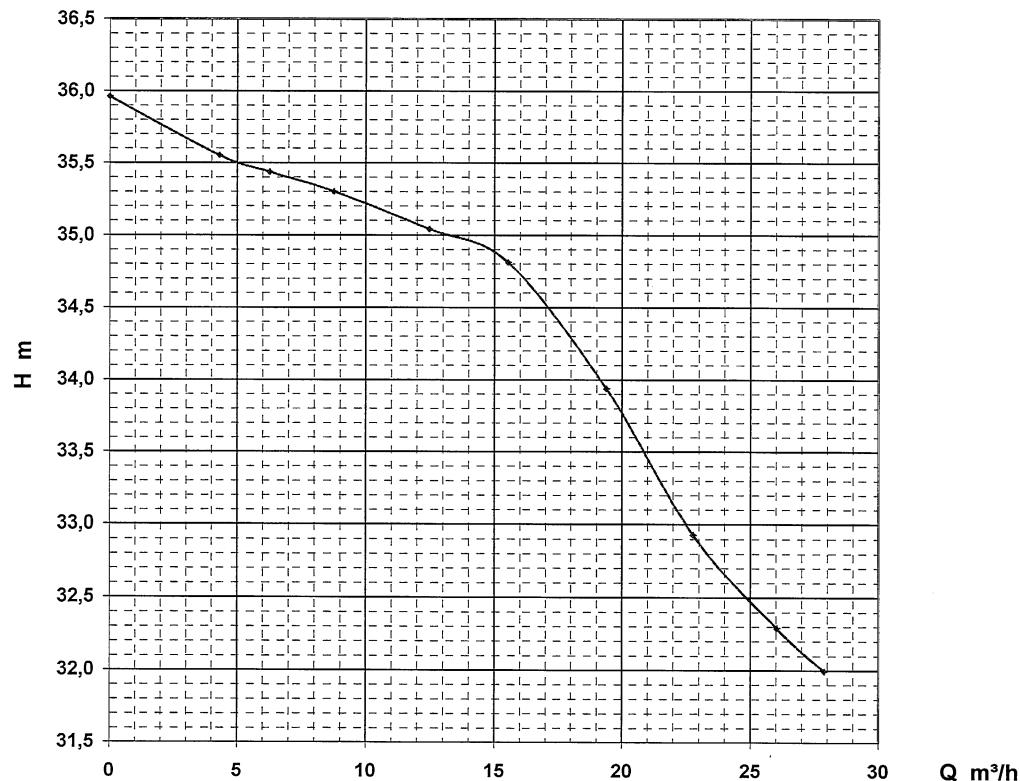
ITEM 63P5

ORDER N° 121241 DATE 30/05/2012

IMPELLER DIAM. 161 mm

REQUESTED DATA	CAPACITY	6	m ³ /h	LIQUID	WATER/DETERG.SL	TEST CONDITIONS TESTING BENCH 3	Liquid	water	H Suc. Man.	0	m	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9096:2000 (only for l. bench 9)	MOTOR DATA	Manuf.	BROOK	Serial	JEIS311	
	TOTAL HEAD	30	m	SPEC. WEIGHT	1		Liquid Temp.	21,8	C°	H Disch. Man.	1,3	m		Power	25/18,5	Hp/kW	Pole/Freq.	02-50
	ABS. POWER	14	kW	VISCOSITY	500		Air Temp.	26,9	C°	Suction Man.	0-2 abs.	serial	ONY0165	Voltage	415	V	Current	31,8 A
	SPEED	2900	r.p.m.	TEMPERATURE	60/85		Atm. Press.	1013	mbar	Disch. Man.	0-10 rel.	serial	90Y0372	Cos φ	0,89		Efficiency	90,9
	EFFICIENCY	3,5	%	pH			Suc. Pipe Diam.	50	mm	Flowmeter	DN50	serial	4C012891000					
							Disch. Pipe Diam.	32	mm	Power Abs.	watt.2	serial	WF 4822280002					

PERFORMANCES AT REQUESTED CONDITIONS



NOTES [Commessa: C2F11A]

TEST ENGINEER Davide Paolangelo

DATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 14.15



TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 32-160/1-B/RA-L3

CUSTOMER BALLESTRA S.P.A.

SERIAL N° DI098

ORDER CONF. 1204401 DATE 06/01/12

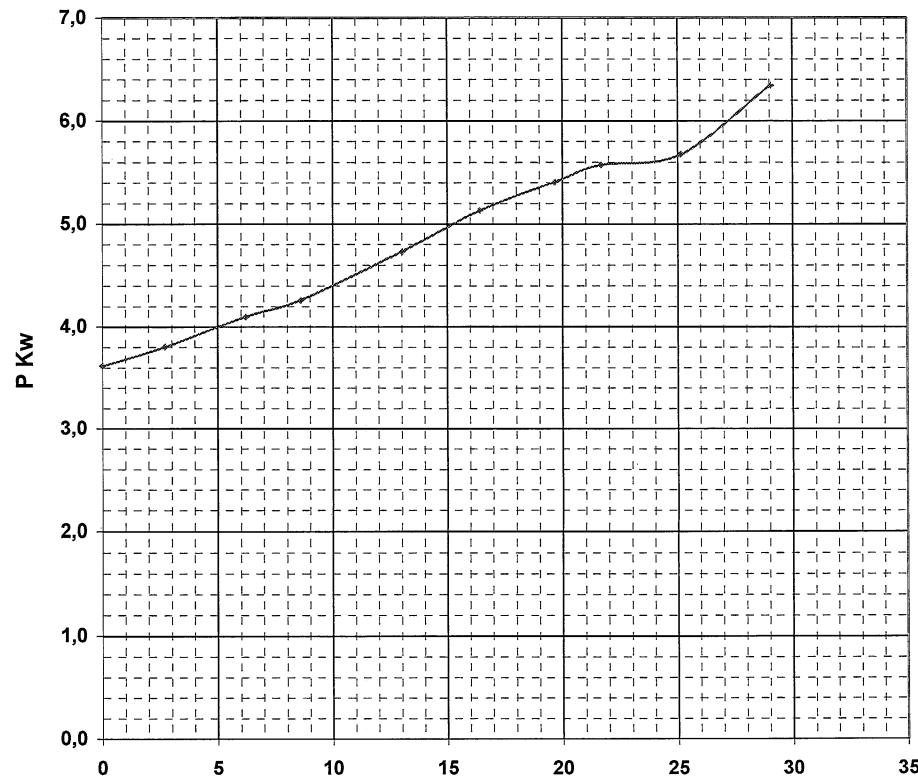
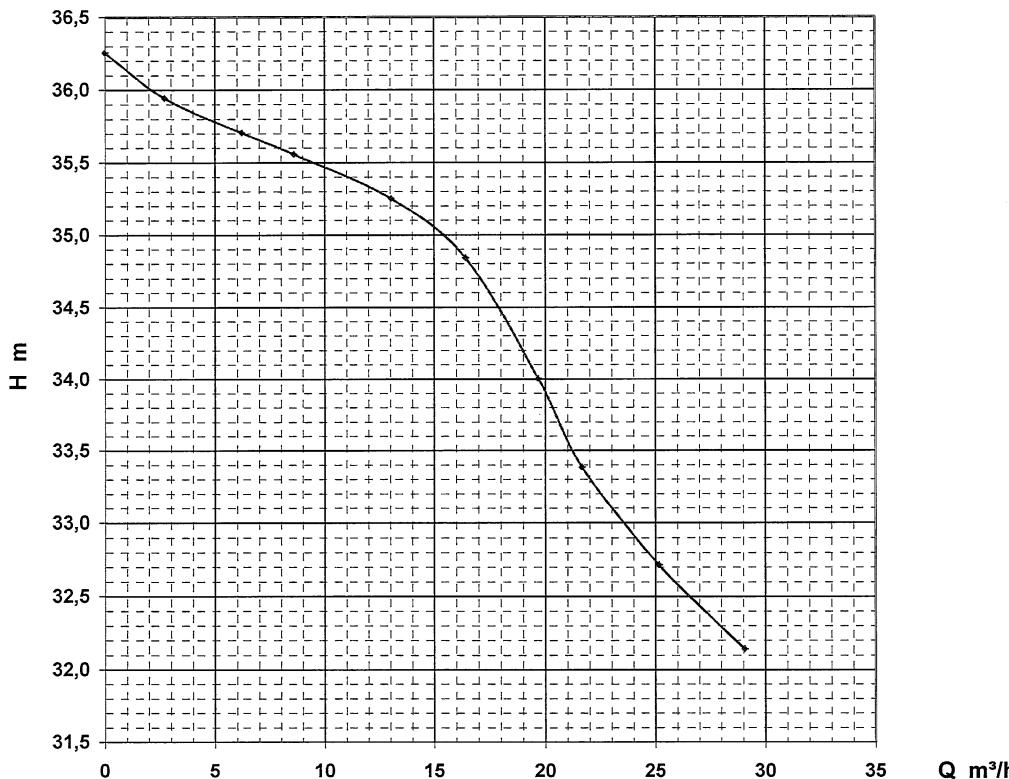
ITEM 63P6

ORDER N° 121241 DATE 30/05/2012

IMPELLER DIAM. 161 mm

REQUESTED DATA	CAPACITY	6	m ³ /h	LIQUID	WASTE WATER/DET	TEST CONDITIONS TESTING BENCH 3	Liquid	water	H Suc. Man.	0	m	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9002/200 (only for bench 3)	MOTOR DATA Manuf.	BROOK	Serial	NF174102	
	TOTAL HEAD	35	m	SPEC. WEIGHT	1		Liquid Temp.	21,8	C°	H Disch. Man.	1,3	m		Power	15/11	Hp/kW Pole/Freq.	02-50
	ABS. POWER	7	kW	VISCOSITY	60		Air Temp.	27,2	C°	Suction Man.	0-2 abs.	serial	ONY0165	Voltage	415	V	Current 19,2 A
	SPEED	2900	r.p.m.	TEMPERATURE	30/50		Atm. Press.	1013	mbar	Disch. Man.	0-10 rel.	serial	90Y0372	Cos φ	0,83	Efficiency	89,4
	EFFICIENCY	8,2	%	pH			Suc. Pipe Diam.	50	mm	Flowmeter	DN50	serial	4C012891000				
							Disch. Pipe Diam.	32	mm	Power Abs.	watt.2	serial	WF 4822280002				

PERFORMANCES AT REQUESTED CONDITIONS



NOTES [Compressa: C2F11A]

TEST ENGINEER Davide Paolangelo DATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 15.05



TEST CERTIFICATE
CENTRIFUGAL PUMP

PUMP TYPE TCH 40-250/1-C/GS

CUSTOMER BALLESTRA S.P.A.

SERIAL N° DI099

ORDER CONF. 1204402 DATE 06/01/12

ITEM 64P1

ORDER N° 121241 DATE 30/05/2012

IMPELLER DIAM. 231/160 mm

UNI EN 10204-3.1B

REQUESTED DATA

CAPACITY 30 m³/h LIQUID WATER
 TOTAL HEAD 70 m SPEC. WEIGHT 1 kg/dm³
 ABS. POWER 11,5 kW VISCOSITY 1
 SPEED 2900 r.p.m. TEMPERATURE 30/50 °C
 EFFICIENCY 49,8 % pH

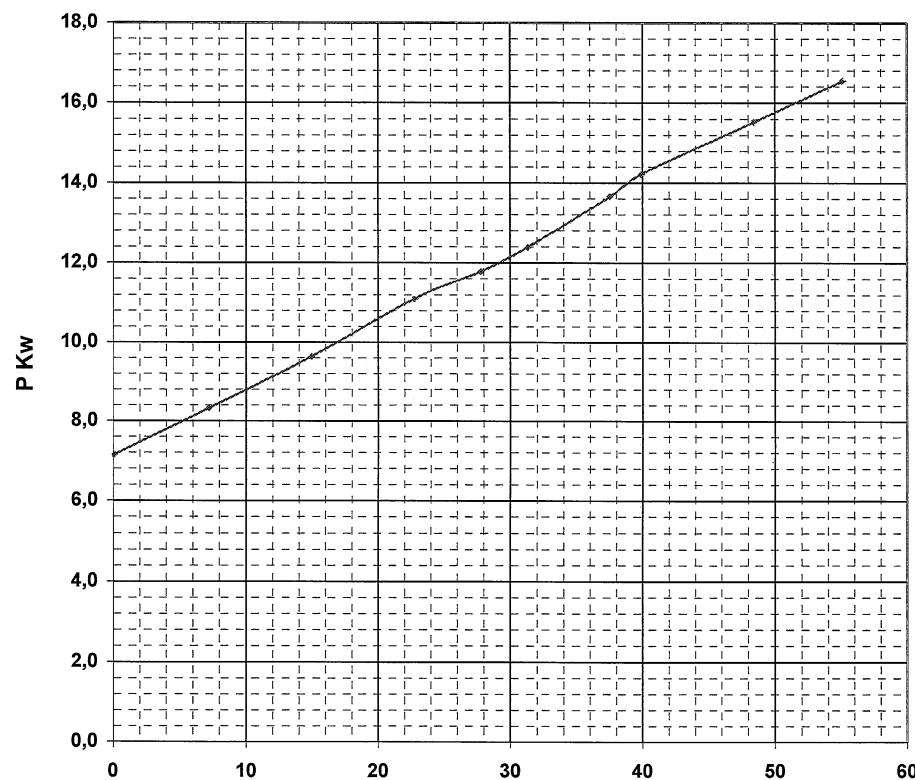
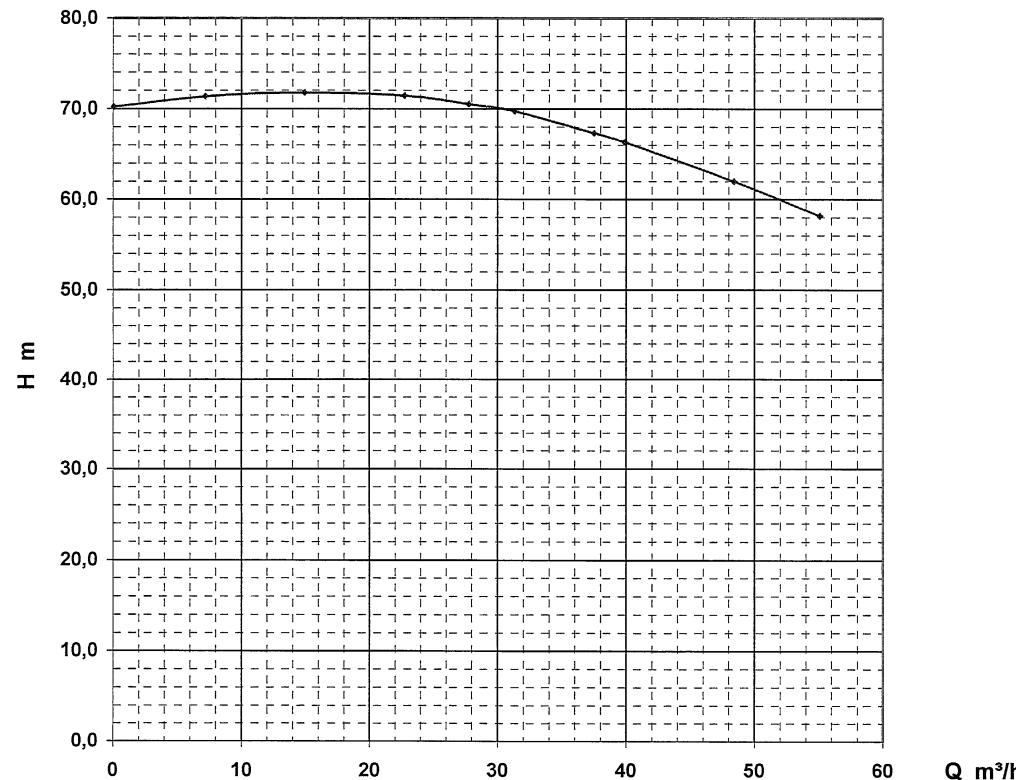
TEST CONDITIONS

Liquid water H Suc. Man. 0 m
 Liquid Temp. 21,8 °C H Disch. Man. 1,3 m
 Air Temp. 27,8 °C Suction Man. 0-2 abs. serial ONY0165
 Atm. Press. 1013 mbar Disch. Man. 0-40 rel. serial 90Y0371
 Suc. Pipe Diam. 65 mm Flowmeter DN100 serial 4C013991000
 Disch. Pipe Diam. 40 mm Power Abs. watt.2 serial WF 4822280002

PERFORMED ACCORDING TO
INDICATIONS OF UNI EN ISO 9906/2000

Manuf. BROOK Serial FV410014
 Power 30/22 Hp/kW Pole/Freq. 02-50
 Voltage 415 V Current 38,1 A
 Cos φ 0,88 Efficiency 91,3

PERFORMANCES AT REQUESTED CONDITIONS



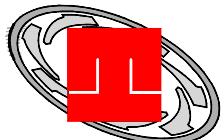
NOTES [Commessa: C2F11A]

TEST ENGINEER Davide Paolangelo

DATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 16.20



pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Performance curves



pompetravaini

TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 50-315/1X-B/RA-L3CUSTOMER BALLESTRA S.P.A.SERIAL N° DI096ORDER CONF. 1204399DATE 06/01/12ITEM 62P1ORDER N° 121241DATE 30/05/2012IMPELLER DIAM. 285 mm

REQUESTED DATA	CAPACITY <u>10</u> m ³ /h	LIQUID <u>SLURRY</u>	Liquid <u>water</u>	H Suc. Man. <u>0</u> m	TEST CONDITIONS TESTING BENCH 3	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9090/2002	Manuf. <u>BROOK</u>	Serial <u>RK410014</u>
	TOTAL HEAD <u>27,3</u> m	SPEC. WEIGHT <u>1,1</u> kg/dm ³	Liquid Temp. <u>21,8</u> °C	H Disch. Man. <u>1,3</u> m			Power <u>30/22</u> Hp/kW	Pole/Freq. <u>04-50</u>
	ABS. POWER <u>17</u> kW	VISCOSITY <u>500</u>	Air Temp. <u>25,6</u> °C	Suction Man. <u>0-2 abs.</u> serial <u>62007301020</u>			Voltage <u>415</u> V	Current <u>38,8</u> A
	SPEED <u>1480</u> r.p.m.	TEMPERATURE <u>60/85</u> °C	Atm. Press. <u>1013</u> mbar	Disch. Man. <u>0-10 rel.</u> serial <u>90Y0372</u>			Cos φ <u>0,86</u>	Efficiency <u>91,6</u>
	EFFICIENCY <u>4,8</u> %	pH	Suc. Pipe Diam. <u>80</u> mm	Flowmeter <u>DN100</u> serial <u>4C013991000</u>				
			Disch. Pipe Diam. <u>50</u> mm	Power Abs. <u>watt.2</u> serial <u>NA4060990016</u>				

PERFORMANCES AT REQUESTED CONDITIONS

CAPACITY		TOTAL HEAD		EFFICIENCY
m ³ /h	m	kW	Hp	%
0,00	34,16	8,19	11,13	0,0
6,47	33,91	8,36	11,37	7,9
11,03	33,71	8,70	11,83	12,8
15,85	33,26	9,15	12,45	17,2
21,33	32,81	9,72	13,21	21,5
26,84	31,67	10,23	13,92	24,8
32,37	30,34	10,83	14,73	27,1
38,42	29,17	11,41	15,51	29,4
43,28	27,93	11,88	16,16	30,5
46,61	26,85	12,35	16,79	30,3
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1	CAPACITY		TOTAL HEAD			R.P.M.	ABSORBED POWER				EFFICIENCY	
	m ³ /h	l/1'	total (m)	discharge	suction		r.p.m.	kW	Hp	Volt	Amp	
0,00	0,0	34,76	33,31	-1,45	0,00	1493	7,64	10,39	405	19,7	0,60	0,0
2	6,53	108,8	34,51	33,04	-1,43	0,04	1493	7,80	10,61	406	19,8	0,61
3	11,13	185,4	34,30	32,69	-1,50	0,11	1493	8,12	11,04	406	20,2	0,62
4	15,99	266,4	33,84	32,10	-1,52	0,22	1493	8,54	11,61	405	20,6	0,64
5	21,50	358,3	33,35	31,32	-1,63	0,40	1492	9,05	12,31	405	21,1	0,66
6	27,06	450,9	32,19	29,83	-1,72	0,63	1492	9,53	12,96	405	21,7	0,68
7	32,61	543,5	30,79	28,03	-1,84	0,92	1491	10,07	13,70	405	22,3	0,70
8	38,68	644,7	29,57	26,25	-2,03	1,29	1490	10,58	14,39	406	23,0	0,71
9	43,57	726,2	28,31	24,55	-2,12	1,64	1490	11,02	14,99	406	23,6	0,72
10	46,89	781,5	27,18	23,01	-2,27	1,90	1489	11,43	15,54	406	24,0	0,74
11	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--

NOTES [Commissa: C2F11A]

TEST ENGINEER Davide PaolangeloDATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 11.35



TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 32-160/1-B/RA-L3CUSTOMER BALLESTRA S.P.A.SERIAL N° DI097ORDER CONF. 1204400DATE 06/01/12ITEM 63P5ORDER N° 121241DATE 30/05/2012IMPELLER DIAM. 161 mm

REQUESTED DATA	CAPACITY <u>6</u> m ³ /h	LIQUID <u>WATER/DETERG.SL</u>	TEST CONDITIONS TESTING BENCH 3	Liquid <u>water</u>	H Suc. Man. <u>0</u> m	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9003:2002	MOTOR DATA (only for l. bench 3)	Manuf. <u>BROOK</u>	Serial <u>JE15311</u>
	TOTAL HEAD <u>30</u> m	SPEC. WEIGHT <u>1</u> kg/dm ³		Liquid Temp. <u>21,8</u> °C	H Disch. Man. <u>1,3</u> m			Power <u>25/18,5</u> Hp/kW	Pole/Freq. <u>02-50</u>
	ABS. POWER <u>14</u> kW	VISCOSITY <u>500</u>		Air Temp. <u>26,9</u> °C	Suction Man. <u>0-2 abs.</u> serial <u>62007301020</u>			Voltage <u>415</u> V	Current <u>31,8</u> A
	SPEED <u>2900</u> r.p.m.	TEMPERATURE <u>60/85</u> °C		Atm. Press. <u>1013</u> mbar	Disch. Man. <u>0-10 rel.</u> serial <u>90Y0372</u>			Cos φ <u>0,89</u>	Efficiency <u>90,9</u>
	EFFICIENCY <u>3,5</u> %	pH _____		Suc. Pipe Diam. <u>50</u> mm	Flowmeter <u>DN50</u> serial <u>4C012891000</u>				
				Disch. Pipe Diam. <u>32</u> mm	Power Abs. <u>watt.2</u> serial <u>NA4060990016</u>				

PERFORMANCES AT REQUESTED CONDITIONS

CAPACITY		ABSORBED POWER		EFFICIENCY
m ³ /h	m	Kw	Hp	%
0,00	35,96	3,71	5,04	0,0
4,30	35,55	4,00	5,45	10,4
6,28	35,44	4,13	5,62	14,6
8,77	35,30	4,29	5,83	19,6
12,48	35,04	4,62	6,28	25,8
15,55	34,81	5,02	6,83	29,3
19,39	33,94	5,32	7,24	33,6
22,79	32,93	5,63	7,66	36,2
26,03	32,29	5,92	8,04	38,6
27,89	31,99	6,15	8,36	39,5
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1	CAPACITY		TOTAL HEAD			R.P.M.	ABSORBED POWER				EFFICIENCY	
	m ³ /h	l'/1'	total (m)	discharge	suction	r.p.m.	kW	Hp	Volt	Amp	Cos φ	%
0,00	0,0	38,28	37,08	-1,20	0,00	2992	4,07	5,54	411	11,3	0,55	0,0
2	4,44	74,0	37,82	36,31	-1,41	0,10	2991	4,39	5,98	412	11,7	0,58
3	6,47	107,9	37,69	36,01	-1,47	0,21	2991	4,53	6,16	412	11,9	0,59
4	9,04	150,6	37,49	35,49	-1,59	0,41	2989	4,69	6,38	412	12,0	0,60
5	12,87	214,5	37,25	34,55	-1,86	0,84	2990	5,06	6,88	413	12,4	0,63
6	16,02	267,1	36,98	33,55	-2,13	1,30	2989	5,50	7,48	411	12,8	0,66
7	19,99	333,1	36,05	31,44	-2,59	2,02	2989	5,83	7,93	411	13,2	0,68
8	23,48	391,3	34,96	29,13	-3,04	2,79	2988	6,16	8,38	411	13,6	0,70
9	26,82	447,0	34,28	27,10	-3,54	3,64	2988	6,47	8,80	411	14,0	0,71
10	28,74	479,0	33,99	25,92	-3,89	4,18	2989	6,73	9,15	412	14,3	0,72
11	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--

NOTES [Commissa: C2F11A]

TEST ENGINEER Davide PaolangeloDATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 14.15



TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCT 32-160/1-B/RA-L3

CUSTOMER BALLESTRA S.P.A.

SERIAL N° DI098

ORDER CONF. 1204401

DATE 06/01/12

ITEM 63P6

ORDER N° 121241

DATE 30/05/2012

IMPELLER DIAM. 161 mm

REQUESTED DATA

CAPACITY	<u>6</u> m ³ /h	LIQUID	<u>WASTE WATER/DET</u>
TOTAL HEAD	<u>35</u> m	SPEC. WEIGHT	<u>1</u> kg/dm ³
ABS. POWER	<u>7</u> kW	VISCOSITY	<u>60</u>
SPEED	<u>2900</u> r.p.m.	TEMPERATURE	<u>30/50</u> °C
EFFICIENCY	<u>8,2</u> %	pH	

TEST CONDITIONS

TESTING BENCH

Liquid	<u>water</u>	H Suc. Man.	<u>0</u> m
Liquid Temp.	<u>21,8</u> °C	H Disch. Man.	<u>1,3</u> m
Air Temp.	<u>27,2</u> °C	Suction Man.	<u>0-2 abs.</u> serial <u>62007301020</u>
Atm. Press.	<u>1013</u> mbar	Disch. Man.	<u>0-10 rel.</u> serial <u>90Y0372</u>
Suc. Pipe Diam.	<u>50</u> mm	Flowmeter	<u>DN50</u> serial <u>4C012891000</u>
Disch. Pipe Diam.	<u>32</u> mm	Power Abs.	<u>watt,2</u> serial <u>NA4060990016</u>

PERFORMED ACCORDING TO
INDICATIONS OF UNI EN ISO 9006:2002

Manuf.	<u>BROOK</u>	Serial	<u>NF174102</u>
Power	<u>15/11</u> Hp/kW	Pole/Freq.	<u>02-50</u>
Voltage	<u>415</u> V	Current	<u>19,2</u> A
Cos φ	<u>0,83</u>	Efficiency	<u>89,4</u>

PERFORMANCES AT REQUESTED CONDITIONS

CAPACITY	TOTAL HEAD	ABSORBED POWER		EFFICIENCY		
		m ³ /h	m	kW	Hp	%
0,00	36,26	3,62	4,92	0,0		
2,71	35,94	3,80	5,17	7,0		
6,21	35,70	4,09	5,57	14,7		
8,60	35,56	4,26	5,79	19,5		
13,04	35,25	4,73	6,44	26,4		
16,42	34,84	5,13	6,97	30,3		
19,68	34,00	5,41	7,36	33,7		
21,66	33,38	5,57	7,58	35,3		
25,15	32,72	5,67	7,72	39,4		
29,06	32,14	6,34	8,62	40,1		
--	--	--	--	--		
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RECORDED DATA

1	CAPACITY		TOTAL HEAD			R.P.M.	ABSORBED POWER			EFFICIENCY		
	m ³ /h	l'/1'	total (m)	discharge	suction		r.p.m.	kW	Hp	Volt	Amp	Cos φ
0,00	0,1	38,50	37,28	-1,22	0,00	2988	3,96	5,38	418	9,3	0,66	0,0
2,79	46,6	38,17	36,78	-1,35	0,04	2988	4,16	5,66	418	9,6	0,67	7,0
6,40	106,6	37,85	36,17	-1,48	0,21	2986	4,47	6,08	419	10,0	0,69	14,7
8,85	147,5	37,70	35,69	-1,61	0,40	2986	4,65	6,32	419	10,2	0,70	19,5
13,42	223,7	37,35	34,51	-1,92	0,91	2985	5,16	7,02	419	10,8	0,73	26,4
16,89	281,5	36,86	33,19	-2,23	1,44	2983	5,58	7,59	419	11,4	0,76	30,3
20,24	337,3	35,95	31,25	-2,64	2,07	2982	5,88	8,00	419	11,7	0,77	33,7
22,26	371,1	35,28	29,86	-2,90	2,51	2981	6,05	8,23	419	12,0	0,78	35,3
25,84	430,8	34,54	27,73	-3,42	3,38	2980	6,15	8,37	417	12,1	0,78	39,4
29,86	497,7	33,94	25,30	-4,13	4,51	2980	6,88	9,36	419	13,1	0,81	40,1
--	--	--	--	--	--	--	--	--	--	--	--	--
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NOTES [Commessa: C2F11A]

TEST ENGINEER Davide Paolangelo

DATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 15.05



pompetravaini

TEST CERTIFICATE
CENTRIFUGAL PUMP

UNI EN 10204-3.1B

PUMP TYPE TCH 40-250/1-C/GSCUSTOMER BALLESTRA S.P.A.SERIAL N° DI099ORDER CONF. 1204402DATE 06/01/12ITEM 64P1ORDER N° 121241DATE 30/05/2012IMPELLER DIAM. 231/160 mm

REQUESTED DATA	CAPACITY	30	m³/h	LIQUID	WATER	TEST CONDITIONS TESTING BENCH 3	Liquid	water	H Suc. Man.	0	m	PERFORMED ACCORDING TO INDICATIONS OF UNI EN ISO 9090/2008	MOTOR DATA (only for t. bench 3)	Manuf.	BROOK	Serial	FV410014
	TOTAL HEAD	70	m	SPEC. WEIGHT	1		Liquid Temp.	21,8	C°	H Disch. Man.	1,3	m		Power	30/22	Hp/kW	Pole/Freq. 02-50
	ABS. POWER	11,5	kW	VISCOSITY	1		Air Temp.	27,8	C°	Suction Man.	0-2 abs.	serial		Voltage	415	V	Current 38,1 A
	SPEED	2900	r.p.m.	TEMPERATURE	30/50		Atm. Press.	1013	mbar	Disch. Man.	0-40 rel.	serial		Cos φ	0,88	Efficiency	91,3
	EFFICIENCY	49,8	%	pH			Suc. Pipe Diam.	65	mm	Flowmeter	DN100	serial					
							Disch. Pipe Diam.	40	mm	Power Abs.	watt.2	serial					

PERFORMANCES AT REQUESTED CONDITIONS

CAPACITY		TOTAL HEAD		EFFICIENCY
m³/h	m	Kw	Hp	%
0,07	70,20	7,14	9,71	0,2
7,24	71,32	8,32	11,31	16,9
14,95	71,76	9,63	13,09	30,3
22,78	71,41	11,09	15,08	39,9
27,79	70,49	11,78	16,02	45,2
31,35	69,72	12,38	16,84	48,0
37,54	67,31	13,65	18,56	50,3
39,91	66,33	14,21	19,33	50,7
48,43	61,98	15,52	21,10	52,6
55,12	58,15	16,54	22,49	52,7
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1	CAPACITY		TOTAL HEAD			R.P.M.	ABSORBED POWER				EFFICIENCY		
	m³/h	l/1'	total (m)	discharge	suction		r.p.m.	kW	Hp	Volt	Amp		
0,07	1,2	74,62	73,31	-1,31	0,00	2990	7,82	10,64	420	18,3	0,64	0,2	
2	7,46	124,3	75,68	74,12	-1,45	0,12	2987	9,09	12,37	419	19,8	0,69	16,9
3	15,39	256,5	76,06	74,02	-1,53	0,51	2986	10,50	14,28	420	21,4	0,74	30,3
4	23,43	390,5	75,58	72,72	-1,68	1,17	2983	12,07	16,42	419	23,4	0,78	39,9
5	28,60	476,6	74,65	71,09	-1,81	1,74	2984	12,84	17,46	418	24,5	0,79	45,2
6	32,25	537,5	73,79	69,65	-1,92	2,22	2983	13,48	18,34	418	25,5	0,80	48,0
7	38,58	643,1	71,12	65,81	-2,14	3,18	2981	14,82	20,16	418	27,3	0,82	50,3
8	41,00	683,3	70,00	64,18	-2,24	3,59	2979	15,41	20,95	419	28,0	0,83	50,7
9	49,72	828,7	65,32	57,42	-2,62	5,27	2977	16,79	22,83	418	30,1	0,84	52,6
10	56,54	942,4	61,19	51,40	-2,97	6,82	2975	17,85	24,28	418	31,7	0,85	52,7
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--

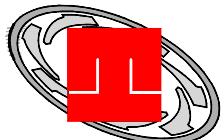
NOTES [Commissa: C2F11A]

TEST ENGINEER Davide Paolangelo

DATE 09/11/2012

CUSTOMER ACCEPTANCE _____

TIME 16.20



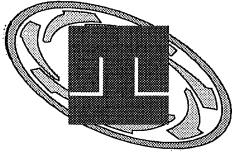
pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Test certificate



ATTESTATO SPECIFICO PRESSATURA IDROSTATICA
HYDROSTATIC PRESSURE SPECIFIC TEST REPORT
RELEVE DE CONTRÔLE SPECIFIQUE DE PRESSION HYDROSTATIQUE
HYDROSTATISCHER DRUCK WERKSsprüfzeugnis
 Sistema qualità mdb - Versione 10.6 - Luglio 2012 PL.J UNI EN 10204/92 -2.2

HT

Nº: 24175

Conferma :
 Confirmation - Code usine - Werkstattauftrag:
 1204399

Ordine :
 Order - Commande - Bestellung:
 121241

Cliente:
 Customer- Client - Kunde:
 BALLESTRA S.P.A.

Tipo pompa:
 Pump Type- Pompe type - Pumpe typ
 TCT 50-315/1X-B/RA-L3

Item:
 Item
 62P1

Matricola:
 Serial/N - N. Matricule - Kenn-n.:
 DI096

Manometro matr.:
 Manometer serial No- Manomètre N. Matricule - Manometer Kenn-nummer:
 DB00A701997 0 - 100 BAR

Con la presente, si dichiara che:

We declare that:

On déclare que:

Wir erklären daß:

la pompa / the pump / la pompe / die pumpe

il corpo della pompa / the casing of the pump/ le corp de la pompe / das pumpengehäuse

è stata sottoposta ad una pressione di:

has been tested whit hydrostatic pressure at:

12

bar

a étéee essaiée avec une pression de:

mit hydrostatischer druck auf:

per un periodo di:

for a period of:

4

min.

pour un périod de:

für:

senza alcuna perdita esterna.

without any loss outwards.

sans aucune perte extérieure.

ohne aussenverlust geprüft war.

Note:
 Notes - Remarques - Bemerkungen

Collaudatore :
 Inspector - Controleur - Abnahmeprufer:
 PAOLANGELO D.

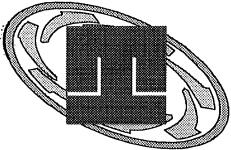
Data :
 Date - Date - Datum:
 28/07/2012

Responsabile A.Q.
 QA Mngr - AQ Mngr - QV Mngr:
 Ing. Luca Porta

Data :
 Date - Date - Datum:

Ispettore Cliente
 Customer inspector - Inspecteur - KundesInspektor

Data :
 Date - Date - Datum:



ATTESTATO SPECIFICO PRESSATURA IDROSTATICA
HYDROSTATIC PRESSURE SPECIFIC TEST REPORT
RELEVE DE CONTRÔLE SPECIFIQUE DE PRESSION HYDROSTATIQUE
HYDROSTATISCHER DRUCK WERKSsprüfzeugnis
 Sistema qualità.mdb - Versione 10.6 - Luglio 2012 PLJ UNI EN 10204/92 -2.2

HT

N°: 24176

Conferma :
 Confirmation - Code usine - Werkstattauftrag:
 1204400

Ordine :
 Order - Commande - Bestellung:
 121241

Cliente:
 Customer- Client - Kunde:
 BALLESTRA S.P.A.

Tipo pompa:
 Pump Type- Pompe type - Pumpe typ
 TCT 32-160/1-B/RA-L3

Item:
 Item
 63P5

Matricola:
 Serial/N - N. Matricule - Kenn-n.:
 DI097

Manometro matr.:
 Manometer serial No- Manomètre N. Matricule - Manometer Kenn-nummer:
 DB00A701997 0 - 100 BAR

Con la presente, si dichiara che:

We declare that:
 On déclare que:
 Wir erklären daß:

- la pompa / the pump / la pompe / die pumpe
 il corpo della pompa / the casing of the pump/ le corp de la pompe / das pumpengehäuse

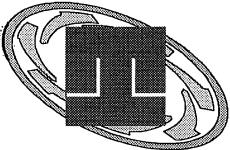
è stata sottoposta ad una pressione di:
 has been tested whit hydrostatic pressure at:
 a étéee essaiée avec une pression de:
 mit hydrostatischer druck auf:

per un periodo di:
 for a period of:
 pour un périod de:
 für:

senza alcuna perdita esterna.
 without any loss outwards.
 sans aucune perte extérieure.
 ohne aussenverlust geprüft war.

Note:
 Notes - Remarques - Bemerkungen

Collaudatore : <i>Inspector - Controleur - Abnahmeprufer:</i> PAOLANGELO D.	Data : <i>Date - Date - Datum:</i> 30/08/2012	Responsabile A.Q. <i>QA Mngr - AQ Mngr - QV Mngr:</i> Ing. Luca Porta	Data : <i>Date - Date - Datum:</i>
		Ispettore Cliente <i>Customer inspector - Inspecteur - KundesInspektor</i>	Data : <i>Date - Date - Datum:</i>



ATTESTATO SPECIFICO PRESSATURA IDROSTATICA
HYDROSTATIC PRESSURE SPECIFIC TEST REPORT
RELEVE DE CONTRÔLE SPECIFIQUE DE PRESSION HYDROSTATIQUE
HYDROSTATISCHER DRUCK WERKSPRÜFZEUGNIS
 Sistema qualità mdb - Versione 10.6 - Luglio 2012 PL.J UNI EN 10204/92 -2.2

HT

N°: 24177

Conferma : Confirmation - Code usine - Werkstattauftrag: 1204401	Ordine : Order - Commande - Bestellung: 121241	Cliente: Customer- Client - Kunde: BALLESTRA S.P.A.
Tipo pompa: Pump Type- Pompe type - Pumpe typ TCT 32-160/1-B/RA-L3	Item: Item 63P6	Matricola: Serial/N - N. Matricule - Kenn-n.: DI098
Manometro matr.: Manometer serial No- Manomètre N. Matricule - Manometer Kenn-nummer: DB00A701997 0 - 100 BAR		

Con la presente, si dichiara che:

We declare that:

On déclare que:

Wir erklären daß:

la pompa / the pump / la pompe / die pumpe

il corpo della pompa / the casing of the pump/ le corp de la pompe / das pumpengehäuse

è stata sottoposta ad una pressione di:

has been tested whit hydrostatic pressure at:

12 bar

a étéee essaiée avec une pression de:

mit hydrostatischer druck auf:

per un periodo di:

for a period of:

4 min.

pour un périod de:

für:

senza alcuna perdita esterna.

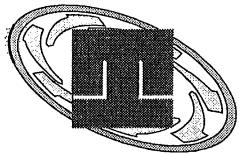
without any loss outwards.

sans aucune perte extérieure.

ohne aussenverlust geprüft war.

Note:
Notes - Remarques - Bemerkungen

Collaudatore : Inspector - Controleur - Abnahmeprufer: PAOLANGELO D.	Data : Date - Date - Datum: 30/08/2012	Responsabile A.Q. QA Mngr - AQ Mngr - QV Mngr: Ing. Luca Porta	Data : Date - Date - Datum:
		Ispettore Cliente Customer Inspector - Inspecteur - KundesInspektor	Data : Date - Date - Datum:



ATTESTATO SPECIFICO PRESSATURA IDROSTATICA
HYDROSTATIC PRESSURE SPECIFIC TEST REPORT
RELEVE DE CONTRÔLE SPECIFIQUE DE PRESSION HYDROSTATIQUE
HYDROSTATISCHER DRUCK WERKSsprüfzeugnis
 Sistema qualità.mdb - Versione 10.3 - Maggio 2012 PL UNI EN 10204/92 -2.2

HT

Nº: 24184

Conferma : Confirmation - Code usine - Werkstattauftrag: 1204402	Ordine : Order - Commande - Bestellung: 121241	Cliente: Customer- Client - Kunde: BALLESTRA S.P.A.
Tipo pompa: Pump Type- Pompe type - Pumpe typ TCH 40-250/1-C/GS	Item: Item 64P1	Matricola: Serial/N - N. Matricule - Kenn-n.: DI099
Manometro matr.: Manometer serial No- Manomètre N. Matricule - Manometer Kenn-nummer: DB00A701997 0 - 100 BAR		

Con la presente, si dichiara che:

We declare that:

On déclare que:

Wir erklären daß:

la pompa / the pump / la pompe / die pumpe

il corpo della pompa / the casing of the pump/ le corp de la pompe / das pumpengehäuse

è stata sottoposta ad una pressione di:

has been tested whit hydrostatic pressure at:

12 bar

a été essaiée avec une pression de:

mit hydrostatischer druck auf:

per un periodo di:

for a period of:

4 min.

pour un périod de:

für:

senza alcuna perdita esterna.

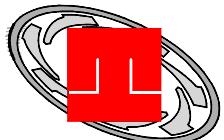
without any loss outwards.

sans aucune perte extérieure.

ohne aussenverlust geprüft war.

Note:
Notes - Remarques - Bemerkungen

Collaudatore : Inspector - Controleur - Abnahmeprufer: PAOLANGELO D.	Data : Date - Date - Datum: 31/08/2012	Responsabile A.Q. QA Mngr - AQ Mngr - QV Mngr: Ing. Luca Porta	Data : Date - Date - Datum:
		Ispettore Cliente Customer inspector - Inspecteur - KundesInspektor	Data : Date - Date - Datum:



pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Hydrostatic pressure test reports



pompetravaini

ATTESTATO DI CONTROLLO DEI MATERIALI

MATERIALS TEST REPORT

AQ.M.10.075.01-UNI EN 10204/92-2.2

N°: **960-12**

MA

Conferma / Confirmation 1204402	Ordine / Order 121241	Cliente / Customer BALLESTRA S.P.A.
Commessa / Job Order C2F11A	Codice / Code TCHG2A02118	Tipo pompa / Pump type TCH 40-250/1-C/GS
Matricola / S/N DI099		
Item / Item 64P1		

VDMA	Tipo pompa Pump type	Materiale Material	Doc.fornitore Supplier doc.
102	Corpo a spirale Volute casing	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
161	Coperchio corpo Casing cover	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
210	Albero Shaft	Acciaio Inox AISI 316L ASTM A276 Type 316L AISI 316L stainless steel ASTM A276 Type 316L	
230	Girante Impeller	Ghisa Grigia EN-GJL-250 EN 1561 - DIN 1691 GG25 EN-GJL-250 grey iron EN 1561 - DIN 1691 GG25	
330	Supporto doppio Bearing housing	Ghisa Grigia EN-GJL-250 EN 1561 - DIN 1691 GG25 EN-GJL-250 grey iron EN 1561 - DIN 1691 GG25	
524	Bussola albero Shaft sleeve	Acciaio Inox AISI 316 ASTM A276 Type 316 AISI 316 stainless steel ASTM A276 Type 316	

Note:
Notes:

ATTESTAZIONE DI CONFORMITA' DEL FORNITORE

Pompetravaini S.p.A. dichiara che i materiali utilizzati e descritti sono pienamente conformi per Analisi Chimiche e Prove Meccaniche alle specifiche tecniche di costruzione dichiarate in conformità alla norma UNI EN 10204/92 - 2.2

COMPLIANCE ACKNOWLEDGEMENT OF THE SUPPLIER

Pompetravaini S.p.A. states that the above listed and used materials are fully according to the construction technical specifications that have been declared and agreed at the order for the Chemical Analysis and Mechanical Tests. Certification according to UNI EN 10204/92 - 2.2

Compilato da / Redacted by Gianni Porta	Data / Date 23/10/2012	Responsabile A.Q. / AQ Mng.	Data / Date
		Ispettore cliente / Customer inspector	Data / Date



pompetravaini

ATTESTATO DI CONTROLLO DEI MATERIALI

MATERIALS TEST REPORT

AQ.M.10.075.01-UNI EN 10204/92-2.2

N°: **959-12**

MA

Conferma / Confirmation 1204401	Ordine / Order 121241	Cliente / Customer BALLESTRA S.P.A.
Commessa / Job Order C2F11A	Codice / Code TCTG1A01004	Tipo pompa / Pump type TCT 32-160/1-B/RA-L3
Matricola / S/N DI098		
Item / Item 63P6		

VDMA	Tipo pompa Pump type	Materiale Material	Doc.fornitore Supplier doc.
102	Corpo a spirale Volute casing	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
110	Distanziale Impeller casing	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
161	Coperchio corpo Casing cover	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
210	Albero Shaft	Acciaio Inox AISI 316L ASTM A276 Type 316L AISI 316L stainless steel ASTM A276 Type 316L	
230	Girante Impeller	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
330	Supporto doppio Bearing housing	Ghisa Grigia EN-GJL-250 EN 1561 - DIN 1691 GG25 EN-GJL-250 grey iron EN 1561 - DIN 1691 GG25	
524	Bussola albero Shaft sleeve	Acciaio Inox AISI 316 ASTM A276 Type 316 AISI 316 stainless steel ASTM A276 Type 316	

Note:
Notes:

ATTESTAZIONE DI CONFORMITA' DEL FORNITORE

Pompetravaini S.p.A. dichiara che i materiali utilizzati e descritti sono pienamente conformi per Analisi Chimiche e Prove Meccaniche alle specifiche tecniche di costruzione dichiarate in conformità alla norma UNI EN 10204/92 - 2.2

COMPLIANCE ACKNOWLEDGEMENT OF THE SUPPLIER

Pompetravaini S.p.A. states that the above listed and used materials are fully according to the construction technical specifications that have been declared and agreed at the order for the Chemical Analysis and Mechanical Tests. Certification according to UNI EN 10204/92 - 2.2

Compilato da / Redacted by Gianni Porta	Data / Date 23/10/2012	Responsabile A.Q. / AQ Mng.	Data / Date
		Ispettore cliente / Customer inspector	Data / Date



pompetravaini

ATTESTATO DI CONTROLLO DEI MATERIALI

MATERIALS TEST REPORT

AQ.M.10.075.01-UNI EN 10204/92-2.2

N°: **958-12**

MA

Conferma / Confirmation 1204400	Ordine / Order 121241	Cliente / Customer BALLESTRA S.P.A.
Commessa / Job Order C2F11A	Codice / Code TCTG1A01003	Tipo pompa / Pump type TCT 32-160/1-B/RA-L3
Matricola / S/N DI097		
Item / Item 63P5		

VDMA	Tipo pompa Pump type	Materiale Material	Doc.fornitore Supplier doc.
102	Corpo a spirale Volute casing	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
110	Distanziale Impeller casing	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
161	Coperchio corpo Casing cover	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
210	Albero Shaft	Acciaio Inox AISI 316L ASTM A276 Type 316L AISI 316L stainless steel ASTM A276 Type 316L	
230	Girante Impeller	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
330	Supporto doppio Bearing housing	Ghisa Grigia EN-GJL-250 EN 1561 - DIN 1691 GG25 EN-GJL-250 grey iron EN 1561 - DIN 1691 GG25	
524	Bussola albero Shaft sleeve	Acciaio Inox AISI 316 ASTM A276 Type 316 AISI 316 stainless steel ASTM A276 Type 316	

Note:
Notes:

ATTESTAZIONE DI CONFORMITA' DEL FORNITORE

Pompetravaini S.p.A. dichiara che i materiali utilizzati e descritti sono pienamente conformi per Analisi Chimiche e Prove Meccaniche alle specifiche tecniche di costruzione dichiarate in conformità alla norma UNI EN 10204/92 - 2.2

COMPLIANCE ACKNOWLEDGEMENT OF THE SUPPLIER

Pompetravaini S.p.A. states that the above listed and used materials are fully according to the construction technical specifications that have been declared and agreed at the order for the Chemical Analysis and Mechanical Tests. Certification according to UNI EN 10204/92 - 2.2

Compilato da / Redacted by Gianni Porta	Data / Date 23/10/2012	Responsabile A.Q. / AQ Mng.	Data / Date
		Ispettore cliente / Customer inspector	Data / Date



pompetravaini

ATTESTATO DI CONTROLLO DEI MATERIALI

MATERIALS TEST REPORT

AQ.M.10.075.01-UNI EN 10204/92-2.2

N°: 957-12

MA

Conferma / Confirmation 1204399	Ordine / Order 121241	Cliente / Customer BALLESTRA S.P.A.
Commessa / Job Order C2F11A	Codice / Code TCTG3A00010	Tipo pompa / Pump type TCT 50-315/1X-B/RA-L3
Matricola / S/N DI096		
Item / Item 62P1		

VDMA	Tipo pompa Pump type	Materiale Material	Doc.fornitore Supplier doc.
102	Corpo a spirale Volute casing	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
110	Distanziale Impeller casing	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
161	Coperchio corpo Casing cover	Ghisa Sferoidale EN-GJS-400-15 EN 1563 - DIN 1693 GGG40 EN-GJS-400-15 ductile iron EN 1563 - DIN 1693 GGG40	
230	Girante Impeller	Acciaio Inox AISI 316 ASTM A351/A351M Grade CF8M AISI 316 stainless steel ASTM A351/A351M Grade CF8M	
330	Supporto doppio Bearing housing	Ghisa Grigia EN-GJL-250 EN 1561 - DIN 1691 GG25 EN-GJL-250 grey iron EN 1561 - DIN 1691 GG25	
923	Ghiera Bearing nut	Acciaio 5S Zincatura passivata 5S passivated galvanized steel	

Note:
Notes:

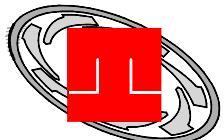
ATTESTAZIONE DI CONFORMITA' DEL FORNITORE

Pompetravaini S.p.A. dichiara che i materiali utilizzati e descritti sono pienamente conformi per Analisi Chimiche e Prove Meccaniche alle specifiche tecniche di costruzione dichiarate in conformità alla norma UNI EN 10204/92 - 2.2

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Compilato da / Redacted by Gianni Porta	Data / Date 23/10/2012	Responsabile A.Q. / AQ Mng.	Data / Date
		Ispettore cliente / Customer inspector	Data / Date



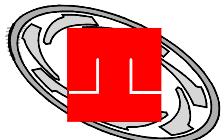
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<http://www.pompetravaini.it>

ISO 9001



Materials test report



pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Test reports & certificates



Pompetravaini S.p.A.
Castano Primo (MI) ITALY

**CERTIFICATO DI ORIGINE & DUAL USE
CERTIFICATE OF ORIGIN & DUAL USE
EUROPEAN COMMUNITY**

DU

24296

Conferma <i>Confirmation</i> 1204399	Ordine : <i>Order:</i> 121241	Cliente <i>Customer</i> BALLESTRA S.P.A.
Tipo pompa <i>Pump</i> TCT 50-315/1X-B/RA-L3	Item <i>Item</i> 62P1	Matricola <i>Serial/</i> DI096
Codice componente <i>Part number</i> TCTG3A00010	Descrizione componente <i>Component</i> MONOSTAGE CENTRIFUGAL PUMP	
Fattura <i>Invoice</i>	Codice Doganale <i>Customs code</i> 84137081 - 90	

- Il materiale in oggetto è stato prodotto anche con componenti di origine extracomunitario e ha subito delle lavorazioni sufficienti tale per cui ha assunto carattere di Origine Preferenziale:

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In : ITALY**

- Il materiale in oggetto non è compreso nell'elenco dei 'Beni Culturali' secondo il Regolamento CEE n. 3911 del 10/09/1992, successive integrazioni e modifiche.
- Il materiale in oggetto non è destinato ad uso bellico e quindi s'intende di libera esportazione. Trattasi di materiale ad esclusivo uso civile.

- Il materiale in oggetto non è compreso nell'elenco delle merci utilizzate per la tortura o per altri trattamenti o pene crudeli, inumani o degradanti come indicato dal Regolamento (CEE) n. 1236 del 30/07/2005, successive integrazioni e modifiche.
- Il materiale in oggetto non è compreso nella convenzione di Washington – Reg. CEE 338/1997
- Il materiale in oggetto non è compreso nell'elenco dei beni a duplice uso (alta tecnologia) indicato dal Regolamento (CE) n. 428 del 2009, successive integrazioni e modifiche. Nello specifico non rientra nelle categorie previste ai singoli:

0A001g - 2B350i - 9A006d - 9A106c - 9A106d

- The above mentioned goods was produced also with non-EC source components and have been sufficiently worked to obtain the preferential origin status:*

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In ITALY**

- The above mentioned goods are not included into the "Cultural assets" list according to the EC Regulation NO. 3911 of 10/09/1992, subsequent amendments and supplements.*
- The above mentioned goods are not for military use and so means of free export. The material is for exclusive civil use.*
- The above mentioned goods are not included into the list of products used for torture, cruel pain, inhuman or degrading treatment as specified by EC Regulation no. 1236 of 30/07/2005, subsequent amendments and supplements .*
- The above mentioned goods are not included in Washington convention – EC Regulation no.338/1997*
- The above mentioned goods are not included into the dual use list (high technology) specified by the EC Regulation No. 428 of 2009 and subsequent amendments and supplements. Specifically they are not included into categories provide for:*

0A001g - 2B350i - 9A006d - 9A106c - 9A106d

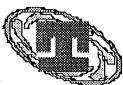
Note:
Notes :

Responsabile AQ
AQ Mngr:
Ing. Luca Rotta

Data
Date
14/09/2012

Amministratore delegato
Managing Director
--

Data
Date



Pompetravaini S.p.A.
Castano Primo (MI) ITALY

CERTIFICATO DI ORIGINE & DUAL USE
CERTIFICATE OF ORIGIN & DUAL USE
EUROPEAN COMMUNITY

DU

24304

Conferma Confirmation 1204400	Ordine : Order: 121241	Cliente Customer BALLESTRA S.P.A.
Tipo pompa Pump TCT 32-160/1-B/RA-L3	Item Item 63P5	Matricola Serial/ DI097
Codice componente Part number TCTG1A01003	Descrizione componente Component MONOSTAGE CENTRIFUGAL PUMP	
Fattura Invoice	Codice Doganale Customs code 84137081 - 90	

- Il materiale in oggetto è stato prodotto anche con componenti di origine extracomunitario e ha subito delle lavorazioni sufficienti tale per cui ha assunto carattere di Origine Preferenziale:

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In : ITALY**

- Il materiale in oggetto non è compreso nell'elenco dei 'Beni Culturali' secondo il Regolamento CEE n. 3911 del 10/09/1992, successive integrazioni e modifiche.
- Il materiale in oggetto non è destinato ad uso bellico e quindi s'intende di libera esportazione. Trattasi di materiale ad esclusivo uso civile.
- Il materiale in oggetto non è compreso nell'elenco delle merci utilizzate per la tortura o per altri trattamenti o pene crudeli, inumani o degradanti come indicato dal Regolamento (CEE) n. 1236 del 30/07/2005, successive integrazioni e modifiche.
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- Il materiale in oggetto non è compreso nell'elenco dei beni a duplice uso (alta tecnologia) indicato dal Regolamento (CE) n. 428 del 2009, successive integrazioni e modifiche. Nello specifico non rientra nelle categorie previste ai singoli:

0A001g - 2B350i - 9A006d - 9A106c - 9A106d

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AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In : ITALY**

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0A001g - 2B350i - 9A006d - 9A106c - 9A106d

Note:
Notes :

Responsabile AQ
AQ Mngr:
Ing. Luca Rotta

Data
Date
14/09/2012

Amministratore delegato
Managing Director
--

Data
Date



Pompetravaini S.p.A.
Castano Primo (MI) ITALY

CERTIFICATO DI ORIGINE & DUAL USE
CERTIFICATE OF ORIGIN & DUAL USE
EUROPEAN COMMUNITY

DU

24309

Conferma Confirmation 1204401	Ordine : Order: 121241	Cliente Customer BALLESTRA S.P.A.
Tipo pompa Pump TCT 32-160/1-B/RA-L3	Item Item 63P6	Matricola Serial/ DI098
Codice componente Part number TCTG1A01004	Descrizione componente Component MONOSTAGE CENTRIFUGAL PUMP	
Fattura Invoice	Codice Doganale Customs code 84137081 - 90	

- Il materiale in oggetto è stato prodotto anche con componenti di origine extracomunitario e ha subito delle lavorazioni sufficienti tale per cui ha assunto carattere di Origine Preferenziale:

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In : ITALY**

- Il materiale in oggetto non è compreso nell'elenco dei 'Beni Culturali' secondo il Regolamento CEE n. 3911 del 10/09/1992, successive integrazioni e modifiche.
- Il materiale in oggetto non è destinato ad uso bellico e quindi s'intende di libera esportazione. Trattasi di materiale ad esclusivo uso civile.
- Il materiale in oggetto non è compreso nell'elenco delle merci utilizzate per la tortura o per altri trattamenti o pene crudeli, inumani o degradanti come indicato dal Regolamento (CEE) n. 1236 del 30/07/2005, successive integrazioni e modifiche.
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- Il materiale in oggetto non è compreso nell'elenco dei beni a duplice uso (alta tecnologia) indicato dal Regolamento (CE) n. 428 del 2009, successive integrazioni e modifiche. Nello specifico non rientra nelle categorie previste ai singoli:

0A001g - 2B350i - 9A006d - 9A106c - 9A106d

- The above mentioned goods was produced also with non-EC source components and have been sufficiently worked to obtain the preferential origin status:*

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

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0A001g - 2B350i - 9A006d - 9A106c - 9A106d

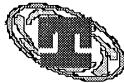
Note:
Notes :

Responsabile AQ
AQ Mngr:
Ing. Luca Porta

Data
Date
14/09/2012

Amministratore delegato
Managing Director
--

Data
Date



Pompetravaini S.p.A.
Castano Primo (MI) ITALY

CERTIFICATO DI ORIGINE & DUAL USE
CERTIFICATE OF ORIGIN & DUAL USE
EUROPEAN COMMUNITY

DU

24313

Conferma Confirmation 1204402	Ordine : Order: 121241	Cliente Customer BALLESTRA S.P.A.
Tipo pompa Pump TCH 40-250/1-C/GS	Item Item 64P1	Matricola Serial/ DI099
Codice componente Part number TCHG2A02118	Descrizione componente Component MONOSTAGE CENTRIFUGAL PUMP	
Fattura Invoice	Codice Doganale Customs code 84137081 - 90	

- Il materiale in oggetto è stato prodotto anche con componenti di origine extracomunitario e ha subito delle lavorazioni sufficienti tale per cui ha assunto carattere di Origine Preferenziale:

AL - BA - CH - CL - DZ - EG - EU - FO - HR - IL - IS - JO - KR - LB - LI - MA - MD - ME - MK - MOEL - MR - MX - NO - RS - TN - TR - XK - ZA

- Made In : ITALY**

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Note:
Notes :

Responsabile AQ
AQ Mgr:
Ing. Luca Porta

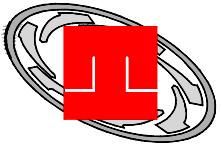
Data
Date

14/09/2012

Amministratore delegato
Managing Director

--

Data
Date



pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001

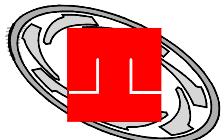


Certificate of origin & Dual Use

 pompetravaini s.p.a.		PIANO CONTROLLO QUALITA' SHOP INSPECTION PLAN				ORDINE N° ORDER N° 121241 – Comm. C2F11A	CLIENTE CUSTOMER BALLESTRA S.P.A.
ITEM 62P1, 63P5, 63P6, 64P1		Conferma d'ordine N° JOB N° 1204399, 1204400, 1204401, 1204402				PCQ N° SIP N° PCQ27-12	DOCUMENTO N° DOCUMENT N° AQ.M.07.025.02

FASE FASE	ATTIVITA' ACTIVITY	DOCUMENTI APPROVATI APPROVED DOCUMENTATION	INTERVENTI INTERVENTION				PRESENZIATO WITNESSED			DATA INTERVENTO INTERVENTIO DATE	DOCUMENTO GENERATO GENERATED DOCUMENTATION
			1 MGS	2 CQ	3 COL	4 PRG	1 AQ	2 Customer	3		
1	Controllo materiale al ricevimento merci / Receiving inspection and test	Disegni / specifiche tecniche / Technical drawing and specification		R		C					Attestato materiali / Material test report secondo UNI EN 10204-2.2 for wet parts Disegni / Specifiche tecniche / Technical drawing and specification
2	Controllo lavorazioni meccaniche / Machining control, In-process inspection	Disegni di lavorazione / Technical drawing		H / N							
3	Prova con pressione idrostatica / Pressure test				C						Bollettino di prova con pressione idrostatica 2.2 / Hydrostatic pressure test certificate 2.2
4	Collaudo finale funzionale ISO 9906/2002 livello 2 / Performances test ISO 9906/2002 livello 2				C						Bollettino di collaudo funzionale 2.2+ curve / Performance test certificate+curves
5	Controllo finale (documentale dimensionale) / Documentation and dimensional control	Disegni d'ingombro / Technical drawing		H/C				W			Certificato visivo e dimensionale 3.1b/ Visual and dimensional certificate 3.1b
6	Attestato di equilibratura ISO 1940 – G 6.3 / Balance Test Report ISO 1940 – G 6.3			D							Attestato di equilibratura/ Balance Test 2.2
7	Attestato di rumorosità UNI EN ISO 3746 con rilievo/Noise test report UNI EN ISO 3746			D							Attestato di rumorosità 2.2/ Noise statement 2.2
8	Attestato di vibrazione UNI ISO 10816 / Vibration test report UNI ISO 10816			D							Attestato di vibrazione 2.2/ Vibration test report 2.2
9	Conformità alle norme europee/ European standards Conformity		D								Certificato CE di conformità/ CE certificate
10	Certificato di costruzione (Dual Use)/Manufacturing declaration			D							Certificato di costruzione (Dual Use)/Manufacturing declaration

TIPO DI INTERVENTO TYPE OF INTERVENT	H : PRESENZA VINCOLANTE. La prosecuzione del ciclo è vincolata alla presenza. H : BINDING WITNESSING. The continuation of the cycle is bound to the witnessing. P : PRESENZA VINCOLANTE PER LA % INDICATA NELLE NOTE. P : BINDING WITNESSING WITH PERCENTAGE AS SHOWED ON THE NOTES. W : PRESENZA NON VINCOLANTE. In caso di mancata presenza il fornitore è autorizzato a proseguire il ciclo produttivo fornendo l'adeguata certificazione. W : NOT BINDING WITNESSING. Without witnessing the supplier is authorized to carry on with the manufacturing plan issuing the proper certification.	R : CONTROLLO DEI CERTIFICATI E/O DOCUMENTI. R : CERTIFICATES AND/OR DOCUMENTS CHECK. C : CONTROLLO ESEGUITO CON RILASCIO DEL CERTIFICATO. C : CHECK WITH CERTIFICATE. N : CONTROLLO ESEGUITO SENZA RILASCIO DEL CERTIFICATO. N : CHECK WITHOUT CERTIFICATE. D : SOLO DOCUMENTAZIONE. D : ONLY DOCUMENTATION.		
EMESSO DA ISSUED BY CONTROLLO QUALITA'	CONTROLLATO DA CHECK BY ASSICURAZIONE QUALITA'	APPROVATO DA APPROVED BY	REVISIONE N° REVISION N°	PAGINA N° SHEET N°
DATA DATE 19/06/2012	DATA DATE 19/06/2012	DATA DATE	DATA DATE	DI TOTALI OF TOTAL 1



pompetravaini S.p.A.

<http://www.pompetravaini.it>

ISO 9001



Shop inspection plan

DIMENSIONI D'INGOMBRO / Overall dimensions
POMPA CENTRIFUGA MONOSTADIO
Monostage centrifugal pump
TIPO / Type
TCH 40-250/1-C/GS

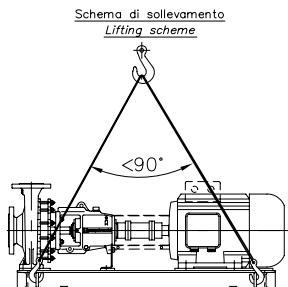
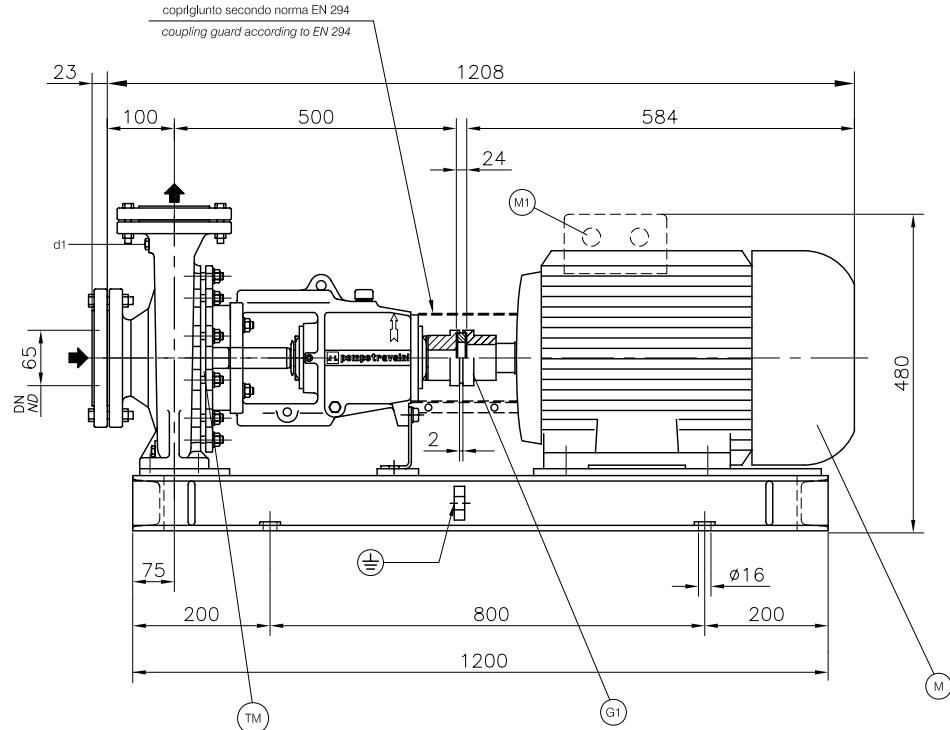


pompetravaini s.p.a.
CASTANO PRIMO (MILANO)

Cliente - Customer	BALLESTRA S.p.a.	Peso in Kg. - Weights in Kgs.
Impianto - Plant		Pompa - Pump
Ordine - Order	121241	Motore - Motor
ITEM	64P1	Base-Giunto - Baseplate-Coupling
Commessa - Job	C2F11A	Total - Total

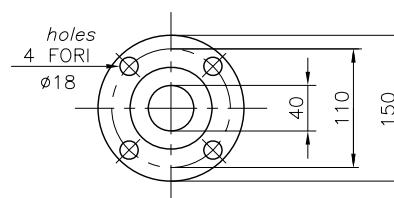
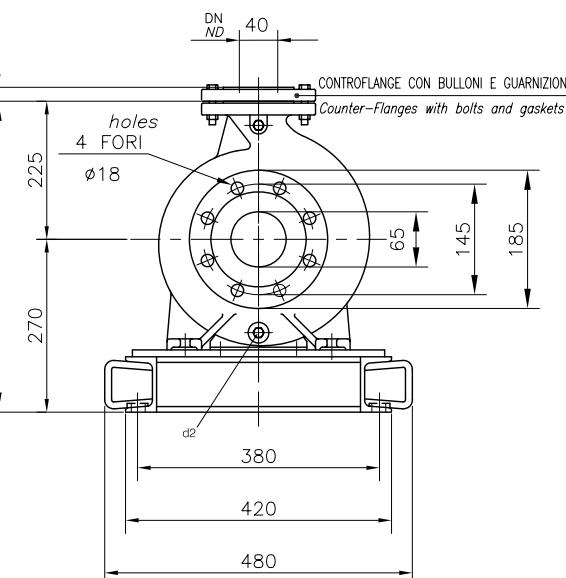
Versione **ACCOPIATA (BASE-GIUNTO ELASTICO)**
COUPLED construction (BASEPLATE-ELASTIC COUPLING)

FUORI SCALA / DO NOT SCALE



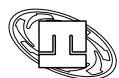
Disegno schematico. Dimensioni in mm con tolleranze secondo EN 735-1995.
Pesi indicativi in Kg. riferiti a pompe in ghisa , non impegnativi,
Schematic drawing. Dimensions in mm with tolerances to **EN 735-1995** standard
Weights in Kgs, referred to pumps in cast iron , not certified.

RIF. - Ref.: V.B./C.T. SOSTITUISCE - Replaces: - 3734.123.2C0.01.9
DATA - Date: Settembre 06 - September 06 N°.: 3734.123.2C0.01.9 Rev.2



FLANGE SECONDO UNI 2223-2229 PN 16
Flanges according to UNI 2223-2229 NP 16

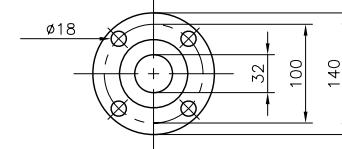
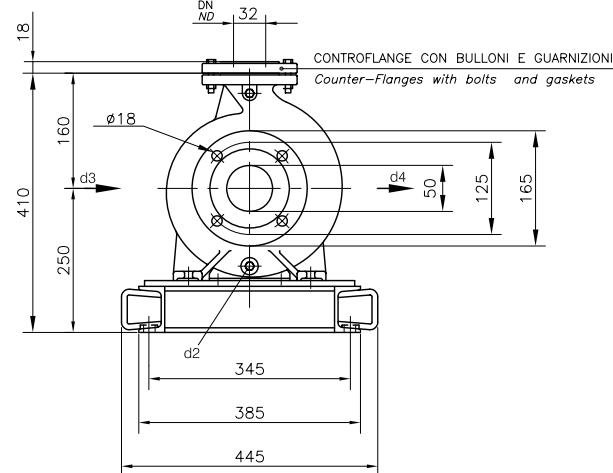
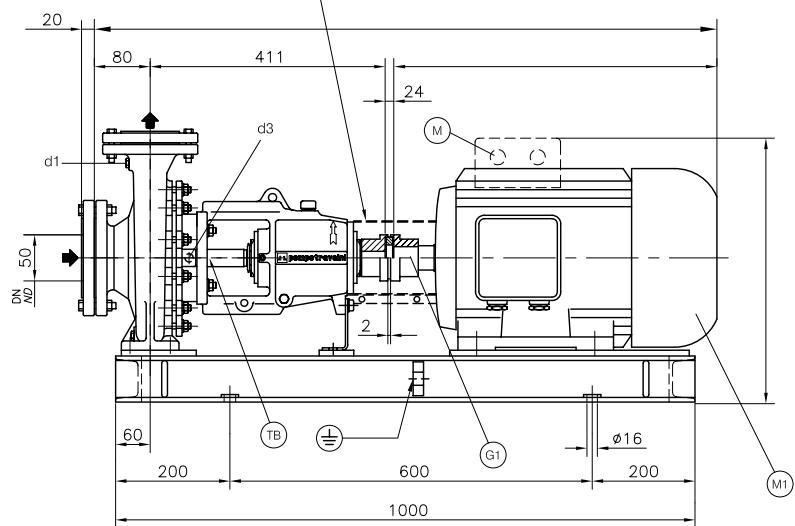
DIMENSIONI D'INGOMBRO / Overall dimensions
 POMPA CENTRIFUGA MONOSTADIO
 Monostage centrifugal pump
 TIPO / Type
TCT 32-160/1-B/RA-L3



pompetravaini s.p.a.
 CASTANO PRIMO (MILANO)

Versione ACCOPIATA (BASE-GIUNTO ELASTICO)
COUPLED construction (BASEPLATE-ELASTIC)

COPRIGUENTO secondo le EN 294
 Guard coupling according to EN 294



FLANGE SECONDO UNI 2223-2229 PN 16
 Flanges according to UNI 2223-2229 NP 16

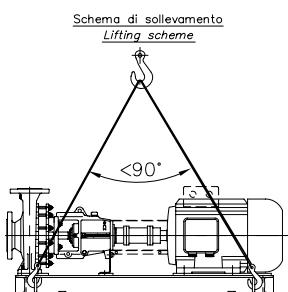
Disegno schematico. Dimensioni in mm con tolleranze secondo EN 735-1995.
 Pesi indicativi in Kg, riferiti a pompe in ghisa, non impegnativi.
 Schematic drawing. Dimensions in mm with tolerances to EN 735-1995 standards.
 Weights in Kgs, referred to pumps in cast iron, not certified.

Cliente - Customer **BALLESTRA S.p.a.**
 Impianto - Plant
 Ordine - Order **121241**
 ITEM **63P6**
 Comessa - Job **C2F11A**

Peso in Kg. - Weights in Kgs.
 Pompa - Pump **42**
 Motore - Motor **-**
 Base-Giunto - Baseplate-Coupling **48**
 Totale - Total **-**

Lista Componenti - Parts List

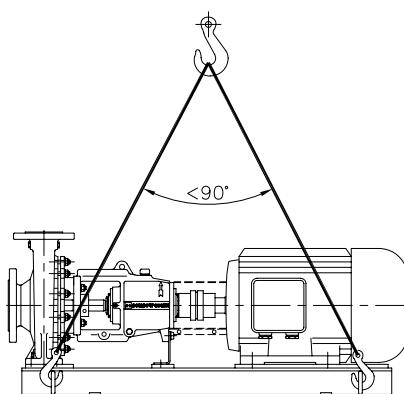
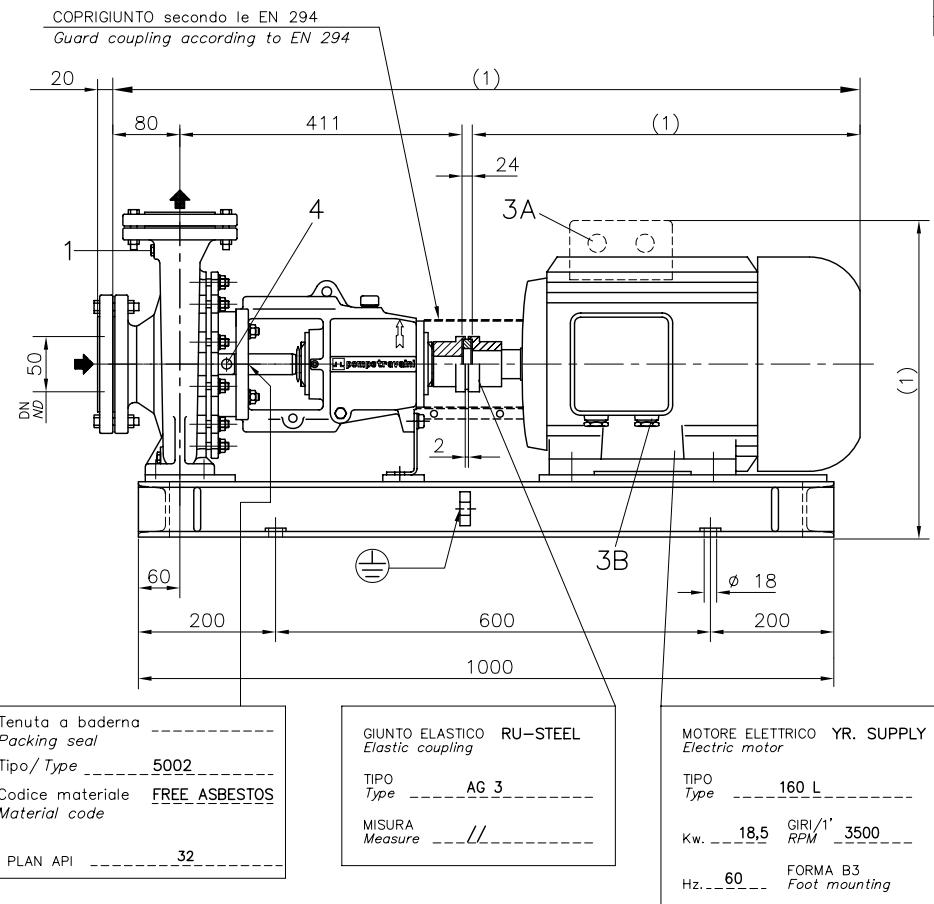
M	Motore Elettrico - Electric Motor	
	Marca - Brand	Vosstra Fornitura - Your supply
	Grandezza Frame size IEC	Giri/min. - RPM 3500
	kW	HP
	160M	11 15 60
	Costruzione - Construction	B3
	Voltaggio - Voltage	-
	Protezione - Protection	-
	Isolamento - Insulation	-
	Note - Notes	-
M1	Entrata cavi - Cables entry	-
G1	Giunto elastico - Elastic coupling	
	Marca - Brand	RU-STEEL
	Tipo - Type	Elastico - Elastic Coupling
	Modello - Model	AG 3
TB	Tenuta a Baderna - Packing Seal	
	Tipo - Type	5002
	Diametro - Diameter	
	Codice materiale	FREE ASBESTOS
	Material code	
	PLAN API / Api plan	
	Attacchi - Connections	
d1	Attacco tappato per manometro Plugged connection for manometer	Ø1/4" GAS
d2	Attacco tappato per scarico corpo pompa Plugged connection for pump casing drain	Ø1/4" GAS
d3	Attacco filettato per ingresso liquido ausiliario di flussaggio BADERNA Threaded connection for external flushing inlet of Packing seal with auxiliary liquid	Ø1/4"NPT F
d4	Attacco filettato per uscita liquido ausiliario Threaded connection for outlet auxiliary liquid	Ø1/4"NPT F



RIF. - Ref.: V.B./C.T.
 DATA - Date: Maggio 07 - May 07

SOSTITUISCE - Replaces: -
 N°: 3922.123.201.01.5

FUORI SCALA / DO NOT SCALE



Schema di sollevamento

(1)= Dimensioni in funzione della marca del motore installato

(1)= Not certified dimensions according to installed motor manufacturer

POS.	CONNECTIONS	
1	MANOMETRO / Pressure gauge	1/4" gas
2	DRENAGGIO / Drain pump	1/4" gas
3	ENTRATA CAVI / Cables entry	
4	INGRESSO FLUSSAGGIO BADERNA <i>Inlet flushing packing seal</i>	1/4" NPT F

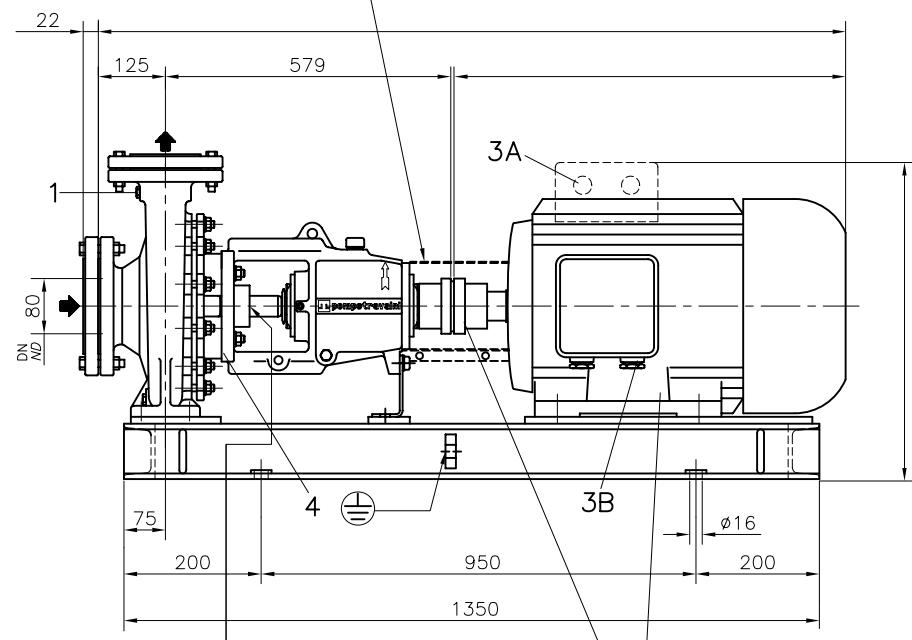


Pump Type
N°. DISEGNO
DWG. NO.

Cliente / Customer	BALLESTRA S.p.a.			Peso in Kg. / Weights in Kgs.	
Impianto / Plant				Pompa / Pump	42
Ordine / Order	121241			Motore / Motor	
ITEM	63 P5			Base - Giunto / Baseplate - Coupling	48
Commissa / Job	2E45A			Totale / Total	
	DISEGNATO Drawn by	CONTROLLATO Checked by	APPROVATO Approved by	TOLLERANZE SECONDO <i>Tolerances according to</i>	Materiale / Material
DATA Date	10-2003	10-2003	10-2003	EN 735	Disegno schematico. Schematic drawing.
FIRMA Signature	V.B.	t.c.	C.T.		Scala / Scale
pompetravaini s.p.a.				DIMENSIONI D'INGOMBRO – Overall Dimensions	
CASTANO PRIMO (MILANO)				POMPA TIPO <i>Pump Type</i> TCT 32-160/1-B/RA-L3	
La pompetravaini s.p.a. è proprietaria di questo disegno e ne vieta la riproduzione e la consegna a terzi senza autorizzazione scritta. This drawing belongs to pompetravaini s.p.a. that does not allow the reproduction and the delivery to third party without written authorization.				N°. DISEGNO <i>Dwg. No.</i> 3922.123.221.01.3	

1 2 3 4 5 6 7 8 9

COPRIGIUNTO secondo le EN 294
Guard coupling according to EN 294

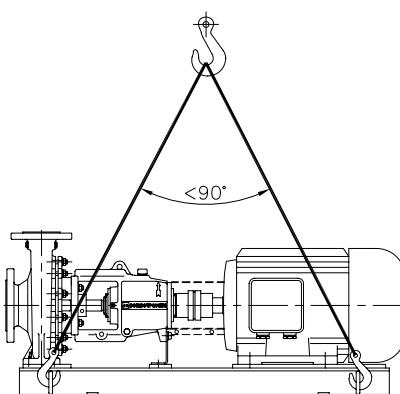


Tenuta a baderna
Packing seal
Tipo / Type 5002
Codice materiale FREE ASBESTOS
Material code
PLAN API 32

GIUNTO ELASTICO RU-STEEL
Elastic coupling
TIPO Type AG 4
MISURA Measure

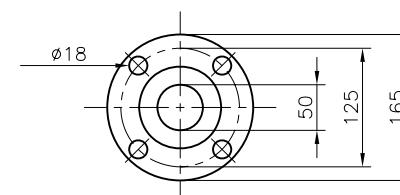
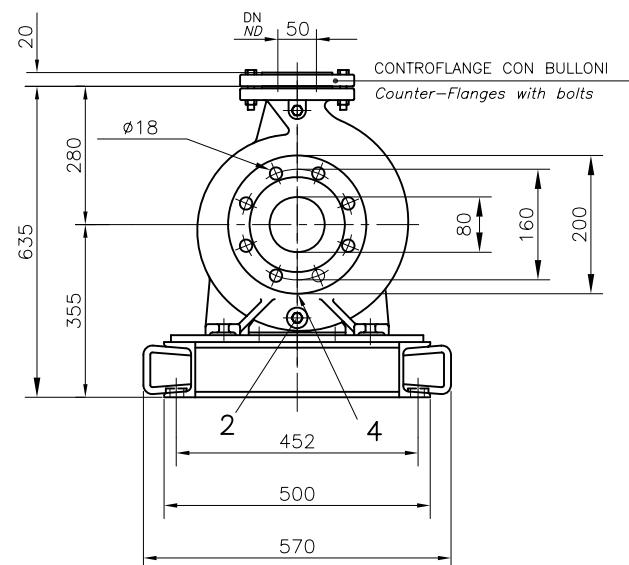
MOTORE ELETTRICO YR SUPPLY
Electric motor
TIPO Type 180 M
Kw. 22 GIRI/1' RPM 1450
Hz. 50 FORMA B3
Foot mounting

Schema di sollevamento
Lifting scheme



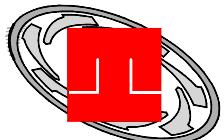
POS.	CONNECTIONS	ϕ
1	MANOMETRO / Pressure gauge	1/4" gas
2	DRENAGGIO / Drain pump	1/4" gas
3	ENTRATA CAVI / Cables entry	
4	INGRESSO FLUSSAGGIO BADERNA Inlet flushing packing seal	1/4" NPT F

FUORI SCALA / DO NOT SCALE



FLANGE SECONDO UNI 2223-2229 PN 16
Flanges according to UNI 2223-2229 NP 16

Cliente/ Customer Impianto/ Plant Ordine/ Order ITEM Commissa/ Job	BALLESTRA S.p.a. 121241 62P1 C2F11A	Peso in Kg. / Weights in Kgs. Pompa/ Pump 118 Motore/ Motor --- Base-Giunto/Baseplate-Coupling 59 Totale/ Total ---	
DATA FIRMA Signature	DISEGNATO Drawn by 02-2006 V.B.	CONTROLLATO Checked by 02-2006 t.c.	APPROVATO Approved by 02-2006 C.T.
TOLLERANZE SECONDO Tolerances according to EN 735		Materiale/ Material Disegno schematico. Schematic drawing. ---	
pompetravaini s.p.a. CASTANO PRIMO (MILANO)		DIMENSIONI D'INGOMBRO - Overall Dimensions POMPA TIPO Pump Type TCT 50-315/1X-B/RA-L N°. DISEGNO DWG. NO. 3945.043.2214.01.1	



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<http://www.pompetravaini.it>

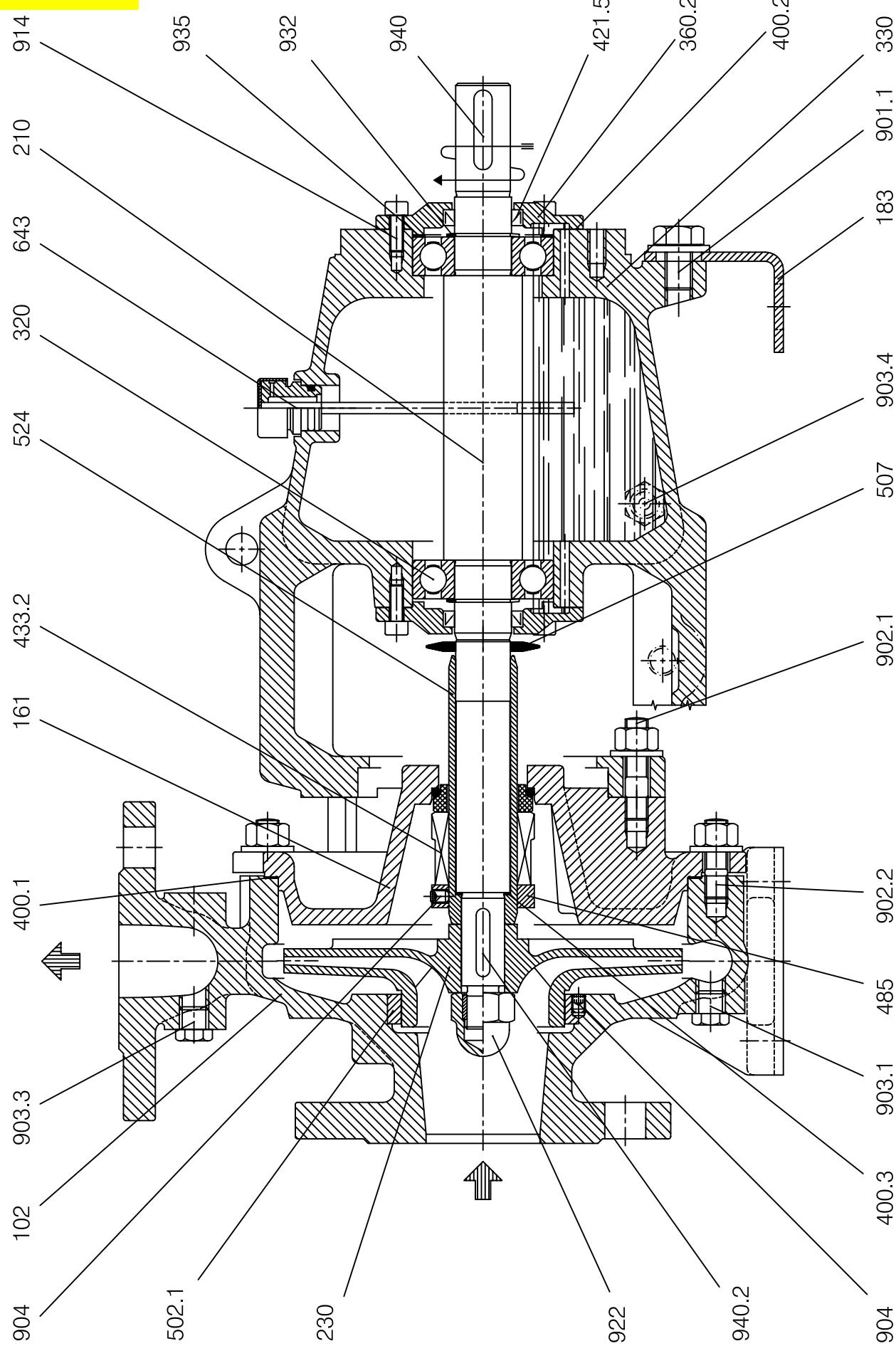
ISO 9001



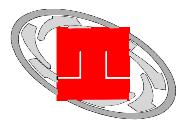
Overall dimensions

TCH/1-C gr.1 e 2

ITEM 64P1



**Generic COMPONENTS
of pumps**



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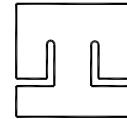
VDMA No.	DESIGNATION	VDMA No.	DESIGNATION	VDMA No.	DESIGNATION
101	Casing	375.1	Collar	680	Guard
102	Volute casing	375.2	Bearing housing cover	681	Coupling guard
106	Suction casing	383	Intermediate guide vertical	685	Guard net
107	Discharge casing	400...	Gasket	701	Circulation pipe
108...	Stage casing	411...	V-Ring	707	Circulation pipe
109...	Stage casing	412...	O-Ring	711...	Support column
110...	Impeller casing	421...	Radial shaft seal	713	Discharge pipe
111	Priming stage casing	433...	Mechanical seal	721	Flange connection
113	Intermediate casing	434...	Radial mechanical seal	723	Companion flange
114...	Channel stage casing	441...	Mechanical seal housing	724	Blank flange
116	Cooling chamber	442	Mechanical seal cover	725	Collar
120	Rear casing	450...	Cooling insert	730	Elbow
132	Fly-wheel	451...	Packing seal housing	731...	Fitting
134	Side plate	452...	Gland	734	M.F. Fitting
135...	Side plate	453	Screwed gland	735	M.M. Fitting
137...	Side element	455	Gland insert	736	Fitting
138	Suction piece	458	Lantern ring	745	Filter
140...	Intermediate plate	460	Gland	800	Electric motor
147	Manifold	461...	Packing seal	801	Flanged motor
147.5	Separator manifold	462	Packing seal	806	Reducer
149...	Diffusor	465	Packing seal housing vertical	818G	Magnetic coupling assembly
161	Casing cover	471...	Mechanical seal cover	853	Shell couplig
162	Suction cover	475	Stationary seal ring	861...	Half coupling
163	Casing cover	485...	Locating ring	867	Coupling dowel
165	Cooling cover	486	Ball	869	Spacer coupling
166	Casing	487	Throttling bush	892	Raising pad
167	Cooling plate	489	Collar	900...	Screw
180	Clamping foot	502...	Wear ring	900.5	Eyebolt
180.5	Valves plate	504	Spacer	901...	Screw
180.6	Metal cover	505...	Shoulder ring	901.7...	Bolt
183...	Support foot	506	Locking ring	902...	Stud
184	Clamping	506.1	Split locking ring	903...	Plug
185	Clamping	506.2	Locking ring	904...	Grub screw
187	Support plate	507...	Thrower	905...	Tiebolt
187.1	Housing guard	510	Oil ring	911	Filling plug
210	Shaft	521	Spacer sleeve	914...	Screw
210.1	Auxiliary shaft	522	Spacer sleeve	920...	Nut
230...	Impeller	523	Shaft sleeve	921	Impeller nut
231	Priming impeller	524	Shaft sleeve	922...	Shaft nut
235	Impeller cover	525	Spacer sleeve	923...	Bearing nut
303	Bearing housing	527	Shaft sleeve	924...	Shaft nut
310...	Bearing bush	530	Centring sleeve	925	Impeller nut
311	Bearing bush	542...	Throttling bush	932...	Circlip
320...	Ball bearing	543	Plate spacer	934	Heli-coil
321...	Ball bearing	550	Junk ring	935	Elastic ring
322	Roller bearing	551	Disk with orifice	940...	Key
323...	Roller bearing	554...	Washer	955	Spring
330	Bearing bracket	554.5	Elastic washer	991	Ball float valve
331	Bearing pedestal	560	Elastic pin		
341	Motor lantern	561	Elastic pin		
345	Pedestal	562...	Cylinder pin		
350...	Bearing housing	635	Grease nipple		
353	Bearing bracket	636	Grease cup		
355	Bearing housing	637	Oil filling plug		
357...	M.S. and bearing housing	639	Oil sight gauge		
358	Bearing housing	640	Constant level oil		
360...	Bearing cover	643	Oil dipstik		
365...	Bearing cover	647...	Grease regulator		
375	Bearing housing	672...	Cock		

RIF. - Ref.: E.C./C.T.

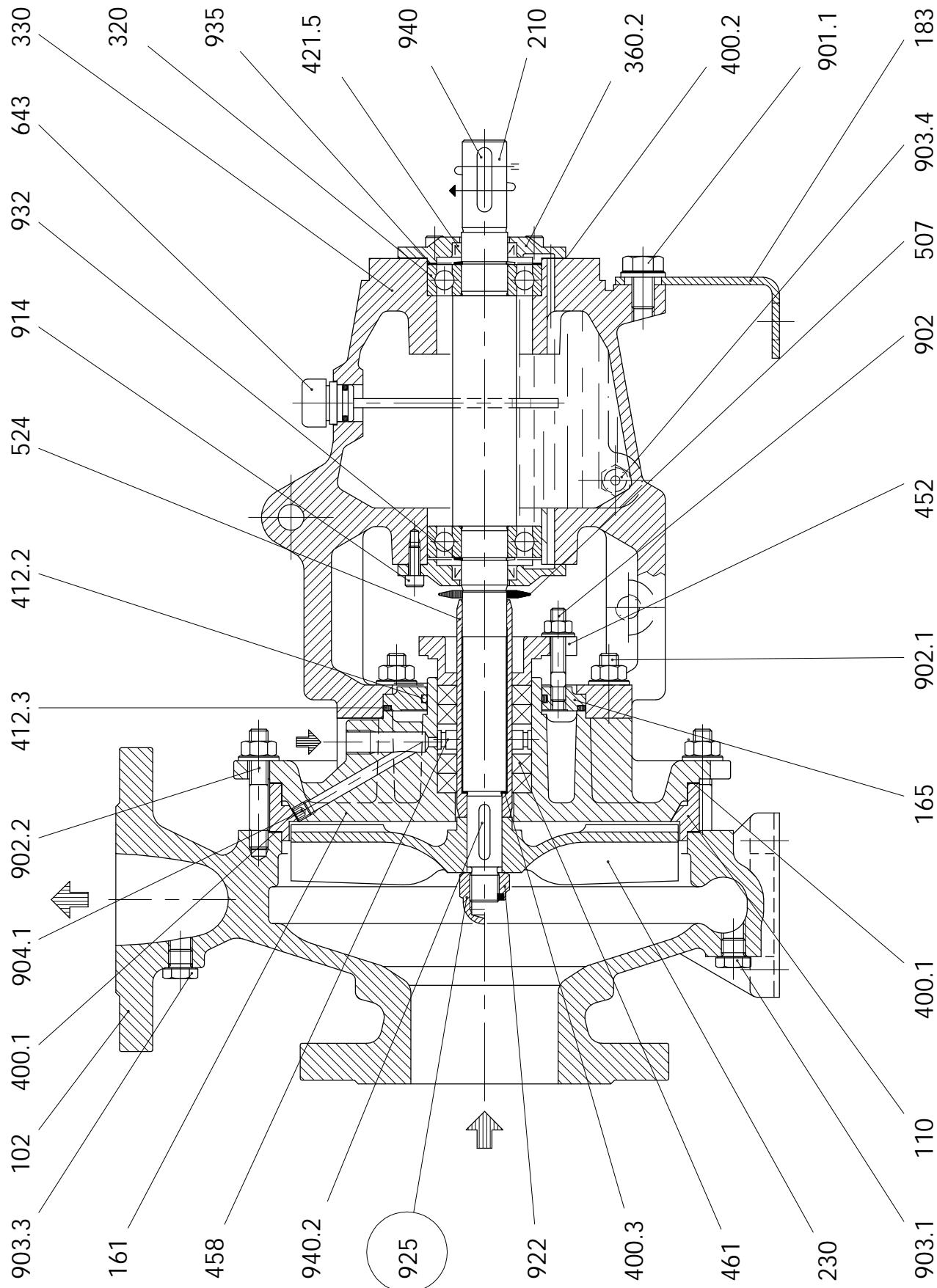
SOSTITUISCE - Replaces: 9300.584.01.01

DATA - Date: Settembre 02 – September 02

N°.: 9300.527.01.02

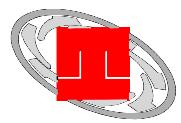


ITEM 63P6



○ SOLO PER ESECUZIONE "A3-B2" / Only for "A3-B2" construction

**Generic COMPONENTS
of pumps**



pompetravaini

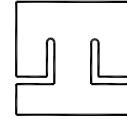
VDMA No.	DESIGNATION	VDMA No.	DESIGNATION	VDMA No.	DESIGNATION
101	Casing	375.1	Collar	680	Guard
102	Volute casing	375.2	Bearing housing cover	681	Coupling guard
106	Suction casing	383	Intermediate guide vertical	685	Guard net
107	Discharge casing	400...	Gasket	701	Circulation pipe
108...	Stage casing	411...	V-Ring	707	Circulation pipe
109...	Stage casing	412...	O-Ring	711...	Support column
110...	Impeller casing	421...	Radial shaft seal	713	Discharge pipe
111	Priming stage casing	433...	Mechanical seal	721	Flange connection
113	Intermediate casing	434...	Radial mechanical seal	723	Companion flange
114...	Channel stage casing	441...	Mechanical seal housing	724	Blank flange
116	Cooling chamber	442	Mechanical seal cover	725	Collar
120	Rear casing	450...	Cooling insert	730	Elbow
132	Fly-wheel	451...	Packing seal housing	731...	Fitting
134	Side plate	452...	Gland	734	M.F. Fitting
135...	Side plate	453	Screwed gland	735	M.M. Fitting
137...	Side element	455	Gland insert	736	Fitting
138	Suction piece	458	Lantern ring	745	Filter
140...	Intermediate plate	460	Gland	800	Electric motor
147	Manifold	461...	Packing seal	801	Flanged motor
147.5	Separator manifold	462	Packing seal	806	Reducer
149...	Diffusor	465	Packing seal housing vertical	818G	Magnetic coupling assembly
161	Casing cover	471...	Mechanical seal cover	853	Shell couplig
162	Suction cover	475	Stationary seal ring	861...	Half coupling
163	Casing cover	485...	Locating ring	867	Coupling dowel
165	Cooling cover	486	Ball	869	Spacer coupling
166	Casing	487	Throttling bush	892	Raising pad
167	Cooling plate	489	Collar	900...	Screw
180	Clamping foot	502...	Wear ring	900.5	Eyebolt
180.5	Valves plate	504	Spacer	901...	Screw
180.6	Metal cover	505...	Shoulder ring	901.7...	Bolt
183...	Support foot	506	Locking ring	902...	Stud
184	Clamping	506.1	Split locking ring	903...	Plug
185	Clamping	506.2	Locking ring	904...	Grub screw
187	Support plate	507...	Thrower	905...	Tiebolt
187.1	Housing guard	510	Oil ring	911	Filling plug
210	Shaft	521	Spacer sleeve	914...	Screw
210.1	Auxiliary shaft	522	Spacer sleeve	920...	Nut
230...	Impeller	523	Shaft sleeve	921	Impeller nut
231	Priming impeller	524	Shaft sleeve	922...	Shaft nut
235	Impeller cover	525	Spacer sleeve	923...	Bearing nut
303	Bearing housing	527	Shaft sleeve	924...	Shaft nut
310...	Bearing bush	530	Centring sleeve	925	Impeller nut
311	Bearing bush	542...	Throttling bush	932...	Circlip
320...	Ball bearing	543	Plate spacer	934	Heli-coil
321...	Ball bearing	550	Junk ring	935	Elastic ring
322	Roller bearing	551	Disk with orifice	940...	Key
323...	Roller bearing	554...	Washer	955	Spring
330	Bearing bracket	554.5	Elastic washer	991	Ball float valve
331	Bearing pedestal	560	Elastic pin		
341	Motor lantern	561	Elastic pin		
345	Pedestal	562...	Cylinder pin		
350...	Bearing housing	635	Grease nipple		
353	Bearing bracket	636	Grease cup		
355	Bearing housing	637	Oil filling plug		
357...	M.S. and bearing housing	639	Oil sight gauge		
358	Bearing housing	640	Constant level oil		
360...	Bearing cover	643	Oil dipstik		
365...	Bearing cover	647...	Grease regulator		
375	Bearing housing	672...	Cock		

RIF. - Ref.: E.C./C.T.

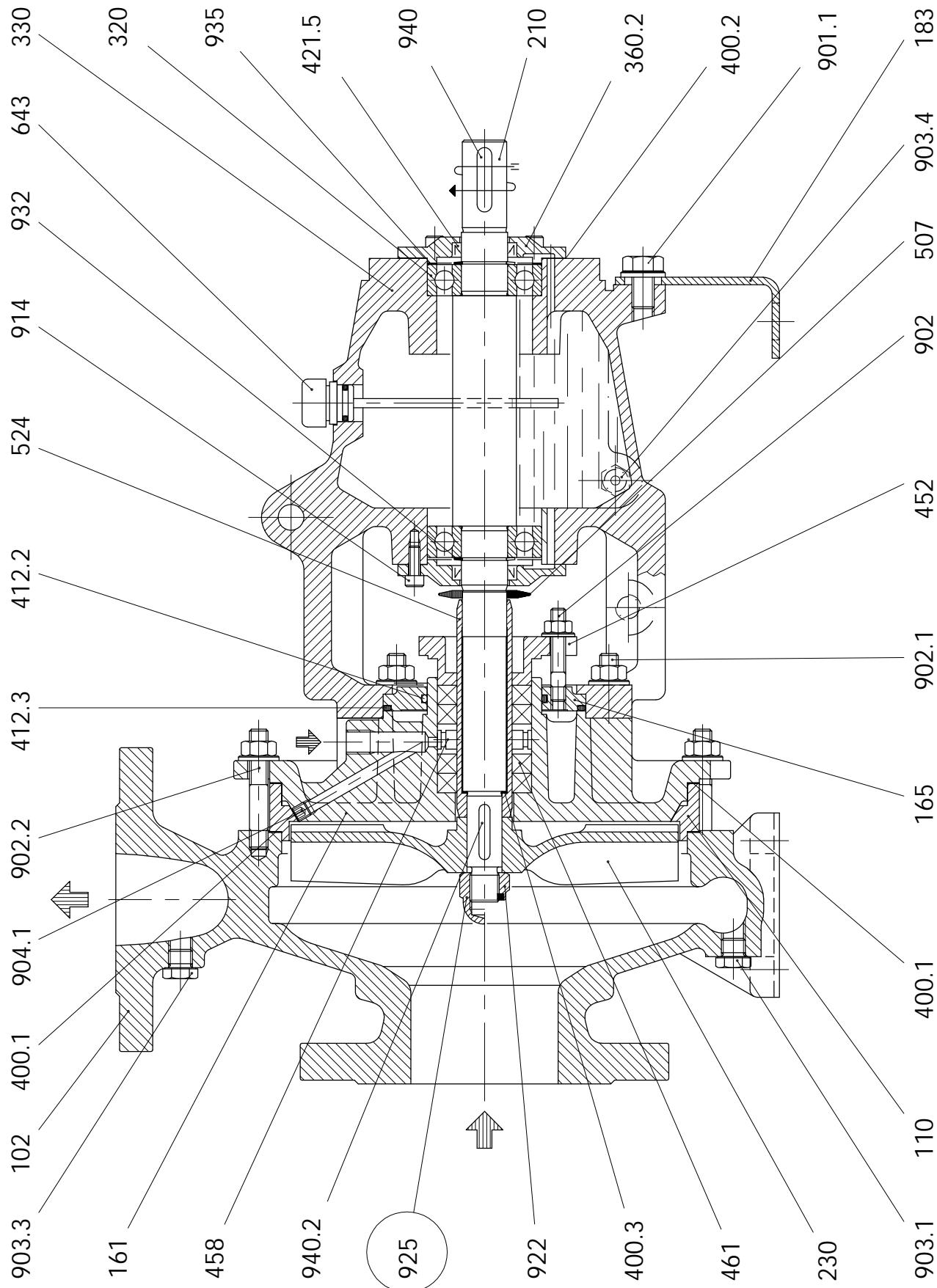
SOSTITUISCE - Replaces: 9300.584.01.01

DATA - Date: Settembre 02 – September 02

N°.: 9300.527.01.02

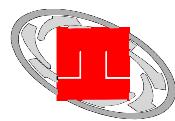


ITEM 63P5



○ SOLO PER ESECUZIONE "A3-B2" / Only for "A3-B2" construction

**Generic COMPONENTS
of pumps**



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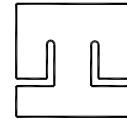
VDMA No.	DESIGNATION	VDMA No.	DESIGNATION	VDMA No.	DESIGNATION
101	Casing	375.1	Collar	680	Guard
102	Volute casing	375.2	Bearing housing cover	681	Coupling guard
106	Suction casing	383	Intermediate guide vertical	685	Guard net
107	Discharge casing	400...	Gasket	701	Circulation pipe
108...	Stage casing	411...	V-Ring	707	Circulation pipe
109...	Stage casing	412...	O-Ring	711...	Support column
110...	Impeller casing	421...	Radial shaft seal	713	Discharge pipe
111	Priming stage casing	433...	Mechanical seal	721	Flange connection
113	Intermediate casing	434...	Radial mechanical seal	723	Companion flange
114...	Channel stage casing	441...	Mechanical seal housing	724	Blank flange
116	Cooling chamber	442	Mechanical seal cover	725	Collar
120	Rear casing	450...	Cooling insert	730	Elbow
132	Fly-wheel	451...	Packing seal housing	731...	Fitting
134	Side plate	452...	Gland	734	M.F. Fitting
135...	Side plate	453	Screwed gland	735	M.M. Fitting
137...	Side element	455	Gland insert	736	Fitting
138	Suction piece	458	Lantern ring	745	Filter
140...	Intermediate plate	460	Gland	800	Electric motor
147	Manifold	461...	Packing seal	801	Flanged motor
147.5	Separator manifold	462	Packing seal	806	Reducer
149...	Diffusor	465	Packing seal housing vertical	818G	Magnetic coupling assembly
161	Casing cover	471...	Mechanical seal cover	853	Shell couplig
162	Suction cover	475	Stationary seal ring	861...	Half coupling
163	Casing cover	485...	Locating ring	867	Coupling dowel
165	Cooling cover	486	Ball	869	Spacer coupling
166	Casing	487	Throttling bush	892	Raising pad
167	Cooling plate	489	Collar	900...	Screw
180	Clamping foot	502...	Wear ring	900.5	Eyebolt
180.5	Valves plate	504	Spacer	901...	Screw
180.6	Metal cover	505...	Shoulder ring	901.7...	Bolt
183...	Support foot	506	Locking ring	902...	Stud
184	Clamping	506.1	Split locking ring	903...	Plug
185	Clamping	506.2	Locking ring	904...	Grub screw
187	Support plate	507...	Thrower	905...	Tiebolt
187.1	Housing guard	510	Oil ring	911	Filling plug
210	Shaft	521	Spacer sleeve	914...	Screw
210.1	Auxiliary shaft	522	Spacer sleeve	920...	Nut
230...	Impeller	523	Shaft sleeve	921	Impeller nut
231	Priming impeller	524	Shaft sleeve	922...	Shaft nut
235	Impeller cover	525	Spacer sleeve	923...	Bearing nut
303	Bearing housing	527	Shaft sleeve	924...	Shaft nut
310...	Bearing bush	530	Centring sleeve	925	Impeller nut
311	Bearing bush	542...	Throttling bush	932...	Circlip
320...	Ball bearing	543	Plate spacer	934	Heli-coil
321...	Ball bearing	550	Junk ring	935	Elastic ring
322	Roller bearing	551	Disk with orifice	940...	Key
323...	Roller bearing	554...	Washer	955	Spring
330	Bearing bracket	554.5	Elastic washer	991	Ball float valve
331	Bearing pedestal	560	Elastic pin		
341	Motor lantern	561	Elastic pin		
345	Pedestal	562...	Cylinder pin		
350...	Bearing housing	635	Grease nipple		
353	Bearing bracket	636	Grease cup		
355	Bearing housing	637	Oil filling plug		
357...	M.S. and bearing housing	639	Oil sight gauge		
358	Bearing housing	640	Constant level oil		
360...	Bearing cover	643	Oil dipstik		
365...	Bearing cover	647...	Grease regulator		
375	Bearing housing	672...	Cock		

RIF. - Ref.: E.C./C.T.

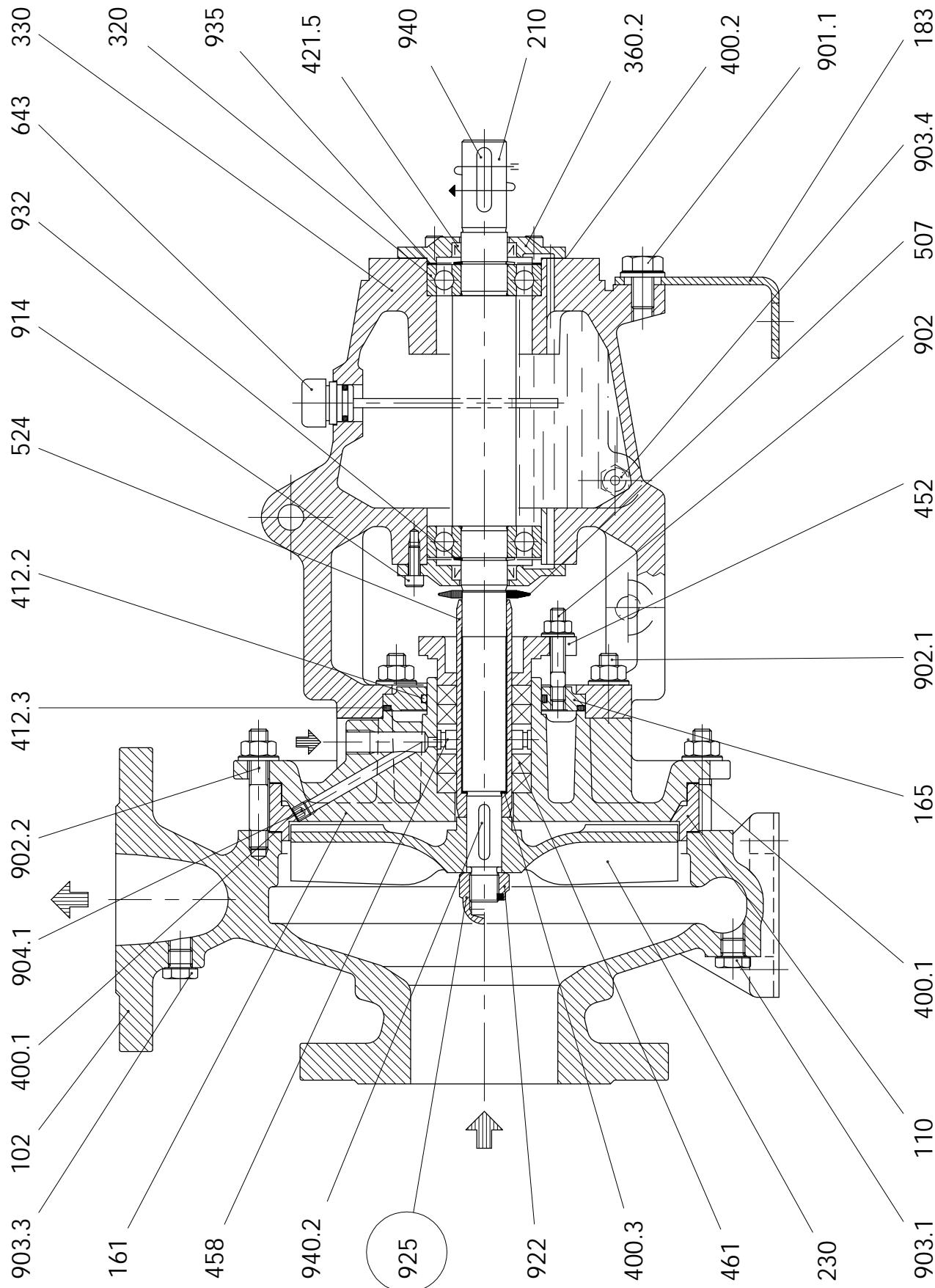
SOSTITUISCE - Replaces: 9300.584.01.01

DATA - Date: Settembre 02 – September 02

N°.: 9300.527.01.02

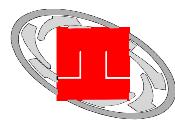


ITEM 62P1



○ SOLO PER ESECUZIONE "A3-B2" / Only for "A3-B2" construction

**Generic COMPONENTS
of pumps**



pompetravaini

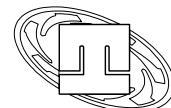
VDMA No.	DESIGNATION	VDMA No.	DESIGNATION	VDMA No.	DESIGNATION
101	Casing	375.1	Collar	680	Guard
102	Volute casing	375.2	Bearing housing cover	681	Coupling guard
106	Suction casing	383	Intermediate guide vertical	685	Guard net
107	Discharge casing	400...	Gasket	701	Circulation pipe
108...	Stage casing	411...	V-Ring	707	Circulation pipe
109...	Stage casing	412...	O-Ring	711...	Support column
110...	Impeller casing	421...	Radial shaft seal	713	Discharge pipe
111	Priming stage casing	433...	Mechanical seal	721	Flange connection
113	Intermediate casing	434...	Radial mechanical seal	723	Companion flange
114...	Channel stage casing	441...	Mechanical seal housing	724	Blank flange
116	Cooling chamber	442	Mechanical seal cover	725	Collar
120	Rear casing	450...	Cooling insert	730	Elbow
132	Fly-wheel	451...	Packing seal housing	731...	Fitting
134	Side plate	452...	Gland	734	M.F. Fitting
135...	Side plate	453	Screwed gland	735	M.M. Fitting
137...	Side element	455	Gland insert	736	Fitting
138	Suction piece	458	Lantern ring	745	Filter
140...	Intermediate plate	460	Gland	800	Electric motor
147	Manifold	461...	Packing seal	801	Flanged motor
147.5	Separator manifold	462	Packing seal	806	Reducer
149...	Diffusor	465	Packing seal housing vertical	818G	Magnetic coupling assembly
161	Casing cover	471...	Mechanical seal cover	853	Shell couplig
162	Suction cover	475	Stationary seal ring	861...	Half coupling
163	Casing cover	485...	Locating ring	867	Coupling dowel
165	Cooling cover	486	Ball	869	Spacer coupling
166	Casing	487	Throttling bush	892	Raising pad
167	Cooling plate	489	Collar	900...	Screw
180	Clamping foot	502...	Wear ring	900.5	Eyebolt
180.5	Valves plate	504	Spacer	901...	Screw
180.6	Metal cover	505...	Shoulder ring	901.7...	Bolt
183...	Support foot	506	Locking ring	902...	Stud
184	Clamping	506.1	Split locking ring	903...	Plug
185	Clamping	506.2	Locking ring	904...	Grub screw
187	Support plate	507...	Thrower	905...	Tiebolt
187.1	Housing guard	510	Oil ring	911	Filling plug
210	Shaft	521	Spacer sleeve	914...	Screw
210.1	Auxiliary shaft	522	Spacer sleeve	920...	Nut
230...	Impeller	523	Shaft sleeve	921	Impeller nut
231	Priming impeller	524	Shaft sleeve	922...	Shaft nut
235	Impeller cover	525	Spacer sleeve	923...	Bearing nut
303	Bearing housing	527	Shaft sleeve	924...	Shaft nut
310...	Bearing bush	530	Centring sleeve	925	Impeller nut
311	Bearing bush	542...	Throttling bush	932...	Circlip
320...	Ball bearing	543	Plate spacer	934	Heli-coil
321...	Ball bearing	550	Junk ring	935	Elastic ring
322	Roller bearing	551	Disk with orifice	940...	Key
323...	Roller bearing	554...	Washer	955	Spring
330	Bearing bracket	554.5	Elastic washer	991	Ball float valve
331	Bearing pedestal	560	Elastic pin		
341	Motor lantern	561	Elastic pin		
345	Pedestal	562...	Cylinder pin		
350...	Bearing housing	635	Grease nipple		
353	Bearing bracket	636	Grease cup		
355	Bearing housing	637	Oil filling plug		
357...	M.S. and bearing housing	639	Oil sight gauge		
358	Bearing housing	640	Constant level oil		
360...	Bearing cover	643	Oil dipstik		
365...	Bearing cover	647...	Grease regulator		
375	Bearing housing	672...	Cock		

RIF. - Ref.: E.C./C.T.

SOSTITUISCE - Replaces: 9300.584.01.01

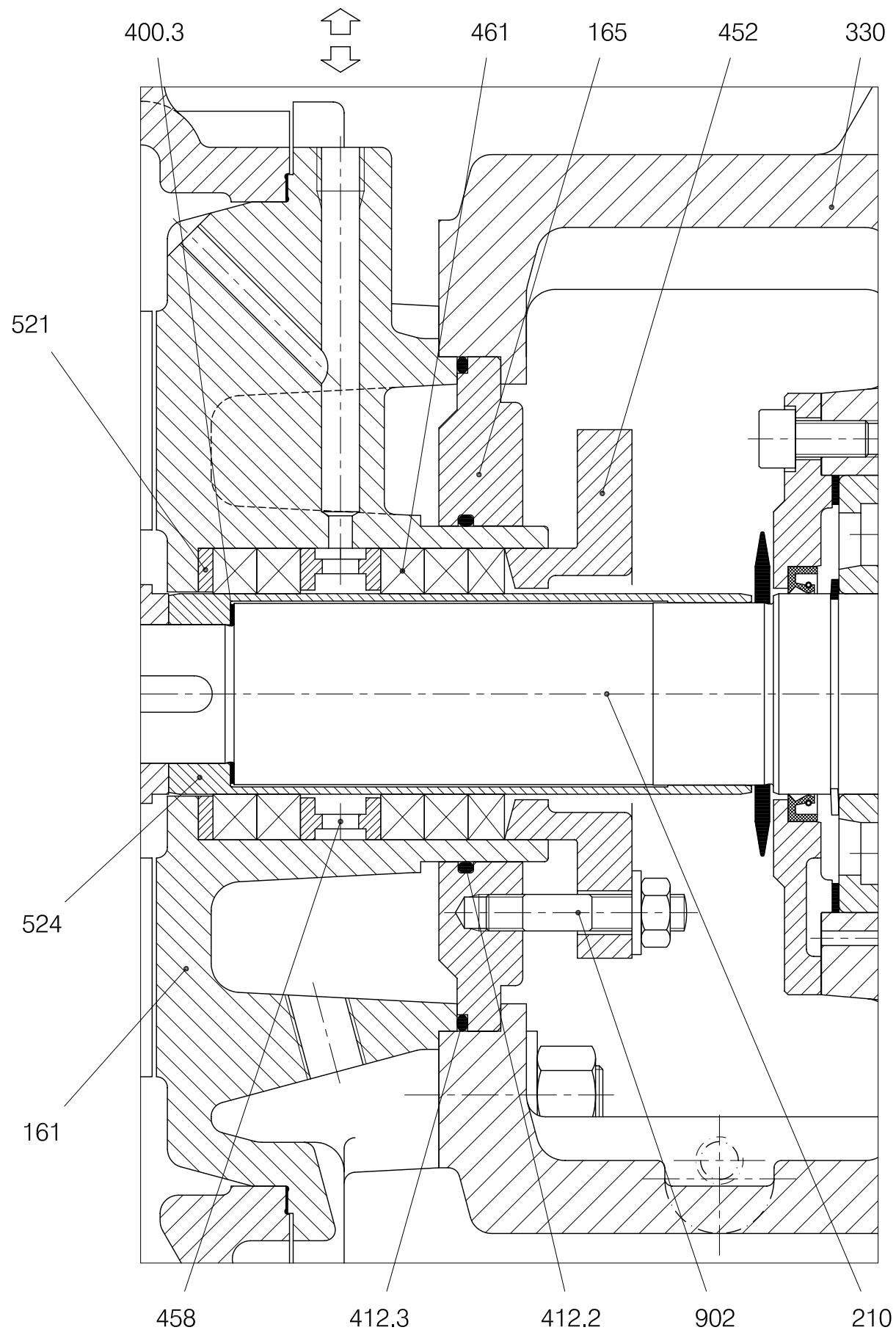
DATA - Date: Settembre 02 – September 02

N°.: 9300.527.01.02



TCH TCT /1X-B gr.3

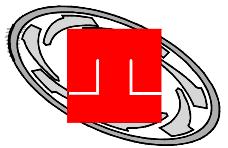
CASTANO PRIMO (MILANO)



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Section drawings



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