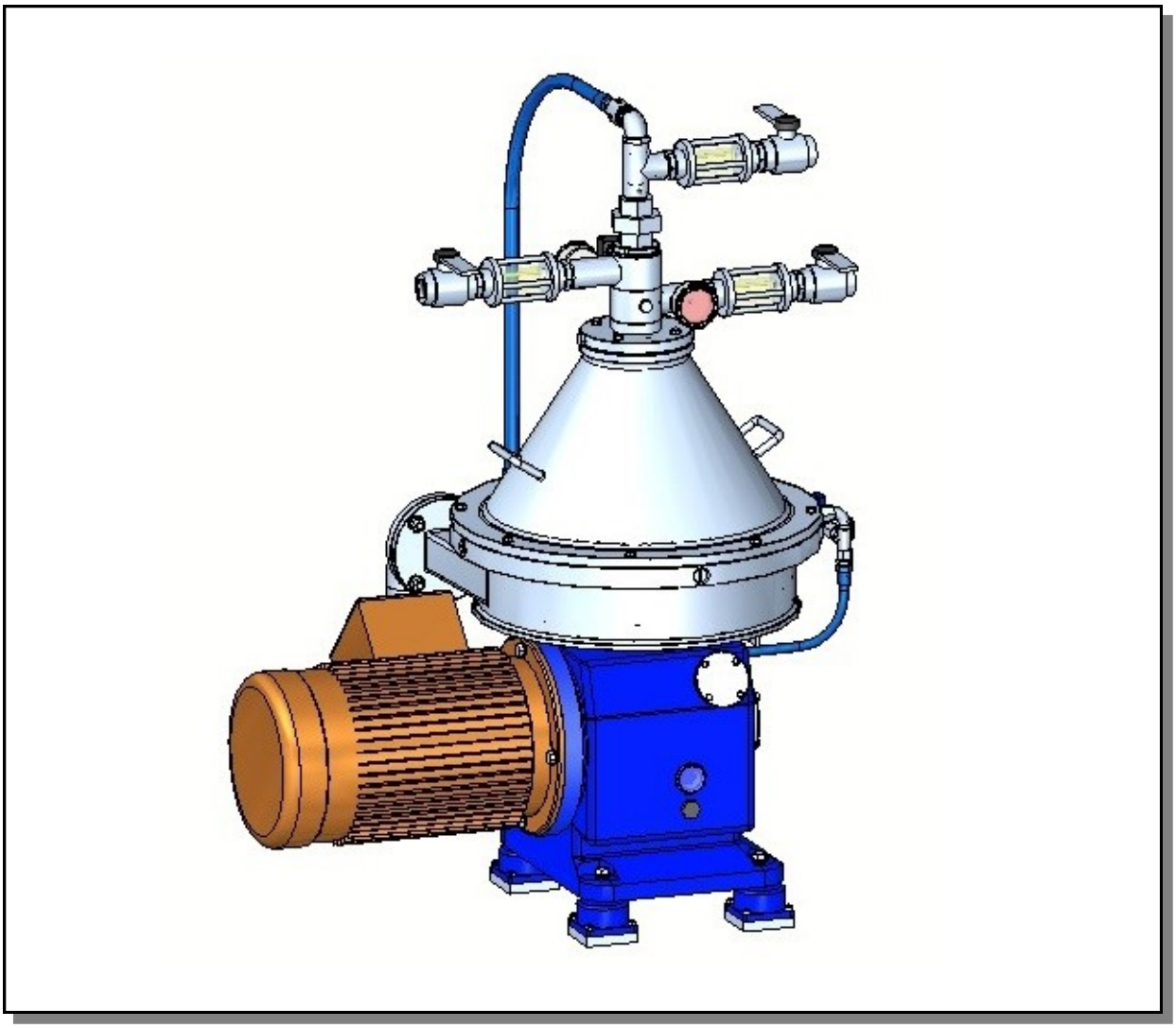

Use and Maintenance Manual

Type: Centrifuge Separator with automatic discharge

Model: **MACFUGE 325 AL PT 3 S**

Client:

Serial number:

Building year: **2016**

MACFUGE325ALPT3S02-00 EN

MACFUGE® by SERVIZI INDUSTRIALI S.r.l.
SEPARATION TECHNOLOGY

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FOREWORD

It is mandatory that the user reads and fully understands the present guide in all its parts before using this machine.

The present guide is an integral part of the centrifugal separator and must be kept for future reference until its disposal.

We would like to remind you that in order to keep information as clear as possible, we have taken into consideration only foreseeable situations. Therefore directions do not concern situations caused by an improper use of the separator and/or its tools.

The tampering of the electrical and electronic instruments without permission by ***Servizi Industriali*** *relieves Servizi Industriali itself from any liability with consequent cancellation of any form of warranty.*


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SEPARATION TECHNOLOGY
s.r.l.

Table of contents

The following documents are attached to the guide, when applicable:

Declaration of compliance
Attachment A System and components plan (P&ID)
Attachment A1 Dimensions and weight
Attachment A2 Connections
Attachment B Electrical diagram
Attachment C Internal commissioning test
Attachment D Materials' certificates
Attachment E Electrical motor guide
Attachment F Frequency converter guide
Attachment F1 Frequency converter parameters
Attachments Components' guides and certificates

1 GENERAL INFORMATION

1.1 GUIDE'S CONTENT

Acknowledged that it is mandatory that the user reads and fully understands the present guide in all its parts before using this machine and that the present guide is an integral part of the centrifugal separator and must be kept for future reference until its disposal, we now describe the guide's content and its consultation methodology.

This booklet titled "**USE AND CARE GUIDE**" provides all the necessary information to correctly perform all the installation, commissioning and maintenance procedures related to the centrifugal separator, object of the present manual.

The guide is divided in chapters, and the table of contents, in the initial pages, speeds up the consultation. The chapters' order reflects the order of the procedures to be performed; therefore the information provided starts from separator installment, assembly of the bulk parts, start-up, usage adjustments, maintenance and replacements.

The following abbreviations are used in the guide:

Pg. = Page,
Fig. = Figure,
Tab. = Table,
Ref. = Reference,
Ch. = Chapter,
Par. = Paragraph
Tab. = Spare parts table.
Att. = Attachment

Furthermore we will use graphical signs together with a description to indicate the risk of damages to people or to the separator. Hereafter we list the different types used.

DANGER:
This sign indicates a situation that, if not avoided, can cause fatal damages to the user and the people nearby.

ATTENTION:
This sign indicates a situation that, if not avoided, can cause injuries to the user and the people nearby.

CAUTION:
This sign indicates a situation that, if not avoided, can cause damages to the separator and the equipment.

PROHIBITION:
This sign indicates a situation and/or an operation not allowed in the use of the separator.

OBLIGATION:
This sign indicates a situation where it is mandatory to respect the signals considered essential for the proper functioning of the machine and for the user's safety.

All information present in this guide is reserved, property of the manufacturing company and provided only and exclusively to the company quoted in this guide's cover.
Any disclosure of this information that is unauthorized by the manufacturer will be criminally sanctioned.

1.2 WARRANTY

- The warranty is **24 months** from the merchandise delivery.
- The warranty provides for the free ex-works delivery of the components presenting manufacturing defects that prevent the proper functioning of the provided equipment.
- The parts to be replaced upon request of the vendor will have to be returned at the buyer's expense.
- Technical assistance, whenever requested, will be at the buyer's expense.
- The warranty does not cover damages caused by an incorrect installment, storage or improper use, as well as damages caused by alterations to the equipment or by extraordinary maintenance performed without the written authorization of the manufacturer.
- The warranty does not cover electrical parts and parts subject to wear.

1.3 CHANGES TO THE SEPARATOR'S FEATURES

In the preparation of this guide we have been extremely careful to assure that the information provided are correct. However, the manufacturer, Servizi Industriali S.r.l., reserves the right to modify, even without notice, both the guide and the product described in this guide. Therefore, the description and the features here described, are not binding nor object of any contractual obligation.

1.4 IMPORTANT NOTES REGARDING THE MANUAL PREPARATION

The images used during the preparation of this manual have an illustrative and explicative purposes, therefore, the parts subject to customizations or otherwise the variables assembling configurations, do not faithfully reproduce the aspect of the part itself or of the machine as its whole. Both, reproductions of the parties specifically discussed in the individual sections and images related to the listed parts referred to Cap.12 are however faithful except for the notes referred to par. 1.3.

In this manual, the description of the discs centrifugal separator is performed at different levels, that is, the manual contains information that generally are applicable to this type of machine, instructions for the particular type/configuration and information related to the specific separator version odject of this manual. The splitting of the information within the manual, for clearness and ease management, is made in such a way that in each single chapter are contained only information of the same type, that is, information that they apply generally or by type/configuration or specific model.

The following table shows the breakdown of the chapters according to the criteria described above.

Chap.	Title	Validity
1	General Information	general
2	General technical description	general
3	Safety	general
4	Handling and storage	general
5	Installation	by type/configuration
6	Connections	general
7	Usage and functioning	by type/configuration
8	Technical sheet	per specifico modello
9	Troubleshooting	by type/configuration
10	Maintenance	specific separator version
11	Demolition	general
12	Parts' list	specific separator version
13	Spare parts	specific separator version
14	Variations	general
15	Summary intervention	By type/configuration
16	Attachments	specific separator version

2 GENERAL TECHNICAL DESCRIPTION

2.1 GENERAL DESCRIPTION

The machine that we are describing it is called Disks Centrifugal Separator.
The disc centrifugal separator is later in this manual for brevity called "centrifuge".

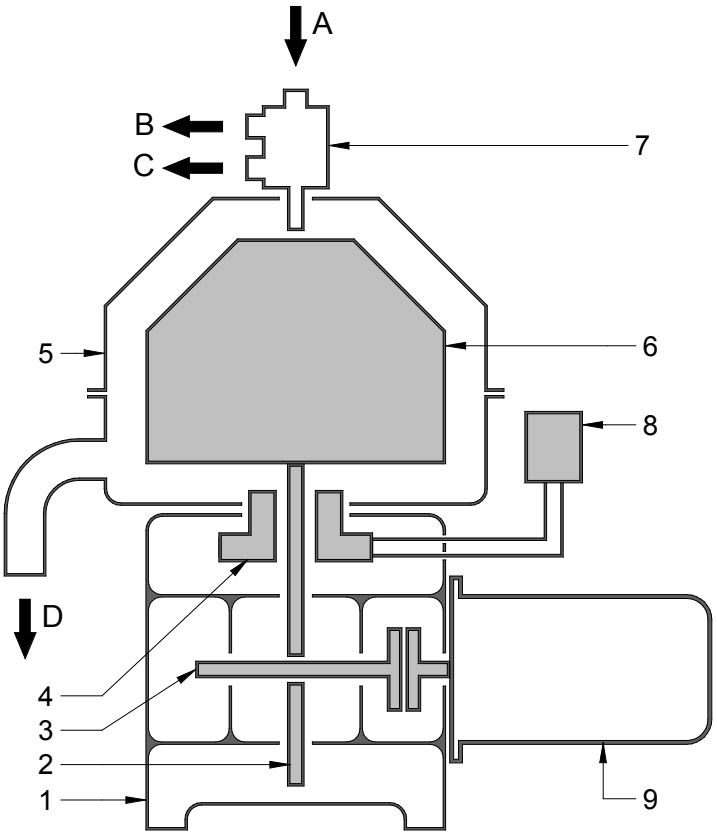
The centrifuge has been designed and built to separate a mixture of two liquids and a solid, having different specific weight (separator version or skimmer/concentrator version) and just one solid and liquid having different specific weight (version clarifier).

The mixture constituting the product to be treated is introduced into a centrifugal acceleration field, generated by the rotation of the rotating parts of the centrifuge, very high, able to accelerate the natural process of separation that the different phases constituting the product would have in the field of gravitational acceleration .

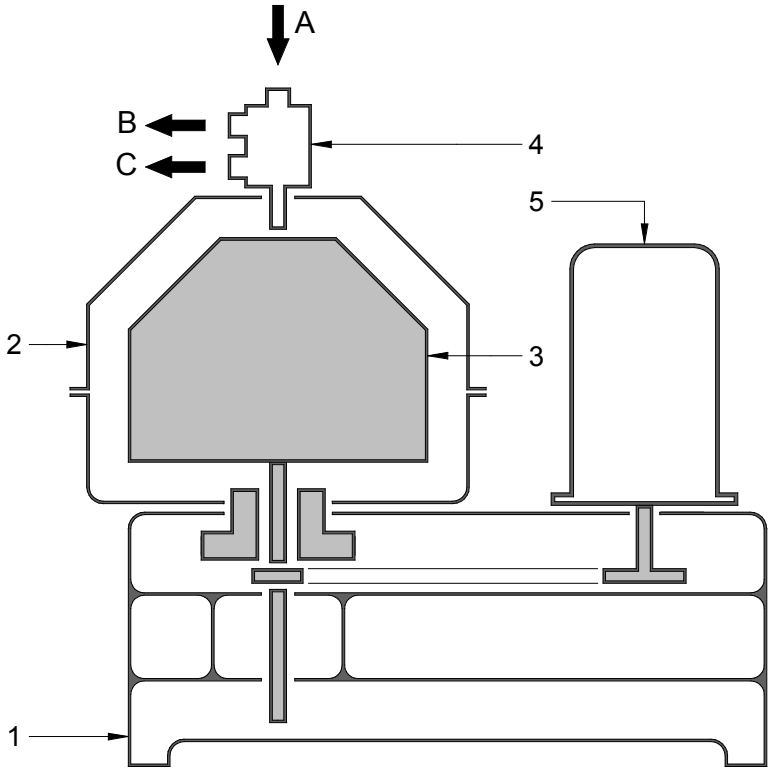
The efficiency of the centrifuge depends on the characteristics of the mixture to be separated: the viscosity, temperature, amount of solid and the difference between the densities of the various phases are parameters that can significantly affect the separation.

The centrifuge can be built in different configurations, for different types of application and with different constructive choices. The main differences in configurations and constructions are the following: the type of application (separator, concentrator/skimmer or clarifier), the discharge type of the solid phase (manual type, automatic or nozzles type), the extraction mode of the separated liquid phases (with centripetal pump or by gravity) and the type of mechanical transmission of motion to the rotating parts (gear or belt drive).
The above features are illustrated in detail in the following paragraphs.

The constituent parts of the centrifuge are conventionally grouped together, for an ease and explanatory management, using criteria that vary, according to the specific model. In the following section has been discussed briefly the two most important of these groups, in two representative cases (automatic centrifuge with mechanical gears drive and manual centrifuge with mechanical belt drive), as an example in order to define the nomenclature used in the following pages. The above mentioned division into groups is the same used in Chap.12 to illustrate the actual list of parts constituting the centrifuge. In Chap.12 are also included those groups that represent the completion of the machine but that does not have significant relevance in the general description of the centrifuge and its operation.



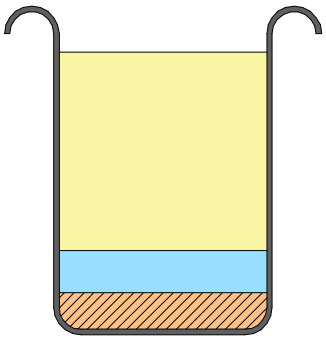
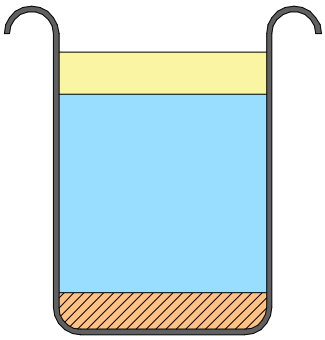
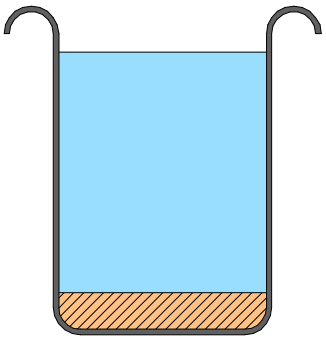
Rif.	Description
1	basament group
2	horizontal shaft group
3	vertical shaft group
4	collar group
5	cover gruop
6	bowl group
7	outlets group
8	solenoid valves group
9	motor
A	inlet group
B	light phase outlet
C	heavy phase group
D	solid phase discharge



Rif.	Description
1	mechanical group
2	Cover group
3	bowl group
4	outlets group
5	motor
A	inlet group
B	Llght phase outlet
C	heavy phase outlet

2.2 CONFIGURATIONS

The centrifuge can be configured in three different ways depending on the required process: separator, concentrator/skimmer or clarifier.

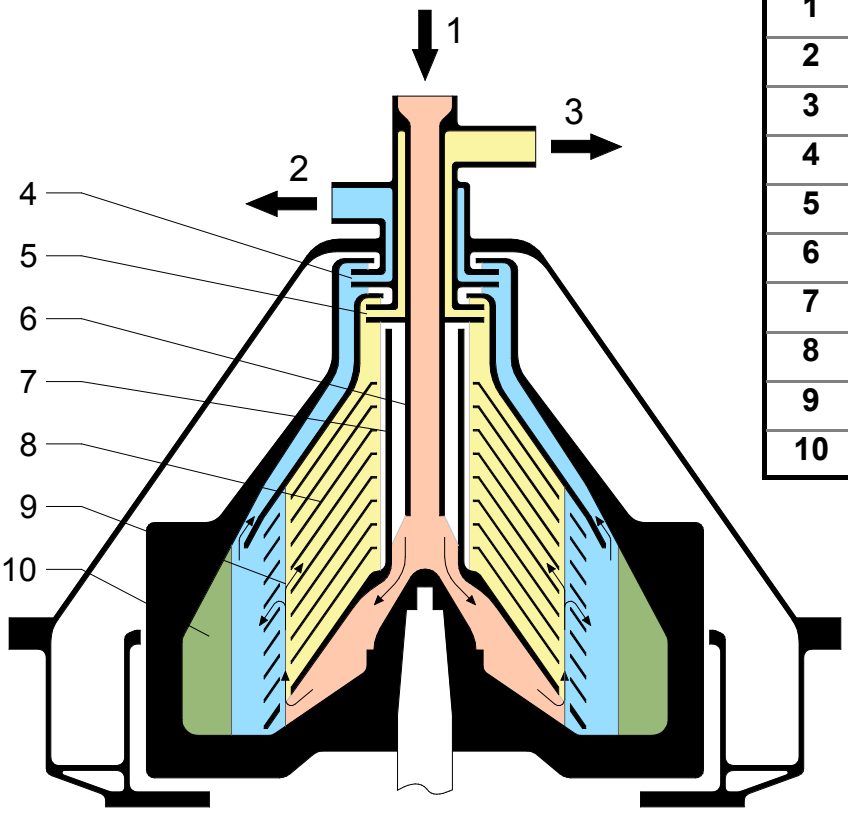
SEPARATOR	CONCENTRATOR	CLARIFIER
		
3 phases centrifuge: • Light liquid phase • Heavy liquid phase • Solid phase Light phase predominant	3 phases centrifuge: • Light liquid phase • Heavy liquid phase • Solid phase Heavy phase predominant	2 phases centrifuge: • Liquid phase • Solid phase

For some models of centrifuge configurations such as concentrator/skimmer or separator, it is foreseen as a standard construction, the possibility to change the configuration from separator or concentrator/skimmer into clarifier, through the simple installation and/or replacement of some components.

2.3 FUNCTIONING PRINCIPLE

2.3.1 SEPARATOR

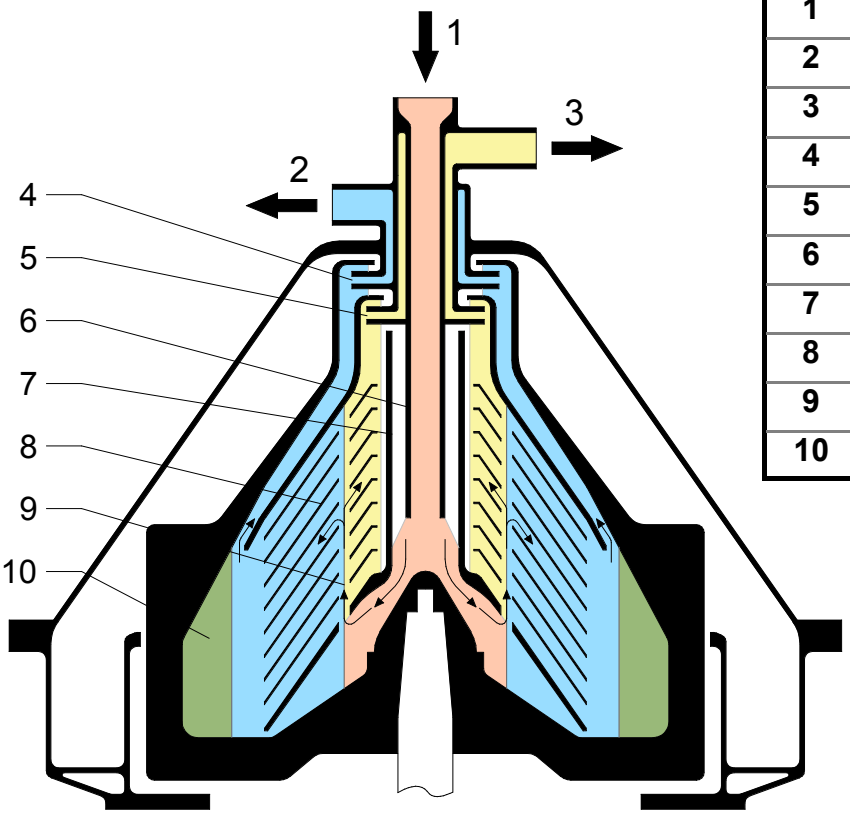
the product is introduced in the rotating bowl via the supply pipe (Rif.6), through the disks column (Rif.7) is routed in the disk stack (Rif.8) where the separation takes place. The heavy phase is separated towards the periphery of the bowl, the light phase toward the axis of rotation.
The interface position between the two separated phases is conventionally called "separation line" (Ref.9). The liquid phases are extracted, as shown in the picture below, by means of centripetal pumps (Ref.4 and Ref.5) conventionally called "turbine", while the solid phase is collected in the sedimentation chamber (Ref. 10), conventionally called "sludge chamber ".



Ref.	Description
1	Product inlet
2	Heavy phase outlet
3	Light phase outlet
4	Heavy phase turbine
5	Light phase turbine
6	Feeding pipe
7	Disks column
8	Disks stack
9	Separation line
10	Sedimantation chamber

2.3.2 CONCENTRATOR/SKIMMER

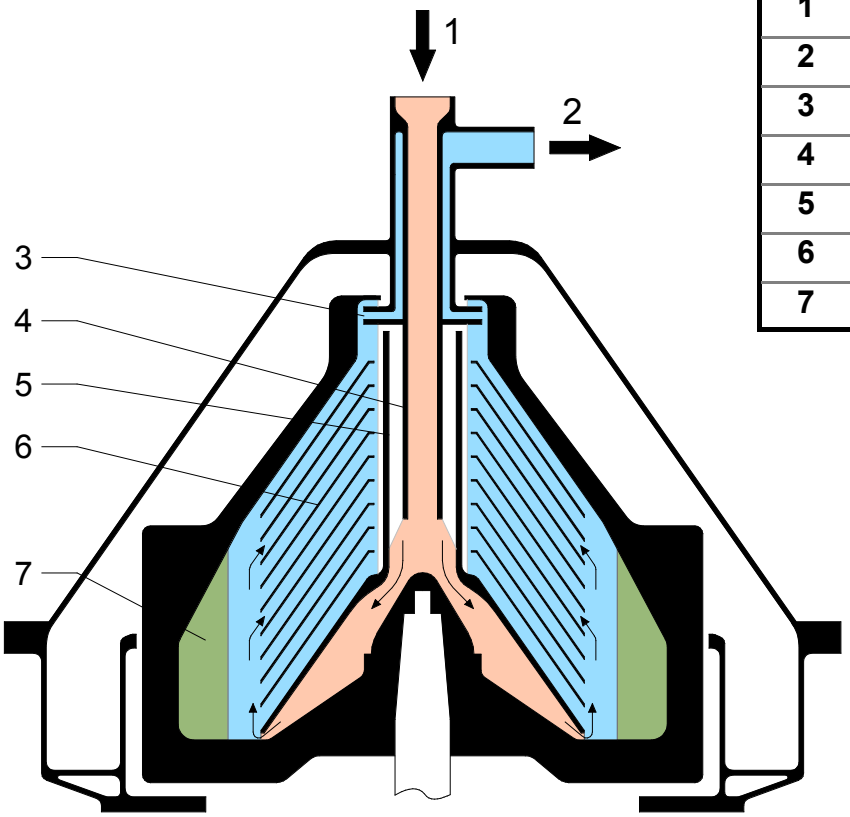
The functioning principle is the same as already described for the separator, the difference concerns the position of the separation line (Ref.9) that results to be, in the concentrator/ skimmer, closest to the axis of rotation.



Ref.	Description
1	Inlet product
2	Heavy phase outlet
3	Light phase outlet
4	Heavy phase turbine
5	Light phase turbine
6	Feeding pipe
7	Disks column
8	Disks stack
9	Separation lime
10	Separation line

2.3.3 CLARIFIER

The product gets introduced into the rotating bowl by means of the feeding pipe (Ref.6), through the disks column (Ref.7) is conveyed to the disks stack (ref. 8) where the separation takes place. The liquid phase is extracted, as shown in the picture below, by means of a centripetal pump (Ref. 4) conventionally called "turbine" and the solid phase is collected in the sedimentation chamber (Ref. 10).



Ref.	Description
1	Inlet product
2	Outlet product
3	turbine
4	Feeding pipe
5	Disks column
6	Disks stack
7	Sedimentation chamber

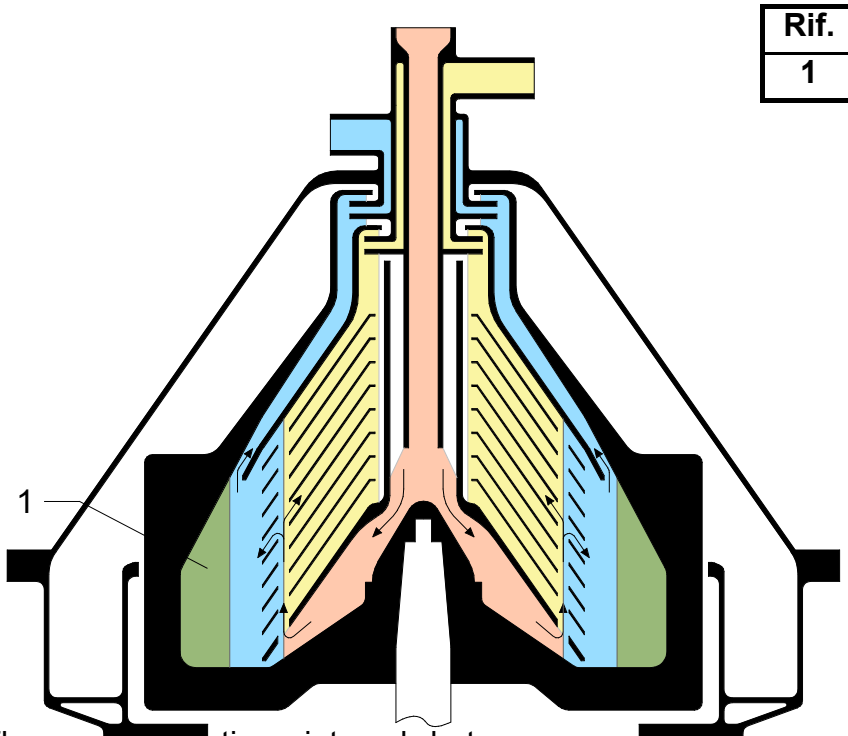
2.4 SOLID PHASE DISCHARGE

The separated solid phase, can be discharged through three different ways: through manual discharge, automatic or nozzles discharge.

2.4.1 MANUAL DISCHARGE

The solid phase is collected in the sedimentation chamber (Ref.1). When the sedimentation chamber it is filled, it is mandatory stop and clean the centrifuge, or remove the solid. The separation efficiency decreases when the chamber is close to the filling.

Rif.	Description
1	Sedimentation chamber



The maximum time interval between a solid phase removal's intervention and the subsequent, depends on the separable solids content at the inlet, from the flow rate and volume of the sedimentation chamber. In the case, where the solids content and the flow rate are constants, the cleaning interval can be calculated according to the following formula:

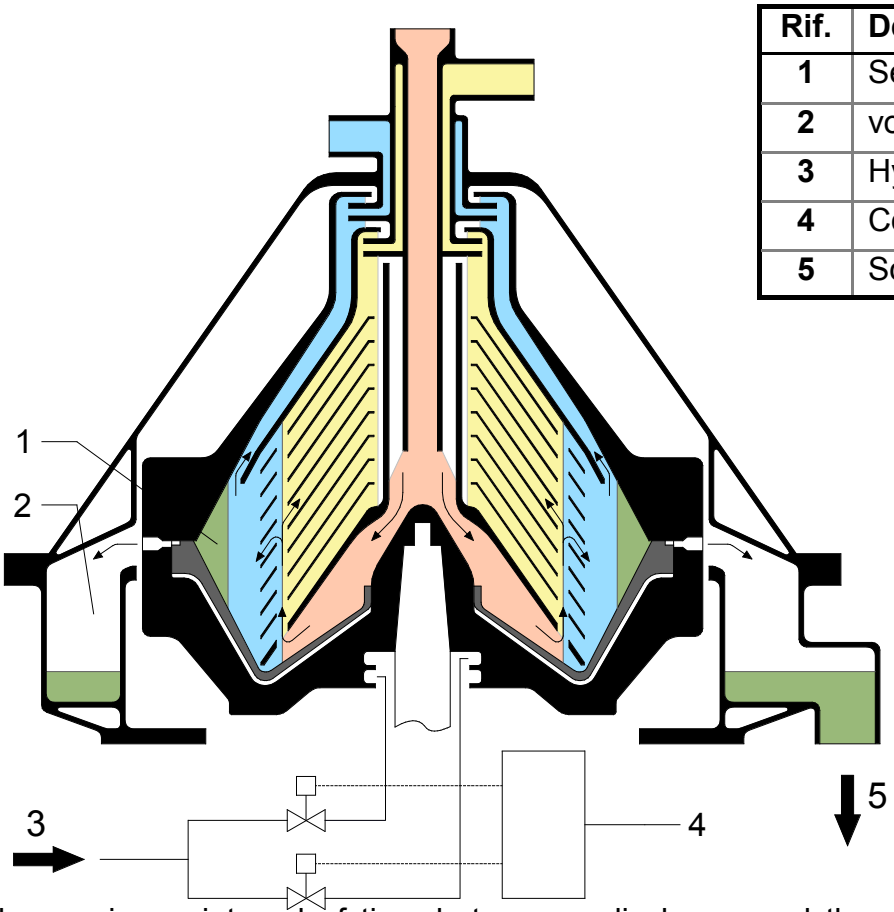
$$\text{cleaning interval (h)} = \frac{\text{Sedimentation chamber volume (l)} * 10^6}{\text{Flow rate (l/h)} * \text{solid content (ppm)}}$$

In the case where the above parameters are not constant, or are still unknown, it is necessary to avoid an excessive accumulation of solids and to foresee a precautionary interval of cleaning or control the separation efficiency.

2.4.2 AUTOMATIC DISCHARGE

The solid phase is collected in the sedimentation chamber (Ref.1). When the sedimentation chamber it is filled, it is mandatory enable the automatic discharge. Automatic discharge means the ability of the centrifuge to eject the separated solid phase while running at full speed. The automatic discharge is activated by means of a hydraulic circuit (Ref.3) which may be manual or operated by the control panel (Ref. 4). The solid phase is collected in a double volute chamber (Ref. 2) from which comes out by gravity (Ref. 5). The separation efficiency decreases when the chamber is close to the filling.

Rif.	Descrizione
1	Sedimentation chamber
2	volute chamber
3	Hydraulic circuit
4	Control panel
5	Solid phase outlet



The maximum interval of time between a discharge and the subsequent (conventionally called "purification time") depends on the separable solids content at the inlet, from the flow rate and volume discharged, that is the volume of the sedimentation chamber. In the case where the hydraulic circuit is automated, the user has the possibility to set, via the control panel, the time of purification and the quantity of the volume discharged; from a fraction of the volume of the sedimentation chamber (partial discharge), up to the entire volume of the bowl (total discharge). Through the control panel it is also possible to manage a sequence of partial and total discharges sets. The purification time should not be less than 3 minutes, unless different authorization coming from Servizi Industriali S.r.l.

In the case, where the solids content and the flow rate are constants, the cleaning interval can be calculated according to the following formula:

$$\text{Purification time (min.)} = \frac{\text{Volume discharged (l)} * 6000}{\text{Flow rate (l/h)} * \text{solid content(\%)}}$$

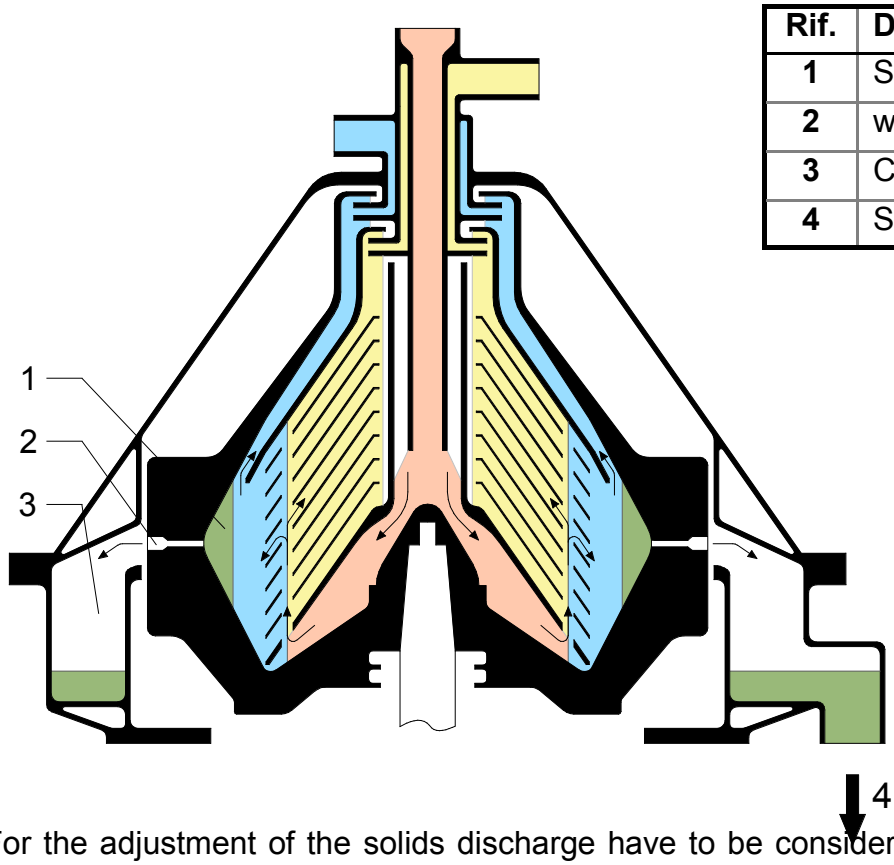
In the case where the above parameters are not constant, or are still unknown, it is necessary to avoid an excessive accumulation of solids and to foresee a precautionary purification time or control the separation efficiency.
In the case where total discharges are executed or it is necessary to restore the hydraulics seal pocket after discharging(see note), it is necessary to stop the feeding of product to the centrifuge during the discharge phase. The effective flow rate of the centrifuge after the above mentioned inactive phase, can be calculated according to the following formula:

$$\text{effective flow rate (l/h)} = \frac{\text{Flow rate (l/h)} * \text{depuration time (min.)} * 60}{\text{Depuration time (min.)}* 60 + \text{inactive phase (s)}}$$

Note: The hydraulic seal pocket is the necessary filling of the sedimentation chamber with the heavy phase before the to feed the centrifuge with the product, you will see in the following pages.

2.4.3 NOZZLES DISCHARGE

The solid phase it is collected in the sedimentation chamber (Ref.1) and continuously discharged through nozzles weighted (Ref.2). The solid phase is collected in a volute chamber (Ref.3) from which comes out by gravity (Ref. 4). The separation efficiency decreases when the sedimentation chamber is close to the filling.



Rif.	Description
1	Sedimentation chamber
2	weighted nozzles
3	Control panel
4	Solid phase outlet

For the adjustment of the solids discharge have to be considered the flow rate, the solids content at the inlet and the requested concentration of the solid phase discharged, therefore it is necessary acting on the nozzles configuration or choose the number and the diameter of the hole. The nozzles configuration have to be such as to ensure enought flow rate to discharge all the solid entered; a discharge capacity insufficient, involves an excessive accumulation of solid inside the bowl. A discharge capacity bigger than what strictly necessary, entails a bigger efficiency of the clarification of liquid phases and a lower concentration of the solid discharged. The total flow rate requested at the outlet of the nozzles, discharge capacity, can be calculated according to the following formula:

$$\text{Discharge capacity (l/h)} = \frac{\text{Flow rate (l/h)} * \text{solid content (\%)}}{\text{Solid phase discharged concentration (\%)}}$$

The discharge capacity calculated, can be obtained with different configurations of nozzles. To chose the correct configuration, it is mandatory to comply with the following methods: the nozzle hole diameter, should be chosen taking into consideration the particle size of the solid, use the highest possible number of nozzles to reduce the possibility of forming stagnation points and accumulation, the configuration of the nozzles have to be symmetrical. The number of nozzles to be used can be calculated with the following formula:

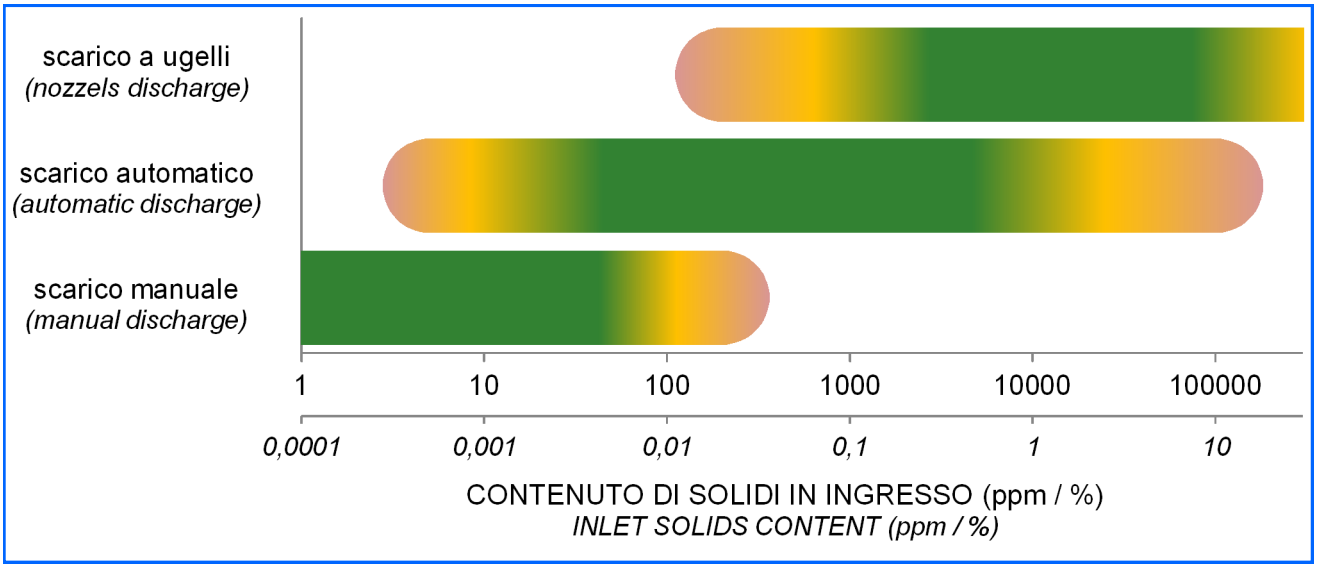
$$\text{Nozzles number} = \frac{\text{Discharge capacity (l/h)}}{\text{Single nozzle capacity (l/h)}}$$

The following table shows the values of the capacity of a single nozzle, according to the drilling diameter. The values shown are for the use with water and under operating pressure, are therefore only indicative. The effective flow rate depends on the physical properties of the treated product and on the operating pressure, which can vary by model to model of centrifuge.

Ø nozzle hole (mm)	Flow rate(l/h)
0,5	70
0,6	100
0,7	140
0,8	180
0,9	230
1	280

2.4.4 CHOICE OF DISCHARGE METHOD

The better choice of the discharge method suitable to the considered process, has to be taken based on experience, possibly with the help of Servizi Industriali S.r.l., because the applications, the variables and issues to be considered are very many. Based on indicative concept, the following diagram shows the fields of application of the three discharge way discussed in the previous pages, in relation to the amount of solid present in the product at the inlet of the centrifuge.

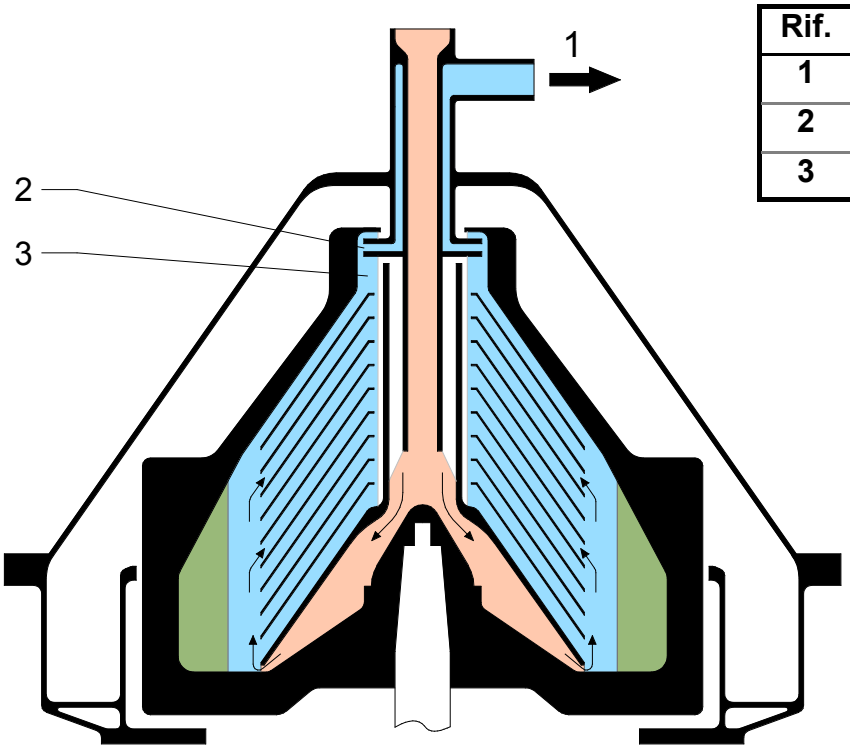


2.5 EXTRACTION OF LIQUID PHASES

The separated liquid phases can be extracted in two different ways: with centripetal pump, conventionally called "turbine", or by gravity. In the remainder of this manual will be used respectively the conventional expressions "turbine outlet" and "outlet by gravity".

2.5.1 TURBINE OUTLET

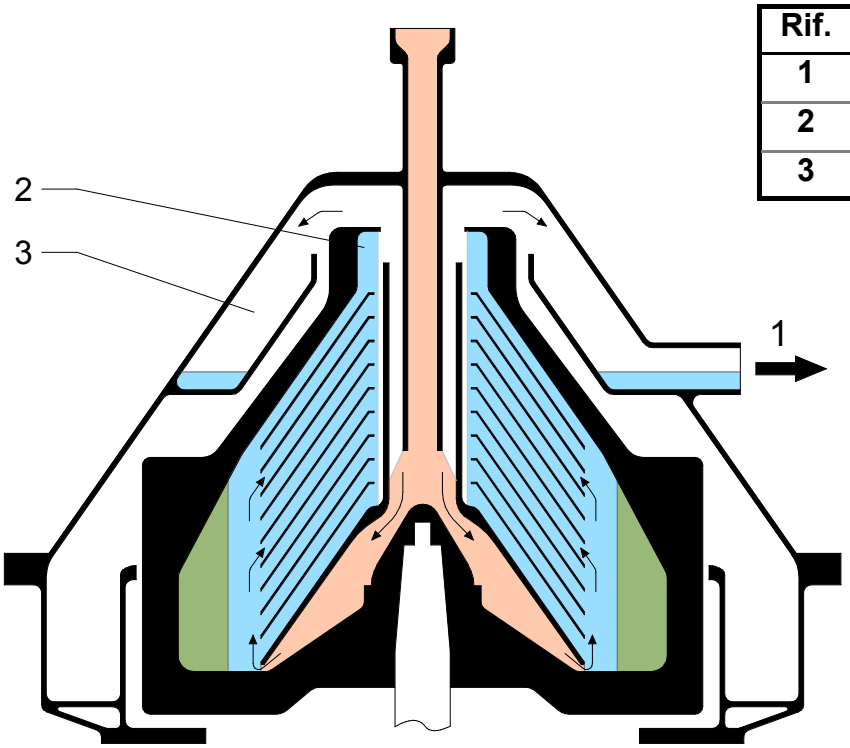
The liquid phase is conveyed to the collecting chamber (Ref.3), extracted by the turbine (Ref. 2), and then send to the product outlet (Ref.1). The turbine is able to provide a variable pressure depending on the model of the centrifuge, on the flow rate and the physical characteristics of the product, approximately the maximum pressure achievable is 2÷5 barg.



Rif.	Description
1	Product outlet
2	turbine
3	Collecting chamber

2.5.2 OUTLET BY GRAVITY

The liquid phase is conveyed to the collecting chamber (Ref.2), from which comes out by overflow, it is collected in a compartment (Ref.3) obtained in the cover of the centrifuge and then conveyed to the product outlet (Ref.1) from which comes out by gravity.



Rif.	Description
1	Product outlet
2	Collecting chamber
3	collecting compartment

2.6 MOTION TRANSMISSION

The centrifuge is moved by an electric motor. The transmission of the motion to the rotating parts can be done in two ways: by means gears drive with orthogonal axes (with torque wheel / pinion with helical teeth) or by means of pulleys and belt drive.

2.6.1 GEAR DRIVE

The centrifuge is moved by an electric motor driven by a frequency converter. Through an elastic connection the motion is transmitted to the horizontal shaft, then, to the vertical shaft through the coupling of wheel / pignon with ratio multiplier. The vertical shaft is elastically supported in both radial and axial direction. The bearings and gears are lubricated by splash of oil.

2.6.2 BELT DRIVE

The centrifuge is moved by an electric motor which can be direct starter for centrifuges of smaller size, or driven by a frequency converter for centrifuges of larger size. For the gradual start up of the centrifuge, in alternative or in substitution to the frequency converter, in some models of centrifuge, it is used a mechanical clutch. Through a couple of pulleys, with a ratio multiplier and a belt drive, the motion is transmitted to the shaft vertical. The vertical shaft is elastically supported in both radial and axial direction. The bearings can be lubricated by splash oil or not require additional lubrication.

2.7 ELECTRICAL CONTROL PANEL

The centrifuge can be supplied with an electrical control panel.

In the case which the centrifuge is not supplied with electrical control panel it is necessary that the user get in contact with Servizi Industriali S.r.l. for the definition of the aforesaid and in any case comply with the specifications described in this manual.

In the case of the solid bowl centrifuge (manual cleaning type), the electrical control panel allows to start and stop the centrifuge. The control panel can also be prepared to manage a number of ancillary devices, available on request: feeding pump, water pocket alarm loss, frequency converter, etc.

In the case of the automatic centrifuge (self cleaning centrifgue) the electrical control panel completed with PLC, controls the entire cycle of the centrifuge: start up, operation working (separation, partial discharges, total discharges), stop. The software of the control panel it is also prepared to manage a number of ancillary devices available on request: evacuation pump and level switches for the tank of the solids discharged, water maneuvering pump, frequency converter, etc.

Cap.7 describes the main functional characteristics of the electrical control panel of both solid bowl centrifuge and self cleaning centrifuge. The foreseen functions may being different, especially for what concerns the management of any devices supplied requested. For the specific definition of the electrical control panel and its functions, you will therefore refer to the wiring diagram of this manual (All.B).

2.8 OTHERS COMPONENTS

2.8.1 INLET AND OUTLET PRODUCT

The inlets and product outlet lines, are supplied with components that may vary according to the model and configuration of the centrifuge, in accordance with specific customer requests (eg. for the connections type) or according to necessities arising from the specific process. In addition to the flexible hoses, that can be provided or not but nevertheless necessary, the main components that are frequently provided are: sight glass, sampling, manual valves, pressure control and pressure gauges.

2.8.2 OTHER STANDARD DEVICES AND SUPPLIES

All centrifuge models are provided as standard of common tools and special wrenches required for the assembly and disassembly of the centrifuge, as well as spare parts for prompt intervention also needed for the commissioning of the centrifuge. Other devices which are designed specifically for some models of centrifuge are as follows: feeding pump of the product with its protective filter, water pocket loss alarm system, soundproofing/ insulation covers , washing / cooling covers, fluidification of the heavy phase and solids discharge.

2.8.3 OTHER DEVICES AND SUPPLIES ON REQUEST

For all the centrifuge models, subject to technical feasibility verification are available, on demand, devices referred to the previous paragraph, are also provided on request the following devices: solid collecting tank and frequency converter.

Note: If the machine is installed on a frame base or other components are added because relevant from the operation and / or the conduct point of view of the centrifuge, it is wrote up and attached to this manual a "Plant User's manual".

3 SAFETY

The centrifugal separator here described has high speed rotating parts; the kinetic energy developed is considerable, great forces are generated and the shut-off time is long.
To guarantee the safety of people and things, strictly follow the safety rules described in this paragraph.

Servizi Industriali S.r.l. declines any responsibility regarding consequences and/or damages caused by the inobservance of the directions of this guide.

The operator must strictly comply with the following general safety rules:

- use the separator only in accordance with the standards given by the manufacturer;
- strictly follow the instructions given by this guide;
- operators using the separator or performing everyday maintenance must be preventively trained by expert personnel, especially with regard to emergency situations; furthermore operators must have read and must keep the present manual handy;
- respect maintenance deadlines and use only original spare parts.

3.1 GUIDELINES AND RULES APPLIED

The centrifugal separator is designed and built in accordance with the following Directives:

- **"Machinery Directive" 2006/42/CE** ((European Parliament and Council, May 17, 2006, on the harmonization of laws of Member States concerning machinery);
- **"Low Voltage Directive" 2006/95/CE** (European Council, December 1, 2006, on the harmonization of laws of Member States concerning electrical equipment designed for use within voltage limits).

Furthermore the following harmonized norms have been applied:

- **UNI EN ISO 12100-1/-2** (Basic concepts for the safety of the machines and design general principles);
- **UNI EN 60204-1** (Machinery safety. Electrical equipment of the machines).

3.2 GENERAL SAFETY RULES

Here following the general safety precautions that have to be observed in predictable situations of use of the centrifuge.

DANGER:

- Use the separator only and exclusively for its purpose and in accordance with the standards given by Servizi Industriali S.r.l.
- It is absolutely forbidden to make any changes to the centrifuge without the prior written consent of Servizi Industriali S.r.l.
- Before starting any maintenance intervention, verify that all rotating parts are completely stopped.
- Before starting any maintenance intervention stop and unplug the electrical supply to avoid the centrifuge's accidental or wanted start.
- The electrical connections must be performed by a licensed electrician and have to be carried out in accordance with the rules in force and in accordance with this manual and the accompanying ancillary equipment manuals.
- After connecting the electrical cables, always verify the rotation direction of the motor. A reverse rotation causes the unscrewing of the rotating parts; it is extremely important that the rotating direction is correct.
- Always verify that the motor power frequency of the separator complies with the one prescribed in this guide and printed on the label of the separator itself. A greater speed due to an incorrect higher value causes damages of great extent.
- In the event of excessive or abnormal vibrations, stop the centrifuge. When the centrifuge is stopped, disassemble it, clean and inspect all parts. Do not restart the centrifuge until the cause of the vibration has not been detected and eliminated.

- Once the separator is functioning, it must be supplied with the proper product. Do not leave the machine in rotation in vain for more than 30 minutes to avoid the overheating of the rotating parts.

- Before starting the separator, correctly assemble all its components, making sure that all protections and covers are fastened in their places.

- It is absolutely forbidden to repair rotating parts through welding. It is absolutely forbidden to heat the bowl's parts with direct flames. The welding or heating of the rotating parts can change the structure of the materials and compromise their resistance.

- The wearing of the thread of the bowl's big locking nut cannot exceed the safety limit mentioned in this guide.

- In the event that it is highlighted the presence of any erosion and / or corrosion on one of the structural parts of the drum (bottom , cover, sliding and big nut), do not use the centrifuge and immediately get in contact with Servizi Industriali S.r.l.

ATTENTION:

- Use lifting devices adequate to perform lifting operations and follow lifting instructions.

- Never work underneath pending loads.

- Use a protective headset in noisy environments.

- The lubricant oil and several machine surfaces can be very hot and can cause severe burns; wait until they reach room temperature before performing any intervention.

- The sharp edges of the bowl discs and the threads of the bowl's locking nuts can cause wound injuries; use protective gloves when performing maintenance interventions.

- The components, including those that are coming from equal centrifuges, must not be interchanged.

CAUTION:

- The respect of the maintenance intervention schedule, along with the prompt replacement of damaged or worn parts, enables the separator to always work in the best conditions. We remind you to use only original spare parts provided by the manufacturer or by an authorized third party.
- Observe the timing of the inspection and cleaning prescribed in this manual.
- For maintenance interventions always use the tools and keys provided; avoid the use of random tools that could damage the separator's components.
- If not immediately installed after its delivery, the centrifuge must be placed in a dried environment protected from atmospheric factors to avoid the occurrence of damages prior to its use.
- Do not leave the bowl dirty in case of an extended inactivity period,
- Do not start the centrifuge if the b wl is dirty.
- Do not start the centrifuge without having previously assembled the bowl otherwise the bearings could be damaged.

Further relevant instructions concerning safety procedures will be reported in following chapters, with particular reference to the controls that have to be carried out before the start up of the centrifuge and during routine maintenance.

Finally it is recalled that the nature of the product, meaning the physical and chemical characteristics of the different phases, their percentage composition within the product and other process conditions such as the temperature, the feeding flow rate, operating pressures, etc., are contractual parameters which the user is obliged to follow, for the correct operation of the centrifuge, then to obtain the perfomance provided and to ensure safety.

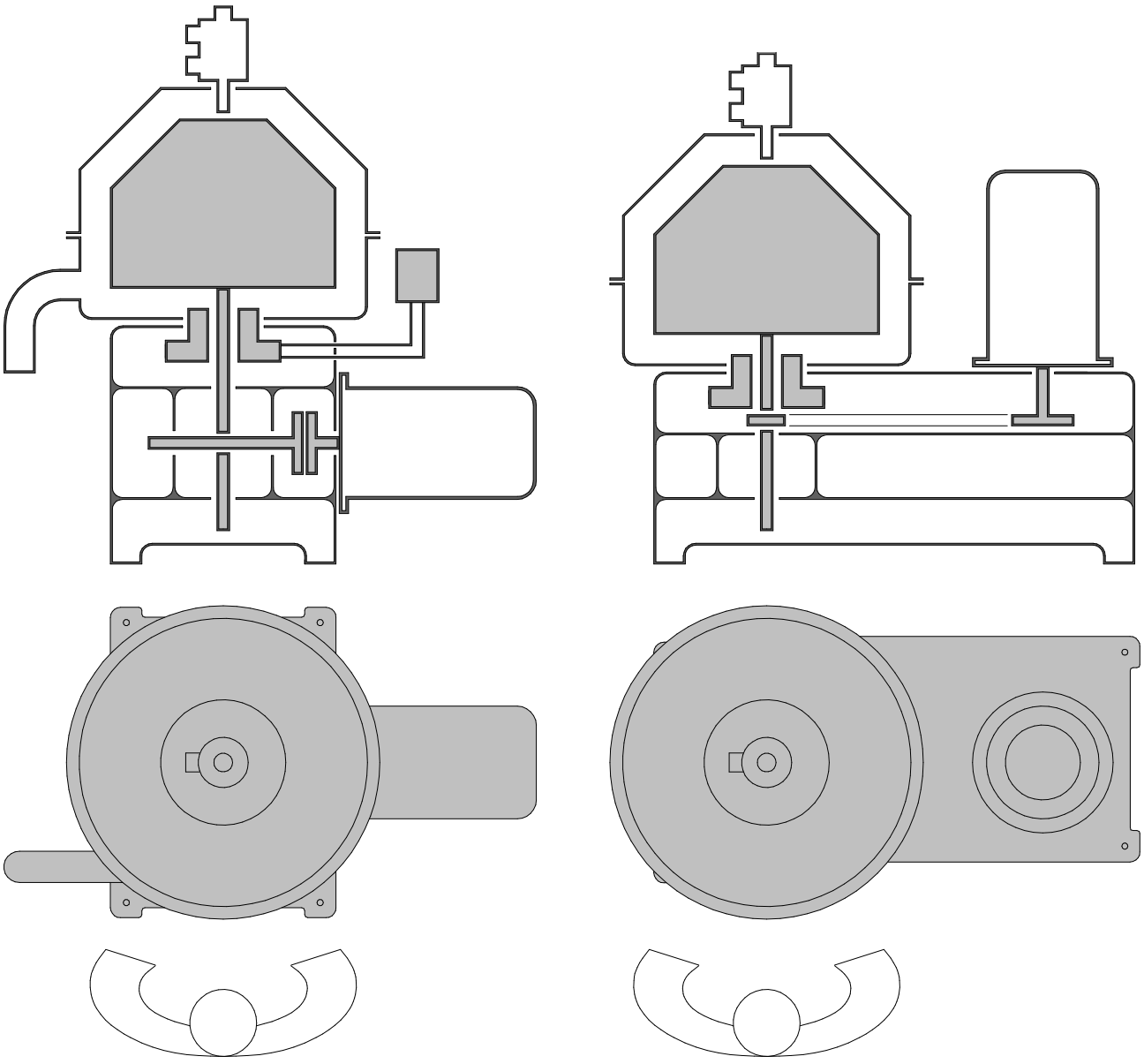
It is absolutely forbidden to process products having qualities different from those specified in the contract for which the separator is built.

Pay special attention to the following features of the product and processing conditions:

- density of the different product phases: maximum allowed density of the product al the inlet is 1200 kg/m^3, maximum allowed density of the solid phase is 2000 kg/m^3;
- product corrosive or abrasive features;
- supplied product temperature (maximum allowed temperature of the product is 95°C);
- features of the solid included in the mixture;
- feeding flow rate: Do not supply the machine with flow rates greater than those contractually agreed without consulting with and obtaining authorization by Servizi Industriali S.r.l;
- percentage of each phase in the product; in particular: do not supply the machine with product if the solid's percentage in the product is greater than the one contractually agreed without consulting with and obtaining authorization by Servizi Industriali S.r.l.

3.3 DESTINATION AND LIMITATIONS OF USE

The centrifuge has designed and built to separate a mixture of two liquids and a solid, having different specific weight (separator version) and just one solid and liquid having different specific weight (version clarifier). The centrifuge has an industrial application; have to be used is in a building or otherwise, under covered place and protected from the weather. To operate the centrifuge is foreseen the presence of an operator at the time of starting and stopping; after starting the separation of the product, the operator could be absent. It mandatory that the operator have an age over 18 years and before using the centrifuge must have read and understood the contents of this manual. The sites around the centrifuge allowed by the operator are shown in the following picture:



It is absolutely prohibited using the machine for other uses other than the one described, in order to warrant in every moment the operator safety and the machine performances.
The operating limits are specified in the technical specification of the centrifuge (see Chapter 8). Further restrictions may be introduced wiht respect of particular products or applications, therefore we remind you to verify what is indicated in the contract of sale.

Respect the limits of use specified in this manual and those indicated in the contract of sale, with particular attention to the limits on the rotation speed and temperature, the density, the pressure discharge of the turbine and the flow rate of the feeding product.

It 'absolutely forbidden to use the centrifuge in environments with a potentially explosive atmosphere or the use in hazardous areas according to Directive 94/9/EC.

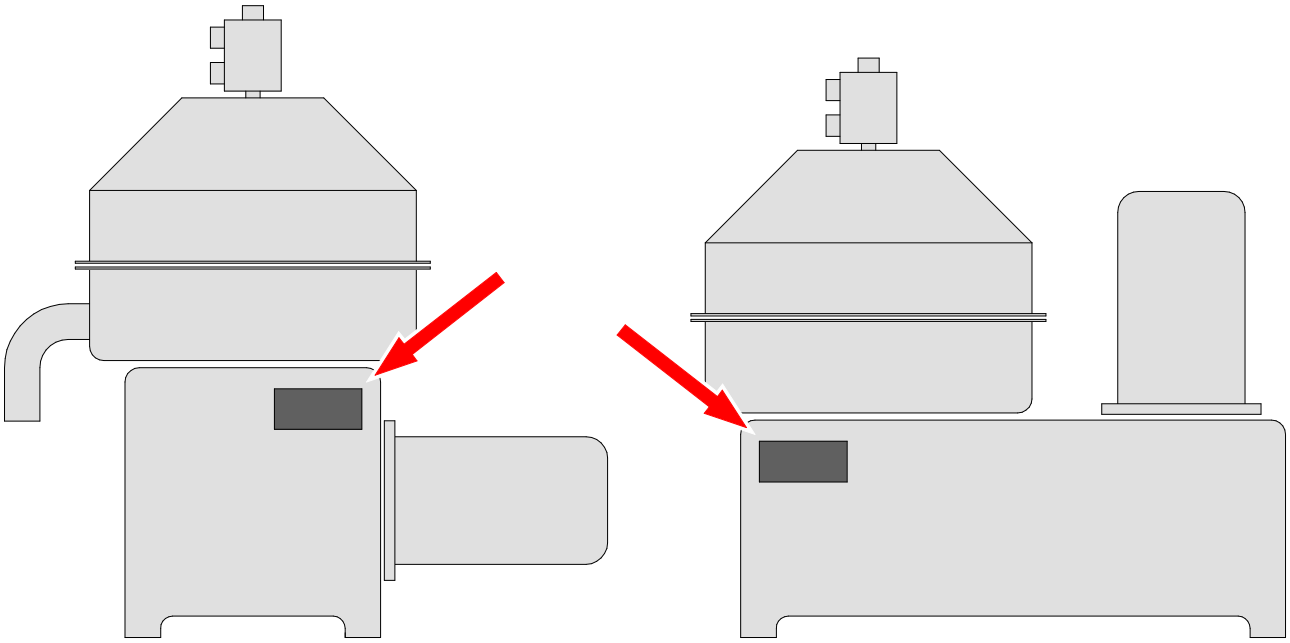
3.4 SOUND LEVEL AND VIBRATIONS

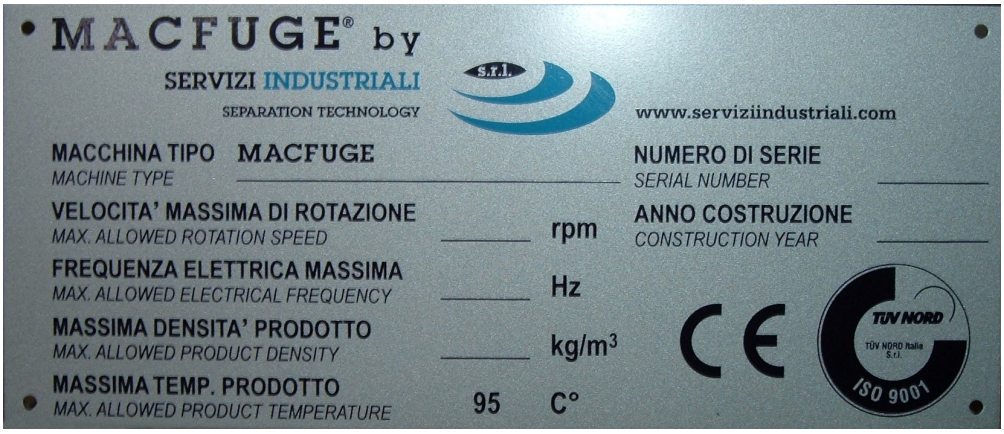
Just after having reached the standard working conditions, far from the start and stop phases, the machine's noise level, measured in an open environment with a phonometer placed 1 meter away from the machine itself, far from echoic surfaces (measured in according to the UNI EN ISO 3746 regulation) less than that indicated in the technical specification of the centrifuge (see Chapter 8). During the start phase, in concomitance with the structure's resonance speeds, and during the solid phase discharge, the noise can reach a higher level for short intervals of few seconds.
The centrifuge is delivered with an operating vibration level, lower than what indicated in the technical specification of the centrifuge (see Chapter 8) (measure in mm / s rms), measured at the significant points listed in the testing certificate (All.C of the present manual). A measurement taken at different points leads to different values of the vibration level that are however insignificant and therefore should not cause concerns. The vibration reaches higher values during the start and stop phases in concomitance with the structure's resonance speeds, even though for a very limited time. The vibrations detection during these temporary events is obviously insignificant.

CAUTION:
an erroneous bowl assembly or the accumulation of sediments in the sludge chamber can cause a significant increase in the vibration level.

3.5 IDENTIFICATION LABEL

The identification label of the centrifuge is placed on the basement as indicatively shown in the following picture. The image of the nameplate shown it is only explanatory and both the information therein contained such as the layout, may vary.



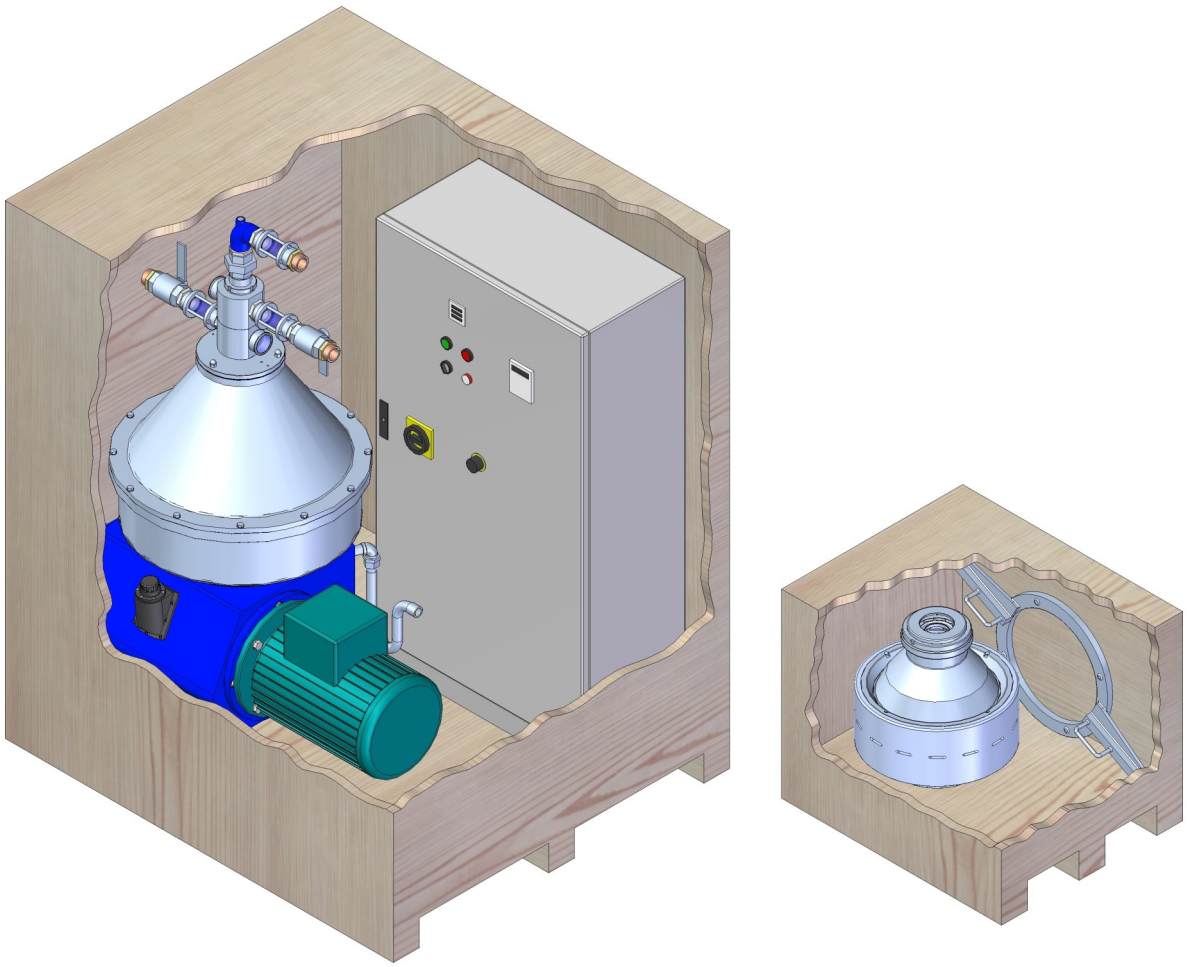


4 HANDLING AND STORAGE

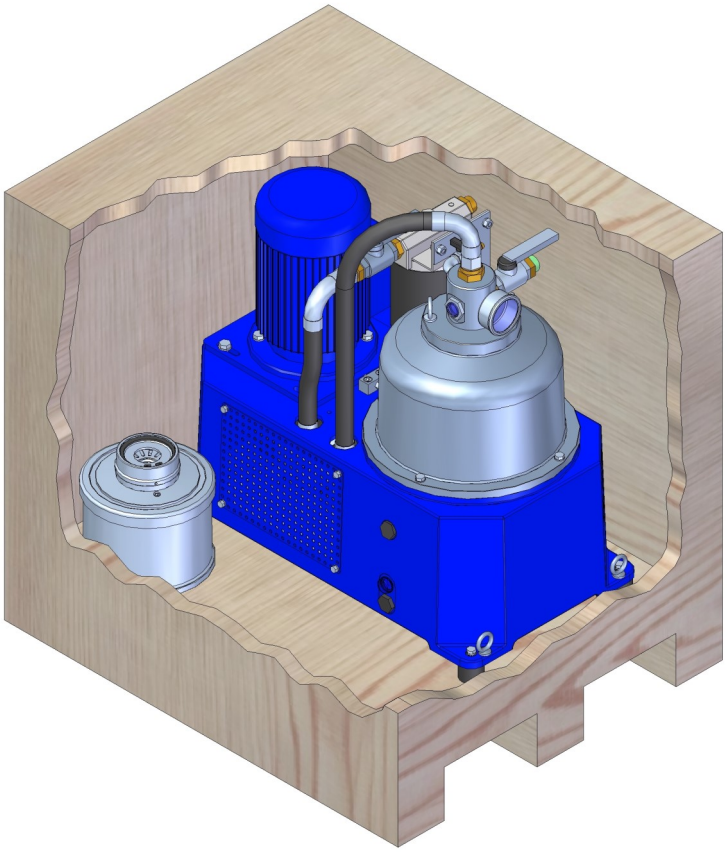
4.1 HANDLING

The separator is provided with packaging (pallet or wooden box). For the total weights and dimensions of the packaging, refer to the shipping documents.

For the bigger sized centrifuge two packaging are delivered: one containing the centrifuge assembled excluding bowl group (in some cases together with the inlet/outlet group), the electrical panel if present and any other components provided (such as flexible hose, solenoid valves, water pocket loss alarm system, etc..) and one containing the bowl group, the inlet/outlet group (if not already installed on the centrifuge) and the special tools group. The above mentioned elements are completely or partially assembled according to the model of centrifuge. The following picture, for example, shows the packaging of a centrifuge with automatic discharge of larger size complete with electrical panel.



The smaller sized centrifuge is delivered to a single package containing the centrifuge completely assembled excluding the bowl group (in some cases also of the inlet/outlet group), the electrical panel if present and any other components provided (flexible hoses, the solenoid valve unit, water pocket loss alarm system , etc.), the bowl group, the group inlet/outlet (if not already installed on the centrifuge) and the special tools group. The above mentioned elements are completely or partially assembled according to the model of centrifuge. The following picture, for example, shows the packaging of a centrifuge of smaller size with manual discharge without a control cabinet.

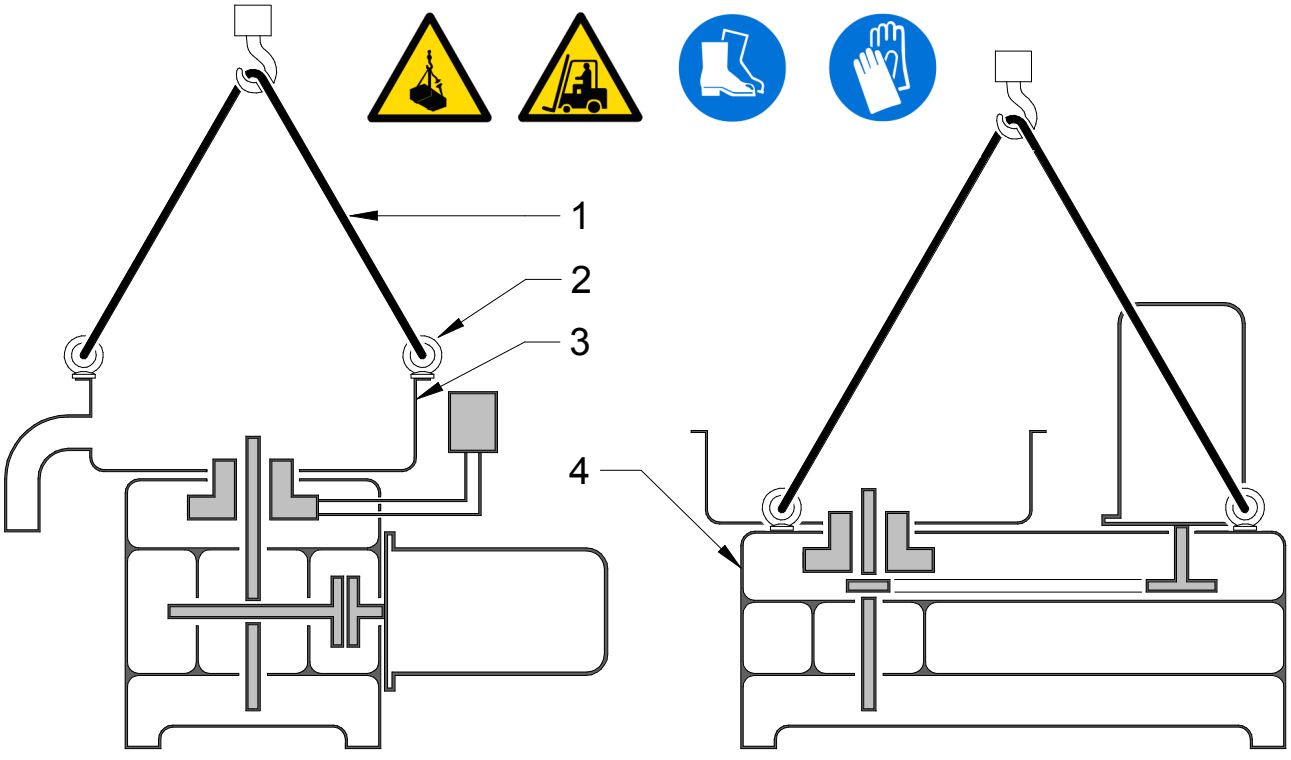


ɜe conditions must be done with adequate tools (forklift) to allow the moving in an easy way that meets safety conditions. Furthermore, the instructions placed on the packaging must be respected.

Once the installment location is reached, remove all parts fixing the separator to the packaging and place them far from the working area, to allow the operator to work in safety conditions.
The correct operations to move the centrifuge at this phase and the steps required for disassembly / assembly of the components are depending on the model of centrifuge; the reader is referred to Chapter 5 for a more detailed description, below it is only briefly summarized the sequence of the tasks to perform:

a) remove the covers ;
b) tighten the four eye bolts provided (Rif.2) to the basin (Rif.3) or to the basement (Rif.4) in the foreseen position;
c) hook up the four eye bolts using cords or chains (Rif.1) adequate for lifting (lifting cords or chains are not provided); their appropriate and necessary length to lift the separator's assembled parts while keeping the vertical shaft orthogonal to the ground during the lifting phase.
d) once the lifting and handling operations are completed, remove the eye bolts and the cords or chains used.

CAUTION:
The handling must be done before and, anyway, without the bowl group assembled on the separator. For what concerns the moving conditions of the bowl, follow the instructions in the next chapters.



4.2 STORAGE

If the machine is not immediately installed after delivery or not used for a long period of time, it is necessary to comply with the following storage instructions.

The correct operations required for disassembly / assembly of the components are depending on the model of centrifuge; the reader is referred to Chapter 10 for a more detailed description, below it is only briefly summarized the sequence of the tasks to perform:

- if the separator has already been used, disassemble the product inlet/outlet groups, disassemble the covers group and carefully wash all parts;
- if the separator has already been used, completely disassemble the bowl group and carefully wash all parts , Once that all parts are perfectly dry, the bowl can be reassembled for ease of storage;
- remove the lubricating oil from the carter;
- disassemble the machine base group and the horizontal shaft group, the collar group and the vertical shaft group, remove the residual lubricating oil and then grease all parts that are wet by the lubricating oil during the process – with special care for the vertical shaft, the horizontal shaft, the bearings, the internal parts of the collar (springs, little pistons, etc.) and the surfaces touching other parts. a questo punto è ammesso, per comodità di stoccaggio, rimontare le parti, gruppo coperture compreso; at this point the parts - covers group included - can be reassembled for ease of storage (All.E);
- make sure that the electrical panel is perfectly covered.

The centrifuge so treated and disassembled, must be placed in a dry environment, protected from atmospheric agents.

Further instructions:

- the bowl cannot be left on the vertical shaft when stored
- at the first start, or after a long period of inactivity, lubricate the radial ball bearing, the bearing that is supported by the bearing collar group, with the same oil used for the transmission.

CAUTION:
not following the centrifuge's storage instructions can cause damages to the centrifuge.

5 INSTALLATION

A correct installation is essential for the proper functioning of the separator and the safety of the work.

The pictures used in this chapter are for explanation purposes, therefore they are complete for the description of this subject matter but can not accurately reproduce the appearance of the centrifuge, object of this manual. For an accurate representation of the centrifuge purpose of this manual, the real dimensions and weights refer to All.A1.

5.1 MACHINE BASE FIXING

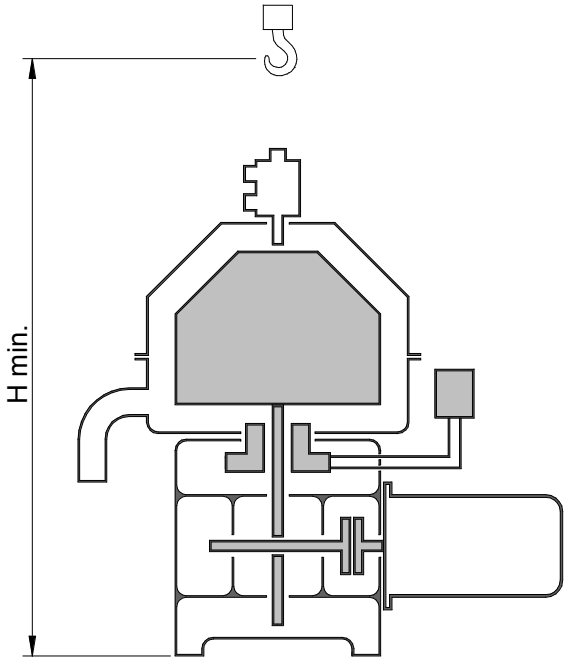
To improve the stability and reduce the potential vibrations to the minimum, the separator must be fastened to the floor or to a metal structure.
For both floor and metal structure fixing, it is necessary to verify that the supporting structure is appropriate to sustain the separator.
The static and dynamic loads transmitted in working conditions from the separator to the supporting structure are illustrated in All.A1.

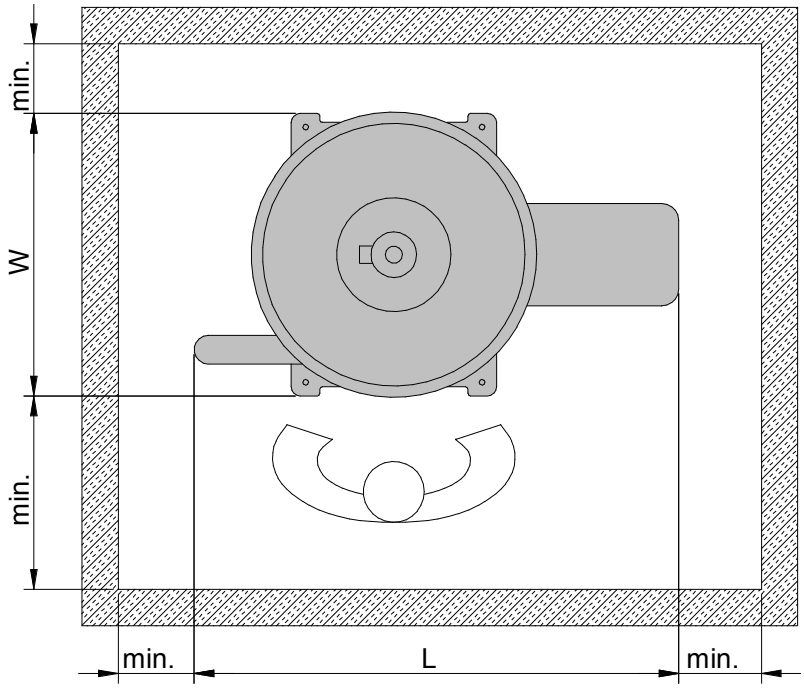
CAUTION:
The dynamic charge could be greater than the one indicated in case of unbalanced rotation (for example due to excessive accumulation of solids) or damaged bearings.

For the machine base fixing, four shock absorber plates are provided. To facilitate the handling and carriage operations, the separator is delivered with the above mentioned shock absorber plates, for the installation, it is necessary to disassemble it by lifting the basement, as described. The floor fixing can be done by anchoring the shock absorber plates to the floor using expansion anchors (not provided). The fixing to a metal structure must be done by welding.

When the separator has to be installed next to walls, other machinery, etc., the minimum distances indicated in All.A1 must be respected to facilitate the separator's activity and ordinary maintenance. In case it was not possible to comply with the measures set out, get in contact with Servizi Industriali S.r.l. to evaluate different solutions.

For the ordinary maintenance, for the bigger size of centrifuge, a lifting block and tackle are required; for its features, refer to All.A1, with particular attention on the load capacity, minimum hook's height, action radius able to guarantee the possibility to move the centrifuge's parts which require the use of lifting, within the area represented. If a motorized block and tackle is used, it is preferable to use a double speed block and tackle, to reduce the risk of damaging the separator during the disassembly/assembly of the components.

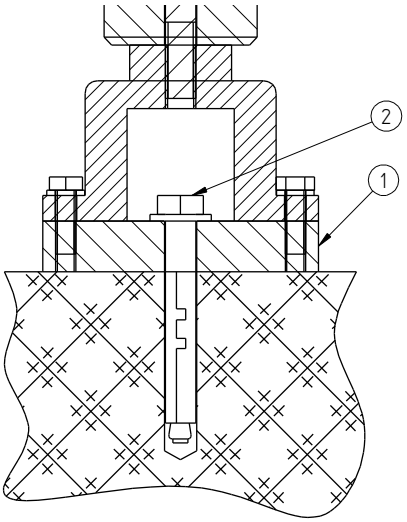




5.1.1 EXPANSION ANCHOR FIXING

The sequence of operations to perform for the expansion anchor fastening is the following:

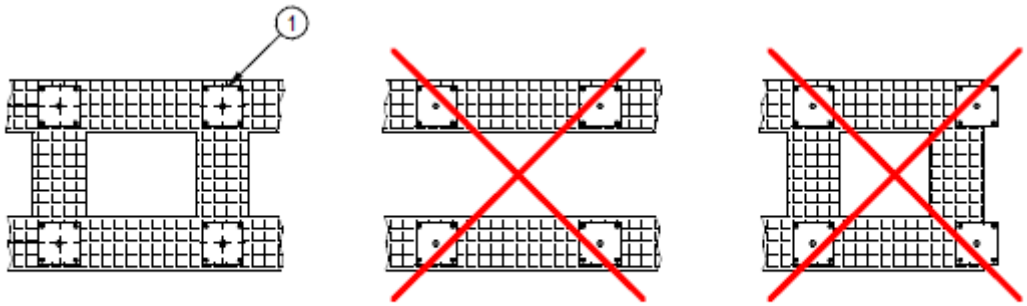
a) choose a place for the installation of the centrifuge that respects the minimum distances ;
b) perform the floor drilling while respecting the distances indicated (look All.A1);
c) fix the four shock absorber plates (Rif.1) to the floor using adeguate expansion anchors (Rif.2) out of supply;



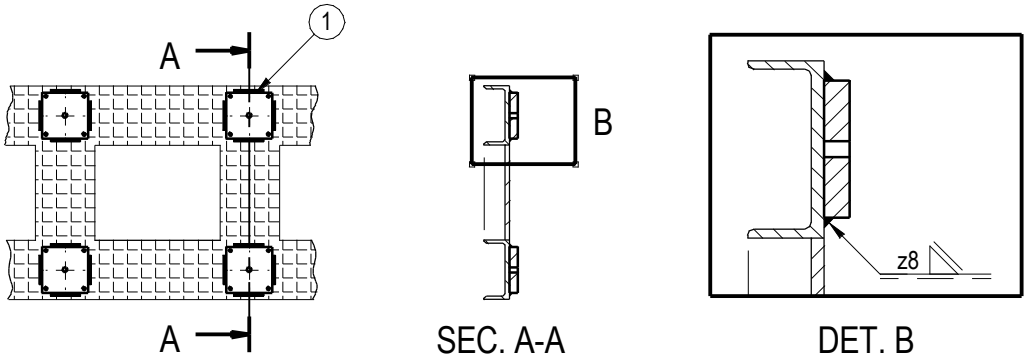
5.1.2 FIXING TO A METAL FRAME

The sequence of operations to perform for fixing to a metal frame is the following:

a) choose a place for the installation of the separator that respects minimum distances;
b) place the four shock absorber plates on the supporting metal structure so that the four beams forming the plate itself are positioned on the structural parts as shown;



c) weld the shock absorber plates in an homogeneous manner symmetrical to the supporting metal structure, for welding modalities follow what shown in the picture.



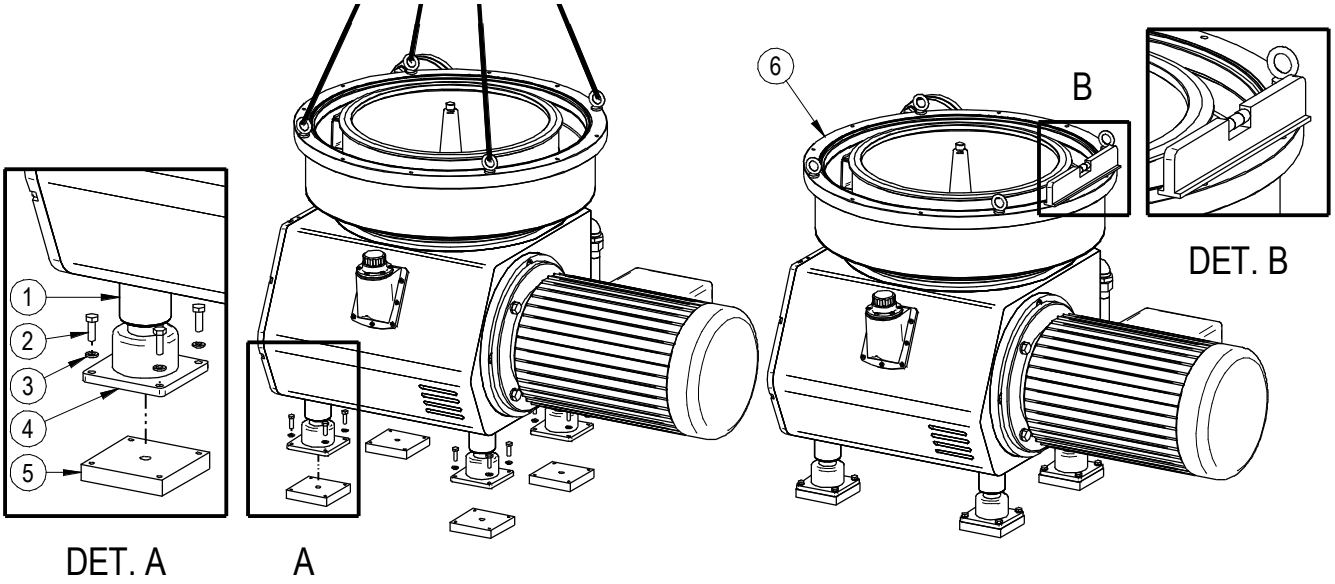
SEC. A-A

DET. B

5.1.3 MACHINE BASE ASSEMBLY

To assemble the machine base on the basement plate fixed The sequence of operations to perform for each of the four centrifuge feet:, is the following:

a) lift the centrifuge as described in par.3.1 and position the base (Ref.1) so that the shock absorbers (Ref. 4) are properly aligned to the plates (Ref. 5) previously fixed to the floor or to the supporting structure;
b) check the leveling of the centrifuge by means of a spirit level placed on the top edge of the basin (Ref.6), in case it is necessary, can correct the leveling (contact the purpose Servizi Industriali), verified the leveling of the centrifuge remove tools lifting;
c) place the four washers (Ref.3) and tighten the four screws (Ref. 2) for fixing each shock absorber (Ref. 4) relative to the plate (Ref. 5).



CAUTION:
the separator's leveling is important for the correct functioning of the supporting system of the rotating parts.

5.2 CENTRIFUGE ASSEMBLY

Once fixed on the basement, it is possible proceed to the assembly of the centrifuge. The operations to follow to assemble the centrifuge are depending on the model, the reader is referred to Chapter 10 for a detailed description; below it is only briefly summarized the sequence of operations to be performed: the bowl assembly, installation of covers and outlets group assembling.

5.2.1 LUBRICATION

The transmission mechanisms (bearing and gear if the centrifuge have this type of moving gear) are lubricated, if foreseen, by oil splashing. The centrifuge is delivered with the appropriate oil load, therefore no topping up is required. Before any start it is however necessary to verify the oil level in the carter, as described in (vedi Cap.10). At the first start, or after a long period of inactivity, lubricate the radial ball bearing, that is, the ball bearing supported by the collar group, using the same oil used for the transmission.

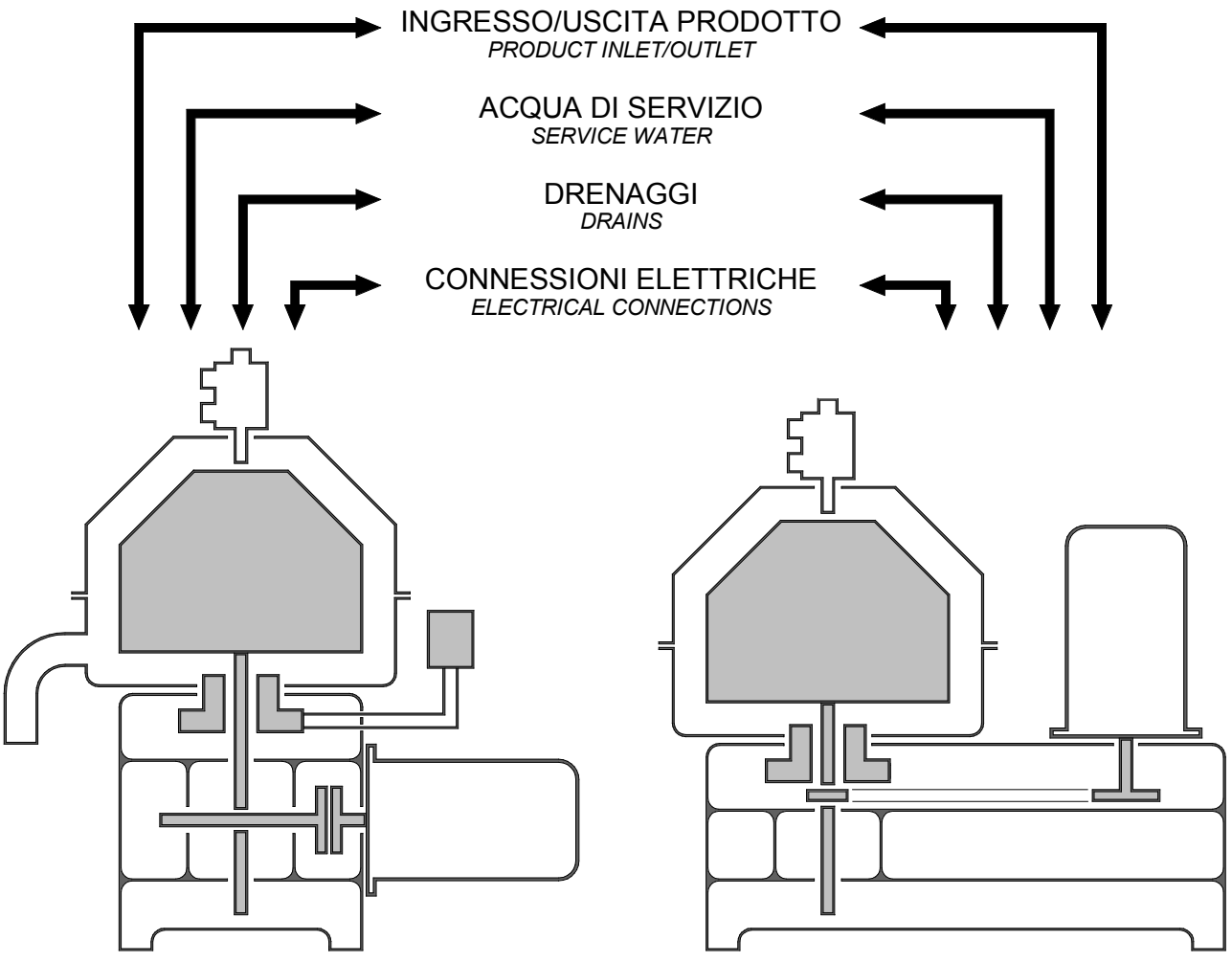
6 CONNECTIONS

This chapter describes the connections that have to be made to put the centrifuge in service. A proper execution of the connections is essential for the smooth operation of the centrifuge and for the work safety.

All separator's connections towards the surrounding environment must be done using elastic elements to avoid the propagation of vibrations produced by the centrifuge.

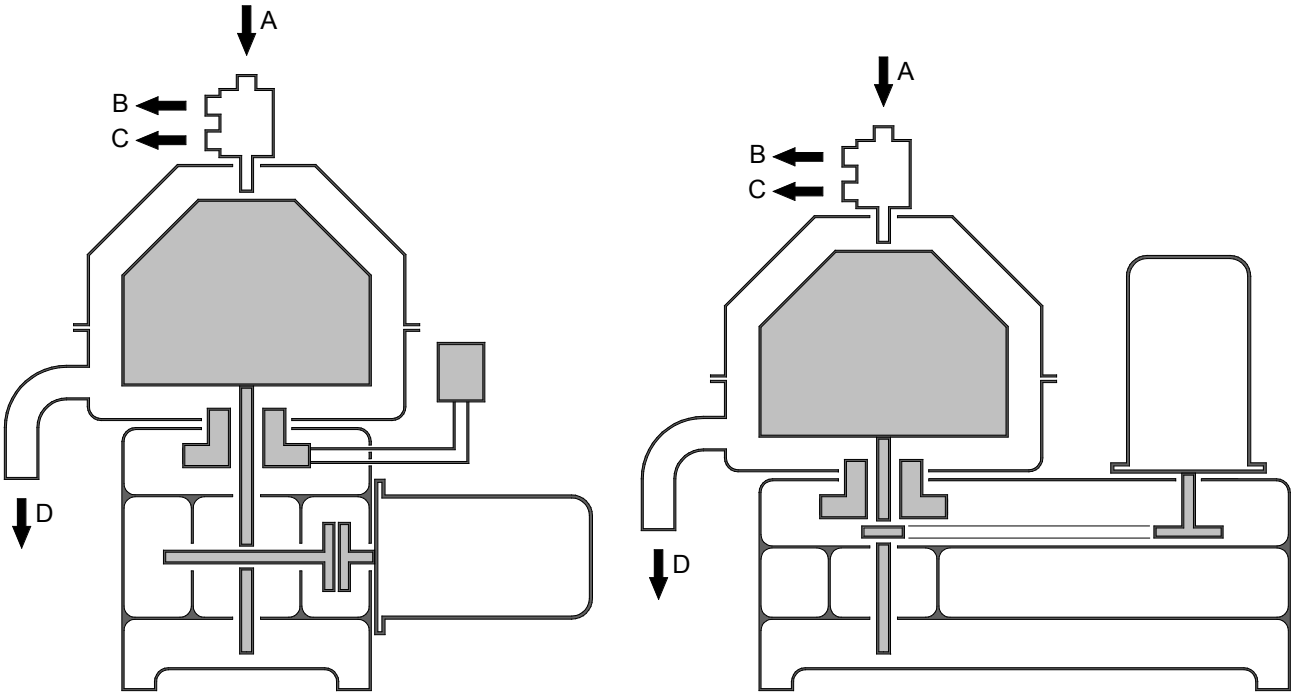
Le connections that have to be done are showed in the following picture.

The pictures used in this chapter are only for explanation purposes, therefore they are complete for the description of the this matter but can not accurately reproduce the appearance of the centrifuge object of this manual. For an accurate representation of the centrifuge purpose of this manual and for a detailed description of the connections refer to All.A2. For the electrical connections, refer to the wiring diagram (All.B).



6.1 PRODUCT INLET/OUTLET

Connect the centrifuge through flexible hoses. The flexible hoses can be supplied or not. If, for any system requirements and / or placement of the centrifuge it is not possible to use any hoses supplied, get in contact with Servizi Industriali S.r.l. to agree on alternative solutions. The connections which must be made are illustrated in the following pictures, for the actual size and type of the specific connection refer to AII.A2.



Rif.	Descrizione	Nota
A	Product inlet	-
B	Light phase outlet	Only for separator or concentrator/skimmer
C	Heavy phase outlet / product	-
D	Solid phase discharge	Only for self cleaning-automatic /nozzle separator

6.1.1 PRODUCT INLET

The supply of the product to the separator requires a pressure head essentially due to the charge losses caused by the percolation of the product through the supply pipe. This pressure head depends on the supply flow rate and on the physical features of the product, indicative values are reported into the specific technical data sheet of the centrifuge (refer to Cap.7).

6.1.2 LIGHT AND HEAVY PHASE OUTLETS

Both light and heavy phase, or the only liquid phase when the centrifuge is a clarifier, can be extracted by turbine or by gravity. The configuration of the centrifuge object of this manual, is described in the technical specification of the centrifuge (refer to section 7). The maximum prevalence output from the turbines, depends on both flow rate and physical characteristics of the product; indicative values are reported into the specific technical data sheet of the centrifuge (refer to section 7). On the outlet line can be installed a regulating valve that allows to vary the operating pressure of the turbine and thus the position of the separation line between the two phases inside the centrifuge, or adjusts the separation efficiency (refer to Section 6). The outlet current pressure of the turbine is read on the manometer.

CAUTION:
The pressure required by the turbine must always allow the extraction of all the product to avoid overflowing and surpassing in any case the limit reported on the specific technical sheet, a possible overflow and a consequent contact between the rotating bowl and the liquid extracted could damage to the centrifuge and create potentially dangerous to people and things.

CAUTION:
in the case of outlet by gravity make the connection so that it is in any case guaranteed the outflow of the liquid phase, in order to avoid overflow from the collecting space, a possible overflow and a consequent contact between the rotating bowl and the liquid extracted could damage to the centrifuge and create potentially dangerous to people and things.

Note: In some centrifuge models, although it is installed a turbine, the product must be drained by gravity and it is not allowed take pressure to turbine.

6.1.3 SOLID PHASE OUTLET

In the case of manual cleaning (solid bowl) centrifuge the solid phase is accrued inside the bowl and it is necessary to stop the centrifuge and partially disassemble it to remove it. In the case of self cleaning centrifuge (automatic discharge) the solid phase is automatically expelled from the bowl in a discontinuous way, at time intervals set through the control panel. In the case of nozzles centrifuge the solid phase is automatically expelled from the bowl in a continuous way through the nozzles. Both for the centrifuge with automatic discharge and with nozzles discharge, the solid discharged it is collected in the basin, and finally conveyed to the exhaust pipe from which, in the case of self cleaning centrifuge it is ejected through high speed. For the solid phase may be foreseen a sludge tank. In the case it is not supply by Servizi Industriali S.r.l. must be properly sized and meet the following requirements:

- must be provided with a safety drainage system placed at a lower level than the machine's outlet to guarantee that an unexpected discharge accumulation reaches the rotating parts inside the centrifuge;
- if it is a covered tank must have a total volume increased by 100% compared to the volume of solid discharged expected before emptying of the tank;
- if it is a covered tank, it must be open towards the outside through a vent with at least 100 cm^2 surface of useful passage, built and positioned to avoid the leaking of material during the discharge;
- the connection between the machine and the collecting chamber must be done using flexible elements to avoid the diffusion of the vibrations produced by the separator.

CAUTION:

The solid phase outlet must be channeled to always guarantee the emptying of the basin since an accidental accumulation of discharged material inside the basin and a consequent contact between the rotating bowl and the discharged material could cause damages to the separator and create situation potentially dangerous for people and things

CAUTELA:

The solid phase outlet must always be channeled in a way that guarantees that the outlet itself it is always free and at atmospheric pressure

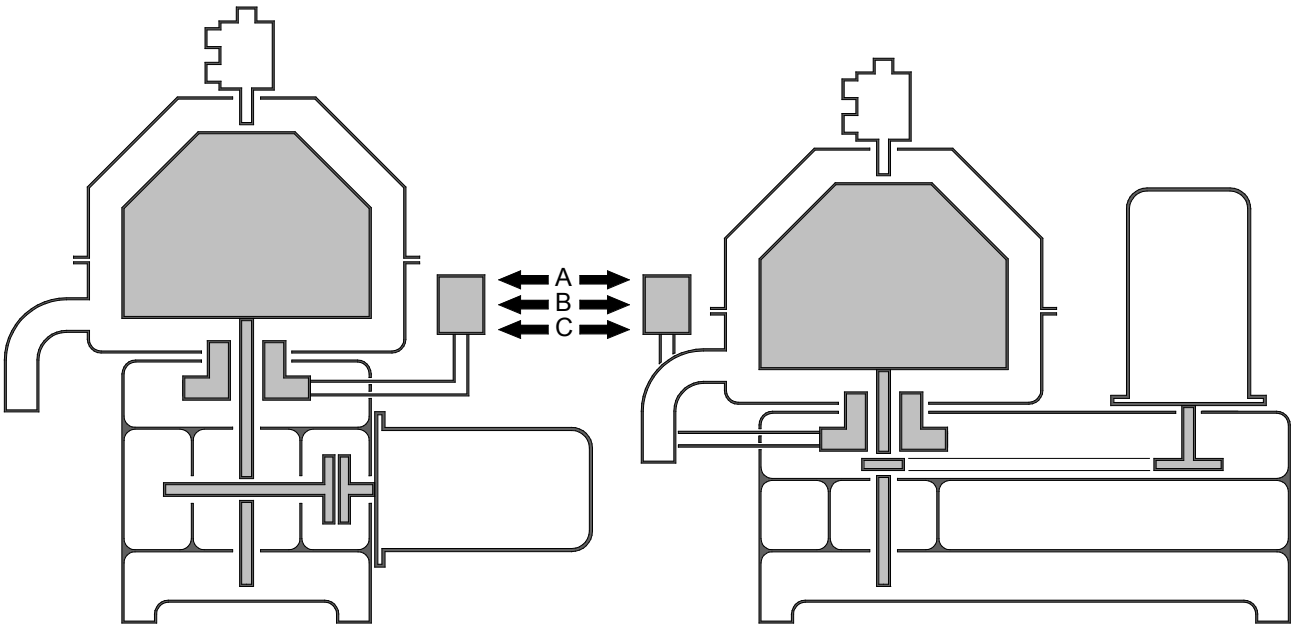
6.2 SERVICE WATER

Connect the centrifuge to the system through the flexible hoses. The flexible hoses are not supplied. All connections in question, are prearranged in the solenoid valves group. The solenoid valves can be installed directly on the centrifuge or can also be expected a separate installation, on the system. The connections to be made are illustrated in the following picture, for the actual size, type of connection and the specific consumption refer to All.A2.

The service water must meet the following specs to ensure proper functioning of the centrifuge:

- Suspended solids: < 1 ppm (volume)
- Particle size: < 50 µm
- Total hardness: CaCo3 < 180 mg/l
- Chlorine ions < 60 mg/l
- pH: 6,0 – 7,5

Further requirements are specified in the paragraphs dedicated to each type of water



Rif.	Descrizione	Nota
A	manoeuvre water	only for the self cleaning centrifuge
B	hydraulic sealing water	only for the nozzles centrifuge
C	washing/fluidification water	only for some model

6.2.1 MANOEUVRE WATER

The water driven to this inlet is used through two distinct solenoid valves (opening and closing lines), for the operations relative to the discharge of the solid phase.
Must be met the following requirements:

- must be provided with a pressure of 2.5 to 5 barg;
- must be provided with a temperature of 5÷30 °C;
- must be provided through a line that can guaranty a flow rate of at least 3000 l / h;

At the inlet of the line there is a pressure reducer that must be calibrated at 1÷1,5 barg. The consumption depends on the frequency and the type of discharge (partial or total) made, approximately the consumption is equal to 1 l per discharge (refer to All.A2).
On the opening and closing lines are prearranged two by-pass, or alternatively the solenoid valves are equipped with manual actuator, to perform manually maneuvers during the stat up phase, optimization of the setting or for troubleshooting. The water used for maneuvers functions is conveyed to the relative drainage from which exits by gravity.

6.2.2 HYDRAULIC SEALING WATER

The water channeled to this inlet is used to create an hydraulic sealing (conventionally called "pocket") inside the bowl or to recreate it after a total discharge. In the case of manual cleaning centrifuge (solid bowl) the hydraulic seal water introduction must be done manually once before the product feeding. In the case of self cleaning centrifuge (automatic discharge) the hydraulic seal water introduction occurs automatically through a dedicated solenoid valve (installed in the solenoid valves group) after each discharge if necessary.
In the case of self cleaning centrifuge (automatic discharge) must be met the following requirements:

- must be supplied with a pressure equal to 2,5÷5 barg;
- must have a temperature that does not depart more than 10°C from that of the processed product in order to avoid the development of emulsions that can damage the efficiency of the separation due to thermal shocks at the entry of the bowl;
- must be provided through a line that can guaranty a flow rate of at least 3000 l/h.

At the inlet of the line there is a pressure reducer that must be calibrated at 1,5÷2,5 barg. The consumption depends on the frequency and the type of discharge (partial or total) as well as the capacity of the sludge chamber. The consuption can be null, in the case where the percentage of heavy phase in the product is such as to make unnecessary to supply additional water, or can reach the maximum, in the case in which are carried out frequent discharges, which can be calculated according to the following formula:

Seal water consumption (l/h) = 1,5 * sludge chamber volume (l) * discharge freq. (1/h)

On line is prearranged one by-pass, or alternatively the solenoid valve is equipped with manual actuator, to perform manually the hydraulic seal water introduction during the stat up phase, optimization of the setting or for troubleshooting. Products where the heavy phase is not water, pocket should be created with the same heavy phase cleaned.

6.2.3 WASHING/FLUIDIFICATION WATER

The water channeled to this inlet is used through two distinct solenoid valves (washing and fluidification lines), for the following operations:

- for the cleaning of the discharge volute of the basin (washing line);
- for the cleaning of the external surface of the bowl and the internal surface of the cover, (washing line)
- fluidification of the heavy phase inside the bowl (fluidification line)
- for the cleaning of the sight glass (fluidification line).

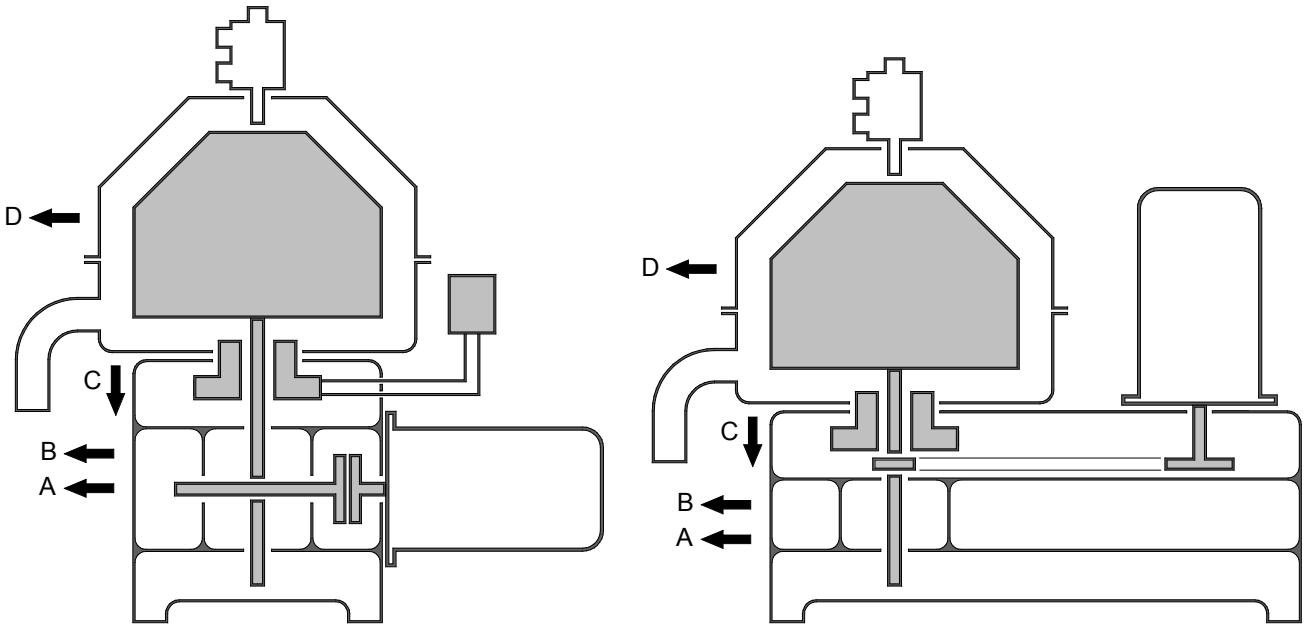
Must be met the following requirements:

- must be provided with a pressure of 1,5÷5 barg;
- must be provided with a temperature slightly lower than that of the product, in order to perform a cooling effect

None of the functions above described it is strictly necessary, the opportunity of the use depends on both the nature of the product and the operating conditions. The consumption can be null, when it is not necessary to perform any of the described operations, or can reach the approximate maximum of 150 l/h. On the differents lines are prearranged manual taps in order to exclude the unnecessary lines or partialize the respective flow rate.
The washing line water, flows to the discharge of the solids, the fluidification line water, flows to the heavy phase outlet.

6.3 DRAINAGE

Connect the centrifuge to the system through the flexible hoses. The flexible hoses are not supplied. The main connections to be performed are illustrated in the following picture; for the actual size, type of connection and the specific consumption refer to All.A2.
The function, the type and the number of connections actually required depends on the model of centrifuge, refer to All.A2 for detailed information.



Rif.	Descrizione	Nota
A	manoeuvre water drainage	only for self cleaning centrifuge
B	safety drainage	
C	basin safety drainage	only for some model
D	cover safety drainage	only for some model

6.3.1 MANOEUVRING WATER DRAINAGE

The water used to perform the automatic diascharge maneuvers drain out by gravity from the drainage of the maneuvering water. In some models of centrifuge it is planned to install a siphon on the outlet line (refer to All.A2). In some models of centrifuge the drainage of maneuvering water and the safety drainage are together.

CAUTION:
The maneuvering water drainage must be channeled to a line in order to guarantee the emptying of the basin since an accidental accumulation of water inside the basin and a consequent contact between the rotating bowl and the water could cause damages to the separator and create situation potentially dangerous for people and things

6.3.2 SAFETY DRAINAGE

The safety drainage allow the outflow of the service water and of the product in the event of overflows due to malfunction or incorrect maneuvers, in order to ensure safety and avoid more extensive damage to the centrifuge also in these eventualities. In particular it serves to avoid that the service water and the product come in contact with the rotating parts or they may reach the basement containing the lubricating oil. For the reasons above, in regular working conditions, from the safety drainage not water or any product flow out, even if only condensation. The safety drainage of the basin and the coverage are present only on some centrifugal models.

CAUTION:
The safety drainage must be channeled to a lines in order to guarantee the emptying of the basin since an accidental accumulation of water or product inside the basin and a consequent contact between the rotating bowl and the water or product could cause damages to the separator and create situation potentially dangerous for people and things.

CAUTION:
The safety drainage must be channeled to an open lines in order to guarantee air circulation and emptying of the basin.

Drains should not be put together of merged into common lines without the consent of Servizi Industriali S.r.l.

6.4 ELECTRIC CONNECTIONS

This paragraph describes the tasks that must be performed to install the electrical panel and how to realize the related electrical connections.

6.4.1 INSTALLATION OF THE ELECTRICAL PANEL

The electric panel features (set up, dimensions and appearance) can vary according to the functionality required. This paragraph describes the general modalities for a correct carriage and installation.

For the actual features of the electrical panel, its correct installation and correct execution of the electrical connections refer to the instructions in the electric scheme attached to this guide (All.B).

The electrical panel is delivered packed together with the centrifuge, its dimensions are described in All.B. Once the installation location is reached, remove all parts fixing the panel to the package. The carriage of the electrical panel must be done using proper equipment (forklift), to facilitate carriage while respecting safety conditions. In the case of cabinets to be placed on the ground, to lift the electrical panel using a forklift, it is necessary to remove the front and the rear part of the cabinet's baseboard.

Place the panel close to the separator. In order to allow the regular air inflowing and out flowing, a distance of at least 20 cm must be allowed between the lateral walls of the panel, where the air intakes for cooling are located, and any other obstacle.

The panel cannot be installed at a distance greater than 100 m from the centrifuge. In case this is necessary, due to the specific conditions of the plant and/or to the machine positioning, contact Servizi Industriali S.r.l.

If the specific conditions of the plant and/or to the machine positioning do not allow the installation of the electrical panel in the immediate proximity of the centrifuge, a button for emergency stop must be installed close to the separator. For this matter, contact Servizi IndustrialiS.r.l.

In the case where the electrical panel was not provided, contact Servizi Industriali S.r.l. for the specific requirements and functionality needed to the electric control of the centrifuge.

6.4.2 ELECTRICAL CONNECTIONS

Before performing the electrical connections, make sure that the supply line section is adequate with respect to the power required by the separator (1.5 times the nominal current, see electrical scheme — All.B) and that it is provided with the grounding connection for protection against direct contacts (see publication IEC 364-4-41).

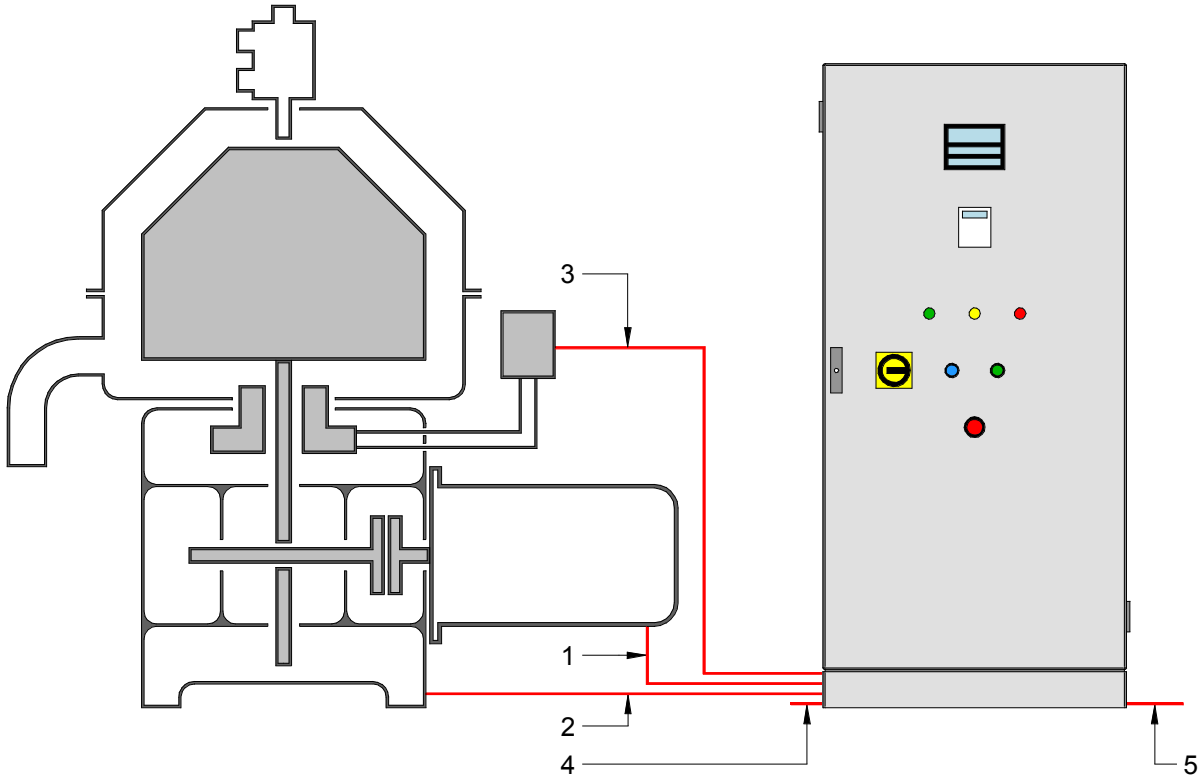
The electrical connections must be made exclusively by professional electricians able to perform a professional job and release a certificate of suitability of the connection certifying that the connection is made in compliance with the norms in force on the matter (2006/95/CEE Directive concerning low voltage, EN 60204-1 concerning electrical equipment of machines).

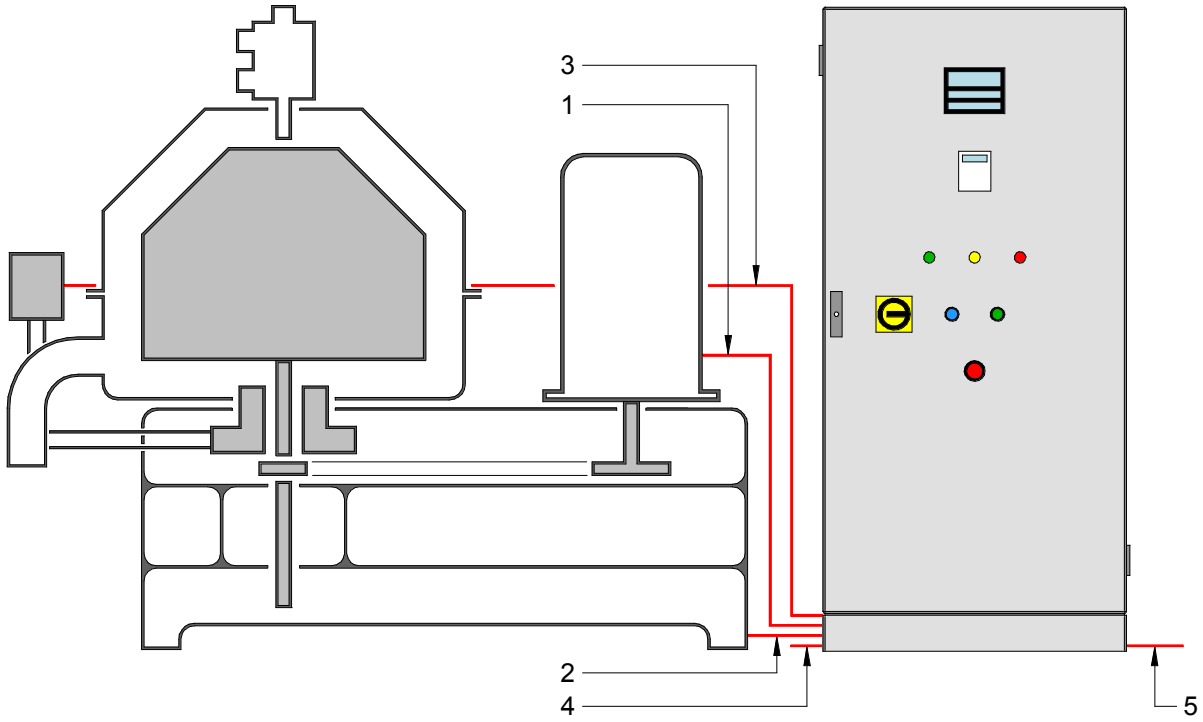
Before performing any electrical connection, always verify the absence of voltage in the equipment on which you intend to work and verify that voltage cannot be accidentally, or intentionally, transmitted to this equipment by third parties.

For the separator's starting, the following electrical connections must be performed (refer to the picture at the following page):

1) electrical panel / electrical engine;
2) electrical panel / separator's ground;
3) electrical panel / solenoid valves group (if foreseen);
4) electrical panel / other auxiliary devices (fedding pump, hydraulic water seal alarm system, etc., if foreseen);
5) local network connection/ electrical panel.

The electric motor must be connected to the electrical panel, that is to the frequency converter, where foreseen, place inside the electrical panel. To perform the connection follow the instructions of the motor and frequency converter manuals if any, attachments of this guide (All.E and All.F), and follow the instructions of the electric scheme (All.B). The frequency convertor is delivered with parameters already set up for a correct functioning in accordance with what prescribed by Servizi Industriali S.r.l. (All.F1).





Rif.	Descrizione	Nota
1	electrical panel / electrical engine	
2	electrical panel / separator's ground	
3	electrical panel / solenoid valves group	only if foreseen
4	electrical panel / other auxiliary devices	only if foreseen
5	local network connection/ electrical panel	

DANGER:
It is forbidden to modify the functioning parameters of the frequency converter without authorization by Servizi Industriali S.r.l.

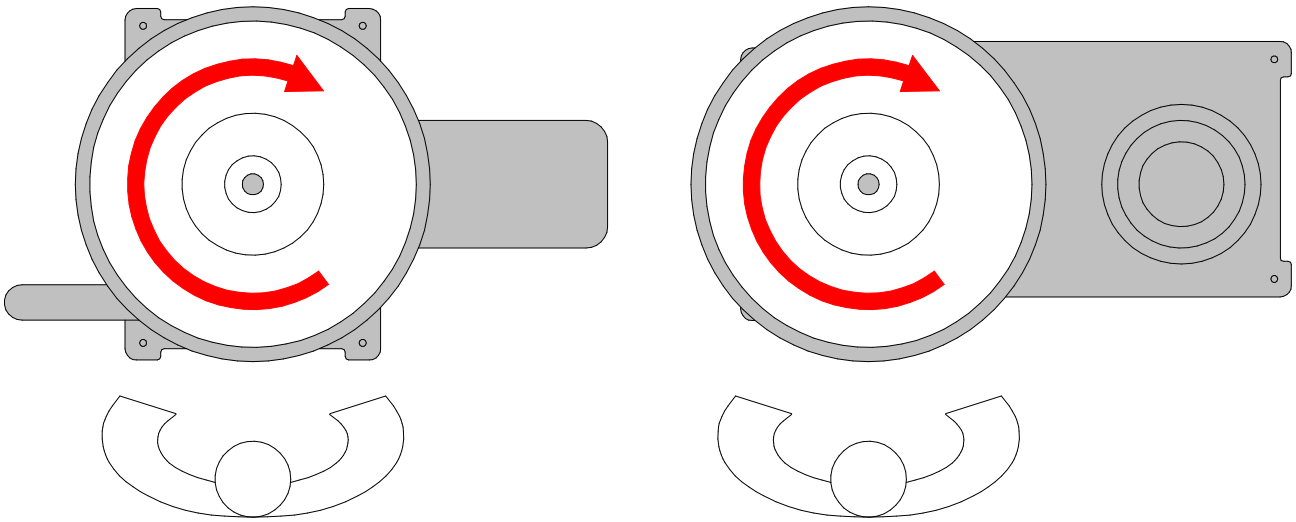
Connect the ground connection of the centrifuge to the electrical panel, for the location of the connection point on the centrifugal refer to All.A2.

Connect the solenoid valves to the electrical panel comply with the instructions of the electric scheme (All.B). To facilitate the connection of the the solenoid valves group to the panel, on some centrifgue models, è it is installed a connection box.

Connect any other auxiliary devices to the electrical panel in accordance with what is described in the wiring diagram (All.B).

Finally, connect the electrical panel to the local network after verifying that the features of the provided voltage correspond to those described in the electrical scheme (All.B).

DANGER:
Verify that the motor's rotation direction is correct (to start the centrifuge see Cap.7): the bowl's vertical shaft must rotate clockwise when it is observed from above, the sense of rotation of the motor depends on the model of centrifuge,refer to the label applied on the engine itself and to All.A2; if the rotation direction is wrong, it is necessary to invert the connection of two of the phases.



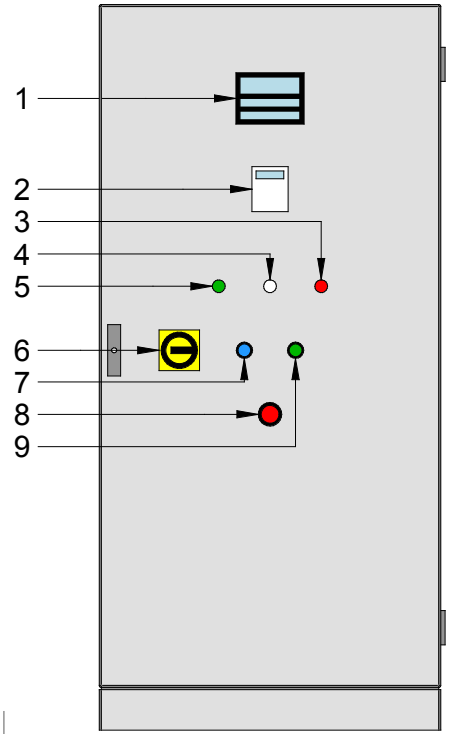
7 USAGE AND FUNCTIONIG

The centrifuge described in this manual is a self cleaning separator with automatic discharge, the heavy and light phases are extracted by means of turbines, the transmission is with mechanical gears. The centrifuge is supplied complete of all necessary devices for the use as clarifier configuration; in this case the only purified liquid phase is extracted by means of the turbine at the light phase outlet. The destination and limits of use of the centrifuge (refer to Ch.3) are specified in the data sheet of the centrifuge (refer to Chapter 8) and in the sales contract.

Comply wiht the limits of use specified in this manual and those indicated in the contract of sale, with particular attention to the limits on the rotation speed, temperature, the density, the discharge pressure of the turbine and the product flow rate at the centrifuge's feeding.

7.1 CENTRIFUGE USE

In this section, we describe how to use the centrifuge with reference to the following picture. The electrical control panel shown is the standard, check on the specific wiring diagram (Att.B) any change and / or implementations.



Ref.	Description
1	Control panel and PLC display
2	Control panel and PLC display of the frequency converter
3	Alarm signal
4	Indicator of voltage presence
5	Indicator centrifuge in operation
6	General switch
7	Start button
8	Emergency stop button
9	Stop button

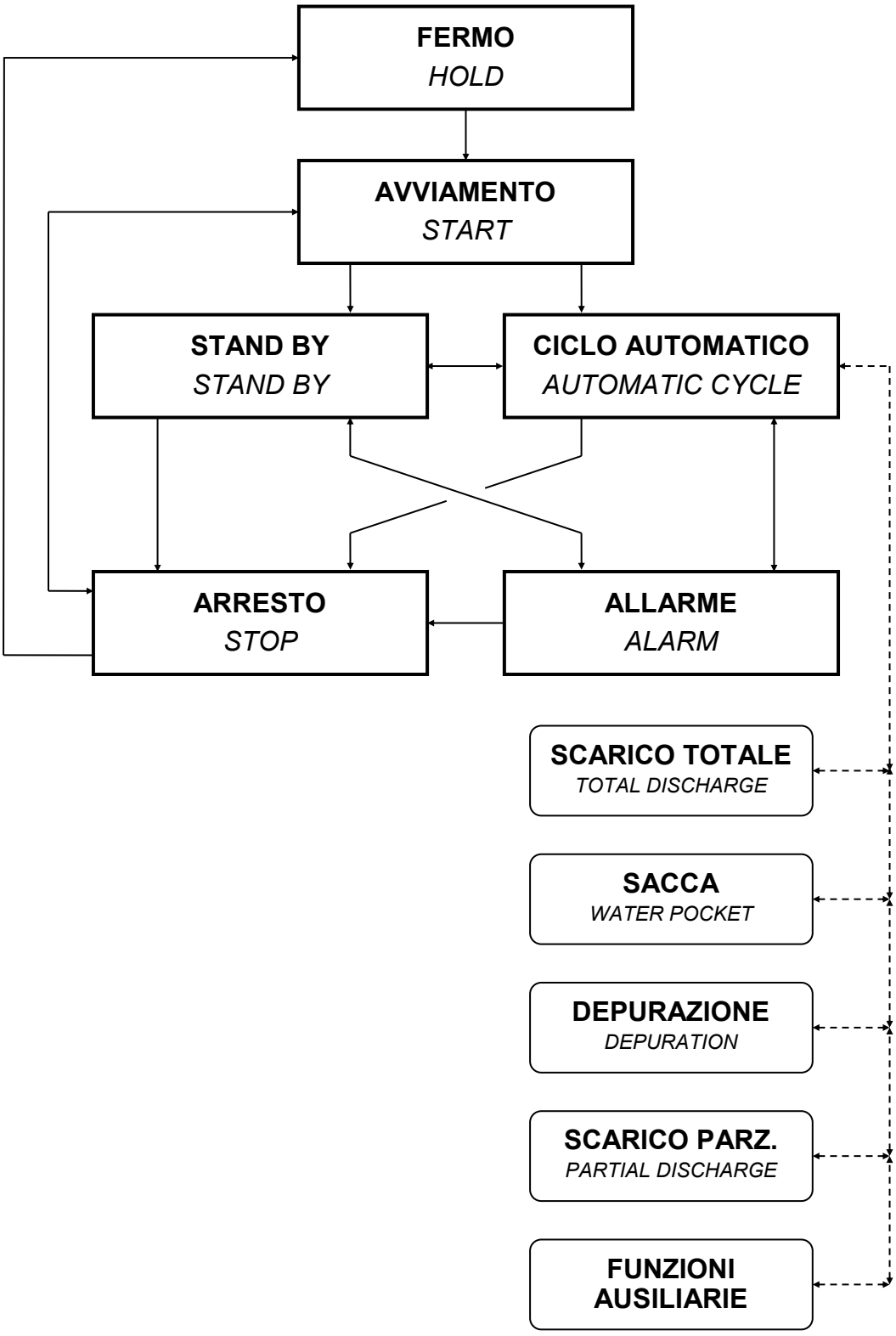
nd the PLC are delivered with parameters already set up. The original parameters of the converter are described in Att.F1, the original parameters of the centrifuge's functioning that are set up on the PLC are described in Att.C1 and Att.C2.

DANGER:
it is absolutely forbidden at the users, to modify the functioning parameters of the frequency converter without Servizi Industriali S.r.l. permission

The parameters for the separator's functioning are divided in two groups: first, those related to the setting of the centrifuge working cycle and the auxiliaries (Att.C1) and second, those related to the system configuration and to the PLC Inlets/outlets (Att.C2 and Att.C3 respectively).
In the first group are included all the parameters related to those features which are necessary and / or accessories which can be managed by the user. In the second group are included all the parameters related to those features which are necessary and / or accessories, which can only be managed by Servizi Industriali S.r.l., or with its authorization.

7.1.1 DESCRIPTION OF THE FUNCTIONING STAGES

The following scheme describes the functioning stages of the separator.



HOLD

When the control panel is connected to the voltage power through the general switch, the separator goes on hold (FERMO): the frequency convertor is connected to the power, the white light on the electrical panel turns on, the motor is on hold. By pressing the appropriate button of the PLC's panel (refer to Par.7.1.2) the system is set up for the automatic mode: at the end of the start phase the system will automatically start a sequence of operations managed by the PLC.

START

By pressing the start button the system is put on start mode (AVVIAMENTO): the motor is powered and controlled by the frequency converter, the green light on the electrical panel turns on. The start time is a set up parameter of the frequency converter (vedi Att.F1).

STAND BY

If the cycle is set as hold, at the end of the start phase the system goes on STAND BY: la centrifuga è a regime, the centrifuge is at steady state speed, it is possible to have access to the list of manual controls and activate them using the appropriate button on the PLC of control panel. By pushing the appropriate button on the PLC of control panel it is possible to go from the STAND BY mode to the automatic cycle mode "AUTOMATIC CYCLE", and vice versa, at any time. Going from AUTOMATIC CYCLE mode to STAND BY mode resets to zero all the time parameters and the counters of the automatic cycle are reset to zero. At this stage it is possible to supply the machine with the product, keeping in mind, however, that all the automated functions are excluded.

AUTOMATIC CYCLE

If the cycle is set on, at the end of the start phase the system goes on AUTOMATIC CYCLE: the centrifuge is at steady state speed, the manual controls are not active, the system automatically performs a series of operations managed by the PLC

STOP

By pushing the stop button the system goes on stop mode ARRESTO: the motor is powered and controlled by the frequency convertor. The stopping time is a set up parameter of the frequency convertor (refer to Att.F1).

ALARM

In case of alarm, the PLC deactivates the automatic cycle and puts the separator on STAND BY; if the alarm implies a potentially dangerous situation, the PLC puts the separator on STOP. In both cases, the red light placed on the electrical panel turns on. Through the PLC it is possible to identify the cause of the alarm and, once the cause is removed, reset it.

The alarms that put the centrifuge on the state of STANDBY or STOP depend by the configuration of the centrifuge itself and by the added components installed (see Att.C2 Att.B and wiring diagram).

The alarms that put the separator on STOP mode are:

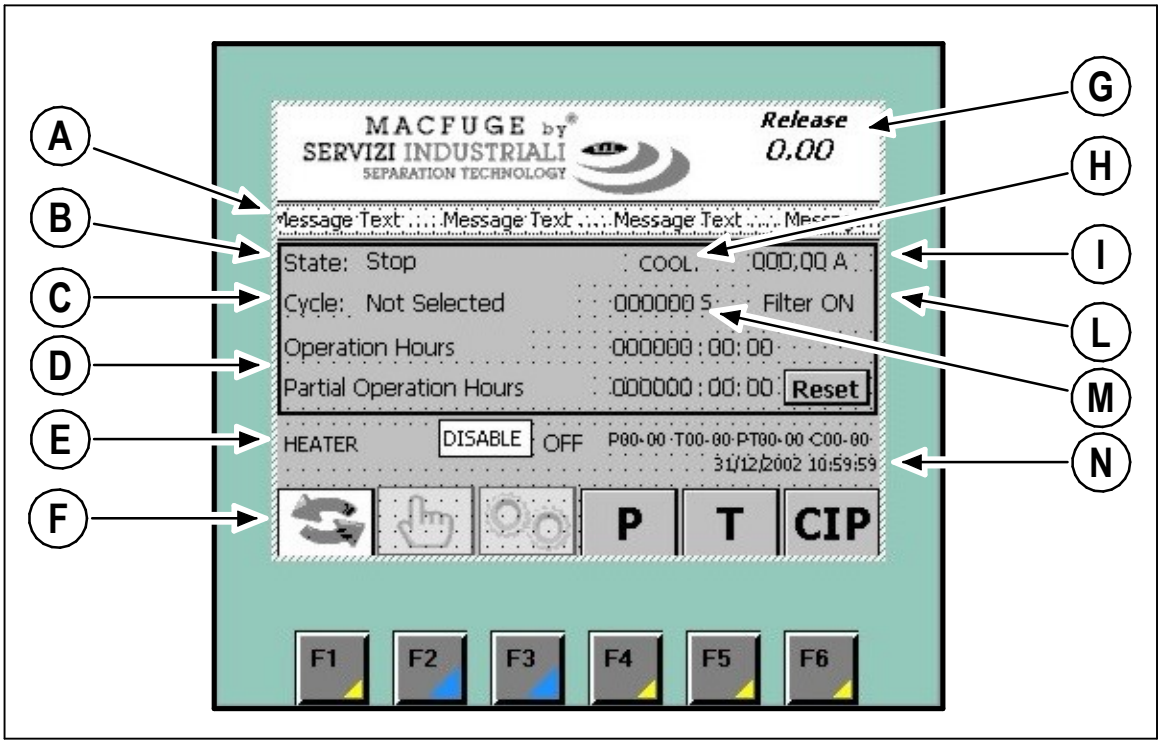
- alarm from the frequency convertor;
- high vibrations (if included).

DANGER:

The alarm high vibrations during start and stop phases could not be activated; it is anyway mandatory to monitor the separator during this phases as described in Par.7.2 e Par.7.3.

7.1.2 PLC's USAGE

When turning on the control panel of the PLC as shown in Fig.46A: the displayed page illustrates the whole state of operation of the plant.



The PLC is programmed to perform a number of applications that can be effectively enabled or not, depending on the required functionality: the actual displayed messages will be only those relating to the required functionality and then enabled by the plant configuration.

In the tables on the following pages are shown, for example, the meanings of the fields displayed above (Table 1) and the functions of control buttons (Tab.1bis).

Note: The parameters described below are related to all the features provided by the PLC program, some of them could not be planned or not implemented on the centrifuge object of this manual.

CONTROL PANEL	
Ref.	**Description**
A	Indication of the last alarm occurred.
B	Indication of the operating state of the centrifuge.
C	Indication of the current phase of the automatic cycle.
D	Partial and total counter of the operation hours of the centrifuge, the partial counter can be reset with the button "RESET" on its side.
E	Indication of the operating state of the heater "ON" / "OFF" by pressing on "DISABLE" / "ENABLED" it is possible enable or disable its operation.
F	Command key, see Tab.1bis on the next page.
G	Software release number
H	Indication of the operation of the valve cooling, it is displayed during the activation phase of the valve.
I	Power absorption of the motor of the centrifuge
L	Indication of the state of operation of one of the components described below, the text of the message is variable depending on the active component: • operation of the motor filter "Filter ON" • activation of the washing solenoid valve "wash." • activation of the fluidification solenoid valve : "Fluid." • activation of the closing solenoid valve for phase of refilling: "Refil." In the case of operation of two or more components shall be indicated only one.
M	Indication of the purification time or CIP, this time it is visible only for the duration
N	Indication of the discharges number (partial "P" Total "T", partial + total "PT" and

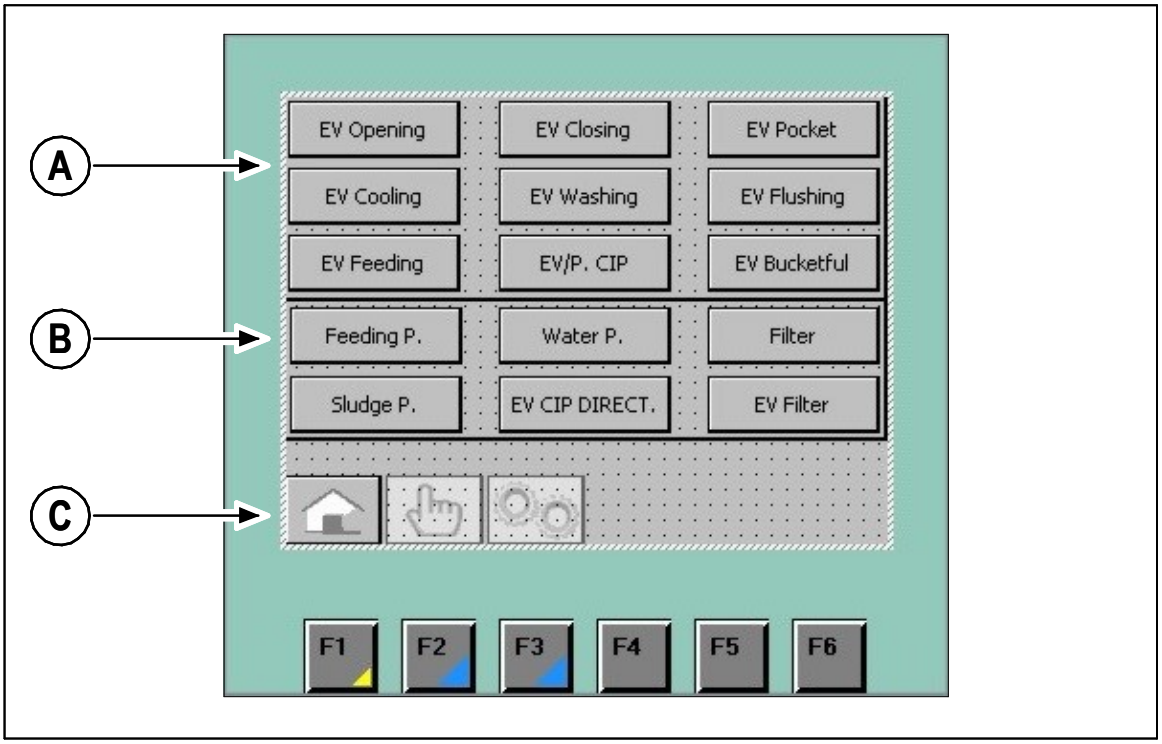
Tab.1

BUTTONS OF THE CONTROL PANEL	
Button	**Function**
	Return homepage.
	Activation/deactivation of automatic cycle.
	Go to manual controls page
	Go to plant operational parameters settings page
	Forced execution of a partial cycle (only available if the automatic cycle is active and the partial opening and closing times are greater than zero).
	Forced execution of a total cycle (only available if the automatic cycle is active and the total opening and closing times are greater than zero).
	Activation of the automatic washing cycle.
	Go to the alarms page

Tab.1bis

7.1.3 MANUAL CONTROLS

To go to the manual controls page from the home page see Par.7.1.2. The following fig. shows all the manual control keys included in the PLC programme; only those included in the plant configuration are effectively displayed.



The first 9 keys (Ref.A), relative to the control of 9 electrovalves, are hold-down control keys (i.e. the electrovalve is only excited as long as the key is kept pressed), the other keys (Ref.B) are of the ON/OFF type.
Press the key (Ref. C) to go back to the home page.
It is possible to feed the machine without using the automatic cycle and use the manual controls to perform basic operations. The use of manual controls to operate the centrifuge is useful when setting up the system, for example to evaluate or verify the correct discharge frequency setting or to perform maintenance and troubleshooting operations.

7.1.4 SYSTEM CONFIGURATION AND PLC I/O PARAMETERS

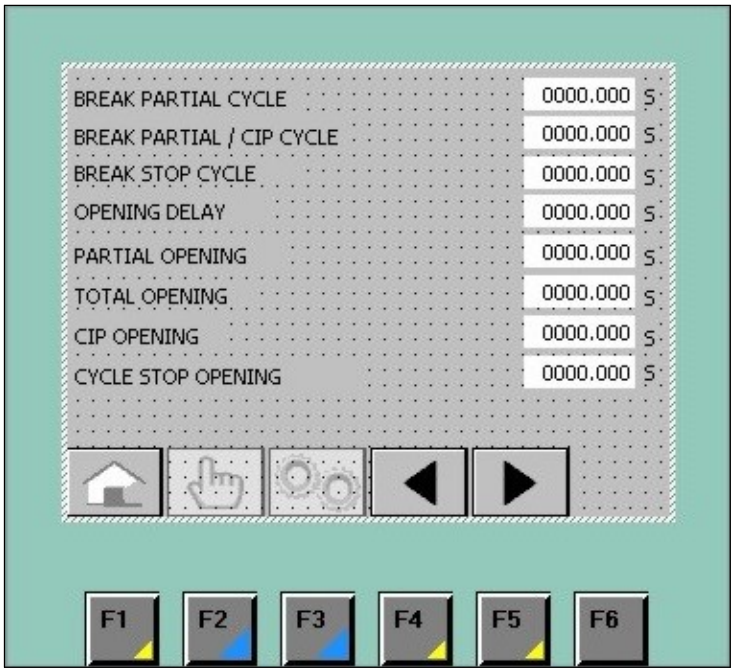
Access to pages relative to plant parameter and PLC I/O settings is reserved for Servizi Industriali S.r.l. Att.C2 shows the list of functions whose control is included in standard PLC programming, Att.B è riportato l'elenco di configurazione degli I/O del PLC. shows the configuration list of PLC I/Os. Some of these functions can be used only if included and requested during set up of the system and electrical panel, that is, if the necessary and related components and equipment items are requested and installed. The above functions list also describes the factory settings of the relative parameters.

It is absolutely forbidden for the user to modify system and PLC I/O configuration parameters without permission from Servizi Industriali S.r.l.

7.1.5 OPERATING PARAMETERS

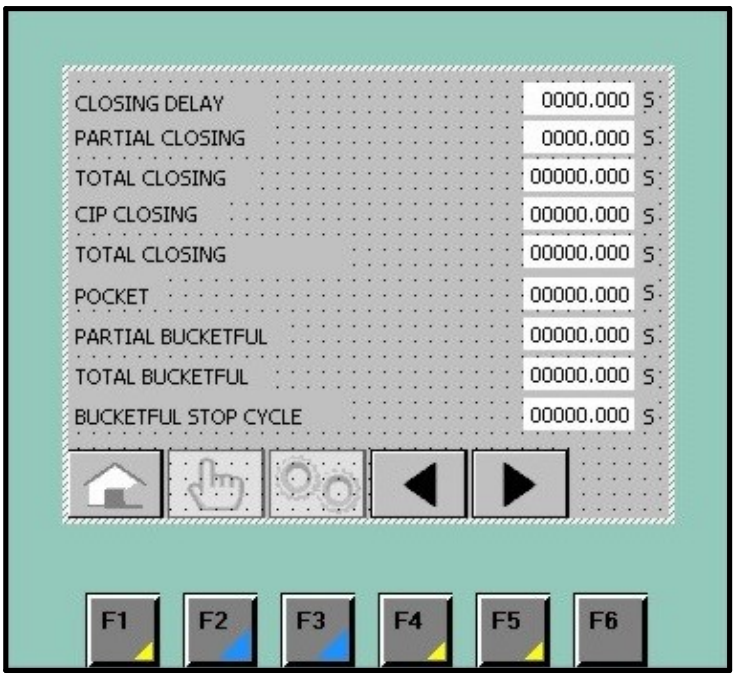
To access the pages relative to operational parameter settings from the home page see Par.7.1.2. The parameters described below (Tab.2A/F) refer to all PLC programme functions, some of which may not be included or implemented on the model to which this manual refers.

***Note**: Servizi Industriali S.r.l., reserves the right to make modifications, without prior notification, to the programme installed on the PLC; the order in which the pages and operational parameters are shown (Tab.2A/2F) may differ from that with which they are displayed on the PLC.*



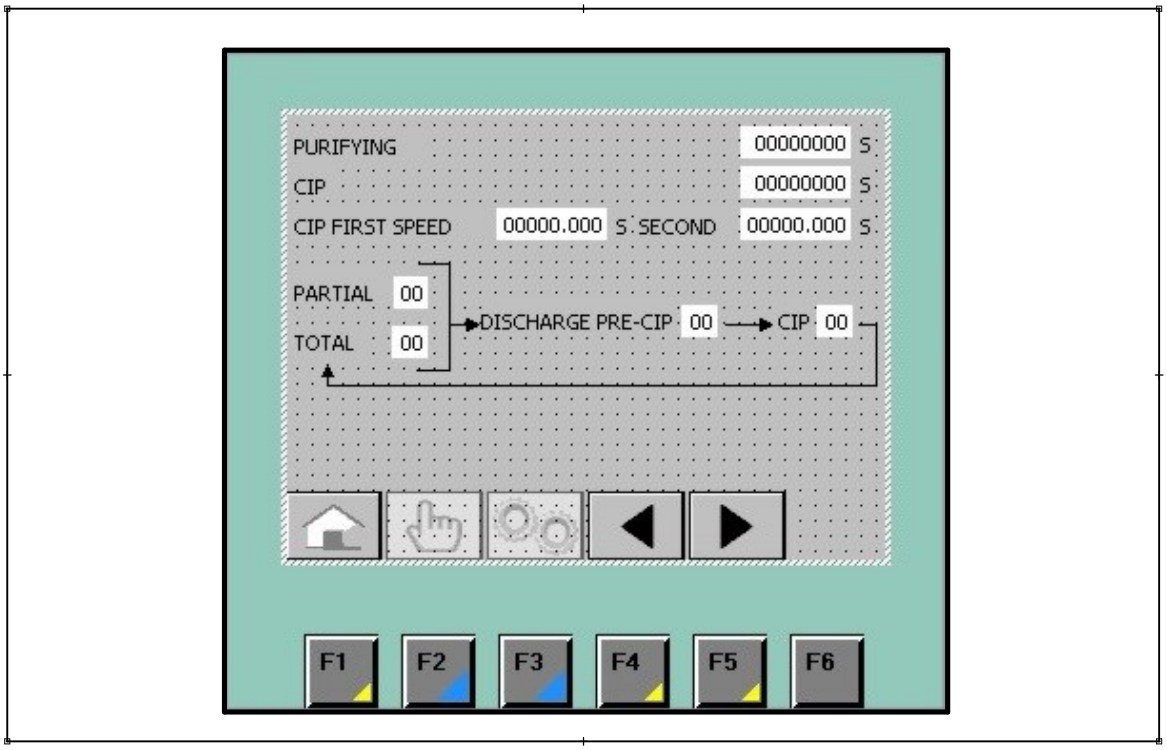
Description of parameters of operation	
Parameter	**Description**
Partial cycle pause	Delay time, in the case of partial discharge, of the start of the discharge phase with respect to interruption of the depuration phase. *Note: The delay time is programmed to allow the start of a manoeuvre water pump or closure of a valve on the product feed line, where applicable.*
Total cycle/CIP pause	Delay time, if there are total discharge or CIP discharge, of the start of the discharge phase with respect to interruption of the depuration phase. *Note: The delay is applied for reasons similar to those stated in the previous point*
Stop cycle pause	Delay time, in the case of if there are total discharge during stop phase, of the start of the discharge phase with respect to the centrifuge stop command *Note: The delay time is programmed to allow the start of a manoeuvre water pump or closure of a valve on the product feed line, where applicable.*
Opening delay	Delay time at effective opening of the opening valve with respect to end of pause time before discharge. This delay allows a lag in opening valve operation with respect to the closure valve .
Partial opening	Opening time of the opening valve during the partial discharge phase.
Total opening	Opening time of the opening valve during the total discharge phase.
CIP opening	Opening time of the opening valve during discharge phase in CIP cycle.
Stop Cycle Opening	Opening time, where automatic discharges are set up during the stop phase, of the opening valve during the discharge-during-stop phase.

Tab.2A



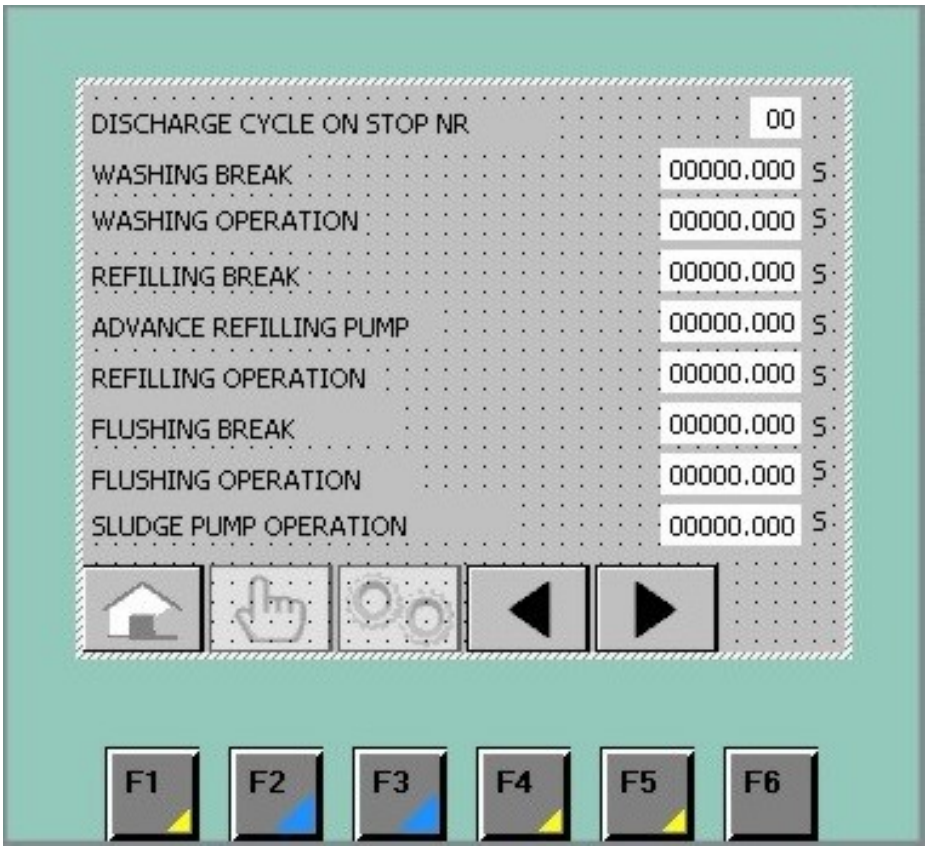
Description of parameters of operation	
Parameter	**Description**
Closing delay	Delay time at effective opening of the closing valve with respect to end of pause time before discharge. This delay allows a lag in opening valve operation with respect to the closure valve .
Partial closing	Opening time of the closing valve during partial discharge phase.
Total closing	Opening time of the closing valve during total discharge phase.
CIP closing	Opening time of the closing valve during CIP cycle discharge phase.
Total closing	Opening time of the closing valve during STOP cycle discharge phase.
Pocket	Opening time of the pocket valve.
Partial bucketful	Opening time of the bucketfull valvole before apartial discharge. *Note: the bucketfull start at the end of the depuration phase concurrently With the time "Partial Cycle Pause".*
Total bucketful	Opening time of the bucketfull valve before total discharge Note: *the bucketfull start at the end of the depuration phase concurrently with the time "Total cycle/CIP Pause".*
Bucketful stop cycle	Opening time of the bucketfull valve, in the case automatic discharge are expected during the STOP phase, before total discharge.*Note: the bucketfull start at the end of the depuration phase concurrently with the time "Stop cycle Pause".*

Tab.2B



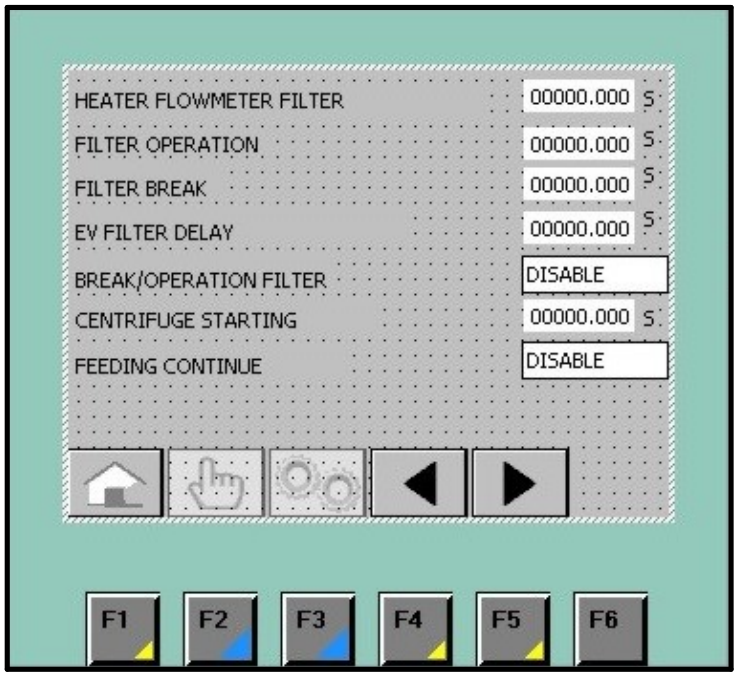
Description of stages of operation	
Parameter	**Description**
Purifying	Depuration time, i.e. the time between two discharges during execution of the automatic cycle.
CIP	CIP cycle depuration time, i.e. the time between two discharges during execution of the CIP cycle.
First/second CIP speed	Respectively operating time of the washing fluid feeding pump to the first and second speed set (the parameters related to the speed must be set on the pump's inverter).
Partials	Number of partial discharges before carrying out total discharges. *Note: if the number of total discharges is equal to zero, the number of partial discharges must be greater than zero and is unimportant; the plant will always and only execute partial discharges.*
Totals	Number of total discharges before carrying out partial discharges. *Note: if the number of partial discharges is equal to zero, the number of total discharges must be greater than zero and is unimportant; the plant will always and only execute total discharges.*
Pre-CIP discharges	Number of partial or total discharges before effective activation of the CIP cycle. *Note: If the number of CIP cycles is zero the plant will go immediately to the CIP cycle.*
CIP	Number of CIP cycles before returning to normal automatic treatment cycle

Tab.2C



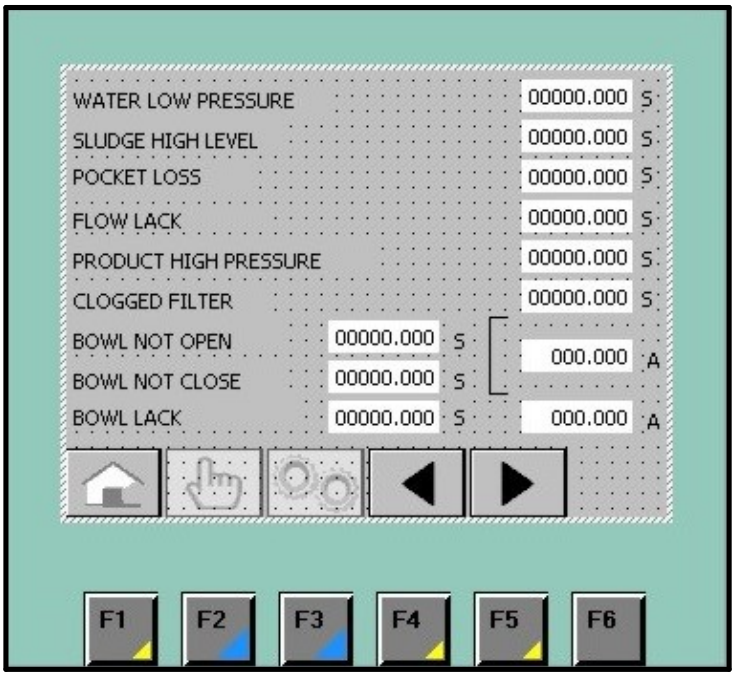
Description of parameters of operation	
Parameter	**Description**
N. of discharge cycles during stop	Number of discharges to be executed during centrifuge stop phase *Note: this only occurs if the machine has been fed at least once since the last start*
Cleaning pause	Time between two wash phases. *Note: parameter used if the "Washing Type" parameter is set to 2 (see Par. 12.2.2).*
Cleaning	Opening time of the wash valve.
Refilling pause	Time between two refilling phases. *Note: refilling consists of restoring the bowl close water: this may be necessary when the depuration time is very high.*
Refilling pump advance	Refilling phase start delay time *Note: The delay is to allow the start of a pump for the manoeuvre water.*
Refilling	Opening time of the closure valve during the refilling phase.
Fluidisation pause	Time between two fluidisation phases. *Note: parameter used if the "Fluidisation type" parameter is set to 1 vedi Att.C2).*
Fluidisation	Opening time of the fluidisation valve.
Sludge pump operation	Working time of the evacuation pump (if installed) that pumps sludge from the collecting tank. *Note: the above parameter is used only if a single level gauge is used for control of collecting tank ((vedi Att.C2).*

Tab.11E



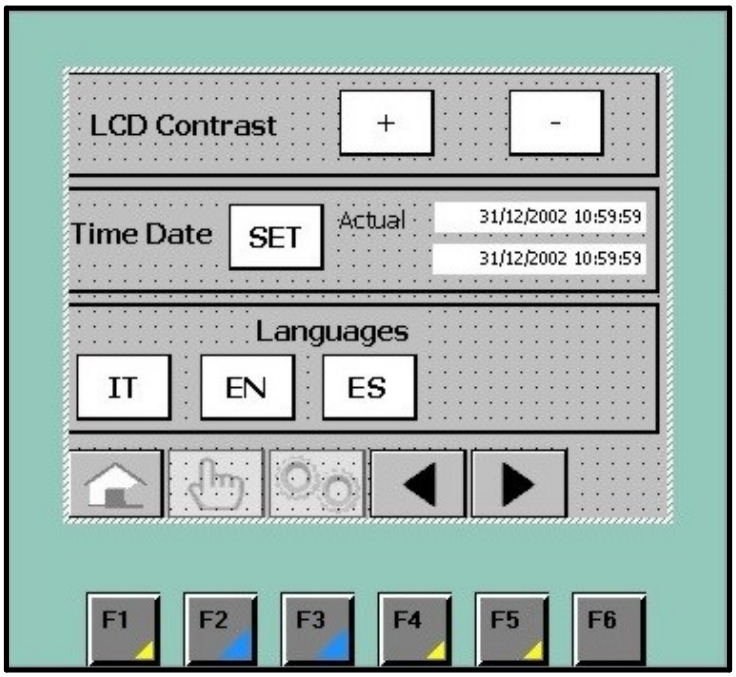
Description of parameters of operation	
Parameter	**Description**
Heater flow meter filter	Delay time between flow meter being tripped and actual no-flow signal *Note: delay needed to prevent the heater being switched on/off by very brief flow stoppages caused by, for example, air bubbles.*
Filtration	Self-cleaning filter motor operation time
Filter pause	Time between two self-cleaning filter motor operation phases
Self-cleaning filter EV delay	Delay time between start of self-cleaning filter motor and opening of the self-cleaning filter discharge valve; the valve will stay open until the motor stops running.
Filter pause / operation:	Enables or disables operation of the filter on the basis of the times in the previous points if the motor is disabled and the filter discharge valve are controlled only by the differential pressure switch.
Refilling	Opening time of the closure valve during the refilling phase.
Centrifuge start	Speed achieved (machine running at working speed) signal delay with respect to the signal received from the frequency converter on achievement of set rotation speed.
Continuous feed:	Specifies whether or not centrifuge feed has to continue during the partial discharge phase. *Note: During the total discharge phase feed consensus is in any case suspended.*

Tab.2E



Description of parameters of operation	
Parameter	**Description**
Low water pressure	Delay time between tripping of pressure switch on manoeuvre water line and effective low pressure alarm signal
High sludge level	Delay time between tripping of sludge tank level gauge and effective high level alarm signal
Pocket leakage	Delay time between tripping of level gauge or pressure switch and effective pocket leakage alarm signal.
No flow	Delay time between flow meter being tripped and actual no-flow signal
High product pressure	Delay time between pressure switch being tripped and actual high pressure alarm signal.
Filter clogged	Delay time between differential gauge installed on self-cleaning filter being tripped and actual clogging alarm signal.
No opening	Delay time between absorption-control frequency converter being tripped and actual no opening alarm signal. *Note: Check not active during CIP and stop discharge phases.*
No closure	Delay time between absorption-control frequency converter being tripped and actual no closure alarm signal. *Note: Check not active during CIP and stop discharge phases.*
Bowl leaking	Delay time between absorption-control frequency converter being tripped and actual no bowl leaking alarm signal.

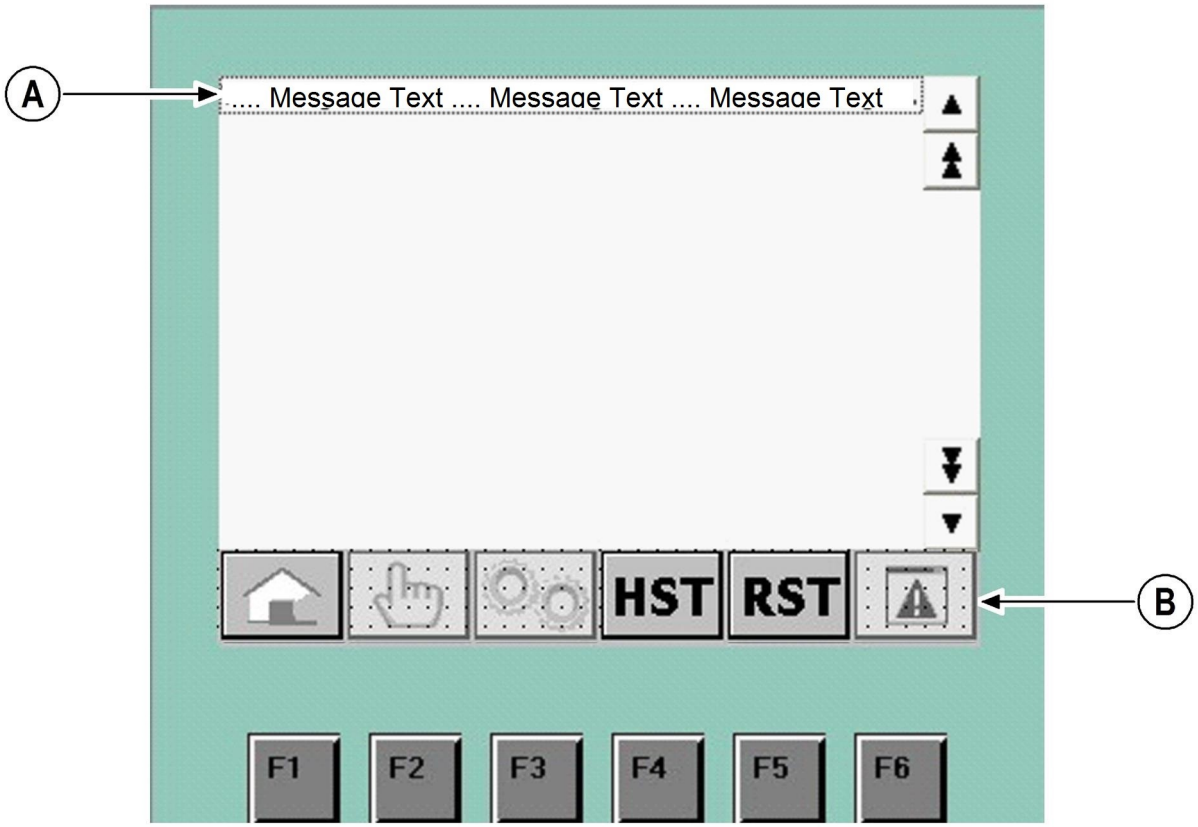
Tab.2F



This page includes keys for adjusting the display contrast, the hour and date setting and choosing the language of on-panel messages .
To change the value of date and time, touch the string date time under the current one, enter the desired date and time and confirm by sending as for the change of any value and then confirm with "SET".

7.1.6 ALARMS LIST

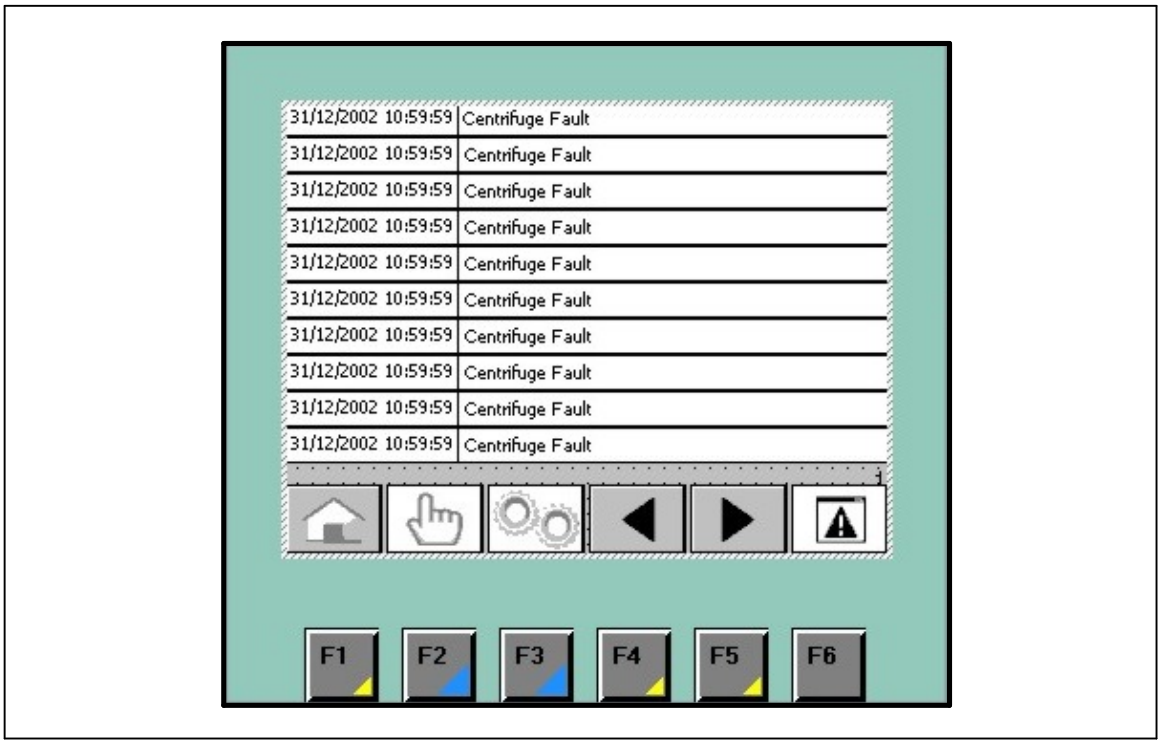
To go to the alarms list page from the home page see Par.7.1.2.



This page gives the list of all the active alarms in chronological order, the most recent at the top (Ref. A). On this page it is possible to reset, by pressing the relevant key “RTS” (Ref. B), alarms requiring intervention by an operator. This is only possible if the effective cause of the alarm has been eliminated. Using "RST" (Ref.B) to access the alarm log.

7.1.7 ALARM LOG

To access the page alarm log see Par.7.1.6.



In these pages displays the alarm log: the left column is the date and time of the event, the right column lists the type of alarm record.
At the bottom right number indicates the page number (1 to 5).

7.2 START

DANGER:

before starting the centrifuge carefully check that:

- the bowl is correctly assembled; in particular verify that the big closure nut is correctly screwed on (see Chapt..10);
- the covers are fitted correctly (see Chapt..10);
- the centrifuge is assembled correctly (see Chapt..10);
- the electrical connection are correctly done (see Chapt..6);
- do not leave the machine rotating empty for longer than 30 min.

CAUTION:

before starting the centrifuge carefully check that:

- the oil level is the quantity foreseen (see Chapt..10);
- the connection pipes are correctly assembled;
- the position of the adjustment valves and the intercepting valves (if present) is as desired.

Furthermore, verify that the necessary are available.

Once the above mentioned checks have been carried out, it is possible to start the centrifuge by performing the following operations:

a) **power the panel using the general switch**: the white light indicating the power is on, il PLC the PLC installed inside the panel starts and automatically performs a self-check of its own functions;

b) **select the centrifuge work mode via the relative key on the PLC panel** ;

c) **press the start button** : the time necessary for the start is a parameter managed by the frequency convertor (vedi Att.F1);

d) **check the direction of rotation of the motor (vedi Par.6.4.2)**: stop the start if the direction of rotation is wrong;

e) **monitor the centrifuge during the start phase**: stop the start phase if there is a malfunction (high vibration, unusual noise etc);

f) **verify that the fully operational rotation rate is as foreseen**: stop the centrifuge if the speed is higher;

g) **feed the centrifuge with the product:**: at the end of the start phase the machine goes to STAND BY or AUTOMATIC CYCLE, depending on the selected mode, see point b);

h) **check the operating conditions of the machine**: especially electrical absorption and delivery pressure of the centripetal pumps (turbines).

With regard to product feed on the centrifuge, bear in mind that:

- if the centrifuge is set to AUTOMATIC CYCLE, at the end of the start phase it automatically performs the bowl closure operations and any operations required to create the pocket; wait for these tasks to be completed before starting the feed;

- if the centrifuge is set to AUTOMATIC CYCLE and the system is also set up to control a feed valve or pump, the feed will start automatically;

- in the event that the centrifuge is set up for STAND BY status before starting the feed it is necessary to close the bowl and if necessary create the pocket by going to the “Manual Controls” page via the relative key (see Par.7.1.3 e Par.7.1.5) on the PLC panel.

7.3 STOP

DANGER:
Before starting any maintenance work, check that all rotating parts have completely stopped.

Stop the centrifuge as follows:

a) **stop the machine feed**;
b) **perform at least one washing sequence on the line**: for a description of this sequence see Chapt..10.;
c) **perform a total discharge manoeuvre**: The discharge manoeuvre is executed automatically after pressing the stop pushbutton if the centrifuge is set to AUTOMATIC CYCLE (see following point); if the centrifuge is in STAND BY mode it is necessary to perform the manoeuvre using the manual controls;
d) **press the stop button**: The time necessary for the stop is a parameter controlled by the frequency converter (vedi Att.F1);
e) **monitor the centrifuge during the stop phase**: At the end of the stop phase the centrifuge goes to HOLD;
f) **visually check the motor has come to a complete halt.**
g) **cut power to the panel using the general switch** : cut the panel voltage only once the stop phase has been completed, the white light indicating that the power is on switch off.

7.4 ADJUSTING THE CENTRIFUGE

The result of the separation depends on several factors; the most relevant are the following:

- **feed rate**: a feed rate reduction improves the result of separation as it increases the permanence time of the product in the centrifugal force area created by the centrifuge;
- **difference between densities**: the greater the difference between the densities of the heavy and the light phase and/or the difference between the densities of the liquid and solid phase, the easier the separation and therefore the better the result;
- **viscosity**: the lower the viscosity of the liquid phase, the higher the sedimentation rate and therefore the better the result;
- **temperature**: a temperature increase usually causes a decrease in viscosity and therefore an improvement in the result;
- **product composition**: separation of two liquid phases is easier if one of the two liquid phases has a predominant percentage in the overall product composition;
- **solid phase granulometry**: a greater size and a more spherical shape of the particles forming the solid phase result in a higher sedimentation speed and therefore in better results.

The following table shows some values linking the above mentioned features to the separation result. The following values are approximate; for a more detailed evaluation taking into account other parameters such as the required feed rate, expected separation efficiency etc., please contact Servizi Industriali S.r.l.

FEATURES INFLUENCING THE SEPARATION RESULT			
Description	**U. of M.**	**Easy separation**	**Difficult separation**
Difference between densities	light/heavy ratio	<0,85	>0,95
Kinematic viscosity	cSt	<4	>40
Product composition	% - %	5% - 95%	50% - 50%
Granulometry of solids	um	>50	<5

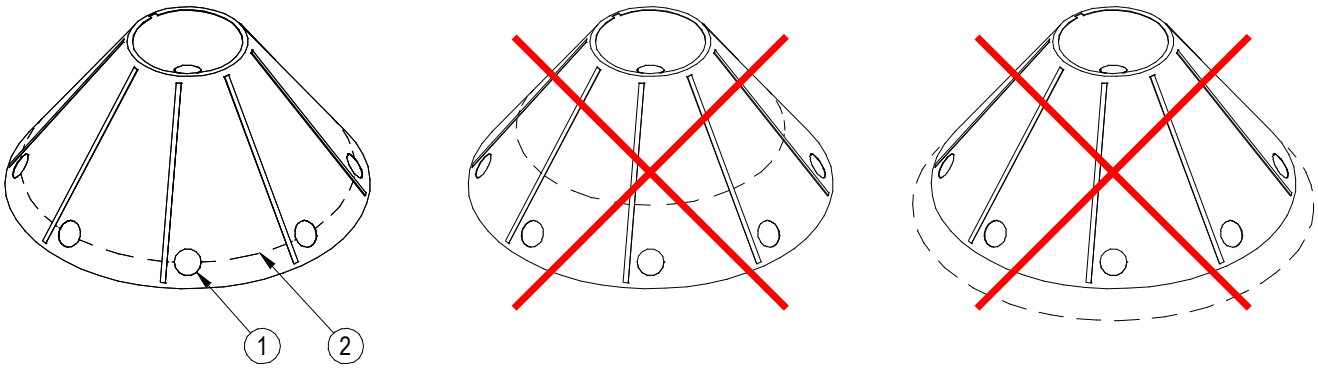
Once the above product and process features have been, as far as possible, adjusted, carry out the following regulations to optimise performance:

- **separation adjustment**: optimal positioning of the separation line;

- **adjustment of discharge of solids:** identification of the optimal solid discharge phase sequence and frequency.

7.4.1 ADJUSTMENT OF SEPARATION

The product fed to the centrifuge, with reference to the following pircture in the next page, is routed to the pile of truncated conical discs where separation takes place. To obtain the best separation efficiency the interface that forms between the two liquid phases (Ref.2), conventionally called the “separation line” - must be at the level of the holes of the truncated conical discs (Ref.1).



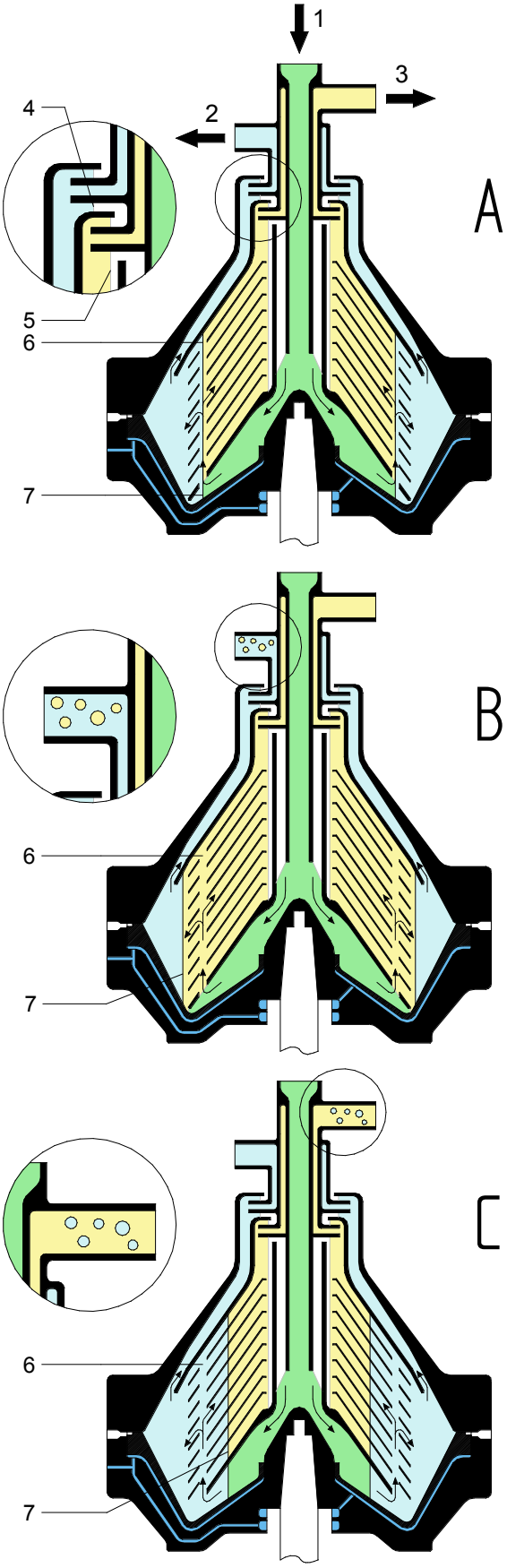
The position of the separation line in static state, i.e. in the absence of product flow inside the bowl, depends only on the relationship between the densities of the two liquid phases and their level inside the bowl, specifically:

- a density increase of the heavy phase causes a shift of the separation line towards the axis of rotation;
- a density increase of the light phase causes a shift of the separation line towards the edge of the bowl;
- a level increase of the heavy phase, i.e. the level gets closer to the axis of rotation, causes a shift of the separation line towards the axis of rotation;
- a level increase of the light phase i.e. the level gets closer to the axis of rotation, causes a shift of the separation line towards the edge of the bowl.

In dynamic state, i.e. in the presence of flow and, in particular, in the presence of high flow rates or fluids with high viscosity, the position of the separation line may differ significantly from the theoretically calculated one.

Best separation efficiency is obtained when the separation line is at the level of the holes of the truncated conical discs (Ref.A), otherwise the two following situations may arise:

- if the separation line is shifted towards the edge of the bowl, light phase will be in the heavy phase at the exit from the centrifuge (Ref.B);
- if the separation line is shifted towards the axis of rotation, heavy phase will be in the light phase at the exit from the centrifuge (Ref.C).



Ref.	Description
1	Product feed
2	Heavy phase outlet
3	Light phase outlet
4	Heavy phase level
5	Light phase level
6	Position of the holes on the disc
7	Separation line

Usually in a separation process only the degree of depuration of one of the two phases is considered binding; it is therefore suggested that you adjust the position of the separation line to have residues traces of the useful phase in the other non-useful phase to guarantee the best depuration of the former.

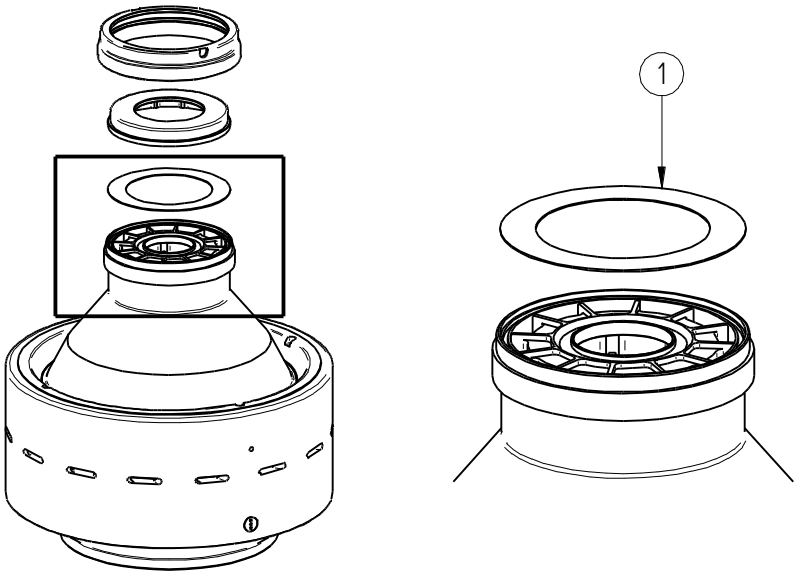
To adjust the position of the adjustment line it is possible to act on the following parameters:

- adjuster ring;
- turbine delivery pressure;

The choice of the most suitable adjusting system depends on several factors, illustrated below.

Adjustment via adjuster ring

If we exclude the possibility of modifying the level of the light phase by adjusting the delivery pressure of its turbine as shown in the next point , this light phase level is fixed. The level of the heavy phase can be set using the adjuster ring (Ref.1).



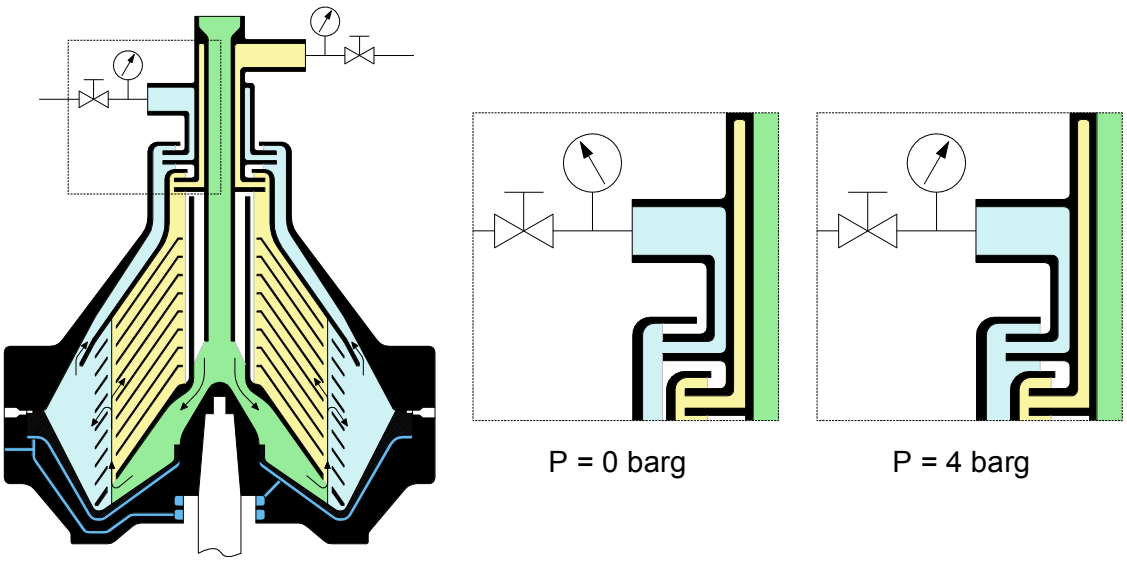
The centrifu meters, or different levels. This above-cited series of rings allows adjustment of the centrifuge for different ratio between the densities of the light and heavy phase. An initial assessment of the proper ring to be used can be made via the diagram shown in the centrifuge technical data sheet (see Chapt..8), as a function of the ratios between the two phases. This choice may need to be reviewed on the basis of subsequent experimental results:

- if the light phase is in the heavy phase it will be necessary to choose a ring with a smaller diameter;
- if the heavy phase is in the light phase it will ne necessary to choose a ring with a bigger diameter.

Adjustment via the adjuster ring cannot be changed while processing; it is necessary to stop the centrifuge and perform a partial disassembly of the bowl to change it. This adjustment method is therefore not convenient when the characteristics of the product to be processed (absolute flow rate, relative flow rates of the two phases, physical specifications of the product, etc.) change. It is however possible to choose a medium adjuster ring and then improve regulation according to changes in processing conditions during the process itself via the adjustment of the turbine delivery pressure.

Adjustment via turbine delivery pressure

It is possible to install an adjuster valve on each outlet line of the depurated liquid phases. Closing or opening these valves allows you to modify the loss of head of the liquid flowing through them and therefore the pressure that must be generated by the turbine. When the pressure requested of the turbine changes, the level of immersion of the turbine, i.e. the level of the relative phase, changes as well, as shown in this generic example.



Pressures can be set during processing; it is therefore possible to adapt the pressure settings to any changes in product or process characteristics that happen during processing. The thus-made adjustment is sensitive to any changes in the pressure downstream from the product outlet lines.

Pressures generated by turbines depend on the flow rates to be processed and on the physical characteristics of the product., indicative values are given in the data sheet of the centrifuge (see Chapter 8)

7.4.2 ADJUSTING SOLID DISCHARGE

The parameters on which to intervene for adjustment of solid discharge are the following:

- time interval between two consecutive discharges (depuration time);
- discharge volume.

These parameters must be chosen to guarantee, during the process, emptying of the sedimentation chamber before the separated solid takes up its entire volume, the available volume is specified in the data sheet of the centrifuge (see Chapter 8).

CAUTION:

an excessive accumulation of solid can cause damage to the centrifuge and create potentially dangerous situations for the people and things.

\ermining the optimal sequence and frequency of discharge it is necessary to consider the volume of the sludge chamber, the content of the incoming solid, the feed rate and the limit of the discharge frequency, which is approximately, unless otherwise prescribed by Servizi Industriali s.r.l., one discharge every 180 seconds (see Par.2.4.2). The technical data sheet of the centrifuge shows a diagram that illustrates the maximal permissible purification times calculated according to the flow rate and solids content of the incoming product. The times shown are approximate and are intended for preliminary evaluation. A practical test allows more precise determination of the most suitable depuration time. The depuration time must be set by setting the “Depuration” parameter on the PLC programming page (see Par.7.1.5), discharge volume must be set through the setting parameter "partial opening", "total opening", "Opening CIP" and "Opening cycle arrest." The volume discharged can be changed via the bowl opening time, from 0 to total discharge. The technical data sheet of the centrifuge shows a diagram that illustrates the volumes discharged as a function of the opening set times. The volumes shown are approximate as they depend strongly on several factors such as product feed rate, pressure and flow rate available on the control circuit, the physical characteristics of the product and any interruption of product feed during the discharge phase. If a feed pump or interception valve has been installed on the product feed line it is possible, via the “Continuous feed” parameter setting to interrupt product feed during the discharge phase. If necessary there is an automatic function for re-establishment of the pocket after the discharge; the parameter for this function is “Pocket” (see also Par.6.2.2).

8 TECNICAL DATA SHEET

8.1 CENTRIFUGE CONFIGURATION

Model	MACFUGE 325 AL PT 3 S
Configuration	separator
Discharge of the solid phase	automatic
Output light phase	with turbine
Output heavy phase	with turbine
Transmission of motion	with gear

8.2 TECNICAL DATA

Description	u. m.	-
Nominal capacity *	l/h	5800
Max capacity washing vegetable oils *	l/h	1800
Volume of the bowl	litri	5
Capacity sludge chamber	litri	1
Max capacity solid phase discharge	l/h	20
Bowl rotation speed	rpm	8700
Power motor	kW	5,5
Voltage / Phases / Poles	V/-/-	400/3/4
Max. frequency to the motor	Hz	53,5
Load absorption	A	5,5
The absorption flow rate of 4000 l/h	A	6
Start-up time	sec.	300
Stop time	sec.	300
Minimum pressure supply product	barg	0
Maximum pressure turbine light phase**	barg	3,9
Maximum pressure turbine heavy phase**	barg	3,7
Temperature Maximum Supply	°C	95
Maximum Product density	kg/m^3	1200
Maximum solid phase density	kg/m^3	2000
maximum noise level	dB(A)	80
Volume lubricating oil	l	1,5
Weight of the bowl	kg	71
Weight of centrifuge with bowl***	kg	350

**: The actual operating capacity depends on the product in the process, from its characteristics in input, the degree of separation required, as well as other process parameters such as the temperature.*

***: The maximum pressure that can be delivered by the turbines is indicative reported being dependent on the physical properties of the product and the required flow;*

****: With engine weight of 75 kg.*

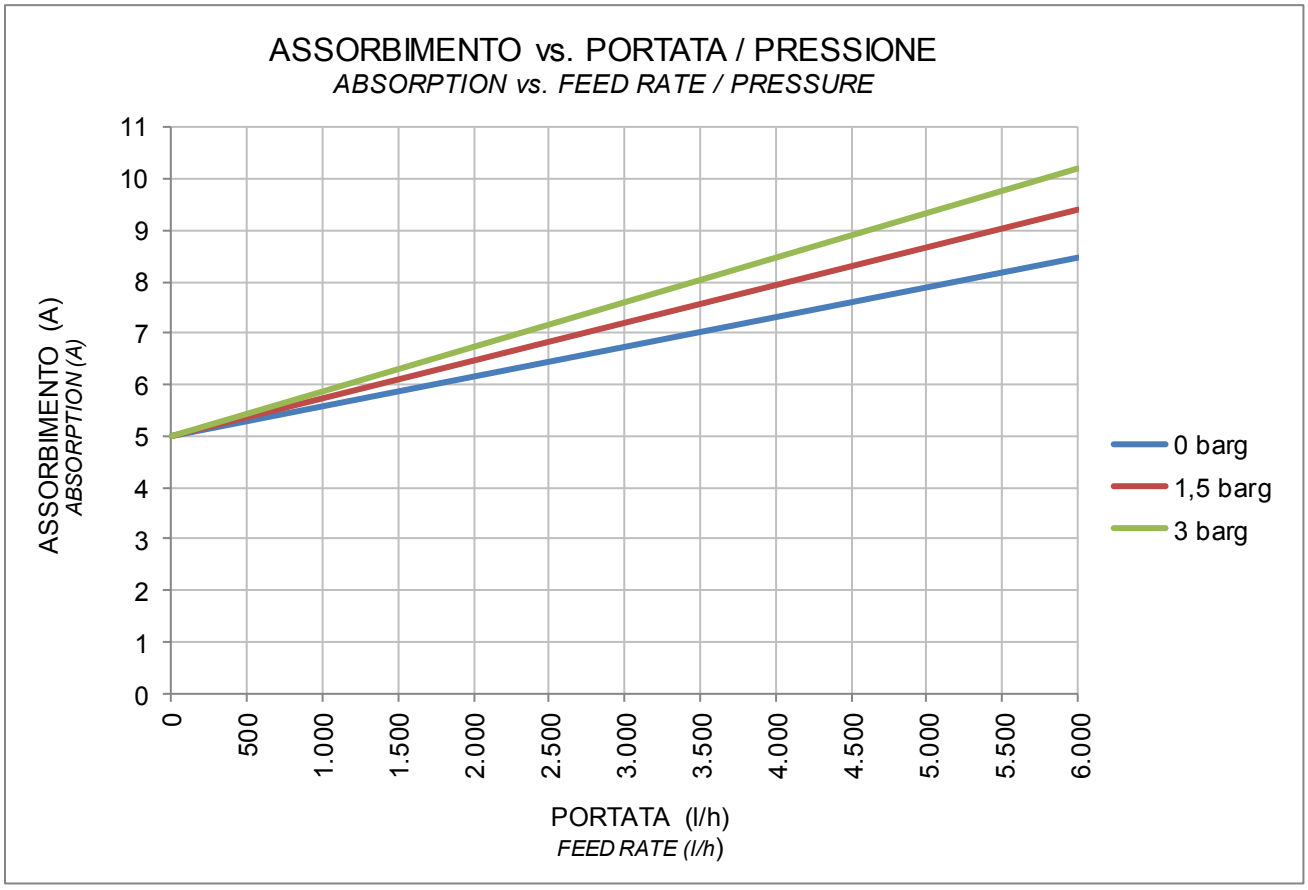
8.3 ELECTRICAL ABSORPTION

The electrical absorption of the centrifuge depends on the following:

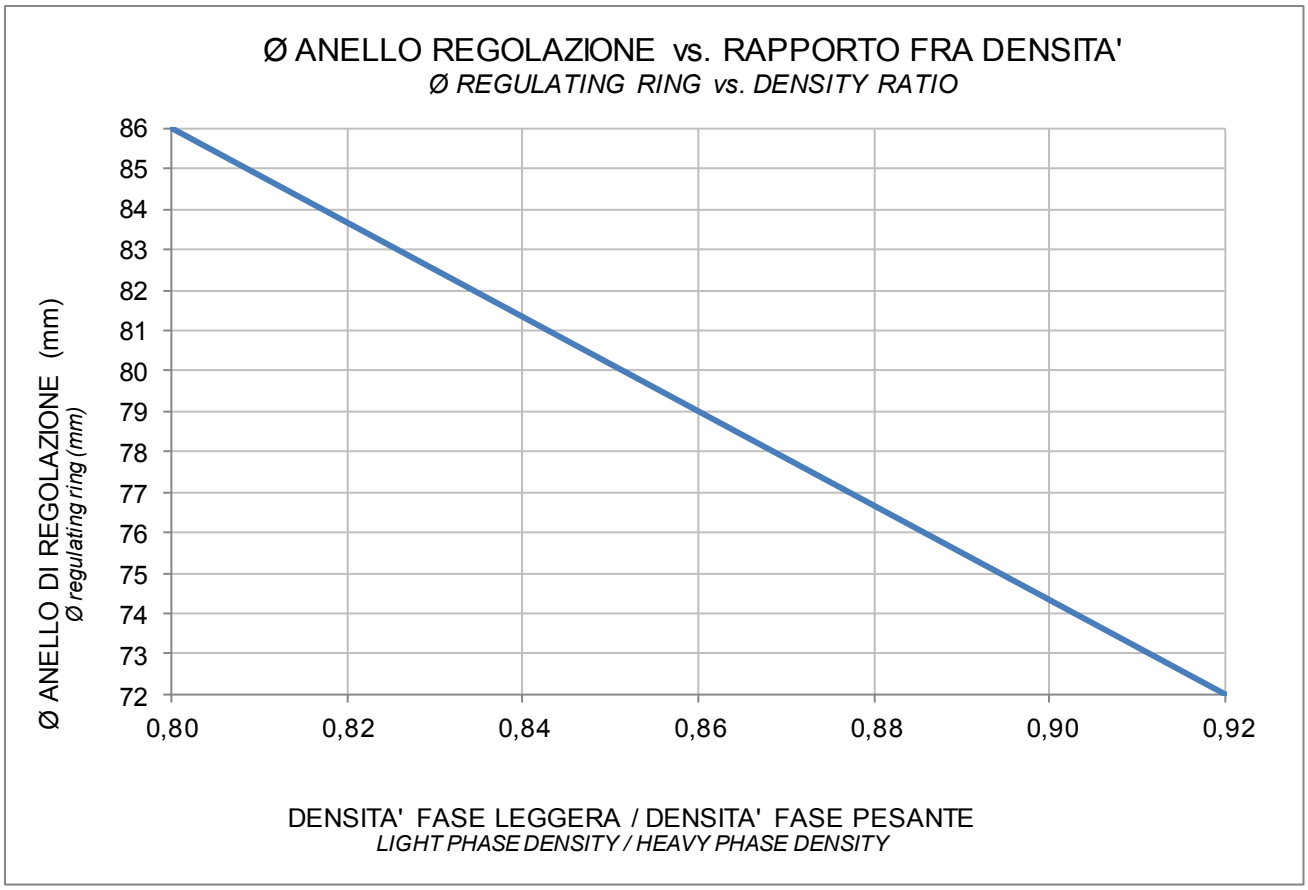
- flow rate processed;
- delivery pressure of the turbine;
- properties of the product.

The following table shows the electrical input and processed according to the scope of the discharge pressure of the turbine of the light phase. The data are indicative for a product having the following physical characteristics, for products with different physical characteristics absorptions may also vary significantly:

density = 880 kg/m^3;
viscosity = 20 cSt.



8.4 DIAGRAM OF ADJUSTMENT RING



9 TROUBLESHOOTING

The following table shows the most frequent problems and the possible actions that can be performed also by non specialized personnel. We remind you to analyze this table before requesting the intervention of specialized personnel of Servizi Industriali S.r.l.

DANGER:

If you cannot identify with certainty the cause of the problem, especially in case of malfunctioning that can compromise safety, contact Servizi Industriali S.r.l.

PROBLEM	CAUSE	ACTION	REFERENCE
The separator does not start	The electrical connection is wrong or the supply voltage is not adequate.	Control the electrical connections and the supply voltage.	Par.6.4.2 Att.B
	Electrical motor or frequency convertor failure.	See attached guides	Att.E Att.F
	Alarms presence.	Remove the alarm's causes and reset the PLC	Par.7.1.6
	The separator is not correctly assembled.	Check the assembly	Cap.10
The bowl does not reach the prescribed speed or reaches it in excessive time.	The electrical connection are wrong	Check the electrical connections and the power supply voltage	Par.6.4.2 Att.B
	Voltage drop in the supply line.	Check the tension in the line and remedy to this problem.	Att.B
	Electrical motor or frequency converter failure.	See attached guides	Att.E Att.F
Anomalous vibrations while functioning	The bowl is not correctly assembled.	Verify the correct assembly of the bowl.	Cap.10
	The bowl is dirty (no-load vibrations are higher).	Open the bowl and clean it, check whether the accumulation of solids was determined from insufficient discharges (see hereafter) or by the maintenance of the bowl not correct.	Cap.7 Cap.10
	The bowl has been damaged during the assembly or disassembly stage.	Ship the bowl to Servizi Industriali S.r.l. or request the intervention of a technician.	
	The springs of the vertical shaft's collar are damaged.	Replace the springs and check the wear and tear of the small pistons	Cap.10
	The bearings are worn out.	Replace the bearings	Cap.10
	The gears are in a bad state.	Replace the worn out parts, carefully clean the gear chamber and change the oil.	Cap.10
Separazione non soddisfacente.	The regulation of the separation line is wrong.	Re-evaluate the product's features and make adjustments	Par.2.4 Cap.7

PROBLEM	CAUSE	ACTION	REFERENCE
The light phase comes out of the heavy phase outlet	Pocket's leak.	Check that the bowl has been filled properly, reset the hydraulic pocket, if the problem persists, check the seals.	Par.6.2 Par.6.2.2 Cap.7 Cap.10
Part of the product to process comes out from solids discharge	The trapezoidal gasket is worn or damaged.	Replace this gasket	Cap.10
	The trapezoidal gasket has been mounted incorrectly.	Insert the gasket into the seat without forcing it (must be the piston of the bowl to settle it correctly,at the first start).	Cap.10
	The bowl is overflowing due to excessive pressure.	Reduce backpressure.	Par.6.1.2 Cap.8
Tutto il prodotto da trattare esce dallo scarico dei solidi, il tamburo non chiude.	The squared gasket of the slide loses.	Replace this gasket	Cap.10
	No water is coming from the hole of the distributor which feeds the closure	Check the water distributor (collar cover) and also clean its rubber hoses.	Cap.10
	The solenoid valve of closing water has not been held for a sufficient time in the open position.	Increase the time of closing.	Cap.7
	If is the case of first closing, the maneuver water may be missing or insufficient.	Check the filter, if present, and clean it if necessary, check the water pressure.	Par.6.2
Bowl full of solid	The cleaning of the bowl is carried out at too long time intervals	Increase the frequency adn/or the volume of discharge	Par.2.4 Cap.7
	The solids inlet are higher than expected	Increasing the frequency and / or volume of discharges, reduce the flow rate.	Par.2.4 Cap.7
The bowl carries out the discharge maneuver irregularly.	No water for maneuver or does not have enough capacity.	Check the available pressure and the hydraulic circuit, possibly disconnecting the pipes connected to the centrifuge or by using the by-pass valves installed in the group.	Par.6.2
	The holes in the conveyor and / or distributor (collar cover) are blocked.	Check and clean the water distributor and the distributor (collar cover)	Cap.10
	The gaskets of the conveyor are worn or damaged.	Replace these gasket	Cap.10
	The valve of the bowl is not working properly.	Reviewing the valve.	Cap.10

10 MAINTENANCE

The centrifugal separator is able to generate great forces in all directions and is subject to the centrifugal force law. Even in optimal conditions the components and the transmission supports are subject to wear. To guarantee a safe and efficient functioning for a long period it is necessary to replace the worn parts with the frequency described in the following paragraphs.

DANGER:

The worn parts not replaced or wrongly assembled can cause serious damages.

For a correct and safe assembly respect the following general instructions:

a) always use only and exclusively the tools provided;
b) apply the provided antiseizing paste to the threads when so indicated;
c) do not use lubricants unless specifically required nor use lubricants different from those indicated;
d) some separator's components threads are left oriented; pay attention to the instructions;
e) during the assembly procedures, always verify that the matching surfaces of the parts and the gaskets' seats are clean;
f) use the required equipment for personal protection.

It is absolutely forbidden to perform any maintenance or cleaning intervention while the mechanisms are in motion.

Before any intervention on the separator stop the electrical voltage

Maintenance is divided in two categories, ordinary and extraordinary:

- **ordinary maintenance**: set of activities aimed at maintaining the use and functioning conditions of the separator formed by the type of intervention described below, performed by the operator and/or by the personnel responsible for the maintenance at the established frequency.

- **extraordinary maintenance:** set of activities aimed at maintaining the use and functioning conditions of the separator formed by several types of intervention exclusively performed by technicians working for the manufacturer and/or by authorized assistance service centers, at the established frequency or in case of wear or breakdown.

DANGER:
to guarantee a safe and efficient functioning of the separator, carefully respect the deadlines and instructions prescribed for all maintenance interventions and inspections.

This chapter describes the ordinary maintenance interventions; these instructions are the technical support for the maintenance personnel.

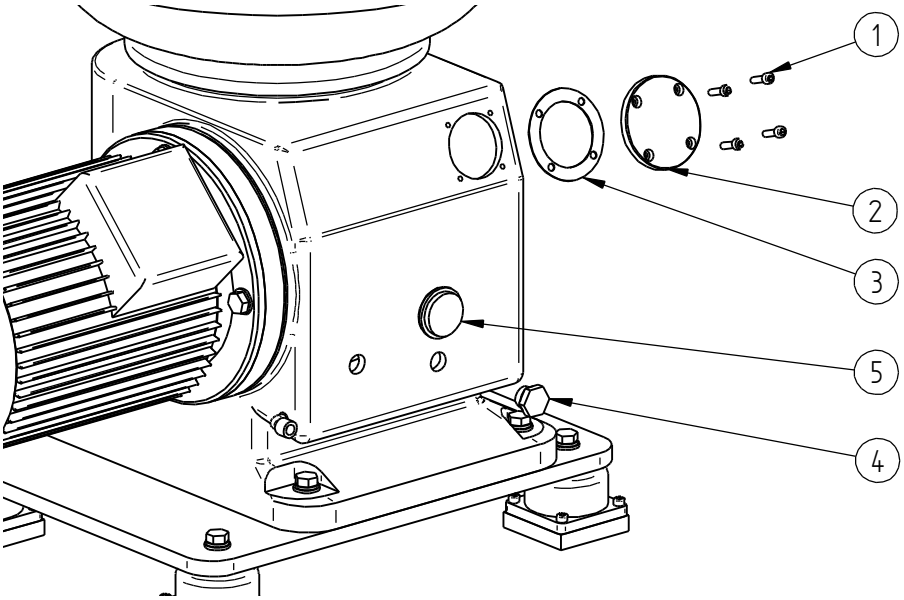
The final pages of the manual (chapter 15) include a table, named "Summary of maintenance" to describe and record the tasks performed on the machine. It is mandatory to anyone to execute, being local personal or staff of Servizi Industriali, a significant intervention on the machine, including routine maintenance planned at least once a year and fill out in detail the above table.

It is mandatory by the person performing a significant intervention on the machine, fill out in detail the table "Summary of maintenance."

10.1 LUBRICATION OIL CHANGE

The lubrication oil change requires the following operations:

- Unscrew the screws (Ref.1), then remove the cover (Ref.2), while paying attention to the gaskets (Ref.3);
- after bringing a container nearer to collect the exhausted oil, remove the cap (Ref.4) to empty the gear chamber (if you are performing ordinary maintenance operations, once the gear chamber has been emptied from the oil carefully clean it without using any detergent);
- Once the grar chamber is empty fix the the cap as it was
- top up the gear chamber with the provided oil up to about to the half of the level indicator (Ref.5);
- Fix the cover through the screw as it was, while paying attention to the gaskets.

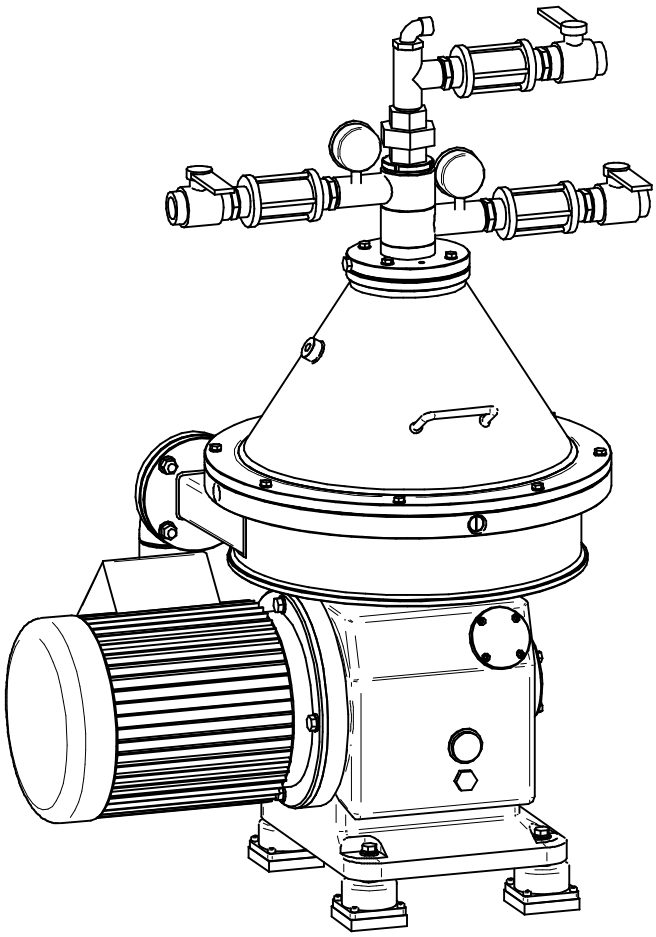


The first oil change must be performed after 500 working hours; further oil changes must be done once a year. The oil used has been appositively studied for the use on centrifugal separator transmissions. The reference is ROL OIL SINCAT 220. Once you finish the provided recharges, you should request the new recharges to the manufacturer or search for comparable types of oil as per the below table

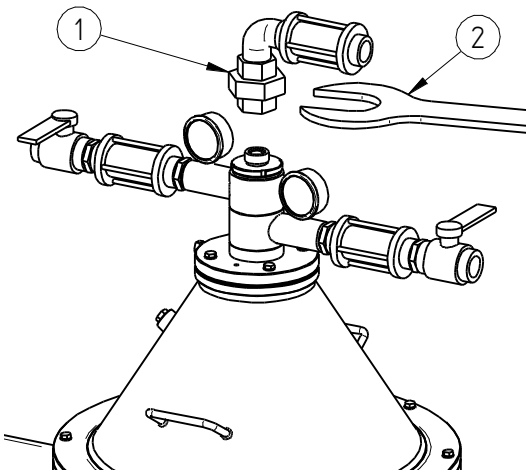
List of lubricant oil alternative to ROL OIL SINCAT 220							
TEXACO	SYNLUBE CLP 220		CASTROL	OPTIMOL OPTIFLEX A220		FINA	GIRAN S 220
AGIP	TELIUM VSF 220		MOBIL	GLICOILE 30		SHELL	TIVELA OIL WB
BP	ENERSYN SG-XP 220		ESSO	GLYCOLUBE RANGE 220		TOTAL	CORTUSA SY 220

10.2 COVERS AND OUTLETS GROUP

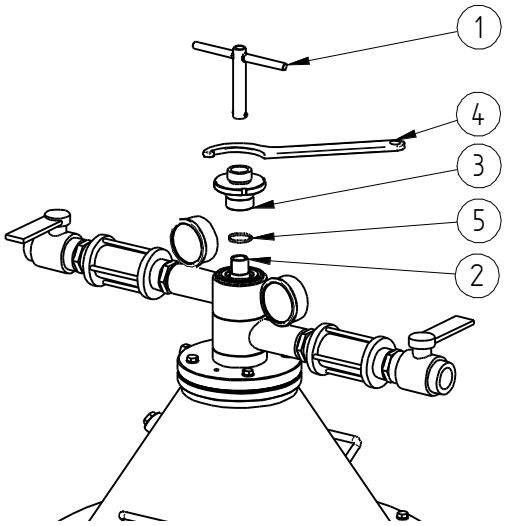
To the covers and outlets disassembly's description it is supposed to have the centrifuge fully assembled.
It is then assumed to proceed withthe disassembly of the subject group starting from the configuration illustrated.



10.2.1 COVERS AND OUTLETS GROUP DISASSEMBLY



a) *Removing the product inlet pipe:*
Use the special tool supplied (Ref.2) remove the pipe (Ref.1).



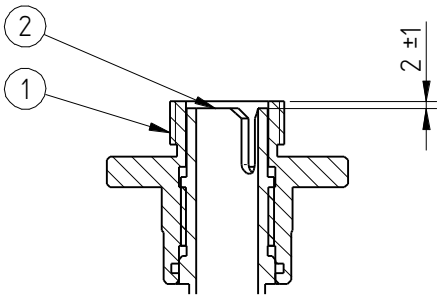
b) *Feeding ring nut disassembly:*

Insert the supply tube special tool (Ref.1) in the feeding pipe (Ref.2) to block the rotation of the tube during the phases of ring nut disassembly (Ref.3). Unscrew the feeding ring nut through the special tool provided (Ref. 4), while paying attention to the gasket (Ref. 5).

***Note**: the thread of the* feeding ring nut *is left oriented*

Note for the assembly:

After finishing the assembly of the feeding ring nut (Ref.1) verify the correct installation by measuring the distance between the feeding ring nut and the feeding pipe (Ref. 2), which must be 2 mm ± 1 mm.



ATTENTION:

A different value implies incorrect installation, then do not proceed further in the assembly of the separator before finding and removing the cause.

c) *Outlets support disassembly:*

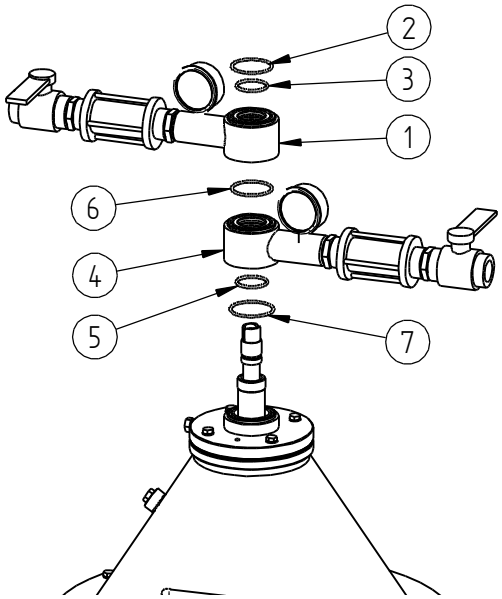
Lift the heavy phase outlet (Ref.1), paying attention to the gaskets (Ref. 2 and 3).

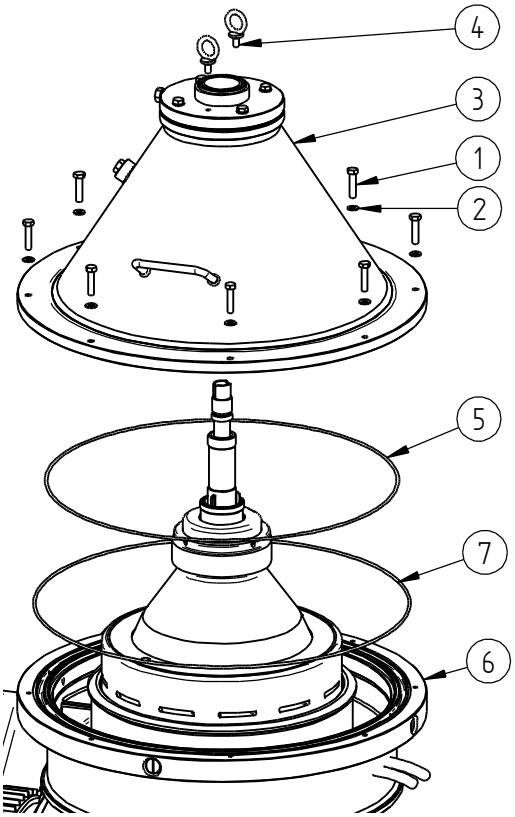
Lift the light phase outlet (Ref. 4), paying attention to the gaskets (Ref. 5, 6 and 7)

Note for the assembly:

even if the outlet body does not have an unambiguous angular position of assembly, its assembly can be oriented only in relation to the position of the cover holes and of the eyebolts.

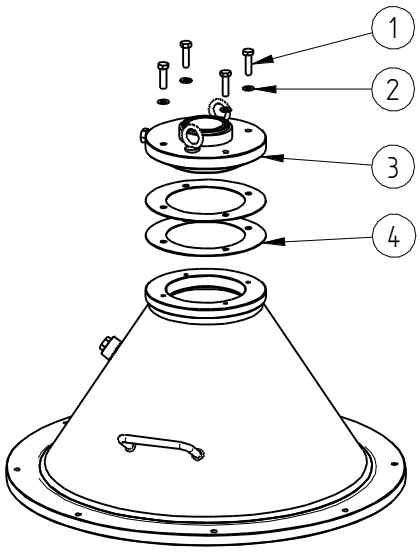
The outlet direction can be chosen, with the limitations mentioned above, according to the needs of the plant and / or positioning machine.





d) *Cover disassembly :*

Unscrew the screws (Ref.1) remove its washers (Ref.2), then lift the cover (Ref.3) with the eyebolts supplied (Ref.4).
Remove the gaskets (Ref.5 e 7) from the housing of the basin (Ref.6).



e) *Support outlet flange disassembly:*

Unscrew the screws (Ref.1) remove its washers (Ref.2), then lift the support outlet flange (Ref.3) and its spacer (Ref.4).

10.2.2 MAINTENANCE AND PERIODICAL INSPECTION

Periodical maintenance

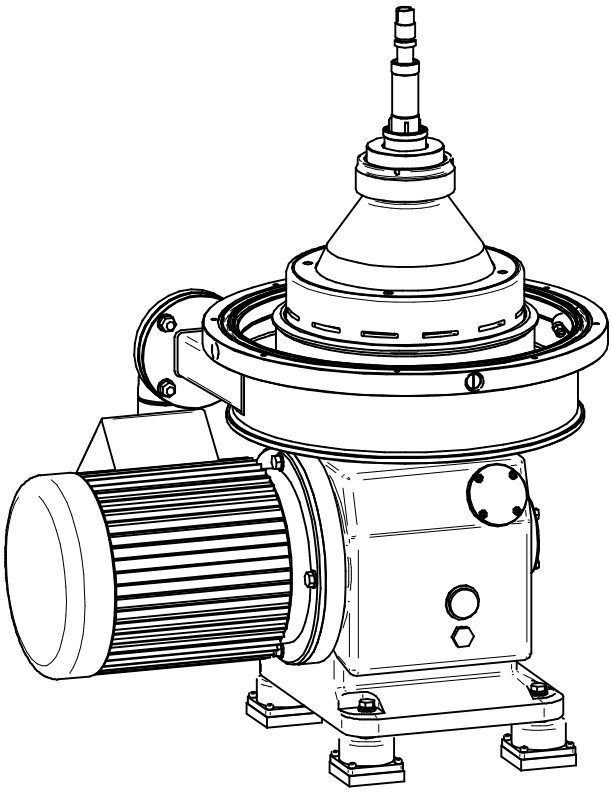
The periodical maintenance required for the cover group basically consists in its cleaning and in the replacement of the seal elements that are damaged or no longer functional. The cleaning must be performed together with the cleaning of the bowl group and (at least for the parts that get in contact with the product) with the modalities here following described. Per quanto riguarda le manutenzioni e ispezioni periodiche relative alla turbina vedi paragrafi successivi.

Periodical inspections.

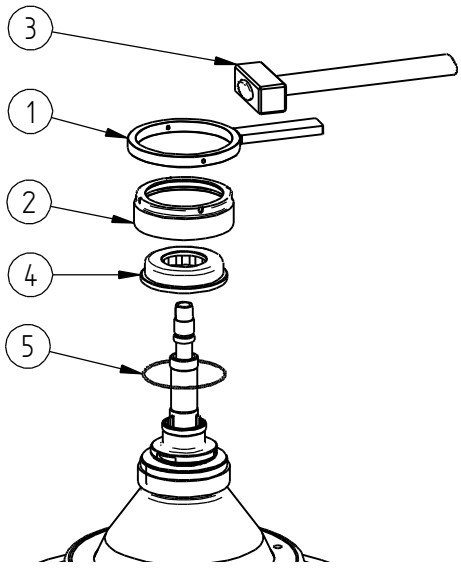
With regard to the maintenance and periodical inspections related to the turbine see following paragraphs.

10.3 BOWL GROUP

To the bowl group disassembly's description it is supposed to have the centrifuge fully assembled.
It is then assumed to proceed withthe disassembly of the subject group starting from the configuration illustrated.

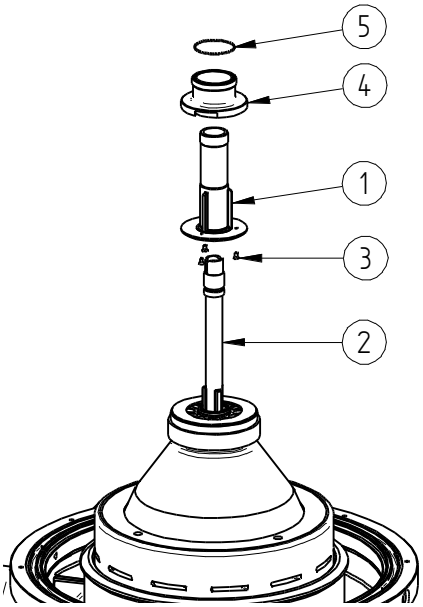


10.3.1 BOWL GROUP DISASSEMBLY



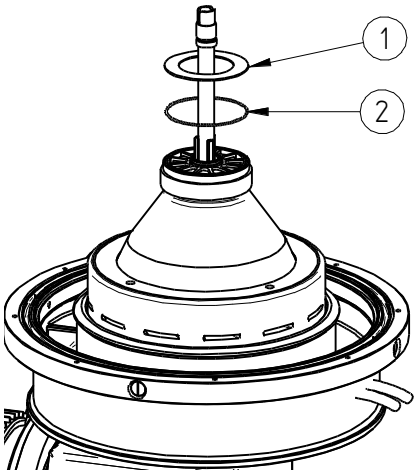
a) *Little nut and collecting chamber disassembly :*

Use the special tool provided (Ref.1), unscrew the little nut (Ref.2), using a rubber mallet (Ref.3) that is not provided.
Then lift the dividing code cover (Ref.4), while paying attention to the gasket (Ref.5)
Nota: *the thread of the little nut is left oriented.*
Note for the assembly: *apply the antiseizing paste to the little nut.*



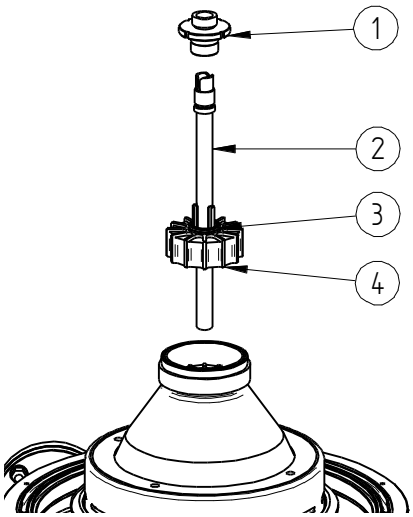
b) *Turbine and heavy phase plate disassembly:*

Pull off the heavy phase turbine plate (Ref.1) from light phase plate (Ref. 2), unscrew the three screws (Ref.3) from the light phase plate and remove the heavy phase turbine (Ref. 4), paying attention to the gasket (Ref. 5).



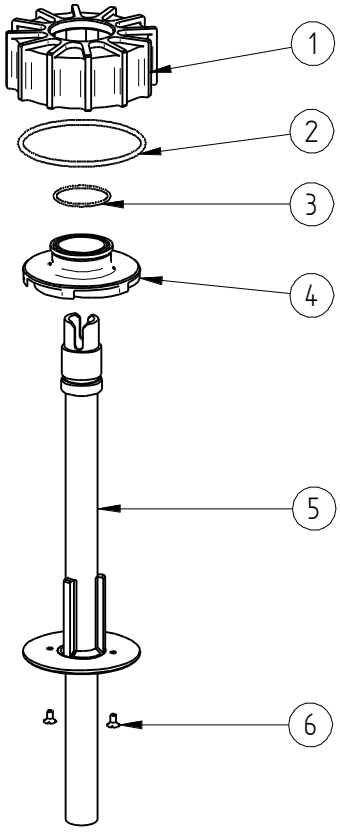
c) *Regulating ring remuval :*

Remove the regulating ring (Ref.1) and its gasket (Ref.2).



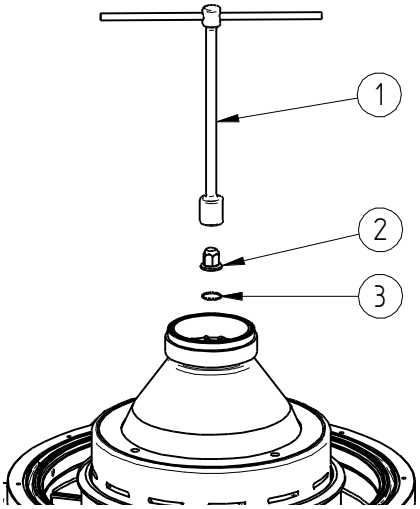
d) *Light phase plate disassembly:*

Lock the feeding ring nut (Ref.1) to the light phase plate (Ref. 2). Manually lift, by gripping on the feeding ring nut, the light phase plate complete with light phase turbine (Ref.3) and dividing cone cover (Ref. 4).



e) *Light phase plate and dividing code disassembly:*

Pull upwards the dividing cone (Ref.1) from the light phase turbine(Ref. 4) paying attention to the gasket (Ref. 2). Unscrew the screws (Ref.6) from light phase plate (Ref. 5) and pull up the light phase turbine paying attention to the gasket (Ref.3).

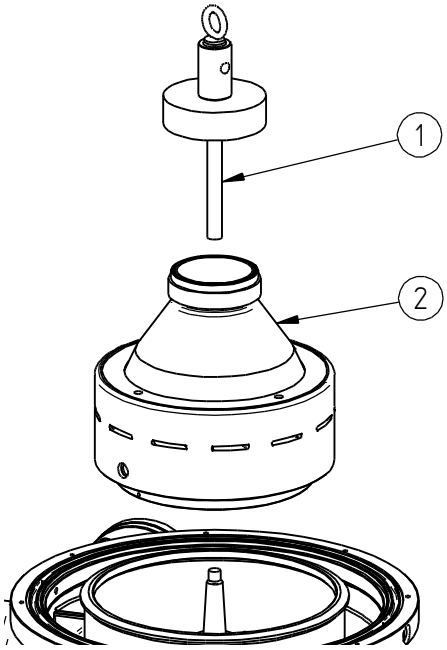


f) *Locking nut disassembly :*

Unscrew the bowl locking nut (Ref. 2) using the supplied special tool (Ref.1), paying attention to the gasket (Ref.3).

Nota: *the thread of the locking nut is left oriented.*

Note for the assembly: *apply the antiseizing paste to the llocking nut.*

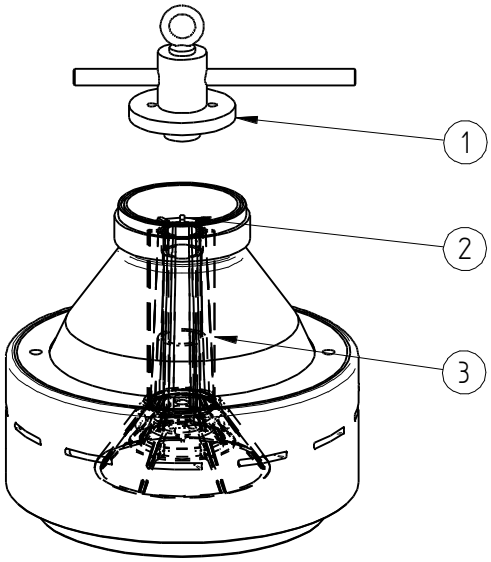


g) *Bowl body lifting:*

Screw the unlocking tool (Ref.1) and unlock the bowl (Ref. 2), lift then the latter and place it on a workbench.

***Note**: the thread of the* unlocking tool *is left oriented*

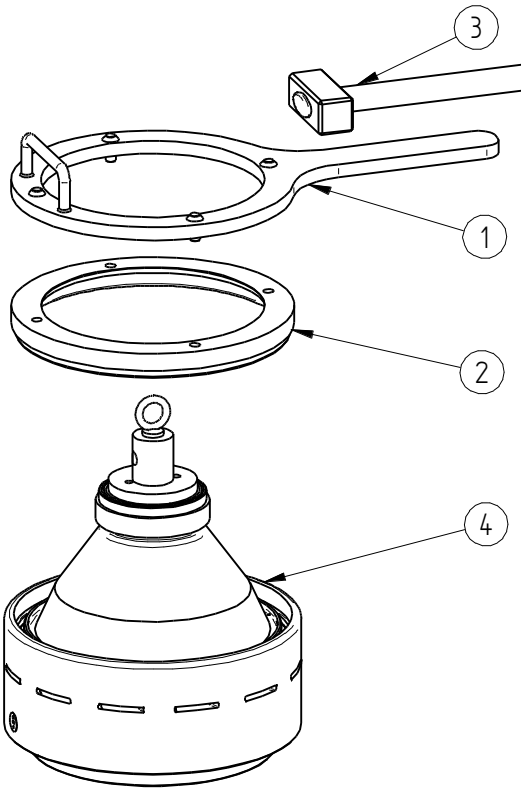
h) *Disks pressing tool assembly*



before proceeding to the bowl disassembly it is necessary to press the discs, that is discharge the pressure that the discs pile, elastic element overall, exerts on the bowl's cover. To perform this operation place the discs pressing tool (Ref.1) on the dividing code (Ref.2) and fasten the discs-pressing screw to the column (Ref.3) using the provided lever; Fasten the screw until the package formed by the mentioned tools, the column, the dividing cone and the discs pile axially adjusts to the bowl

***Note**: the thread of the* screw *is left oriented*

***Note for the assembly:** apply the antiseizing paste to the thread of he discs-pressing screw.*



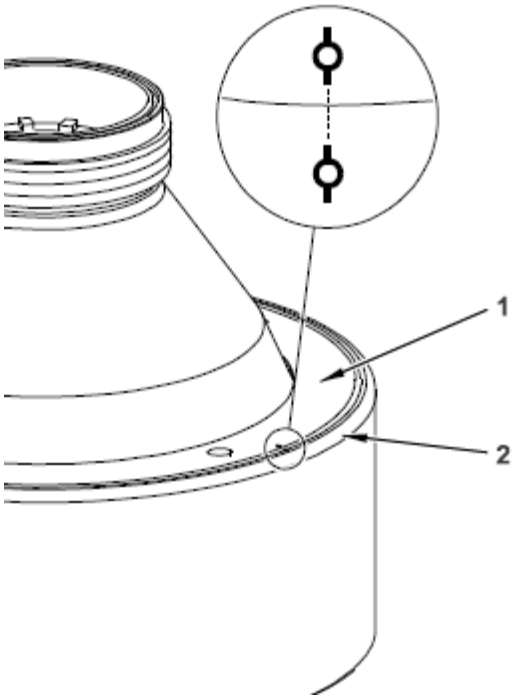
i) *Disassembly of the big nut:*
assemble the big nut key that is provided (Ref.1) on the big nut (Ref.2), ans using the mallet not provided (Ref.3) hit on the wrench to unscrew the big nut from the bowl bottom (Ref.4).
Remove the key, the press-disks screw and finally the big nut using the both chain and eyebolts supplied.

***Note for the assembly**: during the assembly perform the discs-pressing progressively, together with the ongoing fastening nut .*

***Note**: the thread of the big nut is left oriented.*

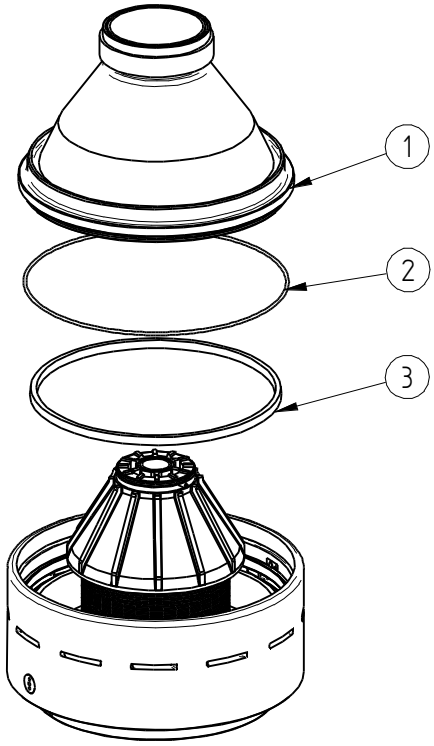
***Note for the assembly:** apply the antiseizing paste to the thread.*

***Note for the assembly**: completely fasten the big nut until its upper part ((Ref.1) is maximum ~ 1,5 mm higher than the upper part of the bowl's bottom (Ref.2) di non più di ~ 1,5 mm and the signs printed on the big nut and on the bowl's bottom match. A normal wear of the thread can cause the sign on the nut to be higher - counterclockwise - than the sign on the bowl's bottom when the nut is fastened. If the mismatch becomes greater than 10 mm, please contact the manufacturer.*



DANGER:

The big nut must be correctly fastened; before starting the separator always verify that the above mentioned conditions are respected.

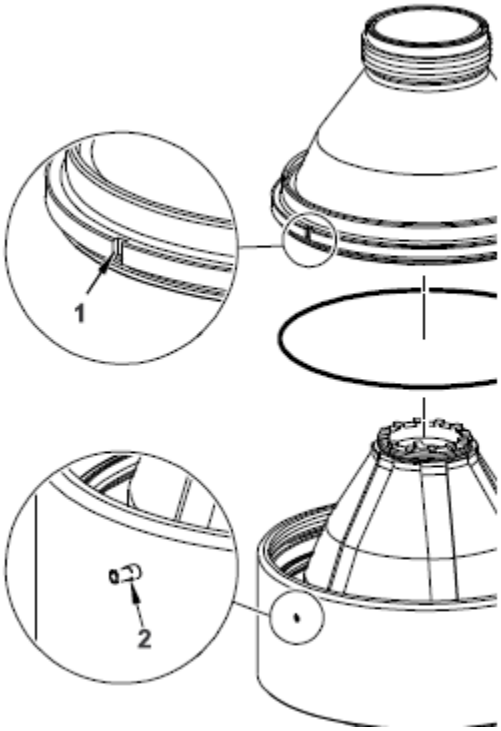


j) *Disassembly of the bowl cover:*

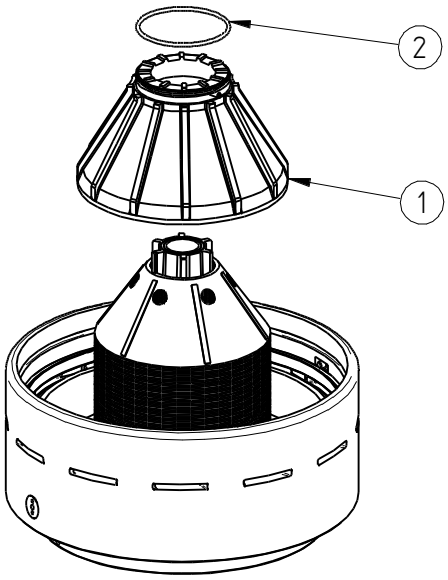
Remove the screw form press-disks tool, lift the bowl's cover (Ref.1) paying attention to the gasket (Ref.2 e 3).

***Note**: the thread of the screw is left oriented.*

***Note for the disassembly**: apply the antiseizing paste to the thread of he discs-pressing screw.*

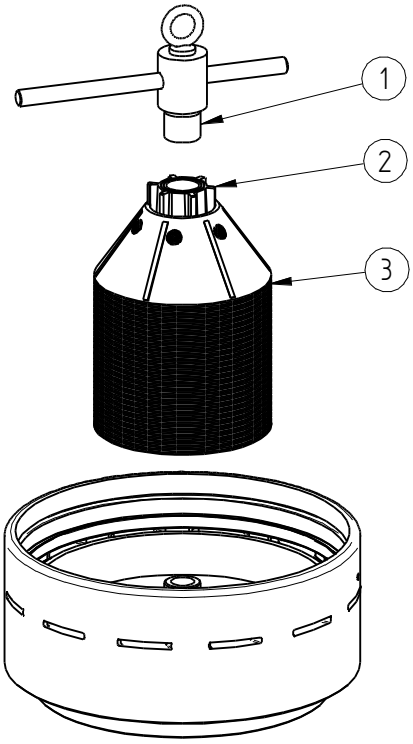


***Note for the disassembly**: verify that the slot (Ref.1) on the cover coincides with the reference pin (Ref. 2), mounted on the bottom of the bowl.*

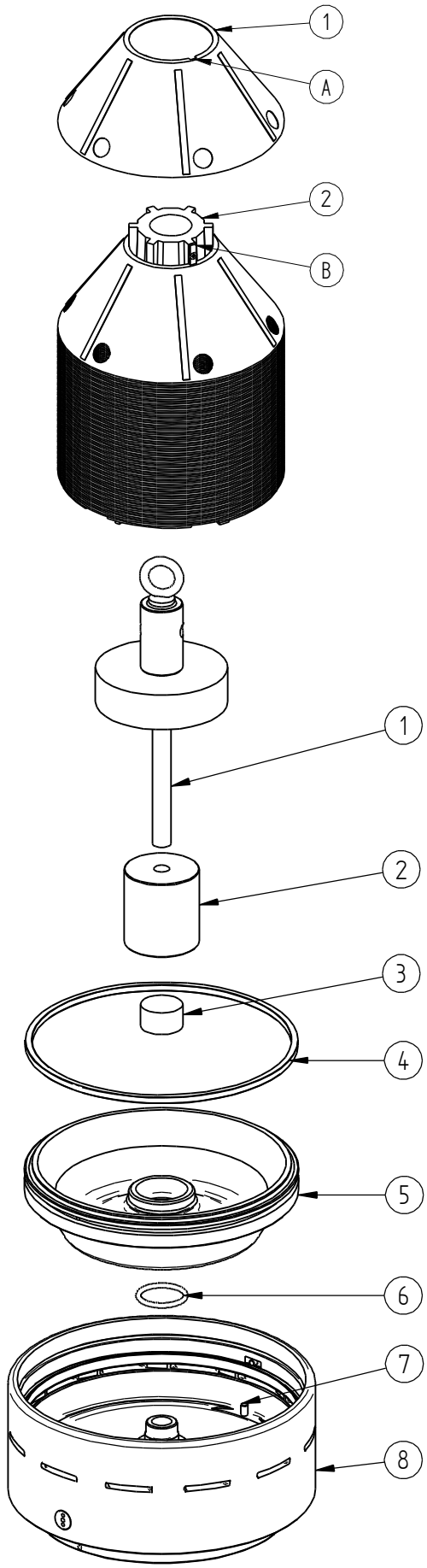


k) *Dividing cone disassembly*

Manually list the dividing cone (Ref.1) paying attention to the gasket (Ref.2).



l) *Column disassembly:*
fasten the screw of the press-disks tool (Ref.1), to the column (Ref.2). Lift the column complete of pile disks (Ref.3).
***Note**: the thread of the screw is left oriented.*
***Note for the assembly**: the column is referred to the bowl's bottom by a screw mounted on the bowl's bottom, verify that this screw is correctly placed in their seats on the column.*



m) *Discs disassembly:*

Remove the disks (Ref.1), (to replace and/or to clean them), from the column (Ref.2). Use protective gloves, because the edge of the disk is sharp.

***Note for the assembly**: the discs are referred to the column by a profile (Ref.A) on the same, check carefully that the above profile is correctly matching in its housing strip (Ref.B) mounted on the column.*

n) *Disassembly of the sliding part:*

Place the protection (Ref.3) on the bowl's bottom (Ref.8), fasten the sliding part's lifting tool (Ref.2) to the sliding part (Ref.5), fasten the tool (Ref.1) to the lifting tool until the sliding part is completely free from the bowl's bottom then and place it on a workbench.

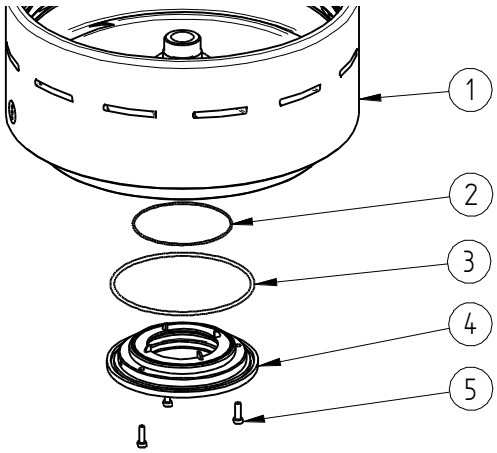
***Note**: the thread of the* sliding part's lifting tool *is left oriented*.

***Note for the assembly**: the sliding part is referred to the bowl's bottom by a pin (Ref.7), mounted on the bowl's bottom, carefully check that the above pin is correctly matching in its seat (Ref.B) on the sliding part.*

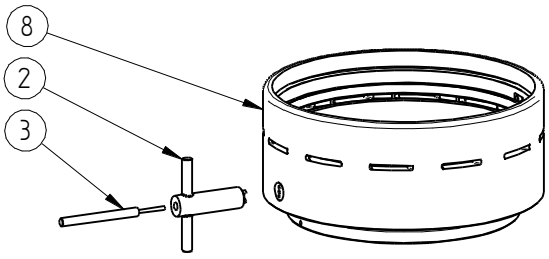
Remove the slide part's squared gasket (Ref. 4) and the hub bottom bowl gasket (Ref.6).

Note for the assembly: to perform the squared gasket removal force the the gasket's outlet from its seat by blowing compressed air into the hole formed in the lower part of the slide part.

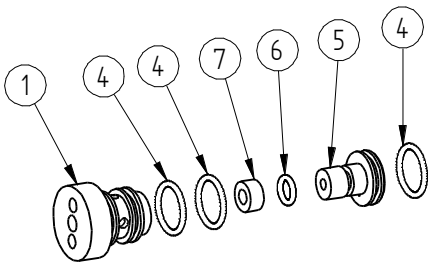
***Note for the assembly:** grease the squared gasket and force it into its seat so that it does not protrude from the external rim of the sliding part .*



o) *Disassembly of the water conveyor:*
unscrew the fixing screws (Ref.5), remove the conveyor (Ref.4), the gasket (Ref.3) and the gasket (Ref.2) form the bowl's bottom (Ref.1).
Note: *check all gaskets and replace them if necessary; clean all the parts if necessary.*



p) *Valve disassembly:*
Place the valve key unit (Ref.2) in the valve (Ref.1), screw the valve key tie rod (Ref.3) to the valve's piston (Ref.5), then unscrew the valve using the valve's key and extract it from the bowl's bottom. (Ref.8). Unscrew the tie rod and remove the piston and the valve pad (Ref.7), finally, remove the gaskets Ref.4) and the gasket (Ref.6).
Note: *replace the gaskets and pad if necessary.*
Note for the assembly: *the valve must be pre-assembled before being fastened to the bowl's bottom; the* valve key tie rod *can also be used to verify that the piston smoothly slides into its seat, once the valve is assembled.*



Note for the assembly*: grease the seats of the gaskets, the gaskets and the sliding surfaces of the piston/valve unit.*
Note for the assembly*: apply the antiseizing paste to the valve unit's threads*
Note for the assembly*: the valve pad is a delicate seal element, crucial for the proper functioning of the valve; it must not be damaged during the assembly. To place it in its seat inside the valve unit use adequate tools to avoid damaging the seal surfaces*

10.3.2 BOWL CLEANING

Even though with different frequency and modalities, the bowl cleaning must be performed both on the line and on the disassembled bowl.

Cleaning on the line.

The cleaning on the line can be performed by supplying the separator with water, preferably hot, eventually with the addition of a mild alkaline detergent .

Cleaning with disassembled bowl

Once the bowl has been disassembled, as described later, wash the parts forming the bowl in the following manner:

- immerge the parts in warm water and wash them with an alkaline detergent;
- brush the parts, when necessary; never use hard materials brushes (for example do not use a steel wool);
- rinse abundantly with clean water;
- dry the parts, or let them dry, before reassembling the bowl.

It is absolutely forbidden to use chlorine compounds, in particular hydrochloric acid, in any phase of the washing cycle due to the corrosive properties of these substances with respect to inoxidizable steel.

The required frequency of the cleaning with disassembled bowl depends on the features of the processed product and on the usage modalities of the separator (quantity of the solid at inlet, discharge frequency during process, cleaning frequency, etc.). Perform a first maintenance, inspection and cleaning intervention on the disassembled bowl after the first 8 working hours, perform a second one after the first 40 working hours and then, progressively, modify the amount of working time before the required next cleaning based on the bowl's conditions, particularly based on the amount of solid which has accumulated in the sedimentation chamber.

It is prescribed to perform a maintenance, inspection and cleaning intervention on the bowl after the first 8 working hours, then after the first 40 working hours and then perform at least one intervention every 500 working hours or at least once a year.

DANGER

Perform the cleaning with enough frequency to ensure that an excessive accumulation of solids does NOT accruing in the sedimentation chamber; an excessive accumulation of solids can generate a performance decreasing until complete occlusion of the bowl, generating situations of damage to the centrifuge and dangerous situations to the operator.

If your experience shows that the required frequency of disassembled bowl's cleaning is higher than the one prescribed for the maintenance and inspection intervention, it is sufficient to disassemble the bowl up to the discs disassembly. Once the cleaning is completed, before reassembling the bowl verify the seal of all seal elements — compatibly with the disassembly stage reached — and replace them when necessary. Furthermore, perform all the inspections scheduled, again compatibly with the disassembly stage reached

10.3.3 MAINTENANCE AND PERIODICAL INSPECTIONS

DANGER:

respect very carefully the deadlines for the maintenance and inspection interventions in order to immediately identify the possible presence of corrosive and/or erosive processes, avoid their progression and the creation of highly dangerous situations.

Periodical maintenance

The periodical maintenance required for the bowl group basically consists in its cleaning, and in the replacement of the seal elements that are damaged or no longer functional. Wash with particular care the turbine's channels where the product is passing through.

Periodical inspections

The periodical inspections of the parts forming the bowl are very important for the safety of people and things and must be performed according to the deadlines previously described. We here describe the controls that must be performed, with special attention to the presence of potential corrosive and/or erosive phenomena, particularly check the status of the turbine at the points of the liquid phases's inlets and replace the turbine if its wear is such as to compromise the functionality.

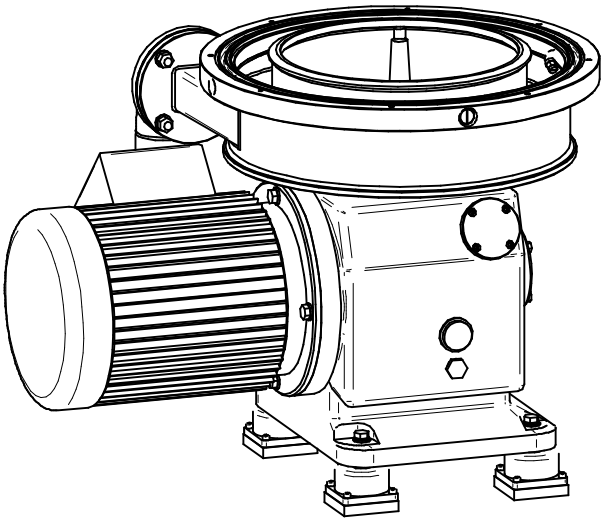
- inspection of the conditions of the external and internal surfaces of all bowl's structural elements (bowl bottom, locking nut);
- inspection of the conditions of surfaces of all bowl's group with special attention to possible erosions and/or corrosions;
- inspection of the state of wear of the coupling surfaces of all the bowl's group components.;
- inspection of the state of threads relating to the coupling with lifting tools

If the presence of any erosive/corrosive phenomena in any of the bowl's structural parts (bowl bottom, and locking nut) arises during the inspections here described, do not use the separator and immediately contact Servizi Industriali.

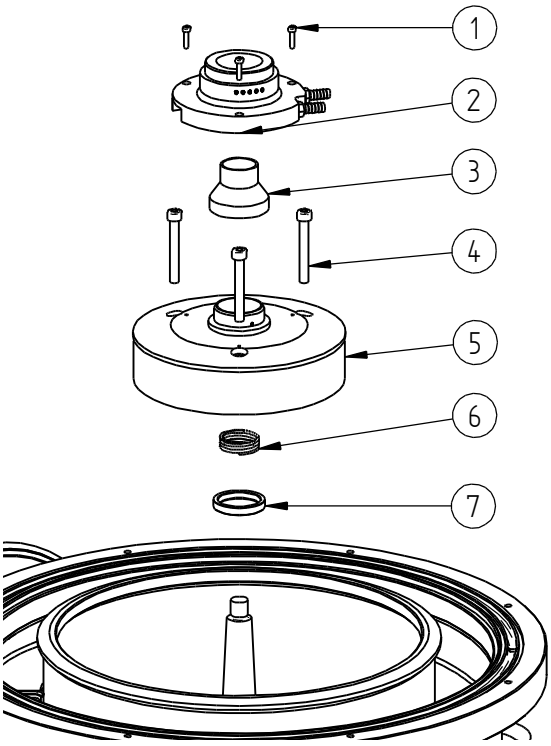
It is absolutely forbidden to repair the rotating parts through welding.

10.4 COLLAR GROUP

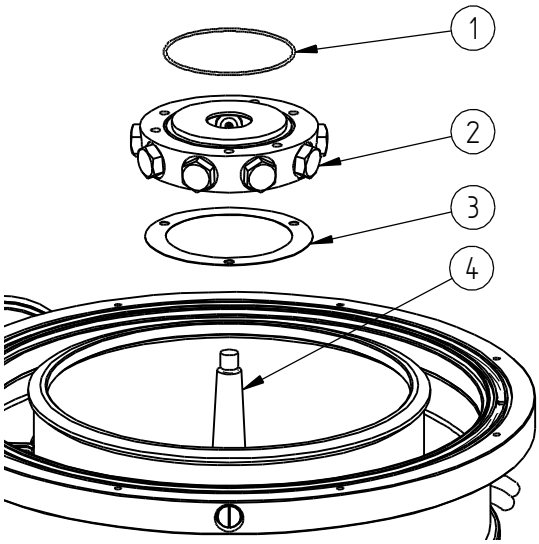
To describe the disassembly of the collar group we assume that the operations described in the previous paragraph have already been performed.
It is then assumed that is the disassembly procedure of this group starts from the situation here shown.



10.4.1 COLLAR GROUP DISASSEMBLY

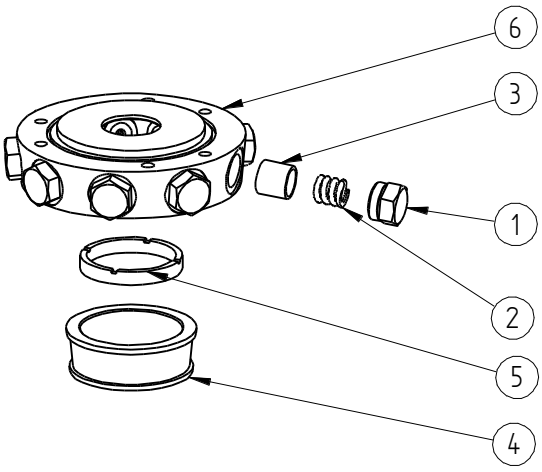


a) *Distributor and Collar cover disassembly:*
unscrew the screws fixing the distributor (Ref.1), remove the distributor (Ref.2) and labyrinth (Ref.3), svitare poi le viti di fissaggio del copricollare (Ref.4) unscrew the screws fixing the collar cover (Ref.5), and the labyrinth spring (Ref.6). Remove the gasket ring (Ref.7) from the collar cover.
Note for the assembly: *the fixing screws of the collar unit (must be fastened with a tightening torque of 200 Nm; use threadlocker adhesive of medium strength*



b) *Collar unit removal:*

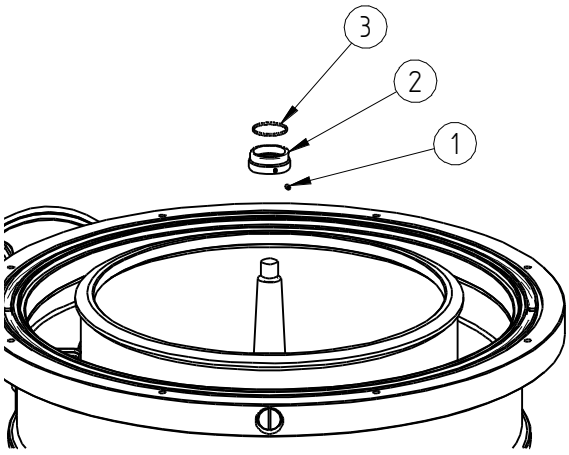
Remove the collar unit gasket (Ref.1), pull up the assembled collar unit (Ref.2) from in the basement (Ref.4) and remove the gasket (Ref.3). Then place it on a workbench.



c) *Disassembly of the collar unit:*

Unscrew the cap (Ref.1), remove the spring (Ref.2) and piston (Ref.3); repeat the operation with 9 caps (alternately) from the collar unit (Ref.6). Finally remove the guide ring (Ref. 4) and stop ring (Ref. 5). Replace, if necessary, the pistons (Ref.3) and springs (Ref. 2).

***Note for the assembly**: use threadlocker adhesive of medium strength for the caps fixing the pistons (Ref.1) .*



d) *Removing protective sleeve:*

Unscrew the pin(Reference 1), remove the protective sleeve (Ref.2) from the vertical shaft paying attention to the gasket (Ref.3)

10.4.2 MAINTENANCE AND PERIODICAL INSPECTIONS

Periodical maintenance.

The periodical maintenance operations prescribed for the collar group are here described:

- the first lubricant oil change should be made after 500 working hours or at least once a year;
- Ball bearing replacement once a year.

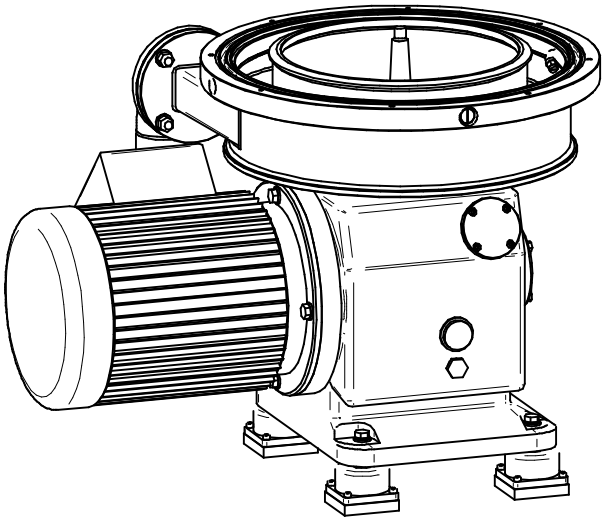
Periodical Inspections

The periodical inspection operations prescribed for the collar group are here described:

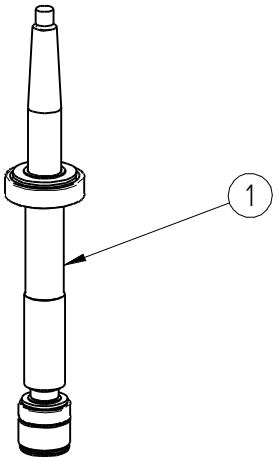
- Together with the change of the particulars object of the periodical maintenance, verify before every starting the lubricant oil level, furthermore that the oil is not contaminated by water, then the wear status of the springs and pistons and proceed to their replacement when necessary

10.5 VERTICAL SHAFT GROUP

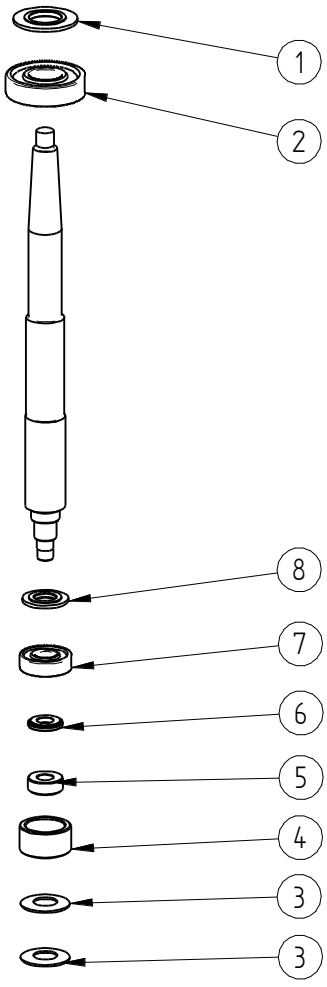
Before performing the vertical shaft disassembly it is necessary to empty the carter as previously described.
To describe the disassembly of the vertical shaft group we assume that the operations described in the previous paragraph have already been performed.
It is then assumed that is the disassembly procedure of this group starts from the condifuration shown.
Will be illustrated the disassembly of only those parts that are relevant for the ordinary maintenance and not, for example, of those used parts fixing the separator at the time of installation or those parts that are assembled permanently. The disassembly tools for the ball bearings (dampers) are not provided.



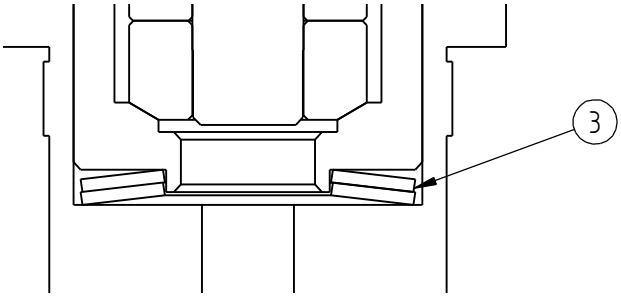
10.5.1 VERTICAL SHAFT GROUP DISASSEMBLY

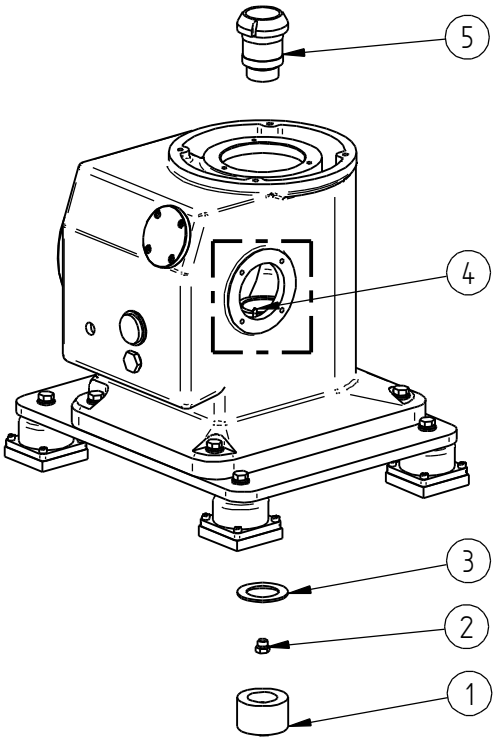


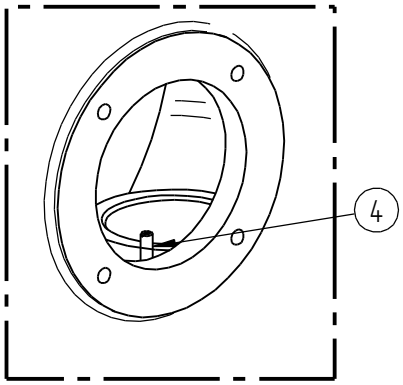
a) *Vertical shaft removal :*
Manually pull up the assembled vertical shaft (Ref.1) and place it on a workbench.



b) *Verticla shaft disassembly :*
Pull up the ball bearing protection (Ref.1) and the ball bearing (Ref.2). Then take off the belleville springs (Ref.3), the bearing housing (Ref. 4), the bearing (Ref. 5), the thrust bearing spacer (Ref.6), the bearing (Ref.7), and bearing protection (ref. 8).
Note for the assembly*: all the bearings must be hot assembled at a temperature of 85°C; while the belleville srpings have to be positioned as shown in the below picture.*







c) *Bottom cap disassembly :*

Disassemble the bottom cap (Ref.1) and remove the gasket (Ref.3), then unscrew the screw (Ref.2), at this point it is possible to pull out from the basement. the support (Ref.5).

***Note for the assembly**: the support is reported to the basement by means of pin (Ref. 4) and mounted on the basement, carefully check that the above pin match correctly in its respective seat on the support.*

10.5.2 MAINTENANCE AND PERIODICAL INSPECTIONS

Periodical maintenance.

The periodical maintenance operations prescribed for the vertical shaft group are here described:

- the first lubricant oil change should be made after 500 working hours or at least once a year;
- Ball bearing replacement once a year.

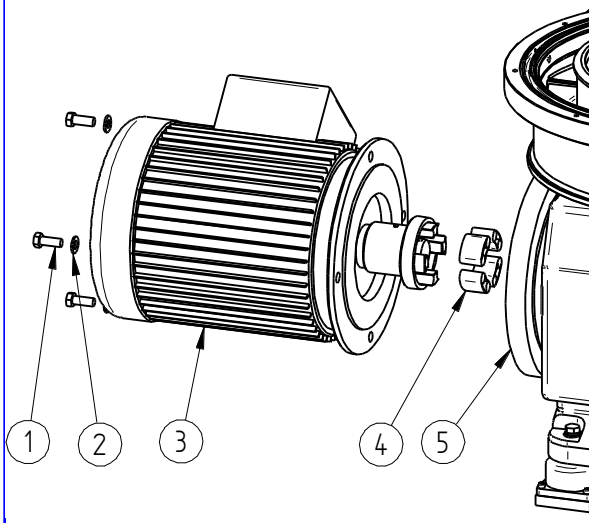
Periodical Inspections

The periodical inspection operations prescribed for the vertical shaft group are here described:

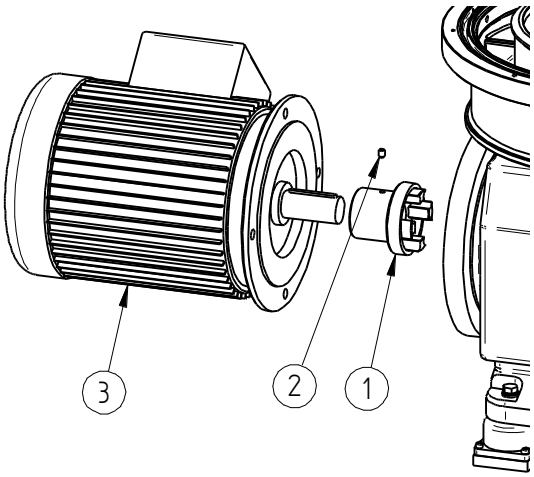
- Together with the change of the particulars object of the periodical maintenance, verify before every starting the lubricant oil level, furthermore that the oil is not contaminated by water, then the wear status of the vertical shaft and proceed to their replacement when necessary

10.6 HORIZONTAL SHAFT GROUP

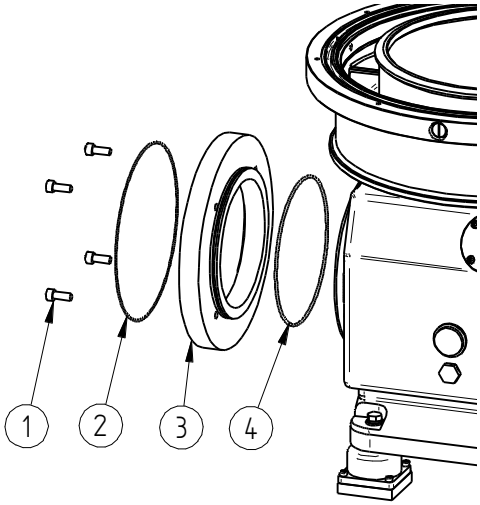
10.6.1 HORIZONTAL SHAFT GROUP DISASSEMBLY



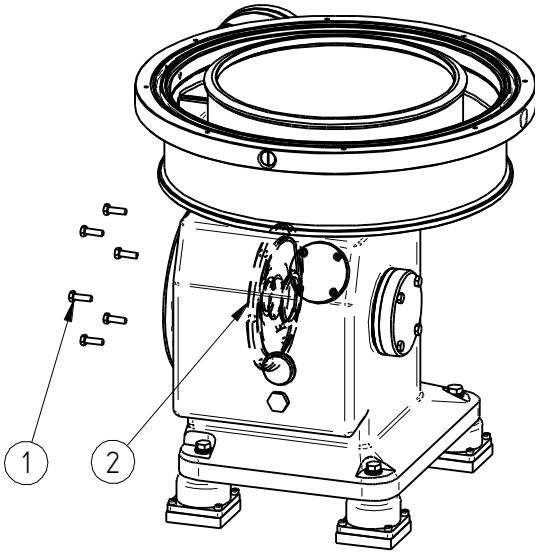
a) *Disassembly the assembled engine:*
Unscrew the screws (Ref.1) fixing the motor to the connection's flange (Ref. 5). Pull out the screws and its washers (Ref. 2). Remove the motor (Ref.3) paying attention to the elastic elements (Ref. 4)



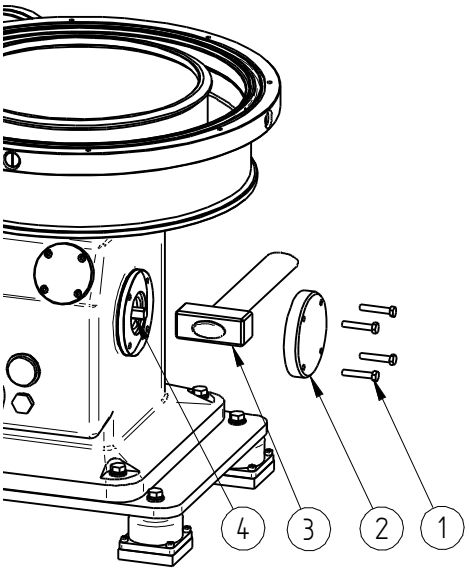
b) *Semi-coupling motor side disassembly:*
unscrew the screw (Ref. 2), pull out the semi-coupling motor side (Ref.1) from the motor (Ref. 3).



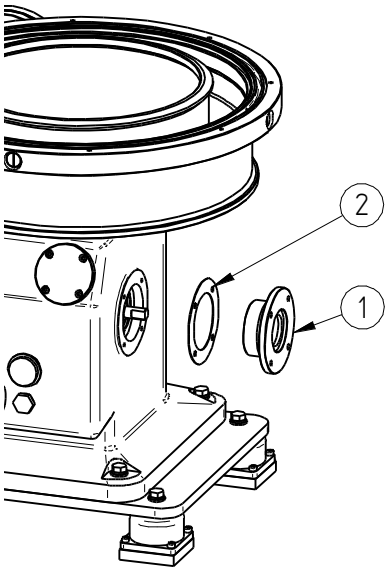
c) *Motor flange disassembly:*
Unscrew the screws (Ref.1) fixing the motor flange (Ref.3), remove the motor side gasket (Ref. 2), remove the motor flange, paying attention to the machine side gasket (Ref. 4).



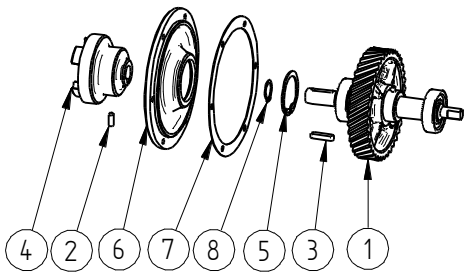
d) *Screws fixing bearing support disassembly:*
Unscrew the screw fixing (Ref.1) the ball bearing support (Ref.2).



e) *Assembled horizantal shaft disassembly :*
Unscrew the screw fixing (Ref.1) the cover (Ref.2), and remove it
With a rubber mallet not provided (Ref.3), pull out the assembled horizontal shaft (Ref. 4) and place it on a workbench.

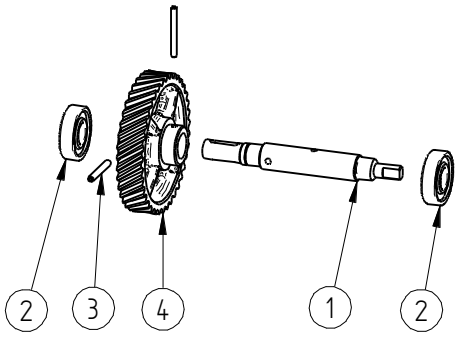


f) *Ball bearinf support flange disassembly :*
Remove the ball bearing support flange (Ref.1) from the basement, paying attention to its gasket (Ref.2).



g) *Semi couplig shaft side disassembly :*

Uncrew the screw (Ref.2), pull out the semi coupling shaft side (Ref.4). Remove the strip (Ref.3) of the assembled horizontal shaft (Ref.1). Remove the elastic rings (Ref. 5 and ref.8), the ball bearing support (Ref.6), paying attention to the gasket (Ref.7).



h) *Worm wheel dissembly:*

Remove the ball baring (Ref.2) form the horizontal shaft (Ref.1). Remove the elastic pins (Ref.3) and pull out the worm wheel (Ref.4).

10.6.2 MAINTENANCE AND PERIODICAL INSPECTIONS

Periodical maintenance.

The periodical maintenance operations prescribed for the horizontal shaft group are here described:

- the first lubricant oil change should be made after 500 working hours or at least once a year;
- Ball bearing replacement once a year.

Periodical Inspections

The periodical inspection operations prescribed for the mechanical group are here described:

- Together with the change of the particulars object of the periodical maintenance, verify before every starting the lubricant oil level, furthermore that the oil is not contaminated by wate; then the wear status of the worm wheel, the coupling elastic elements, all the seal elements and proceed to their replacement when necessary

10.7 *MAINTENANCE AND PERIODICAL INSPECTIONS*

The following table summarizes the operations of maintenance and inspection prescribed in the previous paragraphs.

DANGER:
in order to ensure a safe and efficient operation of the centrifuge, it is mandatory respect scrupulously the deadlines and modalities prescribed for maintenance and inspection.

Teming	Prescibed maintenance and inspection
Before every startin	comply with the requirements previously described
Before every stop	comply with the requirements previously described
After the first 8 working hours	• Inspection and bowl cleaning • Inspection and outlets group cleaning
After the first 40 working hours	• Inspection and bowl cleaning • Inspection and outlets group cleaning
After the first 500 working hours	• Lubricant oil replacement
every 500 working hours or at least once per year	• Inspection and bowl cleaning • Inspection and outlets group cleaning • Inspection and covers group cleaning
Once per year	• Maintenance and ispection of both vertical and horizontal shaft groups and colla group • Lubricant oil replacement

11 DEMOLITION

When dismantling the centrifuge it is mandatory to follow the laws of the country where the dismantling takes place and separate the parts composing the centrifuge according to the different type of building materials (plastic, copper, iron, etc.).

Lubricant liquids and other potentially polluting fluids cannot be discharged in the environment but must be disposed by authorized companies specialized in the dismantling of the different type of products.

12 PARTS LIST

To guarantee perfect operation of the centrifuge in the long time you must maintenance operations with the times and in the manner described in this manual. If you need replacement parts please do not hesitate to do it and especially use original spare parts supplied by the manufacturer.

When ordering spare parts, please always specify:

- model of the centrifuge;
- serial number;
- description of the part to be ordered, relevant reference code and quantity required;
- clearly indicate the full legal name of fiscal data;
- indicate the destination of the centrifuge;
- indicate the means of transport required.

In Par.13.2 shows a module orders spare parts to be used for the request.

12.1 VARIATIONS TO THE PARTS LIST

The list of parts shown in the tables and the tables below refers to the standard configuration of the centrifuge. Some groups may vary as a result of specific customer requests (eg for the type of input and output connections), the need for installation tools or insertion of the centrifuge in a system more complex. The above any changes are set out in Chapter 14 In the event that a facility is provided, more detailed information is also included in the manual of use and maintenance of the plant.

12.2 MACHINES GROUPS

The constituent parts of the centrifugal separator are conventionally grouped together for ease of management and explanatory, the following groups:

- horizontal shaft group (Tav.1);
- vertical shaft group (Tav.2);
- collar group (Tav.3);
- covers group (Tav.4);
- bowl group (Tav.5);
- outlets group (Tav.6);
- solenoid valves group (Tav.7).
- tools group (Tav.8).
- assembly kit (Tav.9)

Table 1	HORIZONTAL SHAFT GROUP	2950000003

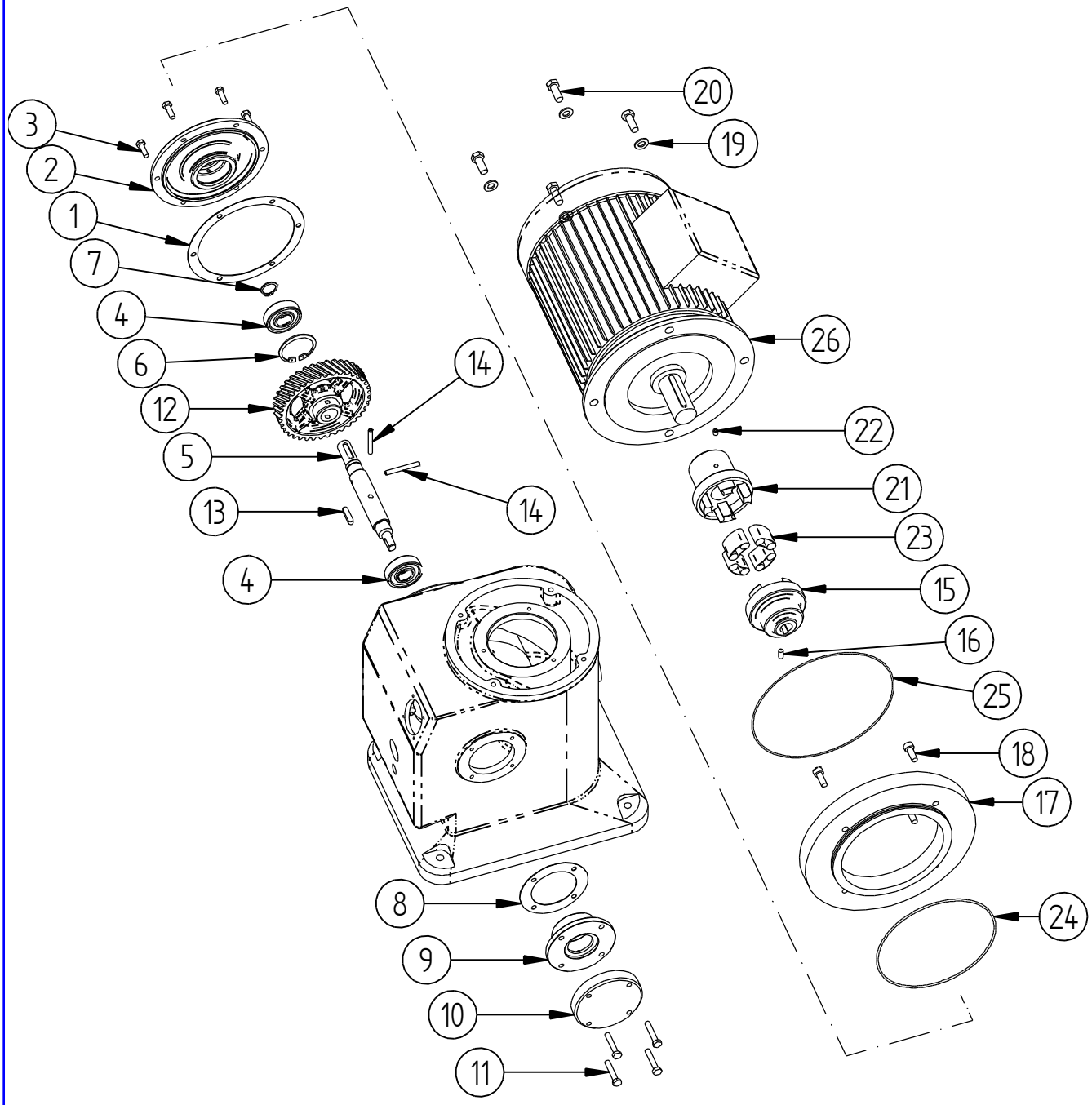


Table1	HORIZONTAL SHAFT GROUP	2950000003

Ref.	Description	Q.ty	Code
1	GASKET	1	0760300974
2	BEARING'S SUPPORT	1	0760400503
3	SCREW	6	9900080026
4	BEARING	2	9918650000
5	HORIZONTAL SHAFT	1	0760100294
6	HOLE'S ELASTIC RING	1	9926570026
7	SHAFT'S ELASTIC RING	1	9926560026
8	GASKET	1	0760200974
9	BEARING SUPPORT FLANGE	1	0760500314
10	COVER	1	0760800804
11	SCREW	4	9900680001
12	SPIRAL WHEEL	1	0760100703
13	TONGUE	1	9925510026
14	PIN	2	9926120026
15	SHAFT SIDE SEMI-JOINT	1	0320701004
16	SCREW	1	9901330026
17	MOTOR'S FLANGE	1	2950100262
18	SCREW	4	9900450026
19	PLAIN WASHER	4	9907710001
20	SCREW	4	9900410026
21	MOTOR SIDE SEMI-JOINT	1	2950702004
22	SCREW	1	9901320026
23	MOTOR'S SPACER	4	9931570060
24	GASKET	1	9911570063
25	GASKET	1	9911950063
26	MOTOR	0	N.A.*

**: see All.C*

Table 2	VERTICAL SHAFT GROUP	3310000001

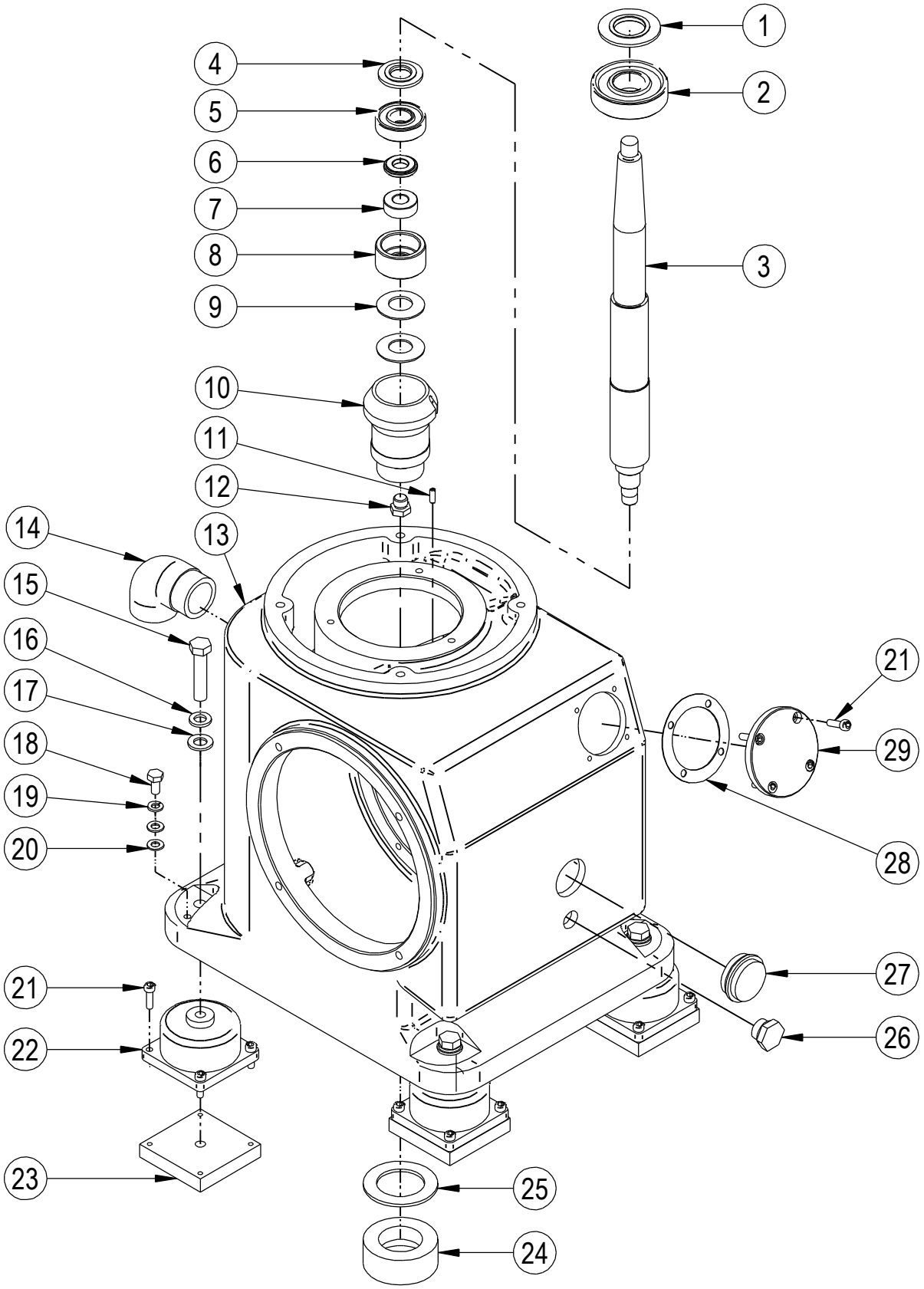


Table 2	VERTICAL SHAFT GROUP	3310000001

Ref.	Description	Q.ty	Code
1	BERAING PROTECTION	1	0740200344
2	BEARING	1	9918620000
3	VERTICAL SHAFT	1	3310100294
4	PROTECTION	1	0740300704
5	BEARING	1	9918630000
6	THRUST BEARING SPACER	1	0740400314
7	BEARING	1	9918640000
8	THRUST BEARING SEAT	1	0740500284
9	BELLEVILLE WASHER	2	9929040030
10	SUPPORT	1	0740600314
11	PIN	1	0740900344
12	SUPPORT PLUG	1	0741400344
13	BATY	1	0741000501
14	CURVE	1	9933310026
15	SCREW	4	9900430026
16	SPRING WASHER	4	9907640026
17	FLAT WASHER	4	9907540026
18	SCREW	1	9900190001
19	SPRING WASHER	1	9907520001
20	FLAT WASHER	2	9907680001
21	SCREW	20	9900400001
22	SHOCK ABSORBER	4	9931560060
23	SHOCK ABSORBER PLATE	4	0741200344
24	BOTTOM PLUG	1	0740800294
25	BOTTOM PLUG GASKET	1	0740700634
26	PLUG	1	9938210094
27	OIL LEVEL INDICATOR	1	9938200094
28	OIL LEVEL GASKET	1	0741300974
29	OIL LEVEL COVER	1	0741100804

Table 3	COLLAR GROUP	3300000003

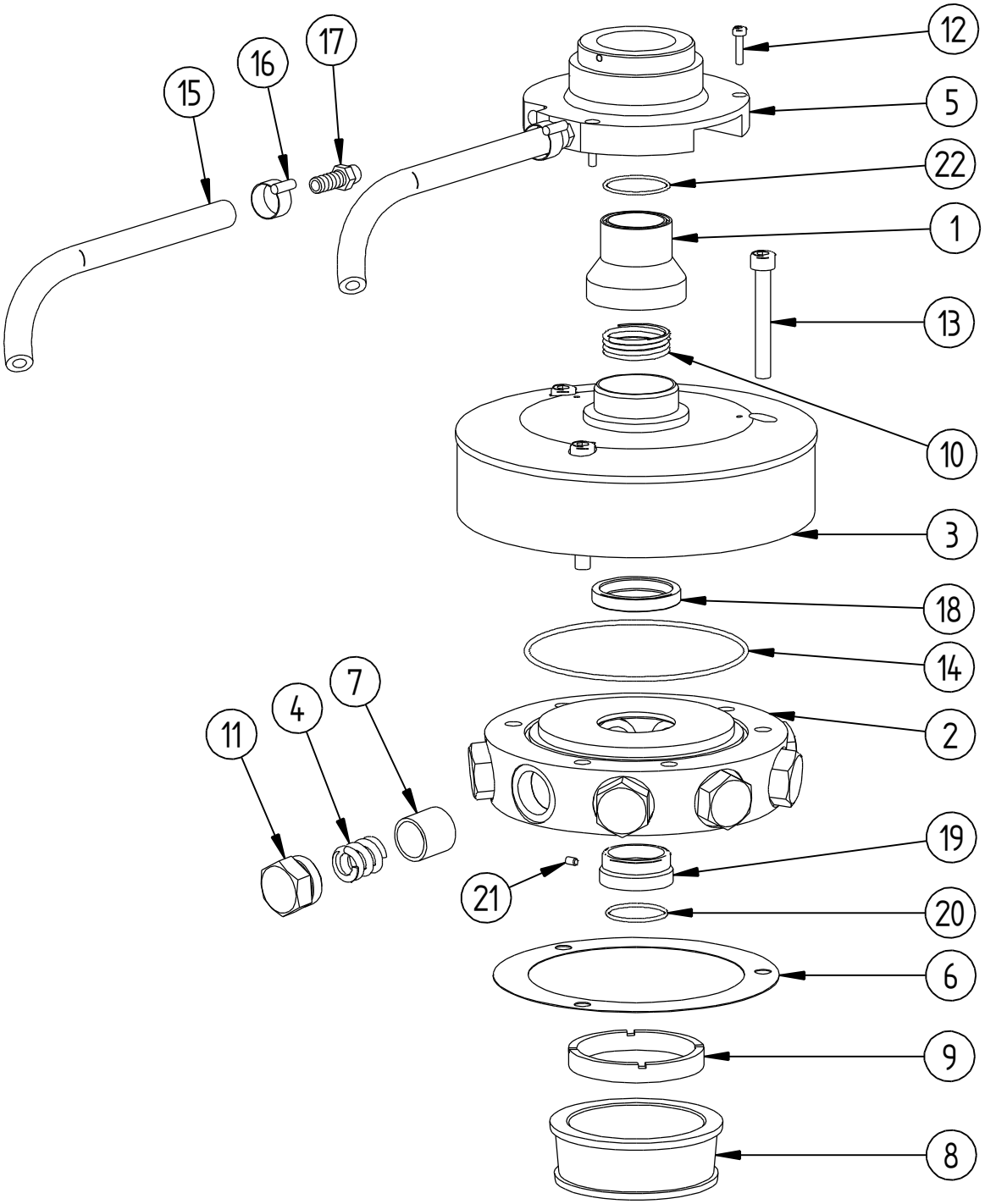


Table 3	COLLAR GROUP	3300000003

Ref.	Description	Q.ty	Code
1	LABYRINTH	1	5720100043
2	COLLAR UNIT	1	0710200513
3	COLLAR COVER	1	3300100013
4	COLLAR SPRING	9	0710400354
5	DISTRIBUTOR	1	0710500703
6	COLLAR GASKET	1	0710600974
7	PISTON	9	0710700314
8	COLLAR'S GUIDE RING	1	0710800514
9	STOP RING	1	0710900364
10	LABYRINTH SPRING	1	0711000354
11	COLLAR CAP	9	0711100344
12	SCREW	3	9900520001
13	SCREW	3	9900530001
14	GASKET	1	9910990061
15	FLEXIBLE HOSE	2	9932850094
16	HOSE CLAMP	2	9938160001
17	HOSE ADAPTER	2	9933070090
18	GASCKET	1	9914860061
19	PROTECTION SHAFT BEARING	1	3300200904
20	GASKET	1	9911440061
21	SPRIG	1	9942330026
22	GASKET	1	9910660061

Table 4	COVERS GROUP	3020000003

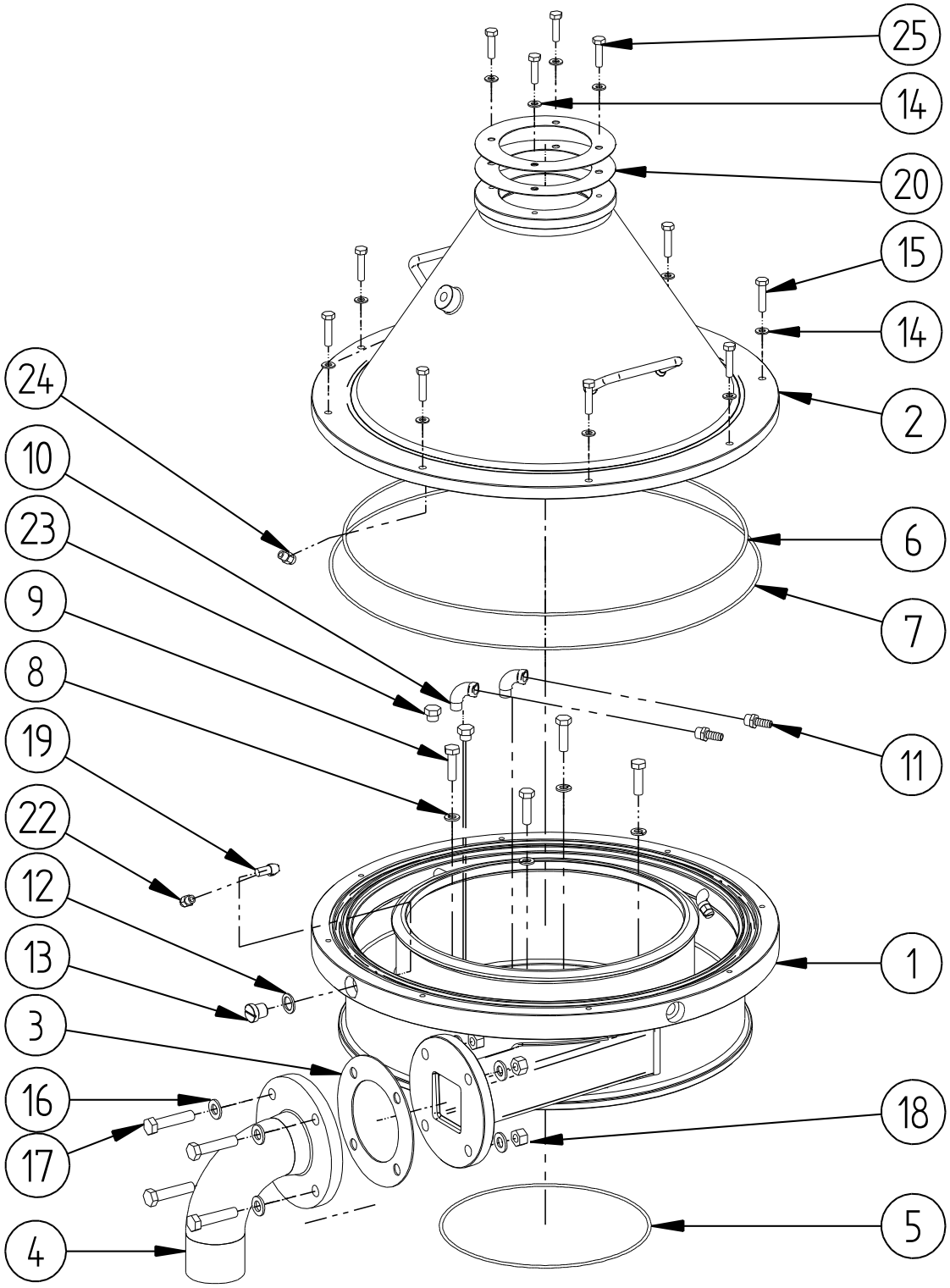


Table 4	COVERS GROUP	3020000003

Ref.	Description	Q.ty	Code
1	BASIN	1	3020100011
2	COVER	1	3020200012
3	GASKET	1	9942700094
4	SLUDGE DISCHARGE PIPE	1	5730600043
5	GASKET	1	9912030061
6	GASKET	1	3020300614
7	GASKET	1	3020400614
8	SPRING WASHER	4	9907590001
9	SCREW	4	9901800001
10	CURVE	2	9934530001
11	HOSE ADAPTER	2	9935800002
12	GASKET	3	0961100954
13	CAP	3	0961000014
14	PLAIN WASHER	12	9907680001
15	SCREW	8	9900200001
16	PLAIN WASHER	8	9907710001
17	SCREW	4	9900430026
18	NUT	4	9902560001
19	CURVE	4	9934640001
20	SPACER	2	0780300014
22	NOZZLE	4	9939110001
23	CAP	2	9935150002
24	NOZZLE	1	9939100001
25	SCREW	4	9901200001

Table 5	BOWL GROUP	4700000003

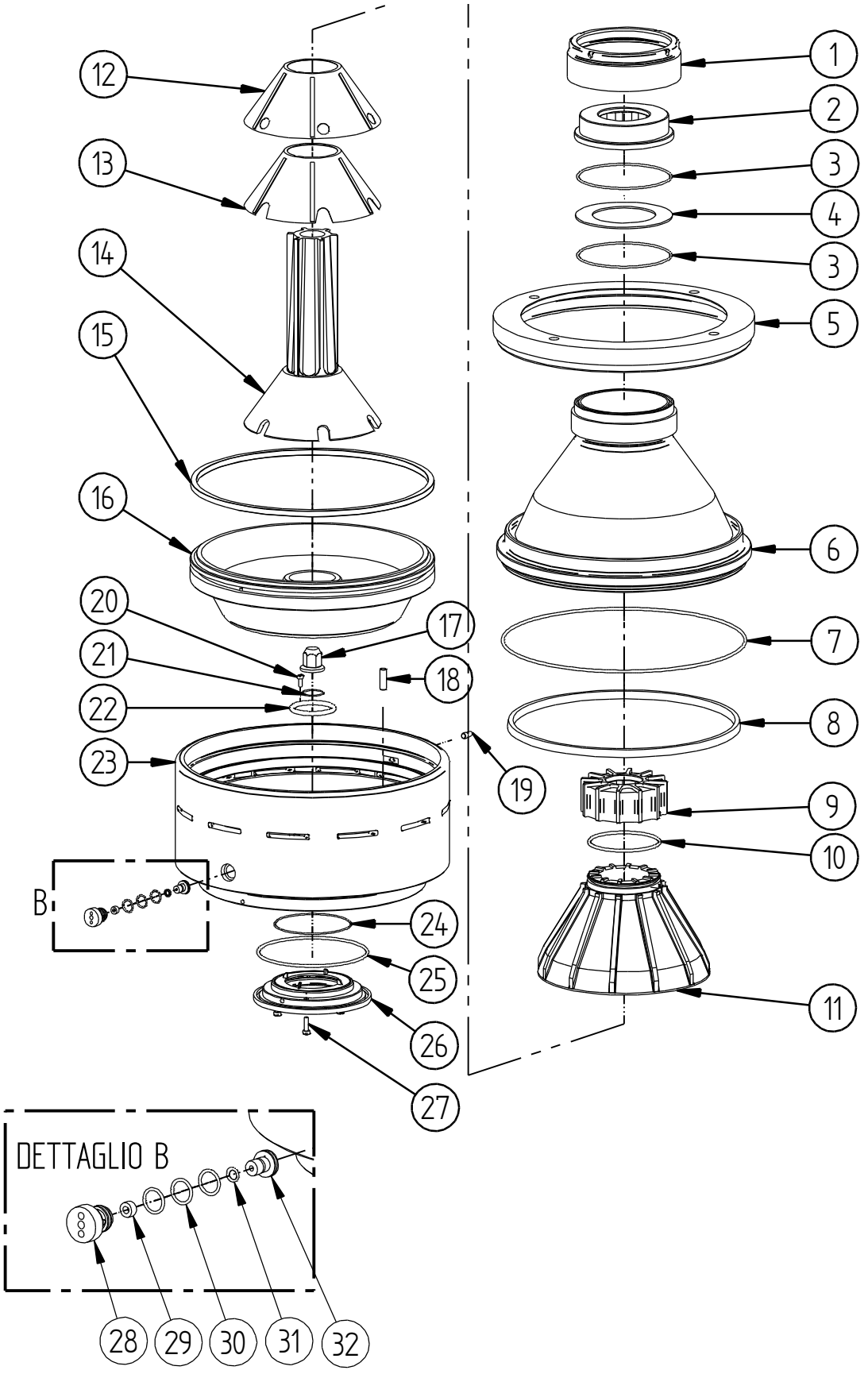


Table 5	BOWL GROUP	4700000003

Ref.	Description	Q.ty	Code
1	SMALL NUT	1	3030600023
2	HEAVY PHASE COLLECTING CHAMBER	1	4701300023
3	GASKET	2	9911080061
4	ADJUSTING RING	1	0701100013
5	BIG NUT	1	0700401253
6	BOWL'S COVER	1	0700302063
7	GASKET	1	9911040061
8	GASKET	1	0701400914
9	DIVIDER CONE'S COVER	1	3032100023
10	FASKET	1	9910530061
11	DIVIDER CONE	1	3030200023
12	TRUNCATED CONICAL DISC	70	3030400024
13	SLOTTED TRUNCATED CONICAL DISC	20	3030500024
14	COLUMN	1	3032200022
15	GASKET	1	0701700614
16	SLIDING PART	1	0700202063
17	BOWL'S LOCKING NUT	1	0700700014
18	SLIDING PART PIN	1	0701400014
19	BOWL'S COVER PIN	1	0701800014
20	SCREW	1	9900550001
21	GASKET	1	9911020061
22	GASKET	1	9911030061
23	BOWL'S BOTTOM	1	0700102063
24	GASKET	1	9911010061
25	GASKET	1	9911000061
26	WATER CONVEYOR	1	0701300013
27	SCREW	3	9900540001
28	VALVE	1	0700800014
29	PISTON VALVE	1	0701600894
30	GASKET	3	9911070063
31	GASKET	1	9911060063
32	VALVE SPLITTER	1	0701500014
*	DISC KIT	1	4709400004

Not displayed

Table 6	OUTLET GROUP	4690000003

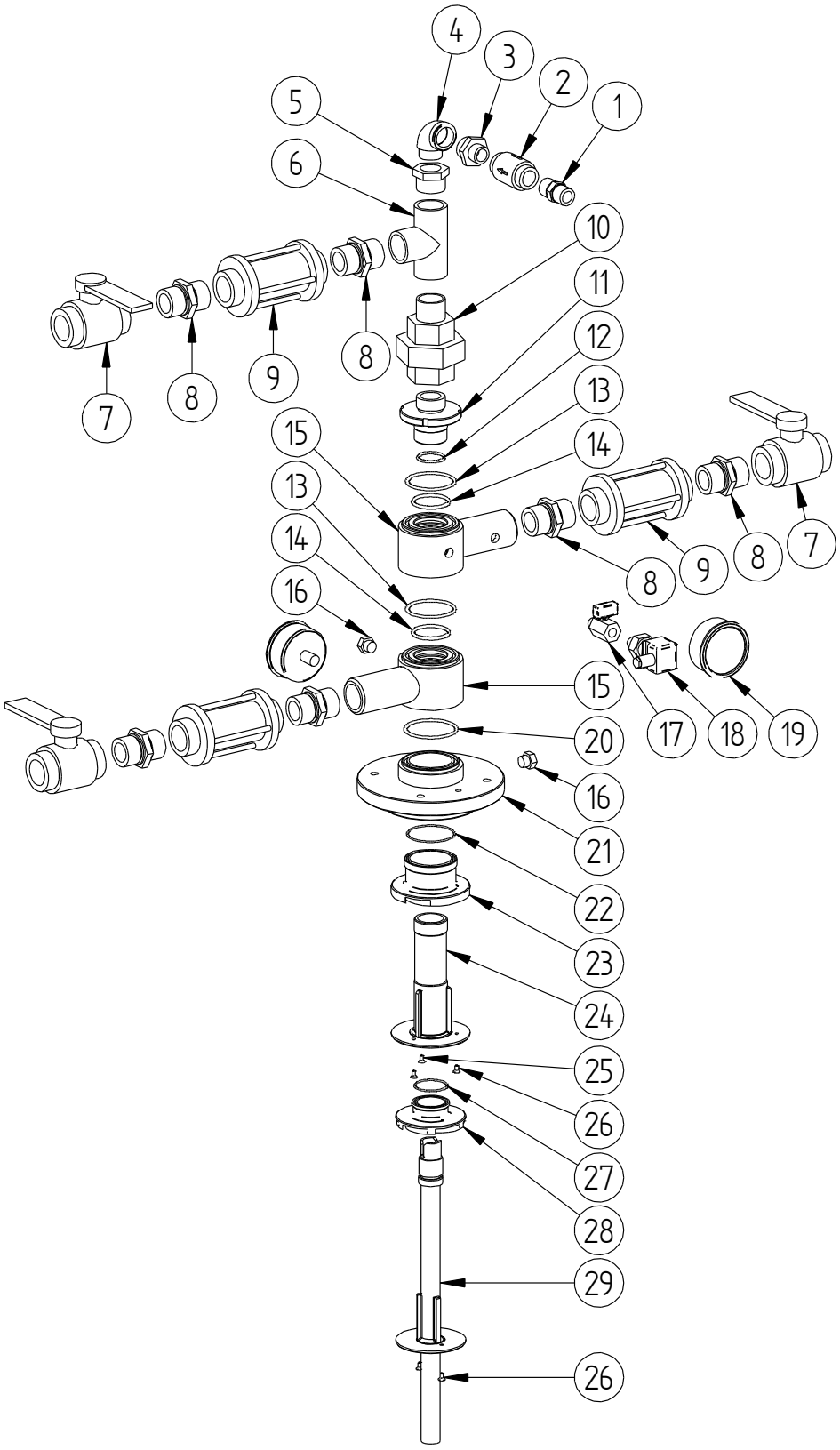


Table 6	OUTLET GROUP	4690000003

Ref.	Description	Q.ty	Code
1	NIPPLE	1	9948750001
2	CHECK VALVE	1	9944230002
3	NIPPLE	1	9945990003
4	CURVE	1	9934450001
5	REDUCTION	1	9948050002
6	T	1	9946980002
7	MANUAL VALVE	3	9947020002
8	NIPPLE	6	9942300002
9	SIGHT GLASS	3	9946990002
10	PIPE UNION	1	9947000002
11	FEEDING NUT	1	790500043
12	GASKET	1	9911100061
13	GASKET	2	9911110061
14	GASKET	2	9911140061
15	OUTLET BODY	2	5480200024
16	PLUG	2	9943680003
17	MANUAL VALVE	1	9949480002
18	PRESSURE SWITCH	1	9951860094
19	PRESSURE INDICATOR	2	9941250001
20	GASKET	1	9912040061
21	SUPPORT FLANGE	1	3040300023
22	GASKET	1	9912230061
23	HEAVY PHASE TURBINE	1	3040400023
24	HEAVY PHASE PLATE	1	3040600023
25	SCREW	2	9900370001
26	SCREW	3	730800014
27	GASKET	1	9910970061
28	LIGHT PHASE TURBINE	1	3040500024
29	LIGHT PHASE PLATE	1	3040200023

Table 7	SOLENOID VALVES GROUP	6530000003

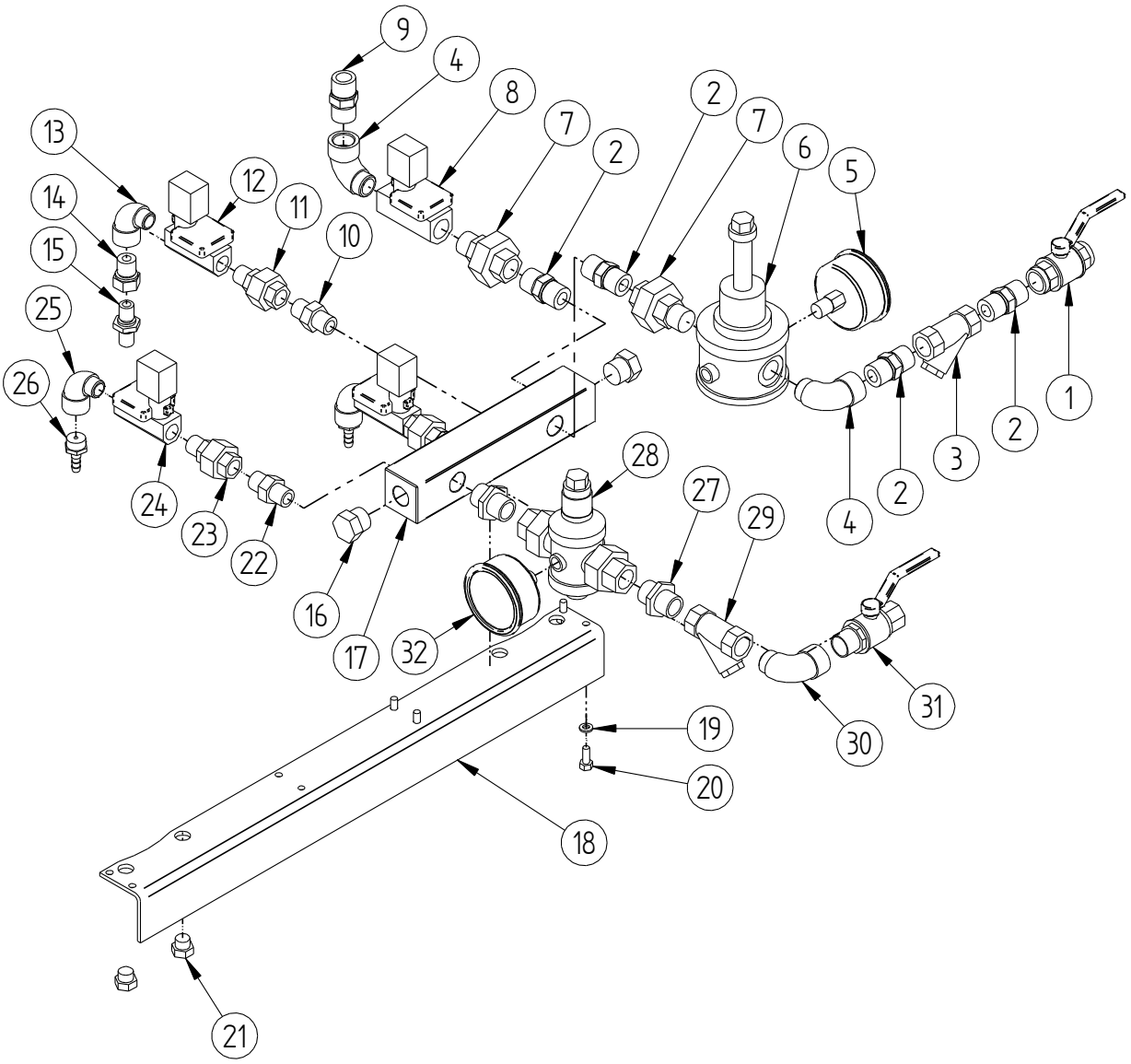


Table 7	SOLENOID VALVES GROUP	6530000003

Ref.	Description	Q.ty	Code
1	VALVE	1	9942940002
2	NIPPLE	4	9945110001
3	FILTER	1	9943870002
4	CURVE	2	9943690003
5	PRESSURE INDICATOR	1	9941250001
6	PRESSURE REDUCER	1	9943880094
7	PIPE UNION	2	9943990002
8	SOLENOID VALVE	1	9946780002
9	NIPPLE	1	9948750001
10	NIPPLE	1	9935470001
11	PIPE UNION	1	9946760002
12	SOLENOID VALVE	1	9946770002
13	CURVE	1	9946960002
14	REDUCTION	1	9935270001
15	NIPPLE	1	9943270002
16	PLUG	2	9941140001
17	COLLECOTR	1	6530100013
18	SUPPORT PLATE	1	4710100013
19	WASHER	4	9907750001
20	SCREW	4	9900030001
21	PLUG	2	9935150002
22	NIPPLE	2	9935120090
23	PIPE UNION	2	9945850090
24	SOLENOID VALVE	2	9941220090
25	CURVE	2	9945770090
26	FLEXIBLE HOSE	2	9933430070
27	NIPPLE	2	9945840090
28	PRESSURE REDUCER	1	9936530090
29	WATER STRAINER	1	9932090090
30	CURVE	1	9947840090
31	MANUAL VALVE	1	9934350001
32	PRESSURE INDICATOR	1	9939440094

Table 8	TOOLS GROUP	3060000003

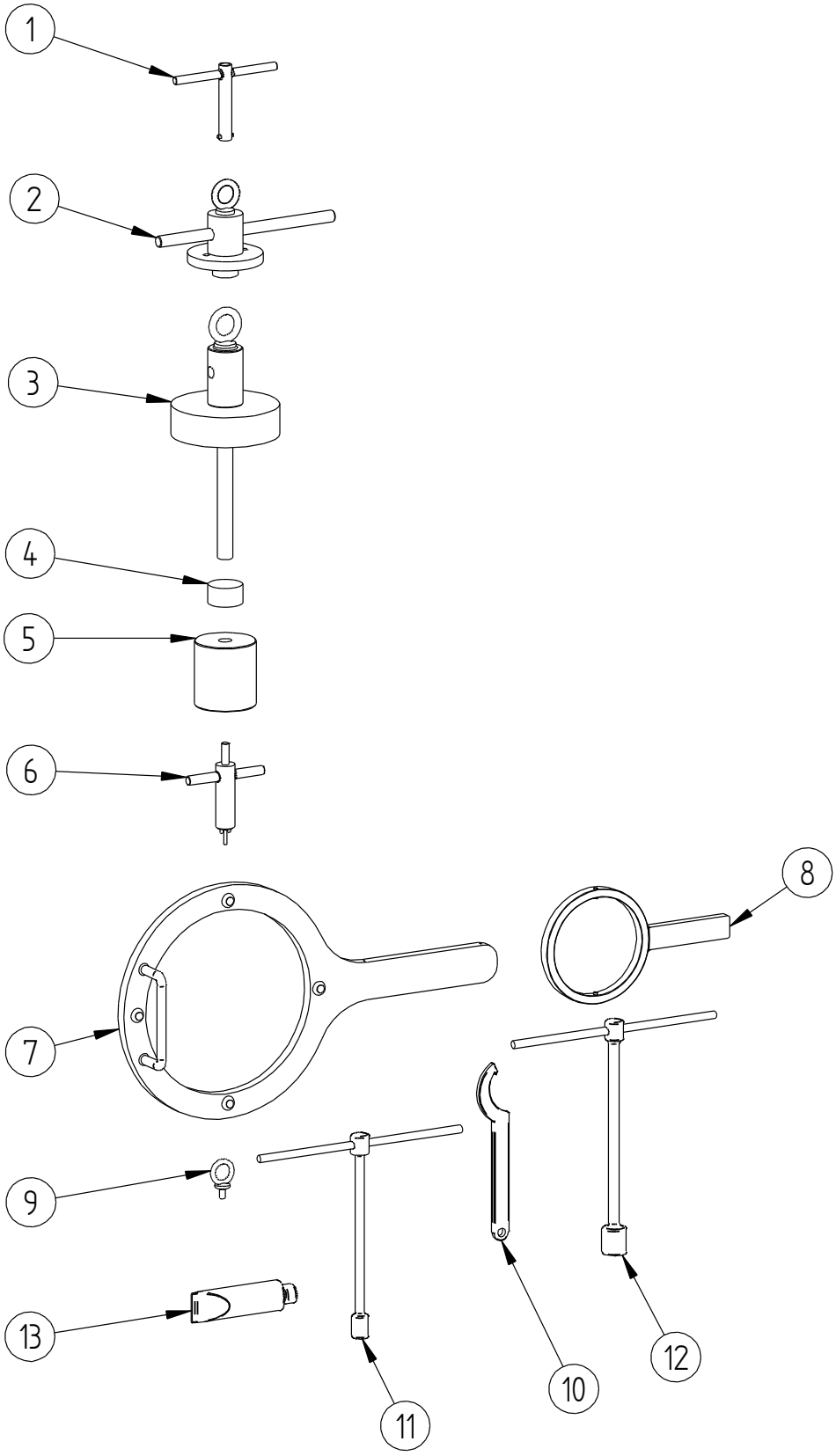


Table 8	TOOLS GROUP	3060000003

Ref.	Description	Q.ty	Code
1	TURBINES WRENCH	1	0820100014
2	DISC-PRESS TOOL	1	0820200343
3	BOWL LIFTING TOOL	1	0820300343
4	BOWL PROTECTING BUSH	1	0820400344
5	SLIDING PART LIFTING TOOL	1	0820500344
6	VALVE WRENCH	1	0820600014
7	BIG NUT WRENCH	1	0820700013
8	SMALL NUT WRENCH	1	0820800013
9	EYE-BOLT	2	9937700026
10	SPANNER	1	9937950020
11	LOCKING NUT KEY	1	9937960020
12	LOCKING NUT KEY	1	9938350094
13	MOLYKOTE	1	9938630094
*	SPARE PARTS GASKET KIT	1	3061300944

**: not illustrated*

Table 9	ASSEMBLY KIT	6470000003

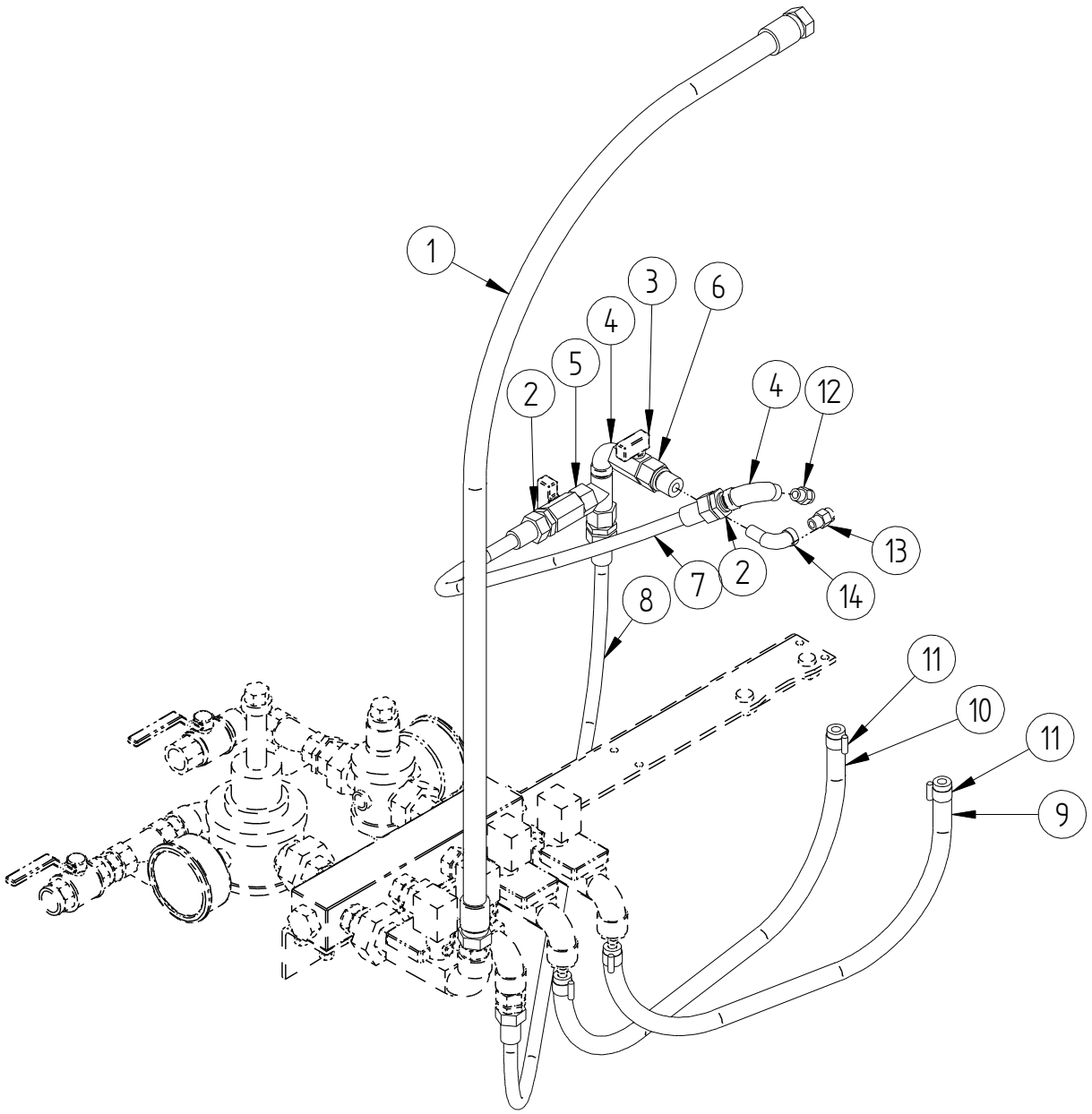


Table 9	ASSEMBLY KIT	6470000003

Ref.	Description	Q.ty	Code
1	FLEXIBLE PIPE	1	9949290001
2	CONNECTION	3	9943270002
3	VALVE	2	9949480002
4	CURTE	2	9934530001
5	T	1	9935730001
6	CONNECTION	1	9934310002
7	FLEXIBLE PIPE	1	9949320001
8	FLEXIBLE PIPE	1	9949330001
9	RUBBER PIPE	1	9932850094
10	RUBBER PIPE	1	9932850094
11	CLAMP	4	9939590001
12	NOZZLE	1	9939100001
13	NOZZLE	4	9939110001
14	CURVE	4	9934640001

13 SPARE PARTS

13.1 SPARE PARTS PRESCRIBED

With reference to the terms and timescales already described in Chapter 10, the spare parts required for the proper conduct of the centrifuge covered by this manual are as follows:

- **spare parts gasket kit**: parts which may be necessary during maintenance and inspections required according to the schedule described above and must be kept available, a number of these spare parts is supplied as a kit, the number of these parts has code 3061303944.

- **spare parts 1 year of work meccanical kit**: parts which may be necessary during maintenance and inspections to be carried out at least once a year and must be kept available, bearing replacement is required in every case regardless of the state in which they are found at the time of maintenance, the series of these parts has code 3061301944.

13.2 SPARE PARTS ORDER FORM

Client (business name and fiscal data): _____

Centrifuge model: _____

Serial number: _____

List of the requested spare parts

Ref.	Code	Description	Q.ty	Ref.	Code	Description	Q.ty
1				16			
2				17			
3				18			
4				19			
5				20			
6				21			
7				22			
8				23			
9				24			
10				25			
11				26			
12				27			
13				28			
14				29			
15				30			

Headquarter address: _____

Shipping address: _____

Bank coordinates for payment: _____

Subscribed or desired carrier: _____

Date: _____

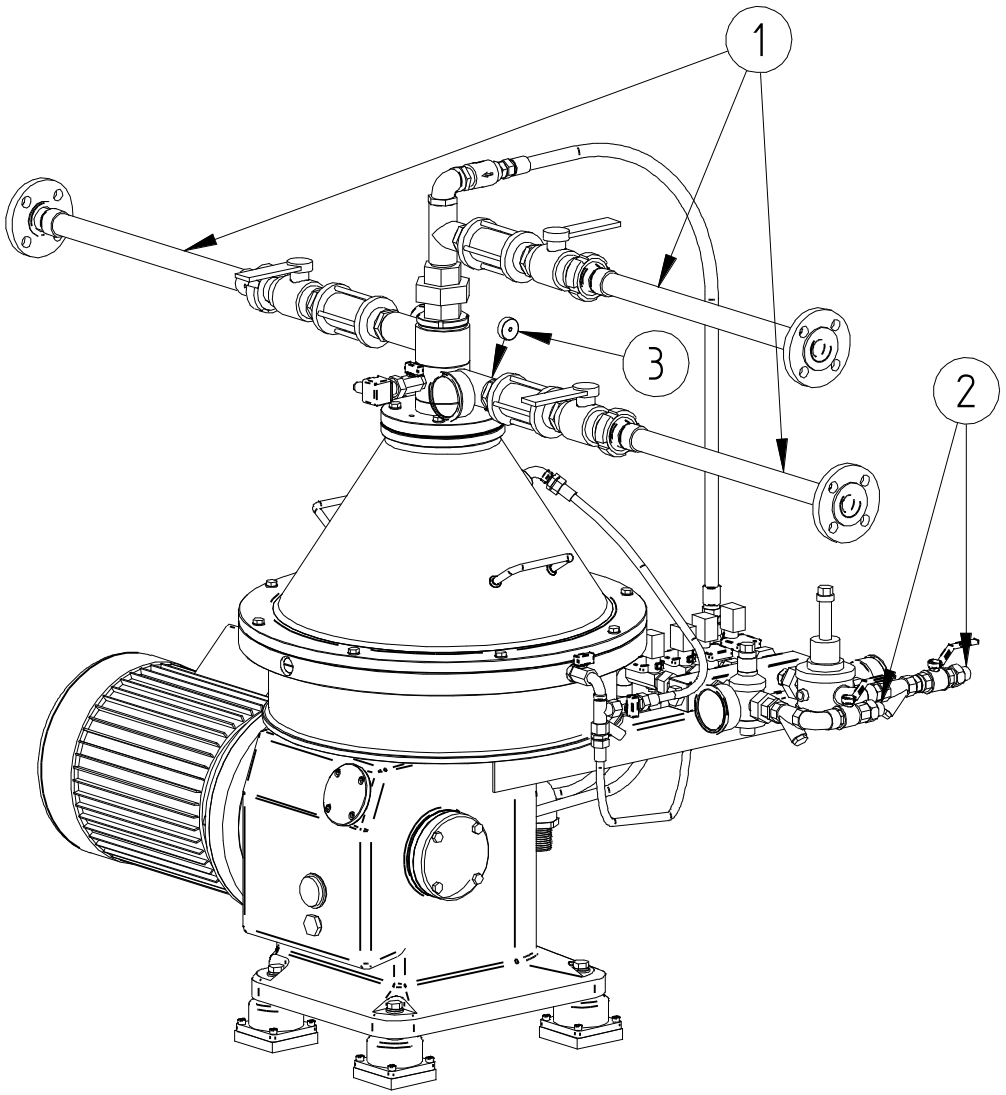
Signature: _____

14 VARIATIONS

Here following are described the variations eventually made to the centrifuge compared to the standard configuration.

The following parts are supplied with the centrifuge:

Ref.	Description	Q.ty	Code
1	FLEXIBLE PIPE	3	7530000003
2	NPT CONNECTION	2	9958100002
3	DIAPHRAGM	1	1985300954



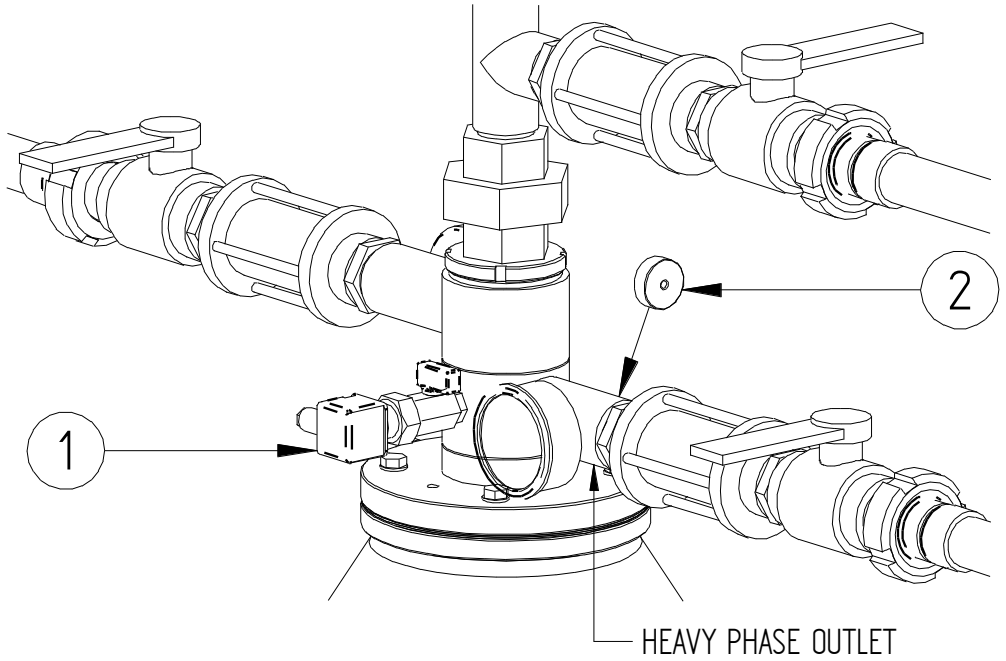
A copy of this form is recorded by Servizi Industriali S.r.l.

The following parts delivered with the centrifuge comprising the pocket loss alarm system. Below is described the principle of functioning.

1) Pressure switch
2) Diaphragm

The centrifuge is normally configured as separator, only a small amount of liquid flow out the heavy phase outlet and the pressure is around 0 barg. In case of pocket loss all the light phase tends to exit from the heavy phase outlet, directly increasing the pressure in the line.

The pressure switch (Ref.1) detect this pressure increase and switch the electric contact to stop the feeding to the centrifuge. To make the pressure switch (Ref.1) intervention more sensitive, a diaphragm (Ref.2) is delivered installed inside the heavy phase outlet body. The diaphragm (Ref.2) has a calibrated hole: as soon as the liquid flow increase, the increase in pressure is immediate.
Pressure switch (Ref.1) is calibrated around 0,5barg more than working pressure.



15 SUMMARY OF MAINTENANCE

Use the following forms to record the main maintenance or service made by users or any other assistance authorized by Servizi Industriali S.r.l.

It is mandatory fill out in detail the table "Summary of maintenance" by the person performing a significant intervention on the machine.

n° intervention: 1	Operating hours: _____	
Intervention description:	_____ _____ _____ _____	
Spare parts replaced:	_____ _____ _____	
date: _____	technician: _____	technician sign: _____

n° intervention: 2	Operating hours: _____	
Intervention description:	_____ _____ _____ _____	
Spare parts replaced:	_____ _____ _____	
date: _____	technician: _____	technician sign: _____

n° intervention: 3	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 4	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 5	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 6	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 7	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 8	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 9	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 10	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____

n° intervention: 11	Operating hours: _____	
Intervention description:	_____	
Spare parts replaced:	_____	
date: _____	technician: _____	technician sign: _____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