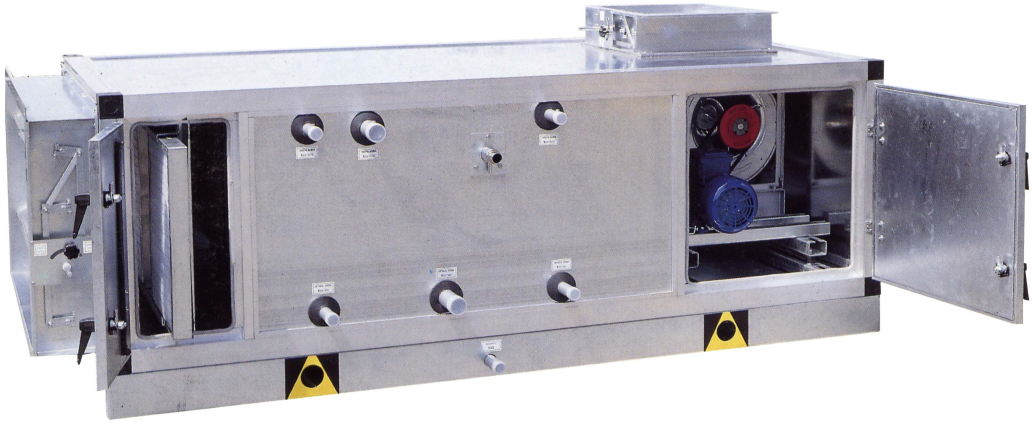
THERMAC®

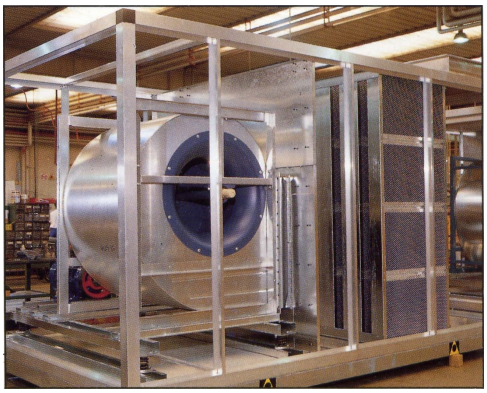
Air Handling Units
“Panel Block”

INDEX

CENTRAL AIR HANDLING UNITS PCS
Panel Block

The central air-handling units PCS "Panel Block" series have the self-supporting frame made with aluminium alloy profiles. The joints of frames are bolted by special corners in fiber-glass reinforced plastic. Casing i made with double skin panels with internal insulation of polyurethane foam or fiber-glass.
The panels are fixed to the supporting frame without using screws but by means of special retaining bars that allow to avoid any air leakage. The panel thickness can be 25 mm or 50 mm and can be made with different materials for the inner and outer skin and internal insulation. All components (fans, coils, etc.) are fixed to the frame only by means of bolts; this allow a very easy disassembling for service.
The THERMAC PCS central station air handling units present very high standard: they are modular, very strong and tight; the casing can support high working pressures, both positive and negative up to 2000 Pa. the leading idea in designing these units was SEMPLIFICATION: all the connection are removable to allow assembling and disassembling all the unit's parts in a very simple way.
The special design of pentapost profiles, with a thin slot into wich to insert the retaing bar, allows to fix the panel without the use of screws. All the panels easily removable more and more times for service.
The aesthestic result is very good and the apparence clean and linear.





Avoiding the usual selftapping srews in fixing the panels to the frame, we have eliminate all the inner stinging points and all the thermal bridges with related condensation areas.

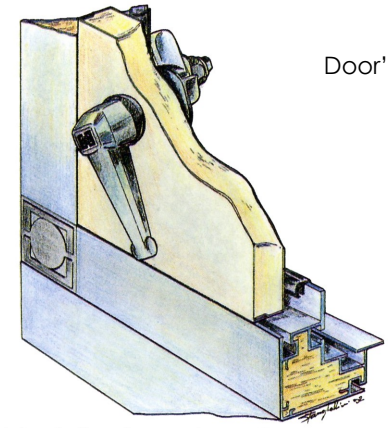
For very humid climates it is possible to use profiles with "thermal brake", with plastic insulation between the inner and outer part of the profile.
The PCS system eliminates all the air leakages between frame and panels; the uniform and constant pressure obtained with the use of retaining bars get the gasket to work in a very proper manner, giving a strong sealing.
On request the profiles can be welded with TIG system (tungsten inert gas); in this case the frame cannot be disassembled.

The THERMAC PCS central air handling units can be used in all type of air conditioning plants:
- Single zone – with constant or variable air flow;
- Multizone;
- Double duct – with constant or variable air flow.

It is possible to manifacture special air handling units with different features:
- Very low noise units;
- Sanitized units for food processing plants or hospitals;
- Stainless units.

The THERMAC PCS central station air handling units composition can be chosen to meet any designer requirements.

Door's opening handle with internal lever



Flanging joint

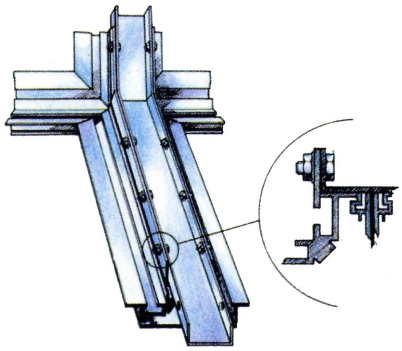
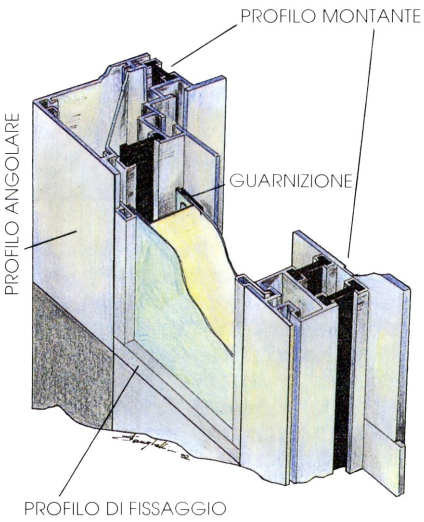
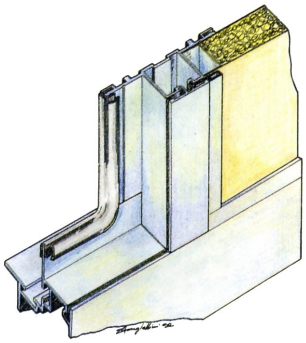
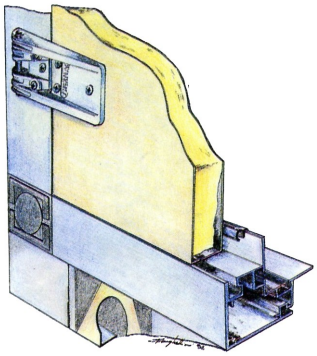


Diagram of the locking system "Panel Block" (brev.)



Insulation between internal and external profile side





Unit door's aluminium hinge

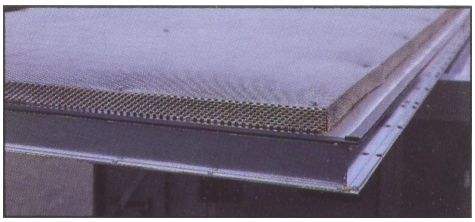
NOISELESSNESS AND POLLUTION PREVENTING

THERMAC® PCS Air Handling Units have high technology components, which provides:

- Very low noise levels and no-vibrations;
- High energy saving;
- Long life and working reliability.

These characteristics are given by the design developed by THERMAC®

FAN SECTIONS



Insonorized fan section: particular of double skin steel with micro-holes for soundproofing materials conteinment.

Various choices of fans are available for every size of PCS unit to satisfy any possible installation requirement. Moreover for each size of central station it is possible to choose between two or more size of fans usually assembled are the following:

- Forward blade fan: suitable for simple application with pressure up to 1000 Pa;
- Backward blade fan: with a winged flat section, suitable for applications with a pressure over 1000 Pa. they can be supplied with a system for the variation of the air flow rate in case they are assembled on central stations with variable flow rate;
- Axial fan: with inclination of the variables blades while in motion; to avoid the transmission of vibration, the motor-fan group is isolated from the rest of the unit by means of rubber or spring supports, while the outlet of the fan is connected to the output of the conditioner by means of an antivibrant joint in selfextinguishing canvas. On request we also build inertial bases for the motor-fan group. Moreover, it is possible to coat the inner part of the ventilating sections with sound absorbing panels protected by punced plate.

Tab. 1 – Fan type

FAN TYPE	BLADE TYPE	STATIC PRESSURE (Pa)
THA	Forward blade	< 800
THF	Forward blade	< 1200
THB	Backward blade	< 1800
THR	Backward wing-blade	< 2000
THRA	Backward wing-blade	< 2800

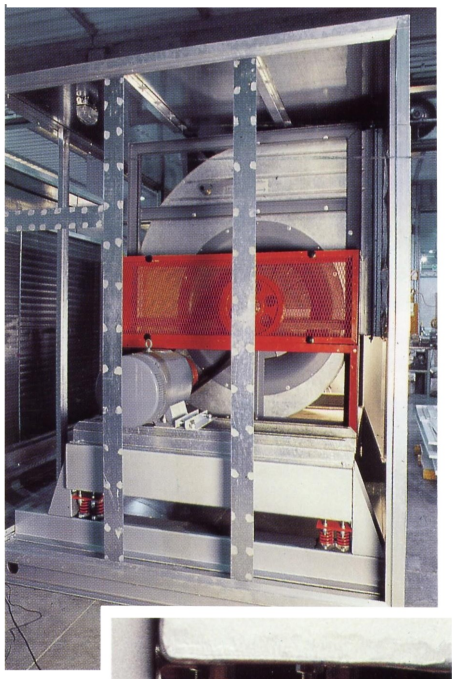
Tab. 2 – Fan implementation

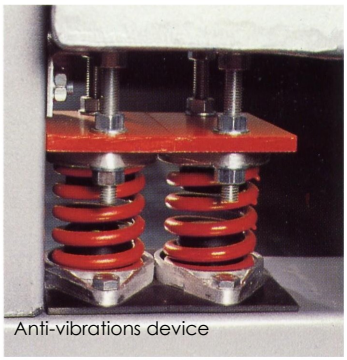
FAN TYPE	GIRANTE	COCHLEA	DRIVESHAFT
THA	galvanized steel	galvanized steel	carbonium steel
THF	galvanized steel	galvanized steel	carbonium steel
THB	reinforced poliamide or jointed and painted steel	galvanized steel	carbonium steel
THR	aluminium fusion or jointed and painted steel	galvanized steel	carbonium steel
THRA	jointed and painted steel	jointed and painted steel	carbonium steel

Tab. 3 – fans installed on PCS AHU

TIPO PCS	THF	THB	THR	THRA
12	160			
16	180 200	180 200		
20	200	200		
24	200 225	200 225		
32	225 250	225 250		
40	250 280	250 280	250	
48	280 315	280 315	280	
62	315 355	315 355	315	12 13
75	315 355	315 355	315	12 13
87	355 400	355 400	400	13 15
114	400 450	400 450	450 500	15 16
154	450 500	450 500	450 500	16 18
188	500 560	500 560	500 560	18 20
237	560 630	560 630	560 630	22 24
283	630 710	630 710	630 710	24 27
342	710 800	710 800	710 800	27 30
393	800 900	800 900	800 900	30 33
448	800 900	800 900	800 900	30 33
525	900 1000	900 1000	900 1000	33 36
590	900 1000	900 1000	900 1000	33 36
718	1000	1000	1000	36

Centrifugal back-warded blades fan group with "inlet guide vane", security carter and inertial basement.





Anti-vibrations device

All fans can be provided with air flow range variation if needed.

Most used VAV systems are:
- dampers on inlet guide vane;
- RPM variation using inverter;
- variable pitch axial fans.

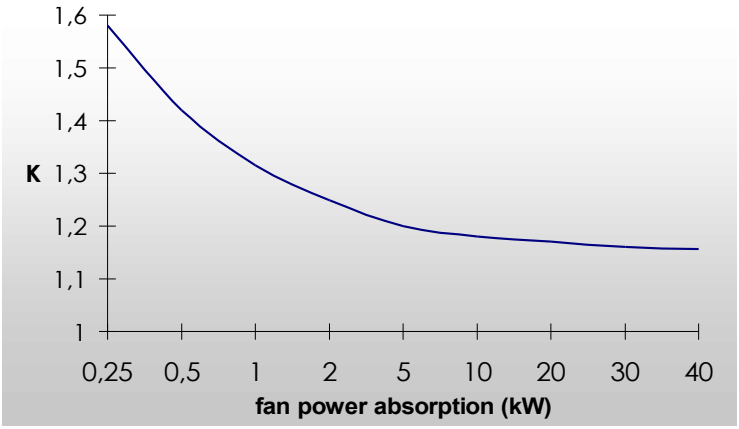
Motor selection.

After fan and size selection, we have to determinate the motor power to install; in example, if we have a PCS 188 size with a THB 500 fan type, with the following working characteristics:

Air flow	=	17.000	m^3/h
Total static pressure	=	910	Pa
Rotation speed	=	1820	RPM
Absorbed power	=	6,1	kW

to determine the right motor power, considering the transmission's performance, we have to moltiplicate the power drown by the fan by the K coefficient shown in the Graph. 1.
In our example we have: 6,1 x 1,19 = 7,26 kW; roundig to the unified size up, we choose the 4 poles / 75 kW / size 132 motor.

Graph. 1 – power coefficient.



Standard characteristic of the motors:

- asynchronous three-phases with cage-motor, closed implementation, air cooled;
- constructive shape IM B3;
- minimum protection level;
- minimum insulation class "F";
- environment working temperature: 40°C (verify outlet coil's temperature);
- voltage of 220/380 V up to 4 kW of power; 380/660 over 4kW, with "stella-triangolo" starting at 380V;
- voltage of 380V for double-polarity motors.

Options:

Different electric voltages and frequencies, inverter functioning motors, internal thermical protections, higher protection levels, scaldiglie anticondensa, antideflagranti executions, etc.

Tab. 4 – One-speed motors.

SIZE	Ø shaft	4 POLES		6 POLES	
		power (kW)	voltage In at 380 V (A)	power (kW)	voltage In at 380 V (A)
71	14	0, 37	1,2		
80	19	0,55	1,7	0, 37	1,2
80	19	0,75	2,2	0,55	1,7
90S	24	1,1	2,8	0,75	2,2
90L	24	1,5	3,8	1,1	3,2
100L	28	2,2	5,2	1,5	4,1
100L	28	3	6,8		
112M	28	4	9	2,2	5,7
132S	38	5,5	12	3	7,3
132M	38	7,5	16	4	9,6
132M	38	9	20	5,5	
160M	42	11	23	7,5	13
160L	42	15	31	11	24
180M	48	18,5	37		
180L	48	22	44	15	32
200L	55	30	58	18,5	38,5
200L	55			22	46
225S	60	37	72		
225M	60	45	87	30	60
250M	65	55	107	37	74

Tab. 5 – double-speed motors.

SIZE	Ø shaft	4/8 POLES (1500/700 rpm) 1 Dahlander wrapping		4/6 POLES (1500/900 rpm)	
		Power (kW)	voltage In at 380 V (A)	Power (kW)	Voltage In at 380 V (A)
71	14	0,26/0,05	0,9/0,4	0,26/0,07	0,9/0,54
80	19	0,37/0,07	1,2/0,5	0,37/0,11	1,2/0,6
80	19	0,55/0,11	1,65/0,6	0,55/0,17	1,8/0,9
90S	24	0,75/0,15	2,15/0,8	0,75/0,24	2,15/1,1
90L	24	1,1/0,22	2,8/1	1,1/0,34	2,8/1,4
100L	28	1,5/0,29	4/1,2	1,5/0,44	3,8/2
100L	28	2,2/0,44	5,5/1,7	2,2/0,59	5,5/2,3
112M	28	3/0,59	6,8/2,3	3/0,88	7,2/3
132S	38	4/0,81	9/2,9	4/1,18	9/3,4
132M	38	5,5/1,1	12/3,8	5,5/1,6	12/4,5
160M	42	7,5/1,5	16/4,3	7,5/2,2	16/6
160L	42	11/2,2	22/6	11/3,3	23/9
180M	48	15/3	29/8	15/4,4	31/11,5
180L	48	18,5/3,7	36/9,3	18,5/5,9	37/15
200L	55	22/4,4	43/11	22/7,5	43/18
200L	55	25,5/5,1	50/12,5	30/9,6	57/23
225S	60	30/5,9	57/15	33/10,3	64/25
225M	60	33/6,6	64/16	37/11,8	72/28
250M	65	40/8,1	80/20	45/13,2	87/31

Transmissions.

The transmissions are executed with pulleys and trapezoidal belts. Pulley are multi-throated type with a conic taper-bush to improve the installation easiness. It is possible to install pulley with unified profiles type A, B and C, of which are respectively given the standard primitive diameters in tab. 6.
If requested, are available variable diameter pulley, with 1 or 2 throats, which allow fan speed regulation up to 15-20% (see tab. 7).

Tab. 6 – primitive unified diameters of pulleys.

PRIMITIVE DIAMETER	PULLEY "A" Throat nr.			PULLEY "B" Throat nr.					PULLEY "C" Throat nr.		
	1	2	3	1	2	3	4	5	3	4	5
80	•	•	•								
85	•	•	•								
90	•	•	•								
95	•	•	•								
100	•	•	•								
106	•	•	•	•	•	•	•	•			
112	•	•	•	•	•	•	•	•			
118	•	•	•	•	•	•	•	•			
125	•	•	•	•	•	•	•	•			
132	•	•	•	•	•	•	•	•			
140	•	•	•	•	•	•	•	•			
150	•	•	•	•	•	•	•	•			
160	•	•	•	•	•	•	•	•			
180	•	•	•	•	•	•	•	•	•	•	•
200	•	•	•	•	•	•	•	•	•	•	•
225	•	•	•	•	•	•	•	•	•	•	•
250	•	•	•	•	•	•	•	•	•	•	•
280	•	•	•	•	•	•	•	•	•	•	•
315	•	•	•		•	•	•	•	•	•	•
355	•	•	•		•	•	•	•	•	•	•
400	•	•	•		•	•	•	•	•	•	•
450		•	•		•	•	•	•	•	•	•
500		•	•		•	•	•	•	•	•	•
560		•	•		•	•	•	•	•	•	•
630		•	•		•	•	•	•	•	•	•

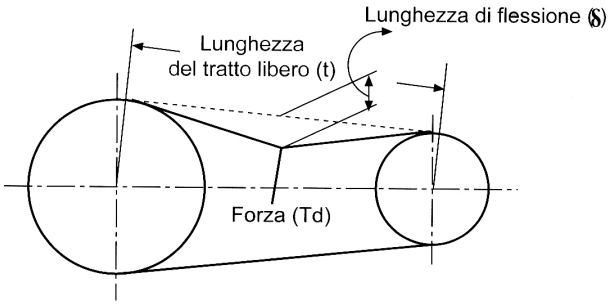
Tab. 7 – Variable pulley's primitive diameters (mm).

1 OR 2 THROAT PULLEY	"A" BELT TYPE Ø PRIM. MIN	"A" BELT TYPE Ø PRIM. MAX	"B" BELT TYPE Ø PRIM. MIN	"B" BELT TYPE Ø PRIM. MAX
PV 108	70	100	74	96
PV 120	82	112	86	108
PV 138	100	130	104	126
PV 160	108	138	112	150
PV 180	128	158	132	170
PV 200	149	177	152	190
PV 250	199	226	202	240

Transmissions tensioning.

The ideal transmission's tension is the lowest at which the belt does not slip under maximum load conditions; to check the tension of a conventional transmission, use the following procedure:

- measure the length of the free section, t;
- at the centre of the free section (t), apply a force (perpendicular to the free section) sufficient to bend the belt of d=1,6 mm for 100 of length of the free section. For example, the bending of a free section of 1000 mm will be 16 mm;
- compare the force you have applied to the values given in the table. If the force is between the values "maximum force" and "minimum force" the transmission tension is satisfactory. A force lower than "min. force" indicates an under tensioned transmission. If the force is higher than "max. force" value, the transmission



is over tensioned. Nevertheless, a new transmission may be initially tensioned at twice the "min. force" value to enable a normal tension adjustment while functioning.

Tab. 8 – Belts tensioning parameters.

Belt-size type	Force (Td) min (kg)	Force (Td) max (kg)
A	0,7	1,0
B	1,6	2,4
C	2,9	4,7

Maintenance advice.

1. check the belt tension during the first 24/48 working hours;
2. an overtension reduces the life of belt and bearings;
3. keep belts free from materials which may cause them to slip;
4. check the transmission periodically. Tension it when it sleeps.

HEAT RECUPERATORS

THERMAC PCS central station AHU can be normally equipped with two types of recuperator units:

– **static:** cross flow type with aluminium exchange plates;
– **dynamic:** thermal wheel type.

The recovery efficiency is in the range of 50% to 80% on the exhaust air flow, reducing considerably the consumption of energy for the fresh airtratment both in winter and summer.

There are many solution, to satisfy each plant design requirement:

Thermal recovery coils.

It consists in a couple of coils jointed with a hydraulic circuit. One coil is positioned in the resumption section and, during the winter working, absorbs the heat from the air pushed out. The heat recovered in that way passes in the second coil positioned in the AHU and can be used to warm-up the inlet-air. In summer working we have the reverse functioning. The fluid is, normally, water or water with glycol. Efficiency up to 65%.

Heat recovery unit with heat-pipes.

It is build with copper coil with aluminium fins, and it is balance-working installed, with rotation axis perpendicular to the coil's pipes. Pipes are filled with a refrigerant fluid. The exchange is the counter-current type. The fresh air flow passes through the upper side, while the hot air flow passes though the lower side: in this way, the fluid in the bottom evaporate, absorbing the warmth from the exhaust air flow; then the vapour goes in the upper side where, giving its warmth to the air, it condenses. When the season changes, the coil's slope has to be inverted.
The device efficiency is normally 50-60%; it has a simple installation in a small place. The system is auto-regulating; a better regulation can be obtained changing slope inclination.

Heat recovery unit cross-flow type with-or-without by-pass "CROSS THERM".

It is constituted by exchanging plates, in which the aluminium (or, on request, in stainless steel) are packaged. The exchanging pack is inside a sendzimir-steel shell; the aluminium fins are connected to subdivide the exhaust air flow from the renewal air flow in many smaller air flows, which exchange heat each-other. The efficiency can be up to 70%. Working temperatures are from -30°C to +60°C for standard executions, from -30°C to 200°C for special executions.
The CROSSTHERM units can work also in condensation conditions, having the necessary drainage.

Rotating recovery unit "ROLLTHERM".

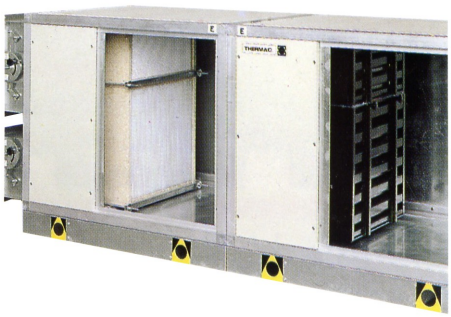
It is constituted by an aluminium (or stainless steel) latten bended and wrapped around the shaft. The exhaust air, passing through an half roll, gives (or gets) heat to the roll itself; the roll gets (or gives) heat to the air that passes through the other half. According the latten's thickness, the recovery effects the sensible heat or the total heat. Efficiency can reach 88%.

FREE COOLING

The *free cooling* is a great way to improve pant's energy saving, specially during Spring an Fall seasons. It is performed by a particular system of dampers in the mixing box, ruled by a thermostat or an enthalpy probe. The PCS units can be arranged for free cooling in the requested working conditions. The mixing boxes can be built in a special configuration, even for roof installation.

FILTER SECTIONS AND AIR QUALITY

In each filter section is possible install almost every filter type: from flat-panel filter to HEPA filters, absolute filters, and many other for every employment, both industrial and civil. Moreover it is possible install carbon filters for smell control and industrial process gas absorption. For special employments, the units can be realized in washable version, without discontinuity in order to prevent dust accumulation.



Filters characteristics:

– **Panel Filters**
FM: aluminium wool treated with high viscosity liquids.
Efficiency 70% ashrae 52-76 weight arrestance.
FO: synthetic fibers of various types in non woven patterns G2 (EU2).
Efficiency 88% ashrae 52-76 weight arrestance G3 (EU3).

– **Bag filters**
FS: can be 592 mm or 287 mm long.
Filtration efficiency can be 55%, 85%, 95% according to ashrae 52-76 atm.
Dust spot F5 (EU5); F7 (EU7); F9 (EU9).

– **Roll filters**
FR: designed for installation in the units without exceeding standard unit dimensions.
Efficiency 85% ashrae 52-76 (weight arrestance) G4 (EU4).
Actuated by a differential pressure switch with set point from 30 to 250 Pa W.G. and with sensitivity 15 Pa w.g.

– **Absolute filters**
FA: standard length 292 mm.
Efficiency of this class of filter can be 95%, 99,97%, 99,99% DOP method H13 (EU13); H14 (EU14).

Tab. 9 – Filters classification.

MEDIUM EFFICIENCY FILTERS				
CLASSIFICATION ACCORDING EUROVENT 4/5	EU 1	EU 2	EU 3	EU 4
Starting up efficiency % Gravimetric method	65	80	90	

HIGH EFFICIENCY FILTERS					
CLASSIFICATION ACCORDING EUROVENT 4/4	EU 5	EU 6	EU 7	EU 8	EU 9
Starting up efficiency % Opacimetric method	40	60	80	90	95

ABSOLUTE FILTERS					
CLASSIFICATION ACCORDING EUROVENT 4/4	EU 10	EU 11	EU 12	EU 13	EU 14
Starting up efficiency % Opacimetric method	95	99,9	99,97	99,99	99,999

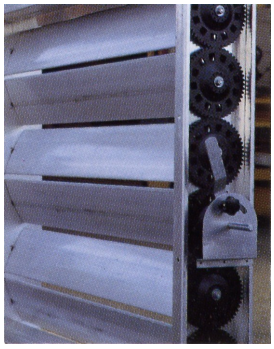
Tab. 10 – filters choosing.

FILTER TYPE	FILTERING EXAMPLES	CLASS	APPLICATIONS
Medium efficiency	insects textile fibres and hair sand	EU 1 EU 2	Simple applications (insect protection in small devices)
	ashes pollens Spore Cement dust	EU 3 EU 4	Pre-filtration for class EU 6 up to EU 8 filters. Industrial and kitchen extractors. Protection against foulness of small conditioning devices.
High efficiency	pollens Spore Cement dust	EU 5	Extractors in low severity prescriptions (laboratories, garages)
	bacteria and germs on particles	EU 5 EU 6 EU 7	Pre-filtration or filters on aeration devices. End-filters in offices, shops, production divisions. Pre-filtration for EU11/EU12 filters and carbon filters.
	Oil smokes and soot Cigarette smoke Metal oxide smokes	EU 7 EU 8 EU 9	End filters in office conditioning, production divisions, hospitals, CED. Pre-filtration for EU11/EU12 filters and carbon filters.
absolutes	Germs, bacteria, viruses Cigarette smoke Metal oxide smokes	EU 10 EU 11 EU 12	End filters for environment with restrictions (pharmacological factories, precision mechanics factory, optic industry, electronic industry).
		EU 11	.
	Oil smokes and dust Radioactive suspensions	EU 12	End filters for white cameras from 100000 up to 10000 class. Nuclear plants estractors.

Tab. 11 - Filter cells quantity and dimensions.

PCS size	Flat filters			Bag/absolute filters		
	n.	dimensions (mm)	surface (m^2)	n.	dimensions (mm)	surface (m^2)
12	1	625 x 400	0.25	1	592 x 287	0.17
16	1	625 x 500	0.31	1	592 x 592	0.35
20	1	625 x 500	0.31	1	592 x 592	0.35
24	1	625 x 500	0.31	1	592 x 592	0.35
32	2	500 x 400	0.40	1	592 x 592	0.35
40	2	500 x 500	0.50	1 1	592 x 592 592 x 287	0.52
48	2	500 x 500	0.50	1 1	592 x 592 592 x 287	0.52
62	2 2	625 x 400 400 x 300	0.74	1 2	592 x 592 592 x 287	0.70
75	4	500 x 400	0.80	1 2	592 x 592 592 x 287	0.70
87	4	625 x 400	1.00	2 2	592 x 592 592 x 287	1.04
114	4 2	625 x 400 400 x 300	1.24	2 4	592 x 592 592 x 287	1.38
154	4 4	625 x 400 500 x 400	1.80	4 2	592 x 592 592 x 287	1.74
188	3 1 3 1	625 x 500 625 x 400 500 x 500 500 x 400	2.14	6	592 x 592	2.1
237	9 3	500 x 500 500 x 400	2.75	6 3	592 x 592 592 x 287	3.01
283	12	500 x 500	3.00	6 3	592 x 592 592 x 287	3.01
342	8 4	625 x 500 500 x 500	3.50	9 3	592 x 592 592 x 287	3.66
393	10 5	625 x 500 500 x 500	4.38	12	592 x 592	4.2
448	14 7	625 x 400 500 x 400	4.90	12 3	592 x 592 592 x 287	4.71
525	28	500 x 400	5.60	12 7	592 x 592 592 x 287	5.39
590	20	625 x 500	6.25	15 5	592 x 592 592 x 287	6.1
718	24	625 x 500	7.50	18 6	592 x 592 592 x 287	7.32

AIRTIGHT DAMPERS



Dampers of THERMAC PCS AHU can be manufactured with galvanized metal sheet blades or airfoil extruded aluminium blades; steel rods rotating on nylon supports. The blades can be equipped on the edges with synthetic rubber gaskets assuring a very good air sealing and energy saving. The damper blades are connected by mechanical links or gears out of air flow. The air leakage is less then 100 m^3/h for a front area of 1 m^2 under pressure of 100 Pa. Dampers can be manually operated or motorized.
Free cooling is a good source for energy saving. PCS mixing boxes are suitable to achieve this function.
Special mixing boxes are available for units to install on roof (Roof-Top Units).

THERMIC EXCHANGE COILS

Heating and cooling coils are normally fabricated in copper tubes, with plate type aluminium fins, suitable to be fed with different fluids: water, refrigerant, steam. The fins can be made in copper or copper tinned. The coils are available in 1 through 12 rows. The coils are fixed to the frame in way to be easily slide-out for servicing.
Under the cooling coil there is a drip-pan, inside the unit casing; in such way any condensation is avoid.
In relation with the tube diameter and geometry, we have type of coils: P6016, P3016 and P2510.

Geometry can be:
- P6016 – triangular arrangement; tube pitch 60 mm, row pitch 30 mm; OD 5/8";
- P3016 – square arrangement; tube pitch 30 mm, row pitch 30mm; OD 5/8";
- P2510 – square arrangement; tube pitch 25 mm, row pitch 25 mm; OD 3/8";

fin pitch: standard – 2.5 mm
on request – 1.6 mm, 2 mm, 4 mm, 6 mm.

Materials: copper tube - DIN standard 1754 – 1787 – 1785 – 17671 99.90 CU.
Aluminium fins - DIN standard 1725 – 1784 – 1788.

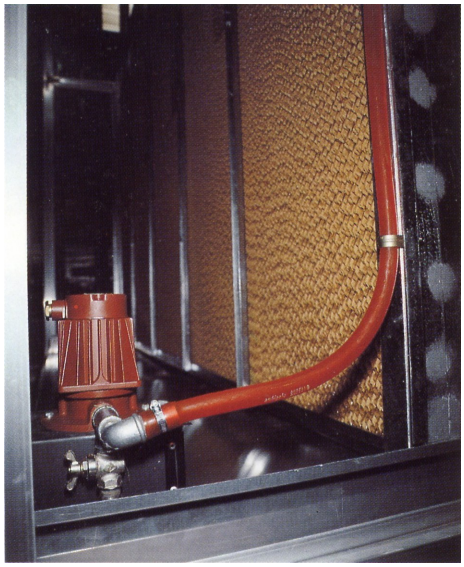
Special constructions:
- Copper fins;
- Copper tinned fins;
- Pre-painted fins;
- Steel tubes – aluminium fins;
- Stainless steels tubes and fins.

ELECTRIC HEATERS

Heavy-duty construction type with absolutely safe finned pipes. Maximum specific power is 4 W/cm^2.
The heaters can be single or multistage and are easily removable.
All heaters are supplied with safety high temperature cut-out.

HUMIDIFIERS

Several humidification devices can be installed onto PCS AHU.



Wet deck humidifier.

This high efficiency system allows the elimination of the bank of nozzles. The water is distributed evenly over the wet deck. This is made of cellulose impregnated with phenolic resins which make it imputrescible.
The system can be operated with city water or with water recirculated by a pump. In both cases a pan in is provided unbeneath the wet deck to allow the drain or the recircualtion of water (see photo).

Spray nozzles humidifiers.

The system consists of an empty section with a drain pan. A bank of nozzles is provided at the inlet of section, fed by city water. Normally a drip eliminator is included at the outlet of the section.

The efficiency of the system is increased if between the nozzles bank and the drip eliminator an evaporating surface of some kind is placed, which is either the cooling coil or a honey comb structure.

In this case a pump can be installed to recirculate the water in the basin.
The drip pan or basing are manufactured in aluminium alloy named "peralluman" as standard. Stainless steel construction is available on request. Stainless steel or plastic eliminators are available on request.

Air-washer humidifier.

The system offers a higher efficiency than the sprayed surfaces- in this case there are one ore two banks of spray nozzles and the pump is of higher capacity. The evaporating surface is placed between the spray nozzles and the drip eliminator. A separator is placed at the inlet of the air washer section to prevent water droplets to reach the previous sections. The spray chamber is independent from the casing and is manufactured in "peralluman" as standard. Stainless steel construction is available on request.

SILENCERS

Noise-sending analysis.

Choosing the fan type to install in the AHU and its functioning point determinate the spectrum of the sound pressure level (Lw) outside the casing at the different frequencies. This sound source gives out noise to the conditioned rooms by the air-distribution-canalization-system.
In example, we suppose we have this emission of the spectrum:

central band frequencies (Hz)	63	125	250	500	1000	2000	4000	8000
Lw (dB)	93	91	90	88	86	82	78	74

In the acoustic planning of the rooms to be conditioned, it is necessary start from the fan's sending-out spectrum, then estimate all the sound losses (bends, branches, acoustic coating, plenums, etc.) that take part in the air distribution path and the conditioned environment characteristics. If the obtained noise level is higher than the request one, it is necessary mount other attenuation devices like silencers. The attenuation of the silencers is given in the next table.

Tab. 12 – silencers noise level attenuation capacities.

	central band frequencies (Hz)							
Frames length (mm)	63	125	250	500	1000	2000	4000	8000
600	2	4	8	12	16	18	13	10
900	6	10	17	24	35	36	26	22
1200	7	12	21	31	37	38	32	28
1500	7	13	24	35	39	39	36	31

Noise passing through casing analysis.

Considering the fan in the previous example, we now calculate the noisiness given out from the AHU through the casing: suppose we choose PV-ZN25-PU casing, that has a sound transmission loss, at 3 m, as given in tab. 21. Moreover, we suppose we calculated the sound pressure level (Lp cdz) inside the unit, considering the contribution of direct and reverberated fields, and that it is numerically at the same level of fan sound pressure (important: the Lp cdz calculation is due to geometric and physics characteristics of each specific installation). Now it is possible to find the 3 meters Lp level in a free field, subtracting the panel's STL from Lp cdz level. The STL values for each panel type are given in tab. 21.

Tab. 13

	central band frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Lp cdz (dB)	93	91	90	88	86	82	78	74
STL (dB)	37	38	40	44	41	51	62	51
Lp a 3 m (dB)	56	53	50	44	45	31	16	23

dB(A) corrected scale.

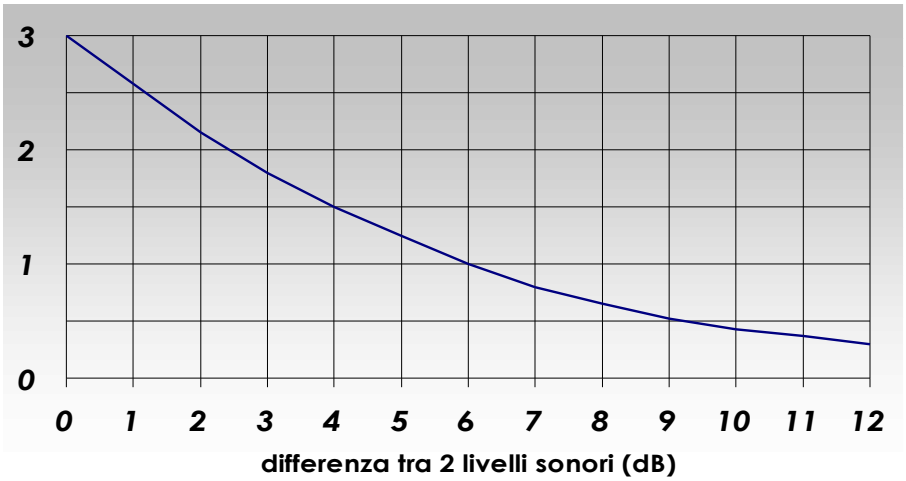
Often, in sound pressure level valuation, it is necessary refer to dB(A) sound Scale, simulating human ear perception at various frequencies; it is possible obtain that correction algebraically adding the values given in tab. 14 to the sound pressure spectrum (Lp cdz) values.

Tab. 14 - dB(A) corrected scale.

	central band frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Lp (dB) a 3 m	56	53	50	44	45	31	16	23
Pond. Scala A	**- 26**	**- 16**	**- 8.5**	**- 3**	**0**	**1**	**1**	**- 1**
Lp (dBA) a 3 m	30	37	41.5	41	45	32	17	22

To calculate the overall sound pressure level it is necessary calculate, using a logarithmic adding, the various levels at single frequencies. Using the graph. 2 we obtain, adding two by two, the levels at several frequences, ordering them in a decreasing way.

Graf. 2 - Increase up to the highest level (dB)



Level to be added (dB)	difference (dB)	increasing (dB)	result (dB)
45 + 41.5	3.5	1.7	46.7
46.7 + 41	5.7	1.1	47.8
47.8 + 37	10.8	0.3	48.1
48.1 + 32	16.1	0	48.1

Now, the sum with the successive values does not affect the global sound pressure level in a relevant way: in fact it is equal about to 48.1 dB(A) at 3 meters.

Air-flow regulator influence in noise pressure level increasing.

When the fans have a flow ruler the noisy will increase, according the value shown in the next table:

- up to size 560 : + 6.5 dB(A)
- from size 560 to size 800 : + 5.0 dB(A)
- from size 900 to size 1000 : + 3.5 dB(A)

IMPORTANT
The noisy values of the fans graphically (with the curves) or mathematically (with ASHRAE method) obtained, can be modified by installation characteristics, by other AHU and by other factors; for this reason, ask the constructor's technical team the necessary data concerning its AHU.

Fan sound pressure level.

The sound pressure level is normally declared by fan constructor for each octave band(Hz 63; 125; 250; 500; 1000; 2000 ; 4000; 8000).
The sound pressure levels for the standard fans mounted in THERMAC PCS AHU are always given. Nevertheless, if the fans mounted are out-of-standard, the levels could not be known, so them have to be calculated mathematically.
The ASHRAE method we use here is the specific sound pressure level one: for this method, we have to consider the sound pressure level the fan gives out at reference conditions of 1 m^3/s and 1Pa of total static pressure.
In tab. 15 are given the values of the standard-mounted fans.

To calculate the effective working conditions, we can apply the following equation, for each octave band:

$$(1)\ L_w = 30 + K_w + \left(10 \log \frac{Q}{Q_1} + 20 \log \frac{P}{P_1} \right) + C$$

Where we have:
L_w = Fan sound pressure level at effective working conditions;
K_w = Specific sound pressure level (Tab. 15);
Q = Air flow(m^3/s);
Q_1 = 0,472 (constant);
P = Static pressure (Pa);
P_1 = 249 (constant);
C = Correction factor in dB for each working point. See Tab. 16

Finally, the real sound pressure level has to be corrected for the pure tone, generated by the fan's wings pass-by rate.

$$(2)\ Bf = \frac{(n/1' \times n° \text{ of wings})}{60}$$

Otherwise, it can be determined in tab. 17, concerning each fan type.

Tab. 15 - specific sound pressure levels (dB).

		Central band frequences (Hz)							incr. freq. shift padd. Hz
		63	**125**	**250**	**500**	**1000**	**2000**	**4000**	
Fan type	**Fan diameter**								
Centrifugal									
Wing profile,	> 900 mm	32	32	31	29	28	23	15	3
backward blades	< 900 mm	36	38	36	34	33	28	20	
Forward blades	tutti	47	43	39	33	28	25	23	2

Tab. 16 – correction factor "C" for out of high efficiency working zone

Static efficiency % of higest value	Correction factor dB
90 - 100	0
85 - 89	3
75 - 84	6
65 - 74	9
55 - 64	12
50 - 54	15

Tab. 17 – octave band in which there is increased noise due to blade passing frequency .

Fan type	Octave band in which there is increased level (Hz)
Centrifugal	
wing profile, backward blades	125 -250
forward blades	500
radial blades for high pressure	125

Note
The native ASHRAE equation has'nt the 30 term, becouse it refer to a unitary air flow value of 1 l/s; introducing the term 30, we can consider a unitary air flow value of 1 m^3/h, according to the common use.

Computing example.

We consider an AHU with a forward wings double inlet fan, with 24 wings. The air flow is 4,15 m^3/s, with 375 Pa of static pressure, working al 18,4 rps (1100 rpm). We consider the fan is working in the higher efficiency zone. Finally the AHU has bags air filter and a roll type pre-filter.

Solution.

The sound pressure level for the specific fan is indicated in tab. 18, at row (1).

$$\Delta L = 30 + \left(10 \log \frac{Q}{Q_1} + 20 \log \frac{P}{P_1} \right)$$

The term in equation (1), with example data,

is 43 dB.
The C value is 0, for the fan is working in higher efficiency zone (the value of 43 dB is taken from row (2)).
The wings pass-by frequency is:
Bf = 18,4 x 24 = 441 Hz, and it belongs to 500 Hz band. From row (3) we take the value of 2 dB.
Now it is possible determinate the fan sound pressure level at working conditions (see row (4)).
Considering only the resumption (or the sent one), the sound level is reduced of 3dB (see row (5)).
There are two attenuation effects that could develop inside an AHU:

1. plenum attenuation;
2. filter attenuation.

For plenum attenuation takes long calculations, it will be not considered in this example.
The filters attenuation comes from their own characteristics and it has effect, normally, only on the resumption side (except absolute-filter applications, which are always mounted after the fan; in this case we have a double attenuation effect: on the resumption and, more, on the sent side). In this example is considered only the resumption side attenuation. The reference values for bag-filter attenuation (with efficiency of 85%, opacimeter), can be taken from the following table:

Hz	63	125	250	500	1000	2000	4000
ΔL dB	1	2	2	3	4	6	12

The attenuation in example is shown at row 6.
Even the coil (cooling and heating ones) have a part in the sound pressure level attenuation. It is influenced by row's number and fin's spacing. With coils grater than 4 rows, and at least 10 fpi spacing, it can be considered an attenuation as the following:

Hz	63	125	250	500	1000	2000	4000
ΔL dB	1	1	2	2	3	4	6

The coil's attenuation in example is considered at row 7.
Finally, the sound pressure level, on the AHU's resumption, is obtained by subtracting both filters and coils attenuation from the starting value: the result is shown in row 8.

Tab. 18 – Summary table.

			Center frequency						
			63	125	250	500	1000	2000	4000
1.	Sound power level specific Kw Tab. 15	dB	47	43	39	33	28	25	23
2.	Equation (1) (result ΔL)	dB	43	43	43	43	43	43	43
3.	Equation (2) or Tab. 15	dB	-	-	-	2	-	-	-
4.	Sound power level effective	dB	90	86	82	78	71	68	66
5.	Sound power level actual supply and extract	dB	87	83	79	75	68	65	63
6.	Attenuation filters	dB	1	2	2	3	4	6	12
7.	Attenuation coil	dB	1	1	2	2	3	4	6
8.	Lw actual recovery	dB	85	80	75	70	61	55	45

CASING

THERMAC® PCS AHU have an it-self-carrying structure made by aluminium profiles jointed together with fiber-glass-strengthened nylon corners. The profiles have two different dimensions; each one can carry 25 mm or 50 mm thickness panels. The airtight is provided by a closed-cell gasket made in expanded gum. To prevent any thermal-bridge, the PCS units can be equipped with a special EPDM gasket.
Internal components are assembled directly on the profiles with screws, allowing an easy dismantling of all of them.

Tab. 19 – Section type.

TYPES OF PROFILE "PANEL BLOK" USED TO FRAME PCS	
DP25	**Standard profile for panel thickness 25mm**
DP50	**Standard profile for panel thickness 50mm**
DP25TB	**Profile for panels 25mm thick cut of thermal bridges**
DP50TB	**Profile for panels 50mm thick cut of thermal bridges**
DP25A	**Standard profile for panels 25mm thick anodized**
DP50A	**Standard profile for panels 50mm thick anodized**
DP25TBA	**Profile for panels 25mm thick cut of thermal bridges anodized**
DP50TBA	**Profile for panels 50mm thick cut of thermal bridges anodized**

Panels

Panels are made with a galvanized-steel double skin sendzimir Z 275 6/10 mm, with internal polyurethane foam, which density is 45 kg/m^2. Available thickness are 25 and 50 mm, with a transitance of 0.93 W/m^2°C e 0.52 W/m^2°C respective. Fire resistant class 1.
The insulation cam be made with fibre-glass with a density of 50 kg/m^2, boxed double skin of 10/10 mm thickness. Panel thickness 25 mm or 50 mm with transitance of 1,1 W/m^2°C e 0,58 W/m^2°C respective.

Tab. 20 – Panel type.

STANDARD TYPES						
code	**External wall material**	**Internal wall material**	**Insulation material**	**thick. mm**	**Covering acoustic material**	**mm**
ZN – ZN 25 PU	Galvanized steel	Galvanized steel	polyurethane	25		
ZN – ZN 50 PU	Galvanized steel	Galvanized steel	polyurethane	50		
PV – ZN 25 PU	Pre-painted steel	Galvanized steel	polyurethane	25		
PV – ZN 50 PU	Pre-painted steel	Galvanized steel	polyurethane	50		
AL – AL 25 PU	Peralluman	Peralluman	polyurethane	25		
AL – AL 50 PU	Peralluman	Peralluman	polyurethane	50		
ZN – ZN 50 LM	Galvanized steel	Galvanized steel	Fibre-glass	50		
PV – ZN 50 LM	Pre-painted steel	Galvanized steel	Fibre-glass	50		
AL –AL 50 LM	Peralluman	Peralluman	Fibre-glass	50		
ZN – ZN 50 RIV	Galvanized steel	Galvanized steel	polyurethane	50	Holed metal sheet + fibre	25
PV – ZN 50 RIV	Pre-painted steel	Galvanized steel	polyurethane	50	Holed metal sheet + fibre	25
AL –AL 50 RIV	peralluman	peralluman	polyurethane	50	Holed metal sheet + fibre	25

Tab. 21 – Panels characteristics.

THERMAL AND ACOUSTICAL CHARACTERISTICS									
PANEL code	**Sound transmission loss (STL) dB**								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**Transmittance W/m2 °C**
ZN – ZN 25 PU	37	38	40	44	41	51	62	51	0,93
ZN – ZN 50 PU	34	38	40	43	42	55	62	59	0,52
PV – ZN 25 PU	37	38	40	44	41	51	62	51	0,93
PV – ZN 50 PU	34	38	40	43	42	55	62	59	0,52
ZN – ZN 25 LM	29	38	41	43	46	52	57	52	1,1
ZN – ZN 50 LM	29	38	42	42	52	55	57	53	0,58
PV – ZN 25 LM	29	38	41	43	46	52	57	52	1,1
PV – ZN 50 LM	29	38	42	42	52	55	57	53	0,58
ZN – ZN 25 RIV	39	39	43	45	48	52	63	54	0,54
ZN – ZN 50 RIV	38	39	43	45	49	55	63	59	0,41

COMPONENTS PRESSURE DROPS – AIR SIDE

In the following graphes are shown the components pressure drops – air side of PCS AHU. Diagrams refer to air speed through coils.

Description		Pressure drop (Pa)
- Mixing box	:	18
- Bag-filters 85% efficiency (half-cleaned)	:	200
- Heating coil 2 R standard (P60)	:	17
- Humidification with wet-deck 200 mm + pump	:	100
- Drop eliminator	:	20
- Cooling coil 8 R standard (P60) wet	:	75
- Heating coil 2 R standard (P60)	:	17
- Total internal pressure drop	:	447
- Circuit Pressure drop	:	463
- Total static fan pressure	:	910

We have to add the dynamic fan pressure to the static one, which is 80 Pa with 11 m/s fan outlet speed

- Dynamic pressure	:	80 Pa
- Total pressure (static + dynamic)	:	990 Pa

If there are special installation, it is necessary consider system effects, as explained in the appropriate chapter.

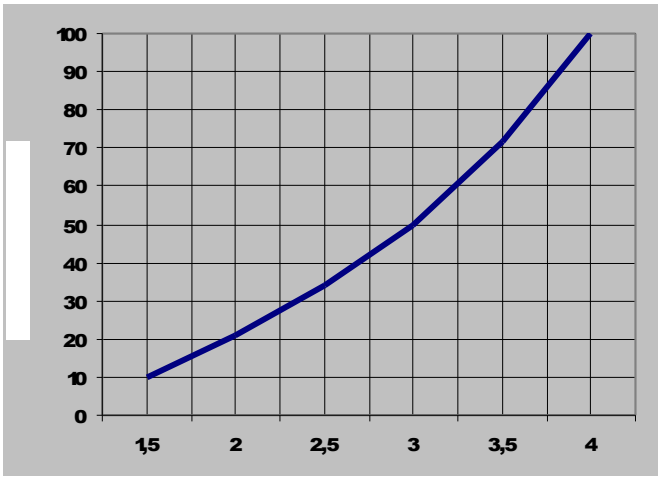
- Total fan pressure	:	990 Pa
- Added pressure drop (8% total pressure)	:	80 Pa
- Marked total fan pressure	:	1070 Pa

Otherwise, if you will install a THERMAC® silencer on the send-side with frames of 900 mm long we have:

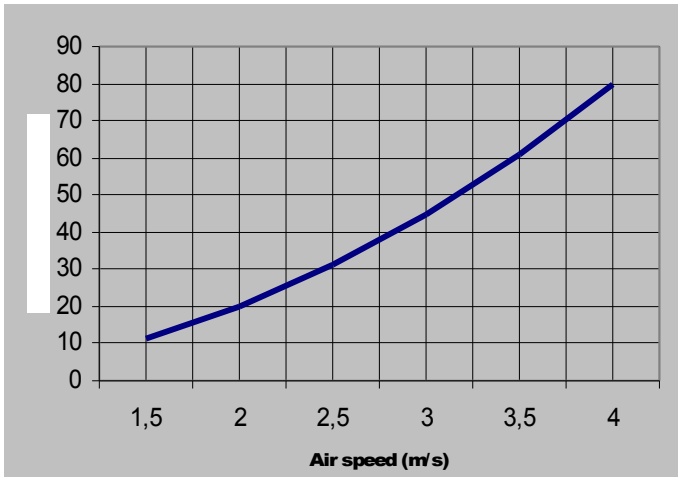
- Total fan pressure	:	990 Pa
- Silencer pressure drop	:	60 Pa
- Added plenum pressure drop (1,5 x dyn. pressure)	:	120 Pa
- Marked total fan pressure	:	1170 Pa

Graphes - internal components pressure drop – air side

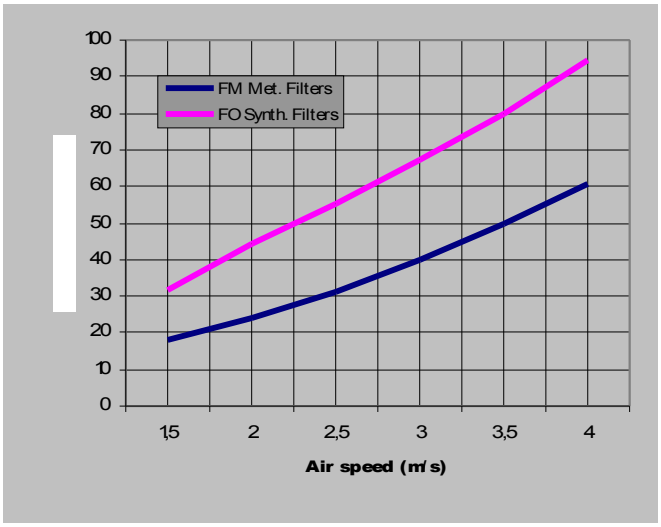
Graf. 3 – mixing box



Graf. 4 – base-frame section for vertical AHU

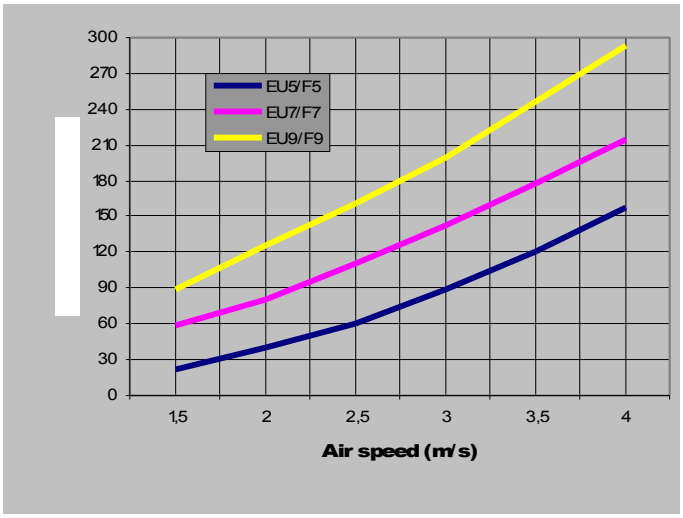


Graf. 5 – Synthetic and metallic filters

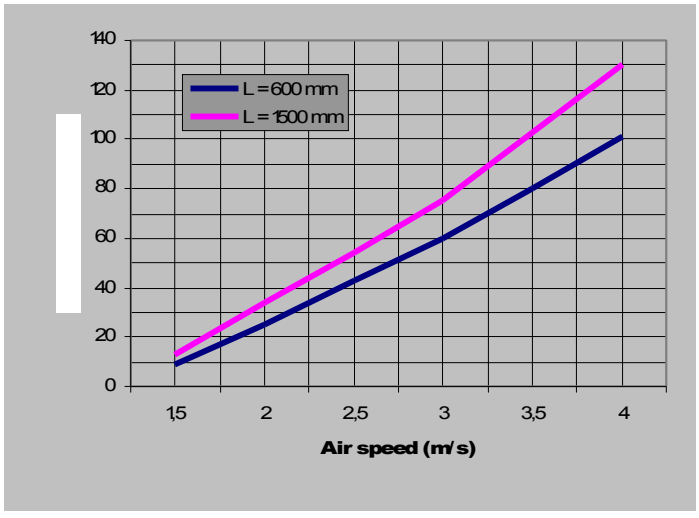


Graf. 6 – Roll filters

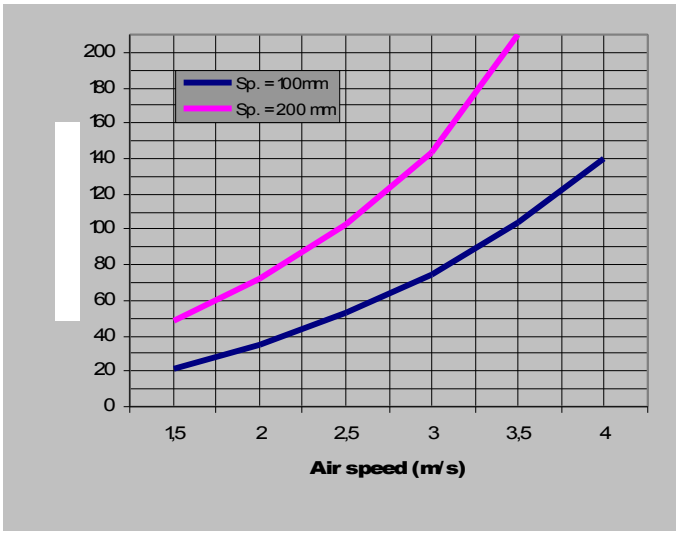
Graf. 7 – Bag filters



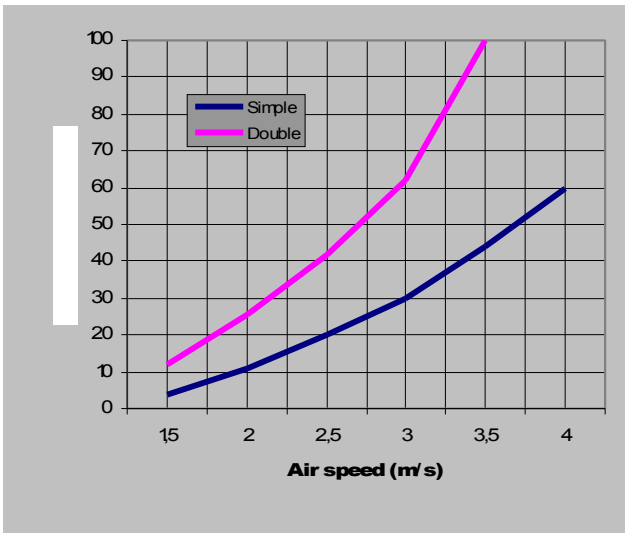
Graf. 8 - Silencers



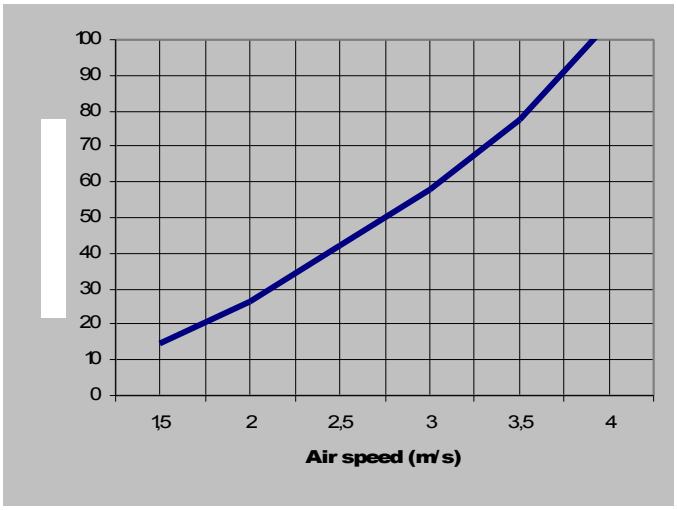
Graf. 9 – Wet Deck



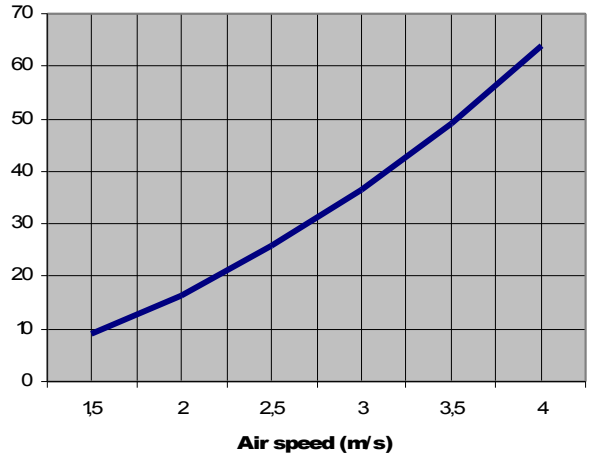
Graf. 10 – Drop eliminator



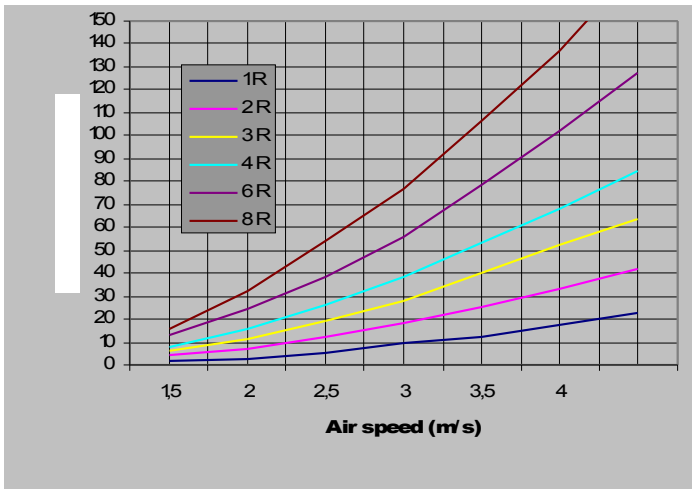
Graf. 11 – Multi-zone section



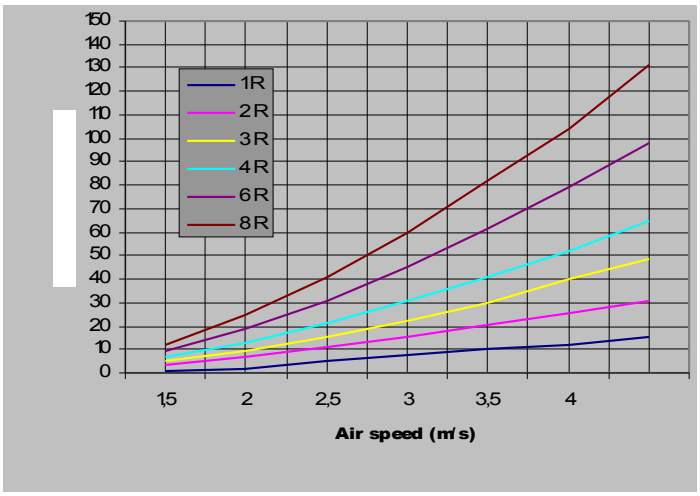
Graf. 12 – By-pass section



Graf. 13 – Exchange coil P. 25



Graf. 14 – Exchange coil P. 60



diagrams refers to a coil surface.
For wet surface consider the corrective constant FC 3 as given in tab. 22

Tab. 22 – Marking factors to different coils and working characteristics

Fins spacing (mm)	FC 1
2	1.2
2.5	1
3	0.9

T. aria (°C)	FC 2
0	1.1
20	1
40	0.9

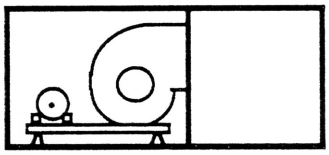
R = sensible heat/ total heat Ratio	FC 3
1	1
0.8	1.1
0.6	1.3
0.4	1.5

SYSTEM EFFECTS

System effects pressure drop.

Here is an influence valuation of some particular installation on centrifugal fan efficiency. We explain some situations in which it is necessary consider the added pressure drop when calculating the fan working pressure. In the examples are given some calculation coefficients, which are referred to dynamic or total fan pressure, and they have been deduced by our tests according AMCA Pubblication 201 "fans and systems" and SMACNA 15D "H.V.A.C. system duct design".

Sending in plenum.

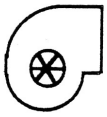


when a fan send its air flow directly in a box, without channelling the fan outlet, we mean "sending-in-plenum"; in example, when after a fan is installed a frame silencer, a mixing box or a multi-zone box: we have a pressure drop equals to 1,5 x dynamic fan pressure.

p.d.c. = 1.5 x p. din

Air flow ruler.

Fan with inlet-ruler. This device partially covers the fan inlet, even if completely opened; pressure drop is a function of fan size, so we have the following:

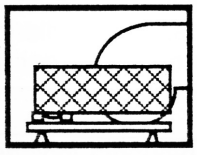


Backward-curved wings fan up to size 560 **p.d.c. = 8% P. tot**

Backward-curved wings fan over size 560 **p.d.c. = 4% P. tot**

Carter.

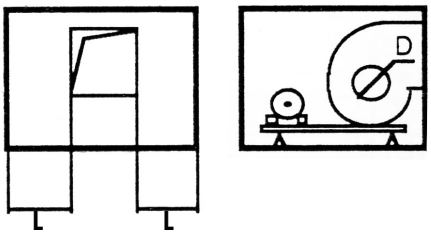
Installing a carter, which protect the transmission, cover partially the fan inlet; its pressure drop is equals to 0.5 x dynamic fan pressure.



p.d.c. = 0.5 x p. din.

Side-wall effects.

The distance between fan and box walls influences the fan aspiration; with the following table is simple to calculate the correct system-effect value starting from the L/D ratio:



L/D	p.d.c.
0.75	0.3 x p. din.
0.5	0.5 x p. din.
0.4	0.7 x p. din.
0.3	0.9 x p. din.

Note:
p.d. = Adding local pressure drop
p. din. = Dynamic fan pressure (Pa)
p. tot. = Total fan pressure (Pa)
D = Fan inlet diameter (mm)
L = Distance between box walls and fan inlet (mm)

AHU AIR FLOW
Selection table

Air-flow range

The THERMAC® PCS AHU are manufactured in 16 sizes and they cover the range of air-flow delivers from 1.000 m^3/h to 100.000 m^3/h. Then number identifying the size corresponds to the coil surface expressed in $m^2 \times 10^2$. For instance size 188 means a front area of coil of 1,88 m^2. In the table five air-flow deliveres are given against the air velocity through the coil.

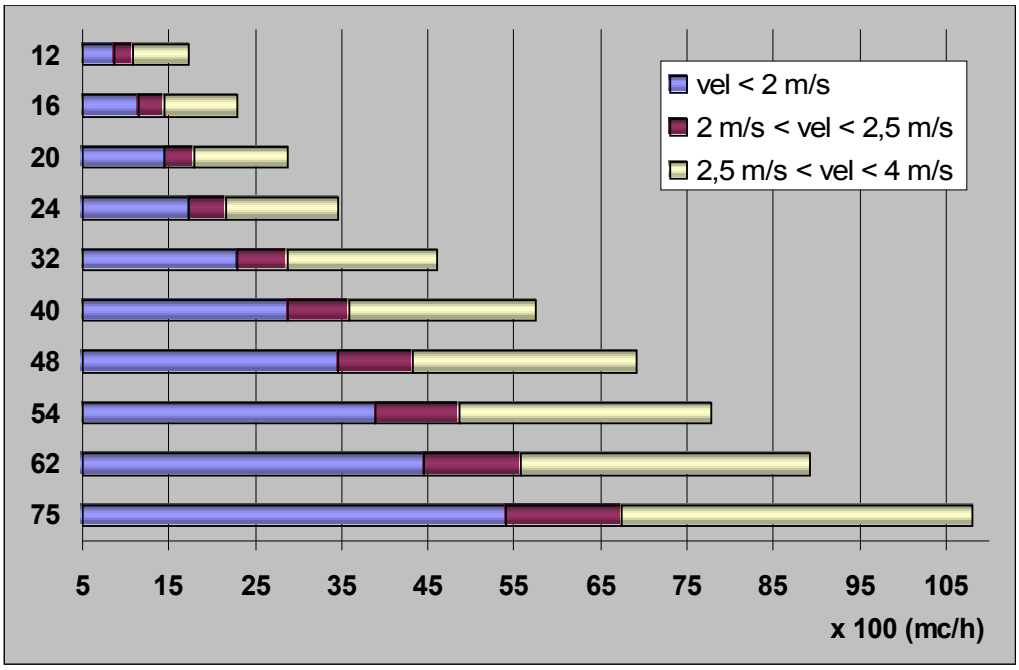
Suggested air velocity
v < 2 m/s : special applications;
2 < v < 2,75 m/s : air conditioning with wetted surfaces;
2,75 < v < 3,25 m/s : can be usedfor air conditioning, but with wetted surfaces the drip eleminator is necessary;
3,25 < v < 4 m/s : thermo ventilanting units only.

Tab. 23 – PCS sizes.

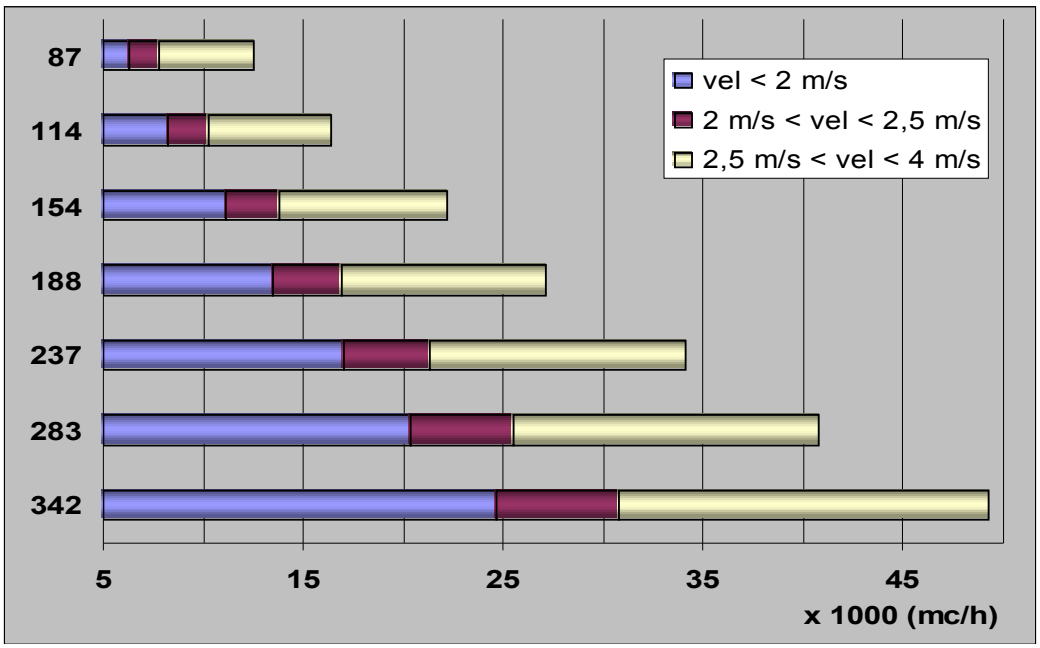
UNITÁ PCS - portata d'aria			
Grandezza	Portata aria		
	nominale vel 2,5 m/s	nominale vel 2 m/s	nominale vel 4 m/s
12	1.080	864	1.728
16	1.440	1.152	2.304
20	1.800	1.440	2.880
24	2.160	1.728	3.456
32	2.880	2.304	4.608
40	3.600	2.880	5.760
48	4.320	3.456	6.912
54	4.860	3.888	7.776
62	5.580	4.464	8.928
75	6.750	5.400	10.800
87	7.830	6.264	12.528
114	10.260	8.208	16.416
154	13.860	11.088	22.176
188	16.920	13.536	27.072
237	21.330	17.064	34.128
283	25.470	20.376	40.752
342	30.780	24.624	49.248
392	35.280	28.224	56.448
448	40.320	32.256	64.512
525	47.250	37.800	75.600
590	53.100	42.480	84.960
718	64.620	51.696	103.392

SELECTION DIAGRAMS

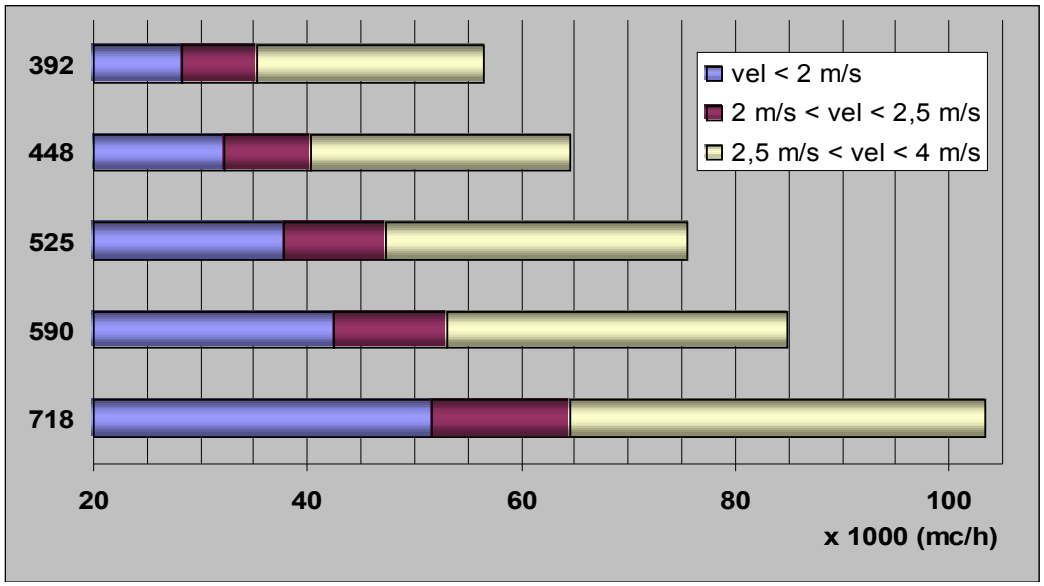
Graf. 15 – PCS 12 ~ PCS 75 (air flow gap 500~11.000 m³/h)



Graf. 16 – PCS 87 ~ PCS 342 (air flow gap 5000~50.000 m³/h)



Graf. 17 – PCS 392 ~ PCS 718 (air flow gap 20.000~105.000 m³/h)



CENTRAL AIR HANDLIG UNITS – MODULES AND MISURES

The modul of 630 x 630 mm is at the base of sizing PCS AHU. The front dimensions of a PCS unit are simply calculated by adding to the number of moduls multilpied by 630, the frame: 95 mm for PCS25; 145 mm for PCS50 thickness.

Dimensions computing example for a PCS air handling unit

We have to calculate the length of a unit with an air flow of 17.000 m³/h, with 25 mm casing thickness; the components of the unit are:

- mixing box with standard bag filter;
- preheating coil 3 rows;
- humidification with wet deck 200 thick with recirculating pump and drop eliminator;
- cooling coil 8 rows;
- 2 rows post-heating coil;
- fan section with fan type THF 500.

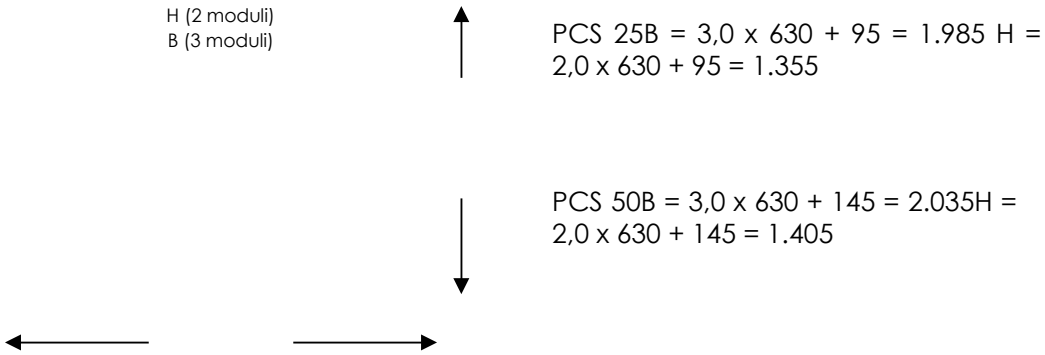
Tab. 24 – PCS modules and dimensions.

PCS 25					
Grandezza	MODULI		DIMENSIONI		
	ORIZZ.	VERT.	B	x	H
12	1		725	x	485
16	1	1	725	x	725
20	1	1	725	x	725
24	1	1	725	x	725
32	1,25	1	875	x	725
40	1,5	1	1.040	x	725
48	1,75	1,25	1.190	x	875
54	1,75	1,25	1.190	x	875
62	1,5	1,5	1.040	x	1.040
75	1,75	1,5	1.190	x	1.040
87	2	1,5	1.355	x	1.040
114	2,5	1,5	1.670	x	1.040
154	2,5	2	1.670	x	1.355
188	3	2	1.985	x	1.355
237	3	2,5	1.985	x	1.670
183	3,5	2,5	2.300	x	1.670
342	3,5	3	2.300	x	1.985
393	4	3	2.615	x	1.985
448	4,5	3	2.930	x	1.985
525	4,5	3,5	2.930	x	2.300
590	5	3,5	3.245	x	2.300
718	6	3,5	3.875	x	2.300

PCS 50					
Grandezza	MODULI		DIMENSIONI		
	ORIZZ.	VERT.	B	x	H
12	1		775	x	485
16	1	1	775	x	775
20	1	1	775	x	775
24	1	1	775	x	775
32	1,25	1	925	x	775
40	1,5	1	1.090	x	775
48	1,75	1,25	1.240	x	925
54	1,75	1,25	1.240	x	925
62	1,5	1,5	1.090	x	1.090
75	1,75	1,5	1.240	x	1.090
87	2	1,5	1.405	x	1.090
114	2,5	1,5	1.720	x	1.090
154	2,5	2	1.720	x	1.405
188	3	2	2.035	x	1.405
237	3	2,5	2.035	x	1.720
183	3,5	2,5	2.350	x	1.720
342	3,5	3	2.350	x	2.035
393	4	3	2.665	x	2.035
448	4,5	3	2.980	x	2.035
525	4,5	3,5	2.980	x	2.350
590	5	3,5	3.295	x	2.350
718	6	3,5	3.925	x	2.350

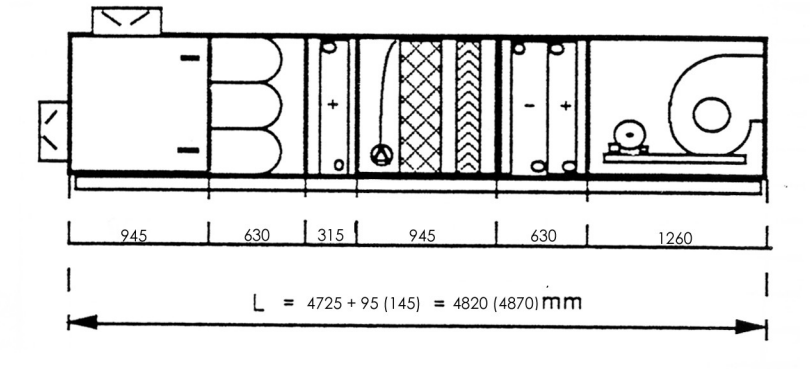
From the table of air flow, for a face velocity of 2,5 m/s, the suggested size appears 188. the external dimensions of the AHU (B x H) are given in the table and correspond to 3 moduls in width and 2 moduls in height.

Fig. 1 – Modules in PCS air handling units.



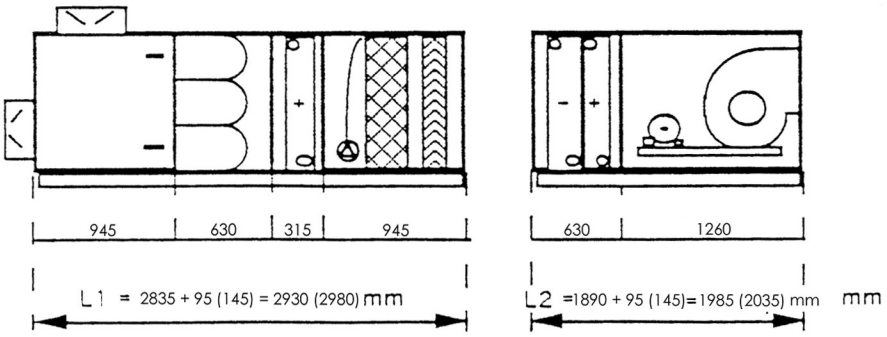
The overall length of the unit is given by the sum of the length of single components plus 95 mm (plus 145 mm for PCS 50 panels) to consider the frame; damper thickness must be added.

Fig. 2 – one-section AHU example.



If it is necessary to split the unit in 2 or more parts, determine the lengths of the single section (L1 + L2 + ... + Ln) as in the previous example, and add to the sum of length as many 95 mm as the numbers of splits (145 mm for PCS 50 panels).

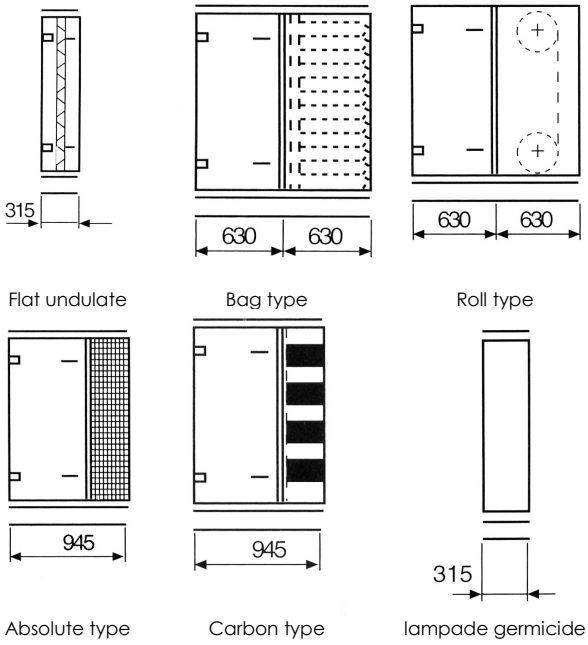
Fig. 3 – two-section AHU example.



COMPONENTS DIMENSIONS

In the following pictures are given the standard length of each unit's component; for special developments, please refer to our technical offices.

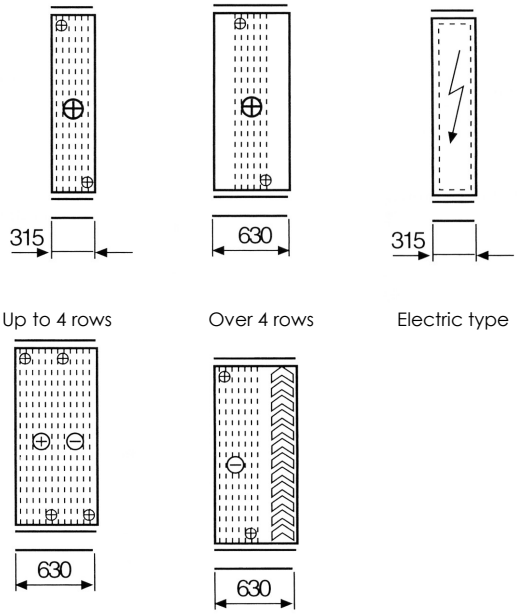
Fig. 4 – Filters.



Flat undulate | Bag type | Roll type

Absolute type | Carbon type | lampade germicide

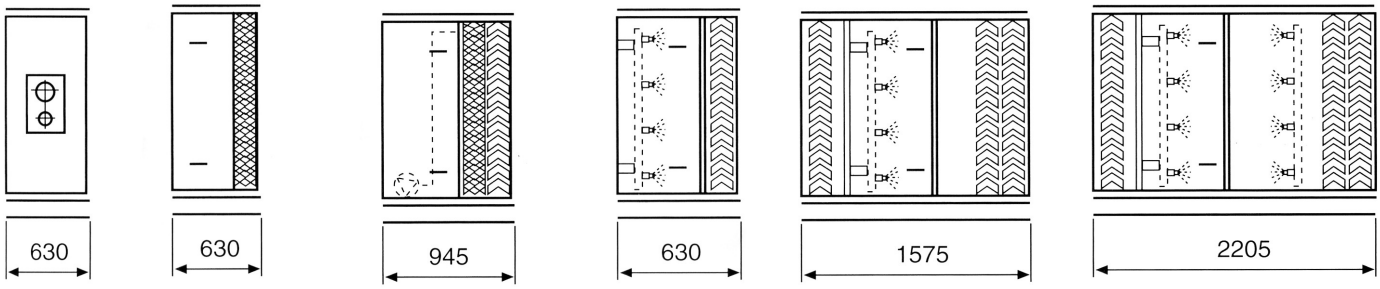
Fig. 5– Coils.



Up to 4 rows | Over 4 rows | Electric type

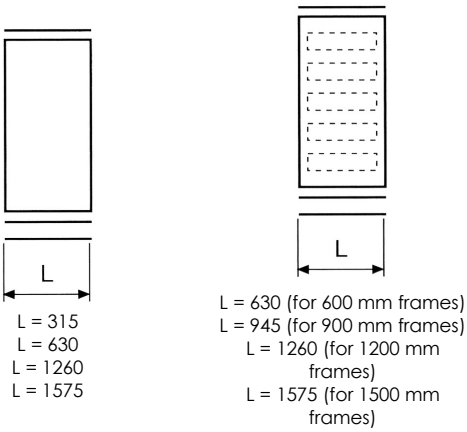
coupled | With drop eliminator

Fig. 6 – Humidifiers.



steam distributor | 100 mm wet deck without pump | 100/200 mm wet deck with pump and drop eliminator | Spray nozzles with drop eliminator | Single-deck air washer | Double-deck air washer

Fig. 7 – Plenum and silencers.



L = 315
L = 630
L = 1260
L = 1575

L = 630 (for 600 mm frames)
L = 945 (for 900 mm frames)
L = 1260 (for 1200 mm frames)
L = 1575 (for 1500 mm frames)

Fig. 8 – basin connections.

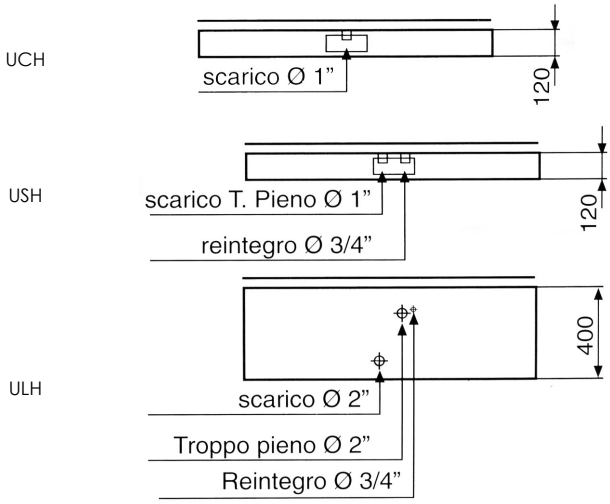


Fig. 9 – Dampers and mixing boxes.

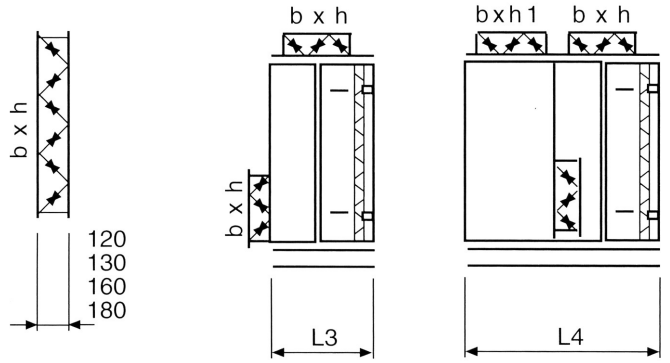
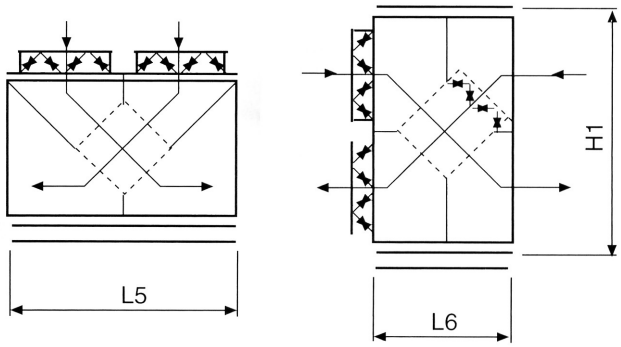


Fig. 10 – Recovery units.



Tab. 25 – Dampers and mixing boxes dimensions.

PCS size	b	h	h_1	L3	L4
12	600	370	210	315	630
16	600	610	210	315	630
20	600	610	210	315	630
24	600	610	210	315	630
32	750	610	210	315	630
40	950	610	310	630	945
48	1065	610	310	630	945
62	950	910	310	630	945
75	1065	910	310	630	945
87	1250	910	310	630	945
114	1550	910	410	630	1260
154	1550	1210	510	630	1260
188	1900	1210	510	630	1260
237	1900	1510	610	945	1575
283	2200	1510	610	945	1575
342	2200	1810	610	945	1575
393	2500	1810	710	945	1890
448	2800	1810	810	945	1890
525	2800	1960	910	2205	2205
590	3150	1960	910	2205	2205
718	3750	1960	910	2205	2205

Tab. 26 – recovery sections dimensions.

PCS size	L5	L6	H1
12	800	630	1230
16	945	630	1470
20	945	630	1470
24	945	630	1470
32	945	630	1470
40	945	630	1470
48	945	630	1470
62	1260	945	2080
75	1260	945	2080
87	1260	945	2080
114	1260	945	2080
154	1575	1260	2710
188	1575	1260	2710
237	1575	1570	3340
283	1575	1570	3340
342	1575	1785	3340
393	Non standard		
448	Non standard		
525	Non standard		
590	Non standard		
718	Non standard		

Fig. 11 – Multi-zone.

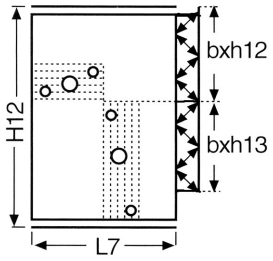
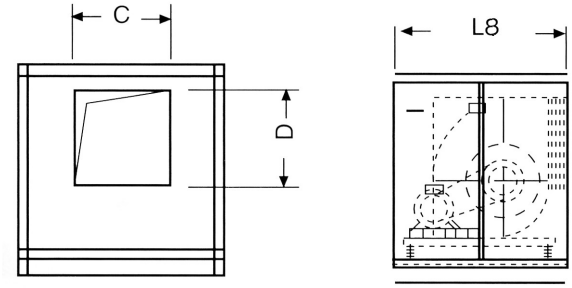


Fig. 12 – fan section



Tab. 27 – Multi-zone dimensions.

PCS size	L7	H2	b	h_2	h_3
12	-	-	-	-	-
16	1040	1040	600	240	420
20	1040	1040	600	240	420
24	1040	1040	600	240	420
32	1040	1040	750	240	420
40	1040	1040	950	240	420
48	1040	1040	950	360	420
54	1040	1040	950	360	420
62	1355	1355	950	360	620
75	1355	1355	1100	360	620
87	1355	1670	1250	360	620
114	1355	1670	1550	360	620
154	1670	1985	1550	470	820
188	1670	2300	1900	470	820
237	1985	2300	1900	590	1020
283	2300	2300	2200	590	1020
342	2930	2615	2200	700	1220
393	2930	2615	2500	700	1220
448	2930	2615	2800	700	1220
525	3560	2930	2800	810	1420
590	3560	2930	3150	810	1420
718	3560	2930	3750	810	1420

Tab. 28 – Fan section dimensions.

THB	L8	c	d
160	630	232	232
180	630	232	232
200	945	259	259
225	945	291	291
250	945	325	325
280	945	364	364
315	945	407	407
315	945	407	407
355	945	456	456
400	1260	510	510
450	1260	572	572
500	1260	641	641
560	1575	718	718
630	1575	804	804
710	1575	901	901
800	1890	1010	1010
900	2205	1133	1133
1000	2205	1271	1271

Tab. 29 – coils dimensions

size	length (mm)	height (mm)	surface (m^2)	Pipe number	Ø manifold
12	400	300	0.12	5	1" ¼
16	440	360	0.16	6	1" ½
20	440	480	0.21	8	1" ½
24	440	540	0.24	9	1" ½
32	600	540	0.32	9	1" ½
40	745	540	0.40	9	2"
48	900	540	0.48	9	2"
54	900	600	0.54	10	2"
62	745	840	0.62	14	2"
75	900	840	0.75	14	2" ½
87	1040	840	0.87	14	2" ½
114	1355	840	1.14	14	2" ½
154	1355	1140	1.54	19	3"
188	1650	1140	1.88	19	3"
237	1650	1440	2.37	24	3"
283	1965	1440	2.83	24	3"
342	1965	1740	3.42	29	4"
393	2260	1740	3.93	29	4"
448	2575	1740	4.48	29	4"
525	2575	2040	5.25	34	4"
590	2890	2040	5.90	34	4"
718	3520	2040	7.18	34	4"

WEIGHTS

We give, for more complete description, the weight of all AHU components. All weight are not definitive, and you can take them to help you in first designing; refer to our technical offices in order to have a more precise unit description.

Tab. 30 – Fans.

		Fan size																
		160	180	200	225	250	280	315	355	400	450	500	560	630	710	800	900	1000
TI	THF	5.6	6.5	9.1	10.8	12.6	17.5	22.8	32.0	40.7	52.1	63.5	90.8	113.5	160.7	230.1	287.0	330.0
p	THB	-	6.5	9.1	10.5	12.4	17.2	21.7	31.0	35.6	43.5	71.1	94.3	128.6	183.1	236.0	320.0	381.0
o	THR	-	-	-	-	-	-	-	41.5	50	66.5	103	142	177	223	288	357	463.0

weight in kg

Tab. 31 – Motors and transmissions.

Type	4 poles electric motors		transmissions	
	Power (kW)	Weight (kg)	Power (kW)	Weight (kg)
71	0.37	8	0.37	3
80	0.55	10	0.55	3
80	0.75	12	0.75	4
90 S	1.1	15	1.1	5
90 L	1.5	19	1.5	6
100 L	2.2	22	2.2	7
100 L	3.0	26	3.0	9
112 M	4.0	32	4.0	11
132 S	5.5	50	5.5	17
132 M	7.5	56	7.5	20
132 M	9.0	63	9.0	22
160 M	11.0	77	11.0	25
160 L	15.0	95	15.0	38
180 M	18.5	118	18.5	49
180 L	22.0	126	22.0	57
200 L	30.0	163	30.0	65
225 S	37.0	210	37.0	74
225 M	45.0	244	45.0	80
250 M	55.0	295	55.0	88

Tab. 32 – Filters

Cell dimensions (mm)			Filter type (weight expressed in kg for each cell)				
A	x	B	Flat undulated sp = 48 (mm)	Bag L = 636 (mm)	Stiff bag L = 292 (mm)	Absolute L = 292 (mm)	Carbon L = 400 (mm)
400	**x**	**400**	0.90	-	-	-	-
500	**x**	**400**	1.0	-	-	-	-
500	**x**	**500**	1.14	-	-	-	-
592	**x**	**287**	0.9	1.6	1.6	19	19.6
592	**x**	**592**	1.4	2.4	2.4	29	34.6
625	**x**	**400**	1.14	-	-	-	-
625	**x**	**500**	1.32	-	-	-	-

Tab. 33 – Coils

	Number of rows							
size	**1 R (kg)**	**2 R (kg)**	**3 R (kg)**	**4 R (kg)**	**5 R (kg)**	**6 R (kg)**	**7 R (kg)**	**8 R (kg)**
12	5	6	7	10	11	13	15	19
16	5	7	9	11	14	16	17	23
20	7	8	11	13	17	20	21	28
24	7	9	12	14	19	20	25	28
32	9	11	15	19	22	28	32	35
40	10	12	18	23	26	33	38	42
48	12	15	21	27	30	38	44	48
54	13	16	23	29	32	41	48	52
62	14	17	26	33	36	46	53	58
75	15	20	30	38	42	54	62	67
87	19	25	36	46	51	66	75	82
114	23	30	45	57	63	81	93	101
154	29	38	57	73	80	105	120	129
188	33	45	68	86	94	123	142	151
237	40	54	82	105	115	151	174	183
283	45	63	95	122	133	175	202	212
342	53	73	112	144	156	207	238	249
392	63	87	133	169	185	243	280	294
448	70	97	148	189	206	272	313	327
525	79	111	170	218	237	313	361	376
590	86	122	188	241	261	346	399	414
718	106	149	230	294	319	423	488	506

Data referred to standard coils: fin spacing 2.5 mm – pipes spacing
60 mm – rows spacing 30 mm

Tab. 34 – Empty sections.

	Panels materials and thickness (kg/m)							
PCS size	**Zn / Zn 25 mm PU**	**Zn / Zn 25 mm LM**	**Al / Al 25 mm PU**	**Al / Al 25 mm LM**	**Zn / Zn 50 mm PU**	**Zn / Zn 50 mm LM**	**Al / Al 50 mm PU**	**Al / Al 50 mm LM**
12	48	57	37	44	56	66	45	53
16	48	57	37	44	56	66	45	53
20	48	57	37	44	56	66	45	53
24	48	57	37	44	56	66	45	53
32	55	66	42	50	62	75	50	59
40	55	66	43	51	63	75	51	60
48	58	69	43	52	66	79	52	63
54	62	74	45	54	70	84	54	64
62	63.5	77	47	56	74	88	59	70
75	65	77	46	58	78	93	63	75
87	76	90	53	63	86	103	63	76
114	82	98	57	68	95	113	70	84
154	89	106	61	73	101	120	73	88
188	94	113	65	77	109	131	80	96
237	109	131	76	90	123	147	90	107
283	116	139	80	95	131	156	95	113
342	119	143	83	98	132	158	96	114
393	127	152	86	103	140	168	100	120
448	133	160	90	107	150	178	106	127
525	145	173	100	118	160	192	116	138
590	158	190	107	128	175	210	125	149
718	175	210	120	142	195	233	140	165

Tab. 35 – Recovery units, silencers, humidification, drop eliminator, air-washer.

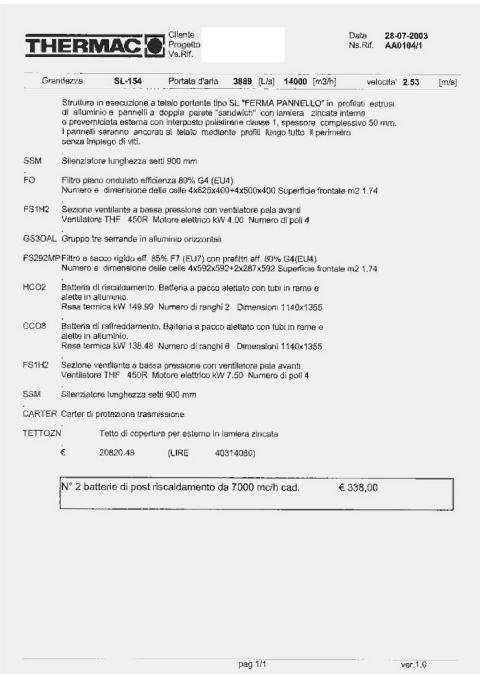
PCS size	Heat recovery unit	Silencer				humidification				Drop eliminator	Air-washer	
		L = 600 mm	L = 900 mm	L = 1200 mm	L = 1500 mm	100 mm *	200 mm *	100 mm **	200 mm **		single	double
12	7	14	19	27	31	1	1	2	1	6	14	15
16	7	14	19	27	31	1	1	3	2	8	17	18
20	7	14	19	27	31	2	1	3	2	9	20	22
24	15	14	19	27	31	2	1	4	3	11	24	26
32	20	18	25	32	40	2	2	4	3	13	29	31
40	24	22	32	40	50	3	2	5	4	16	35	37
48	27	27	37	48	59	3	2	6	4	19	42	45
54	27	31	43	56	68	4	3	7	5	23	50	54
62	38	37	51	65	79	4	3	9	6	28	60	65
75	44	43	59	76	93	5	4	11	7	33	72	78
87	50	54	75	95	120	6	4	13	9	40	87	93
114	68	59	81	104	127	8	5	15	10	48	104	112
154	68	84	116	148	187	9	6	18	12	58	125	135
188	81	103	142	181	229	11	7	22	15	69	150	162
237	109	122	168	213	270	13	9	26	18	83	180	194
283	127	142	197	250	316	15	11	31	21	100	217	233
342	172	166	230	292	370	18	13	37	25	120	260	280
393	196	188	260	330	420	22	15	44	30	144	312	336
448	221	216	299	380	482	26	18	53	36	173	375	404
525	267	241	332	422	536	32	22	63	43	208	451	485
590	297	290	400	508	645	38	26	75	52	250	541	583
718	356	338	467	592	753	45	31	90	62	300	650	700

* cellulose deck ** PVC deck

CHOOSING ASSISTANCE AND SELECTION PROGRAM

PCS series offers a wide sizes range, modules and component in order to satisfy each plant requirement.
The selection is computer-made, with a selection algorithm developed by THERMAC, which is very simple to use, and which can be given to our agents and clients

Fig. 13 – Offering examples which are made with THERMAC algorithm.



THERMAC

Cliente
Progetto
Vs.Rif.

Data 28-07-2003
Ns.Rif. AA0104/1

Grandezza SL-154 Portata d'aria 3889 [L/s] 14000 [m3/h] velocita' 2.53 [m/s]

Struttura in esecuzione a telaio portante tipo SL "FERMA PANNELLO" in profilati estrusi di alluminio e pannelli a doppia parete "sandwich" con lamiera zincata interna e preverniciata esterna con interposto poliuretano classe 1, spessore complessivo 50 mm. I pannelli saranno ancorati al telaio mediante profili lungo tutto il perimetro senza impiego di viti.

SSM Silenziatore lunghezza setti 900 mm

FO Filtro piano ondulato efficienza 80% G4 (EU4)
Numero e dimensione delle celle 4x625x400+4x500x400 Superficie frontale m2 1.74

FS1H2 Sezione ventilante a bassa pressione con ventilatore pala avanti
Ventilatore THF 450R Motore elettrico kW 4.00 Numero di poli 4

GS3OAL Gruppo tre serrande in alluminio orizzontali

FS2S2MP Filtro a secco rigido eff. 85% F7 (EU7) con prefiltri eff. 80% G4(EU4)
Numero e dimensione delle celle 4x592x592+2x287x592 Superficie frontale m2 1.74

HCO2 Batteria di riscaldamento. Batteria a passo alettato con tubi in rame e alette in alluminio.
Resa termica kW 149.99 Numero di ranghi 2 Dimensioni 1140x1365

CCO8 Batteria di raffreddamento. Batteria a passo alettato con tubi in rame e alette in alluminio.
Resa termica kW 138.48 Numero di ranghi 8 Dimensioni 1140x1365

FS1H2 Sezione ventilante a bassa pressione con ventilatore pala avanti
Ventilatore THF 450R Motore elettrico kW 7.50 Numero di poli 4

SSM Silenziatore lunghezza setti 900 mm

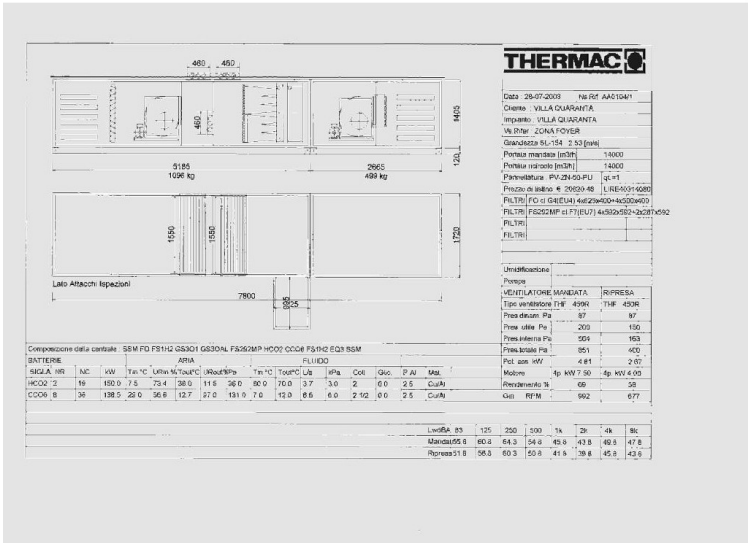
CARTER Carter di protezione trasmissione

TETTOZN Tetto di copertura per esterno in lamiera zincata

€ 20820.48 (LIRE 40314080)

N° 2 batterie di post riscaldamento da 7000 mc/h cad. € 338,00

pag 1/1 ver.1.0



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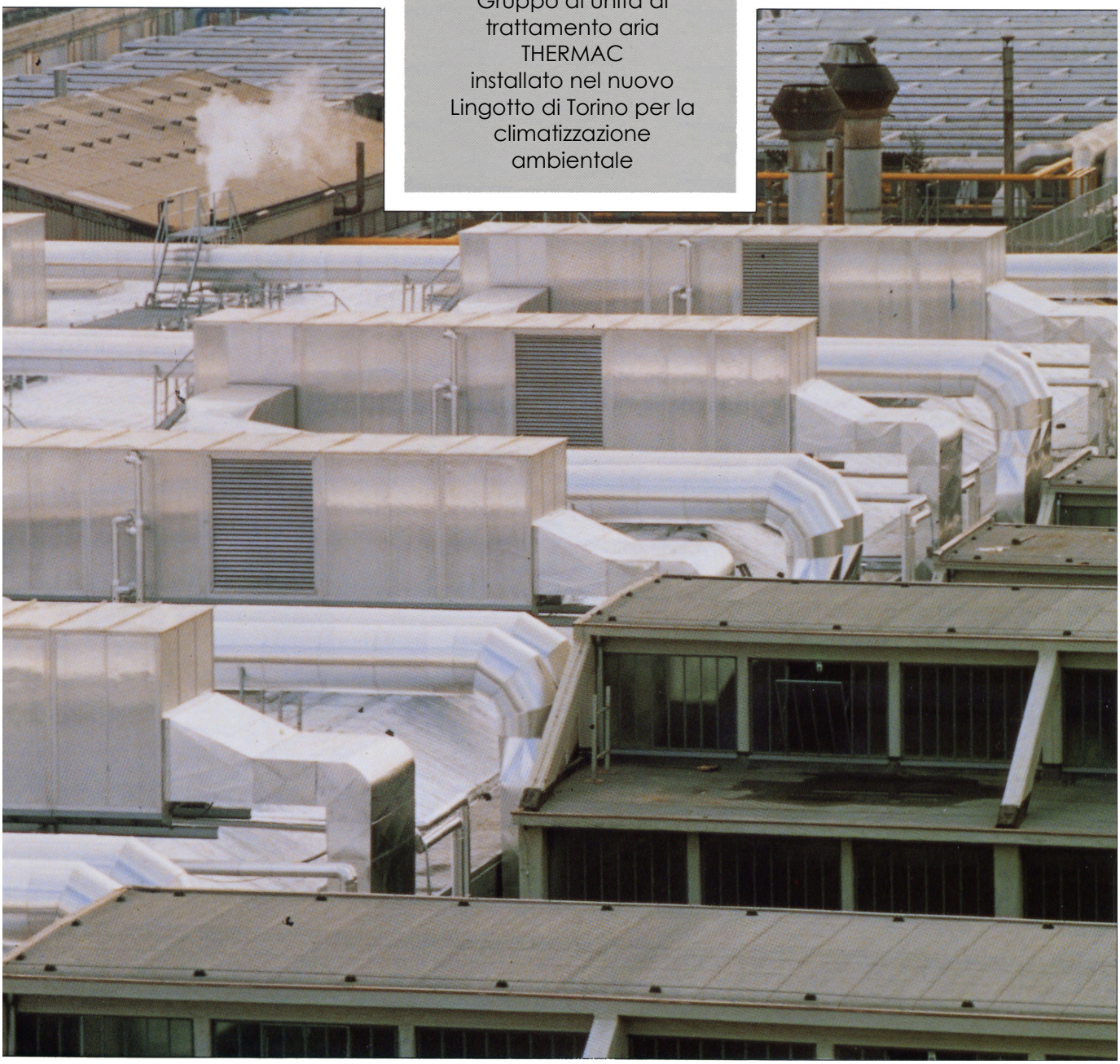
NOTE:

Gruppo di unità di trattamento aria THERMAC installato nel nuovo Lingotto di Torino per la climatizzazione ambientale



per gentile concessione Soc. Lingotto s.r.l. (foto Vallinotto)

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