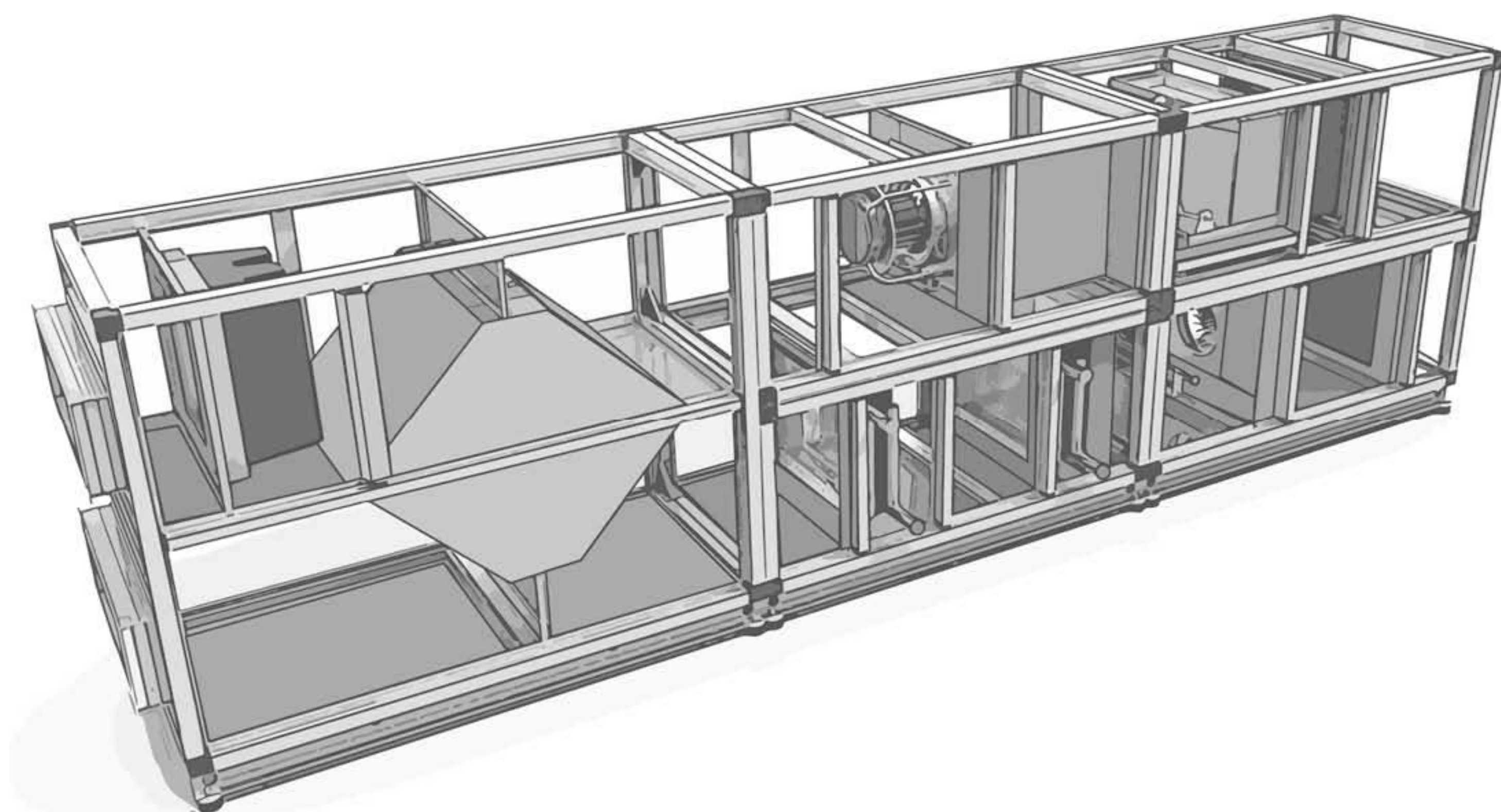




EVAIR

SMART AIR SOLUTIONS



ENGLISH

Serie AHU's

Use and maintenance Manual

AHU_AIR HANDLING UNIT

ENGINEERING MANUFACTURING OF AIR, S.L.L.

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SPAIN

This manual is according to the technology used at the time of publication. Printed version is not updated regularly, so before using it is necessary to contact the technical team of the company to verify the latest version.

Document subject to change.

VERSION: **IT_UTA-EXT-03**



We thank you for choosing the Air Handling Units of the SMART series from EVAIR, manufactured in Spain complying with a series technological development procedures and quality requirements that determine the final disposition of the equipment.

The purpose of this document is to provide information on the components of the equipment, its characteristics, commissioning, use and maintenance, and, where appropriate, disassembly. A long useful life of equipment, is not only related to follow the indications of this manual. It also requires the operation of a qualified technical service.

Warranty summary

EVAIR guarantees the proper condition of the components of its Air Handling Units belonging to the SMART series. In case of any problems with them, derived from faults of its materials (except corrosion) or construction problems, provided that the equipment has been used in accordance with the conditions indicated in this manual, the company undertakes to replace them as quickly as possible. EVAIR assumes no responsibility for damage caused by improper use of the equipment.

The equipment has a warranty of 12 months from the date of delivery of the goods. If the start-up of the work took place after 1 year of delivery of the material, it must be communicated to EVAIR, and the decision to extend the guarantee remains in its possession. The guarantee offered by EVAIR on its equipment applies whenever the equipment has been installed, maintained and used in normal conditions in accordance with its manuals, and its operation takes place within its limit values. This manual provides those considerations related to the delivery, unloading, transport, storage, assembly, installation, electrical connections, commissioning, maintenance, safety, malfunctions and disassembly of the equipment.

If the equipment is repaired without written authorization by EVAIR, or if any component is replaced with another than the original one, the warranty will be cancelled. In case of performance of the guarantee, the faulty element will be checked at the factory and either replaced or repaired. In case the problem causing the failure is within the scope of the guarantee, EVAIR will assume the transport costs, otherwise the customer will be.

A detailed description of the guarantee is included in the general conditions of sale of the equipment.

Delivery acceptance

Before signing the delivery document at the destination of the equipment, it must be thoroughly examined while it is still inside the vehicle that has transported it. In case of damage, it must be noted on the delivery document and notified to EVAIR. In order to prepare a damage report, it is recommended to take photographs before unloading the equipment.

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1. GENERAL CONDITIONS

This manual seeks to become a guide for proper reception, transport, unloading, installation, start-up and maintenance of Air Handling Units designed and manufactured by EVAIR.

This document must be read by anyone who has contact with the Air Handling Unit. For further information or if any of the supplied elements are not mentioned in this manual, check their individual instructions manual.

Following these standards ensures the correct installation of the equipment. These standards are mandatory.

Reception, installation, start-up and maintenance require qualified personnel.

Are excluded from the EVAIR's warranty, the damage produced in any of the elements of the Air Handling Unit for breach of the instructions of the installation, start-up and maintenance established in this manual.

It is advised that the components or defective parts are replaced by replacement parts from EVAIR.

Units must be used only for the purpose for which they were designed. The manufacturer is not liable if it is destined for uses not specified.

It is excluded from the warranty any modifications made to the equipment or any of its components without the express written consent of the EVAIR's technical department.

The design and manufacture of EVAIR's Air Handling Units comply with current regulations.

For a complete guide visit our website:

WWW.EVAIR.ES

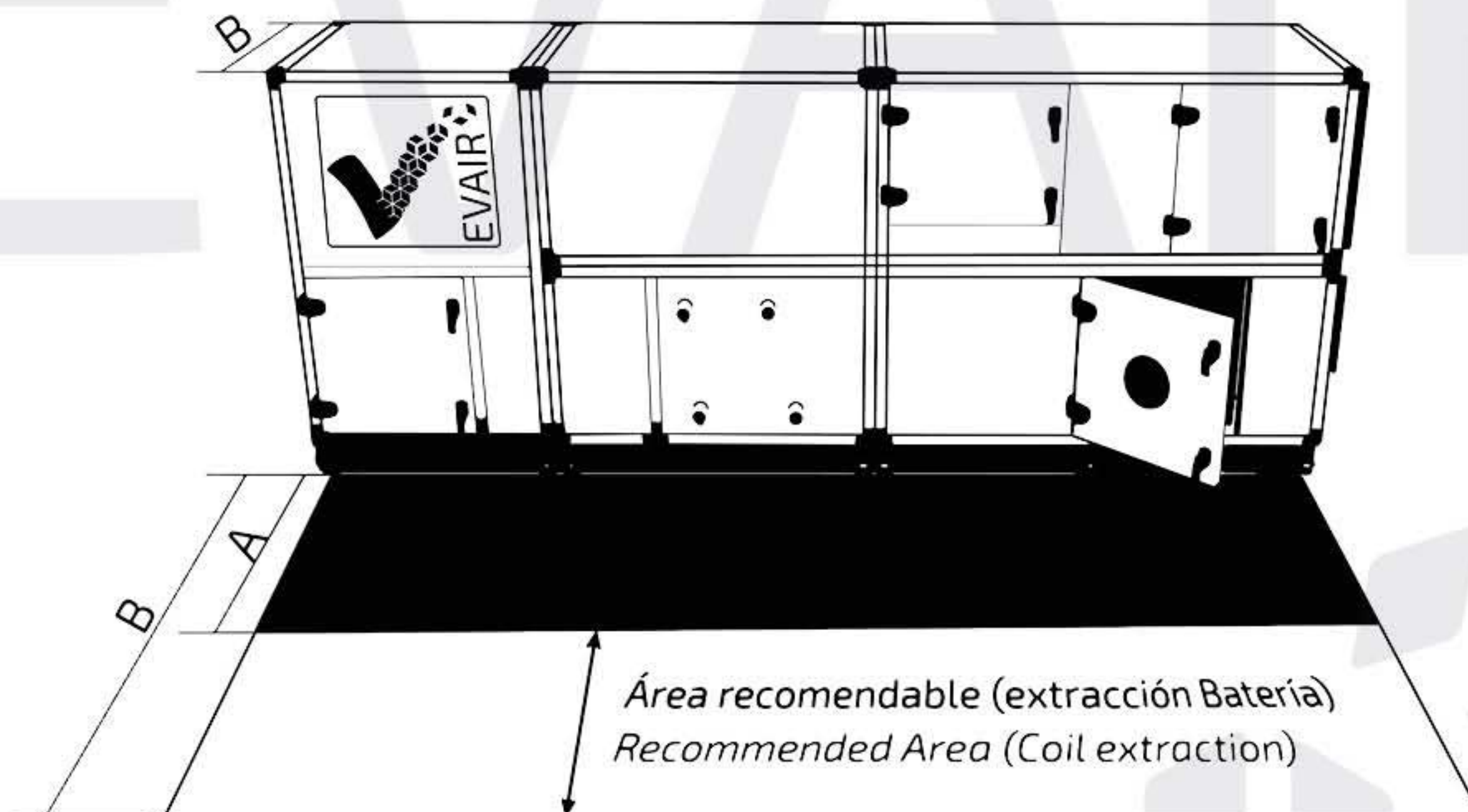


AHU_AIR HANDLING UNIT

1.1. Space requirements

During the installation of the unit, it is necessary to consider enough space to make easy maintenance and access.

Verify that the service area is as indicated in the following figure, thus there is enough space to carry out the inspection, maintenance (change of unit filters, access to components, etc.), connection and discharge of the condensate tray.



**Space requirements.*

Dimension A will remain mandatory for any point of access to the unit. This dimension will usually remain between 700-800 mm.

It is advisable to provide the installation with the space of dimension B, since it will allow greater ease of access to the components and the extraction of the coils if these had to be replaced or revised.

1.2. Transport and Storage

The units and their components must be transported and stored in such a way that the integrity of the equipment does not suffer any risk. When the equipment is stored for a long time it is convenient to check the tension of the transmissions by pulleys and check any rotating or mobile element of the equipment.

1.3. Installation

In case the equipment is supplied in sections, which must be joined on site, the operation must be carried out according to this manual.

1.4. Pre-Commissioning Considerations

The unit will start up as long as the instructions indicated in this manual have been followed. Safety systems in the start-up must be effective, and a stop switch of the unit must be placed near the AHU access door.



1.5. Fire protection

Adequate protection systems (fire dampers and security logic in the installation) must be in place to avoid transport of flammable parts of any equipment component in case of fire propagation.

1.6. Frost protection

If the intake air temperature could produce freezing, it is recommended to add antifreeze to the working fluids and/or to consider not to turn off the unit to avoid problems in dampers or failures during operation.

1.7. Manufacturer instructions

In addition to following the instructions in this manual, the manuals of each component must be consulted to verify their proper operation according to their manufacturer's recommendations.

The final pressure drop of filters in the equipment manufactured by EVAIR is set according to UNE active Standard or the manufacturer statement in case this Standard does not apply. The final pressure drop must be respected to ensure the performance, energy efficiency of the unit and its structural integrity.

In certain occasions the equipment is supplied to a third party that installs the necessary peripherals for the automatic management of the Air Handling Unit; in these cases, it must be verified that there is the possibility of varying the speed of the fan (and therefore the air flow rate), as well as the possibility of thermal bypass of the heat recovery systems, as indicated by current regulations.

2. SECURITY INSTRUCTIONS



2.1. Caution

Personal injuries with serious health consequences, can occur in these equipment. Some elements inside the unit are commanded by a controller and may turn on suddenly, so it is required to take them into consideration. Similarly, there are highly dangerous mechanical-electrical elements, such as motors and elements attached to them mechanically.

2.2. Access to the unit

Access to the unit must be performed under the following conditions:

- The equipment that provide power for air supply must be disconnected and general machine feed cut.
- Wait 20 minutes after disconnection of the frequency converter to avoid residual voltage.
- Activated anti-start protections.
- Fixation of moving parts (fan, belts, rotary motors).
- Heat exchangers and water systems at room temperature (production stop or bypass).
- Pressure bearings without pressure.
- Use of appropriate clothing.

Any work on the unit must be performed by qualified personnel.

The applied loads shall not exceed 60kg/m² (uniformly distributed and preferably on the profiles) in any part of the unit casing.

2.3. Exceptional conditions

In case of fire, all electrical and electronic equipment must be disconnected, as well as activate, if any, the devices in charge of stopping the fire advance (air supply, dampers...). In the event that there is a fire control logic in the supplied equipment (see EVAIR control manual), it must be active.

Appropriate safety measures must be used, in order to keep people out of danger.



3. MAINTENANCE AND CLEANING INSTRUCTIONS

If disinfectants are used, they must be those with the correct proportion of alcohol allowed by the appropriate Standard of the destination country of the equipment.

Before connecting the unit after a maintenance service, the corresponding cleaning and vacuuming must be carried out, and in critical areas that must maintain a water tightness, a proper operation and no leakage test must be carried out.

Unless otherwise indicated in the section of each of the components of the Air Handling Unit, the following cleaning instructions must be followed:

- An industrial vacuum cleaner will be used to remove coarse and dry dirt.
- A damp cloth with grease and oil solvent cleaners should be used if necessary (a neutral pH cleaner between 7 and 9 will be used if possible).
- If necessary, and the construction of the tray allows it, it must be removed to clean it correctly.
- A mild spray must be used on galvanized steel.
- Traces of corrosion must be removed/repainted with a specific paint for this purpose.
- Remove dirt and dust in the holes or slots with a damp cloth with a neutral cleaner or a vacuum cleaner.

In order to carry out the maintenance and cleaning of hazardous work areas (ATEX), the corresponding equipment must be carried out for such work (at least in accordance with EN 1127-1 Standard). The maintenance intervals are specified in the corresponding section of this manual.



4. UNLOADING AND TRANSPORTATION



4.1. General conditions



In case the transport is carried out by EVAIR, appropriate means to carry it out will be chosen. If the client carries out the transport of the equipment, it must be ensured that the means used is adequate, according to the equipment dimension, its cover and its loading and unloading system.

In case the client has doubts about the transport, he should inform EVAIR; the technical department will communicate the basic requirements of the means of transport to be used according to the characteristics of the equipment.



4.2. Packaging

The Air Handling Units are delivered, as standard, with a base protection stretch film. These materials are potentially dangerous and should be kept out of reach of children. Recycle packaging materials in accordance with local regulations.

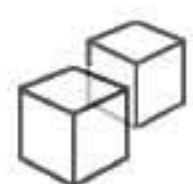
Those Air Handling Units that are to be sent by agency are provided with special packaging.

Equipment documentation is accessible, either physically with the equipment delivered, or from the route indicated on the outside of the unit by QR code. It includes CE marking, control manual, electrical diagrams and the present installation, start-up and maintenance manual.



4.3. Secure fastening of the equipment

The equipment must be securely attached to the base of the truck by means of slings or other suitable means that provide the necessary clamping strength (wires, chains, lifting straps). In case of there were any risk of damage to the equipment due to friction with the clamp, it will be protected with contact with a suitable material.



4.4. Unit position

Units are provided with the necessary eyebolts in order to transport them. They could be transported on pallets if required. During transport, the unit must be in its position of use and not stacked. (unless determined by the manufacturer).



4.5. Inspection on delivery

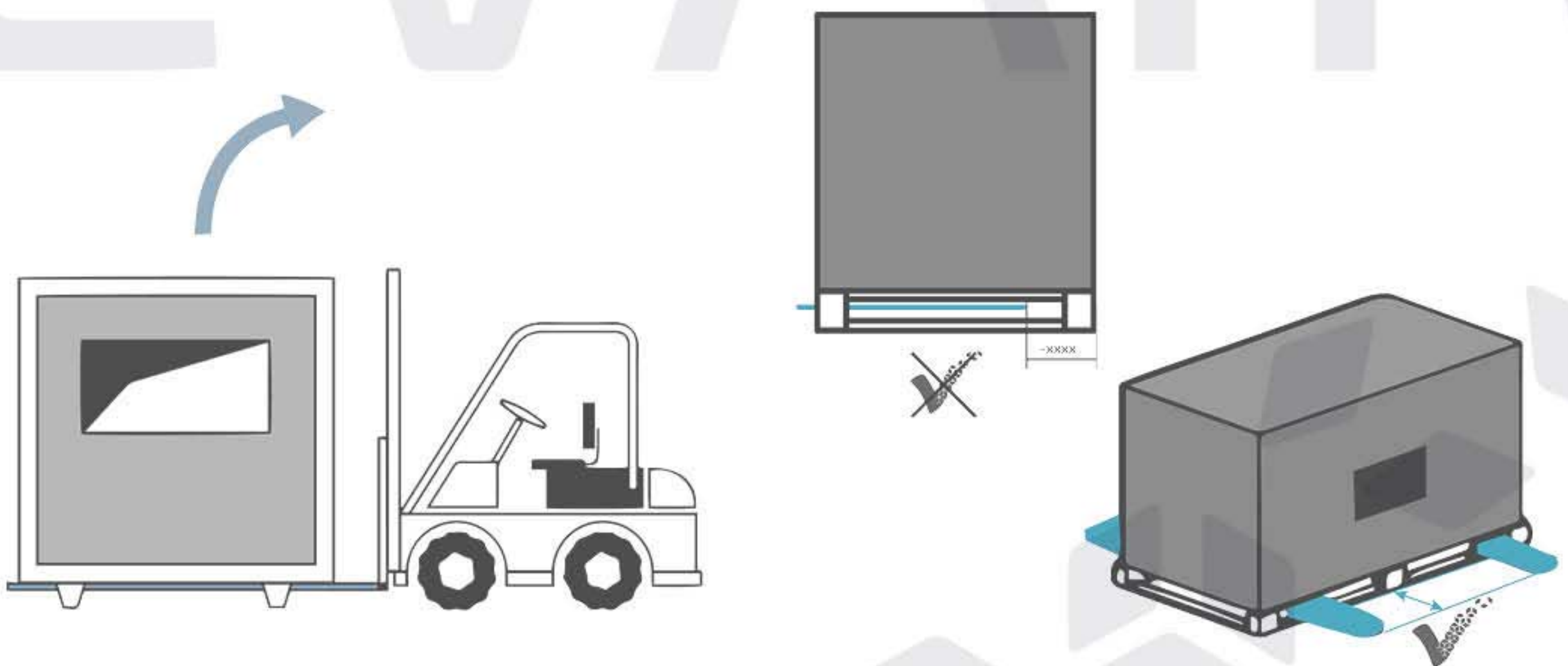
When the units are received is necessary to carry out a thorough check of the components, ensuring that during transport has been no damage. Any damage must be indicated to the carrier and the EVAIR's logistics department, adding a reservation clause in the delivery note and specifying the type of defect within a maximum 48 hours. It is mandatory to document by means of images the damages observed with the unit still in the truck.

4.6. Unloading

Truck unloading (if any) will be preferably carried out with crane or forklift. During unloading, there must be no people under the loads in the air to avoid serious damage.

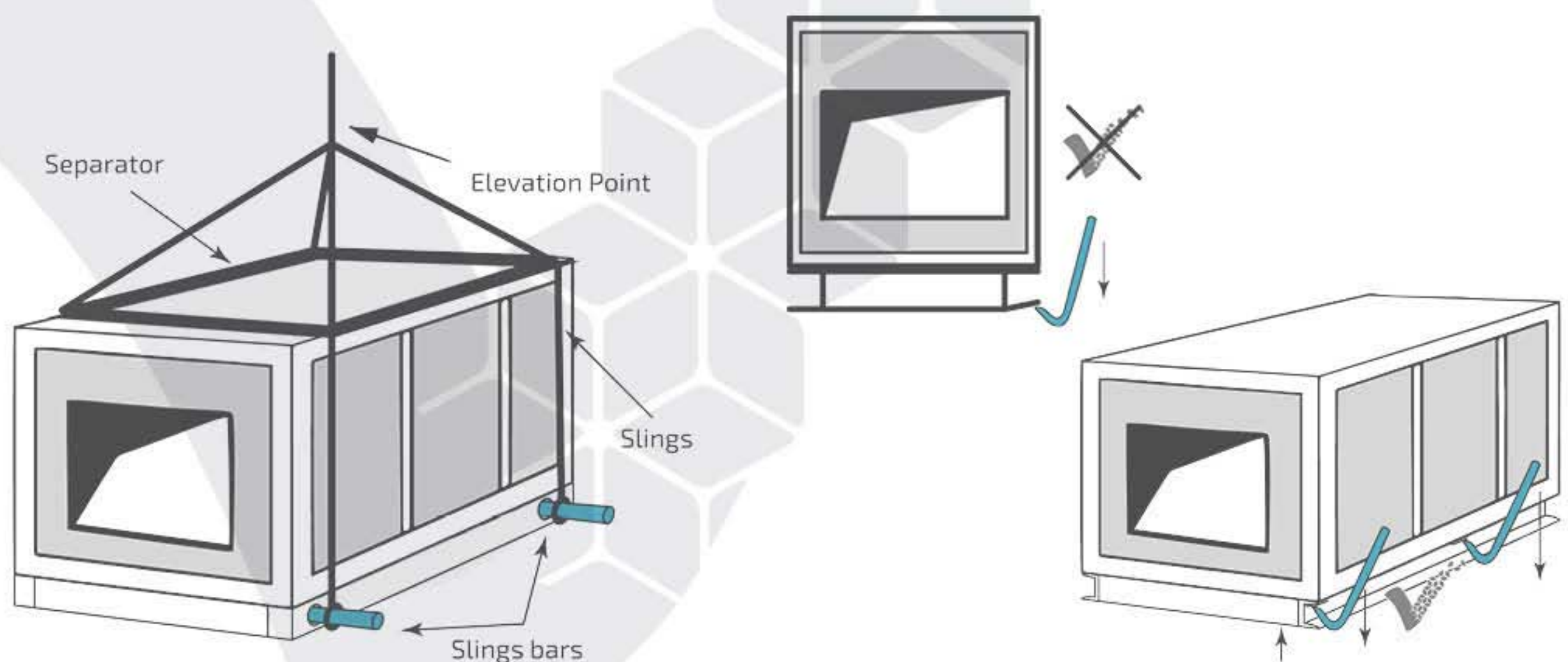
The elements that are part of the Air Handling Unit are not to be used as anchoring points, but rather the elements ordered for this purpose (hoists for lifting, or pallets where appropriate).

If the unit is unloaded in a forklift truck, the uniform distribution of the load and the absence of risk of hitting elements of the unit with the forks of the vehicle must be ensured. The Air Handling Units equipped with feet are easily loadable with a forklift; in case they do not have feet, the metal support has holes for fixing hooks or eyebolts for lifting with ropes.



**Correct position of the load (uniform horizontal distribution).*

In case of unloading with a crane, the same precautions must be taken, adding the use of a frame with hangers and/or the use of blocking beams to avoid damage to the equipment. The angle of inclination between the sling and the load should be approximately or greater than 45° .



**Equipment protection with a blocking frame to prevent damage.*

AHU_AIR HANDLING UNIT

Air Handling Units with special dimensions will have appropriate suspension boths for safe unloading.

In case of using another means for unloading, the securing means must also be placed under the unit in order to facilitate lifting, avoiding blows to the equipment and trying to make the distribution of load uniform and lift the unit in its position of use.

Any modification of the components of the Air Handling Units for the discharge (coils displacement, connections, dampers, etc.), will void the warranty of the unit.

The maximum inclination of the unit during unloading must not exceed 2 degrees. Unloading with a higher slope will cause problems in the alignment of components and will void the warranty of the unit.

Once the unit is positioned, in case the floor is not completely levelled, it must be shifted without causing a deflection in the baseframe, so that the unit is level. If the unit is uneven, problems will arise with the alignment of components and the warranty of the unit will be voided.

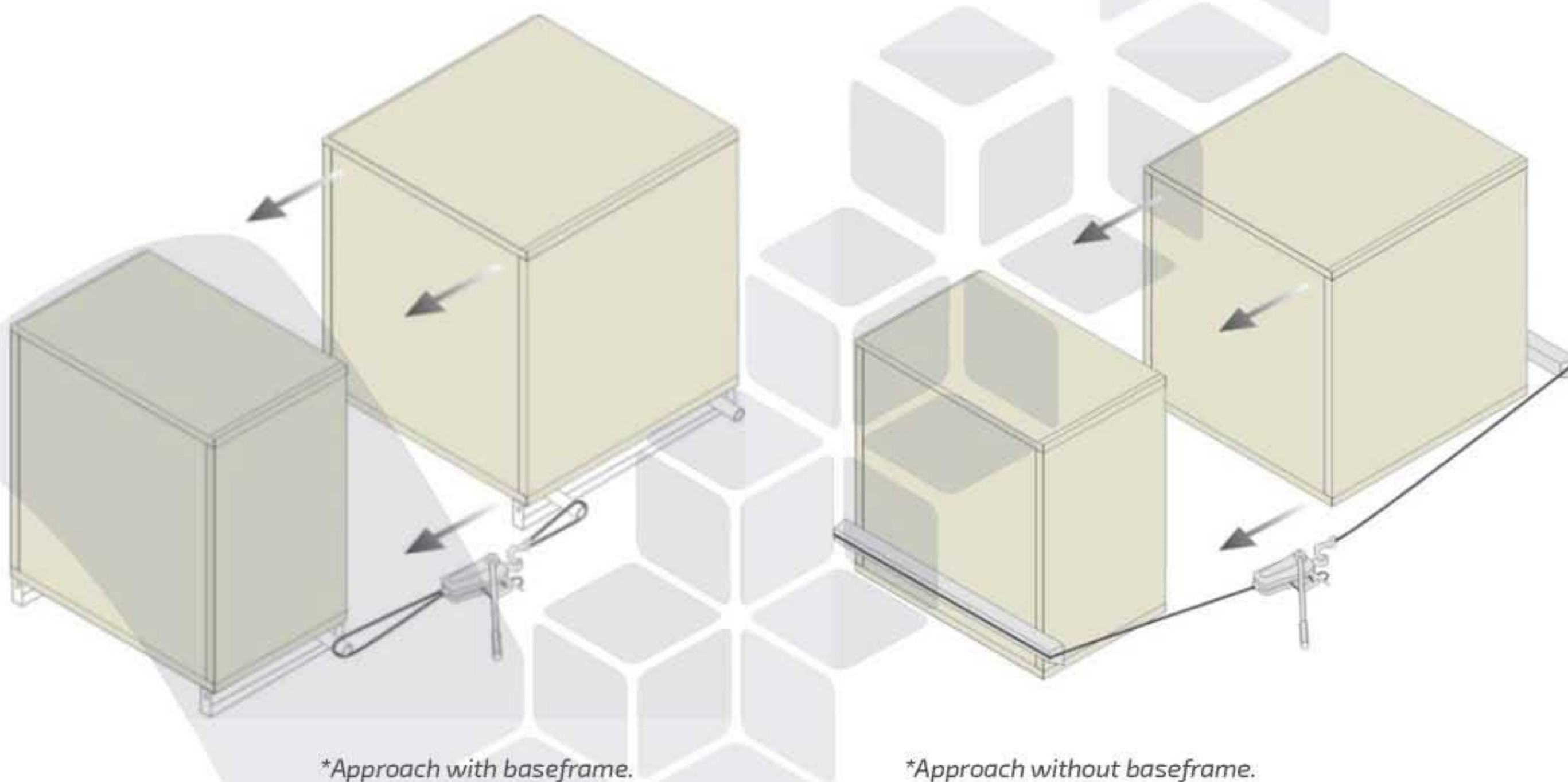


4.7. Displacement of the sections

Depending on their size, the Air Handling Units are supplied in a single piece or in modules that allow their transport and handling.

In case the unit is supplied by sections, they must be joined by moving them in the correct way according to the figures shown below. The blows should be avoided as much as possible.

To the displacement of the unit, must be carried out on wheels that allow its running or on completely smooth surfaces. To exert the force that allows its approach, in case of having a baseframe, the mechanical element that performs the force will be connected to it; otherwise it will approach by means of supports on the opposite side to the union side.



NOTE: It is the installer's responsibility to have the appropriate physical means for the correct handling and positioning of the modules.



5. FINAL PLACEMENT OF THE UNIT

5.1. Space requirements

Air Handling Units must be unpacked at the time of their placement and not before. The unit position must have, in addition to the maintenance space already indicated, minimum safety distances: 1,5 meters from inlet/outlet lines to the first obstacle, and 1 meter from the side wall to the first obstacle. The most restrictive among the maintenance space and these must be maintained.

5.2. Unit tilt

The supporting surface of the unit must be horizontal, flat, tough and level to ensure the drain and the opening and closing of the inspection doors. Irregularities that may cause instability should be flattened with the appropriate means. The maximum inclination with respect to the horizontal is 0,3°.

5.3. Support surface requirements

The supporting surface must be able to stand the weight of the unit. If necessary, the ground will be provided with additional structural safety by means of the construction of a concrete base with metal profiles.

This support base must meet the requirements specified in the air conditioning project, in terms of structural safety, acoustic insulation and water drainage. The distance between beams will be enough to allow the firmness of the structure, especially in the case of installation of large equipment.

Although in most cases the vibratory components that are separated from the structure of the equipment by means of silentblocks, it is necessary to plan the baseframe or support feet of the unit have a natural frequency of vibration different from the natural frequency of each one of the vibratory components that make up the Air Handling Unit. This is guaranteed inside the equipment.

5.4. Supports between the unit and the support surface

The unit is supplied with feet or baseframe, unless another type of finish has been requested and agreed with the client. Anti-vibration supports must be included (silentblocks or similars) between the base of the unit and the support surface. The baseframe of the Air Handling Unit is provided with holes for coupling these components in the installation on site.

Between the modules of the unit it is necessary to adjust the tightening torque of the joints and provide a weather strip to them (union kit that includes the unit) to avoid transmitting vibrations.

5.5. Suspended units

Air Handling Units that are installed hanging from the ceiling (usually of small size) shall be secured from the ceiling by means of hanging devices coupled to supports of sufficient rigidity to support the unit. EVAIR recommends using its own suspension kits for hanging and wall-supported equipment.

5.6. Outdoor units

If the units provided are placed in an outdoor area, if the client so specifies, they are supplied with additional rain protection (cover that prevent the passage of rain towards the unit and protection against wind). The openings of the unit (ducts) must not be placed according to the dominant direction of the wind to avoid transversal thrust.

Each of the unit's joints, such as joints between sections or the base of the unit, must be properly sealed to prevent leaks. In addition, the base will be provided with a suitable height to prevent the accumulation of snow or water and avoid leaks.

If the rain protection has been assembled at the factory, it will be checked for any damage or breakage caused by transportation. In case it must be mounted in the final location, it must be installed following the instructions in point 5.8.

In case of direct air aspiration from the outside, the section will be provided with a protective mesh to prevent the entry of undesirable elements into the unit, this protection may be provided by EVAIR. Similarly, the units will have a special embouchure to prevent water leaks due to rain; this protection may be provided by EVAIR.

5.7. Duct connection

Duct connection must be made stress-free (screws or flanges slightly loosened), so that vibrations are not transmitted through the elements. At the unions, joints must be placed to prevent air leaks, and when installed, tighten the joints. If necessary, polyurethane mastic will be applied to improve the sealing, or other material that fulfils the same purpose and is suitable for it.

The joints between conduits and the Air Handling Unit must have a minimum width, and they must be made of a flexible material.

The outlet ducts of the unit should not present, as far as possible, an angular shape to avoid excessive load and noise losses. EVAIR does not guarantee the performance of pressure and sound level beyond the connection of the duct to the Air Handling Unit if the angle between the horizontal and the inclined part of the transition is greater than 50°.

5.8. Mechanical connection of modules

When needed, Air Handling Units are delivered disassembled so that they have to be assembled on site. The correct assembly of these modules will be the responsibility of the installer and it must be carried out according to the indications in this document.

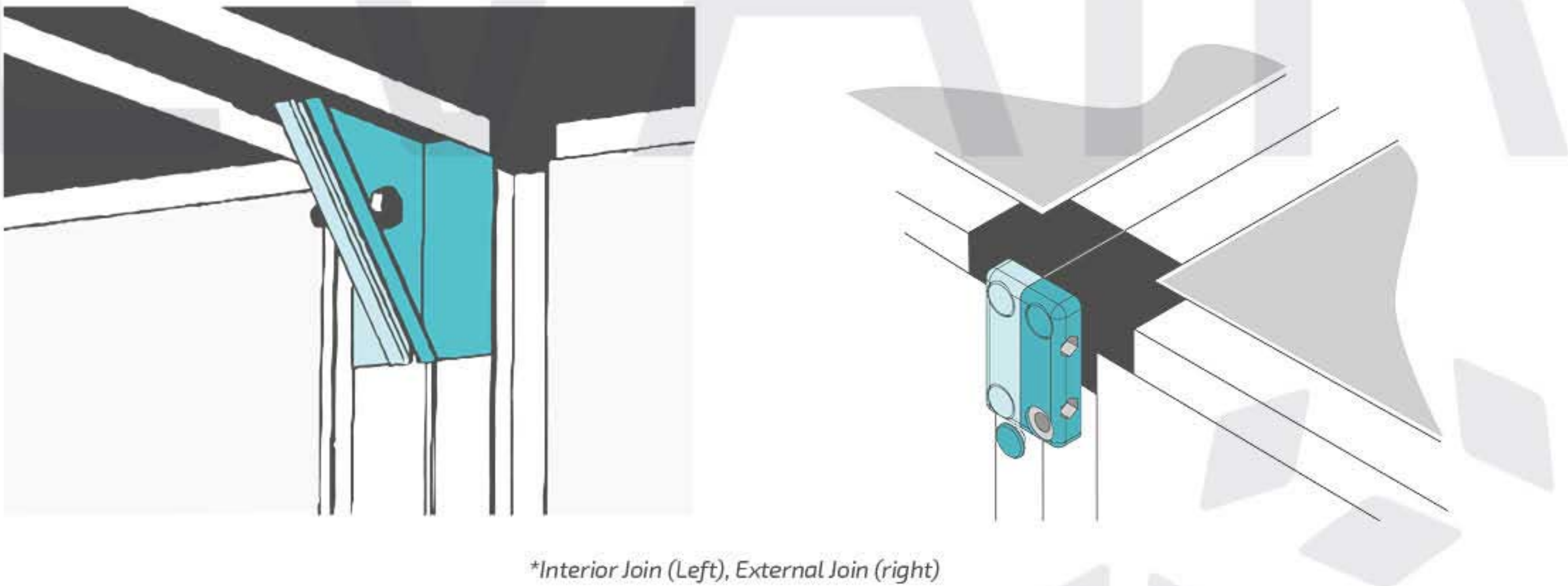
The assembly procedure should be planned with sufficient time, since it is a time-consuming task. Modules will be placed according to the plans of the AHU supplied by EVAIR. The modules must be placed in the marked sequence according to the direction of the air flow. Each module is identified in position within the general manufacturing drawing.



**Sequence of mechanical connection of modules (from left to right)*

The assembly area must be clean and it is necessary to ensure that there is sufficient space to join the sections. The joining must be carried out once the modules are facing and aligned with each other (join the modules together moving them by the baseframe, never use the joining brackets to approximate them) and in the order established by the design of the unit. The assembly operation includes positioning the equipment, placing the self-adhesive gasket, aligning, levelling the modules (aligning is facilitated by the registration brackets) and screwing. **The self-adhesive gasket, weatherstripping, screws and the necessary material for joining modules is supplied inside the unit.**

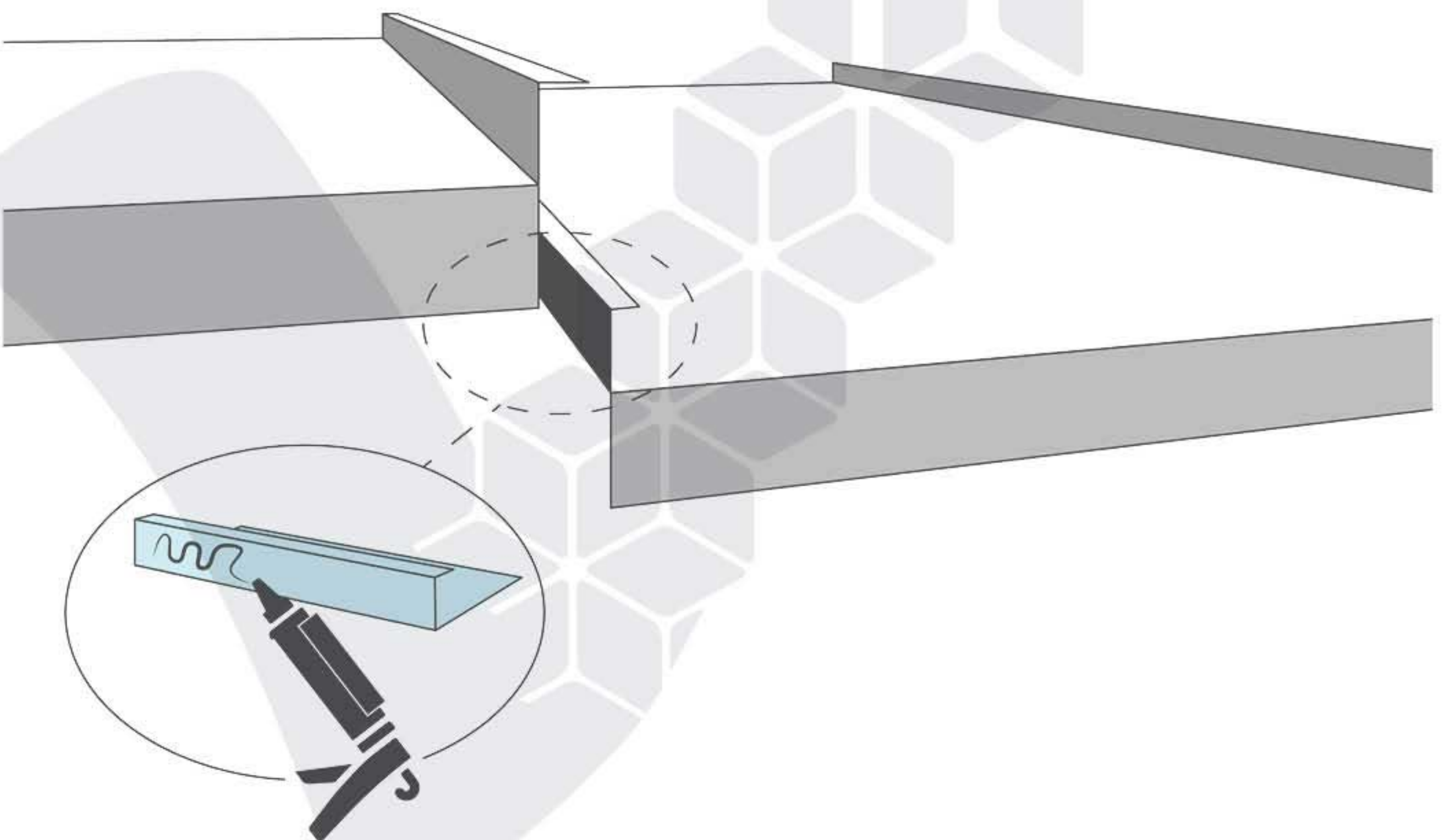
The joints are generally made externally, although on certain occasions they are positioned interior union brackets. (see pictures)



**Interior Join (Left), External Join (right)*

When the unit is fitted with rain protection, the section with the roof inner flange must be placed first, and then the section with the outer flange must be overlapped (see picture). Before the modules are joined together, apply anti-water filler to ensure a watertight joint.

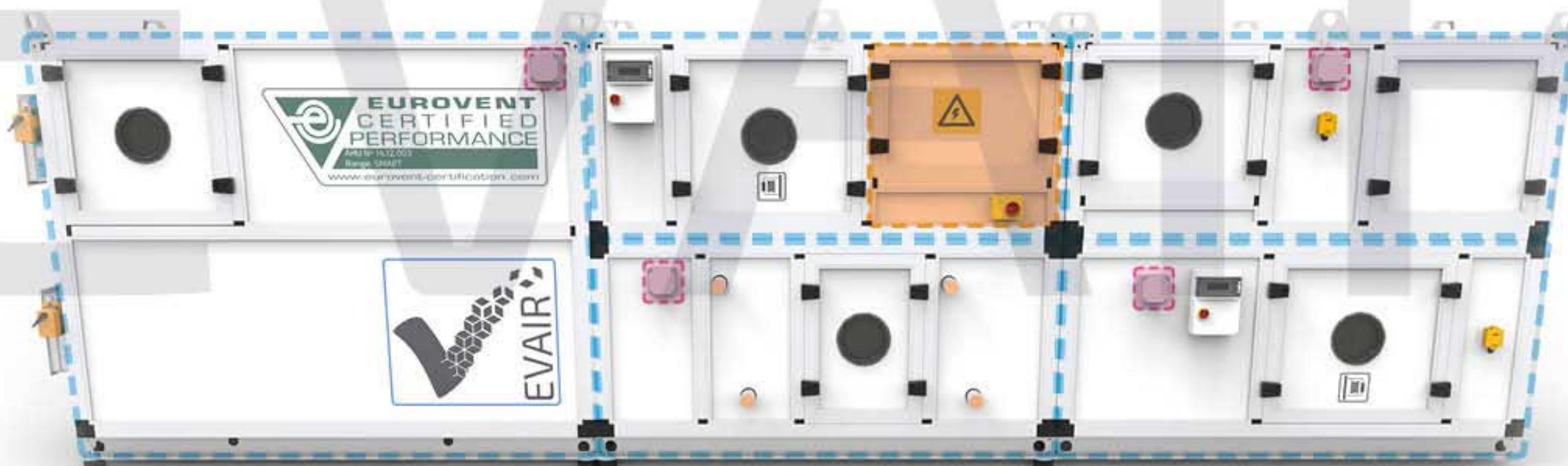
When the rain protection is designed with a single or gable slope, the installer must carry out the assembly on site (following the specific manual).



**Rain-protection connection in moduled Units*

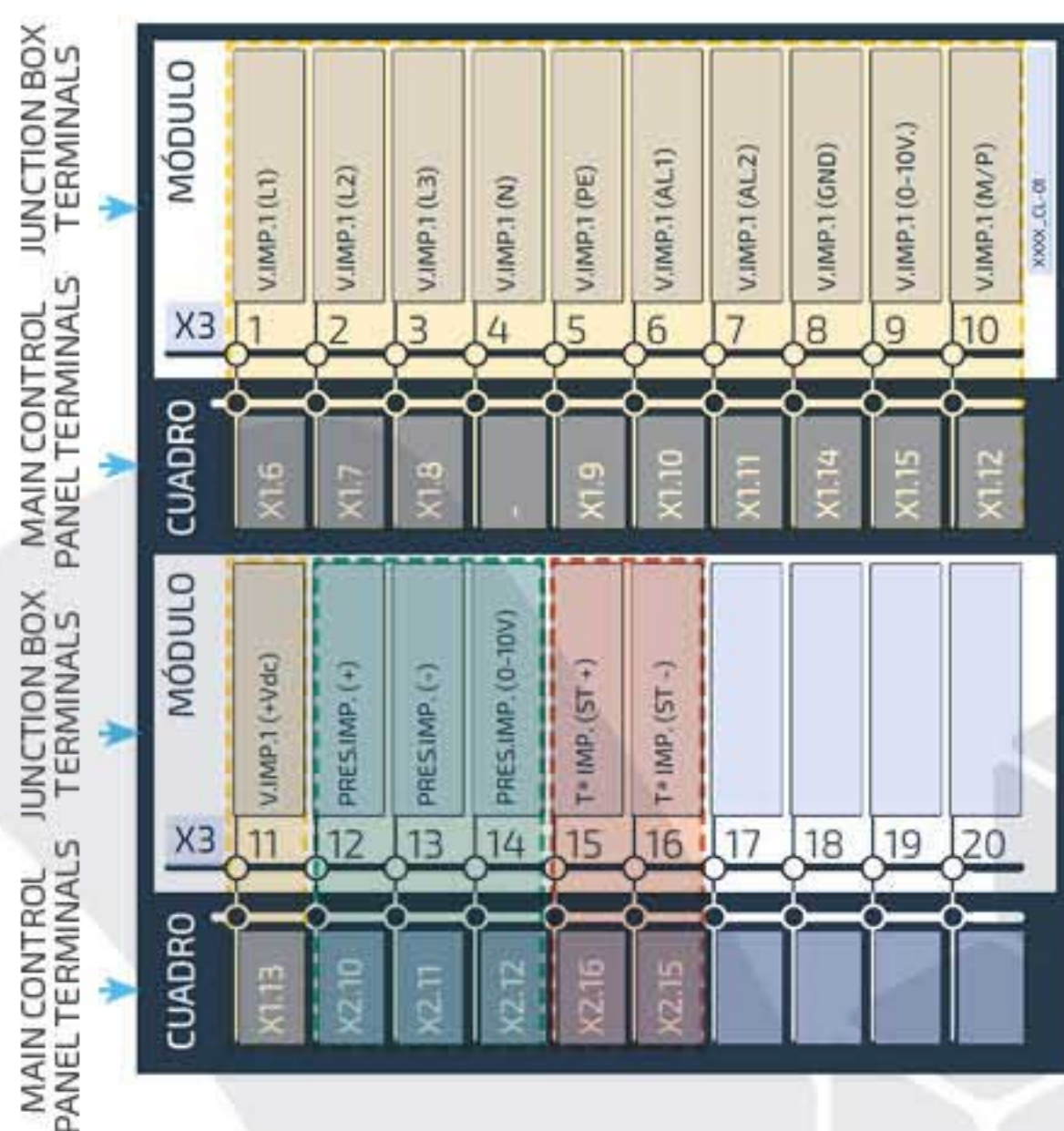
5.9. Electrical connection of modules

When the equipment is supplied disassembled in modules and it is fitted with integrated control, the secondary modules (those in which the electrical panel is not located) must be electrically connected to the main control panel (highlighted orange in the image). To facilitate this process, in the secondary modules are provided junction boxes (highlighted in pink in the image) where the control elements present in the module (fans, probes, etc.) are connected.



*Example of modular equipment with electrical installation

The installer must electrically connect these junction boxes to the main electrical cabinet following the electrical diagram. In the case of air handling units supplied in modules and incorporating control, **the installer is responsible for the wiring from the auxiliary boxes of each module to the electrical panel**, carrying out the wiring **once all the modules have been assembled** and where **the installer considers most appropriate. No pre-installation is incorporated** for the wiring to be carried out from the auxiliary boxes to the control panel.



As an aid to this wiring process, there are labels on the interior of the boxes (see example below) indicating the terminals of the main panel to which each terminal of the junction box should be connected (the number of terminals may change depending on the elements present in the module).

The example label shown below can be seen the connections needed to be made by the installer, highlighted in yellow for the fan, green for the pressure probe and red for the temperature probe. It is the installer's responsibility to ensure that these connections are carried out in accordance with local regulations.

Example of connection:

- Terminal **x3.1 of the junction box** must be connected to terminal **x1.6 of the control panel**.
- Terminal **x3.2 of the junction box** must be connected to terminal **x1.7 of the control panel**.

5.10. Other considerations

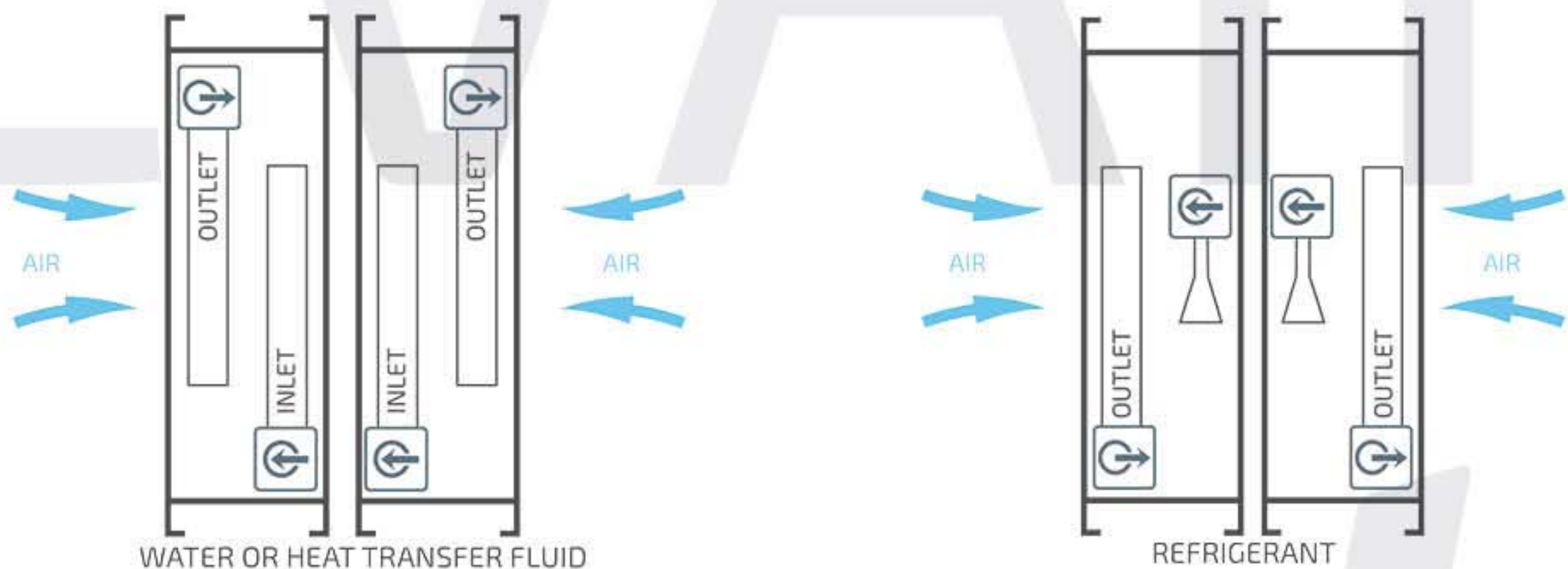
When the Air Handling Unit is designed in double-height, the width of the modules will be the same, so none protrudes laterally. The upper modules may have lateral attachments for positioning; these must be removed once the upper module has been placed. If the upper modules consist of a second intermediate baseframe, it will be positioned on the lower modules and can be anchored if necessary to the profile of the indoor unit. Between the base and the lower unit there must be a layer of perimeter weather strip to avoid friction and attenuate the transmission of vibrations.

The equipment roof is NOT practicable. Any item that is not part of the equipment should have its own independent support.

6. INLETS AND CONNECTIONS TO THE AIR HANDLING UNIT

6.1. Water connections in heat exchangers (Coils)

The connections to the pipelines must be carried out correctly according to the adhesives that indicate the water inlet and outlet. EVAIR does not guarantee the thermal performance of the equipment if the principle of the counterflow is not respected (maximum use of the available water-air thermal jump).



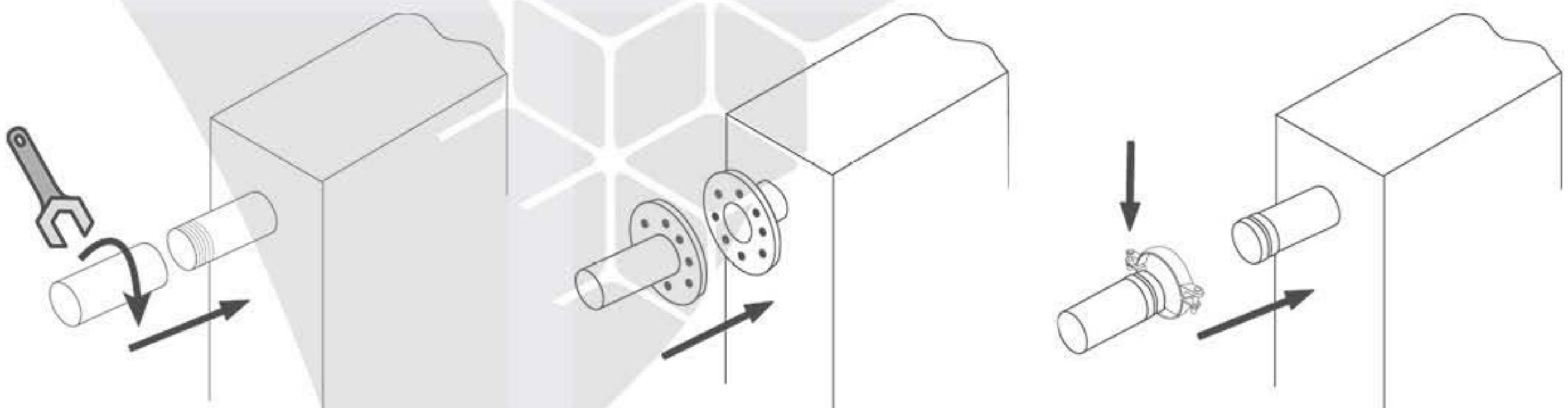
**Correct connection of water in a counterflow coil.*

Water outlet will take place at the top of the coil. The air vent should be placed at the top of the coil as well or checked to be installed. In the lowest part of the coil there must be installed or checked that it is a drain pipe to be able to carry out a complete drainage. The coils should not be submitted to any type of stress (either due to weight, vibrations, dilatations, or any other physical phenomenon that may alter its natural state), using stress compensators if necessary. This implies that the connections design must be done to allow thermal expansion.

Coils are supplied with the water inlet and outlet pipes taken outside the unit. These pipes incorporate a sealing system to prevent leakage. In the same way, the tray incorporates an outlet pipe for drainage to the outside of the unit. A slight bending has to be permitted on those pipes.

To adjust threaded connections to the coil, a wrench must be used in the proper way so that the connections are not damaged. In case of flange connections, the sealing and tightening must be adjusted to avoid leaks. In case of joining with a Victaulic type flange for grooved pipes, the sealing and tightening must be adjusted to avoid leaks. Pipes must incorporate flanges that allow their free movement in cases of maintenance or replacement.

Before the commissioning of the coil is necessary to check that there are no leaks. It is advisable to install a valve to control the fluid inlet to the coil. A purge of the water circuit must be carried out from the highest point of the coil, and it must be verified that there are no problems derived from the transmission of vibrations from the water circuit to the structure of the coil.



**Types of coils connections (from left to right), Threaded, Flanged, and Victaulic.*

AHU_AIR HANDLING UNIT

In case of coils with fluid at more than 90 °C, it is necessary to install devices that avoid the problems that may occur due to the inlet of hot water to the coil with the fan stopped.

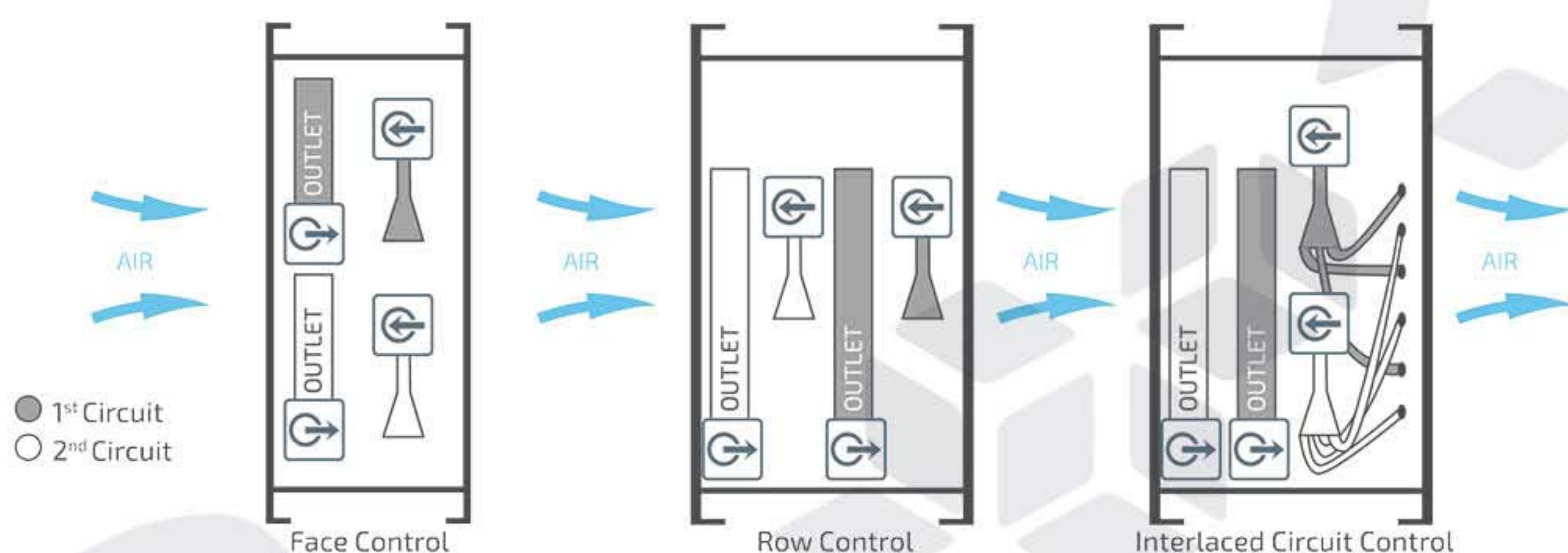
Excess oxygen, sulphates, nitrates and chlorides can lead to corrosion in copper tubes. It is not possible to quantify in an exact way the concentration of each substance that gives rise to the beginning of the corrosion phenomenon, since it depends not only on the concentration but on many other factors such as temperature, contact time, pH, speed, etc. In addition, the presence of bacteria or microorganisms can lead to a microenvironment where oxidation reaction occur. Below are some recommendations to reduce the potential corrosion in the copper tubes of the coils:

- Avoid sulphate content higher than 70 mg/L.
- Avoid TOC greater than 1,5 mg/L.
- Avoid carbon dioxide higher than 20 mg/L.

To receive more information about pH, chlorides, nitrates, dissolved substances, fluid velocity, etc., contact the technical department of EVAIR.

6.2.Refrigerant connections in direct expansion coils

The refrigerant connections in the pipes must be made correctly according to the adhesives that indicate the refrigerant inlet and outlet. EVAIR does not guarantee the thermal performance of the equipment if the principle of counterflow is not respected.



*Arrangements for Coils with Multiple Thermostatic Expansion Valves

Direct expansion coils attached to VRF kits require some special features associated with:

- Number of required refrigerant stages/circuits or maximum capacity of kits to be installed.
- Construction (*Face Control*, *Row Control*, *Interlaced Circuit Control*).
- Maximum internal volume of each stage/refrigerant circuit or for each of the possible kits to be installed.

In the technical description of the Air Handling Unit these characteristics appear above indicated, being approved with the order of the equipment. In case that the characteristics approved in the technical offer are not valid, it will be the responsibility of the client to request a new technical offer to the technical department of EVAIR.



6.3. Water connections in evaporative humidifiers with recirculated water

Water connections

Connect the water supply to the float valve using suitable piping with a cut-off valve. It is advisable to install a water filter to prevent dirt from entering the hydraulic system. The float valve can be regulated to set it to a range of water supply pressures.

Water basin supply

Adjust the water level of the basin to between 3 cm below the level of the overflow by regulating the float valve. The water level must never fall below the minimum water level of the pump. Water levels below this minimum will irreparably harm the pump.

Water regulation valve will be adjusted at start-up so that the air reaches the desired humidity conditions in the most critical situation (unless there is another type of control for its regulation).

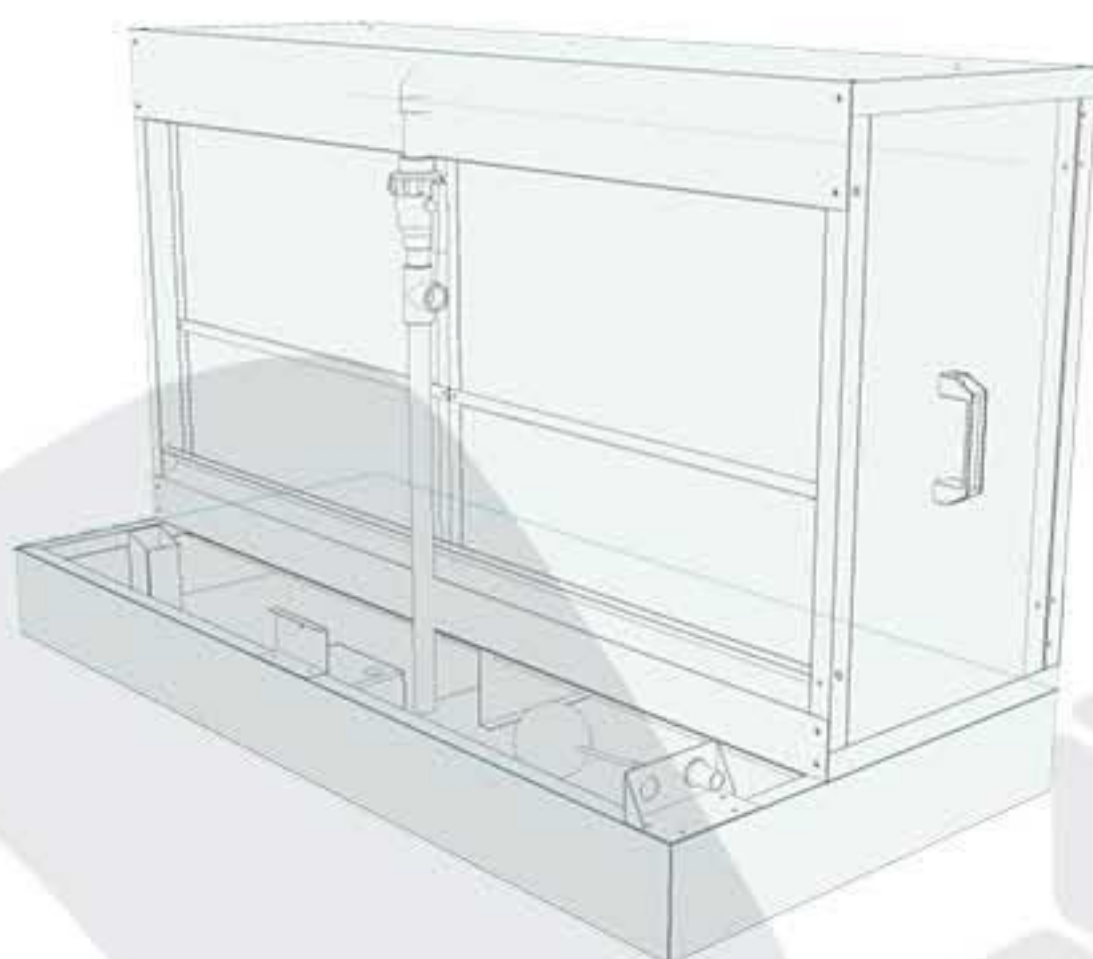
Connecting the drain to the water trap

Connect the common outlet for the draining / overflow / constant bleed-off with no cut-off valve, to the network. A cut-off valve (manual or automatic depending on specifications) can be included for drainage control.

The connection of the water outlet to the drainage must include a water trap high enough to exceed the pressure in the system, so the water tank can be completely emptied, for hygiene reasons. The system will also have the normal slope of typical drainage lines. Recovering water from the humidification process into the drinking water network is absolutely prohibited.

NOTE: For more detail and support on this equipment, please refer to the specific manual of the component.

6.4. Water connections in evaporative humidifiers with direct water



*Evaporative Humidifiers

Connection to the water supply

Connect the water supply using suitable piping with a cut-off valve. It is advisable to install a water filter to prevent dirt from entering the hydraulic system.

When the temperature of the supply water is below the dew point of the incoming air flow, it is recommended to isolate the manifold and inlet pipe to prevent possible condensations. To work according to hygienic certificate VDI6022 (ISO846) the isolations should also meet that standards.

Connecting the drain to the water trap

Connect the common outlet for the draining with no cut-off valve to the network.

The connection of the water outlet to the drainage must include a water trap high enough to exceed the pressure in the system, so the water tank can be completely emptied for hygiene reasons. The system will also have the normal slope of typical drainage lines. Recovering water from the humidification process into the drinking water network is absolutely prohibited.

NOTE: For more detail and support on this equipment, please refer to the specific manual of the component.

6.5. Water connections in electrode steam humidifiers by electrodes

Use only water from the network with:

- Pressure between 0,1 and 0,8 MPa (14,5 and 116 PSI), temperature between 1 and 40°C and an instantaneous flow rate not lower than the nominal flow rate of the supply solenoid valve.
- Hardness not exceeding 40°f (equal to 400 ppm of CaCO₃), conductivity range: 75 ... 1250 µS / cm.
- Absence of organic compounds.

SUPPLY WATER CHARACTERISTICS	UNIT OF MEASURE	COMMON WATER		LOW SALT CONTENT WATER	
		MIN.	MAX.	MIN.	MAX.
Hydrogen ion activity (pH)		7	8,5	7	8,5
Specific conductivity at 20°C (σ _R , 20°C)	µS/cm	300	1250	75	350
Total dissolved solids (CR)	mg/l	(1)	(1)	(1)	(1)
Fixed residue at 180°C (R180)	mg/l	(1)	(1)	(1)	(1)
Total hardness (TH)	mg/l CaCO ₃	100 (2)	400	50 (2)	150
Temporary hardness	mg/l CaCO ₃	60 (3)	300	30 (3)	100
Iron + Manganese	mg/l Fe+Mn	=	0,2	=	0,2
Chlorides	ppm Cl	=	30	=	20
Silica	mg/l SiO ₂	=	20	=	20
Residual chlorine	mg/l Cl-	=	0,2	=	0,2
Calcium sulfate	mg/l CaSO ₄	=	100	=	60
Metal impurities	mg/l	0	0	0	0
Solvents, thinners, detergents and lubricants	mg/l	0	0	0	0
(1)=values dependent on specific conductivity; in general: Cr=0,65* σ _R , 20°C; R80=0,93 * σ _R , 20°C					
(2)=not less than 200% of the chloride content in mg/l Cl-					
(3)=not less than 300% of the chloride content in mg/l Cl-					

There is no reliable relationship between water hardness and conductivity.

Do not treat the water with decalcifiers, as these could cause the formation of foam, affecting the operation of the machine. Do not add disinfectants or anticorrosive compounds to water, as they are potentially irritating. The use of well water, industrial water or water from refrigeration circuits and, in general, potentially contaminated water (chemically or bacteriologically) is discouraged.

The drainage water contains the same dissolved substances as the supply water, but in larger amounts. It can reach a temperature of 100°C. It is not toxic and can be drained in the drainage system.



During water installation, note the following:

- Have all work performed by a professional.
- Disconnect power supply before installation.
- Obey local public utility regulations
- Verify that necessary safety measures have been taken - in compliance with either German Technical and Scientific Association for Gas and Water (DVGW) guidelines (DIN EN1717) or local regulations - to eliminate backflow of polluted water into drinking water treatment facilities. This can mean installing a backflow preventer. Within the humidifier, a double check valve (58) is in the water supply line. It prevents - in accordance with DIN EN 61770 - the backflow of water.
- The water supply temperature may not exceed 40° C.
- Water installation pressure: 1 - 10 bar (100 x 103 to 100 x 104 Pascal).
- For water installation please use the water connecting hose that is delivered with the unit..

Operation with softened water

Salt bridges cause electrical arcs. These are indicated by the presence of black grooves in the top part of the cylinder. The top part must be replaced to prevent further damage to the cylinder material, as well as short circuits which trip main circuit breakers.

Foam meets the maximum water level sensor electrode and triggers a signal indicating the cylinder is filled to capacity, even though this is false, and the nominal current has not yet been reached.

If using a water softening system, we recommend diluting the softened water with normal tap water to produce an overall hardness between 4-8°dH. This value can be set lower if the water does not foam.

In case of mixing softened water with deionized water (conductivity = 5-20 µS / cm) care should be taken to ensure that the mixture neither generates foams nor its conductivity is too low.

Water supply

Before carrying out the hydraulic connections, disconnect the humidifier from the electrical network.

Shut-off valve and water filter are not supplied with the unit. Install a water filter when the quality of water requires it.

It is provided a water hose with a cap nut at both ends which can be used for water installation.

Install as follows:

- Screw and tighten the cap nut with its inner seal ring around the water supply screw connection that protrudes from the base. Tightening too much will destroy the fitting. The valve strainer must be placed inside the solenoid valve.
- Use a cap nut with inner seal for connection to the water inlet of the installation.

Steam transport

Avoid the formation of pockets or siphons (cause of condensation) and the strangulation of the hose. The end of the hose must be fixed to the manifolds of the humidifier and steam distributor by means of metal clamps, so that it does not become loose due to the high temperature effect.

Tensions must be avoided that involve mechanical stress on the outlet stem of the cylinder steam.

Water drainage

During blow-down, hot water with a temperature of about 100°C is being drained. The contact of water with the skin can cause burns.

Pay attention for free and non-pressure drainage of the water. During blow down up to 0,3 L/sec are being drained. For water discharge, we recommend installation of a flexible water drain hose. Humidifier and wastewater discharge must be on the same pressure level.

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Please note:

- Install discharge line and drain pipe made from temperature resistant material (to 100°C).

Install water discharge as follows:

- Loosely insert a length of 1 1/4 " drain hose, approx. 250 - 1000 mm, into a drain pipe with a minimum inner diameter of 40 mm and seal with a rubber gasket.
- Fit water drain hose over the pump drain hose and fasten to the housing drain connection.

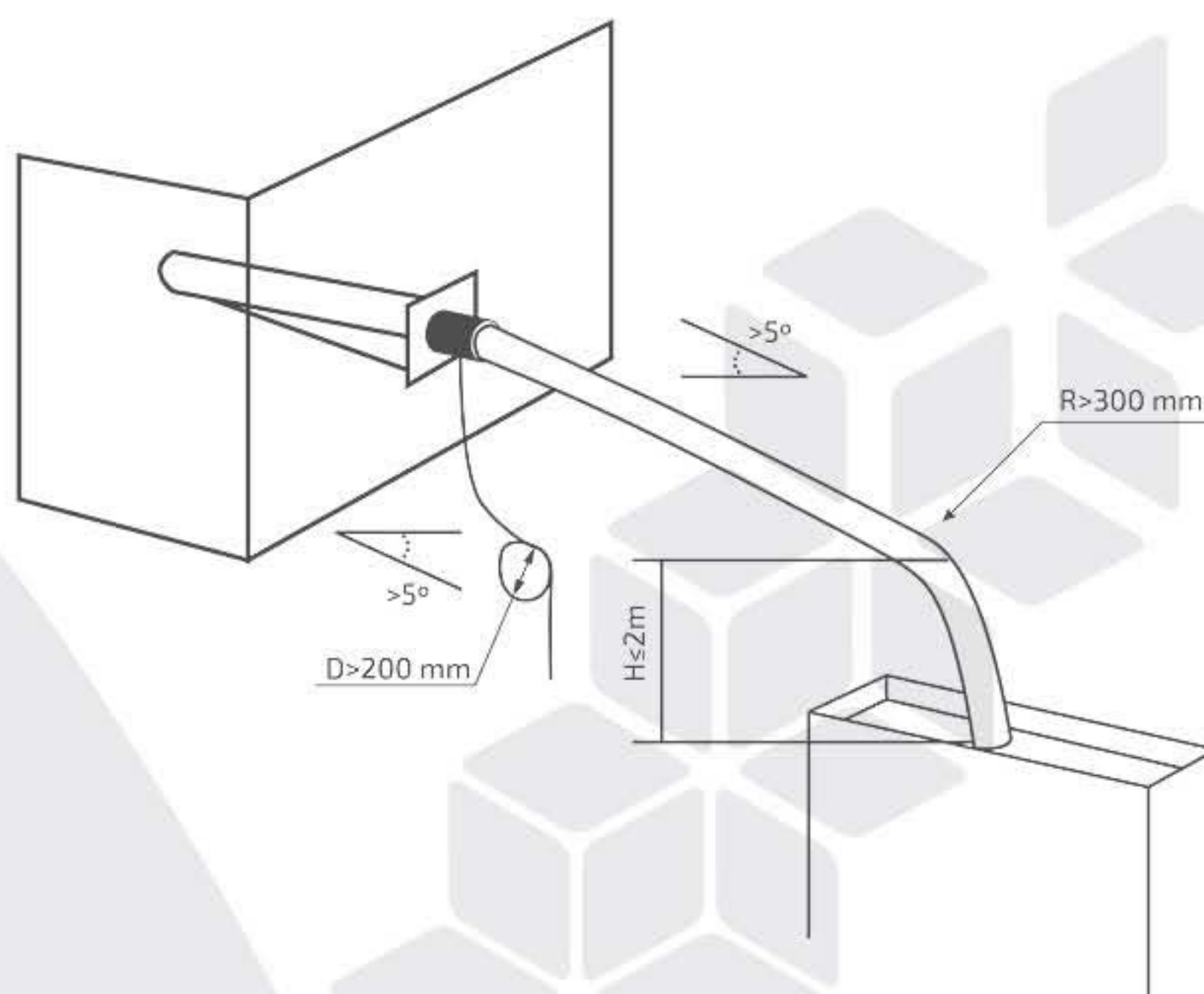
2 grounding clips can be fixed on the inner surface of the housing drain connection. The end of the pump drain hose is pushed into one of these clips. During blow-down, the grounding clip is in direct contact with the water and shunts potential residual electric currents away from the housing.

There is a 3mm-wide crack between the pump drain hose jacket and the inner surface of the housing drain connection. If water collects in the base plate, it will flow through this crack into the drainage system.

Once the installation is complete, purge the supply hose for about 30 minutes, emptying the water directly into the drain without introducing it into the humidifier. By doing so, any residuals and substances left over from the installation work that can clog the drain valve and cause foam formation during the boiling of the water will be eliminated.

Final checks

During operation of the humidifier part of the steam may condense, causing loss of performance and noises in the form of gurgling). To drain the condensate, connect the hose to the base of the distributor with a siphon and a minimum slope of 5°.



**Installation humidifier connections*

- The steam outlet hoses go upwards, and the distributor has a climb slope of at least 2 degrees.
- The ends of the hose are secured to the fittings with metal clamps.
- The curves of the tubes are sufficiently wide (radius > 300mm / 11,8") so as to form folds or constrictions.
- The steam hose has no bags or siphons in which condensate can form.
- The paths of the steam and condensate hoses are as described in this manual.
- The length of the steam hose is not more than 4 meters.



- The inclination of the steam hose is sufficient to allow the correct drainage of the condensate (>20 degrees in the ascending sections, >5 degrees in the descending sections).
- The slope of the condensate hose is at least 5 degrees at every point.
- The condensate pipe is equipped with a siphon (filled with water before start-up to prevent steam scaping).

NOTE: For more detail and support on this equipment with self-production system, please refer to the specific manual of the component.

6.6. Water connections in steam humidifiers by resistances

SUPPLY WATER CHARACTERISTICS	UNIT OF MEASURE	WATER	
		MIN.	MAX.
The supply water of the humidifiers by resistances must not be corrosive, it must not emit bad odors and it must not be too chalky to avoid excessive incrustations. This, taken from a drinking water or demineralized network, must have the following characteristics. Specific conductivity at 20°C	σ_{20} - $\mu\text{S}/\text{cm}$	0	1500
Total dissolved solids	TDS-mg/l	(1)	(1)
Fixed residue at 180°C	R180-mg/l	(1)	(1)
Hydrogen ion activity	pH	6	8,5
Total hardness	TH-mg/l CaCO_3	0 (2)	400
Temporary hardness	mg/l CaCO_3	0 (3)	300
Chlorides	ppm Cl	=	50(4)
Iron+Manganese	mg/l Fe+Mn	=	0,2
Silicon	mg/l SiO_2	=	20
Residual chlorine	mg/l Cl^-	=	0,2
Calcium sulphate	mg/l CaSO_4	=	100
Metal impurities	mg/l	0	0
Solvents, thinners, detergents, lubricants	mg/l	0	0
1. Values dependent on specific conductivity; in general $\text{TDS}=0,93^* \sigma_{\text{R}}, 20^\circ\text{C}$; $\text{R180}=0,65^* \sigma_{\text{R}}, 20^\circ\text{C}$.			
2. Not less than 200% of the chloride content in mg/l Cl^- ;			
3. Not less than 300% of the chloride content in mg/l Cl^- ;			
4. It may be necessary to intervene in the rate of emptying to avoid a concentration in boiling water higher than 300 mg/l Cl^- ;			
For particularly aggressive water (conductivity $<1\mu\text{S}$) use the titanium resistances.			

Water treatment with water softeners or polyphosphate dispensers is allowed, guaranteeing at least 60% of the initial hardness value and not less than 5°F. Decalcified water allows the reduction of maintenance. Decalcified water favours concentration conditions of dissolved salts, in the water inside the boiler, with the possible subsequent formation of foam.

The use of well water, of industrial water or taken from cooling circuits and, in general, of potentially contaminated water, chemically or bacteriologically, is discouraged. The addition to the water of disinfectant substances or anticorrosive compounds, which are potentially irritating, is discouraged.

There is no reliable relationship between water hardness and conductivity; however, purely indicative, a water with a hardness of 40°F should have, approximately, a conductivity of about 900-1000 mS/cm at 20°C.

The emptying water contains the same dissolved substances in the feed water; but, in larger quantities, it can reach 100°C. It is not toxic and can be emptied into the water collection system. In versions with temperature draining, the drain water temperature will be 60°C, guaranteeing a temperature at inlet of 25°C.

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Completely demineralized water is aggressive. For connection to a hydraulic system with completely demineralised water, use only plastic installation material resistant to chemical agents (e.g. polypropylene) or stainless steel.

Water inlet

Before carrying out the hydraulic connections, disconnect the humidifier from the electrical network. A shut-off valve, not included, must be installed upstream of the installation. It will be necessary to install a mechanical filter (not included) to retain any solid impurities (to be connected downstream of the tap).

Steam transport

Avoid the formation of pockets or siphons (cause of condensation) and strangulation of the hose. The end of the hose must be fixed to the manifolds of the humidifier and steam distributor by means of metal clamps, so that it does not become loose due to the high temperature effect.

Tensions that involve mechanical stress on the outlet stem of the cylinder steam must be avoided.

Water drainage

A section of pipe must be installed for emptying (resistant to temperatures up to 100°C) with a minimum internal diameter of 40 mm. A funnel must be used to ensure interruption of the continuity in the drain pipe. A siphon must be connected to prevent the return of odours. In the versions with temperature draining, the drain water temperature will be 60°C, guaranteeing a temperature at the inlet of 25°C.

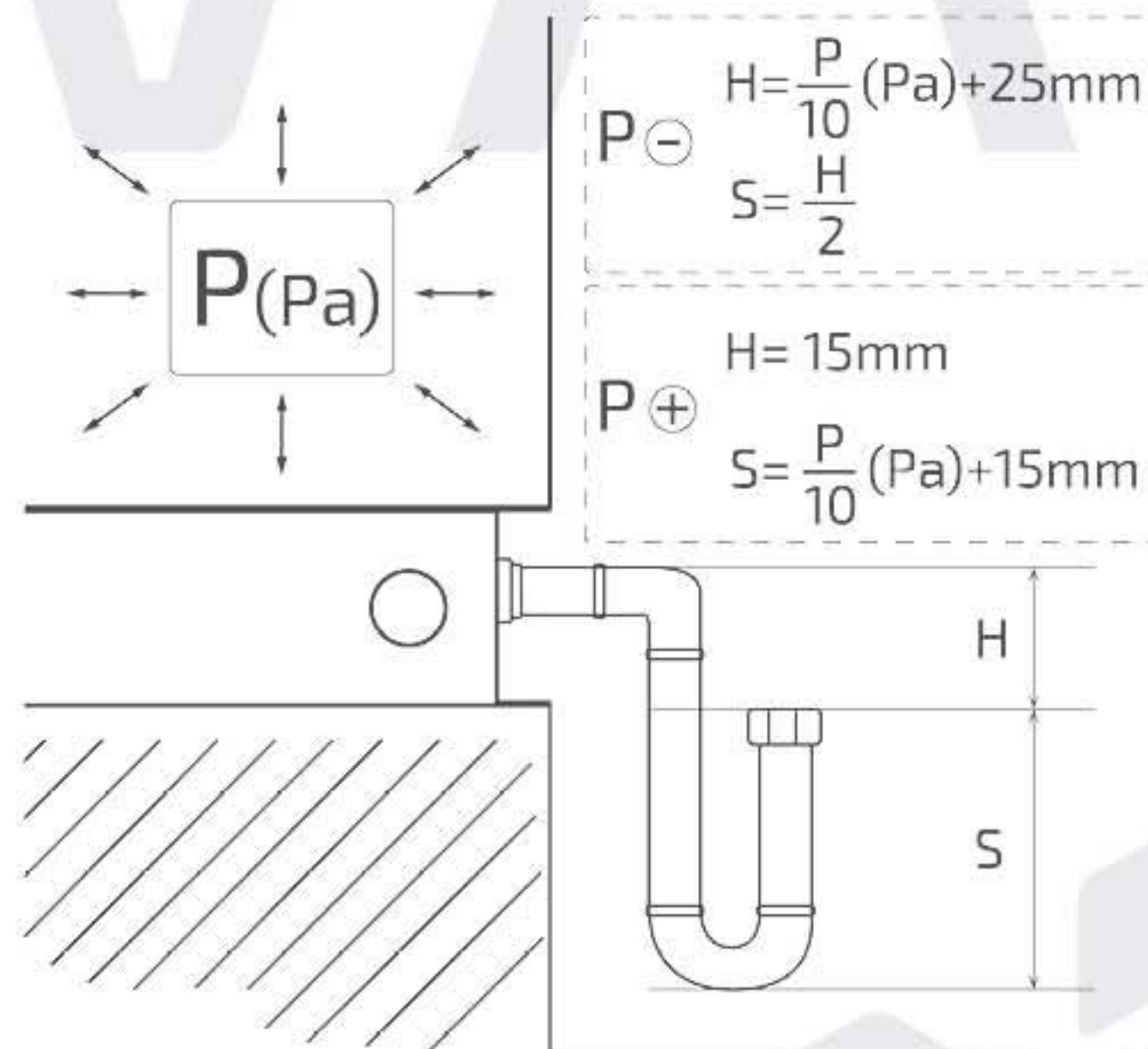
NOTE: For more detail and support on this equipment with self-production system, please refer to the specific manual of the component.

6.7. Water connections in condensate trays

Sections where condensation may will incorporate a partial or full condensate tray.

The water outlets/drains of the Air Handling Unit (energy recovery systems, humidifiers, coils) must incorporate a siphon to eliminate waste water properly (unless a condensate pump is installed, which in most cases avoids the need of a siphon). The siphon height should be sized according to the under or overpressure of the ventilation unit, so that the suction or discharge of the drain water is not caused.

In practice, the dimension S will be between 12,5 cm (under pressure) and 20 cm (overpressure), being the dimension H two times the dimension S (under pressure) or bigger than 1,25 cm (overpressure).



*Drain siphon dimensions

Related to the incorrect design of this element, several problems can be found, mainly related to the return of odours that can affect the air-conditioned room. In case there are multiple drains, it is recommended to install a siphon for each of them.

If several trays are connected to a siphon, a situation occurs in which, if the fans operate at different pressures (different equipment configuration, different filter clogging, different components...), one of the pipes draws air from the other, resulting in a situation similar to the absence of siphon (in one of the trays).

Before the start-up of the installation, the siphon must be filled, it should be separated approximately 100 mm from the condensate tray, and it must be checked that the drain pipe has the proper inclination (at least 2,5%, and 5% is recommended).

The siphon will never be responsible for drainage problems. To avoid drainage problems, it is necessary to avoid that the pressure drop of the drainage pipe (in mca) is higher than the height (in meters) from the drain of the unit to the final discharge.

7. ELECTRICAL CONNECTIONS

These operating instructions contain important information on the operation of the machine. To work safely, all safety and operating instructions must be observed and followed.

The electrical connections must be performed by qualified personnel and the installation should allow the compliance with the Machinery Directive (2006/42 EC), Electromagnetic Compatibility (2014/30/EU) and Low Voltage (2014/35/EU).

Connections must be made with regulatory wires, ensuring their protection according to local regulations and proper gauge.

It is recommended to install the appropriate electrical protections so as not to cause damage to people or to the installation itself.

When the unit is supplied with a power and control panel by EVAIR, the power protection will be responsibility of the installer, who must install the protections that are deemed necessary in the head of line.

When the unit is supplied without power and control panel by EVAIR (as been requested), it will be the responsibility of the installer of the machine the placement in the box of the necessary protection for compliance with the Machinery Directive (2006/42 EC), Electromagnetic Compatibility (2014/30/EU) and Low Voltage (2014/35/EU). In both cases, the protections to be installed by the installer will be the specific ones indicated in the current regulation in the destination location of the unit.

In addition to what is indicated above, whether the machine is supplied with control and power panel, or if it is supplied without it, if it is necessary to install a differential switch in the header of the supply line, this must be of type B, B+ or superimmunized, which is not supplied by EVAIR as standard (it is only available upon request). The ground connection will be properly installed in accordance with the installation instructions provided by the supplier of each component or as indicated in the diagram provided by EVAIR (this will be included as long as the equipment incorporates some type of wiring or additional electrical preparation to the standard components). The components have their own scheme and can be consulted in their technical documentation and installation manual also incorporated in the equipment.

7.1. Unit wiring

If the unit is supplied with a control and power panel, those peripherals and components existing in the module in which the panel is installed will be supplied wired. Wiring the rest of the modules and peripherals will be responsibility of the installer of the unit. The installer must conform, to make this wiring, to the electrical and control scheme that includes the equipment. Modification of the existing wiring or incorrect wiring will cause the equipment to lose its warranty, as this can cause loss of life of some components and breakage in an extreme case. The probes included in the unit are tested and registered in the factory prior to shipment in accordance with the EVAIR quality control process.

It is recommended that control wires be separated from the power supply wires, in order to avoid problems of electromagnetic interaction.

The necessary inspections must be carried out according to this manual and according to the regulations of low voltage installations of the unit's location. This same will be the one that marks the conditions of supply and the necessary precautions in case of intervening on the system.



7.2. Motor connections

7.2.1. Connection of asynchronous motors

Joints must be perfectly placed, fixed by their corresponding protections. If the equipment is supplied without a power panel, it must be considered that the fans with built-in EC motor have their own protections (described in its data sheet), but if it is a fan with an AC motor, it will be necessary to protect the component according to the local regulations of the location of the machine. If wires go through one of the fixed panels of the unit, they must be covered with waterproof tubes provided by the installer.

7.2.2. Star of asynchronous motors

- **Direct start:** Direct connection from the motor to the network. It is a connection that can lead to high start currents. Motors with great power (usually 4 kW or more) will use a star-delta start or progressive start devices.

VOLTAGE OF 400V	WINDING	TERMINAL BOX
CONNECTION Y 230/400 V		
CONNECTION Δ 400/609 V		

- **Start-delta start:** This connection will be used in motors above 4 kW in order to optimize voltage at start decreasing the current consumed. Through this connection, the current can be reduced approximately a 30% of its value with a conventional connection.

VOLTAGE OF 400V	WINDING	TERMINAL BOX
CONNECTION Y 400/609 V		

- **Start by frequency inverter:** A progressive start is allowed because it is controlled by the frequency variation.
- **Start by "soft" starter:** A progressive start is allowed.

All the additional requirements indicated by the manufacturer of the motor/inverter (type of wires, minimum distances, protection classes ...) must be met.

Once the connection is completed, the operation of the protection elements will be checked.

7.2.3. Synchronous motors electronically commutated (EC) connection

EC fans have a brushless synchronous motor with permanent magnets and electronic commutation. These motors have a higher efficiency than the rest due to their operating mechanism and electronics.

To facilitate the accessibility, safety and ease of connection of the fans in the EVAIR AHUs, auxiliary junction boxes (called "EC boxes") are installed as a standard policy. These fans are wired in such a way that their electrical connections, if necessary, are accessible in an external box, thus facilitating the connection work.

The functions found in these boxes are as follows:

FUNCIÓN	DESCRIPCIÓN	TIPO
Alimentación	Alimentación eléctrica del ventilador	Según Modelo
Consigna	Señal para control de velocidad	0-10V
Alarma	Contacto de fallo	Contacto Seco
Habilitación	Contacto de habilitación electrónica (marcha/paro)	Entrada Digital

NOTE: For more detail and support on this equipment, please refer to the specific manual of the component.

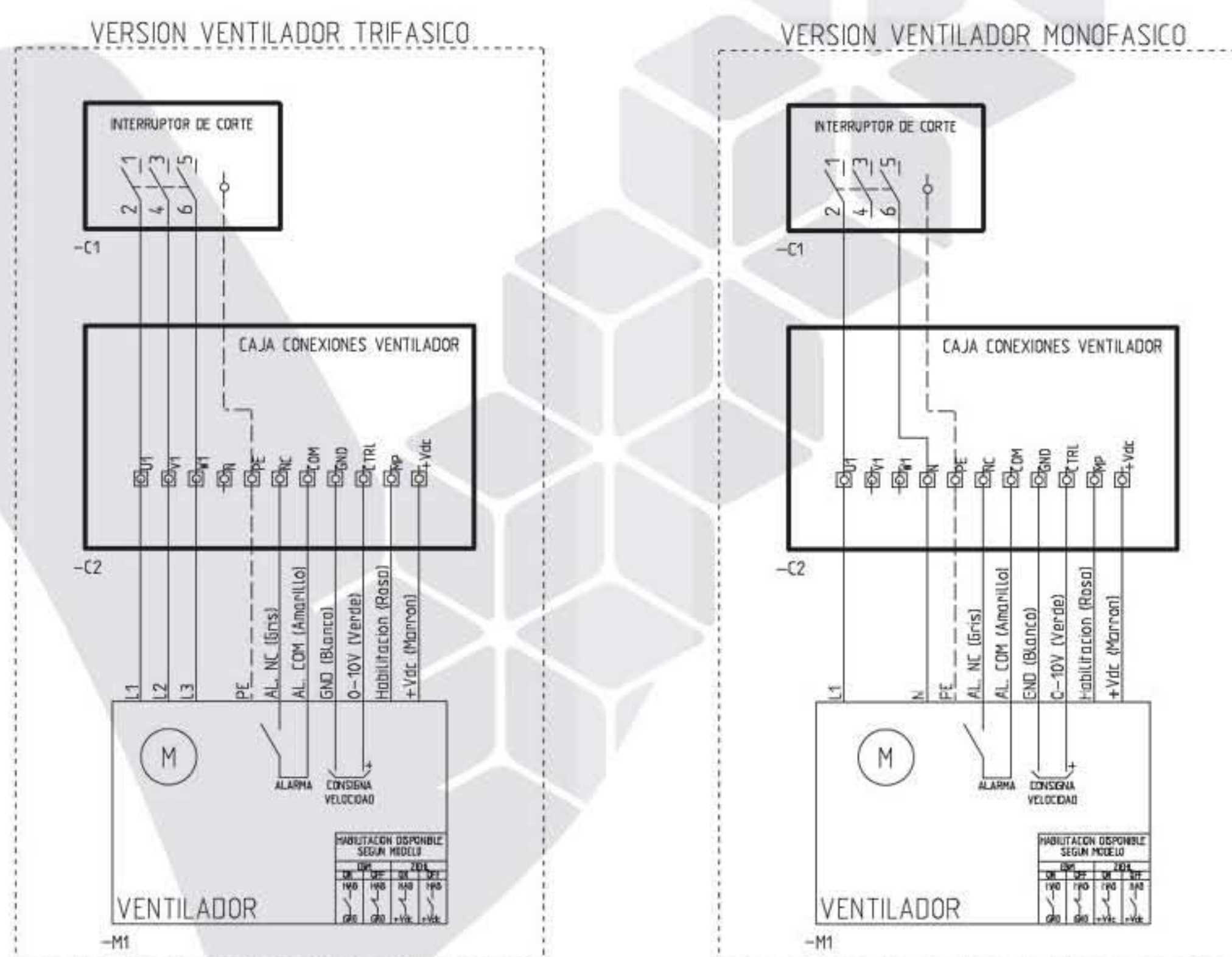
The fan connections are made differently for units with and without integrated control. The criteria followed for both cases are given below.

AHU'S WITHOUT INTEGRATED CONTROL

All fans are fitted with a cut-off switch to isolate the power supply to the fan. In addition to the power supply, the fan control signals are routed to an external box. The format and number of connections of this box depend on the number of fans in each fan section, according to the indications shown below:

1 Fan

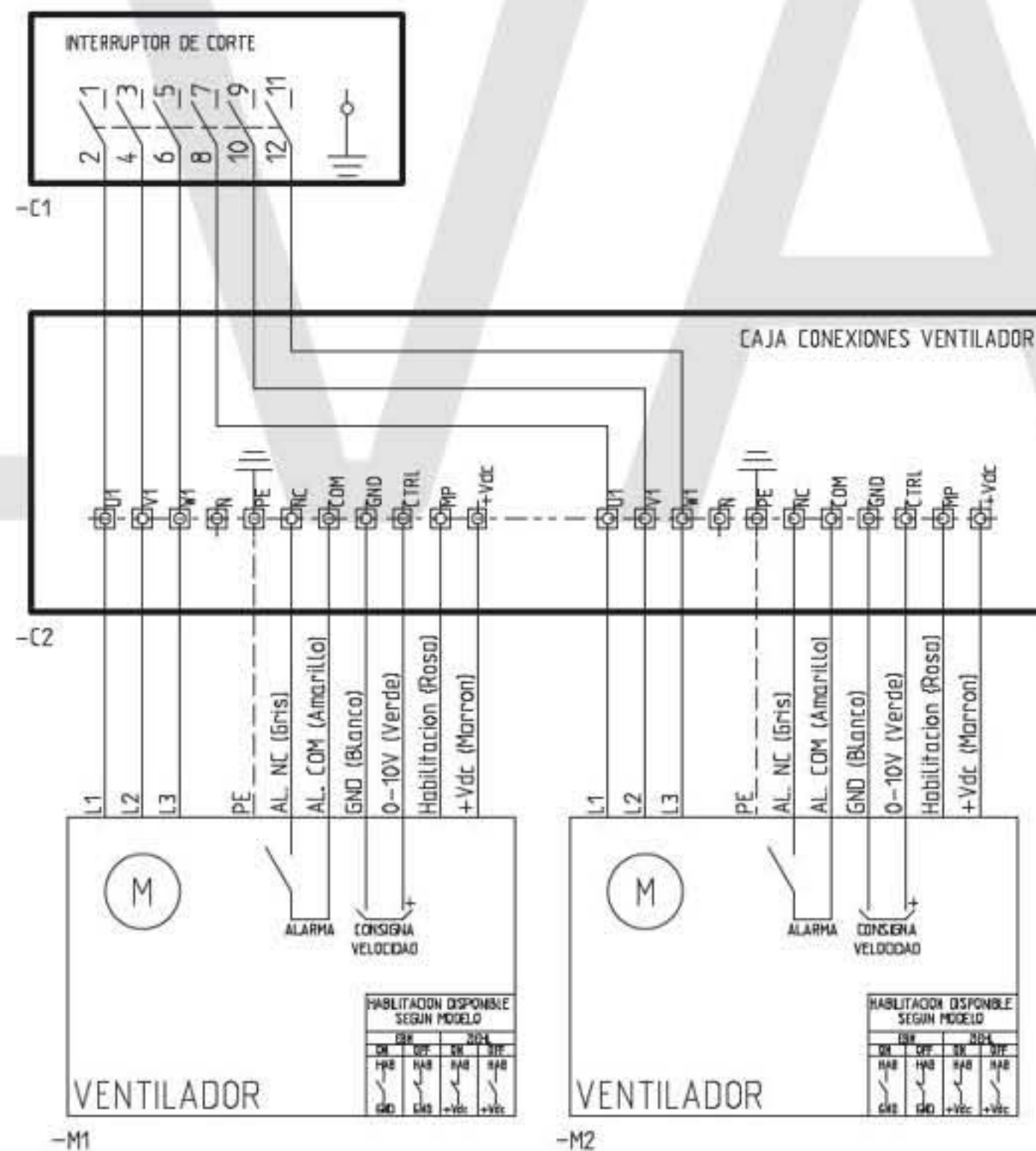
A 3-pole cut-off switch and an EC Box are provided, to which the following 11 fan connections are taken. The power supply to the fan must be provided by the cut-off switch and the control must be carried out by means of signals from the EC box.



*Left: Wiring diagram for 1 fan; Right: Peripherals (Cut-Off Switch and EC Box)

2 Fans

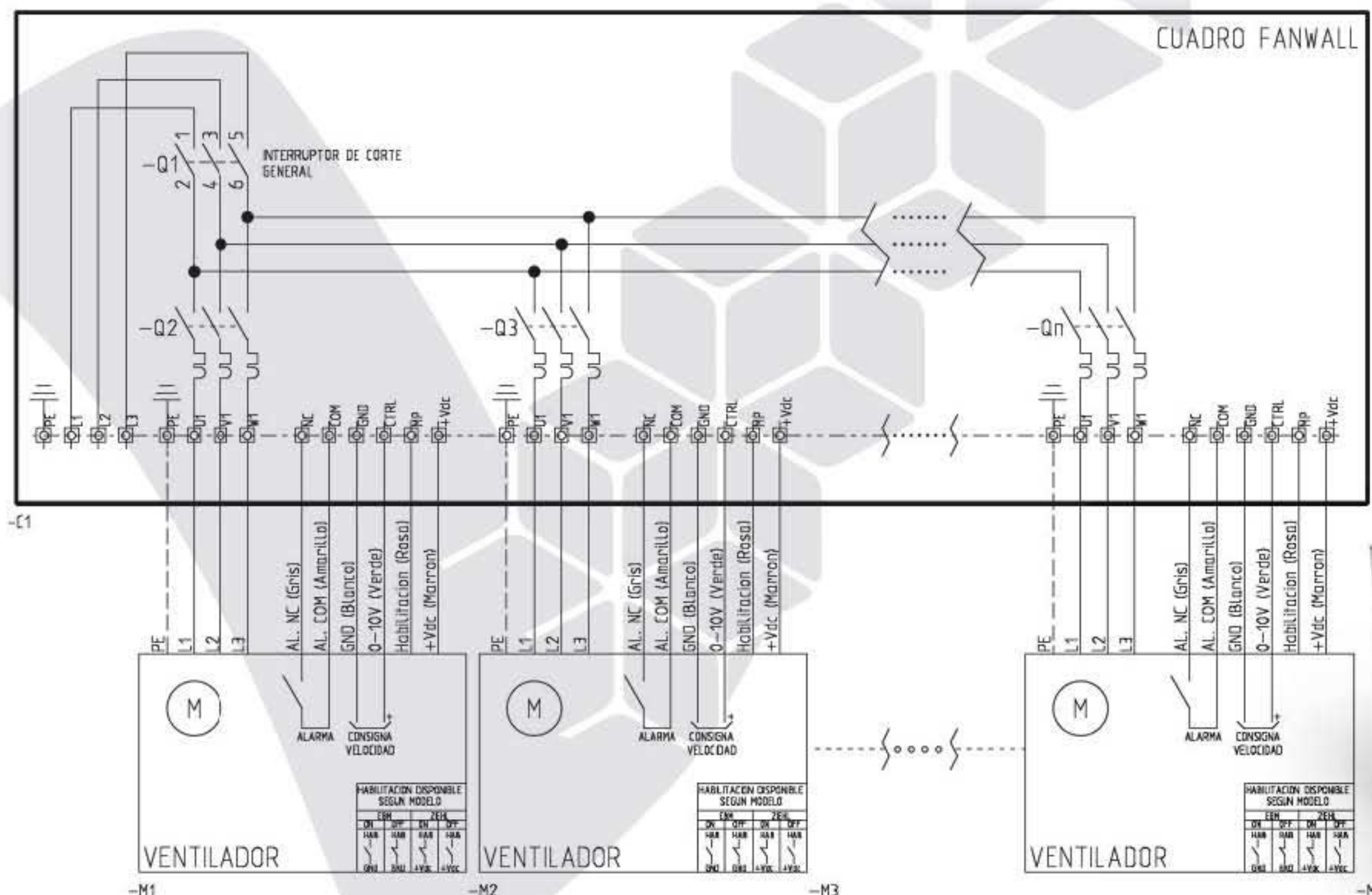
There is a 6-pole circuit breaker and an EC box, where the following 22 electrical connections of the 2 fans are connected. The power supply to the fans is to be provided via the cut-off switch and the control is to be carried out via the signals from the EC box.



*Left: Wiring diagram for 2 fans; Right: Peripherals (Cut-Off Switch and EC Box)

3-6 Fans

Each ventilation section includes a fanwall box, which integrates independent protections for each one of the fans, a general cut-off switch and the 11 terminals for each fan necessary for their electrical power supply and control.



*Left: Wiring diagram for 3 fans; Right: Peripherals (Cut-Off Switch and EC Box)

AHU_AIR HANDLING UNIT

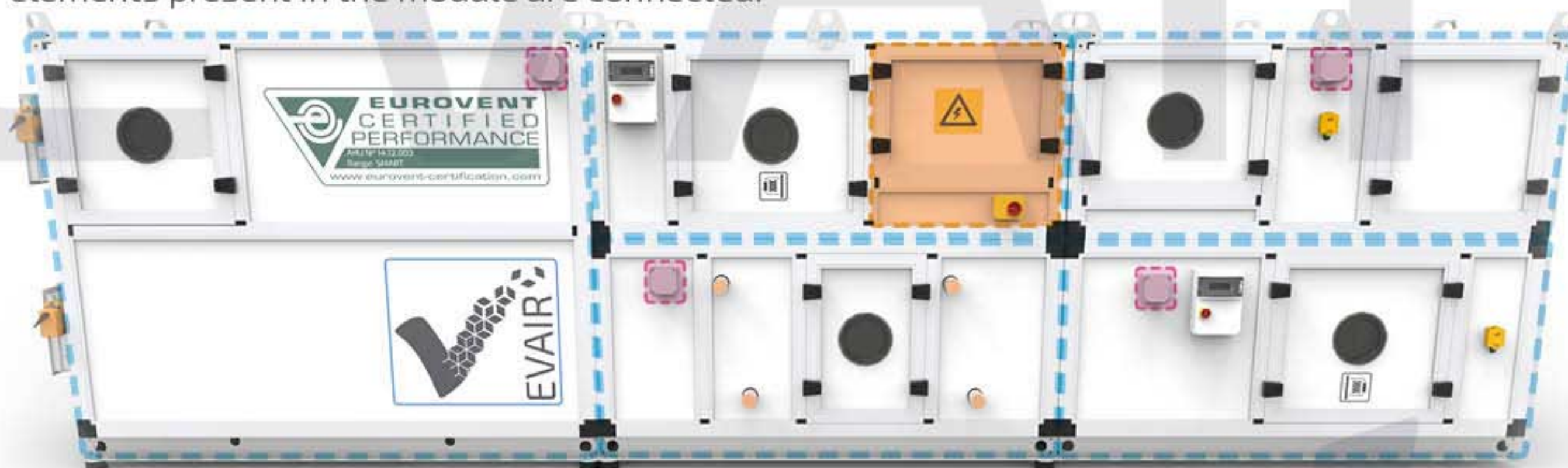
7 or More Fans

A customised electrical cabinet will be provided according to requirements. See specific documentation.

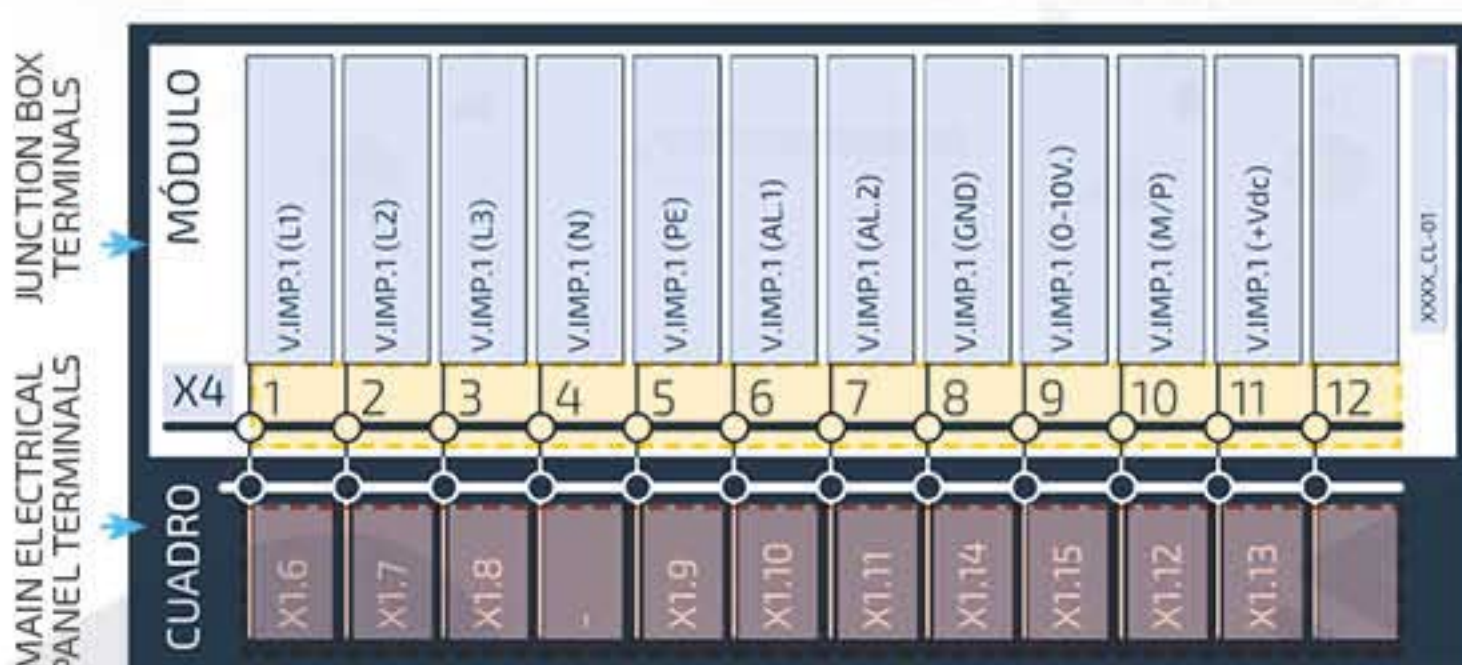
AHU'S WITH INTEGRATED CONTROL

When the AHU is supplied with integrated control and the fans are in the same module as the electrical panel, the power supply and control signals for the fans will be connected to the main panel, so that the installer does not have to perform this task.

If the unit is supplied disassembled in modules and it has integrated control, in the secondary modules (those where the electrical control panel is not located), junction boxes are installed to which the elements present in the module are connected.



*Example of modular equipment with electrical installation



The installer must electrically connect these junction boxes to the main electrical panel following the electrical diagram. In the inside of these junction boxes, on the back of the cover, there are labels indicating the terminals of the electrical panel to which each of the elements present in the junction box must be connected. These labels must serve as a help to the wiring of the modules. It is the installer's responsibility to ensure that these connections are carried out in accordance with local regulations and respecting the electrical diagram of the equipment.

Example of connection:

- Terminal **x4.1 of the junction box** must be connected to terminal **x1.6 of the control panel**.
- Terminal **x4.2 of the junction box** must be connected to terminal **x1.7 of the control panel**.

1 Fan

By default, the fan is wired directly to the main control panel, except in the case that the unit is supplied divided into modules, in which case a junction box with 11 terminals shall be provided for the power supply and operation of the fan together with the necessary terminals for the rest of the components that incorporate control (damper actuators, probes, etc.) of said module.

2 Fans

The fans are electrically connected to an EC box which includes 10 terminals necessary for the power supply and control of the fans. If the unit is supplied divided into modules and needs to be connected to the main panel, in addition to the above, a junction box with 11 terminals will be provided for controlling the fans in parallel, together with the terminals required for the rest of the components (damper actuators, probes, etc.) of the module. The only connection to be made by the installer will be between the junction box and the electrical panel.



3-6 Fans

Each ventilation group includes a fanwall box, which integrates independent magneto-thermal protections for each one of the fans, a general cut-off switch and the 11 terminals for each fan necessary for the power supply and control of the fan. If the unit is supplied divided into modules, in addition to the above, a junction box with 11 terminals will be provided for the power supply and operation of the set of fans together with the necessary terminals for the rest of the components (damper actuators, probes, etc.) of said module. The only connection to be made by the installer will be between said junction box and the electrical panel.

Example of connection:

- **Connection of a module with a fanwall with 3 fans and a pressure sensor:**

The three fans of the module are connected directly to a fanwall box, where they will have their corresponding magneto-thermal protections and a general cut-off power switch. In the fanwall box, the power supply and control signals of the three fans are unified and these connections are taken to an auxiliary box together with the rest of the components (pressure probe). The installer will only have to make the connections between this auxiliary box and the main electrical panel.

7 or More Fans

A customised electrical cabinet will be designed according to requirements. See specific documentation.

7.2.4. Motors with frequency inverter connection

Asynchronous motors with inverter allow to vary the frequency of operation of the motor, being able to regulate the rpm, either manually or remotely through external signals.

Electrical connection diagrams of the motor with frequency inverter will be attached by EVAIR. To configure the frequency inverter, EVAIR includes in the documentation its own start-up manual. The motor supply through the inverter must be done with shielded wire. The connection rules appear in the frequency inverter manual.

NOTE: For more detail and support on this equipment, please refer to the specific manual of the component.

7.3. Rotary heat exchanger connection

The motors of the rotary heat exchangers are pre-wired (not the power supply) only if they incorporate a speed controller. If a terminal box is requested for the rotary heat exchanger, these connections are located outside the Air Handling Unit in a protected box with a connection diagram. As a standard procedure, the same considerations should be followed as in standard equipment. Depending on the supplier, access to the heat exchanger can be found in the previous section (usually filter section) through an opening with wing knobs.

7.4. Electric coils connection

Electric coils can be supplied wired by EVAIR (wiring diagrams will be attached), or unwired. The wiring of the heater will be the responsibility of the customer or installer if it is not carried out by EVAIR. Coils will be powered, unless otherwise requested, at 400 V in three-phase. The section of the power cable must be sized according to the local regulations of the machine's final location.

For the normal operation of the coil protections according to the local regulations must be included, and additionally:

- Automatic reset high limit safety thermostat (to 75°C)
- Manual reset high limit safety thermostat (to 90°C)
- Air Flow detector

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The safety thermostats must be connected in series with the activation signal of the contactors of the coil stages, deactivating them in case of opening. The flow detector or pressure switch must be placed in the fan section that causes air flow in the coil and, if it is not possible to interlock it, consider its signal in the control logic to avoid that the coils are active without air flow.

In case the coil is supplied wired, the details of the protections can be found in the wiring diagram attached to the unit. Verify carefully that the nominal values of the coil correspond to the selected power source and the control equipment. It will be the responsibility of the installer to install the electrical protection of this component and the adequacy of the logic (either from an EVAIR control or from an external control) to the performance of each of the stages of the electric coil.

The heater must be connected with a wire designed for permanent use.

As for the logic, if it is not programmed by EVAIR, it must be considered that it should not be possible to turn off the associated fan unless the coil power supply has been turned off in advance or simultaneously (proper interlocking).

Among the protections to be installed, it is recommended that the coil has at least two overheat protectors (one of which can be manually restarted), in order to avoid high temperatures with low air flows and avoid overheating in case of overheating a fault somewhere in the system.

7.5. UVC emitters connection

Once the location of the UVC emitter has been chosen, it must be ensured that it can be supplied with the necessary electrical and assembly requirements, as well as radiometers in the installation, if they are used, and physical access for service and maintenance.

Consult all the current regulations before starting the installation. Read the equipment plates to check the electrical requirements and the supply voltage from an electrical outlet, protected with its proper fuse and ground connection.

Powering with other voltages will void the warranty and will permanently damage the unit. The equipment can operate continuously (recommended in all applications) or can be connected to a timed circuit for operation in start / stop cycles.

Use kits to wire the luminaires together using the power supply source, energy block (see label) but wire all the green wires together with wire nuts luminaire per luminaire.

During maintenance, disconnect all electrical power, never expose eyes or skin to UVC light from any power source. Wear gloves, face shields and cover all exposed skin. Do not touch the UVC lamps without gloves.

Install UVC lamps before connecting the power. Failure to do so will trigger the lamp operation circuit and the lamp will not turn on. If this happens, disconnect the power for 10 minutes, reinstall and reconnect the power. The lamp will light.

NOTE: For more detail and support on this equipment, please refer to the specific manual of the component.



7.6. Electrostatic filters connection

If the Air Handling Unit is supplied as a plug & play unit with control and power panel, considerations on the electrical connection of this component must be followed in the scheme provided by EVAIR with the equipment, which includes power and alarm signal (as indicated in previous sections, if the filter is in the same module as the electrical panel, the wiring will be done in factory). Otherwise, it must be followed the connection instructions that appear in the manual of the component, included in the equipment, as well as install the corresponding electrical protections in accordance with current regulations.

To access the equipment, once the power has been switched off, 60 seconds have to be waited to avoid problems with residual voltages.

The power supply must be carried out according to its technical data sheet or diagram (usually 230V 50/60Hz), using the power supply wire. It is possible to obtain an alarm signal by means of the corresponding optional kit. The position of the power supply, the connection of the safety switch, the start and stop signals, the alarm signal and the power supply wire are indicated in the component manual.

For a proper electrical operation, the following considerations must be carried out:

- Cleaning the wiring (wiping the wires with a cloth dampened with alcohol and, if there is rust, removing it with an abrasive tool or a soft pad).
- The ionization wires are subject to wear, because of the high voltage. To avoid unexpected breaks, it is recommended to replace all wires once a year, following the steps below:
 - › In case of breakage of the ionization wire, remove any piece of wire that is in the filter, as well as the springs that keep the wire in tension.
 - › Place the upper part of the wire spring.
 - › Catch the wire with pliers with curved sides.
 - › Attach the spring head with the button hole opened to the electrostatic filter voltage bar disks.
 - › Holding the ionization wire taught with one hand, connect it to the other disks of the voltage bar using the same curved side pliers.

NOTE: In addition to taking the previous considerations, it is necessary to consult the specific manual of the component and follow the instructions indicated in it for its star-up, operation and maintenance.

7.7. Evaporative humidifiers with recirculated water connections

Electricity connection of the recirculation pump

Connect the power supply line to the terminal box of the water irrigation pump using the appropriate type of connection.

The machine must be provided with adequate logic to prevent the pump from working in a vacuum (signal with nibstat or other equivalent device).

NOTE: In addition to taking the previous considerations, it is necessary to consult the specific manual of the component and follow the instructions indicated in it for its star-up, operation and maintenance.

7.8. Electrode steam humidifiers water connections

The electronic components of the humidifier control are very sensitive to electrostatic discharges. In order to protect these components during any type of installation, precautions must be taken to guard against damage from electrostatic discharge (ESD protection).

NOTE: In addition to taking the previous considerations, it is necessary to consult the specific manual of the component and follow the instructions indicated in it for its star-up, operation and maintenance.

7.9. Resistance steam humidifiers water connections

The electronic components of the humidifier control are very sensitive to electrostatic discharges. In order to protect these components during any type of installation, precautions must be taken to guard against damage from electrostatic discharge (ESD protection).

NOTE: In addition to taking the previous considerations, it is necessary to consult the specific manual of the component and follow the instructions indicated in it for its start-up, operation and maintenance.

7.10. Motor protections

Motor protections will be carried out in accordance with the local regulations of the final location of the unit.

7.11. Lightning protection in outdoor installations

Local regulations determine the operation and installation of lightning rods.



8. CONTROL SYSTEMS

All instructions referring to the electrical connection and operating instructions of the units supplied with control by EVAIR can be found in the control manual supplied with the unit.

9. PRE-COMMISSIONING CONSIDERATIONS

STEPS	CONSIDERATIONS BEFORE COMMISSIONING OF THE AIR HANDLING UNIT
RECEPTION, TRANSPORT AND UNLOADING	
1	Read this installation, commissioning and maintenance manual completely.
2	Follow the instructions for unloading, moving and assembly.
3	Check that there is not any damage on the equipment.
4	Verify that all parts (especially rotating) are fixed.
5	Ensure that the bearing lubrication is correct.
6	Verify that there is no undue material inside the Air Handling Unit and that there is no blockage in the air inlet/outlet.
7	Verify the presence of the peripherals to be installed (according to the list of components)
8	Verify that the tubing not come loose due to transport of the unit.
CONNECTION AND VALVES	
9	Water circuits must be hermetically connected.
10	Drains should be installed with their siphon in the water outlets of the unit. Faucets or valves, if any, must not be blocked.
11	The valves of the coils must be properly connected and sealed, according to the following sequence: shut-off valves, balancing valves, regulations and filling/emptying sectors.
12	Shut-off valves for all fluid flow circulation systems must be open.
13	It must be verified that the airflow and temperature conditions of the chillers and/or heat pumps correspond to the design conditions.
14	It must be verified, in case there is a humidifier, that its water supply is correct and the conditions of hygiene and water quality necessary in the supply according to this manual are met.
UNIT STATUS	
15	If the client decides to incorporate an element in an empty section (usually a humidification), it must do so in a way that does not damage the unit (e.g. splashes)
16	It has to be checked the correct opening of the dampers and the correct position of all components of the Air Handling Unit.
17	Verify the correct condition of panels and the closing of access to the unit for maintenance. Adjust the correct sealing/tightening of doors (hinges, locks, etc.) if necessary.
ELECTRIC CONNECTION	
18	It has to be verified that ground connections have been carried out in all elements where they are needed, and the installation is correct.
19	Check that the voltage connections conditions are within the limits specified on standards
20	Verify that the electrical protections of the unit have been carried out in accordance with local regulations
CONTROL	
21	Verify that control systems (both elements as microprocessor) operate property, with correctly wired peripherals, correct ranges, complete configuration and with no alarms.



COMMISSIONING	
22	It has to be verified that the external conditions correspond to the operating range of the Air Handling Unit
23	Verify that, in case centrifugal fans with motor and transmission have been installed, the number of belts matches with the number of channels in the pulleys.
24	Verify that, in case centrifugal fans with motor and transmission have been installed, the tension of the belts is correct.
25	Coils operation begins with their loading and purging, which must be done by a qualified personal and following the manufacturer's instructions (refrigerant shown as technical indication and in case of coil water with antifreeze, amount thereof indicated by the manufacturer). *Gas loading requires additional personnel and permits.
SECURITY	
26	It must be verified that the emergency shutdown systems and fire security systems are operative.

10. COMMISSIONING PROCESS

COMMISSIONING PROCESS OF THE AIR HANDLING UNIT	
VERIFICATIONS	
1	It must be verified that there are no turning/moving blocks of components (fans, dampers).
2	Check that the filters are in place, since during the start-up they must protect the unit from the dirt in the pipes due to the work.
UNIT START-UP	
3	In case belt driven centrifugal fans have been installed, check that at the start the pulleys do not slip, and if they do, check the transmission. It is not uncommon for them to slip if the power is greater than 10 kW.
4	Start the fan slowly, and check the direction of the rotation is correct. If the direction is wrong, change the polarization of the phases of motor supply.
5	Check that temperatures are not higher than those indicated as maximum in each component (if not indicated, take 40°C as maximum). To perform this check, the heat coil (if exists) have to be working under normal operation, and the fan at minimum speed.
6	Check that no control alarms have appeared in this phase of the process. If they have occurred, read their source in the driver/BMS and solve the problem. If there doubts about this, request an appointment with the Technical Department of EVAIR.
OPERATIONAL ADJUSTMENT OF THE UNIT	
7	Verify that the airflow is correct. If it is not, verify that the regulation of the controller is correct (if it does not exist, check the relationship pressure drop-airflow, since the state of the filters will alter the design point of the equipment). If the regulation is correct and the airflow is lower than due, verify that the measurement through the tubing is correct (according to this manual). If the tubing is correct, check the pressure drop of the filters according to the technical data sheet of the equipment. If there are doubts about this, request an appointment with the Technical Department of EVAIR.
8	Verify that the thermodynamic conditions at the air outlet are correct. If not, check that the situation is consistent by comparing the design conditions with the start-up conditions. If there are doubts about this, request an appointment with the Technical Department of EVAIR.
9	Check that the fan does not produce vibrations or strange sounds.
10	Check that the drainage of the condensate trays occurs correctly. If it is not, verify that the siphon has been filled with water and the drain height is greater than its pressure drop.
11	Check that the air velocity is correct, and there is no droplet in the coiling section, or in any section with condensation.
12	During commissioning it is convenient to measure the resonance frequency of the fan and remove it from the frequency converter to avoid vibrations on the equipment.
13	In case belt driven centrifugal fans are installed, belt should be adjusted and aligned. After two hours of operation, the fan has to be stopped, and properly adjust and realign pulleys and bearings.



11. AIR HANDLING UNIT COMPONENTS

11.1. Casing

Units structure is made of aluminium profiles and joined by nylon corners. To complete this structure, the unit is covered with panels of different materials according to the specification of each project. Those panels can be screwed directly to the profiles or assembled to the structure with a special profile that acts as a stop between the structural profile and the panel.

The correct alignment of the access doors must be checked, and if they are removed for maintenance reasons, the tightening torque and alignment must correspond to the state prior to the operation performed.

- Types of profiles:
 - › Standard profiles (30 mm, 37 mm, 50 mm or 55 mm). It can be ordered with different coverings (painted, anodized, normal)
 - › Thermal break profile (37 mm, 55 mm, 60mm)
- Type of panels:
 - › Fixed panels
 - › Door with hinge and lever
 - › Removable panels
- Fill of the panels:
 - › Mineral wool (different densities)
 - › Polyurethane

An inspection window of different types can be placed on the panels depending on the project specification.

The materials of the structure can consist of alloys of different types of materials, with different coatings, and special finishes for anticorrosion applications available in the EVAIR catalogue: RC3, RC4 and RC5. These finishes require special maintenance that must be consulted with the Technical Department of EVAIR.

Commissioning and operation considerations

The operation of the air handling unit with no regulation or under an incorrect regulation can cause the static pressure in the housing to exceed its mechanical limit, thus losing the unit warranty. The pressure inside the unit, in absolute value, will never exceed 1900 Pa in operation unless EVAIR indicates otherwise in its technical project study.

Correct alignment of the access doors to the unit must be checked, and if they are removed for maintenance reasons, the tightening torque and alignment must correspond to the state prior to the operation performed.

Necessary attentions

An optimum tightness adjustment of panels and doors is made at factory. In the start-up and reception of the equipment, it is necessary to verify the perfect placement of panels and sealing of closures and doors to rule out possible imbalances caused by transportation, loading and/or unloading of the unit.



Safety considerations

Precautions indicated in this manual must be considered.

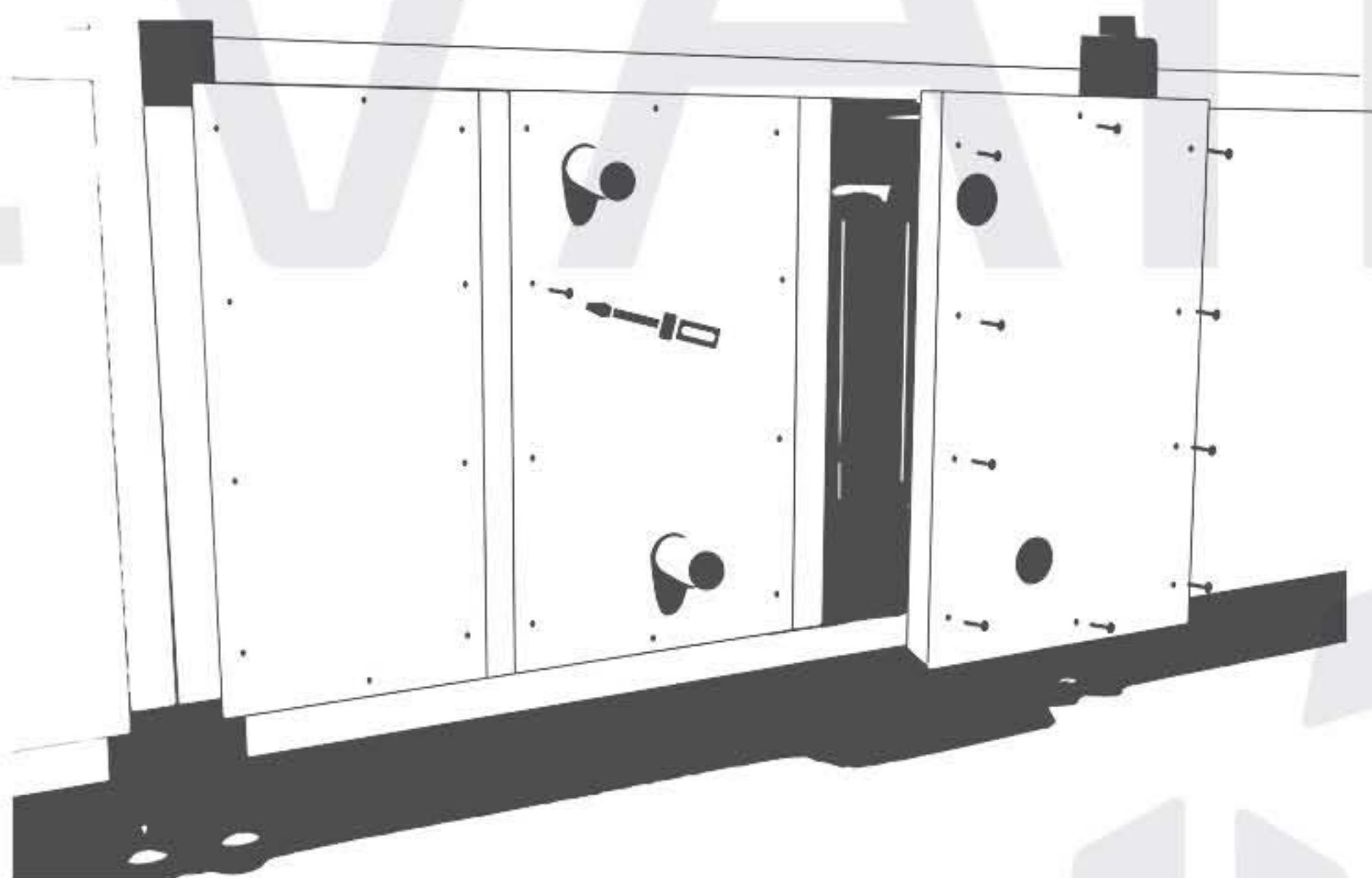
AHU_AIR HANDLING UNIT

Maintenance considerations

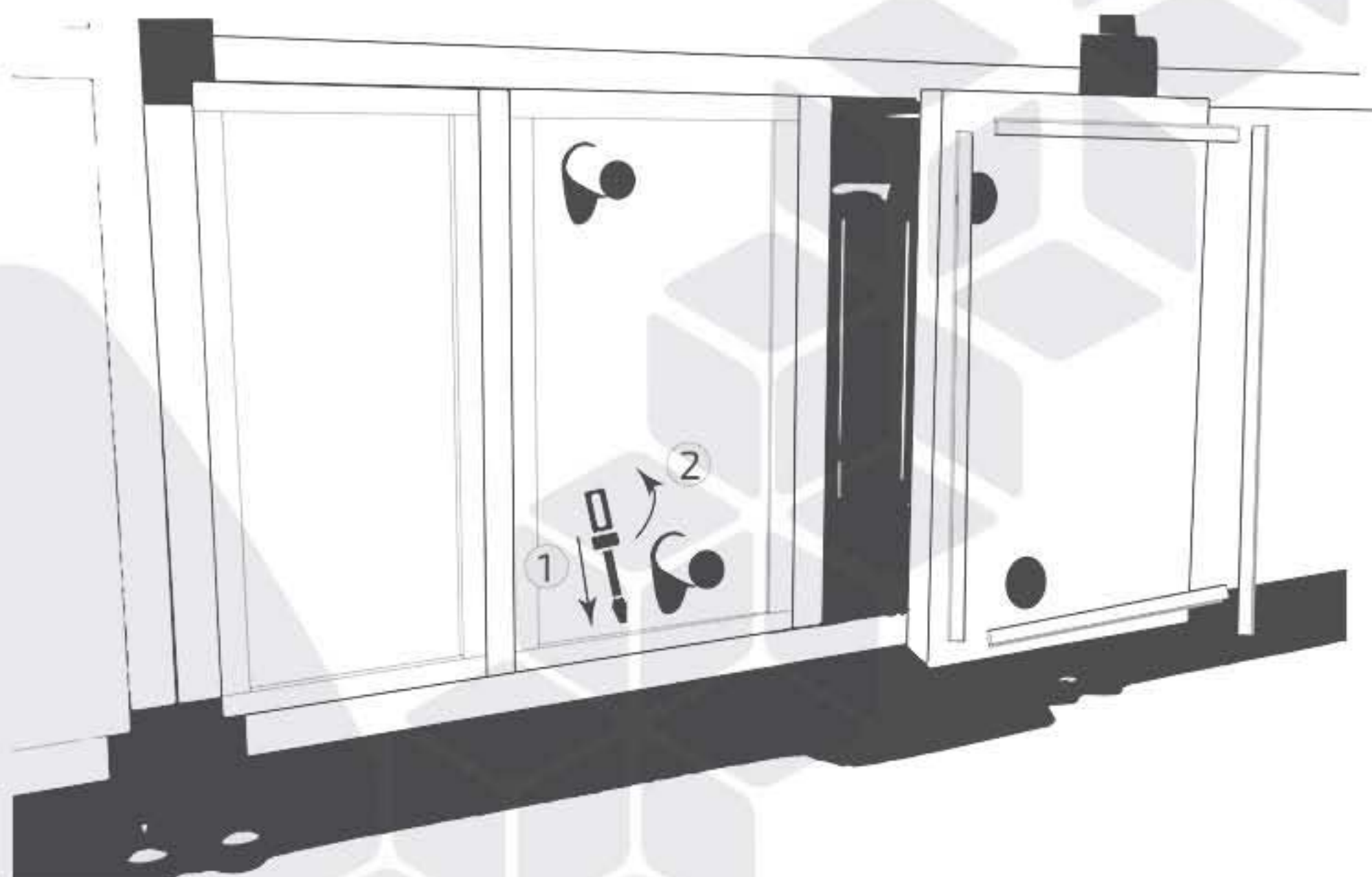
The structure must be checked periodically to clean and paint those metal surfaces that could give corrosion symptoms. In case the units are located outdoors, the condition of the roof, the asphalt cloth or any other element of protection against infiltration should be checked.

To disassemble the panels of the Air Handling Unit for maintenance situations that require it, the following instructions must be followed carefully.

Enclosure with screw fixing panels



Enclosure with panels for fastening by perimeter profiles



NOTE: Prior to the disassembly of the panels in enclosure without screws, the operation must be planned, and the appropriate tools must be available to carry out the operation. Any damage related to the structure due to incorrect disassembly can cause leaks, lack of structural safety and loss of equipment warranty.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.



11.2. Dampers

To regulate/determine the path of the airflow it is necessary to install dampers in the air inlet, air outlet and recirculation sections (there may be others such as bypass, backstop, etc.).

- **Standard dampers:** Dampers can be made of extruded aluminium, galvanized steel or stainless steel with nylon gears, aerodynamic profile and sealing gasket.
- **Backdraft dampers:** Allow the airflow in only one direction. They open when the flow hits the slats and close when there is no airflow, because of gravity. They must never withstand a pressure greater than 1.000 Pa for lengths less than 1 meter. The maximum pressure decreases as the size increases, for more information consult with the Technical Department of EVAIR.
- **Sand trap dampers:** Special dampers, designed to be the primary filters for air intakes in areas where airborne sand and dust are very significant. They should not work at a velocity higher than 2,2 m/s.
- **Weather hood dampers:** Protect the unit from adverse weather conditions. They can be equipped with an anti-bird grille.

General considerations regarding these components are discussed below.

Commissioning and operation considerations

At the factory, EVAIR technicians perform necessary checks to ensure that the damper opens and closes completely. It must be verified by the user that the transport or installation of the equipment has not impaired the movement of the damper blades, being their responsibility in his case.

During operation, the correct adjustment of the drive must be maintained. Due to wear, vibration can occur in the blades, which will be corrected with proper maintenance.

Necessary attentions

It must be considered that the dampers can have a significant effect on the regulation of the pressure drop within the equipment to obtain a certain airflow. Check that the tightening of the screws is adequate. When the drive is motorized, it must be checked that the start and end of the stroke correspond to the 0° and 90° positions.

The correct tighten of the screws must be checked. It must be verified that there is not any leakage when air flows in the opposite direction. It must be checked that movement of the damper has not been damaged during transport, being his responsibility in that case.

It is vital to ensure that the control logic is correct, because if the polarization or action is opposite to the necessary one, it can produce overpressure in a damper above its limit, bending the slats and causing leaks and hisses in normal operation.



Safety precautions

Special care must be taken when operating with the damper, because depending on the activate system, can exist risk of personal damages. Electrical and electronic activating system must have their corresponding grounding.

Precautions indicated in this manual must be considered.

Maintenance considerations

The drive and the correct status of the dampers, as well as that of the protection equipment such as grilles must be checked taking into account the possible damages due to knocks or corrosion. The adjustment of the slats and the lubrication of the moving elements must be verified. In case of being electrically operated, the stroke of the slats must be verified, as well as the electrical protection systems.



Safety precautions

Caution must be taken when operation with the damper, since depending on the type of drive there may be risk of personal injury.

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.3. Fans

EVAIR uses different types of fans according to the application and the needs of each installation:

- Double suction Centrifugal fans
- Plug-fans
- EC plug-fan

The Motor-fan groups, for centrifugal fans, are fixed on supports made of aluminium or galvanized steel equipped with shock absorbers. The transmission is performed with V-belts and pulleys removable with conical hubs (taper). These fans can be supplied optionally in non-sparking construction, epoxy paint finish, RC5 protection, etc. It must be verified during start-up that the frequency of rotation of the components of the motor-fan group is not equal to the natural frequency of the support system (resonance and risk of breakage).

The electric motors are fixed on a tensioning base coupled to the fan baseframe whose dimensions depend on the housing. Usually, the tensioning of the belts can be adjusted by means of an endless screw. Unions of fans with diaphragms are protected with anti-vibration joints / flexible canvas.

The interior of the ventilation section can be manufactured in perforated sheet to reduce the radiated sound power. There are models of ATEX fans available designed for explosive atmospheres.

Commissioning and operation considerations

Motors, fans and moving parts are installed in such a way that they cannot cause an accident (except negligence), protected from the access of people in accordance with the Machine Safety Directive (2006/42/CE). Before and during the start-up, it must be verified that the safety measures are in perfect condition and perform their function (stop stroke, covers, special closures or the elements of the particular unit). The position of the elements according to their departure from factory is the appropriate one, if modified, the manufacturer is not responsible for the operation of the equipment or its possible consequences.

Faced with a strange operation situation, the motor-fan group must be stopped. The nominal conditions of the fan are indicated on the rating plate, as well as the maximum conditions (revolutions-rotation frequency), which must not be exceeded at any time.

Necessary attentions

During transport, elements that prevent damage (blocking) are included in certain components of the equipment (this is the case of the fan), which must be removed before the equipment begins to work (after removing them, the turbine must be rotated with the hand and disconnected to check that it turns freely).

The position of the anti-vibration mounts (silentblocks) between the fan base and the motor base is calculated by EVAIR in such a way that resonance does not occur. In case the quantity or position of the supports is modified, EVAIR is not responsible for the possible damages in terms of integrity and functionality referred to in the equipment.

If a high-powered non-EC motor is installed, the start must be carried out by means of a progressive start component (see section on electrical connections).



Safety precautions

Care must be taken when handling the equipment, since auditive problems and physical injuries may occur due to the speed of the fan impeller.

Precautions indicated in this manual must be considered.

Maintenance considerations

The maintenance tasks related to the fan must include the following habitual actions:

- Clean the blades to avoid vibrations and imbalances.
- Check that there is no oxidation or corrosion in the fan, and if it exists, it must be repaired, and the damaged areas painted.
- Check the perfect condition of the flexible canvas (absence of cracks) and the anti-vibration mounts (absence of signs of fatigue or breakage).
- Replace the bearings before 40.000 hours of operation, or those specified by the component manufacturer.
- Lubricate the bearings before 1.500 hours of operation, or those specified by the component manufacturer.
- Check the balance of the fan turbine.
- Check the correct condition of the protection elements (both physical and electrical).

The maintenance tasks related to the motor must include the following habitual actions:

- Clean the motors to keep them free of dust and oil.
- Replace the bearings before 40.000 hours of operation or those specified by the component manufacturer.
- Lubricate the bearings according to the motor nameplate (in case the motors do not have grease nipples, it is understood that they do not require any maintenance, the service life is unique for the complete component).
- Check that the current and voltage are correct and do the same with the symmetry of the phases of the motor after each maintenance.
- Check the correct connection of the motor terminals after each maintenance.
- Check the wiring of the motor after each maintenance.
- Check the correct condition of the protection elements (physical and electrical) after each maintenance.
- Check the correct tightening of the fixing screws to the bedplate.
- Check the correct alignment of axis and pulley.
- Check that the motor case does not present any rust or corrosion, and if it does, repair it and paint the damaged areas.

The maintenance tasks related to the transmission must include the following habitual actions:

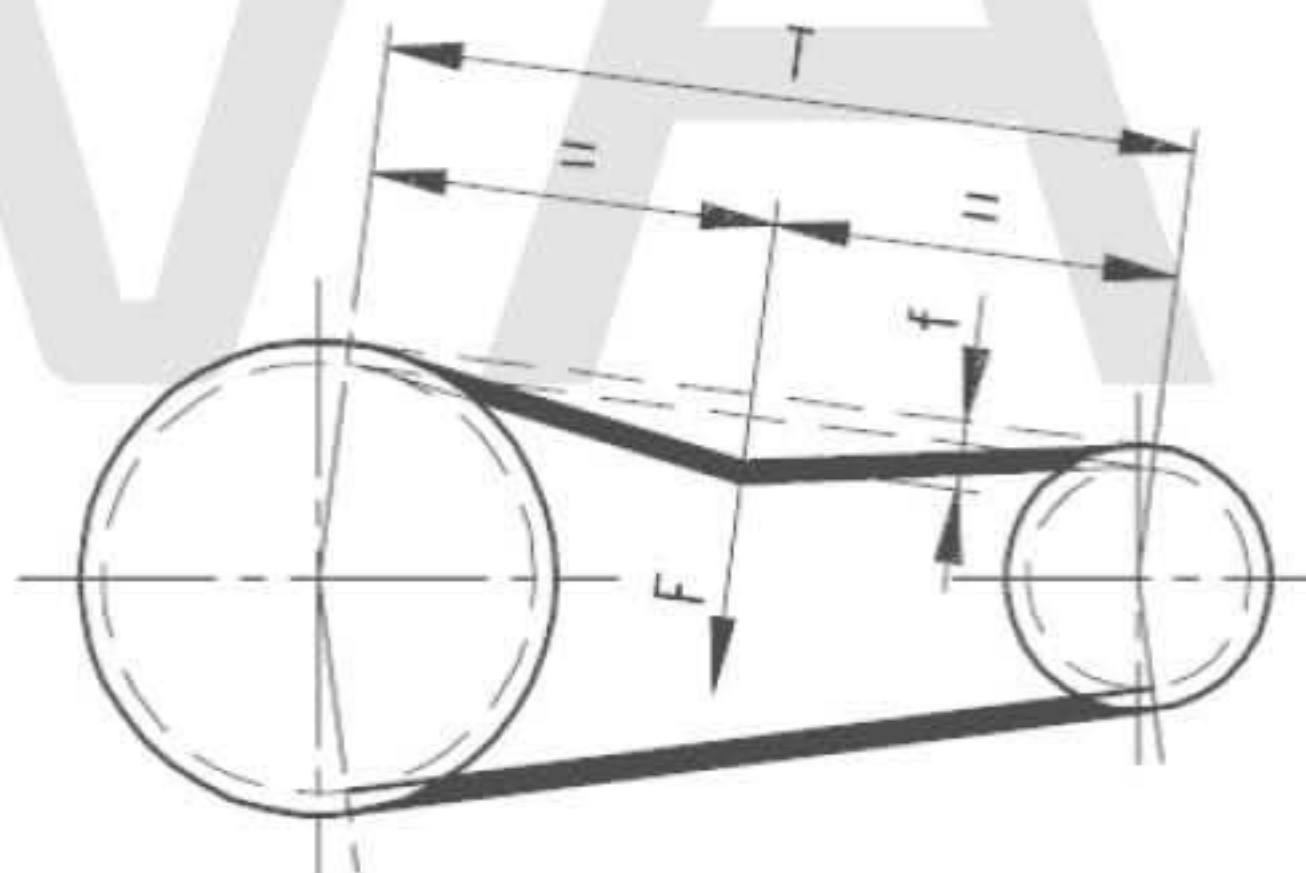
- Clean the transmission and every coupling on it.
- Check there is no excessive belt or pulley wear.
- Replace the transmission belts when they show minimal wear or cracking.
- If it is necessary to change any belt of a transmission with double belt, both belts must be replaced and their alignment revised.
- Check that the stress and the alignment of the belts are correct
- Check the correct condition of the protection elements (cover pulley if exists)

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- Check that the belt does not reach undesired temperatures while is working
- Change the oil of the transmission.

The correct stress of the pulleys will be adjusted following the sequence showed in the following figure:

- Measure "T" branch.
- Use a dynamometer in the middle of branch T to apply a force "F" perpendicular to the belt, which generate a displacement "f" of 1,50 mm for every 100 mm of "T" branch.



*Diagram of forces in transmission by pulleys

Once the force is measured, it must be checked that it is, according to the type of belt, between the maximum and minimum levels of the following table, as well as that the speed of rotation corresponds to the operating range of the pulley.

	OUTER DIAMETER OF THE SMALL PULLEY	RPM OF THE SMALL PULLEY	F MINIMUM [N]	F MAXIMUM [N]
Z	40 ÷ 55	2500 ÷ 5000	5	6,5
	60 ÷ 75	1500 ÷ 3800	7,5	10
	80 ÷ 95	1000 ÷ 2800	8,5	10,5
	100 ÷ 110	900 ÷ 1500	9	13
A	50 ÷ 65	1900 ÷ 3800	7,5	10
	70 ÷ 90	1300 ÷ 2800	11	16
	95 ÷ 120	1000 ÷ 1700	13,5	20
	125 ÷ 190	600 ÷ 1000	17	24
B	95 ÷ 110	1000 ÷ 2500	18	25
	115 ÷ 140	800 ÷ 2000	21	31
	150 ÷ 200	600 ÷ 1500	25	36
	210 ÷ 250	400 ÷ 1200	27	40
C	140 ÷ 230	600 ÷ 1500	37	53
	240 ÷ 430	400 ÷ 1000	49	70
D	230 ÷ 400	400 ÷ 1000	74	107
	420 ÷ 580	250 ÷ 700	104	152
E	360 ÷ 520	300 ÷ 1000	120	170
	540 ÷ 950	200 ÷ 500	160	230



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.4. Mechanical and chemical filtration

The equipment operation unfiltered (unless it has been designed for it) is not allowed under any circumstances, as this could lead to the fouling of critical elements in the equipment and therefore could result in deterioration and a loss of efficiency or break.

UNE-EN 779 and EN 1822 (until 2018) specify four ranges of filters according to their effectiveness:

- Coarse filter (G1 to G4)
- Medium filters (M5 and M6)
- Fine filters (F7 to F9)
- EPA filters (E10 to E12)
- HEPA filters (H13 to H14)
- ULPA filters (U15 to U17)

ISO 16890 establishes the classification of filters according to their retention efficiency for particles of 1 µm, 2,5 µm, and 10 µm.

GROUP DENOMINATION	EFFICIENCY			CLASS RETENTION VALUE
	URBAN SIZE DISTRIBUTION		RURAL SIZE DISTRIBUTION	
	ePM1, MIN	ePM2,5, MIN	ePM10	
ISO Coarse	-	-	< 50%	Initial gravimetric retention
ISO ePM10	-	-	≥ 50 %	ePM10
ISO ePM2,5	-	≥ 50 %	-	ePM2,5
ISO ePM1	≥ 50 %	-	-	ePM1

Consideraciones de puesta en marcha y operación

Both air speed and dirt accumulation in the filters influence its pressure drop. It is important to verify that the airflow is correct so that the pressure drop in filters is correct.

All Air Handling Units that work with ventilation air and have filters in their configuration, must have a visual signal of change filter warning. If this accessory has not been included in the technical offer, it will be the responsibility of the installer of the machine to include it before the start-up.

Necessary attentions

It is recommended the installation, not only of a visual warning signal, but also of a probe that allows to monitor the pressure drop of the filter in real time.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

The final pressure drops recommended by EVAIR are shown on the table below:

FILTRATION TYPE	FINAL PRESSURE DROP
G3	150
G4	150
F5	200
F6	200
F7	200
F8	300
F9	300
H10	420
H11	420
H12	420
H13	600
H14	600

FILTRATION TYPE	FINAL PRESSURE DROP
ISO Coarse	The smallest value of the following: • $DP_{initial} + 50Pa$ • $DP_{initial} \times 3$
ISO ePM ₁	The smallest value of the following: • $DP_{initial} + 100Pa$ • $DP_{initial} \times 3$
ISO ePM _{2.5}	
ISO ePM ₁₀	

**End pressure drops recommended.*

About these pressure drops, those from filters G3 to F9 correspond to the UNE-EN 13053 indication. The remaining pressure drop are according to the manufacturer's indications.

In the event that the filter is classified according to ISO 16890, the final pressure drop will be that of its equivalent classification according to the previous table (in case this does not exist, it will be the one recommended by the manufacturer).

It is vital importance to respect this final pressure in order to keep an optimum equipment performance and efficient energy operation. The unit must have filter change alarms. It is mandatory to replace the filters according to the active standards. The unit can suffer serious structural damage due to breakage of filters or breakage of internal support. Non-compliance leads to the loss of the warranty.

In addition to checking the pressure drop, the filtration stage requires a series of maintenance operation:

- Check any damage or corrosion that may have been generated in the filters during operation. In case of problems, the filters have to be replaced.
- Check tightness of the filters (frame with reduced bypass).
- Check that the extraction rail does not show signs of oxidation or any other damage.
- Check that the fixing cell of the filter does not show signs of oxidation or any other damage.
- Check that there are no odours which could contaminate the air. In case of problems, the filters have to be replaced.

As for the adsorption filters, the end of its useful life is marked by the saturation of its main component, which is commonly activated carbon. In case of doubt when replacing filters, please contact EVAIR technical service.



Safety precautions

Additional protection must be available for possible physical damages (mainly respiratory) due to contact with the dirt accumulated in the filters.

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.



11.5. Electrostatic filters

To keep the filter running with high efficiency, only contaminants for which this component is developed should be filtered.

Pollutants that can be filtered: Dry gases (which cannot produce and cause agglomerations of oily or liquid substances on the filter), fine dust particles (up to 0,3 µm), electrically charged gases, oil vapours (upon express request in the technical offer phase).

Pollutant that cannot be filtered: Water vapours (even in low concentrations), large amounts of dust with high particle size, shavings, iron filings and residues in general, gases.

The following agents have to be totally avoided, since they present a risk of breakage and critical safety:

- Fine metallic powder.
- Gases produced by the combustion of organic materials such as wood, coal, oil, gasoline, diesel, etc.
- Any agent in explosive atmospheres.

Commissioning and operation considerations

Check the cleanliness of the filter, verify the connection of the power connector between filters and general, and that the general connector is correctly fixed to the housing. It must be verified that there is a limit switch that cuts the power supply to the component when the access door is opened.

The driving logic must consider that the filter should only work when there is airflow.

There is a signal in the electrostatic filter that indicates the correct operation of the filter. If there is a fault or the filtration is blocked, this signal changes colour and/or blinks. If the light signal is not lit, the electrical connections must be checked.

Necessary attentions

In addition to taking into account the previous considerations, it is necessary to consult the specific manual of the component to follow the instructions indicated in it for its start-up, operation and maintenance.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

The maintenance of the filter consists in the cleaning of the filter when it begins to reduce its filtration efficiency, a continuous layer of dirt is seen in the filter slats, or it increases its pressure drop beyond 70-100 Pa. The following inspections must be carried out by a qualified technician:

- Check that the filter in general is in good condition (no broken shafts or flakes).
- Check the ionization wires (no breakage or dirt).
- Ceramic insulators have to be checked (no dirt, cracks or breakage).
- High voltage power terminal (no signs of burning).

During maintenance it must be checked that the pre-filter mesh is in perfect condition and does not cause the loss of metallic wires in the electrostatic filter. It must be checked that the frames have not been damaged during maintenance, transport or cleaning operations.

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To carry out a proper maintenance with regard to cleaning, first of all the metal pre-filter that protects the electrostatic filter must be removed. The materials that are required for cleaning are:

- Plastic or stainless-steel tank with a base raised 2-3 cm to help decant dirt.
- Detergent recommended by EVAIR and/or the manufacturer of the component.
- Gloves and goggles.
- Proper clothing.
- Water.

Introduce a steel frame in the tank to keep the filters elevated on the base (to be able to maintain a bottom with sediments decanted). Prepare a wash base with warm water (maximum 45°C) or cold water, according to the detergent used. Add the detergent solution according to the instructions and proceed as follows:

- Immerse the filter in the tank.
- Leave it submerged for the time indicated in the detergent instructions until the dirt has been completely eliminated.
- Remove the filter, let it drain on the tank and rinse it with water taking care not to destroy the ionization wires.
- Let the filter rest against a wooden support or insert it in a dry oven with a maximum temperature of 60°C.
- The filter can be reintroduced into the unit once it is clean and dry.

Some alkaline detergents may leave residues on the filter that are not removed with the described procedure. To avoid a loss of efficiency due to this phenomenon, the filter must be introduced in an acid solution for a few minutes and immediately it has to be rinsed and dried.

Necessary attentions

The fluid resulting from the cleaning must not be disposed of without precaution in the environment, it must be deposited in the appropriate place according to the local regulation of the final location of the equipment, and classified as non-toxic special waste.

In addition to taking into account the previous considerations, it is necessary consult to the specific manual of the component to follow the instructions indicated in it for its start-up, operation and maintenance.



Safety precautions

Additional protection must be available for possible physical damages (mainly respiratory) due to contact with the dirt accumulated in the filters.

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.



11.6. Coils

Commissioning and operation considerations

Before start-up, remove any caps and/or other protectors. Once removed, do not expose the equipment to the weather to avoid water infiltration which may cause oxidation and/or breakage due to frost.

Every heat exchanger is designed and manufactured to operate in a precise position; by means of adhesives the inlet and outlet of the heat transfer fluid is indicated. The design of the coil and the position of the water/refrigerant flows take place in such a way that perfect drainage and ventilation take place, as well as heat transfer is maximized. Make sure that the equipment is installed in accordance with these instructions.

Make sure that the system is clean before putting it into service, that there is a water filter in the hydraulic connection and that the pipe is free of contamination (such as chips, algae, sand, etc.) that may block the exchanger tubes. Always stop the flow of fluid when stopping the equipment.

In order to measure flow and pressure drop in the water coils, it is advisable to install temperature probes (air side and water/refrigerant side) and pressure gauges at the inputs and outputs of the equipment.

The pipe/valve diameter should be of the same size as the heat exchanger connections (in case it is not, the installer must place a transformation). Inlet and outlet connections should not be mounted rigidly; allowance must be made for a suitable means of expansion to avoid damage in service due to inevitable thermal expansions.

Start-up the equipment gradually. Do not put hot fluid into the heat exchanger suddenly when it is empty and cold. Open the coil vents and allow the fluid to circulate inside the coil until it is completely filled. Close the vent valves and gradually bring the heat exchanger up to the working temperature. Gradually pressurise the heat exchanger, taking care to note the presence of any leaks or other problems. At the first sign of such stop the equipment immediately in case they are detected.

The initial charge of the equipment must be carried out using the refrigerant or suitable heat transfer fluid specified by the manufacturer or supplier of the equipment. The system must be purged (from the top of it) to avoid the development of air pockets that reduce the equipment capacity.

During the operation of the equipment attention must be paid to the thermodynamic conditions of the air inlet or outlet, as well as to the pressure drop, which may increase due to dirtiness or deposition of particles on it (if this happens during start-up, the coil must be cleaned before the operation).

Excess oxygen, sulphates, nitrates and chlorides can lead to corrosion in copper tubes. It is not possible to quantify an exact way the concentration of each substance that gives rise to the beginning of the corrosion phenomenon, since it depends not only on the concentration but on many other factors such as temperature, contact time, pH, velocity, etc. In addition, the presence of bacteria or microorganisms can lead to a microenvironment where oxidation reactions occur. Below there are some recommendations to reduce the potential corrosion in the copper tubes of the coils:

- Avoid sulphate content higher than 70 mg/L.
- Avoid TOC greater than 1,5 mg/L.
- Avoid carbon dioxide higher than 20 mg/L.

To receive more information about pH, chlorides, nitrates, dissolved substances, fluid velocity, etc., contact to the Technical Department of EVAIR.

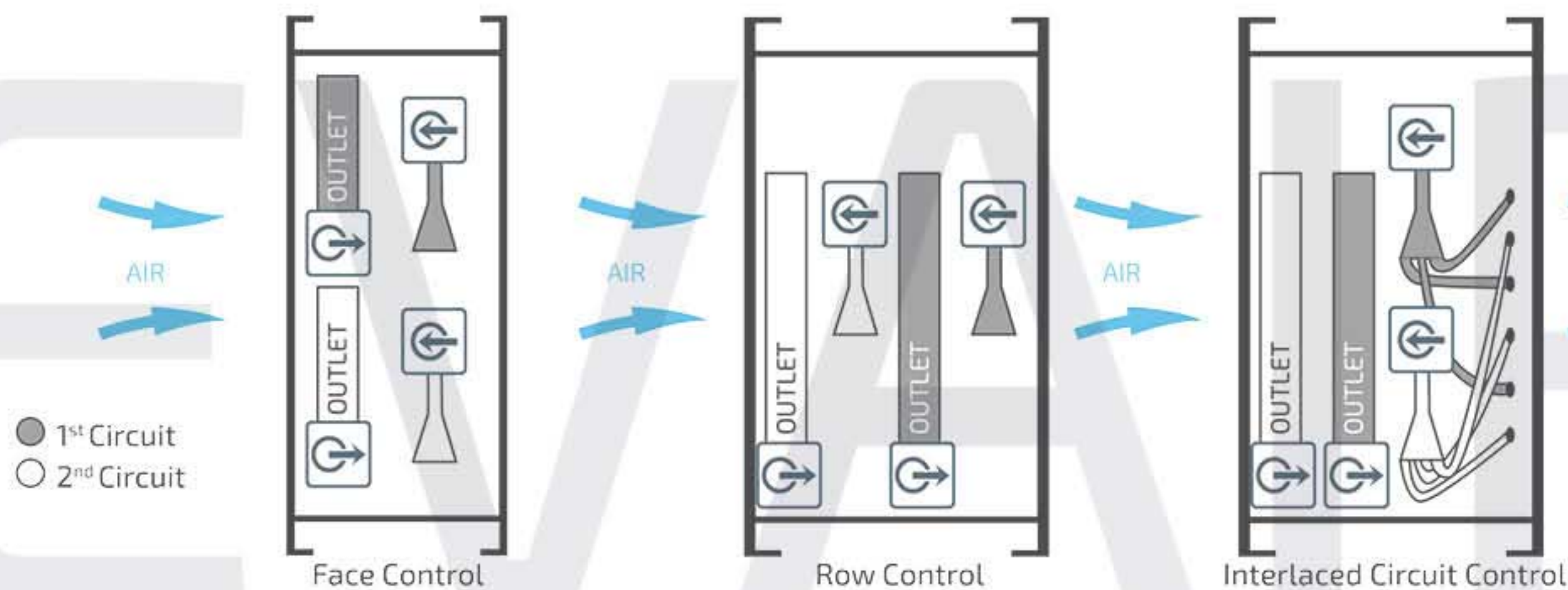
Necessary attentions

The connection of the direct expansion coils must be carried out in accordance with the instructions of the installer of the compression circuit or the VRF circuit that supplies the component. Perform all installation operations wearing suitable PPE, such as safety gloves, etc.

The refrigerant connections in the pipes must be made correctly according to the adhesives that indicate the refrigerant inlet and outlet.

EVAIR does not guarantee the thermal performance of the equipment if the principle of counterflow is not respected.

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**Arrangements for coils with Multiple Thermostatic Expansion Valves*

Direct expansion coils attached to VRF kits require some special features associated with:

- Number of required refrigerant stages/circuits or maximum capacity of kits to be installed.
- Construction (face control, row control, interlaced control).
- Maximum internal volume of each stage/refrigerant circuit or for each of the possible kits to be installed.

In the technical description of the Air Handling Unit these characteristics appear above indicated, being approved with the order of the equipment. In case that the characteristics approved in the technical offer are not valid, it will be the responsibility of the client to request a new technical offer to the technical department of EVAIR.

Some heat exchangers are normally supplied pressurised. Before starting installation reduce the pressure to atmospheric. During installation operations, high pressure or high temperature jets emissions may occur. Use suitable protection to avoid and to protect yourself from these risks.

Allow sufficient maintenance space to allow access to the heat exchanger for possible maintenance or removal operations. Provide the system with valves (balance, three-way and bypass, balance and two-way, or two-way pressure independent valve) and a by-pass system to stop the primary fluid circulation for inspection or repairs. The regulating valves must have sufficient authority for the regulation to be correct; if these are not provided by EVAIR, in the technical documentation of the equipment, there is enough data to calculate the K_v (three-ways case). In the case of installing two-way valves, it is important to carry out this from the height of the pump and the pressure drop in the installation, and not from the diameter of the connection manifold. If there is a local regulation of the final location of the equipment where the valve authority is indicated, it must be followed by the installer at the time of selecting them. If the valve is supplied by EVAIR, unless expressly requested by the customer, it will be selected under the local regulations of the unit's factory.

Air may be found in the internal fluid circuit, particularly inside the heat exchanger. By releasing the air, air locks are prevented. Level and balance the heat exchanger, so that it may be easily connected to the pipe work system without bending or stressing the headers.

Do not bend or deform (with heat, hammers or other devices) the manifold connections and the manifolds themselves if they are not aligned with the pipe work system. This automatically invalidates the warranty as often such operations result in the breakage of the welding/brazing joining the tubes to the headers.

Carry out the maintenance of the moving parts of the Air Handling Unit correctly, since, if there are excessive vibrations, these can be transmitted to the heat exchanger through common guides or supports. Do not tighten the flange bolts, connections or heat exchanger housings before aligning the pipes.

Do not use the heat exchanger above or below its operating limits (see the corresponding section of this manual and the technical documentation of the equipment). Do not use other primary fluid than the specified one.



If there are leaks between the flanges that connect the manifolds to the pipe, after putting the heat exchanger into service, tighten the flange bolts until the leak disappears: if the leak persists, it may be necessary to replace the gasket. Consider the temperature of the surface of the pipe and the heat exchanger, especially in case of hot oil and steam coils.

During service, sudden emissions of gas, fluid or solid fragments may take place. Take all necessary precautionary measures to avoid damage to people or equipment resulting from these events. Be sure that all pipework complies with all your national laws and regulations.

In certain situations, freezing may occur. To prevent freezing of the water, antifreeze must be added in the appropriate proportion (if there are doubts about this information, consult the Technical Department of EVAIR), and it is possible to carry out a configuration of the equipment in which there is a preheating to avoid freezing of the air. In case of prolonged periods of stop it is recommended to empty the coil.



Safety precautions

There may be hot parts in the direct expansion coil (condensation temperature of common refrigerants around 50°C). Cold parts of the coil can also cause cold burns on contact with the skin. If leakage occurs, there may be poisoning problems.

In the refrigerant charge, special attention must be paid to avoid physical contact with refrigerants and antifreeze.

Precautions indicated in this manual must be considered.

Maintenance considerations

It is recommended to review the start-up instructions again in each maintenance. It is recommended that the equipment is inspected by qualified personnel. If conditions are particularly severe (e.g. too much dirt in the air or internal fluid) frequent checks are required. Carry out all maintenance operations wearing suitable personal protective equipment.

Heat exchangers can be regarded as pressure vessels since their internal working pressure is often higher than atmospheric. It is absolutely forbidden to perform any operation that can affect the sealing or cause any structural damage which may cause leaks and emissions of the internal fluid which is often at hot temperatures and pressures and can cause damages to people and equipment.

Carry out all maintenance operations with the equipment inactive. Having stopped the equipment it is essential that all the internal fluids are discharged and that no seals are removed until the internal pressure is reduced to 1,5 Bar (absolute) and the component temperatures are not higher than 35°C. During these operations, fluid emissions at high pressures/temperatures can occur. Take necessary precautions for such situations. Always ensure that all equipment connections are sealed before restarting the system.

Be sure that all the components of equipment are clean and in perfect working condition. The coil must be cleaned, removing it if necessary, with the appropriate cleaning products that do not damage the construction materials of the equipment. It must be verified that there is no corrosion damage (if they exist they must be repaired and painted). Care must be taken not to blend the fins. If the coil is cleaned with compressed air, do it in the opposite direction, and clean it with water at low pressure. Vent system periodically to avoid air build up in the circuit.

When the heat exchanger is disassembled for any reason, it is recommended that new unions are used. This avoids future possible leaks as the gasket, in time, becomes more fragile due to dehydration.

The condensate tray must be cleaned, and the purge must be checked to verify that there is no corrosion damage either in the coil or in the tray (if they exist they must be repaired and painted). The screws must have the proper tightening so there are no risks of leakage or vibrations during the service.

Inevitably some dust and dirt of various kinds will reach the fins of the heat exchanger. Their effect on the external transfer surface causes a reduction of the heat exchanger capacity. Hence it is necessary to clean the finned pack regularly.

Cleaning methods (basic):

- Cleaning the external surface using compressed air. If the air pressure is extreme, damage could be caused to the fins due to bending.
- Cleaning with water with or without detergent. It is better to use cold water or room temperature water. The use of water with a temperature higher than 40°C is not recommended for evaporators and condensers containing refrigerant and evaporable fluids.
- Cleaning with steam. Do NOT use steam for condensers and evaporators containing refrigerant / 2-phase fluids.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.7. Round-around coils

Commissioning and operation considerations

Before start-up, remove any caps and/or other protectors. Once removed do not expose the equipment to the weather to avoid water infiltration which may cause oxidation and/or breakage due to frost.

Every heat exchanger is designed and manufactured to operate in a precise position; by means of adhesives the inlet and outlet of the heat transfer fluid is indicated. The design of the coil and the position of the water/refrigerant flows take place in such a way that perfect drainage and ventilation take place, as well as heat transfer is maximized. Make sure that the equipment is installed in accordance with these instructions.

Make sure that the system is clean before putting it into service, that there is a water filter in the hydraulic connection and that the pipe is free of contamination (such as chips, algae, sand, etc.) that may block the exchanger tubes. Always stop the flow of fluid when stopping the equipment.

In order to measure flow and pressure drop in the water coils, it is advisable to install temperature probes (air side and water/refrigerant side) and pressure gauges at the inputs and outputs of the equipment.

The pipe/valve diameter should be of the same size as the heat exchanger connections (in case it is not, the installer must place a transformation). Inlet and outlet connections should not be mounted rigidly; allowance must be made for a suitable means of expansion to avoid damage in service due to inevitable thermal expansions.

Start-up the equipment gradually. Do not put hot fluid into the heat exchanger suddenly when it is empty and cold. Open the coil vents and allow the fluid to circulate inside the coil until it is completely filled. Close the vent valves and gradually bring the heat exchanger up to the working temperature. Gradually pressurise the heat exchanger, taking care to note the presence of any leaks or other problems. At the first sign of such stop the equipment immediately in case they are detected.

The initial charge of the equipment must be carried out using the refrigerant or suitable heat transfer fluid specified by the manufacturer or supplier of the equipment. The system must be purged (from the top of it) to avoid the development of air pockets that reduce the equipment capacity.

During the operation of the equipment attention must be paid to the thermodynamic conditions of the air inlet or outlet, as well as to the pressure drop, which may increase due to dirtiness or deposition of particles on it (if this happens during start-up, the coil must be cleaned before the operation).



Necessary attentions

Some heat exchangers are normally supplied pressurised. Before starting installation reduce the pressure to atmospheric. During installation operations, high pressure or high temperature jets emissions may occur. Use suitable protection to avoid and to protect yourself from these risks.

Allow sufficient maintenance space to allow access to the heat exchanger for possible maintenance or removal operations. Provide the system with valves (balance, three-way and bypass, balance and two-way, or two-way pressure independent valve) and a by-pass system to stop the primary fluid circulation for inspection or repairs. The regulating valves must have sufficient authority for the regulation to be correct; if these are not provided by EVAIR, in the technical documentation of the equipment, there is enough data to calculate the K_v (three-ways case). In the case of installing two-way valves, it is important to carry out this from the height of the pump and the pressure drop in the installation, and not from the diameter of the connection manifold. If there is a local regulation of the final location of the equipment where the valve authority is indicated, it must be followed by the installer at the time of selecting them. If the valve is supplied by EVAIR, unless expressly requested by the customer, it will be selected under the local regulations of the unit's factory.

Air may be found in the internal fluid circuit, particularly inside the heat exchanger. By releasing the air, air locks are prevented. Level and balance the heat exchanger, so that it may be easily connected to the pipe work system without bending or stressing the headers.

Do not bend or deform (with heat, hammers or other devices) the manifold connections and the manifolds themselves if they are not aligned with the pipe work system. This automatically invalidates the warranty as often such operations result in the breakage of the welding/brazing joining the tubes to the headers.

Carry out the maintenance of the moving parts of the Air Handling Unit correctly, since, if there are excessive vibrations, these can be transmitted to the heat exchanger through common guides or supports. Do not tighten the flange bolts, connections or heat exchanger housings before aligning the pipes.

Do not use the heat exchanger above or below its operating limits (see the corresponding section of this manual and the technical documentation of the equipment). Do not use other primary fluid than the specified one.

If there are leaks between the flanges that connect the manifolds to the pipe, after putting the heat exchanger into service, tighten the flange bolts until the leak disappears: if the leak persists, it may be necessary to replace the gasket. Consider the temperature of the surface of the pipe and the heat exchanger, especially in case of hot oil and steam coils.

During service, sudden emissions of gas, fluid or solid fragments may take place. Take all necessary precautionary measures to avoid damage to people or equipment resulting from these events. Be sure that all pipe work complies with all your national laws and regulations.

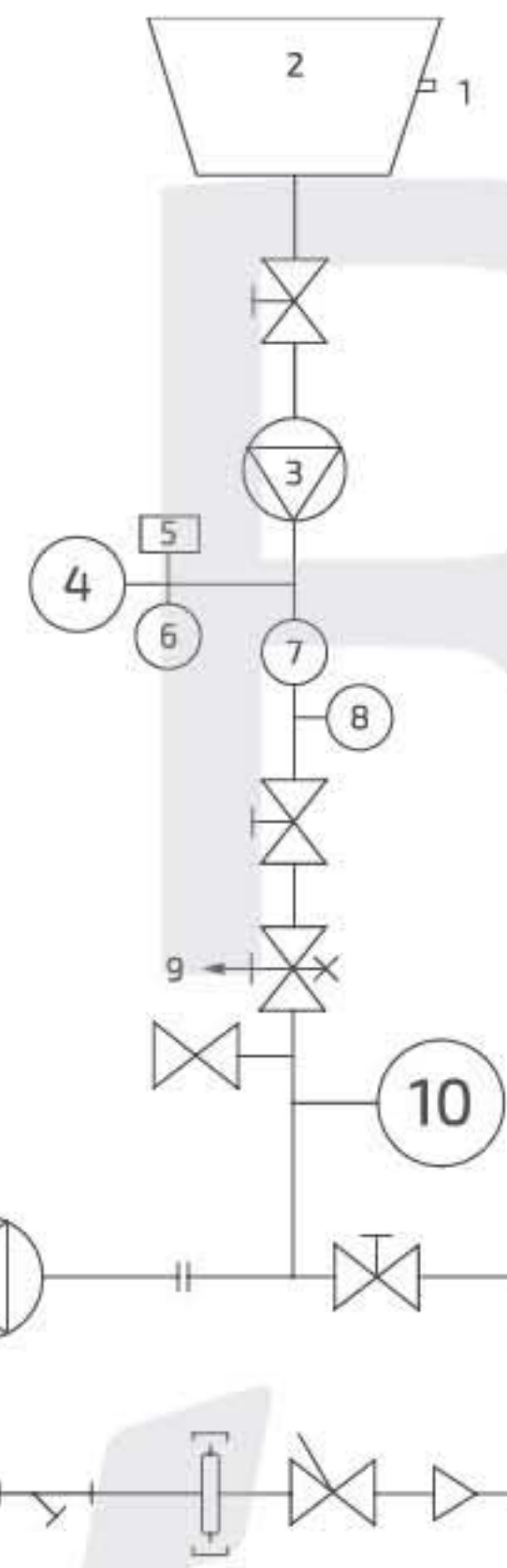
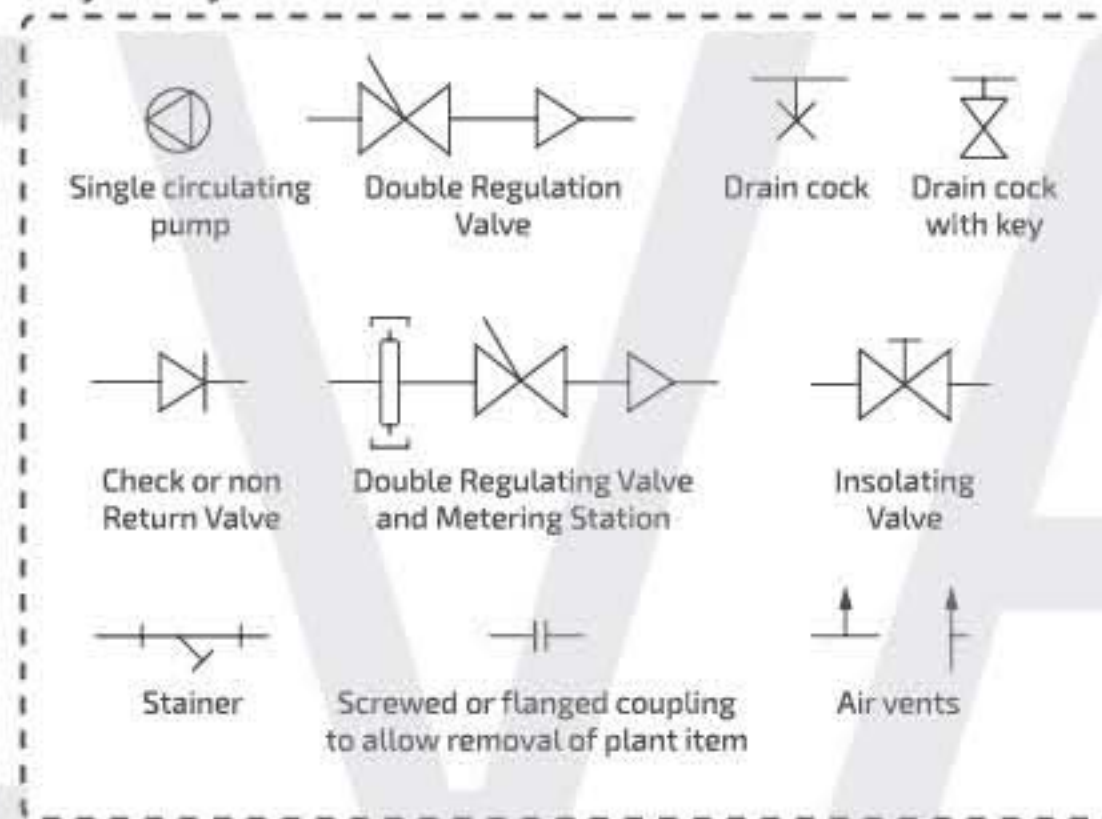
In certain situations, freezing may occur. To prevent freezing of the water, antifreeze must be added in the appropriate proportion (if there are doubts about this information, consult the Technical Department of EVAIR), and it is possible to carry out a configuration of the equipment in which there is a preheating to avoid freezing of the air. In case of prolonged periods of stop it is recommended to empty the coil.

Make sure that all hydraulic connections comply with the local legislation of the equipment final location. It must be verified that all the necessary elements of the hydraulic circuit exist and that the connections are adequate. As a guide, the elements that make up the round-around coils circuit are described below:

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Key to Symbols



*Hydraulic diagram of round-around coils systems.

1. Mains supply - If installed, do not fill manually & fill during maintenance.
2. Break tank with ball valve.
3. Pressurisation pump.
4. Expansion vessel
5. Pressurisation pump.
6. Drain gauge.
7. Pressure regulator.
8. Dial gauge.
9. Safety valve.
10. Pressurized system expansion vessel.
11. Circulation pump.
12. Extract air runaround.
13. Supply air runaround.

Care must be taken not to exceed the maximum pressure of the equipment. In certain situations, freezing may occur. To prevent freezing of the water, antifreeze must be added, and/or, if it is possible, to carry out a configuration of the equipment in which there is a preheating to avoid freezing of the air.

If the water temperature drops below the freezing point of the mixture, despite the precautions taken in the control loop, the coil must be emptied, as well as in long periods of stoppage.



Safety precautions

Hot parts of the coils and the hydraulic pipes can cause burns in contact with the skin. Leaks in direct expansion coils can lead to poisoning problems.

Precautions indicated in this manual must be considered.

Maintenance considerations

Unless EVAIR supplies the hydraulic pack of the Air Handling Unit (own installation, use and maintenance manual), the hydraulic installation must be maintained by qualified personnel in accordance with current legislation in the final location of the machine. The maintenance considerations of the coils are indicated below.

It is recommended to review the start-up instructions again in each maintenance. It is recommended that the equipment is inspected by qualified personnel. If conditions are particularly severe (e.g. too much dirt in the air, or internal fluid) frequent checks are required. Carry out all maintenance operations wearing suitable personal protective equipment.



Heat exchangers can be regarded as pressure vessels since their internal working pressure is often higher than atmospheric. It is absolutely forbidden to perform any operation that can affect the sealing or cause any structural damage which may cause leaks and emissions of the internal fluid which is often at hot temperatures and pressures and can cause damages to people and equipment.

Carry out all maintenance operations with the equipment inactive. Having stopped the equipment it is essential that all the internal fluids are discharged and that no seals are removed until the internal pressure is reduced to 1,5 Bar (absolute) and the component temperatures are not higher than 35°C. During these operations, fluid emissions at high pressures/temperatures can occur. Take necessary precautions for such situations. Always ensure that all equipment connections are sealed before restarting the system.

Be sure that all the components of equipment are clean and in perfect working condition. The coil must be cleaned, removing it if necessary, with the appropriate cleaning products that do not damage the construction materials of the equipment. It must be verified that there is no corrosion damage (if they exist they must be repaired and painted). Care must be taken not to bend the fins. If the coil is cleaned with compressed air, do it in the opposite direction, and clean it with water at low pressure. Vent system periodically to avoid air build up in the circuit.

When the heat exchanger is disassembled for any reason, it is recommended that new unions are used. This avoids future possible leaks as the gasket, in time, becomes more fragile due to dehydration.

The condensate tray must be cleaned, and the purge must be checked to verify that there is no corrosion damage either in the coil or in the tray (if they exist they must be repaired and painted). The screws must have the proper tightening so there are no risks of leakage or vibrations during the service.

Inevitably some dust and dirt of various kinds will reach the fins of the heat exchanger. Their effect on the external transfer surface causes a reduction of the heat exchanger capacity. Hence it is necessary to clean the finned pack regularly.

Cleaning methods (basic):

- Cleaning the external surface using compressed air. If the air pressure is extreme, damage could be caused to the fins due to bending.
- Cleaning with water with or without detergent. It is better to use cold water or room temperature water. The use of water with a temperature higher than 40°C is not recommended for evaporators and condensers containing refrigerant and evaporable fluids.
- Cleaning with steam. Do NOT use steam for condensers and evaporators containing refrigerant / 2-phase fluids.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.8. Electric heater

Commissioning and operation considerations

The temperature of the elements of the electric coils is high. Despite the protections of the equipment to avoid direct contact with these elements, it is necessary to avoid touching them as much as possible. To perform operations on the coil, wait 20 minutes after the unit has been turned off, and verify that the temperature has dropped before touching the elements.

Electric coils ideal situation of operation is where it is an airflow control, since the coil always has enough refrigeration. It is recommended that this flow control includes monitoring in addition to the control element itself.

It must be verified that there is no failure in any of the safety elements and logics (section 7.4) prior to start-up.

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The minimum distance to the nearest component must not be modified, and if it does, it must correspond to the diagonal dimension of the coil, that is, from corner to corner in the part of the heater section.

If the logic of the Air Handling Unit is established by an external agent, it must be considered that the air velocity through the coil must be at least 1,5 m/s and the output operating temperature must not exceed 50°C. If these values are not maintained, the protections against overheating must be activated.

Protections according to the local regulations of the final location of the unit must be included for the normal operation of the coil, and additionally:

- Temperature safety thermostat with automatic reset at 75°C.
- Temperature safety thermostat with manual reset at 90°C.
- Airflow detector

The safety thermostats must be connected in series with the activation signal of the contactors of the coil stages, deactivating them in case of opening. The flow detector or pressure switch must be placed in the fan section that causes air flow in the coil and, if it is not possible to interlock it, consider its signal in the control logic to avoid that the coils are active without air flow.

In case the coil is supplied wired, the details of the protections can be found in the wiring diagram attached to the unit. Verify carefully that the nominal values of the coil correspond to the selected power source and the control equipment. It will be the responsibility of the installer to install the electrical protection of this component and the adequacy of the logic (either from an EVAIR control or from an external control) to the performance of each of the stages of the electric coil.

The coil must be connected with a wire designed for permanent use.

As for the logic, if it is not programmed by EVAIR, it must be considered that it should not be possible to supply power to the coil unless the associated fan has been started (adequate interlocking). It should not be possible to turn off the associated fan unless the coil power supply has been turned off in advance or simultaneously (proper interlocking). Once the battery stages have been disconnected, the fan should run for at least 10 minutes to ensure cooling of the battery.

In addition, it must be taken into account in the logic of activation of the stages that the flow temperature must never exceed 50°C.

Necessary attentions

The electric coils can be supplied wired by EVAIR (wiring drawings will be attached); or unwired, with or without safety devices (thermostats and flow detector), as defined in the technical project. The wiring of the battery will be the responsibility of the client or installer in case it is not done by EVAIR. Batteries shall be supplied, unless otherwise requested, at 400 V in three phase. The section of the power cable must be sized according to the local regulations of the machine location. It will be the responsibility of the installer/customer to verify/realize the indications of this manual prior to commissioning as well as its operability throughout its useful life.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

A periodic functional review is recommended. Any work on the heater such as removing the cover, is combined with the risk of touching live parts, causing death and, therefore, must be performed by a licensed electrician. Despite the protections of the unit to avoid direct contact with these elements, it is necessary to avoid touching them as much as possible. To perform operations on the coil, wait 20 minutes after the unit has been turned off, and verify that the temperature has dropped before touching the elements and there is no voltage.

The operation of the airflow control must be checked (if any), as well as operation of the temperature limiter. It must be verified the absence of damage, dirt, corrosion or lack of restraint.

The equipment must be cleaned properly, removing dirt and repairing damage and corrosion if it exists. Screws that are lightly or completely loose must be tightened.



Safety precautions

Precautions indicated in this manual must be considered.



Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.9. UVC emitters

The UVC device generates UV-C radiation by means of a UV lamp. UV-C radiation neutralizes bacteria, viruses and other pathogenic organisms and stops their reproduction (including Legionella Pneumofila). The UV lamp incorporates a high frequency electronic stabilizer. This stabilizer dampens current oscillations for greater protection of the lamp.

Commissioning and operation considerations

Verify that the door or access panel is interconnected with the power supply to disconnect the lamp(s) when it is opened. Verify that the inspection window (if any) do not allow UVC radiation to pass through. If plastic elements that can meet UVC radiation are introduced into the Air Handling Unit, cover them with aluminium tape. Do not touch the glass with bare hands and it must be cleaned using a special cleaning kit supplied by EVAIR or the component manufacturer.

Verify, once the circuits have been powered, that the lamp emits a light with blue tone. Observe it at a distance with all the skin covered and using a full mask to cover the face.

If the system is not in operation, start the luminaires at least 15 minutes before starting and 20 minutes after switching off the system.

Necessary attentions

Do not touch the glass of UVC lamps without gloves. The lamps may be damaged. The fingerprints grease will be permanently engraved on the lamps and will weaken their structure. Clean the lamp after handling it.

In addition to taking the previous considerations, go to the specific manual of the component and follow the instructions indicated in it for its start-up, operation and maintenance.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

Any internal manipulation inside the unit must be carried out with the germicidal equipment turned off. If, for any reason, they remain on, protection of the skin and eyes is mandatory.

In case the warning labels have worn out, replace them and protect them. The lamps should be changed, as late, annually. The interval may be shortened depending on the start/stop cycles and the hours of use. A UVC radiometer will monitor the performance of the lamps and determine the change (that the lamp is shining does not mean that it is performing its germicidal function).

In general, the replacement of the lamps is recommended when their performance falls below 50% of their initial reading. Generally, the lamps should work all the time.

If the lamps are stained by improper handling, they should be cleaned with 90% Isopropyl alcohol and a dry cotton cloth without wires. The use of cotton or synthetic gloves is recommended for cleaning work.



Safety precautions

The only valid spare parts for this component are those supplied by EVAIR or the component manufacturer. This will allow to maintain the safe operation of the lamp.

The end customer will be responsible for publicizing and enforcing the necessary security measures to ensure satisfactory protection against UVC radiation and will be responsible for creating and bringing to the attention of the workers a mandatory protocol (equipment operation, access to the unit with protective equipment...), in order to avoid potential damage to the eyes and skin of workers.

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The UVC radiation produced by lamps discharges mercury gases. They are normally used to sterilize air, surfaces and water, since radiation eliminates bacteria, viruses, fungi and other microorganisms. Being a light-optical radiation, there is no residual radiation more than a few hundredths of a second after the equipment is turned off.

Workers with access to the facility must be provided with the protective equipment they must wear in order to operate with this component (goggles, face and eyes protective mask, gloves and work clothes covering the entire skin). The best protection is to carry out the necessary work with the UVC equipment turned off.

High doses of UVC radiation cause in humans from reddening of the skin or erythema, to 2nd degree burns (similar to intense and dangerous sunburn). The danger in the eyes starts from painful eye inflammations through loss of vision, to deeper burns of the cornea.

MAXIMUM ALLOWED EXPOSURE TIME FOR SKIN AND EYES (WAVELENGTH FROM 200 NM TO 315 NM - UVC)	
EXPOSURE TIME (HOURS)	POWER DENSITY ($\mu\text{W}/\text{cm}^2$)
8	0,1
4	0,2
2	0,4
1	0,8
30	1,7
15	3,3
10	5
5	10
1	50
30	100
10	300
1	3000
0,5	6000
0,1	30000

The exposure of workers, even with protective equipment, must be minimal, meeting the maximums referred to in the following table:

Precautions indicated in this manual must be considered.

In addition to taking the previous considerations, go to the specific manual of the component and follow the instructions indicated in it for its start-up, operation and maintenance.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.10. Plate heat exchangers

Commissioning and operation considerations

During the operation of the equipment, system pressure drop must be controlled.

If the bypass damper and the heat exchanger have integral shaft and it is not dimensioned for 100% of the airflow, it must be taken into account that the damper can never close completely.

It is important to make sure that the condensate can leave the heat exchanger without restricting the airflow. Completely horizontal plates should be avoided. Verify that the sealing between the heat exchanger frame and the Air Handling Unit is correct so that the internal leakage in the heat exchanger is as small as possible.



Freezing will occur if the exhaust air is cooled down to the condensation temperature so that condensation takes place and the condensing water then comes into contact with a plate surface that has a temperature below 0°C. If freezing occurs, it will start in the cold corner and the exhaust airflow will then gradually decrease because of the blocking of the exhaust channel. If nothing is done, this can continue until the exhaust side is completely blocked.

One of the most common ways to prevent freezing is by totally bypassing the cold supply air when it is below a certain temperature (for example -5°C). Another way is to by-pass only a part of the cold air stream, just enough so that freezing does not start. By mechanically blocking part of the heat exchanger the airflow in the cold corner can be reduced and thus prevent freezing. Another common way is to use a heater to heat the supply air before it is entering the heat exchanger.

Necessary attentions

The absence of polluting substances must be checked. It must be verified that the condensate tray is in the correct position regarding the position and operation of the equipment.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

Plate heat exchangers are designed to prevent dirt from coming into contact with the heat transfer surfaces. Most of dirt and pollutant in the air will just pass through the heat exchanger. Substances which have the highest risk of fouling the exchanger are sticky substances that condense on surfaces and fibers.

The accumulation of dirt in a heat exchanger is often limited to the first 50 mm in the exchanger, which simplifies cleaning. For normal ventilation applications, it is most of the time sufficient to clean the inlet and outlet with a brush. For applications with greater degree of dirt, compressed air or high-pressure water cleaning and disinfection may be necessary. High pressure cleaning must not be made directly against the plates and the pressure must be kept below 5 bar. Make sure that the plates do not deform or break when removing dirt mechanically. If water is used, the temperature must be lower than 60°C or as indicated by the manufacturer of the component.

The cleaning process consists of three steps. First, rinse the heat exchanger with water using a high pressure cleaner to remove dust, particles, deposits, etc. Then, use detergent to clean the heat exchanger. As a third step, remove the detergent with water. Make sure that the nozzle of the high pressure cleaner is adjusted to a plain jet.

The disinfection process consists of two steps. First, spray the heat exchanger with disinfectant and leave to dry. Then, rinse the heat exchanger with water using a high pressure water cleaner. The disinfectant is used undiluted.

It must be checked that the heat recovery unit fins are completely clean, without damage or corrosion. If the equipment has a condensate tray, verify that the siphon and the water outlet are clean and working properly. If there is corrosion it has to be repaired and painted. It must be verified that the detergents or disinfectants used must be suitable for use with the exchanger material (usually aluminium).



Safety precautions

Precautions indicated in this manual must be considered.

Periodo de mantenimiento

Precautions indicated in the corresponding section of this manual must be considered.

11.11. Rotary heat exchangers

The rotary heat exchangers can be equipped, mainly, with the following options:

- Condensation tray
- Purge sector
- Housing
- Cable glands
- Inspection hatches
- Motor with frequency inverter
- Several types of sealing systems
- Others

Commissioning and operation considerations

If the heat exchanger is to be assembled on site, the instructions of the heat exchanger manufacturer, whose installation, start-up and maintenance manual are included in the equipment, must be rigorously followed. In case they are not included in the equipment or have been lost in the transport, request from EVAIR and do not proceed with the installation until they have been sent by EVAIR, since it is of critical importance to follow the steps indicated therein.

In addition to the manufacturer's instructions, the following must be taken into consideration:

- Leave enough space to be able to remove the heat exchanger if necessary.
- If necessary, adjust the brush (sealing between streams) to minimize leakage.
- If the belt slips, adjust the tension of the belt. Rounded belts should have a tension of 3%. Link belts should have a tension of 2%. It is advisable to check the tension after the first 48 hours of work.

It must be verified that the speed predefined in the technical data provided by EVAIR is correct, checking the rotor controller if necessary.

During the operation of the equipment, it must be verified that the rotation of the equipment takes place in the correct direction. If it is the opposite, the polarity of the electrical connections of the motor must be changed.

When there is a lot of condensation in a rotary heat exchanger, it may happen that not all the water that has condensed is captured by the opposite current. If this work point was not foreseen, and a condensate tray has not been installed, EVAIR must be contacted to install a tray that allows the excess water to be collected without causing damage to the rest of the Air Handling Unit.

Check the motor pulley is as close as possible to the centre of the wheel and that the motor supply is correct according to its rating plate.

In the event that the rotary heat exchanger is segmented, the instructions of the use and maintenance manual of the heat exchanger must be followed to be mounted on site. If this manual is not available, ask EVAIR. If the segmented heat exchanger is mounted, but the unit requires several modules to be joined, the final adjustment and alignment has not been done at the factory. It is the responsibility of the installer of the machine to carry out the final adjustment (alignment) of the heat exchanger or to request EVAIR a technician to carry out this task on site. The functions to be performed are those indicated in the installation manual of the rotatory heat exchanger, the final tasks are summarized below:

- Check and make the fixing (by screws) of the heat exchanger after joining modules in the eight corners, in the centre of each side by the two sides of the heat exchanger and in the centre of the wheel (axis) on both sides of the heat exchanger.
- Start up only the heat recovery unit and not the complete unit (if this is not possible, check that there are no unexpected noises or vibrations).
- The finishes (enthalpy, sorption...) can be loosen slightly in the matrix during the first use. This does not affect the performance of the wheel and can be removed with a vacuum cleaner.

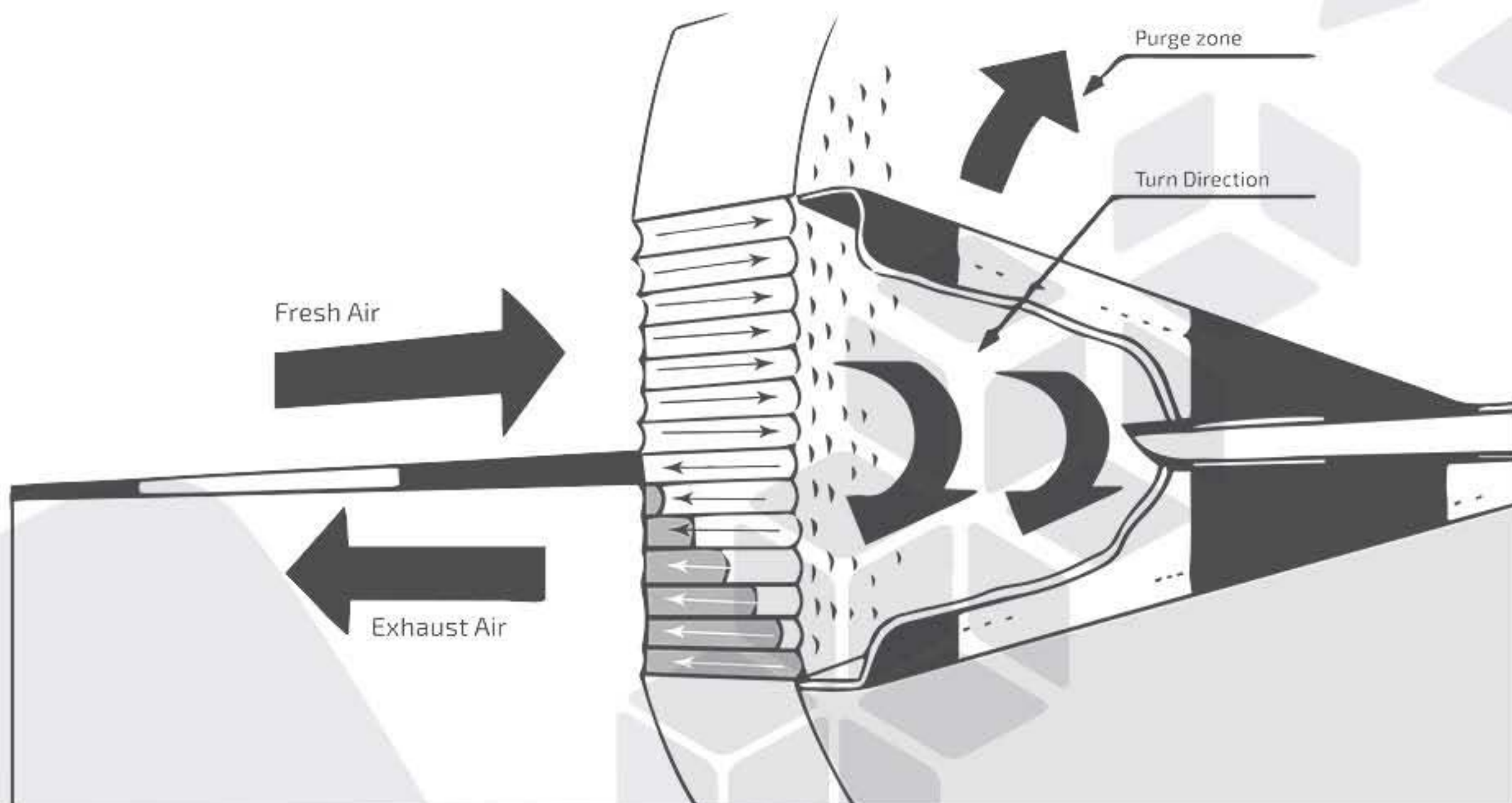


- Prior to start-up, turn the heat exchanger by hand to verify that it is working correctly.
- Install all safety covers on the heat exchanger if they have been removed.
- Feed the heat exchanger and be prepared to turn it off quickly if problems may be observed.
- Let the heat exchanger work for 5 minutes and turn it off again.
- Check the tension of the transmission and adjust if necessary. Check again after 24 hours of operation.
- If there is a space between the inside of the housing and the brush when starting to turn, or if the brush is too close to the casing (misaligned wheel) when the equipment starts operating with pressure (airflow and pressure in supply and return operation), there are some "props" that must be adjusted/tightened until the separation disappears. If the heat exchanger does not have these drops, refer to the manual of the manufacturer of the component (included in the equipment), or to the Technical Department of EVAIR.

Necessary attentions

It must be checked at start-up that there is nothing obstructing the rotation of the rotor, as well as the absence of polluting substances. The strips or sealing gaskets must be located as close as possible to the rotor, avoiding contact.

If the equipment includes a purge sector, check that is in the correct position for cleaning.



**Position of the trap in rotary heat exchanger.*



Safety precautions

Power supply must be disconnected, since in case of working with the equipment running, or a sudden start after a possible network failure, physical damage may occur.

Precautions indicated in this manual must be considered.

Maintenance considerations

If the equipment is not going to work for long periods of time, it must be switched on intermittently to avoid problems when operating it later due to the own weight of the thermal exchange matrix.

It must be checked that there is no corrosion, dirt or damage, and the sealing joints are completely clean. If the degree of dirtiness is high, it is recommended to clean the matrix using one of the following methods (check with the maintenance manual of the manufacturer to observe if there are viability problems):

- If the amount of dirt is low, use a vacuum cleaner.
- If the amount of dirt is considerable, compressed air can be used at a pressure that no damage to the matrix is observed.
- If the dirt is very adherent to the matrix, hot water can be used with a mild detergent. For rinsing, a pressure water nozzle can be used (the pressure must be such that it does not cause damage to the matrix) at a distance of 100 mm from the matrix.

If any of these methods is not recommended by the manufacturer, use those indicated in its maintenance manual.

The transmission voltage must be checked. Rounded belts should have a tension of 3% (length 3% less than the trajectory described when rotating). Link belts should have a tension of 2%. How to make the adjustment depends on the type of belt:

- Standard round belt: It must be cut, adjusted and joined by means of a clip that goes together with the motor in the heat exchanger section.
- Link belt: Remove links (by turning and removing) and reattach the belt.

The tightness between the brush and the housing must be checked. If it needs to be adjusted, the brushes must be unscrewed and screwed back closer to the housing so that they adjust the seal.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.12. Adiabatic humidifiers

Evaporative humidifiers are used to increase the water vapour content of the treated air, by natural evaporation of water from its liquid phase. The air supply being treated is passed through a cellular panel dampened using an irrigation system. This panel is composed of undulating sheets of cellulose or fiberglass with stiffening and water absorbent additives.

The layout, in crossed channels of the panel, offers a huge surface for water-air contact, which maximises water evaporation, and reduces to a minimum resistance to the movement of the air (pressure drop).

The humidifier comprises the following main elements:

- A self-supporting chassis-water tank structure that houses the unit.
- A set of evaporative cassettes of variable sizes and thicknesses, depending on the model and stainless-steel surround.
- A float valve automatic control mechanism for the water supply, to maintain the appropriate level in the water tank, so the unit works correctly.
- A water tank to hold the water, which can be completely emptied by gravity.
- A pump for supplying water from the water tank to evaporative panels.



Operating conditions giving rise to droplet carry-over, can be handled by adding a second panel to the humidifiers to capture the droplets being detached from the evaporative panel.

The humidifier can be supplied with other optional characteristics (solenoid valve, drain valve, step control, standard control, stainless steel base, sliding cassettes, ATEX pumps, PVC connections, water conductivity control, stainless steel pipes, UV lamp incorporated, valves for stage control, etc.).

Commissioning and operation considerations

In order to optimize maintenance/installation, humidifiers must be placed on a leveled waterproof surface, with a drain or run-off, so possible leaks can be dealt with during installation, set up, operation and maintenance.

Assembly inside an Air Handling Unit must ensure the air being treated passes through the evaporative panels, by closing off the perimeters adequately to prevent possible by-passes of the air flow.

When the equipment incorporates its own control, the instructions in the component manual (attached to the equipment) must be followed to carry out the start-up. In case the equipment only incorporates the components without control, the installer will be responsible for verifying the flow control by means of the signal of the level indicator.

The area where the water basin is located can be equipped with an inspection window (minimum diameter of 150 mm). On the area of the raft, if the equipment does not incorporate it, it is recommended that the installer of the unit include an illumination point to perform periodic visual inspections.

It must be verified that the losses in the pipes of the equipment are non-existent, tightening them if necessary. If, after tightening, leaks still exist, contact the manufacturer before replacing them.

If no UV rays are used for continuous disinfection, chemical disinfectants used should not pose a risk to health or to the area of exchange. The humidifier tank must be cleaned with water and non-foaming cleaning products.

Evaporative humidifiers essentially work by means of the irrigation of the evaporative panels. Humidifiers execute their function whenever air currents pass through them and the water pump irrigates the panels.

Necessary attentions

Although the humidifying matrix can be ordered from non-combustible material, it is advisable to not exceed process air temperatures of 50°C, in the event that the pump does not work and there is no resulting irrigation, because the irrigation piping material could be deformed.

When the pump works, 40°C should not be exceeded on the side of the pump.

To ensure complete drying of the cooling pad, after a work period, the air fan of the AHU must be working during the times set out in the following table:

AIR VELOCITY V (m/s)	APROX. EXTRA WORKING TIME OF THE AIR FAN WITH A TEMPERATURE BETWEEN 20-25°C
$V < 2$	15 min
$2 \leq V < 3$	12 min
$3 \leq V < 4$	9 min
$4 \leq V < 5$	6 min

All units using the evaporative humidifier with exterior air must stop the pump and drain the water tank in the event of preheater faults to avoid possible freezing. Units for adiabatic cooling of the return air must drain the water tank water during the winter. If EVAIR performs climate control and humidification, these situations will be foreseen; if not, it must be taken into account when carrying out the control of the unit.

AHU_AIR HANDLING UNIT



Safety precautions

Humidifiers will be carried out according to the RITE in terms of water quality, in case of the final destination is Spain, or according to the corresponding instruction of the country in which the equipment is to be installed.

The water contribution used for humidification must have sanitary quality. Air humidification is not allowed by direct steam injection from boilers, except that it has sanitary quality. Sanitary water quality according to the *Boletín Oficial del Estado* (Spain) is the one that fulfils the parameters indicated in the following table:

PARAMETER	VALUE	UNITS
Aluminum	200	µg/l
Ammonium	0,5	mg/l
Residual combined chlorine	2	mg/l
Free residual chlorine	1	mg/l
Chloride	250	mg/l
Color	15	mg/l Pt/Co
Conductivity	2500	µS/cm a 20°C
Iron	200	µg/l
Manganese	50	µg/l
Odor	3-25	°C Dilution Index
Oxidability	5	mg O ₂ /l
pH	6,5-9,5	-
Flavor	3-25	°C Dilution Index
Sodium	200	mg/l
Sulfate	250	mg/l
Turbidity	1	UNF

Precautions indicated in this manual must be considered.

Maintenance considerations

The following elements require maintenance:

- Irrigation pump: The most important thing is to verify monthly and ensure dirt does not obstruct the suction impulsion circuit and electricity consumption is lower than the power rating shown on its plate.
- Float valve: This must be inspected on a regular basis to ensure its mechanical closure and opening works correctly (by default annually).
- Control valves: These must be inspected to ensure their mechanical regulatory function works correctly (by default annually).
- Solenoid valves (if applicable): These must be inspected to ensure their mechanical closure and opening works correctly (by default annually).
- Evaporative panels: Their operating life basically depends on the correct functioning of the continuous purge system, the concentration of mineral salts (formation of superficial limestone deposits), the quality of drinking or industrial water. If the regulation is not correct, the panels must be replaced in a short period of time, since the airflow will be blocked by the formation of these deposits (by default they must be reviewed quarterly).

The evaporative humidifiers usually work with water temperatures below 24°C, very far from the optimal growth temperatures of the bacteria present in the water, essentially *Legionella pneumophila*, but in any case, it is convenient to install UV lamps if a use is foreseen in which there can be a lot of stagnant water at high temperatures, as well as cleaning and disinfecting in a habitual way. Based on the quality of the water, the inspection, emptying and cleaning plan should be established.



Evaporative humidifiers must be cleaned regularly to prevent contamination. All surfaces of the components (panel, pipes and especially the water basin) should be disinfected with an appropriate solution. It must be paid special attention to cleaning the piping system, especially in bends and junctions; the cleaning process must reach all ends of the system.

In the case of the panels, the use of chemical disinfectants for daily maintenance is not recommended because it could reduce the efficiency of the panel and its useful life. If the use of chemicals is necessary, either for a long period of inactivity or any other reason, an effective method is to dip the panels in chlorine disinfectant such as Sodium Hypochlorite (bleach) or Sodium Percarbonate. In the case of the use of disinfectants with chlorine, it is imperative to consider the formation of toxic chlorine gas when combined with an acid solution. If the panel is made of cellulose, the replacement of the panel is recommended.

NOTE: In humidifiers by water spray nozzles it is recommended to check their conditions once a year, disassemble and clean them or, if necessary, replace them.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.13. Electrode steam humidifiers

Immersed electrode humidifiers produce steam by boiling water contained within the cylinder. The heat required to boil the water is obtained by passing electric current through a voltage to the electrodes immersed in the water.

Initially, when the cylinder is new or has just been cleaned, the amount of current depends exclusively on the type of supply water: the more salt-rich the water, the more current it conducts and the faster the required steam production is achieved.

As time passes, the deposit of salts in the cylinder increases (does not evaporate with water), contributing to reach the nominal production. At a rate, the required production level is maintained automatically by regulating the current input, adjusting the water level in the cylinder.

The salts that are deposited with time are the cause of the progressive exhaustion of the cylinder. To prevent excessive build-up, the humidifier automatically drains and replaces a certain amount of water at set intervals.

The humidifier must not be placed outdoors or must be covered if it is located outdoors. If this accessory has not been selected when configuring the unit, it is the responsibility of the installer of the machine to provide the necessary protection to the self-producing equipment.

Linear steam distributors are sized for the design air velocity in the equipment. If for some reason the airflow is to be increased, the manufacturer must be consulted about the modifications to be made in the installation of the distributing lances. The steam lance must have a slope of about 2 degrees for the condensate drain.

In addition to following the instruction indicated in the hydraulic and electrical connection of this manual, the instruction of the manufacturer of the humidifier, whose installation, start-up and maintenance manual is included in the equipment, must be followed rigorously.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.14. Resistive steam humidifiers

These isothermal steam humidifiers take advantage of the heating of immersed resistors in a boiler full of water. This can be tap water or demineralized water. The heat generated by the resistances increases the temperature of the water to almost 100°C.

The use of demineralized water ensures the prolongation of the service life of the cylinder and the electrical resistances, since virtually the lime deposits could not be formed and grow gradually. On the other hand, when using drinking water, a part of the minerals dissolved in the water is deposited in the cylinder as solids of different composition. To prevent this phenomenon, when the conductivity of the cylinder water exceeds a certain value, a part of the water is discharged and reintegrated periodically to obtain the dilution. In prepared models, the discharge water is mixed with tap water so as not to exceed the maximum temperature established by the national and local regulation (confirm if this is the case). The generated steam has a temperature of almost 100°C and a minimum positive pressure. It is virtually demineralized and free of germs. The steam production can be regulated with ON/OFF logic or with continuous modulation from 0% to 100% of the nominal power, by means of solid-state relays (confirm if this is the case).

The humidifier must not be placed outdoors or must be covered if it is located outdoors. If this accessory has not been selected when configuring the unit, it is the responsibility of the installer of the machine to provide the necessary protection to the self-producing equipment.

Linear steam distributors are sized for the design air velocity in the equipment. If for some reason the airflow is to be increased, the manufacturer must be consulted about the modifications to be made in the installation of the distributing lances. The steam nozzle must have a slope of about 2 degrees for the condensate drain.

In addition to following the instruction indicated in the hydraulic and electrical connection of this manual, the instruction of the manufacturer of the humidifier, whose installation, start-up and maintenance manual is included in the equipment, must be followed rigorously.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.15. Combustion chambers

Commissioning and operation considerations

It must be verified that the airflow is distributed evenly over the chamber, and that it operates with sufficient cooling (flow rate must be that indicated by the manufacturer).

During equipment operation, it may be necessary, depending on the requirement of the system, to increase or decrease the power. The bypass damper, if incorporated in the component, allows the regulation.

If the chamber also incorporates a regulating damper, a minimum and maximum opening must be determined for it, so that the combustion chamber can be minimally refrigerated.

It must be ensured that the gas outlet is correct.

Necessary attentions

The absence of polluting substances must be checked at the start-up, as well as the fuel lines (gas), the position of the sensors and their adjustment values (45°C, 90°C and 120°C) must be purged.

The situation of the burner, and the installation of connections (as well as its sizing), sensors and thermostats must take place according to the manufacturer's instructions.

The connection of the chimney must take place according to the applicable local regulations and must be carried out by a specialized technician to carry out this task.



It must be verified that the chimney complies with the requirements of the applicable regulations, as well as the installation and operation of emergency systems.

The first start-up of the equipment must be carried out by a qualified technician. If necessary, commission the start-up contract to EVAIR or to the manufacturer of the air combustion chamber.



Safety precautions

The flame height must be checked, and the walls of the camera must not be touched at any time. The correct functioning of the triple thermostat installed in the unit must be checked.

Hot parts of the combustion chamber can cause burns in contact with the skin.

Precautions indicated in this manual must be considered.

Maintenance considerations

Instructions for use and maintenance of the burner will be appended to this manual. In case of any need for replacement or repair of damages, contact the manufacturer.

It must be verified that there are no leaks in the gas pipes, connections and the correct functioning of the control system.

The burner must be removed and checked for dirt, damage or danger of losses in the combustion chamber. If there is damage in the flame tank above a slight chipping, the plate must be removed and replaced.

The inner area of the chamber and the burner must be vacuumed. In areas where it is not possible to vacuum, a brush should be used.

Beyond the communication of damages or the cleaning of the equipment, the rest of maintenance or repairs will be carried out in contact with the manufacturer.

The chimney maintenance must be carried out by qualified technician.



Safety precautions

Before starting maintenance tasks, all parts of the equipment must be cooled down to room temperature. The maintenance technician in charge must wear protective clothing to avoid problems due to contact with flammable substances.

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

11.16. Direct Burner

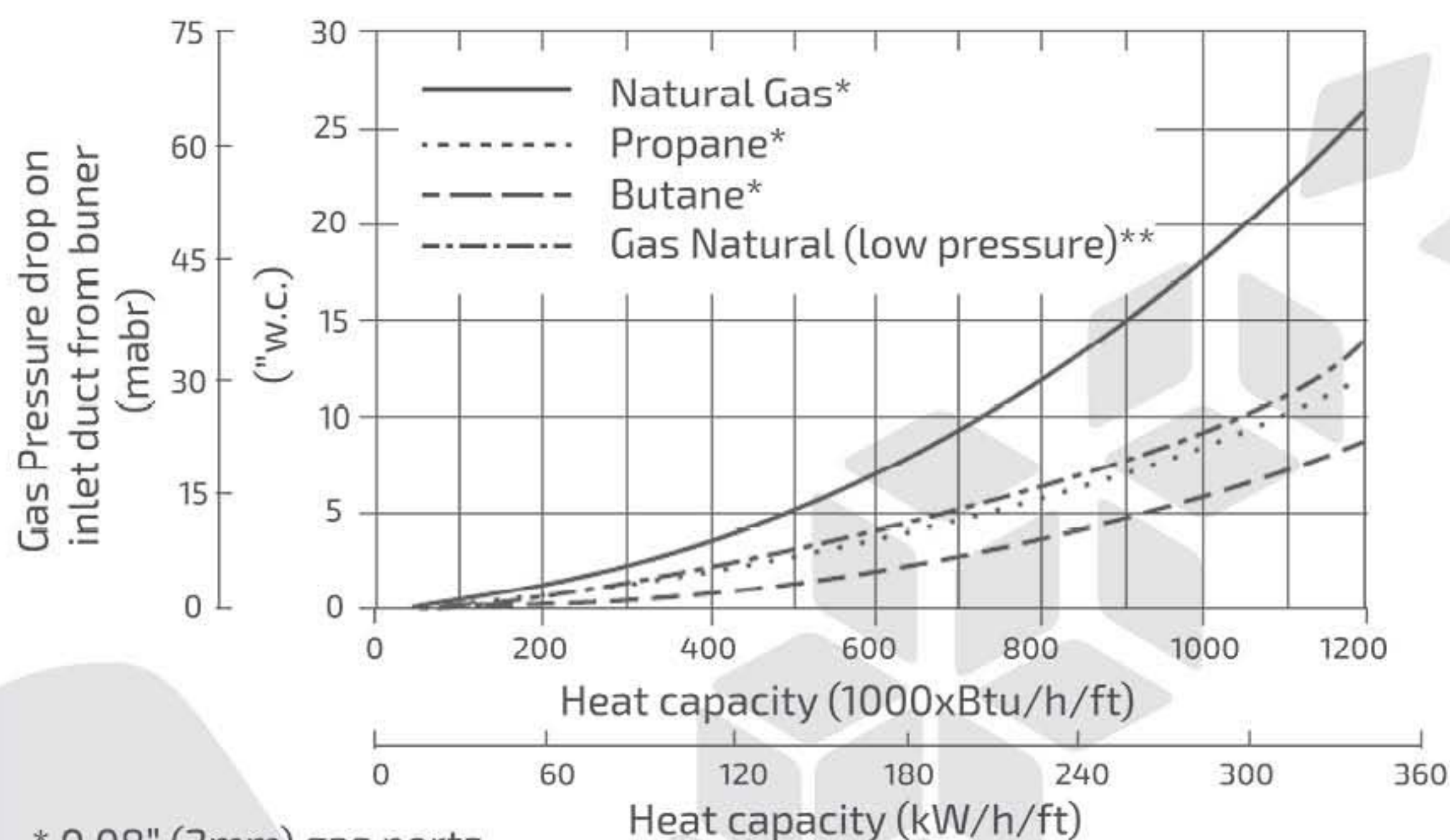
The instructions of the manufacturer of the host gas generator and the burner must be followed rigorously, whose installation, start-up and maintenance manual are included in the equipment. In case they are not included or have been lost in the transport, request them from EVAIR and do not proceed with the installation until they have been sent by EVAIR, since it is of critical importance to follow the steps indicated therein.

Some safety considerations are summarized below.

Commissioning and operation considerations

If it is not clear how to proceed after reading the use and maintenance manual, contact the Technical Department of EVAIR or the component manufacturer and request assistance or start-up. In addition to what is indicated in the component manufacturer's manual, which has priority over the indications described in this manual, the following must be considered.

It must be checked that the supply system is able to provide enough pressure to the element to provide the desired power:



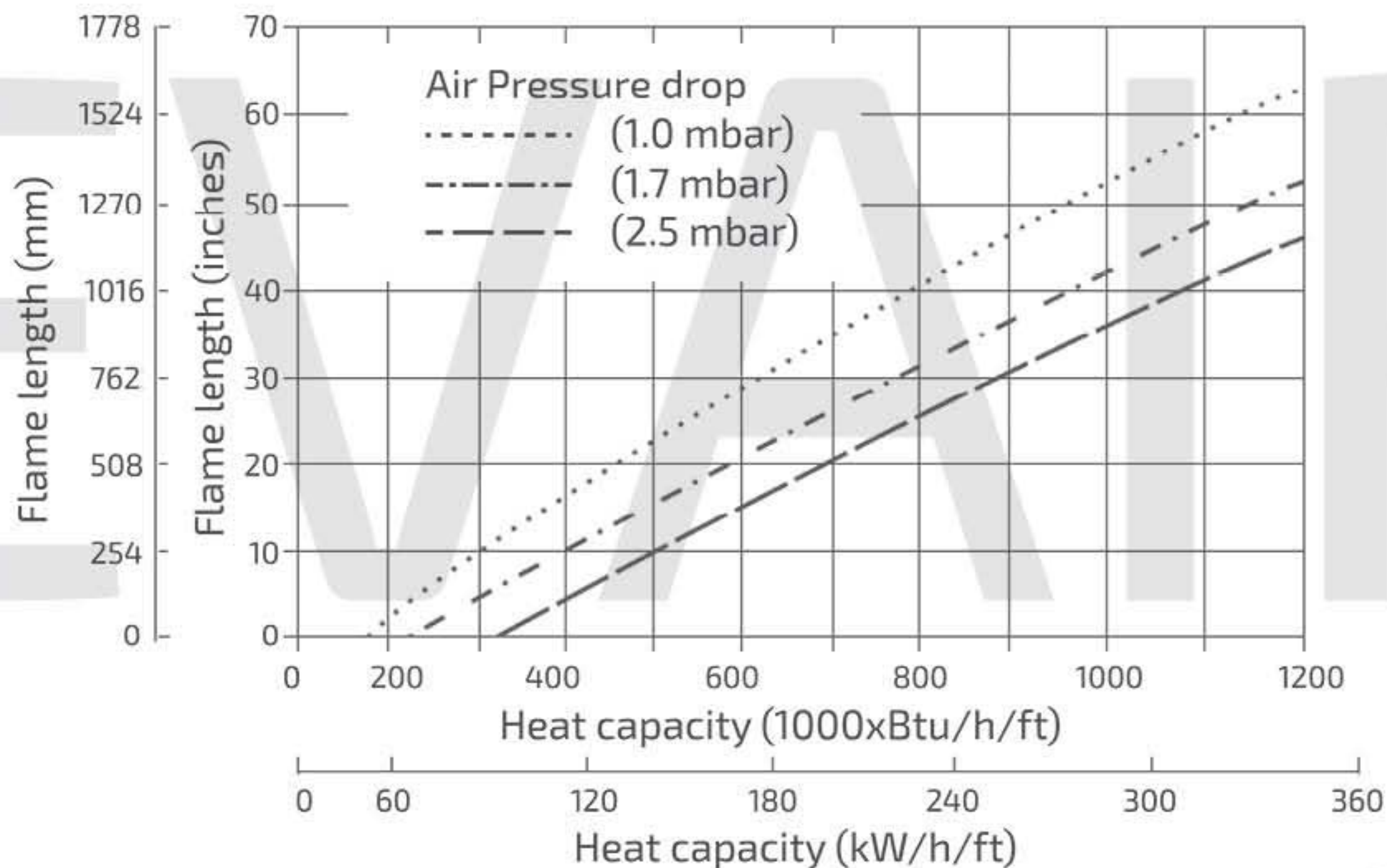
* 0.08" (2mm) gas ports

** 0.09" (2.4mm) gas ports

*Pressure fuel burner.

Pipes must have a manual exclusion valve and a flexible joint to prevent vibrations from propagating from the burner to the pipe. The tightness must be verified by means of a liquid looking for leaks. The connection of the power supply must be made in accordance with the rating plate.

The hot gas generator must not be started without having previously connected the fan of the Air Handling Unit to ensure refrigeration. The flame length should be checked and adjusted necessary.



*Burner flame length.

During the start-up, follow the instructions of the installer and the manufacturer; checking pressure, flow, temperature and pressure drop, both in the supply lines and in the burner.

Necessary attention

The instructions of the manufacturer of the hot gas generator and the burner must be followed rigorously.



Safety precautions

Hot gas parts of the combustion chamber can cause burns in contact with the skin. All workers operating on this component must be provided with at least a protective helmet, protective shoes, protective gloves, protective goggles and overalls.

Precautions indicated in this manual must be considered.

Maintenance considerations

The instructions of the manufacturer of the hot gas generator and the burner must be followed rigorously. In addition to what is indicated in the component manufacturer's manual, which has priority over the indications described in this manual, the following must be considered.

It must be verified that there are no leaks in the gas pipes, connections and the correct functioning of the control system.

The burner must be removed and checked for dirt, damage or danger of losses in the burner, which must be cleaned using a brush so as not to obstruct the air intake or the fuel circulation (using injection needles if necessary).

The following maintenance tasks should be carried out frequently:

- It must be checked that the flame devices are in perfect condition.
- It must be verified that all alarms have the appropriate signals.
- The ignition electrode must be checked by means of a spark, and the separation must be adequate.
- It must be checked that all the actuators and control valves have a smooth and unobstructed movement, as well as their adjustment.

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- The blocking sequence of the safety equipment must be tested, manually causing the failure of each blockage and observing that the corresponding equipment closes or stops according to the manufacturer's specification.
- Check the flame control by manually closing the gas going to the burner.
- The operation of all manual fuel valves must be checked.
- The cleaning of the filters of the main air fan must be checked.
- The strainers or the gas filter have to be checked.

The following maintenance tasks should be carried out less frequently:

- Check that the safety shut-off valves are firmly closed.
- The configuration of the pressure switch must be checked by comparing the movements of the switch for the pressure setting.
- The ignition wire and connectors must be checked visually.
- The gas injection holes and the burner mounting structure must be inspected.
- The position of the profile plate compared with the final position of the initial configuration must be checked.
- Check that all screws and bolts that hold the air wings together and to the burner bodies.
- Both sides of the component must be inspected to ensure that the air holes are not blocked, and no foreign material has accumulated on the wings.
- Check that the air wings are not damaged or bent. Excessive deterioration can indicate a non-uniform pressure drop or an operation outside the recommended limits of power and speed. If necessary, the wings should be replaced.



Safety precautions

Before starting maintenance tasks, all parts of the equipment must be cooled down to room temperature.

All workers operating on this component must be provided with at least a protective helmet, protective shoes, protective gloves, protective goggles and overalls.

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.



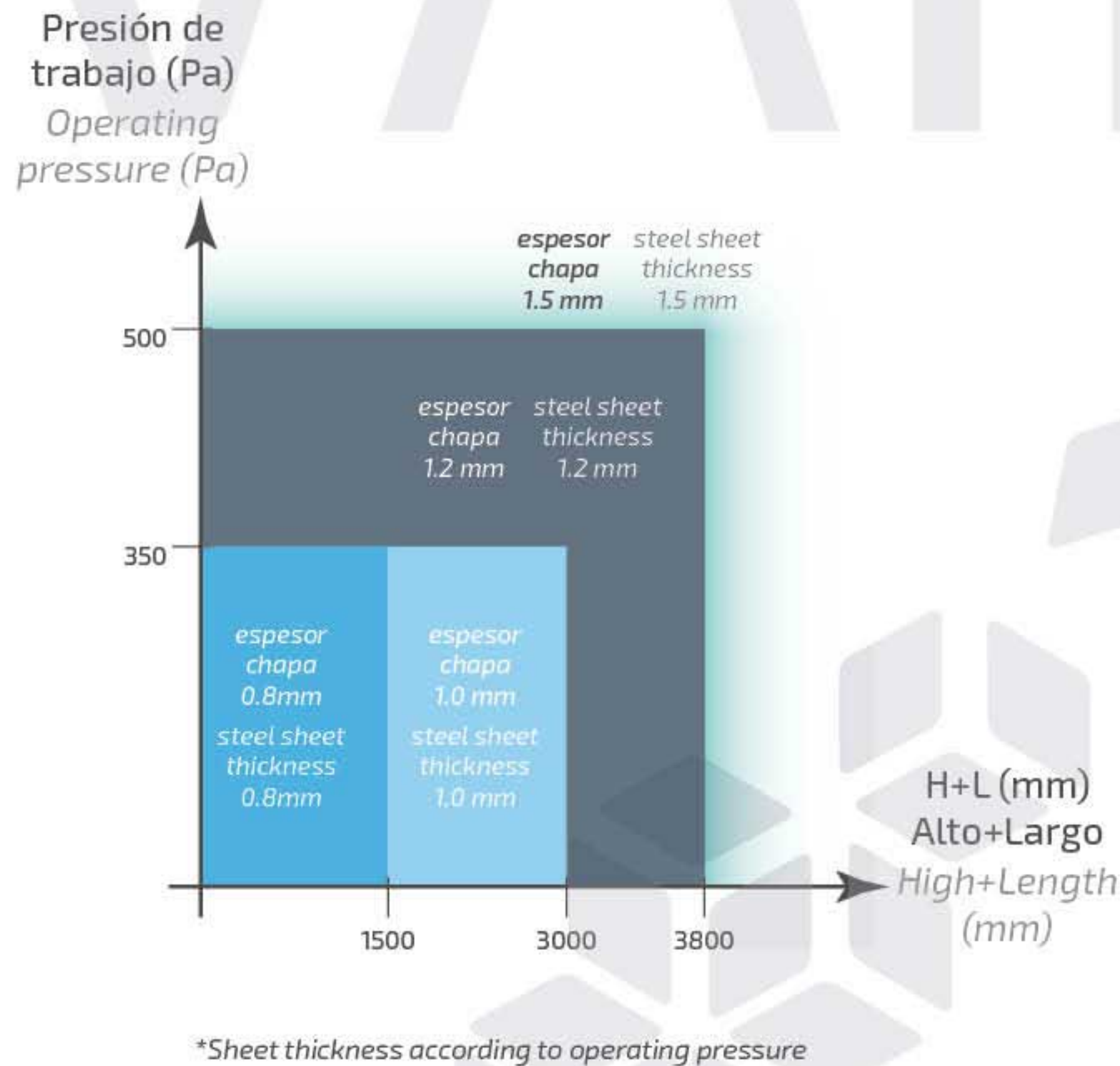
11.17. Sound attenuators (silencers)

Commissioning and operation considerations

During the start-up, it is not necessary to perform tasks beyond those previously described.

Necessary attentions

Prior to commissioning, it must be verified that the pressure that the silencers bear is that of the design. In case of pressure variations due to changes in the installation, verify that the admissible component pressures are not exceeded depending on their size and the thickness of their sheet:



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance considerations

The integrity of the component must be checked, ensuring that there is no damage on it.

The silencers must be cleaned, removing any particles adhering to their surface (preferable by suction to avoid damaging the veil or interior material), and even the corrosion that may have occurred on the metal parts. In case the veil is damaged, the baffle must be replaced, contact EVAIR to request the corresponding spare part.



Safety precautions

Precautions indicated in this manual must be considered.

Maintenance period

Precautions indicated in the corresponding section of this manual must be considered.

12. CONTROL OPERATING PROCEDURES OF THE VENTILATION OR AIR CONDITIONING SYSTEM WHEREIN THE AIR HANDLING UNIT IS INSTALLED.

In addition to the mandatory revision to legalize the installation in accordance with the local regulations for the final location of the equipment, EVAIR recommends carrying out a previous revision of the installation and the unit according to the UNE-EN 12599 Standard, which specifies the tests, methods of test and measuring instruments to verify the correct execution, aptitude of the function, and controls of reception of the installed systems. This Standard applies to mechanical ventilation and air conditioning systems that contain some of the following elements:

- Diffusion and distribution terminal units
- Air Handling Units
- Air distribution systems (supply, extraction)
- Fire protection devices
- Automatic control devices

The Standard mentions stages when evaluating the correct functioning of equipment:

- **1.-Good finish controls:** Its objective is to evaluate the proper execution of the assembly of the system. In this section it must be verified that the components correspond to the specifications in all respects, that the technical rules are satisfied, the control accessibility (operation, cleaning and maintenance) is correct, that the system is clean, and that the start-up documents exist and are correct.
- **2.-Functional controls:** In order to complete the assembly and carry out its adjustment and regulation, a series of preliminary work must be carried out (before starting the operation and on all installed equipment):
 - › Performance test of the entire system under different loads.
 - › Airflow adjustment and air distribution in special operating conditions
 - › Setting the regulatory elements in the air ducts.
 - › Registration adjustment and safety equipment.
 - › Adjusting control systems and anti-icing systems.
 - › Setting automatic controls.
 - › Determination of air supplied in each terminal element, with eventual regulation.
 - › Setting and registration of firefighting devices and smoke.
 - › Adjusting regulatory elements ductwork heating, cooling and humidifying the data relative to required performance.
 - › Adjusting power according to the design conditions.
 - › Document containing the results of the tests.
 - › Training instructions to the personnel responsible for managing the installation.



The procedure when carrying out functional checks is, from the components of the subsystems to complete systems, including the conditional controls, sequences of control and simulation of abnormal conditions in each specific system. Observe the physical responses, as well as electronic signals.

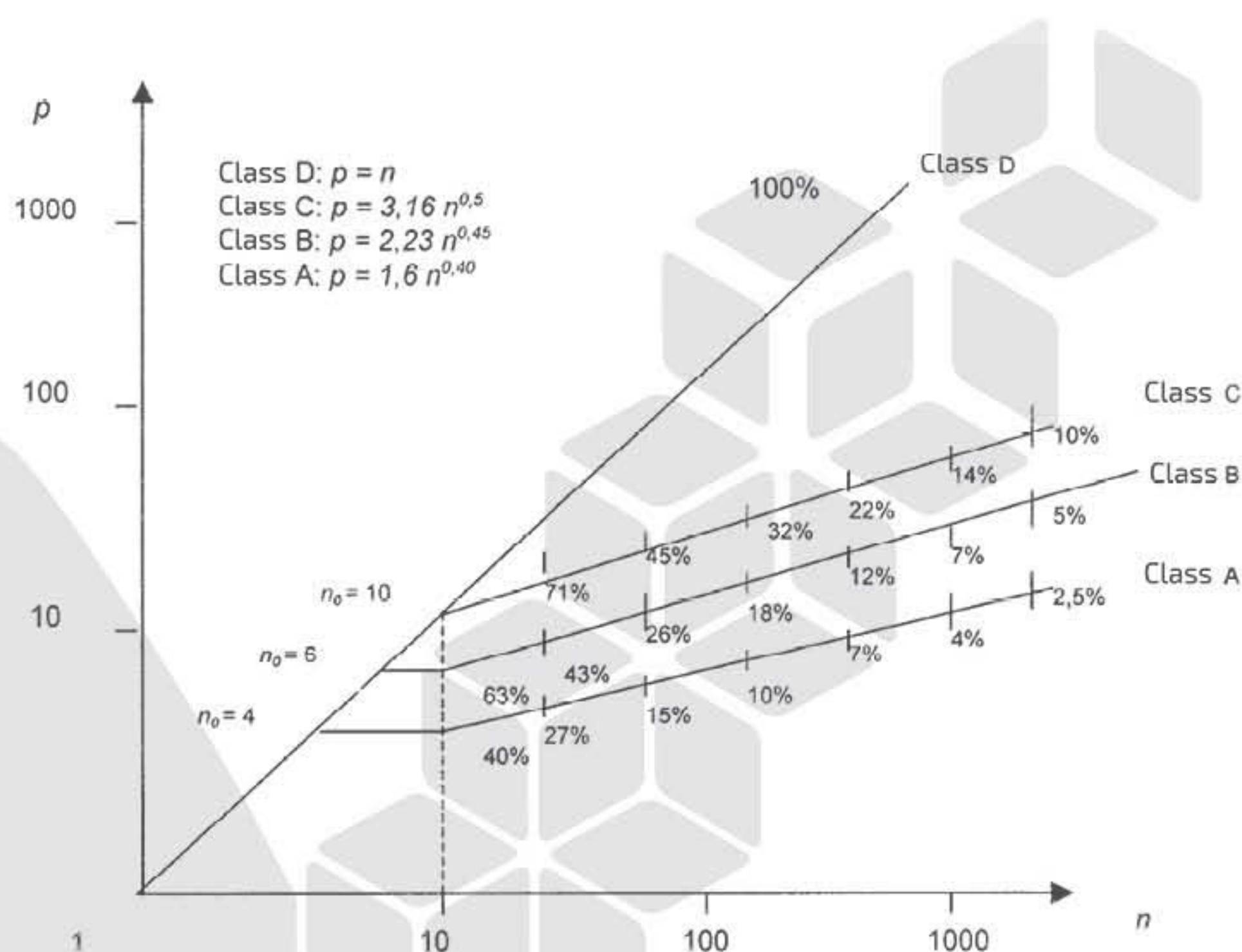
The main components separately studied are as follows:

- Fans and central systems
 - › Direction of rotation
 - › Speed control or flow
 - › Stop switch
 - › Starting and stopping the system of regulation and control gate
 - › antifreeze systems
 - › Direction of movement of the multi-blade gates
 - › Direction of operation and regulation of the control devices
 - › Drive motors safety devices
- Heat exchangers (heat exchangers coils)
 - › Direction of operation and regulation of the control devices
 - › Direction of rotation of the fluid pumps
 - › Control function of rotary heat exchangers
 - › Heat and cold transfer fluids supply
- Air filters
 - › Display and control of the pressure difference.
- Humidifiers
 - › Control function
 - › Inlet and outlet
 - › Operation and direction of rotation of the water pump
- Multiple blade dampers
 - › Control the direction of rotation of the servomotors
- Fire dampers
 - › Test device and interlock signal
 - › Test driving direction and limits of the damper and flag
- Mixing sections, settling chambers, side overheating ...
 - › Control of the regulation and management functions
- Ductwork
 - › Regulatory elements of heating, cooling and humidifying ductwork
 - › Ductwork accessibility

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- Air terminal elements (supply / extraction) and air flow in the local
 - › Performance test for localized control
 - › Smoke test for an initial assessment of airflow in the local as well as an indication of airflow in areas thereof.
- Control devices and control cabinets
 - › Setpoint temperature inside
 - › Setpoint indoor humidity
 - › Ignition switch
 - › Antifreeze functions
 - › Fire dampers (interlock and signal)
 - › Air flow regulation
 - › Heat recovery systems
 - › Union with fire protection systems

In case it is necessary to make successive measurements in equipment (such as diffusers, or filters of different air conditioning equipment, fans, etc.). The extension of the controls could be qualified between four levels A, B, C, D, from lower to higher control needs (for functional measurements, the same rating should be established as for functional controls). The controls, according to the following graphic relationship, must be taken as a minimum in a "p" number of the total "n" of similar locations.



The approximate percentages p/n are represented in the graph. The p number should be rounded to the nearest integer.
 The formulas of levels A,B and C apply to $n \geq 10$

*Número de controls according to UNE-EN 12599.



In case of similar measurements, certain parameters can be measured in a small number of rooms, in the following table these values are shown.

PARAMETERS	NUMBER OF MEASUREMENTS	
	NORMAL	MINIMUM
Air temperature permanently recorded in 24 h	p/10	1
Humidity permanently recorded in 24 h	p/10	1
Vertical profile of temperature	p/10	1
Indoor air speed	p/10	1
Sound pressure level	p/5	3

- **3.-Functional measurements:** The purpose of functional measurements is to ensure that the system meets the design conditions and the set values. Excluding measurements locally, except for measuring air temperature in absence of components with thermodynamic function of air treatment in all elements necessary measurement:
 - › Power absorbed by motors or pumps (if either)
 - › Airflow
 - › Air temperature
 - › Pressure drop

Where necessary, the measurement will be made according to the principles of control. Related to the internal climatic factors and the air flow, the heating, cooling, humidification, electrical characteristics and other design data should be measured with nominal air flow. The admissible uncertainties (including deviations from the design point and from the measurements themselves) are included in the following table

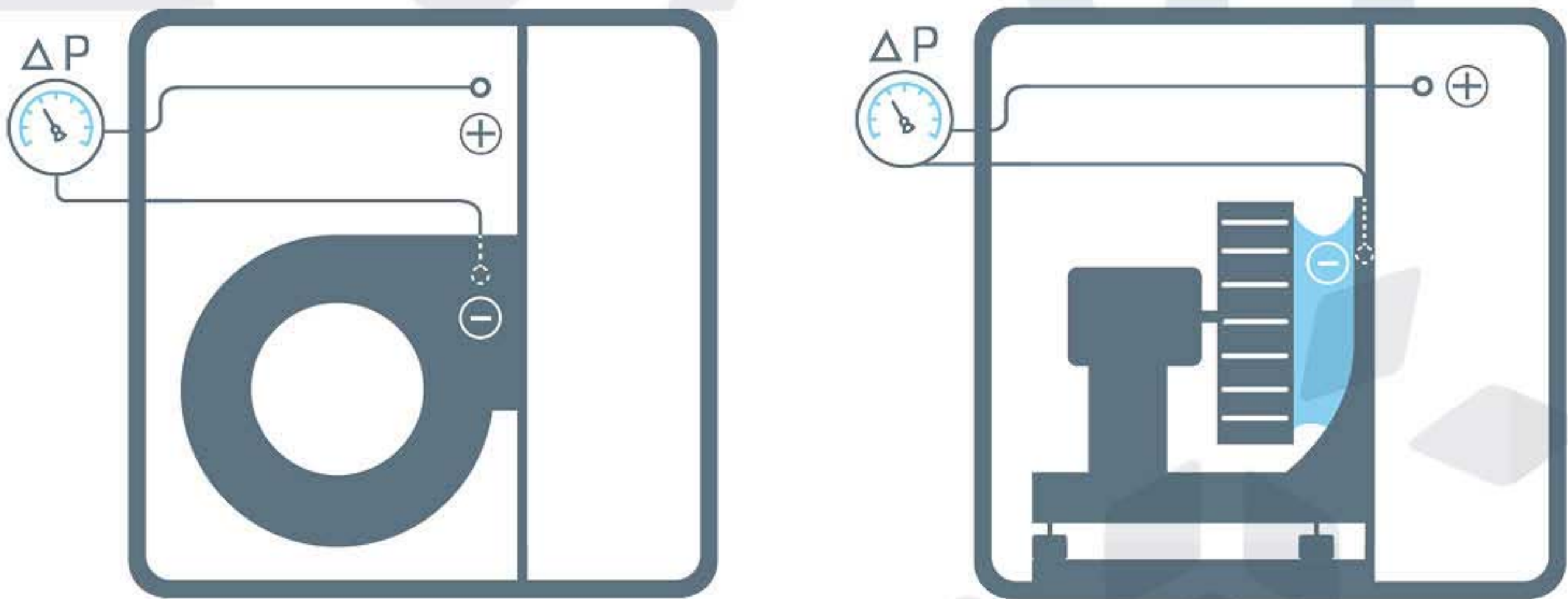
PARAMETERS	UNCERTAINTY
Air flow in each local	± 20 %
Air flow in each system	± 15 %
Supply air temperature	± 2 °C
relative humidity (RH)	± 15 % RH
Air velocity in occupied zone	± 0,05 m/s
Air temperature in occupied area	± 1,5 °C
Sound pressure level at the local	± 3 dB(A)

- **4.-Airflow measurements:** Measuring the airflow that a fan is supplying can be done through different procedures:

› PROCEDURE 1

The airflow measurement is carried out using the pressure check nozzles of the fan which together with a K-factor of calibration, allow finding the airflow rate.

The pressure check nozzle will allow to find the depression generated by the fan; to find this depression, it is necessary to establish a difference between the pressure measured at this point, and the pressure in the suction plenum. To ensure the correct measurement of the pressure in this suction plenum, it must not be distorted by effects of dynamic pressure, being as close as possible to a corner of the plenum and measuring static pressure.



**Installation of probes in fans for airflow measurement schematics*

The expression to be applied must be consulted in the catalogue of the corresponding manufacturer, but it usually corresponds to the following expression:

$$q_a = K \sqrt{\frac{2}{\rho} \cdot \Delta P_{AC}}$$

ΔP_{AC} represents the difference in static pressure between the suction plenum and the fan suction cone. The constant K is given by the manufacturer for each of its fan sizes, including in some cases the term $\sqrt{(2/\rho)}$ and indicating the density taken to find the factors. Likewise, the units of the previous equation elements depend on the units that the manufacturer indicates for its constant, and the units of airflow q_a to obtain.

In case $\sqrt{(2/\rho)}$ is included in the constant, indicating the density (usually 1,2 kg/m³), the expression would be as follows:

$$q_a = K' \sqrt{\Delta P_{AC}}$$

In this way, if the density on this constant is intended to be modified, the expression to be applied is the following:

$$q_a = K' \sqrt{(1,2/\rho)} \sqrt{\Delta P_{AC}}$$



› PROCEDURE 2

Another way to measure the airflow rate is to know the total pressure of the fan and its electrical consumption. In this way, by locating the working point of the fan in its curve, the parameters that define its operation can be known, among them the airflow rate. This method will be valid for all types of fans, but it is usually more inaccurate due to the difficulty of accurately measuring pressure, consumption, etc.

The way to measure total pressure in the fan will be to place a static pressure socket in the suction plenum and another in the discharge plenum.

› PROCEDURE 3

The rest of the procedures are related to the direct measurement of airflow in ducts, which must be carried out in accordance with EN 12599 Standard.

13. SUMMARY TABLE MAINTENANCE PERIODS

MAINTENANCE PERIODS		FREQUENCY [MONTHS]							
	UNIT WITHOUT POWER SUPPLY								
		0.5	1	3	6	9	12	24	OTHERS
INSTALLATION	Inspection of the ground connection						X		
	Electric box ventilation (VFD)		X						
	Duct couplings			X					
	Inspection of drain, siphon and condensate tray (cleaning if applicable)		X						
	Inspection of external interlocks: Control and thermostats				X				
	Inspection of air leaks						X		
	Inspection of the general condition of baseframe and anti-vibration supports				X				
	Cleaning of structures				X				
	External inspection of the equipment and aluminium profiles. Damages and corrosions.				X				
	Inspection of panels, closures, joints, hinges and inspection windows. General condition of the sealing of the housing and access points.				X				
ENCLOSURE	Inspection of the condition of supports, anti-vibration system, shock absorbers			X					
	Internal cleaning of modules		X						
	Corrosion inspection (repair and paint where appropriate)			X					
	Inspection of water leaks		X						
	Filling verification of the water circuit. Air purge.			X					
	Casting corrosion inspection				X				
	Coil inspection (corrosion of fins, bent, deformed tubes)			X					
	Coil inspection (cleaning fins)		X						
	No dirt or dust that indicated air bypass in coils				X				
	Dry cleaning or rinsing of coils				X				
COILS (REFRIGERATION AND HEATING)									



MAINTENANCE PERIODS											
	UNIT WITHOUT POWER SUPPLY	FREQUENCY [MONTHS]									
		0.5	1	3	6	9	12	24	OTHERS		
ELECTRIC HEATER	Checking security and control elements (acting and wiring)			X							
	Checking coil status (corrosion or other damage)						X				
	Check fastening and screw					X					
	Cleaning				X						
FANS	Inspection of the condition of the turbine		X								
	Inspection of the condition of the protection grids (if incorporated)				X						
	Inspection of the condition of the anti-vibration supports and motor and fan anchoring		X								
	Inspection of the condition of the fans: cleaning impeller, turbine and motor		X								
	Checking bearings: clearances				X						
	Status inspection of the transmission belts (alignment, tension, sliding, wear), if any		X								
	Pulleys inspection (alignment, wear and tighten), if any			X							
	Inspection of the tightening of fan terminals, if any				X						
	Check lubrication of bearings			X							
	Inspection status of the turbine flexible connection				X						
MOTORS	Cleaning		X								
	Replacement of bearings		40.000 hours or manufacturer specification								
	Lubrication of bearings			X							
	Check of power supply and phase symmetry				X						
	Terminal connection check				X						
	Wiring revision				X						
	Checking the status of control and security elements			X							
	Screws check			X							
	Shaft alignment check		X								
	Motor housing status check				X						

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MAINTENANCE PERIODS									
	UNIT WITHOUT POWER SUPPLY	FREQUENCY [MONTHS]							
		0.5	1	3	6	9	12	24	OTHERS
FILTRATION	Inspection of air filters and their frame (cleaning & integrity)		X						
	Checking pressure drop within range		X						
	Inspection of air filters and their frame (corrosion or other damage)				X				
	Sealing section check						X		
	Extract rail status check				X				
COMBUSTION CHAMBERS AND HOT GAS GENERATORS	Fuel supply system		X						
	Checking flame devices		X						
	Checking alarms		X						
	Checking electrodes		X						
	Checking actuators and control systems		X						
	Checking Block sequence		X						
	Checking flame control		X						
	Checking fuel valves		X						
	Checking air filters, gas filters and strainers		X						
	Checking safety valves		X						
	Checking pressure switch configuration		X						
	Checking ignition wire and connectors		X						
	Checking gas injection holes and structure		X						
	Checking plate position		X						
	Screws inspection				X				
	Air holes inspection		X						
SOUND ATTENUATORS	* Follow burner manual.								
	Checking the condition of the sound attenuator (corrosion or other damage)			X					
	Cleaning				X				



MAINTENANCE PERIODS									
	UNIT WITHOUT POWER SUPPLY	FREQUENCY [MONTHS]							
		0.5	1	3	6	9	12	24	OTHERS
ADIABATIC HUMIDIFIERS	Complete hygienic inspection by a specialist							X	
	Control of contamination, damage, proliferation of microorganisms and corrosion: cleaning and repair		X						
	Counting of bacteria in the water: if >1000 CFU/ml (1CFU/ml for legionella pneumophila), wash with disinfectants, rinse, dry, analysis of the quality of the feed water	X							
	Check the condensate drain circuit of the tray			X					
	Check the absence of contamination of the recirculation pump and the dirt of the water pipes and check the filters condition: clean the water pump circuit			X					
	Check the condition of the nozzles: clean or replace		X						
	Clean the humidifier if it stopped >48 hours: wash with detergents, /disinfectants, rinse and dry								
	Droplet separator and flow redirector: check contamination, damage, dirt and corrosion. If it is dirty, remove and clean the separator and check the condition of the pipe to separator		X						
	Check that the dirt does not block the suction-discharge circuit in the irrigation pump		X						
	Check that the consumption of the irrigation pump is below the nominal consumption indicated on its plate		X						
ISOTHERMAL HUMIDIFIERS	Inspect the float valve in its mechanical closing and opening function		X						
	Inspect the control valves in their mechanical regulation function, if any		X						
	Inspect the solenoid valves (if applicable) in their mechanical closing and opening function		X						
	Replacing evaporative panels			X					
	Follow indications of the component manufacturer								

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MAINTENANCE PERIODS		FREQUENCY [MONTHS]							
	UNIT WITHOUT POWER SUPPLY								
		0.5	1	3	6	9	12	24	OTHERS
ELECTRIC AND CONTROL SYSTEM	Cleaning the electrical control box		X						
	Ground connection inspection				X				
	Insulation of the electrical installation inspections				X				
	Check tightness of electrical power connections			X					
	Inspect the correct location of the power fuses						X		
	Fan contactors inspection			X					
	Inspection of the condition of the transformers								To request
	Control cards inspection								To request
	Wiring inspection				X				
	Display inspection								To request
	Inspection of pump starters and contactors				X				
	VFD inspection, if any		X						
	Cleaning filter box fans				X				
	Replacement of force fuses (15.000 hours or every 3 years)								3 years
HEAT EXCHANGERS	Replacing panel fans (every 5 years), if any								5 years
	Check direction of rotation (rotary heat exchanger case)				X				
	Check condition of the exchange matrix		X						
	Cleaning, lubrication of bearings (if applicable)								
	Engines (according to motors section)				X				
	Alignment of the heat exchanger (rotary heat exchanger case)		X						
	Checking the status and functionality of the dampers		X						
	Cleaning of slats and frames		X						
DAMPERS	Cleaning, lubrication slats hinges				X				
	Set screw tightening				X				
	Verification of rods and drives			X					
	Verification of opening and closing systems			X					
	Inside								In each revision
PHOTOGRAPHIC RECORD	External								In each revision



MAINTENANCE PERIODS									
UNIT WITH POWER SUPPLY		FREQUENCY [MONTHS]							
		0.5	1	3	6	9	12	24	OTHERS
INSTALLATION	Check derivations (Fluke)						X		
	Check unbalance of voltages with stopped unit (V, F1/F2/F3)				X				
COILS	Valve opening and closing check		X						
	Valve seat/closing level check		X						
FANS	Check direction of rotation		X						
	Variable speed fan operation check		X						
	Checking dirty filter warning function		X						
	Air bypass check on filters and frames				X				
	Verification of vibration level, Alarm verification.		X						
ADIABATIC HUMIDIFIERS	Check the limit probe, if any		X						
	Functional test on the conductivity meter: calibration, if applicable				X				
	Functional test on the sterilization device: repair if necessary			X					
	Verification of automatic stop mechanism			X					

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MAINTENANCE PERIODS		FREQUENCY [MONTHS]							
UNIT WITH POWER SUPPLY		0.5	1	3	6	9	12	24	OTHERS
ELECTRIC AND CONTROL SYSTEM	Control voltage check		X						
	Checking the contactors and thermal sensors of the fans				X				
	Checking the variable speed control of fan motors		X						
	Check flow switches at minimum airflow rate (if any)		X						
	Checking the dirty filter differential pressure sensor		X						
	Checking temperature sensors (if any)		X						
	Checking accumulated alarms (if any)		X						
	Checking the control operating parameters (configurations and setpoints), if any		X						
	Verification of external communications (if any)		X						
	Check configuration tables (motor, setpoints, calibrations, etc.), if any		X						
	Check the VFD (if any)		X						
	Smoke detector test (if any)		X						
	Air quality sensor check (if any)		X						
	Checking remote control and control sensors (if any)		X						
	Verification of indoor lighting (if exists)		X						
	Contactor and thermal devices of other components (if any)		X						
DAMPERS	Check dampers operation (if any)		X						
	Checking security devices (if any)		X						
	Inspection of noises or vibrations. Checking alarms.		X						
	Verification and ciability of the direction of rotation		X						

In this table a quick selection of the main points to be reviewed has been included. The indications considered in the corresponding manual section, the electrical and/or hydraulic connections (if applicable) and the manual for each component (if applicable) must also be consulted. For the elements that do not appear in this table, go to their section in the manual or to the manufacturer's manual. To maintain the warranty of the unit it is required a record of maintenance in accordance with these indications.



14. ANOMALIES MANAGEMENT

The problems that take place in the Air Handling Unit can be related to the improper use of their components. Below are possible causes of frequent failures in the equipment and its commissioning:

SECTIONS	POSSIBLE ANOMALIES	PROBABLE CAUSES
VENTILATION	INADEQUATE AIRFLOW	Incorrect motor speed. Lack of intensity in the power circuit or insufficient motor power.
		Incorrect fan speed (check transmission ratio).
		Wrong direction of rotation. Reverse polarity in the connection terminal.
		Incorrect regulation (clogged tubing, regulating probe/frequency inverter damaged).
		Electromagnetic noise over regulation (electrical and control cable not wired in independent channels or unshielded cable).
		Lack of tension in the drive belts.
		Inadequate transmission ratio.
		Insufficient space available in fan section.
		Pressure drop different from the project
		Uncalibrated closures.
		Leakage.
		Incorrect placement of components, doors or panels.
		Excessive filter clogging or absence of filters in the equipment.
	INADEQUATE POWER CONSUMPTION	Incorrect work point (pressure drops in the installation different from the project ones).
		Insufficient motor power.
		Incorrect power supply.
COILS	INSUFFICIENT THERMAL POWER	Insufficient airflow
		Insufficient fluid flow.
		Water inlet temperature higher than projected.
		Air intake temperature lower than projected
		Excessive dehumidification (high absolute humidity) causes reduction of sensitive power
		Insufficient valve authority does not allow correct regulation
		Incorrect hydraulic connections
		Incorrect water regulation (setpoint, temperature probes wiring, valve actuator wiring)
		Air problems in the coil (malfunction of the coil vent or incorrect filling). It can be detected with an alteration of flow rate and/or fluid outlet temperatures.
	Consider that, in many cases, the problems of improper operation in the coils result from incorrect information in the project definition phase. An incorrect determination of the design conditions will lead to an unexpected operation, not satisfying the operating needs in a percentage (indeterminate) of situations. If this situation occurs, the possibility that the regulation of water flow and temperature are sufficient to satisfy the requirements (evaporation-condensation in case of DX coils) should be analysed.	

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SECTIONS	POSSIBLE ANOMALIES	PROBABLE CAUSES
HUMIDIFIERS	INSUFFICIENT WETTING	Lack of current in the power supply circuit or insufficient power in the motor.
		Existence of dirt, inadequate water (for example, demineralized water in humidification by electrodes) or excessive bacteriological contamination.
		Adiabatic humidifiers: problems in the operation of the pump due to lack of water in the tank (problems in the regulation of the buoy).
		Water supply and/or clogged water drain
		Maintenance and/or improper start-up procedure (see component installation, use and maintenance manual)
BURNERS	INSUFFICIENT POWER	Excessive airflow.
		Insufficient fuel supply.
		Inadequate supply conditions to the burner.
		Leaks in the fuel supply pipes.
		Dirt in the components.
		Maintenance and/or improper start-up procedure (see component installation, use and maintenance manual).
CONDENSATE TRAYS	ABSENCE OF DRAINAGE	Improper dimensioning of the siphon (check overpressure/depression situation).
		Insufficient slope in the drain pipe.
		Empty siphon in depression sealing the drain.
		Obstruction in drainage pipe and/or siphon.
UVC EMITTERS	LAMP DOES NOT TURN ON	Incorrect power supply.
		Need to change the tube of the luminaire.
	IT TAKES 5 SEC. TO START	Incorrect power supply.
		Need to change the tube of the luminaire.
	LOW PERFORMANCE (RADIOMETER READING)	Incorrect voltage line.
		Need to change the tube of the luminaire.
	OPEN CIRCUIT DETECTED	No continuity of the lamp tube. The resistance is not correct (2 to 3,5 Ohms). Through the pins for each end. Check with the provider for more information.
	OTHERS	Maintenance and/or improper start-up procedure (see component installation, use and maintenance manual).
SOUND ENVIRONMENT	EXCESSIVE NOISE LEVEL	Vibration in the Air Handling Unit components
		Poor condition of anti-vibration supports (in the motor-fan group and/or in the unit support).
		Bearings in poor condition.
		Work point of the fan different from the project one
		Incorrect position of the dampers
		Existence of strange elements inside the Air Handling Unit.
		Problems in the start of the fan.
		Location of the unit at an appropriate distance from the area affected by the noise. Verify attenuation/generation of noise in ducts.

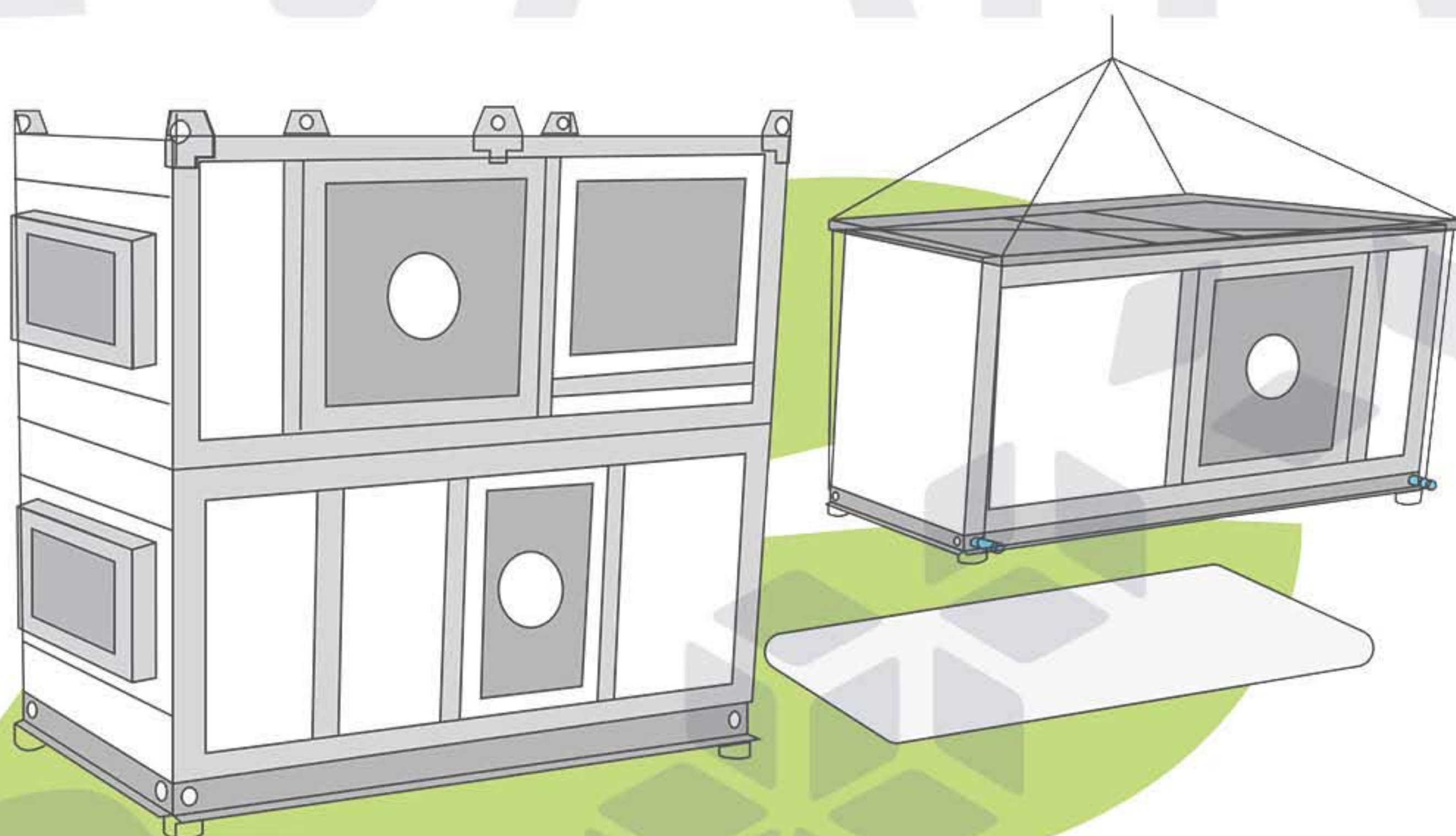


SECTIONS	POSSIBLE ANOMALIES	PROBABLE CAUSES
CONTROL SYSTEM	ELECTRONIC OR CONTROL PROBLEMS	In an Air Handling Unit with control elements, faults can occur due to the possible existence of power peaks.
	The correct action before the problems in electronic and/or control devices is, prior to its replacement, to verify that the problems are not due to the incorrect action of the mechanical elements of the Air Handling Unit.	
	In case none of the previous causes is a reason for the malfunction in the unit, or the problems are different from those commented, you must consult the manual of the component itself and/or contact EVAIR.	

NOTE: It is advisable to start the problem review by a wiring check of the electrical panel and logic of the signals of the equipment controller.

15. UNIT DISASSEMBLY

Inside the Air Handling Unit there are several components, each of them having different requirements, both maintenance that have already been referred to throughout the manual, as constructive and disassembly. So that, when disassembling and eliminate the unit, each one of them must be separated and recycled in a different way. The recycling of the components must be carried out in accordance with the local regulations for the location of the machine. If it is not clear, contact EVAIR and / or the corresponding authorities.





EVIAIR



EVIAIR

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