AERMEC

air conditioning

AIR TREATMENT UNIT - Technical installation, use and maintenance manual

NCS

air flow rates
from 1000 to 45000 m^3/h

AERMEC
COMPANY QUALITY SYSTEM
ICIM
ISO 9001:2008 - Cert. n° 0128
CISQ IQNet
AERMEC S.P.A.

GB

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Dear Customer,
Thank you for choosing AERMEC. It is the fruit of many years of experience and special design studies and has been made of the highest grade materials and with cutting edge technology.
In addition, all our products bear the EC mark indicating that they meet the requirements of the European Machine Directive regarding safety. The standard of quality is permanently being monitored and AERMEC products are therefore a synonym for Safety, Quality and Reliability.

The data may undergo modifications considered necessary for the improvement of the product, at any time and without the obligation for any notice thereof.

Thank you again.
AERMEC S.p.A

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DICHIARAZIONE DI CONFORMITA'
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ
KONFORMITÄTSERKLÄRUNG

Tipo macchina / Type of unit / Type de machine / Maschinentyp	Centrale trattamento aria, Air handling unit, Centrales de traitment d'air, Lüftungsgerät
Modello / Model / Modèle / Modell	
Matricola / Serial Nr / Numéro de série / Seriennummer	

La macchina è conforme alle disposizioni contenute nelle seguenti direttive: / The unit complies with the provisions contained in the following directives: / La machine est conforme aux dispositions contenues dans les directives suivantes: / Das Gerät entspricht den Bestimmungen der folgenden Richtlinien enthaltenen:

2006/42/CE Direttiva Macchine / Machine Directive / Machine Directive / Maschinenrichtlinie

2006/95/CE Direttiva Bassa Tensione / Low voltage Directive / Basse Tension / Niederspannungsrichtlinie

2004/108/CE Direttiva EMC / EMC Directive / EMC Directive / EMV-Richtlinie

La persona autorizzata a costituire il fascicolo tecnico è: / The person authorized to compile the technical file is: / La personne autorisée à constituer le dossier technique est: / Die Person berechtigt, die technischen Unterlagen zusammenzustellen:

Giampaolo Cardin

Bevilacqua, 25/03/2010

Luigi Zucchi

1. WARNINGS REGARDING DOCUMENTATION

1.1. INTENDED USE

The AERMEC NCS series air treatment units are built according to recognised technical standards and safety regulations. There may still arise risks for the safety of the user or third parties, or even damage to the units and other objects, in case of improper use. NCS represents are the blend of experience, research and testing in the specific aeraulic machine sector. The target is that of supplying the customer with a highly industrialised flexible product, with all the advantages that this choice brings in relation to quality and reliability. The NCS series adapts to the all the specific needs of the system, both with regard to operation and to the overall sizes, allowing different air treatment requirements to be met. Any use not specifically indicated in this manual is forbidden and AERMEC cannot therefore be held responsible for any damage whatsoever resulting from the failure to observe these instructions.

1.2. CONSERVING THE DOCUMENTATION

Deliver the following installation instructions with all the complementary documentation to the user of the unit, who shall be responsible for keeping the instructions so that they are always available when needed.

READ THIS DOCUMENT CAREFULLY. The unit must be installed by qualified skilled personnel, in compliance with the national legislation in force in the country of destination. The unit must be installed in such a way as to make all maintenance and/or repair operations possible. The warranty of the device does not in any case cover costs incurred as a result of motorised ladders, scaffolding or any other lifting systems necessary to carry out the operations under warranty. The warranty shall not be valid if the indications mentioned above are not observed.

2. ESSENTIAL SAFETY RULES

Remember that the use of products employing electricity and water requires the observance of some essential safety rules:

- The use of this unit is not intended for people (including children) with any physical or mental disability or any sensory impairment nor for people lacking experience and knowledge, unless they are supervised or instructed on the use of the unit by a person responsible for their safety. Children should be supervised in order to make sure that they do not play with the unit.
- It is forbidden to carry out any technical or maintenance operation before disconnecting the unit from the mains by positioning the system and control panel main switches at “off”.
- It is forbidden to modify safety or regulation devices without the manufacturer's authorisation and indications.
- It is forbidden to pull, disconnect or twist the outcropping electrical cables of the unit even if it has been disconnected from the mains.
- It is forbidden to leave containers and flammable substances near the chiller.
- It is forbidden to touch the unit with wet parts of the body and bare feet.
- It is forbidden to open the access doors to the unit internal parts, without having first turned off the system main switch.
- It is forbidden to spread, leave or keep the packaging material within the reach of children as it may be a possible source of danger.

3. IDENTIFICATION

The unit is identified as follows:

- the technical label located on the electronic box side sill

Note
If the identification plate, or any other means to identify the product, is tampered with, removed or missing, installation and maintenance operations are hampered

4. DESCRIPTION OF THE UNIT

The structure of the central air handling units has a new, softer, ergonomic line realised in aluminium sections with external and internal rounded edges. This prevents the accumulation of dust and dirt, typical of sections with sharp edges, favouring better quality and salubrity of the air handled and making cleaning operations of the entire machine easier.
The FE series, in addition to the pleasant appearance of the finished product, comprises the following characteristics:

- aluminium profile structure;
- glass fibre reinforced nylon angles;
- 25 mm thick unified panels, constructed of the most qualified materials (galvanized steel sheet - galvanized prepainted steel - aluminium alloy - stainless steel) and insulators (injected polyurethane and mineral wool);
- innovative systems for humidification devices with focus on the purity of the treated air, preventing the formation of mould and bacteria and with the objective of minimising the wastage of water used (HYDROSENSOR);
- all the components are inside the casing and therefore the airflow is completely separated from the external atmospheric elements that could penalise its functionality and performance;
- a wide range of accessories and equipment are provided to give to the client an immediate view and control of all the units operating conditions.

4.1. MODULARITY AND SIZES

The NCS series of air treatment units is sized according to a modularity criterion that allows to obtain a high standardisation of components while continuously covering the entire range of flow rates. The corresponding size is selected by choosing the unit in compliance with the air speed through the heat exchange coils (maximum speed ≤ to 3 m/s per cooling coil and humidification systems and maximum speed ≤ to 4.5 m/s for heating coils).

The frontal dimensions of the units and the lengths are modular in multiples of 162.5 mm (1/4 of a module):

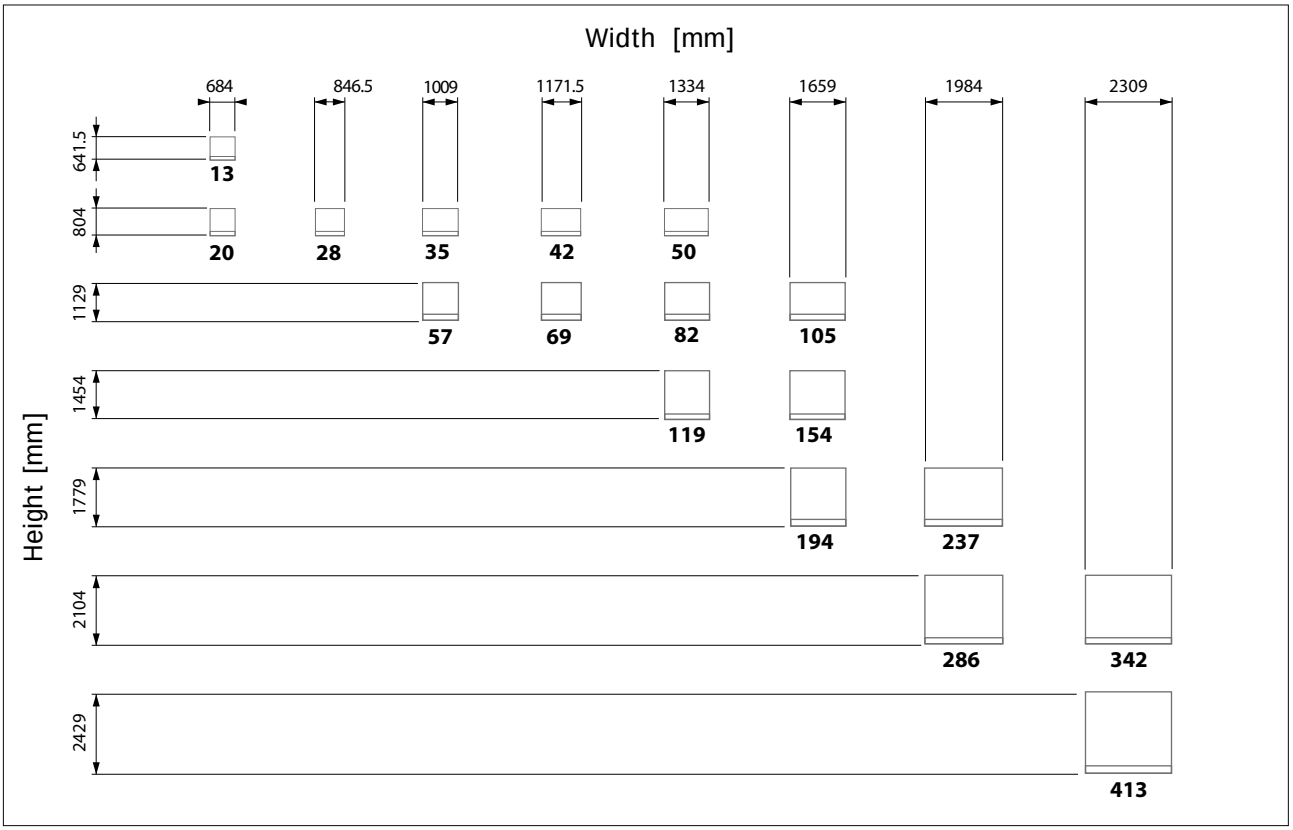
- The widths range from minimum of 1 module to a maximum of 3.5 modules.
- The heights range from minimum of 0.75 to a maximum of 3.5 modules.

A front view of the 17 sizes is represented on the next page.

5. TECHNICAL DATA

Below is the technical and dimensional data with regard to the 17 sizes for the NCS air treatment units. A module equal to a length of 650 mm.

NCS	Width	Height	External dim.		Internal dim.		Dim. coil pack		Coil surface	Air flow rate (m³/h)			
			Width	Height	Width	Height	Width	Height		Frontal speed (m/s)			
	Modules	Modules	mm	mm	mm	mm	mm	mm	m²	2	2,5	3	3,5
1	1	0.75	684	521,5	613	409,5	420	300	0,126	910	1130	1360	1590
2	1	1	684	684	613	572	420	480	0,202	1450	1810	2180	2540
3	1.25	1	846,5	684	775,5	572	580	480	0,278	2000	2500	3010	3510
4	1.5	1	1009	684	938	572	725	480	0,348	2510	3130	3760	4390
5	1,75	1	1171,5	684	1100,5	572	885	480	0,425	3060	3820	4590	5350
6	2	1	1334	684	1263	572	1045	480	0,502	3610	4510	5420	6320
7	1.5	1.5	1009	1009	938	897	725	780	0,566	4300	5090	6110	7460
8	1,75	1.5	1171,5	1009	1100,5	897	885	780	0,690	4970	6210	7460	8700
9	2	1.5	1334	1009	1263	897	1045	780	0,815	5870	7340	8800	10720
10	2.5	1.5	1659	1009	1588	897	1350	780	1,053	7580	9480	11370	13280
11	2	2	1334	1334	1263	1222	1045	1140	1,191	8580	10720	12870	15010
12	2.5	2	1659	1334	1588	1222	1350	1140	1,539	11080	13850	16620	19390
13	2.5	2.5	1659	1659	1588	1547	1350	1440	1,539	14000	17500	21000	24490
14	3	2.5	1984	1659	1913	1547	1645	1440	2,369	17060	21320	25580	29850
15	3	3	1984	1984	1913	1872	1645	1740	2,862	20610	25760	30900	36070
16	3.5	3	2309	1984	2238	1872	1965	1740	3,419	24620	30770	36930	43080
17	3.5	3.5	2309	2309	2238	2197	1965	2100	4,127	29710	37140	44570	51990



6. DESCRIPTION OF THE COMPONENTS

6.1. PANELS

The casing is a supporting frame and infill panels type. The panels have a thickness of 25 mm and are fixed to the frame by panel bracket profiles that are connected to the frame. This system ensures a uniform pressure on the gasket between the panel and frame and a greater air tightness with both with pressurised systems and vacuum systems. The panels are envisioned in the standard versions stated in the following tables. The panels can be supplied with mineral wool insulation with a density of 100 kg/m^3 and different thickness of sheet metal.
The perfect match between panel edges and frame makes the internal surface of the air handling unit completely smooth with consequent benefits in terms of reduced dust deposits inside the unit and easier cleaning and maintenance. The panels are sized so that the air handling unit has no horizontal joints on the sides, where possible, thus improving overall strength. The inspection doors are supported by two fibre glass reinforced nylon hinges with steel pins, and secured by two or three handles of the same material depending on the height. Special panelling can be designed to soundproof the ventilating sections . In this case, contact the Sales Technical Dept.

Set-up	External Panel	Insulation	Internal Panel
PZP	Pre-painted galvanised steel	Injected polyurethane	Galvanised steel
	Thickness 0.6 mm	Density 42 kg/m^3	Thickness 0.6 mm
AAP	Aluminium alloy	Injected polyurethane	Aluminium alloy
	Thickness 0.8 mm	Density 42 kg/m^3	Thickness 0.6 mm
XXP	STAINLESS steel Aisi 304	Injected polyurethane	STAINLESS steel Aisi 304
	Thickness 0.6 mm	Density 42 kg/m^3	Thickness 0.6 mm
PXP	Pre-painted galvanised steel	Injected polyurethane	STAINLESS steel Aisi 304
	Thickness 0.6 mm	Density 42 kg/m^3	Thickness 0.6 mm
ZZP	Galvanised steel	Injected polyurethane	Galvanised steel
	Thickness 0.6 mm	Density 42 kg/m^3	Thickness 0.6 mm
PZL	Pre-painted galvanised steel	Mineral wool	Galvanised steel
	Thickness 1.2 mm	Density 100 kg/m^3	Thickness 0.6 mm

KEY

1^a letter	*external panel*
2^a letter	*internal panel*
3^a letter	*insulation*

Example of codes:
PZL: **P** = Pre-painted galvanised steel, **Z** = Galvanised steel, **L** = Mineral wool
PXP: **P** = Pre-painted galvanised steel, **X** = STAINLESS steel, **P** = Injected polyurethane

6.2. FEATURES OF THE PRE-PAINTED GALVANISED SHEET STEEL

Hot galvanized sheet steel (UNI EN 10142 EN 10147) prepainted for external application on HDG support with polyester resin (antislip), with self-adhesive plastic film protection to prevent damage during the handling of panels in the workshops and during the transport and positioning of the units on site. The characteristics of the sheet metal are indicated in the table below. The internal surface of the panels undergo further treatment to facilitate clinching of the injected polyurethane foam.

6.2.1. Characteristics of the aluminium alloy sheet metal

Aluminium alloy sheet with self-adhesive plastic film protection to prevent damage during handling of the panels in the workshop and during transport and positioning of the unit on site.

6.2.2. Stainless steel sheet steel features

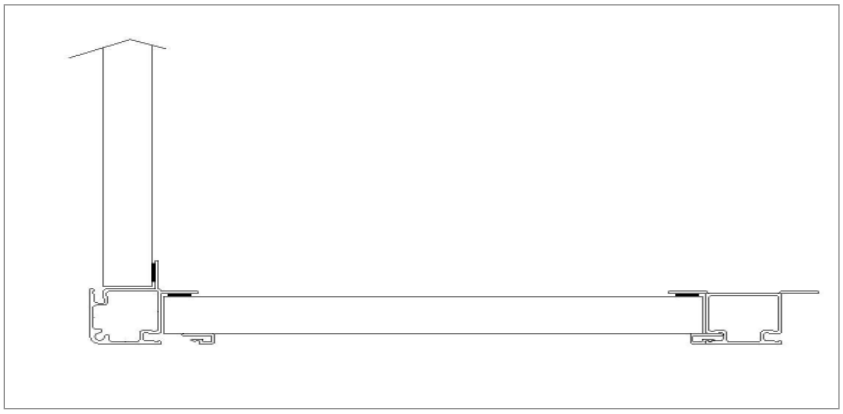
AISI 304 sheet steel protected by plastic film as described above. This type of steel is particularly resistant to the most aggressive atmospheric agents and is suitable, without undergoing alterations, for all types of washing and sanitisation, for specific uses in hospital plants and in the food, chemical and pharmaceutical industries etc.

FEATURES OF THE GALVANISED PREPAINTED SHEET METAL

Thickness of the film	μ m 25 (ECCA T-1)
Mirror gloss angle 60°	40 (EN 13523-2)
Pencil hardness (Koh-i-noor scale)	Grade “F” (ECCA T-1)
Bend test (without cracking)	3.0 T (ECCA T-7)
Bend test (adherence)	1.5 T (ECCA T-7)
Degree of reticulation MEK	100 d.c. (AICC n°23)
Resistance to saline mist	500 h blister max 8, max. penetration 3 mm (ECCA T-8)
Humidity resistance	1000 h blister max 8 (ASTM D2247)
Resistance to ageing Q.U.V.B	400 h (EN 13523-10)

6.3. FRAME

The frame is built of UNI 6060 extruded aluminium alloy profiles connected to each other by fibreglass reinforced nylon corner pieces and self-tapping screws. The tubes forming the frame are completely enclosed and therefore the thermal bridges are reduced and the "by-pass" of air around the various internal components of the system is eliminated. On request, the frame is also available in anodized aluminium UNI 6060 with or without thermal break. The shape of the profiles and panels is illustrated in the drawing below, which shows the horizontal base profile with the bottom panel and an intermediate vertical upright



6.4. BASE

The base is continuous for all sizes and is made of galvanized sheet steel.

6.5. ROOF

If requested this can be made as standard with 12/10 prepainted galvanized sheet metal with the same characteristics described above for the sheet metal used for the panels. Other materials can also be considered. The roof is positioned flush with frame depending on the size of the system.

6.6. AIR INLET

The provided dampers are made with a galvanized steel frame and aluminium blades. The transmission of rotary motion is by means of nylon gearwheels.

6.6.1. Front dampers

The types provided are illustrated in the table below.
The damper cannot be requested: alternatively the intake may be an opening, a flange or a blank panel in which a hole of the desired size must be made on site.

6.6.2. Mixing chamber

The configurations provided are illustrated in the table below .
The dampers do not have to be requested: alternatively the vents can be envisioned as simple openings, with flange or blank panels on which an opening of the desired size must be made on site.

6.6.3. 3 damper units

The configurations for the three-way mixing chambers are the following:

- two upper dampers and one internal for recirculation;
- two front dampers and a horizontal internal for recirculation (for stacked units);
- two internal side dampers and an internal recirculation damper (configured for not ducted replacement air expulsion and intake).

The dampers do not have to be requested: alternatively the vents can be envisioned as simple openings, with flange or blank panels on which an opening of the desired size must be made on site.

damper set-ups

damper POSITION	DIMENSION	INSTALLATION
Frontal	the entire section	external
Frontal	partial	external or internal
Upper	partial	external or internal
Right side	partial	external
Left lateral	partial	external

damper set-ups in the mixing chamber

DAMPERS POSITION	INSTALLATION
Frontal and upper	external
Upper and right lateral	external
Upper and left lateral	external
Frontal and right lateral	external
Frontal and left lateral	external

7. FILTRATION

The choice of the filter is a determining factor in order to obtain good quality of the air handled and correct hygiene in the entire ducted air distribution system.
The following tables describe the characteristics and identification of various filtering systems, however, the designer must make a careful choice that accurately reflect the specific needs of the system, and also take into account the data of air that must be treated and the routine maintenance to which all filtration systems must undergo.
The filtering systems can also be equipped, as an accessory, with differential pressure indicators with alarm to verify the efficiency remotely and with the machine running.
A filter classification table is illustrated for example only:

Classification according to the EN 779 Standard

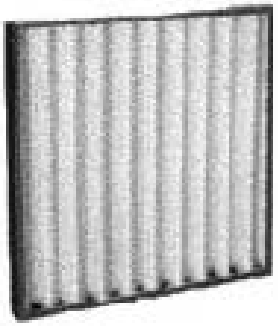
Initial colorimetric efficiency (EA)		EA < 20 %	EA >= 20 %
Characteristics		Average weight efficiency	Average colorimetric efficiency
		Am (%)	Em (%)
Filter unit	Class of filter	Class limit	
Large granule dust (G)	G 1	Am < 65	-
	G 2	65 <= Am < 80	-
	G 4	Am >= 90	-
Fine granule dust (F)	F 5	-	40 <= Em < 60
	F 6	-	60 <= Em < 80
	F 7	-	80 <= Em < 90
	F 8	-	90 <= Em < 95
	F 9	-	Em >= 95

HEPA and ULPA filters classification according to the EN 1822 Standard

Filter class	Average efficiency of the entire filter surface (Overall efficiency value)	Efficiency in a specific point of the filter (Local efficiency value)
	Efficiency (%)	Efficiency (%)
H 10	85	-
H 11	95	-
H 12	99.5	-
H 13	99,95	99,75
H 14	99,995	99,975
U 15	99,9995	99,9975
U 16	99,99995	99,99975
U 17	99,999995	99,9999

7.1. CELL PRE-FILTERS

The removable cell pre-filters are the most widely used in the central air handling units owing to their practicality, renewability and because they are easy to find on the spare parts market. The filtering material of the cells can be synthetic or metal depending on the use to which they are intended and according to the efficiency required in the specifications. The filtering cells can generally be regenerated by simple immersion into soapy water and can be reused after rinsing. Only metal filters, (generally used for air flows with greasy vapours) can be alternatively washed using solvents and dried with compressed air.
The quantity and size of the cells used are those listed in the table below:



Mod. NCS	FLAT FILTER 290x595	FLAT FILTER 490x595	FLAT FILTER 595x595	FLAT FILTER 290x290	FLAT FILTER 490x290	Sur. [m^2]
1	1					0,17
2	1			1		0,26
3	1				1	0,31
4		1			1	0,43
5		1			1	0,43
6	1		1			0,53
7		1	1			0.65
8			2			0,71
9	1		2			0,88

Mod. NCS	FLAT FILTER 290x595	FLAT FILTER 490x595	FLAT FILTER 595x595	FLAT FILTER 290x290	FLAT FILTER 490x290	Sur. [m^2]
10		2			4	1,08
11	3	3				1,39
12		6				1,75
13		6			2	2.03
14		8				2.33
15		9				3.19
16	3	9				3.70
17	6	9				4.22

7.2. ROLL FILTERS

The roll filters are generally used as an alternative to cell filters, when the selected filtering system is to be given a long duration without short term periodical maintenance. The efficiency of the roller filter is similar to that of synthetic filter cells (see table). Nevertheless, they have the great advantage of automatic renewal in accordance with an automatic signal (differential pressure switch) that allows to roll the dirty side of the roller introducing the clean part in the flow of air.

The duration of the non-regenerative filter is closely linked to the dustiness of the air, however it still allows long-term maintenance and is indicated by an optical or acoustic alarm signal that can also be remote from the unit (to the synoptic panel of the system).

The roll filter is normally supplied complete with wired control equipment, ready to work.

NCS	External dim. (mm)		Internal dim. (mm)		Filter dimensions (mm)	N° filters	Position
1	735	525	620	410	not available	-	-
2	1055	525	940	410	not available	-	-
3	1215	525	1100	410	not available	-	-
4	1055	685	940	570	not available	-	-
5	1215	685	1100	570	not available	-	-
6	1055	845	940	730	not available	-	-
7	1215	845	1100	730	1000 X 630	1	horizontal
8	1375	845	1260	730	1200 X 630	1	horizontal
9	1695	845	1580	730	1500 X 630	1	horizontal
10	1695	1005	1580	890	1500 X 830	1	horizontal
11	2015	1005	1900	890	1800 X 830	1	horizontal
12	2015	1165	1900	1050	1800 X 930	1	horizontal
13	2335	1165	2220	1050	2200 X 930	1	horizontal
14	2655	1165	2540	1050	2500 X 930	1	horizontal
15	2015	1965	1900	1850	1800 X 1830	1	vertical
16	1335	1965	1220	1850	1800 X 2130	1	vertical
17	2335	2285	2220	2170	2100 X 2130	1	vertical

7.3. BAG FILTERS

The bag filters are the soft or rigid types in compliance with design choices. They are generally preceded by regenerable cell or roll pre-filters that increase their duration by stopping larger polluting particles and can be followed by even greater efficiency filters.
The filter bags are fixed to a special support frame with hermetic sealing systems to prevent any air bypass of untreated air, and their extractability is ensured by a special inspection chamber upstream of the cells of suitable dimension to allow access to maintenance engineers.Special versions of cells filter for specific uses in hospitals, chemical industry, etc.. (anti-contamination systems) can be studied by our Technical Sales Department on specific request.

7.4. ABSOLUTE FILTERS

The absolute filters are generally used where it is necessary to guarantee purity of the air and high-level aseptic conditions.
The most common uses concern machines for hospital use (operating rooms and similar) and machinery for the chemical and electronics industry.
These types of filters are generally positioned in flow conditions, after the ventilating sections, and are preceded by progressive efficiency filtering systems (cell filters plus bag filters). A differential pressure switch must be supplied with the absolute filters, which indicates the degree of cleanliness and so allows the cells to be replaced in due time. Particular care is taken in the realisation of the cells housing system in order to prevent any possibility of air by-pass and to make cell replacement in the maintenance phase easier.

The following tables indicate the quantities and dimensions of the cells used. The data is valid for both the bag and absolute filters.

NCS	POCKET FILTER 290 x 595	POCKET FILTER 490 x 595	POCKET FILTER 595 x 595	POCKET FILTER 490 x 290	Surface m²
1	1				0,17
2	1				0,17
3				2	0.28
4		1		1	0,43
5		1		1	0,43
6	1		1		0,53
7	1		1		0,53
8			2		0,71
9	1		2		0,88

NCS	POCKET FILTER 290 x 595	POCKET FILTER 490 x 595	POCKET FILTER 595 x 595	POCKET FILTER 490 x 290	Surface m²
10	2	2		1	1.07
11	3	3			1,39
12	3		3		1,58
13	4		3		1,75
14	4		4		2,11
15			9		3.19
16	3		9		3.70
17	6		9		4.22

8. COILS

8.1. HEAT EXCHANGE COILS

The heat exchange coils are the most important elements that make up the air treatment units since it is inside the coils that the heat exchange takes place between the primary fluid (hot or cold water, hot or cold gas), and the secondary fluid, namely the air to be treated in the unit. The coils must be precisely scaled for the role they should perform according to the treatment that is required by the unit itself. Secondly, they must meet the technical parameters relating to the materials they are built to ensure the required mechanical strength. The coils are always scaled in accordance with a range of characteristics within which the design features are included; this fact allows good standardisation of sizes as will be explained below.
Our Technical Sales Department may examine particular projects for the implementation of coils not given in this catalogue.

Standard execution:
• P6030 geometry in copper-aluminium;

Optional executions:
• Copper-copper;
• Copper-tinned copper;
• Copper-pre-painted aluminium;
• Fe-Al;

Functioning:
• Water;
• Heated water;
• Steam;
• Direct expansion.

Extractability:
Lateral (with the condensate drip tray for the cooling coils).

Condensate drip tray:
Made of aluminium alloy or stainless steel with side discharge (on the panel) 1" G. They are reserved exclusively to the coils and therefore, in the case of cold coils followed by humidification, there are two tanks connected together by an aluminium alloy plate.

Rows:
The coils are available as standard from 1 to 8 rows and different circuits as shown in detail in the following tables. For different n° rows, circuits, louver pitch, consult the Sales Technical Dept.

8.2. WATER COILS

The features are given in the following table (P6030 geometry).

NCS	SINGLE ZONE			
	Upp. front	Height	Length	Pipes/Range
	[m^3]	[mm]	[mm]	[n°]
1	0,126	300	420	5
2	0,218	300	725	5
3	0,266	300	885	5
4	0,348	480	725	8
5	0,425	480	885	8
6	0,479	660	725	11
7	0,584	660	885	11
8	0,690	660	1045	11
9	0,891	660	1350	11
10	1,053	780	1350	13
11	1,283	780	1645	13
12	1,579	960	1645	16
13	1,886	960	1965	16
14	2,194	960	2285	16
15	2,862	1740	1645	29
16	3,419	1740	1965	29
17	4,127	2100	1965	35

8.2.1. headers diameter for single zone water coils with 60x30 geometry

NCS	Diam. (R1,2)	Diam. (R2,2)	Diam. (R3,2)	Diam. (R4,1)	Diam. (R4,2)	Diam. (R6,1)	Diam. (R6,2)	Diam. (R8,1)	Diam. (R8,2)
1	1"	1"	1"	1"	1"	1"	1"	1"	1"
2	1"	1"	1"	1"	1"	1"	1"	1"	1"
3	1"	1"	1"	1"	1"	1"	1"	1"	1"
4	1"	1"	1"	1"	1"	1"	1"	1"	1"
5	1"	1"	1"	1" 1/2	1" 1/2	1" 1/2	1" 1/2	1" 1/2	1" 1/2
6	1"	1"	1"	1" 1/2	1" 1/2	1" 1/2	1" 1/2	2"	2"
7	1"	1"	1"	1" 1/2	1" 1/2	1" 1/2	1" 1/2	2"	2"
8	1"	1"	1"	1" 1/2	1" 1/2	1" 1/2	1" 1/2	2"	2"
9	1"	1"	1" 1/2	1" 1/2	1" 1/2	1" 1/2	1" 1/2	2"	2"
10	1"	1"	1" 1/2	1"1/2	1"1/2	1" 1/2	1" 1/2	2" 1/2	2" 1/2
11	1"	1" 1/2	1" 1/2	2"	2"	1"1/2	1"1/2	2" 1/2	2" 1/2
12	1"	1" 1/2	1" 1/2	2"	2"	2"	2"	2" 1/2	2" 1/2
13	1"	1" 1/2	1" 1/2	2"	2"	2"	2"	3"	3"
14	1"	1" 1/2	1" 1/2	2"	2"	2"	2"	3"	3"
15	1" 1/2	2" 1/2	2"	2" 1/2	2" 1/2	3"	3"	4"	4"
16	1" 1/2	2" 1/2	3"	2" 1/2	2" 1/2	3"	3"	4"	4"
17	2"	2" 1/2	3"	3"	3"	3"	3"	4"	4"

8.3. DIRECT EXPANSION COILS

The geometrical features are given in the following table.

NCS	Frontal sur.	Height	Length	Pipes/ row	Circuits							
	[m]	[mm]	[mm]	[n°]	R 3.1	R 3.2	R 4.1	R 4.2	R 6.1	R 6.2	R 8.1	R 8.2
1	0,126	300	420	12	3	6	3	6	4	6	6	12
2	0,218	300	725	12	3	4	6	3	4	6	5	6
3	0,266	300	885	12	3	4	6	4	5	6	6	8
4	0,326	450	725	18	6	9	6	9	9	18	9	12
5	0,398	450	885	18	6	9	6	9	9	18	12	18
6	0,435	600	725	24	5	7	6	6	8	10	10	14
7	0,531	600	885	24	6	8	10	7	10	13	12	16
8	0,627	600	1045	24	7	9	10	8	11	15	14	18
9	0,810	600	1350	24	9	12	15	10	14	18	16	22
10	1,013	750	1350	30	9	15	15	20	22	30	24	30
11	1,234	750	1645	30	12	15	22	15	20	28	26	34
12	1,481	900	1645	36	14	18	22	18	26	32	30	38
13	1,769	900	1965	36	17	21	29	22	30	38	38	44
14	2,057	900	2285	36	20	24	29	24	34	42	42	52
15	2,879	1750	1645	70	35	52	35	70	52	70	70	140
16	3,439	1750	1965	70	35	52	46	70	70	105	70	140
17	4,127	2100	1965	35	10	17	14	35	21	35	28	35

8.4. ELECTRIC COILS

The electrically powered coils are often used for small thermal loads in small and medium-sized units mainly for summer post-heating when turning on the traditional hot water system is not possible or convenient. The electric coils can also be used as an anti-freeze device for protection of the filters or water coils without glycol. They are made with finned tubular steel armoured resistance fed with 400V. Equipped with limit thermostat with automatic reset and safety thermostat with manual reset. The powers and number of stages are indicated in the following table.

The thermal heads Dt refer to the nominal flow corresponding to a face velocity on the coils of 2.5 m/s.

NCS	1st Stage			2nd Stage			3rd Stage			4th Stage		
	Elements	Power	Dt	Elements	Power	Dt	Elements	Power	Dt	Elements	Power	Dt
	[n°]	[W]	[°C]	[n°]	[W]	[°C]	[n°]	[W]	[°C]	[n°]	[W]	[°C]
1	3	2100	6	6	4200	11	9	6300	17	12	8400	22
2	3	2100	3	9	6300	10	12	8400	14	18	12600	21
3	3	3000	4	9	9000	11	12	12000	14	18	18000	21
4	3	3600	3	9	10800	10	12	14400	14	18	21600	21
5	3	3900	3	9	11700	9	12	15600	12	18	23400	18
6	3	4500	3	9	13500	9	15	22500	15	21	31500	21
7	6	7200	4	15	18000	11	21	25200	15	27	32400	19
8	6	7800	4	18	23400	11	24	31200	15	33	42900	21
9	6	9000	4	18	27000	11	24	36000	15	33	49500	20
10	6	10800	3	18	32400	10	27	48600	15	36	64800	20
11	9	13500	4	27	40500	11	36	54000	15	45	67500	19
12	9	18000	4	27	54000	12	36	72000	15	45	90000	19
13	12	24000	4	30	60000	10	45	90000	15	60	120000	20

9. HUMIDIFICATION

The humidification treatment is a very important component for creating a climate of well-being in air-conditioned environments. The humidification systems described below must be aimed at the specific use for which they are destined in compliance with the fluid available. It is obvious that the fact that moulds and bacteria find a favourable environment on humid surfaces and in stagnant water must be taken into consideration. The anti-mould evaporator packs can be equipped with sensors that intercept the water flow as soon as the pack is saturated, allowing for low consumption of water. The steam system is recommended for small capacities and use where the salubrity of the air is particularly required (e.g. in hospitals).

9.1. EVAPORATOR PACK HUMIDIFICATION

The following types can be envisioned:

a) 100 mm paper wet pack and non-returnable water;
b) with 200 mm paper wet pack and non-returnable water;
c) with 100 mm paper wet pack and circulation pump;
d) with 200 mm paper wet pack and circulation pump;

9.2. STEAM HUMIDIFICATION

The following types can be envisioned:

- with just steam distribution ramp supplied;
- with immersed electrodes steam generator.

9.3. CONDENSATE DRIPTRAYS

- For compressed air water humidification and steam humidification: aluminium alloy or stainless steel internal condensate drain pan (height 50 mm) with 1" G discharge;
- for evaporator pack humidification (type a, b of paragraph 18.1): aluminium alloy or stainless steel internal condensate drain pan (height 50 mm) and reinforced polypropylene sump tank with 1" GJ discharge and 1" GJ reintegration;
- for evaporator pack humidification (type g, h of paragraph 18.1): aluminium alloy or stainless steel internal condensate drain pan (height 50 mm) and reinforced polypropylene sump tank with 1" GJ discharge and 1" GJ reintegration with solenoid valve;
- for evaporator pack humidification (type c, d of paragraph 18.1): aluminium alloy or stainless steel internal condensate drain pan (height 50 mm) and reinforced polypropylene sump tank with 1" GJ discharge and 1" GJ reintegration with float valve;

For sizes NCS 13, NCS 20 and NCS 28 the sump tank is made of aluminium alloy.

9.4. DROP ELIMINATORS

The drop eliminators, carefully designed to ensure maximum effectiveness of retention of water droplets that are generated within the unit for the specific treatment required (humidification and dehumidification), are proposed as an optional component as well as a compulsory component. They can always be removed laterally.
Use is mandatory in the following cases:

- cooling coil: air speed above 2.6 m/s;
- wet pack humidifiers: air speed above 2.6 m/s;
- steam and water-compressed air humidifiers;
- washers (with inlet flow rectifier).

Materials used:

- PVC.

10. VENTILATING SECTIONS

10.1. FANS

The fans are among the most important components for the units, in that the fan motor assembly is the only part of the machine in continuous motion, and as such, is subject to wear and tear, noise, maintenance, safety equipment etc..
A correct dimensional and technological choice guarantees the good functioning of the machine through time. We have therefore made it possible to use a good number of fans with completely different characteristics for the same size of unit that are adaptable to the actual situation of the project by optimising performance, sound levels and operational flexibility.

- Range: The fans envisioned are in compliance with the DIN 323 R20 series (square mouth) of the following types:
- forward curved blade;
- backward inclined blade;
- backward inclined air foil blade.

- Sizes: the size of the fan is selected on the basis of the capacity and static pressure requested. The sizes listed in the table below are available for each size of unit. The codes indicate the external diameter of the rotor in mm;

- Orientation: the orientation for the fans are shown in the diagram on the following page. The directions with equal even final number refer to right hand unit direction; those with an odd final number refer to the left hand unit direction. The choice of direction depends on the real plant situation in the room in which the unit is positioned and must consider, apart from the fan-motor inspection side, also the small pressure drops that can be obtained in the fitting between the unit and the channelling.
- Anti-vibration supports: standard versions have rubber anti-vibration mounts (60°Sh) and anti-vibration seals on the flow vent. The use of spring supports is envisioned as an option with minimum efficiency of 80% (in this case the dimensions may undergo variations with respect to those indicated). This option is available starting from and including fan size 450 (please contact our Sales Technical Department).

The ventilating sections are supplied as standard with:

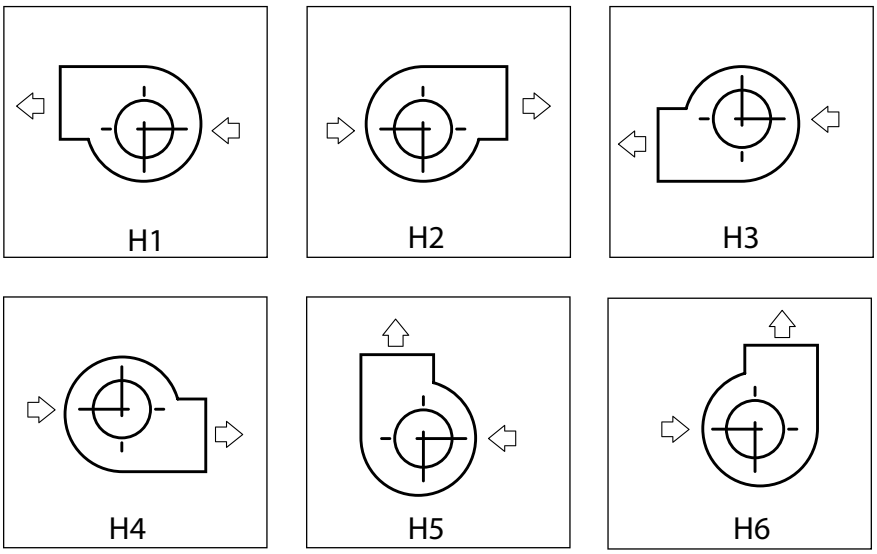
- safety grille behind the inspection door in replacement of the guard;

- earthing cable between the motor cradle and the base frame.

10.2. FANS/CENTRAL UNIT COMPATIBILITY TABLE

UNIT SIZE	FAN SIZE 180	200	225	250	280	315	355	400	450	500	560	630	710
1	■												
2		■	■										
3		■	■	■									
4		■	■	■	■								
5			■	■	■								
6				■	■								
7					■	■	■	■					
8					▒	■	■	■					
9						■	■	■					
10							■	■					
11								■	■	■	■		
12									■	■	■		
13										■	■	■	
14										▒	■	■	■
15										▒	▒	■	■
16										▒	▒	■	■
17										▒	▒	■	■

10.3. FAN DIRECTION LAYOUT



11. MOTORS

The motors are three-phase asynchronous with squirrel cage rotor, enclosed construction, external ventilation in compliance with the electrical characteristics of the IEC 60034-1 standards (general requirements for electrical equipment), IEC 60072-1 (dimensional characteristics) and IEC 34-7 (mounting arrangements IM B3 - IM1001).

- Protection rating: IP55
- Stator winding class: **F**
- The motors are envisioned with single polarity (2, 4, 6 poles depending on fan speed) and, on request, with double polarity 4/6, 4/8 poles with simple winding. The motors can be supplied with inverter.

11.1. TRANSMISSION

The pulleys can be fixed or variable for improved calibration of the fan speed in the system.
The transmission belts can be the SPA, SPB or SPC type.
The pulleys are supplied with “Taperlock” tapered locking set and are statically and dynamically balanced. The belt-tensioner system guarantees easy periodical maintenance.

12. RECUPERATORS

The heat recovery units are increasingly used in the plant engineering sector where it is necessary to use, for reasons of environmental well-being or for different processes, large volumes of air drawn from outside rather than recirculated air from the environment. The use of recuperators is more valid for large volumes of fresh air to be treated and the greater the heat drop between the temperature of the exhaust and fresh air.

Types envisioned:

- static cross-flow with synthetic corrugated filters and peraluman condensate collection trap;
- static cross-flow with bypass damper (for the exclusion of the heat recovery unit in "free cooling"), with synthetic corrugated filters and peraluman condensate collection trap.
- static cross-flow with recirculation damper (3 damper group with heat recovery unit), with synthetic corrugated filters and peraluman condensate collection trap.

Other types for which it is necessary to consult the Sales Technical Dept:

- with heating pipes;
- rotary (sensitive recovery or sensitive + latent);
- with double coil.

Efficiency:
- There is a choice of 3 sizes of heat recovery units for cross flow recovery associated with each size of unit.

Standard installation:
- With horizontal axis

Configuration of the central air handling unit:
- inline recovery and delivery;
- overlapped recovery and delivery.

13. EMPTY SECTIONS

Empty sections a re envisioned to allow the insertion of anti-freeze probes, access for inspection of components and to perform maintenance. They have the features listed below:

Lengths:
- 325 mm
- 650 mm
- 975 mm

Versions:
- simple;
- with 50 mm high aluminium alloy condensate drain pan and side discharge;
- with inspection door.

14. SILENCERS

Noise must be considered as one of the many polluting factors produced by modern technological machines. It is therefore important to take care in limiting noise emission from the fans with an accurate choice of the fan working point. Silencers can be installed in intake and flow of the ventilating section in order to further reduce noise levels.

Baffle lengths:
- 560 mm
- 880 mm
- 1200 mm
- 1520 mm

Baffle thickness:
- 200 mm

Air passage width:
- min. 105 mm
- max. 114 mm

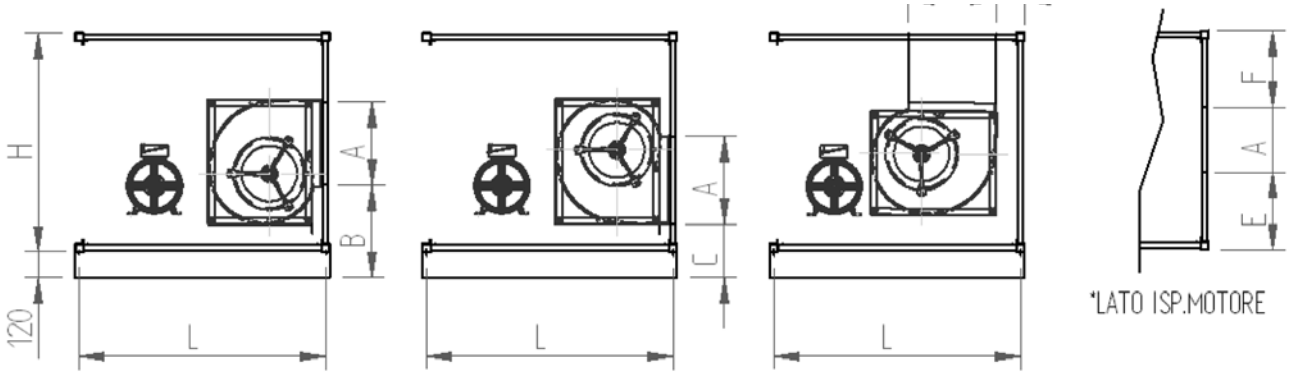
Construction:

Mineral wool with surfaces in contact with the air protected with polyester film and contained between expanded galvanised steel sheets. Sound attenuation at various frequencies is shown in the table below.

Sound attenuation [dB]								
Length [mm]	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**	**8000 Hz**
560	2	5	10	17	18	22	26	13
880	5	10	18	26	29	39	41	20
1200	7	14	24	35	39	48	48	28
1520	9	16	30	44	45	48	48	31

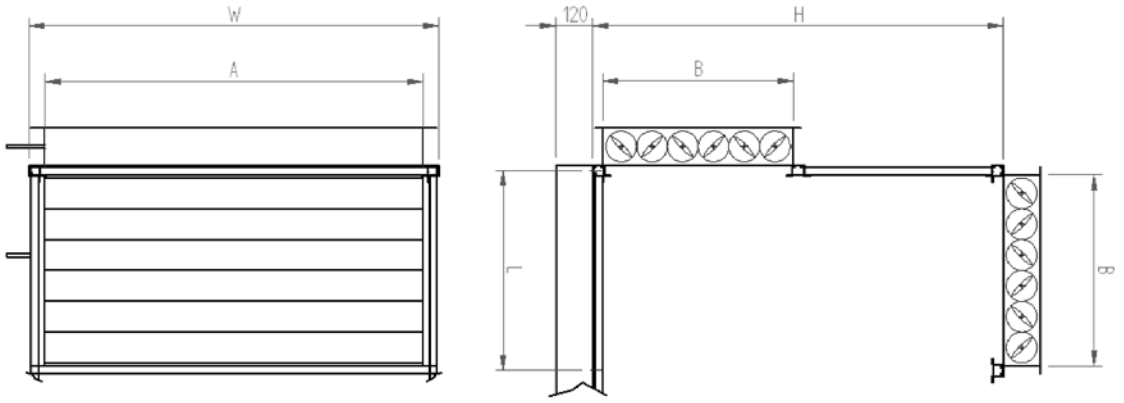
15. DIMENSIONS

15.1. FAN ASSEMBLY SECTIONS DIMENSIONS



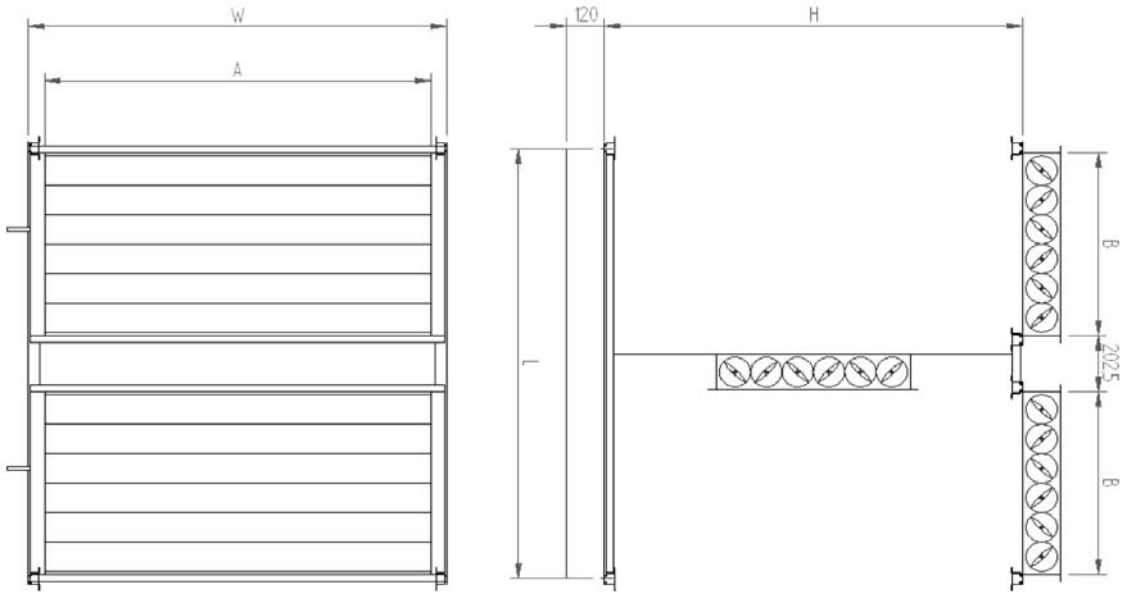
NCS	VENT.	W	L	H	A	B	C	D	E	F
1	180	684	812,5	521,5	209	310	242.5	122,5	237,5	237,5
2	200	684	975	684	236	358,5	248,5	128,5	224	224
	225	684	975	684	268	375,5	253,5	98,5	208	208
3	200	846,5	975	684	236	358,5	248,5	128,5	305,25	305,25
	225	846,5	975	684	268	375,5	253,5	98,5	289,25	289,25
	250	846,5	975	684	302	386	253	116	272,25	272,25
4	200	1009	975	684	236	358,5	248,5	128,5	386,5	386,5
	225	1009	975	684	268	375,5	253,5	98,5	370,5	370,5
	250	1009	975	684	302	386	253	116	353,5	353,5
	280	1009	975	684	336	369,5	218,5	68.5	336,5	336,5
5	225	1171,5	975	684	268	375,5	253,5	98,5	451,75	451,75
	250	1171,5	975	684	302	386	253	116	434,75	434,75
	280	1171,5	975	684	336	369,5	218,5	68.5	336,5	499
6	250	1334	975	684	302	386	253	116	516	516
	280	1334	975	684	336	369,5	218,5	98,5	499	499
7	280	1009	975	1009	336	369,5	218,5	98,25	336,5	336,5
	315	1009	1137,5	1009	384	428	258	138	312,5	312,5
	355	1009	1137,5	1009	433	463,5	271,5	98,5	288	288
	400	1009	1300	1009	487	506,5	284	98,5	261	261
8	315	1171,5	1137,5	1009	384	428	258	138	393,75	393,75
	355	1171,5	1137,5	1009	433	463,5	271,5	98,5	369,25	369,25
	400	1171,5	1300	1009	487	506,5	284	98,5	342,25	342,25
9	315	1334	1137,5	1009	384	828	258	138	475	475
	355	1334	1137,5	1009	433	763,5	271,5	98,5	450,5	450,5
	400	1334	1300	1009	487	506,5	284,5	98,5	423,5	423,5
10	355	1659	1137,5	1009	433	463,5	271,5	98,5	613	613
	400	1659	1300	1009	487	506,5	284,5	98,5	586	586
11	400	1334	1300	1454	487	506,5	284,5	98,5	423,5	423,5
	450	1334	1462,5	1454	569	474,5	228,5	108,5	382,5	382,5
	500	1334	1625	1454	638	500,5	228,5	108,5	348	348
	560	1334	1625	1454	715	533	230,5	85,5	309,5	309,5
12	450	1659	1462,5	1454	569	474,5	228,5	108,5	545	545
	500	1659	1625	1454	638	500,5	228,5	108,5	510,5	510,5
	560	1659	1625	1454	715	533	230,5	85,5	472	472
13	500	1659	1625	1659	638	500,5	228,5	108,5	510,5	510,5
	560	1659	1625	1659	715	533	230,5	85,5	472	472
	630	1659	1950	1659	801	534,5	230,5	110,5	429	429
14	560	1984	1625	1659	715	533	230,5	85,5	634,5	634,5
	630	1984	1950	1659	801	534,5	230,5	110,5	591,5	591,5
	710	1984	2112,5	1659	898	583,5	231.5	111,5	543	543
15	630	1984	1950	1984	801	534,5	230,5	110,5	591,5	591,5
	710	1984	2112,5	1984	898	583,5	231.5	111,5	543	543
16	630	2309	1950	1984	801	534,5	230,5	110,5	754	754
	710	2309	2112,5	1984	898	583,5	231.5	111,5	705,5	705,5
17	630	2309	1950	2309	801	534,5	230,5	110,5	754	754
	710	2309	2112,5	2309	898	583,5	231.5	111,5	705,5	705,5

15.2. MIXING CHAMBER WITH EXTERNAL DAMPERS



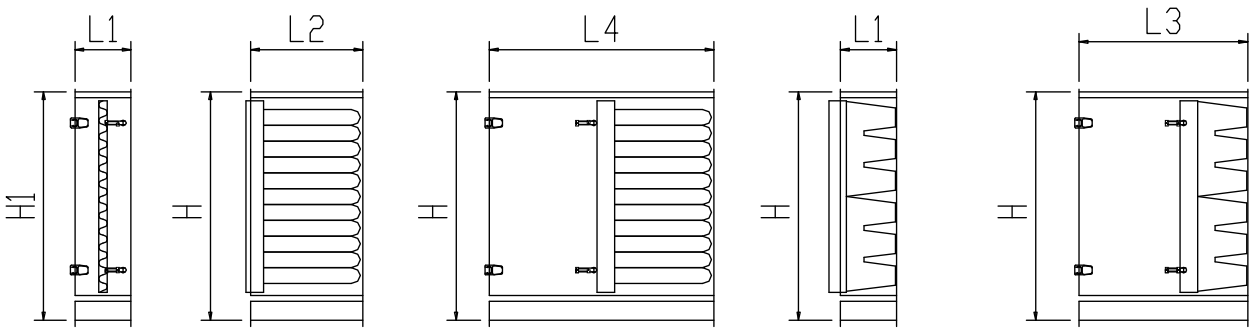
NCS	W (mm)	H (mm)	L (mm)	A (mm)	B (mm)
1	684	521,5	325	610	285
2	684	684	325	610	285
3	846,5	684	325	772,5	285
4	1009	684	325	935	285
5	1171,5	684	325	1097,5	285
6	1334	684	325	1260	285
7	1009	1009	325	935	285
8	1171,5	1009	325	1097,5	285
9	1334	1009	325	1260	285
10	1659	1009	487,5	1585	447,5
11	1334	1334	650	1260	610
12	1659	1334	650	1585	610
13	1659	1659	650	1585	610
14	1984	1659	650	1910	610
15	1984	1984	812,5	1910	772,5
16	2309	1984	812,5	2235	772,5
17	2309	2309	975	2235	935

15.3. 3 DAMPER UNITS WITH EXTERNAL DAMPERS



NCS	W (mm)	H (mm)	L (mm)	A (mm)	B (mm)
1	684	521,5	325	610	285
2	684	684	325	610	285
3	846,5	684	325	772,5	285
4	1009	684	325	935	285
5	1171,5	684	325	1097,5	285
6	1334	684	325	1260	285
7	1009	1009	487,5	935	447,5
8	1171,5	1009	650	1097,5	610
9	1334	1009	650	1260	610
10	1659	1009	650	1585	610
11	1334	1334	812,5	1260	772,5
12	1659	1334	812,5	1585	772,5
13	1659	1659	975	1585	935
14	1984	1659	975	1910	935
15	1984	1984	975	1910	935
16	2309	1984	975	2235	935
17	2309	2309	1300	2235	1260

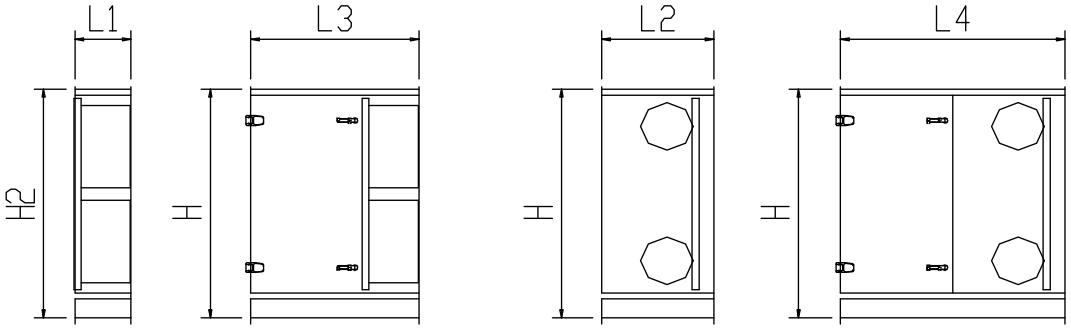
15.4. FILTER SECTIONS



Corrugated synthetic and metal

With soft bags

With rigid bags

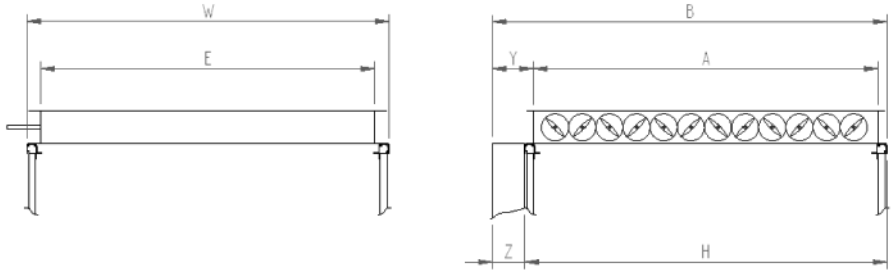


Absolute

Roller

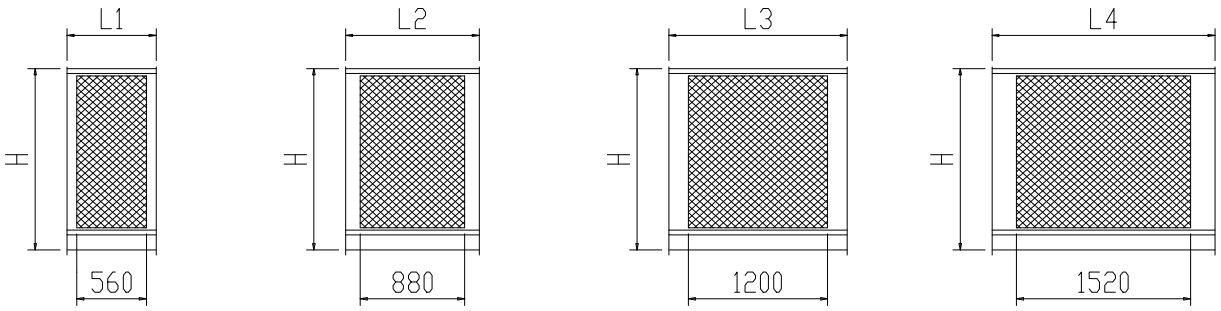
NCS	H (mm)	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)
1	641,5	162,5	650	812,5	1300
2	804	162,5	650	812,5	1300
3	804	162,5	650	812,5	1300
4	804	162,5	650	812,5	1300
5	804	162,5	650	812,5	1300
6	804	162,5	650	812,5	1300
7	1129	162,5	650	812,5	1300
8	1129	162,5	650	812,5	1300
9	1129	162,5	650	812,5	1300
10	1129	162,5	650	812,5	1300
11	1454	162,5	650	812,5	1300
12	1454	162,5	650	812,5	1300
13	1779	162,5	650	812,5	1300
14	1779	162,5	650	812,5	1300
15	2104	162,5	650	812,5	1300
16	2104	162,5	650	812,5	1300
17	2429	162,5	650	812,5	1300

15.5. INTAKE VENTS WITH EXTERNAL DAMPERS



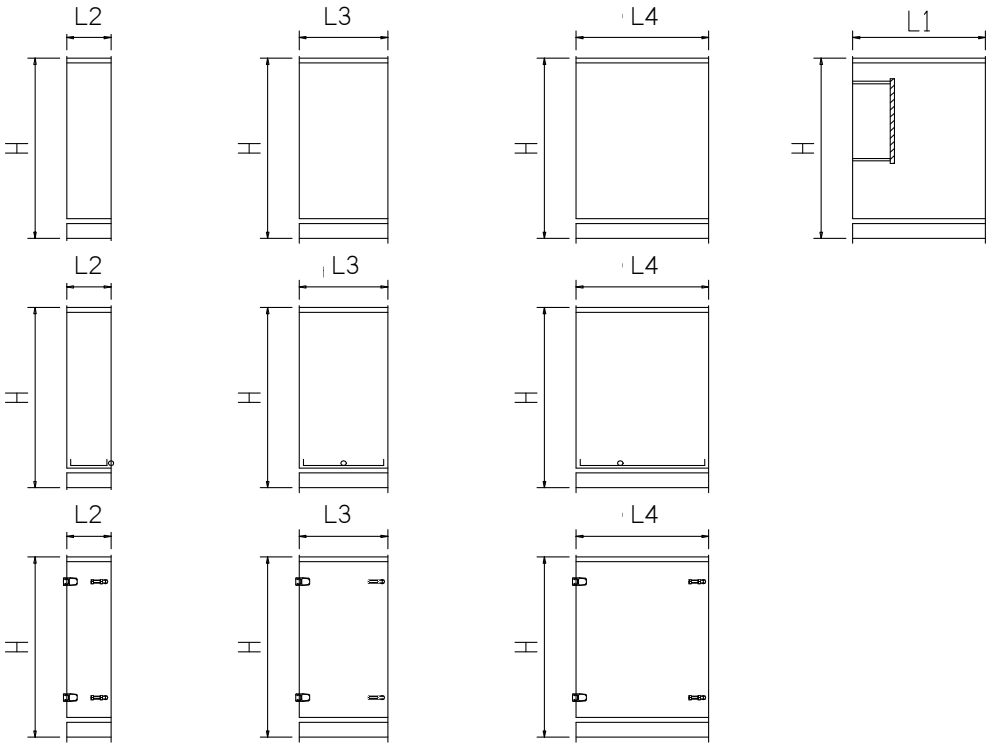
NCS	B (mm)	G2 (mm)	L2 (mm)	R (mm)	X (mm)	Y (mm)	W (mm)	H (mm)
1	641,5	285	325	447,5	37	157	684	521,5
2	804	285	325	610	37	157	684	684
3	804	285	325	610	37	157	846,5	684
4	804	447,5	487,5	610	37	157	1009	684
5	804	447,5	487,5	610	37	157	1171,5	684
6	804	610	650	610	37	157	1334	684
7	1129	447,5	487,5	935	37	157	1009	1009
8	1129	447,5	487,5	935	37	157	1171,5	1009
9	1129	610	650	935	37	157	1334	1009
10	1129	772,5	812,5	935	37	157	1659	1009
11	1454	610	650	1260	37	157	1334	1334
12	1454	772,5	812,5	1260	37	157	1659	1334
13	1779	772,5	812,5	1585	37	157	1659	1659
14	1779	935	975	1585	37	157	1984	1659
15	2104	935	975	1910	37	157	1984	1984
16	2104	1097,5	1137,5	1910	37	157	2309	1984
17	2429	1097,5	1137,5	2235	37	157	2309	2309

15.6. SILENCERS



NCS	H (mm)	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)
1	641,5	650	975	1300	1625
2	804	650	975	1300	1625
3	804	650	975	1300	1625
4	804	650	975	1300	1625
5	804	650	975	1300	1625
6	804	650	975	1300	1625
7	1129	650	975	1300	1625
8	1129	650	975	1300	1625
9	1129	650	975	1300	1625
10	1129	650	975	1300	1625
11	1454	650	975	1300	1625
12	1454	650	975	1300	1625
13	1779	650	975	1300	1625
14	1779	650	975	1300	1625
15	2104	650	975	1300	1625
16	2104	650	975	1300	1625
17	2429	650	975	1300	1625

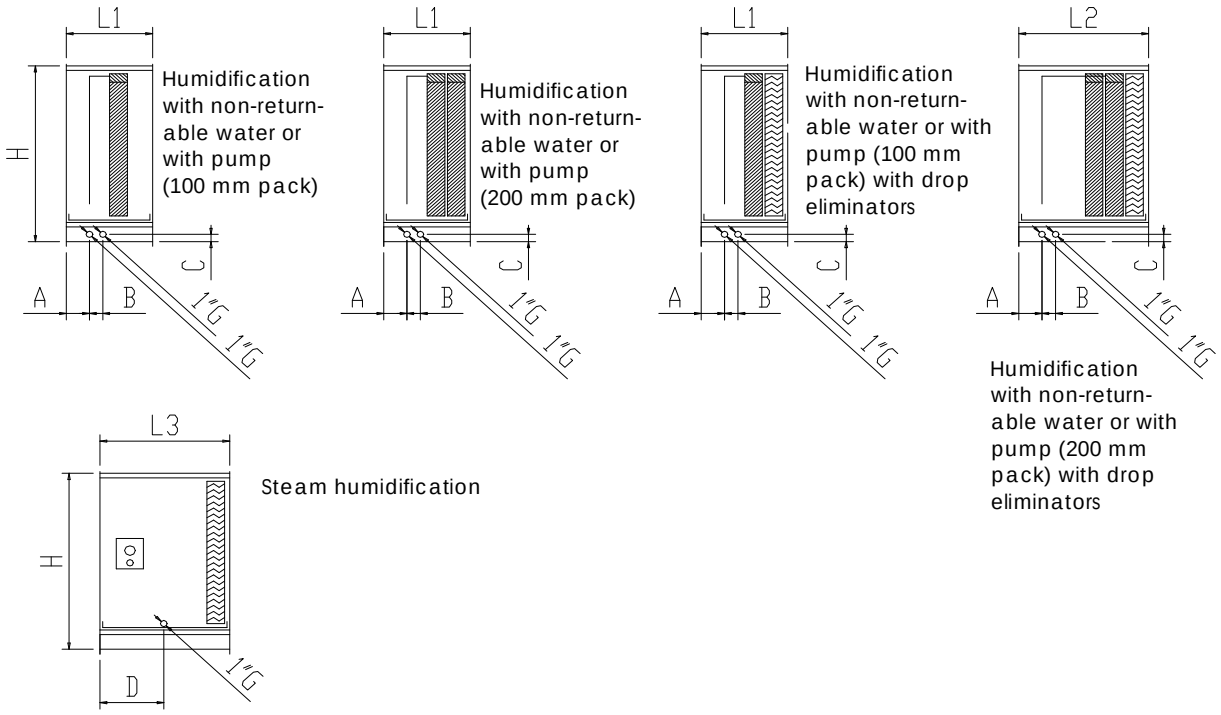
15.7. PLENUM WITH VACUUM SECTIONS



NCS	H (mm)	L2 (mm)	L3 (mm)	L4 (mm)
1	641,5	325	650	975
2	804	325	650	975
3	804	325	650	975
4	804	325	650	975
5	804	325	650	975
6	804	325	650	975
7	1129	325	650	975
8	1129	325	650	975
9	1129	325	650	975
10	1129	325	650	975
11	1454	325	650	975
12	1454	325	650	975
13	1779	325	650	975
14	1779	325	650	975
15	2104	325	650	975
16	2104	325	650	975
17	2429	325	650	975

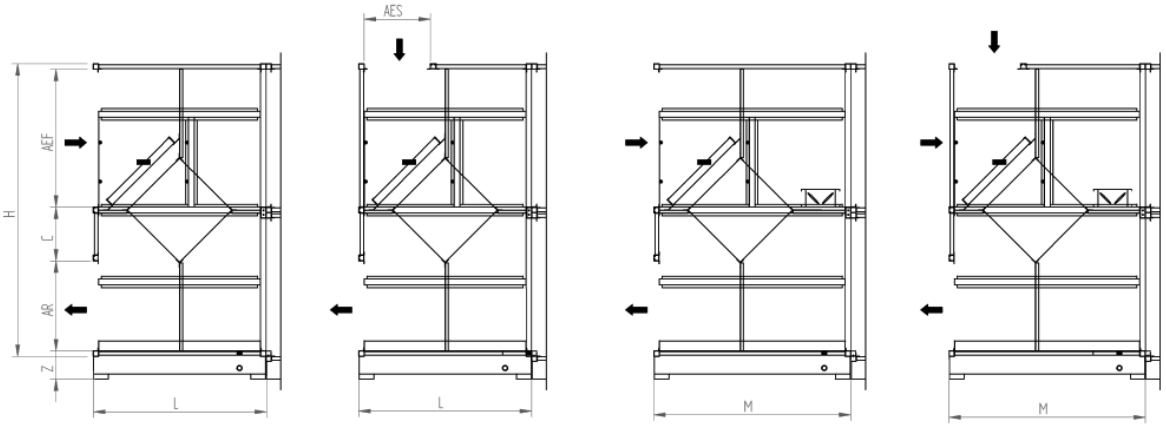
Fan	L1 (mm)
180	325
200	320
225	320
250	320
280	320
315	650
355	650
400	650
450	650
500	650
560	650
630	650
710	975
800	960
900	1300
1000	1280

15.8. HUMIDIFICATION



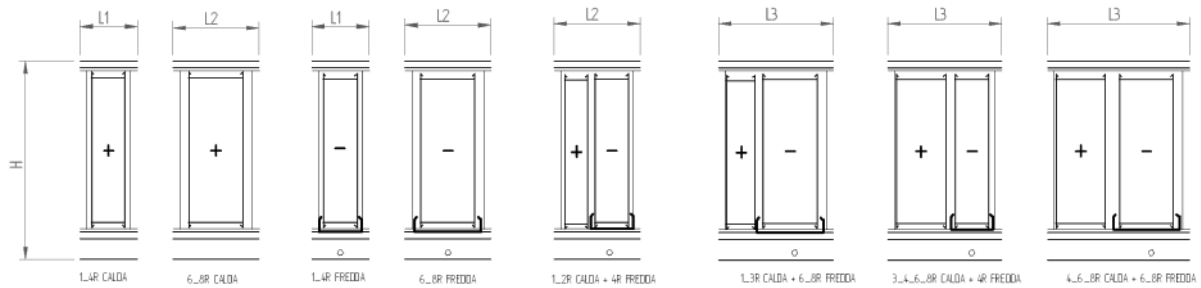
NCS	H (mm)	L1 (mm)	L2 (mm)	L3 (mm)
1	641,5	650	812,5	812,5
2	804	650	812,5	812,5
3	804	650	812,5	812,5
4	804	650	812,5	812,5
5	804	650	812,5	812,5
6	804	650	812,5	812,5
7	1129	650	812,5	812,5
8	1129	650	812,5	812,5
9	1129	650	812,5	812,5
10	1129	650	812,5	812,5
11	1454	650	812,5	812,5
12	1454	650	975	975
13	1779	650	975	975
14	1779	650	975	975
15	2104	650	975	975
16	2104	650	975	975
17	2429	650	975	975

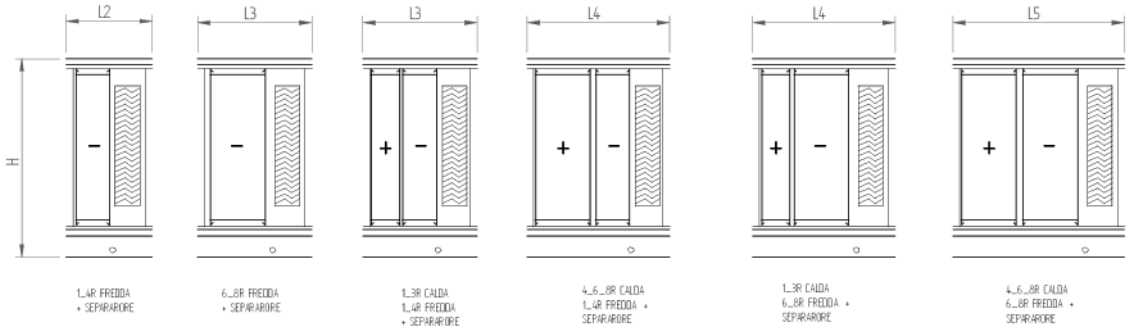
15.9. RECUPERATORS



NCS	Width (mm)	H (mm)	L (mm)	M (mm)	AEF (mm)	AES (mm)	AR (mm)	C (mm)
1	684	1009	684	772,5	447,5	285	285	202,5
2	684	1334	846,5	1171,5	610	285	285	365
3	846,5	1334	846,5	1171,5	610	285	285	365
4	1009	1334	846,5	1171,5	610	285	285	365
5	1171,5	1334	846,5	1171,5	610	285	285	365
6	1334	1334	846,5	1171,5	610	285	285	365
7	1009	1984	1171,5	1334	935	447,5	610	365
8	1171,5	1984	1171,5	1334	935	447,5	610	365
9	1334	1984	1171,5	1334	935	447,5	610	365
10	1659	1984	1171,5	1334	935	447,5	610	365
11	1334	2309	1496,5	1659	935	610	935	405
12	1659	2309	1496,5	1659	935	610	935	405
13	ND	ND	ND	ND	ND	ND	ND	ND
14	ND	ND	ND	ND	ND	ND	ND	ND
15	ND	ND	ND	ND	ND	ND	ND	ND
16	ND	ND	ND	ND	ND	ND	ND	ND
17	ND	ND	ND	ND	ND	ND	ND	ND

15.10. COILS





NCS	H (mm)	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)
1	641,5	325	487,5	650	812,5	975
2	804	325	487,5	650	812,5	975
3	804	325	487,5	650	812,5	975
4	804	325	487,5	650	812,5	975
5	804	325	487,5	650	812,5	975
6	804	325	487,5	650	812,5	975
7	1129	325	487,5	650	812,5	975
8	1129	325	487,5	650	812,5	975
9	1129	325	487,5	650	812,5	975
10	1129	325	487,5	650	812,5	975
11	1454	325	487,5	650	812,5	975
12	1454	325	487,5	650	812,5	975
13	1779	325	487,5	650	812,5	975
14	1779	325	487,5	650	812,5	975
15	2104	325	487,5	650	812,5	975
16	2104	325	487,5	650	812,5	975
17	2429	325	487,5	650	812,5	975

16. HANDLING

16.1. PACKAGING

The NCS air treatment units are usually supplied without packaging with the exception of high-efficiency or absolute filtering cells and assembly accessories, that are supplied in cardboard boxes and are to be installed by the customer. On request the units can be supplied packaged using polyethylene film, on pallets plus polyethylene film, in cages or in crates.

16.2. TRANSPORT

The transportability of the units from a dimensional point of view is highlighted in the Technical Data table (chap.5).

Transport must be performed with the following precautions:
- the load must be well blocked on the lorry;
- protection to prevent contact with protruding parts such as the plumbing connections of the coils, outlets, dampers, handles;
- tarpaulin protection of the load;
- protection with wooden boards between one unit and another in case they are transported stacked.

16.3. RECEIPT OF THE MATERIAL AND CHECKS

On receipt of the unit or individual sections a visual control must be carried out to check no damage has occurred during transport. If damage is discovered, this must be highlighted on the accompanying travel document.

The checks are the following:

- filters: check quantity and type;
- fan motor assembly: check fixing to the control unit;
- verify the integrity of:
- panelling and base;
- roof;
- headers and finned pack, if in view (for that regarding the finned coils);
- pins, louvers and gears (regarding the dampers).

16.4. STORAGE ON SITE

The units without rain protection roof must be stored in a covered area. The flow and recovery vents without dampers must be protected to prevent the entry of dust and foreign bodies and the dampers must be kept closed (and sealed with nylon if stored outdoors) until the units are connected to the recovery and flow channels. The units supplied in several sections must be stored close to each other in the sequence envisioned to prevent the entry of water or foreign bodies.

17. INSTALLATION

17.1. SAFETY PRECAUTIONS AND REGULATIONS

The following safety standards must be respected during installation, start-up, use and maintenance of the central air handling units:

- Be careful when lifting the unit whose centre of gravity can also be strongly off-axis.
- Be careful when securing lifting locking cables/hooks.
- Do not operate the unit if it and its electrical components have not been connected to the building's earth system.
- Do not operate the unit without the vent of the fan having been connected to a channel or protected with accident prevention mesh.
- Do not use the unit as a support for other equipment.
- Do not use the unit as a catwalk or staging.
- Do not use the unit as a shelter for equipment, spare parts, etc..
- Before entering the unit make sure that all the electric utilities have been disconnected. In particular, before opening the inspection doors make sure that the fan is off and cannot be switched on again without the person intervening on the central treatment unit knowing.
- Avoid opening inspection hatches with the fan running, particularly in the pressurised section of the unit.
- Always refit the protective guard of the fan section before restarting the fan.
- Do not leave doors ajar, make sure that all the handles or knobs are perfectly locked.
- Pay attention to the sheet metal edges inside the unit.
- Pay attention to the corners of the roof on outside units.
- Pay attention to possible burns from heating coils.
- Pay attention to possible burns from the steam humidification systems.
- Pay attention to the power-operated shutters that could unexpectedly close.

17.2. LIFTING AND POSITIONING

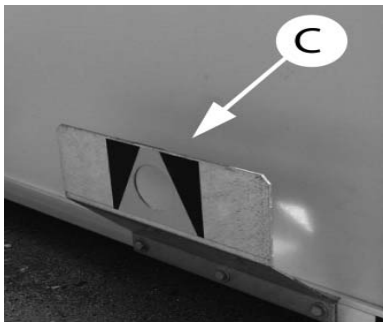
The NCS series units are designed to be lifted with a hook from below. When present, the corner feet and the continuous base have holes for lifting using ropes according to the following methods:

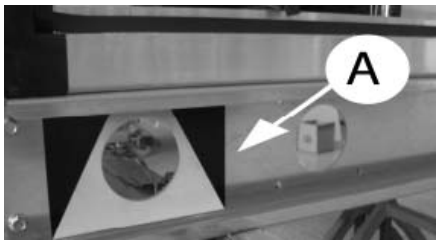
- For units equipped with continuous base and corner feet, insert a suitable tube for lifting the unit safely into the hole with the yellow and black label (indicated respectively by the letters A and B in the figure below).
- For units without feet or continuous base brackets are prepared that are anchored to the frame (indicated by C in the figure) which, must be removed after movement.

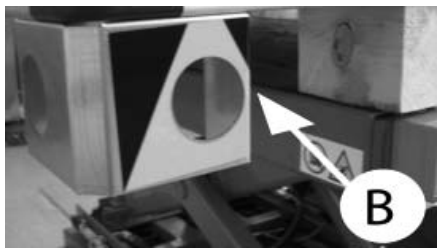
The positioning must be done using two transpallet one for each side of the section, preferably acting on the longer sides. Alternatively the positioning can be done by sliding the centre on the tubes that act as rollers. The sections without continuous base can be made to slide directly over the floor. The fan motor assemblies are assembled on anti-vibration supports; however it is recommended to interpose an anti-vibration mat between the base of the unit and the floor.

WARNING!
Anchorage must always take place using the holes marked by the yellow/black label. The centre of gravity of the central unit may be out of axis.

Anchorage points







WARNING!
Use a beam or place a strut between the ropes to annul the horizontal pull component that could deform the roof of the central air handling unit. When lifting, pay attention not to damage projecting components such as the dampers, headers, drains and handles.

17.3. MINIMUM TECHNICAL CLEARANCES

When positioning the central air handling unit the space necessary for routine and extraordinary maintenance must be respected. The optimal situation is a corridor of 700 mm minimum on the inspection and header side and leave a distance equal to the width of the unit plus 100 mm on the opposite side to remove the coils from the opposite side to the headers without having to disassemble the valve group (Fig. A) If the unit has to be placed next to a wall, leave a corridor with a width equal to that of the unit plus 100 mm on the inspection and header side (fig. B).

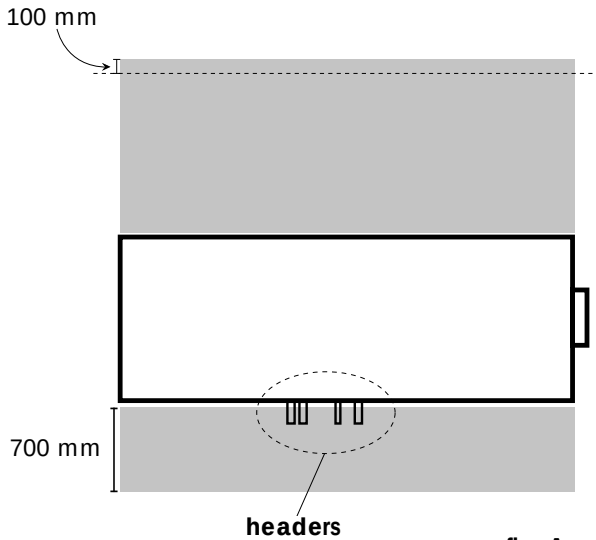


fig. A

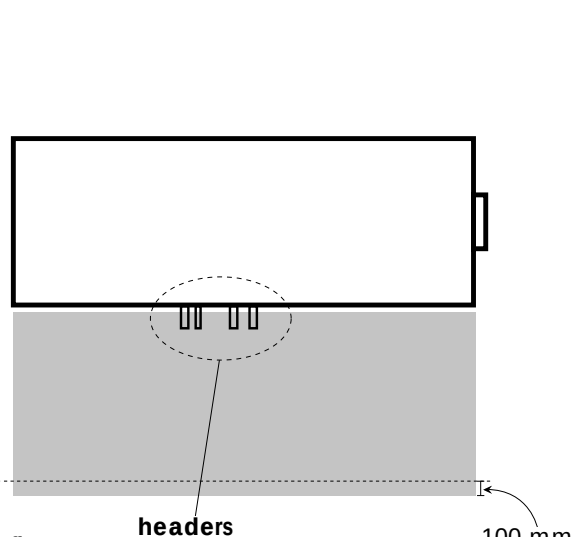
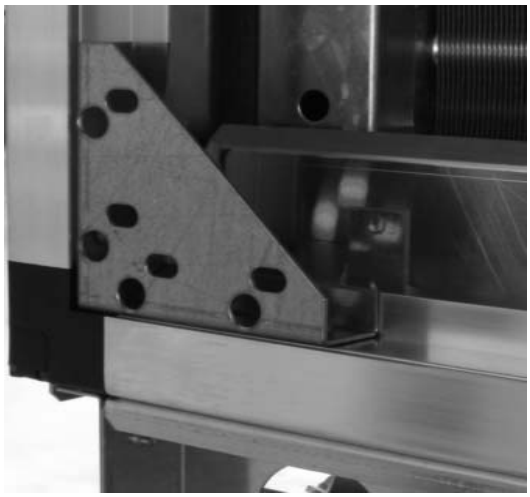


fig. B

17.4. JOINING THE SECTIONS

Units supplied in various sections should be assembled following the design attached to unit, using the supplied materials contained in a box (usually placed in the fan section). Before joining the sections, interpose neoprene adhesive gasket, then place together and mix them using two bolts in the slots for each corner.

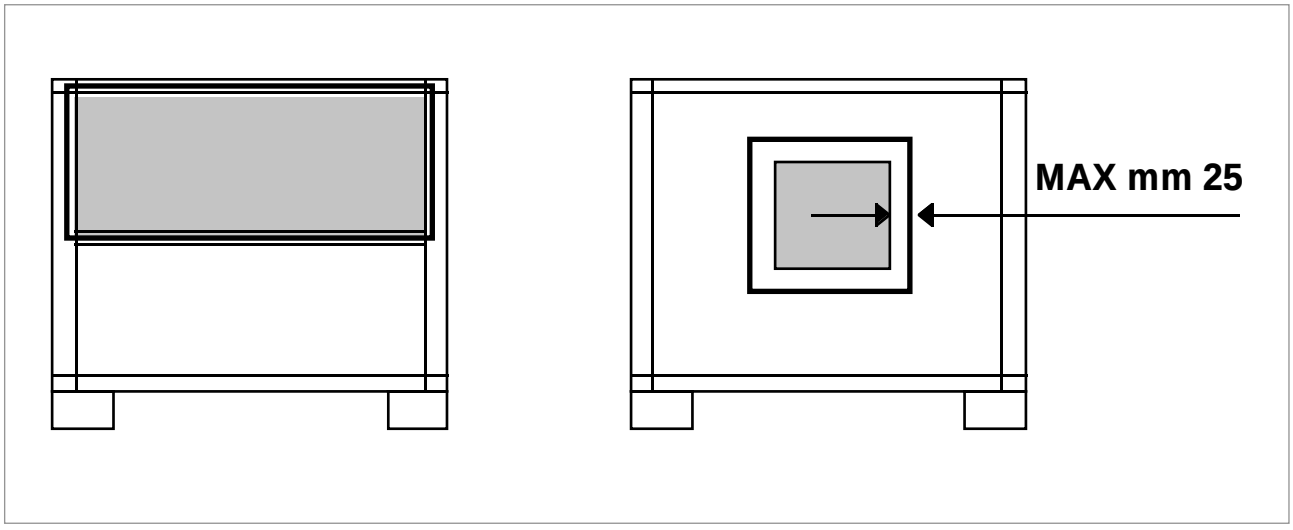


18. CONNECTIONS

18.1. AERAULIC CONNECTIONS

IMPORTANT !
It is prohibited to start the air treatment unit if the fan inlets are not ducted or are not protected by an accident-prevention system

- The delivery and pick-up mouths must be connected to the channels, interposing a vibration damper joint. The vibration damper joint is connected to the unit, screwing it into the flange or the damper (when present). failing this, the vibration damper joint is screwed to the unit with self-drilling screws to the frame of the unit in the case of the recovery vent, and to the panel in the case of the delivery vent as follows.
- The electric equipotential between the unit and the channelling must be ensured with a ground wire that provides the bridge on the vibration damper joint.

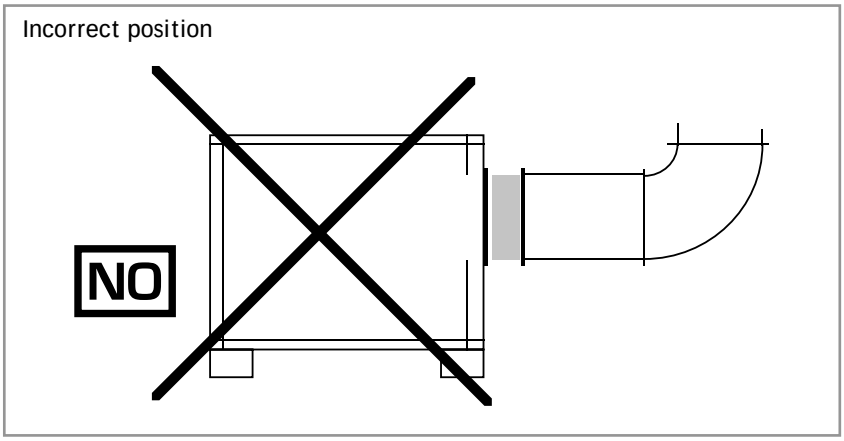


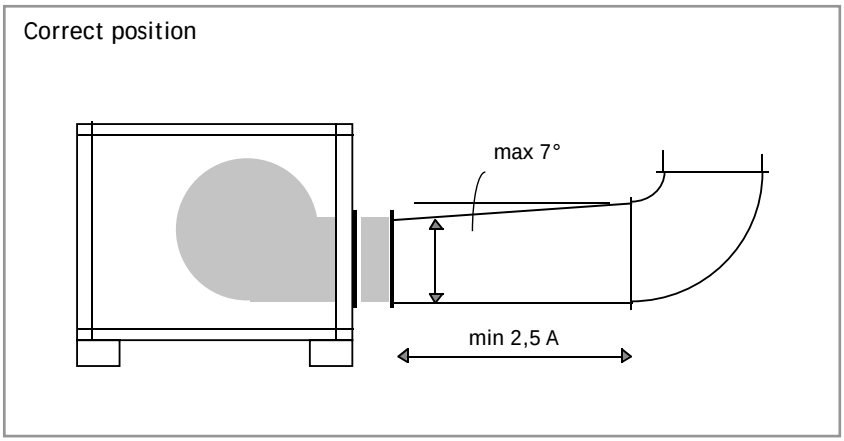
18.1.1. Recovery and flow vents

- Arrange (before bends, branches etc.) the delivery channel with a straight part of a length at least 2.5 times the shorter side of the channel, to avoid drops in the channelling performance levels;
- Ensure the channelling does not have slopes in the diverging tracts greater than 7°C.

The orientation of the fan must be chosen in accordance with the course of the first curve as shown in the compatibility diagram (Chapter 10). The directions with equal even final number refer to right hand unit direction; those with an odd final number refer to the left hand unit direction.

To clarify the provision of the fans' delivery refer to the following figures:





18.2. HYDRAULIC CONNECTIONS

a) Water coils connections

The headers of the heat exchange coils have threaded female connections for the entry and exit of water. Where flanged connections are required, threaded flange must be used to allow the removal of the coil that involves the release of headers from the side panel of the unit. Follow the indications given below for correct coil connection:

- The route of the pipes must be designed so as not to create obstacles in the case of removing the coils and not to interfere with the inspection door of the unit.
- Water inlets and outlets should be arranged in such a way as to ensure counterflow heat exchange. Follow the information given on the WATER INLET and WATER OUTLET plates. Generally, the coils with right connections are fed from below, while those with left connections from above.
- Firmly clamp the pipes outside the unit, to prevent them weighing on the coil;
- During the screwing operations of the system's hydraulic circuit coil headers, avoid using force that may damage the coil;
- Fit a breather valve above and a discharge valve below.
- Install shut-off valves to isolate the coil from the rest of the circuit in the event of special maintenance.
- With the connection made, push the external rubber gasket against the panel to prevent air leakage and possible condensation.
- When adjusting, interlock the pipe side coil with the fan off to prevent overheating inside the unit with possible damage to some components.
- Provide anti-freeze protection devices for units with external air intakes.

For the sizes of the heat exchange coils and the dimensions of the headers, see the tables on pages 15 and 16 of this manual.

b) Direct expansion coil connection

Follow the indications given below for correct direct expansion coil connection to the cooling circuit:

- Make sure that the coil exchange takes place in counter-flow;
- the cooling circuit must be equipped with all the regulation and safety devices to avoid any damage to the coil;
- the piping shall be dimensioned and equipped with appropriate traps to allow the movement of oil to ensure the lubrication of the compressor;
- pay attention to the vibrations transmitted to the direct expansion coil that could lead to the rupture of the welds.

c) Humidification connection with evaporator pack and disposable water

This type of humidification implies the connection of the water supply pipe and the drain. The power supply must be intercepted by a solenoid valve (not supplied) coupled to an environment humidistat and an eventual limit humidistat on the delivery duct (not supplied). The drain must be connected with the criteria stated in paragraph 15.5. The attachments for supply and draining are found under the tray in the thickness of the unit base.

- Supply connector diameter: 1" GJ
- Discharge connector diameter:
- 1" GJ

d) Evaporator pack humidification connection and supply control

This type of humidification implies the connection of the water supply pipe and the drain. The power supply must be intercepted by the provided solenoid valve in interlocked to the electronic power supply control that is connected in series with an environment humidistat and an eventual limit humidistat on the delivery duct (humidistats are not included). The drain must be connected with the criteria stated in paragraph 15.5. The attachments for supply and draining are found under the tray in the thickness of the unit base.

- Supply connector diameter:
- 1 -1/2" GJ
- Discharge connector diameter:
- 1" GJ

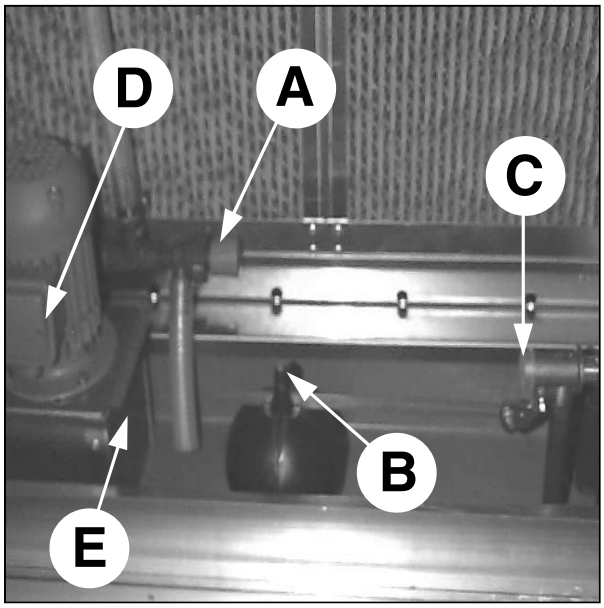
e) Evaporator pack humidification connection and pump

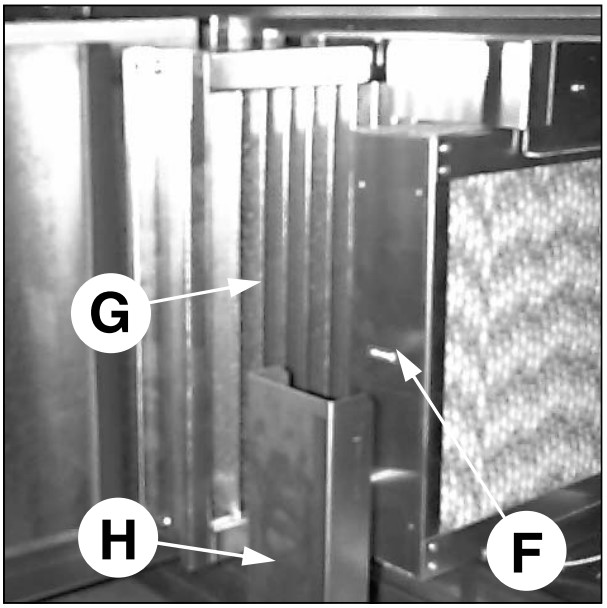
This type of humidification implies the connection of the water supply pipe and the drain.
The supply must be intercepted by a valve (not supplied) for maintenance, while during normal functioning it is adjusted by a float valve (C in the figure). A pump (D in the figure) coupled to an environment humidistat and an eventual limit humidistat on the delivery duct (not included) supplies the evaporator pack. The drain must be connected with the criteria stated in the paragraph on page 37. The attachments for supply and draining are found under the tray in the thickness of the unit base.

- Supply connector diameter: 1" GJ
- Discharge connector diameter:
- 1" GJ

Preliminary operations :

- Check the positioning of the evaporator pack (F) and possible drop eliminators (G) which are both removable. The evaporator pack is laterally protected by spray guards (H);
- check that the filter mesh (E) is inserted to his full height on the guides of the pump support;
- connect the pump (three-phase);
- check that the water level is about 20 mm below the surface of the metal pan; if this is not the case, adjust the float valve by acting on screw (C) and/or on the position of the float (B) on the control rod;
- adjust the flow of water on the pack by means of the by-pass valve (A) so that the pack is soaked without causing jets of water.





f) Steam humidification connection

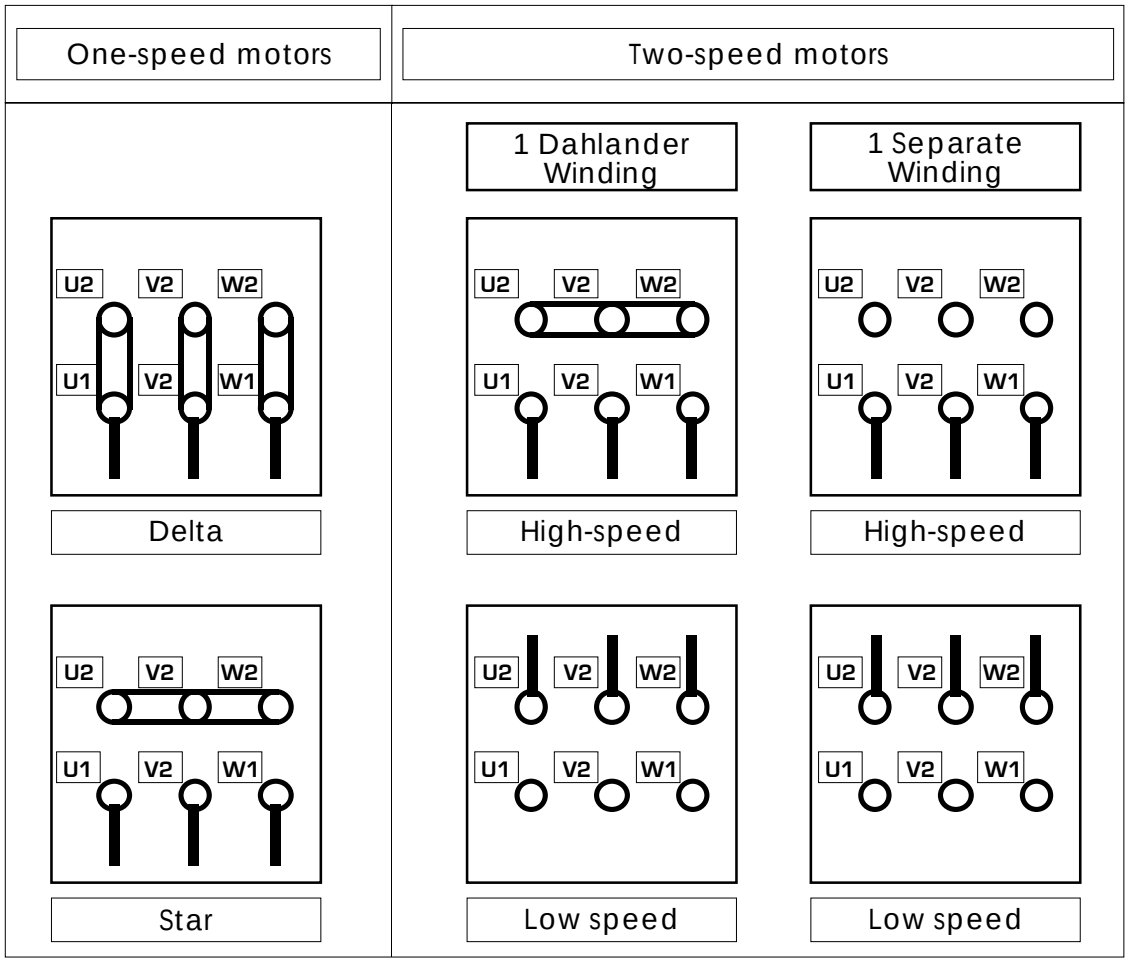
The steam humidification sections are supplied in standard executions only with the steam distributor pipe. This pipe has a 1" G attachment for the supply of steam and a 3/8" GJ attachment for the recovery of condensate. Adjustment valves can be connected to this distributor pipe for centralised steam production or immersed electrode steam generators. If the latter is purchased as an accessory to the central air handling unit, it is normally supplied mounted on the side of the machine and already hydraulically connected (steam and condensate). For maintenance, refer to the manufacturer's manual attached to the appliance. The steam humidification sections are equipped with drop eliminators and condensate drain pan with 1" G outlet to be connected following that indicated in the paragraph on page 37.

18.3. ELECTRICAL WIRINGS

The central air handling units are normally supplied with the electrical appliances not wired. The installer must wire the:
- fan motors;
- humidification pumps;
- roll filters;
- gearmotor,
- limit switch,
- pressure switch,
- pressure switches;
- light points;
- electric coils

ELECTRIC MOTORS

The motors are envisioned with single polarity (2, 4, 6 poles depending on fan speed) and, on request, with double polarity 4/6, 4/8 poles with simple winding. The typical connection layouts of the three phase electric motors are shown in the following diagram (the diagram within the control board of the motor or on the back cover of the control board should be consulted).



The single-speed electric motors and two power supplies with direct start, are star connected if the voltage is increased, or delta if less; 220/400 V motor:

- delta connection for 220 V power supply,
- star connection for 400 V power supply.

400/660 V motor:

- delta connection for 400 V power supply.
- All motors can operate equally well in both rotation directions; The direction of rotation can be inverted by exchanging the two line connections to the stator clamps.
- Always check the diagram that comes supplied with the two-speed motors.

18.4. ELECTRIC PUMPS CONNECTION

The evaporator pack humidification electric pumps have a 220/400 V motor, therefore they are connected:

- delta for 220 V power supply,
- star for 400 V power supply.

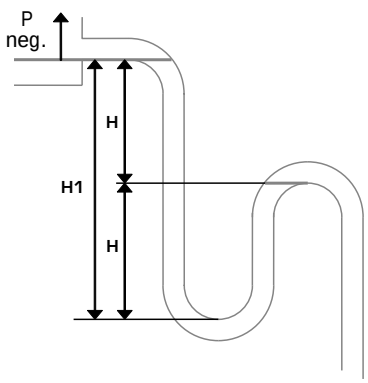
NB:
Regarding the roll filters connection and the connection of electric coils, refer to the wiring diagram attached to each individual coil.

18.5. CONDENSATE DRAIN

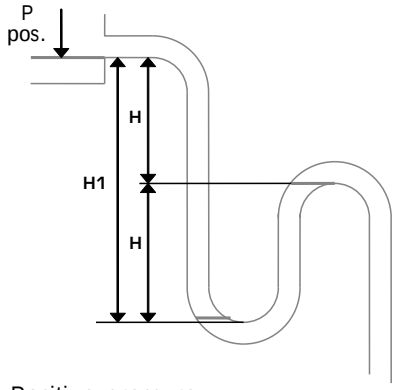
The drainage system should feature an adequately sized siphon to:

- ensure free condensate drainage;
- prevent the inadvertent entry of air into the circuit under negative pressure;
- prevent the inadvertent leakage of air from the pressurised circuit;
- prevent the entry of unpleasant odours and insects.

Below find the rules to follow for the sizing and version of the siphons in the case of vacuum or pressurised tank.



Negative pressure:
H1 = 2P
H2= H1 / 2



Positive pressure
H1 = 2P
H2 = H1 / 2

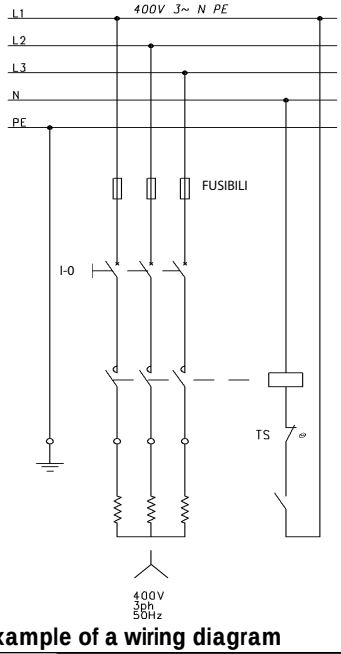
Where P is the pressure expressed in mm of a column of water (1 mm c.w. = 9.81 Pa). The siphon must have a cap for cleaning the lower part or must however allow quick disassembly for cleaning.

18.6. ELECTRIC COILS CONNECTION

Below find several prescriptions necessary for the correct connection of the electric coils:

- when wiring, make sure that nuts, washers, and lugs are securely fastened to the terminal of the heating element;
- Ensure that the section of the cables used for wiring are adequate;
- check that the line voltage is compatible with the data embossed on the data plate positioned above the terminal board or on the coil flange;
- do not open the electric coil cover before having disconnected the electric power supply;
- during routine maintenance check the status of the ceramic insulators and tightness of the nuts;
- when adjusting, interlock the electric coil with the fan to prevent overheating inside the central air handling unit with possible damage to several components.
- adjust the shutdown of the unit's fan 5 minutes after that off the electric coil.

For the electric connection, refer to the main wiring diagram at the side or that attached to each individual coil.



Example of a wiring diagram

18.7. EARTH

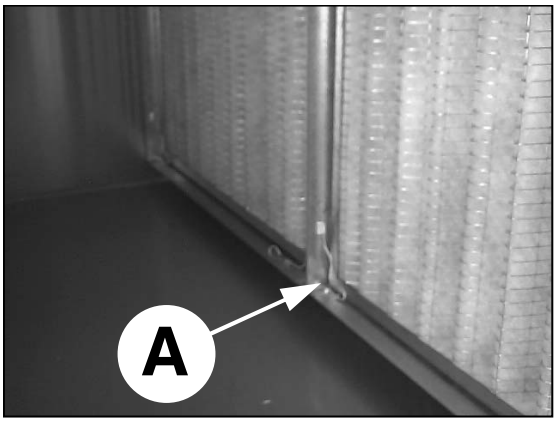
Each electrical appliance must be connected to the earth of the system. Beyond that every section of the unit must also be earthed.

To do this each section is equipped with a M8 screw for connection to the system earth plant. The screw, identified by a special plate, is located near one of the feet of the section as indicated in the figure below.

To earth, use the connectors indicated by the graphical symbol shown above.

18.8. MOUNTING THE FILTERING CELLS

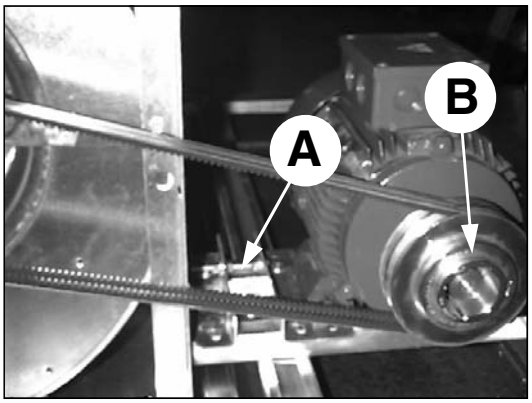
- Pre-filters assembly (synthetic or metal): Normally supplied fitted Otherwise they have to be slid along the guides taking care to connect each cell to the next with a special supplied metal hook to make removal easier for subsequent maintenance.
- Pre-filter assembly with bag filters (synthetic or metal):
- They are normally delivered in boxes housed inside the central air handling unit. They should be introduced on the frames from the front and attached thereto by the supplied clips (A in the figure).
- Absolute filters assembly: They are always delivered in boxes housed inside the central air handling unit. They should be introduced on the frames from the front and attached thereto by the supplied brackets with knobs. Depending on the size of the central air handling unit, the anti-splash nozzle may have to be disassembled in order to perform mounting. This is installed facing the fan vent (this operation is carried out by loosening the threaded bars from the fan bulkhead).
- Roll filters assembly: The rolls are normally supplied already mounted. For disassembly and successive reassembly, refer to the manufacturer's instructions supplied.



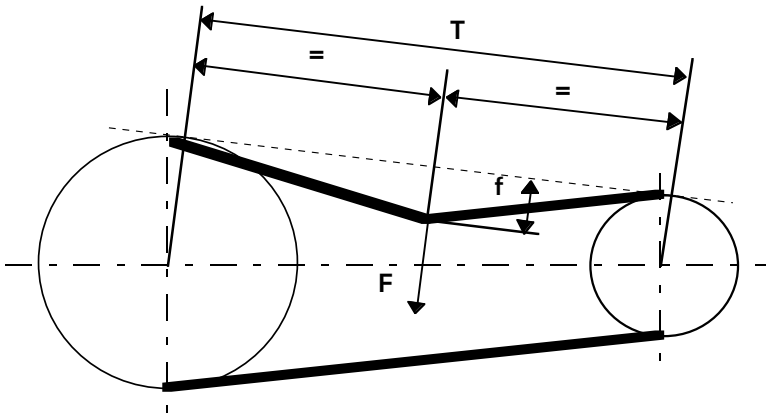
19. PUTTING INTO SERVICE

19.1. FANS

- Check the tightness of the screws on the fan motor assembly;
- check the tightness of the pulleys on their couplings;
- alignment of the pulleys;
- check the free rotation of the fan and motor;
- disassembly of any safety retainers prepared in the case of set-up using springs;
- belt tension: belt tension must be checked again after a few hours according to the schematised procedure;
- direction of rotation: the fan rotor must turn in the direction indicated by the arrow on the fan auger; if the direction of rotation is incorrect, invert the two phases on the motor terminal board;
- electrical absorption: calibrate the heat protections on the control board regarding the plate absorption of the motor and use an ammeter to check that the current absorbed does not exceed this value. If absorption is excessive it is probable that the air distribution pressure drops have been overestimated and the capacity is overabundant. In this case, introduce an additional resistance with a calibration damper or, preferably, reduce the fan rotation speed by changing transmission. In central air handling units with variable pitch pulley the speed is varied by changing the pitch (B in figure 16.1.1). This problem may occur particularly in forward curved blade fans.



◊ **Belt tension**



- Measure the free tract T.
- Use a dynamometer to apply a force F to a belt perpendicularly at half of T. This must be able to cause an arrow f of 1.5 mm for every 100 mm of T.
- Compare the value of F supplied by the dynamometer with the values of F' and F" given the table (paragraph 19.1.1) that follows:
  - If F<F' the belt must be tensioned.
  - If F>F" it must be loosened.
- Since there is rapid decrease of tension during the break-in period of new transmissions, the new belt will need to be tightened so that the force F to obtain the arrow f, is 1.3 times the value of F" shown in the Table. Belt tension is adjusted by acting on the motor slide screws (A in the figure).

19.1.1. Table of dynamometer values

Belt section	Smaller pulley external diameter (mm)	N° revolutions - Smaller pulley[rpm.]	F' minimum (N)	F" maximum (N)
SPA	90 - 145	900 - 1800	25	35
	150 - 195	600 - 1200	30	45
	200 - 250	400 - 900	35	50
SPB	170 - 235	900 - 1800	35	45
	250 - 320	600 - 1500	40	60
	330 - 400	400 - 900	45	65
SPC	250 - 320	900 - 1800	70	100
	330 - 400	600 - 1200	80	115
	440 - 420	400 - 900	90	130

19.2. HEAT EXCHANGE COILS

Before any check of the heat production of the heat exchange coils, it is recommended to:

- check the correct connection of the coils;
- check the temperature of the fluids;
- check the correct functioning of the adjustment logic and adjustment parts (3-way valves servomotors, etc.)

19.3. ELECTRIC PUMPS

- rotation direction,
- calibration of thermal protection,
- electrical power consumption
- by-pass valve adjustment.

19.4. FILTERS

- correct positioning and fixing of cells,
- cleaning of cells and inside the unit.

19.5. HUMIDIFICATION

- correct positioning of the evaporator pack,
- proper connection to the mains and adjustment of the float valve.

19.6. DAMPERS

- operation (manual and automatic if foreseen),
- position: remember that start-up with closed dampers cannot be possible for fans with a maximum static pressure exceeding 2000 Pa if not envisioned explicitly in the order phase.

20. MAINTENANCE

The components installed must undergo the operations described in the following table with the indicated frequency. The frequency indicated is approximate (average): particularly for the filters, the dirtying of which is very different according to function of the central air handling unit. The intervals may be shorter for the fans in the case of continuous functioning.

Component	Phase	Type of control	Instrument	Limit value	Scheduled time
Ventilating section	•Check belt tension, •Check belt wear, •Check pulleys functioning, •Check rotor cleanliness, •Check bearings noise.	•Instrumental •Visual •Visual •Visual •Visual	Dynamometer		• twice a month • twice a month • twice a month • twice a month • twice a month
•Synthetic filters, •Bag filters, •Absolute filters, •Roll filters.	•Check dirtying, •Check dirtying, •Check dirtying, •Reel end check.	•Visual •Instrumental •Instrumental •Visual	Pressure gauge Pressure gauge	300 Pa 600 Pa	•every two weeks •every two weeks •every two weeks •on indication
Evaporator pack humidification	•Check pack blocking, •Tank cleanliness, •Cleaning the water filter, •Tank emptying, •Water level.	•Visual •Visual			•every two months •every two months •every two months •at the end of the season •every two months
Coils	•Check pack cleanliness, •Check condensate tray cleanliness.	•Visual •Visual			•yearly •yearly

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