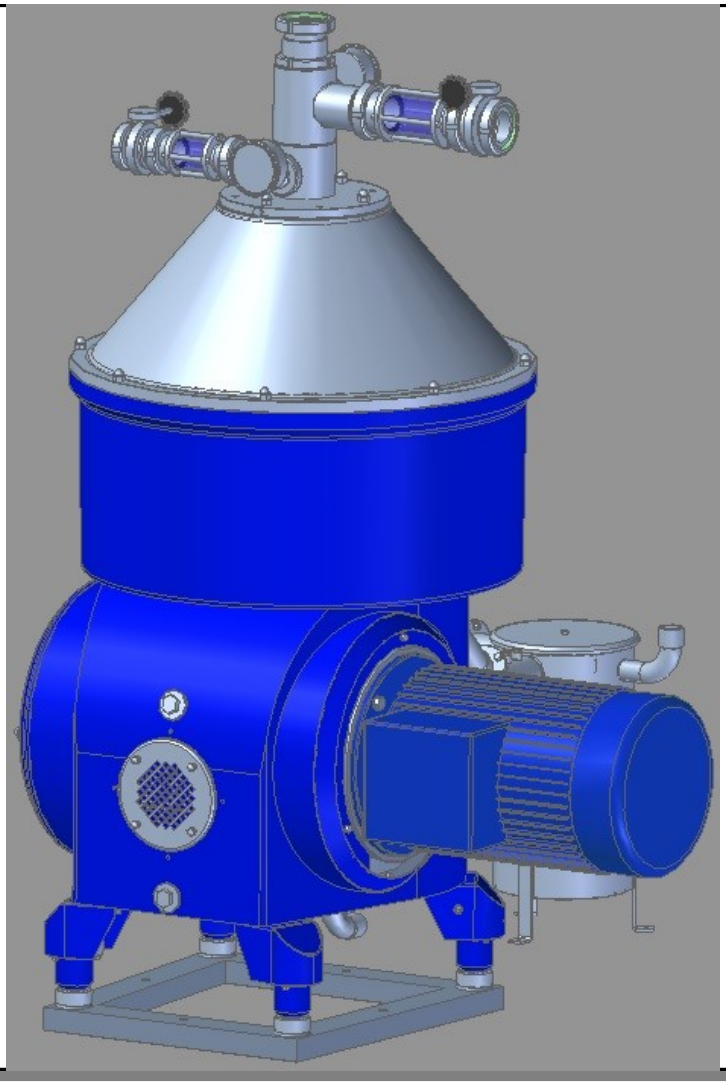

# User's and Maintenance Manual

Translation of the original: MACFUGE107BDM3SA

| | |
|---|---|
| Type: | Centrifuge Separator with manual cleaning |
| Model: | **MACFUGE 107 BD M 3 S A** |
| Customer: | BIOAGRA |
| Serial number: | 85216 |
| Year of construction: | **2016** |

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

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MACFUGE107BDM3SA-00 EN TRANSALTION OF THE ORIGINAL: ITALIAN MACFUGE 107 BD M 3 S A

MACFUGE® by
SERVIZI INDUSTRIALI
SEPARATION TECHNOLOGY

## *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.

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

Declaration of conformity
Attachment A System and components plan (P&ID)
Attachment A1 Dimensions and weight
Attachment A2 Connections
Attachment B Electrical diagram
Attachment C Test report
Attachment D Material certificates
Attachment E Electrical motor guide
Attachment F Inverter user manual
Attachment F1 Inverter parameters
Attachments Components guide 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 object 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 | specific separator version |
| **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".

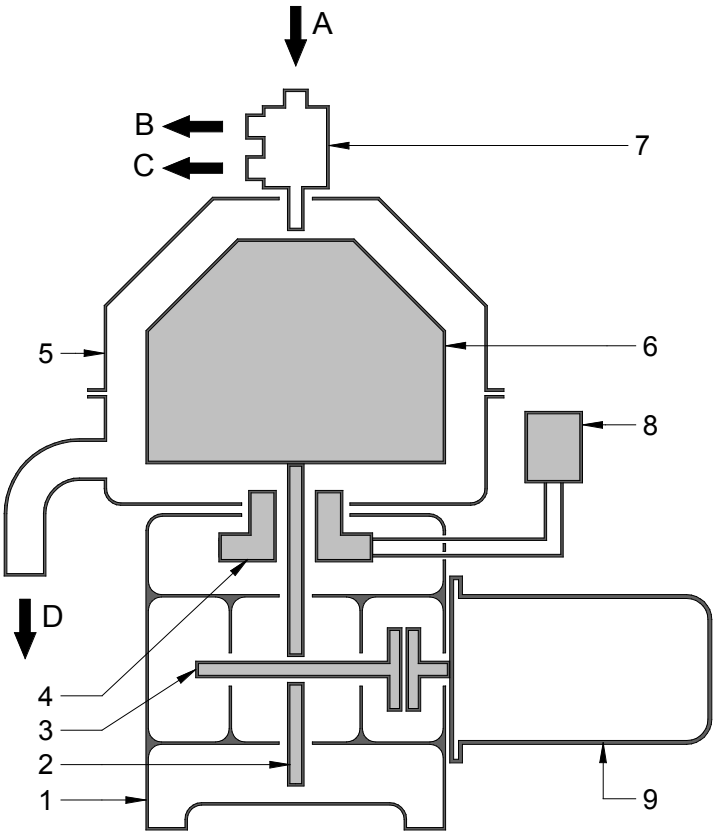
The centrifuge has been designed and built to separate a mixture of two liquids and a solid, having different specific weight (separator version or skimmer/concentrator version) and just one solid and liquid having different specific weight (version clarifier).

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 .

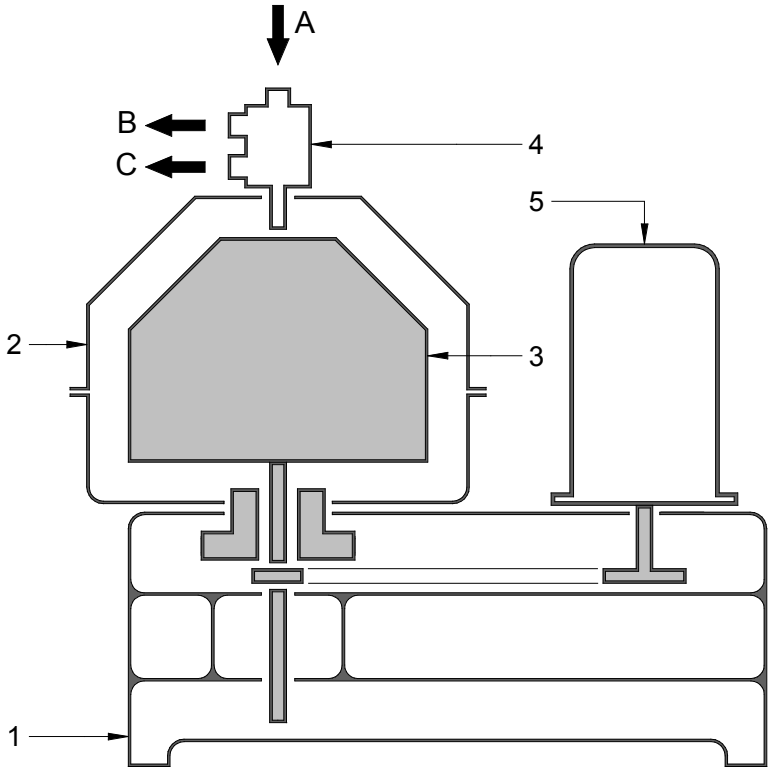
The efficiency of the centrifuge depends on the characteristics of the mixture to be separated: the viscosity, temperature, amount of solid and the difference between the densities of the various phases are parameters that can significantly affect the separation.

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.



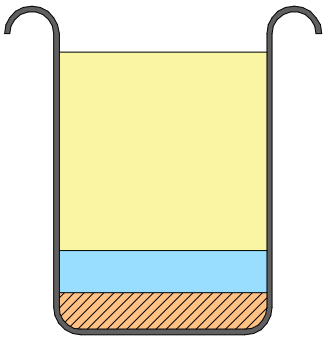
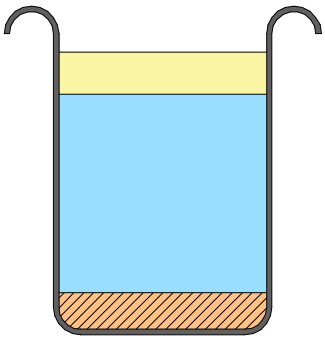
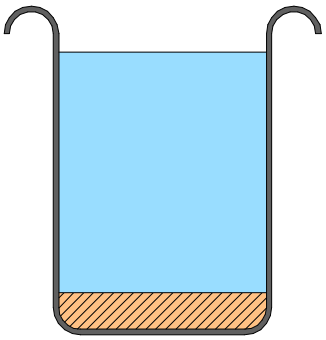

| Rif. | Description |
|---|---|
| 1 | basament group |
| 2 | horizontal shaft group |
| 3 | vertical shaft group |
| 4 | collar group |
| 5 | cover gruop |
| 6 | bowl group |
| 7 | outlets group |
| 8 | solenoid valves group |
| 9 | motor |
| A | inlet group |
| B | light phase outlet |
| C | heavy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

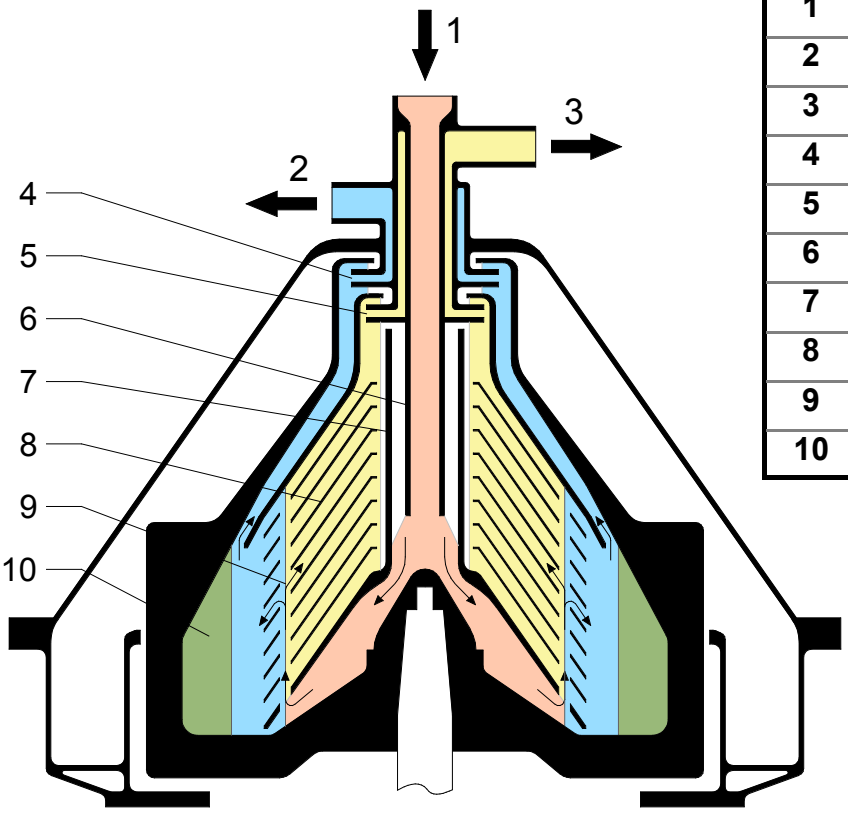
| SEPARATOR | CONCENTRATOR | CLARIFIER |
|---|---|---|
|  |  |  |
| 3 phases centrifuge:<br>• Light liquid phase<br>• Heavy liquid phase<br>• Solid phase<br>Light phase predominant | 3 phases centrifuge:<br>• Light liquid phase<br>• Heavy liquid phase<br>• Solid phase<br>Heavy phase predominant | 2 phases centrifuge:<br>• Liquid phase<br>• 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*

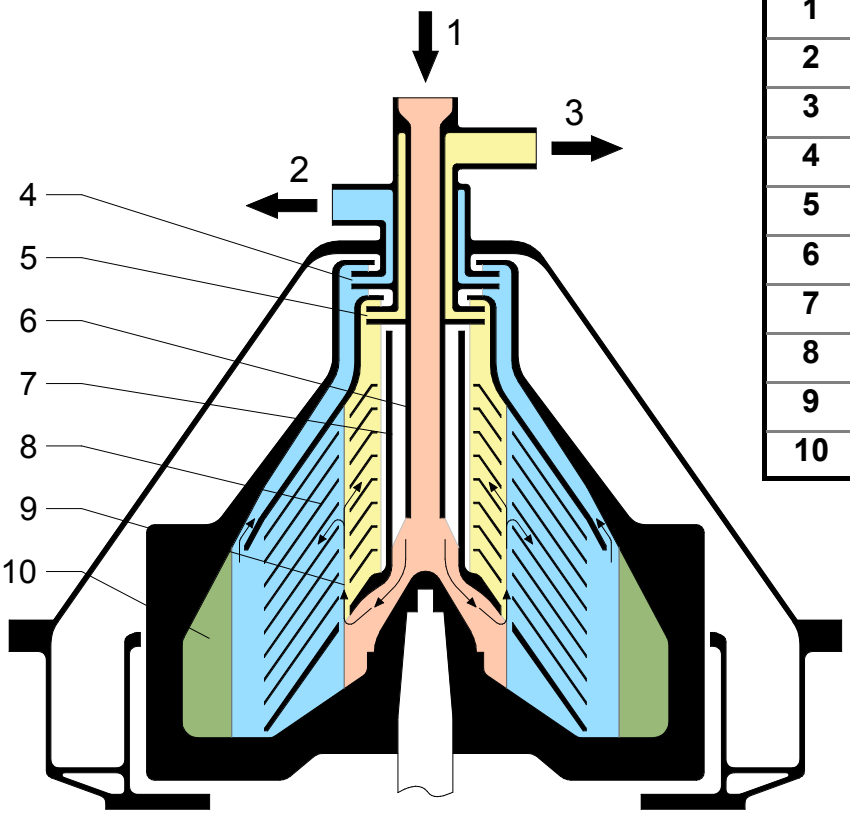
the product is introduced in the rotating bowl via the supply pipe (Rif.6), through the disks column (Rif.7) is routed in the disk stack (Rif.8) where the separation takes place. The heavy phase is separated towards the periphery of the bowl, the light phase toward the axis of rotation.
The interface 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

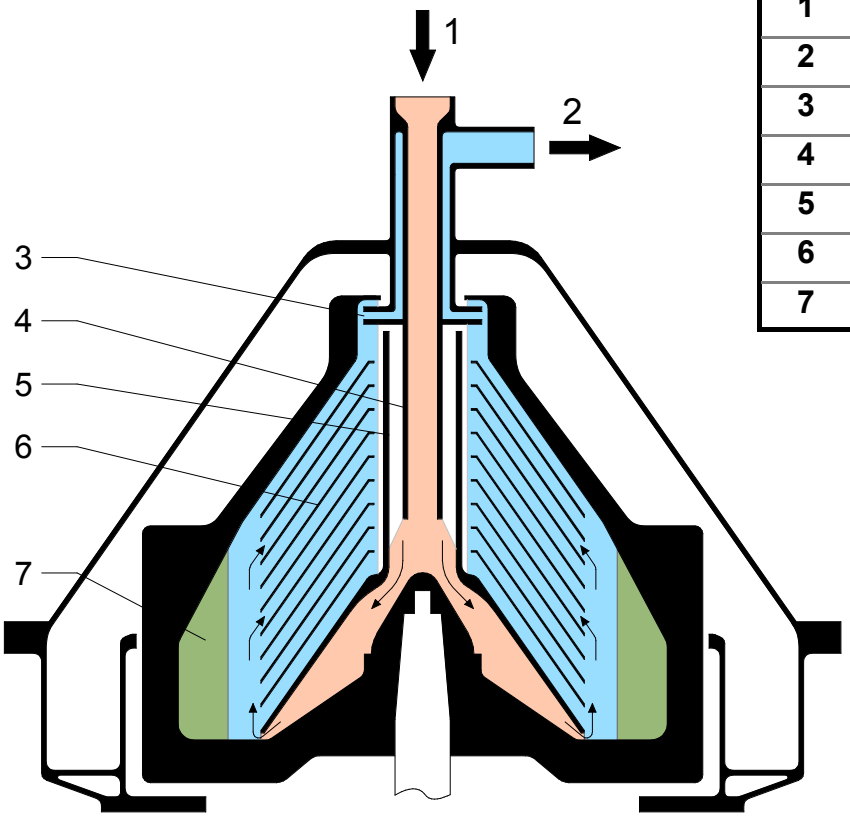
The functioning principle is the same as already described for the separator, the difference concerns the position of the separation line (Ref.9) that results to be, in the concentrator/ skimmer, closest to the axis of rotation.




| 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 |

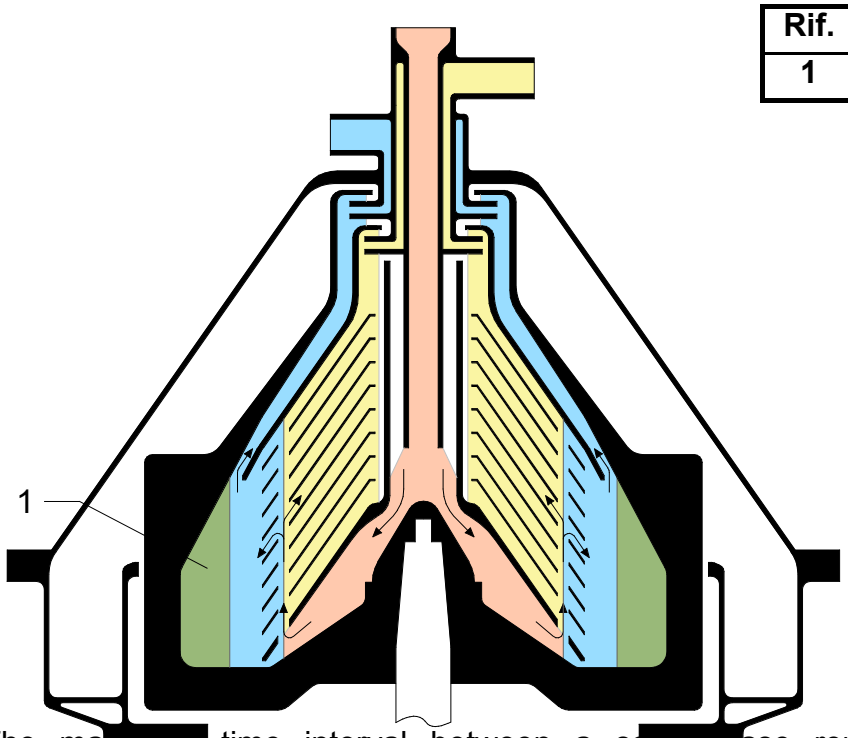
## 2.4 SOLID PHASE DISCHARGE

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 |



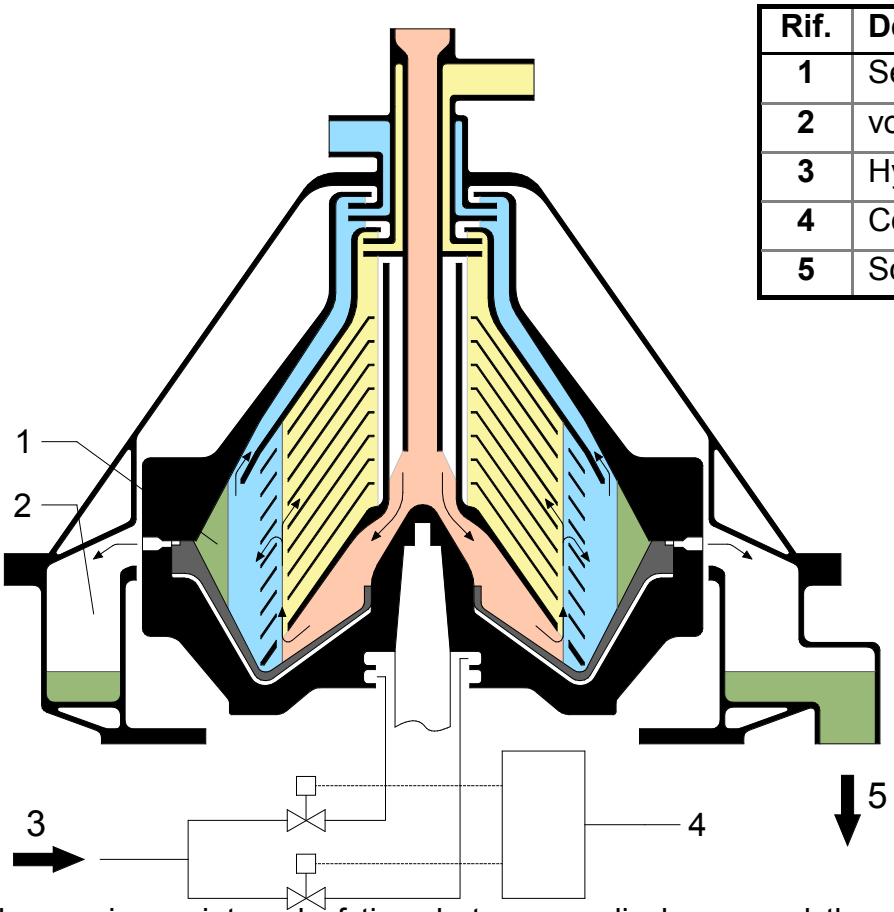

The maximum time interval between a solid phase removal's intervention and the subsequent, depends on the separable solids content at the inlet, from the flow rate and volume of the sedimentation chamber. In the case, where the solids content and the flow rate are constants, the cleaning interval can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

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

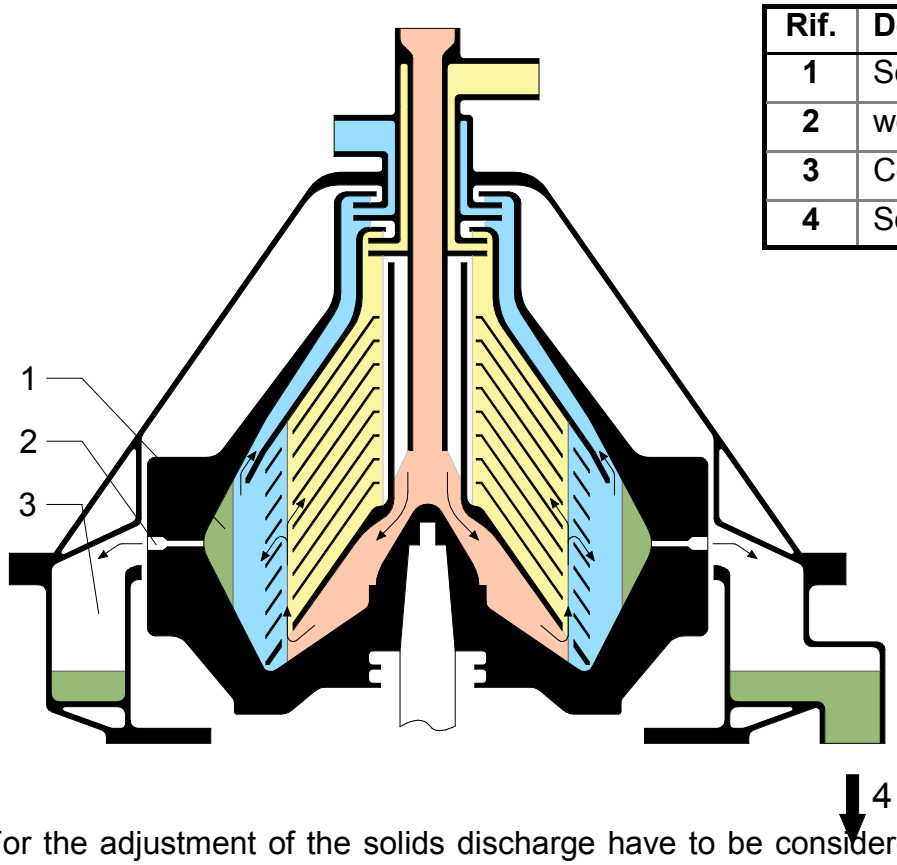
In the case where the above parameters are not constant, or are still unknown, it is necessary to avoid an excessive accumulation of solids and to foresee a precautionary purification time or control the separation efficiency.
In the case where total discharges are executed or it is necessary to restore 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:

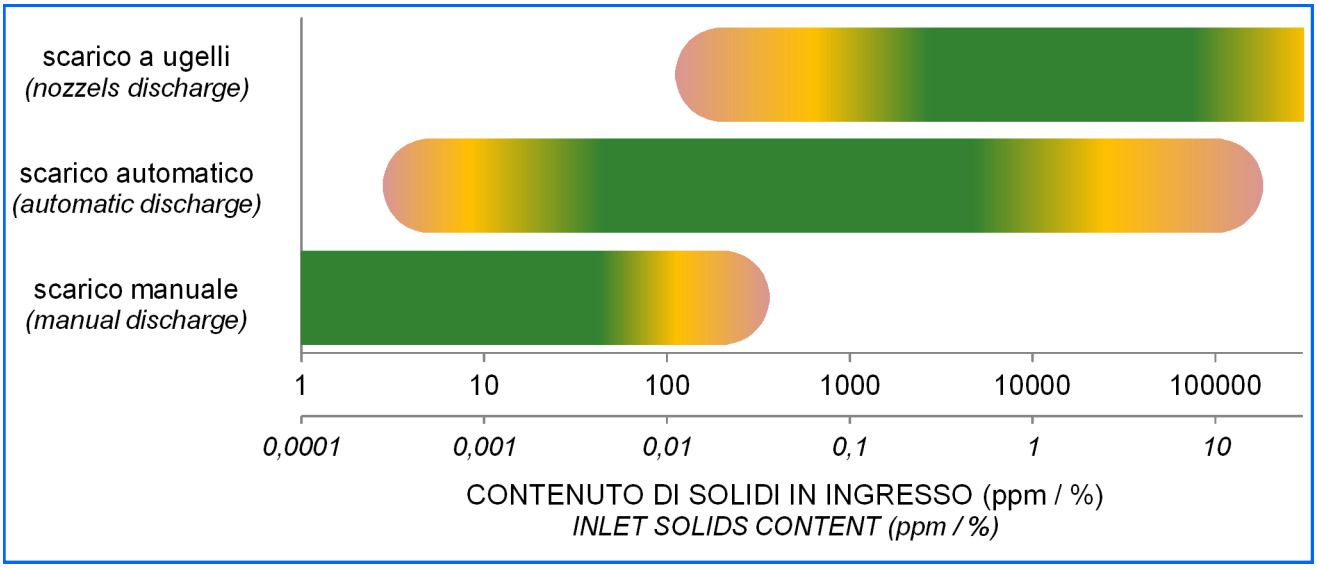
$$\text{Nozzles number} = \frac{\text{Discharge capacity (l/h)}}{\text{Single nozzle capacity (l/h)}}$$

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.

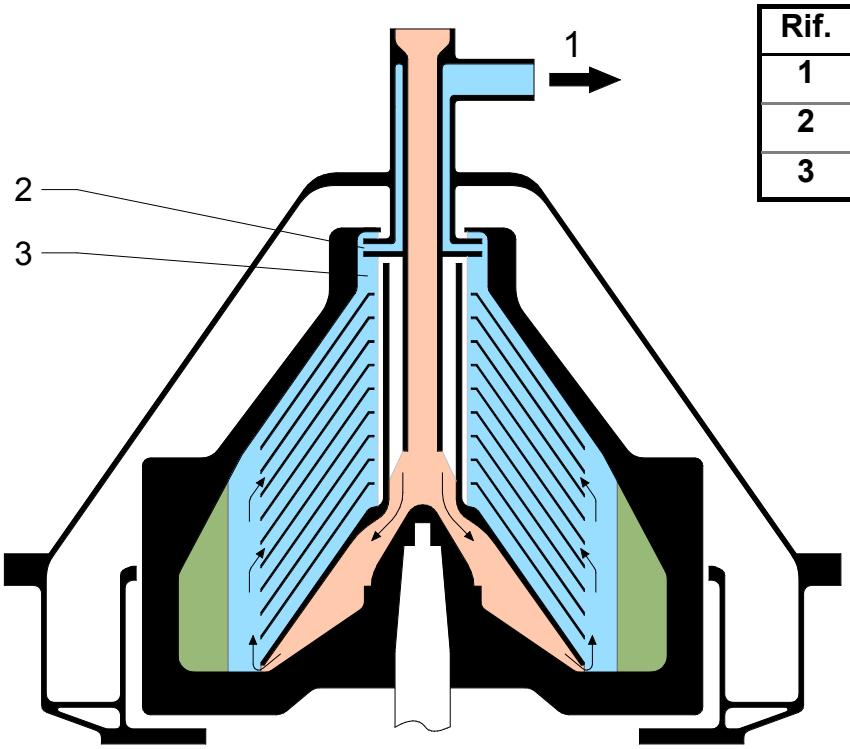


## 2.5 EXTRACTION OF LIQUID PHASES

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*

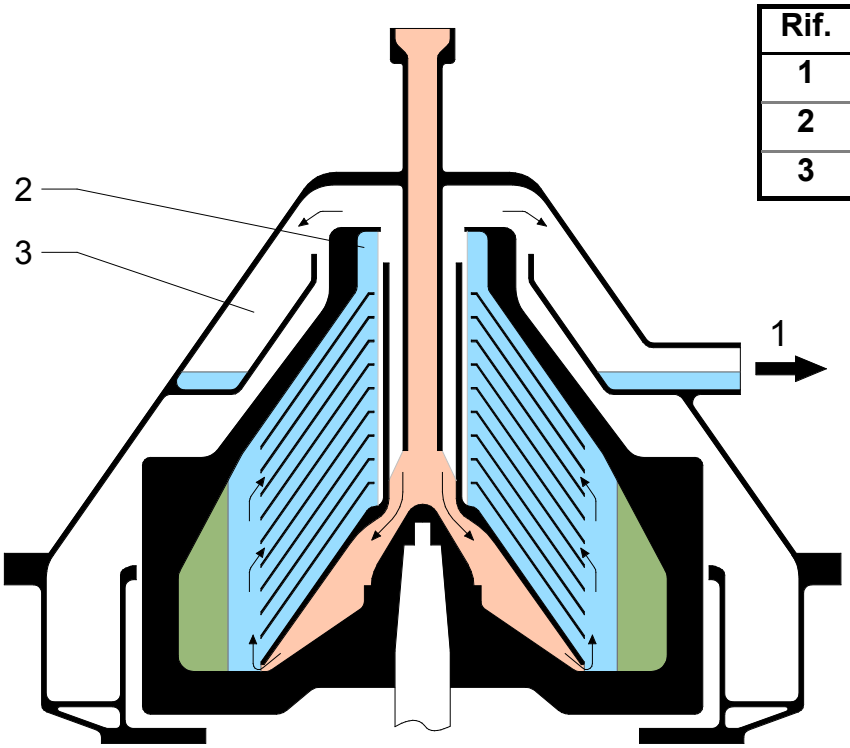
The liquid phase is conveyed to the collecting chamber (Ref.3), extracted by the turbine (Ref. 2), and then send to the product outlet (Ref.1). The turbine is able to provide a variable pressure depending on the model of the centrifuge, on the flow rate and the physical characteristics of the product,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

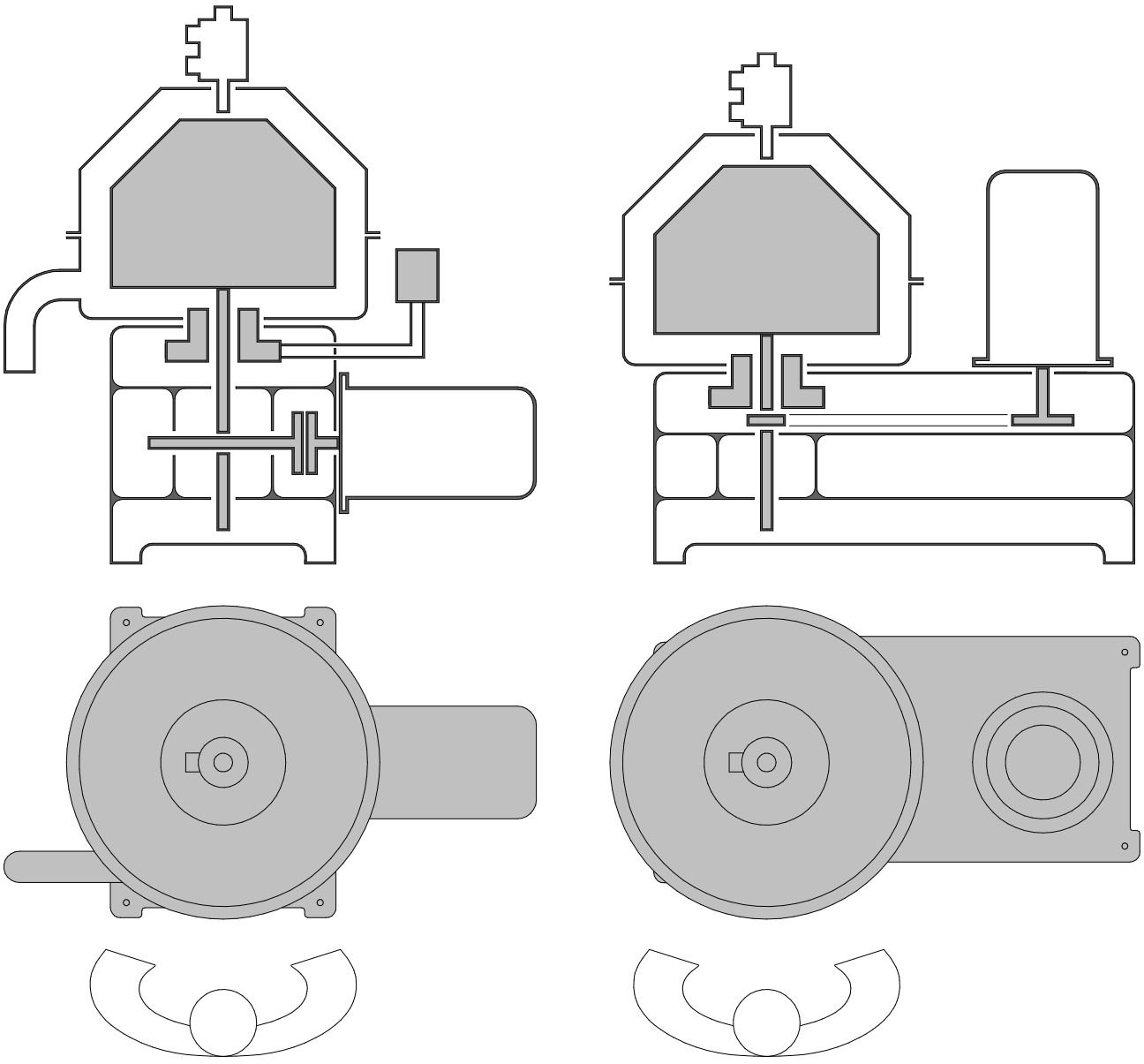
**It is absolutely forbidden to process products having qualities different from those specified in the contract for which the separator is built.**

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.

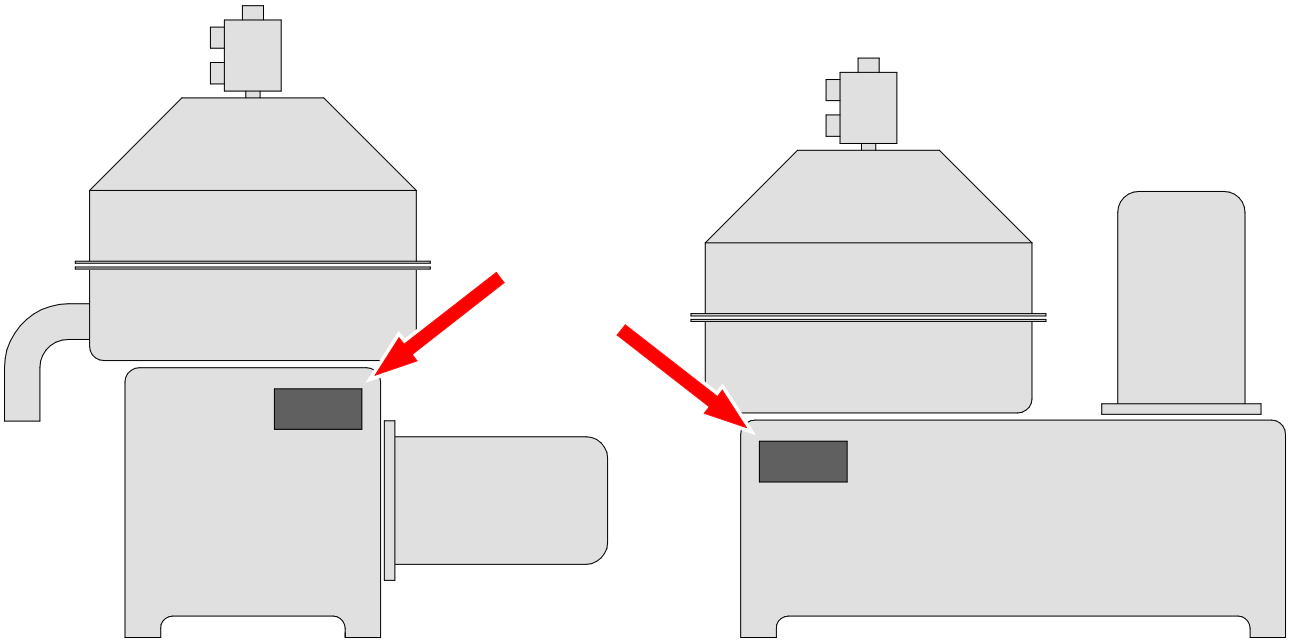
### 3.4 SOUND LEVEL AND VIBRATIONS

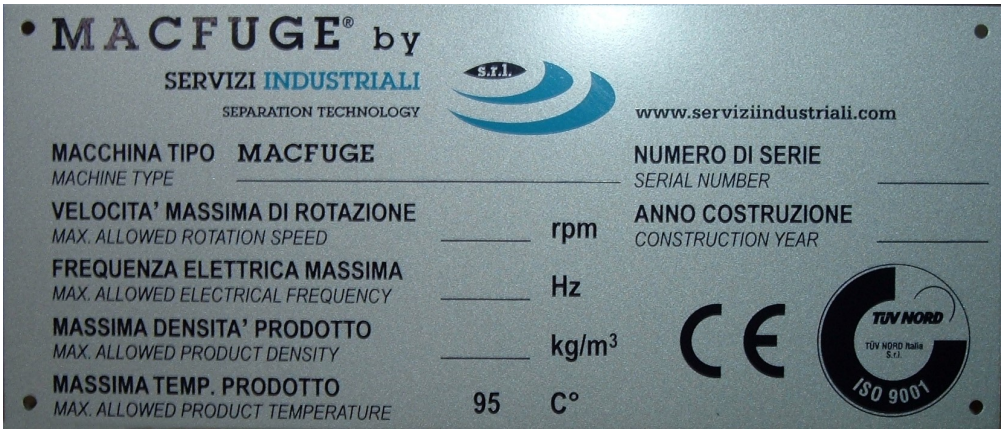
Just after having reached the standard working conditions, far from the start and stop phases, the machine's noise level, measured in an open environment with a phonometer placed 1 meter away from the machine itself, far from echoic surfaces (measured in according to the UNI EN ISO 3746 regulation) less 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.



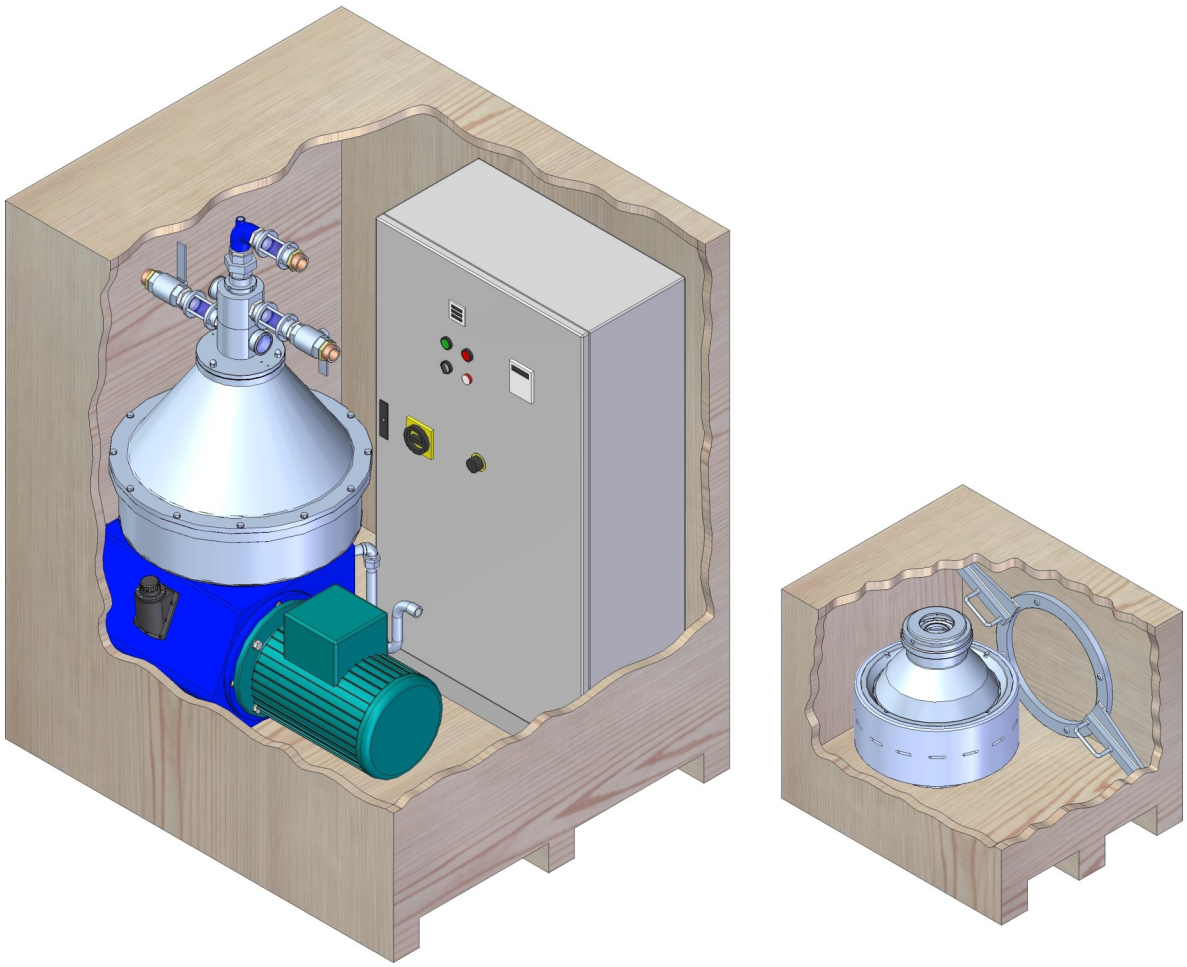


# 4 HANDLING AND STORAGE

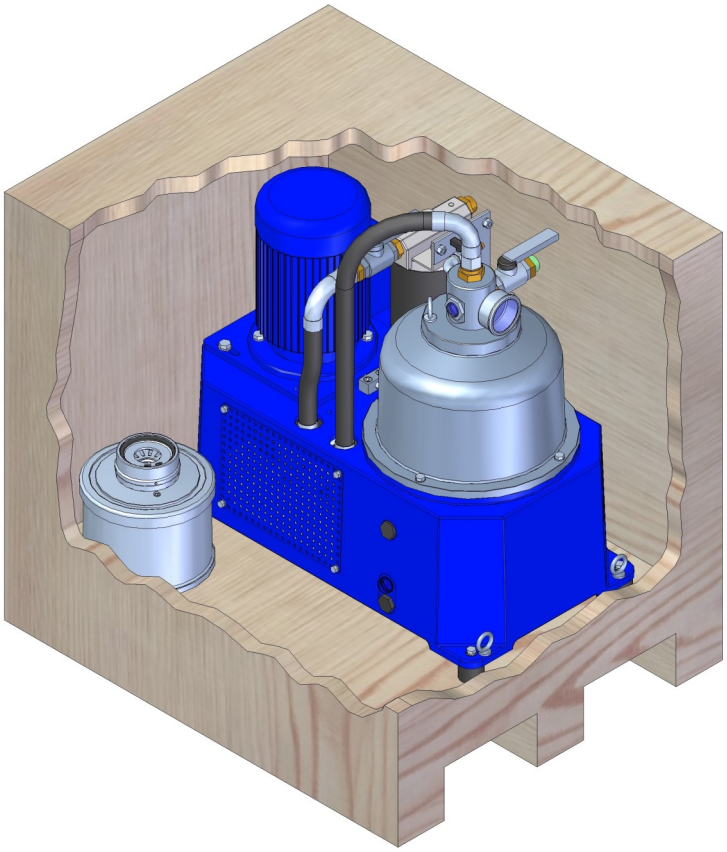
## 4.1 HANDLING

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.

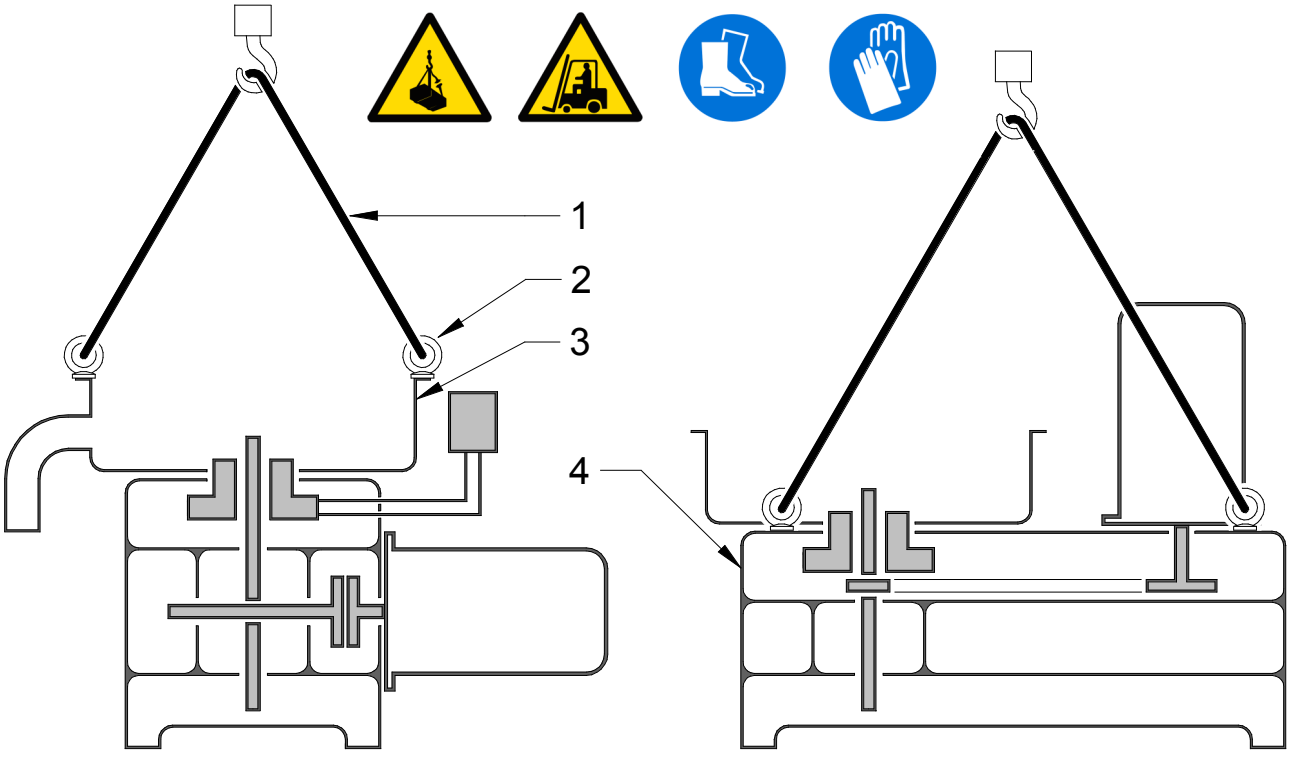


ɜe conditions must be done with adequate tools (forklift) to allow the moving in an easy way that meets safety conditions. Furthermore, the instructions placed on the packaging must be respected.

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

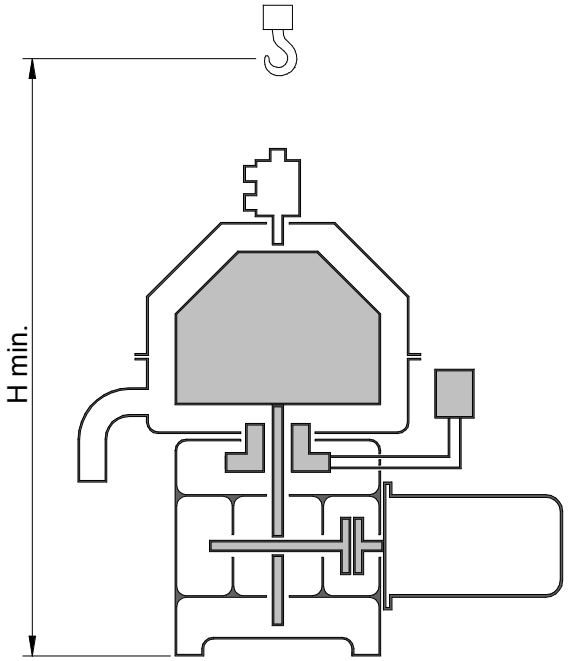
To improve the stability and reduce the potential vibrations to the minimum, the separator must be fastened to the floor or to a metal structure.
For both floor and metal structure fixing, it is necessary to verify that the supporting structure is appropriate to sustain the separator.
The static and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

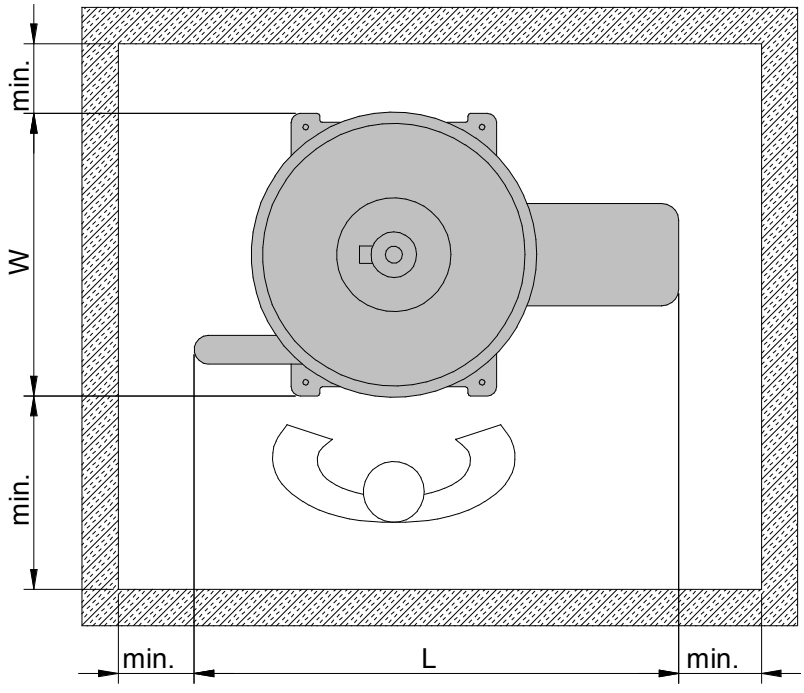
**CAUTION**:
The dynamic charge could be greater than the one indicated in case of unbalanced rotation (for example due to excessive accumulation of solids) or damaged bearings.

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.

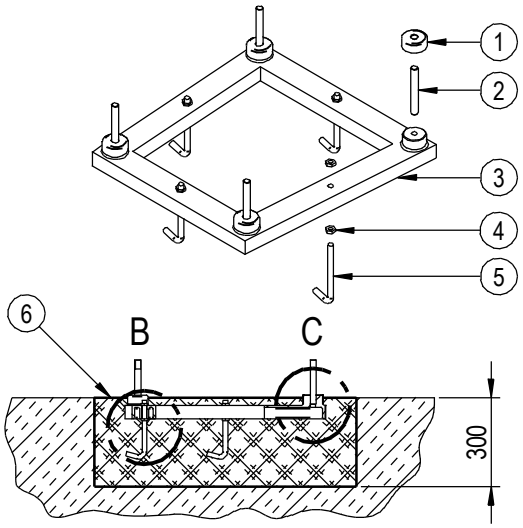


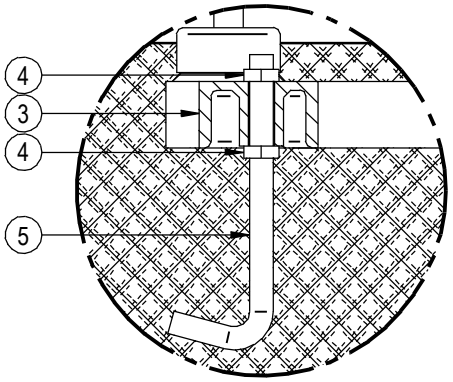
### *5.1.1 CAST FIXING*

The sequence of operations to perform for cast fixing is the following:

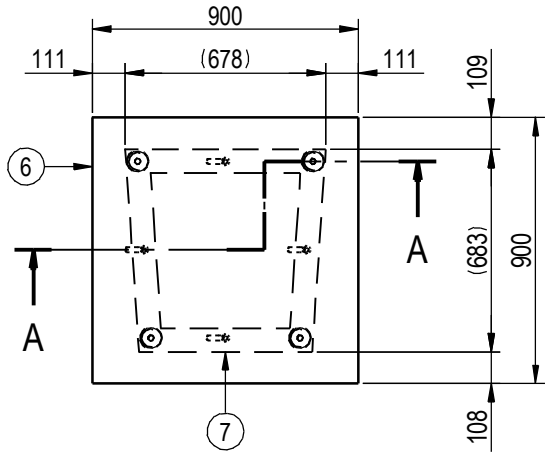
a) choose a place for the separator installation that respects minimum distances;
b) prepare a concrete foundation (Ref.6) with the showed dimensions;
c) fix the four foundation bolts (Ref.5 and Tab.11 Ref.30) to the basement plate (Ref.3 and Tab.1 Ref.30) using the provided nuts (Ref.4 and Tab.11 Ref.29) as shown in detail B. Fix the four studs (Ref.2 and Tab.1 Ref.29) to the basement plate and place the four protections (Ref.1 and Tab.1 Ref.28) as shown in detail C;
d) place the basement plate so that the measures indicated (see also detail C) are respected, considering also the position of the machine front (Ref.7) and controlling the machine leveling with a spirit level;
e) perform the concrete cast making sure that the protections are in contact with the plate

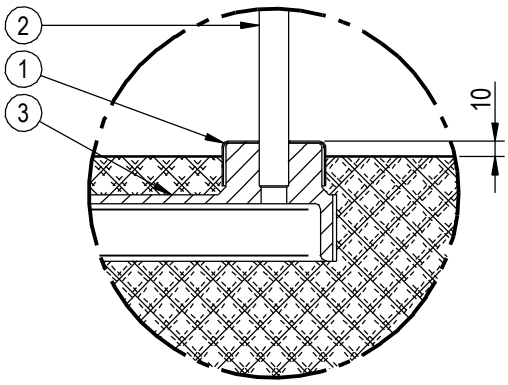



SEC. A-A




DET. B



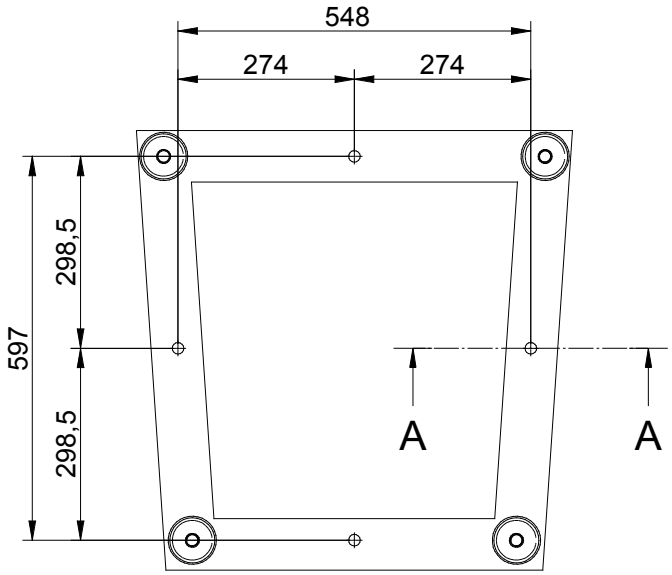



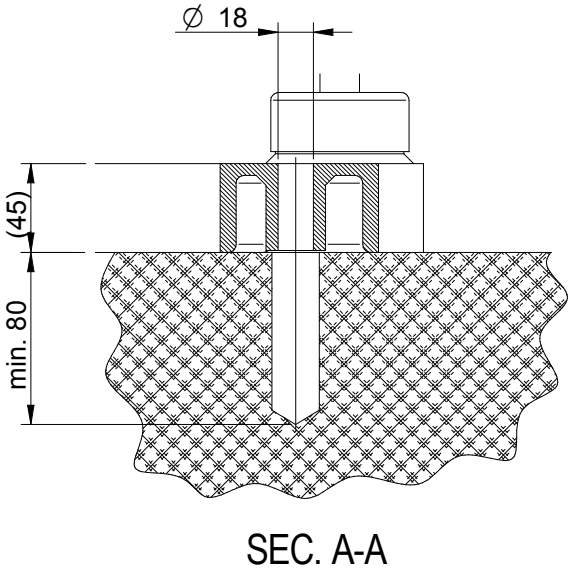

DET. C

### *5.1.2 EXPANSION ANCHOR FIXING*

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

a) choose a place for the separator installation that respects minimum distances prescribed;
b) perform the floor drilling while respecting measures indicated below, that is using the basement plate as drilling scheme;
c) fix the basement plate using adequate expansion anchors.



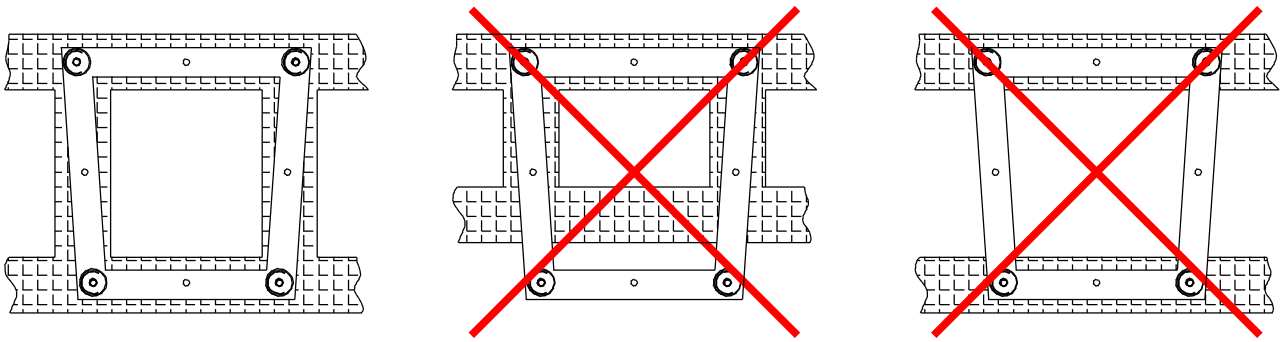

SEC. A-A

### *5.1.3 FIXING TO A METAL FRAME*

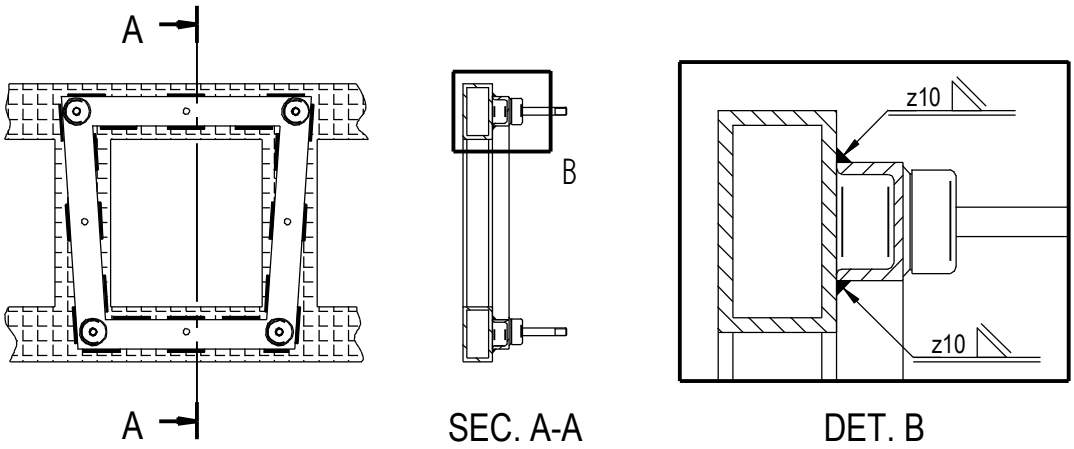
The sequence of operations to perform for the fixing to a metal frame the following:

a) choose a place for the separator installation that respects minimum distances prescribed;

b) place the basement plate on the bearing metal structure so that the four beams forming the plate itself are positioned on the structural parts;



c) weld the basement plate in an homogeneous manner symmetrical to the bearing metal structure , with a total welding length equal at least at 2000 mm; for welding modalities follow indication below.




SEC. A-A DET. B

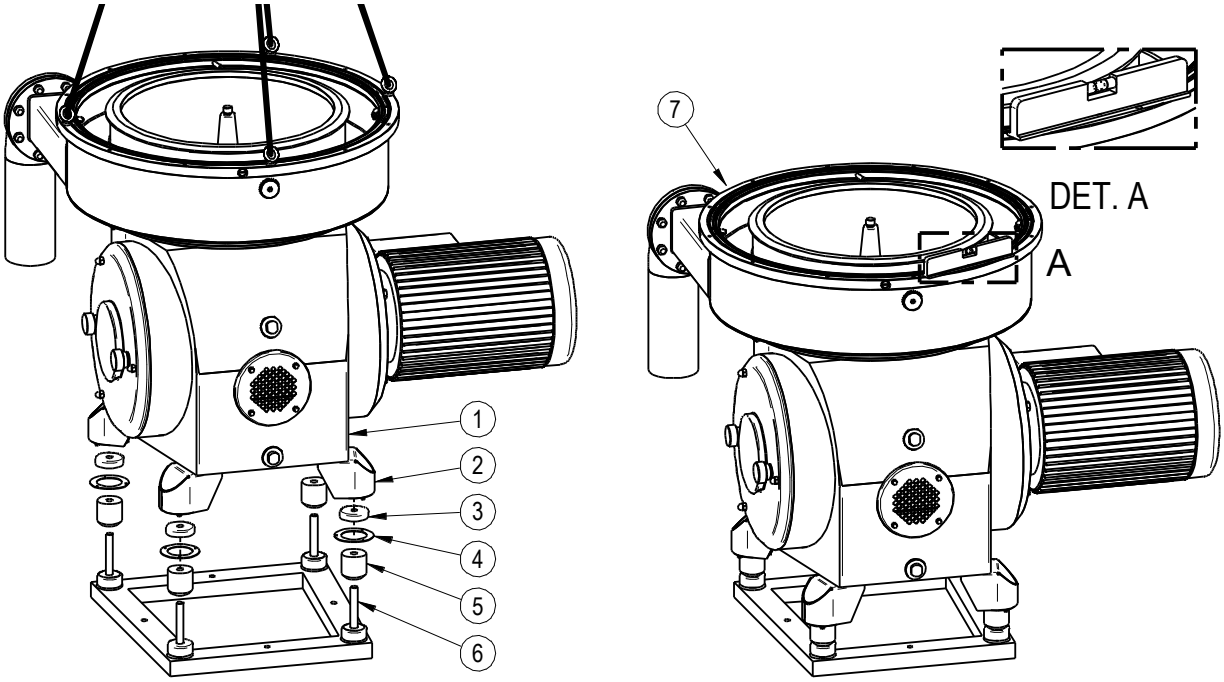
**CAUTION:**

when the machine must be installed on a metal structure, make sure that the metal structure is sufficiently robust and rigid to avoid resonance vibrations generated by excessive elasticity.

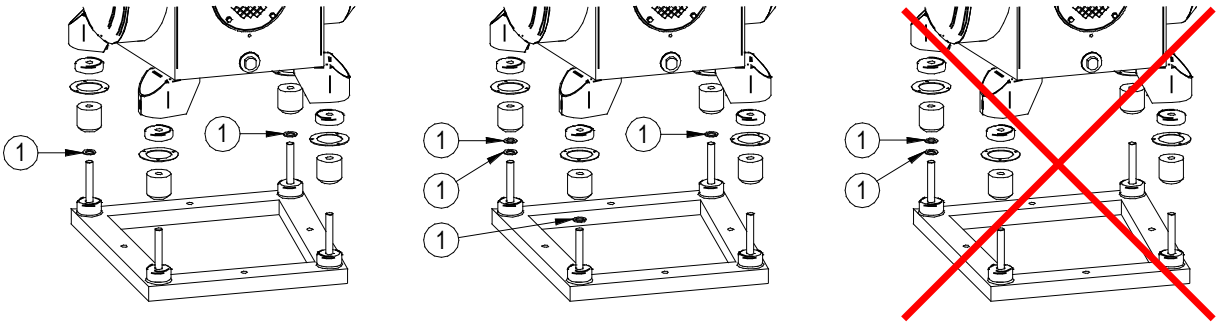
### *5.1.4 MACHINE BASE ASSEMBLY*

To assemble the machine base on the basement plate fixed as described in previous paragraphs, the sequence of operations to attend for each of the four separators feet is the following:

a) Lift the separator and put on the foot (Ref.5) on the prisoner (Ref.6);
b) Put on the shock absorber blockage washer (Ref.4) on the foot;
c) Overlap the shock absorber (Ref.3) to the foot;
d) Lift the separator and place the machine base (Ref.1) so that the shock absorbers are places in their corresponding seats in the legs (Ref.2);

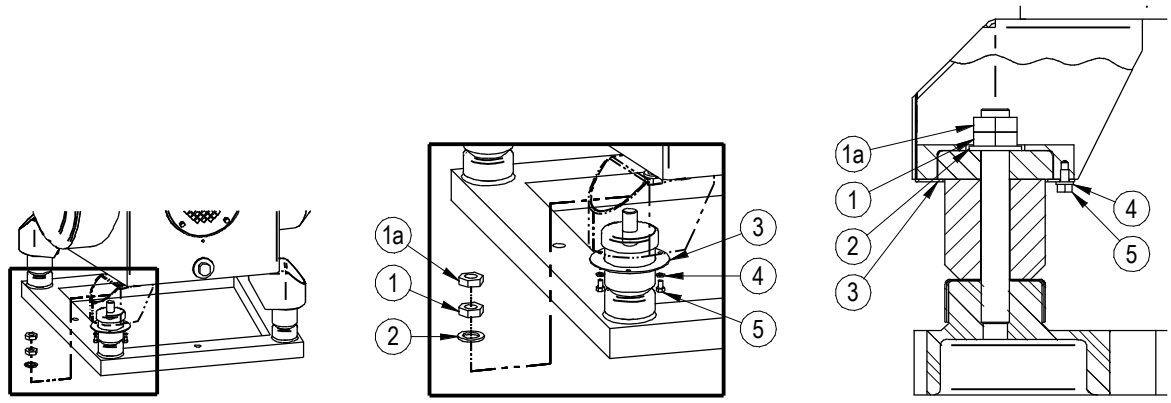



washers provided (Fig.17), inserting them between the feet and the protections; in this case the washers must be placed in an homogeneous and symmetrical manner as shown in the examples of Fig.17. After verifying the separator's leveling, permanently remove the lifting tools (eye-bolts and ropes or chains);



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

f) put on the flat washer (Ref.2) on the prisoner, while verifying that they are on the shock absorber, tighten the first nut (Ref.1) to block the shock absorber without excessively deforming it;
g) block the first nut (Ref.1) with the second nut (Ref.1a);
h) fix the shock absorber blocking washer (Ref.3) with the appropriate washers (Ref.4) and screws (Ref.5).




## 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 LUBRIFICAZIONE*

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.

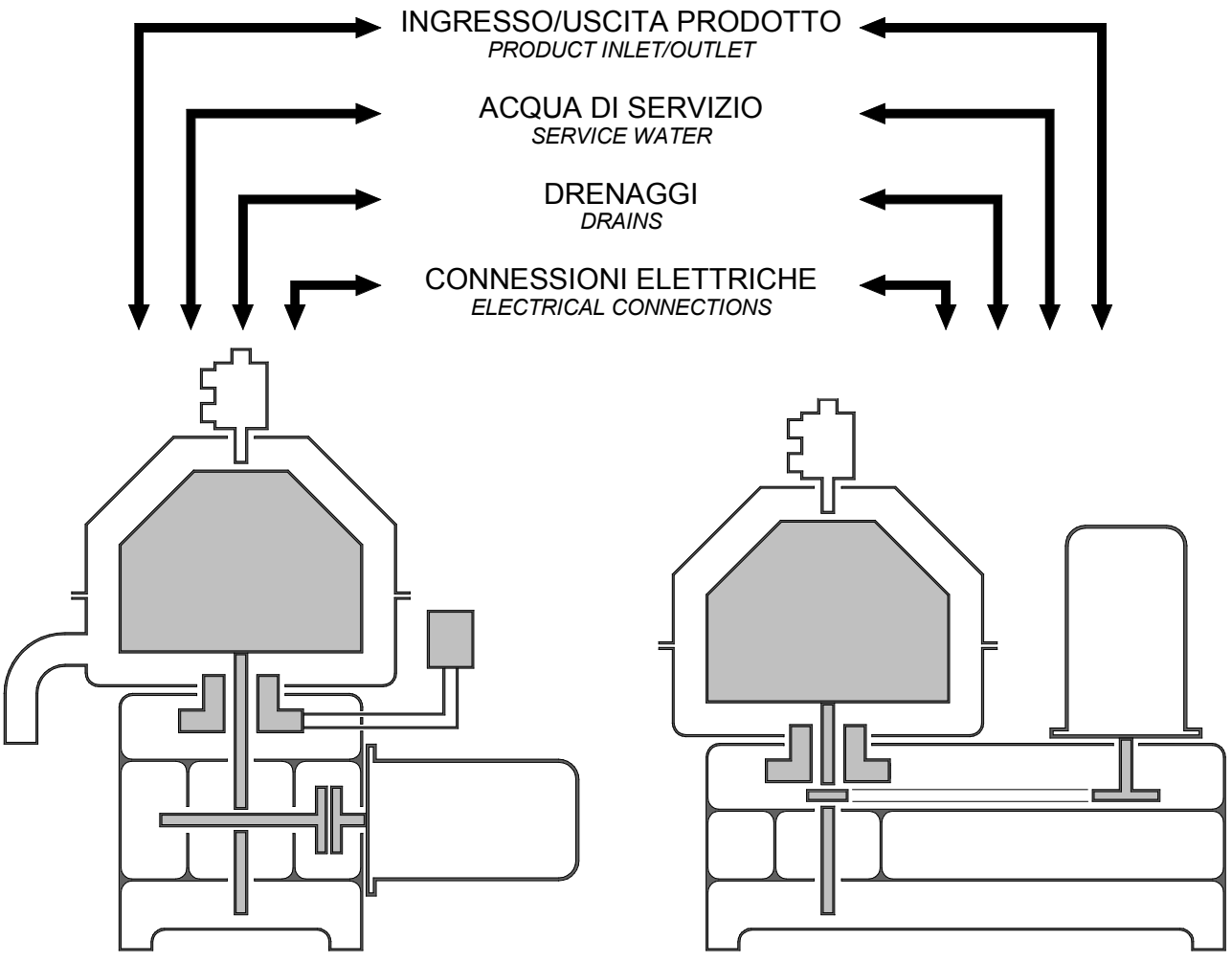
## 6 CONNECTIONS

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.

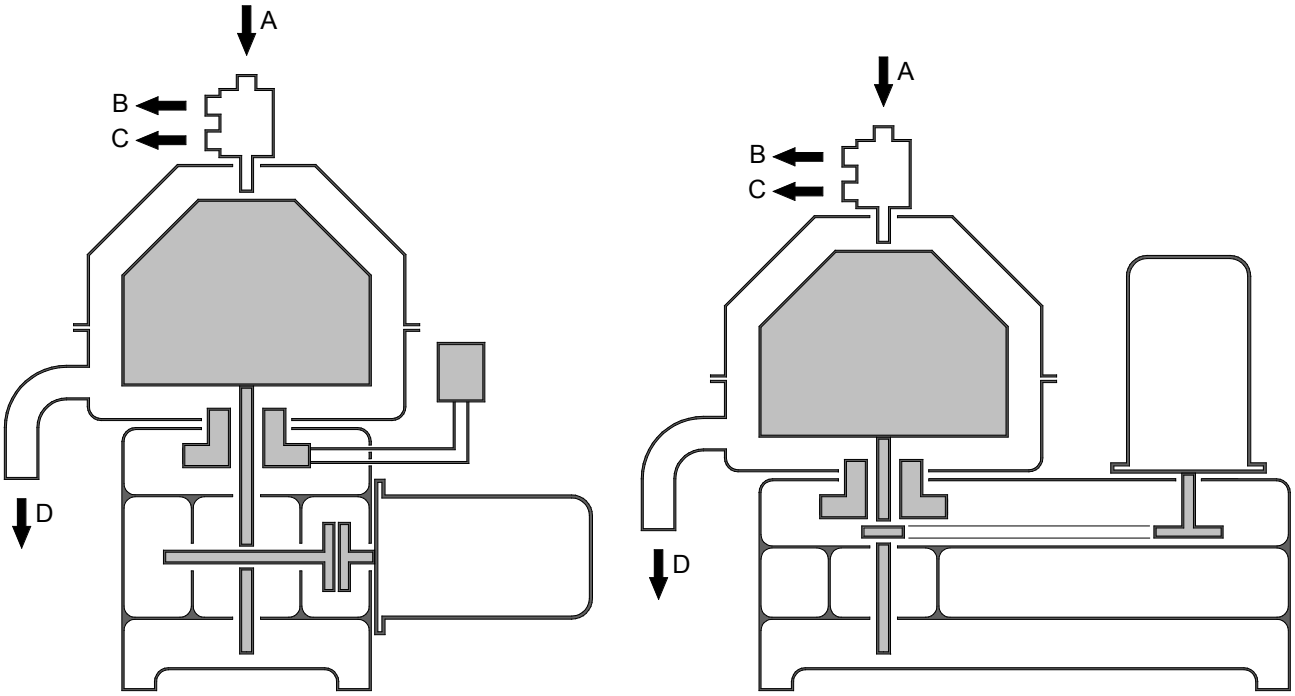
Le connections that have to be done are showed in the following picture.

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:

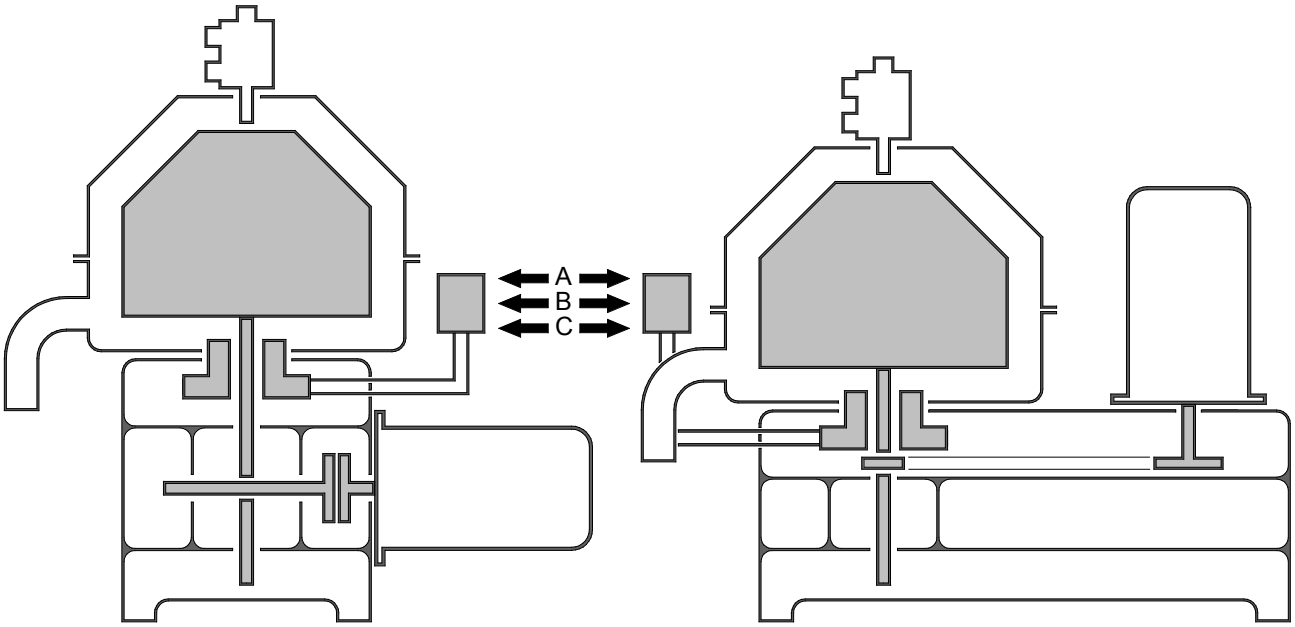
- must be provided with a safety drainage system placed at a lower level than the machine's outlet to guarantee that an unexpected discharge accumulation reaches the rotating parts inside the centrifuge;
- if it is a covered tank must have a total volume increased by 100% compared to the volume of solid 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.




| 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:

- the water must be clean, in particular, it must not contain solid particles in suspension;
- must have a hardness of less than 22 ° f in order to reduce at minimum the limescale deposits that may interfere with the automatic discharge system;
- 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;
- must not be demineralized.

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:

| consumo acqua di sacca (l/h) = 1,5 * volume camera fanghi (l) * frequenza scarichi (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:

- the water must be clean, in particular t must not contain solid particles in suspension;
- 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.

### *6.2.3 ACQUA RAFFREDDAMENTO*

L'acqua portata a questo ingresso viene utilizzata per le seguenti funzioni:

- raffreddare il carter (linea di raffreddamento);
- Evitare innalzamento della temperatura dell'olio e del gruppo collare (linea di raffreddamento).

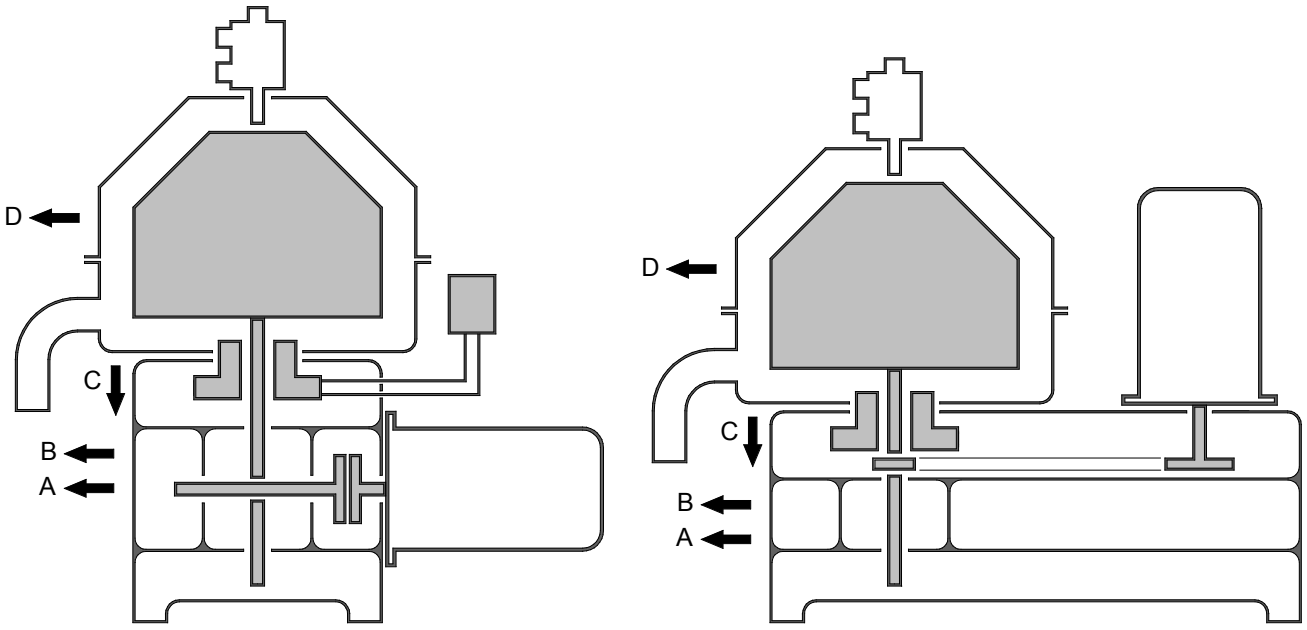
Deve soddisfare i seguenti requisiti:

- deve essere pulita, in particolare deve non contenere particelle solide in sospensione;
- deve essere fornita con una pressione di 1,5÷5 barg;
- deve essere fornita fresca per svolgere al meglio la funzione di raffreddamento.

Nessuna delle funzioni sopra descritte è strettamente necessaria, l'opportunità dell'utilizzo dipende dalla natura del prodotto e dalle condizioni operative. Il consumo può quindi essere nullo, nel caso in cui non sia necessario utilizzare alcuna delle funzioni previste, fino ad massimo indicativo di 10 l/h. L'acqua della linea di raffreddamento confluisce nel drenaggio catino, l'acqua del dispositivo ermetico confluisce nella linea di uscita della fase pesante.

## 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*

I drenaggi di sicurezza servono a consentire il deflusso di acqua di servizio e del prodotto in caso di tracimazioni dovute a malfunzionamenti o errate manovre, allo scopo di garantire la sicurezza ed evitare danni di maggiore entità alla centrifuga anche nelle suddette evenienze. In particolare servono ad evitare che l'acqua di servizio e il prodotto eventualmente tracimati vengano contatto con le parti rotanti o possano raggiungere il carter contente l'olio di lubrificazione. Per i motivi di cui sopra, in condizioni di lavoro regolari, dai drenaggi di sicurezza non deve uscire ne acqua ne prodotto, eventualmente solo condensa. I drenaggi di sicurezza relativi al catino e alla copertura sono presenti solo su alcuni modelli di centrifuga.

**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).

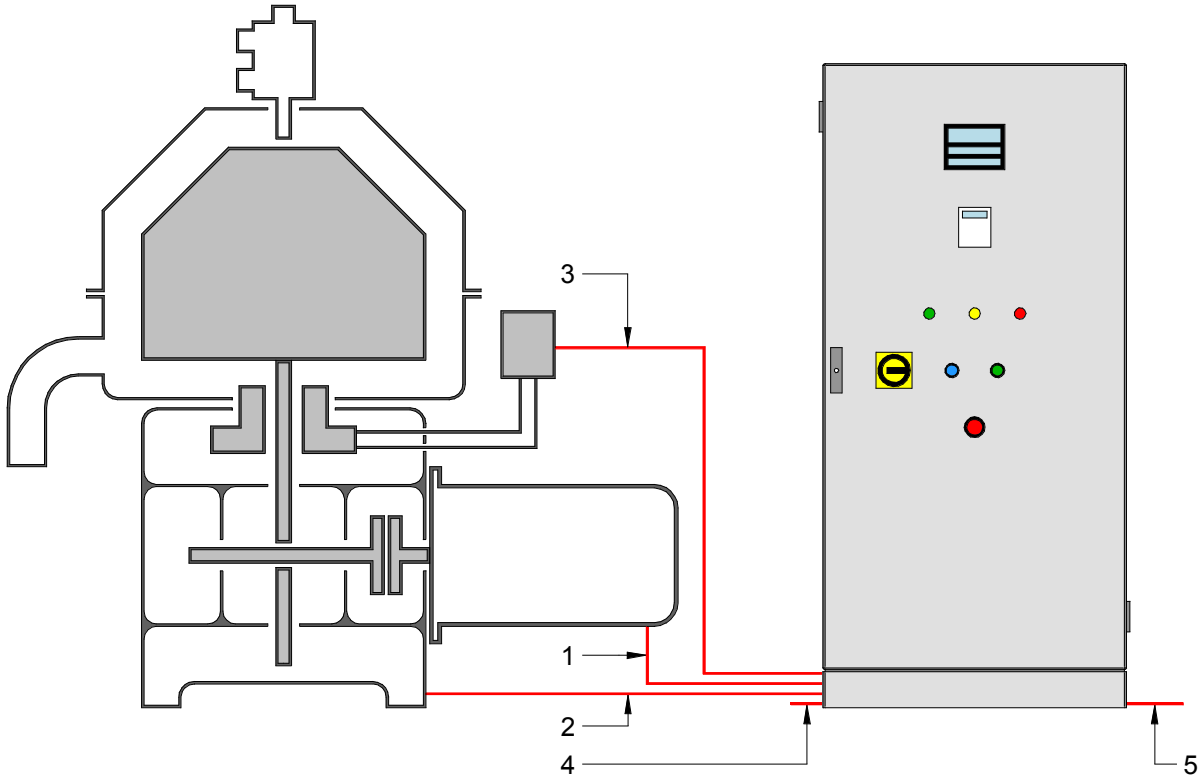
The electrical connections must be made exclusively by professional electricians able to perform a professional job and release a certificate of suitability of the connection certifying that the connection is made in compliance with the norms in force on the matter (2006/95/CEE Directive concerning low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

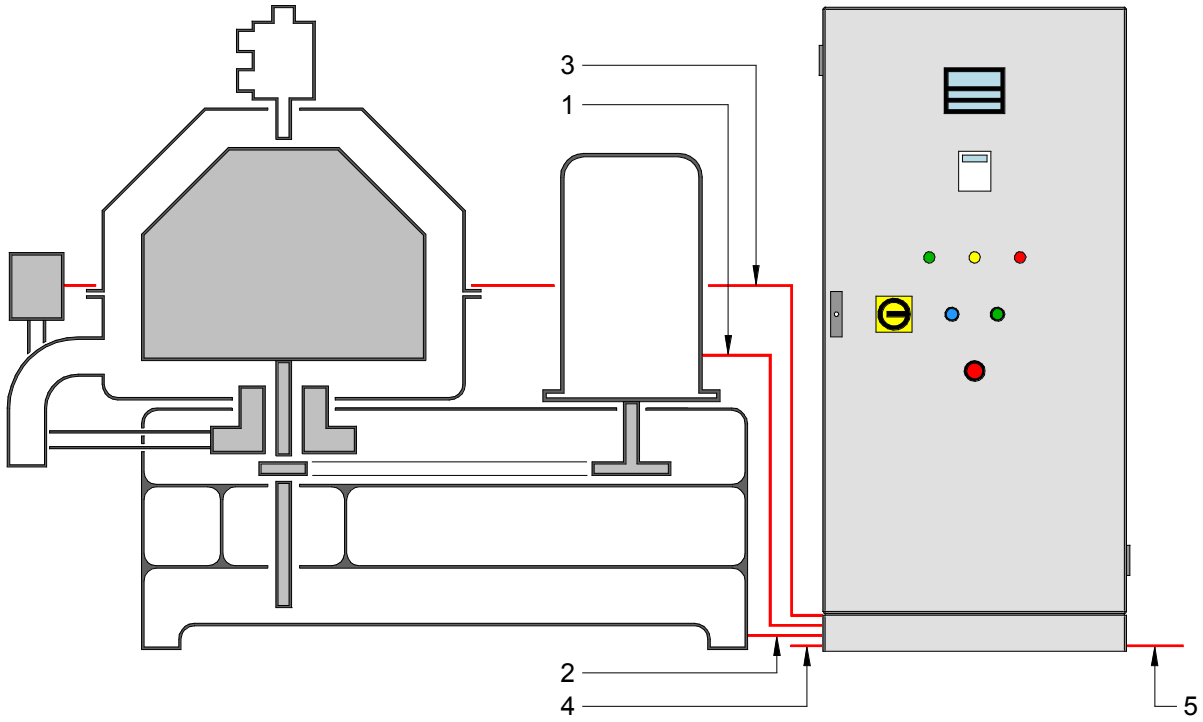
Before performing any electrical connection, always verify the absence of voltage in the equipment on which you intend to work and verify that voltage cannot be accidentally, or intentionally, transmitted to this equipment by third parties.

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.

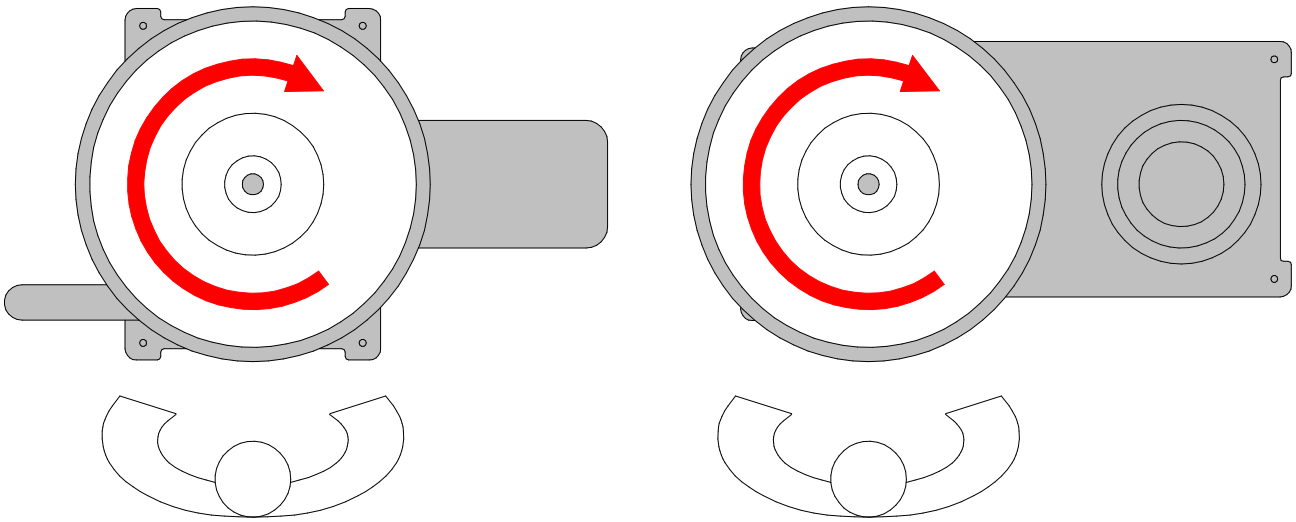
Connect the ground connection of the centrifuge to the electrical panel, for the location of the connection point on the centrifugal refer to All.A2.

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.



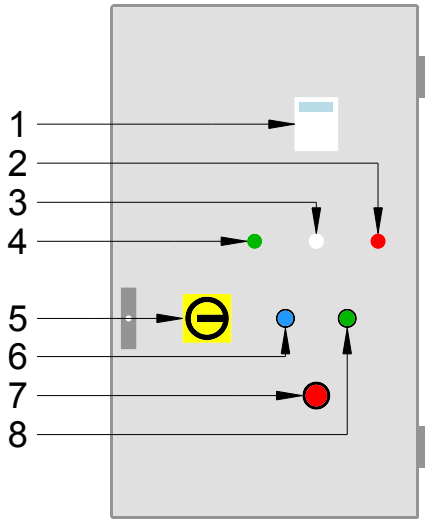
# 7 USAGE AND FUNCTIONING

The centrifuge described in this manual is a self cleaning separator with manual discharge, the heavy and light phases are extracted by means of turbines, the transmission is with mechanical gears. 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 (All.B) any change and / or implementations.




| Rif. | Descrizione |
|---|---|
| 1 | Control panel and display of the frequency converter |
| 2 | Alarm signal |
| 3 | indicator of voltage presence |
| 4 | indicator centrifuge in operation |
| 5 | General switch |
| 6 | Start button |
| 7 | emergency stop button |
| 8 | Stop button |

The frequency converter is delivered with the parameters already set. The factory parameters relating to the converter are shown in All.F1,

**DANGER:**
it is forbidden to the user to modify the operating parameters of the frequency converter without the consent of Industrial Services Srl

## 7.2 STARTING

**DANGER:**

before starting the centrifuge verify that:

- the bowl is mounted correctly, in particular that locking nut is screwed on correctly (see Chapter 10);
- The covers are mounted correctly (see Chapter 10);
- The centrifuge is mounted correctly (see Chapter 10);
- The electrical connections are made correctly (see Chapter 6);
- The bowl is full of water (see Chapter 6);
- do not let the centrifuge rotation in vacuum for more than half an hour.

**CAUTION:**

before starting the centrifuge verify that:

- the connecting pipes are fitted correctly;
- check that the position of the regulating valves and any shut-off valves is that destre
- Also verify that the necessary utilities (see Section 6) are available.
- Once you have checked all of the above you can start the centrifuge:

a) **Fill the bowl completely (see Chap.6)**;
b) **supply voltage to the control panel to the main switch**: the presence of white light voltage turns on, the frequency converter is in tension.
c) **Press the start button**: the motor is powered and controlled by the frequency converter, the green light on the control panel lights up. The starting time is a parameter setting of the frequency converter (see All.F1).
d) **check the direction of rotation of the motor (see Chap.6)**: interrupt the starter in the case where the direction of rotation were to be wrong
e) **supervise the centrifuge during the starting phase**: interrupt the starter in case of malfunctions (high vibrations, unusual noise, etc..);
f) **feed centrifuge with the product**: see note.
g) **verify the operating conditions of the centrifuge**: in particular the electric absorption and the discharge pressure of the turbine.

*Note: If the centrifuge is supplied complete with feed pump above the pump will start automatically at the end of goodwill or by switch or button start / stop, see the enclosed wiring diagram (All.B).*

## 7.3 STOP

**DANGER:**
before starting any maintenance operation ensure that all moving parts have completely still.

**DANGER:**
the centrifuge coasts to a stop, the minimum time required is specified in the data sheet of the centrifuge (see Chapter 8).

Stop the centrifuge, using the following steps:

a) **stopping the power supply of the centrifuge**:
b) **perform at least one sequence of washing in line**: for the description see Chap.10
c) **Press the stop button**: the motor is powered and controlled by the frequency converter. The stopping time is a parameter setting of the frequency converter (see All.F1).
d) **supervise the centrifuge during the stop phase**;
e) **visual access to a complete stop engine**;
f) **remove power from the panel the main switch**: switch off the panel only once the stop phase, the presence of white light voltage is turned off.

The alarms that put spin on the state of STOP depend on the configuration and the installed add-ins (see All.C2 All.B and wiring diagram).
The alarms that put spin on the state of STOP are at least the following:

- alarm from the frequency converter;
- high vibration (if applicable).

**DANGER:**
*the alarm high vibrations during the phases of starting and stopping may not be active, in each case it is compulsory supervise the centrifuge during such phases as described in section 7.3 and Par.7.2.*

## 7.4 SETTING THE CENTRIFUGE

The result of the separation depends on several factors, the most significant are the following:

- flow rate: a reduction of the flow rate improves the result of the separation as it increases the residence time of the product in the field of centrifugal forces generated from the centrifuge;
- difference between the density: the greater the difference between the density of the heavy phase and that of the light phase and / or the difference between the density of the solid phase and that of the liquid phase, the easier is the separation and thus the better the result;
- viscosity: the lower the viscosity of the liquid phase, the higher the speed of sedimentation and thus the better the result;
- temperature: a temperature increase usually results in a reduction in viscosity and therefore an improvement of the result;
- composition of the product: the separation of two liquid phases is easier if one of the two liquid phases appears to be mainly in the percentage composition of the product;
- particle size of the solid phase: the larger the size of the particles constituting the solid phase and the more their spherical shape, the greater the speed of sedimentation and thus the better the result.

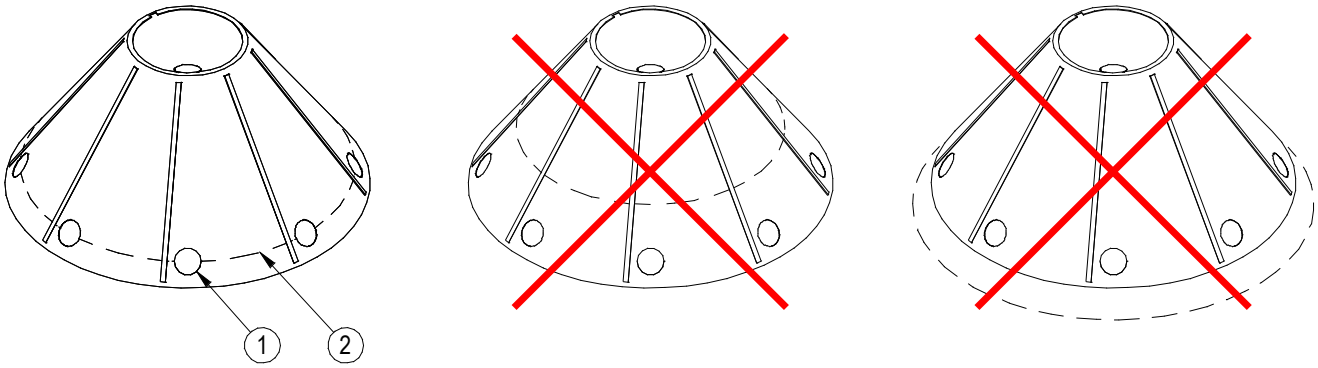
The following table shows some values that correlate the features above with the result of the separation. The values shown are indicative only, for a more detailed assessment and performed taking into account other parameters such as the required flow, the separation efficiency waiting, etc.., Please contact Servizi Industriali S.r.l.

| CHARACTERISTICS THAT AFFECT THE RESULT OF SEPARATION | | | |
|---|---|---|---|
| **Description** | **U.M.** | **Easy separation** | **Difficult separation** |
| **Difference between the densities** | ratio light / heavy | <0,85 | >0,95 |
| **kinematic viscosity** | cSt | <4 | >40 |
| **Composition of the product** | % - % | 5% - 95% | 50% - 50% |
| **Particle size of solids** | um | >50 | <5 |

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

### *7.4.1 SETTING OF SEPARATION*

The product feed to the centrifuge, with reference also to figure referred to in the following pages, is conveyed up to the stack of conical discs, inside which the separation occurs. To obtain the best separation efficiency of the interface that is formed between the two liquid phases (Ref.2), conventionally called "parting line", must be in correspondence with the holes of the conical discs (Ref.1).

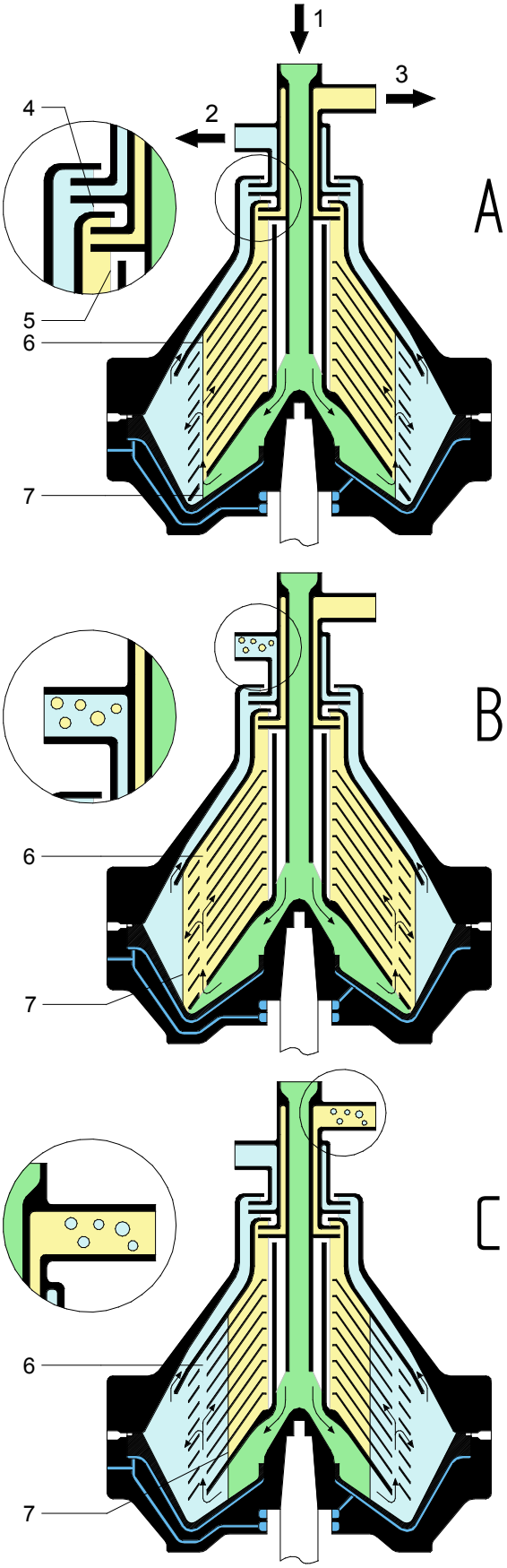



The position of the separation line in static conditions, ie in the absence of flow of product within the drum, depends only on the ratio between the densities of the two liquid phases and their level inside the drum, in particular:

- an increase in the density of the heavy phase causes a displacement of the separation line toward the axis of rotation;
- an increase in the density of the light phase causes a displacement of the separation line to the periphery of the bowl;
- an increase in the level of the heavy phase, ie a level approaching the axis of rotation, determines a shift of the separation line toward the axis of rotation;
- an increase in the level of the light phase, ie a level approaching the axis of rotation, determines a shift of the separation line to the periphery of the drum.

In dynamic conditions, ie in the presence of flow, and in particular with high flow rates or in the presence of fluids with high viscosity, the position of the separation line may significantly differ from that calculated theoretically.
The best separation efficiency is achieved if the separation line is located in the holes of the discsconical (Ref.A), otherwise you may encounter the following two cases:

- if the separation line is shifted towards the periphery of the drum will be present, in the centrifuge outlet, in the light phase heavy phase (Ref.B);
- if the separation line is shifted towards the axis of rotation will be present, in output to the centrifuge, heavy phase in the light phase (Ref.C).




| Ref. | Description |
|---|---|
| 1 | Feed product |
| 2 | Output heavy phase |
| 3 | Output light phase |
| 4 | Level of the heavy phase |
| 5 | Level of the light phase |
| 6 | Position of the holes on the disk |
| 7 | Separation Line |

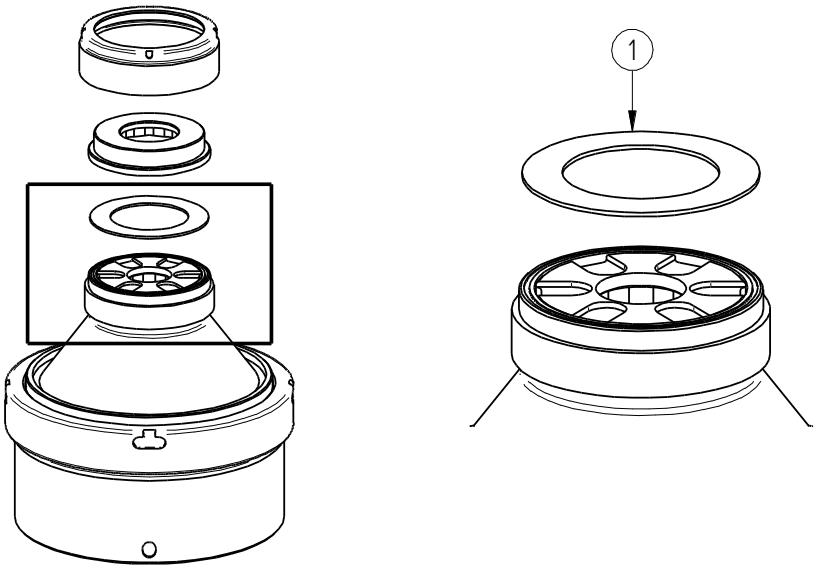
Usually in a process of separation is considered binding the degree of purification of one of the two phases, it is therefore convenient to adjust the position of the separation line in such a way as to have residual traces of the phase useful in that not useful, in order to ensure the better purification of the useful phase. For the positioning of the adjustment line is possible to intervene on the following parameters:

- diameter of the adjusting ring;
- delivery pressure of the turbine.

The choice of the adjustment system most suitable depends on various factors described below.

**Adjustment by adjusting ring**.

The level of the light phase, if we exclude the possibility of modifying it by adjusting the delivery pressure of the turbine as shown on the next point, is fixed. The level of heavy phase can be set by means of the adjusting ring (Ref.1).



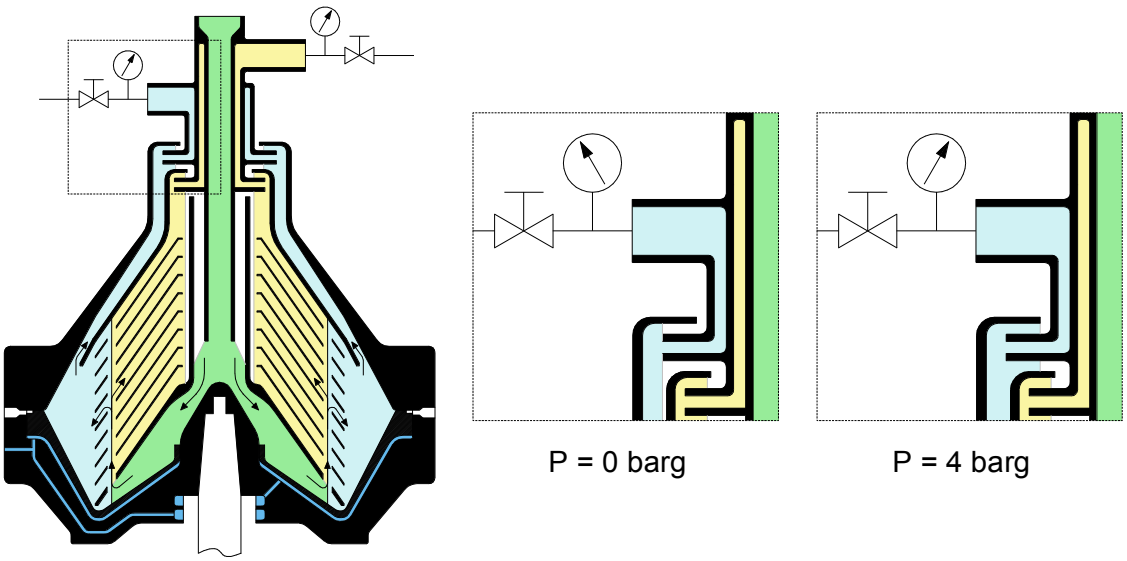

The centrifuge is supplied with a series of adjustment rings with diameters of passage, and consequent levels, different. The above-mentioned series of rings adjusts the centrifuge for different ratios between the density of the light phase and that of the heavy phase. A first assessment of the adjustment ring can be made suitable by means of the diagram shown in the technical details of the centrifuge (see Chapter 8), in function of the ratio between the densities of the two phases. It may be a need to refine the selection on the basis of the experimental results the following:

- in the case of light phase in the heavy phase will be necessary to choose a ring with a diameter of passage minor;
- in the case of heavy phase in the light phase will be necessary to choose a ring with a diameter of larger passage.

The adjustment by means of the adjusting ring is not changed during the process, it is in fact necessary to stop the centrifuge and perform a partial disassembly of the drum to be able to replace. This method of adjustment is therefore inconvenient in the case in which the characteristics of the product in power (absolute flow rate, relative flow of the two phases, the physical characteristics of the product, etc.), Are variable. can still choose a control loop average and perform any fine tuning adjustment to changing process conditions during the process, by means of adjusting the delivery pressure of the turbines.

**Adjustment by the discharge pressure of the turbines.**

On each output line of the purified liquid phases is possible to install a control valve. Closing or opening these valves it is possible to modify the load loss undergone by the liquid flow which passes through them, and then change the pressure that must be generated by the turbine. By varying the pressure required to the turbine varies the level of immersion of the same, or the level of the phase involved, as illustrated in the general example.




The setting of the pressure can be carried out during the process, you can then adjust the configuration of the pressure to any changes during the process of the characteristics of the product or process. The adjustment made in this way is sensitive to any changes of pressure downstream of the output lines of the product. The pressures to be generated by the turbines depend on the course that must be processed and the physical characteristics of the product, the indicative values are given in the data sheet of the centrifuge (see Chapter 8).

### *7.4.2 MANUAL DISCHARGE OF SOLIDS*

The solid phase collected in the sludge chamber must be periodically removed (see Par.2.4.1). The time interval between one cleaning and the next must be such as to ensure that the sludge chamber does not arrive to never complete filling during use. The available volume is specified in the data sheet of the centrifuge (see Chapter 8).

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

# 8 TECHNICAL DATA SHEET

## 8.1 CENTRIFUGE CONFIGURATION

| | |
|---|---|
| Model | MACFUGE 107 BD M 3 S A |
| Configuration | Separator |
| Solid phase discharge | Manual |
| Light phase outlet | With turbine |
| Heavy phase outlet | With turbine |
| Motion transmission | With gear |

## 8.2 TECHNICAL DATA

| Description | u. m. | - |
|---|---|---|
| Product maximum capacity of biodiesel* | l/h | 40000 |
| Bowl volume | litri | 70 |
| Sludge chamber capacity | litri | 24,5 |
| Bowl rotational speed | rpm | 5130 |
| Motor power | kW | 30 |
| Tension/Phases/Poles | V/-/- | 400/3/4 |
| Max. frequency of electrical supply (motor) | Hz | 57 |
| No-load absorption | A | ~24 |
| Absorption at 40000 l/h capacity | A | ~41 |
| Starting time | sec. | 900 |
| Stop time | sec. | 900 |
| Product inlet min. pressure | barg | 0 |
| Light phase turbine max. pressure** | barg | 3 |
| Heavy phase turbine max. pressure** | barg | 4,5 |
| Product max. temperature | °C | 95 |
| Product max. density | $kg/m^3$ | 1200 |
| Solid phase max. density | $kg/m^3$ | 2000 |
| Max. noise level | dB(A) | 84 |
| Lubricant oil volume | l | 7,5 |
| Bowl weight | kg | 620 |
| Bowl and separator weight*** | kg | 2150 |

**: the effective operational capacity depends on the product be processed, its features at the inlet, the separation level required and other processing parameters such as temperature, for example.*

***: the maximum pressure that can be supplied by the turbine is approximate as it depends on the physical features of the product and the requested flow rate.*

****: with 245 kg motor.*

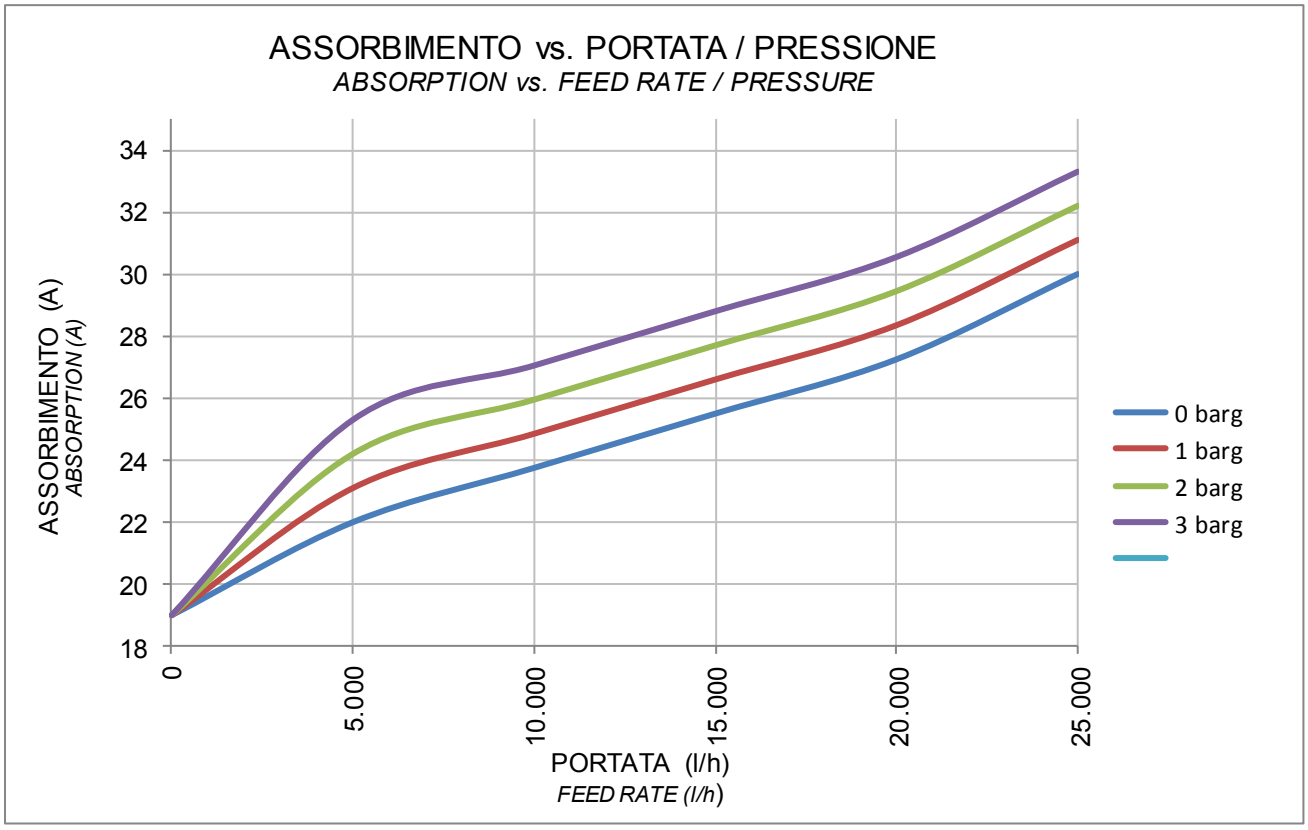
## 8.3 ELECTRICAL ABSORPTION

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 = 830 kg/m$^3$;
viscosity = 4 cSt.

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SEPARATION TECHNOLOGY
s.r.l.

## 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<br>Att.B |
| | Electrical motor or frequency convertor failure. | See attached guides | Att.E<br>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<br>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<br>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<br>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<br>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<br>Par.6.2.2<br>Cap.7<br>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<br>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<br>Cap.7 |
| | The solids inlet are higher than expected | Increasing the frequency and / or volume of discharges, reduce the flow rate. | Par.2.4<br>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.

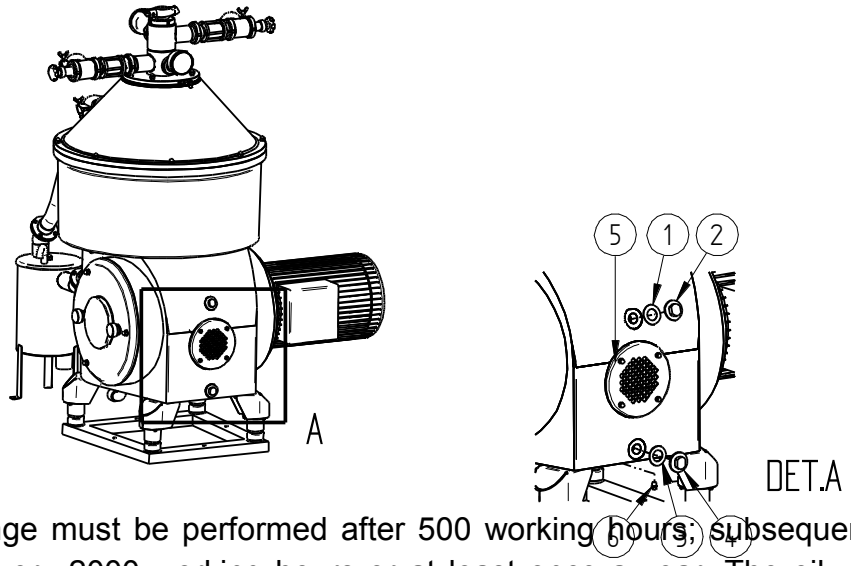
The final pages of the manual (chapter 15) include a table, named "Summary of maintenance" to describe and record the tasks performed on the machine. It is mandatory to anyone to execute, being local personal or staff of Servizi Industriali, a significant intervention on the machine, including routine 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 involves the following operations (refer to Fig.56):

a) remove the oil filler cap (Ref.2) and then, after bringing a recipient nearer to collect the exhausted oil (about 7.5. l), remove the cap (Ref.4), while paying attention to the relative gaskets (Ref.1 and Ref.3);
b) after emptying the gear box, also remove the cap (Ref.6) of the bottom insert to empty the residual oil from it;
c) if you are performing routine maintenance operations, once the oil has been emptied from the gear box carefully clean the latter without using any detergent;
d) fix the cap (Ref.4) and the cap (Ref.6) as they were;
e) top up the gear box with the provided oil up to the level line printed on the glass (Ref.5);
f) fix the cap as it was (Ref.2).

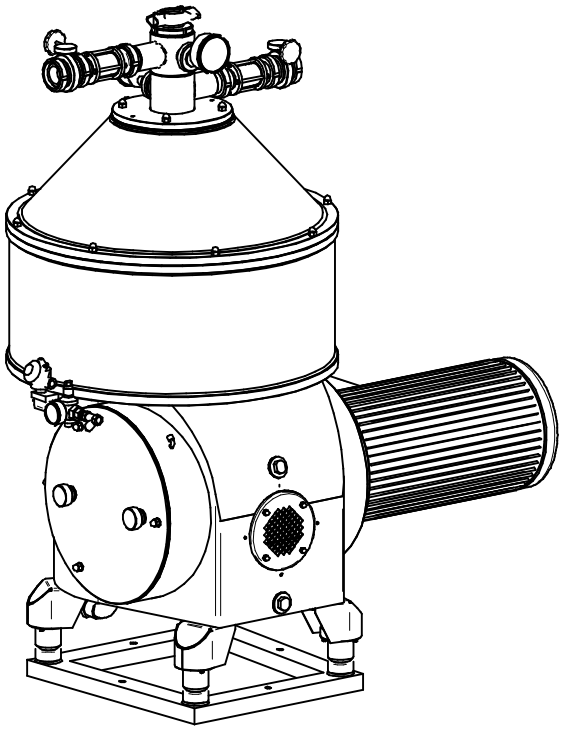



The first oil change must be performed after 500 working hours; subsequent oil changes must be made every 2000 working hours or at least once a year. The oil used has been specially studied for use on centrifuge transmissions. The reference oil is **ROL OIL SINCAT 220**. Once you have finished the provided stock of oil you should request further stocks from the manufacturer or seek comparable types of oil.

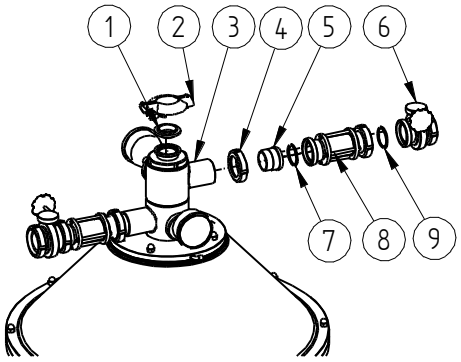
| **Elenco oli lubrificanti alternativi al ROL OIL SINCAT 220** | | | | | | | |
|---|---|---|---|---|---|---|---|
| TEXACO | SYNLUBE CLP 220 | | CASTROL | OPTIMOL OPTIFLEX A220 | | FINA | GIRAN S 220 |
| AGIP | TELIUM VSF 220 | | MOBIL | GLICOILE 30 | | SHELL | TIVELA OIL WB |
| BP | ENERSYN SG-XP 220 | | ESSO | GLYCOLUBE RANGE 220 | | TOTAL | CORTUSA SY 220 |

## 10.2 COVERS AND OUTLETS GROUP

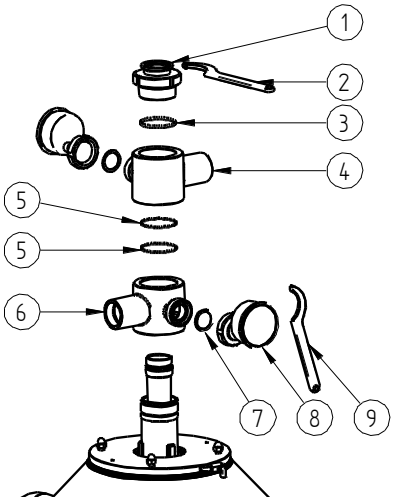
To the covers and outlets disassembly's description it is supposed to have the centrifuge fully assembled.
It is then assumed to proceed with the disassembly of the subject group starting from the configuration illustrated.



### *10.2.1* COVERS AND OUTLETS GROUP DISASSEMBLY




a) *Disassembly inlet and outlet lines:*
remove the clamp (Ref.2) and the gasket (Ref.1) from the inlet line.
For the disassembly of outlet lines, remove the valves (Ref.6), the gasket (Ref.9), the sight glass (Ref.8) the gasket (Ref.7), the fitting (Ref.5) and the connection sheave (Rif.4).




b) *Outlet body disassembly:*

Unscrew the feeding ring nut (Ref.1) through the sector wrench provided (Ref.2), paying attention at the gasket (Ref.3).

Lift the heavy and light phase outlet body (Ref.4 e Ref.6) paying attention at the gaskets (Ref.5).

through the sector wrench provided (Ref.9) is possible to remove the pressure gauge (Ref.8) paying attention at the gasket (Rif.7).

***Installation Note:***

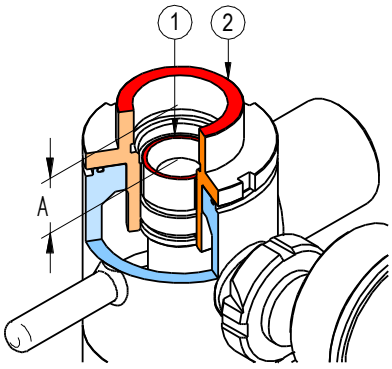
*even if the body outlet does not have an unambiguous angular position of assembly. The outlet direction can be chosen according to the needs of the installation plant and / or machine positioning.*

***Note:***

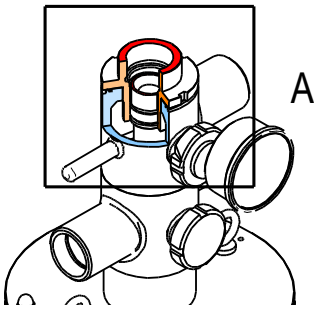
*the instructions for mounting the pressure gauge are given even if at the time of delivery is already assembled and it is not necessary to remove it from the outlet body for the routine maintenance.*

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

***Note:*** *apply the provided anti-seizing paste to the thread on the feeding ring nut.*




DET. A

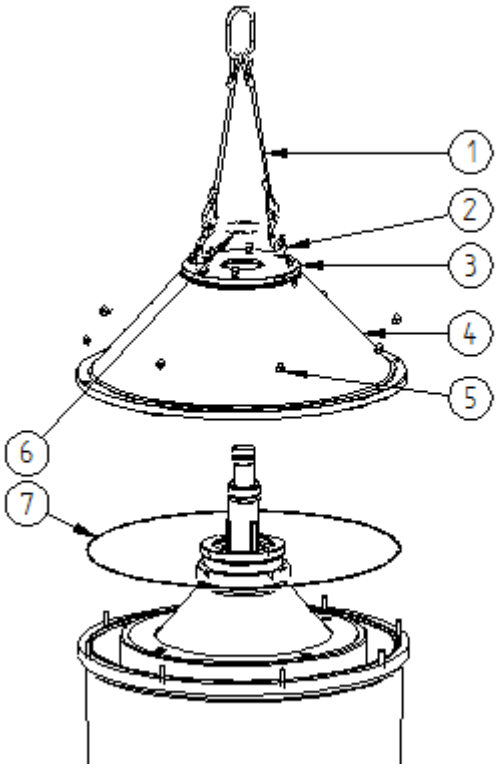



***Installation Note:***

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).

**DANGER:**

check that "A" is 35 mm ± 0,5 mm, a different measure implies an incorrect installation, do not proceeding with assembly of the centrifuge before you don't have discovered and removed the cause.

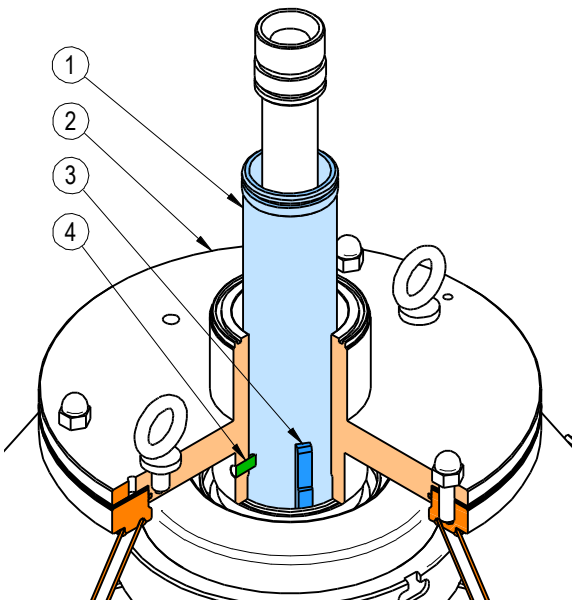



c) *Cover disassembly :*

unscrew the nuts (Rif.5) located on the cover (Rif.4). Screw the eye bolts (Rif.2) to the support flange (Rif.3) and hook theme with the lifting chain (Rif.1).

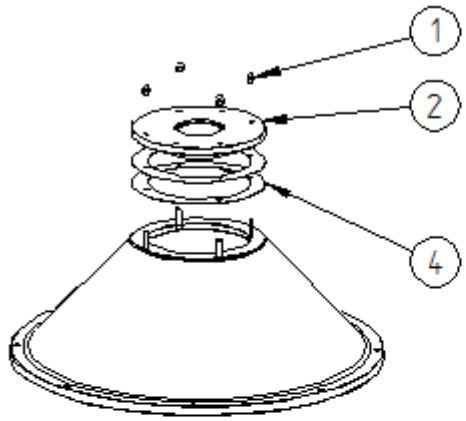
Lift the cover by means of the hoist and place it on the ground.

Check the basin gasket (Rif.7) and the outlet support flange gasket (Rif.6).




***Installation Note:***

The cover must be fitted by engaging the pin (Ref.4) of the outlets support flange (Ref.2) between any two tabs (Ref.3) on the heavy phase plate (Ref.1).




d) *Outlet support flange dismantling:*
unscrew the nuts (Ref.1), lift the outlet support flange (Ref.2) and unscrew the ball valve coupling of the hermetic device (Ref.3), and finally lift the spacers (Rif.4).

### *10.2.2 PERIODICAL MAINTENANCE AND INSPECTIONS*

**Periodical maintenance**

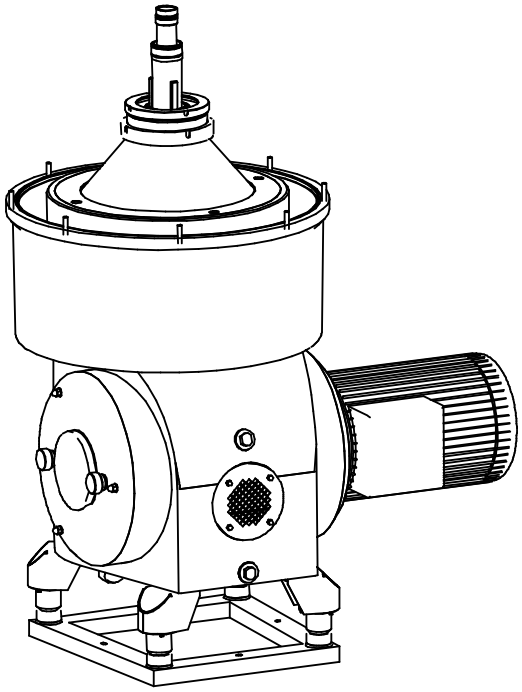
The prescribed periodical maintenance required for the cover group and outlets basically consists in its cleaning and in the replacement of the seal elements that are damaged or no longer functional. The cleaning must be performed together with the cleaning of the bowl group and (at least for the parts that get in contact with the product) with the modalities described below. With regard to the maintenance and periodical inspections related to the turbine see following paragraphs.

**Periodical inspections**

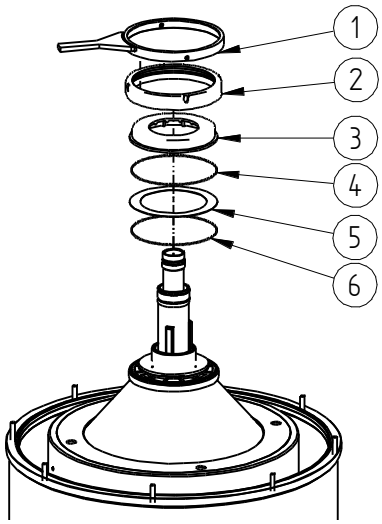
While cleaning this group, also check with special attention to the presence of potential corrosive and/or erosive phenomena.

## 10.3 BOWL GROUP

To describe the bowl group removal we assume that the operations described in the previous paragraph have already been performed.
It is then assumed that the disassembly of the group in object starts from the configuration here below illustrated

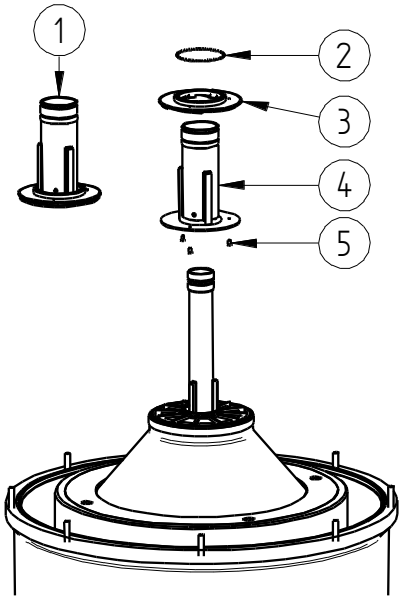


### *10.3.1 BOWL GROUP DISASSEMBLY*




a) *Small nut disassembly :*
with the special key provided (Ref.1), unscrew the small nut (Ref.2), using a rubber mallet not supplied.
Then lift the collecting chambre (Ref.3), paying attention to the gasket (Ref.4)
Remove the regulating ring (Ref.5) and its gasket (Ref.6).

***Note:*** *the threads of the nuts are left oriented.*
***Assembling note:*** *apply the provided anti-seizing paste to the thread on the nuts.*



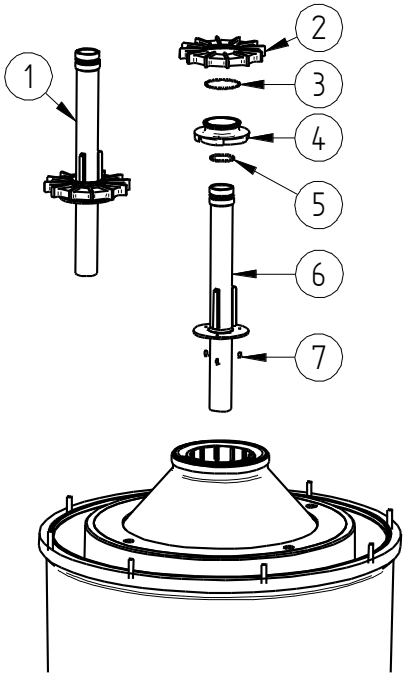

b) *Heavy phase turbines disassembly:*

Remove the heavy phase turbines assembled (Ref.1) and place it on a clean work place.

Therefore, unscrew the screws (Ref.5), lift the heavy phase turbine (Ref.3) paying attention to the related gasket (Ref.2).

Finally place the heavy phase turbine plate (Ref.4) on a clean work place.

***Note**: The complete heavy phase turbine consists of the already assembled heavy phase turbine components (Ref.3), heavy phase plate (Ref.4) and fixing screws (Ref.5).*




c) *Light phase turbines disassembly:*

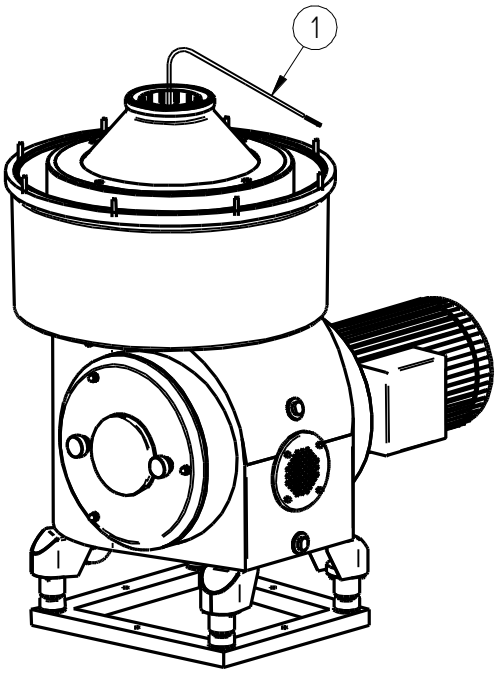
Lift the light phase turbines with the insert cap (Ref.1).

Using a clean work place, continue the dismantling removing the insert cap (Ref.2), in case of trouble use n°2 M8 eye bolts not supplied.

Unscrew the screws (Ref.7) from the light phase turbine plate (Ref.6) and lift the light phase turbine (Ref.4) paying attention at the related gaskets (Ref.3 e Ref.5).

***Note**:*

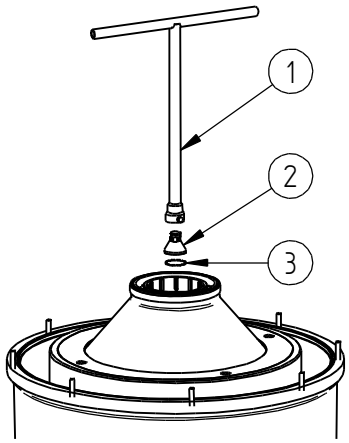
*The complete light phase turbine consists of the already assembled light phase turbine components (Ref.4), light phase plate (Ref.6) and fixing screws (Ref.7).*




***Note:*** *before proceeding with the disassembly, remove the liquid, possibly present in the bowl using a flexible pipe (Ref.1) not supplied.*

**DANGER:**

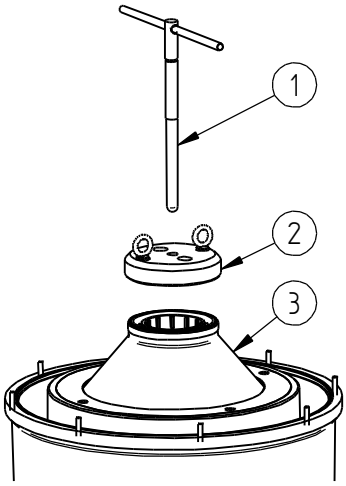
*The possible presence of liquid in the bowl during the next steps of disassembly, could have dangerous consequences for the safety of the centrifuge.*




d) *Bowl lock nut disassembly :*

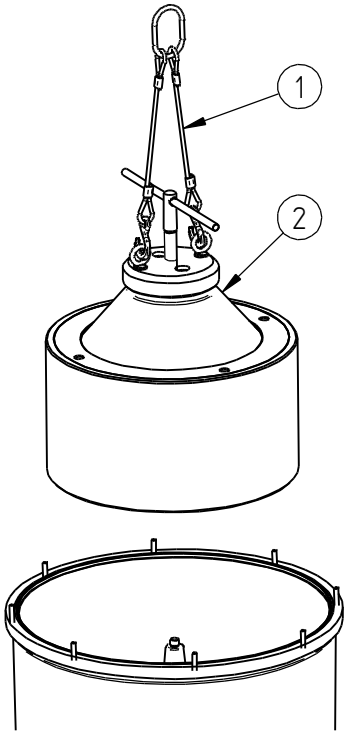
Unscrew the bowl lock nut (Ref.2) using the special tool supplied (Ref.1), pay attention to the gasket (Ref.3).

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




e) *Bowl unlocking:*

Screw the special bowl lifting tool supplied (Ref.2) to the bowl cover (Ref.3), therefore screw the unlocking bowl tool (Ref.1) to the bowl lifting tool till the bowl is unlocked.

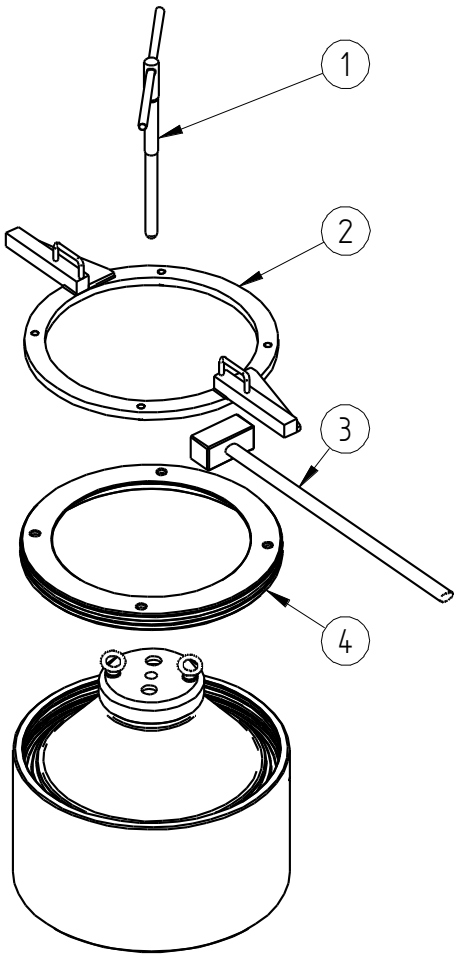


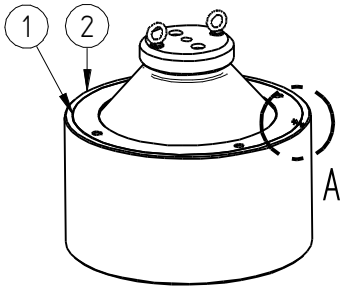

f) *Bowl handling and positioning*:

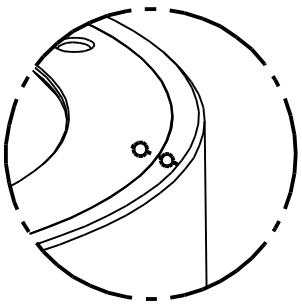
hook the lifting chain (Ref.1) to supplied bowl lifting tool and lift the bowl (Ref.2) by means of a hoist. Clean the conical seat of the bowl bottom and the corresponding extremity of the vertical shaft. Place the bowl on a clean work place for the next steps of dismantling.

**DANGER**:

before proceeding with handling of the bowl, check that the big nut is correctly screwed to bottom of the bowl even if the bowl is delivered completely assembled.



DET. A

g) *Big nut disassembly* :

Assembly the big nut wrench supplied (Ref.2) on the big nut (Ref.4), moving it if necessary by using the lifting chain, not shown in the picture, and hit the tool shaft with the provided mallet (Rif.3) to unscrew the big nut.

Disassembly the bowl unlocking tool (Rif.1) from the bowl lifting tool.

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

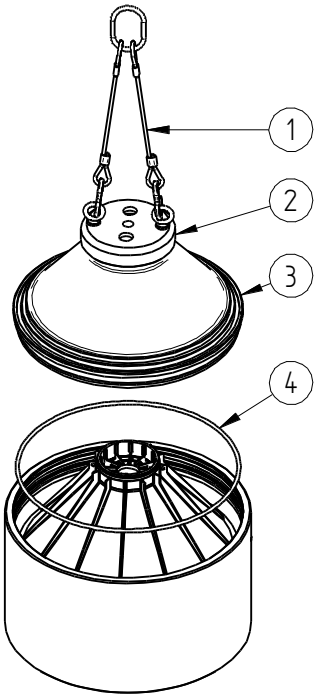
***Assembling note**: apply the provided anti seizing paste to the thread on the big nut.*

***Nota per il montaggio**: completely fasten the big nut, that is, until its upper part (Ref.2) is no more than ~ 0.5 mm higher than the upper surface of the bowl bottom (Ref. 1) and the " " marks stamped on the big nut and on the bowl bottom match.*

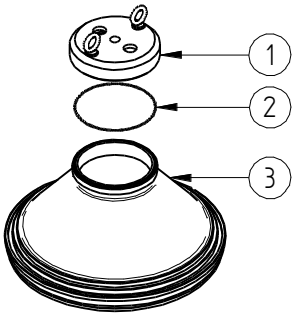
*Normal wear of the thread can cause the mark on the nut, with the nut fastened, advances counter-clockwise with respect to the mark on the bowl bottom; if the mismatch becomes greater than 15 mm, please contact the manufacturer.*

**DANGER:**

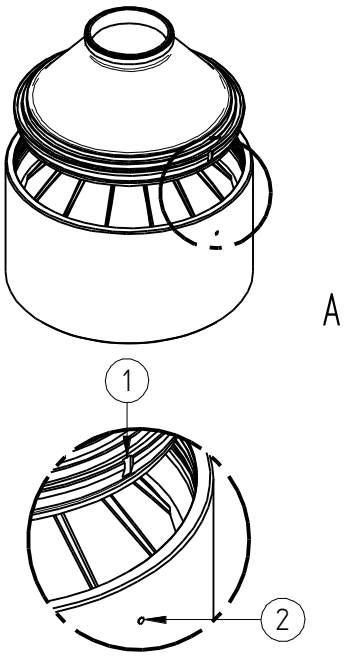
the big nut must be correctly fastened before starting the centrifuge; always check that the above mentioned conditions are respected.



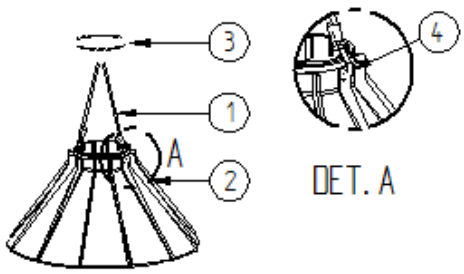

Remove the large nut wrench and, by way of the supplied chain and eyebolts (Ref.1), the large nut itself; then set it down on a protected surface (rubber, wood etc.).
Lastly using the lifting chain (Ref.1), hook the lifting bowl tool (Ref.2), and extract the bowl cover (Ref.3) paying attention to the related gasket (Ref.4).



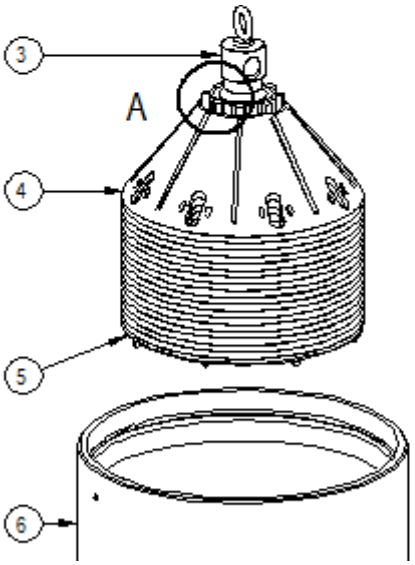

Remove the lifting bowl tool(Ref.1) paying attention to the gasket (Ref.2) of the bowl cover (Ref.3).



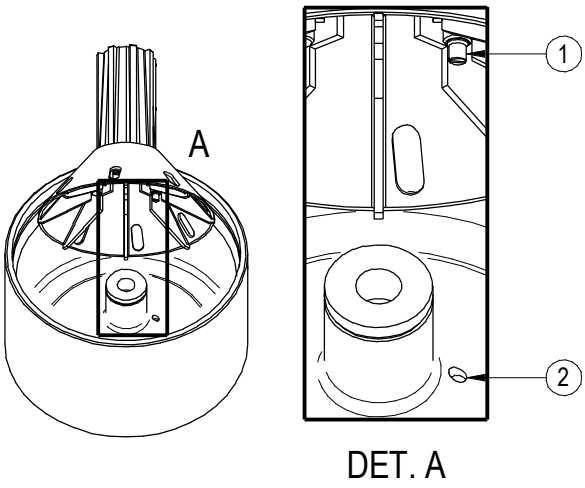

***Assembling note**: the bowl cover is related to the bowl bottom by means of a pin mounted on the bowl bottom (Rif.2) and a groove placed in the bowl cover (Rif.1).*



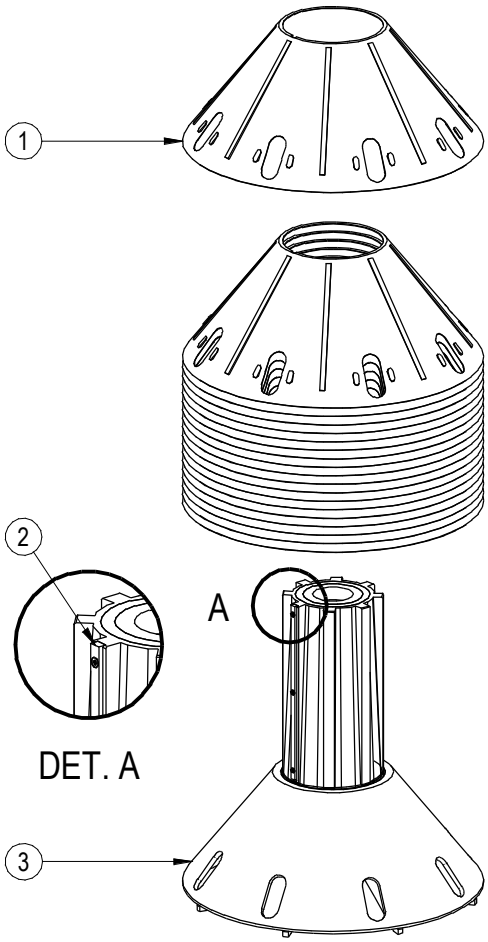

h) *Divider cone disassembly*:
remove the divider cone (Ref.2) by way of the supplied chain and eyebolts (Ref.1), paying attention to the gasket (Ref.3).




i) *Column disassembly*:
fasten the discs pressing screw (Reif.3) to the column (Ref.5), lift the column and the discs stack (Ref.4) using the chain (not shown), place the column on a working area and finally remove the chain and the discs pressing screw.




***Note for the assembly:*** *the column is related to the bowl's bottom (Ref.6) by a plug assembled on the column itself. Carefully verify that this plug is correctly placed in its seat in the bowl's bottom.*




l) *Disc disassembly*:

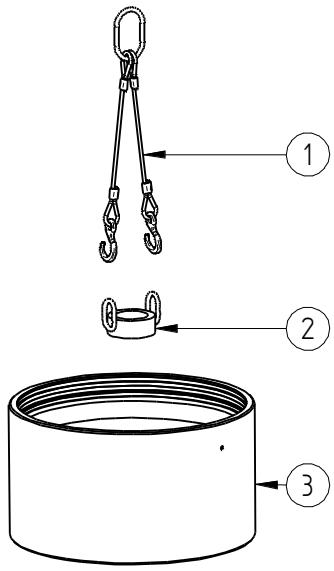
Remove the discs (Ref.1) one by one, using the protection gloves as the disc's rims could be sharp.

***Note for the assembly**: the discs are related to the column by the alignment strip (Ref.2) applied to the column itself (Ref.3).*

***Nota**: The figure shows only part of the discs used to keep the clarity of the sketch.*

**ATTENTION:**

To remove the discs use the protection gloves as the disc's rims could be sharp.




m) *Bowl bottom handling*:

Lastly using the lifting chain (Ref.1), hook the bowl bottom lifting tool (Ref.2) beforehand screwed on the bowl bottom (Ref.3).

### *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 in the following chapters wash the parts forming the bowl in the following procedure:

- 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 (discharge frequency during process, cleaning frequency, etc.). Perform a first maintenance, inspection and cleaning intervention on the disassembled bowl 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, in particular in function of 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 once a year.

**DANGER:**

Perform the cleaning stage with a frequency sufficient to ensure that an excessive accumulation of solids does not accrue in the sedimentation chamber; an excessive accumulation of solids can generate a falling of the performance, up to complete occlusion of the bowl, generating situations of damage to the centrifuge and dangerous situations for 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 wing insert 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:**

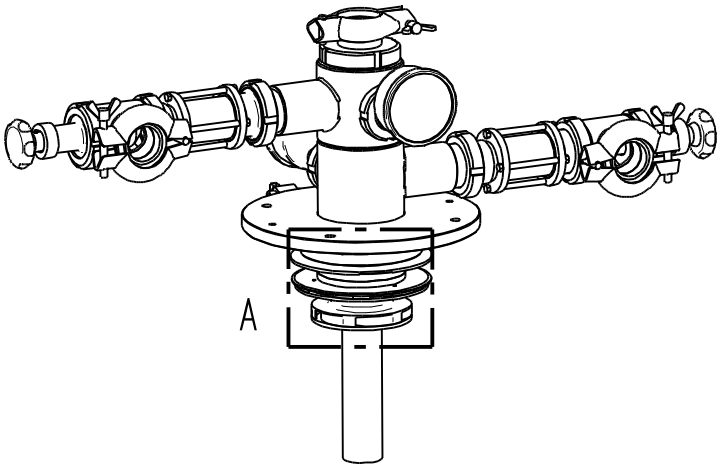
respect very carefully the deadlines for the maintenance and inspection interventions in order to immediately identify the possible presence of corrosive and/or erosive processes, avoid their progression and the creation of highly dangerous situations.

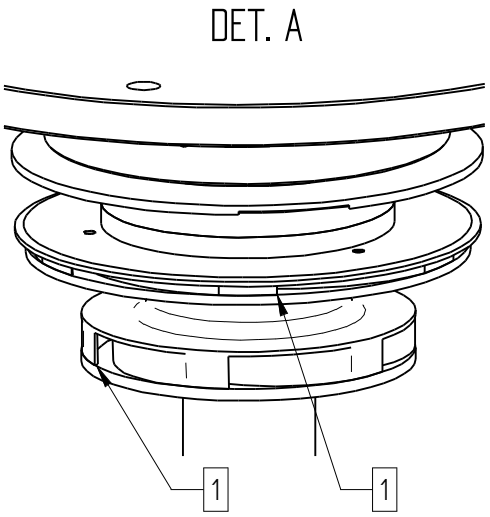
**Periodical maintenance**

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 channels of product's passage.

**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, in particular check the status of the turbine (Ref.A) at the entry points of the liquid phases and replace the turbine if the wear were such as compromising its functionality.



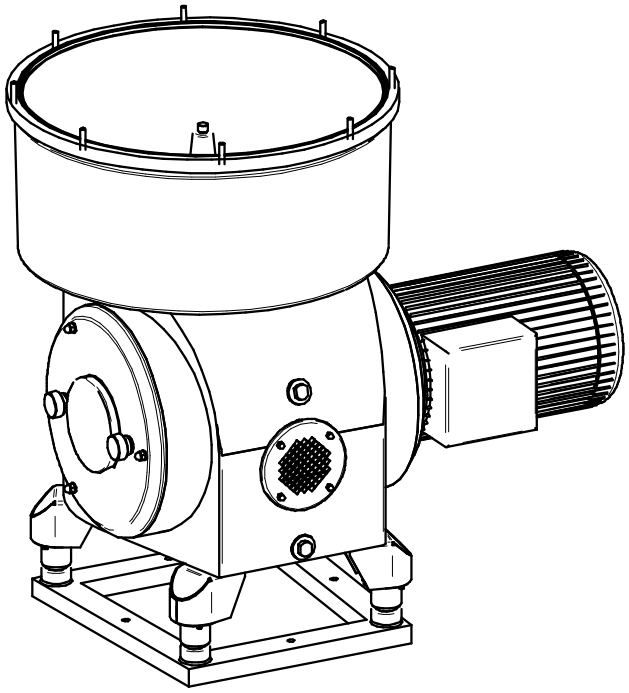
- inspection of the conditions of the external and internal surfaces of all bowl's structural elements (bowl bottom, big nut blocking);
- inspection of the conditions of the surfaces on the bowl's group with special attention to the presence of potential corrosive and/or erosive phenomena;
- inspection of the wear and tear conditions of the matching surfaces on the bowl's group with special attention to possible erosions;
- inspection of the threads for the matching with lifting tools

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

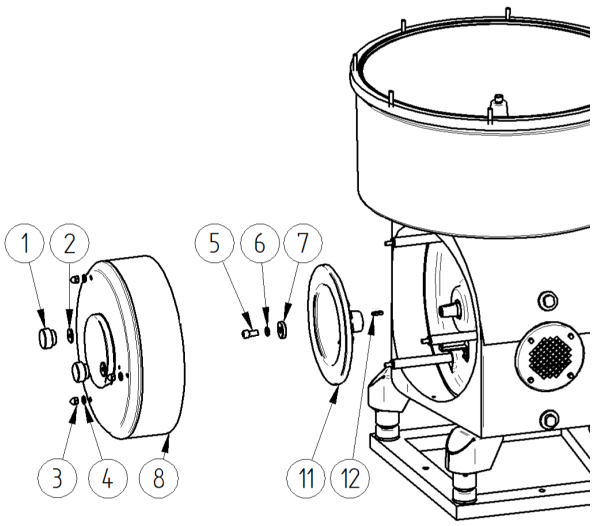
It is absolutely forbidden to repair the rotating parts through welding.

## 10.4 BASE GROUP AND HORIZONTAL SHAFT GROUP

For the description of the disassembly of the base and horizontal shaft groups it is supposed you already performed the dismantling steps previously described. It is assumed that we shall proceed with disassembly of these groups starting from the situation shown, in practice, however, the disassembly here described is totally independent, from a mechanical perspective, from disassembly of all the other groups. Here we shall only illustrate disassembly of base group parts relevant for routine and unscheduled maintenance; for example we shall not show disassembly of the parts used for securing the centrifuge at the time of installation or disassembly of parts that remain permanently assembled. The tools for disassembly of the bearings (pullers) are not provided.



### *10.4.1 DISASSEMBLY OF THE BASE GROUP AND HORIZONTAL SHAFT GROUP*

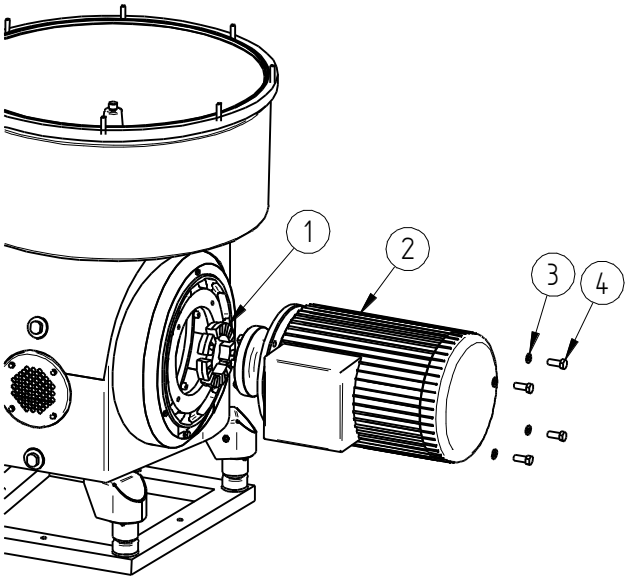



a) *Casing drainage:*

*drain the casing as previously shown.*

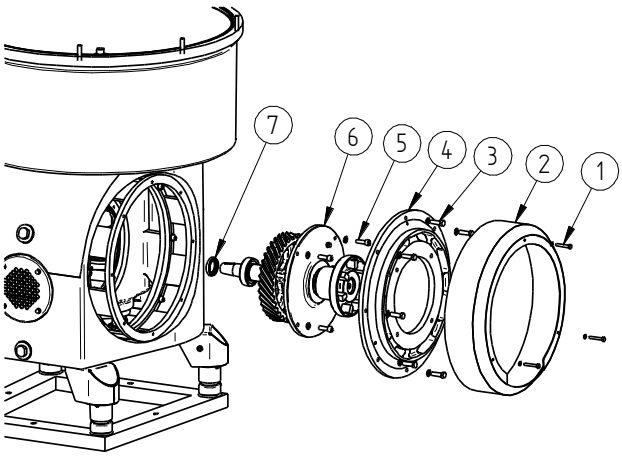
b) *Brake disassembly:*

unscrew the fixing nuts (Ref.3) of the brake guard (Ref.8); remove the guard. Undo the fixing screw (Ref.5) of the dome (Ref.11), remove the elastic washer (Ref.6), the dome washer (Ref.7), the dome and the tab (Ref.12); unscrew the hand wheel (Ref.1), remove the hand wheel gasket (Ref.2),



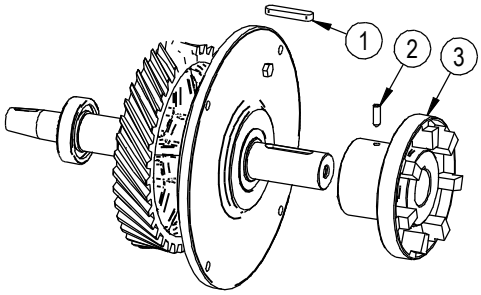

*c) Motor disassembly:*

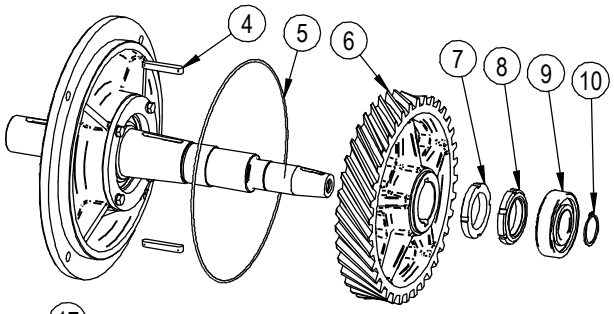
set out all the motor handling tools (follow the manufacturer's instructions, see attached guide Att. E), remove the fixing screws (Ref.4), remove the motor (Ref.2) and the elastic elements of the motor side joint (Ref.1).

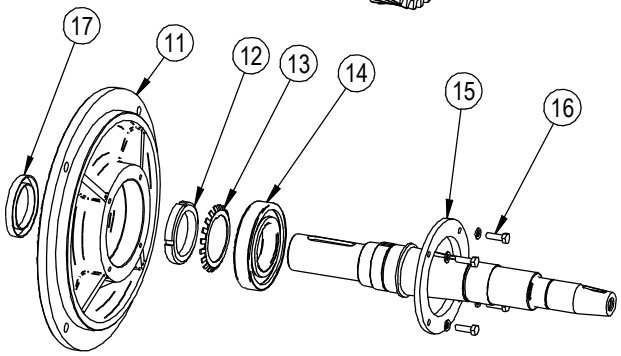



d) *Horizontal shaft flange disassembly :*

unscrew the fixing screws (Ref.1) of the base flange casing (Ref.2) and remove the latter; unscrew the screws (Ref.3) fixing the motor flange (Ref.4) and remove the latter; unscrew the screws (Ref.5) fixing the horizontal shaft flange (Ref.6) and remove it together with all its assembled items. Remove the seal ring (Ref.7) from the base (on the opposite side with respect to that indicated in the figure).

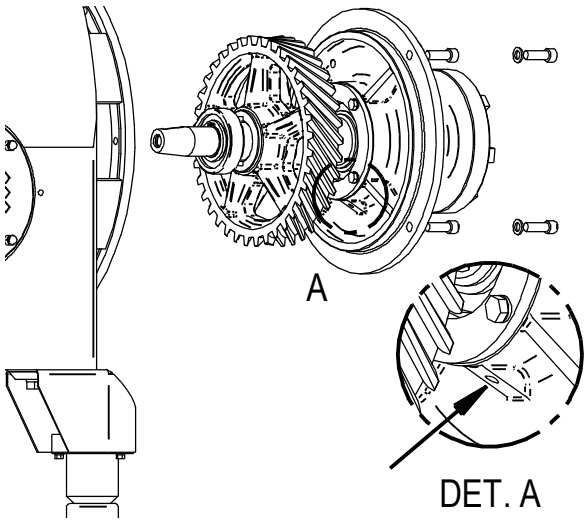



e) *Horizontal shaft disassembly:*

Place the horizontal shaft flange on a workbench (Ref.11 ), undo the screw (Ref.2), disassemble the semi-joint (Ref.3) and tab (Ref.1); remove the elastic ring (Ref.10) and extract the bearing (Ref.9), unscrew the self-braking ring (Ref.8) and the ring (Ref.7), remove the worm wheel (Ref.6), the tabs (Ref.4) and the horizontal shaft flange gasket (Ref.5); undo the fixing screws (Ref.16) of the bearing closure flange (Ref.15) and remove the latter; undo the ring (Ref.12), the washer (Ref.13), extract the bearing (Ref.14) and remove the seal (Ref.17).




***Note for assembly**: the bearings must be assembled hot, at a temperature of 85°C.*

***Note for assembly**: during assembly of the horizontal shaft flange make sure it is positioned correctly; the lubricant oil passage hole to the casing must be placed downwards, as shown.*

### *10.4.2 MAINTENANCE AND PERIODICAL INSPECTIONS*

**Periodical maintenance**

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

- The first lubricant oil change have to be done after 500 working hours or at least once a year;
- replace the bearings once a year.

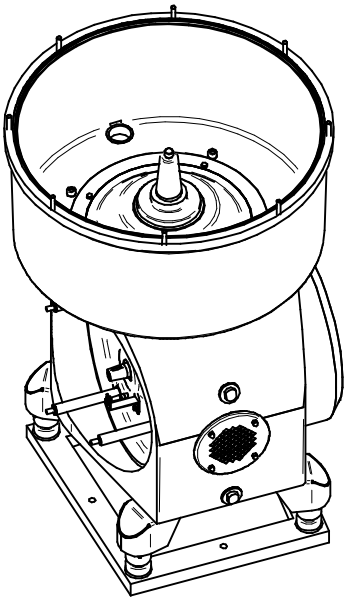
**Periodical Inspections**

The periodical inspections prescribed for the horizontal shaft group are here below described:

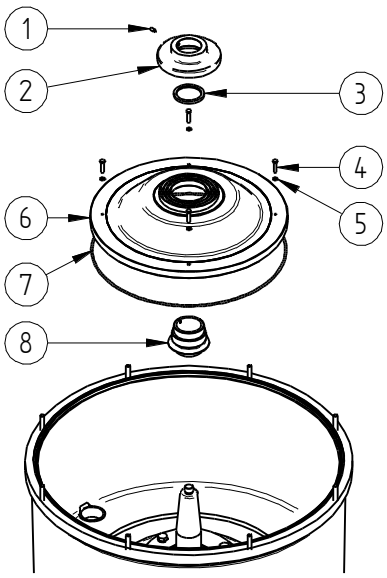
- During the replacement of the parts referred to periodical maintenance, check before each start-up of the lubricating oil level, make sure that to the oil is not contaminated with water, check the state of wear of the vertical shaft, the pistons and springs, all of the sealing elements, and then to replace them if necessary.

## 10.5 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 the disassembly of he group in object starts from the configuration here below illustrated. The tools for disassembly of the bearings (pullers) are not provided.

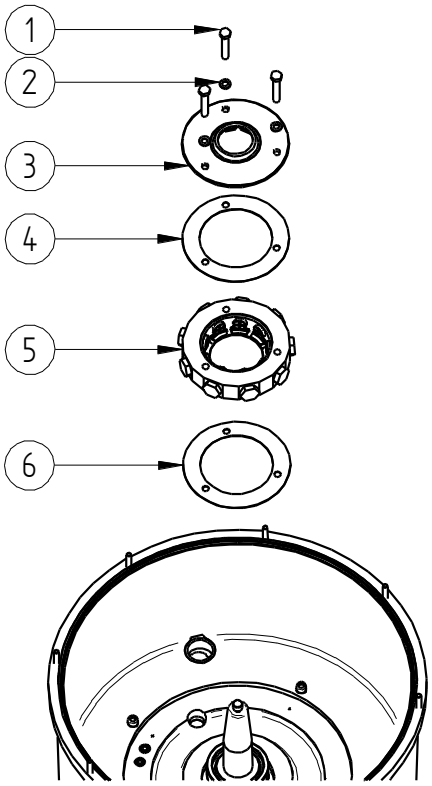


### *10.5.1 COLLAR GROUP DISASSEMBLY*




*a) <u>Collar cover disassembly</u>:*
unscrew the screws of the locking shaft (Ref.1) from the upper labyrinth (Ref.2) and remove theme with the gasket (Ref.3). Undo the fixing screws (Ref.4) of the collar cover (Ref.6), remove the cover collar, if necessary with the aid of not supplied eyebolts, remove the gaskets between the collar cover and base (Ref.7), remove the lower labyrinth (Ref.8).

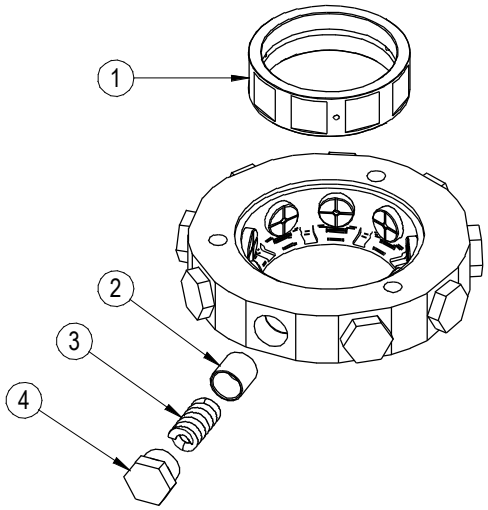
***<u>Note</u>**: verify the seal surface and the state of the gasket (Rif. 3).*




b) *Collar disassembly:*

undo the fixing screws (Ref.1) of the collar body (Ref.5), remove the collar cover (Ref.3), the upper collar body gasket (Ref.4), the complete collar body and the lower collar body gasket (Ref.6).

***Note for assembly**: the fixing screws of the collar group (Ref.1) must be fastened with a tightening torque of 200 Nm; use threadlocker adhesive of medium strength.*




c) *Disassembly of the collar group:*

the complete collar body (or group), disassembled as described in the above point, can be broken down into its parts on the workbench; progressively unscrew, in an alternating sequence, the 9 fixing screws (Ref.4) of the splitters (Ref.2), remove the springs (Ref.3) and splitters, then, lastly, remove the collar ring (Ref.1).

***Note for assembly**: use threadlocker adhesive of medium strength for the screws fixing the splitters.*

### *10.5.2 MAINTENANCE AND PERIODICAL INSPECTIONS*

**Periodical maintenance**

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

- The first lubricant oil change have to be done after 500 working hours or at least once a year;
- replace the bearings once a year.

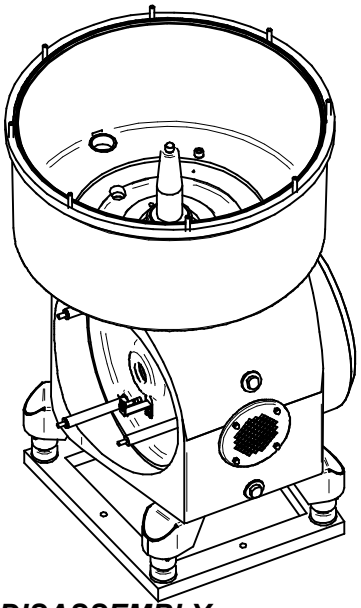
**Periodical Inspections**

The periodical inspections prescribed for the collar group are here below described:

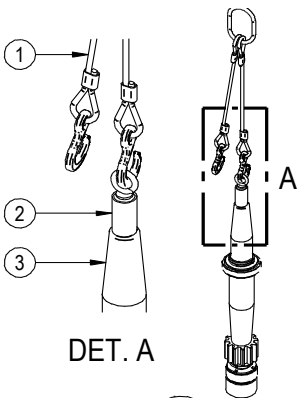
- During the replacement of the parts referred to periodical maintenance, check before each start-up of the lubricating oil level, make sure that to the oil is not contaminated with water, check the state of wear of the vertical shaft, the pistons and springs, all of the sealing elements, and then to replace them if necessary.

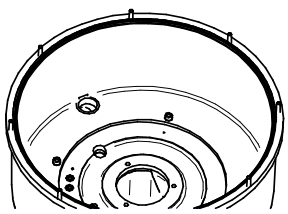
## 10.6 VERTICAL SHAFT GROUP

To describe the disassembly of the collar group and vertical shaft we assume that the operations described in the previous paragraph have already been performed. It is then assumed that the disassembly of he group in object starts from the configuration here below illustrated. It is possible to disassembly the vertical shaft group only after removing the horizontal shaft group. Here we shall only illustrate disassembly of base group parts relevant for routine and unscheduled maintenance; for example we shall not show disassembly of the parts used for securing the centrifuge at the time of installation or disassembly of parts that remain permanently assembled. The tools for disassembly of the bearings (pullers) are not provided.



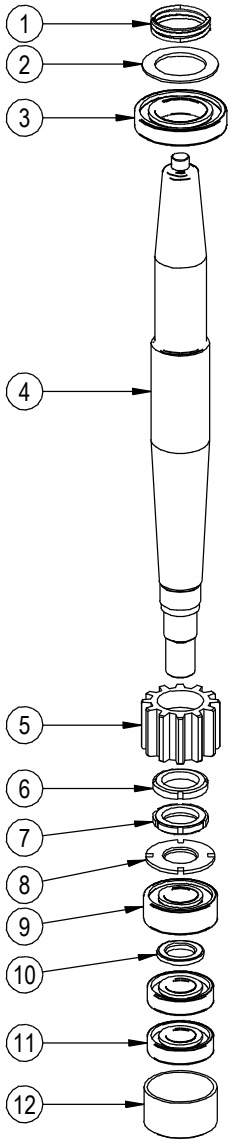
### *10.6.1 VERTICAL SHAFT GROUP DISASSEMBLY*



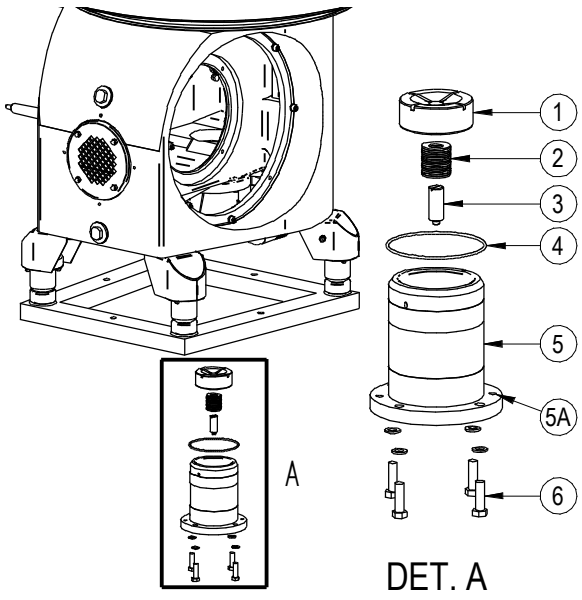
a) *Vertical shaft disassembly:*

fasten the vertical shaft lifting tool (Ref.2 ) to the vertical shaft (Ref.3). Remove the latter with the aid of the supplied lifting chain (Ref. 1) and the hoist. At this point the vertical shaft can be placed on the workbench for disassembly of the items assembled on it.




remove the labyrinth spring (Ref. 1) and collar bearing washer (Ref. 2) from the vertical shaft (Ref.4); then extract the bearing (Ref.3). Remove the bearing holder box (Ref.12), extract the bearings (Ref.11), remove the lower bearing washer (Ref.10), extract the bearing (Ref.9), remove the upper bearing washer (Ref.8), unscrew the ring nuts (Ref.6 and Ref.7) and then disassemble the pinion (Ref.5).

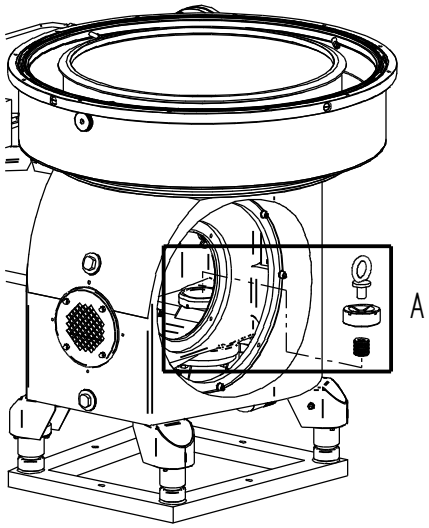
***Note for assembly**: all the bearings illustrated here (Ref.3, Ref.9 and Ref.11) must be assembled hot at a temperature of 85°C.*

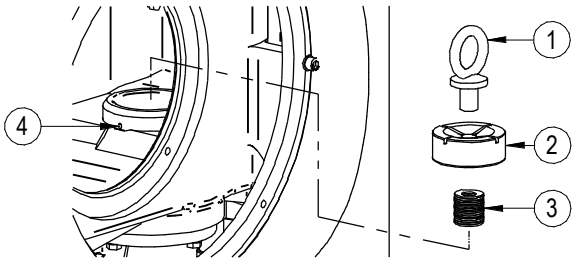



DET. A

b) *Disassembly of the bottom insert:*

Unscrew the screws (Ref.6) fixing the bottom insert (Ref.5), and remove the latter while fastening the just removed screws in the extraction holes (Ref.5A) on the insert itself; remove the relative gasket (Ref.4), the thrust seat (Ref.1) and the 16 Belleville springs (Ref.2); for routine maintenance operations it is not necessary to remove the guide pin (Ref.3).

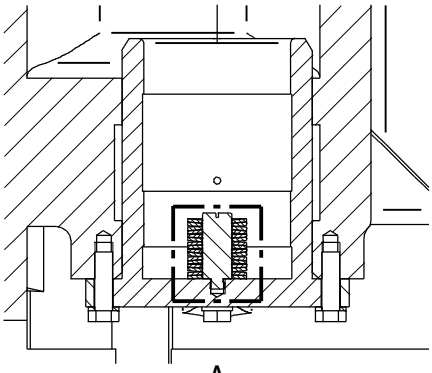


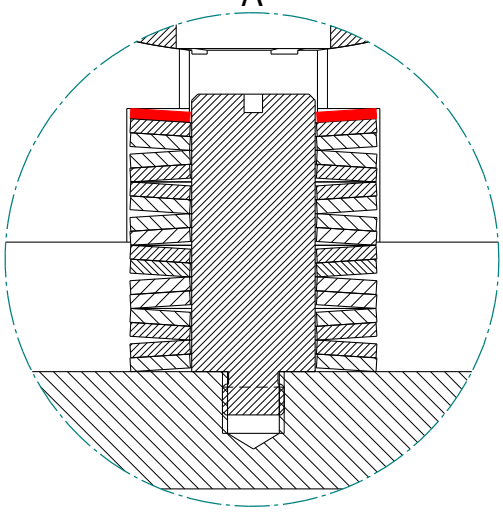

DET. A

***Note for disassembly***: *for routine maintenance operations, it is not strictly necessary to disassemble the bottom insert. It is possible to remove the thrust seat (Ref.1) and the Belleville springs (Ref.2), as shown, if necessary using an eye-bolt or a M24 screw (not provided) to extract the thrust seat.*

***Note for assembly***: *place the bottom insert so that the oil drainage hole (Ref.4) faces the machine front, as shown.*



A



***Note for assembly***: *the Belleville springs must be placed in the bottom insert as shown.*

### *10.6.2 MAINTENANCE AND PERIODICAL INSPECTIONS*

**Periodical maintenance**

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

- The first lubricant oil change have to be done after 500 working hours or at least once a year;
- replace the bearings once a year.

**Periodical Inspections**

The periodical inspections prescribed for the vertical shaft group are here below described:

- During the replacement of the parts referred to periodical maintenance, check before each start-up of the lubricating oil level, make sure that to the oil is not contaminated with water, check the state of wear of the vertical shaft, the pistons and springs, all of the sealing elements, and then to replace them if necessary.

## 10.6 MAINTENANCE AND SCHEDULED INSPECTIONS

The following table (summarizes the maintenance and inspection operations described in the previous paragraphs.

**DANGER**:
to guarantee a safe and efficient functioning of the separator, respect very carefully the deadlines and the modalities prescribed for the maintenance and inspection interventions.

| Time schedule | Maintenance and scheduled inspections |
|---|---|
| **before any start** | comply with the requirements described above |
| **before any stop** | comply with the requirements described above |
| **first 8 hours** | • inspection and cleaning of the bowl<br>• inspection and cleaning of the outlets group |
| **first 40 hours** | • inspection and cleaning of the bowl<br>• inspection and cleaning of the outlets group |
| **first 500 hours** | • change lubricant oil |
| **first 500 hours**<br>**Or at least once a year** | • inspection and cleaning of the bowl<br>• inspection and cleaning of the outlets group<br>• inspection and cleaning of the covers group |
| **Once a year** | • maintenance and inspection of the horizontal shaft group, vertical shaft group and collar group<br>• change lubricant oil |

## 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

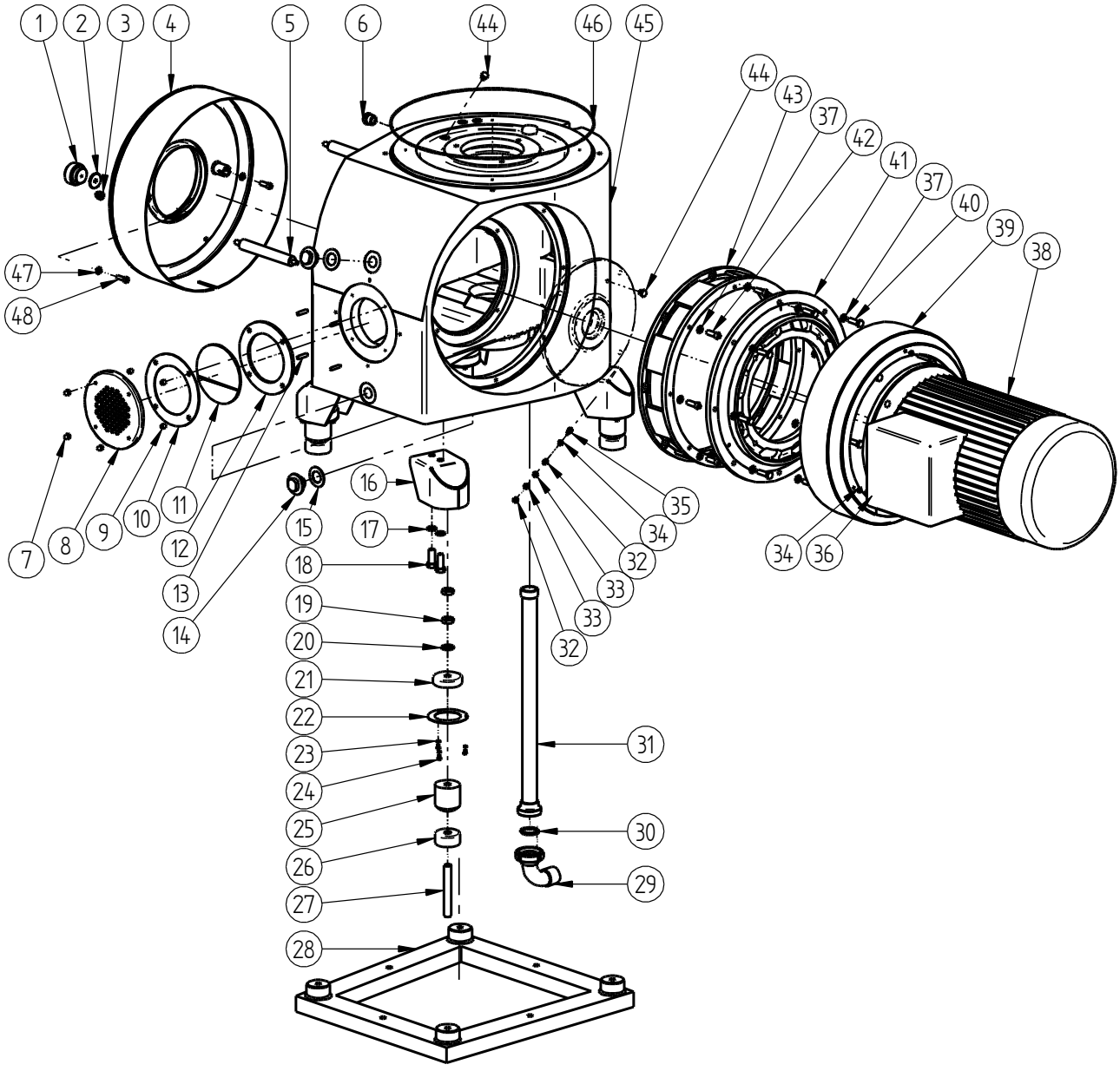
The list of parts shown in the tables and the tables below refers to the standard configuration of the centrifuge. Some groups may vary as a result of specific customer requests (eg for the type of input and output connections), the need for installation tools or insertion of the centrifuge in a system 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:

- basement group (Tav.1);
- horizontal shaft group (Tav.2);
- vertical shaft group (Tav.3);
- collar group (Tav.4);
- cover group (Tav.5);
- bowl group (Tav.6);
- outlets group (Tav.7);
- pipes group (Tav.8);
- tools group (Tav.9);
- silencer group (Tav.10).

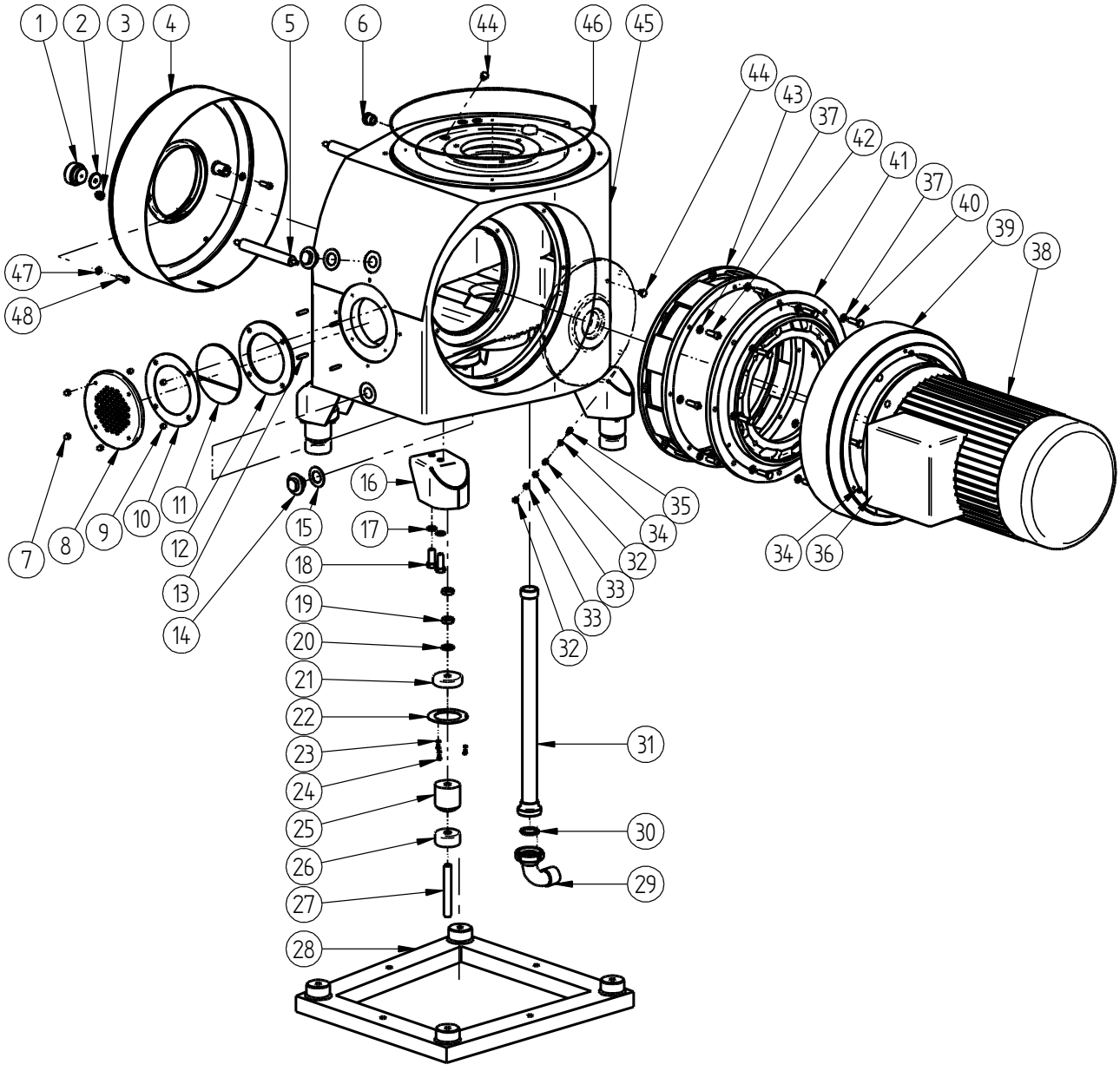
| Table 1 | BASEMENT GROUP | 7300000002 |
|---|---|---|



| Table 1 | BASEMENT GROUP | 7300000002 |
|---|---|---|

| Ref. | Description | Q.ty | Code |
|---|---|---|---|
| 1 | HANDWHEEL | 2 | 0021400014 |
| 2 | HANDWHEEL GASKET | 2 | 0021300954 |
| 3 | BLIND NUT | 3 | 9902540001 |
| 4 | SHELTER IN BRAKE | 1 | 5901000013 |
| 5 | CLAMPING STUD BOLT | 3 | 5900400014 |
| 6 | CAP | 1 | 9938430001 |
| 7 | BLIND NUT | 4 | 9902650001 |
| 8 | SIGHT GLASS CAP | 1 | 0012420014 |
| 9 | SPACER | 4 | 0011300014 |
| 10 | SIGHT GLASS GASKET | 1 | 0012500974 |
| 11 | SIGHT GLASS | 1 | 0012600964 |
| 12 | SIGHT GLASS GASKET | 1 | 0011100614 |
| 13 | CLAMPING STUD BOLT | 4 | 0013000001 |
| 14 | OIL CAP | 2 | 0012300014 |
| 15 | OIL CAP GASKET | 2 | 0011200974 |
| 16 | LEG | 4 | 5901500014 |
| 17 | SPRING LOCK WASHER | 12 | 9907530026 |
| 18 | SCREW | 12 | 9900040026 |
| 19 | NUT | 8 | 9902520001 |
| 20 | PLAIN WASHER | 4 | 9907560001 |
| 21 | SHOCK ABSORBER | 4 | 0011600604 |
| 22 | SHOCK ABSORBER LOCKING WASHER | 4 | 0011700014 |
| 23 | SPRING LOCK WASHER | 12 | 9907600001 |
| 24 | SCREW | 12 | 9900290001 |
| 25 | FOOT | 4 | 5901800014 |
| 26 | BEDPLATE SHIELD | 4 | 0011900014 |
| 27 | STUD BOLT | 4 | 0012000274 |
| 28 | FOUNDATION PLATE | 1 | 0012100502 |
| 29 | DRAINAGE | 1 | 0190500014 |
| 30 | GASKET | 1 | 9914510061 |

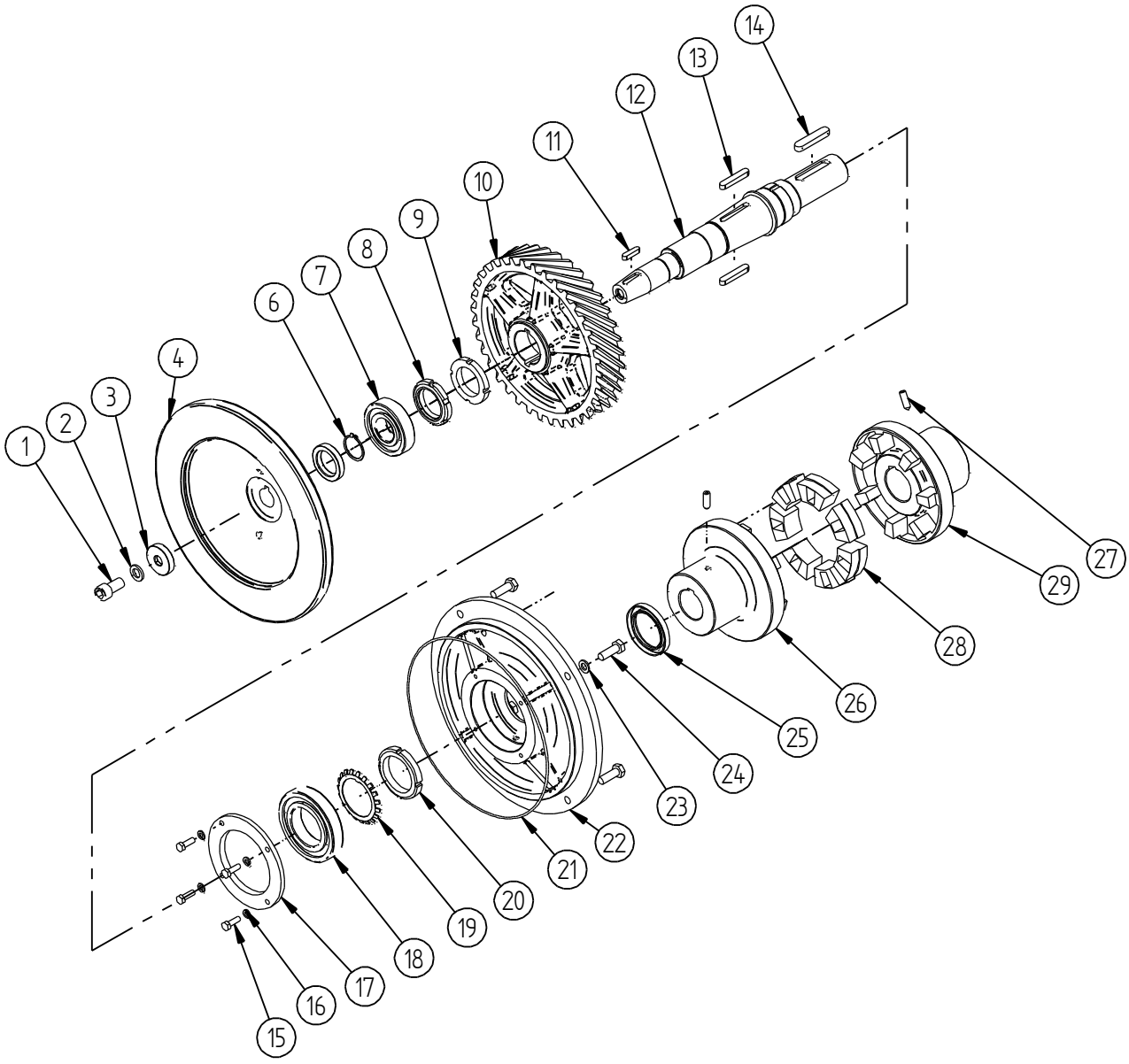
| Table 1 | BASEMENT GROUP | 7300000002 |
|---|---|---|



| Table 1 | BASEMENT GROUP | 7300000002 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| **31** | TUBE | 1 | 0230300024 |
| **32** | NUT | 2 | 9902550001 |
| **33** | WASHER FLAT | 2 | 9907680001 |
| **34** | SPRING WASHER | 4 | 9907520001 |
| **35** | SCREW | 1 | 9900110001 |
| **36** | SCREW | 3 | 9900380001 |
| **37** | SPRING WASHER | 16 | 9907640026 |
| **38** | ENGINE | 0 | 9945170094 |
| **39** | CARTER | 1 | 5901500013 |
| **40** | LIVES | 8 | 9900050026 |
| **41** | FLANGE | 1 | 0190100502 |
| **42** | LIVES | 8 | 9900020026 |
| **43** | FLANGE | 1 | 0011000502 |
| **44** | STOPPER | 2 | 9934710070 |
| **45** | BASEMENT | 1 | 1430100501 |
| **46** | OR | 1 | 0190400634 |
| **47** | WASHER FLAT | 2 | 9907690001 |
| **48** | SCREW | 2 | 9901450026 |

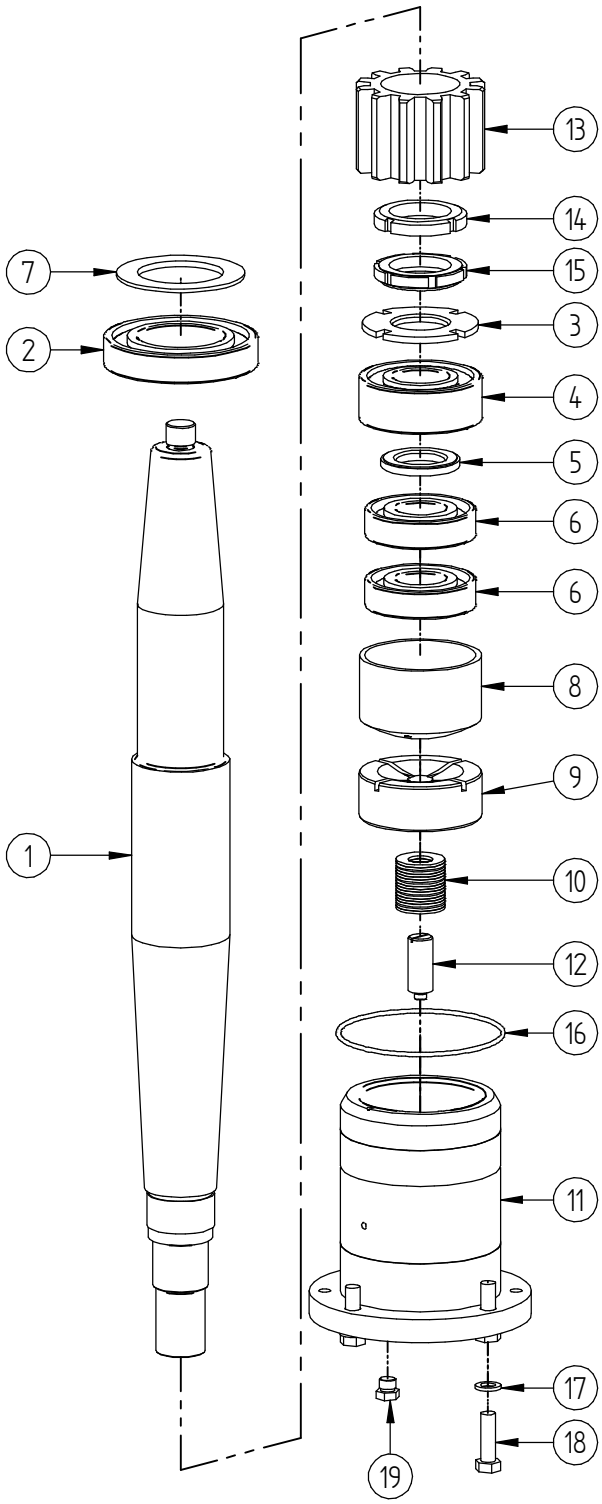
| Table 2 | HORIZONTAL SHAFT GROUP | 1740000002 |
|---|---|---|



| Table 2 | HORIZONTAL SHAFT GROUP | 1740000002 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| **1** | SCREW | 1 | 9900090026 |
| **2** | SPRING LOCK WASHER | 1 | 9907530026 |
| **3** | BRAKE BELL WASHER | 1 | 0020800264 |
| **4** | BRAKE BELL | 1 | 0021800503 |
| **5** | SEALING RING | 1 | 9914550060 |
| **6** | SHAFT SNAP RING | 1 | 9926510026 |
| **7** | BEARING | 1 | 9918540000 |
| **8** | SELF-BRAKING LOCK NUT | 1 | 9922510026 |
| **9** | LOCK NUT | 1 | 9922540026 |
| **10** | RING GEAR | 1 | 0020101702 |
| **11** | LUG | 1 | 9925510026 |
| **12** | HORIZONTAL SHAFT | 1 | 0020300313 |
| **13** | LUG | 2 | 9925530026 |
| **14** | LUG | 1 | 9925520026 |
| **15** | SCREW | 4 | 9900080026 |
| **16** | SPRING LOCK WASHER | 4 | 9907520001 |
| **17** | BEARING GRIPPING FLANGES | 1 | 0020700264 |
| **18** | BEARING | 1 | 9918550000 |
| **19** | WASHER | 1 | 9925010026 |
| **20** | LOCK NUT | 1 | 9922520026 |
| **21** | GASKET | 1 | 9910890061 |
| **22** | HORIZONTAL SHAFT FLANGES | 1 | 0020401502 |
| **23** | SPRING LOCK WASHER | 4 | 9907640026 |
| **24** | SCREW | 4 | 9901090001 |
| **25** | SEALING RING | 1 | 9914560060 |
| **26** | MACHINE SIDE JOINT | 1 | 0030301504 |
| **27** | DOWEL | 2 | 9900120026 |
| **28** | JOINT SPRINGING PART GL8 | 7 | 9931580060 |
| **29** | MOTOR SIDE JOINT | 1 | 0030401504 |

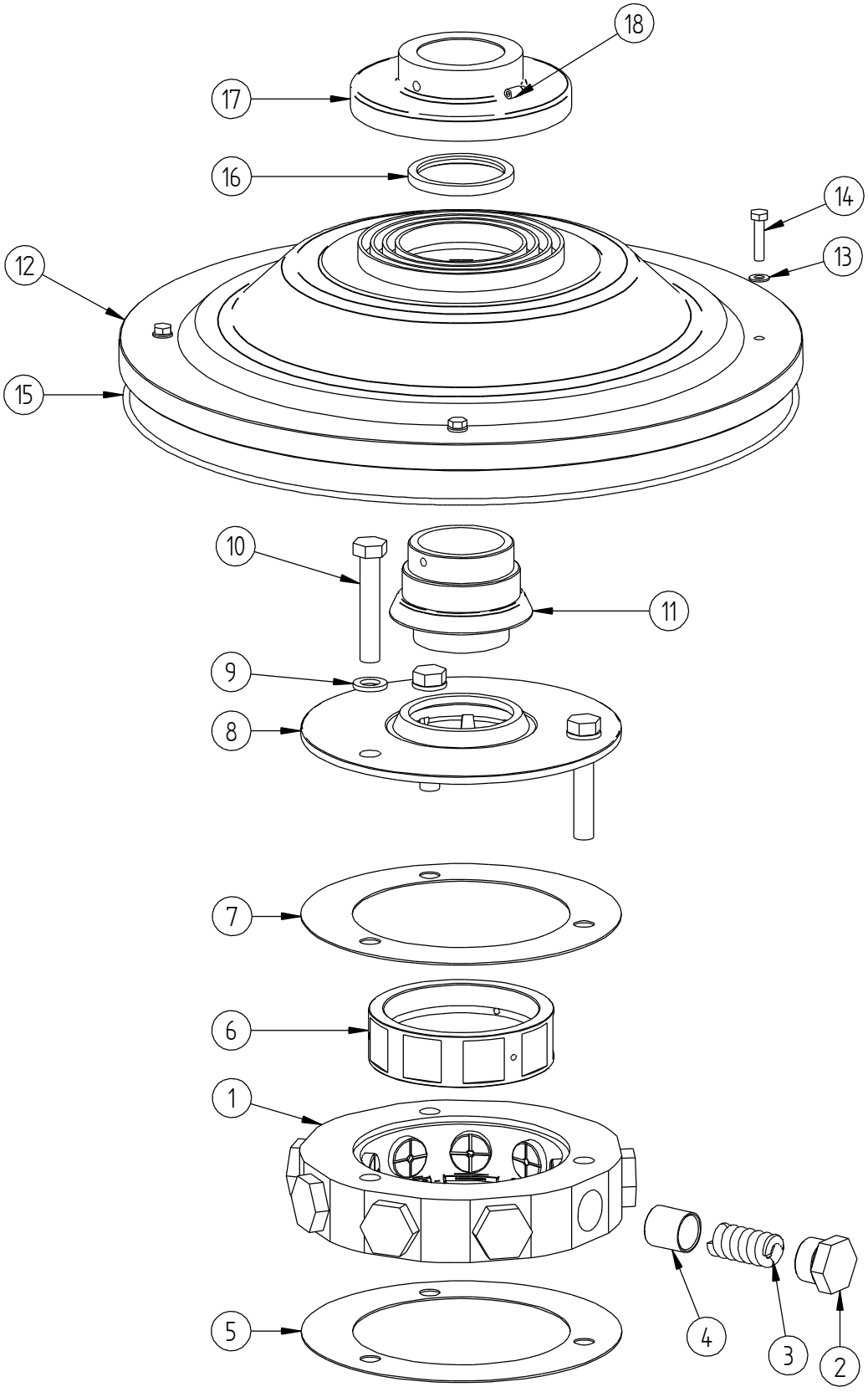
| Table 3 | VERTICAL SHAFT GROUP | 0180000003 |
|---|---|---|



| Table 3 | VERTICAL SHAFT GROUP | 0180000003 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | VERTICAL SHAFT | 1 | 0010100053 |
| 2 | BEARING | 1 | 9918520000 |
| 3 | BEARING UPPER WASHER | 1 | 0010200274 |
| 4 | BEARING | 1 | 9918530000 |
| 5 | BEARING LOWER WASHER | 1 | 0010300274 |
| 6 | BEARING | 2 | 9918510000 |
| 7 | COLLAR BEARING WASHER | 1 | 0040500274 |
| 8 | BEARING CARRIER BOX | 1 | 0010400284 |
| 9 | SEAT THRUST | 1 | 0010700504 |
| 10 | BELLEVILLE SPING | 16 | 9929010030 |
| 11 | END PLATE BUSH | 1 | 0010800503 |
| 12 | GUIDE PIN | 1 | 0010900284 |
| 13 | PINION | 1 | 0010501293 |
| 14 | LOCK NUT | 1 | 9922540026 |
| 15 | SELF BREAKING LOCK NUT | 1 | 9922510026 |
| 16 | GASKET | 1 | 9910610061 |
| 17 | SPRING LOCK WASHER | 4 | 9907640026 |
| 18 | SCREW | 4 | 9900050026 |
| 19 | CAP | 1 | 9934710070 |

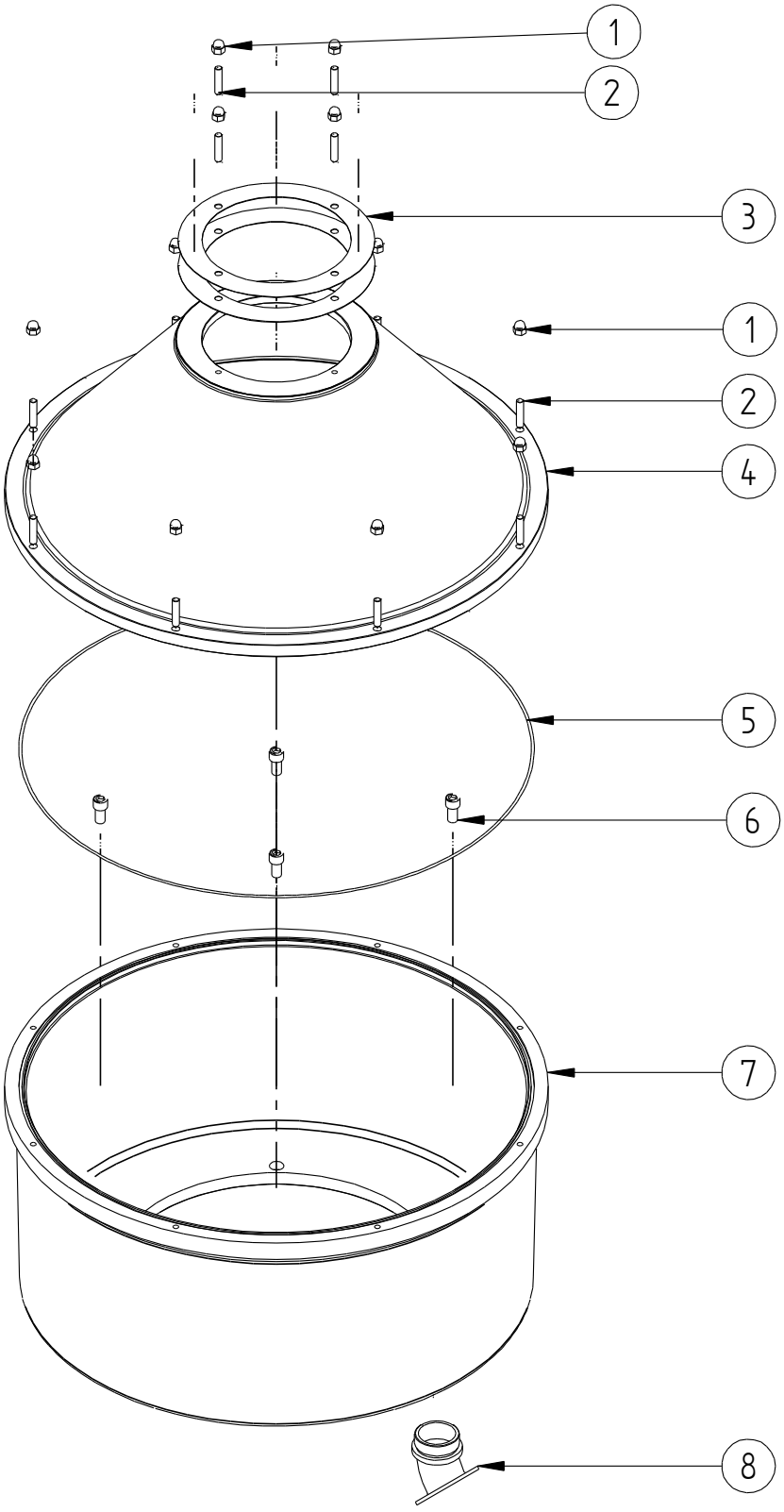
| Table 4 | COLLAR GROUP | 5200000003 |
|---|---|---|



| Table 4 | COLLAR GROUP | 5200000003 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | COLLAR BODY | 1 | 0040200503 |
| 2 | PLUNGER CLAMPING SCREW | 9 | 0040800274 |
| 3 | COLLAR SPRING | 9 | 0040400324 |
| 4 | PLUNGER | 9 | 0040700284 |
| 5 | COLLAR BODY GASKET | 1 | 0040300884 |
| 6 | COLLAR RING | 1 | 0040600283 |
| 7 | COLLAR BODY GASKET | 1 | 0040300974 |
| 8 | COLLAR CAP | 1 | 0040100503 |
| 9 | SPRING LOCK WASHER | 3 | 9907530026 |
| 10 | SCREW | 3 | 9900100026 |
| 11 | INTERNAL LABYRINTH | 1 | 0210100013 |
| 12 | COLLAR COVER | 1 | 0200200803 |
| 13 | SPRING WASHER | 4 | 9907680001 |
| 14 | SCREW | 4 | 9900200001 |
| 15 | GASKET | 1 | 9911380061 |
| 16 | GASKET | 1 | 9914870061 |
| 17 | EXTERNAL LABYRINTH | 1 | 3690200013 |
| 18 | SCREW | 1 | 9900910001 |

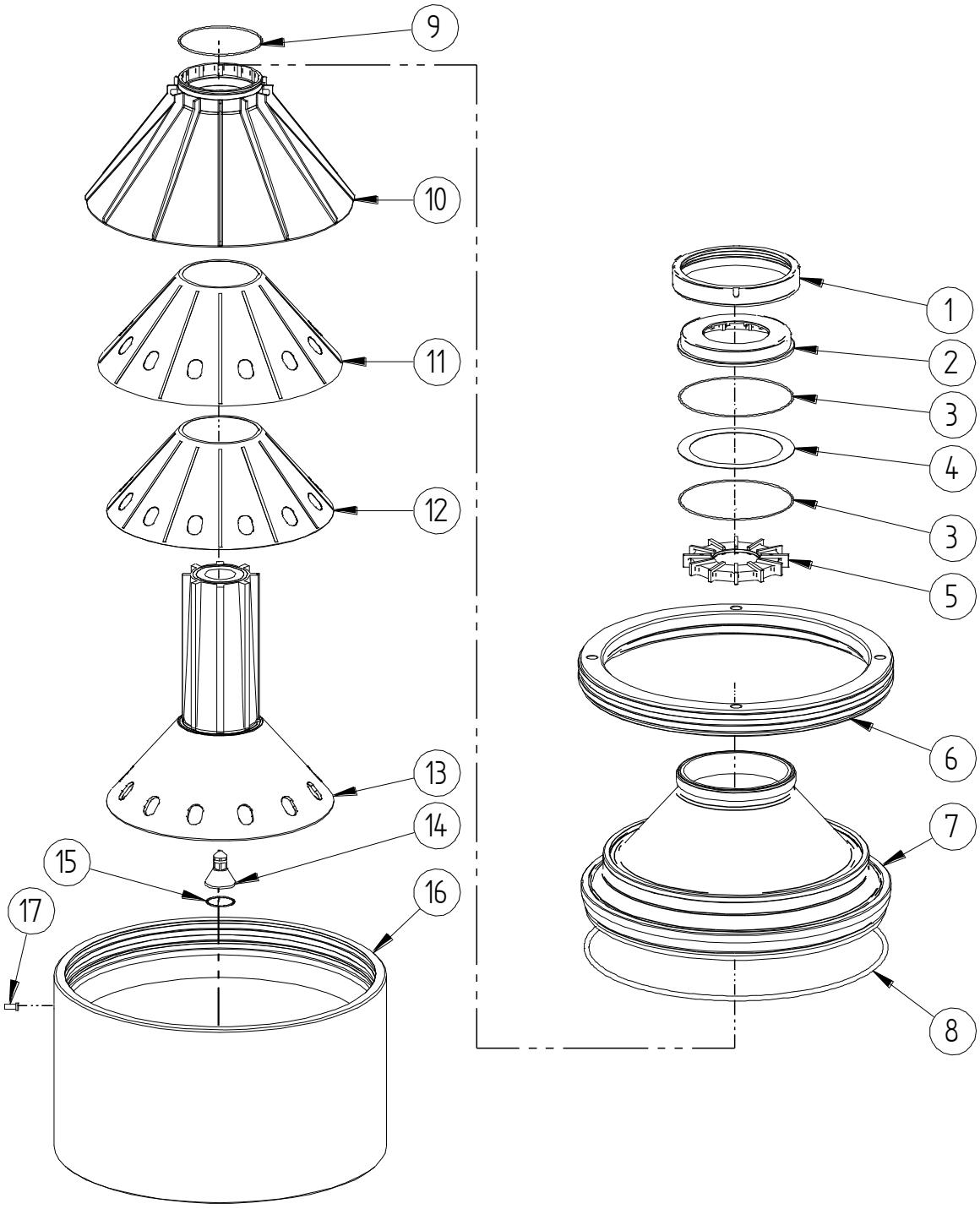
| Table 5 | COVER GROUP | 7020000003 |
|---|---|---|



| Table 5 | COVER GROUP | 7020000003 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | NUT | 12 | 9902540001 |
| 2 | STUD BOLT | 12 | 0060300014 |
| 3 | SPACER | 2 | 0070900014 |
| 4 | COVER | 1 | 7020200012 |
| 5 | GASKET | 1 | 0650100614 |
| 6 | SCREW | 4 | 9900970001 |
| 7 | BASIN | 1 | 0610300502 |
| 8 | DISHARGE PIPE | 1 | 0140106014 |

| Table 6 | BOWL GROUP | 7000000001 |
|---|---|---|

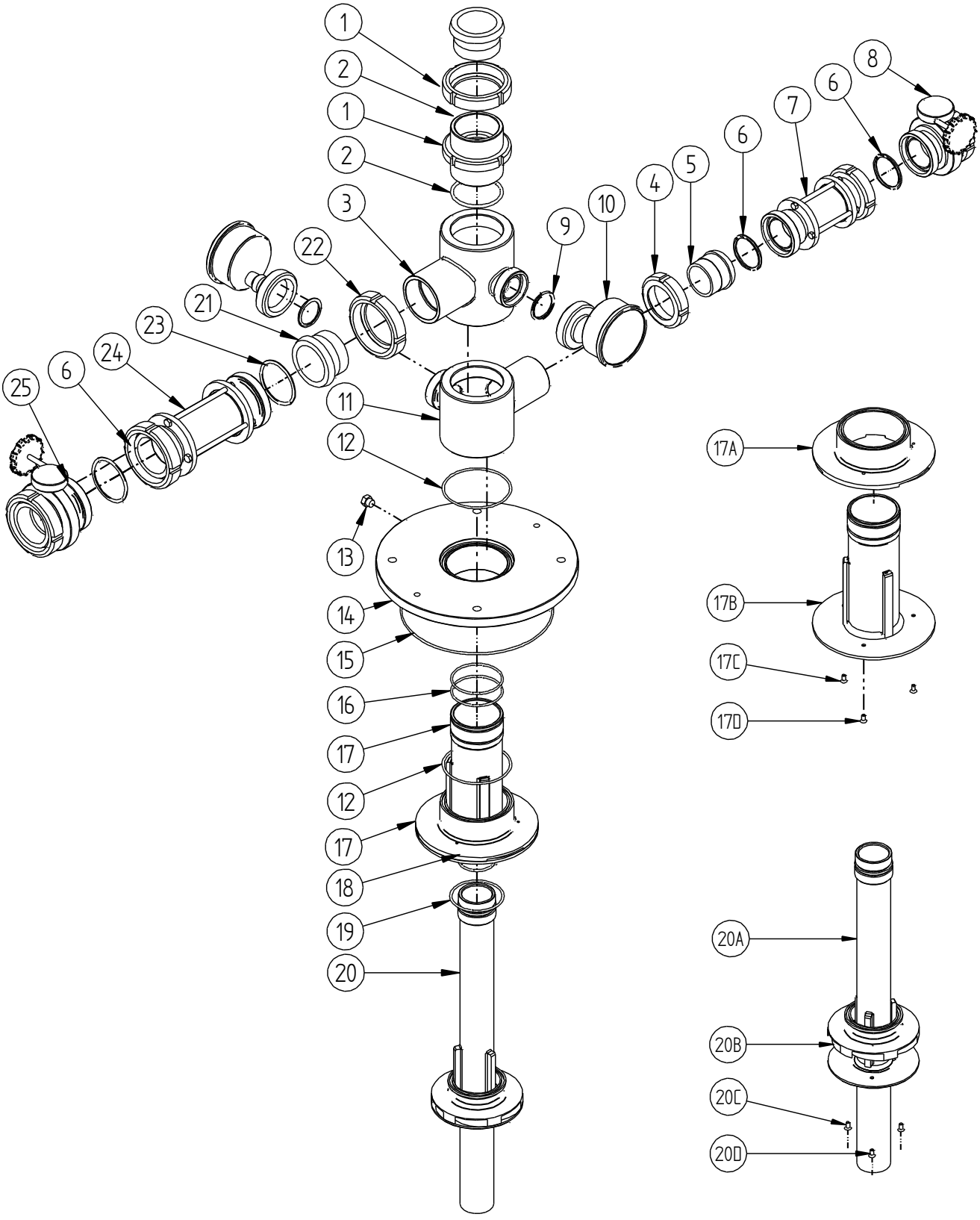


| Table 6 | BOWL GROUP | 7000000003 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | NUT COVER DRUM | 1 | 0050700253 |
| 2 | COLLECTION ROOM | 1 | 7000600023 |
| 3 | OR | 2 | 9910580061 |
| 4 | ADJUSTMENT RING | 1 | 7000900024 |
| 5 | INTERPOSED COVER | 1 | 0220200023 |
| 6 | BIG NUT | 1 | 7000700073 |
| 7 | DRUM COVER | 1 | 7000200072 |
| 8 | SEALING COVER | 1 | 0051000614 |
| 9 | OR | 1 | 9910600061 |
| 10 | CONE DIVIDING | 1 | 7000300022 |
| 11 | DISC TRUNCATED CONE | 182 | 7000800023 |
| 12 | DISC TRUNCATED CONE | 12 | 7000400023 |
| 13 | COLUMN DISTRIBUTOR OVER | 1 | 7000500023 |
| 14 | NUT LOCKING DRUM | 1 | 0951900014 |
| 15 | OR | 1 | 9911240061 |
| 16 | DRUM FUND | 1 | 7000100072 |
| 17 | STUD OF REFERENCE | 1 | 0050102024 |
| 18* | KIT DISCS | 1 | 7009400004 |

*not illustrated

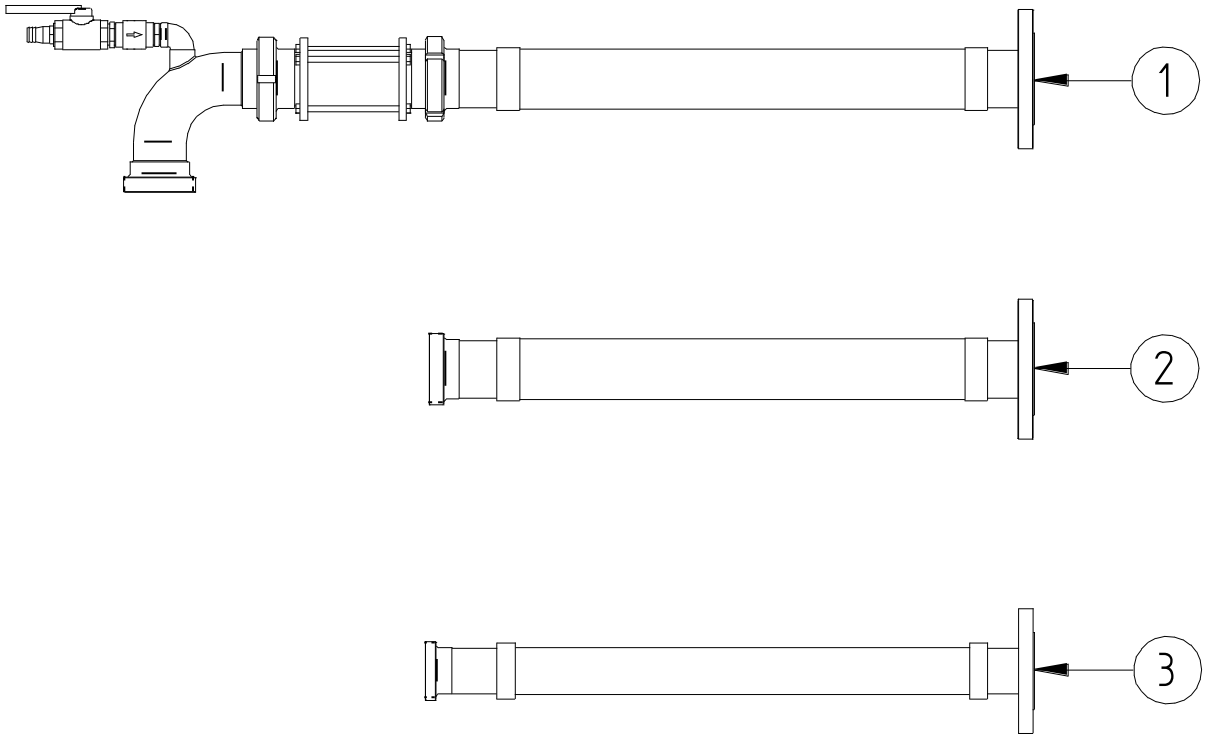
| Table 7 | OUTLET GROUP | 7010000003 |
|---|---|---|



| Table 7 | OUTLET GROUP | 7010000002 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | RING | 1 | 7010300023 |
| 2 | OR | 1 | 9910540061 |
| 3 | OUTPUT UPPER BODY | 1 | 7010200023 |
| 4 | GIRELLA | 1 | 9932030001 |
| 5 | FITTING + ANKLE | 1 | 9932020002 |
| 6 | SEAL | 2 | 9914530061 |
| 7 | VISUAL PASSAGE | 1 | 9932960001 |
| 8 | THROTTLE | 1 | 9938730094 |
| 9 | SEAL | 2 | 9914510061 |
| 10 | GAUGE | 2 | 9937510094 |
| 11 | OUTPUT LOWER BODY | 1 | 0110100023 |
| 12 | OR | 2 | 9910520061 |
| 13 | STOPPER | 1 | 9948420001 |
| 14 | FLANGE SUPPORT | 1 | 0071010023 |
| 15 | OR | 1 | 9911210063 |
| 16 | OR | 2 | 9910530061 |
| 17 | STAGE TURBINE COMPLETE HEAVY | 1 | 7010400023 |
| 17A | TURBINE STAGE HEAVY | 1 | 7010400023 |
| 17B | PLATE TURBINE | 1 | 7010401023 |
| 17C | TSPIC SCREW | 2 | 9900850001 |
| 17D | SCREW HOLES | 1 | 0070306014 |
| 18 | OR | 1 | 9910550061 |
| 19 | OR | 1 | 9910510061 |
| 20 | TURBINE STAGE FULL LIGHT | 1 | 7010100023 |
| 20A | STAGE TURBINE PLATE LIGHT | 1 | 7010101023 |
| 20B | TURBINE STAGE LIGHT | 1 | 0071302023 |
| 20C | TSPIC SCREW | 2 | 9900850001 |
| 20D | SCREW HOLES | 1 | 0070306014 |
| 21 | FITTING | 2 | 9956450001 |
| 22 | GIRELLA | 2 | 9947090002 |
| 23 | SEAL | 2 | 9914540061 |
| 24 | VISUAL PASSAGE | 1 | 9947100002 |
| 25 | THROTTLE | 1 | 9956500001 |

| Table 8 | KIT PIPES | 6870000004 |
|---|---|---|

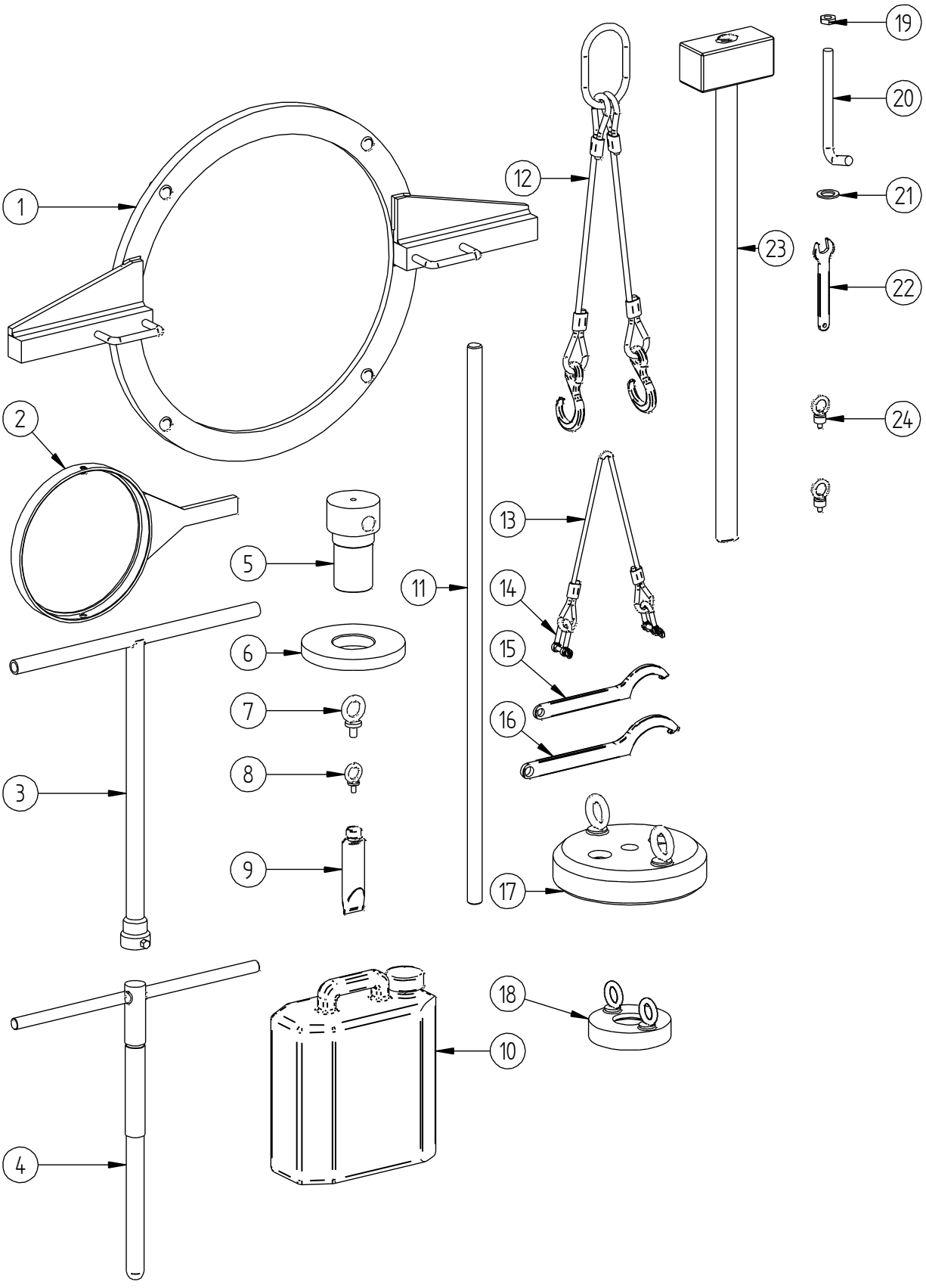


| Table 8 | PIPES GROUP | 6870000004 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| **1** | PRODUCT INLET | 1 | X1520100003 |
| **2** | LIGHT PHASE OUTLET TUBE | 1 | X1520101003 |
| **3** | HEAVY PHASE OUTLET TUBE | 1 | X1520200003 |
| **4*** | GASKET | 2 | 9914540061 |
| **5*** | GASKET | 1 | 9914530061 |

** NOT DISPLAYED*

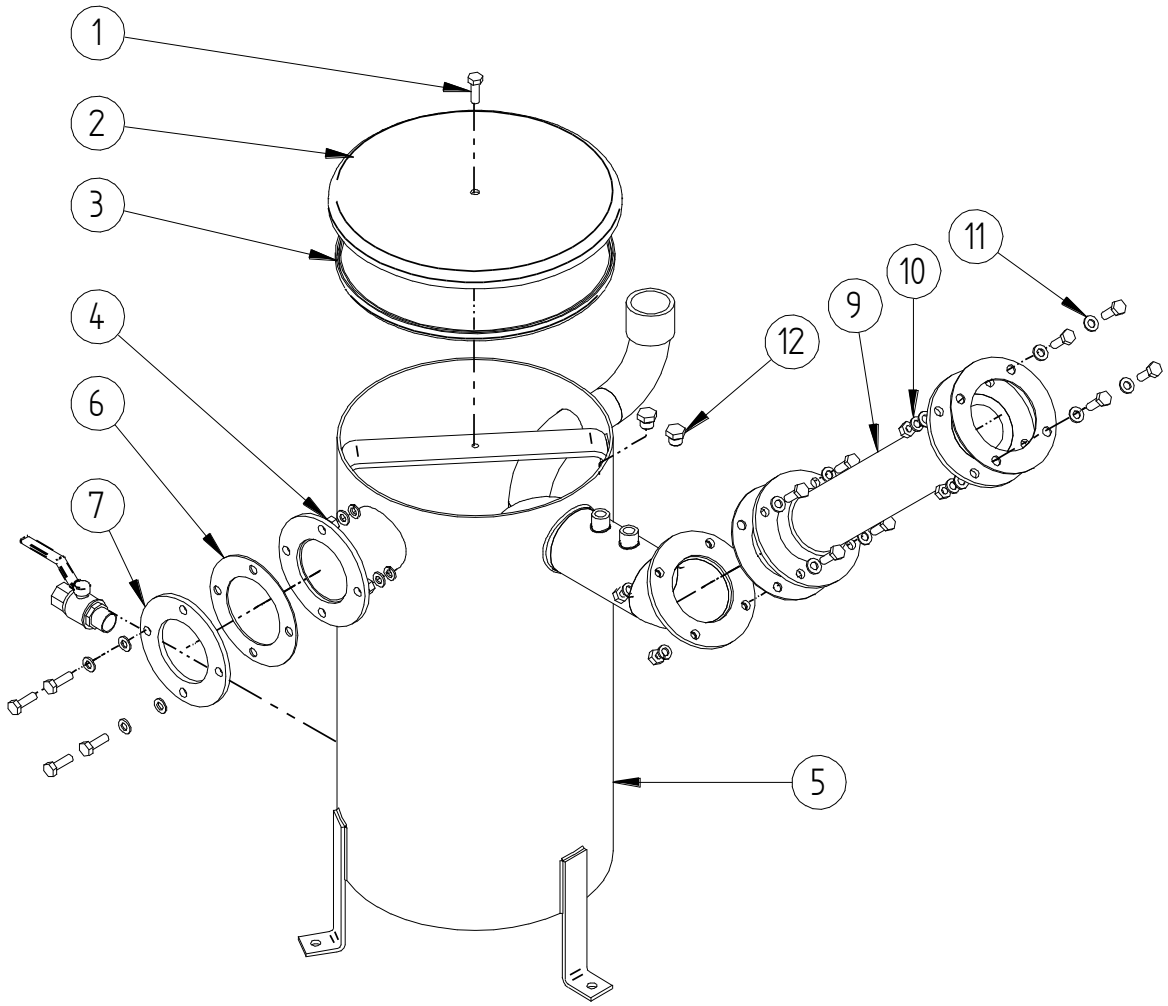
| Table 9 | TOOLS GROUP | 7030000003 |
|---|---|---|



| Table 9 | TOOLS GROUP | 7030000003 |
|---|---|---|

| Rif. | Descrizione | Q.tà | Codice |
|---|---|---|---|
| 1 | BIG NUT SPANNER | 1 | 7030100263 |
| 2 | SMALL NUT SPANNER | 1 | 0130400263 |
| 3 | BOWL STOP SPANNER | 1 | 0130200263 |
| 4 | THREADED ROD | 1 | 1050200363 |
| 5 | THREADED PIN | 1 | 0090101264 |
| 6 | DISK | 1 | 0090102264 |
| 7 | EYEBOLT | 2 | 9937600026 |
| 8 | EYEBOLT | 2 | 9937700026 |
| 9 | MOLIKOTE PASTE TUBE | 1 | 9938630094 |
| 10 | OIL TANK | 1 | 9937850040 |
| 11 | LEVAER | 1 | 0090103264 |
| 12 | BIG CHAIN | 1 | 9937640026 |
| 13 | SHORT CHAIN | 1 | 9937620026 |
| 14 | HOOK BOLT | 2 | 9938470026 |
| 15 | PIN WRENCH | 1 | 9937580020 |
| 16 | PIN WRENCH | 1 | 9937570020 |
| 17 | LOOSENING RING | 1 | 1050100363 |
| 18 | END PLATE HOIST SPANNER | 1 | 1050300364 |
| 19 | NUT | 8 | 9902530026 |
| 20 | FOUNDATION BOLTS | 4 | 0012200264 |
| 21 | PLAIN WASHER | 4 | 9907560001 |
| 22 | WRENCH | 1 | 9937590020 |
| 23 | SLEDGE | 1 | 9937690031 |
| 24 | TOOL BIG NUT LIFTING | 2 | 7030200263 |

| Table 10 | HYDRAULIC SEAL GROUP | 1510000002 |
|---|---|---|



| Table 10 | HYDRAULIC SEAL GROUP | 1510000002 |
|---|---|---|

| Ref. | Description | Q.ty | Code |
|---|---|---|---|
| 1 | SCREW | 13 | 9900110001 |
| 2 | FLANGE COVER MUFFLER | 1 | 0690200012 |
| 3 | GASKET | 1 | 1110400012 |
| 4 | NUT | 12 | 9902550001 |
| 5 | BODY SILENCER | 1 | 0690100012 |
| 6 | GASKET | 3 | 0060500974 |
| 7 | FLANGE | 1 | 0140104014 |
| 8 | BALL VALVE | 1 | 9934350001 |
| 9 | TUBE | 1 | 0140105014 |
| 10 | SPRING WASHER | 12 | 9907520001 |
| 11 | WASHER FLAT | 24 | 9907680001 |
| 12 | CAP | 2 | 9934710070 |

# *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 7031300944.

- **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 7031301944;.

## 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.

Note:

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

## 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: | _____<br>_____<br>_____<br>_____ | |
| Spare parts replaced: | _____<br>_____<br>_____ | |
| date: _____ | technician: _____ | technician sign: _____ |

| n° intervention: 2 | Operating hours: _____ | |
|---|---|---|
| Intervention description: | _____<br>_____<br>_____<br>_____ | |
| Spare parts replaced: | _____<br>_____<br>_____ | |
| 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: _____ |

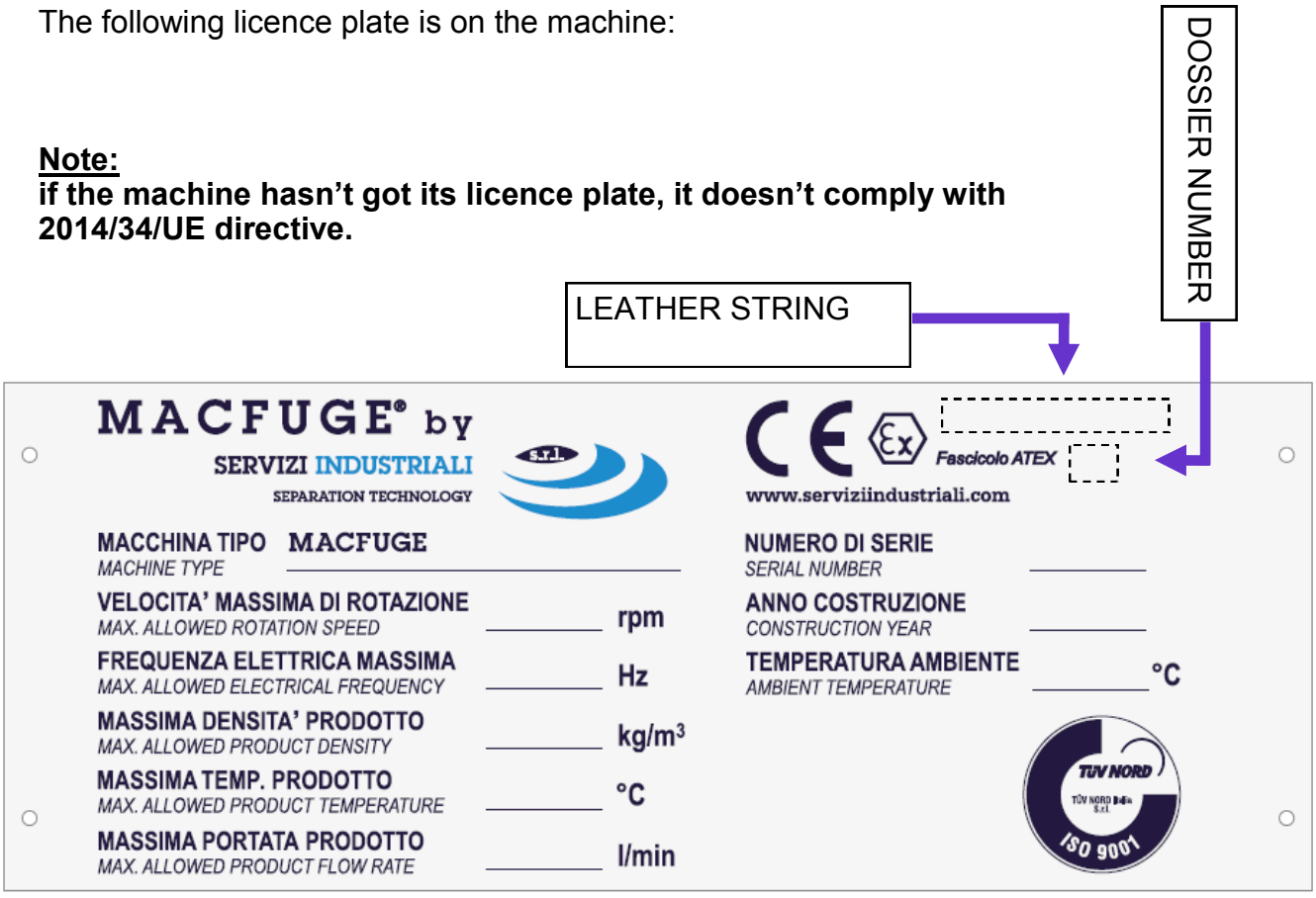
## 16 INSTALLATION INTO AN ESPLOSIVE ATMOSPHERE

In case the machine has been bought for installation into an explosive atmosphere, it complies with 94/9/CE directive and it is a set according to the directive itself.
The machine complies with the following harmonized reference standards:

- EN 1127-1: 2011
- EN 13463-1: 2009
- EN 13463-5: 2011

The compliance with the above mentioned standards requires the observance of all the indications contained in the following chapter, besides those already contained in the manual, the machine installation has to be done according to EN 60079-14 norm.
The documents that state the conformity of the machine with 2014/34/UE directive are “declaration of conformity”, attached to this chapter.
The technical file of the machine called ATEX 09 is filed at the Notified Body TÜV NORD CERT of Hannover.

The following licence plate is on the machine:




**Note:**
**if the machine hasn't got its licence plate, it doesn't comply with 2014/34/UE directive.**

The licence plate is secured on the front side of the bedplate of the machine through rivets.

Interpreting of the labelling string:

**II 3G c IIB T4 X**

| | |
|---|---|
| **II** | Surface equipment. |
| **3G** | Apparatus designed to operate in accordance with the operating parameters established by the manufacturer and able to ensure a normal level of protection. This appliance is designed for environments where there is little chance they develop explosive atmospheres (EN 1127-1 par.6.3) |
| **“c”** | Protection mode through manufacturing safety, harmonized reference standard EN 13463-5: 2004. |
| **IIB** | Accepted fluid group (EN 50014). |
| **T4** | Temperature class. |
| **X** | The machine is designed to operate in a temperature range between 0-40 ° |

## *16 ATTACHMENTS*

Below are attached, if applicable, the following documents:

Conformity Declaration

| | |
|---|---|
| Attachment A | System and components diagram (P&ID) |
| Attachment A1 | Dimensions and weight |
| Attachment A2 | Connections |
| Attachment B | Electrical diagram |
| Attachment C | Test report |
| Attachment C1 | System's configuration parameters |
| Attachment D | Material's certificates |
| Attachment E | Electrical motor's guide |
| Attachment F | Frequency converter's guide |
| Attachment F1 | Frequency converter's parameters |
| Attachment G | Component's guides and certificates |

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SEPARATION TECHNOLOGY