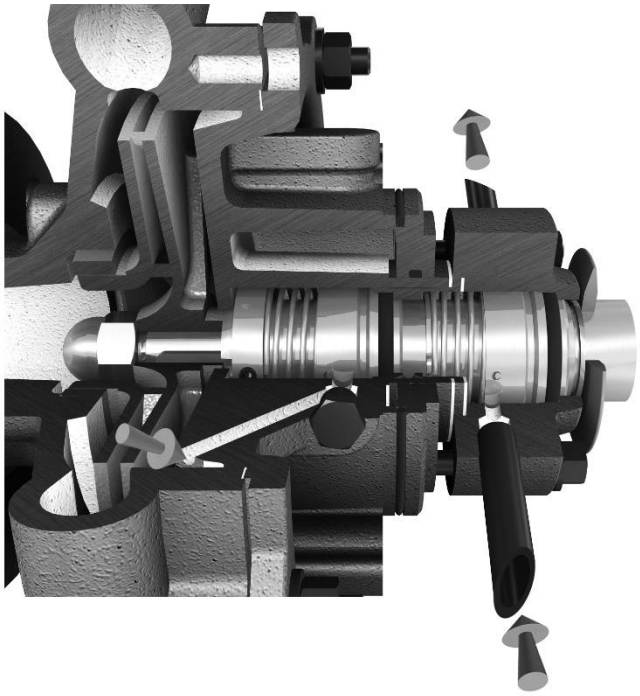
pompetravaini

(Rev. 2.1_07-2022)

ABSTRACT FROM OPERATING MANUAL FOR CENTRIFUGAL PUMPS

AT - TB... - MC... - TC... - TMA

OF MECHANICAL SEALS FLUSHING INSTRUCTIONS



15 – MECHANICAL SEALS

DANGER!

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

Purpose of mechanical seals is to retain handled product inside the pump in the area where the shaft exits the pump casing. Mechanical Seals can be of many different materials, types and configurations (see fig. 28-29-30 for some examples). To assure maximum reliability and safe operation Pompetravaini evaluates seal choices at time of pump selection in connection with customer's requirements, application and liquid details.
In the case of self lubricated single mechanical seals (API Plan 01, 02 or 11, see fig. 28) flushing and /or pressure system are not required, pump has been engineered to provide proper seal lubrication with pump operating pressure.
In the event the application requires increased safety margin against possibilities of product leaking through a single type mechanical seal, it is possible to install two mechanical seals working simultaneously thus creating a safety barrier from the pumped liquid.
There are two possible types of double mechanical seals: Back-to-Back (also known as "Opposite" type) API Plan 54, see fig. 29 and in Series (also known as "Tandem" type) API Plan 52, see fig. 30.
Double mechanical seals Back-to-Back are generally selected where pumped liquid is absolutely not allowed to leak from the pump. Double mechanical seals in Series are chosen where the pumped liquid may escape the pump toward the pump exterior but it is controlled and contained in the closed seal loop but never to escape to the atmosphere.
Double mechanical seal installations require a flushing (buffer) liquid from an external source that is compatible with the pumped product as well as the working conditions. Flushing liquid system is such as to guarantee adequate buffer liquid pressure and temperature to the mechanical seals: seal flushing system with proper instrumentation and controls is of paramount importance for a successful pump installation, it must be installed by qualified personnel familiar with every details of the application and with system set-up.
All flushing systems MUST use tubing with diameters equal or larger than the connections provided on the pump, buffer liquid must be compatible with the pumped product. Pressure on the buffer liquid should always be constant and/or high enough to cover the entire pump performance.
In the case of 'once through' seal flushing (buffer liquid not recycled), it is very important the regulation and control of pressure in the seal housing. In the double seal case it is recommended to adjust the buffer liquid pressure with a flow regulating valve installed after the seal housing while reading pressure on a gauge installed between the seal housing and the valve. Avoid controlling buffer liquid pressure before the seal housing, reading the pressure before the seal housing is NOT recommended as it could lead to wrong conclusions which could be cause for serious damages. With an adequate seal tank in the system (see fig. 33) a closed loop seal flushing, containing possible leakages is provided. Adequate controls and/or instrumentation will provide pressure and liquid level controls in the tank to indicate the conditions of the sealing system. Increase of liquid level (or pressure) is indication of product leaking through the pump seal. Decrease of liquid level (or pressure) is indication of buffer liquid leaking inside the pump or to the atmosphere through the outside seal, in which case the leakage is also visible.
The liquid to be used in the seal tank must offer full compatibility with the pumped liquid in the event the seal at pump side will leak, (for example when the two liquids will mix there must not be any dangerous chemical reactions) as well the liquid must offer good lubricating characteristics and good heat dissipation. Some good examples of suitable buffer liquids are water, vaseline oils or vegetable oils.
Pressure in the seal tank is often kept with pressurised Ozone or Nitrogen bottle. Cooling of the buffer liquid in the loop (picks up friction heat from the seal faces) is achieved with fresh liquid through the cooling coil fitted inside the seal tank. Seal tank is provided with Inlet & Outlet connections for sealing liquid. DO NOT reverse these two connections; the liquid circulates by natural heat convection (warm liquid moves upward and cold liquid downward), reversing the connections would prevent the start of such natural phenomenon. The buffer liquid outlet connection going to pump seal housing is at bottom of tank while the return connection is approximately at the middle of the tank.
Checking of proper liquid circulation is done while pump is in service; the piping at seal housing connection should be colder by 3 to 5°C than the outlet tubing exiting the seal housing going to the tank. If this is not the case simply change the tubing on the seal housing (connect tubing from inlet to the outlet and vice versa) do not change the connections on the tank. Sometimes this adjustment is required because the rotation of the mechanical seal (and at times peculiar seal design) generates an hydraulic pressure that could be opposite and higher than the natural. 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 and 2.5 accuracy. Additional data and information may be requested from Pompetravaini or its local representative if required.

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

Seal housing with double mechanical seals back-to-back type, must always have a pressure such that the inside seal (closer to pump impeller) will not be pushed out of its seat by the total pump pressure (suction plus pump operating pressures) even when pump is in stand-by mode. Flushing liquid therefore must be at least 0.5 bar over the maximum pump discharge pressure throughout its performance.
A lower pressure, even if for a moment, will cause the stationary part of internal seal to come out of its seat and the pumped liquid will mix with the flushing liquid due to the higher pressure inside the pump, see fig. 27.
In the case of double seals in series (Tandem) the pressure of the flushing liquid should be as low as possible but high enough to provide good flow in the circuit. High pressures (over 0.3 bar over the atmospheric pressure) may push the stationary seat of mechanical seal at product side (closer to pump impeller), out of its seat (especially when pump is at rest without pressure), therefore flushing liquid would mix with the product inside the pump following seal system damage.

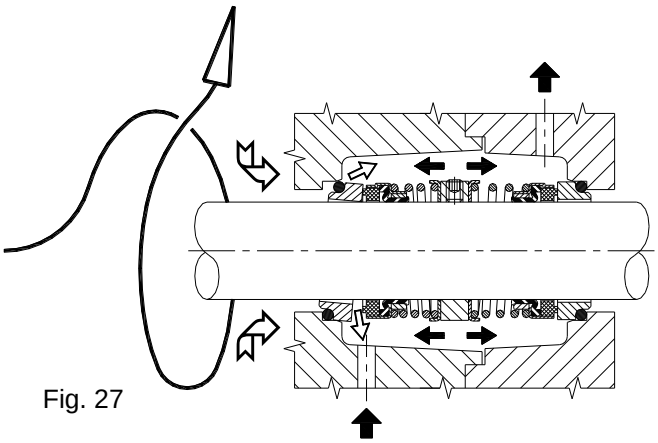


Fig. 27

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

See fig. 20-21-22-23 and operating manual for centrifugal pumps for locations of liquid flushing connections. Required flow and pressure for buffer liquid are listed in tab. 3 and/or contact Pompetravaini and/or seal supplier. See tab. 4 for liquid flow required to cool or heat the seal housings. For a longer seal life cooling is recommended when pumping liquids over 90°C. Tab. 4 also lists cooling or heating liquid flow for pumps of “U2” design that include jacketed pump casing.
Standard mechanical seals supplied with our pumps meet ISO 3069/UNI EN 12756 standards, see pump “Disassembly and Assembly Instructions” for overall dimensions. Special or non-standard seals can be installed after proper evaluation by our technical department. Mechanical seals do not require maintenance until losses of liquid are visible (for seal replacement see “Disassembly and Assembly Instructions”). Losses of few drops of liquid in several minutes is normally considered acceptable and it is not an indication of seal failure.
Seal leakage or even seal failure should be properly corrected considering the impact on environment, toxicity and safety issues.

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

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

MECHANICAL SEALS WITH QUENCH
There are two types of Quench/Barrier, available upon request: API Plan 61 and 62.
System Plan 61 (see fig. 31) includes a bushing on the back of the seal at atmospheric pressure side (single or double) to hold the bulk of the liquid in the event of accidental failures. The bushing requires a minimum clearance over the shaft therefore the liquid is NOT sealed completely but most of it will be retained in case of a sudden seal breakage. Drain and vent connections are threaded. This arrangement does not allow a continuous flushing because the above mentioned clearances would cause considerable losses of liquid over the shaft toward the outside. This system is chosen for avoid emergencies or to limit losses of liquid.
System Plan 62 (see fig. 32) requires (contrary to Plan 61) a constant flushing because the auxiliary seal is of the contact type and CANNOT work without a liquid that removes the generated heat of friction. The auxiliary seal is usually a lip seal (radial seal ring) not to be confused with the traditional mechanical seal. Losses of several liquid drops should be tolerated and with time its reliability will decrease. This system is often used where there is the need to wash the back of the mechanical seal on the atmospheric side preventing crystallization or coking of handled product. It is a less effective alternative to the double mechanical seals in series. Pressure of buffer liquid must follow same rules as for the double seals in series, therefore max pressure can be 0.3 bar over the atmospheric pressure and temperature can be max 60°C.

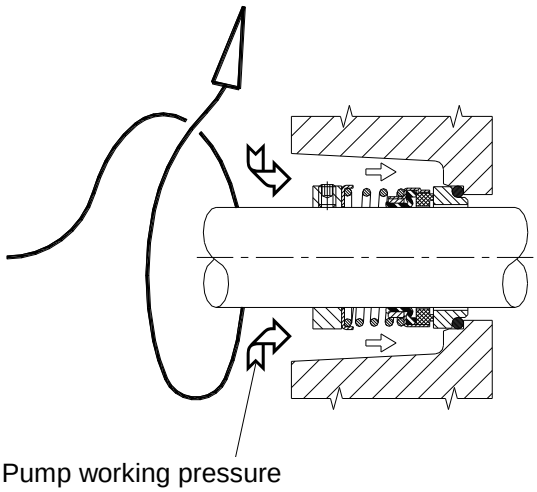


Fig. 28
Typical example of self-flushed SINGLE seal
API Plan 01, 02 or 11

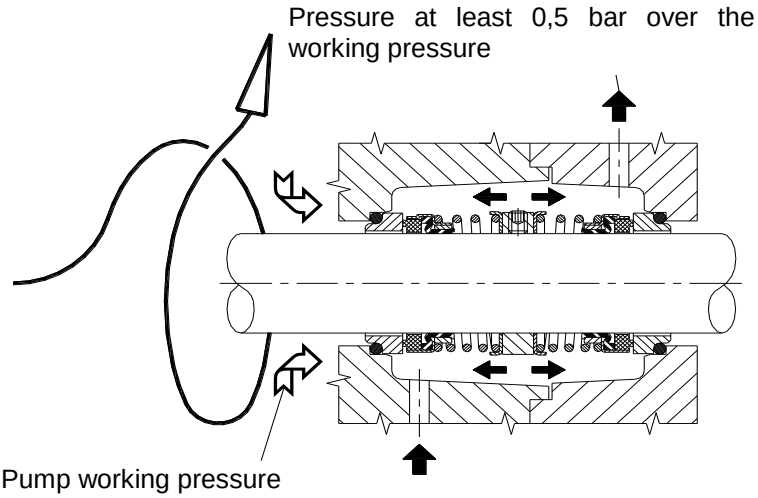
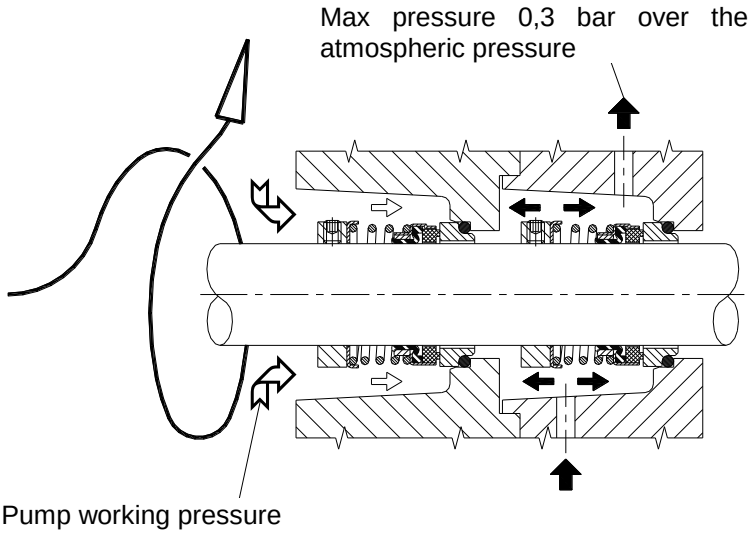


Fig. 29
Typical example of double Back-to-Back mechanical seal with liquid from an outside source – API Plan 54



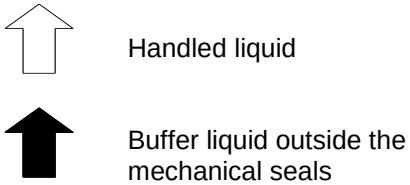


Fig. 30
Typical example of double mechanical seals in SERIES with buffer liquid from an outside source – API Plan 52

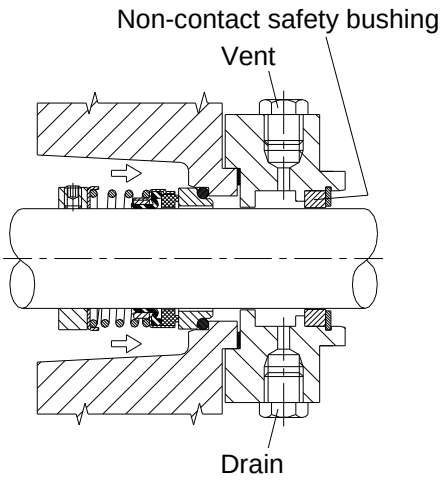


Fig. 31
Example of SINGLE mechanical seal
with QUENCH – API Plan 01/61
(NOTE.: Continuous flushing is not possible)

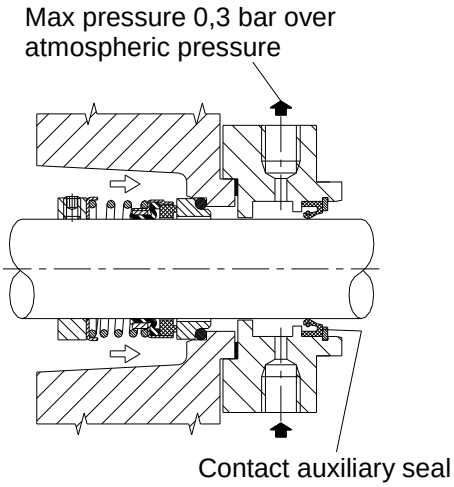


Fig. 32
Example of SINGLE mechanical seal with
QUENCH – API Plan 01/62

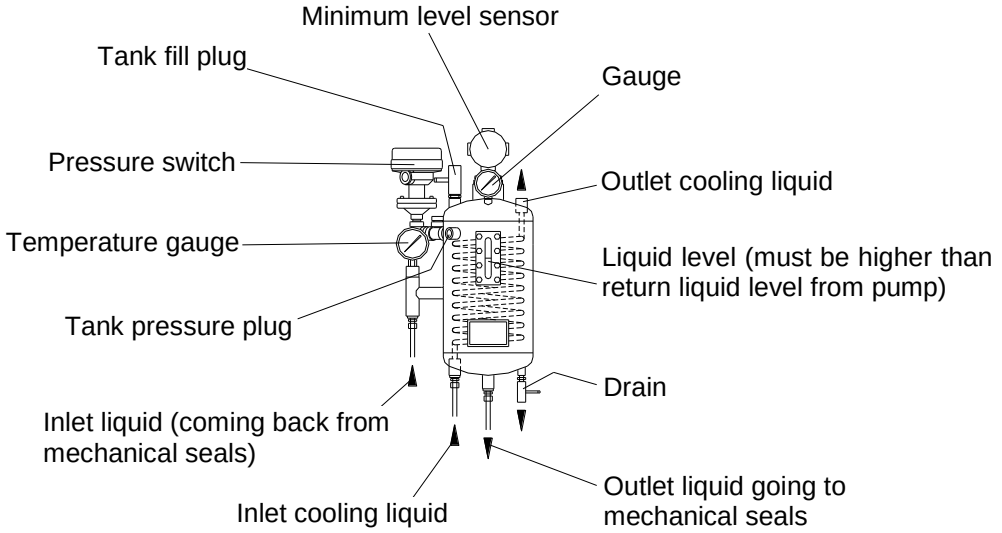
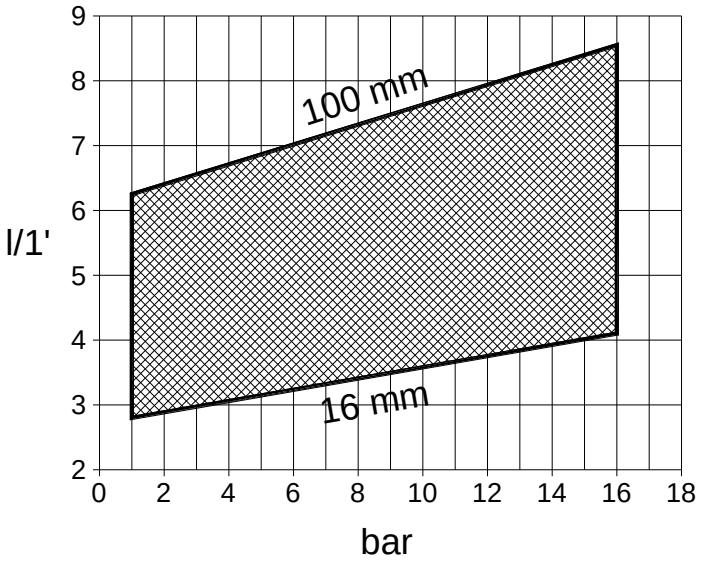


Fig. 33
Typical example of seal tank, pressurised, cooling liquid and instrumentation. (Instrument location can vary)

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



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

mm = installed shaft seal diameter

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

l/1' = required liquid flow (lit/min) for single seals or double in series type seals (tolerance +/-25% depending upon temperatures)

NOTE: DOUBLE quantity of liquid flow for double mechanical seals back-to-back type.

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

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

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

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

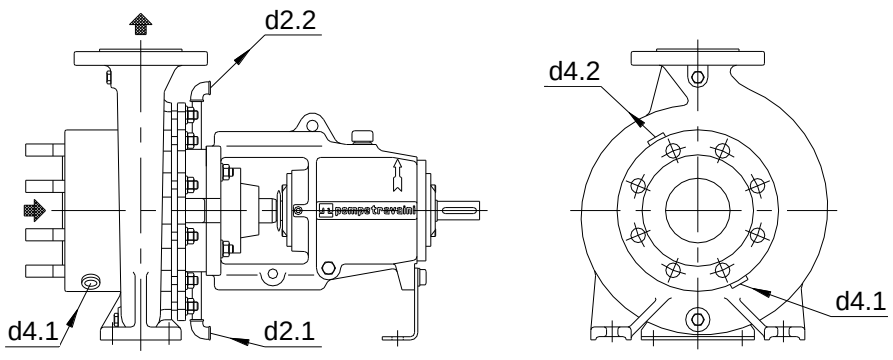


Fig. 34
d2.1 Threaded connection – Inlet cooling/heating liquid to mechanical seal housing
d2.2 Threaded connection - Outlet cooling/heating liquid to mechanical seal housing
d4.1 Threaded connection – Inlet cooling/heating liquid pump jacketed casing
d4.2 Threaded connection - Outlet cooling/heating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

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NOTES

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

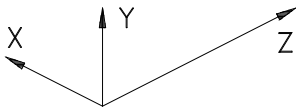
LIQUID handled	Capacity	Suction Pressure	Discharge Press.	Temperature
.....	.....m^3/h	.....m	.....m	.....°C

☐ Lethal ☐ Toxic ☐ Noxious ☐ Corrosive ☐ Irritant ☐ Malodorous ☐ .....

☐ Clean ☐ Dirty ☐ With suspended parts	Spec. Gravity.....	Viscosity.....	PH.....

TOTAL WEIGHT
.....KGs.

MAXIMUM DIMENSIONS



X =.....cm
Y =.....cm
Z =.....cm

NOISE (measured at 1 m)
Pressure =.....dB(A)
Power =.....dB(A)

INSTALLATION	
☐ Inside	☐ Outside
☐ Explosive area	☐ .....

SERVICE	
☐ Continuous	☐ Intermittent
☐	

MOTOR type / Frame	No Poles	No Revolutions	Absorbed power	Installed Power
.....	.....	.....RPM	.....Amp	.....kW / .....HP
Frequency	**Supply**	**Enclosure**	**Insulation class**	**Absorbed Power**
.....Hz	.....Volt	IP.....	.....	.....kW / .....HP

COMMENTS

MONOSTAGE CENTRIFUGAL PUMPS

MAGNETIC DRIVE MONOSTAGE CENTRIFUGAL PUMPS

SELF-PRIMING CENTRIFUGAL PUMPS

MAGNETIC DRIVE SELF-PRIMING CENTRIFUGAL PUMPS

MULTISTAGE CENTRIFUGAL PUMPS

LIQUID RING VACUUM PUMPS

LIQUID RING COMPRESSORS

PACKAGE VACUUM UNITS WITH PARTIAL OR TOTAL SERVICE LIQUID RECIRCULATION

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ISO 9001

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