Applied Systems

Technical Data

Air Handling Units

EEDEN11-800

D-AHU Professional

DAIKIN

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General features

The DAIKIN series of air handing units is the synthesis of more than 40 years of consolidated European experience. They can be adapted to all system needs to control thermo-hygrometric conditions, both in terms of available space for installation and, with simple structural variations, being suitable for application in various sectors for civil and industrial applications.

Sizes

The DAIKIN AHU series is sized according to the following criteria.

- Default sizes.
  Twenty-seven predefined sizes, from 850 mm to 5,990 mm wide and a height (overall) from 550 mm to 3,000 mm.

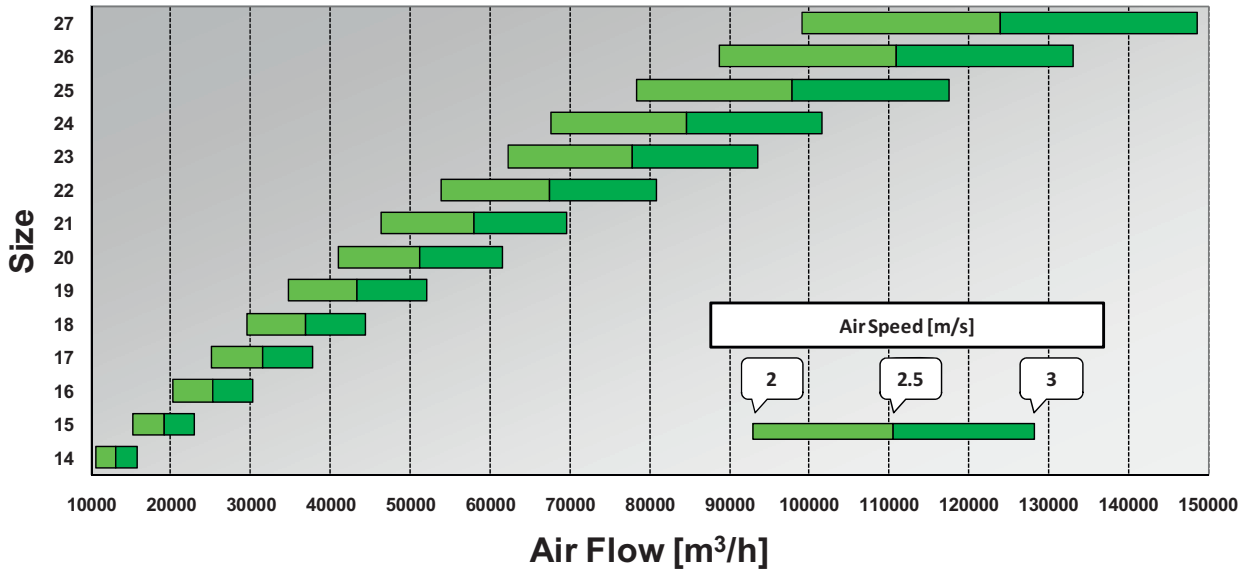
- "Infinitely" variable sizes.
  Sizes can be made with base-height size increments of 50 mm, designed to make up for restrictive installation conditions.

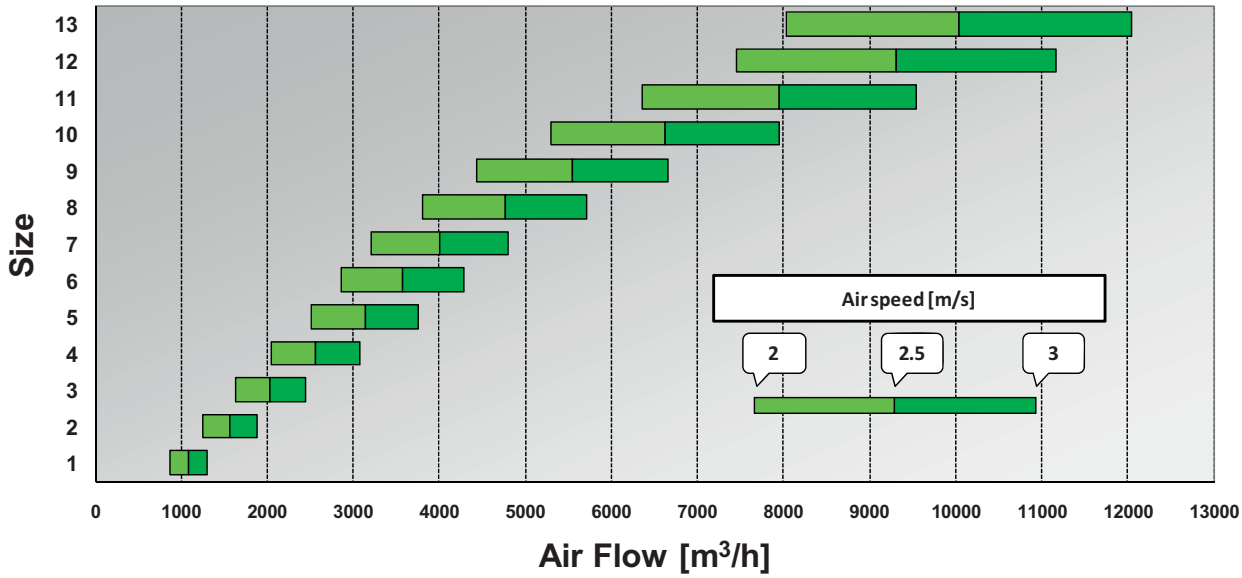
The size can be selected by choosing the unit in relation to the air speed through the coil's surface; the advised air speed is 2.5 m/s if there are cooling coils.

The 27 default sizes, considering an air speed of 2.5 m/s through the coil's surface, cover a capacity range 1,105 m³/h to 124,000 m³/h.

Size	Air flow capacity [m^3/h] (battery air speed 2.5 m/s)	Height [mm]	Width [mm]
1	1,105	550	850
2	1,550	600	900
3	1,980	650	950
4	2,600	780	1,000
5	3,170	780	1,150
6	3,550	800	1,150
7	4,000	800	1,250
8	4,800	850	1,300
9	5,560	900	1,350
10	6,600	900	1,550
11	7,950	1,100	1,550
12	9,320	1,100	1,650
13	10,050	1,150	1,650
14	13,200	1,400	1,850
15	19,200	1,500	2,100
16	25,300	1,580	2,650
17	31,500	1,750	2,750
18	37,000	1,800	3,240
19	43,400	2,100	3,090
20	51,300	2,250	3,340
21	58,000	2,250	3,820
22	67,500	2,400	4,040
23	78,000	2,450	4,490
24	84,700	2,700	4,490
25	98,000	2,850	4,890
26	111,000	2,850	5,490
27	124,000	3,000	5,990

For each of the 27 default sizes, the tables below show the air flows considering an air speed of 2 m/s, 2.5 m/s and 3 m/s.

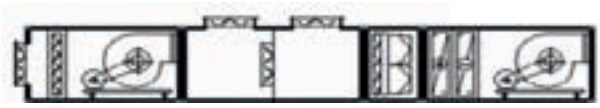




Every size is made of modular sections in order to facilitate their transport and assembly on site: if the unit is wider than 2,400 mm, the maximum length of each section will be 2,400 mm.
Since there are no welded parts, the units can be supplied as CKD (completely knocked down) so they can be completely disassembled and easily re-assembled on site.
Moreover, it is possible to satisfy any need for assembling the unit on site.

Configurations

The standard sample type of configurations is shown below.

Type	Sample arrangement
Horizontal with one fan	
Horizontal with two fans	
Double-deck	
Side by side	

However, Daikin is always available to evaluate and check the feasibility of any other specific configuration request and eventually to deliver the best solution.

Casing structure

The casing structure is made up of the following elements:

- profiles
- joints
- panels
- base frame
- inspection doors
- windows
- roof

Profiles

The profiles are made of natural aluminium. Units to be installed in strongly corrosive environments are made of anodised aluminium.
The aluminium used is produced in compliance with the following regulations:

- AA 6060 (United States of America)
- UNI 9006/1 (Italy)
- DIN ALMGSI 0.5 (Germany)
- AFNOR 6060 (France)
- BS 6060 (United Kingdom)
- SN ALMGSI 0.5 (Switzerland)

The following profiles are available:

- corner profiles
- intermediate profiles
- ‘omega’ profiles

Corner profiles

These are made with nominal external dimensions of 40 mm and 61 mm.
For units up to the "predefined" size 17, or with air flow capacities of up to 31,500 m³/h (battery-face velocity of 2.5 m/s), it is possible to use either 40 mm or 61 mm profiles; for larger capacities, the unit is only built with 61 mm profiles.

The rounded external part, with a radius of 10 mm, adds value because it both prevents accidents and is aesthetically pleasing.

Because of the "double chambered" construction, the screws used to fasten the closure panels remain inside the profiles.

Seal gaskets may be inserted into the lengthwise grooves on the panels, where they meet and fasten. The gasket is made up of a rigid part, which is inserted in the groove, and a flexible silicon rubber part with a "balloon-type" section, which sticks out of the groove and, when pressed against the panel, makes a perfect seal.

For hygienic and clean applications, profiles with internal rounded corners are also available.

Section-to-section profiles

With a nominal external dimension of 45 mm is used with 61 mm corner profiles, currently available only for the thermal break profile.

The particular configuration of intermediate profiles enables making the units completely flat on the internal and external surfaces: this avoids the accumulation of dust and makes cleaning activities extremely effective. This special section-to-section profile works as a real thermal break between the sections if compared with a standard solution (using two simple corner profiles to join two sections).

"Omega" profiles

These are used in the unit construction to divide the panels, to install access and inspection doors, and to fix internal sheets.

They have nominal external dimensions of 40 mm and 60 mm, and their configuration allows the units to be completely flat on the internal and external surfaces, similar to the intermediate profiles.

Thermal break profiles

All the described profiles are also available as thermal break profiles by adding 20 mm polyamide bars to the inside of them.

Corner and "omega" profiles have 60 mm nominal dimensions, while the nominal dimension of the intermediate profile is 45 mm.

The particular shape of intermediate profiles enables an excellent performance in terms of thermal break characteristics and completely eliminates the continuity of heat-conducting material between the internal and external parts of the unit.

Joints

The joints are made of Nylon 30% glass-filled

The following joints are available:
- corner joints
- section-to-section joints
- "omega" joints

Corner joints

These are made to be a perfect fit when inserted into the grooves of the corner profiles, guaranteeing excellent performance against leakage.

For hygienic and clean applications, the internal corner is rounded (one-eighth of a sphere) and fits together with rounded profiles and step panels to create completely flat surfaces with no corners.

Intermediate joints

These have a specific configuration that creates completely flat surfaces: the two joints fit together without internal or external nooks, making it easier and more effective for the cleaning process.

"Omega" joints

The "omega" joints allow for a simple and quick joining of the omega profile to the corner profile.
Otherwise, it would be necessary to remove the internal part of the omega profile, near its extremities, in order to guarantee that the corner profile shape will fit with the omega - than the omega profile would be welded to the corner profiles, which obviously would make it difficult to assemble and disassemble the unit on site.

Panels

The panels are manufactured and designed using high technical standards, both in terms of material quality and assembly method.

The distinctive elements of the panels are outlined below:
- insulation
- skin (internal and external)
- configurations
- fixing method

Insulation

- *Polyurethane*

Double-skin steel panels filled with hot-injected polyurethane without CFC (Chlorofluorocarbon). Characteristics:

- average density: 40-45 kg/m³
- thermal conductivity: 0.020 W/m*K
- U value
  ≤ 0.880 W/m²*K (panel thickness 25 mm)
  ≤ 0.045 W/m²*K (panel thickness 50 mm)
- class 1 fire reaction
- combustion without flames and without developing toxic fumes

- *Mineral wool*

Double-skin steel panels, filled with orientated and crossed mineral wool fibres glued to the internal walls. This feature stops the mineral wool filling inside the panel from sliding and consequently the deformation of the panel itself. This characteristic will help to increase the rigidity, making it possible to walk on the panel.

- average density: 90 kg/m3
- thermal conductivity:
  0.036 W/m*K (average temperature 10°C)
  0.037 W/m*K (average temperature 20°C)
  0.038 W/m*K (average temperature 50°C)
- class 0 fire reaction

Skin (internal and external)

Internal and external sheets of:

- 0.8 mm aluminium
- 1.0 mm aluminium
- 0.5 mm galvanised steel
- 0.7 mm galvanised steel with grey plasticised cover
- 0.6 mm AISI type 304 stainless steel

In order to fulfil specific needs, it is also possible to use different materials from those specified above for both internal and external skin.

Configurations

- step panels (42 mm and 62 mm thickness)
- flat panels (25 mm and 46 mm thickness)

When utilising profiles with panels, four different solutions are possible

A. 40 mm profile – 25 mm flat panel
B. 40 mm profile – 42 mm step panel
C. 61 mm profile – 46 mm flat panel
D. 61 mm profile – 62 mm step panel

Fixing method

Galvanised steel screws are used to fix the panels to the profiles.
The self-tapping screws are positioned inside nylon 30% glass-filled conical bushes, embedded in insulating material and equipped with closing caps; the cap protects the screws from the outside environment and makes the outer surface smooth. Moreover, because of the particular profile shape, the screw ends are not exposed to the internal treated air because they remain within the profiles. Thus the screws are never exposed to either internal or external air.

Base frame

The underside of each section is made of aluminium and is 100 mm high while galvanised steel is used for profiles more than 100 mm high. Base frame profiles are connected using self-tapping screws.
The corners made of die-cast aluminium provide holes for lifting.

Inspection doors

Doors are made from the same panel (either mineral wool or polyurethane).

There are two ways to open them:

- traditionally rotating the door from one side by using two hinges and the glass-loaded nylon handle
- removing or rotating the door from its right or left side by using the four glass-loaded nylon devices, each of which works as either a hinge or a handle

The door opens outwards.
For doors installed in sections with positive pressure, reinforcement bars are used if the doors are of a small dimension. However, to allow access inside the unit, the doors can be opened inwards by using the traditional hinges and handle.

All the doors can be supplied with a lockable function. If there is more than one door in a system it is possible to use one key for all of them, even if they are in different units.

In order to prevent wearing on the handles, bands of anti-friction material are applied to the profiles where the door closes.

Windows

These are double-panel polycarbonate, which guarantees their integrity and transparency over time, and the seals are made of EPDM rubber (ethylene propylene diene monomer).

The fixing screws are not screwed into the door panel, but are located within the windows itself.

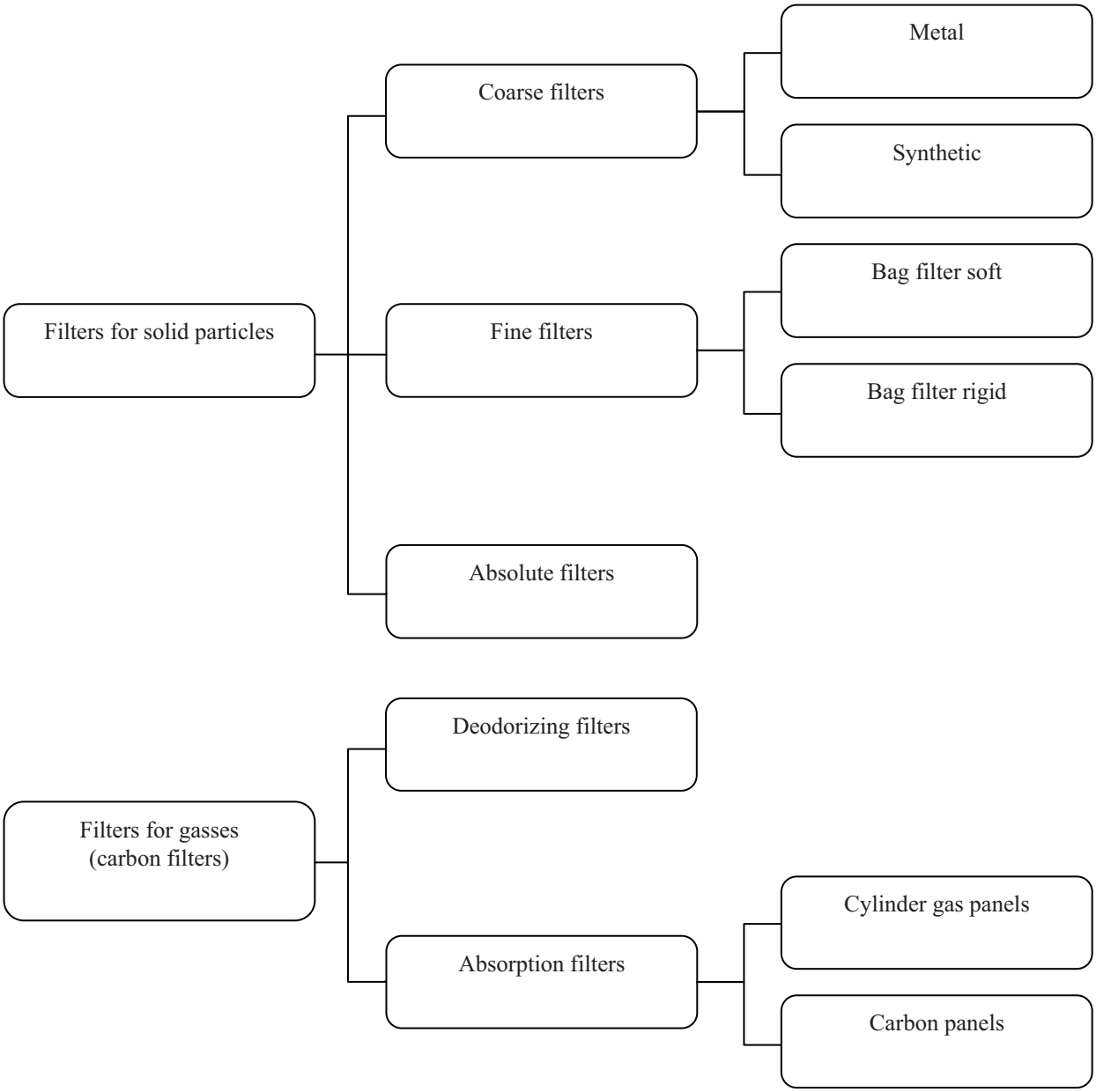
The particular construction prevents condensation, so visibility is perfect in any operating condition, and it guarantees the maximum sealing against any sort of air leakages.

Roof

This can be made of galvanised steel, aluminium alloy or other specifically requested materials.
It is made with specific curves to prevent both rainwater from collecting on it and water leaking through the section joints.
The side edge is folded towards the inside in order to allow the water to flow downwards, and, in line with health and safety regulations, to avoid any accidents on the sharp edge.

Filter section

The following filters are used to fulfil any customer/application needs.



Filter for solid particles

Filter classification

Below are listed some filter classifications

- Coarse filters, classification CEN EN 779

Filter class	Average arrestance (A_m*) of synthetic dust
G1	50% ≤ A_m ≤ 65%
G2	65% < A_m ≤ 80%
G3	80% < A_m ≤ 90%
G4	90% < A_m

* The average arrestance A_m is calculated based on the gravimetric testing method.

The gravimetric testing method is carried out using standard synthetic dust and the arrestance is the ratio between the amount of dust held by the filter and the amount of dust used in the test. Since filter performance varies based on the quantity of dust held, the average arrestance is used as a representative value. This is the average of the arrestance values obtained at different moments during the test, carried out from the initial condition until the filter pressure drop reaches 250 Pa.

- Fine filters, classification CEN EN 779

Filter class	Average efficiency E_m**
F5	$40\% \le E_m \le 60\%$
F6	$60\% < E_m \le 80\%$
F7	$80\% < E_m \le 90\%$
F8	$90\% < E_m \le 95\%$
F9	$95\% < E_m$

** The average efficiency E_m is calculated based on the testing method, which involves counting DEHS particles (diethylhexyl-sebacate) with a diameter of 0.4 µm.
The efficiency is expressed by the ratio between the number of particles held by the filter and the number of particles released below the filter; since filter performance varies based on the quantity of particulate held, the average efficiency is used as a representative value. This is the average between the efficiency values obtained in different moments of the test, conducted from the initial condition until the filter pressure drop reaches 450 Pa.

- Active HEPA filters (High Efficiency Particulate Air filter), classification CEN EN 1886

Filter class	Integral efficiency MPPS E***	Local efficiency MPPS E***
H10	85%	-
H11	95%	-
H12	99.5%	-
H13	99.95%	99.75%

*** The efficiency E is calculated based on the testing method, which involves counting the DEHS particles (diethylhexyl sebacate) with the most penetrating diameter (MPPS, Most Penetrating Particle Size).
The integral efficiency expresses the ratio between the number of particles retained by the filter and the number of particles released under the filter; if it refers to the filtering surface's maximum penetration point, this ratio defines the local efficiency value.

Filter selection based on the internal and external air quality

The CEN EN 13779 regulation is reported below. It can be considered as the most important for choosing filters, based on both external and internal air quality.
The regulation identifies five levels for external air quality (from ODA1, best level, to ODA5, worst level) and four levels for internal air quality (from IDA1, best level, to IDA4, worst level).
The type and effectiveness of filters to be used are based on the external air quality level and on the desired internal air quality level.

External air quality classes	Internal air quality classes		
	IDA1 excellent	IDA2 medium	IDA3 low
ODA1, pure air with possible presence of natural pollutants	F8	F7	F6
ODA2, air with high concentration of dust	G4 + F8	G3 + F7	G3 + F6
ODA3, air with high concentration of gas	G4 + F8	G3 + F7	F6
ODA4, air with high concentration of dust and gas	G4 + F8	G3 + F7	G3 + F6
ODA4, air with very high concentration of dust and gas	G4 + F9	G4 + F8	G3 + F6

Coarse filters (“G" class, classification CEN EN 779)

Metal coarse filters

- filter class (EN 779): G1
- filtering media: overlapping of different crossed layers of aluminium mesh
- frame: U profile in galvanised steel and protective electro-welded galvanised mesh
- standard thickness: 48 mm
- assembly:
  - sliding (side extraction)
  - counter-frame (front extraction)
- limits of use:
  - temperature in continuous operation: 200°C
  - relative humidity: 100%
- high capacity for retaining oils and fats
- can be cleaned by washing with warm water and detergent

Synthetic coarse filters

Figure 1: Synthetic coarse filters

- filter classes (EN 779): G3, G4
- filtering media: synthetic fibre, folded, to offer more filtering surface with the same front size
- frame: U profile in galvanised steel and protective electro-welded galvanised mesh
- standard thickness: 48 mm
- assembly:
  - sliding runner (side extraction)
  - counter-frame (front extraction)
- usage limits:
  - temperature in continuous operation: 80°C
  - relative humidity: 90%
- recommended final pressure drop: 200 Pa
- good mechanical resistance
- high capacity for retaining medium-sized particles
- good mechanical resistance
- can be partially cleaned by washing with water and detergent or by blowing air counter-currently

Fine filters (class "F", classification CEN EN 779)

Soft pocket filters

- filter class (EN 779): from F5 to F8
- filtering media: synthetic microfiber (graduated density)
- frame: galvanised steel
- standard thickness: 535 mm (635 mm UK)
- assembly:
  - sliding runner (side extraction)
  - counter-frame (front extraction)
- usage limits:
  - temperature in continuous operation: 80°C
  - relative humidity: 100%
- recommended final pressure drop: 350 Pa

Rigid bag filters

- filter class (EN 779): from F6 to F9
- filtering media: folded fibreglass paper
- frame: extruded pressed polystyrene structure
- thickness: 290 mm
- assembly:
  sliding (side extraction)
  counter-frame (front extraction)
- usage limits:
  temperature in continuous operation: 70°C
  relative humidity: 100%
- recommended final pressure drop: 450 Pa
- good mechanical resistance

Figure 2: Rigid bag filters

Active HEPA filters (class "H", classification CEN EN 1822)

Active HEPA filters

- filter class (EN 1882): from H10 to H13
- filtering media: water-repellent fibreglass paper with small folds and continuous thermoplastic separators
- frame: galvanised steel with semi-rounded profile elastomer seal gasket, which is a single piece without joints
- seal: sealing with polyurethane resin
- thickness: 292 mm
- assembly:
  counter-frame equipped with tie rods for the filter to adhere perfectly to the seal gasket (front extraction)
- usage limits:
  temperature in continuous operation: 80°C
  relative humidity: 100%

Filtering for retaining gaseous substances (carbon)

Deodorising filters

- filtering media: micro granular activated carbon enclosed between two layers of nonwoven fabric
- frame: extruded moulded polystyrene structure
- thickness: 290 mm
- carbon content:
  4.4 kg – entire cell (592x592X290 mm)
  3.1 kg – half cell (592x287x290 mm)
- assembly:
  sliding (side extraction)
  counter-frame (front extraction)
- usage limits:
  temperature in continuous operation: 50°C
  relative humidity: 70%
- effective against many types and origins of organic steams

Cartridge absorption filters

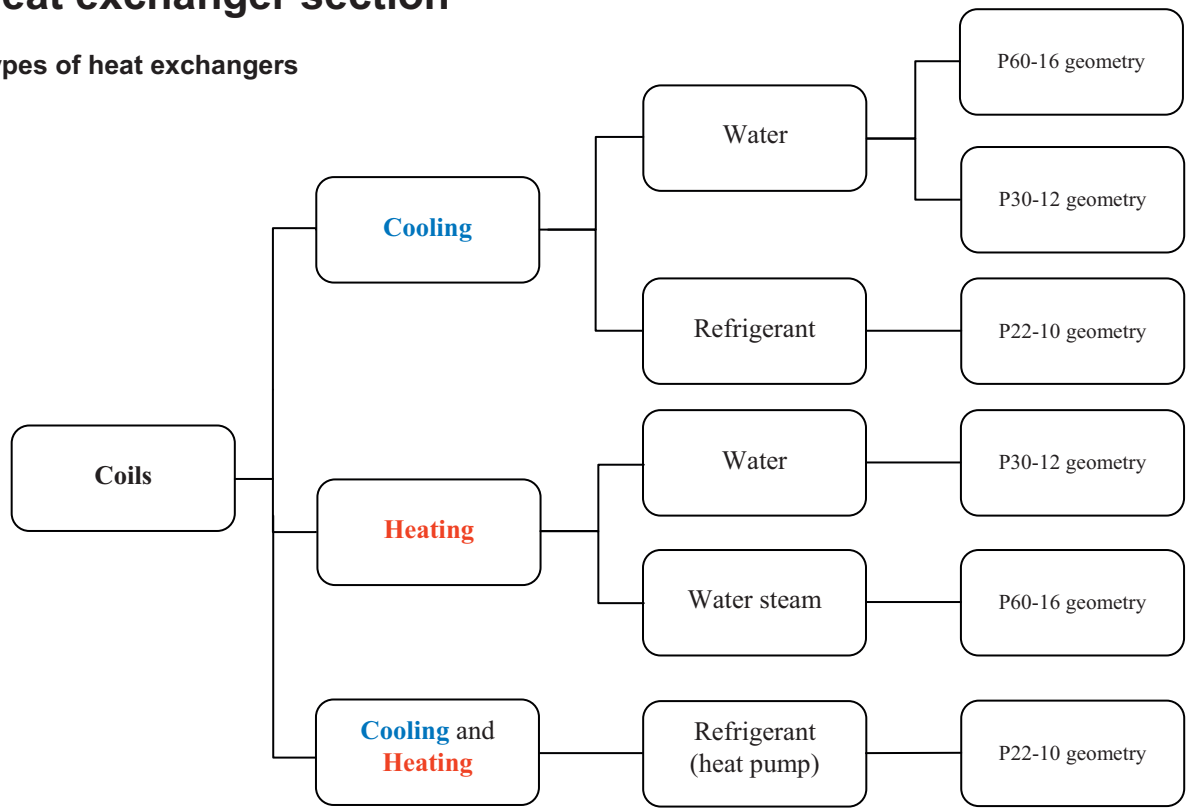
- filtering media: mineral granular activated carbon
- granular activated carbon impregnated for acid vapours
- aluminium oxide spheres impregnated with potassium permanganate for acid environments
- frame: galvanised steel plate with micro-pressed galvanised cartridges
- thickness: 470 mm
- carbon content:
  57 kg – entire cell (610x610X470 mm)
  28.9 kg – half cell (610x305x470 mm)
- usage limits:
  temperature in continuous operation: 50°C
  relative humidity: 70%
- effective against many types and origins of organic steams

Interchangeable panel absorption filters

- filtering media: mineral granular activated carbon, impregnated granular activated carbon and aluminium oxide spheres
- frame and containment mesh: powder-coated galvanised steel
- thickness: 500 mm
- carbon content:
  69 kg - entire cell (600x600X500mm)
  40 kg - half cell (300x600x500mm)
- usage limits:
  temperature in continuous operation: 50°C
  relative humidity: 70%

Heat exchanger section

Types of heat exchangers



Coils

Geometry	P22-10		P30-12		P60-16	
Purpose	Cooling	Cooling / Heating	Cooling	Heating	Cooling	Heating
Uses	refrigerant	refrigerant	water or water-glycol	water or water-glycol	water or water-glycol	water, water-glycol or Steam**
Rated tube diameters	3/8"	3/8"	1/2"	1/2"	5/8"	5/8"
Tube material	Cu	Cu	Cu	Cu	Cu	Cu - Steel**
Tube/Row spacing (mm)	25 - 21,65	25 - 21,65	30 - 30	30 - 30	60 - 30	60 - 30
Fin material	Al - AlPr - Cu - CuSn*	Al - AlPr - Cu - CuSn*	Al - AlPr - Cu - CuSn*	Al - AlPr - Cu - CuSn*	Al - AlPr - Cu - CuSn*	Al - AlPr - Cu - CuSn*
Fin spacing (mm)	2 - 2,5 - 3 4 - 5 - 6	2 - 2,5 - 3 4 - 5 - 6	2 - 2,5 - 3	2 - 2,5 - 3	2 - 2,5 - 3 4 - 5 - 6	2 - 2,5 - 3 4 - 5 - 6

* Only for UK

** Coils for Steem available only with Alluminium Fin and Steel tube

Fin Material	
Cu	Copper
Al	Alluminium
AlPr	Pre painted Alluminium
CuSn	Tinned Copper

Design features

- The coil elbows are constructed with uniformly thick walls and welded with a phosphorous copper alloy.
- The headers are made of steel or copper. Copper is only used if the coil tubes are copper.

There are two different solutions for connections: threading and flanging. For copper collectors, the threaded part is made of brass and has a 2-inch diameter; the rest is stainless steel.

- The containment frame is made of galvanised steel, at least 1.5 mm thick and with no welding. The collared pipe passage holes are stamped, which prevents the tube from wearing since it tends to expand when hot fluids pass through it. If the air is highly corrosive, stainless steel containment frames may also be provided.

- As the coils are mounted on runners inside the unit, they can be easily extracted, either from the side where the hydraulic connections are or the other side, by removing the side panel.

Figure 3: Close-up of a droplet eliminator and coil header

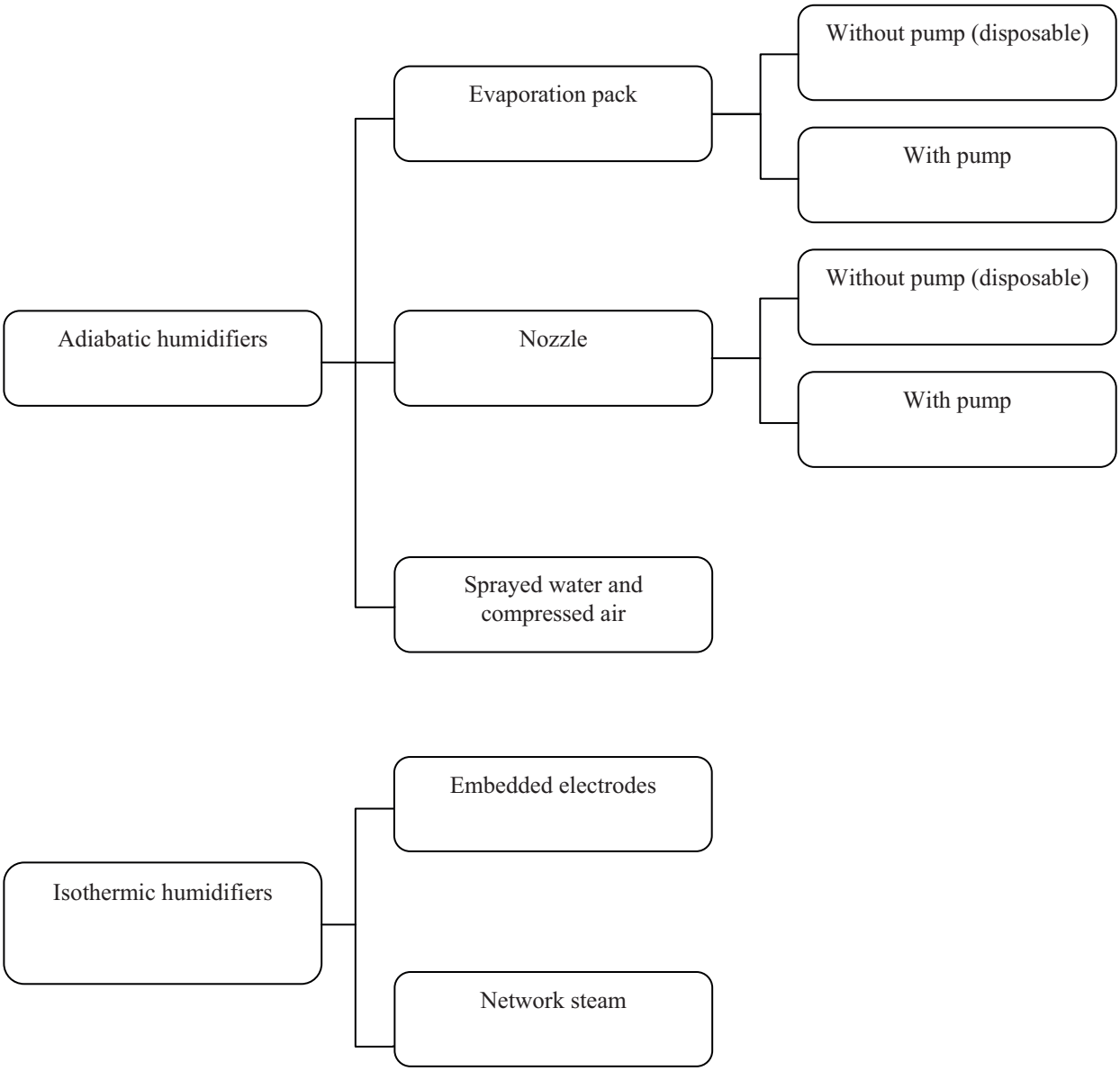
There are air-tight seals on the connection passages through the panels.
It is possible to place more coils side by side; side-by-side coils may have connections on the same side.
A drainage purge valve on the headers allows them to be completely emptied.
Concerning cooling coils, the section has a large condensation drain pan, which is inclined towards the drain in order to avoid water collecting. According to requirements, the basin may be made of galvanised steel, aluminium or AISI type 304 stainless steel (also of AISI 316L and Polypropylene in the UK).

Certifications

- The water and refrigerant coils come with a certification to say that an inspection was carried out using a 30-bar air pressure seal test with the coil immersed in water. All the R410 DX coils are tested with a maximum pressure of 40 Bar.
- The steam coils come with a PED certification.

Humidification section

The following humidification systems are used.



Adiabatic humidifiers

Evaporation pack humidifiers

- Design features

The alveolar pack is made of a special pure cellulose kraft paper, impregnated with resin, in order to obtain high absorption and notable mechanical resistance.
Protection against fungi, algae and bacteria is guaranteed by anti-microorganism agents that are distributed in the cellulose fibre.
The alveolar pack is 100 mm thick for humidifiers without a pump and 200 mm thick for humidifiers with a pump.

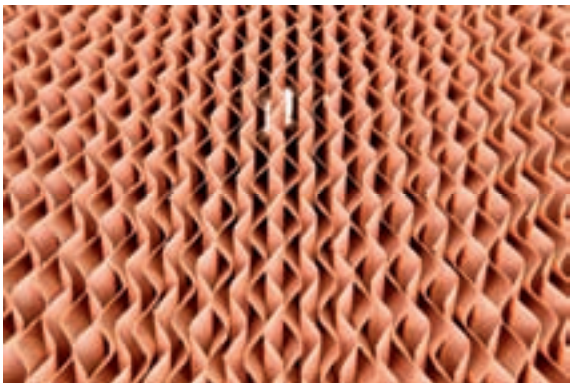


Figure 4: Close-up of an evaporating pack

Water is distributed uniformly from above, with a flare-shaped system.
Humidifiers with a pump have an immersion pump located inside the recirculation tray.
The recirculation tray automatically refills using a float system, and it has a tap to regulate the quantity of water sent while a direct drainage system allows for the control of the concentration of scale in the water thus avoiding excessive calcification.
The amount of water in the recirculation tray is correctly regulated for the system, thus reducing the possibility of algae forming and the proliferation of colonies of bacteria.

For the system without a pump, a basin collects non-evaporated water at the bottom. For the system with the pump, the basin collects water coming from the recirculation tray. The basin is inclined towards the drain in order to prevent water from stagnating.

The humidifiers can be removed completely from the unit to facilitate cleaning, which is necessary to prevent algae and colonies of bacteria from forming - for humidifiers with a pump, it is possible to partially extract just the alveolar pack, leaving the recirculation tray inside the unit, with the pump fitted to it.

- Efficiency

60% for humidifiers without a pump, with 27°C input air and water temperatures between 13°C and 15°C

75% for humidifiers with a pump, with 27°C input air and water temperatures between 13°C and 15°C

Nozzle humidifiers

- Design features

Water is distributed inside the section through spray nozzles mounted on PVC ramps.
The water distribution cones cover the entire air flow but do not overlap, thus preventing the formation of macro-drops that cannot be absorbed by the air.

The humidification section is double chambered, made of steel and equipped with inspection ports, so that the water sprayed does not reach the internal part of the panels.

Humidifiers with a pump have the pump mounted on a proper support outside the unit.

A basin at the bottom, which is inclined towards the drain, helps to drain the non-evaporated water while preventing its collection; in humidifiers with pumps, a float system automatically refills this basin.

- Efficiency

70% for humidifiers without a pump, in the standard version with a counter-current ramp, with 27°C input air and water temperatures between 13°C and 15°C

85% for humidifiers with pump, in the standard version with a counter-current ramp, with 27°C input air and water temperatures between 13°C and 15°C

Water spray and compressed air humidifiers

- Design features

The atomiser nozzles, made of AISI type 316 stainless steel, are mounted in the inflow on the proper ramps and use an automatic needle valve for self-cleaning.
The water is finely sprayed and distributed in the form of droplets with a diameter of about 10µ.

The containment section is double chambered, made of steel and equipped with inspection ports, so that the water sprayed does not reach the internal part of the panels.

There is a bottom basin, inclined towards the drain, which helps to drain non-evaporated water and prevents it from collecting.

A supervision cabinet outside the unit enables the automatic management of compressed air and water flows, cleaning the atomiser nozzles and generally controlling the humidification system.
The supervision cabinet is easily operated by connecting it to the electricity network with a 220 Volt mono-phase voltage supply.

- Efficiency

90% with 27°C input air and water temperatures between 13°C and 15°C

Isothermic humidifiers

Immersed electrode humidifiers

- Design features

The completely independent steam producer is located outside, near the unit.
It is made of a galvanised steel cabinet, which contains the cylinder boiler and the electronic system for adjusting the quantity of steam produced.
The regulation system is modulated and receives a humidity probe signal, which is located in the environment or on the recovery channel; the probe is an accessory, which could be included with the supply.

Figure 5: Isothermal humidifier steam pipe and droplet eliminator

The steam generator is also equipped with a keyboard and graphic display to allow for easy programming and controlling operations.

The distribution nozzles, made of stainless steel and supplied by the proper steam conveyance pipes, are double-sleeved and provided with a condensation drain in order to only issue steam into the air flow.
Their size is optimised in order to uniformly distribute the steam within the air flow.

The section's bottom basin, which is inclined towards the drain, collects and drains the condensation without internal collection.

- Usage conditions

Steam generator installation environment:
temperature: from 1°C to 40°C
relative humidity: from 10% to 60%

Water supply:
temperature: from 1°C to 40°C
pressure: from 1 bar to 8 bar
hardness: less than 40°f
electricity conductivity: from 75 µS/cm to 1250 µS/cm

Humidifiers with network steam

- Design features

The distribution nozzles are double-sleeved and made of stainless steel.
They are supplied by the appropriate valve equipped with a shutter and designed to be commanded by the main electrical or pneumatic actuators; the actuator is an accessory, which may be included in the supply.
The valve includes a condensation discharge and a "Y" filter to be mounted on the steam supply.

Based on the amount of steam flow to be used and the system's operating conditions, it is possible to reduce the size of the chamber using multi-ramp steam distributors.

Usage conditions: Input network steam pressure less than 4 bar

Ventilation section

Centrifugal fans are used for:

- double inlet double width (DIDW) with belt and pulley transmission
- plug fans

Double inlet double width centrifugal fans with belt and pulley transmission

Versions

- forward-curved blades (MCF)
- backward-curved blades (MCB)
- backward-curved AIRFOIL blades (MCB-AF)

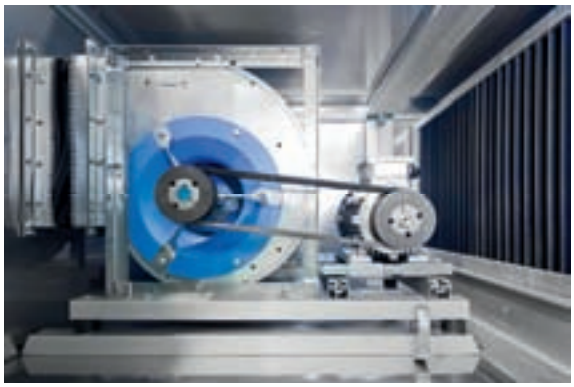


Figure 6: Fan-motor assembly and droplet eliminator

Component design features

- galvanised steel housing
- rectangular galvanised steel frame
- spherical, self-aligning permanent lube bearings
- rotator, statically balanced, with:
  - rectified steel hub
  - galvanised steel blades for the forward-blade version and painted steel for the backward-blade version
- statically balanced cast iron pulleys
- three-phase asynchronous motor, compliant with international IEL regulations, with:
  - closed construction with external ventilation
  - squirrel-cage rotor
  - power supply with nominal European voltages compatible with inverters
  - B3 shape
  - IP55 level of protection
  - F insulation level

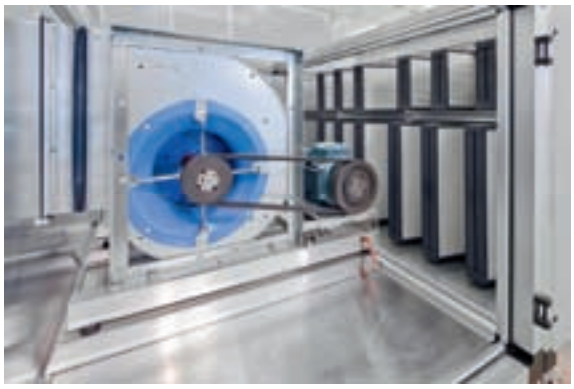


Figure 7: Fan section and bag filter

Performance

- tolerance class 1 in accordance with DIN 24166

Technical solutions adopted

Figure 6: Close-up of fan-motor assembly (offset motor)

- Stress generated by the fan motor unit is absorbed inside the unit, so no additional anti-vibration system needs to be used below the AHU base frame.
  The fan-motor assembly rests on a strong base made of closed double-aluminium profiles with spring or rubber anti-vibration mounts.
  The closed profiles allow for adequately countering the strong stress at the peak. If the profiles were not closed, this stress would widen the opening of the profiles and eventually break them.
- Transmission occurs through trapezoidal rubber belts and conical bush pulleys.
  The sliding tensioning device allows for automatic belt-tightening, which eliminates having to adjust the motor-fan alignment every time the belts are re-tightened.
  The belts, built in accordance with ISO/R 460, are sized to transmit 1.5 times the installed power, with a minimum of two belts for motors with more than 1.5 kW of power.
  The pulleys, balanced in accordance with ISO/R 254, have variable pitches (optional) for power less than 3 kW, in order to make it easier to calibrate the system.

- It is possible for the fan housing to have an (optional) inspection port, which can be opened with tools.
  The port allows for washing the fan wheel with a pressure water washer, so there is a optional drainage joint on the lowest part of the fan housing, equipped with threads to connect it to the drainage pipe.
- A flexible connection is mounted on the discharge outlet pipe, and is composed of a PVC sleeve seamed to galvanised supports and flanges in extruded aluminium sections.
- According to system needs, the fan housing output flow can be horizontal, downwards or upwards.

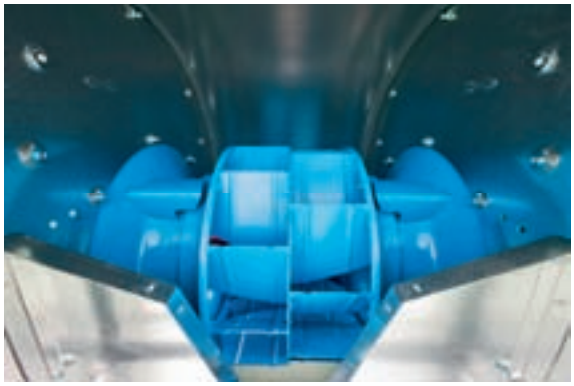


Figure 7: Backward-curved fan

Accessories

- protective mesh on inlet opening
- casings on the transmissions, made of galvanised electric-welded mesh and easily removable with a tool, in order to control the level of belt wear
- safety micro switch, which can stop the power supply to the fan when the access door to the section is opened
- protective mesh, removable with a tool, over the section access door

Figure 8: Forward-curved fan

Special features

- motor outside the air flow
- double motor, one on stand-by
- one motor with twin fans
- unit with two fans at 50% of air flow
- unit with two fans at 100% of air flow, one on stand-by

Plug fan centrifugal fans

Component design features

- galvanised steel frame profiles
- rotator, balanced in accordance with DIN ISO 14694, with painted steel backward blades
- three-phase asynchronous motor, compliant with international IEL regulations, with:
  - squirrel-cage rotor
  - energy supply with nominal European voltages
  - compatible with inverters
  - B3 shape
  - IP55 level of protection
  - F insulation level

Figure 9: Plug fan and door opening inwards

Performance

- tolerance class 1 in accordance with DIN 24166

Technical solutions adopted

- Stress generated by the fan motor unit is absorbed inside the unit, so no additional anti-vibration system needs to be used below the unit base frame.

Accessories

- safety micro switch, which stops the power supply to the fan when the access door to the section is opened
- protective mesh, removable with a tool, over the section access door

Heat recovery section

Two types of heat exchanger devices are used:

- plate
- rotary

Plate heat exchanger devices

Figure 10: Close-up of a plate heat exchanger

Operating principle

- It is based on heat exchange between cross-flow exhaust and fresh air; the air goes through adjacent but completely separate channels, so that the two flows do not contaminate each other.

Design features

- The heat exchange pack is made of pressed aluminium plates (plastic is the alternative for small units), with profiles optimised to obtain the following benefits:
  - high rigidity due to horizontal and vertical frames (or, for heat exchangers with capacities over 50,000 m³/h, a crossed grain design)
  - minor impact of the air speed on the efficiency of heat recovery
  - falling condensation drops in each direction
  - balancing the air flow, which may be irregular, within the exchanger
  - minor static pressure drop
  - strong obstacle to the accumulation of impurities

  In aggressive atmospheres, the plates have a protective acrylic coating (optional).

- The housing structure is made of an aluminium profiled frame, with metal or plastic sheet closing panels bolted to it; the proper seal gasket, which, along with the specific shape of the profiles, guarantees the maximum seal.

- The edges of the heat exchange pack are fastened to the profiles by a patented technique which uses resins this guarantees that the pack is optimally integrated within the housing structure

- The recovery systems can be supplied with a bypass section, located on the side or in the centre.
  The dampers are fixed to the housing structure flanges near the air inlet section, without reducing rigidity and without damaging the heat exchange pack.

- Within the section in which the heat exchanger is placed, it is also possible to install a pre-filter and, as the heat exchanger is installed on runners, it can be easily extracted.
  The section also has up to two drain basins, one for each section of the exchanger. The galvanised steel basins are inclined so as to collect and drain condensation. They can also be made of stainless steel.

Usage limits:

- The maximum pressure difference between the two air flows is between 1,500 Pa and 2,500 Pa, based on the size of the recovery device

Efficiency

- Between 40% and 60%

Rotary heat exchanger devices

Operating principles

- The heat recovery wheel is made of a rotating drum; exhaust air passes through half of it and fresh air passes through the other half. Thus, due to the continuous rotation of the exchange pack, there is a transfer of heat but with an inevitable, though minimal, contamination between the two flows.

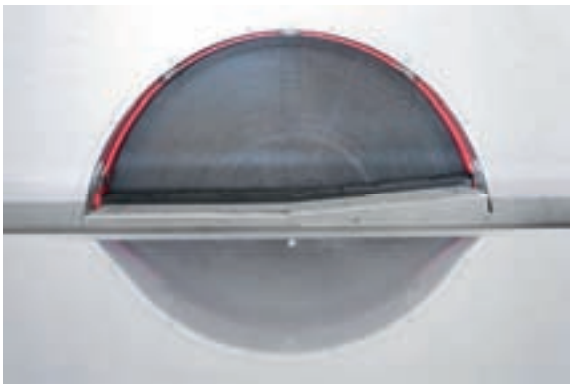


Figure 11: Heat recovery wheel

Design features

- The rotor is made by assembling aluminium corrugated blades, so placed in order to obtain tight axial channels, with triangular sections.
  The rotor is 200 mm deep in the direction of the air flow; the triangular sections are from 1.6 mm to 2.9 mm high, and the blades are from 60µ to 120µ thick.
  Two types of materials are used for the blades:
  - natural aluminium for when energy is transferred by condensation on the hot side
  - aluminium coated in absorbing substances for when energy is transferred without condensation

  The rotor is strengthened with double beams that are welded to the hub and to the perimeter shell. If the rotor is quite large, it can be made in more than one segment.
  The hub, fastened to the containment structure, has a pair of spherical bearings inside; this offers the following benefits:
  - effective protection from the accumulation of impurities
  - axial locking with Seeger rings, which makes it easy to remove and replace
  - exact alignment
  - accurate relative positioning of axes, hub and rotor
  - notable stability due to the shaft being joined to the two crossbars of the containment structure

- There are two different designs of the containment structure:
  - self-supporting galvanised steel frame
  - extruded aluminium construction for diameters greater than 2,620 mm

- There is a side opening for inspection and maintenance.

- The plastic sealing gasket is pressed on to the rotor and on to the containment structure's frame with a double spring; a sealing brush on the crossbars prevents the contamination of the two air flows.

- A belt transmission motor runs the rotor.
  The motor, located on a support fastened to the structure, is operated:
  either by the on/off mode
  or by the inverter (0-10V signal)

- The unit section, which contains the recovery device, includes folded synthetic G3-G4 filters over the fresh air and regulating shutters on the external air intake and the exhaust.
  If the relative humidity of the extracted air is higher than 50%, there is also a basin for collecting and draining the condensation. The basin is made of galvanised steel, but upon request can be made of stainless steel.

Usage limits:

- The maximum pressure difference possible between the two air flows is 1,500 Pa.

Efficiency

- Between 60% and 80%

Gas burners

Figure 12: Gas heater exchanger

The units can be equipped with two different gas burner modules:

- PCH condensation module
- GH module

PCH condensation module

Technical features

- AISI type 430 stainless steel combustion chamber, with particular "tear-drop" shape, which optimises the heat exchange process
- Stainless steel heat exchanger with low carbon content
- Airtight combustion circuit
- Microprocessor with continuous modulation of thermal power
- Use of an innovative air/gas mixing technique that makes the module completely safe, since the gas valve dispenses the fuel in relation to the air flow, according to a regulation predefined in the company

Configuration

- The module is already prepared to be inserted into the unit and is able to work independently; it just has to be connected to the electricity network and the gas supply network.

Performance

- Maximum thermal power: 197 kW
- Performance: 105% (referring to the lower calorific power)
- Emissions of:
  carbon oxide (CO) = 0 ppm
  nitrogen oxide (NOx) = < 30 ppm

Certifications

- 90/396/EEC Gas Directive; 90/392/EEC Machinery Directive; 72/23/EEC Low-voltage Directive; 89/336/EEC Low Emissions Directive

GH module

Technical features

- Galvanised supporting structure
- AISI type 430 stainless steel combustion chamber, with high exchange surface
- Flame inversion furnace, with completely welded combustion circuit with three flue gas passes
- High-performance heat exchanger made of stainless steel with low carbon content, made of a shell and tube conical section, with aerodynamic profile

Configuration

- The supporting structure, inserted inside the unit, contains the combustion chamber and the heat exchanger. The burner and the cabinet with the electronic control and the user interface are outside the unit while the burner and control cabinet can be provided as accessories.

Performance

- Maximum thermal power: 920 kW
- Performance: 94% (referring to the higher calorific power)

Certifications
90/396/EEC Gas Directive

Silencers

The silencers used have high acoustic performance, great construction quality and low pressure drop loss of charge.

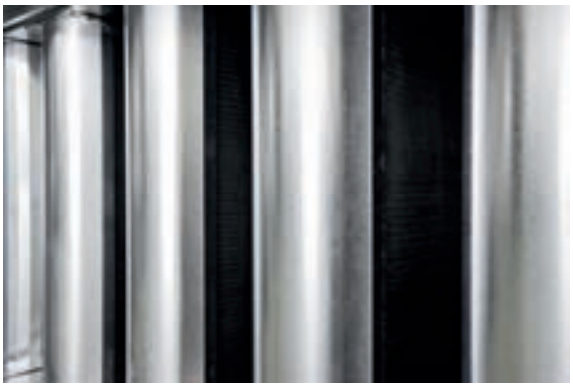


Figure 13: Close-up of silencers

Features

- galvanised steel frame
- sound baffles 200 mm wide and housed in galvanised steel frames; the two side silencers are 100 mm wide and are obtained by dividing the 200 mm partitions on the vertical symmetry plan
- 60 kg/m3 density sound-absorbing mineral wool is covered with a stiffened surface in the standard version although special requests include covering in perforated metal with a protective polyester membrane, which is waterproof and resistant to temperatures up to 120°C
- aerodynamic profiles on the edges of the silencer reduce the resistance to air flow and the regeneration of noise as much as possible

Design and size considerations

- short-circuit of noise is avoided by using silencers with a length equal to the width of the unit section.
- dimensioning, in case of a pitch of less than 100 mm, sizing based on a face velocity from 6m/s to 12m/s, with a pressure drop of not more than 70 Pa

Certifications

- sound-absorption material manufactured in accordance with the EC 97/69 note Q directive, or classifiable as a non-carcinogenic substance
- acoustic damping data tested in accordance with ISO regulation 11691
- pressure drop testing carried out in accordance with ISO regulation 7244

NOTES

Daikin's unique position as a manufacturer of air conditioning equipment, compressors and refrigerants has led to its close involvement in environmental issues. For several years Daikin has had the intention to become a leader in the provision of products that have limited impact on the environment. This challenge demands the eco design and development of a wide range of products and an energy management system, resulting in energy conservation and a reduction of waste.

Daikin Europe N.V. participates in the Eurovent Certification programme for Air conditioners (AC), Liquid Chilling Packages (LCP) and Fan coil units (FCU), Check ongoing validity of certificate online: www.eurovent-certification.com or using: www.certiflash.com

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