

**LENNOX**

Think far\*

# Installation, operating and maintenance

## CLEANAIR

23LX

Modular air handling unit

1000 → 100000 m<sup>3</sup>/h



CLEANAIR-IOM-0409-E



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Our company is member of the Eurovent certification program. The CleanAir 23LX Lennox air handling units are tested and rated in accordance with Eurovent certification program.



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## INTRODUCTION

The scope of this manual is to ensure a correct installation, commissioning and maintenance of the air handling unit; it is therefore of fundamental importance that:

- The following instructions are read with all due attention
- The unit is installed, commissioned and maintained by qualified personnel
- The manufacturer declines all responsibility and the guarantee is annulled in the case of mechanical or electrical modifications.
- Unauthorised modifications or procedures not contained in this manual decline the guarantee.
- Local security regulations must be observed.
- Check that the electrical supply is suitable for the data on the unit identification plate on the fan section door.
- The present manual and wiring diagram, where supplied, must be kept safe and available for authorised staff.
- The packing materials (plastic film, polystyrene, nails etc) are a source of danger and must be kept out of the reach of children and properly recycled according to local laws.
- The unit must be used exclusively for the use for which it was designed as shown in the TECHNICAL DATA SHEETS.
- Any use different from the design absolves the manufacturer from all responsibility
- Shut down the unit in case of breakdown or malfunction.
- Eventual repairs must be carried out by personnel authorised by the manufacturer and original spare parts must be used.
- Failure to respect the above can compromise the safety of the unit.
- The manufacturer declines all responsibility for damage which may be caused directly or indirectly to people or things if the present instructions are not respected.

### TECHNICAL DATA

Please see data sheet attached to the specific unit

### SOUND LEVELS

Please see data sheet attached to the specific unit

### DIMENSIONS

Please see drawing attached to the specific unit

## FUNCTIONAL LIMITS

Component			Limit	Note
Casing	Max. pressure	Pa	2000	
	Max. negative pressure	Pa	2000	
Water coils	Max. operating pressure	kPa	2000	
	Max. tube side temperature	°C	120	Higher values on request; in that case see datasheet attached to the unit
	Min. tube side temperature without glycol	°C	5	
	Max face velocity without eliminator	m/s	2.5	Cooling coils with probabile condensation
Plate recovery units	Max. differential pressure	Pa	800	
Humidifiers	Max face velocity without eliminator	Pa	2.6	
Fans	Max. rotational speed	rpm	As supplied	Contact after sales service before modifying the drive
	Max. absorbed power	kW	As supplied	See in stalle power on data sheet su scheda tecnica. Contact after sales service before replacing the motor

### USE

The unit has been designed for air treatment as shown on the attached data sheet (in general this could include air movement, mixing of two airflows, different levels of filtration, heating, cooling, humidifying, dehumidification, and attenuation).

### SAFETY PRINCIPLES

The unit has been designed and constructed to avoid risks to the health and safety of people.

With this in mind solutions have been adopted to eliminate possible causes of risk wherever possible or to sensibly reduce the event of risk. Where it has not been possible to intervene in the design stage please refer to the instructions found in the section LATENT RISKS

## STANDARDS AND CERTIFICATES

### PRODUCT STANDARDS

LENNOX airhandling units are produced following the procedure in:  
 EN1886:1998  
 EN13053:2001

Product designed and manufactured under a quality management system certified ISO 9001.

### CE STAMP

LENNOX products are supplied with the CE stamp in according to the following European Community legislation, including the latest modifications, and with the relative national legislation. The conformity declaration is supplied as a copy together with the product.



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## LATENT RISKS

Latent risks are identified as all those risks which cannot be completely eliminated by design or mechanical protection

### SAFETY INSTRUCTIONS

#### ATTENTION!

THIS CHAPTER INDICATES EVERY OPERATION WHICH CAN GENERATE A RISK SITUATION AND SAFETY MEASURES TO BE APPLIED TO SPECIFIC CASES

All units are supplied with warning pictograms

The units are safe, as long as they are not tampered with and safety devices are left in place.

The technical preparation, the adherence to the safety procedures in this manual and the warning devices ensure safe operation

During installation, start up, running and maintenance of the units the following safety rules must be respected:

#### BANS !

- The unit must not be run unless the earthing of electrical components and the unit itself have been connected to the earthing network of the building.
- The unit must not be run without a ducting connection or protection grille on the fan outlet.
- The unit must not be used as a support for other machinery
- The unit must not be used as a walkway or scaffold.
- The unit must not be used as a store for tools, spare parts, etc.
- Do not open fan section doors when the fan is running, particularly on sections in positive pressure.
- Do not leave doors partially open; check the all door handles or wing nuts are perfectly closed.
- Personnel should not be exposed to the light in germicide lamp sections.

#### IT IS OBLIGATORY

- To wear suitable protection before commencing work on the unit.
- To cut off all electrical supplies to the unit before starting work. In particular, before opening fan inspection doors make sure that the fan cannot be restarted without the consent of the person in the fan section.
- To reinstall the protection grille on the fan section before restarting the fan

#### ATTENTION!

- Check that the centre of gravity of the unit is not off centre before lifting the unit
- Check that the lifting cables and hooks are securely fixed before lifting
- Beware of corners on the inside of the unit.
- Beware of the corners of weathering roofs on external units.
- Beware of the possibility of scalding from heating coils
- Beware of the possibility of scalding from steam humidifiers.
- Beware of automatic dampers which may close unexpectedly

### DANGEROUS ZONES

The illustration below shows the area in which only authorised personnel should operate.

-The danger zone around the unit is clearly shown and the same area should be respected in the case of a suspended unit.

-Internal danger zones are all those zones which can only be accessed by the removal of protection devices or panels.



## RECEPTION/POSITIONING

### IDENTIFICATION OF UNIT

The unit is identified by the plate shown here. The plate shows the type of unit (series and size), the serial number, the main functional data and the year of construction.

The identification plate is to be found on the supply fan section door on the inspection side of the unit.

The identification plate must not be removed for any reason.

MODELLO/MODEL	<input type="text"/>	
N°MATRICOLA/SERIAL NO.	<input type="text"/>	
	<i>MANDATA SUPPLY</i>	<i>RIPRESA RETURN</i>
PORTATA/FLOWRATE m <sup>3</sup> /s	<input type="text"/>	<input type="text"/>
POTENZA/POWER INPUT kW	<input type="text"/>	<input type="text"/>
POLI/POLES	<input type="text"/>	<input type="text"/>
VOLT/PH/HZ	<input type="text"/>	
MASSA/WEIGHT kg	<input type="text"/>	
DATA/DATE	<input type="text"/>	

### RECEPTION PROCEDURE

The units are normally shipped without packing except for wooden feet at the corners of the various sections which compose the airhandling unit. On request they can be shipped on pallets, in crates and/or with nylon protections on the openings.

On arrival check that the unit has not been damaged during transport and that the unit is complete with all the sections as ordered. In the case of visible damage the transport document should be marked with "RECEIVED WITH RESERVE AS DAMAGE IS EVIDENT". This is important in the case of an eventual insurance claim.

### IMPORTANT

ALL THE FOLLOWING OPERATIONS MUST BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT SAFETY LEGISLATION. THIS APPLIES BOTH TO THE TOOLS USED AND THE OPERATIONS CARRIED OUT.

### ATTENTION!

BEFORE MANOUVERING THE UNIT CHECK THAT:

- THE CRANE OR LIFTING DEVICE IS CAPABLE OF LIFTING THE WEIGHT OF THE UNIT.
- THE CENTRE OF GRAVITY IS NOT OUT OF CENTRE
- THE WEIGHT OF THE SECTION CAN BE FOUND ON THE DRAWING OF THE UNIT.

### BEWARE

- MOVE THE UNIT WITH CARE
- KEEP DRY
- DO NOT PLACE OTHER OBJECTS OR MACHINERY ON TOP OF THE UNIT.

## POSITIONING

Particular care must be taken during loading, unloading and transport. The units supplied with corner feet can be easily lifted by fork-lift or with proper lifting belts or chains.

The main sections are supplied with a base profile complete with lifting holes into which lifting hooks or 2 inch diameter tubes may be inserted for lifting with cables.

Units without base frames are supplied with suitable lifting lugs.

- ! Do not leave the unit suspended in the air.
- ! When moving the unit do so only at slow speed and beware of slopes.
- ! Be careful when unloading the unit from the truck, during the positioning and assembly of the unit sections to avoid damage to the unit casing and delicate components.
- ! The various sections should be loaded and unloaded with particular care being taken to avoid damage to protruding parts: hinges, door handles, pipe connections etc. which should not be used as handles while positioning.



## STORAGE

If the units are not installed immediately they should be stored in a dry place protected from the weather. Protect from: sun's rays, rain, sand and wind.

- Maximum temperatures: 60°C minimum -10°C
- Maximum relative humidity 90%
- The above conditions guarantee protection from oxidation.

The manufacturer does not supply, unless specifically requested, units with protection against rain and dust or similar hazards on the air inlets and outlets. Where supplied these protections should be removed when positioning is carried out.

! Important: the outside of the unit panels are protected by a layer of plastic film (except for units with plain galvanized panels) The protective film should be removed within two weeks of the units exposure to the weather: If left longer than this period removal could become **impossible** to remove.

## UNPACKING

During the removal of eventual packing personnel should wear proper protective clothing (gloves, glasses etc.) Check for visible damage.

Dispose of packing materials in a proper manner at waste recycling centres (observing local bylaws) Remove PVC and polystyrene packing taking care not to damage the unit.

## WEIGHT DISTRIBUTION AND CENTRE OF GRAVITY

The weight of the unit can be found on the drawing supplied with the unit.

Check the position of the centre of gravity by slightly raising the unit very slowly, before raising completely for positioning.

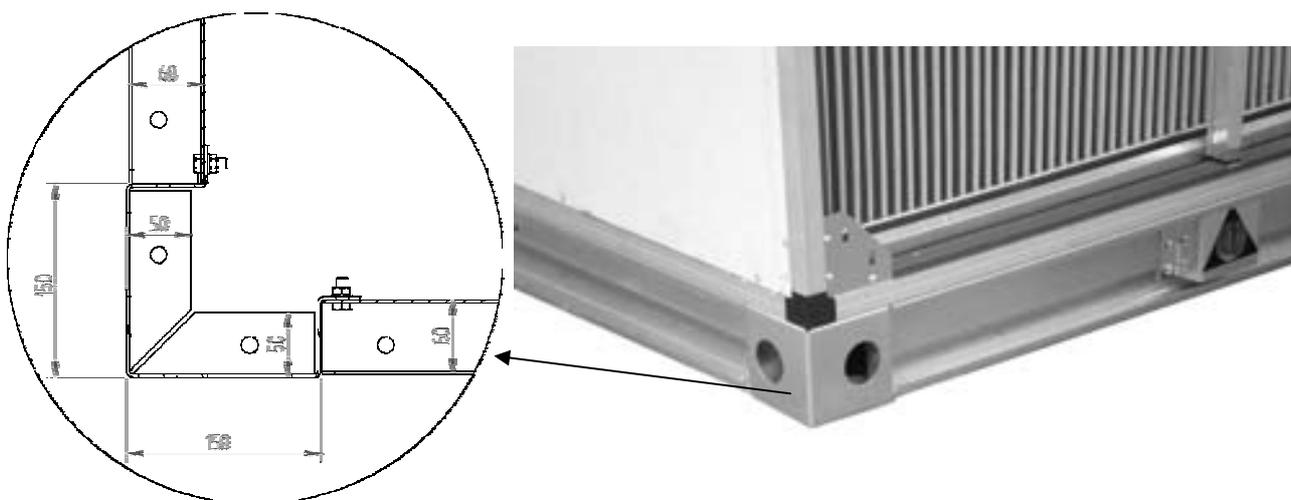
## POSITIONING AND ACCESS SPACE

The load capacity of the floor on which the unit is to be placed should be checked before positioning the unit after which the following instructions should be adhered to:

- The surface on which the unit is to be installed should be perfectly flat to avoid stress on the unit panels and frame during the joining of the unit sections.
- The use of a spirit level is indispensable and shims should be inserted below the unit if necessary, to permit the correct opening of the access doors.
- The unit can be installed directly on any floor capable of supporting the unit's weight.
- It is however, good practice to position the unit on a concrete or steel base.
- Normally it is not necessary to install antivibration mounts below the unit since the internal moving parts are already isolated from the unit structure. If special conditions require that the entire unit is supported on antivibration mounts, please contact the manufacturer.
- Suspended units should be attached to the ceiling by drop rods or other means which have been calculated to support the unit's weight.

The base frame is formed by a "C" in 2.5mm thick galvanized sheet steel. Depending on the size of the section, as shown in the table, the base is continuous around the whole perimeter of the unit, for medium-large sections and with mounting feet or base frame on the longer sides only for smaller units. Medium large units have additional transversal bracing.

The base frame of all sections are provided with four corner mounting feet with lifting holes suitable for the insertion of heavy section 2 inch diameter tubes.



Section type	Size 23LX	Section width [mm]	Base type (at ground level)
General	all	$\leq 1190$	4 feet and 2 longitudinal beams
General	all		4 feet and 4 beams
Crossflow heat recovery unit	$\leq 07013$	$> 1190$	4 feet

The installer must ensure that the position of the unit is sufficient to permit all the necessary maintenance and parts replacement procedures. In particular:

- At least on one side of the unit, sufficient space should be left to permit the withdrawal of the unit coils ( normally approximately the width of the unit)
- On the side of the unit fitted with access doors sufficient space should be left to completely open the doors, not less than 600mm
- Before positioning the unit the size of the condensate drain siphon should be calculated along with the slope of the drain pipe.
- Particular care should be taken when installing the gaskets between sections.
- If a weathering skirt is to be fitted to the base of the unit care should be taken to avoid water infiltration.
- The unit mounting base should be of sufficient height to avoid water or snow infiltration.

To limit the risk of damage you should:

- Protect the unit casing when lifting with cords or chains a spacer bar should be inserted between the lifting cords.
- Lower the unit gently into place, lowering the unit brusquely may cause rivets to shear or other damage.
- If the unit has a weathering roof already installed check for loose screws or other damage.
- External units require extra care for the motives already explained and also for the correct installation of the weathering roof which can be subject to wind damage.
- If the weathering roof is to be site installed check the inventory of the materials supplied: roof sheets, reinforcements, screws, etc.
- Particular care should be taken when installing the gaskets, if necessary, use also a silicone sealant.

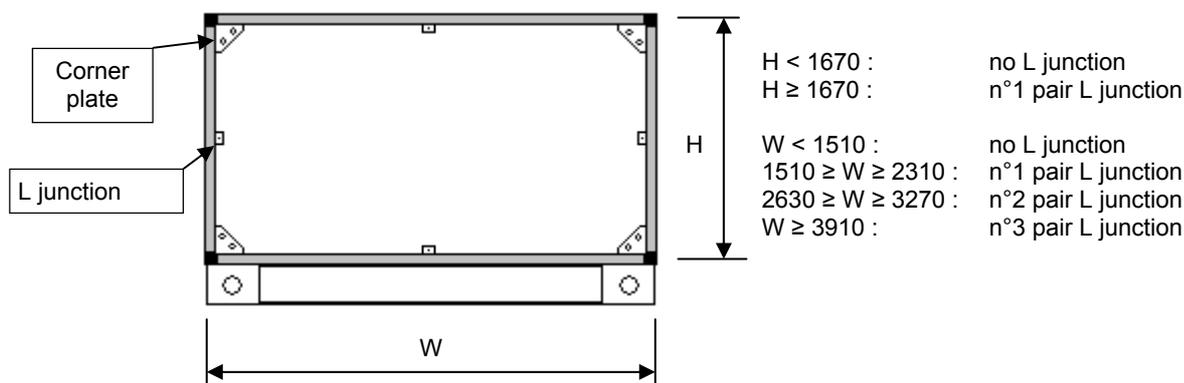
### ASSEMBLY SECTIONS

The units are often supplied in sections: In this case the installer must join the various sections together on site.

This operation is carried out using the materials provided, to be found in the inside of the unit sections:

- Apply the selfadhesive gasket to the aluminium unit frame of one of the two sections to be joined together.
- Screw the angle reinforcement plates together
- Screw the "L" plates together.

Note: in some cases it may be necessary to remove the front and rear panels which are simply screwed to the unit frame.



### ASSEMBLY OF HEAT RECLAIM SECTIONS

Due to their size the heat reclaim sections are shipped separately and units above the 07xx size are supplied partially disassembled. In these cases particular attention must be paid to these delicate components.

- Check that the gaskets and silicone sealing do not permit any air bypass.
- If fitted check that the bypass damper functions correctly and closes perfectly.

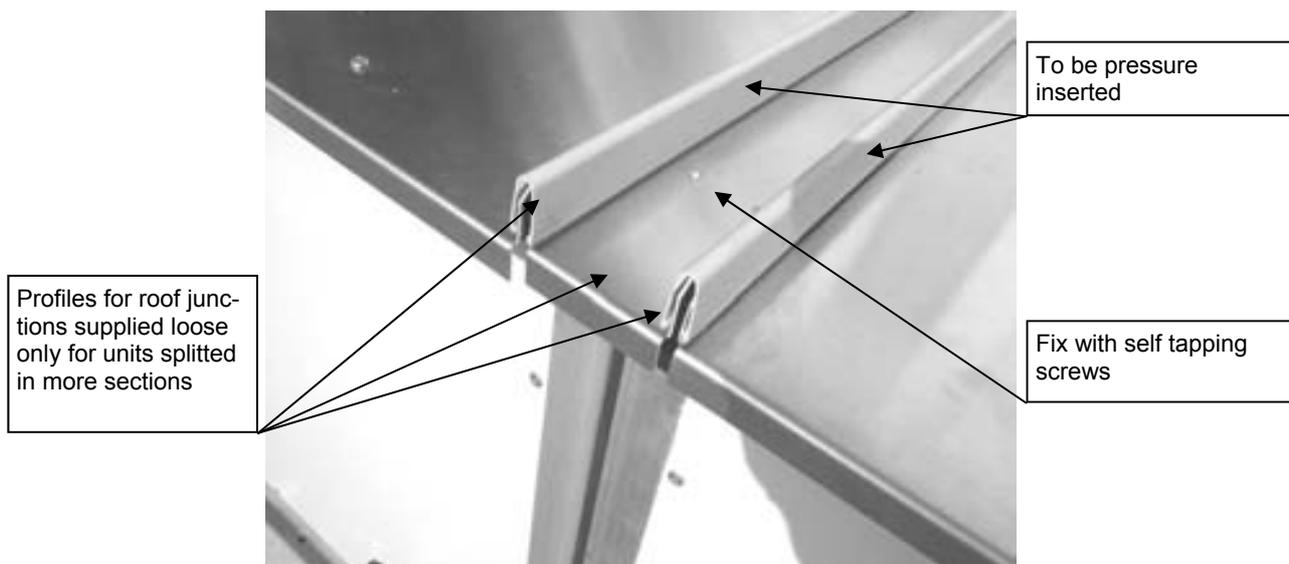
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- Check that the gaskets and silicone sealing do not permit any air bypass.
- If fitted check that the bypass damper functions correctly and closes perfectly.

### INSTALLATION OF WEATHERING ROOF

On units with weathering roof in two or more sections the weathering roof must be finished on site by installing distance pieces and plastic joint coverings as shown.



### EQUALISERS

Fans which blow into any type of plenum are supplied with equaliser air spreader plates which are supplied loose. The installation is very simple with pre-drilled holes and screws

## DUCTING, WATER AND ELECTRICAL CONNECTIONS

### DUCTING CONNECTIONS

When connecting supply and return air ducting it is recommended to install cloth flexible connections. Even if these are not supplied with the unit it is recommended that the flexible connections are not stretched when installed.

To install the connections:

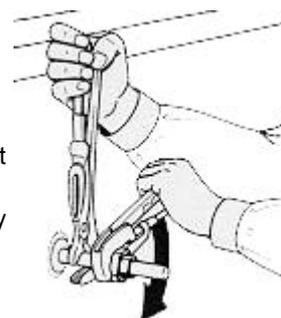
- apply a gasket to the flange to avoid air leakage
- tighten all screws included the less accessible ones
- apply silicone for a perfect seal

Note: the flexible connections can be screwed directly to the unit's aluminium frame or to the panel at the fan outlet.

### WATER CONNECTIONS

It is recommended that:

- Isolating valves are installed on any component which may need to be replaced without emptying the piping system.
- Install thermometers on the entrance and exit of heat exchangers to aid maintenance.
- Install a water filter on coil inlet pipes.
- When filling the piping network check carefully for any leaks.
- Isolate vibration to coil piping which can cause work hardening and consequent breakage of copper piping.
- Do not apply torsion forces to copper coil and drain connections which are easily damaged



### ELECTRICAL CONNECTIONS

#### ! ATTENTION

ALL ELECTRICAL CONNECTIONS SHOULD BE MADE WITH THE CURRENT SWITCHED OFF. MAKE SURE THAT THE ELECTRICAL PANEL AND LOCAL ISOLATING SWITCHES ARE IN THE OFF POSITION.

- The airhandling units are supplied without electrical panels. The installer should connect the motor or other electrical apparatus to the control panel.
- Pay particular attention that:
- The electrical connections are made by qualified personnel.
- The connection cables must be protected against short circuiting and overload by approved electrical apparatus which conform with local regulations.
- The cable cross section should be sufficient for the rating of the overload protection device the temperature, type of installation, the number of cables in the cable tray and cable insulation. Refer to the relative tables according to local regulations.
- It is of fundamental importance that the equipotential and earthing network is installed with due care, using cables of suitable crosssection and quality (see local regulations). It is important that the protection cable runs parallel to the nearby power cable.
- Power supply cables should be dimensioned taking into consideration the values of , absorbed current and start up current shown on the motor label.

## **WATER COIL CONNECTIONS**

### **! DANGER OF SCALDING**

- The coils must be connected as indicated on the labels; the water must flow in counterflow to the direction of airflow in order to obtain the maximum efficiency of the coils.
- An air vent should be installed for every coil at the highest point in the system.
- We do not advise dimensioning the diameter of the connecting pipework based on the diameter of the coil - connections since these are standardized by the coil manufacturers.

The coil connection pipework must allow for easy coil withdrawal from the unit.

- The weight of the coil connection pipework must not be borne by the coil connections: install suitable piping supports.
- The overheating inside the unit when the fan is not operating constitutes a danger! The accidental halt of the fan will cause an overheating of the stagnant air within the unit casing with relative damage to the motor, bearings, insulation and plastic components. The system should be supplied with a suitable device which closes the water supply to the heating coil in the event of a fan failure.
- To avoid frost damage to the coils when the temperature is below 3°C add antifreeze to the system or completely drain the system. These precautions are principally for units which function intermittently.

## **STEAM COIL CONNECTIONS**

### **! DANGER OF SCALDING**

All the steam coils have the tubes inclined towards the condensate header to facilitate drainage, in some cases the tubes may be vertically installed.

- The coils must be connected as shown on the pictogram labels: the steam should be connected to the upper connection, which is normally of a larger diameter than the lower condensate connection.
- The steam piping should not be sized by using the same diameters as the coil connections since these are standardized and chosen by the coil manufacturer.
- The steam piping must be installed to allow for easy removal of the coil from the unit.
- The coil connection must not be used to support the steam distribution piping: suitable piping supports should be provided.
- The overheating inside the unit when the fan is not operating constitutes a danger! The accidental halt of the fan will cause an overheating of the stagnant air within the unit casing with relative damage to the motor, bearings, insulation and plastic components. The system should be supplied with a suitable device which closes the steam supply to the heating coil in the event of a fan failure.
- To avoid damage to the coil, (pipe hammering) particular care should be paid to the choice of steam regulating valve and condensate drain trap.
- Avoid pockets of condensate in the coil, in the coil headers, and in the supply pipework.
- Every steam coil should be equipped with its own condensate drain trap

## **DIRECT EXPANSION COIL CONNECTIONS**

- The connection of the direct expansion coils must be carried out by a qualified refrigeration specialist.
- The coil piping is protected from humidity by a charge of nitrogen. The headers should therefore only be opened when they are to be connected to the distribution piping.
- The coil must be connected as shown on the pictogram labels. The refrigerating fluid must flow through depth of the coil in the opposite direction to the airflow in order to have the maximum cooling effect.
- We do not advise dimensioning the diameter of the connecting pipework based on the diameter of the coil connections since these are standardized by the coil manufacturers.
- The coil connection pipework must allow for easy coil withdrawal from the unit.
- The weight of the coil connection pipework must not be borne by the coil connections: install suitable piping supports.
- It is indispensable that the refrigerant flow to the coil is shut off automatically when the unit fan is not functioning.

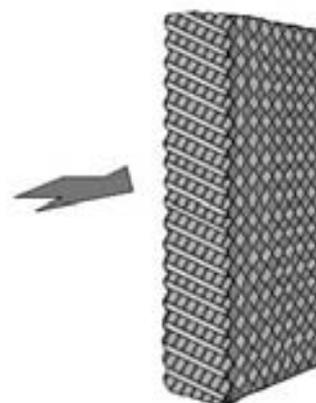
## RUN AROUND COILS

- The coils must be connected as shown on the pictogram labels; the fluid must flow through the coil depth in the opposite direction to the airflow in order to obtain the maximum heat exchange.
- Install an air vent for each coil in the highest point of the piping system.
- Install a drain point for each coil in the lowest point of the piping system.
- We do not advise dimensioning the diameter of the connecting pipework based on the diameter of the coil connections since these are standardized by the coil manufacturers.
- The coil connection pipework must allow for easy coil withdrawal from the unit.
- The weight of the coil connection pipework must not be borne by the coil connections: install suitable pipework supports.
- To avoid frost damage to the coils when the temperature is below 3°C add antifreeze to the system or completely drain the system. These precautions are principally for units which function intermittently.
- Pump, expansion vessel and piping are not supplied.

## CONNECTIONS OF ELECTRIC COILS

The connection of the coils should only be carried out by a qualified electrician.

- The coils must be connected as shown on the wiring diagram supplied with the unit.
- It is indispensable that the manual reset safety thermostat is connected to coil supply switch.
- It is indispensable that the coil shuts down automatically when the unit fan is not working. The coil should switch off automatically at least 2 minutes before fan shutdown to permit the coil to cool down.



## EVAPORATIVE PACK AND WASTE WATER HUMIDIFIERS

! Attention: the evaporative packs mounted in the humidifiers have a predetermined position with regard to the airflow and the counterflow water. An incorrectly mounted pack can compromise the correct functioning and may result in water carry over to the downstream section.

- Connect the humidifier to the mains water supply.
- Connect the drain pan.
- Install a siphon on the drain pipe.
- An automatic ONOff valve must be supplied on the mains water supply pipe (not included in standard supply). The valve should be commanded by a humidity sensor or by the unit control panel.
- The mains supply should also be fitted with a water balancing valve (not included in the supply) to regulate the water flow according to the mains pressure.

## EVAPORATIVE PACK AND RECIRCULATED WATER HUMIDIFIERS

! Attention: the evaporative packs mounted in the humidifiers have a predetermined position with regard to the airflow and the counterflow water. An incorrectly mounted pack can compromise the correct functioning and may result in water carry over to the downstream section.

- Connect the humidifier to the mains water supply.
- Connect the drain.
- Install a siphon in the drain pipe.
- Connect the unit pump to the three phase electrical supply using CE approved materials.
- Check that the pump rotates in the correct direction.
- Check the absorbed current.
- The pump should be equipped with an ONOFF automatic control commanded by a humidity sensor or unit control panel.
- The mains water supply should also be fitted with a water balancing valve (not included in the supply) to regulate the water flow according to the mains pressure.

## ATOMIZED WATER HUMIDIFIERS

! Attention: atomized water humidifiers can only operate with osmotized water. The necessary water treatment plant must be installed.

- Install the necessary water piping in stainless steel AISI 304.
- Connect the humidifier to the stainless steel piping network.
- Install the high pressure pipe between the pressurization cabinet and the nozzle spray tree.
- Install a siphon on the drain line.
- Connect the electrical control valve to the pressurization cabinet.
- Connect the three phase electrical supply to the pressurization cabinet with approved CE materials.

## STEAM HUMIDIFIERS

! DANGER OF SCALDING

- Connect the steam control valve ( not included) to the steam distributor.
- Connect the condensate drain of the distributor to the condensate trap and valve ( not included in the supply)
- Connect the condensate drain pan to the drain network.
- Install a siphon on the condensate drain line.

## AIR WASHERS

- Connect the air washer to the water mains.
- Connect the drain connection.
- Connect the overflow connection to the drain.
- Install a siphon on the drain line.
- Connect the three phase pump (or pumps, if two are supplied) to the electrical supply using approved CE materials.
- Check that the pump rotates in the correct direction.
- Check the absorbed power of the pump.

## NOTES ON CONDENSATE DRAINS

The condensate drain pans of the cooling coils and humidification sections are supplied with a 1 inch screwed male connection.

The drain connection is an elbow visible on the access side within a hole in the base frame.

- It is indispensable to install a siphon on the drain line to prevent the fan sucking obnoxious odours or bacteria from the drain system, creating ideal condition inside the airhandling unit for the proliferation of pathogenic germs and micro organisms, also favouring the diffusion of " Legionella Pneumophila" responsible for "Legionnaires' disease"
- A drain connection without a siphon, or with an incorrectly installed siphon, allows air to be sucked into the unit,
- The condensate cannot drain and is carried over into the next section of the unit and the condensate will spill out of the unit, flooding the surrounding area, when the fan is shut down.
- The siphon must not be hermetically connected to the drain line to permit air locks to be broken.
- A siphon in positive pressure must never be connected to another in negative pressure.
- The drain line downstream of the siphon must have sufficient slope to carry away the condensate and its' diameter should be at least the same as the unit drain connection.
- The drain piping can be in various materials: steel, copper, PVC. If the drain line is improperly supported it may deform, create air locks and prevent proper drainage of the condensate.
- It is good practice to insulate the siphon and drain line to prevent the formation of condensate on the outside of the piping. In winter antifreeze should be added to the water in the siphon.
- Beware of evaporation of the water in the siphon during shut down periods. The maintenance personnel should ensure that the siphons are always full.
- The siphon should be equipped with an inspection plug in an easily accessed position.
- The condensate drain pan should be cleaned periodically to avoid stagnant condensate, formation of algae, and encrustations.

## SIPHON CALCULATION THEORY

! If the following rules are not adhered to the siphon will empty and the condensate will not drain.

### DRAIN IN POSITIVE PRESSURE

Formule

$$T = 2 p$$

$$S = T / 2$$

$$H = T - S$$

Example

$$p = 400 \text{ Pa} = 40 \text{ mm c.a.}$$

$$T = 80 \text{ mm}$$

$$S = 40 \text{ mm}$$

$$H = 40 \text{ mm}$$

### DRAIN IN NEGATIVE PRESSURE

Formule

$$T = - 2 p$$

$$S = T / 2$$

$$H = T - S$$

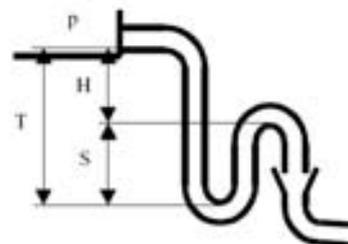
Example

$$p = - 250 \text{ Pa} = - 25 \text{ mm c.a.}$$

$$T = 50 \text{ mm}$$

$$S = 25 \text{ mm}$$

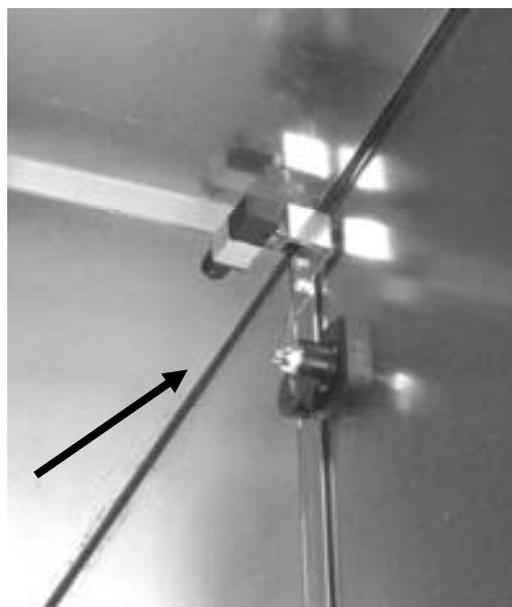
$$H = 25 \text{ mm}$$



## CONNECTION OF MICROSWITCH

The fan sections are equipped with a microswitch and/or a protection grille behind the fan section door.

Where the normally open microswitch is installed it should be connected to the fan supply line switch so that when the fan section door is opened the fan stops automatically.



## CONNECTION OF ELECTRICAL MOTORS

The airhandling units are supplied as follows:

STANDARD single pole motors up to 4Kw

- Direct on line start up 230/400V: delta on 230V star on 400V

STANDARD single pole motors above 4Kw

- Star delta start up 400V: delta on 400V star on 690V

Note: 230/400 motors can also have star delta connections, but only if a 3 phase 230V line is available.

- Remove the cover of the motor terminal box and check that the terminal connections conform with the available electrical supply.
- Connect the power supply to the terminal block including the earth line, according to CE regulations.
- The hole to be made in the airhandling unit panel should be equipped with a proper cable gland.
- The cables on the inside of the unit should be firmly fixed to the inside of the unit to prevent movement due to the airflow.
- The power supply to the motor should be protected by fuses and the absorption of the motor will be controlled by a thermal protection device which should be rated for the data shown on the motors' identification plate.
- To avoid humidity in the terminal block check that the gaskets are properly seated and the cover is screwed on tightly.
- The following diagrams show standard motor connections. Always check however, the motor diagram which is usually found on the back of it's terminal block cover.

## SINGLE SPEED MOTORS WITH D.O.L OR STAR DELTA START UP

### TWO VOLTAGE TYPE MOTORS WITH Y OR Δ START (6 TERMINALS)

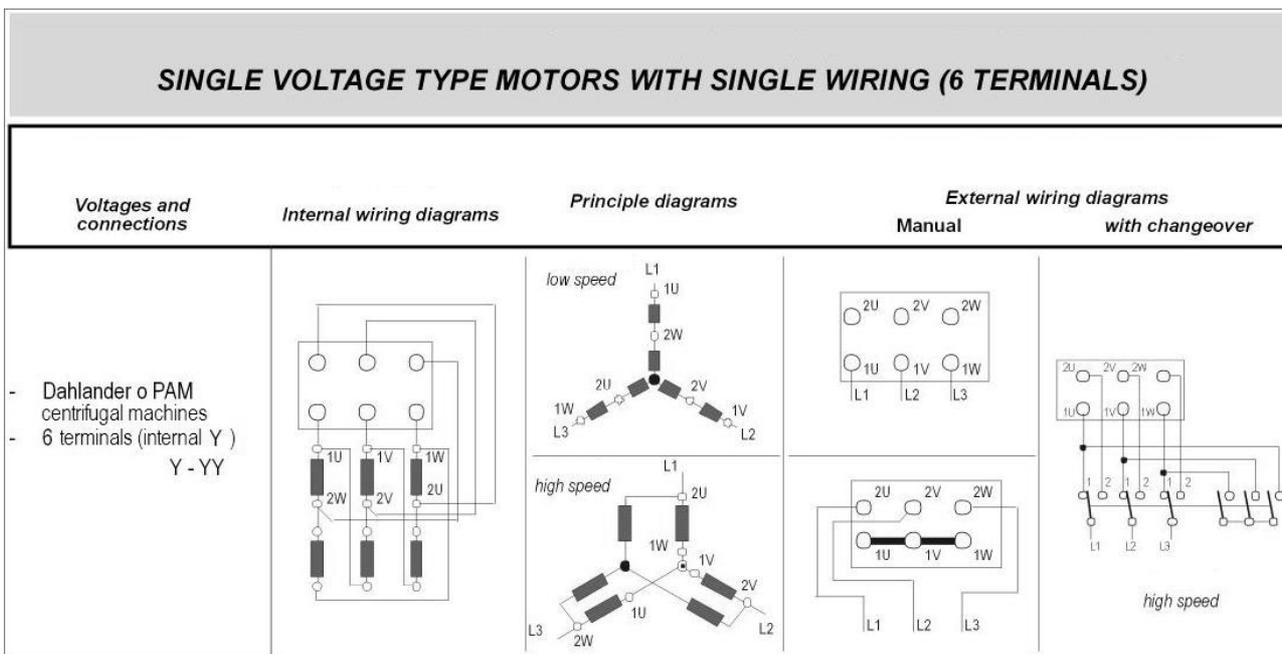
Voltages and connections	Internal wiring diagrams	Principle diagrams	External wiring diagrams	
			direct start	Y/Δ start
<ul style="list-style-type: none"> <li>- Tension : U</li> <li>- Wiring Δ (at lower voltage) es.: 230 V / Δ</li> </ul>				
<ul style="list-style-type: none"> <li>- Tension : <math>U\sqrt{3}</math></li> <li>- Wiring Y (at higher voltage) es.: 400 V / Y</li> </ul>				

## SINGLE SPEED MOTORS FOR PARALLEL/SERIES WIRING

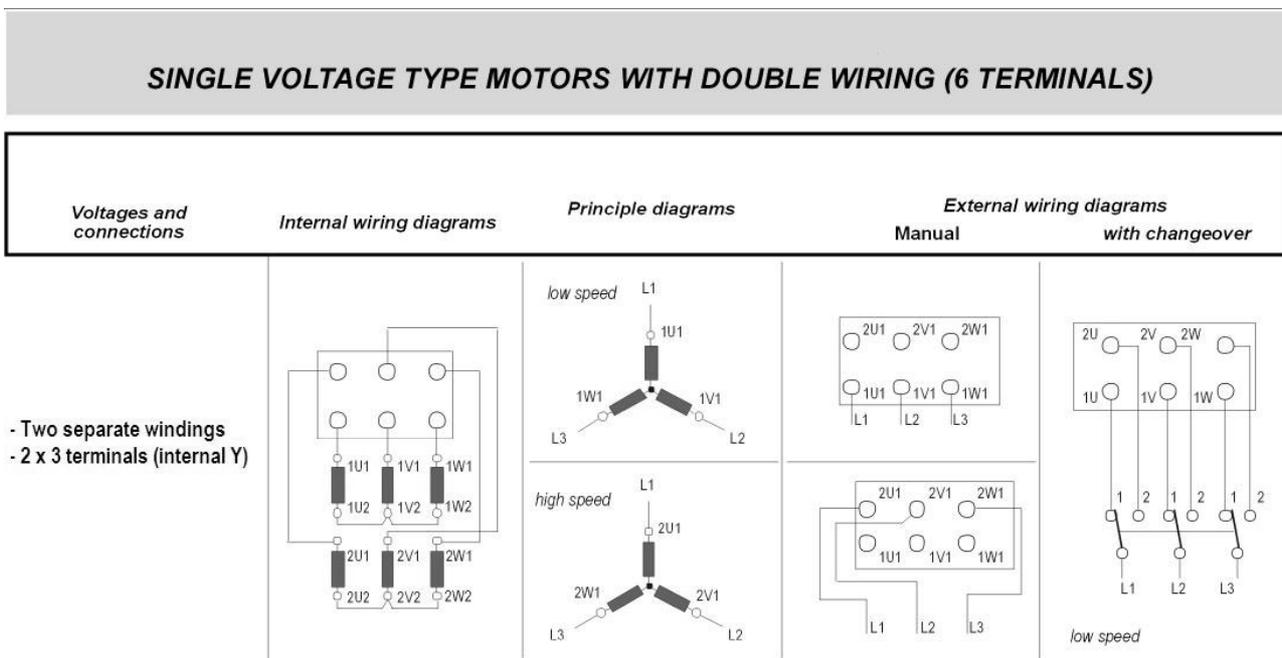
### TWO VOLTAGE TYPE MOTORS WITH SERIAL/PARALLEL WIRING (9 TERMINALS)

Voltages and connections	Internal wiring diagrams	Principle diagrams	External wiring diagrams	
			direct start	Y/Δ start
<ul style="list-style-type: none"> <li>- Tension : U</li> <li>- Wiring : YY (at lower voltage) es.: 230 V / YY</li> </ul>				
<ul style="list-style-type: none"> <li>- Tension : 2 U</li> <li>- Wiring : Y (star at upper voltage) es.: 460 V / Y</li> </ul>				

TWO SPEED DAHLANDER MOTORS WITH D.O.L. START UP



TWO SPEED MOTORS WITH DOUBLE WINDINGS D.O.L. START UP



## TWO SPEED MOTORS WITH DOUBLE WINDINGS D.O.L. OR STAR-DELTA START UP

### TWO VOLTAGE TYPE MOTORS WITH Y, Δ WIRING (12 TERMINALS)

Voltages and connections	Internal wiring diagrams	Principle diagrams	External wiring diagrams	
			direct start	Y/Δ start
<ul style="list-style-type: none"> <li>- Tension : U</li> <li>- Wiring : Δ (at lower voltage) es.: 230 V / Δ</li> <li>- Tension : <math>U\sqrt{3}</math></li> <li>- Wiring : Y (at upper voltage) es.: 400 V / Y</li> </ul>	<p>low speed</p>	<p>lower voltage</p> <p>upper voltage</p>		
<ul style="list-style-type: none"> <li>- Tension : U</li> <li>- Wiring : Δ (at lower voltage) es.: 230 V / Δ</li> <li>- Tension : <math>U\sqrt{3}</math></li> <li>- Wiring : Y (at upper voltage) es.: 400 V / Y</li> </ul>	<p>high speed</p>	<p>lower voltage</p> <p>upper voltage</p>		

#### NOTES:

In order to avoid secondary currents It is recommended to open the triangle for the velocity not powered.

(1) security contact opened during two velocities working

#### ROLL FILTERS

- Consult the wiring diagram provided by the filter manufacturer for the electrical connections.
- Wire the filter drive motor and check the sense of rotation.
- Install the roll of filter media and ensure that it is installed straight to ensure even winding.
- All electrical connections should conform to CE regulations.

#### HEAT WHEELS

- Consult the wiring diagram in the control provided by the heat wheel manufacturer for electrical connections.
- All electrical connections should conform to CE regulations.
- The heat wheel access door must be provided with a microswitch.

## PRECAUTIONS DURING START-UP

- Access doors must be opened with unit off only. Stop the fan before working on the unit.
- When fan is running the access door must be closed to avoid motor's overloading and thermal protection intervention.
- Access doors are equipped with microswitch and/or guard in front of the door: unscrew with proper tool the safety screw for the microswitch and/or the protection guard before accessing the fan.
- According to his size, the fan can need even more than 1 min' before stopping completely. Wait for its complete stop before approaching.



## CONTROL CHECKS BEFORE AND DURING START UP

### ELECTRICAL PANEL (SUPPLIED BY OTHERS)

- Check the calibration of the thermal overloads.

### AIR DUCTING DISTRIBUTION (BY OTHERS)

- Check the position of the dampers on the unit. The blades should be in the design position otherwise the dampers could cause an excessive pressure drop and cause the unit fan to function at the wrong point on it's curve.

### DAMPERS

- Check that the dampers function correctly and avoid running the fan with the dampers in a closed position, which in the case of high pressure fans, could result in structural damage to the unit.

### PRE-FILTERS

- Check that the prefilters (panel or bag) are correctly installed.
- The prefilters must be installed before start up of the unit.
- Check that the filter gaskets are correctly positioned to avoid any air bypass.

### ROLL FILTERS

- Check that the drive chain (where fitted) is correctly aligned and suitably greased.
- Check that the filter media is correctly aligned to insure even winding.

### SOFT BAG FILTERS

!Attention: absolute, active carbon and bag filters should only be mounted after the unit is connected to the ducting system and has run for at least half an hour. This will ensure the removal of the dirt, dust and detrius accumulated in the ducting system during installation and avoid damage and clogging of the non washable filters.

- Check that the bags are free and that there are no obstacles which might impede the passage of air.
- The weak point of bag filters is where the bags are attached to the filter frame when the bags become heavy with dust they tend to break at this point.

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## RIGID BAG FILTERS

!Attention: absolute, active carbon and bag filters should only be mounted after the unit connected to the ducting system has run for at least half an hour. This will ensure the removal of the dirt, dust and detrius accumulated in the ducting system during installation and avoid damage and clogging of the non washable filters.

! Attention: since the filters are made of cardbord and glass fibre they are delicate and should be handled with care.

- Check that the filter gaskets are correctly installed to avoid any air by-pass.

## ABSOLUTE FILTERS

! Attention: the filter cells are extremely delicate, any damage however slight, means that the filter cells must be replaced.

- Check that the filter gasket is correctly installed.
- If neccessary seal any possible bypass areas with silicone.

## ACTIVE CARBON FILTERS

- Check that the carbon cartridges are correctly inserted and that the filter gaskets are air tight.

## DIRTY FILTER DETECTION DEVICES

On request we can supply a differential manometer for pre, bag, and absolute filters. Settings as follows:

- Synthetic and roll filters max 200Pa
- Soft bag filters: 250Pa
- Rigid bag filters: 400Pa
- Absolute filters 600Pa
- As an alternative a visual or acoustic differential pressurestat may be supplied.
- Roll filters are supplied with a differential pressure switch as standard.

## FANS

- Remove the blocking devices fitted below the fan base frame during shipment so that the fan antivibration mounts are free to function.
- Check that the fan and motor pullies are correctly aligned ( see Maintenance section)
- Check that the fan rotates in the same direction as the arrow on the fan scroll.
- After running for one hour, check that the temperature of the fan bearings does not exceed 60°C.
- Measure the absorbed current of the fan motor and compare it with the motor data. When the measured absorbed current exceeds or is below that of the motor data then the presure loss of the ducting system should be checked. Excessive absorbed current, particularly with forward curved fans, means that there is excessive airflow due to low resistance in the ducting circuit. Vice versa a low absorbed current indicates a low airflow due to excessive pressure loss in the ducting system. To correct either of these faults it is necessary to alter the fan speed by changing the transmission. Proper dimensioning and calculation of the system pressure drop will avoid this inconvenience.

## ROUTINE MAINTENANCE

### INTRODUCTION

Maintenance must be carried out only by qualified personnel.

Maintenance personnel must adhere to all local safety regulations.

Before commencing any maintenance operation the unit should be switched off and isolated from the electricity supply.

Warning notices should also be posted that the unit is undergoing maintenance

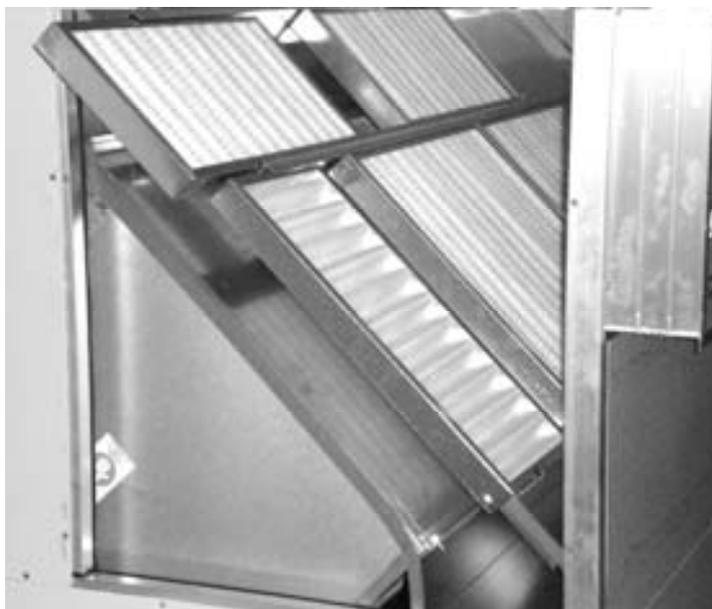
### DAMPERS

For extruded aluminium dampers with interlocking nylon cog wheels the only maintenance necessary is a periodic clean since there are no parts which require lubrication. Dampers with interconnecting levers require periodic lubrication.

### PANEL FILTERS

The pressure drop caused by the filter increases as dust accumulates. When the pressure drop reaches 200Pa the filter should be cleaned or replaced. The frequency of this operation depends on the quantity of dust in the airstream.

- If the filter is fitted with a differential manometer or visual or acoustic pressurestat then the operation is easier otherwise it is necessary to check the filters frequently until a periodic inspection period is established.
- It is good practice to keep a spare set of filter cells to avoid long unit shut down periods, or worse still, the unit functioning without filters.
- The panel prefilters are mounted on slide rails and the filters are slid into the unit from the access side, unless the prefilters are mounted together with the bag filters in the same frame, in which case refer to the bag filters paragraph.
- Where necessary the introduction and extraction of the filters may require the use of a hook.
- The Ushaped slide rails must be clean and the filter cells should be kept well pressed together to avoid bypass of air.



### PANEL FILTERS WITH REGENERATIVE FILTER MEDIA

The filters can be cleaned by:

- simply shaking them by using a vacuum cleaner, making sure that vacuum cleaner is applied to the air on side of the filter.
- by running water always applying to the air on side of the filter.

In the absence of a manometer or pressurestat the substitution of the filters must be left to the good judgement of the maintenance staff.

### METALLIC FILTERS

- Clean with hot water and detergent, or in a bath of caustic soda and oil with mineral oil.

These filters can be washed for two or three times, after which, they should be replaced.

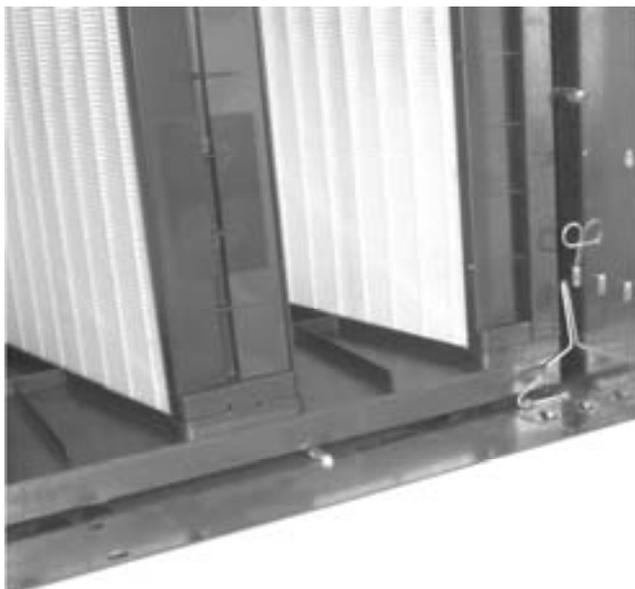
### ROLL FILTERS

- The filter media is not regenerable. Replace with a new roll when finished.

## SOFT BAG FILTERS

The pressure drop increases as dust accumulates. When the pressure drop through the filter reaches max. 250Pa the filter must be replaced. The frequency of this operation depends on the quantity of dust in the airstream.

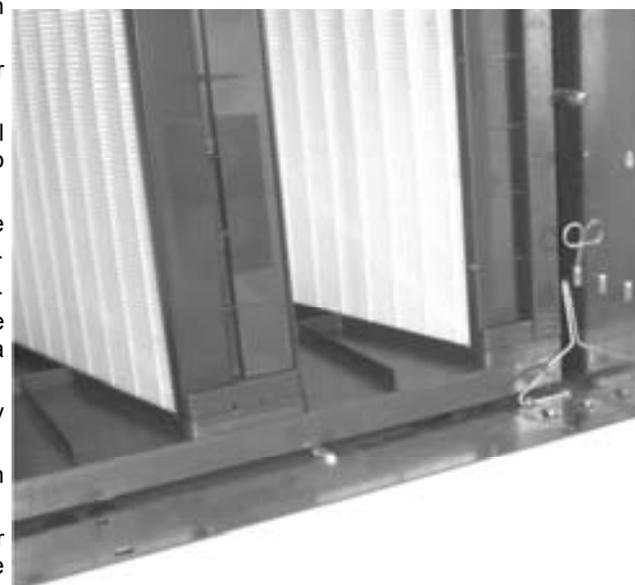
- The unit should be fitted with a manometer or visual or acoustic pressurestat to show the filter pressure drop.
- The bag filters should be inserted in their metal mounting frame.
- The mounting frame has a gasket installed where the filter seats on the frame which ensures an airtight seal.
- The filter cell is fixed to the frame by means of springs.
- Since the filters are not regenerable, they must be replaced. To prolong their life it is advisable to install a panel prefilter.
- The filter frame gasket should be checked at every filter change and replaced if it shows signs of wear.
- Each filter cell has four springs, all of which must be in place to avoid air bypass.
- The dirty filter should be removed with care and the air on side closed with cardboard or similar to avoid the exit of dust from the filter cell.



## RIGID BAG FILTERS

The pressure drop increases as dust accumulates. When the pressure drop through the filter reaches max. 400Pa the filter must be replaced. The frequency of this operation depends on the quantity of dust in the airstream.

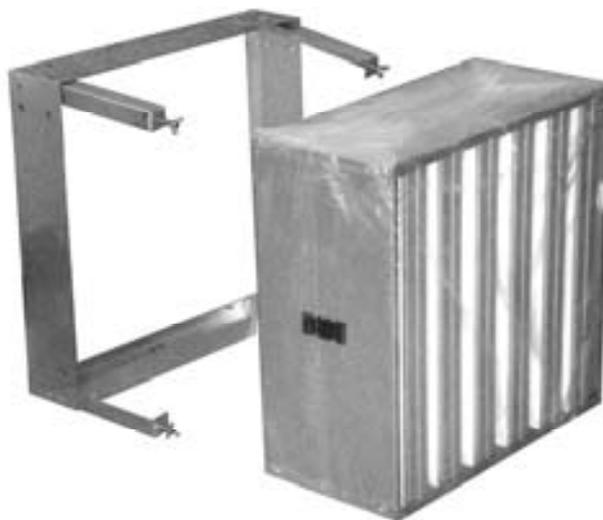
- The unit should be fitted with a manometer or visual or acoustic pressurestat to show the filter pressure drop.
- The bag filters should be inserted in their metal mounting frame. Filters up to F7 efficiency may also be mounted in "U" type slide rails.
- The mounting frame has a gasket installed where the filter seats on the frame which ensures an airtight seal.
- The filter cell is fixed to the frame by means of springs.
- Since the filters are not regenerable, they must be replaced. To prolong their life it is advisable to install a panel prefilter.
- The filter frame gasket should be checked at every filter change and replaced if it shows signs of wear.
- Each filter cell has four springs, all of which must be in place to avoid air bypass.
- The dirty filter should be removed with care and the air on side closed with cardboard or similar to avoid the exit of dust from the filter cell.



### ABSOLUTE FILTERS

The pressure drop increases as dust accumulates. When the pressure drop through the filter reaches max. 600Pa the filter must be replaced. The frequency of this operation depends on the quantity of dust in the airstream.

- The unit should be fitted with a manometer or visual or acoustic pressurestat to show the filter pressure drop.
- EU11 and EU13 absolute filters complete with gaskets are inserted in their metal mounting frames.
- The filter seal is ensured by four thumbscrews which when tightened ensure the airseal.



### ACTIVE CARBON FILTERS

- The cartridges should be replaced when the concentration of the polluting gas exceeds the design limit.

### WATER COILS

- Vent the air from the coils periodically by means of the air vent.
- Wash the coil surface at each change of season.
- Clean the condensate drain pan on cooling coil sections periodically.

### PLATE HEAT EXCHANGERS

- Clean the heat exchanger at regular intervals using a vacuum cleaner or jet of water, taking care not to damage the plates.
- Clean the condensate pan periodically.

### HEAT WHEELS

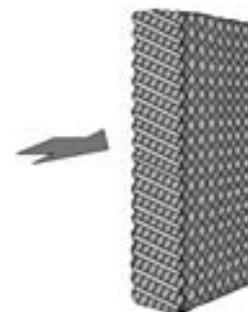
- Clean periodically by means of a vacuum cleaner or jet of water, taking care not to damage the rotor.
- Check the tension and state of the drive belt regularly.

### EVAPORATIVE PACK AND WASTE WATER HUMIDIFIERS

- Close the mains water isolating valve.
- Extract the evaporative pack.
- Check the pack and water distribution pipe for lime encrustations. The holes in the PVC distribution pipe can be cleaned, the evaporative pack should be replaced.
- Wash the inside of the drain pan and internal components.
- Reinstall the evaporative pack taking care to respect the correct airflow direction.

### EVAPORATIVE PACK AND RECIRCULATED WATER HUMIDIFIERS

- Deactivate the recirculating pump.
- Close the mains water isolating valve.
- Extract the evaporative pack.
- Check the pack and water distribution pipe for lime encrustations. The holes in the PVC distribution pipe can be cleaned, the evaporative pack should be replaced.
- Remove and clean the pump filter.
- Wash the inside of the drain pan and internal components.
- Reinstall the evaporative pack taking care to respect the correct airflow direction.



## STEAM HUMIDIFIERS

! DANGER OF SCALDING

- Clean the condensate pan.

## IMMERSED ELECTRODE STEAM HUMIDIFIERS

! DANGER OF SCALDING

- Clean the condensate pan.
- Check the electrodes for encrustation and replace if necessary.

## ATOMIZED WATER HUMIDIFIERS

- Clean the condensate pan.
- Clean the filters in the pressurization cabinet.

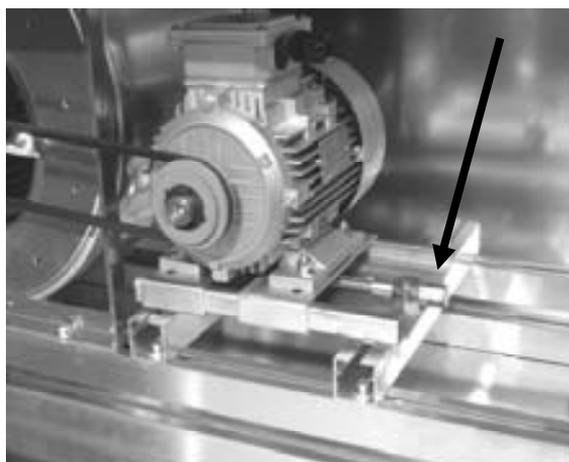
## AIR WASHERS

- Clean the water tank.
- Clean the filter.
- Check the nozzles for encrustations and clean if necessary.

## FANS

! Before starting work cut off the electrical supply to the unit and ensure that it cannot be restarted by others.

- After the first working period (two working days), check the fan belt tension. Fan belt tension should be regularly checked at longer intervals thereafter and the correct tension applied by moving the fan motor backwards or forwards by means of the motor slide base.
- The ideal belt tension is when it deflects two centimetres when pressure is applied to the mid point of the belt.
- Too much tension will damage the fan and motor bearings.
- Check that the fan and motor shafts are exactly parallel and that the pulleys are correctly aligned.
- The fans equipped with open type bearings will require periodic lubrication (approx. 6months) while those fans equipped with self lubricating bearings require no maintenance for 20,000 hours of operation.
- Worn bearings can be detected by an increase in noise, overheating and grease exiting from the bearings.



# TROUBLESHOOTING

## INTRODUCTION

- The following table lists possible malfunctions and their causes. The table cannot be considered to cover all possible malfunctions.
- The intervention of a safety device indicates a malfunction, before rearming the device, the cause must be eliminated.

## !ATTENTION

- The operations must be carried out by qualified personnel who respect all aspects of local safety regulations.
- Before intervening on any moving parts or devices connected to the electric supply, cut off tension at the unit isolating switch.

<b>TROUBLESHOOTING AT START-UP</b>	
LOW AIRFLOW	Dampers not calibrated
	fan rotating in the wrong direction
	Slipping fan belts
	Low supply current
	System pressure higher than design or blocked ducting
INSUFFICIENT HUMIDIFICATION	Pump rotating in the wrong direction. Invert wiring
	Dirty nozzles
	Insufficient water in tank due to bad regulation of float valve
WATER CARRY OVER	Excessive airflow
	Excessive water flow to humidifier
EXCESSIVE NOISE	Blocking device under fan base not removed
	Defective bearings
	Magnetic hiss of motor due to low supply current or defective motor
	Foreign objects in the fan scroll
	Vibration of damper blades
	Whistling due to vibrating ducting components turning vanes, grilles etc.
	"Pumping" of the supply fan ( too much counter pressure for the supply air)
Excessive airflow	
LOW THERMAL PERFORMANCE OF COIL	Insufficient temperature or fluid flow
	Coil wrongly connected
	Air in coil: vent coil
	Malfunction of automatic regulation.
	Wrong type of condensate trap ( steam coils)
EXCESSIVE AIRFLOW	Ducting resistance lower than design
	Uncalibrated dampers
	Filters not installed
	Access doors open or panels removed
ELECTRIC MOTOR	Absorbed power greater than motor plate. Check causes of excessive airflow
	Motor turning in wrong direction. Invert wiring.
EXCESSIVE AIRFLOW	Decreased system resistance due to uncalibrated dampers
	Decreased system resistance due to missing or damaged filters
	Decreased system resistance due to open access doors
	Decreased system resistance due to uncalibrated supply grilles

TROUBLESHOOTING IN USE	
LOWERING OF AIRFLOW	Increase of system resistance due to dirty filters or formation of frost
	Increase of system resistance due to encrusted coil fins
	Increase of system resistance due to uncalibrated dampers
	Increase of system resistance due to encrusted evaporative pack
	Increase of system resistance due to dirty heat recovery equipment
	Broken fan belt
	Accidental obstructions or dirty components in the ducting system
WATER CARRY OVER	Excessive airflow
	Excessive water flow to humidifier
	Defective sealing around eliminator section
INSUFFICIENT HUMIDIFICATION	Dirty water filter
	Dirty nozzles
	Encrusted evaporative pack
	Low water level in tank due to bad regulation of float valve or leaks
LOW THERMAL PERFORMANCE OF COIL	Insufficient temperature or fluid flow
	Coil wrongly connected
	Air in coil: vent coil
	Malfunction of automatic regulation.
	Wrong type of condensate trap ( steam coils)
EXCESSIVE NOISE	Slipping fan belts
	Defective bearings
	Magnetic hiss of motor due to low supply current or defective motor
	Foreign objects in fan scroll
	Vibration of damper blades
	Whistling due to vibrating ducting components turning vanes, grilles
	Loosening of fan wheel on shaft
	Loose fan cut off plate
	Loose fan wheel on electric motor
	Excessive airflow

## SHUTDOWN

### DISCONNECTION OF UNIT

The disconnection of the unit must be carried out by qualified personnel and the section on latent risks should be read before proceeding with the disconnection.

Before disconnecting the unit the following substances should be recovered:

- refrigerant gas for unit with direct expansion coils ( only in the case where it is not possible to leave the gas in the circuit by means of the appropriate isolating valves) the extraction of the gas should be carried out by means of the appropriate vacuum pump and no gas should be allowed to disperse in the atmosphere.
- antifreeze present in the piping: during the removal ensure that there are no leaks or spillage to drains. The liquid should be stored in the appropriate vessels.

#### IMPORTANT:

During all recovery operations of substances present in the unit all possible precautions should be taken to avoid damage to persons, things, and the surrounding atmosphere.

While awaiting disposal the unit may be stored in the open since weather and changes of temperature will not provoke damage to the environment.

### DISASSEMBLY AND DISPOSAL

! FOR DISASSEMBLY AND DISPOSAL THE UNIT MUST BE CONSIGNED TO AN AUTHORISED DISPOSAL CENTRE.

- During disassembly the fan, motor and coils, if in working order may be recycled or reused.
- All materials should be recycled or disposed of according to local bylaws.
- The materials used in the construction or present in the various components are shown in in the following table.

Material	Use	Quantity as per total weight of unit	Presence
Sheet steel	Base frame,panels,motor, fan, eliminator sections	High	Always
Aluminium	Frame, fan frame, motor carcass, coils, dampers, condensate pans, eliminator sections	High	Always
Copper	Coils, motor	medium	Always
Polyurethane	Panels	High	Optional
Mineral wool	Panels, silencers	High	Optional
Rubber materials	Gaskets, antivibration mounts, flexible connections	Scarce	Always
Nylon	Handles, hinges	Scarce	Always
Paper	Evaporative pack	Medium	optional





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