SOLUZIONI AEROMECCANICHE S.p.A.

# AIR HANDLING UNIT

## OPERATION AND MAINTENANCE MANUAL

*Machine Name:*

# AIR HANDLING UNIT

*Model:*

*Year of Manufacture:*

# OPERATION AND MAINTENANCE MANUAL

*Date of publication: August 2014*

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|---|---|
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# CONTENTS

# 1.
# General Information

## 1.1. General information

This Operation and Maintenance Manual is an integral part of the AIR HANDLING UNIT (identified in this Document with the term MACHINE) manufactured by the SAMP S.P.A. company; for this reason if the MACHINE is sold to a new user or owner, this manual must accompany it.

This manual must be carefully stored and protected from any agent which could damage it, for the entire lifecycle of the machine.

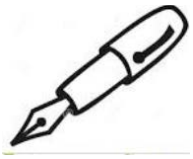
This manual has been prepared with the purpose of supplying operators and technicians assigned to MACHINE maintenance with the essential information and instructions for correctly working and in safe conditions.

***WARNING***: *since the manual needs to be easily and immediately consultable, it must be placed in a well-known and accessible place.*

This manual contains all the data and information needs for preliminary instruction and training of personnel assigned with correct management of the MACHINE; it is obligatory to use it for this purpose.

***HAZARD:*** ***for the sake of clarity, some of the illustrations in this manual show the MACHINE or its components open or disassembled; however, it is prohibited to use the MACHINE in these conditions.***

Despite all the cautions and warnings for correct use of the MACHINE by the operators or to let the personnel assigned to maintenance operate correctly, this manual assumes that occupational safety and hygiene regulations are complied with in the areas where the MACHINE is installed and that the personnel assigned to running and maintenance possess an educational level which lets them correctly interpret the provided information.



***NOTE**:* *The User may request a copy of this document (for example, if the original document is damaged) by written request to the Manufacturer's Technical Department (see Paragraph 1.6.1 - Request for Assistance in this Chapter), with the agreement to return the damaged copy.*

## 1.2. Copyright



The manufacturer declares that the information contained in this manual matches the technical and safety specifications of the MACHINE which the manual refers to. The drawings, diagrams and technical data contained herein are updated as of the date of publication of this document and are solely valid for the MACHINE to which they are attached.

The Manufacturer reserve the right to make changes or improvements to this document material without prior notice.

The Manufacturer shall not be held liable for any direct or indirect injury to individuals or pets or property damage due to the use of this material or the MACHINE in conditions other than those prescribed.

## 1.3. Contents of the Operation and Maintenance Manual

This Use and Maintenance Manual is aimed at operators and technicians so that they can become familiar with the MACHINE and use it correctly.

In addition to a functional description of the MACHINE and its main parts, this manual includes instructions and indications to:

- correctly transport and install the MACHINE;
- correctly use the MACHINE;
- carry out correct cleaning, adjustment and maintenance operations on the MACHINE;
- focus on the most elementary safety and accident prevention rules:

The personnel described above will thus be able to learn the features of the MACHINE and problems which may occur in running it.

All of the chapters must be carefully read to understand the indications supplied in this manual and to work with the MACHINE; for a later and easier search of the contents see Table 1, which includes a description of the topics covered in the chapters.

*Table 1 – Structure of the Operation and Maintenance Manual*

| CHAPTER | CONTENTS | RECIPIENTS |
|---|---|---|
| ***Chapter 1 General Information*** | ➢ Description of this Use and Maintenance Manual, its structure and the conventions used;<br>➢ definition of terms used;<br>➢ Definition of the relationship between the Manufacturer and Buyer/user (for *warranty and assistance conditions*). | All personnel assigned to the MACHINE. |
| ***Chapter 2 Description of the machine*** | ➢ Description of the machine and production process. | All personnel assigned to the MACHINE. |

| CHAPTER | CONTENTS | RECIPIENTS |
|---|---|---|
| ***Chapter 3 Safety and Technical Data*** | ➢ Presentation of general indications on the MACHINE, solutions adopted for the protection of operating personnel, ***generic warnings to observe to use it correctly*** and residual risks present in the lifecycle of the MACHINE;<br>➢ Presentation of the main ***technical data*** regarding the MACHINE. | All personnel assigned to the MACHINE (in particular the mechanical and electrical maintenance personnel and those assigned to handling it). |
| ***Chapter 4 Transport and Installation*** | ➢ Description of the necessary requirements for the MACHINE ***installation site***;<br>➢ Description of the procedures for ***lifting and transporting*** the parts composing the MACHINE; Description of the connection procedures for the power supply and utilities;<br>➢ Description of MACHINE ***storage*** procedures. | All personnel assigned to the MACHINE (in particular the mechanical and electrical maintenance personnel, the Manufacturer's technicians and those assigned to handling it) |
| ***Chapter 5 Set up after installation*** | ➢ Presentation of instructions for acceptance ***testing and commissioning*** of the MACHINE. | All personnel assigned to the MACHINE. |
| ***Chapter 6 Commissioning and use of the machine*** | ➢ Description of the procedures to follow for ***start-up and use*** of the MACHINE. | All personnel assigned to the MACHINE. |
| ***Chapter 7 Maintenance and Scrapping*** | ➢ Description of the ***control and test procedures*** for MACHINE parts and components (in particular the parts subject to the greatest wear);<br>➢ Description of the procedures which let assigned personnel carry out ***cleaning*** of the MACHINE;<br>➢ Indications related to disposal of waste produced by the MACHINE.<br>➢ Presentation of the indications for carrying out ***dismantling and scrapping*** of the MACHINE. | All personnel assigned to the MACHINE (in particular the mechanical and electrical maintenance personnel, the Manufacturer's technicians and those assigned to handling it). |
| ***Chapter 8 Troubleshooting*** | ➢ Indications related to troubleshooting for faults which may occur on the machine | All personnel assigned to the MACHINE |
| ***Chapter 9 List of spare parts*** | ➢ List of machine spare parts | All personnel assigned to the MACHINE (in particular the mechanical and electrical maintenance personnel and Manufacturer's technicians) |

| CHAPTER | CONTENTS | RECIPIENTS |
|---|---|---|
| ***Chapter 10 Attachments*** | ➢ Indications for finding:<br>o Technical drawing, operating diagrams, assembly and installation diagrams related to the MACHINE;<br>o Use and Maintenance manuals related to components not manufactured by the Manufacturer;<br>o additional data and information. | All personnel assigned to the MACHINE. |

# 1.4. Conventions and definitions

## 1.4.1. General information

The MACHINE Operation and Maintenance Manual has been divided into chapters so that for each main phase of the MACHINE lifecycle (transport, installation, use, adjustment, maintenance and decommissioning) it is easy to find relative information necessary for the MACHINE User.

All of the documents related to the MACHINE have been prepared based on the subjects indicated in the Machinery Directive (2006/42/EC) and current safety regulations; therefore it is indispensable to read all of the relative material to obtain the best performance from the MACHINE and ensure maximum duration of all its parts.

The layout of some parts or devices described or shown in the documents may differ from those actually found on the MACHINE in the specific set-up created based on particular needs or safety regulations Any tools or special equipment supplied with the MACHINE is strictly related to the specific characteristics and safety regulations in force in each country. The drawing and photographs are supplied as an example for an easier understanding of the text.

## 1.4.2. Terminology conventions

MACHINE: is the term used in this Operation and Maintenance Manual to indicate the Air handling unit.

PPE: is the abbreviation for Personal Protection Equipment.

## 1.4.3. Definitions

**DANGER ZONE**

Any ZONE within and/or around machinery in which a person is subject to a risk to his health or safety.

**USER**

Any PERSON (enterprise owner/enterprise) who correctly uses the MACHINE or entrusts its use or connected operations to trained personnel.

**EXPOSED PERSON**

Any PERSON who is wholly or partially in a danger zone.

**OPERATOR**

The person or persons, generally without specific expertise, who perform the operations necessary for operating the MACHINE and cleaning the MACHINE and its installation site; if necessary they can perform simple adjusting and repairing operations on the MACHINE.

**MECHANICAL MAINTENANCE PERSONNEL**

QUALIFIED TECHNICIAN who can operate on any mechanical part to perform necessary adjustment, repair and maintenance operations.

Mechanical maintenance personnel must possess sufficient experience in the pneumatic and hydraulic field and in testing techniques; normally they are not authorized to perform operations on live electrical systems.

**ELECTRICAL MAINTENANCE PERSONNEL**

QUALIFIED TECHNICIAN who is responsible for all operations of an electrical nature (adjustment, maintenance and repair) and, when necessary, works with the power on inside electrical cabinets and shunt boxes.

**HANDLING PERSONNEL**

QUALIFIED PERSONNEL who perform handling MACHINE jobs or for materials used when the operation requires the use of lifting devices.

**MANUFACTURER'S TECHNICIAN**

QUALIFIED TECHNICIAN made available by the MACHINE's Manufacturer to perform operations of a complex nature in particular situations or when established with the user.

## 1.4.4. Personal protection equipment and conduct rules

Personal protection equipment is indicated for each of the operations described in this manual which personnel is required to use (possibly in addition to the equipment the personnel is required to wear at the MACHINE installation site) and the conduct rules which make it possible to protect the safety of operators.

***NOTE:*** *Paragraph 3.6.1. Warnings and General Conduct Rules of Chapter 3 - Safety and Technical Data, in particular, contains a series of general recommendations to follow to prevent risk conditions for people or damage for the MACHINE.*

## 1.4.5. MACHINE state

The MACHINE state is the characteristic which described its operation mode (for example, start or stop) and the condition of the safety devices present (for example guards enabled, guards disabled, disconnection of electricity).

## 1.4.6. Printing conventions

The graphic layout of this Use and Maintenance Manual is such as to allow easy recognition of its contents; for example, for this purpose the instructions are associated with lists as indicated below:

- this symbol indicates a general bullet point list or a bullet point list formed by simple actions (the order in which the actions are presented is not binding, but recommended):

This identifies a numbered list of a complex procedure (the order in which the actions are presented is binding to correctly and safely perform the operation in question).

Text in italics is mainly used for:

- cross references; cross references used in this manual are expressed in the following form: “Paragraph/Figure/Table” with the number and generally “Chapter” with the number and relative name (when this is not specified it is understood that the paragraph, table or figure belong to the current chapter).

- the technical and specialist terms, the first time they appear in the text;
- terms in a foreign language which are not commonly used (normally these are also in italics the first time they appear).

**The text in bold is used to highlight words, sentences or parts of procedures.**

In the description of the MACHINE, its components, its use and maintenance, descriptive figures are used for the portion in question and the specific points of interest on them are indicated as follows:

| | |
|---|---|
| number | Symbolic representation of a control or warning device (for example, buttons, selectors or warning lights). |
| letter or number | Symbolic representation of a MACHINE part. |

In addition, to guarantee a more in-depth knowledge of the MACHINE and the instructions for its correct and safe use, the text of the Use and Maintenance Manual is accompanied by indications which complete it, providing supplementary information, indispensable warnings or particularly significant hazards to bear in mind; the following are used for this purpose:

***NOTE:*** *indicates notes, warnings, suggestions and other points to draw the reader's attention or complete an explanation with additional information.*

***CAUTION:*** *indicates situations or operations where exists the possibility of damagingthe MACHINE, equipment connected to it or the environment.*

***HAZARD:*** ***indicates situations or operations which must be performed or information which warrants particular attention to avoid injury.***

## GRAPHIC SYMBOLS USED TO INDICATE THE NEED FOR PERSONAL PROTECTION EQUIPMENT

This paragraph indicates the graphics symbols used in this manual to indicate the need to wear certain PPE.

Indicates the need to use protection devices for the head appropriate for performing the described operation.

Indicates the need to use protection devices for hearing appropriate for performing the described operation.

Indicates the need to use protection devices for the eyes appropriate for performing the described operation.

Indicates the need to use protection devices for the face appropriate for performing the described operation.

Indicates the need to use protection devices for the respiratory system appropriate for performing the described operation.

Indicates the need to use adequate protection gloves for
performing the described operation (possibly dielectric for operations on the electrical system).

Indicates the need to use protective clothing appropriate for performing the described operation.

Indicates the need to use safety shoes appropriate for performing the described operation.

Indicates the need to use slings appropriate for performing the described operation.

# 1.5. Warranty

## 1.5.1. General conditions

The Manufacturer, SAMP S.P.A., guarantees that the AIR TREATMENT UNIT and the equipment manufactured by the same Manufacturer is free from material and processing defects for a period which is established when the MACHINE sales contract is stipulated.

During the warranty period, the Manufacturer agrees to eliminate any material or machining flaws and defects within the time necessary in the event of malfunctioning or breakage as long as the MACHINE has been installed with assistance of the Manufacturer's technicians and that it has been used according to the best running and maintenance practices indicated in this manual.

Defective parts under warranty shall be repaired or replaced free of charge by the Manufacturer, if it can be demonstrated that they are original defects.

Transport and shipping costs, unless otherwise specified in the sales contract, as well as travel expenses for the Manufacturer's technicians to work at the User's site are set out in the sales contract.

To manufacture the MACHINE the Manufacturer uses materials, parts and mechanisms which it believes, at its sole discretion, to be of the type, state and quality suitable for the operations the MACHINE must perform. Based on its policy of continual product development and upgrading, the Manufacturer reserves the right to change the functional and aesthetic specifications, to make changes to the drawing of any operating or ancillary part, or suspend production and supply, without the need to supply prior notice and without undertaking any obligation. In addition, SAMP S.P.A. reserves the right to make any structural or functional change, in addition to changing the supply of spare parts and accessories without the obligation to provide notice to anyone for any reason.

### 1.5.2. Parts not under Warranty

Parts subject to wear and tear, all tools and consumables supplied by the Manufacturer with the MACHINE are not covered under the warranty.

### 1.5.3. User's responsibilities

The customer is responsible for the following:

- Electrical panel and control panels (drives) necessary for the operation
- of the machine;
- Set-up of water mains;
- Set-up of pneumatic mains;
- Tools and consumables.

### 1.5.4. Operations which result in Forfeiture of the Warranty

Any attempt to disassemble, change or tamper with a MACHINE part by the User or unauthorised personnel shall result in forfeiture of the warranty and release the Manufacturer from all liability related to any property damage or personal injury resulting from such tampering.

The Manufacturer shall also not be held liable and the warranty shall be forfeited for the MACHINE in the following cases:

- Unintended uses of the MACHINE (see Paragraph 3.6 – Correct and incorrect use of the MACHINE of Chapter 3 – Safety and Technical Data);
- Any use not in compliance with the requirements in force in the country of use;
- Installation of the MACHINE in conditions other than those specified in Chapter 4 – Transport and Installation;
- Connections not in compliance with the specifications contained in Chapter 4 – Transport and Installation; use of work equipment other than that specified in Chapter 6 – Use of the machine and Chapter 7 – Maintenance and Scrapping;
- Total or partial non-compliance with the instructions contained in this Manual; failure to perform maintenance or incorrect maintenance;
- Use of non-original spare parts or parts which are not specific by the Manufacturer.

## 1.6. Assistance

In terms of obtaining maximum advantage of the performance provided by the MACHINE and the extraordinary maintenance operations, this manual does not replace the experience of trained and qualified installers, users and maintenance personnel.

In this particular case, SAMP S.P.A.'s Technical Assistance Service supplies:

- telephone assistance regarding the specifications and simplest operations which can be performed on the MACHINE;
- sending of documents;
- training of the User's personnel assigned to the MACHINE (only upon request);
- operations to modify the MACHINE (only upon request).

***CAUTION**: in the event of doubts related to the correct interpretation of the instructions contained in the Use and Maintenance Manual, contact the Technical Assistance Service (as indicated below) to obtain the NECESSARY explanations.*

### 1.6.1. Requests for Assistance

To contact the Technical Assistance Service:

TECHNICAL DEPARTMENT OF SAMP S.p.A.
Via Vittorini, 9
20863 Concorezzo (MI)
ITALY
Telephone: (+39) 039 690901
Fax: (+39) 039 6042241
E-mail: info@samp-spa.com
Website : www.samp-spa.com

When calling to request assistance quote the MACHINE name and model.

# 2. Machine description

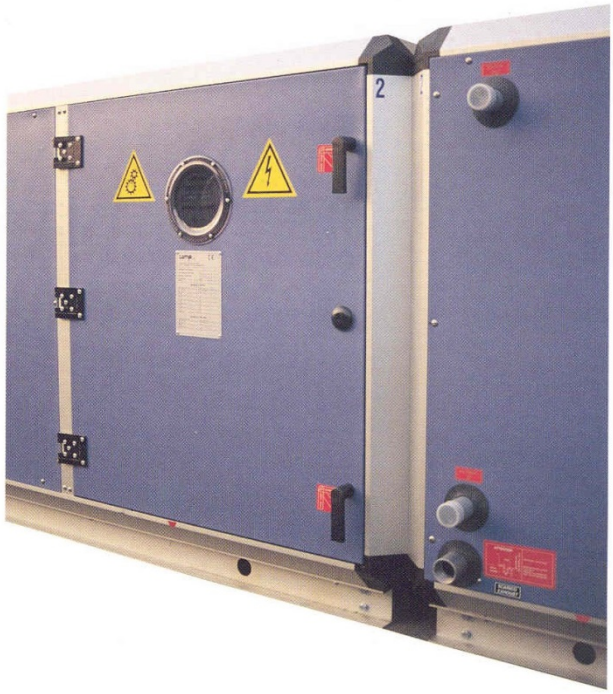
The MACHINE has been designed and built for air treatment. Specifically, the machine is supplied without electrical panels and control panels and thus only with the actuators but without drives. In this sense it does not meet the definition of machinery according to the Machinery Directive (2006/42/EC) since, although it does possess moving parts, it does not perform a determinant function. Thus, the manufacturer, as stated above, sells the machine with the manufacturer's declaration (Annex II, point B of directive 2006/42/EC). It will be the subsequent task of the machine buyer to install an electrical panel and control panels on it, and to mark the entire system CE, as per the Machinery Directive and the Low Voltage Directive.

The MACHINE may have different lay-outs based on the type of treatment requested by the customer. For this purpose, the MACHINE is composed of various sections, each of which with a specific function, which may or may not be present in relation to the requested treatment type. The same sections can also be interchanged based on the design specifications of the type of job order in question.

The machine lay-out is shown in the technical drawing in the manual annexes.

The entire MACHINE is enclosed in a metal frame which permits isolation of the single air handling units from the external ambient. Specifically, the support frame is composed of AISI 316L profiles. The stainless steel fixing screws are embedded in the profile so that there are no sharphy surfaces in the interior. The frame panels are built out of die pressed steel skins with mineral wool insulation. Doors with locking handles and/or windows for internal machine inspection are installed where necessary in the panelling

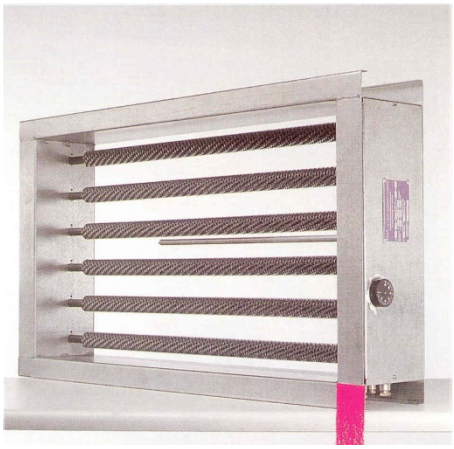
*Figure 1 - Frame*



Usually, units are composed by the following components:

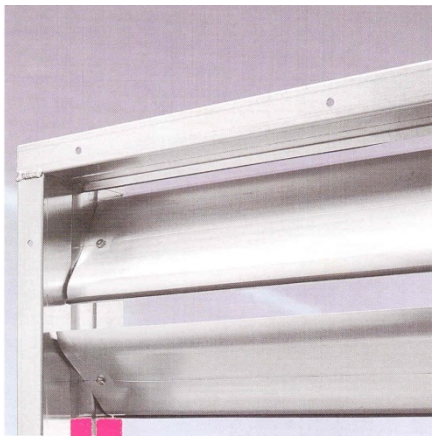
- **Heating coil** (Figure 2): the heating coils are used for heating the air supplied with hot or heated water, steam, diathermic oil or for cooling supplied with chilled water, anti-freeze solutions, water/glycol mixtures or by direct expansion. Alternatively, electrical coils can be used where the air is heated by passing near heating elements.

*Figure 2 – Heating coil*



- **Dampers** (Figure 3): the dampers are composed of framing with a series of galvanised steel or drawn aluminium fins. Damper control can be manual or motorised.

*Figure 3 - Dampers*

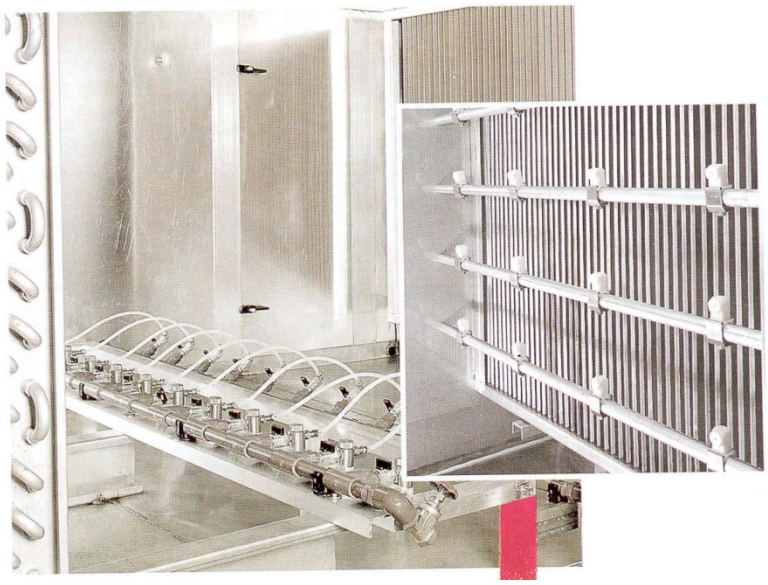


- **Pleated filters**: these filters are pleated type composed of a galvanised sheet, openable, frame with filtering medium in washable synthetic fabric held between two galvanised electrowelded mesh screens. Upon customer request it is possible to measure filter clogging using differential pressure gauges located outside the filtering section.
- **Rotary filters**: these filters are composed of a frame with sliding guides for a filtering cloth in synthetic fibre round on a roll automatically run via a differential pressure gauge.
- **Bag filters** (Filter 4): composed of a sealed counterframe and synthetic material bags. Also in this case it is possible to measure filter clogging using differential pressure gauges located outside the filtering section.

*Figure 4 – Bag filters*

- **Humidification chambers** (Figure 5): available in various types based on the requested application. They may be adiabatic type without water recycling and with absorber or nozzles. Or adiabatic type without water stagnation, with ultrasound system or water and compressed air. For the type with no water recycling and water circulated by pump and nozzles (the most common), a dual chamber housing is included which houses the water distribution network, completely built of galvanised steel, aluminium, PVC or stainless steel pipes, including the header with self-cleaning nylon nozzles. The collection trays and tanks are all built in aluminium alloy. The humidification chamber includes inspection doors and connections for the drain and overflow.

*Figure 5 – Humidification chamber*



- **Fan section** (Figure 6): the standard unit includes the use of double inlet centrifugal fans, in single or tandem configuration. The fan scroll and impeller are in galvanised steel sheet. The impeller is supported by a ground steel shaft supported by ball bearings, preloaded with grease, and with rubber or cast iron seats. Other types of fans can be installed upon request: for medium and high pressures with reverse blade impellers and spark proof for special applications. The fan and motor are mounted on a single base made of special aluminium profiles. Spring-type dampers are mounted under the base to prevent the transmission of vibration to the external frame. The electric motors usually installed are UNEL-MEC series: a.c., closed and self-ventilated. The drive between the motor and fan is via highly efficient DIN standard rubber V belt and cast iron statically and dynamically balanced pulleys- All pulleys have a tapered hub.

For powers up to 2.2 Kw all pulleys are variable pitch. The motors are normally installed inside, they can be moved outside by lengthening the fan shaft and putting dampers under the air treatment unit to avoid vibrations.

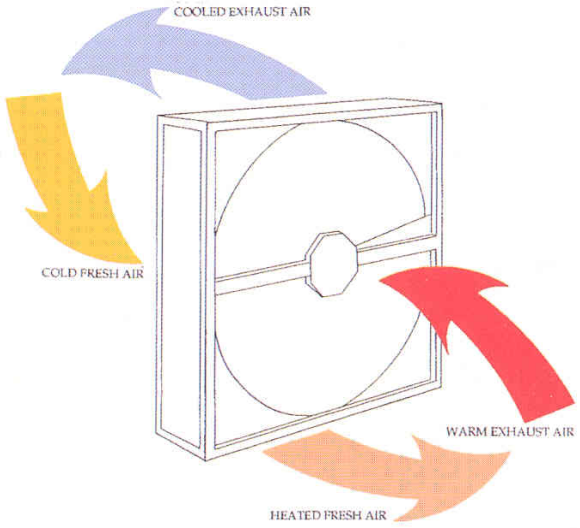
*Figure 6 – Fan section*

- **Recovery units**: the machine can be equipped with recovery units of the plate, rotary, heat pipe, of water coil type. They provide considerable energy savings. In the plate recovery unit (Figure 7) the ultra thick spaces aluminium plates compose the heat recovery unit. These plates are perfectly sealed together at the ends so that the fresh air is not contaminated by exhaust. The enclosure is in galvanised or aluminium sheet.

*Figure 7 – Plate recovery unit*

The **rotary recovery units** (Figure 8) are basically composed of a rotating recovery unit, formed of thin pleated aluminium sheets enclosed in an aluminium frame. The enclosure panels are simple to remove making maintenance and cleaning easier. The recovery unit can be equipped with a speed regulator to change the revolutions of the rotating unit and thus the heat exchange rate.

*Figure 8 – Rotary recovery unit*



# 3. Safety and Technical Data

## 3.1. General Safety Information

### 3.1.1. Design Criteria

To design the MACHINE the principles and concepts introduced by the pertinent paragraphs of harmonised standards where use. They are indicated in ***Table 2***.

*Table 2 – Main harmonised standards used to design the MACHINE*

| NORMA | TITOLO |
|---|---|
| **ISO 12100-1 : 2005** | Machinery safety - Fundamental concepts, general design principles. Part 1: Basic terminology, methods |
| **ISO 12100-2 : 2005** | Machinery safety - Fundamental concepts, general design principles. Part 2: Technical principles |
| **ISO 14121-1 : 2007** | Machinery safety – Risk assessment – Part 1: principles |
| **ISO 13857: 2008** | Machinery safety - Safety distance to prevent reaching dangerous zones with the upper and lower limbs |
| **EN 349-1 1994** | Machinery safety – Safety distances to prevent crushing of human body parts |
| **EN 953-1 2000** | Machine safety - General requirements for the design and construction of fixed and mobile guards |

The compliance with the pertinent paragraphs of the aforesaid harmonised standards has made it possible to eliminate or reduce the risks in the best manner possible, both during normal operation, and during adjustment and maintenance operations for the entire MACHINE life cycle.

The components used have been carefully selected from those available on the market and the materials comprising the MACHINE (and its ancillary accessories) are risk free for the health and welfare of people. All parts supplied by third parties are CE marked (when required) and in compliance with relative reference directives. All parts have been severely controlled in compliance with quality standards required by current norms.

In addition, the necessary warning and protection measures for residual risks have been adopted for the machine (see Paragraph 3.3 – Warnings related to Residual Risks).

## 3.2. Material present on the machine

The MACHINE has been designed and built for air treatment. In general, none of the material present on the machine is hazardous for the operations assigned to running the machine. However, if the machine has active charcoal filter, particular attention needs to be paid during operations which require their handling, storage and disposal since they can cause allergies or be irritants for the operators.

Thus the user of the MACHINE must supply adequate PPE (for example, goggles, masks, gloves or protective clothing), independent from the supply of the MACHINE, to the operators who work in contact with or within the action range of materials which generate the above type of hazards.

Waste and scrap resulting from normal maintenance work on the machine must be disposed of by the MACHINE buyer according to the laws in force in the country of installation of the MACHINE. Disposal must be carried out so as not to damage the environment or injure or harm people or animals, in compliance with relevant laws.

## 3.3. Devices and Solutions for Protection

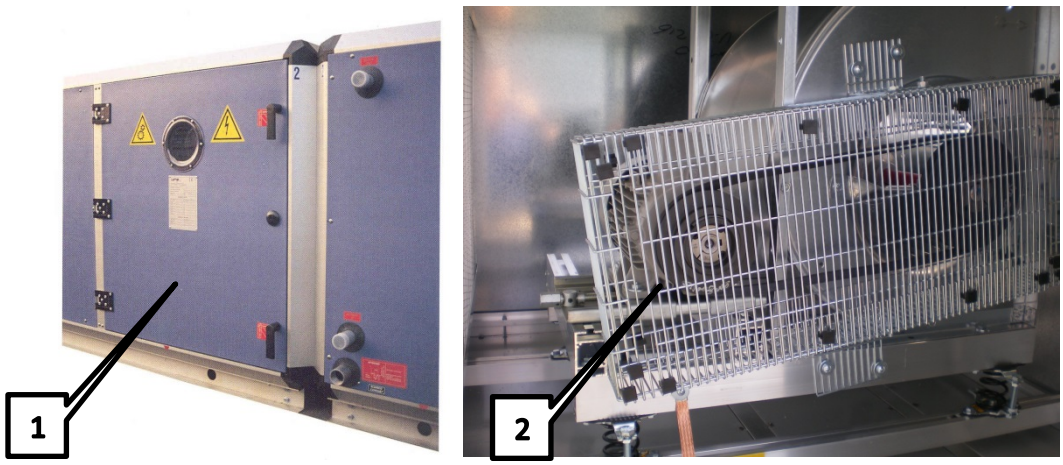
The machine is manufactured by the Manufacturer without electrical panel and control panels (drives) which need to be supplied by others. Thus some of the safety and process devices described below need to be added by the buyer, in the control and emergency circuit he must supply.

### 3.3.1. Passive safety devices

The construction devices and solutions described below have adopted for the MACHINE.

- Metal frame which encloses the single air treatment units present on the machine ( 1 in Figure 9).
- Doors equipped with locking handles for access inside the single treatment unit.
- Metallic mesh screen or guard for the fan unit and corresponding transmission parts ( 2 in Figure 9) (only upon request).
- Safety signs located on the external protection frame (see Paragraph 5-5 in this chapter).

*Figure 9 – Passive safety devices present on the machine*



### 3.3.2. Active safety devices

The active safety devices described below have adopted for the MACHINE.

- Blade microswitches installed on the access doors of the fan sections present on the machine ( 1 in Figure 10).
- If the machine has an electrical heating coil a thermostat is present to detect the coil temperature.

*Figure 10*


### 3.3.3. Process devices

The process devices described below are present on the MACHINE.

- If the machine has motorised dampers, a time is used to automatically stop the fan when the dampers are closed.

## 3.4. Warnings on Residual risks

In order to prevent any hazardous condition for people or damage to the MACHINE caused by residual risks, or those risks which remain despite all of the adopted devices, or from unclear residual risks, the Manufacturer recommends that operators, maintenance personnel and all personnel assigned to the MACHINE scrupulously follow the warnings indicated on the following pages.

***CAUTION:*** *always comply with the signs and indications on the plates affixed to the MACHINE and only work based on the instructions provided in this manual (for example, those in Paragraph 3.9 - Warnings and General Conduct Rules).*

### 3.4.1. Lifting and Transport

#### 3.4.1.1. RESIDUAL RISKS PRESENT IN THE LIFTING AND TRANSPORT PHASES

In the lifting and transport phases there are risks connected with:

- operations on the MACHINE by unqualified, untrained, uninstructed or not correctly equipped personnel;
- incorrect choice or incorrect use of MACHINE component transport and handling equipment (for example crane, hoist, elevators and forklifts);
- crushing of operators assigned to handling;
- loss of load stability during the operations in question;
- projection of moving MACHINE parts which are not removable or not appropriately fixed;
- collision of MACHINE parts or components with people or things caused by sudden movements of the MACHINE or incorrect conduct by those assigned to the operation;
- collision or falling of MACHINE components, damaging the MACHINE and relative guards;
- unhealthy positions or excessive strain for the operators assigned to transport and handling of MACHINE components.

### 3.4.1.2. NECESSARY PERSONAL PROTECTION EQUIPMENT

### 3.4.1.3. MEASURES TO FOLLOW IN THE LIFTING AND TRANSPORT PHASES

The measures described in this paragraph must be followed in the lifting and transport phases.

- For these operations only assign specialised personnel who are instructed on machinery handling procedures and able to select and safely use the lifting and transport equipment best suited to the circumstances (for example, crane, hoist, elevator, trolley or forklift).
- Follow the normal precautions related to the use of fork lifts, hoists or lifting equipment considered suitable for performing the lifting and transport operations (considering their maximum load capacity), in particular, trying to avoid collisions and flipping over; for example when using a fork lift it is indispensable to insert the forks under the support structure of the load to handle, when using a hoist it is necessary to check that the load is correctly secured in order to prevent it from giving way during lifting and transport operations, when using a crane it is often necessary to use a guide rope to prevent dangerous swaying of the load.
- Check and make sure that all the parts which are able to move are correctly secured (or, if required, remove them and refit them when the operation is finished).
- Check and make sure that all of the MACHINE or ancillary equipment pipes are drained.
- Do not lift the various MACHINE parts for any reason by grasping non-structural elements (for example, cables or cable glands).
- Make sure there are no people in the area when lifting, handling and unloading operations take place and always keep at a safe distance.
- Always warn people before starting operations.
- Do not walk under hanging loads.
- Do not “ride” with the loads.

## 3.4.2. Installation and Connection

### 3.4.2.1. RESIDUAL RISKS PRESENT IN THE INSTALLATION AND CONNECTION PHASES

During the installation and connection phases risks are present connected to:

- operations on the MACHINE by unqualified, untrained, uninstructed or not correctly equipped personnel.
- contact with live parts;
- collision with, being crushed, drawn in or trapped by moving MACHINE components;
- tripping or falling near electrical connections;
- falling from a height (during operations at a certain height for positioning or adjusting operations);
- ejection of pressurised fluid (for example, steam);
- damage to the MACHINE during installation and connection phases.

### 3.4.2.2. NECESSARY PERSONAL PROTECTION EQUIPMENT

### 3.4.2.3. SIGNS PRESENT

The MACHINE is equipped with specific danger and prohibition warning signs; see Paragraph 35 – Safety Signs.

### 3.4.2.4. MEASURES TO FOLLOW IN THE INSTALLATION AND CONNECTION PHASES

The measures described in this paragraph must be followed in the installation and connection phases.

- Set up suitable safety equipment (for example, trestles, platforms and scaffolding) so that assigned operators can easily access the work site, setting up all the equipment necessary to prevent falling from above.

- Follow all of the instructions related to safety in Paragraph 3.4.1 – Lifting and Transport during the necessary MACHINE component handling operations.
- Only use ancillary equipment or any other machinery or tools (electrical or pneumatic) after having understood the instructions in the relative Use and Maintenance Manuals or after having followed specific, formal training.
- Select an installation site which:
  - includes sufficient space for normal MACHINE use and maintenance, including the space for any additional equipment
  - makes it possible to correctly connect the MACHINE for its operation,
  - and that it has the specifications described in Paragraph 4.1.2 – Ambient conditions of the Installation of Chapter 4 – Transport and Installation.
- For the electricity, connect the earthing system before any other connection to the mains.
- Protect the piping for connections to energy sources with suitable rigid glands or cable trunking.
- Perform all of the required operations using instruments which are up to standard (ladders, slings and various tools) and paying utmost attention to elements which could cause tripping, cuts and injuries).
- The operating stations of the MACHINE cannot be used until the acceptance test of the MACHINE is performed: the presence of any assembly or installation errors could cause serious accidents for operators assigned to operations.
- Before carrying out the acceptance test and commissioning the MACHINE make sure that none of its parts have physical damage due to collisions, tears or scratches and that all of the connections have been made correctly without the possibility of being disconnected.
- Do not leave the dampers open during the machine connection phases.
- Make sure the machine is perfectly level in order to prevent the inspection doors from closing incorrectly and becoming damaged over time.
- Do not leave the machine or its single parts exposed to inclement weather, make sure they are adequately protected.

## 3.4.3. Use and Fitting Out

### 3.4.3.1. RESIDUAL RISKS PRESENT IN THE USE AND FITTING OUT PHASES

In the use and fitting out phases there are risks connected with:

- use of the MACHINE by unqualified, untrained, uninstructed or not correctly equipped personnel.
- contact with live parts.

### 3.4.3.2. NECESSARY PERSONAL PROTECTION EQUIPMENT

### 3.4.3.3. SIGNS PRESENT

The MACHINE is equipped with specific danger and prohibition warning signs; see Paragraph 35 3. 5 – Safety signs.

### 3.4.3.4. MEASURES TO FOLLOW IN THE USE AND FITTING OUT PHASES

The measures described in this paragraph must be followed in the use and fitting out phases.

- Only run the MACHINE if all the protection are safety devices are intact.
- Do not remove the installed safety devices and guards for any reason.
- Follow all of the safety and danger signs affixed to the MACHINE.
- Make sure that all of the safety and danger signs affixed to the MACHINE are always legible.
- Wear all the necessary PPE, regularly checking them for damage (immediately report any PPE which are no longer able to perform the task for which they were assigned).
- Do not work near the MACHINE without first having completely and carefully read this manual.
- Only use ancillary equipment or any other machinery or tools (electrical or pneumatic) after having understood the instructions in the relative Use and Maintenance Manuals or after having followed specific, formal training.

- Immediately report any abnormal operating situations.
- Do not perform any operation (including lubrication and cleaning) near moving parts or hot surfaces.
- Do not attempt to make the MACHINE perform any operations which are not allowed (see the indications contained in this manual).
- Do not use the MACHINE when under the influence of medicines or alcoholic beverages which can lower your reflexes.
- Do not put equipment inside the machine.
- Do not put equipment / pipes / ducts on the roof of the machine.
- Do not walk on the roof of the machine.
- Check for the presence of any other operators near the dampers before starting the machine.
- If the machine has an electrical heating coil, make sure its thermostat is perfectly connected before starting the machine.

## 3.4.4. Maintenance and Scrapping

### 3.4.4.1. RESIDUAL RISKS PRESENT IN THE MAINTENANCE AND SCRAPPING PHASES

During the maintenance and scrapping phases risks are present connected to:

- operations on the MACHINE by unqualified, untrained, uninstructed or not correctly equipped personnel.
- contact with live parts of the electrical system;
- collision with, being crushed, drawn in or trapped by moving MACHINE components;
- ejection of pressurised fluid (for example, steam);
- forgetting objects on the MACHINE at the end of maintenance or adjustment operations;
- contact with hot parts of the MACHINE or related equipment (including fluids needed for the work process);
- contact with elements which can cause allergic or irritating reactions (for example the active charcoal filters);
- fall from a height (while performing operations at a height).

### 3.4.4.2. NECESSARY PERSONAL PROTECTION EQUIPMENT

### 3.4.4.3. SIGNS PRESENT

The MACHINE is equipped with specific danger and prohibition warning signs; see Paragraph 35 3. 5 – Safety signs.

### 3.4.4.4. MEASURES TO FOLLOW IN THE MAINTENANCE AND SCRAPPING PHASES

The measures described in this paragraph must be followed in the maintenance and scrapping phases.

- Perform the required operations using instruments which are up to standard ladders, scaffolding,
- trestles, slings and various tools) and always wear the necessary PPEs.
- Performance of maintenance and scrapping operations must always be carried out by qualified, specifically trained personnel.
- Comply with the frequencies indicated in this manual for maintenance operations.
- Make sure that the power supplies have been appropriately disconnected and that no one can restart them before the end of the required operations (use of locks, appropriate signs and tested work procedures); also make sure that any residual energy has been discharged before starting the operations.
- When possible work on the MACHINE and pipelines after draining them, and accurately clean the system before restarting.
- Obtain all the necessary permits and make sure that all the procedures for setting up the MACHINE for maintenance operations have been correctly performed.
- Only use ancillary equipment or any other machinery or tools (electrical or pneumatic) after having understood the instructions in the relative Use and Maintenance Manuals or after having followed specific, formal training.

- Do not use petrol, solvent or flammable fluids for any reason to clean parts; use commercial, homologated detergents which are not flammable and non-toxic.
- Do not make any modifications, transformations or applications on the MACHINE which can compromise its safety, without having obtained written authorisation from the Manufacturer.
- Before restarting the MACHINE, make sure that no one is performing maintenance operations (including inside the machine) and that all of the MACHINE safety devices have been reset.
- Do not climb up on or jump off the MACHINE.
- When handling lubricants do not smoke, eat or drink; comply with all regulations related to handling mineral oils and greases.
- Do not stand inside the machine for operations which are not maintenance or to fit filters.
- Do not use the inspectable sections of the machine as a storage area for equipment or as locker room, bathroom, bivouac or other.
- Do not hit the machine frame or panels with tools or anything else.
- Do not tamper with components inside the machine.

## 3.5. Safety signs

The signs indicated in Table 3 are present on the MACHINE.

*Table 3 – Description of signs present on the MACHINE*

| | TARGA | DESCRIZIONE |
|---|---|---|
| A |  | Indicates that it is prohibited to remove the installed safety devices and guards; it is normally accompanied by the words: DO NOT REMOVE PROTECTION DEVICES. |
| B |  | Indicates that it is prohibited to perform any operation (including lubricating and cleaning) near moving parts; normally it is accompanied by the words: DO NOT REPAIR OR SET WHILE OPERATING. |
| C |  | Indicates a danger due to the presence of live parts near the machine zone where it is positioned. |
| D |  | Indicates the danger of being dragged in and consequent crushing near the machine zone where it is positioned. |

## 3.6. Work Area and Operator's Position

The machine operates completely automatically, an operator's intervention is only needed to turn it on and off. The operator's position during these two operations can only be defined after the buyer has installed the electrical panel and control panels for running the machine on the machine.

## 3.7. Information on Noise and Vibrations

### 3.7.1. Noise

The AIR TREATMENT UNIT has been designed and constructed in such a way to reduce the level of emitted noise during normal operation to the lowest level.
The A-weighted sound pressure level generated by the AIR TREATMENT UNIT and measured in compliance with criteria set by current laws, is less than 70 dB (A) during operation.

### 3.7.2. Vibrations

Vibrations do not result in any risk in use conditions in compliance with the instructions supplied by the manufacturer in this manual.
However, if the operator notices vibrations, he must immediately stop the machine and report the vibrations to the Manufacturer's assistance service.

## 3.8. Correct and incorrect use of the MACHINE

The MACHINE can only be used to treat air according to the procedures envisaged for the treatment unit installed on the machine.

The MACHINE has been designed and constructed to work in areas where there is not potentially explosive atmosphere and cannot itself generate a potentially explosive atmosphere.

As a precaution, powder extinguishers should be provided near the machine. To prevent a fire risk the machine needs to be kept free from pieces of plastic, oils, solvents, paper and rags.

The use of the MACHINE for different operations can injure people or damage the MACHINE and are thus considered incorrect use for which the Manufacturer shall not be held liable.

***CAUTION***: *if the intended use will be different it is indispensable to first contact the Manufacturer's Technical Department.*

## 3.9. Warnings and General conduct rules.

In order to avoid any risk condition for people or damage to the MACHINE, it is advisable to scrupulously follow the warnings and general conduct rules described below.

***HAZARD:*** ***the Manufacturer shall not be held liable for any propertydamage and/or injury to people resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

The operators assigned to run the MACHINE must be appropriately instructed for best using it and without risk and must operate in a comfortable environment which can guarantee the best safety and hygiene conditions possible.

***HAZARD***: **do not allow the MACHINE to be used by unauthorised personnel or uninstructed personnel without supervision: before starting to work, each operator must be perfectly aware of the position and the operation of all controls and the MACHINE specifications; in addition, he must have ENTIRELY read this manual.**

Before using the MACHINE make sure that any condition which is hazardous for safety has been appropriately eliminated and that no operators are present in the danger zones near the machine.
Before using the MACHINE, make sure that the walk-on surfaces, all guards or other protection devices are in place and that all safety devices are present and working correctly.
Notify supervisors of any irregular machine operation and any problems related to the conditions of the MACHINE guards.
Consult this manual for current safety regulations and specific PPE to use for personal safety; in particular, personnel assigned to the MACHINE must wear suitable clothing avoiding or paying careful attention to:

- loose clothing,
- long sleeves,
- ties or hanging scarves,
- necklaces, bracelets and rings.

- To prevent causing damage to the MACHINE and creating dangerous situations, it is advisable not to attempt stand on MACHINE components.
- The personnel assigned to MACHINE maintenance must know all of the procedures contained in Chapter 7 – Maintenance and Scrapping and have a adequate
- technical background to correctly interpret the instructions and diagrams attached to this manual and for operating on the MACHINE.
- The area where maintenance operations (ordinary and extraordinary) are performed must always be clean, dry and with suitable equipment always available and in good working condition.
- The work area must never be occupied so that it interferes with the operator's freedom to move. In the event of an emergency, immediate access must be guaranteed to the machine for assigned personnel.
- People who are not directly assigned to machine operation are prohibited access to this area in order to avoid hazards due to distraction or negligence during operations on the machine.
- It is prohibited to access parts of the machine which are not accessible through the access door.
- If it is necessary to perform operations near the electrical components work with completely dry hands and wear dielectric gloves (working with electrical components with wet hands may lead to a practically certain risk of electrocution).

***HAZARD:*** ***before starting any type of operation on the MACHINE or near its components or ancillary accessories the power supplied must be disconnected; if this is not possible it is necessary to take measures to that it is possible to work safely near the MACHINE.***

***HAZARD:*** ***tampering with or unauthorised replacement of one or more MACHINE parts and the use of accessories, tools and consumables other than those indicated by the Supplier may generate a risk of accident.***

***CAUTION:*** *all materials with an environmental impact which must be eliminated following operations or processing on the MACHINE must be disposed of according to current laws.*

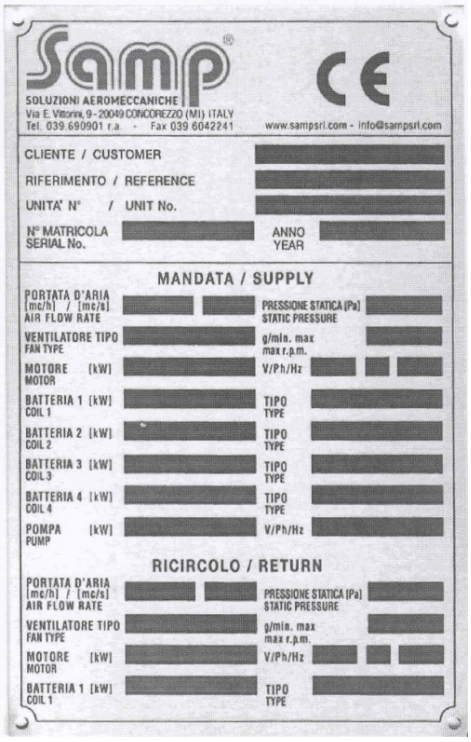
*If necessary use specialised facilities for their disposal.*

# 3.10. MACHINE Data and Technical specifications

## 3.10.1. Identification plate

A specific plate (Figure 11) has been affixed to identify the MACHINE; the identification data on this plate must be quoted to the Manufacturer's offices for any request for assistance or to order spare parts.

Figure *11*




# 3.11. Technical data and Dimensions

The machine technical specifications and dimensions can be found on the Technical diagram found in the annex of this manual.

# 4.
# Transport and installation

## 4.1. General information

The installation or reinstallation of the MACHINE must be performed by qualified personnel. Supervision by the Manufacturer's specialised personnel is recommended.

However, before installing the MACHINE it is necessary to prepare the power supplies and utilities required for correct operation of the system, following the instructions contained in this Chapter and, if necessary, consulting with the Manufacturer's Technical Department ahead of time.

***HAZARD**: the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.*

### 4.1.1. Power supplies and Utilities

The necessary power supplies and utilities (up to the Buyer) for operating the MACHINE are listed below:

- electricity;
- water;
- supply of pressurised steam.

Unless otherwise indicated, the Buyer is also responsible for:

- setting up the transport means and lifting equipment necessary for transporting the MACHINE parts to the assembly and installation site;
- preparing the equipment necessary for assembly and installation;
- preparing the installation site (see Paragraph 4.1.2. – Ambient conditions of the Installation Site and Paragraph 4.1.3 – Minimum spaces for MACHINE installation);
- preparation of any ancillary equipment and consumables (for example non-flammable and non-corrosive detergents, materials and instruments necessary for cleaning and drop cloths).

### 4.1.2. Ambient conditions of the Installation Site

The MACHINE can be used in almost all difficult, lengthy work conditions thanks to its intrinsic robustness. The machine does not require special ambient conditions for its operation. For a correct installation it is sufficient to prepare a levelled support surface, indispensable for correct operation of the machine and to ensure normal opening of the inspection doors. The altitude of the installation site must be under 1,000 metres above sea level (at higher altitudes the electrical motors supply powers lower than rated ones).
Based on the model, the machine can be installed and work in closed spaces away from inclement weather (including in basements) or outdoors. The machine has a metal cover if it is installed outdoors.

***CAUTION**: in any case, make sure the ambient light is sufficient for working safely, if it is not the Buyer must install one or more light sources, appropriately places making sure that dangerous dark zones do not exist, not blinding light or stroboscopic effects.*

***CAUTION***: *if the machine has been designed, based on the buyer's requests, for use in a closed environment, away from inclement weather, if is prohibited to install it outdoors. Doing so may cause faults on the machine or malfunctioning which could result in hazardous situations for the operators. Thus, the use of a machine designed for inside us* ***represents an incorrect use****, for which the Manufacturer* ***shall not be held liable*****.**

## 4.1.3. Minimum space for installing the MACHINE

Installation in the workplace must be done so that the MACHINE and its equipment are accessible for starting it, stopping it and performing the required maintenance work.

Generally, in selecting the site, it is important to bear in mind that an operator needs to be able to move around the machine without obstructions. The minimum distance compared to the closest wall must be at least equal to the width of the machine.

If there is no transport equipment for moving the machine, enough free space must be left for any repair work. Obviously, a space must be planned large enough for regular operation, as well as machine maintenance, including all the space for any peripheral equipment.

In terms of the dimensions of the MACHINE components, to be taken into consideration for the purposes of the installation, refer to the technical drawing contained in the annexes to this manual.

***CAUTION:*** *the Manufacturer shall not be held liable for any operations performed by the User which can decrease the level of safety of the MACHINE.*

## 4.2. Transport and handling

The instructions contained in this paragraph must be complied with during the MACHINE transport and handling phases, which may occur in the following situations:

- MACHINE storage;
- assembly and first installation of the MACHINE;
- uninstalling and disassembly of the MACHINE;
- movement and repositioning of the MACHINE.

***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

To perform the job in question the following Personal Protection Equipment is necessary:

During transport and handling of the machine it is necessary to follow the warnings below:

- During loading operations with a forklift make sure the weight is correctly balanced and that the forks are always protruding. In addition, be careful not to hit or damage the perimeter base with the forks.
- During unloading, handling or other operations do not push or pull the various sections of the coil headers, handles or any other component inside the units. During handling operations slide the sections on pipes if possible.
- Do not walk on the machine.
- Do not place board, tools or any other weights on it.
- Make sure the access doors are always closed and locked when handling the machine.
- Do not hit the machine frame or enclosure panels with tools or anything else.

## 4.2.1. Lifting

***HAZARD:*** ***lifting operations must be performed with the direct supervision of a qualified mechanic maintenance person or Manufacturer's technician.***

Handling and positioning of the monoblock air treatment unit or in various sections can be performed using any adequate equipment and complying with the indications given in Figure 12 and Figure 13.

*Figure 12 – Indications for lifting*

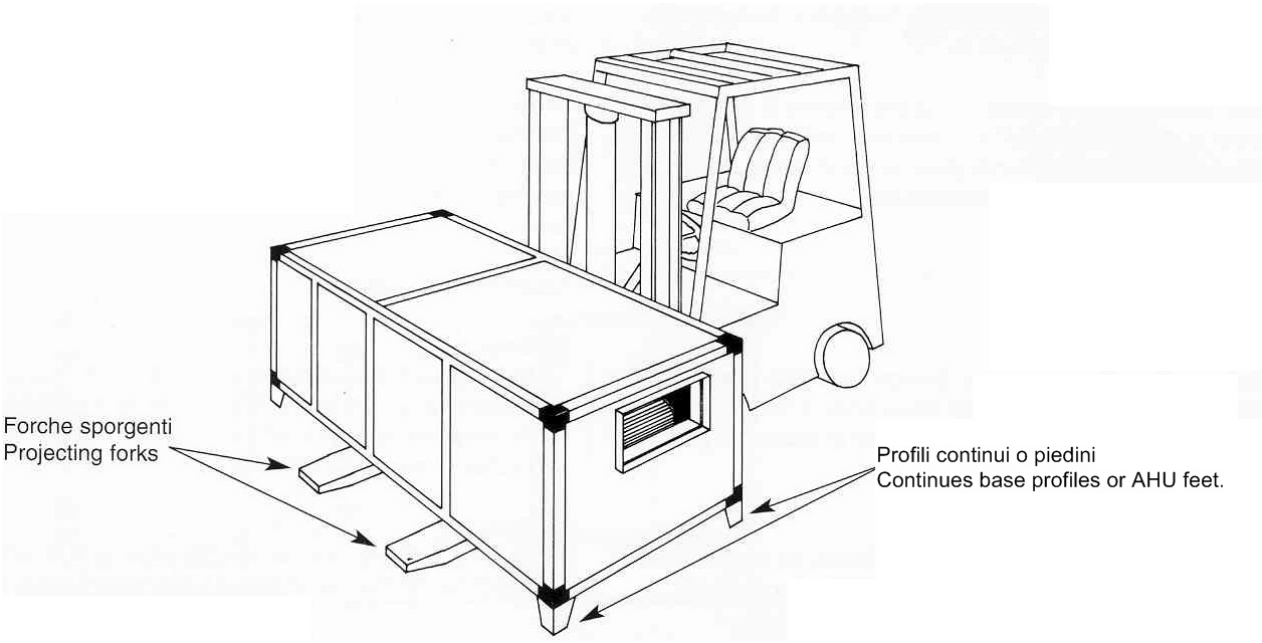
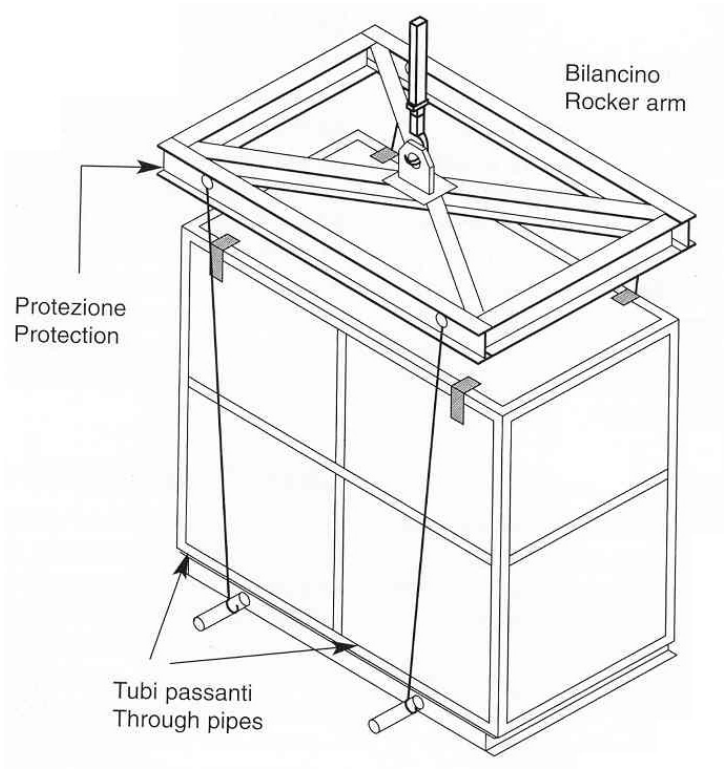


*Figure 13 – Indications for lifting*




To correctly perform the lifting operations, follow the warnings below:

- Never use two lifting devices at the same time.
- Never stand under hanging loads.
- If steel cables are used always apply the end eye to the lifting hook.
- If using steel cables, be careful not to create sharp bends, or with a curve radius less than that of the eyelets at the end of the cables.
- Use cables of an adequate length so that the angle between the cable and the horizon is always greater than 45°.
- If they are equipped with lifting eyebolts, the shackles at the ends of the cables must be screwed by hand and facing the direction of the work.

## 4.2.2. Handling the MACHINE

For short distances, for example transport towards the assembly or storage site for MACHINE components, it is necessary to use lifting equipment (for example, cranes, hoists, elevators or forklifts) suitable for the dimension and weight of the specific parts.

***CAUTION:*** *during all of these operations take the necessary precautionary measures to prevent collisions and flipping over, handling the MACHINE components so as not to unbalance them.*

***HAZARD***: ***make sure that no unauthorised personnel is near the area when lifting, handling and unloading operations take place and always keep at a safe distance.***

## 4.2.3. Transport

To correctly perform the transport operations, follow the warnings below:

- Always make sure that the dimensions of the transport equipment is sufficient for the goods to transport.
- For transport, secure the machine to the equipment bed with wedges, wood boards and tightly secure the parts which cannot be anchored to the lorry bed.
- If transport is via container, they need to be positioned correctly as specified in the indications which can be seen on them. Each container must clearly indicate the hooking and lifting points, the maximum allowed weight and measured weight.

## 4.3. Installation

***CAUTION:*** *given the nature of the necessary operations, they must be ONLY performed by personnel who is instructed, trained and authorised by the Manufacturer.*

***CAUTION:*** *for a correct installation se the instructions specified in the documents in the annexes (technical drawing, etc.).*

***HAZARD: the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

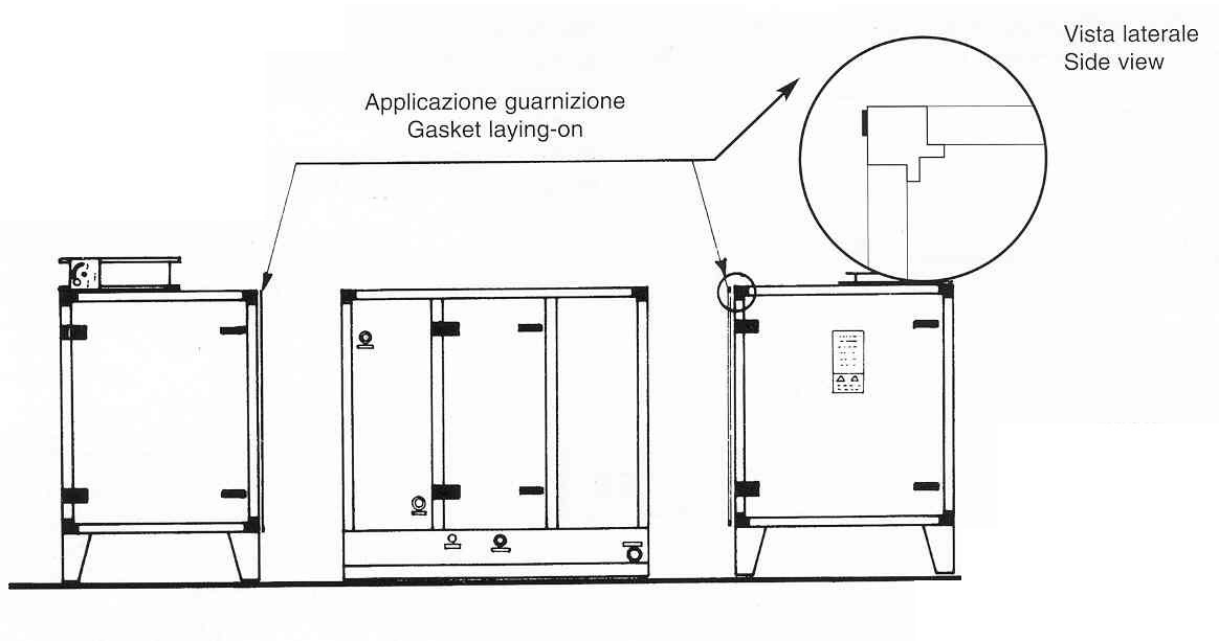
To perform the job in question the following Personal Protection Equipment is necessary:

For installation of a monoblock treatment unit it just needs to be positioned on the support surface and levelled, using shims if necessary.

If the processing unit is composed of various sections the following procedure needs to be adopted, bearing in mind that all of the sections are supplied with gaskets in rolls, threaded rods, nuts and washers for the assembly:

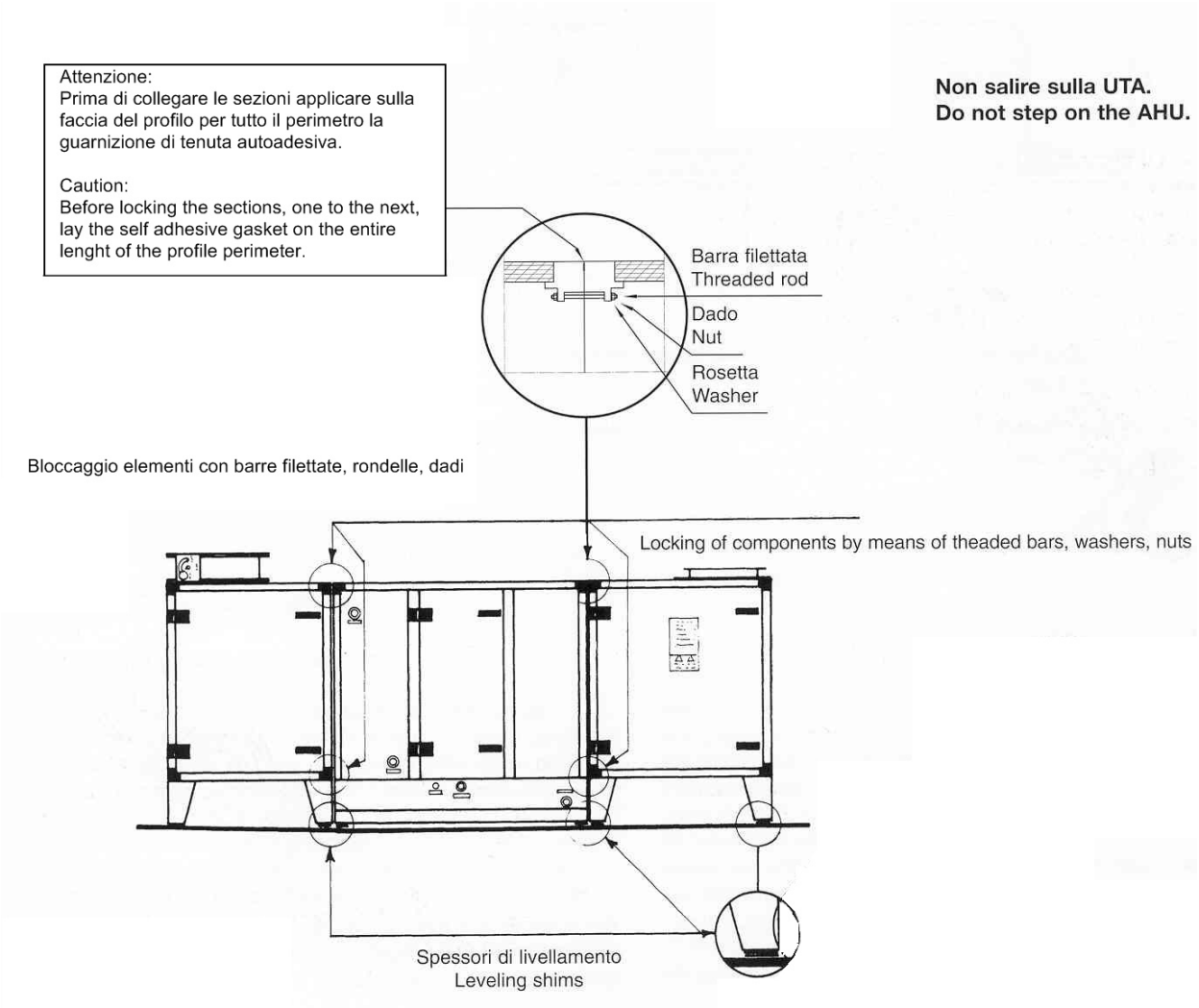
1. Place the sections as shown on the technical drawing in the annexes, distancing them enough to be able to place the gaskets; position a gasket along the entire perimeter of each joint (Figure 14).

*Figure 14 – Gasket laying-on*




2. Bring the sections closer together, levelling them, if necessary with shims under the bases (feet, tanks and bases).
3. Open the inspection doors and bolt the sections from the inside, removing the specific panels if needed (Figure 15).

*Figure 15 – Bolting the sections*




For the dimensions see the technical drawing in the manual annexes.

### 4.3.1. Connection to electricity mains

***HAZARD:*** ***this activity must be performed by an authorized technician (electrical maintenance personnel).***

The machine is constructed by the Manufacturer without any electrical panel and control panels; this, the electrical connection of the machine must be done based on the system designed by the buyer and thus he is responsible for this.

The electrical supply (including in terms of voltage and frequency) supplied by the Buyer must be sufficient for correctly supplying the machine.

The following additional conditions should be taken into consideration regarding the electrical supply:

- in terms of harmonics: harmonic distortion due to the sum of harmonics from the second to the fifth which does not exceed 10% of the total effective voltage value between live conductors; an additional distortion is allowed, for the sum of harmonics from the sixth to the thirtieth, equal to 2% of the total effective voltage value between live conductors;
- relation to the three phase voltage unbalance: neither the inverse sequence component, nor the zero sequence component of the three phase voltage should be greater than 2% of the voltage direct sequence component;
- related to voltage interruption: voltage interrupted or reset for a time not greater than 3 ms, in any instant of the supply cycle with more than 1 s between two successive interruptions;
- related to voltage dips: voltage dips which do not exceed 20% of peak voltage for one cycle; more than 1 s must elapse between two successive dips.

The electrical connection must be made in compliance with laws in effect in the country of installation (in Italy, for example the CEI 64-8 series is used: Italian electrical system users with rated voltage not greater than 1000 V in a.c. and 1500 V in d.c.) and must guarantee correct operation.

Additional warnings related to connection of the electricity:

- An adequate differential type protection needs to be installed upstream from the mains connection points to the machine, in order to be able to isolate each of its parts in the event of faulty operation; the selection of the differential protection device must not be in conflict with local laws or standards, with the plant electrical specifications or machine specifications.

- Differential switches are recommended where not in conflict with local laws or system specifications. They should have an adjustable current and tripping time and not be affected by high frequency.
- The connection cables for the various machine parts to the mains must be shielded or pass through metallic trunking in order to reduce electromagnetic disturbance. The shielding or trunking must be earthed.
- Once the system is prepared, it is possible to connect the machine to the electricity mains.

**CAUTION**: *connection of the machine earthing line is mandatory and must be done BEFORE connecting the phase cables, in order to prevent possible electrocution or damage to the line.*

***HAZARD: the operations for connecting the electricity to the machine present a risk of electrocution.***

The instructions below must be followed by the buyer for the operations for connection to the electricity mains.

- Direct starting (short circuit): the simplest system for starting an electric motor is to connect the mains voltage directly to the coils. In this case the starter equipment will only consist of an overload cutout. However the start-up current will be high. This type of start-up is recommended up to 5.5 kW.
- Star/Delta starting a motor wound at 400V needs to be started with a star-delta starter- The principle of this starter and the contact connections in triangle connection and in delta connection are described in Figure 16.

The utility supply voltage should not deviate more than 10% from normal voltage. Higher voltage differences can cause damage to the utilities and electrical system, malfunctioning of the fans and noise. Therefore it is indispensable to check that actual voltage values match rated ones. Figure 16 shows the operating diagrams for connecting single speed motors and multispeed variable torque tapped winding motors. The diagrams are to use as a guideline and can be changed and completed by the engineer.

*Figure 16 – Operating diagrams for motor connections*

## *Single speed motors connections*

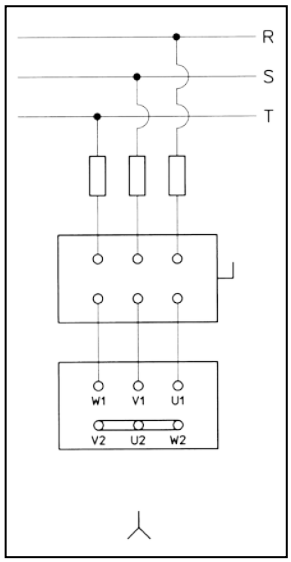



***Fig. 12.1 - 3 Phase 400 Volt Star connection: for motors up to 5.5 kW.***

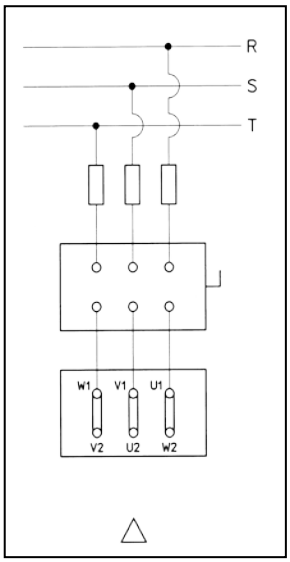



***Fig. 12.2 - 3 Phase 240 Volt Delta connection: for motors up to 5.5 kW.***

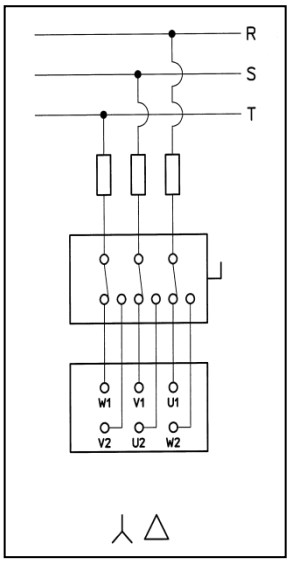



***Fig. 12.3 - 3 Phase 400 Volt Star- Delta connection: for motors of 7.5 kW and more.***

## *Multi speed motors connections*

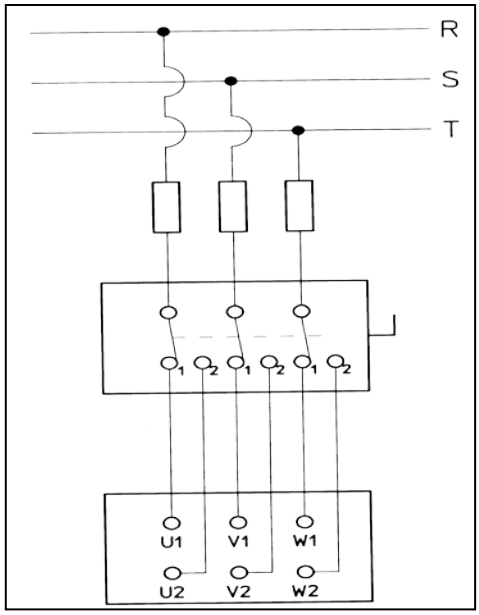



***Fig. 13.1 - Three phase multi-speed variable torque tap- ped winding motor connection (Dahlander).***

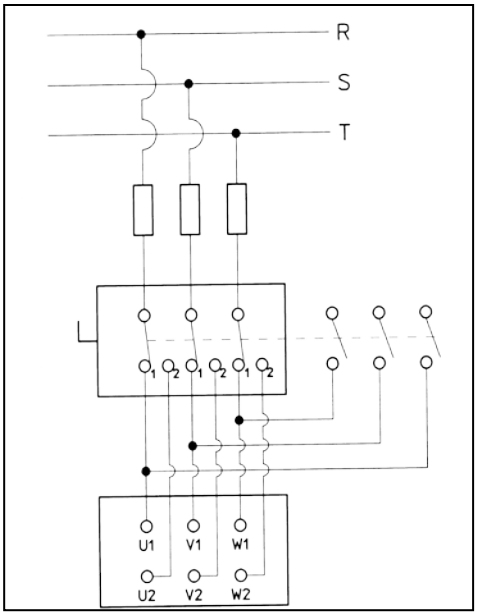



***Fig. 13.2 - Three phase multi-speed variable torque two winding motor connection.***

## 4.3.2. Air duct connection

The air treatment unit must be connected to air ducts via flanged anti-vibrating joints and calibration dampers; if these components are not supplied the coupling can be made by connecting directly to the mains making sure to add a suitable antivibration system between the mains and the duct.

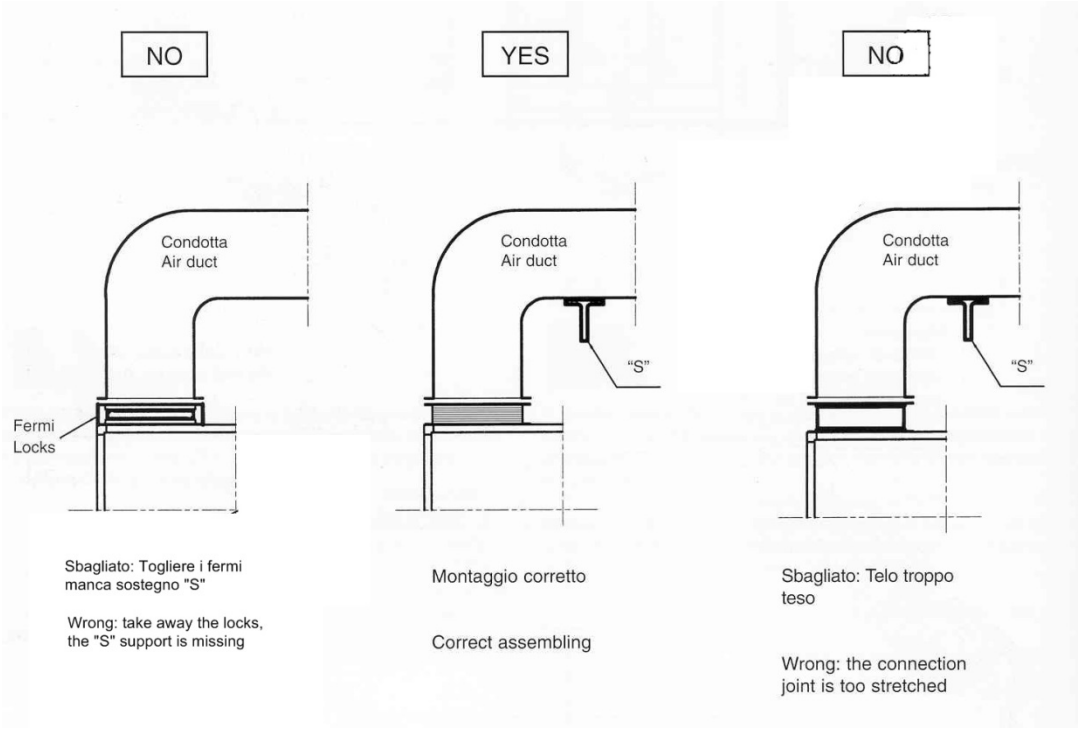
For correct operation of the machine the ducts need to be dimensioned based on the system and the aeraulic specifications of the machine fan.

In order to optimise the connections with the ducts and for correct operation of the whole system, the following is recommended:

1. cleaning of the coupling surfaces between the ducts and machine;
2. sealing with a specific gasket or silicon of all connection points between machine and ducts to prevent water infiltration;
3. insulating of the ducts to prevent their condensation and emission of noise.

If the machine is connected to the ducts with anti-vibration joints follow the figure below and make sure that the anti-vibration joint is not too tight or completely crushed.

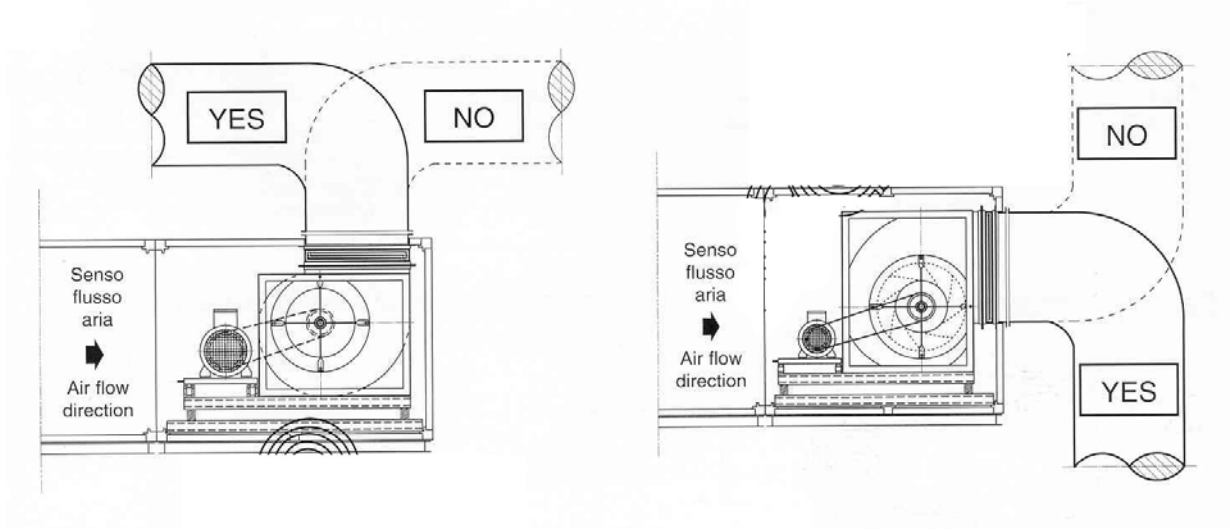
*Figure 17 – Duct connection*



It is indispensable for correct machine operation that the weight of the ducts does not affect the machine in any way, thus it is necessary that they are supported with specific brackets and/or frames.

In order for the fan to supply the expected performance the duct section connected to the fan delivery must have the same dimensions as the opening of the fan. In addition, to prevent quickly damaging the fan, the air flow, in its route, must follow the geometry of the scroll, i.e. so that it moves so that vortexes are not formed. See Figure 18 below.

*Figure 18 – Correct air circulation*

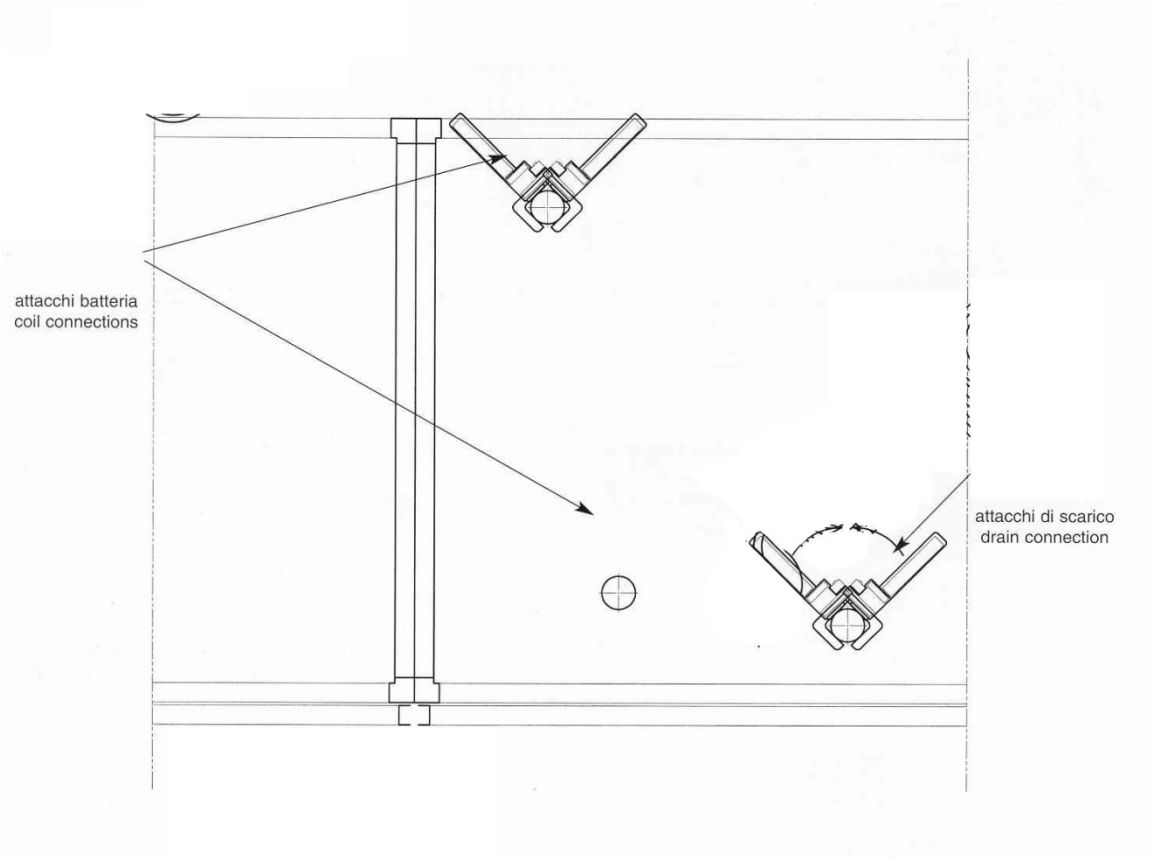



## 4.3.3. Water connections

To make the water connections follow the instructions on the plates located near the connection.

However make sure that the water inlet and outlet are such as to allow heat exchange in the opposite direction of air flow. In order to prevent damaging the heat exchange coils it is necessary to reduce the screwing force on the connections as much as possible, using a second pipe clamp. See Figure 19 for this.

*Figure 19 – Water connections*




***CAUTION**: always keep the machine connection pipe blocked when making the connection with the related distribution and/or drain pipe.*

It is important that the water system pipes do not put a strain on or transmit stress and vibration to the coil connections to prevent breaking their manifolds; for this purposes suitable bracketing or supports for the connection pipes need to be prepared.

***CAUTION:** All water connection operations must be performed by specialised personnel.*

### 4.3.3.1 CONNECTION OF HEAT EXCHANGE COILS

The machine can be supplied with water, steam or direct expansion heat exchange coils.

In order to guarantee optimal hear exchange it is advisable to wash the heat exchange coils before they are connected to the mains; after connection make sure there is no air in the system. This can be done by using the specific valves on the water circuit.

The route of the water inlet and outlet pipes needs to be designed so that no obstructions are created if the heat exchange coils is extracted, and so that correct opening of the machine inspection doors is not obstructed.

On-off valves to disable the water circuit coil must be included.

All of the coils must be fitted with a specific valve for their complete drainage and for bleeding air; the first will be positioned on the lower header, the other on the upper header.

#### WATER SUPPLIED COILS

These coils are installed with horizontal pipes. These circuit pipes must be dimensioned by calculating the water flow necessary for obtaining the design heat output.

#### STEAM SUPPLIED COILS

These coils are structured with pipes inclined in the direction of the condensation drain.

The circuit pipes needs to be dimensioned by calculating the steam flow necessary for obtaining the design heat output (make sure the steam pressure is the same as the design pressure to avoid irreparable damage in the invent of pressure and thus temperature which is not compatible with the selected materials.

To avoid damage to the coil the accessories (control value, condensation drain and on-off valves) should be correctly dimensioned for the actual pressures and flows. In addition the feed steam should be dry saturated to prevent suctioning of the condensation and prevent water hammers.

To prevent the formation of a vacuum in the coil, a in addition to the control valve and condensation drain, a vacuum relief valve needs to be fit at the steam inlet zone.

To prevent overheating of the machine parts, when the fan is off it is indispensable that the steam flow be cut.

### DIRECT EXPANSION COILS

These coils are installed with horizontal pipes.

When the general chilling system has been completed, prepare connection to the coil as follows:

- Cut the header.
- Remove the distributor protection caps.

***CAUTION:*** *be careful not to let moisture and dirt get into the coil.*

The system pipes need to be connected to the coil connections using braze welding, letting dry nitrogen flow through the pipes until oxides are formed.

Thermostatic expansion valves, on-off valves, dehydrator filters and visual warning lights need to be fitted.

The liquid suction pipes need to be dimensioned for the required potential and so as to ensure oil circulation even when the coil operates at minimum load. In order to prevent the oil present with the coolant from being blocked in the coil, it is necessary to keep the gaseous coolant at speeds over 6m/sec. in the vertical section and at least 2.5m/sec. in the horizontal sections.

During operation with partial loads the speeds will be lower, therefore it is indispensable to set up adequate siphons for the oil and an inclined suction pipe.

## 4.3.3.2 WATER HUMIDIFIER WATER CONNECTIONS - NOZZLES / ABSORBER

If there are humidification sections with a absorber this section needs to be connected to the mains with appropriate accessories (not supplied with the machine) for correct operation. These include:

- On-off valves.
- Control valve.
- Filters.
- Pressure gauges.

This piping with relative accessories must be built so that it does not create obstructions for normal maintenance work on this section, such as cleaning nozzles or replacing the absorber.

For correct operation of the machine it is important that both the drain and overflow (which the sections are equipped with) are not connected directly to the drain pipe to the sewer system.

### 4.3.3.3 HUMIDIFICATION WITH HONEYCOMB ABSORBERS

Before starting operation make sure the honeycomb absorber is correctly installed. At the first start-up visually check that the honeycomb absorber becomes uniformly wet; if you see sprays of water on the surface the water flow needs to be adjusted using the specific cock.

### 4.3.3.4 HUMIDIFICATION WITH CIRCULATION PUMP

To prevent damage to the pump, before starting up check that:

- The electrical connection has been perfectly carried out, according to local laws.
- The tank is completely free from any foreign material from the installation that could cause it to clog.
- The water level inside the tank is kept at 15-20 mm below the level of the overflow. If there is not enough water in the tank the pump motor will overheat; if there is too much water it will overflow and flood the equipment and installation site.

### 4.3.3.5 HUMIDIFICATION WITH DIRECT STEAM

For air treatment units which have mains steam humidification systems, the steam distributor with all necessary accessories, the valve body and its drive need to be connected carefully following the manufacturer's manual in the annexes in this manual.

### 4.3.3.6 HUMIDIFICATION WITH SELF-GENERATED STEAM

For air treatment units which have electrically generated steam humidification systems with submerged electrodes, it is necessary to:

- Position the cabinet correctly following its manufacturer's instructions.
- Electrically connect the cabinet (see the manufacturer's diagrams and instructions in the annexes of this manual).
- Connect the water supply pipe
- Connect the cabinet drain.

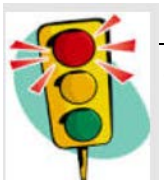
***CAUTION**: the cabinet needs to be supplied with normal water and not demineralised or treated water.*

***CAUTION**: for additional information, troubleshooting, maintenance and anything else see the manufacturer's documents in the annexes of this manual.*

## 4.3.4. Drain and siphoning

Before positioning the machine it is necessary to make sure to leave enough space for installation of the siphon and drain pipe. Near the humidification sections and cooling coils the machine is equipped with a threaded drain which protrudes about 80 mm on the side. Each drain needs to be equipped with a correctly dimensioned siphon in order to allow normal water runoff.

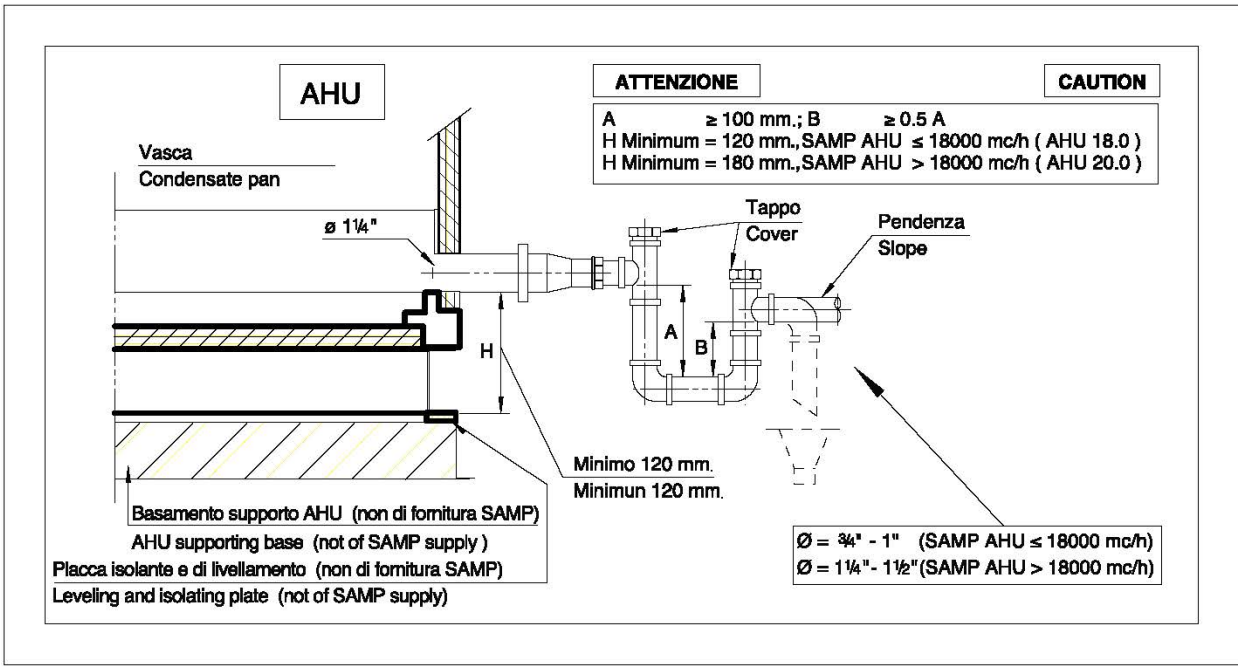
In order to prevent overflowing of the collection tank and consequent flooding of the machine as well as the installation site, the siphon needs to be fitted with a discharge valve to remove any impurities that settle on the bottom.



***CAUTION**: in order not to compromise operation of the drain system, do not connect ressurised siphons with vacuum ones.*

Siphoning of the condensation collection tray drains is indispensable for correct operation and the difference of measurement “A” between the connection and siphon drain depends on the value of the pressure existing above the tray. Normally this measurement difference in mm is 1,5 times the static head of the delivery fan, expressed in water column mm.

*Figure 20 – Drain siphon*




***CAUTION:*** *for fan heads not greater than 1000 Pa (100 water column mm) "A"=100 mm; for each 100 Pa (water column 10 mm) of fan pressure greater than the initial pressure, increase height "A" by 10 mm. For humidification systems with circulation pump, to avoid the increase of salt concentration in the humidification tank, it is important to regularly drain a little water in the overflow by opportunely adjusting the valve installed in the by-pass pipe from the delivery pipe to the pump. To prevent excessive water consumption in the humidification tanks the floating cock needs to be adjusted.*

## 4.3.5. Electrical coil connection

The electrical coils are composed of a galvanised steel frame, or in stainless steel upon request and a series of armoured type finned heating elements, with one or more power stages.

The electrical connection must be made on the end of the frame, inspection side, where there are bores for cables for the electrical supply.

The electrical coils need to be fitted with a safety thermostat which cuts the power circuit (the connection must be made by a qualified electrician contacted by the buyer who is responsible for the machine electrical supply).

***CAUTION:*** *during the heating process if the fan stops it may cause overheating of the air within the machine, with possible and consequent damage to the motor, bearings, insulation and parts in synthetic material. To get around this problem, the system should be set up so that if the fan stops the coil electrical supply is cut.*

***HAZARD***: ***during electrical coil installation make sure that correct connection of the safety thermostat cuts the power to the battery if the machine stops.***

## 4.4. Storage

If the MACHINE needs to be stored for a certain period of time before it is installed (or after uninstalling), it should be adequately protected and stored in a suitable place with the following characteristics:

- external surfaces resistant to inclement weather;
- protected against access by unauthorised people;
- equipped with a fixed floor, with water drain, free from vibrations and suitable for transport and lifting equipment;
- with the following ambient conditions:
  - good ventilation;
  - ambient temperature between –20°C and +50°C;
  - air relative humidity between 30% and 80%;
  - possibly in a dry, non-dusty atmosphere.

***CAUTION:*** *do not remove any packing present for some MACHINE components or adopt appropriate measures to protect the exposed parts.*

For the motor, protect the contact between brush and manifold from corrosion, to prevent poor operating switching.

### 4.4.1. Uninstalling

If it is necessary to disassemble the MACHINE, follow the steps in Paragraph 4.3 – Installation in the opposite order.

***CAUTION**:* *given the nature of the necessary operations, they must be ONLY be performed by the Manufacturer's personnel or personnel instructed, trained and authorised by the Manufacturer.*

***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

To perform the job in question the following Personal Protection Equipment is necessary:

# Chapter 5
# Set-up after installation

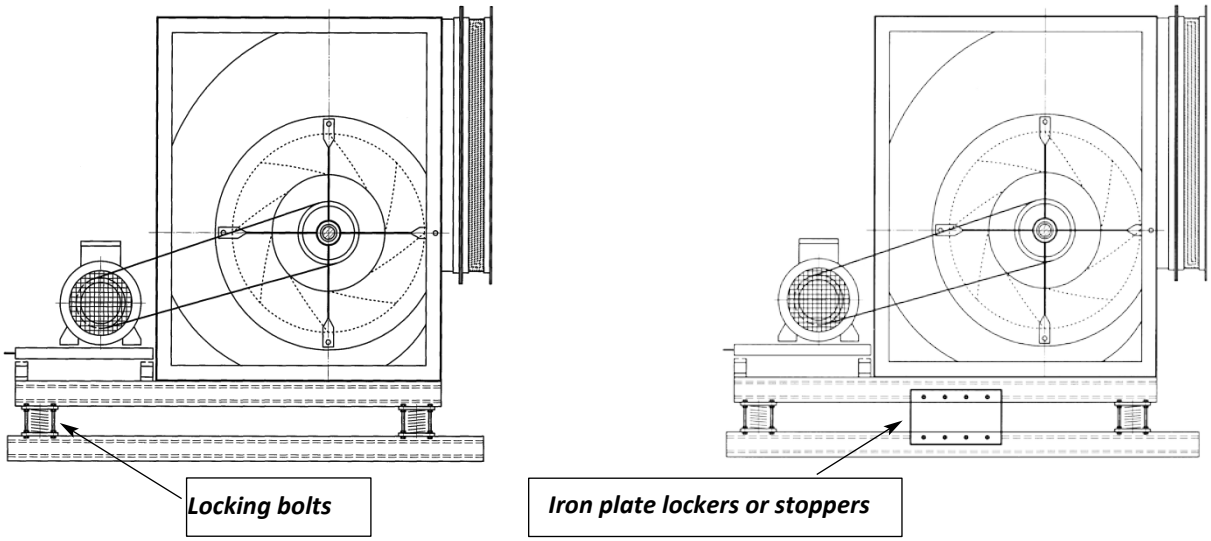
Before commissioning the machine it is necessary to follow the instructions in Chapter 4 – Transport and Installation, regarding the connections necessary for machine operation:

- Electrical supply.
- Water supply
- Aeraulic connection (connection to air ducts).
- Water connection (connection of water pipes to coil headers).

After having made the connections above it is necessary to carry out the following:

1. Unlock the damper locks. The machine and fan sections are shipped with the vibration dampers for the motor-fan units locked. The most frequent locking systems are represented by stay bolts, plates, stoppers or a combination of these (see Figure 21); they are used to avoid damage which can occur during transport and handling of the machine or its fan sections and must be removed only after the machine is positioned and assembled. In particular, at least 4 stay bolts are needed for each motor fan unit.

*Figure 21 – Locks with stay bolts and stay bolts and plates*




2. Make sure the coils are supplied correctly (input/output).
3. Bleed the air on all the coils.
4. Make sure that the drains are built and connected correctly, checking the correct runoff of condensate.
5. Have the siphons installed.
6. Install an anti-vibration joint between the ducts and machine.
7. Check the correct filter installation.
8. Check the tightening of screws and bolts.
9. Make the frame has been earthed.
10. Check the correct fan rotation direction.
11. Check the correct pulley alignment.
12. Check the correct tensioning of the belts.
13. Check the correct operation of the dampers.
14. Check and make sure all the electrical components are connected and correctly supplied, such as microswitches, circuit breakers, lights, pressure switches, sensors, inverters, etc.
15. Remove any foreign material inside the machine.
16. Check the cleanliness inside the machine and have it cleaned if necessary.
17. Make sure the anti-vibration supports and other components are not damaged.

To perform the job in question the following Personal Protection Equipment is necessary:

# Chapter 6
# Commissioning and using the machine

## 6.1. Commissioning the machine

Once the operations and checks for setting up the machine have been completed, as described in Chapter 5 – Setting up the machine after installation it is possible to commission the machine.

***HAZARD:*** ***only operators who are correctly instructed and informed on the risks present and who have completely read this use and maintenance manual can work near the machine. The Manufacturer shall not be held liable for injury to people of property damage resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

To perform the operations described below the following Personal Protection Equipment is necessary:

### 6.1.1 Dampers

To prevent damage to the machine make sure that the external air intake and exhaust dampers are open and that any other dampers positioned on the machine are in the correct position.

### 6.1.2 Motors

Check the correct earthing of the motors. Any incorrect, ineffective or no earthing circuit is a source of danger and can damage the machine.

Check the motor rotation direction. If the rotation direction is incorrect invert the connection of the two supply conductors on the input terminals.

Make sure the motor connections and current absorption are correct.

Do not start the motor -fan units without first making sure the machine connections with all required ducts have been made.

A few seconds after the first start-up, check the value of the absorbed power. It should not exceed that on the motor plate for any reason.

### 6.1.3 Filters

Check the correct installation of the prefilters located on specific counterframes with safety springs or guides.

After removing the filters from the packing (they are supplied in packing to prevent deterioration during transport), insert the bag, absolute and active charcoal filters in the specific housing section, being careful to ensure a rigid assembly and a perfect seal of the gaskets.

***CAUTION**: the operation described above needs to be performed around one hour after the first machine start-up. During this time the dust and other matter is cleaned out of the ducts. By doing this the unwashable filtering section will be better preserved.*

### 6.1.4 Coils

To prevent damage to the coils caused by ice, the water circuit should be filled with anti-freeze or completely drain the coil if the air temperature may fall below 3°C.

***CAUTION**:* *during the heating process if the fan stops it may cause overheating of the air within the machine, with possible and consequent damage to the motor, bearings, insulation and parts in synthetic material. To get around this problem, the system should be set up so that if the fan stops water flow in the coils will be stopped.*

## 6.2. Using the machine

The machine is built without an electrical panel and control panels, it is the buyer's responsibility to supply them and the entire electrical system of the machine. In terms of the machine use procedure (start, stop, emergency stop, etc.) it is necessary to refer to the document created by the buyer.

***HAZARD:*** ***only operators who are correctly instructed and informed on the risks present and who have completely read this use and maintenance manual can work near the machine. The Manufacturer shall not be held liable for injury to people of property damage resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

To use the machine the following Personal Protection Equipment is necessary:

## 6.3. Tests and adjustments

***HAZARD:*** ***only operators who are correctly instructed and informed on the risks present and who have completely read this use and maintenance manual can work near the machine.***

***The Manufacturer shall not be held liable for injury to people of property damage resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

To perform the operations described below the following Personal Protection Equipment is necessary:

### 6.3.1. Testing safety devices

***CAUTION****: checking the efficiency of safety devices installed on the machine is MANDATORY before the first start-up.*

Adopt the following procedure:

1. Open one of the inspection doors fitted with microswitch present on the machine.
2. Make sure that it is impossible to start the machine (in terms of the machine start-up procedures see the documents prepared by the buyer who is the installer of the electrical system).
3. Close the door and open another door equipped with microswitch. Repeat the operation for all the interlocking inspection doors making sure each time that it is impossible to start up the machine.

## 6.3.2. Settings

***HAZARD:*** ***all of the settings described below are ONLY to be performed with the machine in stop condition and after disconnecting the machine from all its power supplies.***

The main general settings are listed below:

- Setting the variable pulleys.
- Setting the transmission belt tensioning.
- Manually adjusting inlet and outlet dampers.
- Setting the electrical coil safety thermostat.
- Setting the drives.
- Setting the humidification floating cock.
- Adjusting the inspection door hinges.

# Chapter 7
# Maintenance and Scrapping

## 7.1. General maintenance information

To guarantee maximum MACHINE reliability and avoid dangerous conditions scrupulously follow the instructions and warnings contained in the following pages.

***HAZARD:*** ***for safety reasons, all of the maintenance operations contained in this chapter must only be performed by qualified, specifically instructed technicians.***
***In addition, all assigned technicians must have all the instruments and PPE needed to work safely.***

***CAUTION****: in order to always guarantee operators complete efficiency and safety of the MACHINE and prevent problems related to a deterioration in safety measures or possibly costly downtime, it is necessary to perform effective preventive maintenance, planning operations at scheduled intervals, aimed at renewing or replacing wear and tear parts and checking the general conditions of mechanical, electrical and pneumatic components of the MACHINE (and its ancillary equipment), thus providing indications on any extraordinary operations that may become necessary.*

Before performing any maintenance or cleaning operation contained in this paragraph, the MACHINE (and its ancillary equipment) must be connected from all power supplies:

- disconnect the voltage from the main control cabinet using the main switch (lock it in the 0 - OFF position using a lock or another suitable device). The electrical cabinet, as well as the entire electrical system are not supplied by the manufacturer but are the responsibility of the buyer;
- place a clearly visible sign with the words “MACHINE IN MAINTENANCE” and at the same time cordon off the machine.

***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained, not adequately equipped or unauthorised personnel.***

### 7.1.1. Safety instructions

To correctly perform the maintenance or cleaning operations it is indispensable to take the following instructions into consideration.

- During operations it is necessary to indicate the operation on the MACHINE using appropriate signs (these signs are positions so as to prevent any undesired on the MACHINE).
- Only authorised personnel can access the work area during operations.

***CAUTION:*** *all maintenance and cleaning operations can only be performed by expert personnel who have read and understood all of the instructions contained in this Use And Maintenance Manual.*

***HAZARD:*** ***only remove the MACHINE parts which are actually necessary for performing the specific maintenance operation.***

***In addition, before redelivering the MACHINE to the operators, make sure it is in correct working conditions.***

- It is prohibited to access parts of the machine which are not accessible through the inspection door.
- All material with an environmental impact which must be eliminated after maintenance operations must be disposed of according to law.

***CAUTION**: to dispose of materials with a high environmental impact,contact specialised facilities if necessary.*

To perform all of the maintenance or cleaning operations near the MACHINE listed below, the following Personal Protection Equipment is necessary:

## 7.1.2. Checking Material Availability

Carry out a detailed examination of the material needed at least 60 days before the date set for maintenance operations:

1. check if the material is present in the warehouse,
2. if necessary ask the Manufacturer's Technical Department for missing part, at least 30 days ahead of time.

## 7.1.3. General cleaning of the machine

***HAZARD:*** ***only operators who are correctly instructed and informed on the risks present and who have completely read this use and maintenance manual can work near the machine. The Manufacturer shall not be held liable for injury to people of property damage resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

***HAZARD:*** ***before performing all of the planned cleaning operations make sure that the machine is disconnected from the electricity and that hot surfaces have cooled.***

For general cleaning operations vacuums and air jets can be used to easily free the machine of impurities. Cleaning operations should not involve the lubricated parts, such as rotating shafts since this could cause operating problems and shorten their life cycle.

### 7.1.4. Routine maintenance operations

***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect or incomplete maintenance.***

***HAZARD:*** ***before performing all of the routine maintenance operations make sure that the machine is disconnected from the electricity and that hot surfaces have cooled.***

The list below provides summary of the most significant and important routine maintenance operations:

- Periodic check of filter cleaning.
- Check the correct pulley alignment.
- Check the correct belt tensioning.

Table 4 includes the components where it is necessary to perform routine maintenance with the average operation frequencies.

The paragraphs below contain the operation procedures for each component.

*Table 4 – Routine maintenance*

| COMPONENT | AVERAGE OPERATION FREQUENCY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N° DAYS | | | N° MONTHS | | | | ΔP Pa | |
| | 7 | 14 | 30 | 2 | 3 | 6 | 12 | maximum recommended | Notes |
| Dampers | | | | | | | * | 250 | (1) |
| Synthetic filters | * | | | | | | | 150 | (2) |
| Metallic filters | | | * | | | | | 200 | (3) |
| Rotary filters | | | | | | | | | (4) |
| Rotary filters with viscose surface Electrostatic filters | | | | * | | | | | (5) |
| Active charcoal filters | | | | | | | | | |
| Bag filters | | | | | * | | | 400 | |
| Absolute filters | | | | | | * | | 500 | |
| Rotary recovery unit | | | | | | * | | | |
| Plate recovery unit | | | | | | * | | | |
| Heat pipe recovery unit | | | | | | * | | | |
| Heating / cooling coils | | | | | | * | | | |
| Electrical coils | | | | | | * | | | |
| Humidification water filter | | | * | | | | | | |
| Nozzles | | | * | | | | | | |
| Condensate collection tray | | | | * | | | | | |
| Humidification tray | | | | * | | | | | |
| heating element | | | * | | | | | | |
| Honeycomb absorber | | | | | * | | | | |
| Pipe to water distribution tray | | | | | | * | | | |
| Transmission belt | * | | * | | | | | | (6) |
| Motor | | | | | | * | | | (7) |
| Fan | * | | | | | * | | | (7) |
| Antivibration connections | | | | | | | * | | |
| Bearings | * | | | | | * | | | (8) |
| Drives | * | | | | | * | | | (9) |
| Float cocks | * | | * | | | | | | (9) |
| Steam generator | * | | * | | | | | | (9) |
| Humidifier valve bodies | * | | | | | | | | (9) |
| Steam distributors | | | | | * | | | | |

1) Wash according to the procedures in Paragraph 7.1.4.2. below
2) Based on indication of differential pressure switch
3) Based on manufacturer's instructions
4) Based on results of air sampling, check and wash
5) Based on results of air sampling, the average duration is 6-12 months
6) Correctly follow the instructions contained in Paragraph 7.1.4.8
7) Follow the manufacturer's instructions
8) Check in the first 7-8 days and then as per the manufacturer's instructions
9) Calibrate at start-up and then as per the manufacturers' instructions

### 7.1.4.1 DAMPERS

Clean the dampers by washing well with water and detergent, then rinse and dry with jets of air. Finish by greasing all levers.

### 7.1.4.2 AIR FILTERS

#### SYNTHETIC TYPE

Cleaning to alternate:

Dry by shaking or with a vacuum (vacuum in the opposite direction of air flow).

Wet with a moderate spray of water and again from the opposite side of air flow; then let dry.

Wet in a hot water bath (maximum 50°C) and detergents rinsing afterwards then with a moderate spray of water and again from the opposite side of air flow; then let dry.

#### METALLIC TYPE

Clean in a hot water bath (90°C) and detergent or low concentration water-caustic soda solution. At the end rinse with hot water and dry with jets of air; then dampen the pad with mineral oil.

#### DRY ROTARY TYPE

Check the correct feed of the filtering medium driven by the differential pressure switch (normally calibrated for $\Delta p$=200 Pa); replace the finished roll following the manufacturer's instructions.

#### ROTARY TYPE WITH VISCOSE SURFACE

Clean the tray with the supplied tool removing all of the residue from the bottom, add oil if necessary to top up the existing level: to change the oil and service the gear motor see the instructions in the manufacturer's manual, present in the annexes to this use and maintenance manual.

**ELECTROSTATIC TYPE**

Periodically check operation and efficiency by air sampling: wash with compressed air or pressurised water (2.5-4.5 bar) with the addition of suitable detergents if necessary.

**ACTIVE CHARCOAL TYPE**

Periodically check efficiency by air sampling since the absorbent power of active charcoal depends on gaseous products and their concentration in the air, humidity, work temperature and air speed. Do not dispose of the contents, contact a specialised facility.

***HAZARD: when cleaning active charcoal filters it is essential to wear a protective mask over the face and protective gloves to avoid contact with the filters which can cause allergies or irritate the skin.***

**DRY BAG TYPE**

Replace the filters.

**ABSOLUTE FILTERS**

Replace the cells and clean the container checking the air tightness. Do not dispose of the contents, contact a specialised facility.

### 7.1.4.3 INERTIAL SEPARATORS

Follow the manufacturer's instruction contained in the annexes of this use and maintenance manual.

### 7.1.4.4 HEATING COILS

At the beginning of each season it is necessary to wash the pack with spray of water so that scales do not form. If there are scales work carefully with special brushes or suitable chemicals.

To avoid the formation of ice in the pipes in the winter, the water needs to be drained from the cold coils in the winter or keep the water constantly circulating.

In addition, always check that the air has been bled correctly from the pipes.

#### 7.1.4.5 ELECTRICAL COILS

Use a vacuum to remove any dust or fuzz.

#### 7.1.4.6 HUMIDIFICATION

**MODEL WITH PUMP AND NOZZLE BANKS**

- Clean the nozzles checking that the dust in the water is uniform; if necessary clean them from the inside with a strong spray of water.
- Clean the water circulation filter by spraying water fairly strongly from the inside towards the outside.
- Clean any lime scales off the tank, by spraying water and using brushes.

**STEAM MODEL WITH SUBMERGED ELECTRODES**

Follow the manufacturer's instruction contained in the annexes of this use and maintenance manual.

**MODEL WITH HONEYCOMB ABSORBER (WITH AND WITHOUT PUMP)**

- Clean the absorber frequently by spraying water always in the opposite direction of air flow; if there are salt or lime scales replace the absorber.
- Clean the water collection tray by spraying water.
- Clean the distribution tray and the pipe by cleaning out the holes.

**STEAM MODEL**

Follow the manufacturer's instruction contained in the annexes of this use and maintenance manual.

**MODEL WITH NOZZLES AND WATER RUNOFF**

- Clean the nozzles checking that the dust in the water is uniform; if necessary clean them from the inside with a strong spray of water.
- Clean any lime scales off the tank, by spraying water and using brushes.

#### 7.1.4.7 BEARINGS

**LUBRICATED FOR LIFE MODELS**

They do not require any periodic lubrication.

**MODELS WITH EXTERNAL GREASING**

After the run-in period when they have to be lubricated weekly, the lubrication frequency depends on the type, dimensions and their rpm. For this purpose follow the manufacturer's instructions contained in the annexes of this use and maintenance manual.

### 7.1.4.8 MOTOR-FAN UNIT

#### DIRECT COUPLING

- Check the motor terminals and make sure the cables are perfectly tightened. If required, lubricate the bearings according to the manufacturer's instructions.
- Check the anti-vibration connections for any air leaks.

#### TRANSMISSION COUPLING

- Check the bolts and nuts, completely tightening the bolts if needed.
- Lubricate the bearings according to the manufacturer's instructions.

During the first hours, and even during the first 7-8 days of operation, the belt tensioning needs to be check frequently; if it has loosened the tensioning needs to be restored using the belt tensioner (slide type with single life slider for motors up to 55 kW and two track type for motors over 55 kW). Belt tensioning can be performed in the following manners:

1. Once the belts are mounted on correctly aligned pulleys, start to move the motor on the slide until the belt lowers significantly.
2. Gradually tension the belts by running the transmission for a bit of time between one tensioning and the next, until their length has increased to the value indicated in Figure 22 for each type and length of belt.

*Figure 22 – Approximate actual elongation*

| Belt Type & Length mm | Elongation mm | Belt Type & length mm | Elongation mm | Belt Type & length mm | Elongation mm |
|---|---|---|---|---|---|
| SPA | | SPB | | SPC | |
| 750/875 | 5,0 | -- | -- | -- | -- |
| 900/1025 | 6,0 | -- | -- | -- | -- |
| 1050/1125 | 7,5 | -- | -- | -- | -- |
| 1250/1425 | 8,5 | 1272/1522 | 9,0 | -- | -- |
| 1450/1700 | 10,0 | 1622/1822 | 10,5 | -- | -- |
| 1718/2000 | 12,0 | 1922/2142 | 12,5 | 2030/2390 | 14,0 |
| 2018/2325 | 14,0 | 2262/2522 | 15,0 | 2530/2830 | 17,0 |
| 2378/2750 | 16,5 | 2672/3022 | 18,0 | 3030/3380 | 20,0 |
| 2818/3168 | 19,0 | 3172/3572 | 21,5 | 3580/4080 | 24,0 |
| 3368/3768 | 22,5 | 3772/4272 | 25,0 | 4280/4780 | 28,5 |
| 4018/4518 | 27,0 | 4522/5022 | 30,0 | 5030/5630 | 34,0 |

For example: an SFB type belt with initial length equal to 2382 mm, will be correctly tensioned when its total length will be equal to 2382 + 15 = 2397 mm.

***HAZARD: during the operation near the motor – fan unit, even though the machine needs to first be disconnected from the electricity, be very careful with the pulleys and transmission belts and do not leave your hands under the belts.***

The values shown in Figure 22 are approximate and refer to standard "Kleber" brand belts subject to uniform torque and resistances.

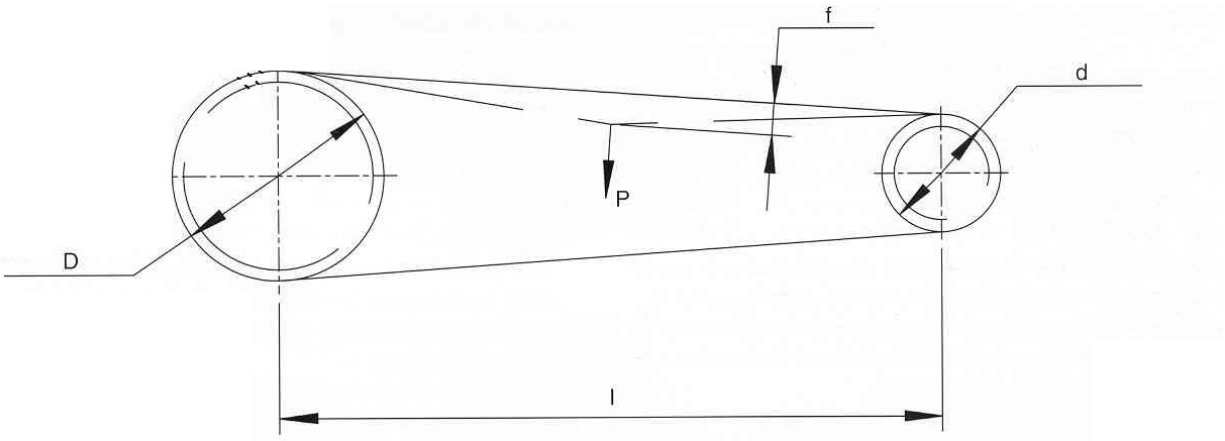
It is also possible to use a faster method, but even more approximate than the first one: pressure with your thumb. According to this method, using the Figure 23 below, a transmission can be considered correctly tensioned when, if the smallest pulley diameter is known and the centre distance of the two pulleys, by putting pressure with a thumb on the centre line of the section between the two pulleys, the value measured with the camber is between the values in Figure 23.

*Figure 23 – Approximate actual camber*

| TIPO DI CINGHIE / BELT TYPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPA | | | | SPB | | | | SPC | | | |
| Diametro puleggia minore<br>Small pulley diameter<br>mm. | Interasse puleggie<br>Pulleys centre distance<br>mm. | Freccia cinghie Belt camber mm.<br>Tensionamento Tensioning<br>Primo First | <br><br>Successivi Subsequent | Diametro puleggia minore<br>Small pulley diameter<br>mm. | Interasse puleggie<br>Pulleys centre distance<br>mm. | Freccia cinghie Belt cambers mm.<br>Tensionamento Tensioning<br>Primo First | <br><br>Successivi Subsequent | Diametro puleggia minore<br>Small pulley diameter<br>mm. | Interasse puleggie<br>Pulleys centre distance<br>mm. | Freccia cinghie Belt cambers mm.<br>Tensionamento Tensioning<br>Primo First | <br><br>Successivi Subsequent |
| < 100 | — — | — — | — — | ≤ 160 | 380 ÷ 510 | 10 ÷ 13 | 7,5 ÷ 10 | < 250 | 2030 ÷ 2390 | 16 ÷ 21 | 13 ÷ 17 |
| | 210 ÷ 310 | 7 ÷ 9 | 5 ÷ 7 | | 550 ÷ 660 | 14 ÷ 17 | 10,5 ÷ 12,5 | | 2530 ÷ 2830 | 22 ÷ 26,5 | 17,5 ÷ 21 |
| | 320 ÷ 390 | 9 ÷ 11 | 7 ÷ 8 | | 710 ÷ 820 | 18 ÷ 21 | 13,5 ÷ 15,5 | | 3030 ÷ 3380 | 29 ÷ 34 | 23 ÷ 27 |
| | 400 ÷ 460 | 11 ÷ 13 | 8 ÷ 9 | | 880 ÷ 1010 | 22,5 ÷ 25,5 | 17 ÷ 19 | | 3580 ÷ 4030 | 36 ÷ 42 | 29 ÷ 33,5 |
| | — — | — — | — — | | 1085 ÷ 1260 | 27,5 ÷ 32,0 | 20,5 ÷ 24,0 | | — — | — — | — — |
| ≥ 100<br>≤ 140 | 440 ÷ 560 | 12 ÷ 15 | 9 ÷ 11,5 | > 160<br>≤ 224 | 910 ÷ 1160 | 22,5 ÷ 28,5 | 17,5 ÷ 22 | > 250<br>≤ 355 | 3030 ÷ 3380 | 20 ÷ 23 | 16 ÷ 18,5 |
| | 570 ÷ 700 | 15 ÷ 18,5 | 11,5 ÷ 14 | | 1285 ÷ 1535 | 32 ÷ 38 | 25 ÷ 29,5 | | 3580 ÷ 4030 | 25 ÷ 30 | 20 ÷ 24 |
| | 710 ÷ 800 | 18,5 ÷ 21,5 | 14 ÷ 16 | | 1660 ÷ 2030 | 41 ÷ 50 | 32 ÷ 39 | | 4280 ÷ 5030 | 32 ÷ 40 | 25,5 ÷ 32 |
| > 140<br>≤ 200 | 790 ÷ 950 | 18 ÷ 21,5 | 14,5 ÷ 17 | > 224<br>≤ 335 | 1060 ÷ 1360 | 20 ÷ 26 | 15,5 ÷ 20,5 | — | — — | — — | — — |
| | 960 ÷ 1160 | 21,5 ÷ 26 | 17 ÷ 21 | | 1485 ÷ 1860 | 28 ÷ 35 | 22 ÷ 27,5 | — | — — | — — | — — |

The camber values in Figure 23 are approximate and refer to "Optibelt" brand belts. The values must not be extrapolated

*Figure 24 – Tensioning of a belt*




D = large pulley diameter (mm). d = small pulley diameter (mm).

I = pulley centre distance (mm).

P = Deflection force (N).

F = camber (mm).

For example: a SPA type belt with the smaller pulley with a 120 mm diameter and centre distance between the pulleys equal to 670 mm it can be considered correctly positioned if the camber value at the first tensioning is within the range of 15-18.5 mm and those for the next tensioning drop to the 11.5-14 range.

***CAUTION:*** *the belts installed on the machine are correctly tensioned for the first start-up by the Manufacturer.*

The methods above can be used for a fast and acceptable preloading of the belts, which are however not very precise in part because the technical specifications of the belts vary based on their type and manufacturer. To prevent tensioning (preloading) which are excessive or insufficient it is necessary to calculate, perform and check the preloading following one of the practical theoretical methods best suited to the type of transmissions in questions, including:

- Checking of the preload via the camber of the section normally used for small centre distances and small and medium powers.
- Checking the preload by measuring the shift normally used for large centre distances.

- 
- Checking the preload by measuring the elongation.

The formulas normally used for the calculation of minimum static tensioning on a section (preload) T ad the shift S are respectively:

$$T = \frac{50 \cdot (2.5 - a) P_C}{a \cdot N \cdot V} + KV^2 \; ; \; S = (1 - \frac{n_{1L} / n_{2L}}{n_{1B} / n_{2B}}) \cdot 100$$

Where:

a = correction factor of the contact arc

k = weight function coefficient per length unit of belt

N = number of belts

U = linear speed of the belt (m/s)

T = static tensioning (preload) (N)

$P_C$ = design power (KW)

S = shift (%)

$n_{1L}$ = drive pulley rpm idling (rpm)

$n_{2L}$ = driven pulley rpm idling (rpm)

$n_{1B}$ = drive pulley rpm under load (rpm)

$n_{2B}$ = driven pulley rpm under load (rpm)

#### 7.1.4.9 HEAT RECOVERY UNIT

**PLATE**

Clean with compressed air (if there is dust on it) being careful not to damage the plate, or spraying with a detergent solution if there is grease on it.

**ROTARY**

***CAUTION:*** *the periodic checking of the more significant components below refers to recovery units operating only during the day. For other operating conditions reduce the operation frequency.*

Operations to perform:

- Inspect and clean the front surfaces of the rotor.
- Check and, if necessary, lubricate the rotor bearings.
- Check the tightening of the sectors composing the rotor.
- Check and adjust, if necessary, the transmission belt tensioning.
- Check the amount of lubricant in the reduction gearbox if supplied with cap; follow the manufacturer's instructions to change the lubricant (oil or grease).
- Check the operation of the monitoring and bleed equipment.

#### 7.1.4.10 CHECKING CONDITIONS OF PANEL RELAY

Must be cheked, opening the control board, the correct relay conditions.

Bad conditions (glued relay) leads to an incorrect operation of the control system.

In case this problem could be found is necessary to proceed with its sostitution.

## 7.1.5. Extraordinary maintenance operations

Extraordinary maintenance operations cannot be foreseen since they are normally due to wear or fatigue consequent to incorrect machine operation

## 7.1.6. Component replacement

***HAZARD: before performing any component replacement of the machine make sure that the machine is disconnected from the electricity and that hot surfaces have cooled.***

The machine has been designed and constructed to me able to perform regular maintenance on it according to the procedures described in Paragraph 7.1.4. However there may be situation which, due to a fault, wear or something else may lead to a breakage and consequent replacement of some of the components installed in the machine.

To replace the individual machine parts see the technical diagram of the machine, in the annexes to this use and maintenance manual.

***HAZARD: only operators who are correctly instructed and informed on the risks present and who have completely read this use and maintenance manual can work near the machine. The Manufacturer shall not be held liable for injury to people of property damage resulting from incorrect operations performed by unqualified, untrained or unauthorised personnel.***

The components which may need to be replaces are listed below:

- Filters
- Belts
- Motor pulley
- Fan pulley
- Fan
- Motor
- Inverter
- Regeneration / heating / cooling coils
- Humidification pump

To replace the mentioned parts see the manuals of the individual manufacturers' manuals in the annexes to this use and maintenance manual.

### 7.1.7. Disposal of use materials - waste

The different types of waste which may be produced during the machine life cycle are described below:

- Cell filters of the suction unit.
- Oil and grease waste from lubrication of the motor-fan unit.
- Rags or paper dampened with substances used to clean various machine parts. Waste from cleaning the panelling.
- Transmission belts.
- TUV germicide lamps (if the machine is equipped with them) must be disposed according to law.

***CAUTION:*** *disposal of waste must be carried out by the user, following the a laws at the site on in the country where the machine is installed.*

The waster of the filtering cells must be handled as special or harmful toxic waste, based on the use, sector and environment you work in.

For the disposal of toxic or harmful wastes treated by the machine use authorised and dedicated facilities such as the Obligatory Consortium of Used Oils for disposing of used oils.

## 7.2. Decommissioning, disassembly and scrapping

To perform the disassembly and scrapping operations the following Personal Protection Equipment is necessary:

### 7.2.1 Decommissioning the machine

To decommission the machine for a long period, perform the following operations:

1. Disconnect the electricity from the general circuit breaker on the electrical panel supplied by the buyer.
2. Clean the machine.
3. Perform the routine maintenance operations then cover the machine with a cloth.

### 7.2.2 Disassembly

If it is necessary to disassemble the MACHINE, follow the procedure described below.

1. Disconnect the MACHINE and ancillary equipment from energy supplies (electricity and water).
2. See Paragraph 4.4.1 - Uninstalling in Chapter 4 - Transport and Installation, then uninstall the MACHINE; also contact the Manufacturer's Technical Department to obtain the necessary assistance during this operation.
3. To handle the MACHINE components, operate according to the instructions contained in Paragraph 4.2- Transport and Handling in Chapter 4 - Transport and Installation.
4. 4. Appropriately prepare the components based on the fact that they need to be transported to another site (see Paragraph 4.2 – Transport and Handling of Chapter 4 – Transport and Installation), which need to be stored (see Paragraph 4.4 – Storage of Chapter 4 – Transport and Installation) or which need to be scrapped (see Paragraph 7.2.3 – Scrapping).

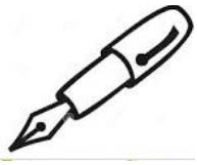
***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained, not adequately equipped or unauthorised personnel.***

### 7.2.3 Scrapping

When the MACHINE (and its ancillary equipment) has finished its life cycle, before the final dismantling, it is necessary to perform a series of operations aimed at minimising the environmental impact related to disposal of the MACHINE components, as well required by laws on waste disposal.

These operations are:

1. recover and dispose the oils, or:
   a. means of a specific pump, discharge the oil contained in the MACHINE components, collecting it in suitable containers;
   b. store the recovered oil in containers or drums;
   c. dispose of the recovered oil at dedicated facilities (Obligatory Consortium of Used Oils).
2. Separate and store parts with an environmental impact, or:
   a. separate the various parts which could cause pollution;
   b. select materials which can be recycled, setting them aside for sorted waste ( in particular plastic, rubber or wood parts).



***NOTE**: for more information on disposal of components not supplied by the Manufacturer which are part of the MACHINE, see the relative Use and Maintenance Manuals.*

3. Dispose of the frames, or once the polluting parts have been removed and stored, contact specialised facilities for disposal of the frames.

***CAUTION**: when the MACHINE is scrapped, the MACHINE identification plate needs to be made unusable and the relative technical documents.*

*The Customer has the option of returning these elements to the Manufacturer's Technical Department which will handle their destruction.*

*Storing these elements in an inaccessible place is not permitted.*

*When the operations have been completed, notify the Manufacturer's Technical Department that the MACHINE has been dismantled.*

# Chapter 8
# Troubleshooting

Table 5 below contains some faults and/or malfunctions which may occur on the machine, along with the possible cause and possible corrective action.

***HAZARD:*** ***for safety reasons, all of the operations contained in the "Correction actions" column of Table 5 must only be performed by qualified, specifically instructed technicians.***

***In addition, all assigned technicians must have all the instruments and PPE needed to work safely.***

***HAZARD:*** ***the Manufacturer shall not be held liable for any property damage and/or injury to people resulting from incorrect operations performed by unqualified, untrained, not adequately equipped or unauthorised personnel.***

To perform the operations contained in the "Corrective actions" column of Table 5 the following Personal Protection Equipment is necessary:

*Table 5 – Troubleshooting*

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***The air treatment unit does not work*** | ***Electrical panel (not supplied with the machine)*** | Make sure that the panel is powered up, in operations and that there are no faults inside it. |
| | | Make sure there are no damaged fuses. |
| | | Make sure there are no damaged relays. |
| | | Check the tightening of the terminals and make sure there are no damaged wires. |
| | ***Adjustment system*** | Make sure that the adjustment system is powered up and correctly connected and that the adjustment loops are enabled and operating. |
| | ***Power circuit breakers*** | Make sure the circuit breakers are correctly connected, operating and in the operating position. |
| | ***Microswitches on the access doors*** | Make sure that the microswitches mounted on access doors are correctly connected, operating and that the doors are closed so that they are in the correct position. |
| | ***Electric motor*** | Make sure it is connected correctly, check for any faults checking the specific documents of the motor included in the annexes to this manual. Possible causes for non-operation of the motor may include: |
| | | • Damaged fuses. |
| | | • Overload. |
| | | • Insufficient power available. |
| | | • Incorrect connections. |
| | | • Interrupted connections. |
| | | • Mechanical fault. |
| | | • Short circuit in the stator. |
| | | • Fault rotor. |
| | ***Fans*** | Check the condition of the fuses and electrical supply circuit breakers. |
| | | Check for broken belts. |
| | | Check pulley tightening. |
| | | Check the motor conditions (see the |
| | | line above). |

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***Excessive air delivery*** | ***Circuits / channels*** | Make sure the total static pressure meets design data. |
| | ***Inverters*** | Make sure the working parameters of the inverters are the design parameters |
| | ***Transmission*** | Make sure the installed pulleys are the ones required by the design, both on the motor and fan. |
| ***Low air delivery*** | ***Circuit*** | Make sure the total static pressure meets design data. |
| | ***Inverters*** | Make sure the working parameters of the inverters are the design parameters |
| | ***Transmission*** | Make sure the installed pulleys are the ones required by the design, both on the motor and fan. |
| | ***Fan*** | Check the correct rotation of the impeller, check for obstructions on the intake and delivery. |
| ***Excessive total static pressure*** | ***Circuit*** | Make sure the total static pressure meets design data. |
| | ***Coils*** | Check the cleaning of the coils, make sure the air flow is not blocked upstream and downstream from the coils.Visually inspect and check the air Δp. |
| | ***Recovery unit*** | Check the cleaning of the recovery unit, make sure there are no blocking of the air flow upstream and downstream from the coils. Visually inspect and check the air Δp |
| | ***Filters*** | Check if the filters are clogged and make sure there are not obstructions upstream and downstream from the filters. |
| | | Visually inspect and check the specific filter pressure switch. |
| | ***Dampers*** | Check the opening of the dampers. |
| | ***Fan*** | Make sure the fan rpm meet the design data. |
| | ***Motor*** | Make sure the fan rpm meet the design data. |
| | ***Inverters*** | Make sure the inverter operating parameters meet the design data. |
| ***Low total static pressure*** | ***Circuit*** | Make sure the total static pressure meets design data. |
| | ***Filters*** | Check filter correct installation |
| | ***Inspection doors*** | Make sure all inspection doors are closed |
| | ***Fan*** | Check fan rpm meets the desing data |
| | ***Motor*** | Check fan rpm meets the desing data |
| | ***Inverters*** | Make sure inverter operating parameters meet the desing data |

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***Anormal machine noise*** | ***Fan*** | Impeller: |
| | | • Tighten the impeller and/or nozzle |
| | | • Tighten the impeller hub or bearing rings on the shaft |
| | | • Tighten the pulleys on the shaft. |
| | | • Remove any dirty from the impeller |
| | | Transmission: |
| | | • Adjust the belt tensioning |
| | | • Align the pulleys adquately |
| | | • Replace worn pulleys |
| | | • Replace faulty bearings |
| | | • Check the impeller balancing |
| | | • Tighten rings and nozzles |
| | ***Excessive air flow*** | Check the machine operating data |
| | ***Dampers*** | Check the correct dampers opening |
| | ***Inspection doors*** | Make sure all inspection doors are closed |
| ***The fan doesn't work properly - Low air flow*** | ***Fan*** | Check the correct rotation of the impeller |
| | | Check for obstructions on the intake and delivery. |
| | | Increase the dan speed |
| | ***Circuit*** | Check the leaking circuit calculations |
| ***The fan doesn't work properly - High air flow*** | ***Fan*** | Decrease fan speed |
| | ***Circuit*** | Redimension the circuit. |
| | | Inspections doors, screens and filters not installed. |
| ***The fan doesn't work properly - High absoption*** | ***Fan*** | Chek the impeller rotation sense |
| | | Decrease the fan rotation speed |
| | ***Circuit*** | Redimension the circuit. |
| | | Check dampes, coils, etc. correct functioning. |
| ***Bearings overheated*** | ***Lubrification*** | Make sure there is not too little or too much grease in the bearing |
| | ***Mechanical causes*** | Replace damaged bearings |
| | | Loosen excessive belt tensioning |
| | | Align bearings |
| ***Inverter doesn't work properly*** | | Check INVERTER MANUAL contained in the annexes of this O&M Manual |

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***The network underpressure steam humidifier doesn't work properly*** | ***Distributors don't deliver pressure*** | Check and fix the following situations: |
| | | • Actuator incorrectly installed or connected |
| | | • Set point limit value too low |
| | | • Connection between control signal and actuator not correct |
| | | • Safety chain with dedicated devices disconnected |
| | | • Maximum flow hygrometer incorrectly positioned |
| | | • Valve with rotating ceramic disks blocked in closed position |
| | | • Actuator or rotary valve blocked |
| | | • No regulation steam pressure signal |
| | ***Faulty steam supply*** | Check and fix the following situations: |
| | | • Closing dampers on the supply line closed (read the pressure gauge) |
| | | • Supply ling clogged by impurities |
| | | • Upstream safety valve closed |
| | ***Rotary valve with ceramic disks nor closed*** | Check and fix the following situations: |
| | | • Actuator incorrectly installed or connected |
| | | • Defective regulator or incorrectly set point |
| | | • Connection between control signal and actuator not correct |
| | | • Faulty actuator |
| | | • Valve with rotating ceramic disks blocked in opened position |
| | | • The ceramic disks clamp spring has no clamping force |
| | ***Steam distributors discharge water*** | Check and fix the following situations: |
| | | • The steam supply is not isolated |
| | | • The steam supply is not adequately drained |
| | | • The steam supply is not adequately connected |
| | | • Excessive primary steam supply pressure |
| | | • Secondary condensate drain faulty or blocked |

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***The plate cross flow recovery unit doesn't work properly*** | ***Dampers*** | Make sure dampers are in the right position for correct air flow across the recovey unit. |
| | ***Air flow*** | Make sure air flow crossing the recovery unit meets the desing data |
| | ***High pressure drop*** | Make sure there are no obstructions upstream or downstream. |
| ***The rotary recovery unit doesn't work properly*** | ***Dampers*** | Make sure dampers are in the right position for correct air flow across the recovey unit. |
| | ***Rotary direction*** | Check wheel fan rotation sense |
| | ***Transmission*** | Make sure transmission belt is mounted correctly and not broken |
| | ***Motor*** | Check motor functioning and connections |
| | ***Air flow*** | Make sure air flow crossing the recovery unit meets the desing data |
| | ***High pressure drop*** | Make sure there are no obstructions upstream or downstream. |
| ***The water heating coils don't work properly*** | ***Air side*** | Make sure air flow crosses the coils meets the design data |
| | | Make sure coil is not obstructed upstream and downstream |
| | | Make sure inlet temperature on coil meets the design data |
| | ***Water side*** | Check correct connection of the inlet and outlet pipes on coil |
| | | Make sure inlet and outlet temperatures on coil meets the design data |
| | | Make sure water flow on coil meets the design data |
| | | Make sure control valve opens and works properly |
| | | Make sure there is no air inside coil circuits |
| | ***Adjustment*** | Check correct operation and calibration of sensors, thermostats and thermometers. |
| | | Check correct positioning of control sensors |

| PROBLEM | CAUSES | CORRECTIVE ACTION |
|---|---|---|
| ***Electric coil doesn't work properly*** | ***Electrical connection*** | Make sure electrical connection has been carried out correctly |
| | ***Safety thermostat*** | Check safety thermostat calibration which must not exceed 40°C |
| | ***Adjusment*** | Check correct positioning and functioning of termperature sensors. |

# Chapter 9
# List of spare parts

## 9.1. Procedure for ordering spare parts

Customers are required to order original spare parts only. Spare parts can also be purchased from the machine Manufacturer.

For ordering spare parts the all machine and spare part identification data needs to be completely provided. This information makes it easier to find and ship spare parts as well as avoid unpleasant misunderstandings. For a clear identification of spare parts see the annexes to this use and maintenance manual.

Please provide the following information:

- Customer order number;
- machine serial number;
- code number of the part to order;
- description of the part;
- quantity requested;
- exact address and company name, with an address for delivery.

The address for contacting the Manufacturer's Technical Assistance Service is provided below:

TECHNICAL DEPARTMENT OF SAMP S.p.A.
Via Vittorini, 9
20049 Concorezzo (MI)
ITALY
Telephone: (+39) 039 690901
Fax: (+39) 039 6042241
E-mail: info@samp-spa.com
Website : www.samp-spa.com

## 9.2. List of machine components

A list of machine components is provided below.

# Chapter 10
# Annexes

# TECHNICAL DRAWING

# HEAT RECOVERY UNIT

# COILS

# FANS

# MOTORS

# INVERTERS

# FILTERS

# NOISE ATTENUATORS

# HUMIDIFIER