pompetravaini

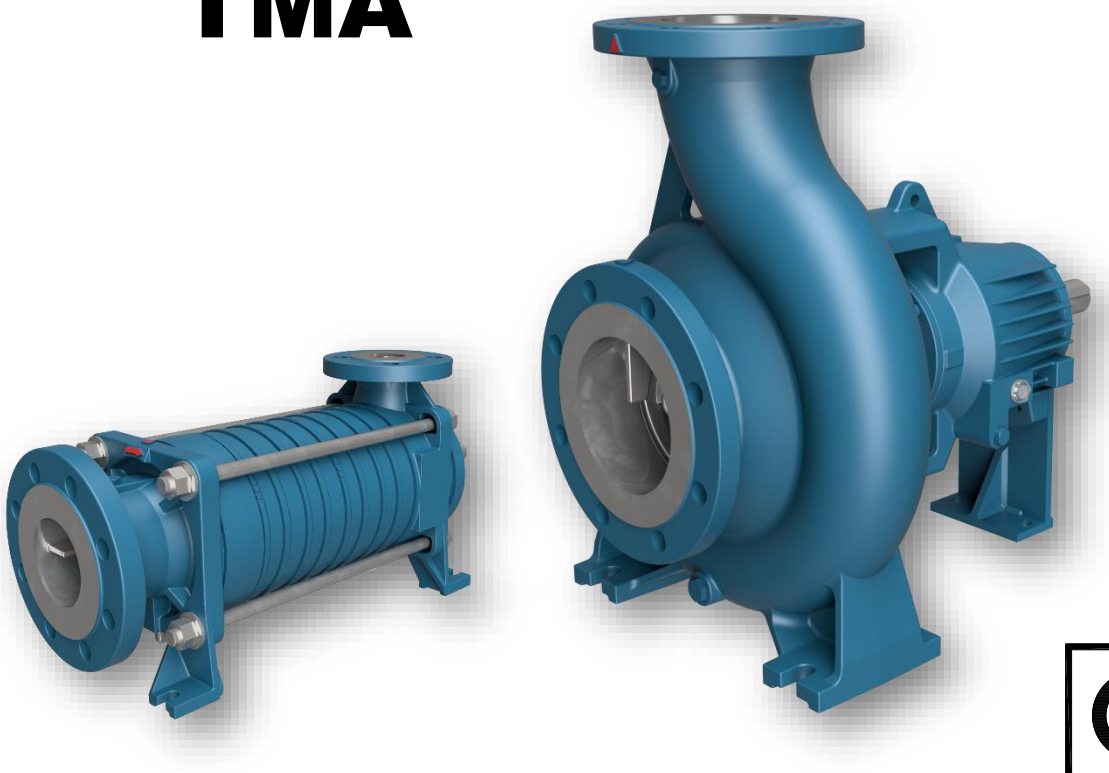
(M00020)

OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB...

MC... - TC...

TMA



CE

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 – TCS - TMA

All pumps are manufactured by:

POMPETRAVAINI S.p.A.

Via per Turbigo, 44 - 20022 CASTANO PRIMO - (Milano) - ITALIA
Tel. +39 0331 889000 - www.pompetravaini.com

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.com".

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 2014/34/EU 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 2014/34/EU directive it is available a dedicated integrative manual.

According to what expected from 2012/19/UE Directive on Waste Electric and Electronic Equipment the electrical pump assembly from us supplied (pump coupled with an electrical motor of Pompetravaini supply or customer supply) placed on the market after the 15th of August 2018 fell within the limits of application of the Directive. As a consequence, conforming to article 14 of the 2012/19/UE Directive of the European Parliament of the 4th of July 2012, Pompetravaini Spa is registered on the Italian list of EEE manufacturer.
The electrical pump assembly supplied by Pompetravaini Spa that should be discontinued from use must not be disposed with common waste because it is composed of different materials that can be recycled at the appropriate facilities. If it is not intended to proceed autonomously at the management of the electrical pump assembly at authorized disposal companies it is possible to contact the Pompetravaini branch closer to you that will give you the necessary information on a proper disposal in accordance with mandatory laws.
The pump unit must be previously cleaned up by the pumped product upon disposal.
After reclamation the electrical pump assembly is not potentially dangerous for human health and environment, not containing harmful substances according to 2011/65/UE (RoHs) Directive, but if abandoned in the environment will have a negative impact on the ecosystem.
Sending the electrical pump assembly to an adequate process of disposal and recovery of materials protect the environment and help to limits consumption of available resources with effective recycling of materials.
The abandonment in the environment of the apparatus or the illegal disposal of the same are punished by law.

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

Pompetravaini ensures that its documentation is compliant in Italian and English languages.

Technical documentation and manuals provided in languages other than these two are subject to a translation by third parties

Documentation and manuals in the two official languages are available on the Pompetravaini website.

INDEX

1 - General instructions
1.1 - General instruction
1.2 - Reading the nameplate
2 - Safety instructions
3 - In case of emergency
3.1 - Basic first aid
4 - Pump outlines
4.1 - Pump model numbers and materials of construction tables
5 - Unpacking, lifting and moving instructions
6 - Storage instructions
7 - Installation instructions
7.1 - Installation of pump/motor assembly
7.2 - Suction and discharge piping
7.2.1 - Suction piping
7.2.2 - Discharge piping
7.2.3 - Piping cleaning
7.2.4 - Pressure testing
7.3 - Accessories and auxiliary connections
8 - Mounting and alignment instructions
8.1 - Monoblock pump/motor and pump/motor assembly mounted on a baseplate
8.2 - Alignment procedure for monoblock and for pump/motor assembly on baseplate
8.3 - Alignment instructions
8.4 - Coupling pump series "TCHM" and "TCTM"
9 - Electrical connections
10 - Check list prior to start-up
11 - Starting, operating and stopping procedures
11.1 - Start-up
11.1.1 - Submersed pump (vertical design)
11.1.2 - Pump with flooded suction
11.1.3 - Pump with suction lift (from well)
11.1.4 - Start-up a pump without back pressure at discharge side
11.1.5 - Start-up a pump with back pressure at discharge side
11.2 - Operation
11.3 - Shut down
12 - Operating check list
13 - Lubrication instructions
13.1 - Grease lubricated ball bearings
13.2 - Oil lubricated ball bearings
14 - Packed stuffing boxes
14.1 - Adjusting the packing
15 - Mechanical seals
16 - Trouble shooting chart - problems, causes and solutions
17 - Pump repair, disassembly and disposal from installation
18 - Spare parts
19 - Engineering data
19.1 - Starting torque
19.2 - Typical performance curves
19.3 - Units conversion table
19.4 - Noise level and vibrations

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 2014/34/EU	Electric dangers for the operator's safety.

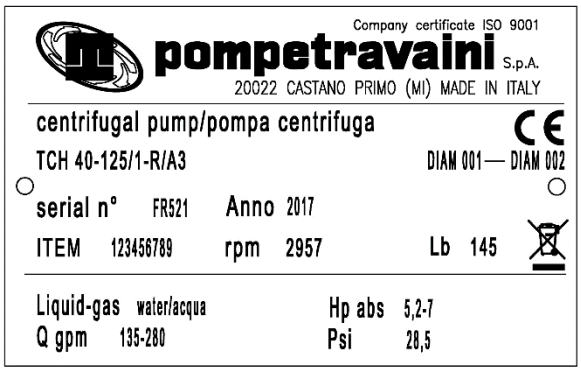
1 - GENERAL INSTRUCTIONS

1.1 - 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.

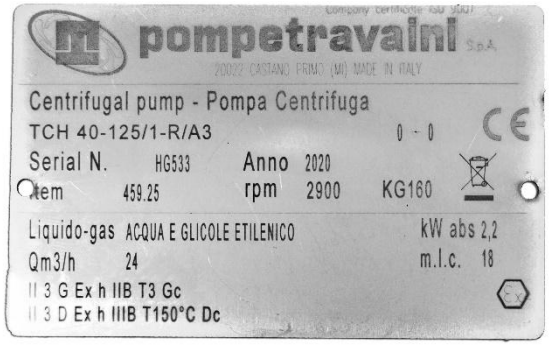
1.2 - READING THE INFORMATIONS MARKED ON PUMP'S NAMEPLATES AND SERVICE CARDS

The machinery Directive 2006/42/EC and the ATEX Directive 2014/34/EU require the marking of certain information on the pump's nameplates. The pump nameplate must be applied so that it is not easily removable and remains legible for long time.
Furthermore, according to the regulations in force, it is necessary to provide the machines with a document, the Declaration of Conformity, to the safety requirements imposed by the Machinery Directive for all pumps (usually named as EC Declaration of Conformity) and to the ATEX Directive for pumps intended for use in environments subject to the directive (usually named ATEX Declaration of Conformity).
Pompetravaini has chosen to make each Declaration supplied with the pump's documentation unique, applying on it an adhesive tag that incorporate the information of the pump nameplate applied on the pump.
In this way each Declaration of conformity is uniquely identified with the same serial number as the pump for which it was issued. By convention in Pompetravaini this tag is called Service Card.

Markings on nameplates of pumps and vacuum systems

The pump nameplate must bear all the all the mandatory information required by the applicable directives (Machinery Directive and ATEX Directive if requested). The appearance and arrangement of the markings on the nameplate may differ depending on the type of pump and the recipient of the pump. Or for some branches of Pompetravaini customized executions are provided. The minimum information required by the regulations remains present in the various possible configurations.
The vacuum system packages are provided with a single nameplate that identify them as an assembly of pump, or pumps, with vessel and accessories. The system nameplate is applied on the body of the vacuum pump (or on the pumps if the system has more than one) and the serial number is unique for the whole system.

For Pompetravaini everything that is supplied as a vacuum package, identified by the serial number on the nameplate and for the bill of material associated to the serial number, it is integral part of the package and therefore included in the EC Declaration of Conformity and also ATEX Declaration of Conformity if required by the Order Confirmation.

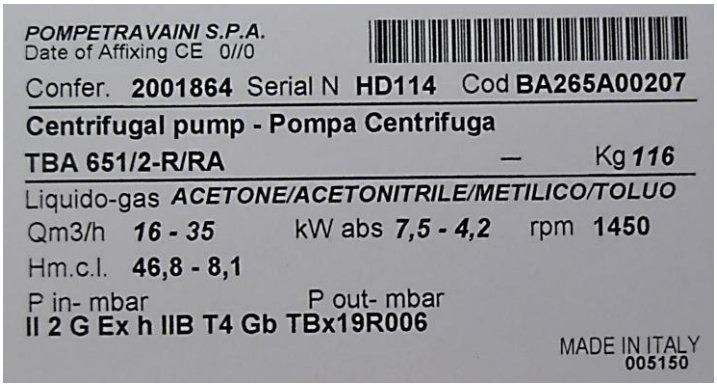


Pompetravaini nameplate shows:

- Name of the manufacturer and address: *Pompetravaini spa*
- Pump type, es.: *Centrifugal pump- Pompa centrifuga*
- Model, es.: *TCH 40-125/1-R/A3*
- Serial number es.: *HG533*
- Year (of production), es.: *2020*
- Number of Item (of the customer), es.: *459.25*
- Turn by minute/rpm, es.: *2900*
- Weight, kg (or lb), es.: *160*
- Pumped fluid, liquid or gas, es.: *Water and glycol*
- Absorbed power, kW abs (or Hp abs), es.: *2,2*
- Requested flow, Q, m3/h (or gpm): *24*
- Pump head, m.c.l. (or Psi), es.: *18*
- ATEX markings (when applicable), es.: *II 3 G Ex h IIB T3 Gc*
- Second line of ATEX markings (when applicable), es.: *II 3 D Ex h IIIB T150°C Dc*

The lasts are the ATEX markings, that begin with a string of characters identifying the level of protection of the pump. The first row is the ATEX marking that refer to a use in a Zone classified for Gas. The second row is the ATEX marking that refer to a use in a Zone classified for Dust.
There could be another string, for example for the Technical File 8TCx19R006) if necessary.
There are also symbols identifying some particularities of the pumps and systems.
The EC symbol CE identify a product subject to the Machinery Directive 2006/42/CE.
The trash bin symbol identify a product subject to the WEEE Directive 2012/19/EU
The symbol EX identify a pump that is also subject to the ATEX Directive 2014/34/EU

Markings on Service Card of pumps and vacuum systems



The Service Card tag applied on the Declaration of Conformity of the pump or vacuum system shows:

La Service Card applicata sulle Dichiarazioni di Conformità della pompa o dell'impianto riporta:

- Name of the manufacturer and address: *Pompetravaini spa*
- Issue date of the Service Card, es.: *01/04/2020*
- Barcode identifying the production order
- Confirmation of Order number, es.: *2001864*
- Serial number es.: HD*114*

- Pump code, es.: *BA265A00207*
- Pump type, es.: *Centrifugal pump - Pompa centrifuga*
- Model, es.: *TBA 651/2-R/RA*
- Weight, kg (or lb), es.: *116*
- Pumped fluid, liquid or gas, es.: *Acetone*
- Portata richiesta, Q, m3/h (or gpm): *16*
- Potenza assorbita, kW (or Hp), es.: *7,5*
- Turn by minute/rpm, es.: *1450*
- Pump head, for centrifugal pumps, m.c.l. (or Psi), es.: *46,8*
- Suction pressure, for vacuum pumps, P in mbar (or Psia), or discharge P out – mbar(or Psi), for vacuum pumps
- ATEX markings (when applicable), es.: *II 2 G Ex h IIB T4 Gb TBx19R006*

The Service Card bears all the information of the pump nameplate and still others more as complement.
For the management system of Pompetravaini, starting with the serial number of the pump or vacuum system it is possible to uniquely identify the product code and its bill of material.
This allows to associate everything provided with the order confirmation sent to the customer.
The code shown on the Service Card includes the pump as the main element, but also the electric motor, vessel or other equipment and instruments included in the supply and included in the bill of material corresponding to the code.
On the Service Card are not marked the same symbols of the nameplate because it is requested by the norms and to have more space for other information.

The EC Declaration of Conformity on which the Service Card is applied, such as the declaration of conformity to the ATEX Directive, they are thus inclusive of everything that is part of the bill of materials associated with the specific code.
Pompetravaini has taken care of assessing that all other equipment and accessories supplied and included in the bill of material are compliant with CE and ATEX requirements and guarantee a degree of protection equal to or higher than that of the pump they are coupled to.
Each device, instrument or accessory has been selected and assembled by Pompetravaini according to the manufacturer's instructions and so as not to compromise its certifications which are provided together with the Pompetravaini documentation.
In the case of pump assemblies coupled with other accessories subject to the ATEX Directive 2013/34 / EU, all the certifications of the individual components issued by their manufacturer remain valid, Pompetravaini has brought everything together in a functional whole.

An example od nameplate for a vacuum system:

- Name of the manufacturer and address: *Pompetravaini spa*
- Pump type, es.: *Vacuum System*
- Model, es.: *HYS 3 2) TRVB 40-110/1C-M/A3*
- Serial number es.: *HD580*
- Year (of production), es.: *2020*
- Number of Item (of the customer), es.: ---
- Turn by minute/rpm, es.: *1450*
- Weight, kg (or lb), es.: *780*
- Pumped fluid, liquid or gas, es.: *Air + Ethanol + Ethilacetate*
- Absorbed power, kW (or Hp) abs, es.: ---
- Requested power, Q, m3/h (or gpm): *43*
- Pump head, m.c.l.(or Psi), es.: *200*
- ATEX markings (when applicable), es.: *II 1/2 G Ex h IIB T4 Ga/Gb PTB06ATEX4001X – 1370*

In this case the ATEX marking is for a vacuum system intended for an application with an atmosphere classified as Zone 0 inside and Zone 1 outside, therefore it includes the code of the certificate received from the Notified Body (*PTB06ATEX4001X*) and the code of the Notified Body that deals with production surveillance (*1370*).

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/ 158°F or lower than -10°C/14°F.
- 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.
Take care of their possible disposal according to the laws into force and to a safe local environment management.

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.

4 - PUMP OUTLINES

The machines are designed for a service life of 20 years, excluding wear parts (such as wear rings, mechanical seals, shaft sleeves, gasket, O-rings) and bearings. After this period, the machine should be dismantled. The expected service life depends on the working conditions: service or duty load. Misoperation or improper maintenance can result in a machine failing to meet these criteria. Maintenance indications are specified in the specific paragraphs for each component. 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/8805 gpm, Max. pressure 16 bar/232Psi - 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/440gpm, Max. pressure 10 bar/145Psi - 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/1100gpm, Max. pressure 7 bar/101Psi - 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/1541gpm, Max. pressure 10 bar/145Psi - 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/2541gpm, Max. pressure 4 bar/58Psi - 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/9246gpm, Max. pressure 4 bar/58Psi - Flanges PN 10
TCN	Single stage centrifugal pumps for clean and dirty liquids - Design with closed impeller - Capacity to 2000 m^3/h/8805gpm, Max. pressure 6 bar/87Psi - 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/1320gpm, Max. pressure 16 bar/232Psi - 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/136gpm, Max. pressure 7 bar/101Psi - Flanges PN 40
TBH	Self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m^3/h/308gpm, Max. pressure 35 bar/507Psi - Flanges PN 40
TBK	Magnetic drive self-priming multistage centrifugal pumps with single lateral channel - Capacity to 70 m^3/h/308gpm, Max. pressure 35 bar/507Psi - Flanges PN 40
TBA	Self-priming multistage centrifugal pumps with centrifugal pre-stage with very low NPSH requirements. Capacity to 35 m^3/h/154gpm, Max. pressure 35 bar/507Psi - 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/154gpm, Max. pressure 35 bar/507Psi - Flanges PN 40
TMA	Multistage centrifugal pumps for clean liquids, medium and high pressures - Capacity to 45 m^3/h/198gpm, Max. pressure 40 bar/580Psi - 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 maximum discharge pressure developed by the pump at the discharge connection.

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
xx**5** ⇨ 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			
Shaft					Incoloy 825
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				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	Cast iron		
Impeller		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 according to the laws into force and to a safe environment management. The packaging could consist of the following materials: wood **FOR50** and/or cardboard **PAP20** and/or cellophane **LDPE 04** and/or stretch wrap **PE-LD 04** and/or polystyrene **PS06** and/or packing strap **PET1**, **PP05**. (D.l.gs. 116/2020 and Decision 97/129/CE).

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/41°F 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/41°F 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.

LONG TERM STORAGE INSPECTION

Even if the machine is properly stored, as described in the instructions above, in case of long term storage the following instructions must be taken into account.

After a storage period of 6 months the lubricant should be replaced completely.

In case of a storage period longer than 12 months, the machine shall be carefully checked and inspected before installation. Following actions should be considered particularly:

- complete replacement of lubricants
- inspection of the bearings, they should be cleaned if necessary
- inspection of O-rings and gaskets (it is recommended to replace them)
- inspection of mechanical seal integrity (replace if necessary).

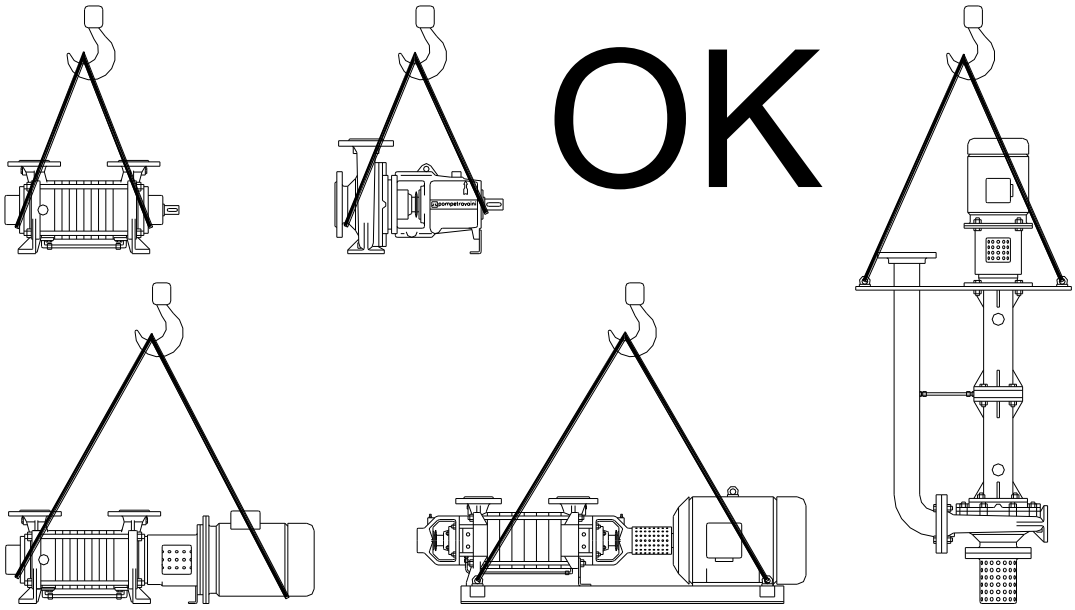


Fig. 1

Fig. 2

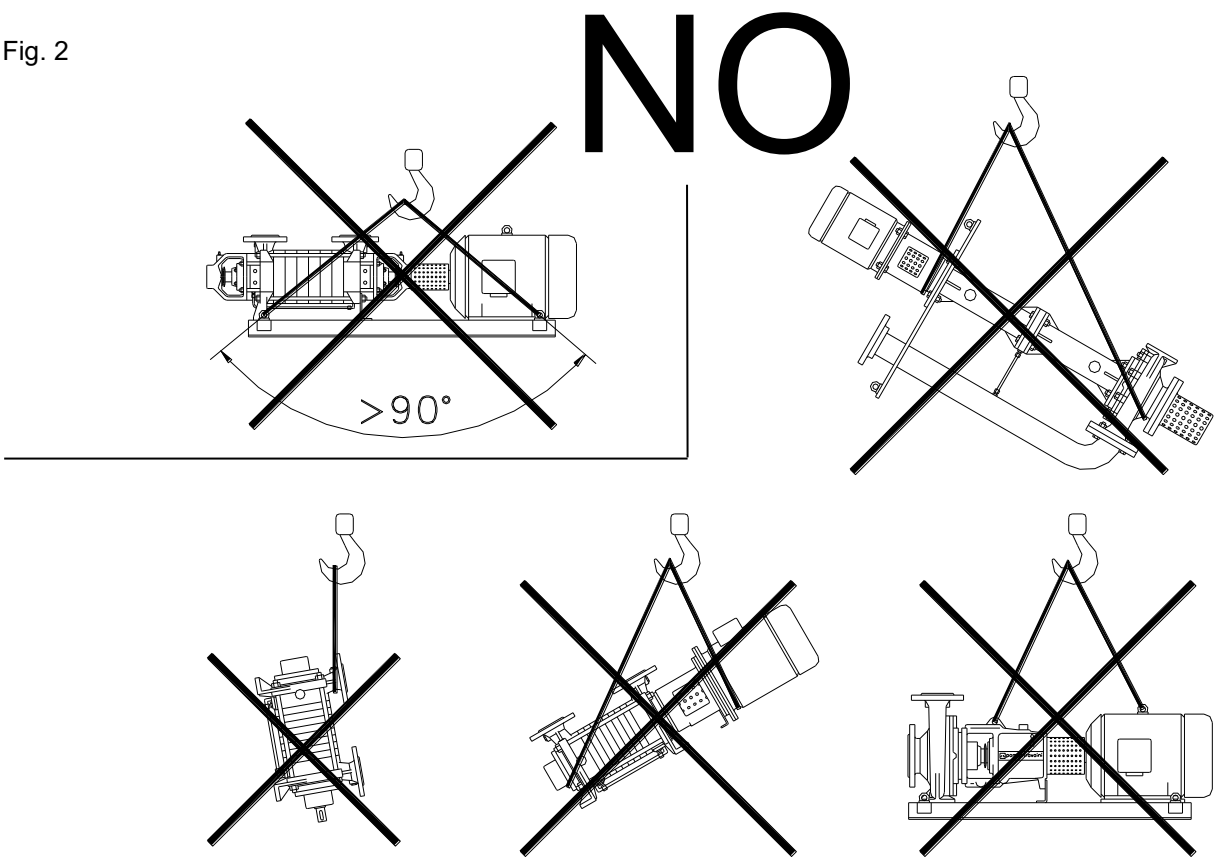


Fig. 3

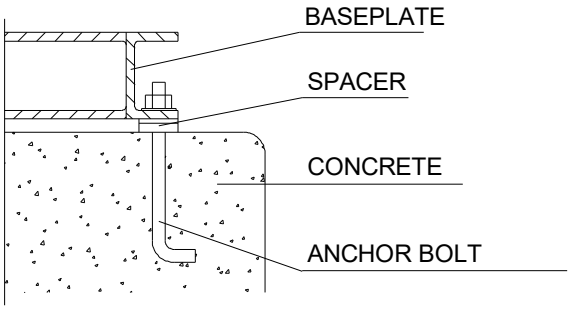
7 - INSTALLATION INSTRUCTIONS

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).



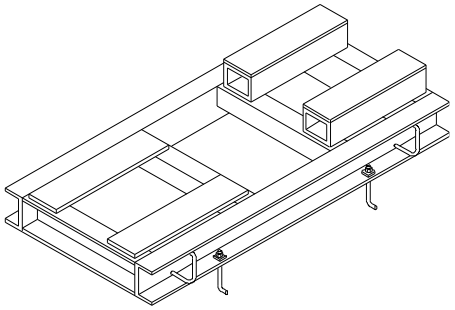


Fig. 4

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/s6,6ft/s and in the discharge piping should be less than 3 m/s/9,8ft/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.

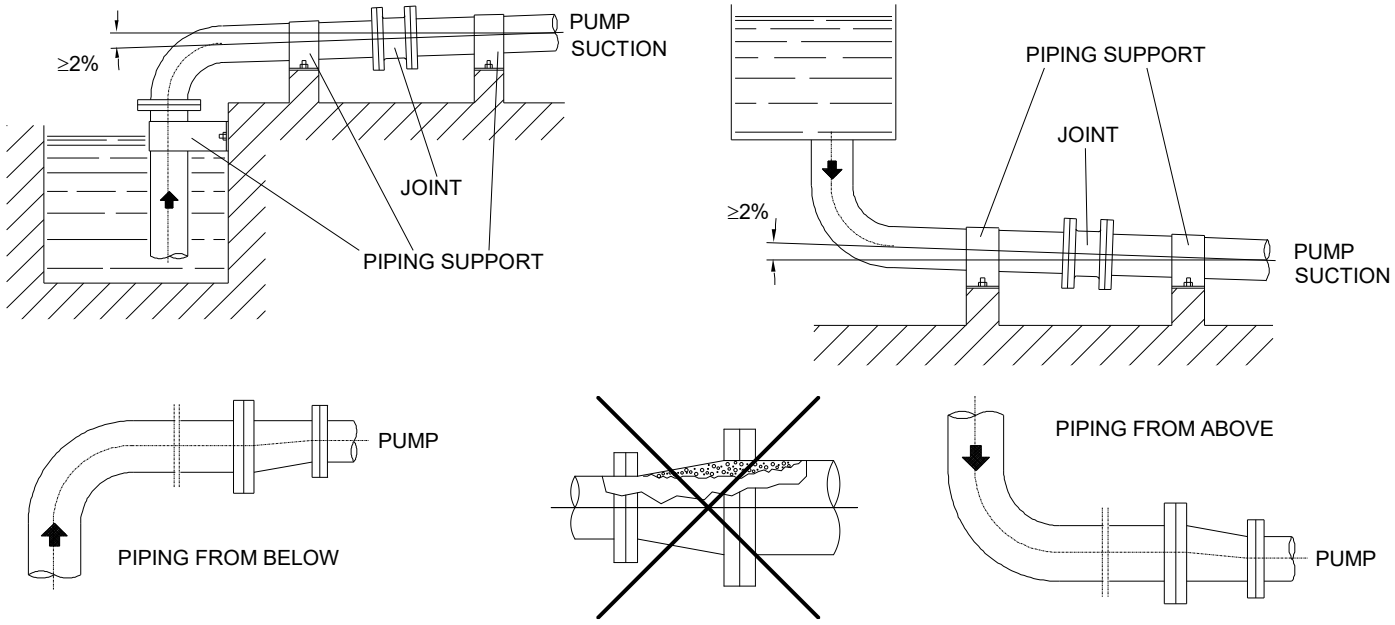


Fig. 5

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

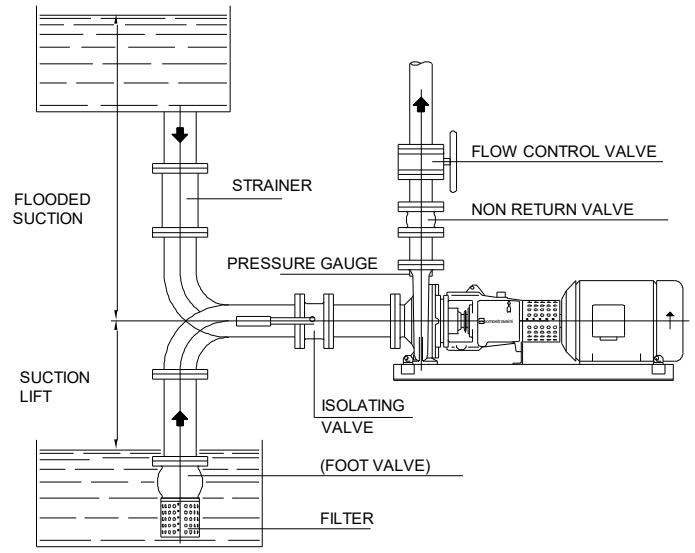
CAUTION!
Possible contact with hazardous media and hazardous substances, cold or warm. Operate only provided with apposite protective devices.

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.

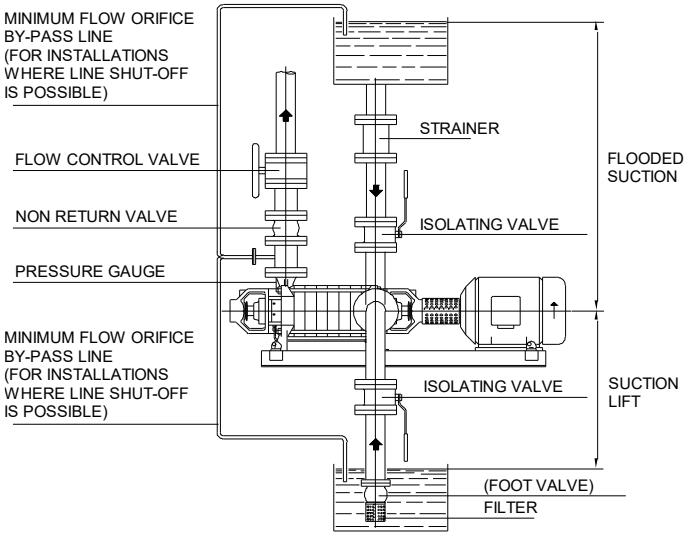
7.2.4 - Pressure testing

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

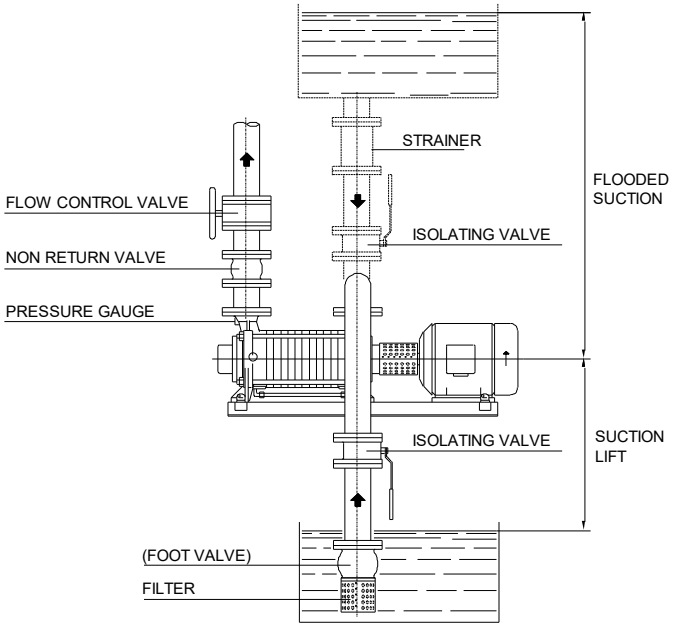
When the installation has been completed it is necessary to test the piping for both static pressure and vacuum.
Testing should be carried out in accordance to the applicable standards for the piping function and the operating pressures.



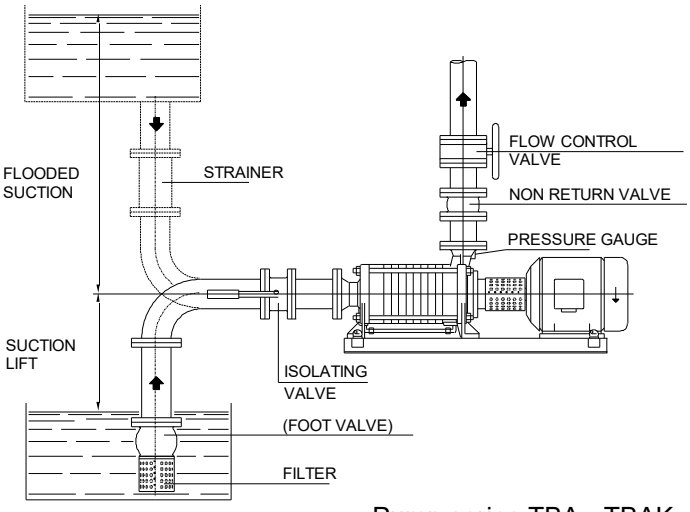
Pump series MC... - TC...- MILLS



Pumps series TMA

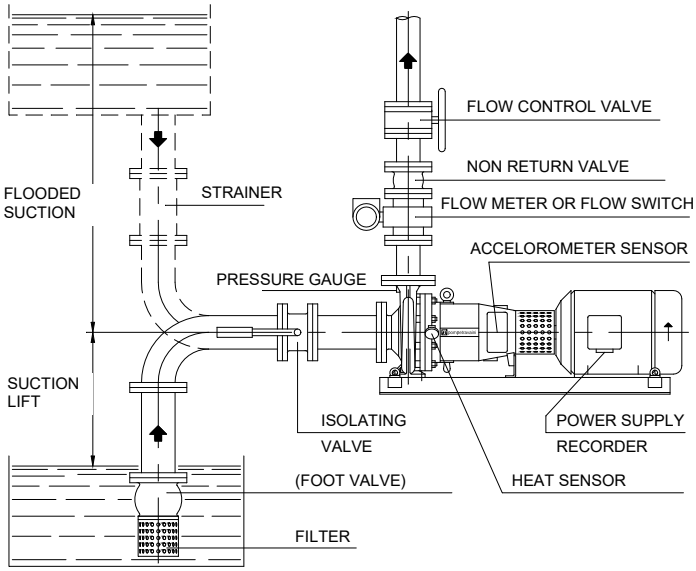


Pump series AT - TBH - TBK

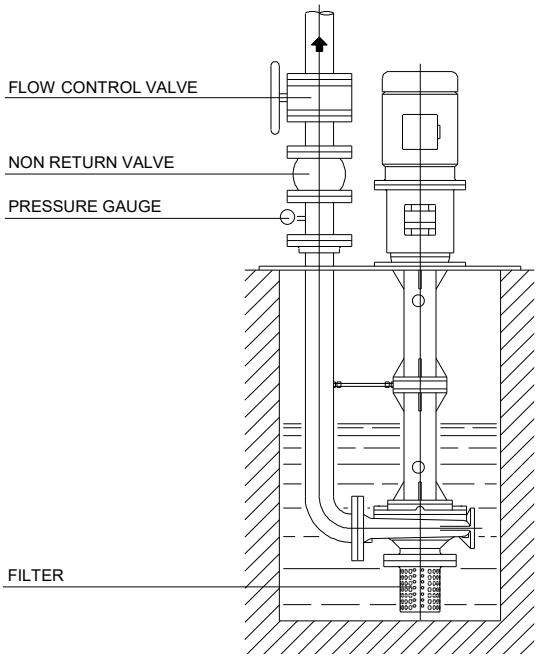


Pump series TBA - TBAK

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/0.314in. 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).

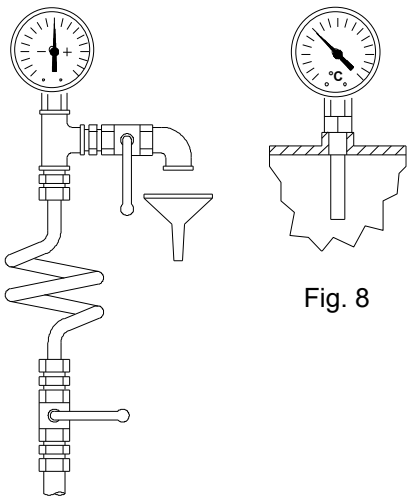


Fig. 8

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).

Only for pumps TCD/2-SP series is necessary to arrange an external flushing for the mechanical seals (Quench-like). Directly or with a seal tank by means of a vegetable or mineral oil compatible with the pumped oil (see fig. 10A and 12). This is required to guarantee a proper lubrication and cooling of the mechanical seal and Viton radial seal rings, to avoid the possible leakage towards outside and the intake of air into the process. Also to prevent the formation of air bubbles, preventing a proper lubrication, which can lead to the damaging the sealing, in case of high temperature, could even lead to dangerous combustion.

Fig. 7

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.

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.

l) It is recommended to start the magnetic pumps and all other pumps with more than 4 KW/5.4Hp 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.

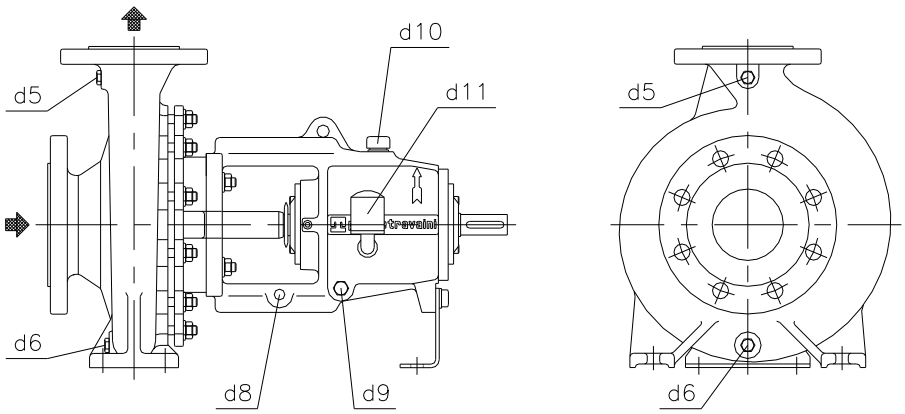
LEGEND for figures 9-10-11-12

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 - inlet oil flushing from the tank (only for TCD/2-SP)
d17 Threaded connection - outlet oil flushing to the 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

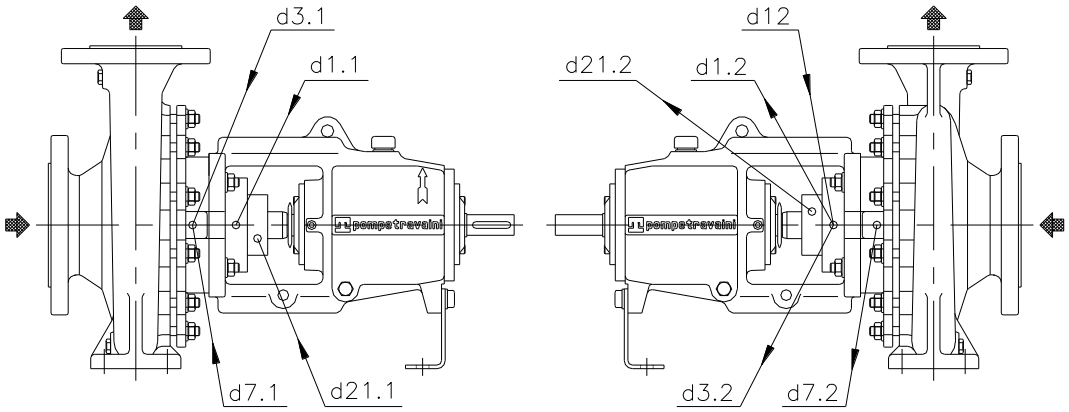
Plugged connection = Plug to be removed in case of use
Threaded connection = Before connecting remove the plastic protection plug

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

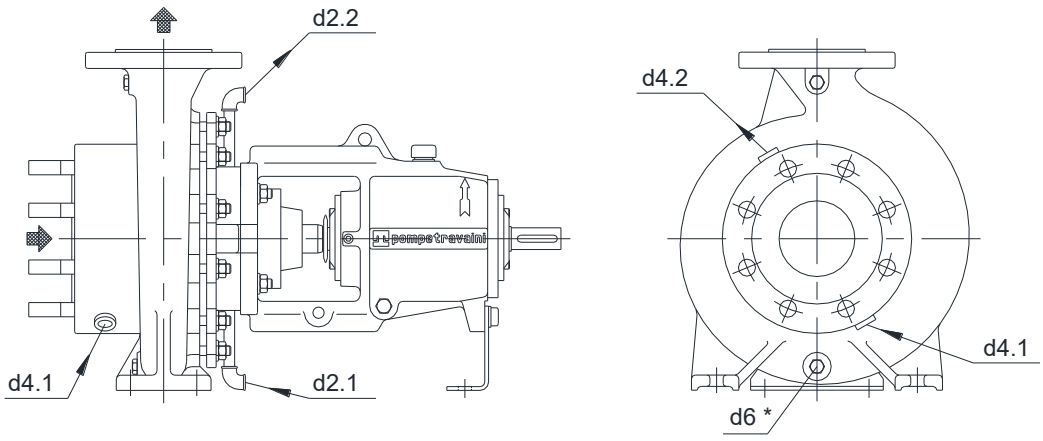
Fig. 9 - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



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

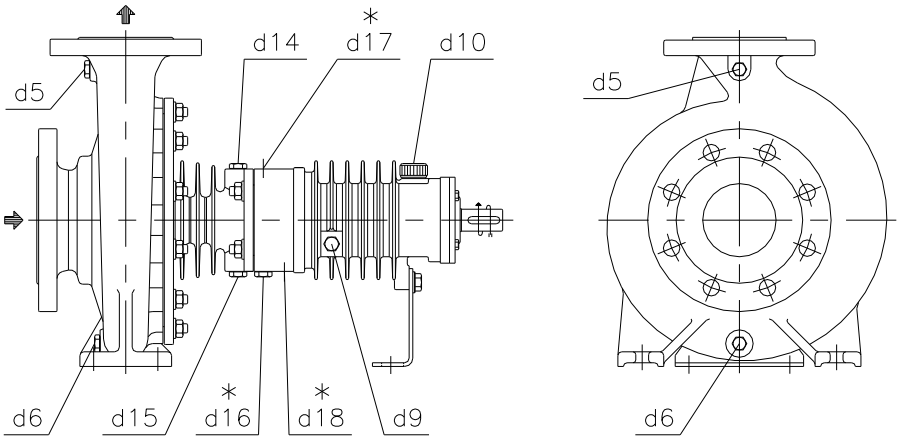


Pumps series MC... - TC...
Connections for designs /C - /R - /RR - /R2 - /B

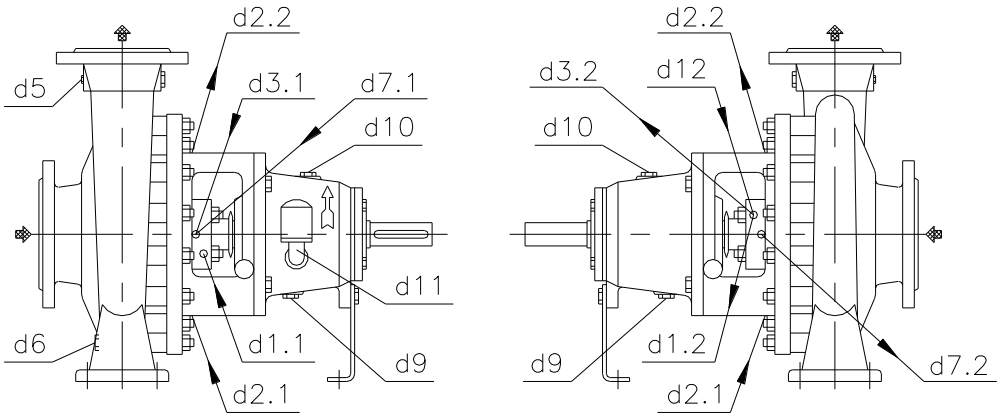


Pumps series MC... - TC...
Connections for designs /T - /U2
(* = Where provided only)

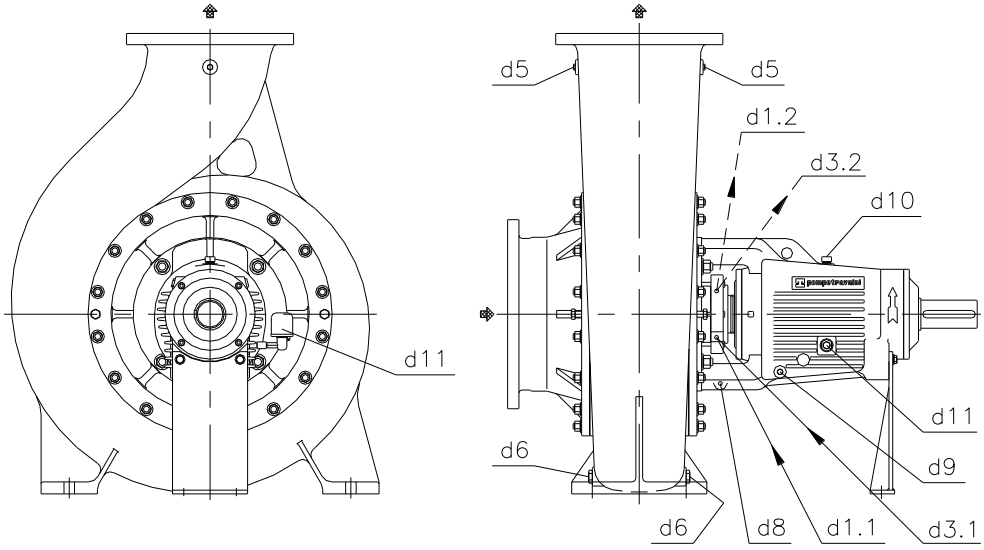
Fig. 10A - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



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

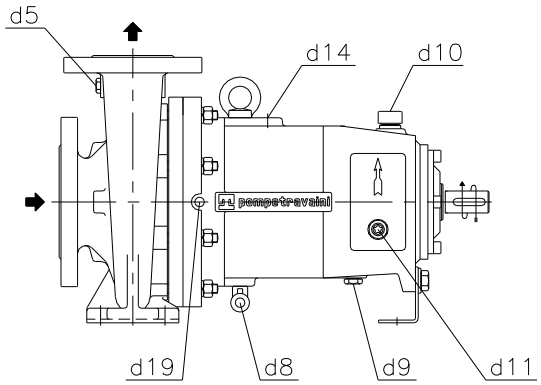


Pumps series MCU-CH n.s. group 3 and 4
Standard hook-ups and connections

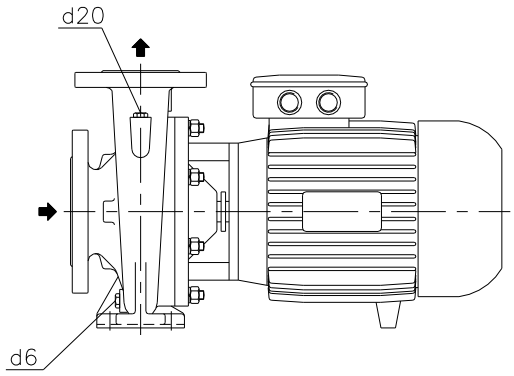


Pumps series TCH and TCN group 5
Standard hook-ups and connections for Double back to back mechanical Seals

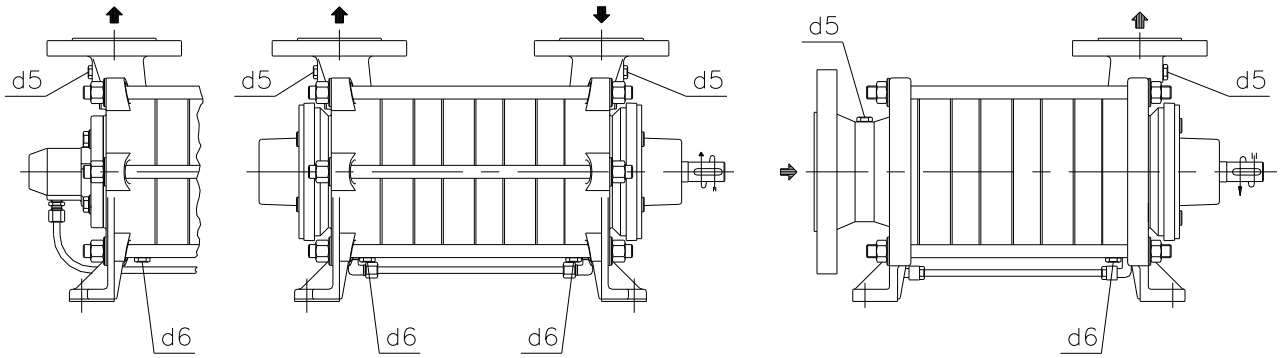
Fig. 10B - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



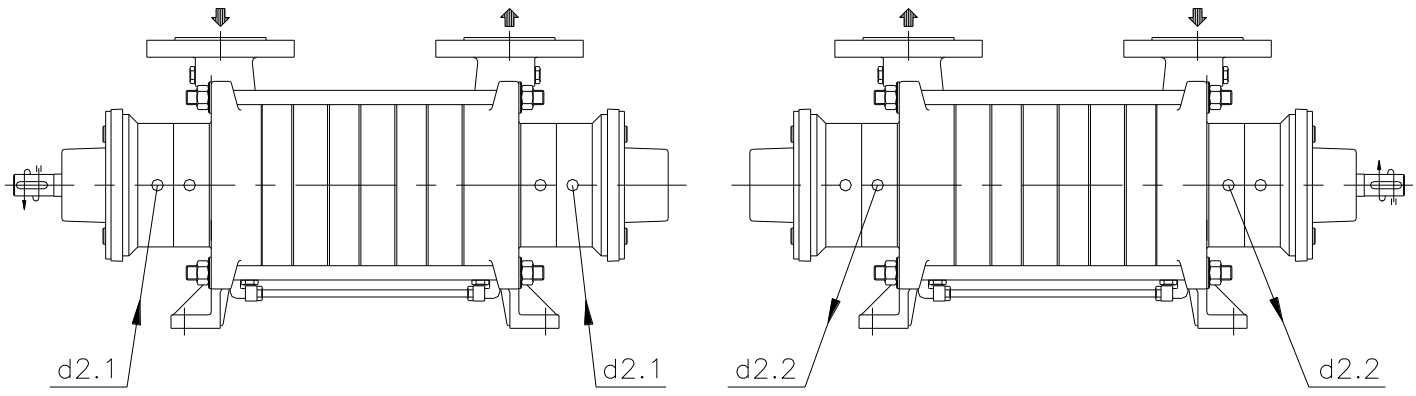
Pump series TCK
Standard connections and hook-ups
NOTE: d19 = on both side for gr. 2



Pump series MCM
Standard connections and hook-ups

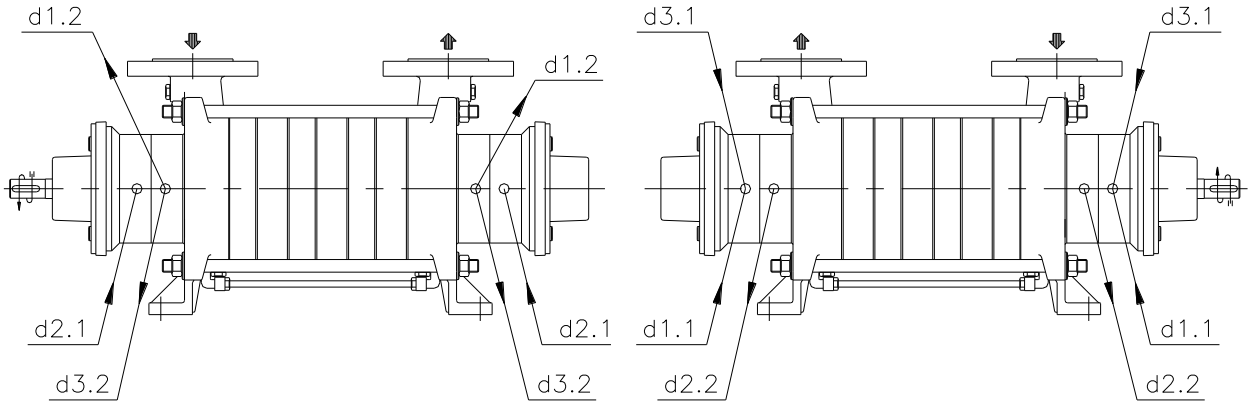


Pumps series TBH/C - TBH/KC - AT/KC - TBA/C
Standard hook-ups and connections

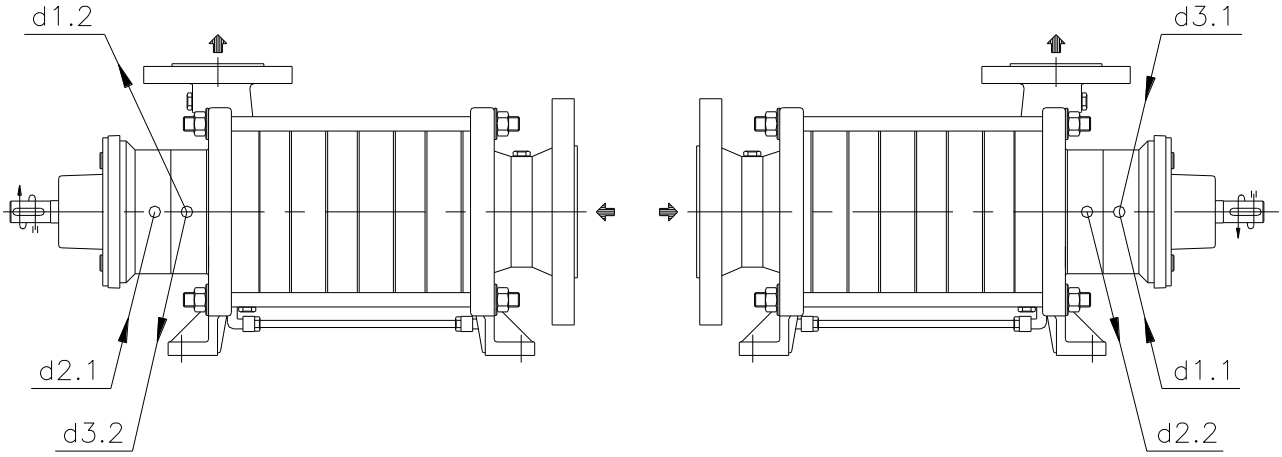


Pumps series TBH/CT - AT/CT
Connections for cooling or heating

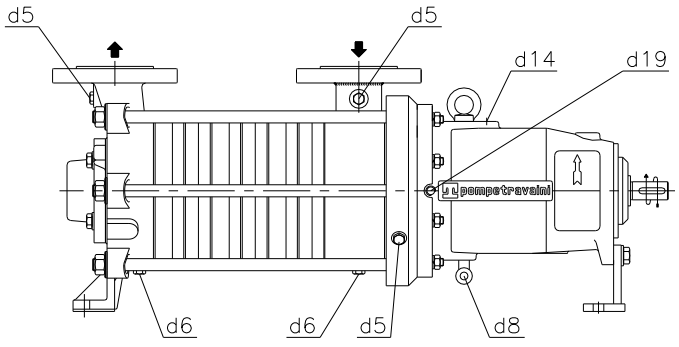
Fig. 11A - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



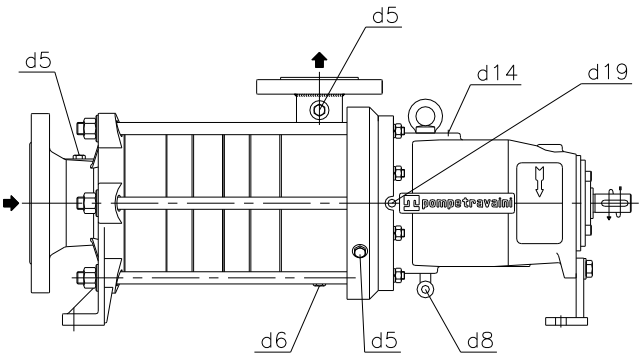
Pumps series TBH/KC-2T - AT/KC-2T
Connections for mechanical seals flushing, cooling or heating



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

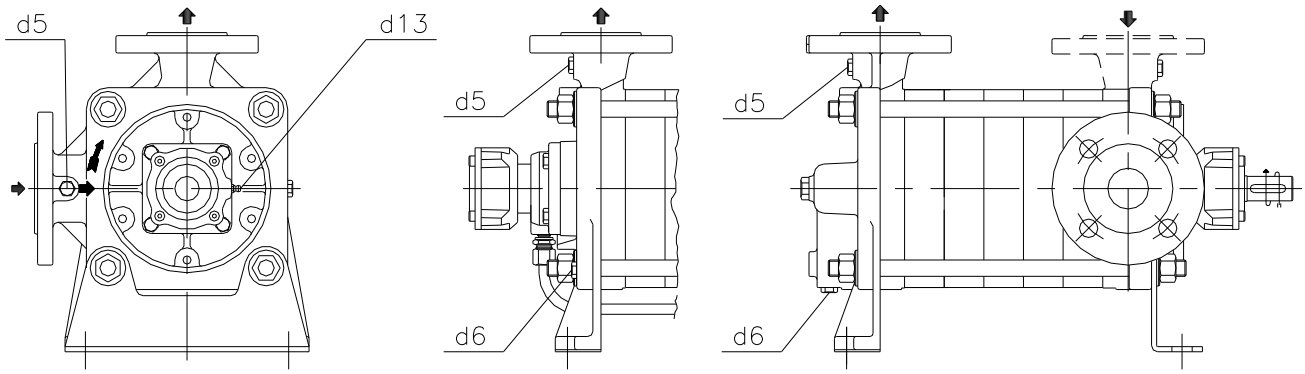


Pump series TBK
Standard connections and hook-ups

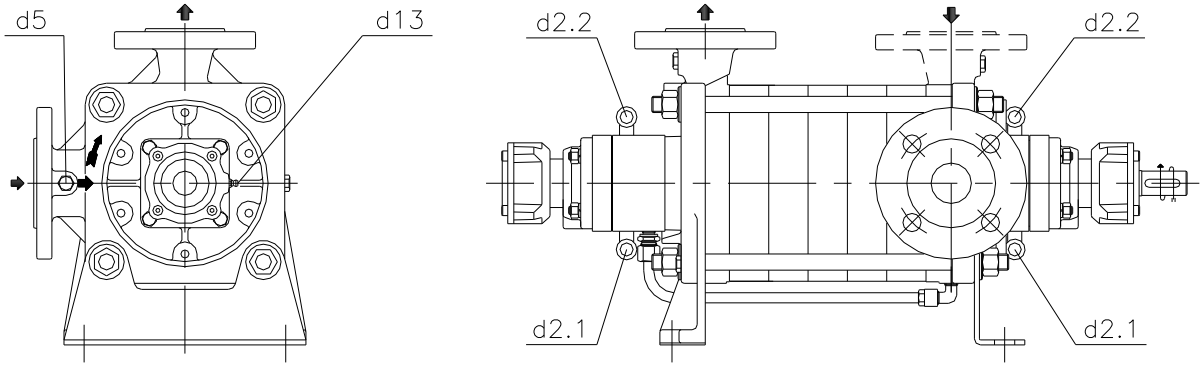


Pump series TBAK
Standard connections and hook-ups

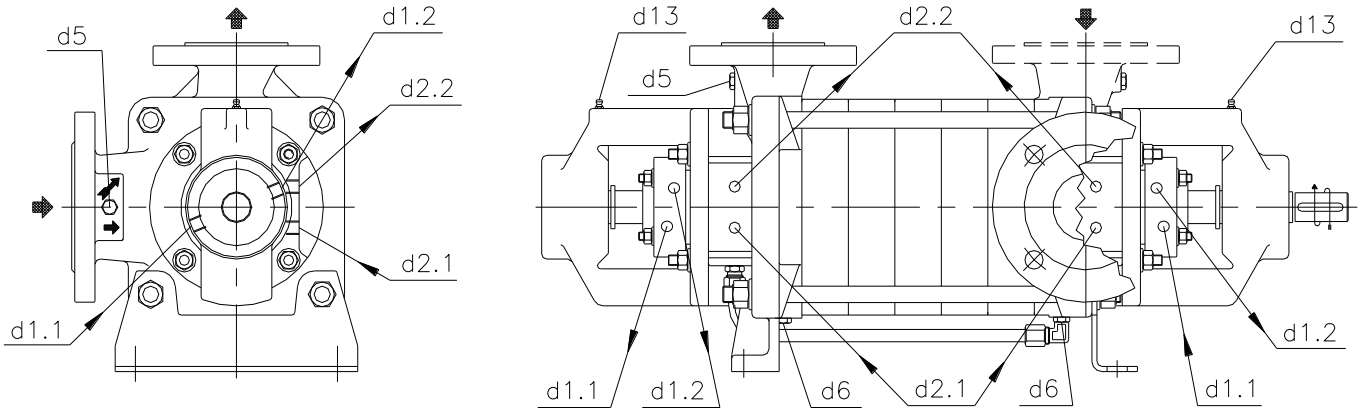
Fig. 11B - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



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

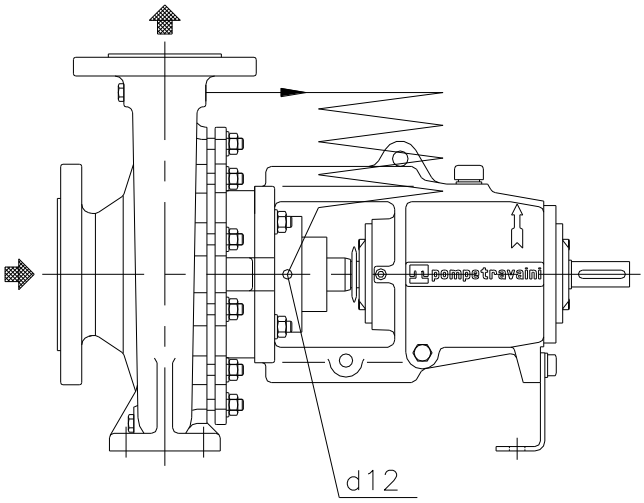


Pumps series TMA 31 and 32/T
Connections for cooling or heating

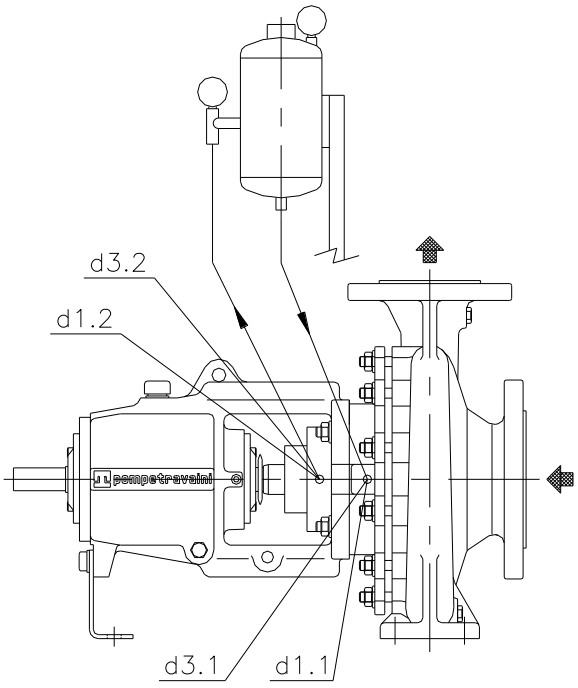


Pumps series TMA 40 and 50/B - /R - /R2
Connections for mechanical seals flushing, cooling or heating

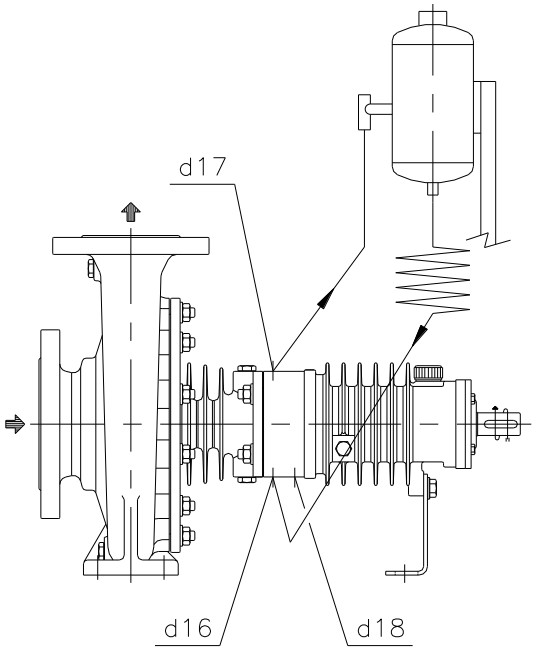
Fig. 12 - **CONNECTIONS AND HOOK-UPS FOR FLUSHING**



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

8 - MOUNTING AND ALIGNMENT INSTRUCTIONS

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, shoes, 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/302°F (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.

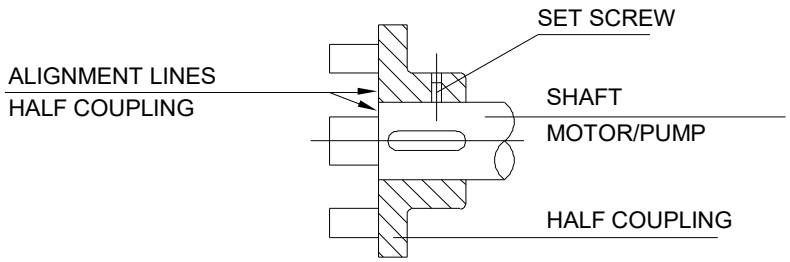


Fig. 13

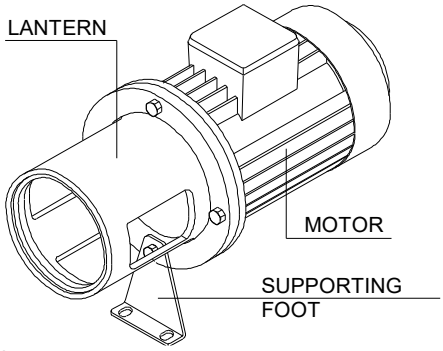


Fig. 14

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.

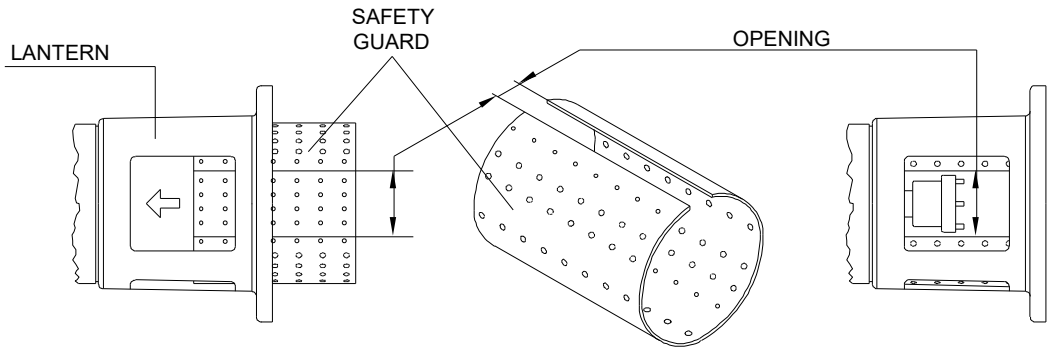


Fig. 15 - PREPARATION TO ASSEMBLY ON MONOBLOCK DESIGN

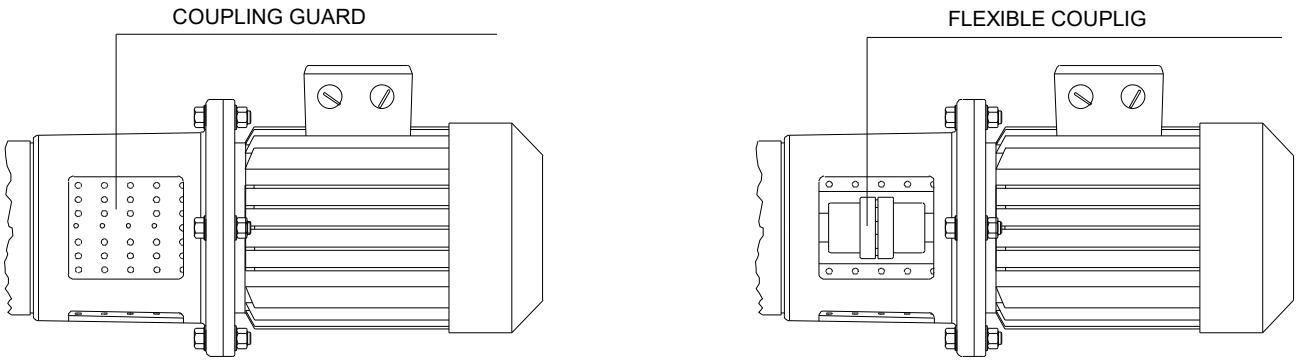


Fig. 16 - CHECKING ALIGNMENT ON MONOBLOCK DESIGN

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.

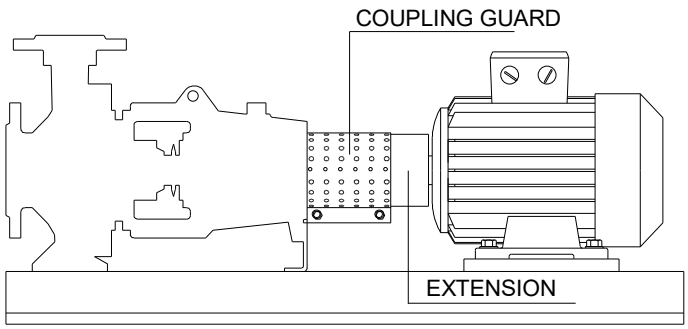


Fig. 17 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

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.

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).

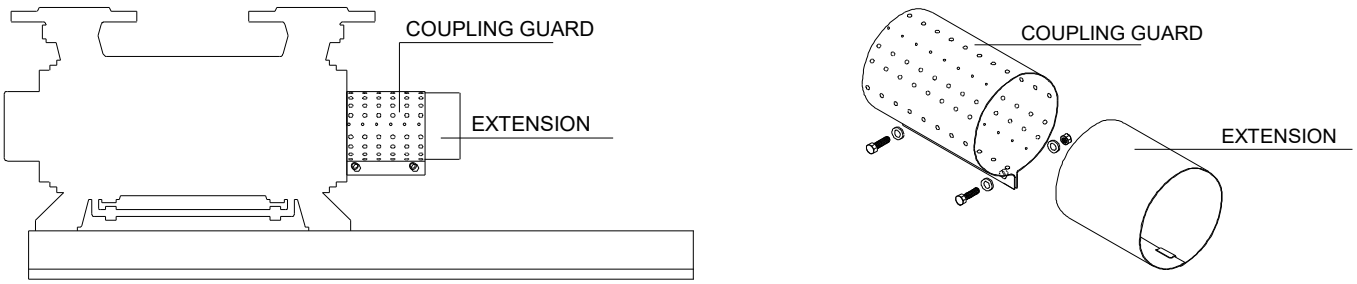


Fig. 18 - MOUNTING THE UNITS ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2 mm/0.078in. 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).

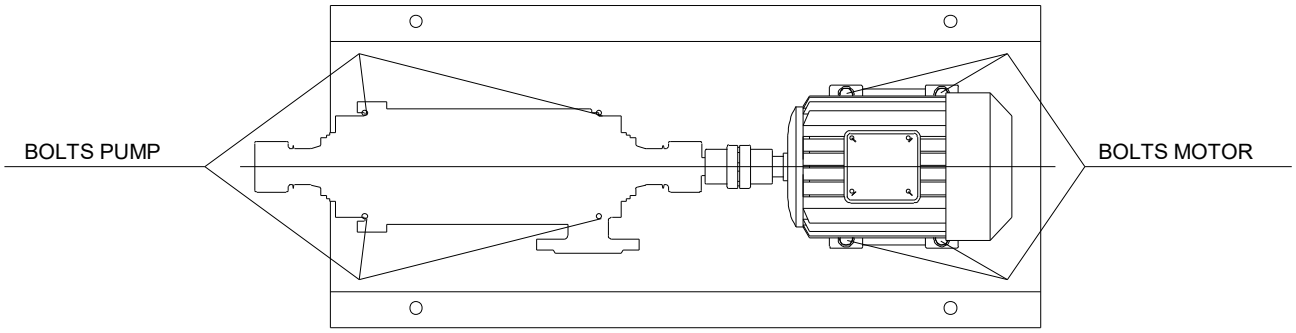


Fig. 19

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).

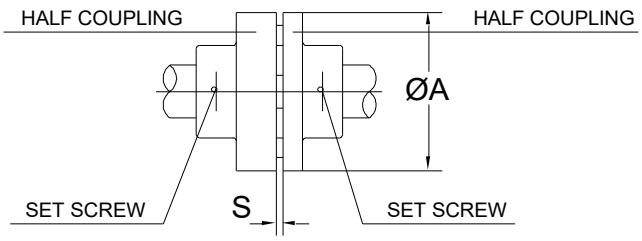


Fig. 20

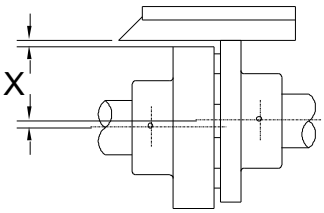


Fig. 21

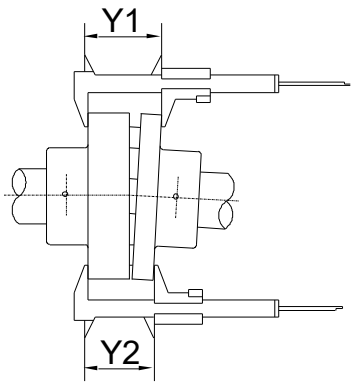


Fig. 22

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” (Y1-Y2) should no 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”		GAP “S”		PARALLEL "X"		ANGULAR "Y"	
mm	in	mm	in	mm	in	mm	in
60 ÷ 80	2.36÷3.15	2 ÷ 2,5	0.08÷0.1	0,10	0.004	0,20	0.008
100 ÷ 130	3.94÷5.12	3 ÷ 3,5	0.12÷0.14	0,15	0.006	0,25	0.01
150 ÷ 260	5.90÷10.24	3 ÷ 3,5	0.12÷0.14	0,15	0.006	0,30	0.012
290	11.41	4 ÷ 5	0.16÷0.2	0,30	0.012	0,30	0.012
330	13	5 ÷ 7	0.2÷0.27	0,30	0.012	0,30	0.012

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).

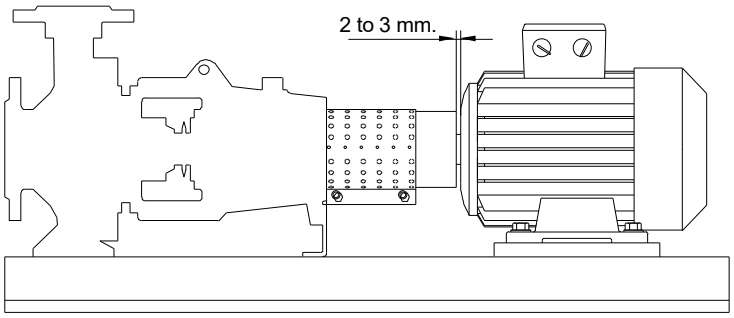


Fig. 23

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).

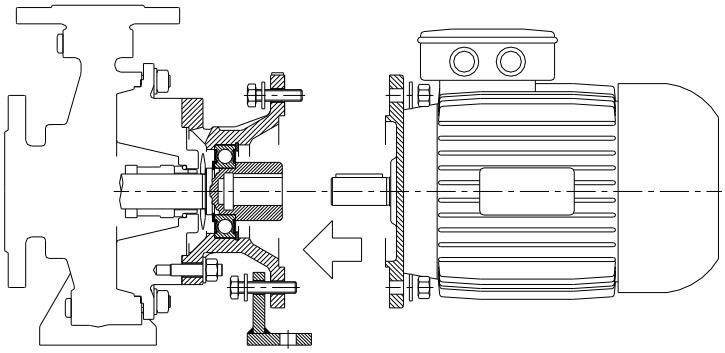


Fig. 23A

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/5.4Hp 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.
When the pump is coupled on baseframe carry out the ground connection also for the baseframe on the preposed position with screw or through hole marked by the ground connection symbol.

Remove a portion of the paint on the connection point to ensure electrical continuity between the base and the earthing cable.
Pump series TCK, TBK and TBAK (and all motors over 4 kW/5.4Hp) 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/185°F.

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).

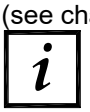
11.3 - SHUT DOWN
DANGER!

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(37.4 to 41°F) 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.
Rolling bearings basic rated life is minimum 17500 hours, when operated within the allowable working condition. Higher values can be reached with special designed bearings.

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(-22 to +284°F).

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.

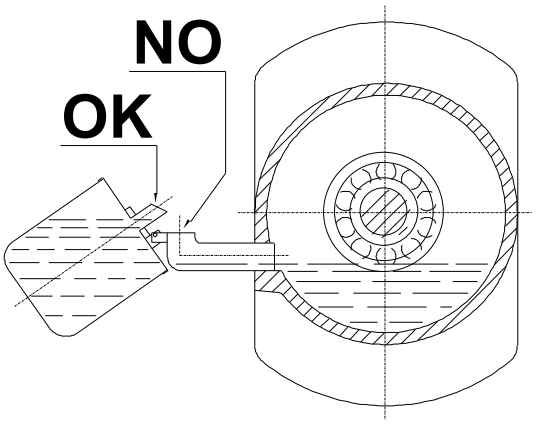


Fig. 24

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/140°F, 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/185°F 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/104°F 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 46 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.

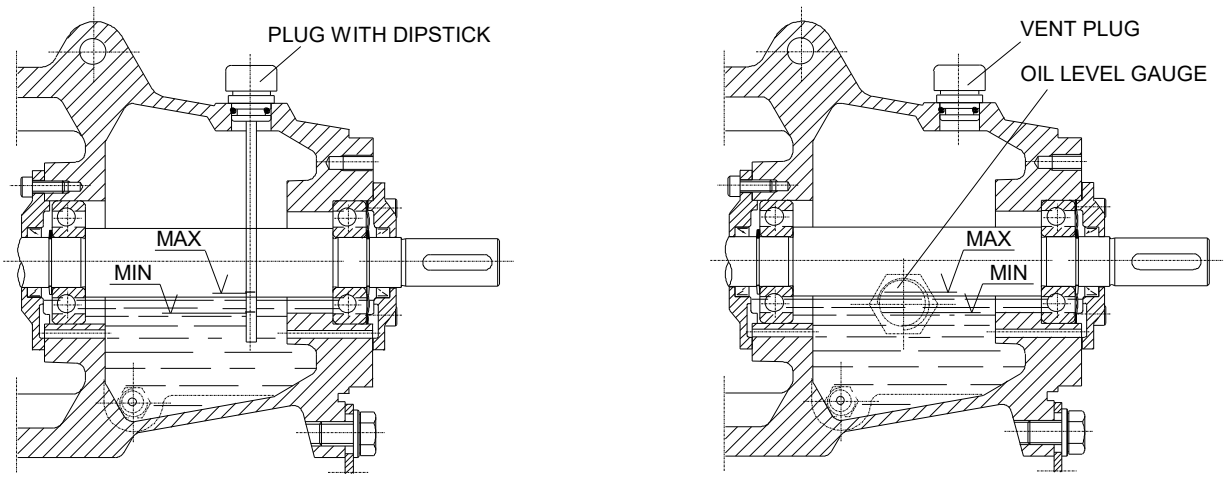


Fig. 25

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.

The packing sealing system requires correct adjustment to guarantee its regular operation, dispersing the friction heat developed through constant lubrication, provided from an external source or directly from the pumped liquid, which leads to a regular dripping of liquid outside.
The extent of the dripping depends on several factors including: the size of the pump, the rotation speed, the pressure existing in the stuffing box, the type of liquid pumped and the packing seal configuration.

Fig.26a - PACKING (Plan 02)

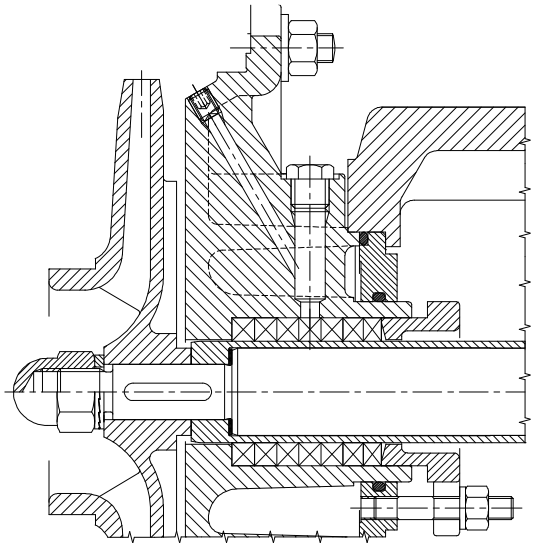


Fig.26b – PACKING WITH INTERNAL FLUSHING (Plan 01)

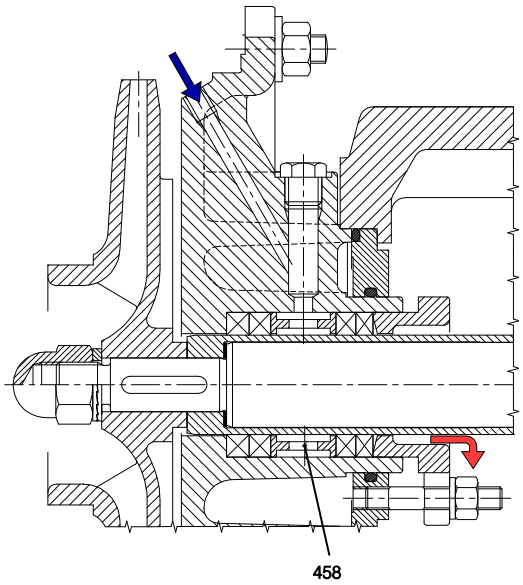


Fig.26c – PACKING WITH EXTERNAL FLUSHING (Plan 32)

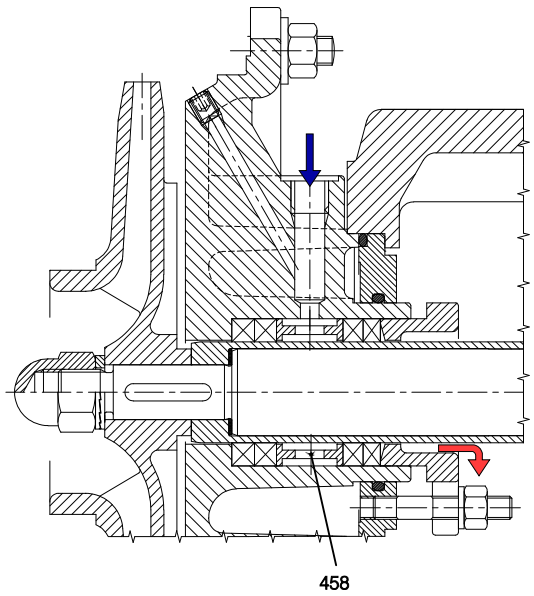
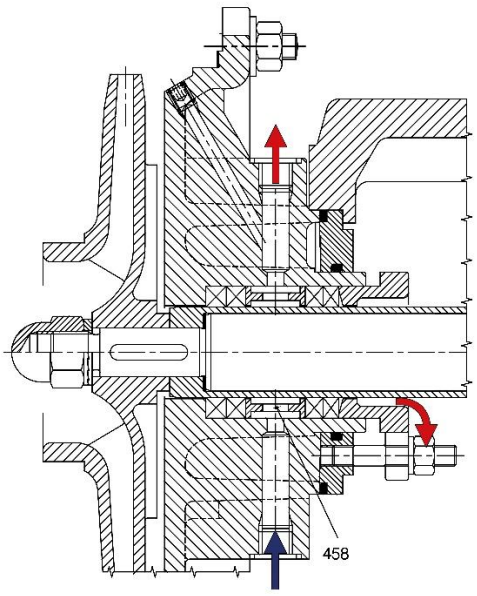


Fig.27d – PACKING WITH EXTERNAL FLUSHING AND WASH (Plan 62)



The configurations of the packing sealing system can be divided into configurations without external flushing (Plan 02 Fig.26a and Plan 01 Fig.26b) and configurations with external flushing (Plan 32 Fig.26c and Plan 62 Fig 26d).

All the adjustment operations described below must be carried out with the PUMP STOPPED, following the safety instructions provided in chapter 2. Check the effectiveness of the adjustments made by restarting the pump.

14.1 - ADJUSTMENT OF PACKING SEALS WITHOUT EXTERNAL FLUSHING

In these configurations, the liquid that dissipates the heat generated by the packing and which will drip outside the pump is the pumped liquid (Fig.26a and 26b). No external liquid supplies are required.
Depending on the type of pump and construction, the fluid that passes through the packing can be the one that enters directly into the stuffing box pushed by the pressure present at its inlet (typical condition for TMA series pumps (type PLAN 02), it can arrive from an internal passage to the pump (type PLAN 01), where the available pressure is higher, or it can be taken from the pump delivery (type PLAN 11) and conveyed to an intermediate position of the packing on the barrier ring (VDMA 458).
When starting the pump for the first time, keep the stuffing box loose enough by acting on the nuts of the stuffing box studs, so as to allow a strong drip to escape. After having verified the extent of the leak, the nuts of the stuffing box studs must be progressively tightened until the leak is reduced to a continuous and controlled drip. When you turn on the pump after an adjustment, wait a few minutes to give the leak time to stabilize and correctly evaluate the adjustment made.
It may take a few hours to bring the operation up to speed (continuous dripping at low temperature). Any increases in losses may require small adjustments in regulation over time. If it is no longer possible to adjust to reduce any increase in losses, the packing seals must be replaced with new ones and the attached "Disassembly and assembly instructions" must be followed for replacing the packing seal rings.
If the pump remains stationary for a few months after initial use, we recommend checking the condition of the packing before turning it on and possibly replacing it with a new one. If the pump is started after more than 24 months, it is advisable to replace the packing rings before starting.
Correct adjustment involves regular dripping outside of approximately 60 drops per minute for a 20 mm diameter shaft which can increase up to 200 drops per minute for a 100 mm diameter shaft. The temperature of the liquid that comes out is an indicator of correct flushing and must be at least ten degrees lower than the boiling temperature of the flushing liquid, however lower than 90°C is recommended. If the temperature of the liquid is high then the dripping is insufficient and must be increased.

14.2 - ADJUSTMENT OF THE PACKING SEALS WITH EXTERNAL FLUSHING

In these configurations the liquid that dissipates the heat generated by the packing is supplied by an external source.
Part of this liquid may enter the pump and mix with the pumped liquid and enter the process: check that it is compatible with your application. A part will drip outside the pump and, with optimal regulation, the leakage of the pumped liquid can be avoided (Fig. 26c e 26d).
The stuffing box chamber is equipped with a connection for external flushing which brings the liquid to an intermediate position of the packing, on the barrier ring (VDMA 458), in case of configuration with flushing there is also an outlet connection for the flushing liquid flushing (Fig. 26d).
Before start-up, the connection for the supply of the flushing liquid and its possible recovery must be set up; a minimum pressure of at least 1 bar, and up to 3 bar, must be guaranteed, higher than that present in the pump suction with a flow rate of a few litres per hour. In the case of an external wash with a washing liquid outlet connection (Fig. 26d) it is recommended to apply a valve to regulate the flow rate and outlet pressure.
When starting for the first time, supply the flushing liquid and keep the stuffing box loose enough by acting on the nuts of the stuffing box studs, so as to allow a significant quantity of liquid to escape.
After having verified the extent of the leak, the nuts of the stuffing box studs must be progressively tightened until the leak is reduced to a continuous and controlled drip. When you turn on the pump after an adjustment, wait a few minutes to give the leak time to stabilize and correctly evaluate the adjustment made.
It may take a few hours to bring the operation up to speed (continuous dripping at low temperature). Any increases in losses may require small adjustments in regulation over time. If it is no longer possible to regulate any increase in leaks, replace the packing seals with new ones and follow the attached "Disassembly and assembly instructions" for replacing the packing seal rings.
If the pump remains stationary for a few months after initial use, we recommend checking the condition of the packing before turning it on and possibly replacing it with a new one. If the pump is started after more than 24 months, it is advisable to replace the packing rings before starting.
Correct adjustment involves regular dripping outside of approximately 60 drops per minute for a 20 mm diameter shaft which can increase up to 200 drops per minute for a 100 mm diameter shaft. The temperature of the liquid that comes out is an indicator of correct flushing and must be at least ten degrees lower than the boiling temperature of the flushing liquid, however lower than 90°C is recommended. If the temperature of the liquid is high then the dripping is insufficient and must be increased.
If there is a wash (Fig. 26d) from the flushing liquid recovery connection, you can check whether there are no unwanted traces of the pumped liquid inside, which are an indication of too low flushing pressure. To avoid this, increase the flushing pressure.

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 (37.4 to 41°F) 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. 0nly 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/2.4in 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/7.3Psi 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 0.3bar/4.35Psi 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.

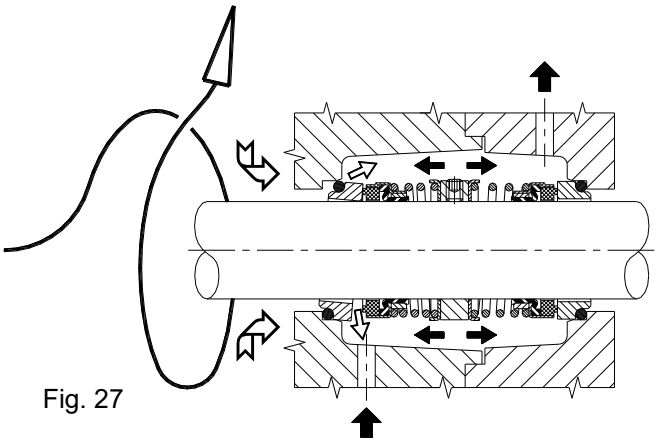


Fig. 27

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 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/194°F. 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.
Mechanical seals are wear parts: the actual mechanical seal life depends on the severity of the duty load.
It is recommended to check the wear of seal faces every 4000 working hours. This is an acceptable normal life span for mechanical seals. Exceeding this life span can lead to losses due to wear and tear and will require seal replacement.
In case a mechanical seal is replaced, the condition of shaft sleeve (if present) must be checked: if the sleeve surface is damaged, or in case of doubt, it is recommended to replace also the shaft sleeve together with the mechanical seals.

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/4.35Psi over the atmospheric pressure and temperature can be max 60°C/140°F.

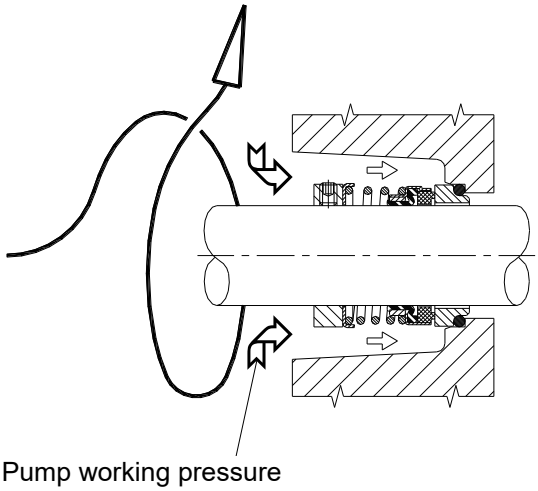


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

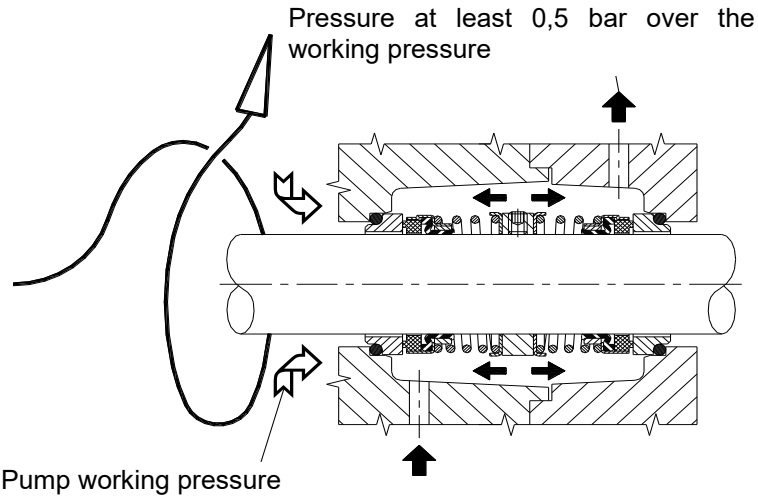
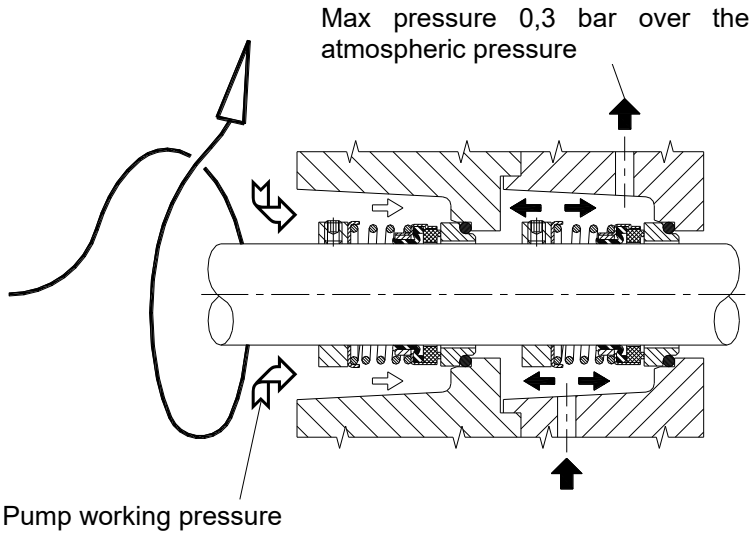


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54



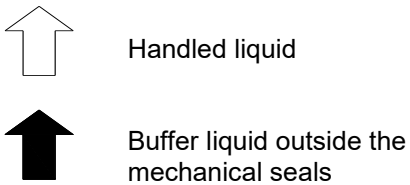


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

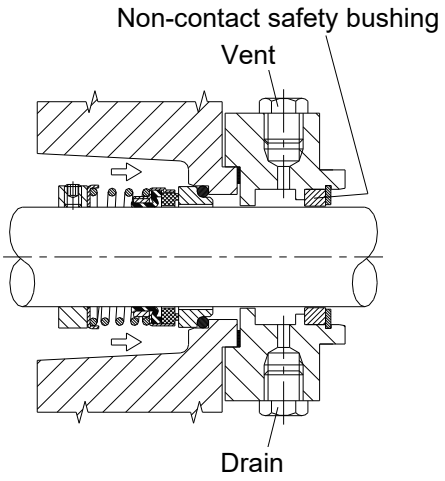


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

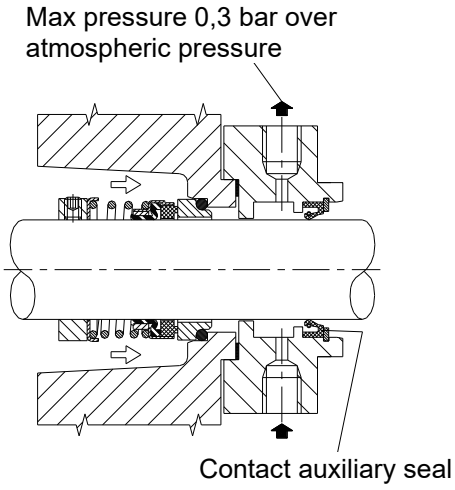


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

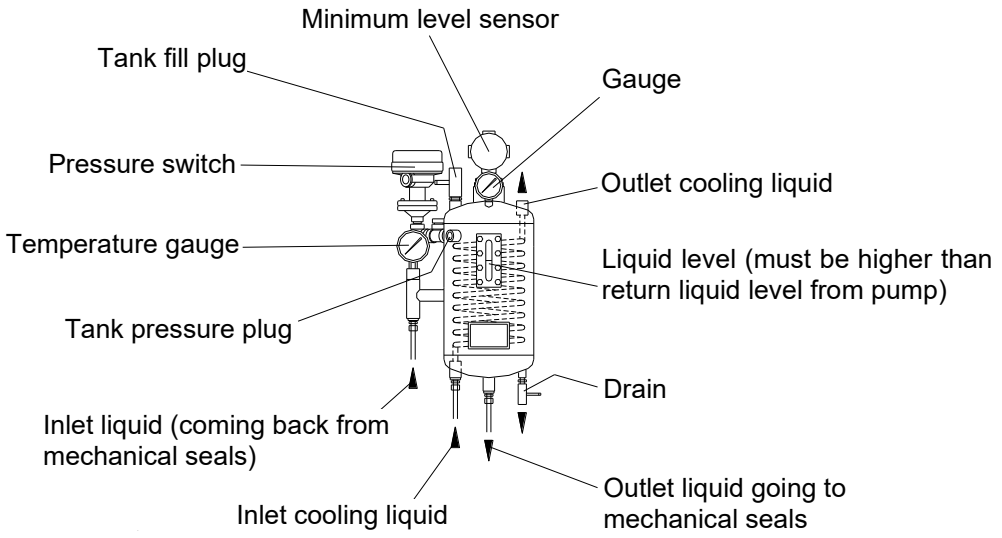
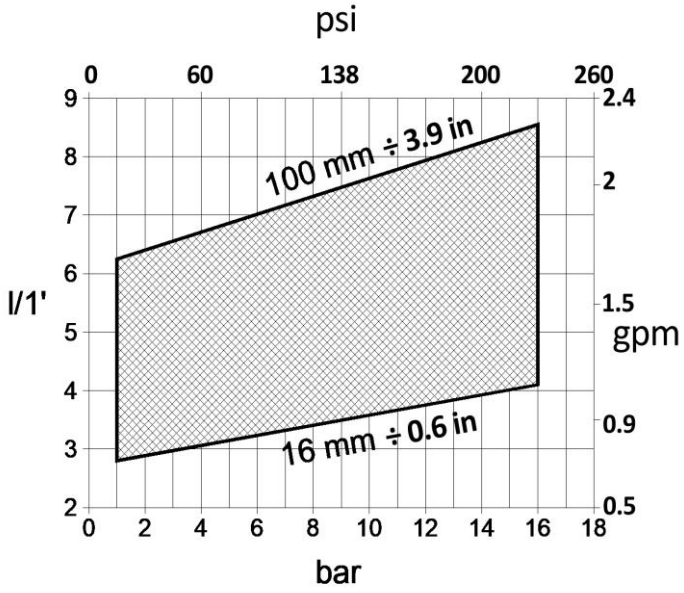


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

NOTE: Tank installation must be at least 1 m/40in above the rotating pump shaft



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

mm/in = installed shaft seal diameter

bar/Psi = maximum pump working pressure (total of inlet pressure and pump generated pressure as measured at pump discharge flange)

l/1'/gpm = required liquid flow (lit/min - gpm) 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/7.25Psi over the max pump working pressure, while NOT more than 0.3 bar/4.35Psi 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/50.8Psi, referred to water and ambient temperature. In case of heating circuit the allowed maximum temperature is 135°C/275°F). 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/50.8Psi and temperature of 135°C/275°F of the pump casing jacket.

PUMP SERIES	FLOW MINIMUM	FLOW MAXIMUM
AT – TB… TC... group 1 – 2 TMA	3 l/m’ 0.8 gpm	8 l/m’ 2.1gpm
MC... group 3 – 4 – 5 TC... group 3 – 4 – 5 MEC	5 l/m’ 1.3gpm	12 l/m’ 3.2gpm

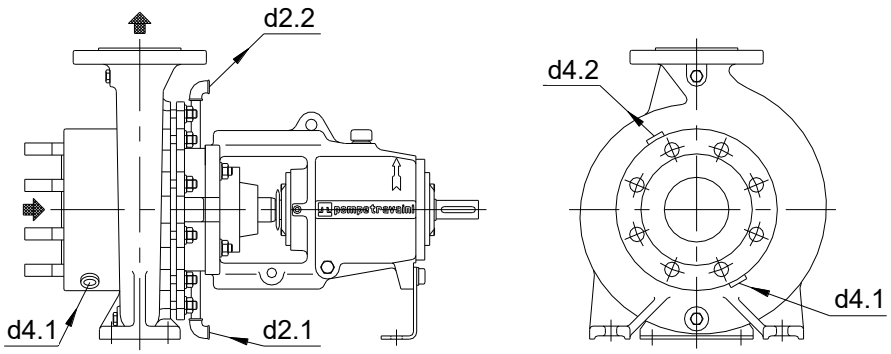


Fig. 34
d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
d4.2 Threaded connection - Outlet cooling/heating 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

17 - PUMP REPAIR, DISASSEMBLY AND DISPOSAL FROM INSTALLATION

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).

18 - SPARE PARTS

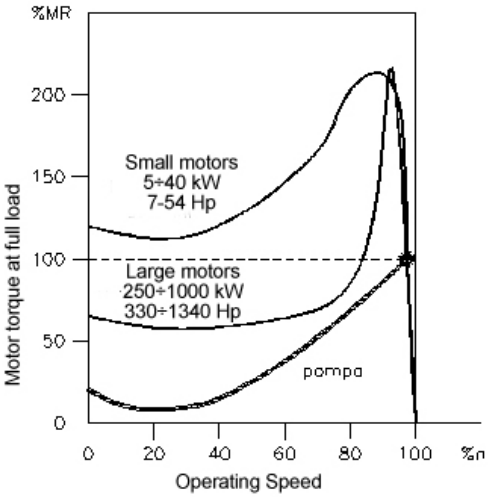
When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimise unnecessary down times in the event of pump failure or routine maintenance.
For better parts management, the VDMA 24296 standards suggest to stock the number of parts in function of the number of pumps being used by the plant (see following table).

Spare parts / Components		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	2	2	3	30%
Impellers				1				
Radial seal rings		2	2	2	3	3	4	50%
Ball or roller bearings								
Shaft complete with keys, nuts, shoulder rings, etc.		1	1		2	2	3	30%
Bushes						3	4	50%
Shaft protection sleeves		2	2		3			
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	2	3	4	5	6	7	90%
	Stationary part							
	Rotating part gasket			6	8	8	10	150%
	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

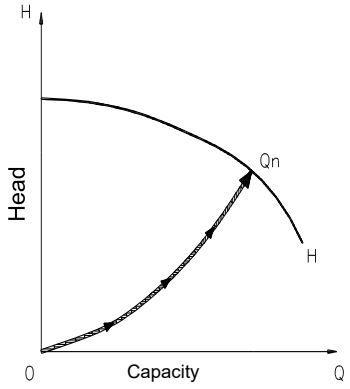


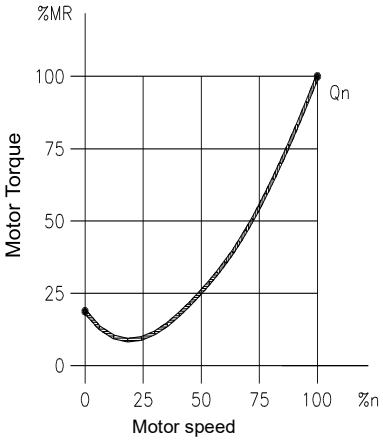
Starting torque of a centrifugal pump is very low. Usually standard electric motors may be safely used to drive this pump. Pump operational speed (any speed) is reached only if motor torque is greater than pump operating torque. See side figure.
Operating Torque is given by:

Operating Torque (Nm) = 9549 x kW (absorbed at operating speed) / RPM (nominal)

Operating Torque (lb in)= 7120 x Hp (absorbed at operating speed) / RPM (nominal)

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





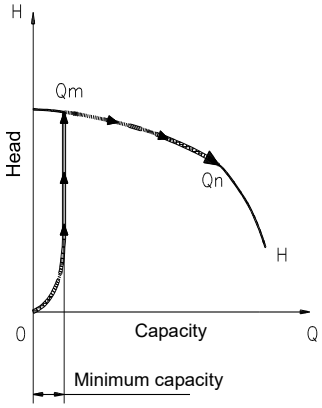
1) Starting with open valve on discharge

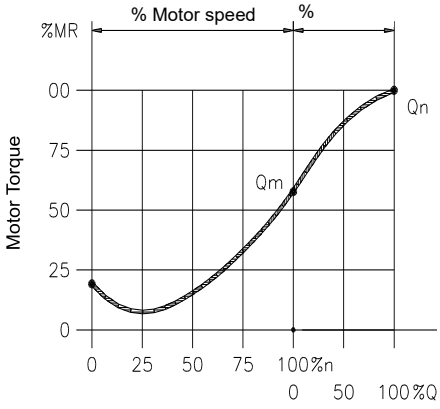
During this starting it can be assumed the curve of Operating Torque in function of the round number similar to a parable that starts from about the 20% of the value of Operating Torque to the value of nominal capacity **Qn**.

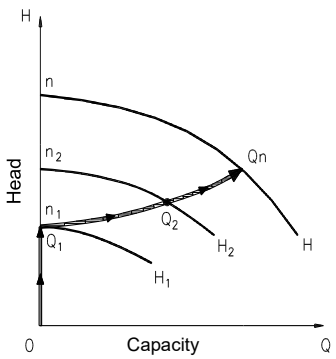
2) Starting with partially closed valve on discharge

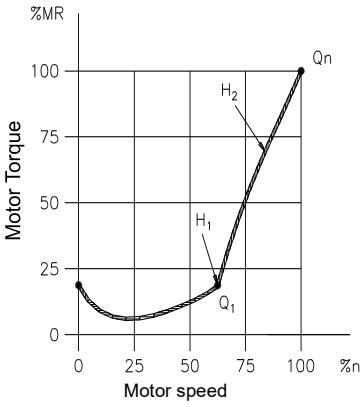
This type of starting requires a particular observation: first the pump must reach a value of minimum capacity **Qm** (correspondent to the partialized capacity of the valve) such to guarantee a correct operation without problems of liquid evaporation or excessive radial loads on the shaft; then the 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**.





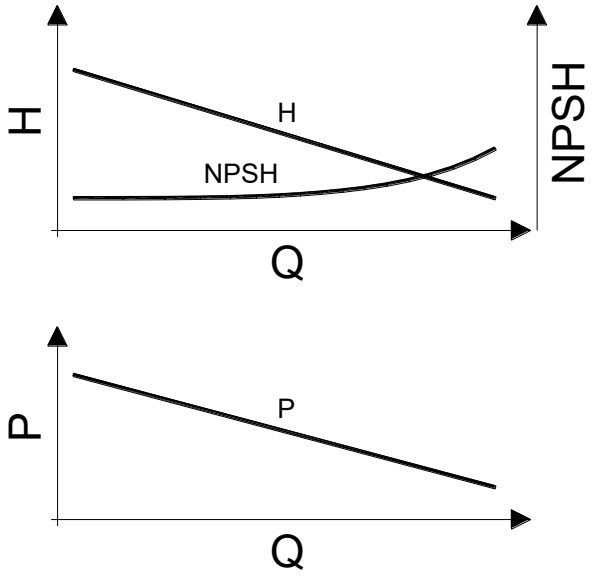




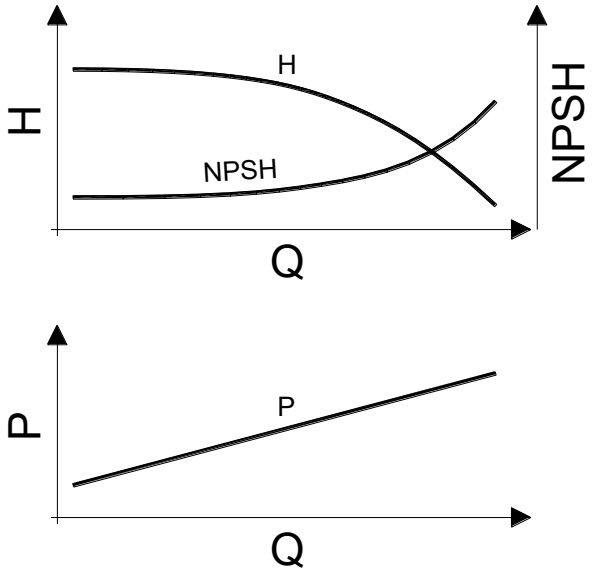
3) Starting with completely open valve and with non return valve on discharge

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			
	Ft^3	U.S. Gal	7.48			
	Ft^3	Imp. Gal	6.228			

	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 Lp at 1 meter distance neglecting motor, with pump installed in the system and sound power level Lw) for pump operating at BEP and motor at 50 Hz operating speed.
Standard tolerances of 2 dB are permitted on these values.
For pumps operating at 60 Hz, 2.5 dB must be added to the current limit for the noise level of the pump and 3 dB for that of the motor, the latter value may vary according to the motor installed.
For pumps of the TCT series, 3 dB must be added to the noise level of the pump and motor.
Contact POMPETRAVINI for further information.

PUMP MODEL TC…	Noise level L_p (L_W) dB(A) poles 8	6	4	2	Vibration level class poles 8	6	4	2
25 – 125	< 70 *(82)*				V1			
25 – 160								
25 – 200								
32 – 125								
32 – 160								
32 – 200								
40 – 125								
40 – 160								
40 – 200								
40 – 250								
50 – 125								
50 – 160								
50 – 200								
50 – 250				73 *(85)*				
50 – 315	< 70 *(83)*			74 *(86)*	V1			
65 – 125				73 *(85)*				
65 – 160				73 *(85)*				
65 – 200				73 *(85)*				
65 – 250				74 *(86)*				
65 – 315				75 *(88)*				
80 – 160				73 *(85)*				
80 – 200				74 *(86)*				
80 – 250				75 *(87)*				
80 – 315	< 70 *(83)*			77 *(90)*	V1			V2
100 – 200				75 *(87)*				
100 – 250				76 *(89)*				
100 – 315				78 *(90)*				
100 – 400	76 *(89)*			---	V2			---
125 – 250								
125 – 315								
125 – 400								
150 – 250								
150 – 315	78 *(92)*			---	V2			---
150 – 400								
200 – 315								
200 – 350								
200 – 400								
250 – 315	79 *(93)*			---	V2			---
250 – 450								
300 – 350								
300 – 450								
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)*	V1
203 ♦		
204 ♦		
29*	< 70 *(82)*	
30*		
31*		
40*	73 *(85)*	
50*	75 *(88)*	
65*	77 *(90)*	

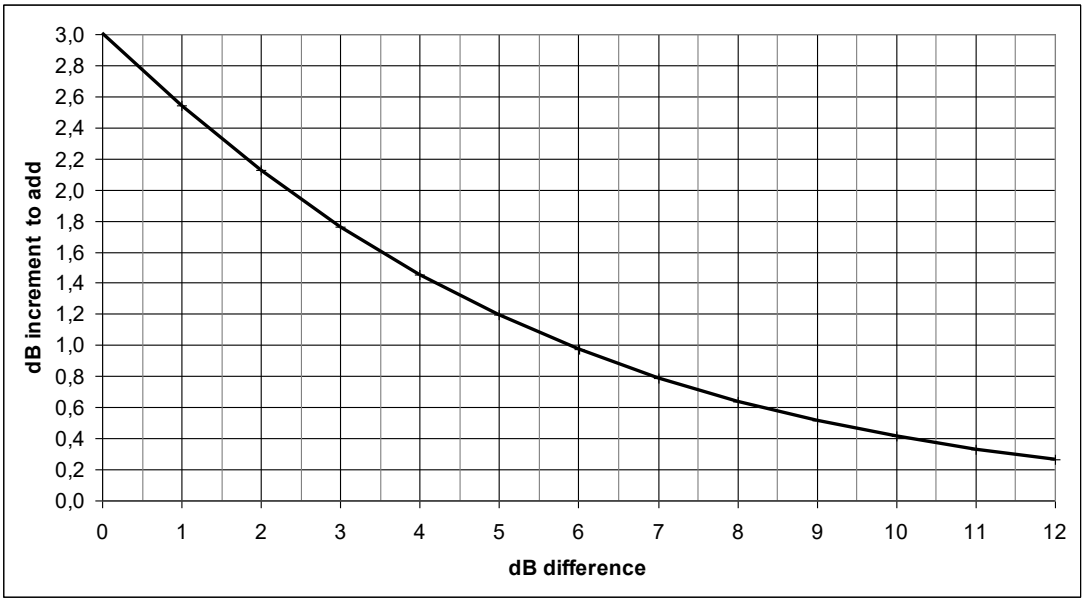
♦ = WARNING: 2 poles motors

PUMP MODEL TBH	Noise level L_p (L_W) dB(A) 4 poles	Vibration level class 4 poles
20*	< 70 *(82)*	V1
29*		
30*		
31*		
40*	74 *(86)*	
50*	75 *(88)*	
65*	77 *(90)*	
100*	79 (93)	V2

PUMP MODEL TMA	Noise level L_p (L_W) dB(A) 2 poles	Vibration level class 2 poles
31	72 *(84)*	V1
32		
40	76 *(89)*	V2
50		

In order to have approximate values of the noise level for tha 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 values can change depending on the installed motor.
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)* dB(A)				Noise level L_p *(L_w)* ATEX 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 *(63)*	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 *(82)*	72 *(82)*	78 *(88)*
37	67 *(75)*	70 *(81)*	75 *(86)*	82 *(93)*	62 *(74)*	72 *(83)*	75 *(86)*	78 *(88)*
45	67 *(75)*	72 *(84)*	75 *(86)*	82 *(93)*	62 *(74)*	67 *(79)*	75 *(86)*	80 *(91)*
55	67 *(76)*	72 *(84)*	78 *(89)*	83 *(95)*	63 *(77)*	67 *(79)*	77 *(88)*	80 *(91)*
75	67 *(76)*	77 *(88)*	77 *(88)*	82 *(94)*	65 *(77)*	67 *(81)*	72 *(84)*	77 *(89)*
90	67 *(76)*	77 *(88)*	77 *(88)*	82 *(94)*	65 *(79)*	71 *(85)*	72 *(84)*	77 *(89)*
110	73 *(85)*	77 *(88)*	79 *(92)*	84 *(97)*	65 *(79)*	72 *(86)*	73 *(86)*	77 *(89)*
132	76 *(88)*	77 *(88)*	79 *(92)*	84 *(97)*		72 *(86)*	77 *(91)*	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)*				



The class of the vibration level in the following table (values rms mm/s and ips) shows the limit values for the continuous working of the pump if properly installed. For higher values proceed with maintenance.
NOTE: Pumps not included in the following tables have to be seen as a particular construction.
Contact POMPETRAVAINI 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

PRINTED IN ITALY

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

ISO 9001

pompetravaini
20022 CASTANO PRIMO (Milano) ITALY
Via per Turbigo, 44
Tel. +39 0331 889000
www.pompetravaini.com

Il dossier tecnico è custodito presso la sede della Pompetravaini Spa. *The technical file is kept at the headquarters of Pompetravaini Spa.*

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	PL	Firm:a

pompetravaini
20022 CASTANO PRIMO (Milano) ITALY - Via per Turbigo, 44
Tel. +39 0331 889000 - www.pompetravaini.com

ISO 9001

I firmataria della presente, dichiara sotto la propria esclusiva responsabilità, che la macchina è conforme a quanto prescritto dalle Direttive
GB the signatory of this letter certifies, under its own responsibility, that the machine complies with the requirements prescribed by the Directives
F signataire de la presente, déclare sous sa propre et exclusive responsabilité, que la machine est conforme aux Directives
D der Unterzeichner dieses Briefes bestätigt unter seiner eigenen Verantwortung, dass die Maschine den in den Richlinien beschriebenen Bestimmungen entspricht
E el firmante de esta carta certifica, bajo su propia responsabilidad, que la maquina cumple con los requerimientos prescritos por las directivas
NL de ondertekenaar van deze verklaring verklaart, onder zijn eigen verantwoording, dat dit product in overeenstemming is met de vereisten, vastgelegd in de richtlijnen
DK signaturen i dette dokument certificerer, under eget ansvar, at maskinen overholder de krav, der stilles i de anførte direktiver
S undertecknare av detta certifkat certifierar, under eget ansvar att maskiner uppfyller följande beskrivna föreskrifter
FIN tämän kirjeen allekirjoitus vakuuttaa että kone täyttää Direktiivien edellyttämät vaatimukset
PL sygnatariusz niniejszego dokumentu zaświadcza, że urządzenie spełnia wymogi opisane w Dyrektywie

Direttiva Macchine / *Machinery Directive* 2006/42/CE

EN ISO 12100:2010 Sicurezza del macchinario/*Safety of Machinery* - EN 809:1998 + A1:2009 Pompe e gruppi di pompaggio per liquidi. Requisiti generali di sicurezza / *Pumps and pump unit for liquids. Common safety requirements* – EN ISO 13857:2019 Sicurezza del macchinario. Distanze di sicurezza / *Safety of machinery. Safety distances* - EN ISO 14120:2015 Sicurezza del macchinario. Ripari/ *Safety of machinery. Guards*. - Compatibilità elettromagnetica / *EMC Directive* 2014/30/UE - Direttiva Bassa Tensione / LVD 2014/35/UE - EN 60204-1:2018 Sicurezza del macchinario. Equipaggiamento elettrico delle macchine / *Safety of machinery. Electrical equipment of machines.* EN 60034-1:2010 Macchine elettriche rotanti. Valutazione e prestazioni / *Rotating electrical machines. Rating and performace.*

I Questa dichiarazione perde validità nel caso in cui alla macchina venissero apportate delle modifiche non esplicitamente approvate dal costruttore o nel caso di un uso non conforme della macchina.
GB This certificate will be invalidated in case any modification not approved by the manufacturer is applied to the machine or in case of improper use of the machine itself.
F Ce certificat sera invalidé dans le cas où une modification qui n'est pas approuvée par le fabricant est appliquée à la machine ou en cas d'utilisation impropre de la machine elle-même.
D Bei jeder Modifikation der Maschine, die nicht durch den Hersteller genehmigt wurde oder im Falle des unsachgemäßen Gebrauchs der Maschine verliert dieses Zertifikat seine.
E Esta certificación quedará invalidada si se le aplica a las maquinas cualquier modificación no aprobada por el constructor o en caso de un uso inadecuado de las mismas.
NL Deze verklaring zal ongeldig zijn, indien een modificatie op dit product heeft plaatsgevonden, zonder toestemming van de fabrikant, of bij onjuist gebruik.
DK Dette certifikat er ikke længere gyldigt, såfremt maskinen modificeres på en måde, der ikke er godkendt af producenten eller i tilfælde af uhensigtsmæssig brug af maskinen.
S Om ändringar görs av maskin eller felaktig användning utan godkännande av producent kommer detta certifikat att ogiltigförklaras.
FIN Tämä vakuutus ei ole voimassa jos koneeseen tehdään muutoksia joita ei ole hyväksytetty valmistajalla tai jos konetta käytetään väärin.
PL Certyfikat traci ważność w przypadku modyfikacji dokonaych bez wiedzy i zgody producenta dołączonej do urządzenia, a także w przypadku nieprawidłowego użytkowania urządzenia.

I Il Presidente e responsabile tecnico
GB The President and Technical Manager
F Le Président et le Directeur Technique
D Der Geschäftsführer und Technische Manager
E El presidente y el director técnico
NL De algemeen en technisch directeur
DK Direktøren og Teknisk Chef
S Verkställande direktör eller Teknisk chef
FIN Toimitusjohtaja ja Tekninen Johtaja
PL Prezes Zarządu i Dyrektor Techniczny

Sig. Carlo Travaini

Service Card