CTS

AIR HANDLING UNITS

COMPANY WITH QUALITY
SYSTEM CERTIFIED

MOODY CERTIFICATION ISO9001
FRANCE
200404937

Company presentation

*ATA is a company that offers the market **twenty years' experience** in the air-conditioning sector, for both civil and industrial applications.The company's facilities cover a total area of around 7,500 m², with 4300 m² dedicated to production, around 700 m² of office space and 2500 m² of outdoor areas, parking and stores.*

The company's main lines of business are the design, production and marketing of air handling systems

The company's philosophy, confirmed by the positive response from the market, is based on the constant upgrading and expansion of its manufacturing capacity, following continuous investments in technology and human resources.

DESIGN PHILOSOPHY

The design of the CTS series air handling units has been performed considering the evolutions in the design and architecture of buildings and the increasingly important needs to reduce the ***spaces*** *occupied by air-conditioning systems.*
The CTS series is the answer to these needs, perfectly combining the concept of ***less space/ less cost****, while maintaining the aim of satisfying a wide variety of systems requirements.*

The units making up the "CTS" series, built in compliance with ***the European directives****, are available in 16 standard sizes, from 01 to 10 with square sections, from 11 to 16 with rectangular sections, covering a range of standard air flow-rates from 1000 to 80000 m³/h. For higher flow-rates, specific configurations are developed based on requirements.*
The ***modular construction*** *and the wide choice of components and accessories make the "CTS" air handling units the most complete and reliable range on the market.*

The photo shows a CTS 08 air handling system complete with the following optional accessories:
Electrical panel;Damper servo motors;Control valves;Valve servo motors;Inspection portholes;Light with switches on the outside;Pressure switches;Control probes.

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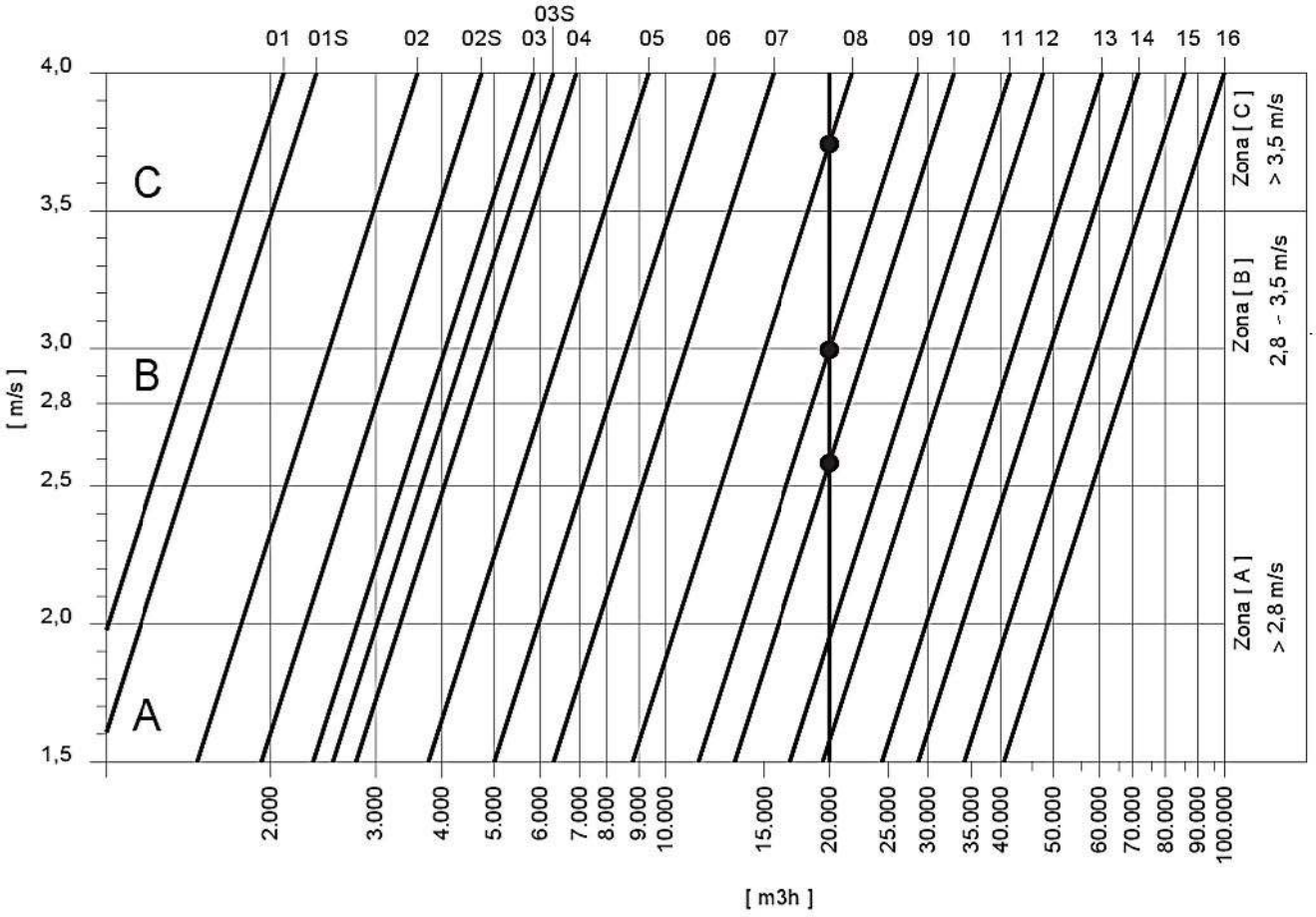
1. METHOD FOR SELECTING THE SIZE

1.1 SELECTING THE SIZE and RATED TECHNICAL SPECIFICATIONS

The concept of modular construction is based on the creation of ***modular sections that are easy to transport and assemble on site****, defined on a case-by-case basis according to the needs of the system.*
The sizing of an air handling system for a specific installation therefore involves the selection of suitable components to guarantee the required performance.
The selection process is performed using special ***selection software*** *that, based on the system design data, automatically configures the best air handling system.*
There are two parameters that define the models in the CTS series: air flow-rate and coil flow-through speed. In the diagram below, once the flow-rate is known (x-axis), the size of the CTS required can be easily identified from the line representing the model at the required air speed (y-axis).

The diagram has been divided into three bands A , B, and C*, which sub-divide the choice of the size based on the type of air handling processes implemented, considering the flow-through speed of the air.*
In fact, when sizing a system, the following aspects should be considered

- ***air speed no higher than 2.8 m/s for units with cooling coils and/or humidification sections – Field A***
- ***air speed no higher than 3.5 m/s for heating only units – Field B***
- ***speed (theoretical) no higher than 4 m/s for ventilation only units, without coils, filters etc.. – Field C***



Having stressed that the choice refers to the field of flow-rates covered by the standard sizes, non-standard configurations are in any case possible.
For these configurations, please contact our technical department.

Example of sizing with an air flow-rate of 20000 m³/h.

- *Optimum selection when cooling coil is used: CTS 10*
- *Optimum selection when heating coil only is used: CTS 09*
- *Optimum selection for ventilation only: CTS 08*
- *It is clear that different decisions may be made according to specific situations. The sizes 01S, 02S and 03S have the same dimensions as the corresponding 01, 02 and 03, but use coils with a larger exchange surface, made using the different constructional criterion possible due to small overall dimensions.*

1.2 SELECTING THE SIZE and RATED TECHNICAL SPECIFICATIONS

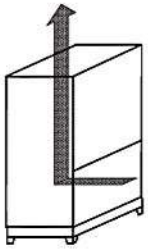
Size UNITA	Front air (m2)	flow rate (m3h)			Coil of heating			Coil of cooling			Front dimensions mm.	
		front flow speed			Rows 10 fins/inch	Heating capacity KW		Rows 12 fins/inch	Cooling Capacity KW			
		2,0 m/s	2,6 m/s	3,5 m/s		2,6 m/s	3,5 m/s		2,0 m/s	2,6 m/s	A	H
01	0.139	998	1297	1746	2 3	13.0 21.0	15.5 25.3	6 8	8.1 12.1	9.8 14.9	610	610
01/S	0.158	1137	1478	1990	2 3	15.0 23.8	20.1 28.8	6 8	9.23 13.8	11.2 16.9	610	610
02	0.243	1750	2274	3062	2 3	22.7 36.7	27.0 44.3	6 8	14.2 21.2	17.2 26.0	730	730
02/S	0.324	2332	3032	4082	2 3	30.1 48.9	40.6 58.9	6 8	19.0 28.3	22.8 34.7	730	730
03	0.402	2804	3645	4906	2 3	37.5 60.7	44.7 73.2	6 8	23.6 35.1	28.4 43.1	850	850
03/S	0.428	3081	4006	5392	2 3	39.8 64.6	53.0 77.9	6 8	25.1 39.8	30.2 45.8	850	850
04	0.488	3370	4380	5897	2 3	45.5 73.7	54.3 88.9	6 8	28.6 42.4	34.5 52.3	910	910
05	0.630	4536	5897	7938	2 3	58.8 95.2	70.1 114.8	6 8	36.9 54.9	44.5 67.5	1030	1030
06	0.816	5875	7638	10282	2 3	76.1 123.3	90.8 148.7	6 8	47.8 71.2	57.7 87.4	1150	1150
07	1.047	7543	9068	13200	2 3	97.7 158.2	116.5 190.8	6 8	61.4 91.3	74.0 112.1	1270	1270
08	1.449	10433	13563	18257	2 3	135.2 218.9	161.3 264.0	6 8	84.9 126.4	102.4 155.2	1450	1450
09	1.910	13789	17926	24132	2 3	178.2 288.6	212.6 348.0	6 8	111.9 166.6	135.0 204.6	1630	1630
10	2.230	16062	20880	28108	2 3	208.1 337.0	248.2 406.3	6 8	130.7 194.5	157.7 238.8	1750	1750
11	2.808	20218	26283	35381	2 3	262.0 424.3	312.5 511.6	6 8	164.5 244.9	198.5 300.7	2140	1770
12	3.213	23138	30079	40491	2 3	299.8 485.5	357.6 585.4	6 8	188.3 280.2	227.2 344.1	2400	1770
13	4.106	29566	38436	51741	2 3	383.1 620.4	457.0 748.1	6 8	240.6 358.0	290.3 439.8	2700	1950
14	4.788	34474	44816	60329	2 3	446.7 723.5	532.9 872.4	6 8	280.6 417.5	338.5 512.8	3000	2010
15	5.760	41472	53914	72576	2 3	537.4 870.3	641.1 1049.5	6 8	337.5 502.3	407.2 616.9	3540	2010
16	6.720	48384	62899	84672	2 3	627.0 1015.4	747.9 1224.4	6 8	393.8 586.0	475.1 719.7	3540	2310

**Cross-section for the passage of air through the coils*

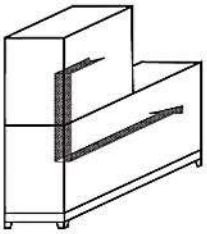
The heating capacity refers to the following conditions :
-intake air 7°C for 2 row coil
-intake air –5°C for 3 row coil
-water inlet/outlet 80/70°C
The cooling capacity refers to the following conditions:
-intake air 28°C DB 20°C WB for 6 row coil
-intake air 34°C DB 23°C WB for 8 row coil
-water inlet/outlet 7/12°C

Once the size of the system has been selected, depending on the needs of the design and the spaces available, various configurations are possible. The more common ones are shown in the following diagram

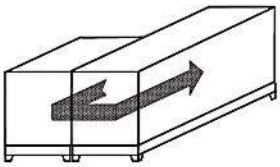
2. SYSTEM CONFIGURATION



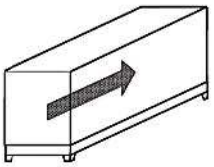
Vertical Unit



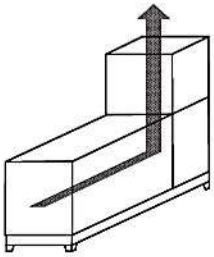
Double deck unit



Wrap around unit



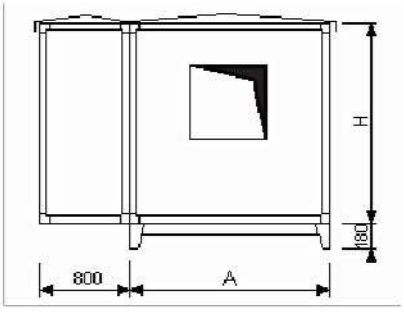
Draw through unit



"L" shape verticle

In the case of outdoor installation, all configurations of the system may feature:

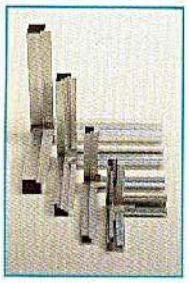
- ***Protective cover** made from weatherproof material. Due to the thickness of the metal plate used, this cover can support the weight of snow and wind, and its **pyramid shape and sloped sides** ensures the even downflow of rain water around the entire perimeter. The protruding ends of the roof are rounded in compliance with the relevant safety standards.*
- *Technical compartment to house the valves and the other control devices. This features the same finish as the unit itself, but without the base panel, unless specifically required, to allow the passage of pipes and cables from below.*



The first figure shows a rectangular section of a CTS installed on a roof with the technical compartment; the second figure shows the joint between two blocks, with details of the joint between the roofs

3. GENERAL CHARACTERISTICS

3.1 Frames



The main characteristic of the frame that represents the containment structure of the CTS series units is its modular design, ensuring ***simple, precise and rapid assembly.***

The load-bearing frame is made from **special extruded aluminium alloy section bars (6060 T5 UNI 3569 Anticorodal 63)**, L-shaped with ledge for the gaskets, suitably sized according to of the dimensions of the systems. To simplify the assembly of the frames, special **fibreglass-reinforced nylon or die-cast aluminium** union joints are used. The assembly system, using three-way joints, allows the system to be divided into a series of parts, making all the transport and on-site handling operations much easier.

This also ensures a rigid and perfectly square frame, without sharp edges or dangerous protrusions, in compliance with the relevant safety standards.
The use of different sized section bars allows the assembly of panels of various thicknesses or made from different materials.
Upon request, special frames are available for thermal break configurations, with rounding of the inside edges and shrouded screws and bolts

3.2 Pannel

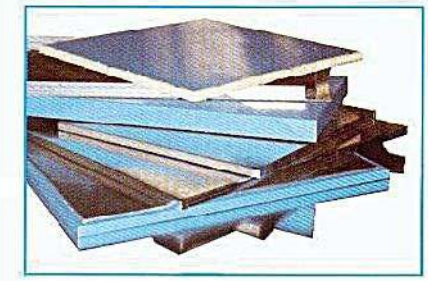
	CHARACTERISTICS OF THE METAL PLATE USED TO MAKE THE PANELLING
Galvanised steel	*Galvanised steel plate,* ***Sendzimir Z200 UNI5753-84****, passivated, thickness no less than 8/10. Overall weight of zinc on the two surfaces 200 g/m2. Tolerances allowed for thicknesses up to 0.9 mm +/- 0.08.*
Pre- painted galvanised steel	*Galvanised steel plate, thickness no less than 8/10,* ***PRE-PAINTED*** *white-grey. Both sides of the metal are applied first with a primer, 5 microns, and when this a dry a 20 micron thick coat, all protected by scratchproof film (to be removed on site). Excellent resistance in saline atmospheres and excellent resistance to aggressive substances. Max. continuous temperature 90°C.*
Plastic coated galvanised steel	*Galvanised steel plate, thickness no less than 8/10,* ***PLASTIC-COATED*** *on the outside with a film of plastic no less than 150 microns thick, applied when hot, and by a further layer of scratchproof film (to be removed on site).*
Aluminium	*Aluminium plate,* ***PERALUMAN*** *P-Al-Mg. 2.5-UNI3574, protected by scratchproof film (to be removed on site).*
AISI 304 stainless steel	***AISI 304 STAINLESS STEEL*** *plate, thickness no less than 8/10, protected by scratchproof film (to be removed on site).*
Micro-perforated metal plate	***MICRO-PERFORATED*** *galvanised steel plate, with suitable holes that, as well as assisting the absorption of noise, guarantee suitable structural rigidity (excluding handling zone wall made from galvanised plate)*

The panels are made from first choice materials, and undergo periodical checks right from the moment of receipt, with weekly checks on their condition during storage. The following table shows the brand names and the products used for the construction of the air handling unit panels

The panels can be completed by different types of inside insulation; the following are those normally used for the panelling on the CTS series air handling units.

	TYPE OF INSULATION
Polyurethane foam	**Polyurethane foam**, closed-cell, **density > 45 kg/m3**, produced by INJECTION. Thickness 23/50 mm. Resistance to flame according to ISO 3580 – ASTM 1692 corresponding to classes M2 – NF P 92- 501, B2 – DIN 4102 and 2 – CSE. Thermal conductivity 0.020 W / m K. Transmittance 0.9 W/m²K for panel thickness 23/25mm, 0.5 W/m²K for panel thickness 50 mm The filling is hot injected so as to guarantee uniformity
Glass wool	**Layer of glass wool**, sized with heat setting resins, **density >40 kg/m3**. Thickness 23/50 mm Thermal conductivity 0.032 W / m K. Transmittance 1.1 W/m²K for panel thickness 23/25mm, 0.6 W/m²K for panel thickness 50 mm Resistance to flame: FIREPROOF, compliant with all the standards on the reaction to fire of combustible materials. CLASS 0 C.S.E.RF 2/75 - C.S.E.RF 3/77 - C.S.E.RF 4/83
Mineral wool	**Layer of MINERAL WOOL**, sized with heat setting resins, **density > 80 Kg/m3**. Reaction to fire : Class 0 according to ISO/DIS 1182.2 Thermal conductivity 0.044 W / m K. Resistance to flame FIREPROOF, compliant with all the standards on the reaction to fire of combustible materials. CLASS 0 C.S.E.RF 2/75 - C.S.E.RF 3/77 - C.S.E.RF 4/83
Polyurethane sheets	Soundproofing layer of POLYURETHANE. Thermal conductivity 0.030 W / m K.

The CTS series envisages different combinations of metal plate making up the casing of the panelling, and the insulation. The table below lists the standard combinations; naturally, other types of panels not shown in the table can be supplied upon request.



		Outer panel / (Type of insulation)			
		Galvanised steel	Galvanised steel Plastic-coated or Prepainted	Aluminium	AISI 304 Stainless steel
Inner panels	Galvanised steel	**211** (B1, B2, B3)	**213** (B1, B2, B3)		
	Aluminium	**219** (B1, B2, B3)	**220** (B1, B2, B3)	**214** (B1, B2, B3)	
	AISI 304 Stainless steel		**217** (B1, B2, B3)	**218** (B1, B2, B3)	**215** (B1, B2, B3)
	Micro-perforated plate		**216 **** (B3)		
	Not present	**221** (B4)	**223** (B4)		

*"**VELOVETRO**" fabric and then enclosed by **micro-perforated metal plate**. In the **soundproofed version for clean rooms**, on the inside surface in contact with the treated air, the glass wool (or mineral wool), as well as being protected by the "**VELOVETRO**", is enclosed in a sealed wrapping, made from special "**clean flow**" material (MYLAR), **suitable for steam disinfection at 120°C**, and then lined with the micro-perforated metal plate.*

All the panelling, both single and double wall (sandwich), is fastened to the frame using self-threading screws, following the insertion of a special long-life resin gasket that guarantees, over time, perfect air-tightness under the pressure created during the operation of the system.

*The panels are mechanically stamped with openings at the perforations for extra strength and allow space for the insertion of the **PVC bushes**. The bushes are inserted in these openings before filling the panels, thus **preventing the insulation from coming into contact with the air**.*

The fastening screws (cadmium-coated galvanised steel), inserted in the PVC bushes, are protected against the weather by special caps; consequently, nothing protrudes from the outer wall that, in this way, is perfectly smooth.

All the panels are simple to remove, while the sections that require maintenance/inspection feature doors with handles and die-cast aluminium alloy hinges.

The different sizes of the various section bars normally used allows the frame to be made according to the size of the unit; the three standard dimensions allow the use of various thicknesses of panelling.

For sizes from 01 to 10, the type Pa35 section bar allows the insertion of 23mm thick panels; for sizes from 11 to 16, the type Pa50 section bar, allows the insertion of 25mm thick panels. For panelling thicker than 25mm and up to 50mm, type Pa70 section bars are used.

The thickness of the panels guarantees that the hardware used to fasten the components is shrouded inside the frame.

As well as this vast range of standard configurations, special configurations are also available, with thermal break frames and panels suitable for harsh climates.

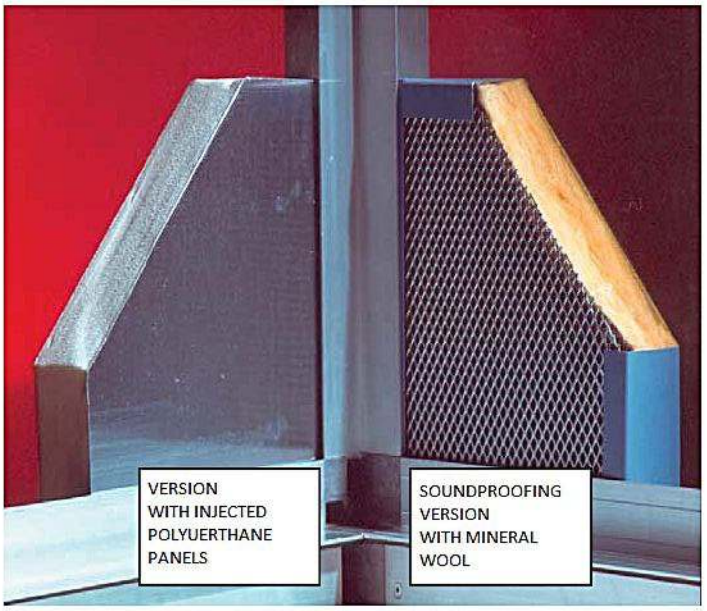
In any case, combinations of inner panel, outer panel and insulation other than those indicated can be created upon request.

SOUND INSULATION CAPACITY OF THE PANELS

(Rw, index of evaluation at 500 Hz)

23/25 mm panels = 32 dB

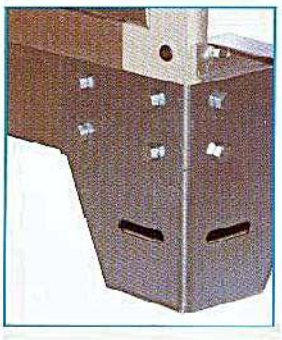
50 mm panels = 35 dB



3.3 Support feet

Support feet (h=100 mm) are bolted to the base so as guarantee the aeration required by the bottom panels of the unit and simplify inspection. *The height of the feet plus the base (180 mm) allows the* ***traps to be installed on the drains****, without requiring further supports, for a total static pressure up to 500 Pa. The height of the feet, in addition, also allows checks to be performed on any leaks or phenomena of condensation.*
The use of the feet, ideal for DRAINING the pans at the bottom, ensures ***perfect downflow****.*

If the unit is to be installed on trellis structures rather than using the feet, a base beam, height 100-140 mm, is required. Both the feet and the base beam are made from ***Senzmir Z200 UNI 5753-84 passivated*** *galvanised steel.*



3.4 Roof for outdoor installation

For the units installed outdoors (in this case the use of **pre-painted or plastic-coated** outer panelling is recommended) can also be fitted with a protective roof.
This is made, unless otherwise requested, with the same outside finish as the system, and with a **slope of around 2%**, so as to prevent **stagnation of the water**. In addition, the edges protruding from the outline of the system are bent inwards for both **safety** reasons and to assist the separation of the droplets of water.

3.5 Assembling the sections

The sections are assembled using **the original coupling strip system** fastened by internal bolts.
All the units are fitted with a perimeter base made up of very thick (minimum 20/10) press-bent Senzmir Z200 UNI 5753-84 passivated galvanised plate. The L-shape of the section bars (height 80 mm) guarantees ***minimum deflection****:* ***each block*** *(section or series of sections)* ***has its own base*** *that renders it independent from the others. The perimeter ring is connected using special cross-beams that ensure* ***uniform distribution of the loads****; the section bars are joined using nuts and bolts.*
The base is joined to the frame using a dual support system, allowing the insertion of the bottom panels, guaranteeing walkability, without the use of protruding screws, in compliance with the relevant safety standards.

4. MAIN SECTIONS

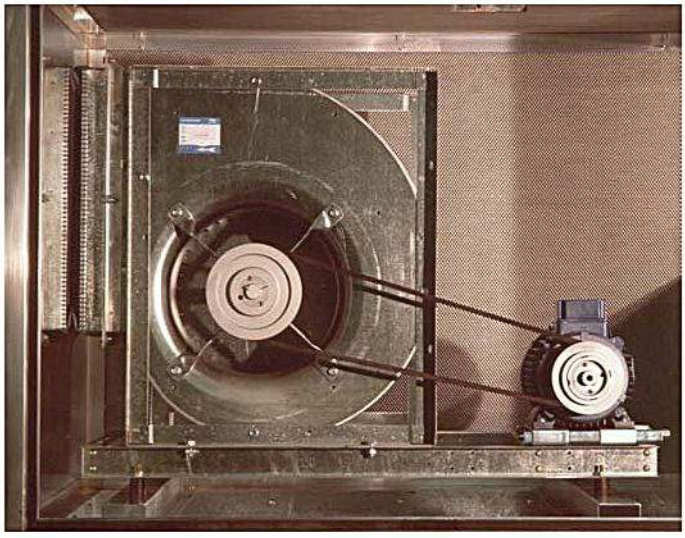
4.1 Ventilation sections

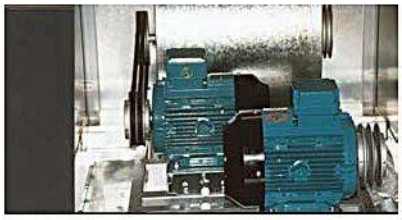
The ventilation sections, available for each size of the standard series, are designed to hold different types and sizes of fans. In addition, different configurations are possible as regards the air distribution: for the outlet fan, for example, the air flow can be aimed in line with the section or alternatively upwards or downwards, according to the needs of the system.
In addition, for special needs, specific sections are available, such as :

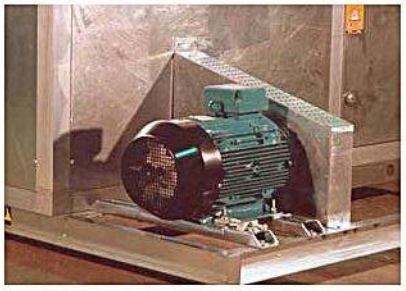
- ***Ventilating section with motor outside the air flow***
- ***Ventilating section with two motors, one in service and one in standby, started, when needed, by inserting the belt/belts.***
- ***Section with two fans each handling 50% of the flow-rate.***
- ***Section with two fans each handling 100% of the flow-rate, one in standby.***

The assembly of the motor-fan unit inside the section has been designed so as to maximise the isolation of the unit from the structure, consequently minimising vibrations and noise.
Two or more omega-shaped beams, made from thick galvanised steel, are fastened to the load-bearing structure, that is, the section bars making up the base.
These in turn support the sturdy base shared by the motor and the fan, again made from galvanised steel, with the insertion of rubber vibration dampers (or springs upon request).
This base is fastened to the motor support slides that allow the belts to be tightened.

The fan is connected to the structure by an elastic joint on the outlet. The latter can be removed, as it uses a double bolted flange and not rivets, allowing the removal of the fan for replacement or special maintenance. The outside of the panel, around the outlet, is fitted with a collar for connecting the air ducts.
Moreover, special care has been paid to the alignment of the transmission between the motor and fan, so as to ensure the envisaged operating conditions and avoid abnormal wear on the belts and consequently annoying vibrations.
In compliance with the EC Machine Directive, the ventilating section is fitted, on the access door, with a bayonet-type safety microswitch, which cannot be bypassed, or alternatively an interlock device with key.







4.1.1 Characteristics of the fans

The following fans are used in the CTS series, based on the flow-rates and pressure gain:

***PAT**: Fans with forward blades, suitable for low and medium pressures from 30 –700 Pa. Rectangular outlet.*

***PAV**: : Fans with forward blades, suitable for low and medium pressures from 30 –1000 Pa. Square outlet.*

***PPR**: Fans with reverse blades, flat type, suitable for high pressure, 700 - 1500 Pa. Square outlet.*

***PRA**: Fans with reverse blades, wing profile, suitable for pressures from 700 - 1500 Pa . Square outlet.*

All the fans installed as standard are made from galvanised steel for the small and medium sizes, and painted steel with epoxy coat for the larger models.

The fans used are centrifugal with dual intake, with ground steel shaft C 40 UNI 7845 protruding on both sides. All the shafts are painted with corrosion-proof coating and are fitted on adjustable bearings, featuring lifetime lubrication with lithium grease and rated for at least 20,000 hours of operation. Each impeller is statically and dynamically balanced with a degree of precision Q = 6.3, according to the CO. AER NU 109 and ISO 1940 standards.

All the medium and large fans are fitted with frames.

The scroll is made from hot galvanised steel plate (Sendzimir) and assembled without welding (Pittsbourgh method) to prevent oxidation.

***The fans selected for the standard ventilation sections are calculated with frontal outlet speeds no higher than 13m/s for flow-rates up to 30,000 m3/h and no higher than 14.5 m/s for flow-rates over 30,000 m3/h;** these, in any case, are selected to operate at a point on the curve near maximum efficiency, such as to allow a variation in the flow-rate and pressure gain of around 20% more or less than the rated value.*

The performance of the fans conforms to the DIN, ISO, DB and AMCA standards.

The fans may be supplied in the following configurations, depending on the operating conditions:

Configuration "S" for small fans, light work

Configuration "R", reinforced, for small and medium fans, light work

Configuration "K/T", reinforced, for small, medium and large fans, heavy work

Configuration "K1/T1" reinforced, for medium and large fans, heavy work

Configuration "K2/T2" reinforced, for medium and large fans, very heavy work.

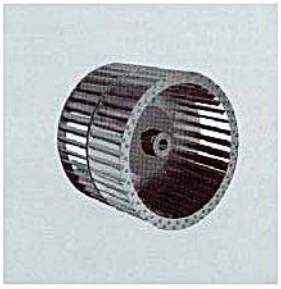
The following optional accessories are available for the fans:

- condensate drain, used in the event of high humidity, installed on the bottom of the fan;

- inspection port, available in one of the three orientations of the rear of the scroll (obviously not for the outlet side of the fan)

- pressure probes, to measure the flow-rate of the fan in real time.

Reverse Blades



Forward Blades

FAN MODEL	A	B	01	01S	02	02S	03	03S	04	05	06	07	08	09	10	11	12	13	14	15	16
PAV/PPR 160	205	205																			
PAV/PPR 180	229	229																			
PAV/PPR 200	256	256																			
PAV/PPR 225	288	288																			
PAV/PPR 250	322	322																			
PAV/PPR 280	361	361																			
PAV/PPR 315	404	404																			
PAV/PPR 355	453	453																			
PAV/PPR 400	507	507																			
PAV/PPR 450	569	569																			
PAV/PPR 500	638	638																			
PAV/PPR 560	715	715																			
PAV/PPR 630	801	801																			
PAV/PPR 710	898	898																			
PAV/PPR 800	1007	1007																			
PAV/PPR 900	1130	1130																			
PAV/PPR 1000	1267	1267																			

The following table indicates, for each size of the CTS and corresponding standard sections, the largest model of fan that can be installed and the corresponding dimensions of the outlet. The grey area highlights all the models whose size is compatible with the overall dimensions of the standard ventilation sections

4.1.2 Characteristics of the motors

The fans are driven by electric motors, with the following characteristics: asynchronous, three-phase squirrel cage, single speed, 4 poles (1500 RPM), 6 poles (900 RPM), or 8 poles (750 RPM), including versions with dual polarity, 2/4 poles (2900/1500 RPM), 4/6 poles (1500/900) and 4/8 poles (1500/750 RPM). ***The 4/6 pole motors always have two windings, while the 2/4 and the 4/8 pole motors have just one winding, commutable by a "Dahlander" connection, with quadratic torque (quadratically proportional to the speed), suitable for the operation of centrifugal devices such as the fans.***
The motors are rated as recommended by the major fan manufacturers, considering the power input, according to this simple rule
P fan ≤ 10 kW : P inst = P fan x 1.2
P fan > 10 kW : P inst = P fan x 1.15
As regards the power supply, all the motors are rated for European power supply, that is, 230/400V ± 10% -3 ph - 50 Hz, and can also operate at 220-240-380-660V 50Hz or 250-280-440-480V 60Hz.
In general, the motors up to 3 kW operate at 220/380 50 HZ, while the motors over 3 kW operate at 380/660V 50 HZ.

The standard specifications are:
Protection IP 55. Insulation class F. Form B3. Series Unel – Mec.
All the motors are suitable for control by inverter.
All the standard motors are built to operate at ambient temperatures no higher than 40°and at an altitude no higher than 1000 m above sea level, *for higher altitudes and temperatures, see the coefficients shown in the table below.*

Ambient temperature °C	40	45	50	55	60	70	
Power allowed in %of the rated power	100	96.5	93	90	86.5	79	
Altitude above sea level in m	1000	1500	2000	2500	3000	3500	4000
Power allowed in %of the power rated	100	97	94.5	92	89	86.5	83.5

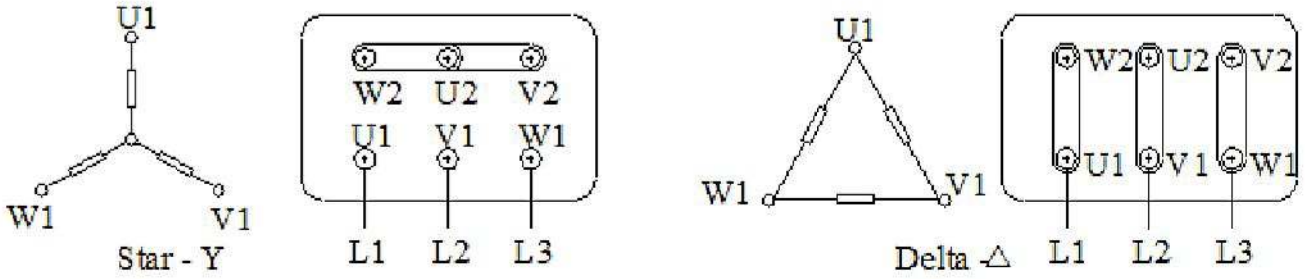
Motors are available in special configurations for operation in harsher conditions, such as:
- tropical configuration, for ambient temperatures above 40°C;
- configuration with corrosion-proofing treatment, for installation in aggressive atmospheres;
- explosion-proof configuration for environments with the risk of explosion, able to insulate sparks and high temperatures from the dangerous atmosphere.
Upon request, all the motors can be fitted with protective Klixons (thermistors).

Table of maximum RPM for asynchronous motors

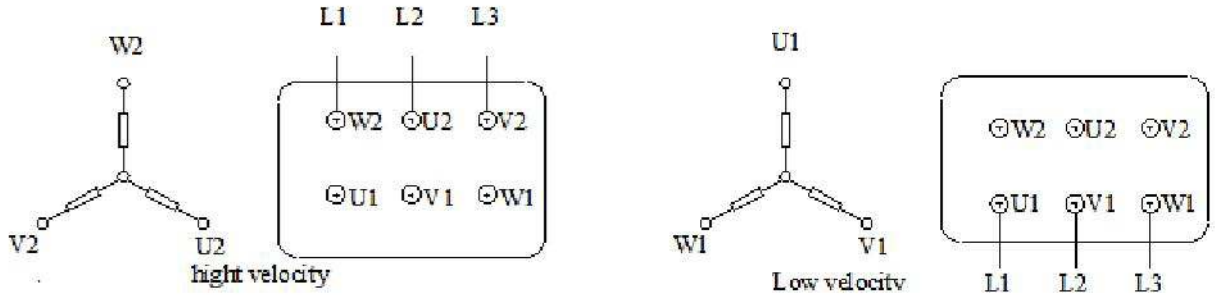
Motor poles	2	4	4/6	4/8
RPM a 50 Hz	2900	1450	1450/900	1450/750
RPM a 60 HZ	3480	1740	1740/1080	1740/900

4.1.3 Connection diagram for three-phase motors according to IEC 34 – 08

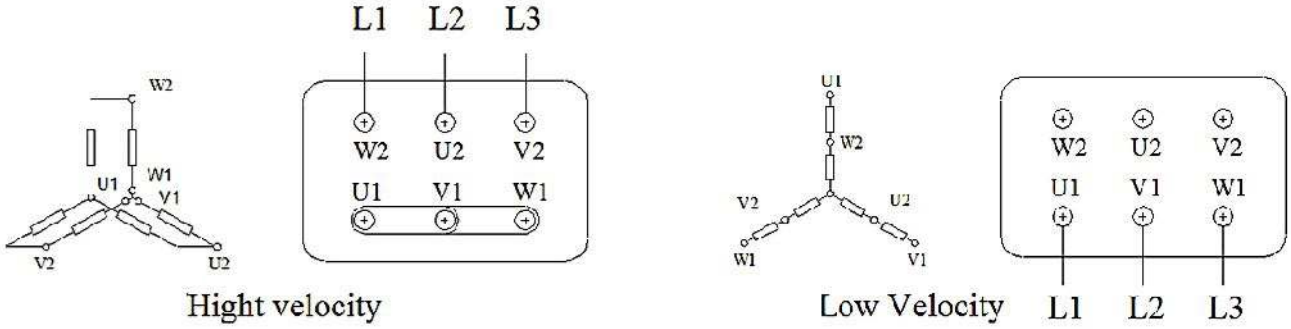
Connection diagram for three-phase motors.
Star and delta connections for one speed motors.
Number of poles 2, 4, 6, 8
Rotation speed at 50 Hz 3000 rpm, 1500 rpm, 1000 rpm, 750 rpm.



Connection diagram for three-phase motors. Connection for two speed motors, two separate windings
Number of poles 2/6, 2/8, 4/6, 6/8
Rotation speed at 50 Hz 3000/1000 rpm, 3000/750 rpm, 1500/1000 rpm, 1000/750 rpm



Connection diagram for three-phase motors. DAHLANDER connection for two speed motors, quadratic torque.
Number of poles 2/4, 4/8
Synchronism speed at 50 Hz 3000/1500 rpm, 1500/750 rpm.



4.1.4 Characteristics of the belt drive

The drives are carefully designed to ensure the maximum duration of the belts. These are made with **pulleys and V-belts**; a belt tightener allows the sliding of the motor so as to ensure the correct tightness of the belts. **As standard, the drive pulleys have a variable pitch (code RST) and the driven pulleys have a fixed pitch (codes SPA-SPB) for power ratings up to 11 kW (up to 15 kW if allowed by the transmission ratio), while for power ratings above 11 kW (or 15 kW), both pulleys have fixed pitch (codes SPA-SPB)**

The use of the **removable conical hub allows** immediate assembly with simple positioning, assisting dismantling, and at the same time guarantees effective tightness on the shaft. Moreover, the conical hub, being scored, allows a certain recovery of the tolerances.

To better understand the fastening system, the following figure shows the assembly onto and dismantling of the pulley from all shaft, using the bush.

Assembly :

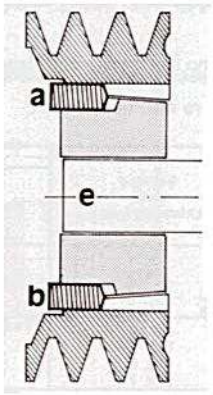
after having coupled the pulley and the hub, position the locking screws **a** and **b**, without tightening then. See Fig. 1;

insert this assembly on the shaft (**e**) and fully tighten the screws. In this way, the conical hole of the pulley grips the scored conical hub and locks onto the shaft, together with the pulley. See Fig. 2.

Dismantling:

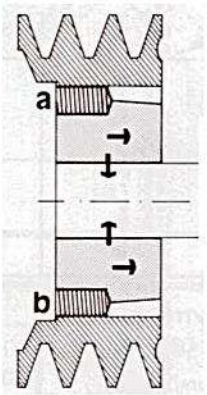
completely unscrew the two locking screws and screw one of them into the third hole (**c**), opposite the notch on the hub, so as to be able to simply remove the bush-pulley assembly (relieving the pressure that locks the hub onto the shaft. SeeFig.3

Fig. 1



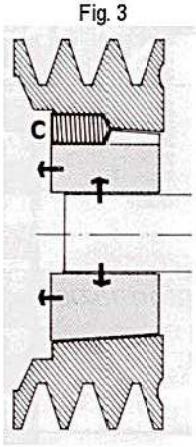
Conical hub

Fig. 2

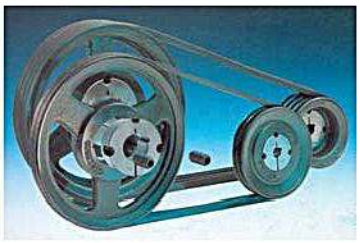


Fastening

Fig. 3



Fastening pressure

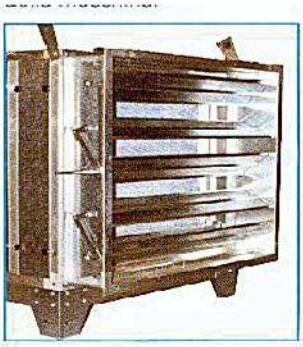


As regards the variable-pitch pulleys, these are pulleys made up of a part fixed to shaft, and a mobile disk, which is locked by two threaded dowels that are inserted into two radial holes on the disk. These are arranged at 90° and by tightening the studs create, thanks to the high precision between the two disks, significant friction due to the contact pressure, which fastens the two parts together. The inclined walls of the race move further away or nearer, consequently raising or lowering the V-belt on different diameters of the pulley, and therefore allowing a variation in the transmission ratio.

4.2 Air intake sections

4.2.1 Front damper

*This is normally used on the units for handling either 100% outside air or recirculation. **It shuts off and controls 100% of the air flow-rate**. It is fitted at the intake to the system and has the same cross-section as the unit, so as to assist the distribution of air into the subsequent sections. It is made up of a corrosion-proof aluminium frame and **opposing aerofoil blades connected by ABS gears**; the damper is fitted for servo control or manual control. Upon request, supplementary gaskets are available for the blades and servo motors.*



4.2.2 Air intake chamber

*This is used when the duct carrying the intake air does not connect to the front of the system, but rather to the top, bottom or side (right or left) of the unit. It is designed to allow the installation of a damper, in constructional terms equal to the front damper described in the previous paragraph, **suitable for shutting off and controlling 100% of the air flow-rate**.*

4.2.3 Mixing chamber

*This is proposed when the outside air needs to be mixed with recirculated air. It is designed to allow the installation of 2 dampers, in constructional terms equal to the front damper described previously, **both controlling 100% of the air flow-rate**, which can be fitted in various positions on the section (top, bottom, right and/or left side), as required.*

4.2.4 Mixing and discharge chamber (freecooling).

*This is used when there is a fan that discharges the air removed from the environment, as well as to mix the outside air with the recirculated air. It is designed to allow the installation of 3 dampers, in constructional terms equal to the front damper described previously, **suitable for controlling 100% of the flow-rate**, which can be fitted in various positions on the section (top, bottom, right and/or left side), as required.*

4.3 Protection for the intake of outside air

4.3.1 Grill with rain cover

On the units to be installed outside, the air inlets (with and without dampers) can be fitted with ***anodised aluminium grills,*** *complete with bird nets. The fins in the grill are made with a special rainproof profile to avoid the entrainment of water into the unit. The standard grill is supplied with fins set 25 mm apart, for the small units, and with fins 50 mm apart for the larger units.*

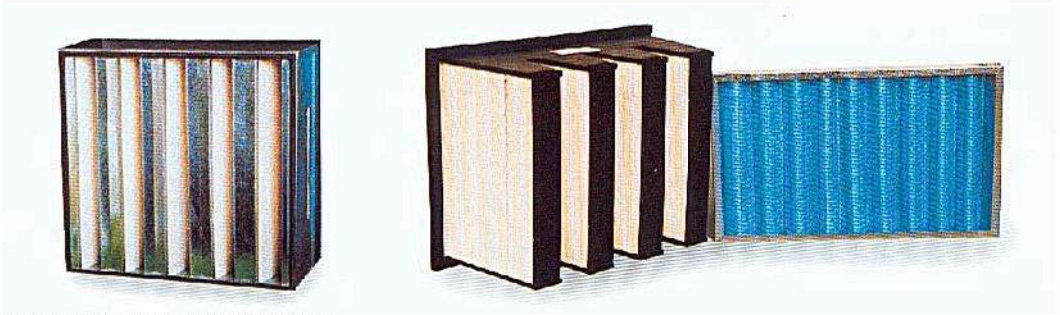
4.3.2 Protective hood with bird net.

On the units to be installed outside, the air inlets and discharge outlets can be fitted with protective hoods made from the same material as the outside finish of the system. These are shaped so as to ensure that the elements, such as rain, do not enter the unit. In addition, a special bird net protects the unit against birds.

The hood is fastened directly to the structure of the unit, and the joint is sealed by silicon. Generally, the hood should be installed in the place of the intake grill when the air flow-through speed is over 4 m/s.

4.4 Filtering sections

The CTS series units can satisfy various filtration requirements, thanks to a design that allows the use of all types of filters available on the market.



In general, the filters can be divided into the following groups:

PRIMARY FILTRATION *– filtration using filtering media and cells that fall within class "G" according to the EUROVENT standards, and are normally used in civil air-conditioning and as pre-filters to the higher efficiency sections.*

FINE FILTRATION *–special filtration process that traps the so-called "fine" contaminants across an extremely wide field of application. Generally performed using bags and media that fall within class "F" of the EUROVENT standards.*

ABSOLUTE FILTRATION*– this is the maximum degree of filtration currently available, and is covered by media that fall within class "H" and "U" of the EUROVENT classification.*

AIR PURIFICATION *– these are filters suitable for resolving problems of pollution deriving from volatile substances or gasses.*
The classes of these filters are defined by the ***UNI 10339 standard, "Air handling systems for comfort applications"****, as described in the table below.*

Class	Efficiency of the filter(E)**	Field of efficiency [%]	Test method
1	M	E<65%	Weighted (Gravimetric)
2	M	65 ≤ E < 80	Weighted (Gravimetric)
3	M	80 ≤ E < 90	Weighted (Gravimetric)
4	M	90 ≤E	Weighted (Gravimetric)
5	A	40≤E<60	Atmospheric (Colorimetric)
6	A	60≤E<80	Atmospheric (Colorimetric)
7	A	80≤E<90	Atmospheric (Colorimetric)
8	A	90≤E<95	Atmospheric (Colorimetric)
9	A	95≤E	Atmospheric (Colorimetric)
10	AS	95≤E<99,9	Sodium flame (DOP)
11	AS	99,9≤E<99,97	Sodium flame (DOP)
12	AS	99,97≤E<99,99	Sodium flame (DOP)
13	AS	99,99≤E<99,999	Sodium flame (DOP)
14	AS	99,999≤E	Sodium flame (DOP)

(E)** M= average efficiency A = high efficiency AS = very high efficiency and absolute filters

The UNI 10339 standard also establishes that each filter with a certain filtration efficiency must be preceded by a filter whose efficiency is in the previous class.

There are therefore three possible cases: ***M, M + A, M + A + AS***

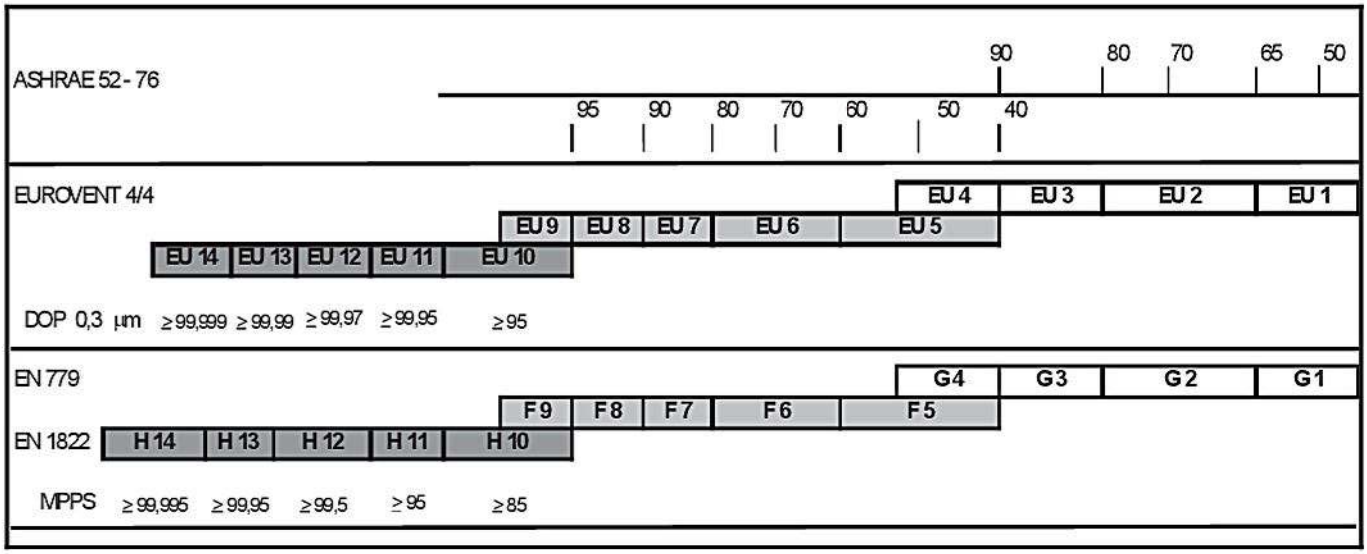
The UNI 10339 standard furthermore classifies the buildings where the filters are installed, indicating the classes of filters that are more appropriate for the characteristics of the different environments: the following table describes this sub-division, which can help select the right filter when configuring the quotation for the CTS unit

Classification of the buildings	Filter class		Filtration efficiency
	min	max	
Buildings for residential use and similar:	4	7	M*, M+A
- Homes, colleges, shelters	4	7	M*, M+A
- Prisons, military barracks, convents	5	7	M+A
Buildings for office use and similar:			
- Offices in general	5	7	M+A
- Meeting rooms	5	7	M+A
Data processing centres	6	9	M+A
Hospitals, clinics, rest homes and similar:	6	8	M+A
- Wards (2-3 beds), corridors	10	12	M+A+AS
- Clean rooms	10	12	M+A+AS
- Maternity, anaesthetics, radiation	12	14	M+A+AS
- Premature birth wards, operating theatres	6	8	M+A
- Clinics, examination rooms	6	8	M+A
- Rehab, physical therapy			
Buildings for leisure activities, clubs, places of worship:			
- Cinemas, theatres, congress halls	5	6	M+A
- Museums, libraries	7	9	M+A
- Places of worship	4	6	M*, M+A
- Bar, restaurants, dance halls:			
bar in general	3	5	M*, M+A
dining halls, restaurants	5	6	M+A
dance halls	3	5	M*, M+A
kitchens	2	4	M
Commercial activities and similar:			
- Large stores, shops in general	4	6	M*, M+A
- Speciality shops			
- food	5	6	M+A
- photographer's and pharmacies	5	6	M+A
- Public areas in banks	4	6	M*, M+A
- Exhibition halls	2	3	M
Buildings housing sport facilities:			
- Pools, saunas and similar	4	6	M*, M+A
- Gyms and similar	2	4	M
Places of learning:			
- Kindergartens and primary schools	7	9	M+A
- Classrooms in general	5	6	M+A
- Other areas:			
- music and language labs	6	7	M+A
- laboratories	6	7	M+A

- *To be adopted for filtration efficiencies up to class 4.*

According to the quality of the atmospheric and recirculated air, as well as the characteristics of the air-conditioning unit, the filtration of the outside air and the recirculated air may be differentiated.
The filters with average efficiency are normally used alone in the case of less intense filtration. In the case of more intense filtration, these carry out the function of pre-filters to protect the subsequent higher class filters. These, in fact, trap the coarser particles, thus avoiding clogging the finer filters, extending their working life and, being less expensive and almost always regenerable, allowing savings in the system running costs.

In practice, to define the efficiency of the filters, the terms used derive from the ASHRAE and EUROVENT classifications, as well as the corresponding test methods; the following table compares the definitions commonly used for the filtering sections of air handling units



N.B.: Weighted or gravimetric efficiency is more correctly defined as arrestance.

4.4.1 Pleated synthetic media filters EUROVENT G3-G4

These are filters with a wide filtering surface made up of a galvanised steel frame that encloses a pleated layer of ***self-extinguishing synthetic fibre****, supported by electro-welded galvanised mesh.* ***The pleating ensures a large filtering surface and thus a low pressure drop, for limited overall dimensions****. The media is made from polyester fibre, and is regenerable by washing with water and detergent, or alternatively by blowing air in the opposite direction to normal flow in the case of dry dust. The maximum operating temperature is 100°C. The filters are available in two different thicknesses, 50 and 100 mm, and, both, in the versions with efficiency EU3/G3 and EU4/G4 (respectively 87% and >90% with weighted method according to ASHRAE).*

The pleated synthetic filters, always made from polyester media with galvanised steel containment frame, are also with available 96% efficiency according to ASHRAE (EU5/F5 according to Eurovent) and thicknesses of 150/200 mm.

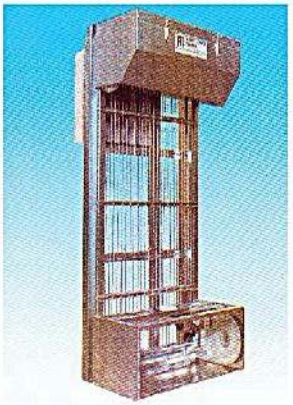
The filtering section of each size of the CTS series is made up of a series of cells, with different standard measurements, that are arranged on special guides so as to allow easy removal from the side through the closing panel. The latter is in fact easily removable for inspection and maintenance, being fastened to the structure by quick-release screws with knobs. Upon request, the pre-filtering section can be supplied with an optional inspection door.

4.4.2 Metal filters EUROVENT G2

These are filters made up of from **flat aluminium wires, with a labyrinth-type layout, supported by electro-welded galvanised mesh** and with a galvanised steel frame. The thickness is 50 mm and the filter has a weighted efficiency of 75% according to ASHRAE, EU2/G2 according to EUROVENT. The filter is regenerable by washing with water and detergent. Moreover, these filters, having a maximum operating temperature of 200°C, can be used in special industrial applications.

The assembly and removal operations are similar to the pleated synthetic filters.

4.4.3 Rotary filters EUROVENT G3



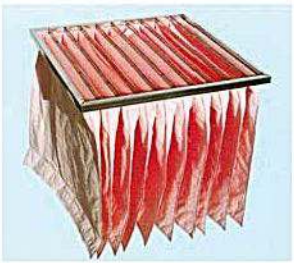
These are filters made up of an **acrylic fibre roller** with automatic movement of the media based on a signal from a configurable differential pressure switch. **The filter is supplied complete with IP54 electrical panel, pressure switch and gear motor with permanent lubrication, pinion, chain and toothed wheels.**
The polyester fabric filtering media is not regenerable, and has a weighted efficiency of 87% according to ASHRAE 52/76 (EUROVENT classification EU3/G3).

The containment frame is made from galvanised steel. The roller can be removed for replacement using a sliding guide, through an access door with double emergency handle

4.4.4 Bag filters for low efficiency EUROVENT G4

*These are filters made up of **polyester fibre bags** with an average weighted efficiency of 90%, Eurovent class EU4/G4. The fibre is arranged so as to form a series of non-rigid, heat sealed, non-regenerable bags, inserted in a metal frame with Neoprene gasket. Assembly is performed using a counter-frame and locking springs to ensure perfect air-tightness. Access to the filters, for maintenance and replacement, is provided through a door with handle and hinges*

4.4.5 Bag filters for average and high efficiency EUROVENT F5,F6,F7,F8,F9



*These are filters made from **reinforced glass microfibre**, not regenerable, with a high capacity to trap dust, installed suitable distances apart. The containment frame is made from galvanised steel. The filtering media is available with a colorimetric efficiency from 50% to 98%, that is, from EU5/F5 a EU9/F9 according to Eurovent. Specifically:*
Efficiency 50% - Class EU5/F5, Efficiency 65% - Class EU6/F6, Efficiency 85% - Class EU7/F7, Efficiency 90% - Class EU8/F8, Efficiency 98% - Class EU9/F9.
The filters can be accessed for maintenance through a door with handle and hinges that normally allows removal upstream in the air flow.

4.4.6 Rigid bag filters for average and high efficiency EUROVENT F5,F6,F7,F8,F9

These are filters made up of a series of ***rigid fibreglass-reinforced paper bags,*** *not regenerable, but totally incineratable, with a high dust retention capacity. Special spring-loaded hooks keep the bags pressed against to the galvanised steel counter-frame, with a Neoprene gasket inserted to guarantee completely airtight assembly and easy maintenance. The filtering media is inert, non-hygroscopic, odourless and does not propagate bacteria. These filters are available with a colorimetric efficiency from 50% to 98%, that is, from EU6/F6 a EU9/F9 according to Eurovent. Specifically:*
Efficiency 65% - Class EU6/F6, Efficiency 85% - Class EU7/F7, Efficiency 90% - Class EU8/F8, Efficiency 98% - Class EU9/F9.
The filters can be accessed for maintenance through a door with handle and hinges that normally allows removal upstream in the air flow.

Note: The filters and pre-filters can be combined in the same section. Both the non-rigid and rigid bag filters, for all classes of efficiency, can be combined with pleated synthetic pre-filters, 50 mm thick, class EU3/F3 or EU4/F4, fitted on a common counter-frame and secured by special springs.
The filters can be accessed for maintenance through a door with handle and hinges that allows easy removal.
The limits deriving from this more economical solution involve the impossibility of fitting a pressure switch or pressure gauge on each filter.

4.4.7 Very high efficiency filters – absolute filters EUROVENT H10,H12,H13,H14

These are filters made from **fibreglass-reinforced media (pleated paper)**, not regenerable, in a dihedron layout, with constant spacing so as to create a large *filtering surface with high particle trapping capacity. The assembly is sealed using special materials to ensure maximum efficiency.*
Special tie rods with knob screws keep the dihedron pressed against the galvanised steel counter-frame, following the insertion of a Neoprene gasket to ensure complete air-tightness and easy maintenance.

The filtering media is flammable, water repellent and comes complete with anti-bacterial treatment.

Filters are available with an efficiency of 95 ≤ DOP ≤ 99.999, that is, H10-H11-H12-H13 according to the Eurovent classification.
The filters can be accessed for maintenance through a door with handle and hinges that allows removal upstream in the air flow.

4.4.8 Activated carbon filters

These are made from painted steel cartridges ***containing activated carbon (around 2.5 kg each),*** *fitted with a special bayonet-type coupling on the holes made in the galvanised steel support plate, secured to the structure of the section. Each cartridge is sized so as to be able to effectively filter 215 m3h.*
The filters can be accessed for maintenance through a door with handle and hinges that allows removal upstream in the air flow.
The activated carbon filters eliminate bad odours of various origins.

The following is a list of substances and the corresponding effectiveness of the activated carbon in abating the odours.

Normally absorbable products	*Acid acetic; butric; caprylic; lactic; palmitic; uric; ethylic. Acetic anhydride, aniline, antiseptics, benzene, petrol, camphor, chloroform, kerosene, creosote, deodorants, detergents, disinfectants, essences, phenol , fertilisers, fruit and citrus, tobacco smoke, rubber and Neoprene, medicines, menthol, mercaptan, naphthalene, nicotine, nitro-glycerine, room deodorisers (hospitals, kitchens, cold rooms and stores), food odours (meat, fish, fruit and cheese), mould odours, waste, decomposing organic products, human and animal odours, rancid oils, lubricants and greases, ozone, soap, cosmetics, perfumes, skatole, carbon tetrachloride, urea, paints and enamels*
Normally absorbable products	*Acetone, formic acid, acrolein, methylated spirits, anaesthetics, butadiene, hexane, ether, vehicle exhaust gases, isoprene, pentane, bleach.*
Products for which special types of activated carbon are required	*Acetylene, ammonia, carbon dioxide, sulphuric dioxide, sulphur dioxide, nitrogen dioxide, butane, butylene, chlorine, ethane, ethylene, formaldehyde, corrosive gases, hydrogen, natural gas, carbon monoxide, propylene.*

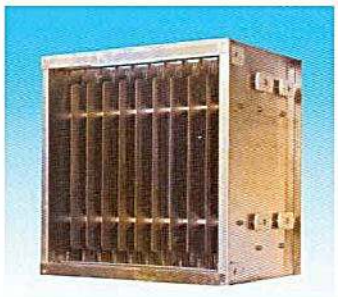
4.4.9 Rigid pleated bag filters with activated carbon EUROVENT F7

These are made up of a series of **rigid pleated paper bags impregnated with activated carbon**, not regenerable, but totally incineratable, with high dust retention capacity. Special spring-loaded hooks keep the bags pressed against to the galvanised steel counter-frame, with a Neoprene gasket inserted to guarantee completely airtight assembly and easy maintenance. These filters are available with efficiency F7 and are ideal for air containing a significant portion of smog (airports, etc.).

The filters can be accessed for maintenance through a door with handle and hinges that normally allows removal upstream in the air flow.

4.4.10 Electrostatic filters

These consist of an ionisation section and a precipitation section. The former uses tungsten electrodes applied with a potential of 10000V, alternating with earthed aluminium plates. The latter involves aluminium plates applied with a potential of 5000V, alternating with earthed plates.



The particles contained in the air stream are electrically charged (positive) when they pass through the electrostatic field of the ionisation section, and are then attracted by and stick to the collection plates in the precipitation section, which are the negative pole of an electrostatic field.

Electrostatic precipitation allows the separation of any particles form the air stream, irrespective of their size; in fact, particles as small as 0.01 micron can be separated. The use of electrostatic filters therefore allows the air to be completely cleaned of impurities (dust, smoke, spores, bacteria, pollens, etc.).
The electrostatic filters are fitted, on the CTS systems, inside non-standard sections sized on a case-by-case basis according to the flow-rate of air and the efficiency required.

4.4.11 Tables of standard filter sizes and quantities

The tables below show, for each standard CTS unit and for each type of filter, the size and the quantity of the filters fitted in the corresponding sections.

	PLEATED FILTERS						
	400X400	400X500	500X500	625X400	500X625	592X592	592X287
CTS 01		1					
CTS 02					1		
CTS 03						1	
CTS 04				2			
CTS 05	2	2					
CTS 06		2			2		
CTS 07			2		2		
CTS 08				6			
CTS 09		3	6				
CTS 10			9				
CTS 11			12				
CTS 12			6		6		
CTS 13						12	
CTS 14						12	3
CTS 15						15	3
CTS 16				20	5		

	BAG FILTERS		
	490X595	595X595	595X287
CTS 01	1		
CTS 02		1	
CTS 03		1	
CTS 04	1		1
CTS 05		1	2
CTS 06		1	2
CTS 07	4		
CTS 08		4	
CTS 09		4	2
CTS 10		4	4
CTS 11		6	3
CTS 12		6	5
CTS 13		12	
CTS 14		12	3
CTS 15		15	
CTS 16		15	5

	ROLL FILTERS		
	NR.	DIM "H"	DIM "L"
CTS 01	1	540	900
CTS 02		540	900
CTS 03		690	1000
CTS 04	1	690	1000
CTS 05		835	900
CTS 06		985	1000
CTS 07	4	1140	1200
CTS 08		1295	1390
CTS 09		1450	1500
CTS 10		1595	1600
CTS 11		1595	2000
CTS 12		1595	2300
CTS 13		1740	2600
CTS 14		1740	2900
CTS 15		1740	3400
CTS 16		2000	3400

	ABSOLUTE FILTERS	
	305X610	610X610
CTS 01	1	
CTS 02		1
CTS 03		1
CTS 04	1	1
CTS 05	1	1
CTS 06	2	1
CTS 07	2	1
CTS 08		4
CTS 09	2	4
CTS 10	4	4
CTS 11	3	6
CTS 12	5	6
CTS 13		12
CTS 14	3	12
CTS 15		15
CTS 16	5	15

4.5 Empty sections (spacers)

*The spacer sections are available in **3** different standard **lengths**, respectively **240 mm, 320mm, 560mm**. Inserted before or after any other section, they simplify access for inspection or allow space for insertion of sensor elements and system control devices, such as probes and thermometers. The sections can be fitted upon request with inspection doors and probe sockets.*

4.6 Multi-zone sections

The multi-zone sections, generally positioned as the last component in the air handling unit, assist the sub-division of the flow of air leaving the fans into two zones, the first where the air is heated by a heating coil, and the second where the air is cooled by a cooling coil.

The two zones are separated by dampers, with opposing blades driven by one single shaft; naturally, both the heating zone and cooling zone may be further divided, if required, to serve a series of zones. The section envisages flow-through speeds less than 2.7 m/s for the cold air duct, and speeds of 3.5 m/s for the hot air duct.
The section is fitted with a condensate collection pan under the cooling coil.

4.7 Humidifying section

To ensure an adequate response to the humidity control requirements, two distinct thermodynamic air humidification process are possible: ***ADIABATIC HUMIDIFICATION and ISOTHERMAL HUMIDIFICATION.***
Adiabatic humidification *is achieved by adding water to the air flow. It is defined as adiabatic because the extent of the heat exchange with the outside is negligible, and the energy required for the evaporation of the water is provided by the air itself, which is consequently cooled.*
The parameter that defines a humidification process is efficiency.
Efficiency refers to the ratio between the quantity of grams of water per kilo of air that can be absorbed in the humidification process compared to the maximum quantity of grams of water per kilo of air in saturation conditions.
While considering the physical limit that makes it impossible to reach 100% efficiency (saturation), the efficiency increases the bigger the air-water exchange surface: this is done by increasing the size of the humidifying section or alternatively reducing the size of the droplets of water in contact with the air.
On the psychrometric chart, adiabatic humidification is represented by a segment of the line representing the wet bulb temperature, corresponding by convention to the isenthalpic line that joins the starting conditions of the air and the final conditions after the treatment.

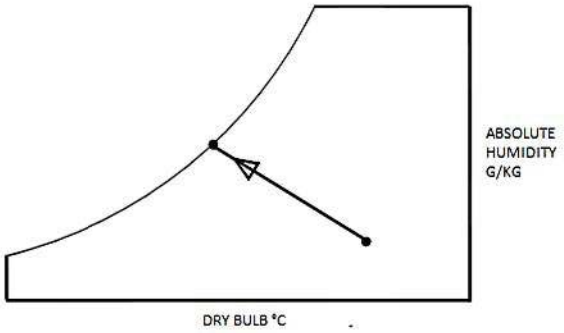
In essence, to create the air-water exchange and therefore to humidify adiabatically, requires:

- *spraying water into the flow of air by nozzles or atomisers, if using compressed air;*
- *wetting a suitably sized and shaped panel (honeycomb packing media), which, thanks to the extended contact with the air, assists the evaporation of the water into the air stream;*

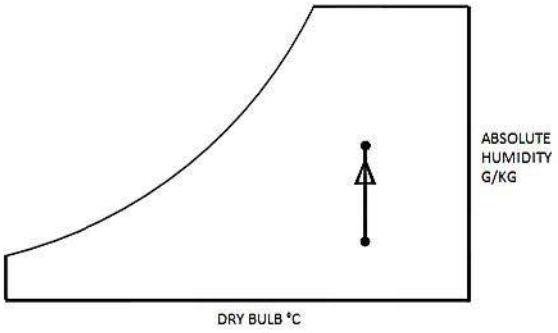
The more common adiabatic humidification systems feature once-through water, without recirculation, or alternatively operate on recirculated water using a submerged pump, located in the collection sump, that takes in the water that has not been absorbed by the air.

Isothermal humidification *is achieved by adding saturated steam directly into the air stream. The variation in temperature is negligible, and consequently the process is isothermal, as the quantity of steam is minimal compared to the flow-rate of air.* ***On the psychrometric chart this process is identified by a segment of the line representing the dry bulb temperature of the inlet air.***
There are various different adiabatic humidification and isothermal techniques: the CTS units are available, as standard, with different systems according to requirements.
Isothermal humidification is normally implemented using two systems:

- *distribution of centralised steam, generated by the heating plant;*
- *stand-alone steam generator, in the system, to be connected to the power supply and the mains water.*

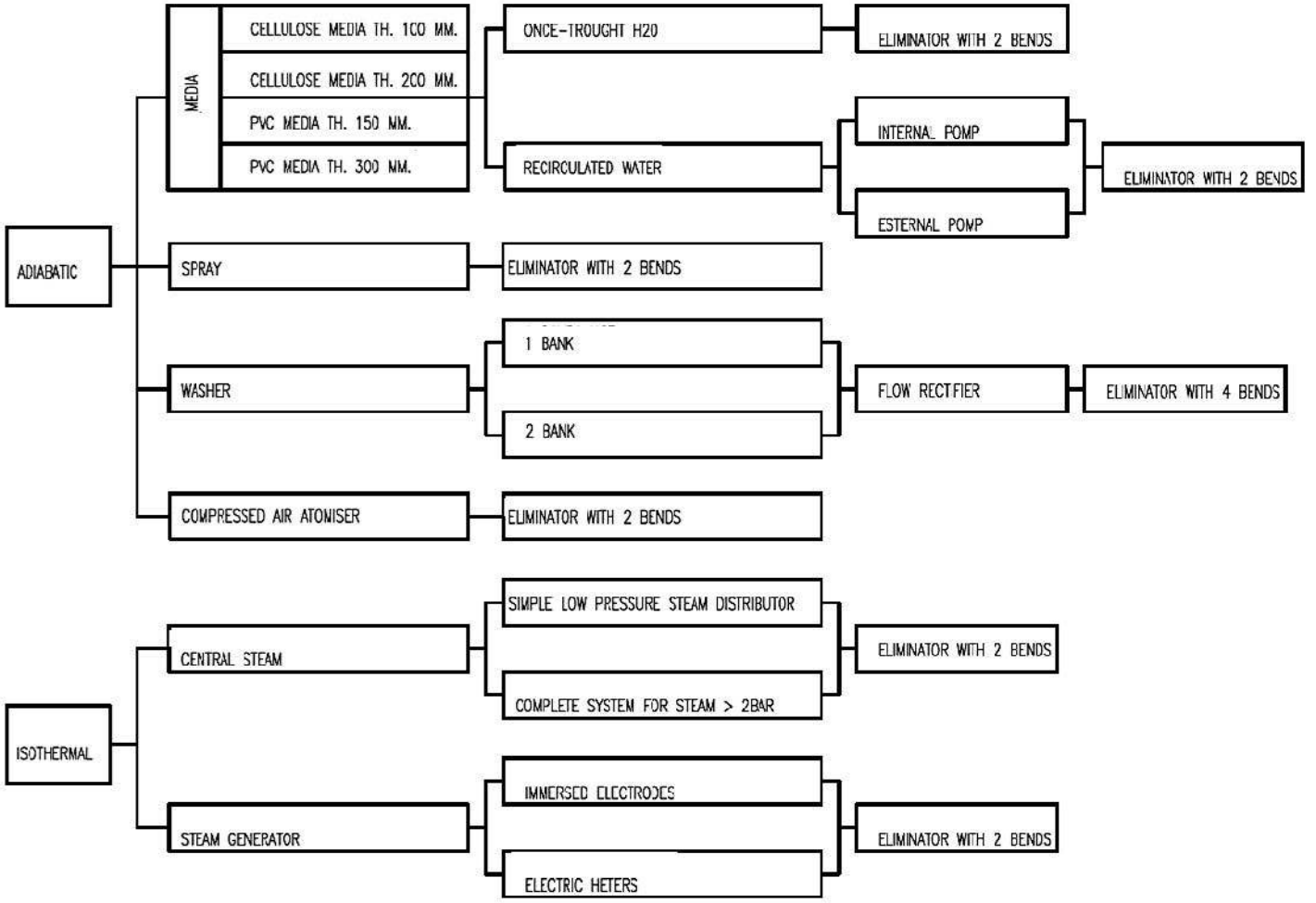


Adiabatic umidification



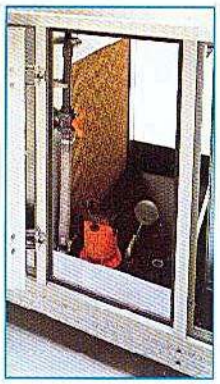
isothermal humidication

The following diagram lists the main options available for the humidification sections..



The containment section of the humidification system, irrespective of the type used, is always fitted with a water collection sump, made from galvanised steel (standard) with a special bitumen coating, or AISI 304 stainless steel (upon request), fitted above the bottom panel, with the same construction as the unit. This guarantees the perfect insulation of the cooled part without risking the formation of condensate on the outside. The sump houses, according to the type of humidification envisaged, the water fittings and the water supply and draining accessories.

7.1 Evaporative media humidification (once-through and with pump)



This system allows a significant saturation efficiency to be reached, with a low pressure drop, both on the air side and water side. *The containment section has been sized so as to ensure the declared efficiency, carefully designing the layout of the components, all located inside. Moreover, it is made using a double chamber so as to avoid the entrainment of water to the outside, it is fitted with a bitumen-coated galvanised steel water collection sump (standard) with independent drain and galvanised steel mist eliminator with three faces and two bends (standard), fitted rigidly, so as to prevent any vibration of the blades. Upon request, stainless steel sumps and stainless steel or plastic mist separators are available.*
separatore di gocce in acciaio INOX o plastica.

The efficiency of the system, based on the conditions of the air being treated, is defined by the thickness and the material used for the honeycomb exchange media:

- ***bakelite cellulose media, rot-proof, thickness 100mm, self-supporting, with high absorbance capacity that ensures an efficiency of 70%;***
- ***bakelite cellulose media, rot-proof, thickness 200mm, self-supporting, with high absorbance capacity that ensures an efficiency of 80%;***
- ***MUNTERS flocked PVC media, rot-proof and self-extinguishing, thickness 150mm, self-supporting, with high absorbance capacity that ensures an efficiency of 75%.***
- ***MUNTERS flocked PVC media, rot-proof and self-extinguishing, thickness 300mm, self-supporting, with high absorbance capacity that ensures an efficiency of 90%***

In the "once-through" system, the water, coming from the mains supply, is distributed on the media by a suitably perforated PVC pipe, fitted on the upper part of the honeycomb packing media, along its entire length. To humidify the air to the extent required, it is sufficient to supply the required quantity of water to uniformly wet the packing media: in this regard, the quantity of water can be controlled by a solenoid valve, not supplied with the system. The collection sump features a 1/2" female fitting for the water supply and a drain hole to be connected, via a drain trap, to the sewerage system (diam. 1" F up to and including model CTS10, 1"1/2 for larger models).
Inspection and maintenance are assisted by the presence of an access door with hinges and handle.
In the system with recirculation pump, the water, distributed on the packing media as in the previous case, is recirculated by the motor-driven submerged pump, made from PVC or stainless steel according to the size, complete with intake filter. To wet the media uniformly, without having excess water, the pump is fitted with a dual control system with the valve calibrated during commissioning. The collection sump features a 1/2" F supply fitting, ball float for filling, overflow (discharge) pipe to be connected, via a drain trap, to the sewerage system, diam. 1" F up to an including model CTS10, 1"1/2 for larger models.

NOTE: Upon request, humidification systems with centrifugal pump installed on a base outside of the section are available, even if these have been replaced by those with the submerged pump. This system, compared to the system with built-in pump, features water fittings on the side and the distribution of water by spraying, with nozzles, onto the honeycomb packing media.
Advantages and disadvantages of humidification with wetted media.

Advantages :
- *low running and maintenance costs;*
- *limited water and power consumption (in the case of the recirculation pump).*

Disadvantages:
- *risk of bacteria formation (Legionella and similar) due to the stagnation of the water;*
- *formation of lime scale on the pack;*
- *imprecise control of the specific humidity at the outlet of the system.*

Size	01	01/S	02	02/S	03	03/S	04	05	06	07	08	09	10	11	12	13	14	15	16
Humidification with built-in pump																			
Type of pump	PJP401							PJP2001						BZP					
'flow rateLt/1°	13							33						125					
AP m.c.a	1.25							2.70						2.70					
Power Watt	16							35						430					
Volatge	220-1-50							220-1-50						220-1-50					
Humidification with once trought water																			
No .of nozzles	1						2				4			6	8		10		12
Nozzles	D.A. 60° B																		
performance of D.A. 60°B nozzles																			
Flow rate l/h	8.4	8.8	10.0	10.8	12.0	13.5	14.2	15.0	16.5	17.5	18.2	Data refer to each nozzle							
Pressure Ate	1.0	1.8	2.1	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0								
Pump type	SPT204								CT 1A			AT 3C			AGT 4C				
Fl.rate m3/h	0.9		0.9		1.3		1.3	1.6	2.2	3.5	4.8	6	7.5	9	12	13.5	15	18	24
AP m.c.a	25		25		18		18	17	18	17	13	13	10.8	11.5	12.7	12.2	12	11.7	10.5
Power Kw	0.33								0.37			0.55			1.1				
No. Of nozzles	2				4			6				8	10	12	14	16	20	24	28
Type nozzles	UGS26				UGS28							UGS39							

4.7.2 Atomised water humidification, with once-through water

These systems are made up of a bank of atomising nozzles that spray water in counter-current to the air directly into the humidification chamber, without evaporative surfaces. The nozzles feature a conical spray that, expanding the spread of the water, increase the theoretical contact surface, improving the absorption of the moisture by the air: ***the guaranteed efficiency is equal to 35%.***

Considering the low efficiency, this type of humidifier is used, generally, when the treated air is all or mostly recirculated, with a minimum percentage of outside air. The two-chamber containment section is in constructional terms identical to the one described for the previous systems, including the mist separator. The bottom sump only has the drain hole to be connected, via a drain trap, to the sewerage system (diam. 1" up to and including model CTS10, 1"1/2 for larger models).

Advantages and disadvantages: similar to those in the previous paragraph, with the difference that the formation of lime scale does not occur on the packing media but rather in nozzles, consequently clogging them.

4.7.3 Atomised water humidification with compressed air

System made up of atomising nozzles supplied by a mixture of water and compressed air, fitted inside the chamber on special racks that act as supports, as well as carrying the two fluids. **The atomising nozzles, which can be adjusted so as to optimise the direction of flow, pulverise the jet of water into very fine droplets (10 micron), able to guarantee a high humidification efficiency of up to 90%.**
The system is fitted with a cabinet, which includes the electrical panel for the single-phase power supply and control, and a fluid section (air and water lines) for flow-rates from 20 to 230 l/h of water.
The compressed air must be as pure as the air that is breathed (especially in the case of civil applications), therefore, the condensate and oil must be eliminated upstream of the compressor (this is also required for the correct operation of the atomisers). The pressure of the water is generally from 1 to 6 bars, while the pressure of the compressed air varies from 7 to 10 bars.
The humidifier is fitted with an automatic nozzle cleaning feature using the compressed air.
The two-chamber containment section is in constructional terms identical to the one described for the previous systems, including the mist separator. The bottom sump only has the drain hole to be connected, via a drain trap, to the sewerage system (diam. 1" up to and including model CTS10, 1"1/2 for larger models).
The cabinet is supplied as standard. Upon request, if possible, it can be installed outside of the humidifying section, on appropriate brackets fastened to the structure of the unit.
The formula can be used for the indicative sizing of the air compressor (at atmospheric pressure) suitable for supplying the system according to the quantity of water required for the humidification process:
V (volume of air taken in by the compressor) = 1.27 [Nm3/h] (at atmospheric pressure) x Water flow-rate for humidification [l]
Example with 50 l/h of water for humidification : 1.27 x 50 = 63.5 Nm3/h
In order to guarantee the right flow-rate of air in all conditions, the value should be increased by 10%

Advantages :

- limited water consumption thanks to the atomisation of the droplets, assisting evaporation;
- precise control of the specific humidity at the outlet of the system, even without implementing post heating;
- reduced risk of the development and proliferation of pathogens, due to the lack of recirculation.

Disadvantages :

- high cost of the complete humidifier;
- cost and consumption of the air compressor required by the system;
- greater operating complexity.

NOTE : In alternative to the water and compressed air humidifier, upon request a new system is available with similar characteristics, which atomises the water using a high pressure pump (up to 80 bars), thus avoiding the costs of the external air compressor and compressed air distribution system.
This system features low energy consumption, 5 W/ (l/h) of atomised water, against, however, a higher equipment cost.

4.7.4 Humidification by air washer

This solution is used in systems that require the combination of humidification, cooling and filtration, that is, the abatement of the impurities suspended in the air thanks to the very high quantity of water sprayed, which creates an actual barrier (hence the term washer) and, therefore, the air washer is essentially used in industrial applications.
The containment section features two chambers, so that the washing zone is completely sealed, without the risk of entraining water outside of the panels.
The water system is made up of PVC atomising nozzles, which are easy to dismantle for replacement and cleaning, with a wide cone for the distribution the pressurised water, and steel pipes and fittings.

The section includes, in addition, galvanised steel flow rectifier on the air intake, mist separator with 6 faces and 4 bends made from galvanised steel plate on the air outlet (both fitted rigidly so as to avoid any vibrations in the blades) and chamber where the actual humidification process is implemented.

The humidifying section is fitted with the following components:
-inspection door, on the actual humidification chamber, in the outer panelling, with man hole in the sealed intermediate space;
-sturdy bitumen-coated galvanised steel plate water collection sump, minimum height 400mm complete with overflow to be connected, via a drain trap, to the sewerage system;
-centrifugal pump fitted outside of the section on a special base.

The washer humidifier is available in two versions:
-with a single bank of nozzles in co-current, minimum efficiency 55%;
-with a single bank of nozzles in counter-current, efficiency of up to 70%;
-with two banks of nozzles, efficiency up to 95%.

In alternative to the standard systems, the following are available upon request:
- *flow rectifiers and separators made from PVC, aluminium or stainless steel;*
- *stainless steel water collection sumps;*
- *full stainless steel washing chamber.*

Advantages :
- *combination of treatments (humidification, cooling and removal of impurities suspended in the air);*
- *low maintenance costs.*

Disadvantages :
- *very high water consumption;*
- *risk of development and proliferation of pathogens.*

4.7.5 Humidification by centralised steam

Considering that steam may be available at low pressure (from 0.25 to 2 bars) or medium - high pressure (above 2 bars), the humidifying section normally supplied is ready to be fitted with a steam distributor, and features, on the bottom, a bitumen-coated galvanised steel collection sump complete with independent drain (diam. 1" up to model CTS10, 1"1/2 for larger models) for connection to the sewerage system via a suitable drain trap, as well as a galvanised steel mist eliminator with three faces and two bends, fitted rigidly so as to avoid any vibrations in the blades.
In the case of low pressure steam, the distributor is made up of one or more stainless steel pipes, according to the flow-rate of steam, which, through calibrated orifices, injects the steam directly into the air handled by the unit. At the end of the pipe, at the bottom, is a hole for discharging the condensate into the collection sump.
In the case of high pressure steam, upon request, a distribution system may be supplied or fitted made up of stainless steel nozzles with calibrated orifices, control valve, steam filter, condensate drain and connection fittings.
di condensa e raccorderia di connessione.

The following can be made upon request :
- *stainless steel pan;*
- *PVC, aluminium or stainless steel mist eliminator.*

Advantages :
- *low running and maintenance costs;*
- *precise control of the specific humidity at the outlet of the system;*
- *reduced risk of development and proliferation of pathogens, due to the lack of recirculation.*

4.7.6 Humidification by stand-alone steam generator 10.

This system is used when the treatment requires steam humidification that, as no centralised network is available, must be generated independently.
The humidifying section, fitted with condensate collection sump made from bitumen-coated galvanised steel, with independent drain (diam. 1" up to model CTS10, diam. 1 "1/2 for larger models) and galvanised steel mist eliminator with three faces and two bends, fitted rigidly so as to avoid any vibrations in the blades, is completed by a local steam generator fitted externally to the unit, with only the electrical and water connections required.
The complete supply consists of a containment cabinet, inside which are one or two boiler cylinders containing stainless steel electrodes, an electrical power and control panel, and the water fittings.
The steam, generated by the electrodes immersed in water that create a potential difference and, consequently, the energy required for the evaporation of the water, is delivered into the unit through a suitable steel stainless distributor pipe (nozzles).
The capacity of an individual generator varies from 3 to 60 kg/h, with the possibility of proportional or on/off control according to the type of input signal. If higher capacities are required, a series of generators can be linked together.

The power supply voltage is 380V/3/50Hz, except for the smaller model (3kg/h, 230V/1/50Hz); the power input in kW is equal to around 75% of the output in kg/h.
Moreover, the generator features an automatic washing cycle that rinses the boiler cylinder so as to avoid, as much as possible, the stagnation of water and consequently prevent the concentration of impurities and limescale that, depositing on the electrodes, affect operation.

N.B.: The supply water must be clean, non-softened drinking water: the use of softened water will corrode the electrodes.

The following can be supplied upon request :

- *stainless steel pan;*
- *PVC, aluminium or stainless steel mist eliminator.*

In alternative, for special applications and upon request, more costly "immersed heater" models are available: in this case, the steam is generated due to the heat supplied to the water by steel stainless electric heating elements immersed in a stainless steel boiler.

Advantages :

- *precise control of the specific humidity at the outlet of the system;*
- *reduced risk of development and proliferation of pathogens.*

Disadvantages :

- *operating costs due to the electrical power requirements;*

The following table summarises the advantages and disadvantages (in terms of costs and complexity) of the various different humidification systems, and may be useful when selecting the system.

● = low ●●●●● = high

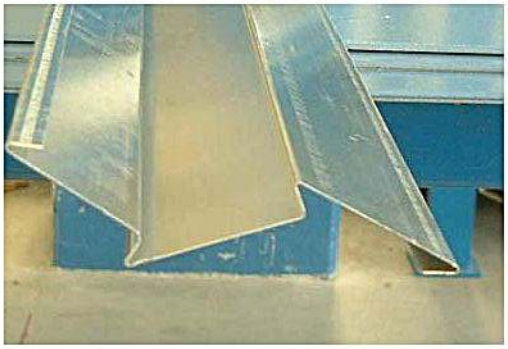
Type of Humidification	Efficiency	Hygiene	System complexity and cost	Water consumation	Energy consumation	Humidity Control
Wetted edia with once-through water	●●●	●●●	●	●●●●	●	●●●
Watted media with rcirculated water	●●●	●	●●	●●●	●●	●●
Washer	●●●	●●●	●●●	●●●●	●	●●●
Atomized water with compressed air	●●●●	●●●●	●●●●●	●	●●●	●●●●
Centralized steam	●●●●●	●●●●●	●	●	●●●●	●●●●
Steam with cabinet	●●●●●	●●●●●	●●●	●	●●●●●	●●●●●

4.8 Mist eliminators

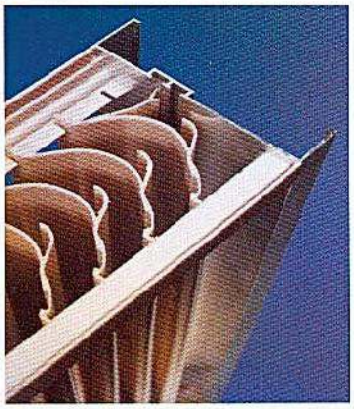
These components are used inside the system when the dehumidification or humidification processes are implemented (see previous paragraphs) so as to avoid the entrainment into the ducts of any droplets of water (condensate) not absorbed by the air.
Available in 2 versions, with 2 bends (3 faces) or 4 bends (5 faces), these are made from galvanised steel and fitted with galvanised and bitumen-coated collection pan.
The special shape of the blades creates a barrier that, based on the impact principle, breaks the flow of air, separating the droplets of water which, hitting against the walls, form a film of liquid that drips by gravity into the collection pan, from where it is then discharged.
The following can be made upon request :

- stainless steel pan;
- PVC, aluminium or stainless steel mist eliminator.

Plastic eliminator

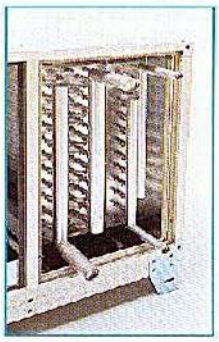


Sheet metal eliminator 2 bends



4.9 Heat exchange sections

The section that contains the coils has been carefully designed so as to allow ***removal on a sliding guide, both from the side of the water fittings, and from the opposite side, by simply taking off a panel****. In this way, the maintenance and cleaning of the finned coil are simplified.*



All the sections that contain cooling coils are fitted with a capacious ***condensate collection pan****, fitted with drain, secured onto the bottom sandwich panel (filled with polyurethane or wool, as are the rest of the panels) and, therefore,* ***thermally insulated*** *from the outside environment. The diameter of the discharge fitting is 1" for sizes up to and including 10, and 1"1/2 for larger sizes.*

HEATING AND COOLING COILS

The standard coils are finned exchangers made from copper tubes with aluminium fins. The latter are fitted with self-spacing collars, created by drawing, which as well as ensuring perfect spacing (step) between the fins, also ensures perfect contact with the suitably expanded copper tubes, guaranteeing, as a consequence, optimum heat exchange.

The frames are made from thick galvanised plate. For larger coils (length > 1300 mm), the exchanger is reinforced with intermediate metal plate. The holes for the passage of the tubes are drawn to allow sliding due to the thermal expansion during operation.

The manifolds are made form steel protected by anti-corrosion paint, or copper, and are sized according to the number of circuits in the exchanger, based to the following table.

No. of circuit	1	From 2 to 6	From 7 to 10	From11 to 13	From14 to 22	From23 to 38	From39 to 55	From56 to 95
Diameter inches	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4

For the coils operating on water and steam, steel fittings with conical gas threads are used as standard; upon request, fittings may be supplied complete with flange and counter-flange.

The direct expansion coils with refrigerant are supplied as standard with welded copper fittings and, based on requirements, may feature a series of circuits for connection to the same number of compressors.

All the coils, before welding, are cleaned using perchloroethylene vapour. The finned exchangers are welded in controlled atmospheres (inert gas).

Each single coil is seal tested in water with dry air at a pressure of 30 At.

The heat exchanger coils are available with different constructional characteristics, depending essentially on the type of application and, sometimes, on the dimensional limits of the system they are fitted in.

In the field of air-conditioning for civil applications, the standard geometry used is called 60/30, and these are in fact the coils that are fitted on the CTS series units.

The following table shows the constructional characteristics of the Cu/Al coils, with the above-mentioned geometry, as well as others used in special applications; for the selection of the latter, please contact our technical department.

The following table shows the constructional characteristics of the Cu/Al coils, with the above-mentioned geometry, as well as others used in special applications; for the selection of the latter, please contact our technical department.

Geometry(step between the tubes and between rows)	Outside diameter of the tube mm.	Tube thickness mm.	Fin thickness mm. (min)
60-30 (standard)	16	0.40	0.12
30-30	16	0.40	0.12
40-30	16	0.40	0.12
25-22	10	0.30	0.10

The thickness of the tube, for example in the case of superheated water, may be increased to 0.75/1 mm.
While stressing that the standard exchangers are made with copper tubes and aluminium fins, it should also be underlined that, upon request, for applications with fluids such as high pressure steam or in the presence of corrosive air, coils with combinations of different materials can be supplied:

- *Iron or stainless steel tubes (AISI 304 or 316);*
- *Pre-painted Al, copper, tinned copper, Fe, stainless steel fins, with cataphoresis treatment, Blygold coatings or heresite.*

ELECTRIC COILS

*These consist of **shielded heating elements made from tinned steel stainless tubes**, assembled on a painted galvanised steel frame for insertion, inside the air handling unit, on special guides, similarly to the water exchangers. They are divided into one or more stages according to the requirements and/or power. Each stage is fitted with a safety thermostat with automatic reset (manual upon request).*
The power supply may be 220V single-phase, usually for small outputs, or 400V three-phase

4.10 Heat recovery sections

The recovery of energy in air-conditioning and ventilation systems has in recent years become an important solution aimed at reducing consumption: the margins for savings are in fact quite considerable, so much so that the legislation on the subject has made the installation of a heat recovery system obligatory above a certain number of fresh air cycles per hour, and according to the climatic conditions.
The CTS series units can be installed with various types of heat recovery systems, with different efficiencies: the choice of the recovery solution depends on the type of system that the air handling unit is installed in, as well as its cost.

4.10.1 Cross-flow air/air heat recovery unit

The heat recovery unit is made up of an aluminium plate exchanger, with an aluminium containment frame.
The operating principle is based on the exchange of heat between the discharged air and the renewal air, flowing in opposite directions: the air flows through adjacent but perfectly separate ducts, so as to avoid any contamination between the two flows.

The efficiency of recovery, also called the temperature ratio, obviously depends on the size of the exchanger and the temperature, but normally varies between 40 and 60%, with a limited pressure drop (max 350 Pa).

The following formula relates the air temperature to the efficiency:
Efficiency or temperature ratio = (Tout – Text) / (Texp – Text) , where :

- *Tout is the temperature of the renewal air leaving the recovery unit;*
- *Text is the outside (or renewal intake) air temperature;*
- *Texp is the discharge temperature.*

Another aspect of the heat recovery unit is its "efficiency", defined by the following formula:
Efficiency = Qr(Tout – Text) / Qe(Texp – Text), where:

- *Qr is the flow-rate of outside air (renewal);*
- *Qe is the flow-rate of discharged air.*

This coincides with the efficiency (or temperature ratio) for the same flow-rates of air.

Cross-flow systems are "static" recovery units, sufficiently compact, reliable and sturdy, and do not require any energy consumption for auxiliary devices: their limit is that the exchange takes place almost entirely in terms of sensible heat, which penalises its operation in the summer season.
The section that houses the heat recovery unit, mounted on guides for easy ***removal****, includes, as standard, pleated synthetic filters, class G3/G4, in the outside air flow, aluminium control dampers on the outside air intake and discharge outlet. If required by the type of system, recirculation dampers for the ambient air and a bypass damper for the outside air are also fitted. The latter is necessary when needing to guarantee the intake of outside air even with very low temperatures (less than -10 / -12°C) with the risk of freezing the condensate from the discharged air on the fins of the exchanger, thus blocking the passage of air. The heat recovery unit bypass, made using a damper divided into two mutually exclusive parts, is used to take in outside air without passing through the plates while the discharged air, flowing through the exchanger, eliminates any frost.*
The section is fitted with a galvanised pan steel plate condensate collection, protected by a water-based bitumen coating (stainless steel pan available upon request), which is also useful when washing the heat recovery unit. The drain fitting is 1" up to and including model CTS10, 1"1/2 for larger models

4.10.2 Water coils

The coil-based recovery system is created by using two (or more) water coils with a number of rows, in constructional terms identical to those described previously, with one (or more) positioned at the discharge and one at the fresh air inlet, are coupled together by an independent water circuit with pump and filling assembly.
The operating principle is based on the indirect air-water-air heat exchange.
In the winter, for example, the discharged air (at around 20°C) heats the water (or the mixture of water and anti-freeze glycol) in the closed circuit of the first coil; this water is pumped to the second coil, placed in the fresh air flow, where it pre-heats the colder outside air. In summer, obviously, the reverse occurs.
The double air/water heat exchange, as well as the inevitable heat losses from the water circuit, reduces the efficiency of recovery, and consequently very large exchange surfaces are required (coils with minimum 6/8 rows).

The average efficiency of recovery varies from 35 to a maximum of 50%.
The use of this solution is especially suitable when the discharged air and outside air ducts are far apart, as the water circuit is much more simple and economical to install than bulky air ducts.
For the coil containment sections and their assembly, refer to the description provided in paragraph 4.9.

4.10.3 Tube heat recovery unit

These heat recovery units consist of finned coils made from copper tubes and aluminium fins. The tubes are sealed and contain a biphasic fluid, usually a refrigerant gas.
The operating principle is based on the exchange between the parallel flows of the discharged air and the renewal air via the biphasic fluid: the latter absorbs heat from the hotter air, transferring it to the colder air.
The exchanger fitted between the discharge duct and the outside air duct, installed adjacent to one another, comes into contact on each side, separated by a partition, with the two different flows of air. Inside the tubes the fluid in contact with the hot air evaporates, absorbing heat, and migrates, by gravity, towards the "cold" half of the exchanger, where it condenses and gives up heat to the other air flow.
As this migration occurs by gravity, the construction and assembly of the coil inside the system vary according to whether the recovery is implemented only in winter or also in summer.

- *Recovery in winter: the exchanger is fitted in its containment section on a sliding guide, like a normal coil, however the finned exchanger tubes are suitably inclined so as to allow the migration of the gas inside from the hotter part relating to the discharged air to the colder part. During summer, there is no exchange of heat.*
- *Recovery in winter and summer: the exchanger is fitted inside the containment section on a swinging system that allows the slope of the entire finned exchanger to be modified, so as to allow the gas to migrate form the hot part to the cold part even when the hot air and cold flows are reversed (in summer, obviously, the discharged air is cooler than the outside air). The swing mechanism may be manually operated or motor-driven.*

The average efficiency of a biphasic recovery unit varies from 45 to 70%, with a relatively low pressure drop.
For special applications, biphasic recovery units can be constructed with pre-painted fins.

4.10.4 Rotary heat recovery unit

The heat recovery unit is made up of a rotating drum (wheel), made from corrugated aluminium, driven by a constant- or variable-speed motor, coupled to the wheel by a belt drive.
The drum, enclosed in a galvanised steel support frame, fitted inside the containment section, is half crossed the discharged air and half by the fresh air: in this way mode, due to the continuous rotation of the exchanger (wheel), the heat of the discharged air is transferred to the fresh air. As the operating principle requires that the two halves of the drum are not insulated from each other, there is inevitable contamination between the two flows. A seal brush is used to reduce this phenomenon, even if, during the design phase, the pressure difference between the two flows should be minimised, as the leaks of air are proportional to this. The brush also cleans the surface of the wheel in the intermediate area between the discharge and the renewal flows.

This heat recovery unit, in the enthalpy version, with the aluminium wheel having a hygroscopic surface, recovers both the sensible heat and the latent heat from the air and is therefore particularly suitable for heat recovery in summer.
The efficiency of a rotary heat recovery unit, in normal conditions, varies from 60 to 80% with a limited air-side pressure drop.

The section that contains the heat recovery unit includes, as standard, pleated synthetic filters - G3/G4 - in the fresh air (outside air) flow, aluminium control dampers on the outside air inlet and discharged air outlet. If required by the type of system, an ambient air recirculation damper is fitted.

4.11 Silencers

In an air handling system, properly designed and manufactured to criteria that almost completely eliminate phenomena of air leaks through the structures and consequently the annoying squealing sound, the noise generated by the system is essentially due to the main motive unit, that is, the fan. In fact, the noise caused by the electric motor coupled to the fan or by any other equipment present can be considered negligible.

From the fan, the noise, which in theory propagates spherically from the source, in practice moves in the direction of the air flow, in both directions, and towards the outside of the unit, though the panels and the structures.

As regards the latter, the double panelling of the unit guarantees significant absorption of noise, also called sound transmission loss (STL), which varies according to the thickness and the density of the insulating material used. In particular, the configuration of the sound-proof panels, made using glass wool and micro-perforated metal plate on the inside (see par. 3.2), ensures, thanks to the sound-absorbing and non-reflecting structure, that the noise levels outside of the unit are further reduced: a porous structure, in fact, causes a series of multiple reflections, with a damping of the sound wave and consequently greater noise abatement compared to a smooth surface.

To abate the noise in the air flow that moves along the ducts from the ventilating section to the rooms being air-conditioned, special SILENCERS are used.

These silencers, with a rectangular cross-section, are made from a galvanised steel plate frame filled with glass wool and lined by a compact fabric called "velovetro", which prevents the flaking of the wool fibre and consequently the entrainment of the fibres in the ducts, all enclosed by micro-perforated metal plate on both sides.

The standard silencers are 200 mm thick, and are placed 100 mm apart, inside a containment section with the same type of construction as the rest of the system.

The sound wave generated by the fan is damped by the impact with the walls of the silencing media: the longer the media the greater the noise abatement.

The CTS series envisages standard silencer sections of different lengths, with limited pressure drop.

The following table shows the different types of silencers and the corresponding noise abatement.

Media L=600 mm	Soun adsorbing media L=600 mm Sound reduction per octave band, expressed in dB								
	Hz	63	125	250	500	1000	2000	4000	8000
	dB	3	6	11	18	24	28	18	12
Media L=900mm	Soun adsorbing media L=900 mm Sound reduction per octave band, expressed in dB								
	Hz	63	125	250	500	1000	2000	4000	8000
	dB	5	11	20	28	40	42	30	20
Media L=1200 mm	Soun adsorbing media L=1200 mm Sound reduction per octave band, expressed in dB								
	Hz	63	125	250	500	1000	2000	4000	8000
	dB	7	14	24	36	46	46	38	29
Media L=1500 mm	Soun adsorbing media L=15200 mm Sound reduction per octave band, expressed in dB								
	Hz	63	125	250	500	1000	2000	4000	8000
	dB	9	16	30	44	49	49	44	30

For special applications, such as in hospitals, that require washing (disinfection) of the inner walls in contact with the air, the media can be supplied lined by a special plastic that is permeable to sound but impermeable to the liquids and the steam used, and resistant up to 120°C.

4.12 Sterilisation section

Sterilisation is performed using UV GERMICIDE LAMPS, installed inside a section made with the same type of sandwich panels as the rest of the system, but with reflecting walls on the inside so as to improve the reflection of the light.

The lamps, wired to an external terminal block, are fastened on a frame fitted with suitable shock-absorbers, secured to a guide for easy removal from the side for periodical maintenance or replacement.

5. ACCESSORIES AND OPTIONS

A wide range of accessories, supplied on specific request, complete the CTS series units, making them among the most reliable and complete solutions current available on the market.

5.1 Lights
Lamp holders with 60W lamps, minimum protection IP54, wired to an on-off switch fitted on the outside of the corresponding section.

5.2 Inspection port
Double glass with space in between so as to allow secure installation in the double wall panels, forming a single body without the risk of leaks.

5.3 Safety switches (microswitches) on the doors
Bayonet type, with safety function that cannot be disabled, these can be fitted on all of the doors or panels that are removable for inspection/access. Supplied as standard on the ventilation sections (see paragraph 4.1).
The wiring of the microswitches is the customer's responsibility.

5.4 Protective safety guard
Installed to protect the transmission, with safety function, this is made from perforated galvanised plate, and is easily removable in order to check the wear on the belts.

5.5 Protective mesh
Fitted inside the system at the inspection/access doors (or panels), with safety function. Can only be removed using a special tool and is normally an alternative to the microswitch and/or guard.

5.6 Lock
Lock with hexagonal key.

5.7 Differential pressure gauge
Used to read the pressure drop between the upstream and downstream of the filters. The standard type is an inclined liquid column.

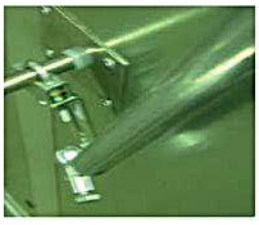
In alternative, on specific request, it may be a glycerine bath (Magnehelic). Fitted on the outside panel of the system, it is connected to the corresponding pressure test points by plastic tubing.

5.8 Differential pressure switch
This provides a dirty filter alarm signal when the set limit pressure value is reached. Fitted on the outside panel of the system, it is connected to the corresponding pressure test points by plastic tubing.

5.9 Damper servo motors
Servo motors with 220V or 24V power supply, on-off or modulating control, with or without spring return. Supplied already fitted but with wiring to be completed by the customer.

5.10 Manual damper control
Lever coupled to the shaft of the damper so as to manually control the opening of the blades. Fitted with graduated indicator showing the position and locking knob.

5.11 Damper coupling mechanism
Drive rods, complete with joints and levers, that allow the operation of two or three compact dampers with just one servo motor.



5.12 Rain grill (unit for outdoor installation)
Made from anodised aluminium with special rainproof profile fins, and fitted with galvanised steel bird net.

5.13 Rain hood (unit for outdoor installation)
Normally made from the same material as the outside panels of the system it is fitted to. Installed at of the discharged air outlet, prevents rain water from entering into the unit. The hood is always fitted with a bird net.

5.14 Protective cover (unit for outdoor installation)
The protective cover, made from the same type of panelling as the outside of the system, is suitably shaped to allow the downflow of rain water.

5.15 Spring vibration dampers
Fitted with calibration screw, these are supplied as an alternative to the standard rubber vibration dampers.

5.16 Inverter
Supplied complete with input filter and programming keypad, for panel mounting with the wiring to be completed by the customer.
All the motors fitted on the CTS units are suitable for control by inverter: the inverter is used to vary the speed of a fan by adjusting on the frequency of the power supply to the motor.

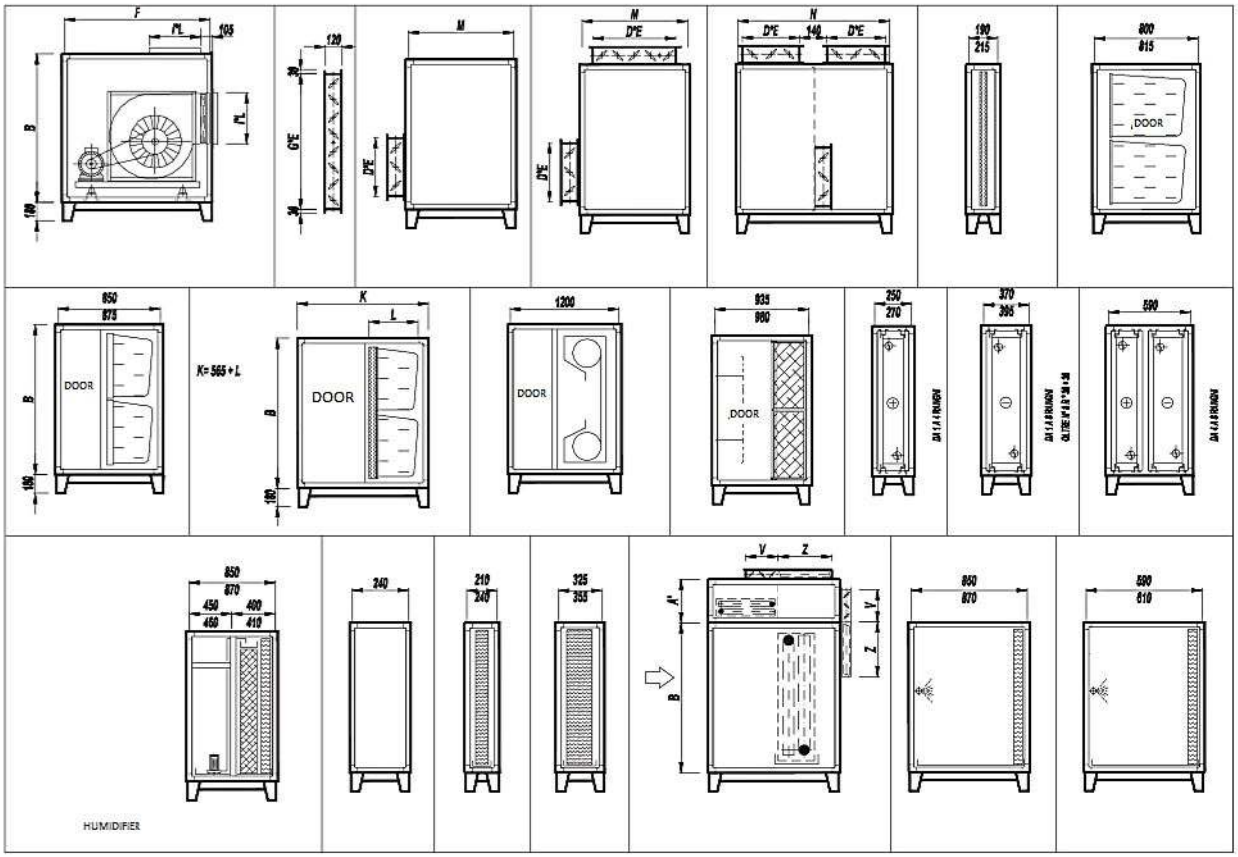
6. PACKAGING

While the air handling units do not normally include, as standard, the packaging for transport, in the event of special deliveries, wooden crates can be made, evaluated on a case-by-case basis.

7. Drawing and dimensions of the various sections

The following diagrams show the modular sections for the standard units.

CTS sizes (measurements in mm)



	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
A'	400	400	450	500	500	570	570	570	730	730	780	780	850	850	950	950
B	610	730	850	910	1030	1150	1270	1450	1630	1750	1770	1770	1950	2010	2010	2310
C	610	730	850	910	1030	1150	1270	1450	1630	1750	2140	2400	2700	3000	3540	3540
D	210	310	410	410	410	510	510	610	710	810	910	910	1010	1010	1010	1210
E	540	660	780	840	960	1080	1200	1380	1560	1680	1950	2210	2510	2810	3350	3350
F	775	895	995	1115	1235	1355	1355	1475	1595	1775	1755	1955	1955	1955	2105	2105
G	540	660	780	840	960	1080	1200	1380	1560	1680	1560	1560	1760	1820	1820	2120
I*	256	361	453	507	569	638	715	801	715	898	898	898	1130	1130	1130	1270
L*	256	361	453	507	569	638	715	801	715	898	898	898	1130	1130	1130	1270
M	270	330	390	420	480	540	600	690	780	840	847	847	948	978	978	1128
N	645	765	885	945	1065	1185	1305	1485	1665	1785	1695	1695	1895	1955	1955	2255
P	995	1235	1235	1355	1355	1475	1595	1775	1915	2105	2085	2185	2255	2545	2545	2545

* the dimensions indicated relate to the outlet of the largest fan installable for the size of CTS

8. SOFTWARE

For the sizing of the CTS series air handling units, special selection software is available that, based on the design data, creates a data sheet complete with all the calculations. The program allows the possibility to choose all the various constructional combinations available, and perform calculations involving the coils (water, steam, direct expansion), the heat recovery units (rotary, cross-flow), the fans (forward blades, reverse blades, reverse blades and wing profiles) and other components.

The selection is provided complete with a preliminary dimensional drawing and the quotation on the costs of the resulting system.