OPERATION AND MAINTENANCE MANUAL

HEAT EXCHANGER ____

Year of construction: 2012

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1. Introduction

This manual provides the instructions and information required for correct use and correct maintenance of the machinery.It describes the procedures to be adopted in order to ensure safety during operation and maintenance and the main rule for reducing risks to a minimum.

It is extremely important to supply proper training to every person in charge of operating the machinery and to ensure that they have access to this manual.
Keep this manual in a safe, accessible place.

2. Safety

a. Symbols used

The manual contains symbols designed to focus the reader's attention on the machine's hazard points.
The following is a list of the symbols used and their meaning:

This symbol indicates generic risk for health and safety or a procedure to be followed to avoid risks for health and safety.

This symbol indicates an electric risk due to the type of operation performed or a precaution required to prevent such risk.

This symbol indicates a risk related to possible damage to the machinery.

This symbol indicates that protective clothing must be worn when performing the operation described.

b. General rules

To operate the machine safely it is absolutely necessary for staff in charge of machine operation and maintenance to:
be thoroughly familiar with this manual;
be able to identify the hazardous points of the machine;
follow the procedures indicated in this operation and maintenance manual.

All potentially hazardous areas are equipped with protection devices.The presence of this devices indicates to staff that a hazard is present.

The machine must never be used without the required protection devices.

c. Safety checklist

- Do not use machine without safety devices;
- Do not perform maintenance operations of any kind when the machine is connected to power;
- Ensure that maintenance operations are performed regularly;
- Do not use the machine if pressure or temperature values do not match design values;
- Do not apply a shaft speed higher than the value indicated in this manual;
- Shut off all fluid supply and power supply during maintenance procedures;
- Do not wear loose-fitting clothing, scarves, shoulder straps, long loose hair or any accessory that may get caught in the machine;
- Before getting close to the machine check position and method for emergency stopping.

d. Requirements for workers' safety

The rules listed below must be read carefully and adopted as a fundamental part of everyday practice in machine operation and maintenance to prevent any sort of personal injury and damage.

- Do not attempt to operate the machine before you have thoroughly understood its operation.If in doubt about any aspect even after having read through the manual and its attachments, please contact MBS technical service department.
- Before starting the machine, the operator must check for visible defects in safety devices and in the machine.If defects are found, notify the area supervisor immediately and inform MBS.
- Every day check all of the safety switches and devices to ensure they are efficient.
- Protection devices must not be removed or made ineffective during machine operation.
- All hazard signs and safety signs must be kept in perfect condition.If damaged or deteriorated hazard and safety signs must be replaced promptly.
- The operator must be familiar with the function and position of controls.
- Replace any faulty parts with others indicated by MBS. DO NOT attempt makeshift solutions.
- Pay maximum attention to all of the precaution, warning and danger signs present on the machine.
- Do not operate the machine with damp hands or objects when the machine is connected to power.

NOTE : Apply all safety rules and ensure they are applied by others.

The machine must be used only for the purpose for which it was designed and in accordance with the instructions provided by MBS.
Do not use the machine for purposes other than those indicated in the manual.
Do not install the machine in potentially explosive environments or where there is a fire hazard.

e. Risk analysis

The following is a list of generic risks for the exchanger:

Risk	Effects	To prevent risk
Overpressure	• Permanent breakage, deformation; • Fluid leaks, metal splinters.	• Respect the maximum pressure conditions indicated on the plate and in this manual; • Install a safety valve.
Overheating	• Permanent breakage, deformation; • Fluid leaks, metal splinters.	• Respect the maximum and minimum temperature conditions indicated on the plate and in this manual; • Provide adequate temperature control.
Operating temperature	• Hot metal surfaces; • Damage from contact, burns	• Protect hot surfaces adequately; • Indicate danger with signs.
Mass of contained substance during operation	• Permanent breakage, deformation; • Fluid leaks.	Respect the indications provided in this manual for support of exchangers.
External events (wind, earthquake, fire and traffic)	• Permanent breakage, deformation; • Fluid leaks.	Install exchanger in suitable environment.
Loads and reaction moments	• Permanent breakage, deformation; • Fluid leaks, metal splinters.	
External loads (weights resting on exchanger)	• Permanent breakage, deformation; • Fluid leaks.	Do not place loads on exchanger or on geared motor unit.

Below is a list of food risks related to the exchanger:

Risk	Causes	To prevent risk
Product contamination by external environment	Service fluids inside product.	Perform correct calibration of operating pressure for product and services (product pressure should be greater than pressure of service fluids).
Problems with cleanliness of parts in contact with product	Washing operations	Give maximum attention to cleanliness of blade support shaft and seat of mechanical seals (see Washing and sanitation paragraph).
Release of parts due to wear	Worn components	Perform periodic inspections and required maintenance.

f. Foreseeable use and prohibited use

Use the exchanger for the intended fluids, as specified at time of sizing and commercial quotation, indicated in this manual under technical data.

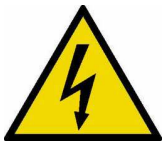
The exchanger must always be used in an environment suitable for the degree of protection of the motor, which must always be checked on the motor plate before installation.

It is prohibited to use the exchanger in environment requiring a degree of protection higher than that specified in the engineering phase.

In this case you must use components that comply with the safety regulations for the kind of environment.

g. Danger signs on the machine

The machine will bear plates with the following symbols designed to highlight the possible hazards present on the machine and the rules that must be respected by staff when operating the machine:



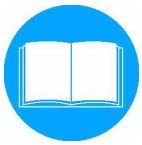
ELECTRICAL HAZARD
Applied on the motor switchboard

MOVING PARTS HAZARD
Applied near moving mechanical parts

DO NOT REMOVE SAFETY DEVICES
Applied near guards in the area around the machine.

DO NOT USE WATER TO PUT OUT FIRE
Applied on electric motor

NO ACCESS FOR UNAUTHORIZED PERSONS
Applied on the motor switchboard (if present)



REFER TO THE OPERATION AND MAINTENANCE MANUAL

Applied on the machine.

h. Use of machine

The exchanger is **not** designed to support the weight of a person.That weight could cause breakage of exchanger resulting in liquid leaks.

It is prohibited to stand on the exchanger or geared motor unit, this could cause damage to the exchanger.

i. Definition of safety terms

The following safety-related terms will be used in this manual:

a) **«hazard»**, a potential source of injury or health damage;
b) **«danger zone»**, any zone inside or near the machine where the presence of a person creates a risk for the safety and health of that person;
c) **«exposed person»**, any person that is totally or partly in a danger zone;
d) **«operator»**, person in charge of installing, operating, regulating, cleaning, repairing or moving the machine or performing maintenance operations;
e) **«risk»**, combination of probability and seriousness of an injury or health damage that can occur in a dangerous situation;
f) **«guard»**, machine element used specifically to ensure protection by means of a material barrier;
g) **«protection device»**, device (other than a guard) designed to reduce risk, alone or in combination with a guard;
h) **«intended use»**, use of machine in compliance with the information provided in the operating instructions;
i) **«reasonably foreseeable improper use»**, use of machine for functions other than those indicated in the operating instructions, but which can derive from easily foreseeable human behaviour.

j. Personal protection equipment

Before starting work, the operator must be familiar with the position and operation of controls and with the characteristics of the machine and have read the full contents of this manual and enclosed manuals.

The employer is required to supply Personal Protection Equipment and inform staff on their correct use and maintenance.

Operators must always comply with the indications supplied by the signs applied on the machine.

The PPE (Personal protection equipment) that operators must use is listed below.

During maintenance, cleaning and transport operations:
Work clothing, boots with anti-slip soles and work gloves.The use of ear protectors is recommended.

It is also necessary to:

- Keep gloves clean according to the instructions provided by the manufacturer.
- Keep gloves in a suitable place.
- Check integrity of gloves before wearing them.

k. Fixed and movable machine guards

To ensure maximum safety of operators who are working on the machine, fixed and movable guards have been designed and fitted so as to provide global protection without affecting ease of use.

The guards fixed on the machine structure can be removed only by authorized personnel using suitable tools.
Unauthorized removal of protection devices is considered as tampering of machine and as such it will be prosecuted by law.

It is prohibited to remove protection devices with the machine in operation.Removal of a protection must always be performed with the machine off, and the master switch off.Do not use the machine without guards in place.

The machine supervisor must comply with the rules and warnings indicated in the above manual so as to achieve maximum safety for staff operating the machine.

The machine guards must always be in place and closed during machine operation.Open or removed guards are dangerous sources of injury by contusion or cutting.

Fixed guards:

The machine is equipped with various fixed guards preventing the operator from reaching danger zones.
All the guards have been fixed onto the machine structure.The guards have been fixed with systems that require the use of tools for opening.The removal of protection devices is permitted only for maintenance operations and must be performed by technicians or qualified operators.See pictures below.

3. Warranty and terms of sale

a. Warranty

All the goods produced by MBS are guaranteed against hidden defects and production errors for a year from the date of purchase MBS will give no guarantee for goods not produced by them, but will pass on to the buyer all the warranties supplied by the manufacturers.

b. Responsibility

MBS shall not be liable for defects due to wear, negligence, abnormal working conditions, failure to comply with MBS's instructions (both verbal and written), improper use, alteration or repair of goods without approval from MBS.

c. Damage during transport

Goods must be inspected by the buyer upon reception.If the goods do not match the description in the delivery note or if the goods are damaged, the buyer must notify MBS and carrier this within 3 days.
Goods that have been used will be considered as not damaged and no complaint will be accepted other than ones related to aspects covered by the warranty.

d. Repairs and/or returns

Goods requiring repair must be returned to our company with transport paid.If the complaint covered by warranty is accepted by MBS, the goods will be repaired and returned to the buyer without any additional costs.If the complaint is not accepted because it is not covered by the warranty, the goods will be repaired and returned to normal trading conditions.
In accordance with the provisions of European Community laws on health, safety and environmental protection,users returning a product for inspection and/or repair, must supply the exchanger cleaned from any contact with toxic, harmful substances or other hazardous fluids that may pose a health risk and/or affect the safety of the environment.

e. Construction materials

MBS guarantees that all the surfaces in scraped surface exchangers that come into contact with the product are made of food grade materials.

4. How to use this manual

This manual has been organized in a way that will help users to quickly and easily find the information they need to operate and service the machine.Users must read every part of the manual carefully and ensure that they are perfectly familiar with the information contained in it.
The secondary function of this manual is to provide a reference that can be used every time some procedure or operation needs to be carried out.Therefore the manual must be available for personnel in charge of operating and servicing the machine so that they may refer to it whenever needed.
The table of contents provided at the beginning of the manual makes it easier to quickly find the chapter illustrating the required topic.
The table of contents includes numbered chapters [a,b] where “a” indicates the number of the general chapter and “b” the subchapter with specific topics.
For the sake of clarity, safety symbols have been included next to some paragraphs to highlight their importance and facilitate their identification.It is important to pay attention to these notes.

5. Applicable laws

- MACHINE DIRECTIVE 2006/42/CE (implemented in Italywith L.D. 17/2010).
- LOW VOLTAGE DIRECTIVE 2006/95/CE (recoded by Dir. 73/23/CE as amended implemented in Italy by Law 791/77)
- ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 2004/108/CE (implemented in Italy with L.D. 194/2007)

6. Applicable regulations

- UNI EN 12100-1:2010: Machine safety- Terminology, basic methodology Principles for risk assessment
- UNI EN ISO 13857:2008: Machine safety – Safety distances to prevent hazard zones being reached with upper and lower limbs
- EN 60204:2006: Electrical equipment of machines – General requirements.

7. Declaration of conformity

All the products manufactured by MBS are made and tested in accordance with the applicable directives.

EC DECLARATION OF CONFORMITY

Annex IIA - Directive 2006/42/CE for harmonizing the legislation of Member states relating to machine safety.

_____ S.p.A.

Address _____

The undersigned _____

as Legal Representative of _____ S.p.A.

DECLARES

under civil and penal responsibility, that the material sup[illegible]h

consists in _____ with the f[illegible]o[illegible]

TYPE:

SERIAL No.:

YEAR :

which complies with all th[illegible]leva[illegible] safety requi[illegible]nts as well as with the application points of the following specific pr[illegible]io[illegible]

- **MACHINE DIRE[illegible]20[illegible]E** (implemented in Italy with L.D. 17/2010).
- **LOW VOLTAGE D[illegible]CTIV[illegible]006/95/CE** (recoded by Dir. 73/23/CE as amended implemented in Italy by Law 791/77)
- **ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 2004/108/CE** (implemented in Italy with L.D. 194/2007)
- **PED DIRECTIVE 97/23/CE (art.3 par.3)**

It also complies with the following harmonized European regulations:

- UNI EN ISO 12100:2010 Machine safety :General design principles – Assessment of risk and risk reduction.

Person authorized to prepare technical file:Mr._____ Address _____

_____

_____ S.p.A.

Legal representative

_____

_____ _____/____/2012

a. Technical data

Dry mass	350 kg
Installed power	5,5 kW
Supply voltage	380 V
Frequency	50 Hz
Max. absorption	10 A

b. Airborne noise and vibrations

Measurement of sound emissions have been performed in accordance with current regulations.
Measurement of sound emissions have been performed in accordance with current regulations.
Sound pressure at 1 metre from machine is 65,5 dB(A).
Sound power is 79,5 dB(A)
Measurement have been performed in conformity with EN 12639 and EN 3744
Vibrations were not measured as there are no parts that come into contact with operators.

If the machine is installed in a reverberating environment or in the presence of other sources of noise and the level of personal daily exposure is over 85 dB(A), there is a condition of risk; in this case the employer is therefore required to provide workers with personal protection devices (earmuffs, ear plugs).

c. identification plate

An identification plate similar to the one shown in Fig.1.1 is present on the machine and provides the following information:

1 Manufacturer data.
2 Machine model.
3 Serial number.
4 Year of construction.
5 Technical characteristics.
6 CE mark certifying that the machine conforms with applicable directives.

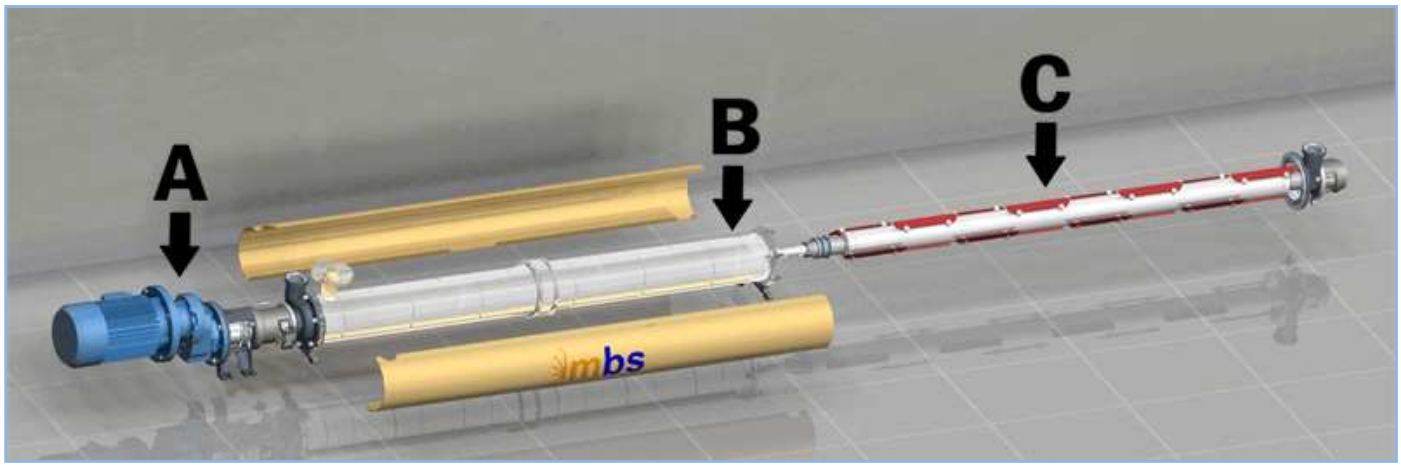
8. Machine description

The scraped surface exchanger is a machine designed to heat or cool viscous products or products with suspended particulates or products with special rheological behaviour.
The exchanger has been designed for installation in an existing plant.

Each scraped surface exchanges consists of:

A. Motor/geared motor;
B. Exchange mono-tube.Jacket tube for circulating heat transfer fluid;
C. Blade support shaft

The exchanger can be equipped with support structure.
Scraped surface exchangers are used to heat or cool down food products that would tend to stick to the exchange walls.Thanks to the scraping blades, the scraped surface heat exchanger prevents this.



a. Drive couplings

The drive couplings used in scraped tube exchangers are designed to transmit torque with no backlash and high torsional stiffness.
This type of coupling enables compensation of angular/radial misalignment and is able to withstand load variations and rotation reversal.
These couplings are **wear free and require no maintenance.**
Due to sizing requirements, the maximum moment that can be transmitted from the coupling under various operating conditions must be smaller than the maximum allowed stress of the coupling.
Exchangers supplied complete with motor unit and base have already been aligned during assembly.However distortion of the base is possible when it is anchored onto an uneven surface.

9. Transport

a. Transport

The type of packaging for MBS exchangers is specified at the time of the order.Unless otherwise requested, the goods are packed for transport only and not for long storage periods; if the exchangers need to be stored outdoors they must be covered with a waterproof cover, so that weather, dust, humidity, etc. do not come into contact with the electrical parts.

b. Reception

Upon reception of the goods, it is necessary to check the integrity of packaging material so that possible damage during transport may be detected and reported to the carrier.If damage is detected, proceed as follows:

- accept the goods with reservation;
- take photographs to have proof of the damage;
- notify the damage by registered letter with advice of receipt to the carrier company enclosing photographic documentation.

c. Handling

Move the packaged exchangers as close as possible to the place of installation using adequate hoisting means (see technical data page.14) and remove packaging material.During this operation use maximum care to ensure that unstable parts do not fall.
Any packaging material must be disposed of by the user in compliance with current regulations in force locally. After packaging has been completely removed, use suitable hoisting straps to lift and move the exchanger-motor assembly to the point of installation.

Do not use the motor eyebolts to lift the entire unit, as these are designed for handling of the motor only.

10. Installation

a. Technical terminology

Product (A)	Fluid going through the tube side section
Service (B)	Fluid going through the shell side section
Pressure	Pressure for tube and shell fluids expressed in [bar]
Temperature	Temperature in tube and shell fluids expressed in [℃],
Volume	Volume of tube and shell section expressed in litres [l]
Length (L)	Exchanger length expressed in metres [m]

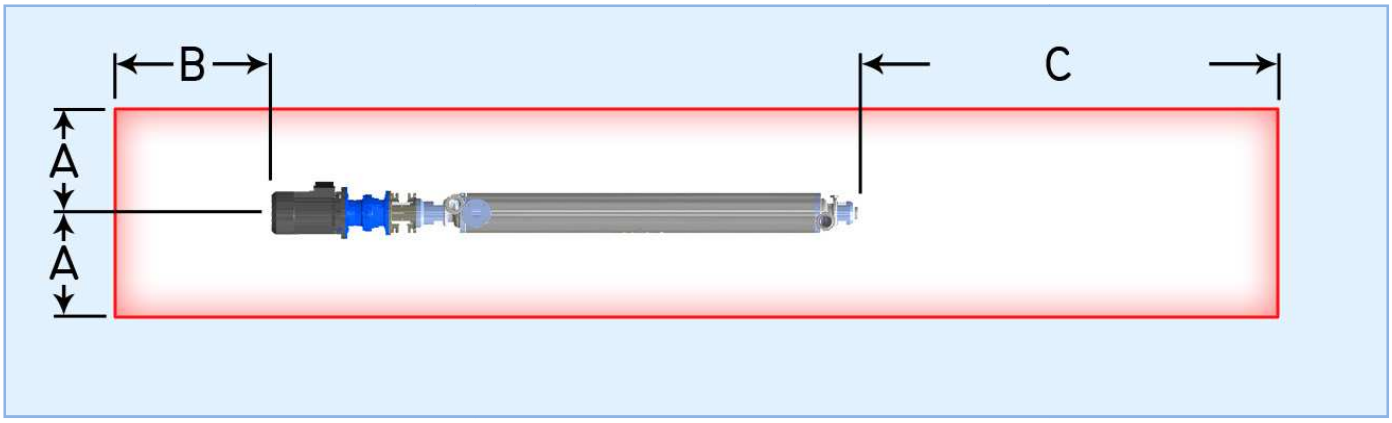
b. Positioning

Install the exchanger in a place that can be accessed for maintenance and inspections; ensure that there is sufficient space if parts need to be removed from the support frame.
Install the exchanger on a level surface.

Install the heat exchanger in a well ventilated and correctly illuminated room.

c. Work area

Allow adequate clearance around the exchanger to enable operation and maintenance operations.Follow the instructions indicated in the table below.

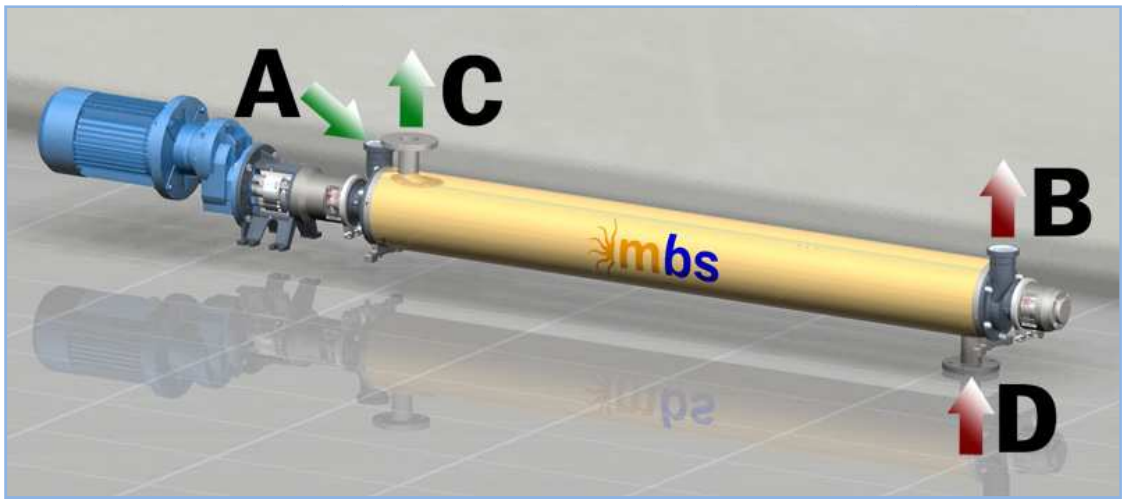


Model	A	B	C
H5	1,2 m	1 m	1,6 m
H10	1,2 m	1 m	2,7 m

d. Hydraulic connection

Connect the exchanger to the system using the diagram in the illustration below:

A. Product inlet;
B. Product outlet;
C. Service fluid outlet;
D. Service fluid inlet;



To prevent damaging stress, inlet and outlet pipes must be fitted to the exchanger inlets without forcing them.These pipes must be supported separately without resting on the exchanger.

If very long pipes are used, a valve should be installed at the exchanger inlet and outlet to facilitate inspection without having to empty out the system unnecessarily.
We recommend installing a filter at the inlet of the exchanger (or set of exchangers) to keep out foreign objects from the exchanger.
We recommend installing a filter at the outlet of the exchanger (or set of exchangers), in case the scraping blades break due to failure to perform scheduled replacement.

Interconnection between a number of exchangers

If a number of exchangers need to be connected in series the following installation conditions must be respected:

- Install each exchanger horizontally checking the position carefully; eliminate any difference in alignment or centre distance to keep weight from resting on product inlet/outlet connections or on service inlets;
- use full face gaskets;
- the connection pipes between adjacent exchangers must be created after the exchangers have been rigidly positioned to ensure optimal closure of connections;
- the distance kept between elements must be sufficient to enable disassembly.

e. Dilation compensation

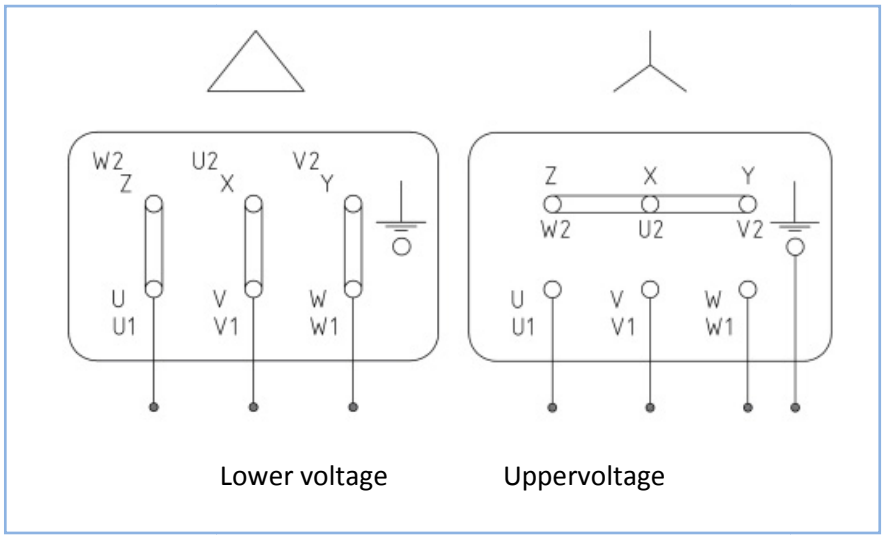
The exchanger is equipped with dilation compensator which, in compliance with directive 97/23/CE, is sized in accordance with pressure values, temperature and number of cycles of the stroke.
It is necessary to check the operating stroke of the compensator according to the temperature difference between product side and service side.
At the maximum temperature and pressure indicated in the technical data in this manual, the number of cycles is:

- axial stroke + 6 / -12 mm => 1000 cycles;
- axial stroke + 3 / -6 mm => 20000 cycles;
- axial stroke + 0 / -3 mm => 100000 cycles.

f. Electrical connection

The operations indicated in this paragraph must be performed exclusively by specialized personnel.

The information provided in this paragraph has a general nature.For electrical connection of the exchanger you should always refer to the enclosed motor manual as well.
Connection of the electrical part must be made after the hydraulic connection; the control system of the motor must comply with current technical regulations and laws (EN 60204-1): in particular a manual power disconnector with adequate current shutoff power must be installed; in addition a surcharge and overload protector (e.g. fuses, automatic switches, etc.) must be installed and, if necessary, a device to prevent spontaneous restarting. **Ensure that the voltage, mains frequency and power available are suitable for the installed motor.**All the material used for the electrical connection (cables, cable glands, switches and protections) must have a degree of protection suitable for the environment where it is installed; it is also important to use a cable section suitable for the value of current specified in the motor plate, to prevent overheating of conductors.
First of all the motor grounding system must be provided, using the terminal present in the motor and a suitably sized conductor.
Connection of cables to the terminal board can be either triangular or star shaped, respecting the data shown on the motor plate for the mains voltage according to the diagram in the figure below;the terminals must be clean and tightened, without subjecting them to stress



Lower voltage Uppervoltage

During the motor starting phase, current absorption increases for a very short time to 5-6 times the nominal value, if the mains are unable to withstand this absorption peak, star-triangle starters or other systems must be used (e.g. auto-transformer).

Once the electric connection is completed, make sure that the direction of rotation of the motor is the same as indicated in the motor plate.If it is not, the electrical connections will need to be inverted.

You are required to install an emergency stopping device in an easily accessible position.

MBS srl will not be liable for damage or personal injury in case of failure to comply with current technical regulations and laws.

11. Preliminary operations

a. *Start-up washing*

After installing the exchanger and before starting up the system, the following procedure must be performed on both product side and service side:

- Ensure that the circuit downstream of the exchanger has free discharge;
- open the washing liquid flow and leave it open for the time required to remove any process residues, dust, etc.;
- start the blade support shaft using the PLC control or switchboard to check the direction of rotation (for procedure performed on product side);
- gradually increase pressure inside the exchanger (using a valve downstream of the circuit) to verify that all the connections are tight (Pmax =Pproject, see technical data on page 16).

12. Operating instructions

Normal machine starting and stopping is integrated with system control and always require the presence of fluid inside the exchange cylinder.

Do not rotate the blade support shaft if the blades are excessively worn out or if their width is less than xx mm.

All the operations must be performed by specialized personnel.

a. *General indications on use of steam and gas*

The use of water steam in the exchanger shell is one of the most widely used applications in the solution of thermal exchange problems.
Check the technical data in this manual to ensure that the exchanger is suited to this application.
The precautions required when the exchanger is used with steam are:

- Protect the steam line with a maximum safety valve set to the maximum plate value shown in this manual and/or in the exchanger plate;
- Install a suitable condensate draining system, with automatic air discharge system;
- Protect the product side in accordance with the instructions provided (see page 21) to prevent overpressure in case it is necessary;
- The water steam used must be of good quality, according to the provisions of regulations concerning steam production in thermal equipment.
    - In particular it must contain no suspended solids and itsPh must be included between 7 and 8.5. It must be in dry saturated form to prevent water hammering inside the equipment.

If the exchanger is installed in a position that enables casual contact with operators, the exchanger shell and the line must be protected with suitable guards.Hazards for operators must be indicated with suitable signs.

b. General remarks about use of liquids at temperature below 0°C

The exchanger is often used successfully to cool product down to low temperatures using fluids with temperature below 0°C.The service fluid normally used is a mixture of water and glycol or alcohol in adequate proportions.
In these cases, you need to ensure that under no work, rest or emergency condition the product drops below the state change temperature with consequent freezing.The solid state will in most cases present a lower density and therefore determine an increase in volume which leads to the **breaking of pipes.**
An analysis of circuit behaviour must be conducted in the way described below.
The exchanger must be used in conditions of sufficient safety with respect to the conditions of product freezing, taking into consideration the variation induced by the regulation systems of the circuit.Suitable means for control of product side temperature must be provided including safety trigger thresholds for freezing temperature.
Critical conditions are normally generated due to insufficient flow in the product side.Suitable flow control means must be provided including safety trigger thresholds for minimum compatible flow.
Very often the thermal potential of the service side is such that it can lead the product side to freezing even when both flows are absent:it is therefore necessary to check for this condition and provide suitable prevention measures.
Protection of the circuit is achieved by draining the product side and shutting off the service side as soon as there is an indication of a possible hazardous condition.
To perform the draining please remember that two different opening outlets are required:

1. one at the bottom, for draining the liquid;
2. one at the top for letting in air to take up the volume previously occupied by the liquid.

In some case, where there are difficulties with draining due to the physical position of the circuit, compressed air can be blown directly in to empty the circuit.
Check the technical data in this manual to ensure that the exchanger is suited to this application.

c. Precautions for overpressure

To guarantee safe conditions during the use of the exchangers, precautions must be used to prevent possible overpressure that could be generated inside the hydraulic circuits with possible damage and/or leaks towards the outside.
To this end, it is important to carefully analyze the circuit where the exchanger is installed and identify possible causes that could induce overpressure.
It is particularly important to verify the type of pumping system used for feeding fluids.A centrifugal pump never exceeds the maximum plate head, even when the circuit is closed; conversely, a positive displacement pump, especially one with pistons (or a homogenizer) can lead to high pressure peaks if the delivery circuit happens to be closed.In this case, as the liquid is not compressible, there is no elastic compensation and the overpressure generated will be transferred onto the entire circuit in a rigid way.
Another condition that can induce overpressure is failure to drain a circuit (typically the jacket side) and keeping the circuit closed when the other side of the exchanger is heated.In this case heating will cause dilation of the liquid in the closed circuit and/or transformation into steam, causing a pressure increase to very high value with consequent breakage or leaks and serious risks for anyone standing in the vicinity.
The use of gas in the jacket, especially refrigerants, can create overpressure situations if the circuit does not have the required characteristics:this is because this kind of gas, normally used with low temperature and low pressure cycles, can expand by effect of the temperature and lead to high pressure values.This can happen, for example, during washing cycles (or in other conditions during which hot fluid circulates in the tube side) if the jacket side is not adequately drained.
Implement all the necessary measure to prevent these situations, installing a suitable maximum pressure valve as indicated below.

Instructions for definition of overpressure protections:

Analyze the application of exchangers in the circuit:if any of the above conditions can be detected, especially in case of breakage of control components, failure of diverter valves, manual control errors, etc. you should provide a valve or safety device of a material and size suitable for protecting the circuit.

The valve must be set to open at the maximum pressure value declared for the exchanger (see page 14 of this manual), and must enable full flow rate withoutany further pressure increase.

The valve will typically have a section equal to the diameter of the feed pipe.

Operation must be mechanical and not be conditioned by any electrical command.

The safety valve must be installed upstream of the exchanger circuit.Drained liquids must be conveyed safely to prevent hazards for operators.

No shutoff systems must be installed between the circuit and the safety valve.

If the circuit features check valves it may be necessary to install more than one safety valve to adequately protect all the circuit sections.The efficiency of the safety valves must be checked periodically with bench tests.

We also recommend installing a pressure transducerwhich in case of overpressure will stop supply to the exchanger and start draining the feeding line to the exchanger.

d. Instructions for use of steam

Startup

1. Send product inside the exchange cylinder keeping the product side volume at a pressure greater than steam pressure;
2. Start the blade support shaft;
3. Open the steam feeding valve;
4. Regulate flows and rotation speed to achieve the desired temperatures.

Stopping

1. Close the steam feeding valve;
2. Stop the service flow;
3. Let water flow through to flush out the product remaining in the system;
4. Stop the blade support shaft;
5. Let water flow through until it comes out perfectly clean.

e. Instructions for use of water

Startup

1. Send product inside the exchange cylinder keeping the product side volume at a pressure greater than the pressure drop in the service side;
2. Open the service fluid feeding valve;
3. Start the blade support shaft;
4. Regulate flows and rotation speed to achieve the desired temperatures.

Stopping

1. Stop in sequence the service flow (closing the delivery valve) and then the product;
2. Let water flow through to flush out the product remaining in the system;
3. Stop the blade support shaft;
4. Let water flow through until it comes out perfectly clean.

13. Startup

The risks and preliminary operations relating to the system where the exchanger is installed are not discussed in this manual.Please refer to the documentation provided by the system manufacturer.

Checklist before system startup:

1. For operators:
    a. Read manual and have access to it;
    b. Adequate experience with startup operations;
    c. Informed about working conditions required;
    d. Familiar with position of manual shutoff valves;
    e. Informed about possible risks connected with use of exchanger and of the system where it is installed;
    f. Keep at adequate distance from machine.
2. As regards the system, ensure that:
    a. All the pipes are welded;
    b. the connections are perfectly closed and fitted with gaskets;
    c. The product and service feeding circuits are in good conditions, protected (if necessary) and equipped with the necessary pressure and temperature indicators;
    d. Safety valves are in place and efficient;
    e. All safety devices are in place, active and efficient;
    f. Service fluid is available and ready to correctly flow inside the exchanger jacket.**It is important to keep pressure and temperature of service fluid under control.**
3. If double seals are installed, ensure that flow rate inside the flushing chamber is sufficient (see MECHANICAL SEALS)

Activate the circuit in accordance with the procedure decided in the design phase, checking operation value on the instruments and indicators; if the conditions do not match project value, stop the test and check efficiency of circuits, devices and accessories in the whole system.
You should also verify that the level of vibrations, noise and other operation conditions are within the design parameters.
After a long period of inactivity, it is necessary to wash the exchanger before use (see page **Errore. Il segnalibro non è definito.**)

14. End of operation cycle

At the end of every production cycle the exchanger must be washed (see page **Errore. Il segnalibro non è definito.**).

15. Emergency stop/power blackout

You are required to install an emergency stopping device in an easily accessible position.

In case of emergency stop (both manual or by control systems) the entire system must be stopped.
Before restarting production, the exchanger must be washed.
We recommend a thorough investigation of the causes that led to the stop and, if needed, adopt suitable measures to correct them.

16. Washing and sanitation

The exchangers are designed to be washed in a CIP cycle inside the process where they are installed.To achieve better results the product side exchanger should be washed immediately after a production cycle, normally with soda and/or acid based solutions in the way indicated below.

For good washing results, it is important to ensure a minimum flow rate of the washing solution so that the speed on the product side is at least 1.5 m/s.It may be necessary to increase this value if viscous products or high temperature cycles are used.

Flow rate and duration of washing cycle must be defined each time according to the product treated and the process performed.

The sterilization cycle (whose parameters are defined according to the kind of process) is performed immediately before starting the following production.

Check the technical data in this manual to ensure that the exchanger is suited to this application.

a. Phases of CIP programme

The CIP programme will generally include the following phases:

- First rinse with water;
- Washing with chemical solution;
- Rinsing;
- Sanitation.

b. Washing solutions

The user is responsible for checking that the solutions used are compatible with the construction materials of the scraped surface heat exchanger.

Below we list the maximum concentrations and temperatures for the acids most widely used in CIP:

Nitric acid:	max concentration 2% @ 60°C;
Citric acid:	max concentration 2% @ 73°C;
Phosphoric acid:	max concentration 2% @ 73°C;
Acetic acid:	max concentration 2% @ 73°C;

Water quality.

The used for service and washing equipment must be of a quality defined as drinkable according to national and European directives.

The chemical characteristics of the water must comply with minimum requirements:

- Ph 7.0 – 8.5;
- Max chloride 30 ppm;
- Max chlorine 0.2 ppm;
- Max iron 002 mg/kg;
- No organic substances;
- No suspended solids.

Water hardness must be checked:calcium, silicon and manganese must be in a quantity that will ensure hardness is below 10 F; otherwise limescalebuildup may be difficult to remove.This problem can be made worse if the presence of large quantity of calcium is combined with high temperature.

If descaling treatments are performed they must be carried out by personnel specialized in the chemical sector, taking all the necessary precautions and using suitable passivated acids with adequate concentration.

c. CIP washing checklist

- Before washing, stop inlet of all service fluids;
- Verify that the shell side can drain freely (prevent overpressure);
- Ensure that the washing solutions have equal concentration;
- Verify that temperature is homogeneous during the washing phases.

If the motor needs to be switched on during washing set it to a max speed of 70 rpm.

d. Verifying washing results

To verify the results of a washing cycle two separate procedures can be used:
Analysis of rinse water after washing with detergent solutions:the water must have neutral Ph and no traces of product in suspension.
Inspection of exchanger:remove heads and ensure there are no traces of burnt product , dry product or other forms of product on the head, in gasket seats, in the first section of the pipes, on the blade support shaft and on the blades (see procedure for removing blade support shaft, page 26).
If the results are not satisfactory, we recommend first of all to prolong the time of each phase; if this increase does not solve the problem, start raising the temperature slightly, and analyze the type of residue to determine the appropriate detergent agent.

17. Ordinary maintenance

Before carrying out maintenance procedures, perform a washing cycle (see page 20) and ensure that all the pipes are empty.

Before performing any maintenance procedure make sure that electric power has been disconnected.

Maintenance and repair operations must be performed exclusively by specialized, trained personnel; the machine must be stopped with **the emergency pushbutton pressed and the emergency switch closed and padlocked.**

DO NOT WORK on moving parts, not even with the help of objects or tools, unless specifically required to do so by this manual and using the precautions described.

IT IS ABSOLUTELY PROHIBITED to tamper with, remove or alter the safety devices of the machine.In these cases the manufacturer will be relieved of all liability for machine safety.

Should any defect affect safe operation, you are required to stop the machine immediately.

The activities described in this paragraph must be **performed only by qualified personnel** namely:
Trained technician who has attended specialization and training courses and has experience in the installation, commissioning and maintenance of systems and is familiar with injury prevention regulations.

Malfunctions due to insufficient or inappropriate maintenance can lead to very high repair costs and long machine shutdown.Periodic maintenance is therefore indispensable.

Safe operation and machine durability depend, in addition to other factors, on regular maintenance.

Summary table of required procedures

Type of procedure	Frequency
Cleaning machine	Every working cycle
Bladewearchack	Weekly
Mechanicalsealcheck	Monthly
Bearinglubrification	Monthly
Gasketcheck	Monthly

Check the instructions provided in the operation and maintenance manuals of the specific components.
Always disconnect switchboard from power before performing maintenance operations.Wear suitable Personal Protection Equipment (gloves, overalls, anti-slip boots and mask)
Buildup of dirt and dust on the surface of the machine will affect the efficiency of the machine's devices.All gaps and crevices must be kept clean.

a. Servicing/replacing scraping blades

To replace the scraping blades you need to remove the blade support from the scraped surface exchanger
To remove the blade support shaft proceed as follows:

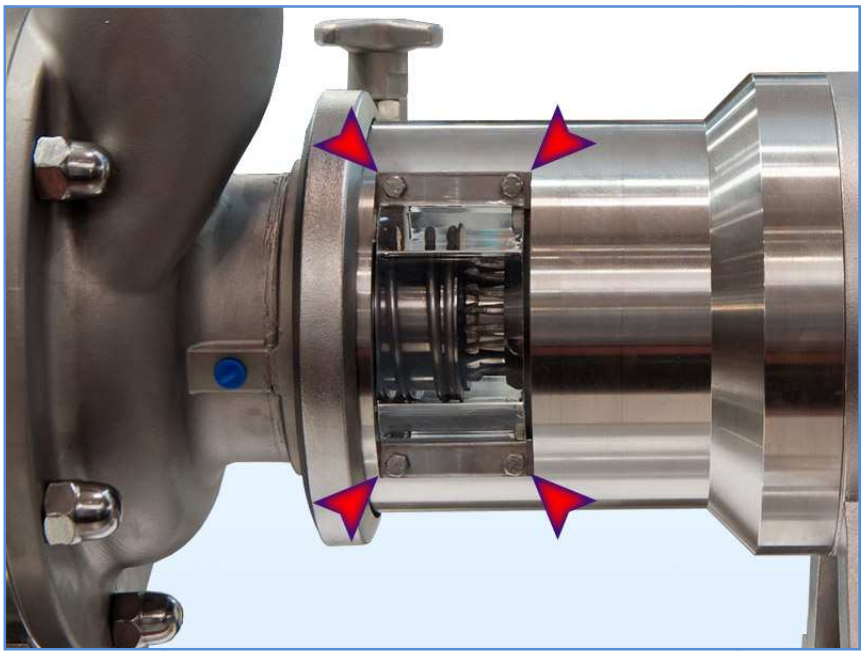
b. Removing blade support shaft

Protective clothing must always be worn before performing the operations listed below.

1. Disconnect electric power;

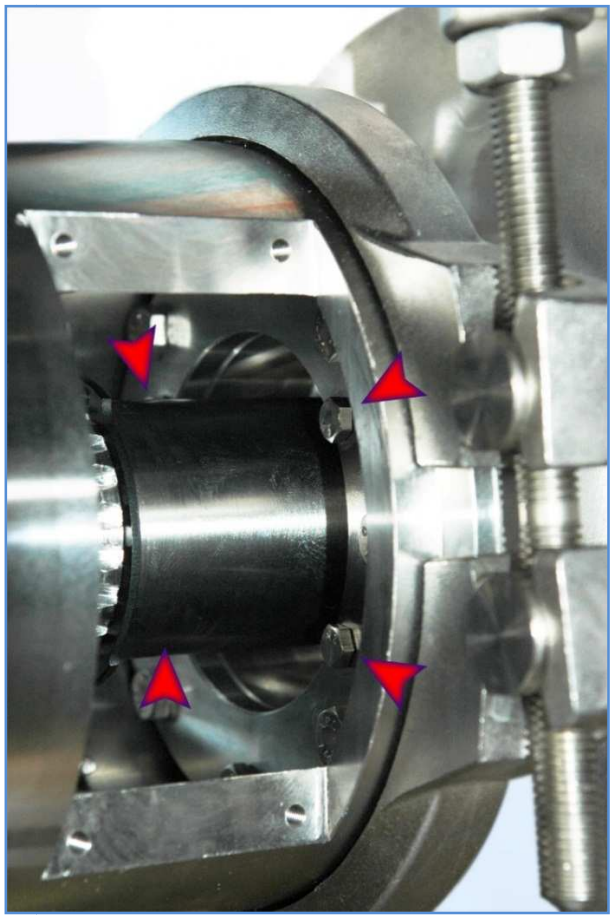
If the motor is inadvertently switched on during removal of the blade support shaft, serious injury can be caused.

2. Disconnect the product outlet pipe (see page 17), with the relevant flushing pipe (if present);
3. Remove the guard, by loosening the 4 screws indicated in the figure.



4. Loosen the 6 bolts from the head, idle side;

5. Loosen the 4 screws securing the seal bushing;



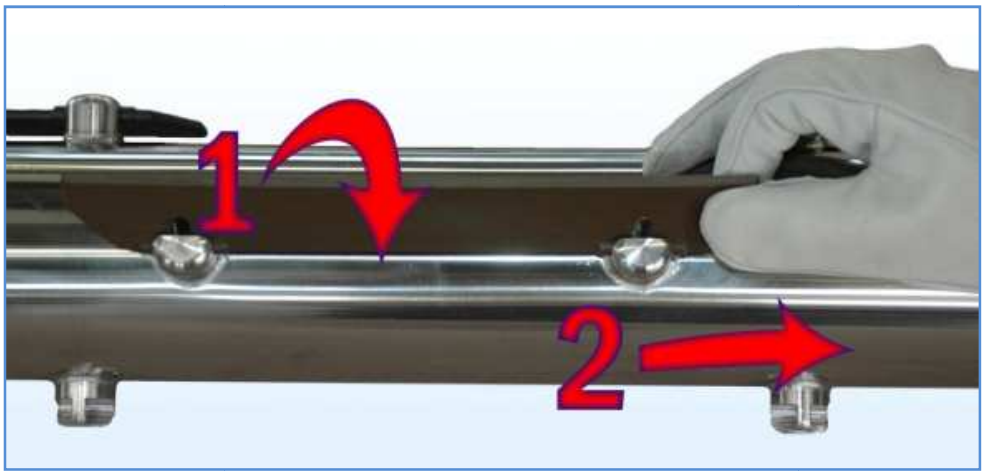
6. Gently extract the blade support shaft with the help of lifting systems.

c. *Replacing the blades*

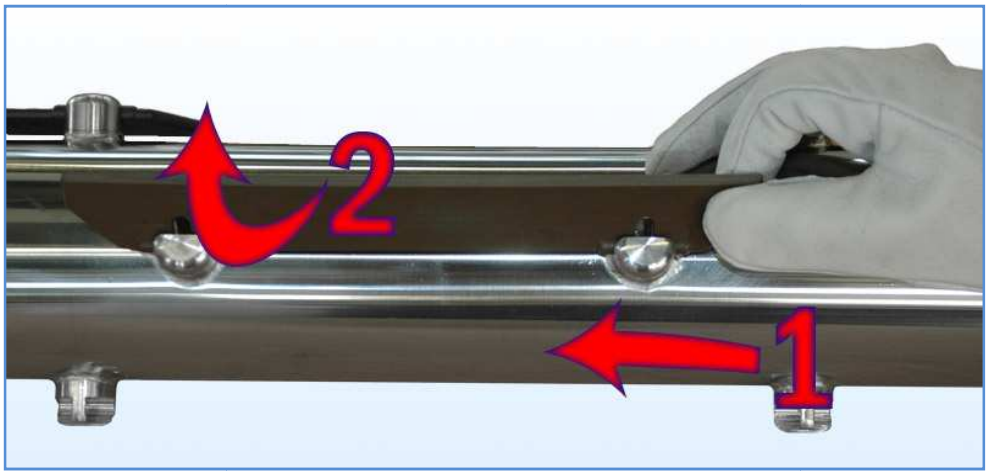
Protective clothing must always be worn before performing the operations listed below.

1. Remove the blades.To remove the blades lift then and pull them out (see figure below);

The blades can be very sharp and cause injury.



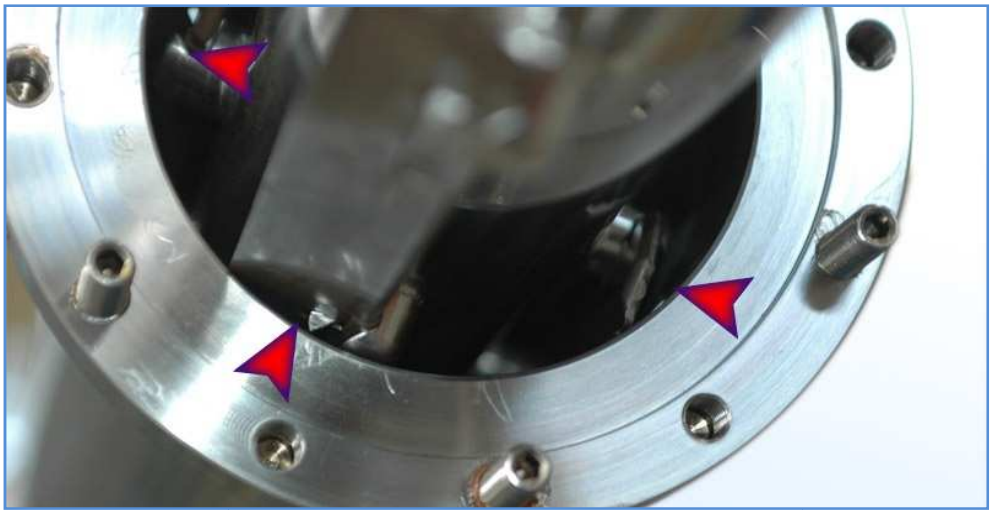
2. Install new blades.



d. Fitting blade support shaft

1. Grease the O rings on the seal bushing, motor side;

2. Gently insert the shaft ensuring that there are two sets of blades in contact with the exchange cylinder;



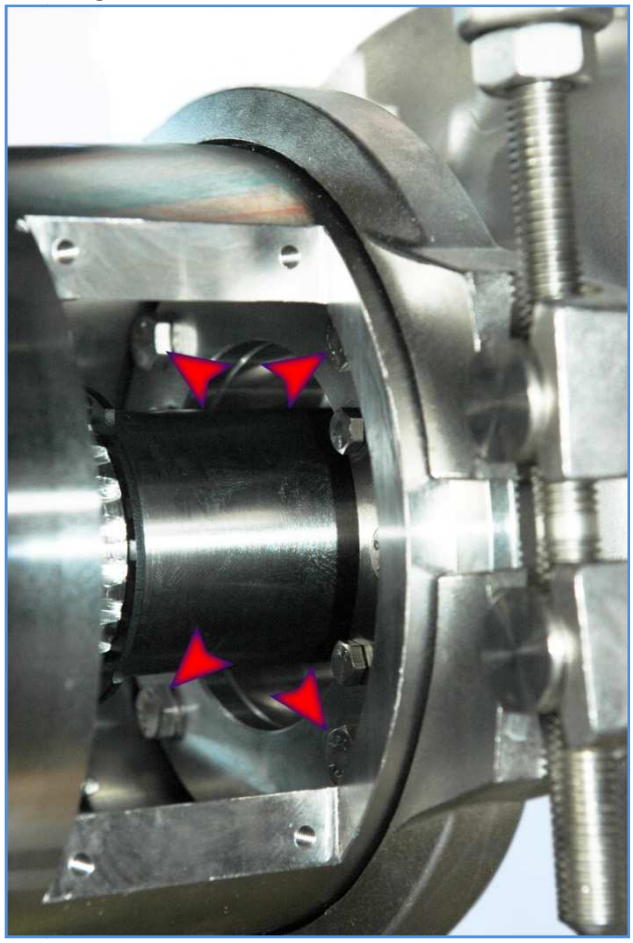
When the shaft is fully inserted, proceed carefully to prevent damage to the seal seat.

3. To facilitate alignment of the keying unit with the bearing bushing use a screwdriver through the hole provided;

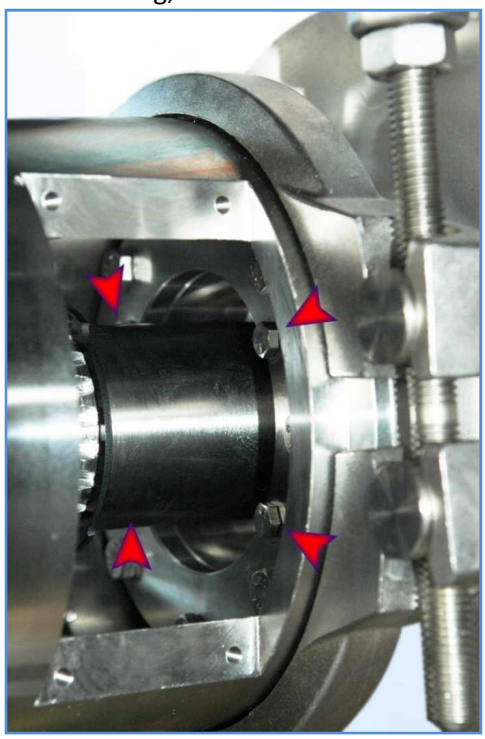
4. To facilitate alignment of the drive coupling manually rotate the shaft on the idle side;

Do not insert shaft all the way.

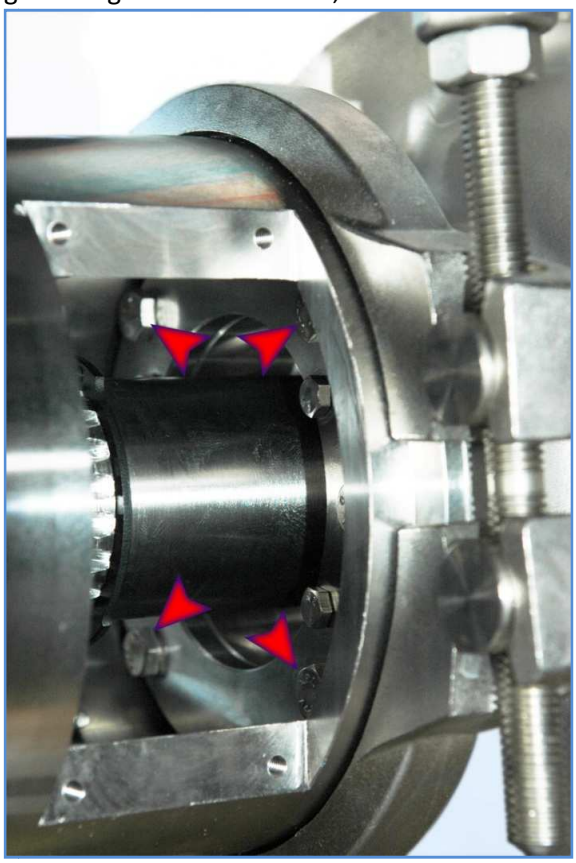
5. Loose the 4 screws securing the flange;



6. Partially tighten the 4 screws of the seal bushing;



7. Correctly align the bushing flange and tighten the 4 screws;



8. Verify that the two O-rings are in place;
9. Insert shaft in all the way and tighten the 6 head nuts ;
10. Fully tighten the four screws securing the seal bushing;
11. Replace the guards.

Check all the screws and bolts to ensure they are properly tightened and that all the guards are in place.

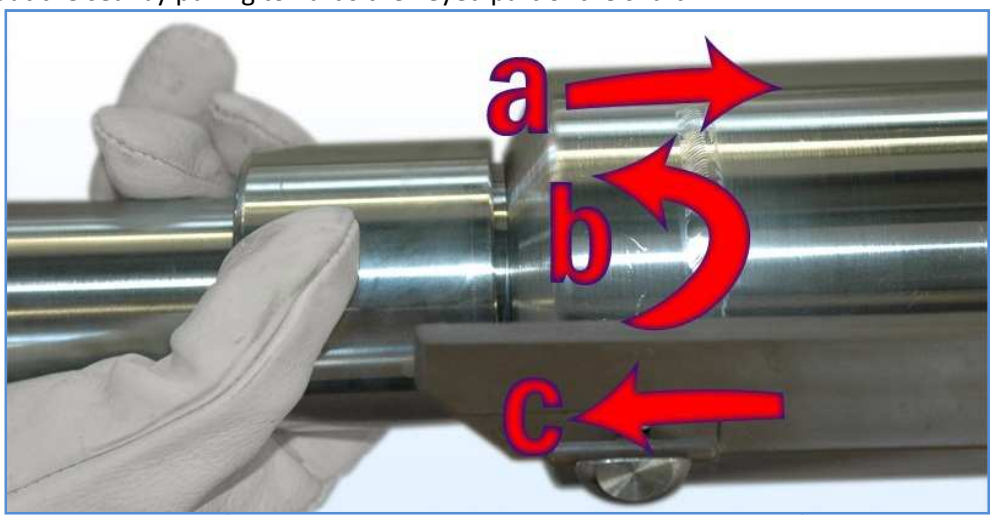
After every maintenance procedure, wash unit before restarting (see page 27)

e. Servicing/replacing individual mechanical seal

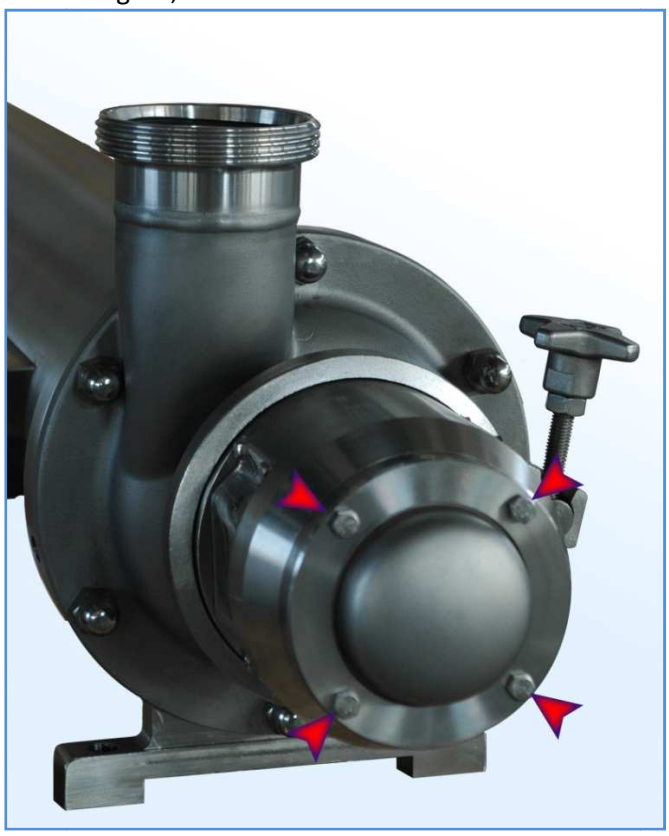
To service/replace a mechanical seal you must first **remove the blade support shaft** (see page27).
After removing the shaft, proceed as follows:

1. Remove Seeger ring;

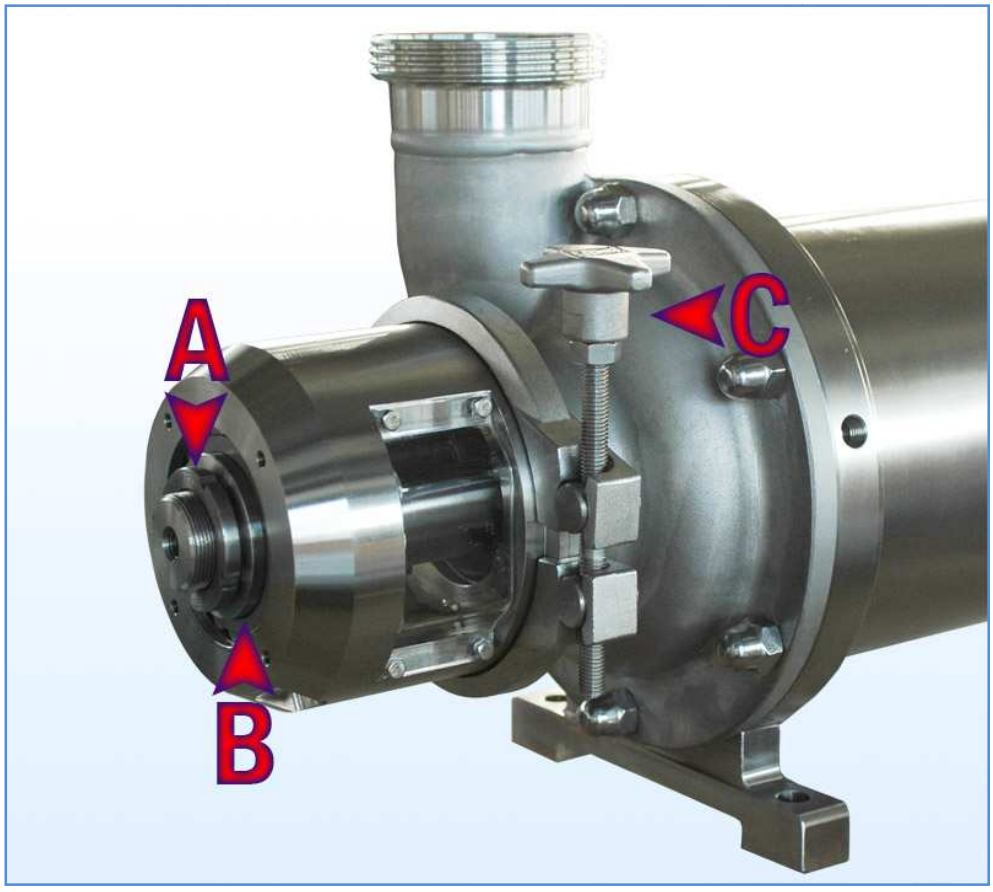
2. Extract the seal bushing;
3. Remove the internal seal:
   a. Push the internal rotary seal towards the central part of the shaft;
   b. Rotate the mechanical seal by holding the shaft in the direction of rotation of the latter,
   c. pull out the seal by pulling towards the keyed part of the shaft.



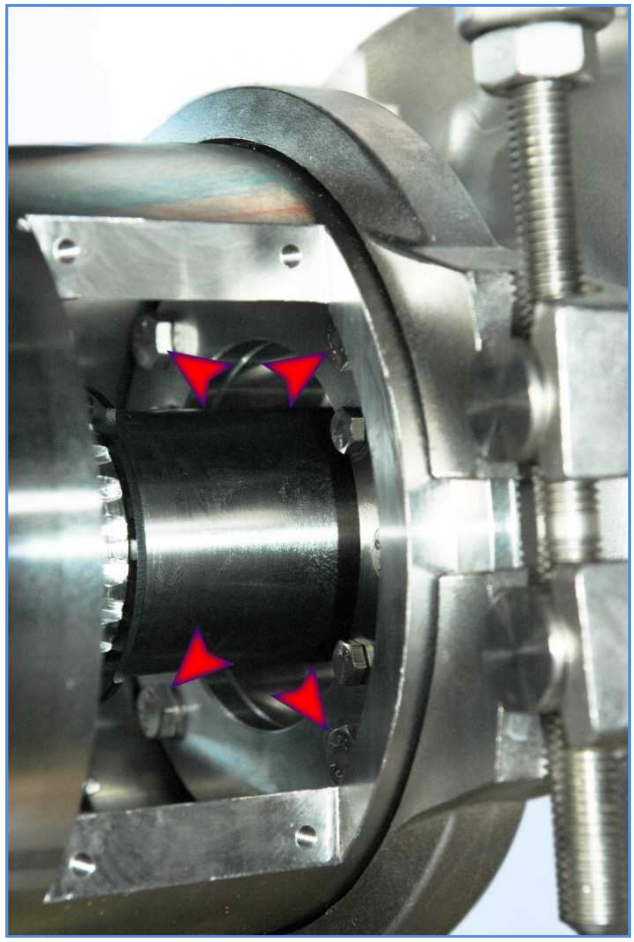
4. Loosen the 4 bolts indicated in the figure;



5. Loosen the safety device on the ring;
6. Loosen the ring (A) using a hook spanner and remove the bushing (B);
7. Open clamp (C);

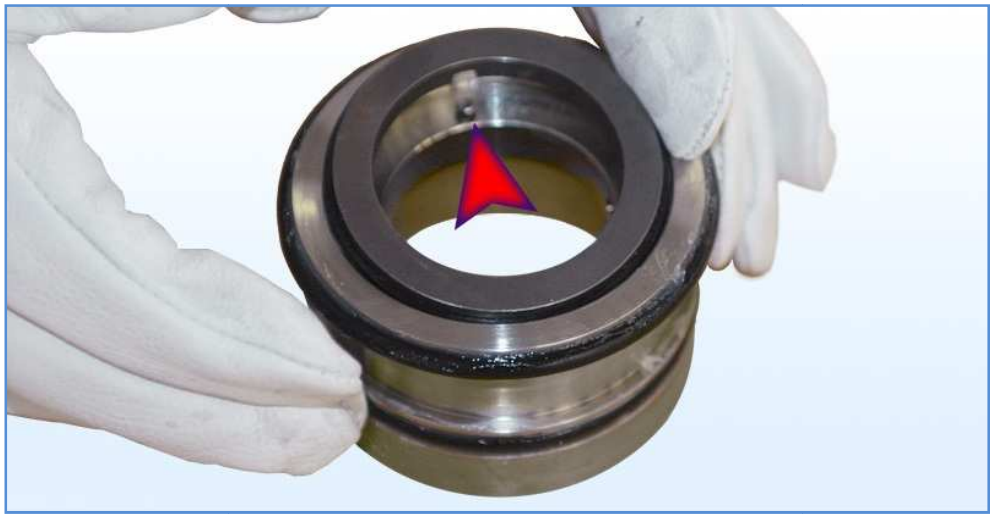


8. Remove the bearing support;
9. Remove the bearing bushing;
10. Remove the exchanger head;
11. Remove the 4 flange screws;



12. Remove the seal bushing and internal seal following the steps performed on the motor side;
13. Remove the fixed walls of the mechanical seals with the help of a thin tool;

14. Fit the fixed walls of the new seals by pushing in all the way the ring and gasket, aligning the slot with the plug.**CAUTION:it is very important to avoid damaging, scratching, chipping the seal walls as this could affect machine operation.**



15. Replace the O-rings and grease them;
16. Fit the rotary parts of the internal seal using the above procedure in reverse order;
17. Grease seal O-ring, align plug with fixed seal slot, push the seal up to (see photo).Rotate in direction opposite to shaft rotation and release.To verify that the seal is properly secured, try to pull it out without rotating;
18. Fit components back both on idle side and motor side, using reverse procedure;
19. Fit back the blade support shaft (see page**Errore. Il segnalibro non è definito.**).

18. Cleaning

The machine can be cleaned by personnel without specific technical skills, provided that they have been correctly instructed on the main power disconnection controls and that they are familiar with the main characteristics of the machine to prevent hazard situations.

Always disconnect switchboard from power before performing cleaning operations.Wear Personal Protection Equipment.

Prolonged contact with detergents, oils or lubricants can cause skin irritations.Personal hygiene and workplace hygiene rules must be followed scrupulously.

General cleaning:

- Do not use water jets, steam or compressed air;
- Clean covers, panels and controls with a soft cloth slightly dampened with detergent solutions;
- Wipe off dust and other dirt from the machine;
- Keep the work area clear of any material that may obstruct operations;
- Keep surrounding area clean; in particular from oil and grease or other materials that can make the floor slippery.

19. Demolition and disposal

At the end of the life cycle of the machine, the user company must dispose of the machine in compliance with current regulations after emptying out lubrication fluids, cleaning the various parts of the machine and separating them.After the machine has been disassembled the various materials must be separated in accordance with the regulations of the country where the machine is disposed of.The machine does not contain hazardous components or substances requiring special disposal procedures.
To dismantle the machine, proceed in the following order:

- Remove electrical power;
- Disconnect pneumatic power;
- Disconnect the electrical parts;
- Disconnect the mechanical parts.

CAUTION:Use appropriate Personal Protection Equipment when handling waste.

20. Disposal of the machine

Disposal of waste deriving from the demolition of the machine must be performed with respect for the environment, preventing pollution of soil, air and water.Applicable regulations in force locally must be complied with.Waste means any substance or object that one chooses to disposed of or is required to dispose of (L.D. 152/2006). **Waste deriving from the demolition of the machine may be classified as special waste.**

21. Demolition materials

This is non-hazardous special waste that can be recycled, pursuant to L.D. 152/2006. As regards disposal, it is important to point out that the materials of the machine are not hazardous materials.
During the disposal process you must comply with current regulations in force locally.
Polluting materials such as oil and solvents must be stored in metal drums.

Consumables:
Used oil, oily residues and objects impregnated with oil must be disposed of through special collection centres, and not discharged into urban sewage.

22. Instructions for adequate waste treatment

Correct handling of special waste requires:

- Storage in suitable places preventing mixing of hazardous waste with non-hazardous waste;
- Ensure that transport and disposal/recycling is performed by authorized carriers and authorized centres;
- Transport of waste to authorized collection centres is allowed only by companies registered in the Environmental Management Register.

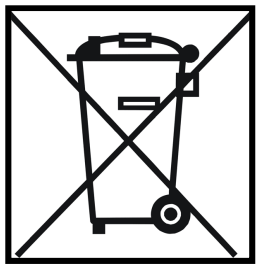
23. Wastre from Electrical/Electronic Equipment (Weee)

With Law Decree no.151 25 July 2005, the Italian Government implemented the directives of the European Parliament on disposal waste from electric and electronic equipment (WEEE) (Directive 2002/95/CE and 2003/108/CE).
In particular the decree lays down measures and procedures aimed at:

a) preventing the production of WEEE;
b) promoting re-use, recycling and other forms of recovery of WEEE, so as to reduce the quantity that will have to be disposed of;

c) improving, from an environmental point of view, the intervention of subjects participating in the life cycle of this equipment (producers, distributors, consumers and operators directly involved in treatment of WEEE);
d) reducing the use of hazardous substances in electric and electronic equipment.

The decree requires limitation and elimination of some substances present in WEEE.The following substances have been banned: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominateddiphenyl ethers.The machine has been designed and constructed in conformity with said directive.The following indications must be complied with.The symbol showing a crossed out wheeled bin indicates that electric and electronic parts of the machine must be collected separately.
The user of this machine can contact the collection centres set up by the Municipalities or directly by the manufacturer, or ask the seller to collect the machine, to ensure it is disposed of correctly.



24. Ordering spare parts and requesting assistance

Every request regarding spare parts or assistance must be sent to **MBS** on:
Tel. no. +39 0521 3971
Fax. no. +39 0521 649085
Mail : mbs@mbs-europe.com

Spare parts list	code
Internal mechanical seals KIT	
External mechanical seals KIT	
Blades PPS KIT	
Blades Peek KIT	
O-Ring KIT	