Carrier

United Technologies

Airovision

Air Handling Unit

39 HQ

The Difference Is In The Detail...

EUROVENT CERTIFIED PERFORMANCE
AHU N°: 08.02.251
Range: 39HQ
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Alarko Carrier

Established in 1954 and operating in the fields of heating, cooling, ventilation, water treatment and pressurization, Alarko Sanayi ve Ticaret A. Ş. entered into a partnership at an equal rate with world leading organization Carrier in 1998 and company name was changed as Alarko Carrier Sanayi ve Ticaret A. Ş.

Alarko Carrier San. Tic. A. Ş. with core business in air-conditioning, has been maintaining operations since 2001 at manufacturing plants having a closed area of 36.800 m^2 on a land of 60.500 m^2 located within Gebze Organized Industrial Zone. At Alarko Carrier main manufacturing plant holding ISO 9001, ISO 14001, ISO 18001, ISO 50001 and SA 8000 certification, air handling units and rooftops are manufactured under Carrier brand and boilers, burners, submersible and circulating pumps and water boosters are manufactured under Alarko brand; panel radiators are manufactured at Radiator Production Plant having a closed area of 9.250 m^2 and 18.000 m^2 open area at Dudullu Organized Industrial Zone.

A total of 609 people; 169 engineers, 216 white collar personnel and 224 workers are employed at Alarko Carrier manufacturing plants and Ankara, İzmir, Adana and Antalya offices.

Alarko Carrier develops products with competition and improvement possibilities by means of R&D activities, manufactures with modern technology and lean manufacturing methods and supplies complementary products and addresses the market. Alarko Carrier conveys products of many international manufacturers to consumers as an agent or partner.

Alarko Carrier who offers manufacturing, sales, export and service as integrated exports products manufactured to many countries all over the world.

Extensive authorized service and sales network throughout Turkey

Carrier was among the first companies to set energy reduction goals for our factories in 1988. This led to our first company-wide global environmental, health and safety goals in 1997.

From 2000 to 2011 Carrier factories reduced water usage by **27%**

From 2000 to 2011 Carrier factories reduced air emissions by **60%**

From 2006 to 2011 Carrier has lowered greenhouse gas emissions by **35%**

Carrier implemented a new machine tool lubrication process that reduced volatile organic compound emissions by more than 80% below the baseline.

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1 Standards

1. STANDARDS

Essential standards applied in Europe for air handling units are specified below:

- **EN 1886: 2007**
  Ventilation for Buildings – Air Handling Units – Mechanical Performance
- **EN 13053: 2006 + A1: 2011**
  Air Handling Units – Ratings and performance for units, components and sections
- **EN 13779:**
  Ventilation for Non-Residential Buildings - Performance Requirements for Ventilation and Room-Conditioning Systems
- **DIN 1946/4 - 2008:**
  Ventilation and Air Conditioning – Part 4: VAC Systems in Buildings and Rooms Used in the Health Care Sector

1.1 EN 1886 - 2007: Air Handling Units – Mechanical Performance

The characteristics of the casing wall construction of the air handling unit must be established in accordance with EN 1886, based on measurements carried out on a model box and a real unit.
A model box is an air handling unit without its installed components that consists of two sections with a joint. Each section also has a door. The dimensions and the construction must comply with the requirements of the standard.
Thermal and acoustic characteristics of a casing wall construction are exclusively determined on the basis of measurements taken on the model box, while mechanical strength, air leakage and filter bypass leakage must be determined on the basis of measurements taken on a real unit, that has been designed for an HVAC application.

Specifications as per EN 1886 – 2007

Specifications (EN 1886)						
Thermal Transmission	T5	T4	T3	T2	T1	
Thermal Bridging	TB5	TB4	TB3	TB2	TB1	
Filter Bypass Leakage	G1-G4	F5	F6	F7	F8	F9
Body Sealing	L3	L2	L1			
Mechanical Strength	D3	D2	D1			

In the table, the class the standard construction model box GP080* complies with is marked in blue .

1.1.1 Mechanical Strength

There are two test criteria for mechanical strength:
• Relative deflection [mm x m^{-1}] of posts and panels under normal design conditions
• Mechanical resistance [no permanent deformation] against maximum fan pressure
When testing the mechanical strength of the model box, the following test pressures apply:
Deflection **• 1,000 Pa over and under-pressure in accordance with EN 1886**
Fan pressure **• 2,500 Pa over and under-pressure in accordance with EN 1886**
The standard differentiates between the following classes:

Mechanical strength classes as per EN 1886 – 2007			
Body class 2007	**Maximum relative deflection mm x m^{-1}**	**Maximum strength against fan pressure**	**Quality**
D1	4	Yes	+
D2	10	Yes	↑
D3	N/A	Yes	-

In the table, the class the standard construction model box GP080* complies with is marked in blue .

* See. Chapter 4 “Casing”.

1.1.2 Casing Air Leakage

Depending on the construction of the air handling unit and the nominal operating pressures air leakage is measured at the following test conditions:

- All sections at 400 Pa negative pressure, if there is only negative pressure in the unit
- Positive pressure sections at 700 Pa or higher positive pressure, if the operating pressure after the fan is higher than 250 Pa. If the operating pressure that occurs is higher than 700 Pa, the positive pressure sections are tested under actual pressure conditions. The permissible air leakage is linked to the filter class in the relevant casing section. The table below lists the air leakage classes together with the associated filter classes.

The remaining sections are tested at 400 Pa negative pressure.

Casing leakage class as per EN 1886 – 2007				
Leakage class 2007	**at -400 Pa maximum leakage l x s^{-1} x m^{-2}**	**at +700 Pa maximum leakage l x s^{-1} x m^{-2}**	**as per EN779 maximum filter class**	**Quality**
L1	0.15	0.22	better than F9	+
L2	0.44	0.63	F8-F9	↑
L3	1.32	1.90	G1-F7	-

In the table, the class the standard construction model box GP080* complies with is marked in blue .

1.1.3 Filter Bypass Leakage

Filter bypass leakage refers to the total amount of unfiltered air after the filter section. The unfiltered air flow is the sum of:

- Air that passes the filter medium outside the filter section
- Air leakage through the walls of the sections after the filter, with negative pressure

Bypass leakage through the filter section is measured at a pressure difference of 400 Pa over the filter section, and filters are sometimes replaced by dummy plates with an air tightness mechanism identical to the one of the filters.
The table below lists the total admissible bypass leakage k in % of the design air flow over the filters as a function of the built-in filter class.

Maximum filter bypass leakage allowed as per EN 1886 - 2007					
Filter class	G1- F5	F6	F7	F8	F9
Total bypass leakage k %	6	4	2	1	0.5

The standard slide-in construction for filters, tested in a model box, is suitable for filter class F9.
In accordance with standard EN 1886, this is based on a face velocity of 2.5 m/s.

1.1.4 Thermal Transmission

The thermal transmission of a model box is the average heat transfer coefficient of the construction in W x m-2 x K-1, referred to the external surface.
The measurement is carried out with heat sources in the model box, where the total power input and the average temperature difference between inside and outside is determined at a stable condition. Thermal transmission is the ratio between the total power input and the internal/external surface temperatures times their surface area. Depending on the measured values the construction has in one of the following classes:

Thermal transmission as per EN 1886 – 2007		
Class	**Heat transfer coefficient [Wxm^{-2} x K^{-1}]**	**Quality**
T1	U < 0.5	+
T2	0.5 < U < 1.0	
T3	1.0 < U < 1.4	↑
T4	1.4 < U < 2.0	
T5	*N/A*	-

The standard construction GP080* complies with class T2, and it is marked in blue in the table.

1.1.5 Thermal Bridging

The thermal bridging factor of a model box is measured for the same set-up that is used to determine the heat transfer coefficient. At the stable condition the highest detectable surface temperature on the outside surface of the model box is measured. The thermal bridging factor is the quotient of indoor air temperature minus highest surface temperature and the air temperature difference between inside and outside.
The measured value is in one of the classes below and indicates if there is surface condensation or not. As the thermal bridging factor increases, the possibility of condensation decreases.

Thermal bridging factor as per EN 1886 – 2007		
Class	**Thermal bridging factor [k_b]**	**Quality**
TB1	$0.75 < k_b < 1.0$	+
TB2	$0.60 < k_b < 0.75$	
TB3	$0.45 < k_b < 0.60$	↑
TB4	$0.30 < k_b < 0.45$	
TB5	*N/A*	-

The standard construction GP080* complies with class TB2, and it is marked in blue in the table.

1.1.6 Acoustic Casing Insulation

Acoustic casing insulation, as defined by EN 1886, is the attenuation achieved by enclosing a noise source with a model box. For this purpose the average sound pressure level of a noise source placed on the floor, is measured in an imaginary enclosing area. The measurement is repeated in the same enclosing area, but with the noise source in the model box.
The difference in the measured sound pressure levels, divided into octave bands of 125 to 8000 Hz, is the attenuation of the casing wall construction, including the doors and joint.
For the standard casing wall construction GP080*, the measured attenuation is shown in the table below:

Acoustic casing insulation as per EN 1886 – 2007							
Average octave band frequency [Hz]	125	250	500	1,000	2,000	4,000	8,000
Sound absorption [dB]	19.0	19.0	2.00	22.0	21.0	29.0	36.0

1.2 Eurovent Energy Class Calculation Method in Air Handling Units – 2013

Energy supplied to the Air Handling Units (AHUs) may be divided in two main groups: thermal energy (for heating and cooling) and electrical energy (for fans). Different levels for thermal energy consumption for heating are covered by the consideration of the Heat Recovery System (HRS) efficiency. The climate dependency for the thermal energy consumption is considered and the difference in primary energy between thermal energy and electrical energy is taken into account to evaluate the impact of the pressure drops across the HRS . The thermal energy for cooling is not considered because it will have less impact (negligible for most of Europe). Regarding electrical energy for fans, the method only accounts for the impact of the unit size and efficiency of fan assembly. Other components (e.g. coils) are not individually covered (hence the total pressure increases for fans are not considered) because there is a huge variation in the use of components in different AHU applications. The major influencing factors; velocity, HRS pressure drop, overall static efficiency of the supply and/or the extract air fan and efficiency of the electric motor(s), will give a good estimation of the used energy for fans. The classification, however, can not be considered as a system energy label.

* See. Chapter 4 “Casing”.

Air Handling Unit Subgroups

Three subgroups, with different label signs, are defined:

a. Units for full or partial outdoor air at design winter temperature ≤ 9°C.

- This subgroup comprises units connected to outdoor air with the design outdoor temperature, winter time ≤ 9°C. If the unit contains a mixing section; it will be treated within this group as long as the amount of recirculation air is less than 85%. If more recirculation is claimed, the calculation value for 85% shall be used in the applicable equation for pressure correction Δpz. This subgroup will consider the velocity in the filter cross section, the HRS efficiency and pressure drop and the mains power consumption to the fan(s). The class signs are A to <E.

b. Recirculation units or units with design inlet temperatures always > 9°C.

- This subgroup includes units with 100% recirculation air, units connected to outdoor air for which the design outdoor temperature during winter time > 9°C or units with (pre-conditioned) inlet temperature > 9°C emanating from a make-up air unit up-stream. This subgroup will only consider the cross section velocity of the filter section and mains power consumption to the fan(s). The class signs are A↪ to <E↩.

c. Stand-alone extract air units

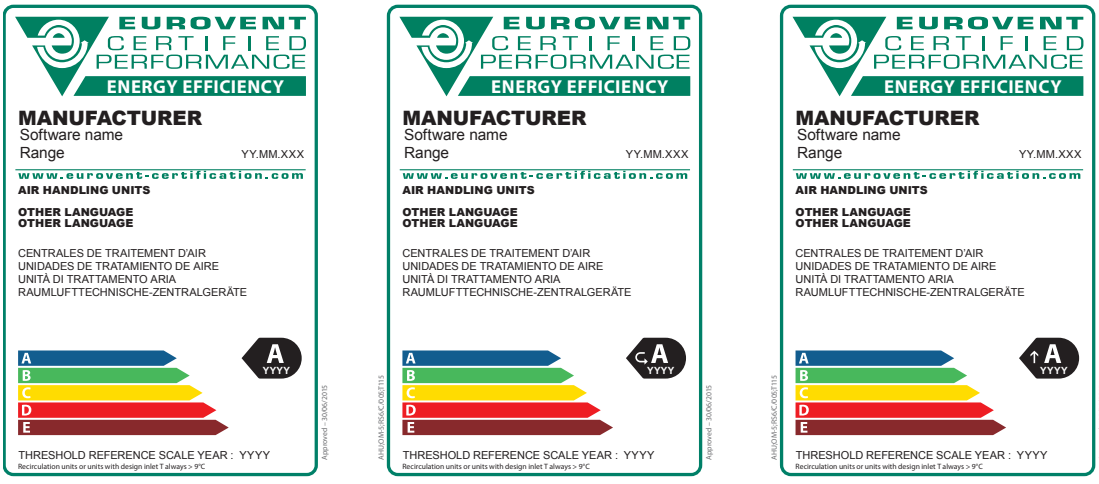
- Subgroup for pure extract air units (First reason to allocate an energy label to this kind of unit application is that they could include heat recovery. Another reason is that the design outdoor temperature has no relevance for such units). This subgroup will only consider the cross section velocity of the filter section and mains power consumption to the fan(s). The class signs are A↑ to <E↓.

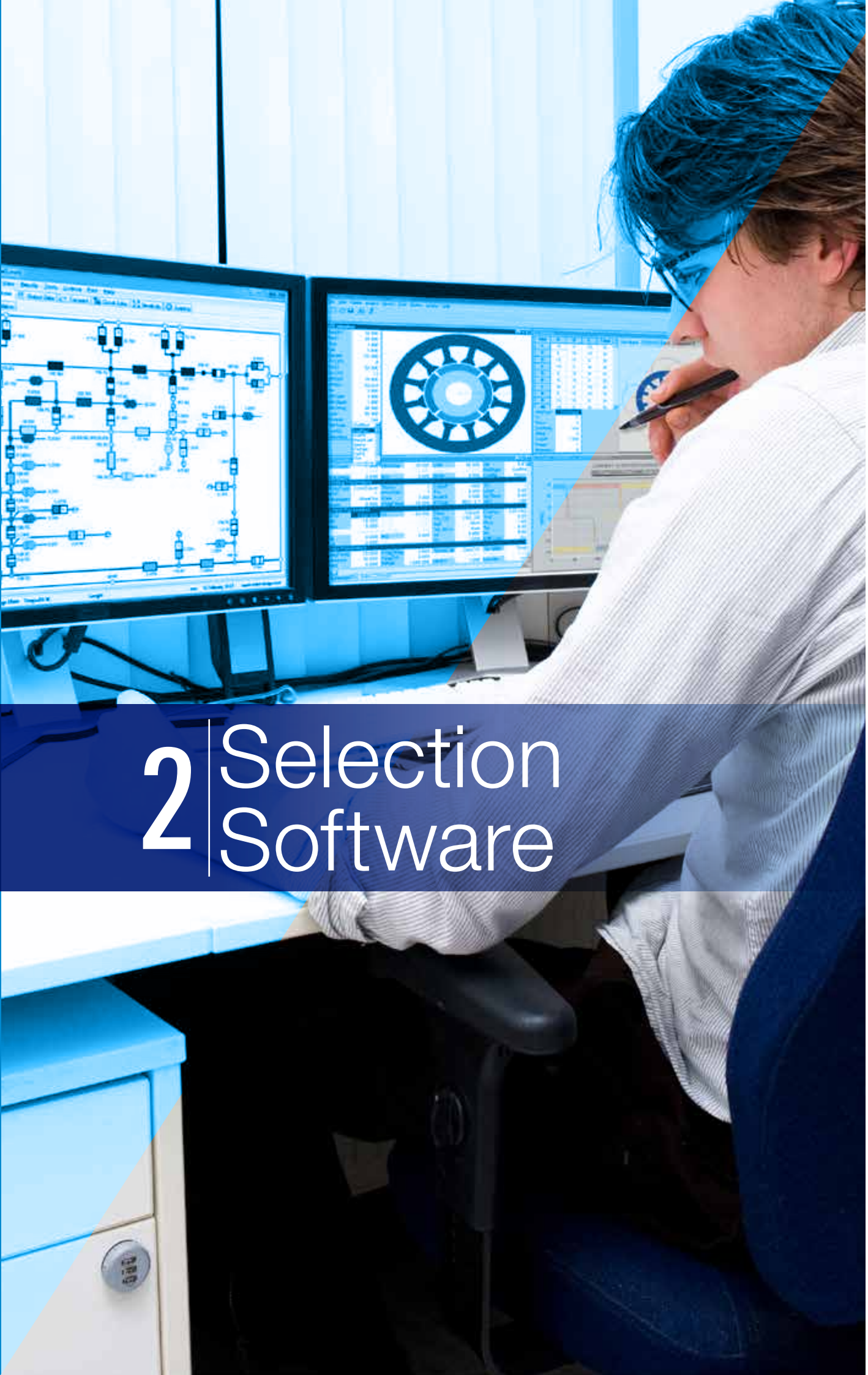
Table for energy efficiency calculations				
Energy Class	All Units	Units for full or partial outdoor air at design winter temperature ≤ 9°C.		
	Velocity V class [m/s]	Heat recovery system ηclass [%]	Δp class [Pa]	Absorbed power factor fclass-pref [-]
A / A↪A↑	1.8	75	280	0.9
B / B↪B↑	2.0	67	230	0.95
C / C↪C↑	2.2	57	170	1.0
D / D↪D↑	2.5	47	125	1.06
E / E↪E↑	2.8	37	100	1.12
E / E↪<E↑	Calculation is not required			Not required

$$f_{s\text{-}Pref} = \frac{P_{s\text{-}sup} + P_{s\text{-}ext}}{P_{sup\text{-}ref} + P_{ext\text{-}ref}}$$

Absorbed power factor; $f_{s\text{–}Pref}$

$P_{s\text{-}sup}$ = active power supplied from the mains, including any motor control equipment, to selected supply air fan [kW]
$P_{s\text{-}ext}$ = active power supplied from the mains, including any motor control equipment, to selected extract air fan [kW]
$P_{sup\text{-}ref}$ = supply air fan reference power [kW]
$P_{ext\text{-}ref}$ = extract air fan reference power [kW]





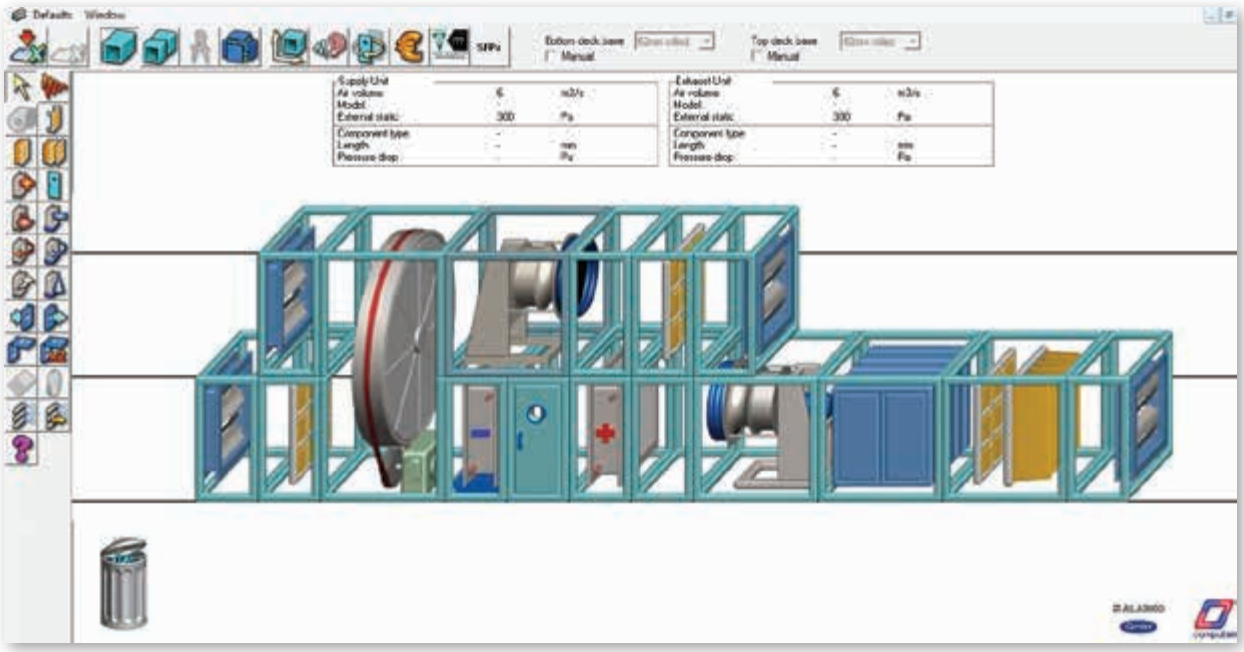
2 Selection Software

2. SELECTION SOFTWARE

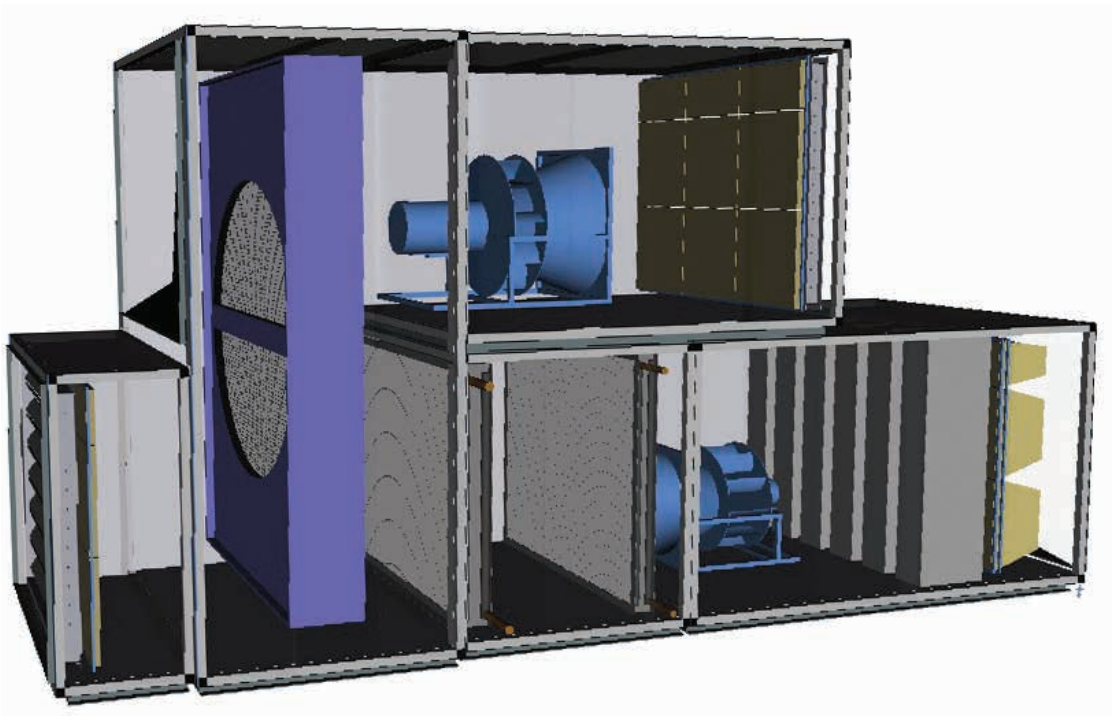
2.1 Airovision Builder

Carrier 39HQ Airovision air handling unit has a very flexible structure as per its design. This flexibility manifests itself both in dimensioning, as it consists of 160 mm imaginary modules, and in the use of any type of component inside it. It can meet any type of expectations of the customers in very different markets as it is exported to 65 different countries in 5 continents.
While selecting an air handling unit, the position and arrangement of components and each cell inside the air handling unit are very important both for reasons of cost and for ensuring the trouble-free operation of the device. Thus, the person making the selection shall pay great attention in the placement of each cell and component. Airovision Builder software provides great ease for the users in the placement of components inside the unit by allowing them to see the device and arrangement they have chosen with the 3 dimensional drawings of all components in the launch screen.

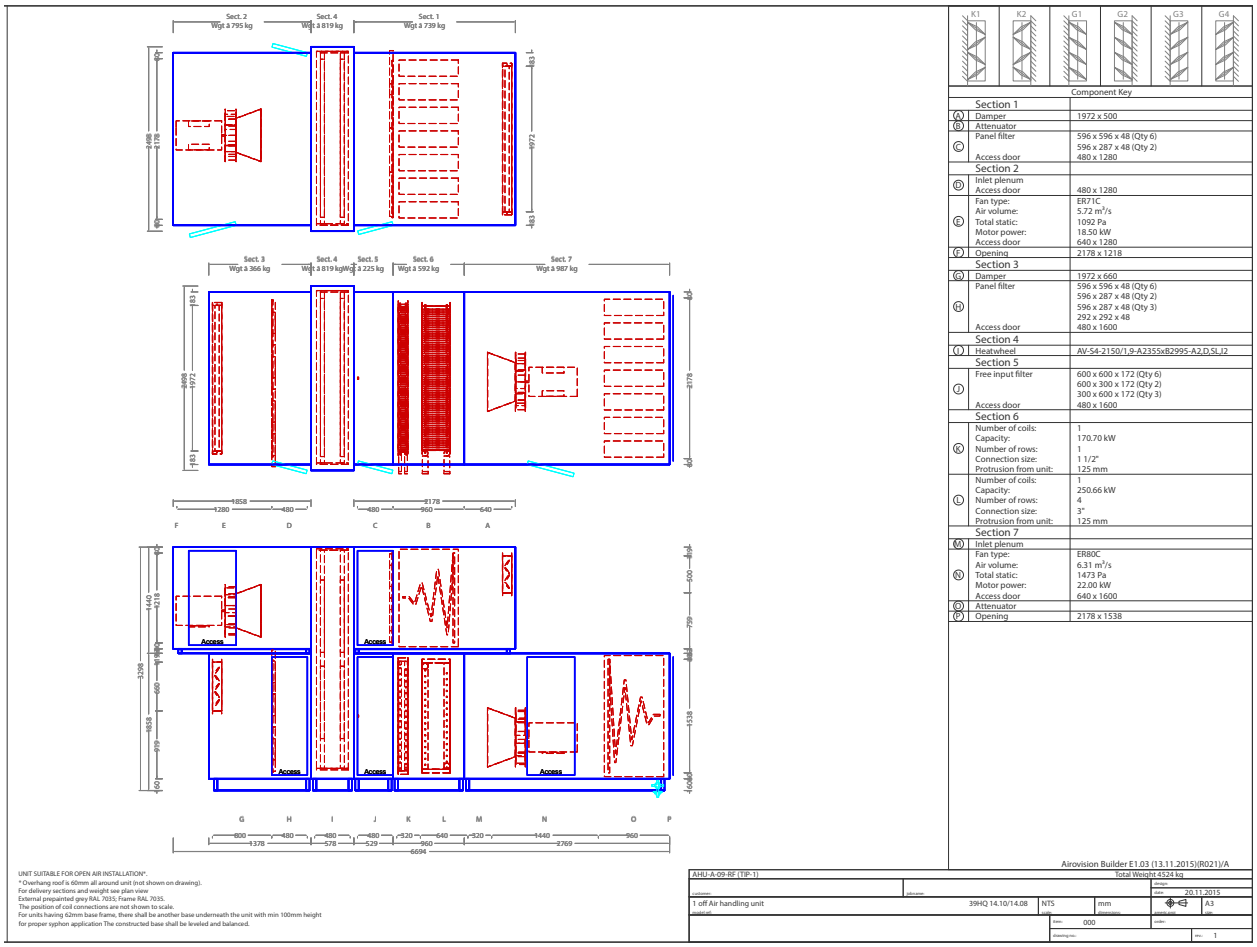
2.2 Airovision Builder Selection Software Interface



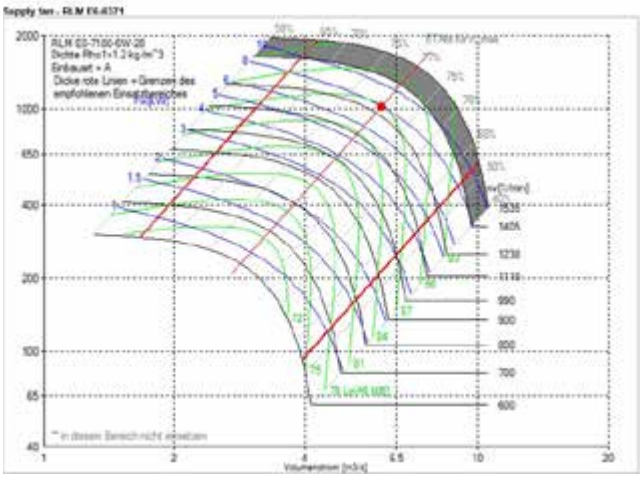
2.3 3-D Unit Image Preview



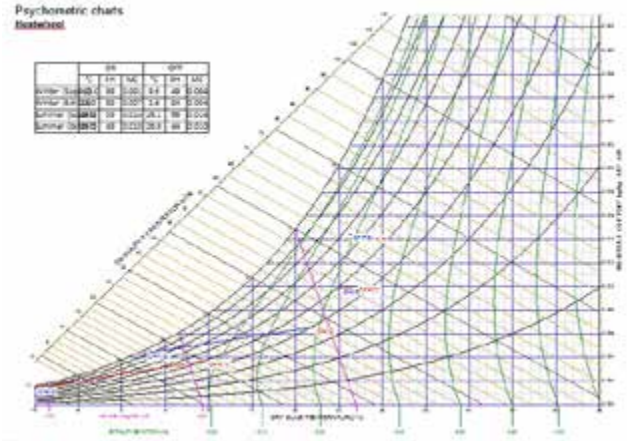
2.4 Unit Drawings in Pdf or Dwg (Autocad) Format



2.5 Selection Report Fan Curves



2.6 Selection Report Psychrometric Diagram Curves



3 Dimensions

3. DIMENSIONS

Module		Width																					
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Elevation	2.5	3	3	4																			
	4	4	5	6	7	8	9	10	11	12													
	6	6	8	9	11	12	14	15	17	18	20	21	23	24	26	27							
	8			12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	
	10					20	23	25	28	30	33	35	38	40	43	45	48	50	53	55	58	60	63
	12						27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
	14									42	46	49	53	56	60	63	67	70	74	77	81	84	88
	16										52	56	60	64	68	72	76	80	84	88	92	96	100
	18		x 1,000 m³/h													81	86	90	95	99	104	108	113
	20																	100	105	110	115	120	125*

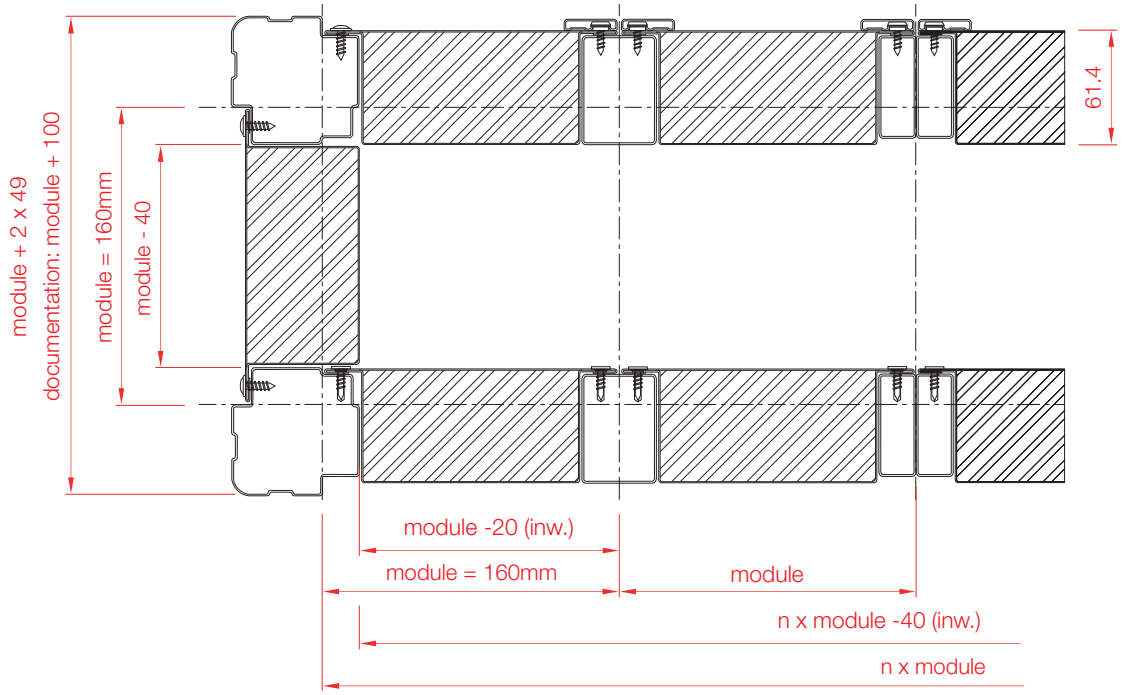
*Note: Modules with larger sizes may be provided.

39HQ 14.12
- Height of Air Handling Unit (module)
- Width of Air Handling Unit (module)

Module size: 160 mm
External width: (n x module) + 98 mm
External height: (n x module) + 98 mm
Base frame height: 160 mm or 62 mm

Example: 39HQ12.10
Width: (12 x 160) + 98 = 2018 mm
Height: (10 x 160) + 98 = 1698 mm
Nominal air flow rate: 8.5 m³/s (30x1000 m³/h)

- 39HQ series air handling units are composed of the combination of virtual modules with a width, height and length of 160 mm.
- They may be manufactured with a total of 122 different cross sections (width x height) for flow rates varying from 2,000 m³/h to 125,000 m³/h.
- Fully flexible production with installation to interior, exterior, vertical and concealed roof types and with any size desired is possible.



4 Casing

4. BODY

The construction of the Carrier air handling units consists of a profile and panels. Profiled 1-mm thick casing sides of galvanised and coated steel plates ensure a rigid and lightweight frame. The profile holds a 60-mm dual-skin casing wall with panels, doors, inspection hatches and removable centre posts. The casing wall construction comes in several versions of steel plate thicknesses, material types and insulation materials used. The internal plating is always 0.8 mm thick. The standard casing wall construction GP080 consists of 0.8 mm internal and external plating with mineral wool (glass wool) in between.
The floor panel of the standard casing wall construction is made with isophenic (IPN) insulation for enhanced thermal characteristics and the possibility to walk on it. Compared with PUR, IPN insulation has an increased insulation value and improved fire resistance. Other advantages of IPN insulation are high pressure resistance and the possibility to walk on it.
As various markets have different requirements there are also versions with rock wool insulation and other panel thicknesses and plate materials, such as stainless steel. The RR125 acoustic version has an additional acoustic plate in the internal panel especially designed to efficiently dampen low-frequency sounds.

Coding	G	P	080	-
Digit	1	2	3	4

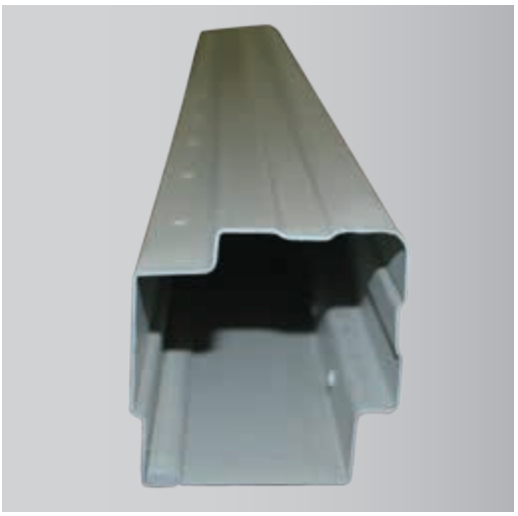
1: G = insulation, side and roof panels (G = glass wool, R = rock wool)
2: P = insulation, floor panel (P = IPN, R = rock wool)
3: 080 = thickness of the external plating (080 = 0.80 mm / 125 = 1.25 mm)
4: A = Acoustic version

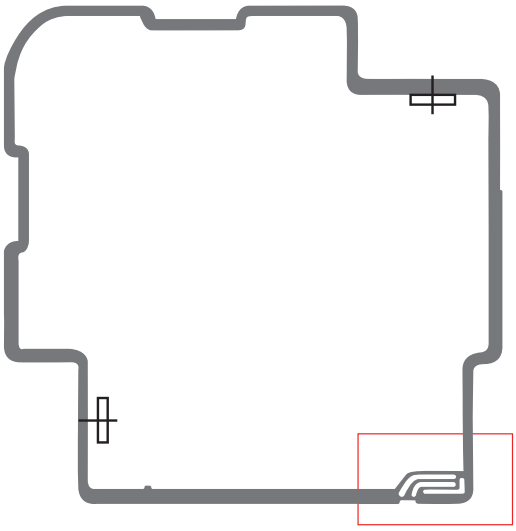
Panels of 39HQ air handling units are designed for easy removal and installation. As the panel and profiles are made of galvanized steel, removal and installation of screws do not cause any kind of deformation on the panel or profile body. This is the main advantage of using galvanized steel profiles against air handling units with aluminium profiles. Because the deformation of the panel or the profile is one of the main elements that would endanger the sealing of the body.
Easily removable panels provides ease both during installation and maintenance and service in the field.
It provides benefits both in terms of hygiene and aesthetic by ensuring a smooth surface inside and outside the air handling units without using any additional components.

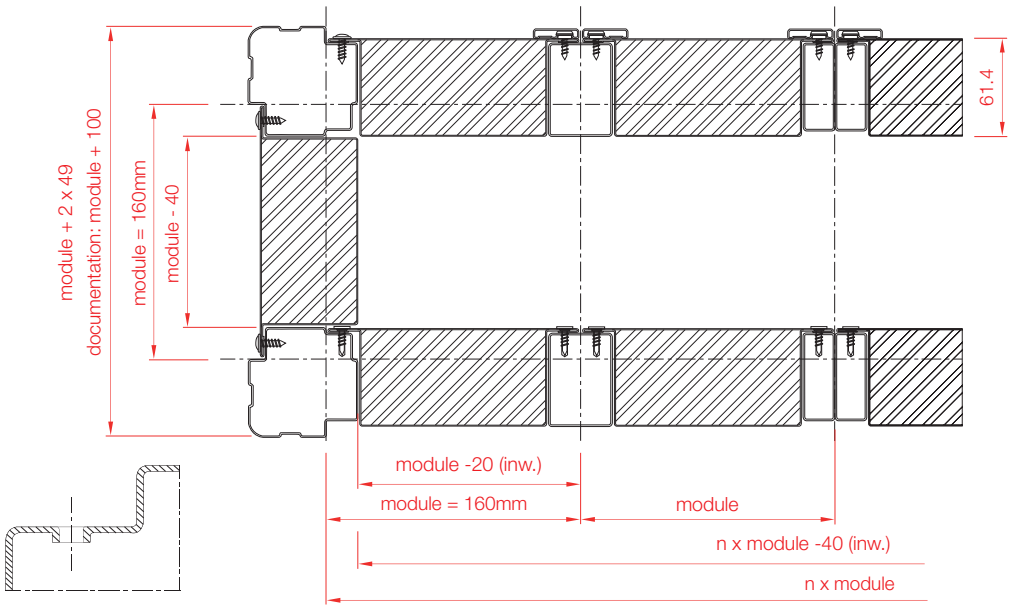
Fully removable panels

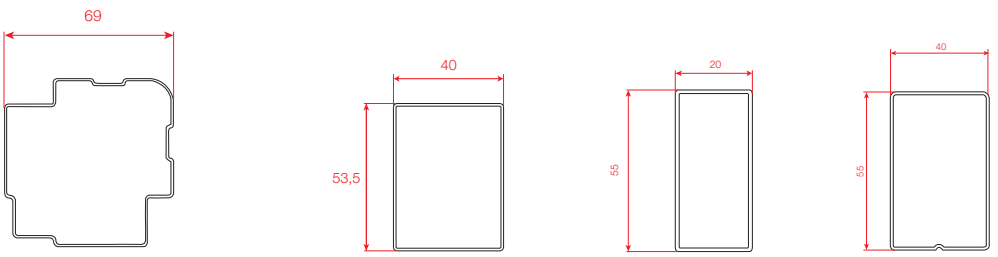
4.1 Profile

Profile is important for the air handling units so much as the skeleton is important for the human body. Polyester powder painted galvanized steel structure with a thickness of 1 mm is used in Carrier 39HQ air handling units.
Screw holes are pre-drilled in the supplier and painted afterwards.
Density of zinc coating 225 gr/m^2 (Z225)
Clamped profile structure.
Imported from Europe.
All profiles are painted both inside and outside









Corner profile

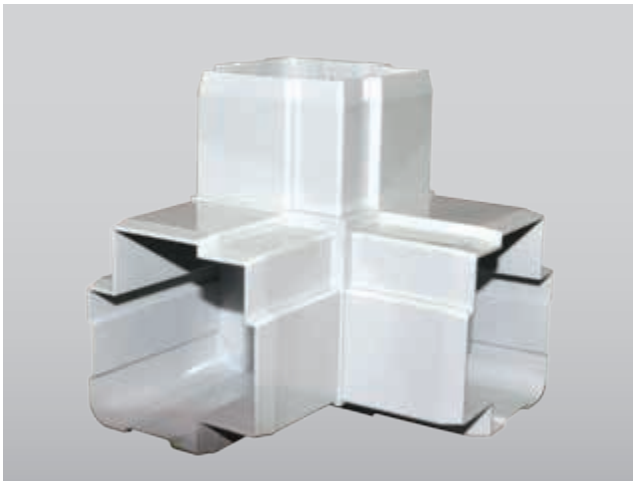
Main profile

Connection profile (sectioning)

Door profile

4.2 Corners

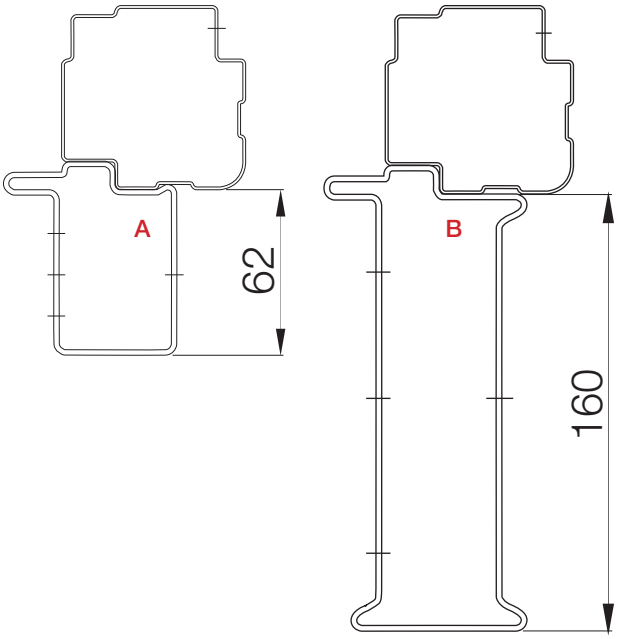
Shock-proof ABS (Acrylonitrile-Butadiene-Styrene) plastic corner
Resistant against corrosion and hygienic



Corner

4.3 Base frame

Polyester coated powder painted galvanized steel with a thickness of 2 mm
A- 62 mm (cross-section of rectangular carriage profile)
B- 160 mm (cross-section of round carriage profile)



4.4 Panels

60 mm sandwich panel with double wall

Inner Plate: 0.8 mm

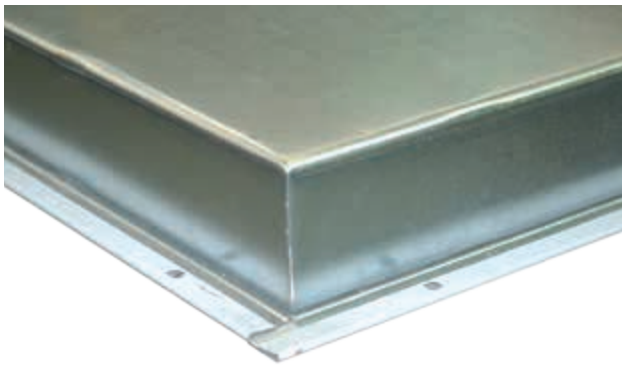
- Galvanized steel (standard) (zinc coating with a density of 160 gr/m^2 (Z160))
- or painted galvanized steel (zinc coating with a density of 225 gr/m^2 (Z225))
- or stainless steel (304 or 316)

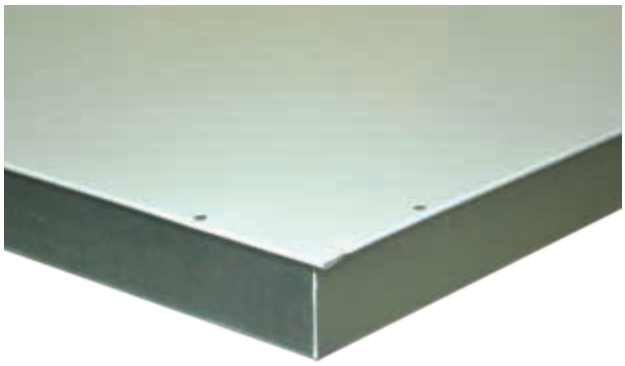
Outer Plate: 0.8 mm or 1.25 mm

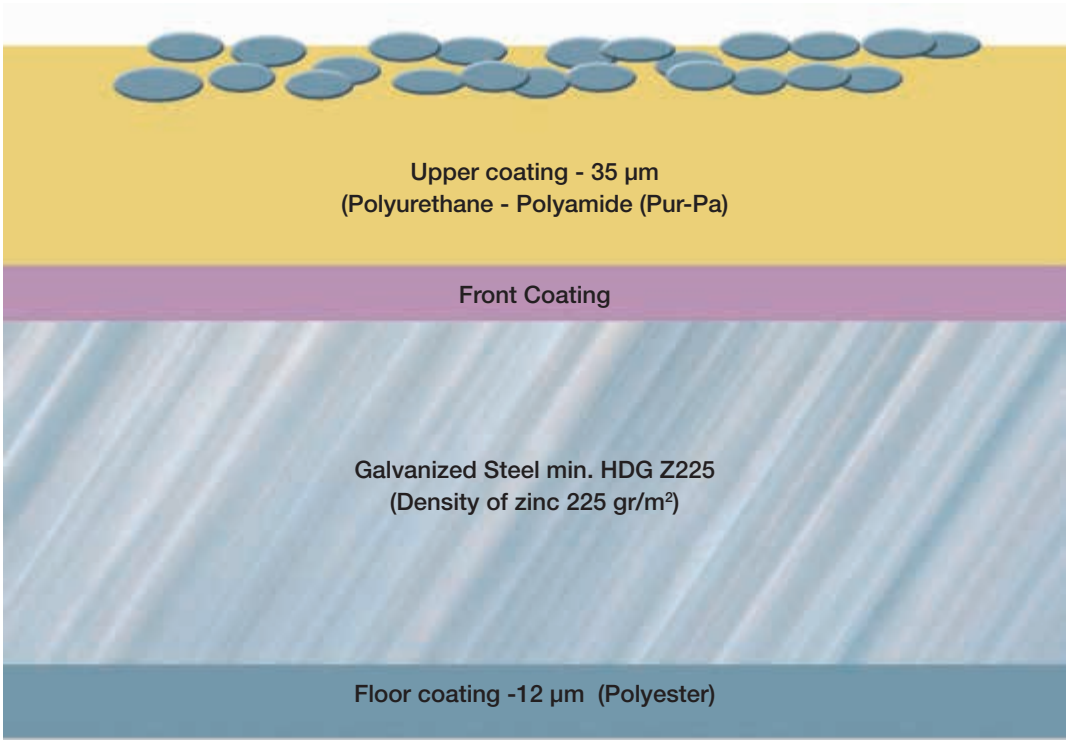
- Painted galvanized steel (standard) (zinc coating with a density of 225 gr/m^2 (Z225))
- or stainless steel (304 or 316)

Paint type: Polyester powder paint. Resistant against 500 hours of salty water test.

- Colour code RAL 9035.

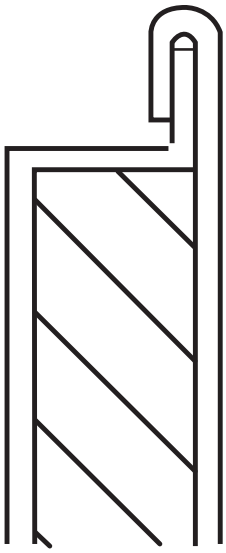


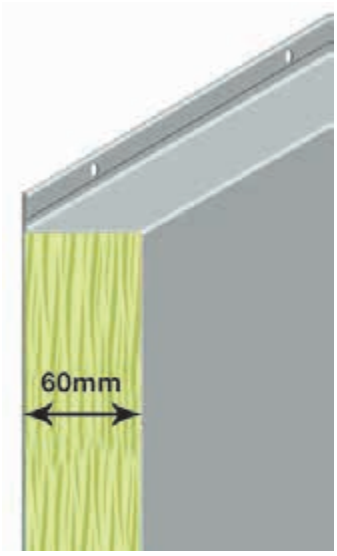


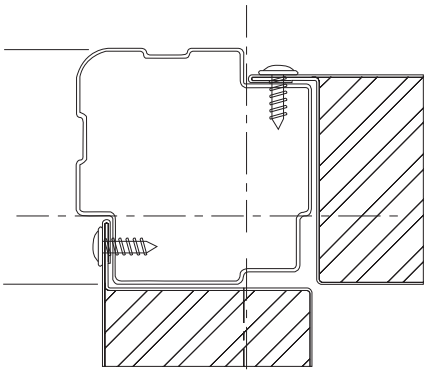


Panel coating

No additional holes are drilled on the panel while installing the panels to the profile.
All panels are procured as completely closed in its insulation from the supplier.
Fully closed panel design



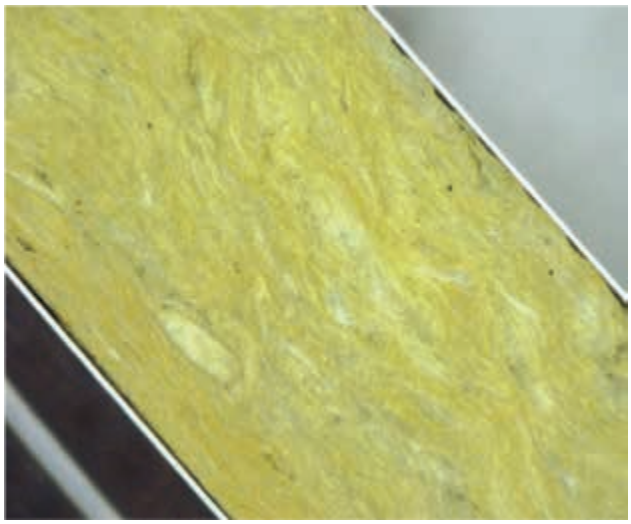




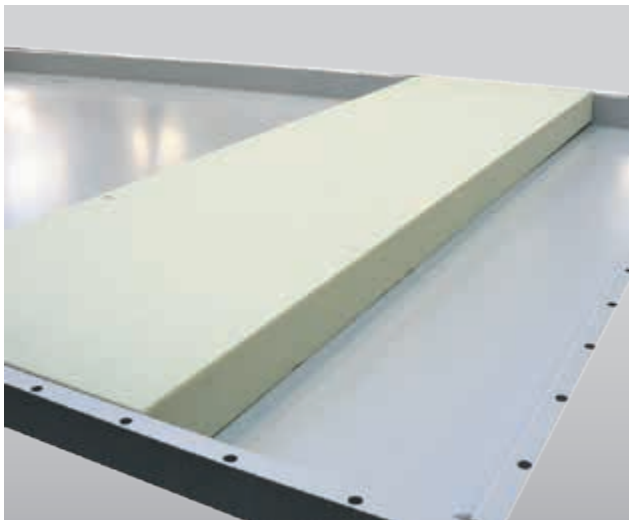
4.5 Insulation

IPN plates are installed in between to ensure strength even if the insulation type is selected as glass wool or rock wool.

Roof and side panels
Glass wool (Standard)
Mineral wool (Optional)



Floor panel
IPN (Isophenic)
Rock wool (Optional)



Floor is made of IPN material that allows the possibility to walk on it.

No	Material	Fire class (EN 13501-1)	(EN 13501-1) (W/mK) EN 12667	Density (kg/m^3)
1	IPN	B-s2-d0	0,024	30 - 40
2	Glass wool	A1	0,035	23
3	Rock wool	A1	0,035	70

4.6 Screws

Interior Unit

Painted galvanized screw

Exterior Unit

Stainless steel screw

4.7 Sealing Strips

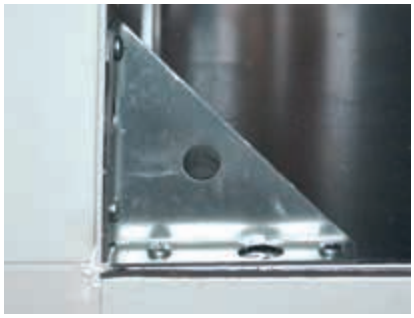
Sealing strips are applied in panel connection places to minimize leakage through casing in all internal and external air handling units as standard.

Sealing strips

4.8 Connection Supports

39HQ air handling units are manufactured as cells as per their dimensions and then they may be assembled in the field. Cells are connected from the inside on the field and no connection parts are seen from the outside in terms of aesthetics.
As per the size of the air handling unit and the area of the sectioning, connection parts may be triangular from the corners or rectangular from the sides.
Connection strips are applied on the internal surface of air handling unit for extra sealing after assembly.
It is air-tight and maintains it's thermal performance because of it's connection method; and thus the surface of air handling unit maintains it's smoothness.

Connection strip

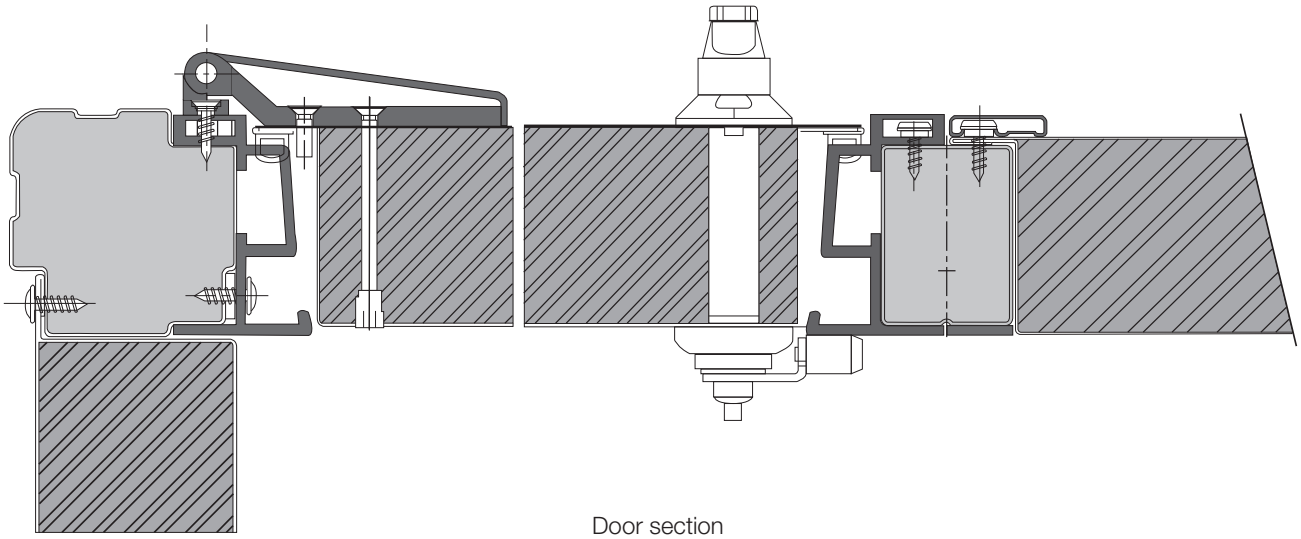


Triangular connection

Rectangular connection

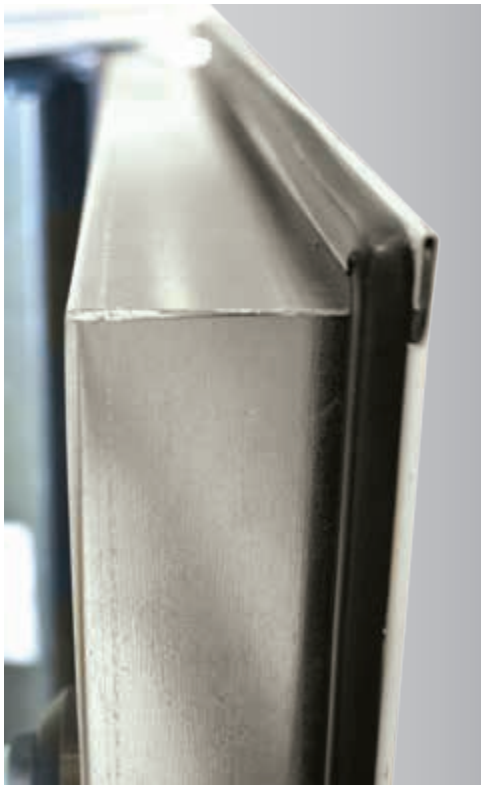
4.9 Doors

Doors and intervention covers are important for accessing the components in case of any installation, service, maintenance or repair work for any machine or air conditioning equipment. However, amongst all air conditioning devices, accessibility is most important for air handling units in order to make an intervention inside the device. The reasons for this are the requirement for assembling the modules in the field as it is built as modular; the fact that each component is in different cells and that access to any component is very important in cases of maintenance and fault. Because it shall be easy to intervene for the maintenance, cleaning and repair of all components as it conditions the air which is the most important requirement for human health. Both in EN 13053 and DIN 1946/4 standards, one of the most emphasized points for hygiene in air handling units is the possibility of easy access to each component in case of maintenance, cleaning and faults.
All doors in the 39HQ air handling units are composed of sandwich panels with a thickness of 60 mm as any other panel in the unit. Thus the specifications of the body does not change whether a door or a cover is used.



Door section

Special gaskets are used to provide air-tightness on door cells.



Door gasket

Interior surface of the air handling unit is completely smooth and there are no thresholds on the doors, thus it is possible to clean the air handling unit by sweeping potential dirt inside the unit easily from the doors to outside.

No thresholds on the doors

Hinged or hatch doors may be installed as optional on the cells where air handling unit components are available.

Hinged door

Hatch door

Inside joint connection kit

Unlocking mechanism from the inside (internal handle)

Door handles may be selected as T-handle, L-handle, L-handle lockable with double bit, L-handle lockable with key.

T-handle

L-handle

L-handle, lockable, double-bit (8MM)

L-handle, lockable, key (IL333)

Lock cylinder

- Features that provide safety and ease such as connection kits with inner joints for high doors,
- high pressure protection for positive pressure cells,
- door handles that allow opening the door from the inside are amongst the other functions of 39HQ air handling units.

Lock mechanism

Door hinge

Locking

Door key

Door high pressure protection (pressure guard)

5 Exterior Installation

5. EXTERIOR INSTALLATION

Following features are provided as standard for air handling units that shall be installed outdoors.

- Water- and UV-resistant roof material that is applied on the air handling unit with a special heat treatment
- Application of extra silicon for better sealing
- Stainless steel type screws with rubber gasket

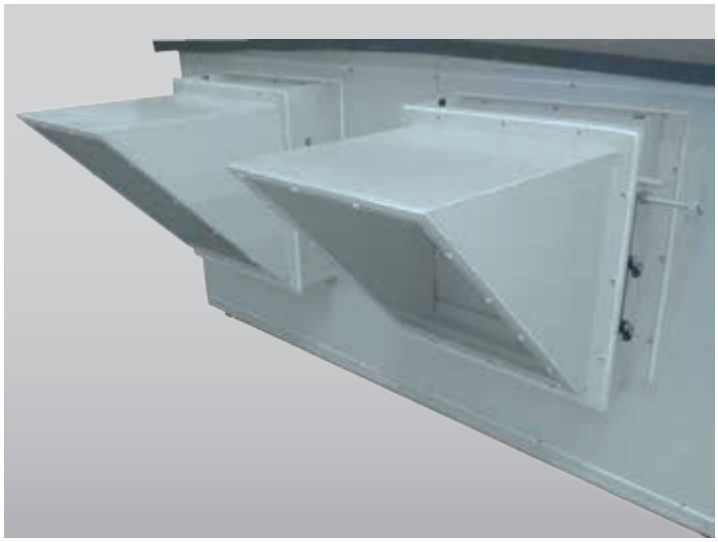
Roof application is delivered as flat as standard; however, it may be delivered as sloped as an option if required.

Flat roof coating

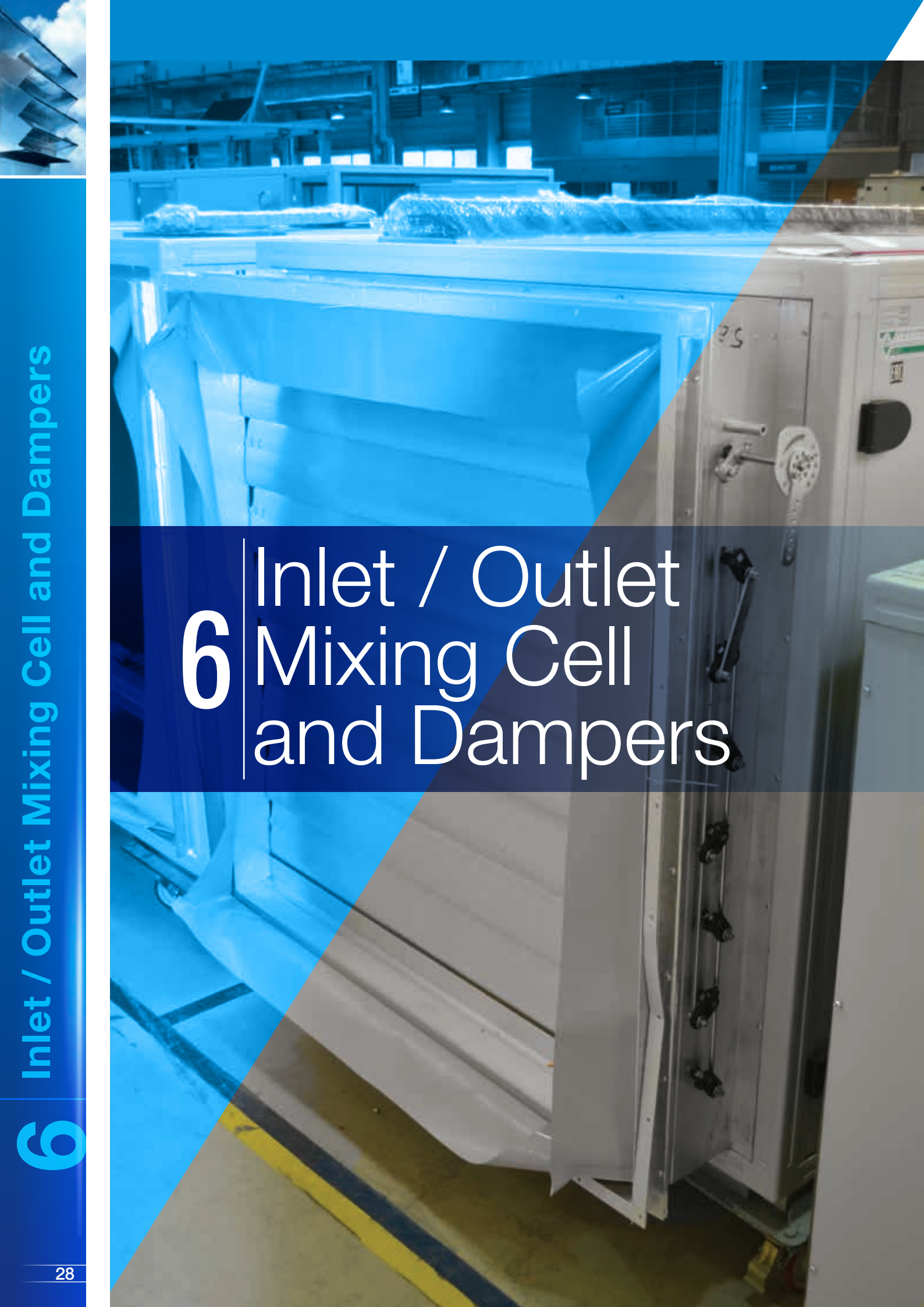
Sloped roof coating

Louvres or cowls may be provided as an option on the fresh air intake or exhaust air outlet cells for air handling units that shall be installed outdoors.

Louvre



Cowl



6 Inlet / Outlet Mixing Cell and Dampers

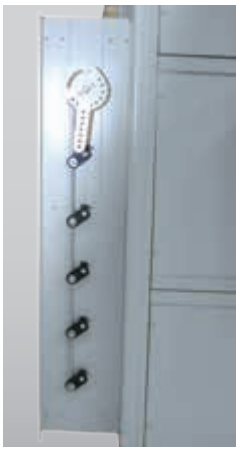
6. INLET / OUTLET MIXING CELL AND DAMPERS

Dampers are used when it is required to adjust the flow rate of air or when the air flow is required to be turned off completely. Rubber gaskets are used to provide sealing on damper blade ends.
It is possible make any selection for inlet and outlet cells with the flexibility as specified below.

- Opening:
  - » Front connection (full face, top face, mid face, bottom face)
  - » Right or left side connection (full opening, half opening)
  - » Top connection (full opening, half opening)
  - » Bottom connection (full opening, half opening)
- Material: Galvanized or aluminium damper
- Damper blades: Parallel or opposite blade
- Damper position: Inside or outside the unit
- In accordance with standard EN 13053, the velocity on the damper shall not exceed 8 m/s (excluding circulation and bypass dampers).
- Dampers may be manufactured as painted as an option.

Opposite blade damper with full face opening from front

Parallel blade damper inside the air handling unit



Damper movement mechanism

Damper motor inside and outside of the unit

- Flexible connection on the circulation air side are provided as standard on double deck units. In the inlet/outlet cells, flexible connections may be selected optionally as single-walled, single-walled with M0 non-combustibility class, double-walled and acoustic. Flexible connections are delivered with counter-flanges if they are selected. Standard flexible connection is made of polyester material with M1 non-combustibility class as per CSTB standard.
- Mixing cells are classified as cells with two dampers or three dampers. Mixing cells with two dampers are used when fresh air is mixed with return air. Mixing cells with three dampers have a return fan and while some of return air mixed with fresh air, remaining air is extracted with the third damper.
- Damper blade shafts are connected with a common drive system and therefore they move together. It is suitable for both manual and motor control. When coupling rod option is selected in mixing cells, a mechanism that allows linear operation of both dampers is provided.

Inlet / Outlet cell damper flexible connection (with counter - flange)

Coupling rod for dampers

Flexible connection for double deck unit mixing cell circulation damper

Mixing cell with two dampers

7 Filters

7. FILTERS

- Filters are divided into categories as per their particle permeabilities, material structures, intended uses and their placing inside the air handling units.
- Filters are inserted to the air handling units either by sliding from the side by a door or sliding from the front.

Side withdrawable panel filter

Side withdrawable combined filter (panel + bag)

Front withdrawable bag filter

Classification of coarse, medium and fine filters as per EN 779:2012

Filter Group	Class	Final Pressure drop (Pa)	Average Arrestance (A_m) of synthetic dust	Average Efficiency (E_m) of 0,4 ηm particles (%)	Minimum Efficiency of 0,4 ηm particles (%)
Coarse	61	250	$50 \le A_m < 65$	-	-
	62	250	$65 \le A_m < 80$	-	-
	63	250	$80 \le A_m < 90$	-	-
	64	250	$90 \le A_m$	-	-
Medium	M5	450	-	$40 \le E_m < 60$	-
	M6	450	-	$60 \le E_m < 80$	-
Fine	F7	450	-	$80 \le E_m < 90$	35
	F8	450	-	$90 \le E_m < 95$	55
	F9	450	-	$95 \le E_m$	70

Average Arrestance (A_m); Average Efficiency (E_m);
Average efficiency at 0,4ηm

Final pressure drop Minimum Efficiency of 0,4 ηm

Classification of high efficiency filters for clean rooms as per EN 1822

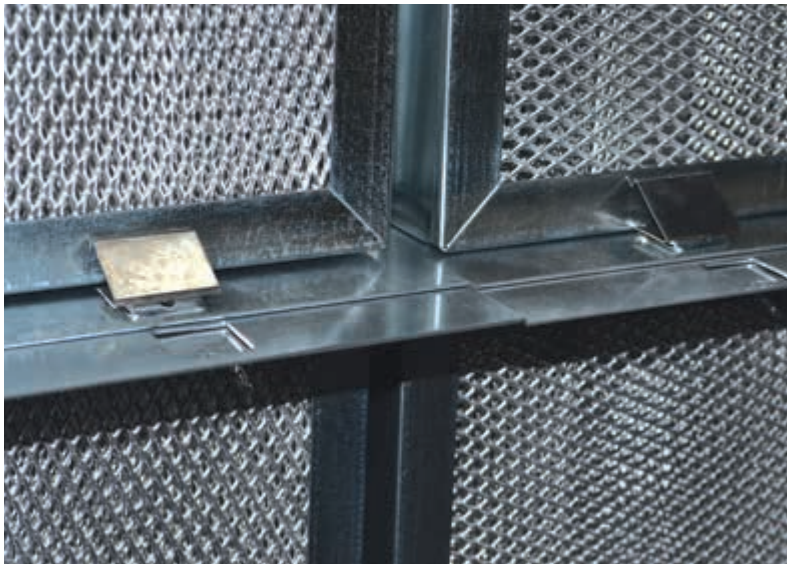
Filter Group	Class	MPPS Integral Values		MPPS Local Values	
		Efficiency (%)	Penetration (%)	Efficiency (%)	Penetration (%)
EPA	E10	85	15	-	-
	E11	95	5	-	-
	E12	99.5	0.5	-	-
	H13	99.95	0.05	99.75	0.25
HEPA	H14	99,995	0.005	99,975	0.025
	U15	999,995	0.0005	999,975	0.0025
ULPA	U16	9,999,995	0.00005	9,999,975	0.00025
	U17	99,999,995	0.000005	999,999	0.0001

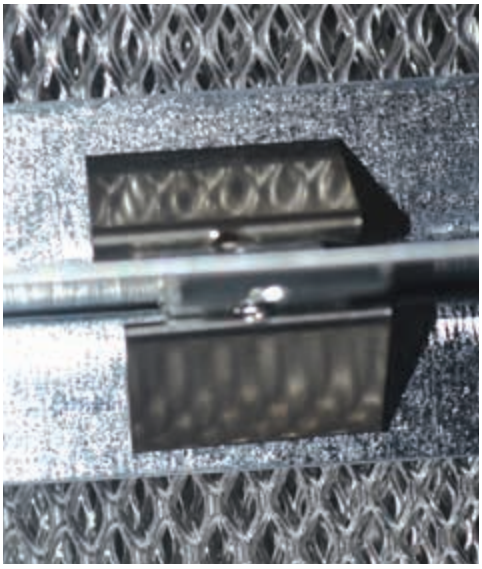
MMPS: Most Penetrating Particle Size **Efficiency**: Efficiency, **Penetration**: Penetration

Another filter type used for special applications in air handling units is the active carbon filters. Active carbon filters entrap and retain gas molecules. Surface of the active carbon filters consists of millions of small pores. Many odorous and poisonous gases are trapped by these pores.

Active carbon filter

- Nuclear filters used in shelter air handling units and electrostatic filters used for absorbing the flue gases are other special filter applications used in air handling units.
- Another important issue for filters used in air handling units beside their permeability is their installation to the inner surface of the air handling unit. If proper sealing is not provided between the filter frame and inner surface of the air handling unit, air shall penetrate through the holes it can find and prevent the filter from operating efficiently. On this issue, there is a filter bypass leakage classification as per EN 1886 that measures the efficiency of the installation and that is also mentioned in the standards section.





Tightening clip for front withdrawable filter

8 Heat Recovery Systems

8. HEAT RECOVERY SYSTEMS

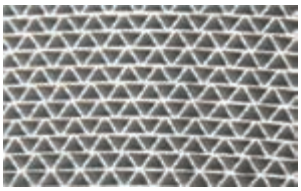
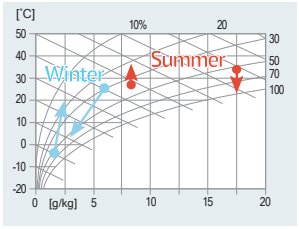
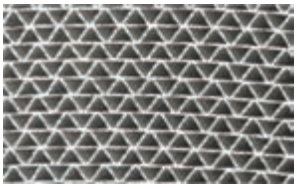
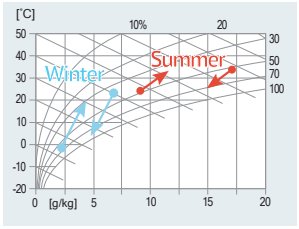
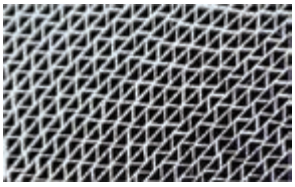
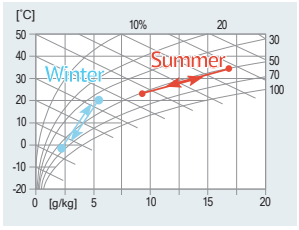
- Heat recovery systems are used for pre-conditioning the fresh air by using the energy of the exhaust air (by reducing the enthalpy of fresh air in summer time and increasing the enthalpy in winter time). Air thus pre-conditioned shall required less heating/cooling for the required supplying temperature and therefore, energy recovery shall be achieved.
- There are many parameters such as initial investment cost, application type, sealing, efficiency, pressure drop, conditions of interior and exterior air, fresh air ratio etc. for the selection of heat recovery type. Heat recovery systems in air handling units are classified into 4 classes.

1. Wheel
2. Plate
3. Round Around
4. Heat Pipe

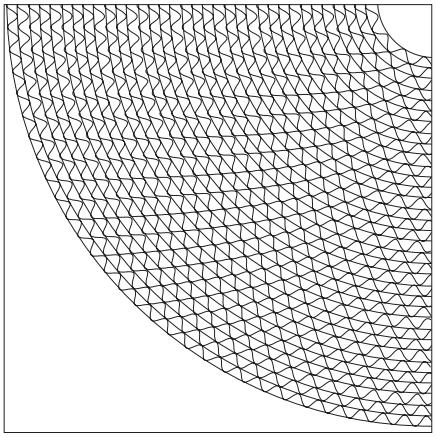
8.1. Wheel Type Heat Recovery

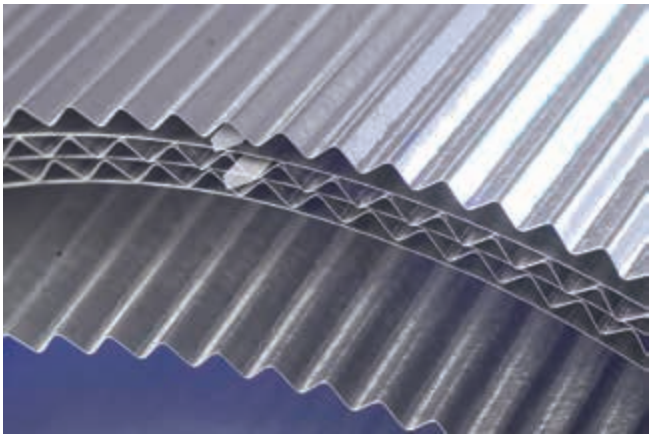
Wheel type heat recovery is also classified into three classes as per the heat transfer surface of the heat recovery wheel.

- Condensation
- Enthalpic
- Sorption

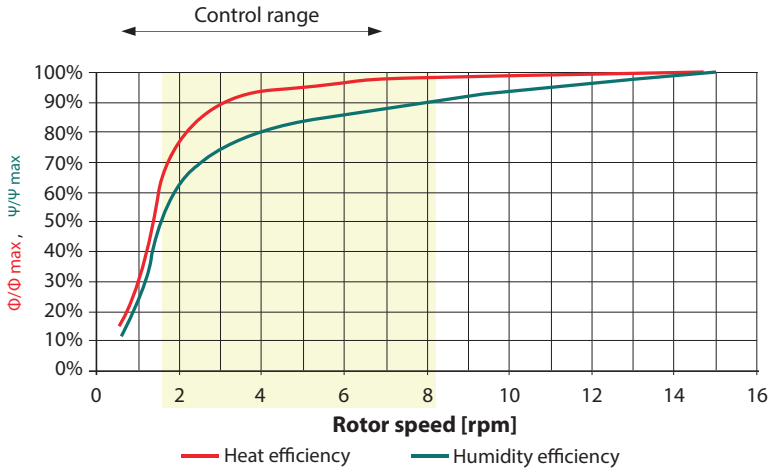
Wheel type	Heat transfer surface	Psychometry	Heat transfer	Application type
Condensation			Only sensible, latent heat transfer in case of condensation	On systems without humidification and cooling
Enthalpic			Sensible and limited latent heat transfer	On systems with humidification and without cooling
Sorption			Sensible and latent heat transfer (through all seasons)	On systems with humidification and cooling

A gap on both upper and lower sides of the wheel shall be provided in wheel type heat recovery systems for installation and intervention when required and access to these cells shall be available by a door.
Wheel type heat recovery systems are the most efficient ones. There is always air mixture, even if very little, between fresh and exhaust air in wheel type heat recovety systems. Although it is possible to reduce the amount of this air mixture using a purge sector but it cannot be completely removed any way.





Wheel heat transfer geometry

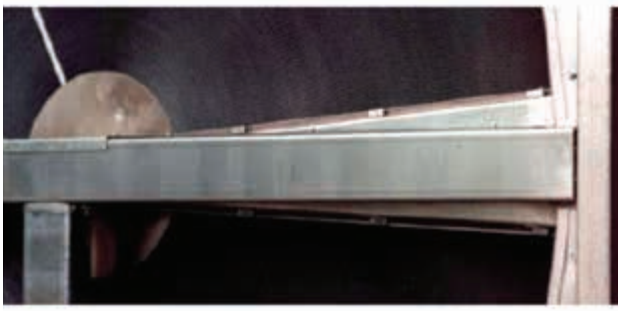


Dependence of the efficiency on the rotor speed

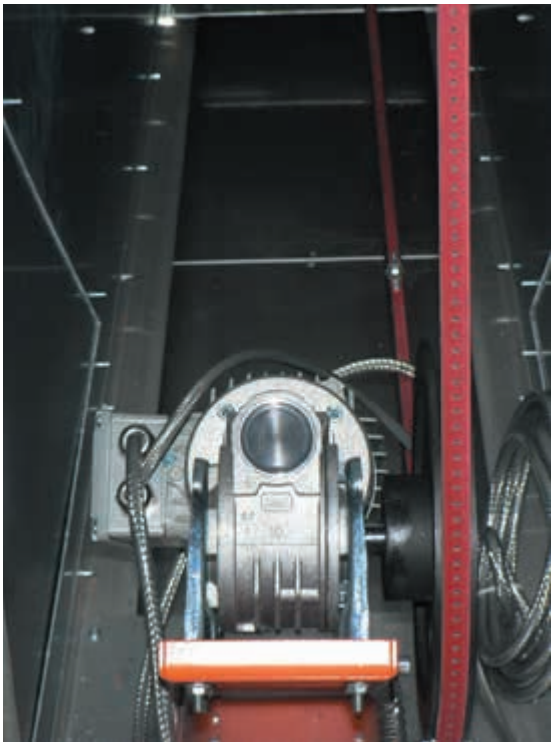
Wheel type heat recovery

Wheel inspection port

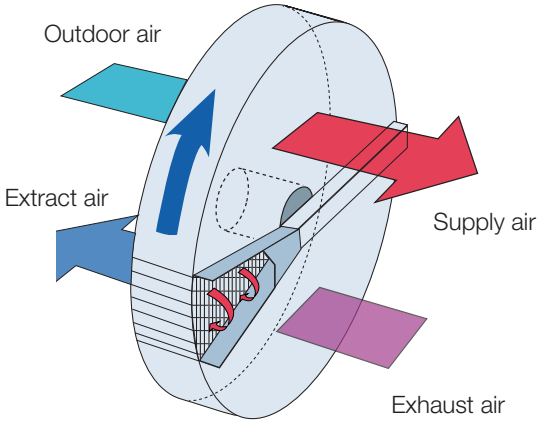
Heat wheel with bypass dampers



Rotor purging sector



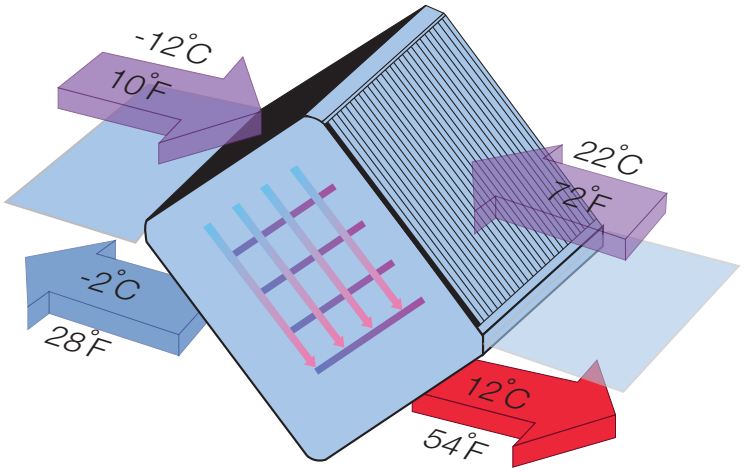
Wheel motor



Rotor controller

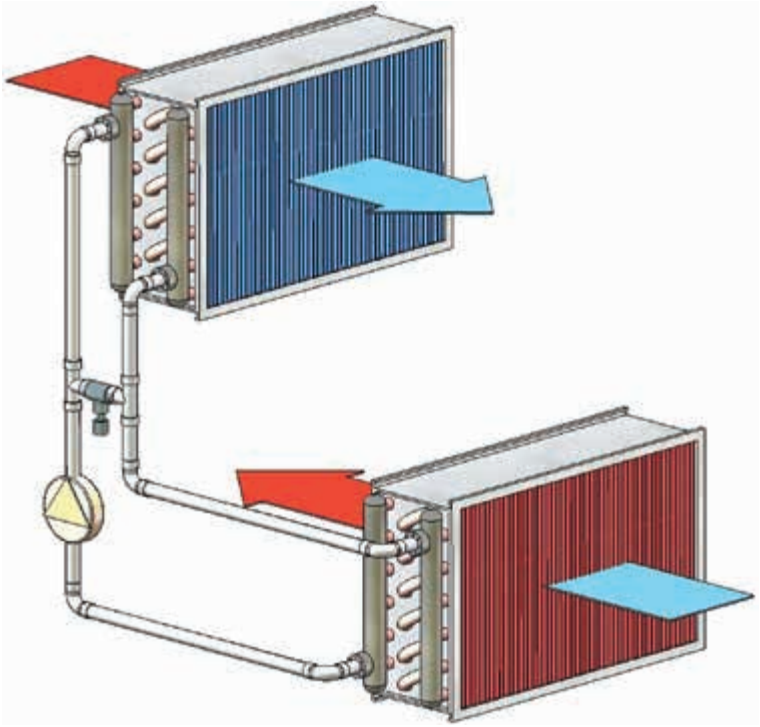
8.2. Plate Type Heat Recovery Systems

Exhaust and fresh air never mix with each other in plate type heat recovery systems. These systems may be delivered with bypass dampers as an option. Plate type heat recovery cell is equipped with a tray that covers whole it's floor, inside of whole pan is covered with a special epoxy material and an outlet is provided from the bottom for draining. Although cross flow is used usually for plate type systems, high efficiency systems with counter flow may also be used for systems with lower flow rate.
Multiple air ducts created by the fins allow heat transfer, thus heat recovery, between the extract air and intake air. Heat transfer occurs between these two airs, there is no humidity transfer. Extract air and intake air passes crosswise through the exchanger. The fact that the positions of intake air and extract air are close to each other, that these airs mix with each other at a low rate, and that it does not have a moving part are typical features of this system.



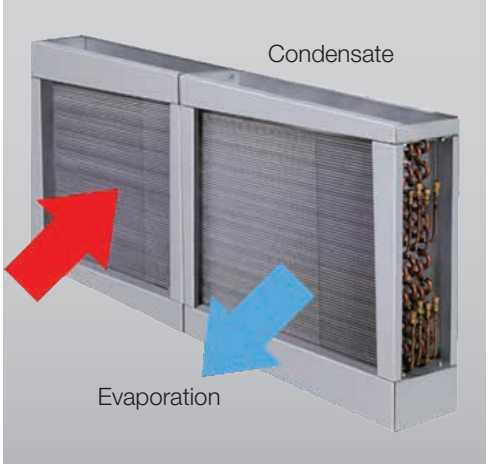
8.3. Round Around Coil Type Heat Recovery Systems

Initial investment cost and efficiency of round around coil type heat recovery systems are lower than the other systems. As it is composed of completely separated coils, it shall not be placed inside the same cell or on top of each other. Another advantage is that the exhaust and the fresh air do not mix.
It provides heat transfer, thus heat recovery, between the exhaust air and fresh air with two or more coils, a circulation pump and a control system. It is a heat exchanger of the sensible type. Heat transfer occurs between two airs, there is no humidity transfer. The positions of fresh air and exhaust air may be away from each other; the fact that these airs do not mix with each other and that it does not have a moving part are typical features of this system.



8.4. Heat Pipe Type Heat Recovery Systems

Heat pipe type heat recovery systems are divided into two as horizontal/vertical type heat pipe and horse shoe heat pipe type heat recovery systems. Heat pipe systems usually include refrigerant instead of water inside the pipes as similar to the coil type systems.

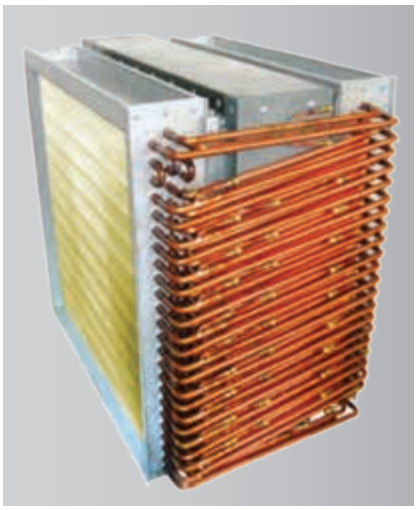


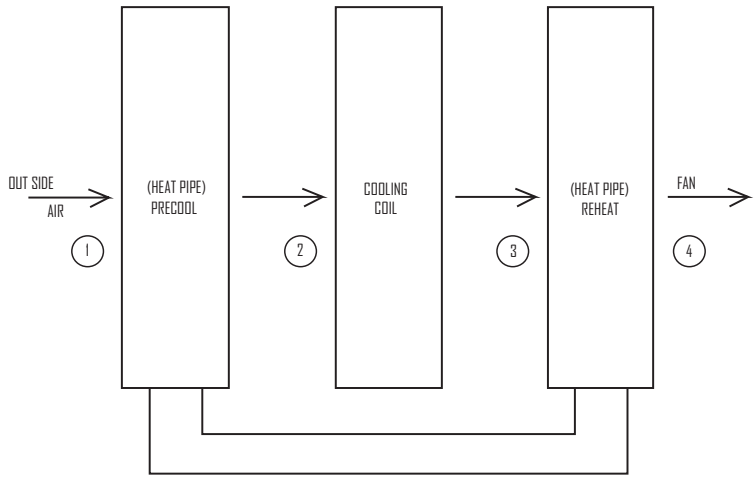
8.4.1. Horizontal/Vertical Heat Pipe Type Heat Recovery

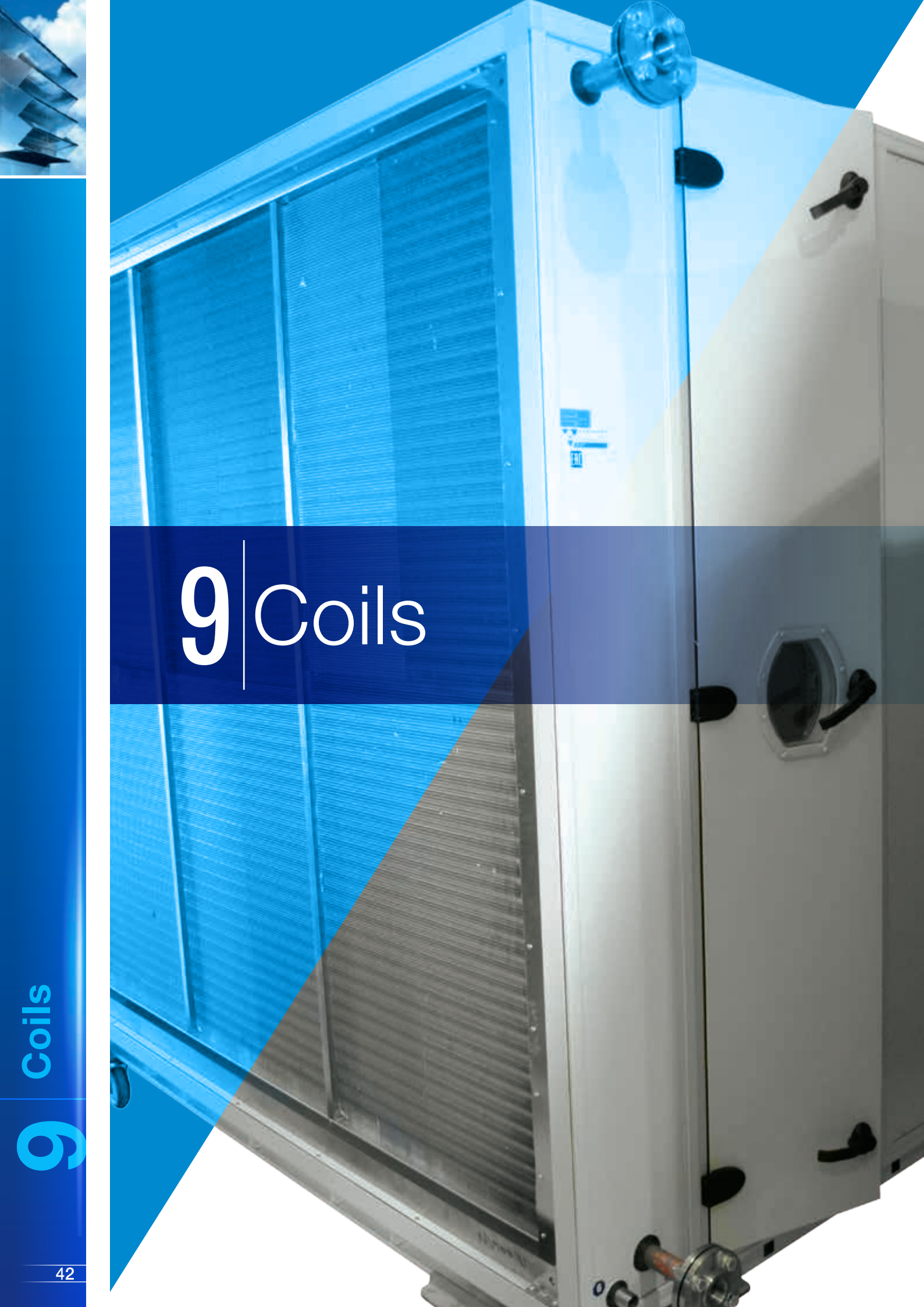
This is a typical pipe / fin exchanger that is composed of two sections that operate as a condenser and an evaporator and that has proper amount of refrigerant inside. Air, of which it's heat shall be extracted, is taken through the evaporator side and it's heat is transferred to the refrigerant. Vaporized refrigerant transfers it's heat to the cold air passing outside of the exchanger on the condenser which is placed higher, and thus heat is transferred to the cold air and heat recovery is ensured. It is of the sensible type, heat transfer occurs between two airs, there is no humidity transfer.

8.4.2. Horse Shoe Heat Pipe Type Heat Recovery

Horse shoe heat pipe type heat recovery exchangers are heat pipe types that are used for dehumidification operations in air conditioning systems. It performs pre-cooling of the air that shall be dehumidified and and reheating of this air with the energy taken. Thus, energy consumption is not required for both processes.







9 Coils

9. COILS

Heat exchangers used for heating, cooling and/or dehumidifying the air in HVAC systems are usually of the finned pipe type and they are called as coils. Air to be conditioned that flows outside of the finned pipes contact the fin surface. A heating or cooling fluid is circulated inside the pipes. Coils may be hot water coils, cold water coils, DX coils and vapor coils.
As Alarko Carrier, we manufacture the water and DX coils used in our air handling units and rooftop units in our own coil workshop. Besides that, coils can be supplied from other coil manufacturers based on business.
All water type coils manufactured are tested with the 30 bar pressurized air test in the water pool inside the factory. Test pressure of DX coils vary as per refrigerant type.

Coil production workshop

For all Water or DX Coil Types,

- it is possible to select freezing protection and measuring nipple options.
- During the installation of coils inside the air handling unit, they are surrounded by bypass plates to prevent bypass of air.
- Pipe connection holes on the pipe outlets of the coils are closed with air-tight gaskets.

Frost protection and thermostat

For the interior unit

For the exterior unit

Measuring nipples

For all Water or DX Coil Types,

Optimum coil is selected by offering the user information such as pipe connection direction, pipe and fin material, pipe thickness, fin thickness and interval, coil frame material etc.

Pipe material;
Copper or electro-tinned copper

Fin material
Aluminium, coated aluminium (polyester coated gold-fin) or copper (electro-tinned copper may also be selected if it is a water type coil)

Coil frame material
It is possible to select steel, and 304 or 316 stainless steel.

DX (Direct Expansion) Coils

DX coils are used inside the air handling unit as indoor unit of the cooling circuit and in air handling units specified as packed system as the outdoor unit. As the usage of VRF units have increased in the recent years, number of applications where VRF outdoor unit and indoor unit with DX coil are used inside the air handling unit are increased.
Pipes of DX coils are taken out of the air handling unit as standard in the factory and the holes opened are sealed. Thus, the installer on the field does not have to drill a hole on the body of air handling unit.
Dx coil collectors are also made of copper.
DX coil inlets are manufactured with distributors and with return connection from the top and intake connection from the bottom.

Positioning of coils inside the air handling units and the velocity of air are important criteria. As more air passes through the coil when the air velocity is increased, it is possible that the capacity of the coil may be increased but the efficiency of the coil shall be decreased, pressure drop shall be increased and the possibility of drifting water to the other components with the air for condensed coils. Therefore, air velocity shall not be selected over the velocity required by the project. Also, for reasons of hygiene, DX coils and cooling coils shall not be placed just before cells such as filters and silencers. Droplet eliminators made of plastic or galvanized steel may be selected to reduce the possibility of drifting of water with the air after the cold water and DX coils. Plastic droplet eliminator is made of polypropylene material that is resistant up to 120 °C.
Also, DX and cooling coil selections allow selection from software as per wet or dry operation pressure drops. Dry and wet selections affect the SFPv and SFPe values of specific fan power.
There is sloped drain pan made of stainless steel that shall also completely cover the droplet eliminator section under the DX and water type coil cells. Drain pan can be selected as 304 or 316 type stainless steel. Syphon for draining the water collected in the drain pan is delivered as standard with the air handling unit. Syphon provided could be used for both positive and negative cells.

Droplet eliminator

Sloped drain pan

Syphon

Water Type Coils

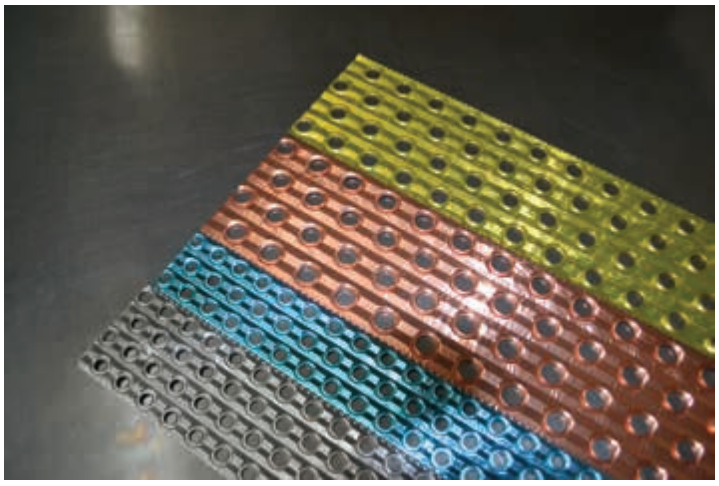
- It is possible to use water with ethylene or propylene glycol with the percentage specified in the selection software besides normal water in water type coils.
- Water type coil collectors may be selected as copper or hot dipped steel. Steel collectors are painted with powder paint after the coil manufacturing and testing stages.
- Pipe connections are threaded as standard. They may be provided without threads, with flanges or with counter-flanges when required.
- Drainage outlet on the bottom and air purger on the top are provided as standard on water type coils.
- Water type coils are counterflow type and they are manufactured so that water inlets are from the bottom and returns are from the top.

Collector

Flange

Counter-flange

Withdrawable frost thermostat option is available on hot water coils.



Aluminium, blue-fin (polyurethane coated), copper, gold-fin (polyester coated) fins

Air vent and drain plug

10 Electric Heater

10. ELECTRIC HEATERS

- Body of the electric heaters are made of Aluzinc coated steel (AZ 185) with corrosion class of C4 and their heaters are made of stainless steel.
- Protection class is IP43 as standard. It may be delivered as IP55 or IP65 as an option.
- Temperature thermostats with automatic reset (75 °C) and with manual reset (120 °C) are available on these components as standard.
- These are delivered as multi-stage controlled as standard, however, they may also be delivered with proportional control as an option. Air flow switch option is also available.
- Cable connection holes are drilled on the hole for easy power connection on the field and hatch door is provided as standard.
- Terminal box including wiring connection details is installed on the air handling unit.
- Cable glands are provided with proper combination for installation from upwards or downwards.
- Heaters are distributed equally inside the casing of air handling unit.

11 Humidifiers

11. HUMIDIFIERS

Although humidifiers are classified with many different methods in different literature, they are categorized as follows by their manufacturing methods as per EN 13053 standard:

11.1 Spray Type Humidifiers:

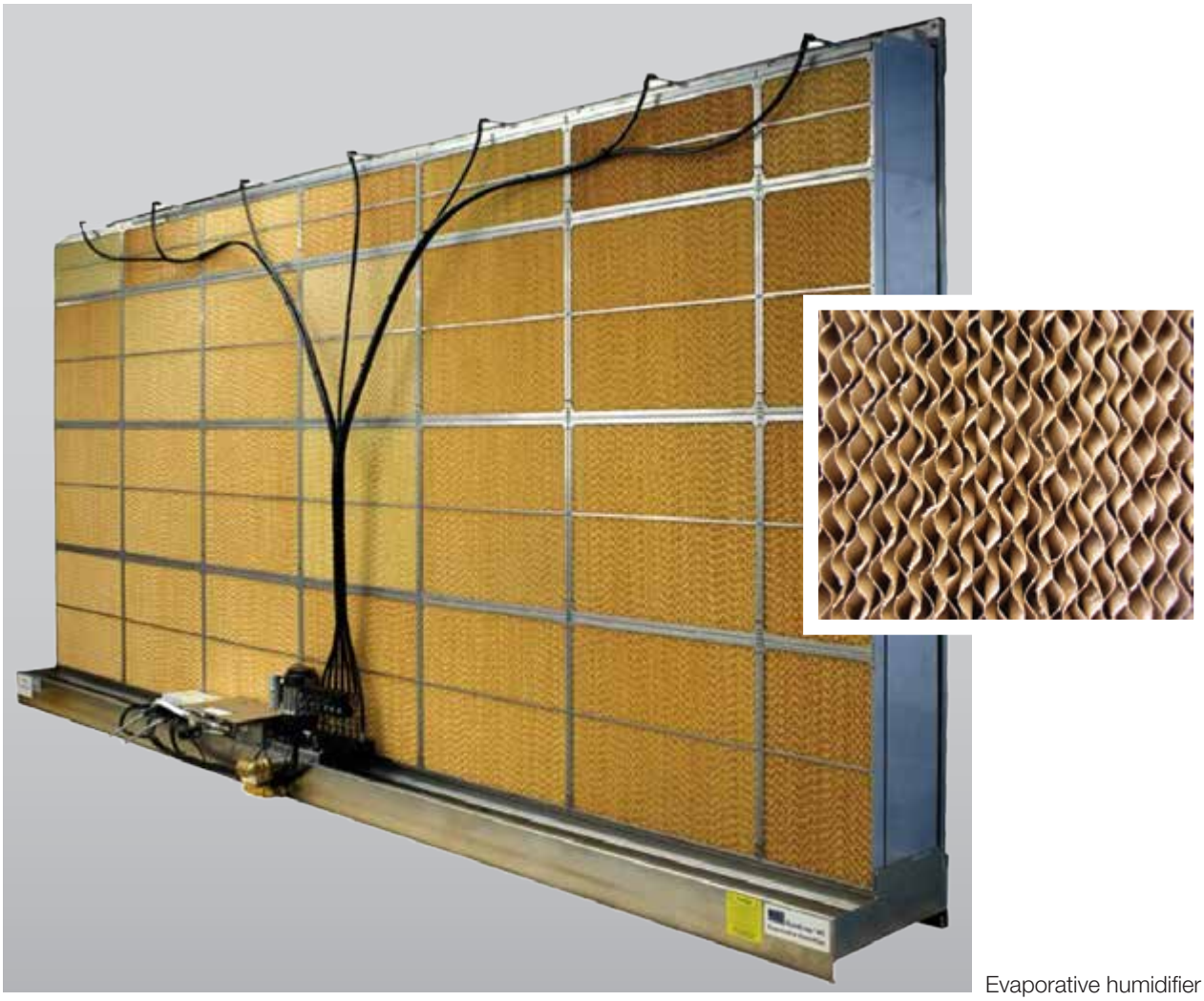
11.1.1 Air Washers
11.1.2 Ultrasonic Humidifiers
11.1.3 High Pressure Humidifiers

11.2 Evaporative Humidifiers:

11.3 Steam Humidifiers:

Humidifier is one of the most important and critical components of the air handling unit. It is very important that length of humidifier section is sized properly to prevent drift of water drops to the components after the humidifier. Also, the drain pan and the draining of the water shall be considered with care as it is cell that contains water and steam.
Any of these different types may be applied inside the air handling unit according to the requirements and sensitivity of the system during the project design stage.
304 type stainless steel drain pan is applied in the humidifiers in 39HQ air handling units. 316 type stainless steel drain pan can also be selected as an option.

Steam humidifiers that may be procured from different manufacturers are installed inside the unit with multiple distribution nozzles.
Pipe connections may be performed from the right or left as requested.



Evaporative humidifier

Spray Type Humidifier

High Pressure Humidifiers

Water / Pressurized Air

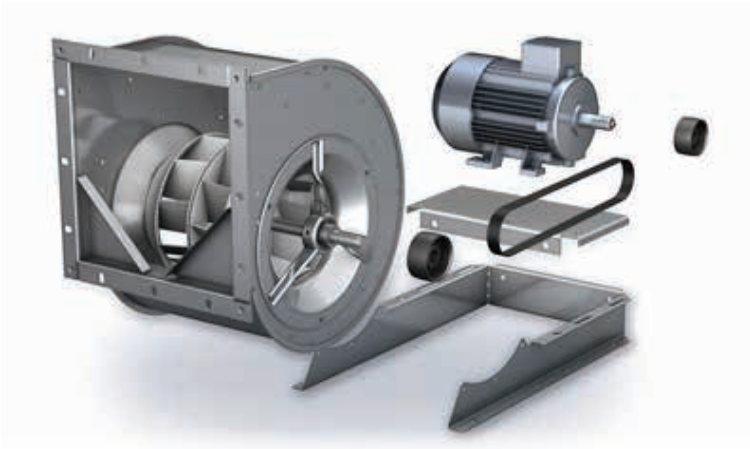
Hybrid

Steam Humidifier application inside the air handling unit

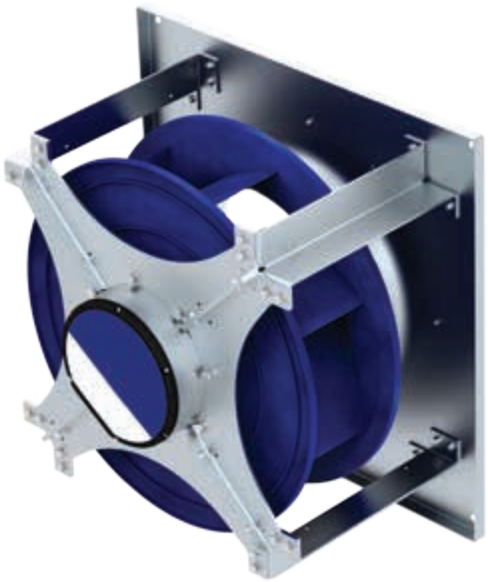
12 Fans

12. FANS

Fans used for pressurizing the supply or return/exhaust air in the air handling units may be of many classification groups as per the application or requirement. (with forward and backward curved blades, belt-driven or direct-driven (plug, EC etc..)



Belt-driven fans



EC fans

Plug fans

Air Velocity (m/s)

Average air velocities in the fan body are classified below as per EN 13053 standard.

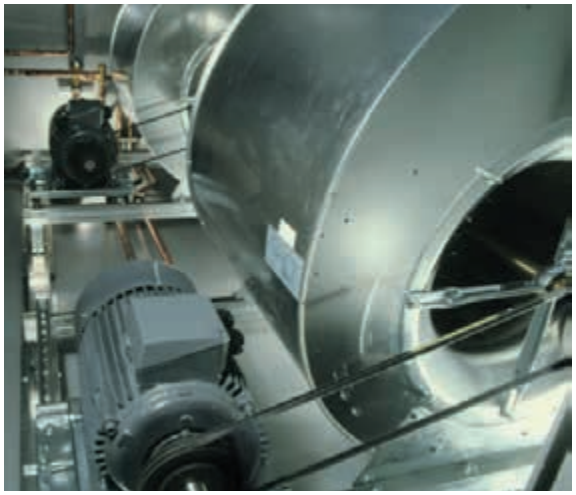
Class	Air velocity m/s
Class V1	Maximum 1.6
Class V2	> 1.6 to 1.8
Class V3	> 1.8 to 2.0
Class V4	> 2.0 to 2.2
Class V5	> 2.2 to 2.5
Class V6	> 2.5 to 2.8
Class V7	> 2.8 to 3.2
Class V8	> 3.2 to 3.6
Class V9	> 3.6

System Effect

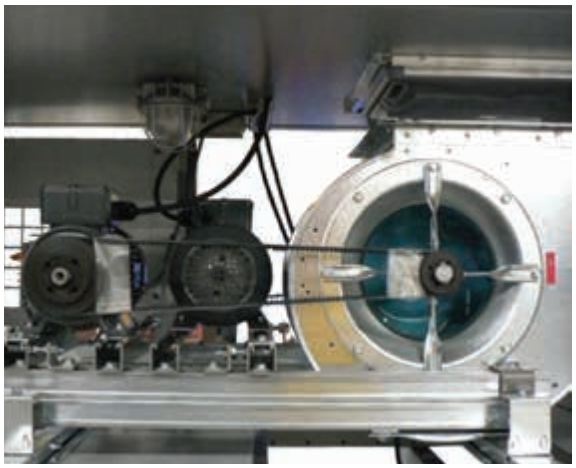
Fan selection is performed by calculating the pressure losses due to system effect in the Airovision Builder air handling unit selection software.

Fan Data		
Total air volume	6.00	m^3/s
Speed	1353	rpm
Maximum speed	2000	rpm
System effect	168	Pa
Total static pressure	459	Pa
Dynamic pressure	84	Pa
Total pressure	543	Pa

Minimum classes for fan motors shall be IE2 for efficiency, IP 55 for insulation, and F for protection. Higher classes can be delivered as option.
Fan motor can be installed outside of the air flow for fan motor connection direction, double fans, standby motor or special applications.



Dual fan



Run & standby motor

Dual fan and run & standby motor

Accessories

Fan cells have doors as standard. Besides that, accessories such as door size, connection direction, sight glass, llight armature, light switch, pressure gauge, pressure switch and measuring nipples may also be added. Some other accessories used in fan cells are shown below.

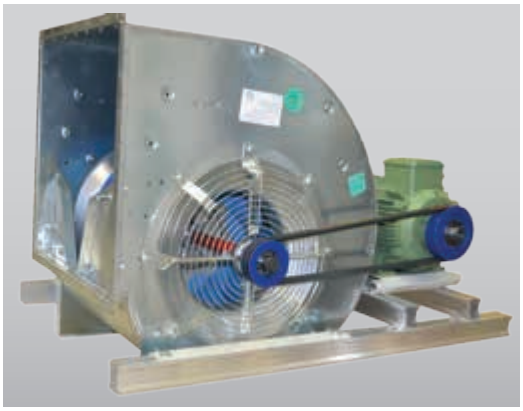
Drain plug

Inspection hatch

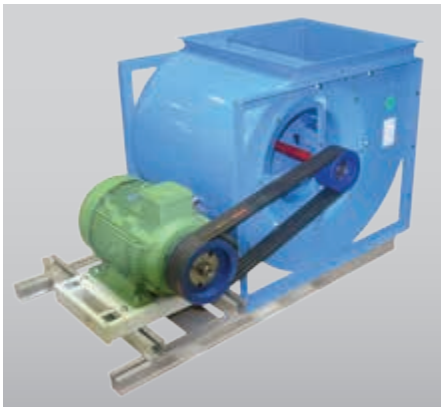
Inlet cone measuring points

Drive guard (wire mesh)

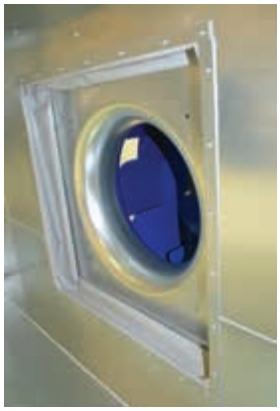
Drive guard (closed)



Fan inlet guard



Epoxy painted fan



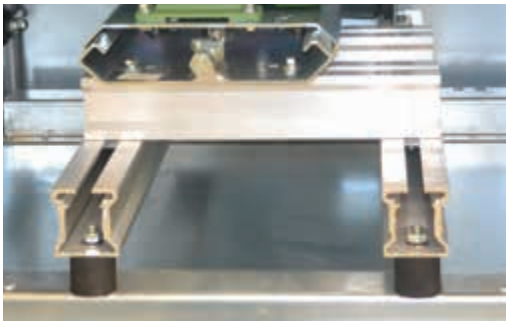
M0 fire class fan flexible connection

Inverter* (IP 20 or IP 55)

Fan emergency stop button

Isolator, fan

IPN (isophenic) type insulation is used as standard on the floor panel of air handling unit to provide high mechanical strength. Vibration dampening types of fans in the air handling units are shown below. In order to dampen the vibration on the fan pedestals, rubber mounts are used for fans with a fan rotor diameter under 280 mm, and spring dampeners are used for fans with a fan rotor diameter over 280 mm.



Rubber anti vibration mounts

Spring anti vibration mounts

Belt-driven centrifugal fans after assembling the fan and the motor parts in the factory, electrical, speed control, belt alignment, vibration and balancing tests are performed for each fan and fans are installed inside the air handling unit after the quality control tests.

A warning label is available outside of the fan cell and an informative label is available inside the fan cell.

*Delivered inside the unit with it's package so that it shall be installed in the field.

13 Diffuser

13. DIFFUSER

Diffusers are used for smoothening the turbulanced flow after the radial fan cells.
They would be delivered as removable as an option.
They are manufactured from galvanized steel as standard. It may be delivered as painted galvanized steel or 316 type stainless steel as an option.

14 Silencer

14. SILENCER

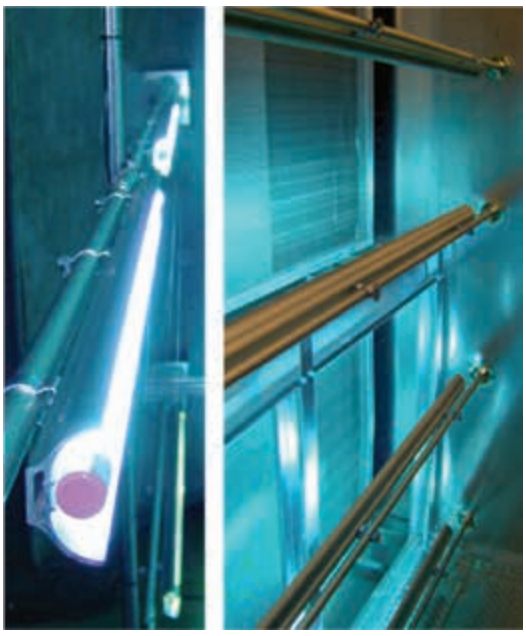
Noise absorption values of the silencer are calculated as per ISO 7235.
Silencer cartridges are placed inside the air handling unit with intervals shaped as rectangular prisms and so that their installation shall prevent deformation and confirm with noise absorption principles.
Cartridges are made of galvanized steel, noise absorbing sections are made of inorganic, mineral wool material that meets the flame spread requirements specified in DIN 4102 Class A-1. Surfaces may be manufactured with perforated plates as an option to increase the noise absorption.

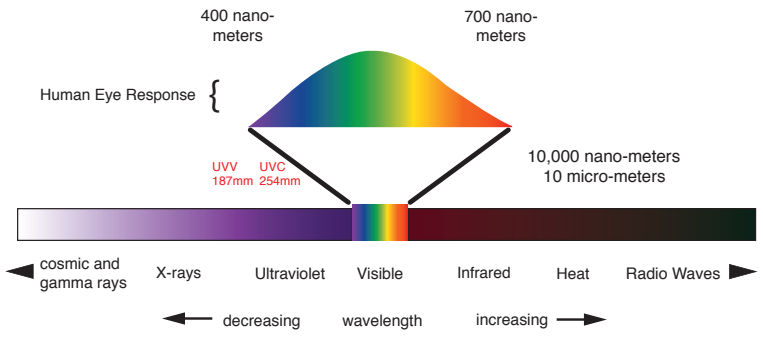
15 UVC Lamp

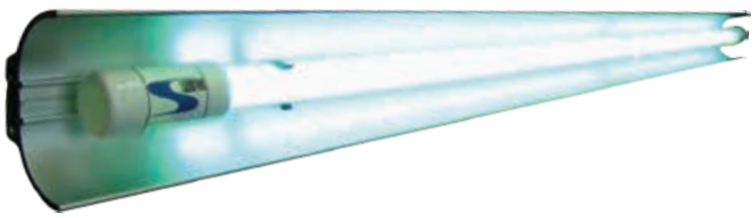
15. UVC LAMP

UVC lamps are used to kill the microorganisms inside the air handling units. «UV» defines whole «UltraViolet» wavelength spectrum. And «UVC» term defines the short wavelength which is the most lethal for germs within UV rays. (wavelength of approx. 250 nanometres)

These are not the equivalent of filters as they do not have a retaining function as filters. Therefore, they are recommended to be used together with the filter systems. Particles inside the air trapped by the filters, but very small microorganisms and the mold that threaten human health and that cannot be retained by the filters are killed within a period of time by damaging their DNAs with UVC lamps. These lamps also reduce the requirement for general maintenance and cleaning of units by preventing spreading of bacteria, mold, spores and odours in the coil area. 19 mm UVC quartz lamps with high density are used.







16 Other Accessories

16. OTHER ACCESSORIES

Light armature

IP54

IP55

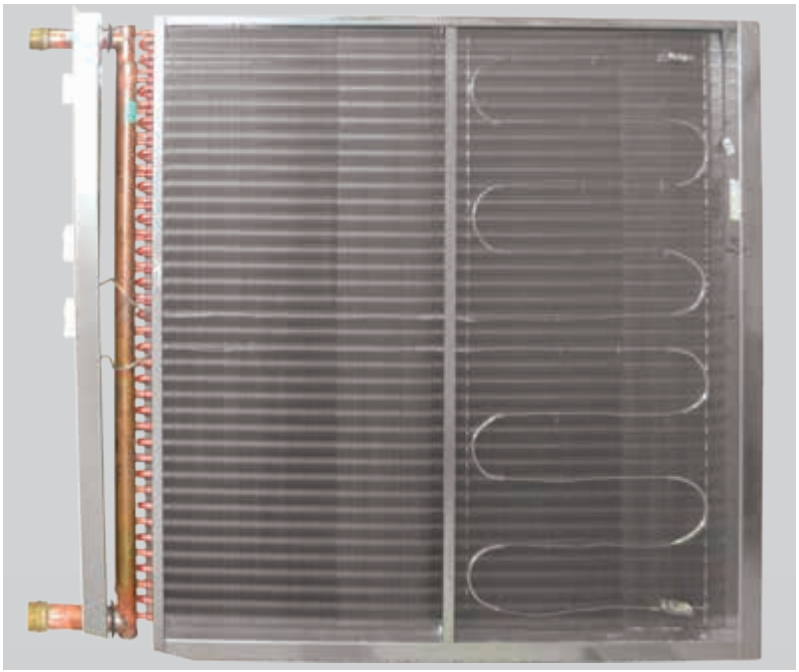
Light switch

Measuring nipples

Sight glass

Pressure gauge

Pressure switch



Frost protection and it's thermostat

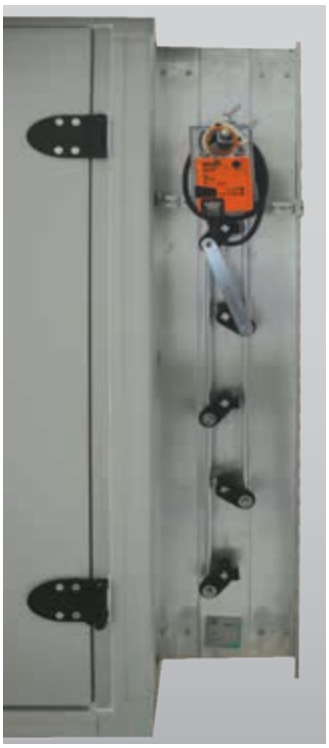
For the interior unit

For the exterior unit

Inverter* (IP 20 or IP 55)

Isolator, fan

Rotor controller



Internal or external damper actuator

Coupling rod for dampers

*Delivered inside the unit with it's package so that it shall be installed in the field.

17 Control

17. CONTROL

Automatic control system that allows remote management of air handling units used for enhancing the air quality and quality of life in crowded areas such as hospitals, malls, hotels, educational institutions, business centres, banks, public institutions, cultural centres, theatres, airports etc. has also become an integral part of the air handling units. While it is possible to perform positioning or switching, automatic or manual operation of the components of the unit with this system, it is also possible to receive information such as faulty component, operation, dirtiness, freezing etc. Also, this system allows monitoring of measurements such as temperature and humidity, air quality etc. on a single SCADA with the measurement equipment used. DDC Panel required for SCADA are manufactured as specific for each project with Automated Logic PLC boards with the assurance of Alarko Carrier so that they shall be environment-friendly, safe, light, easy-to-maintain, high quality and warranted. While, a Carrier brand, Automated Logic products and WebCtrl servers are used in building automation systems, these are also preferred for air handling units. Some operations that may be performed on automated air handling unit production are as follows:

Technical Specifications:

- Provides solutions that offers plug & play operation by leaving the customer the requirement for power supply only,
- where the procurement, installation and testing of automated control equipments are completed in the factory,
- where automation software and testing of these software are completed in the factory,
- where the procurement and installation of MCC panels on air handling units are completed in the factory,
- where the procurement and installation of power and control wiring with terminal connections and the procurement and installation of trays are completed in the factory,
- where special cable conduits are used for projects that require high IP protection class,
- where ease of installation is provided with special connectors used between the air handling unit modules,
- where customer is correctly directed about operation and maintenance with the labels used and thus possibility of errors are eliminated,
- and that are easy to install, practical and that make the life easier.

18 Special Applications

18. SPECIAL APPLICATIONS

Carrier 39HQ Airovision air handling unit may offer a response to any type of application thanks to its inherent flexibility. Thus, it is exported to 65 countries in 5 continents and this number is growing each year. It is used in very wide application areas from petrochemical facilities to very specific hygienic applications, from marine type applications to shelter type units, from military facilities to museums where very specific conditions are required. Examples of some special applications are given below.

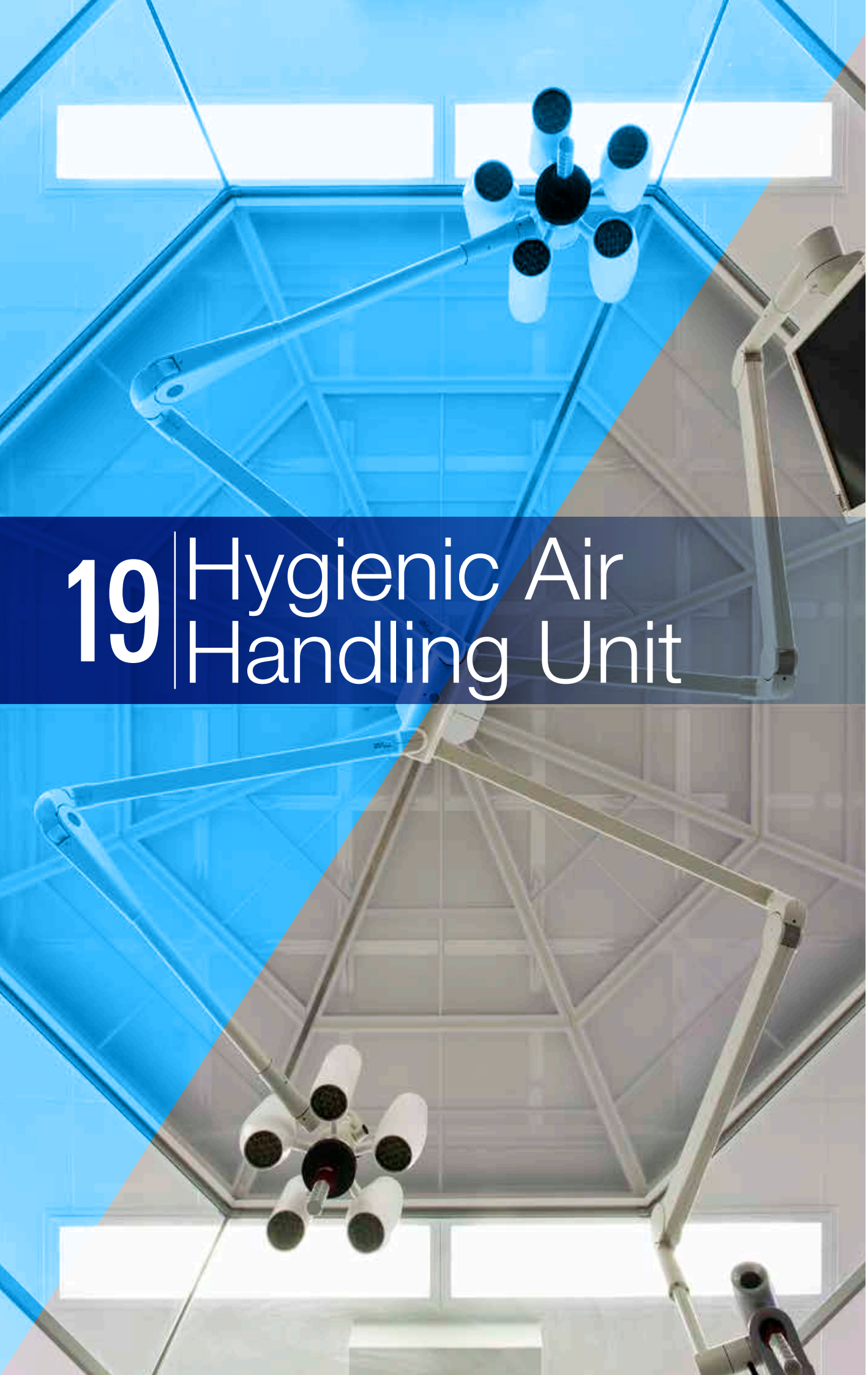
Air handling units with natural gas modules

Completely stainless steel air handling unit (internal-external panels, profiles, base frame, screws, all internal components etc...)

Atex certified components for Ex-proof applications

Other Special Applications

- Vertical Type Air Handling Units
- L-Type Air Handling Units
- Air Handling Units with Fan Walls
- Air Handling Units with Double and Standby Motors
- Air Handling Units with Walking Platform
- Air Handling Units with External Motors



19 Hygienic Air Handling Unit

19. HYGIENIC AIR HANDLING UNITS

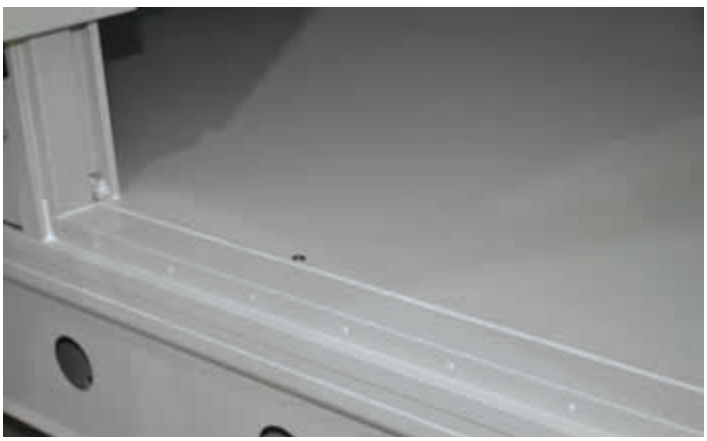
When air handling units are used in hospitals, pharmaceutical plants or special industrial facilities, they shall provide some hygiene standards according to the site that they shall be conditioning the air inside. These standards may vary from one room of the site to another. For example, in a hospital even the operating rooms may have different requirements as per the type of operation to be performed. While many air handling unit manufacturers offer hygienic air handling units as a different series, Carrier branded 39HQ air handling units can be manufactured to meet the hygiene standards by the specifications that can be selected from the selection software as they are fully flexible units.

- Standards
- EN 1886
- EN 13053
- DIN 1946/4
- VDI 6022

39HQ hygienic air handling units have been preferred for hundreds of hospital projects up to this day. They also have a hygiene certificate approved by TUV as per EN 13053, DIN 1946/4 and VDI 6022 standards.
Although hygiene criteria varies as per the criteria of the relevant sites as we have stated above, we can list the hygiene criteria in general as below.

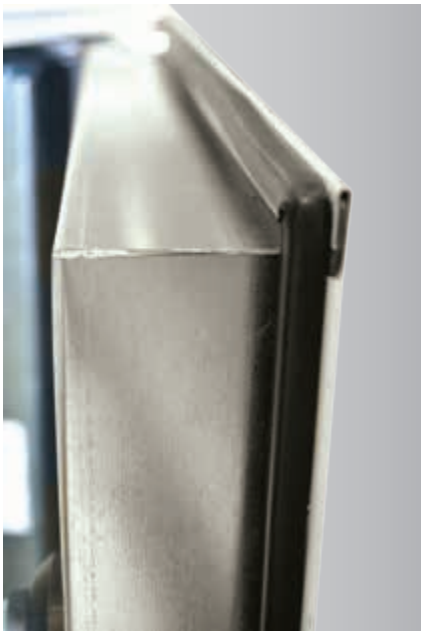
19.1 Panels:

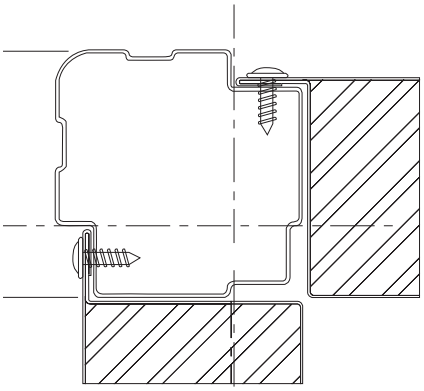
- Fully removable panels
- Panel / profile connections without drilling the panel body
- L2 casing air leakage class
- F9 filter bypass leakage class
- Dampers inside the air handling unit
- 316 or 304 type 0.8 mm stainless steel interior panels
- 0.8 or 1.25 mm pre-painted external panels with a zinc density of 225 gr/m^2 and resistant to 500 hours of salty water test
- Door threshold with the same height as floor panel for easy cleaning



19.1 Panels:

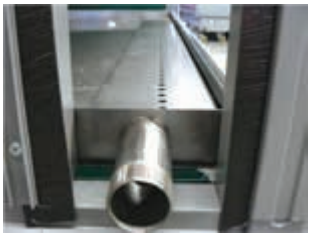
- Hygienic ABS corner resistant against corrosion
- Doors of each size and type and with accessories
- Use of special gaskets for low leakage on the doors
- All screws are made of stainless steel if indoor panels are selected stainless steel.
- On the exterior air handling units
  - » UV-resistant and water-tight special roof coating
  - » Application of extra silicon
  - » All screws are made of stainless steel in outside of the air handling unit.
  - » Possibility of louvres and cowls on the air inlets and outlets

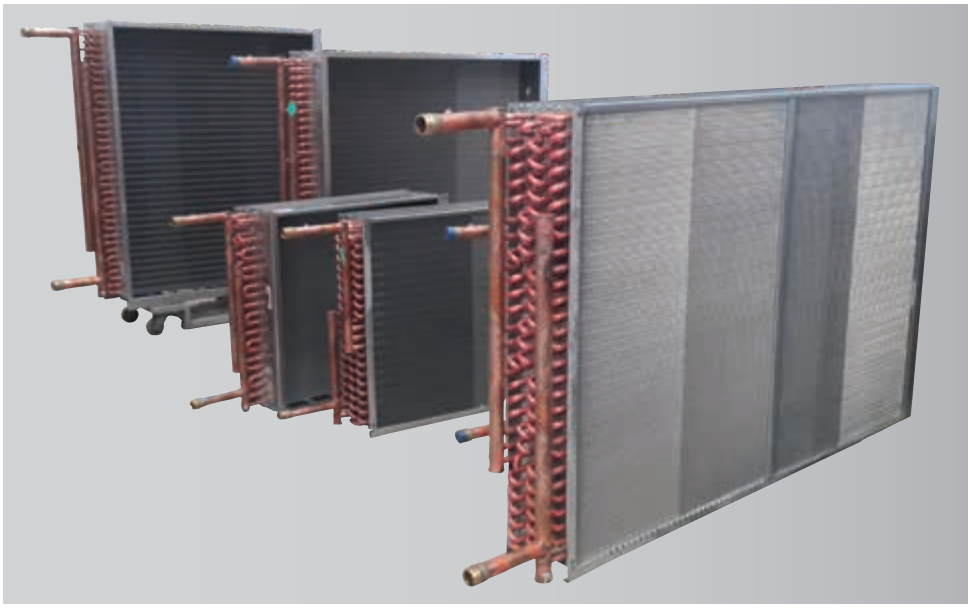




19.2 Coils:

- Maximum surface velocity of 2.5 m/s for cooling coil
- Minimum fin interval: 2 mm for heating coil; 2.5 mm for cooling coil
- Coils pipes coated in copper, fins are aluminium or epoxy coated aluminium, electro-tinned copper or blygold
- Collectors made of copper, coil frame made of stainless steel
- Sloped stainless steel drain pan under the cooling coil and ball type syphon that may be adjusted and installed with different types as per positive and negative pressure to ease the drainage of condensed water
- Installation of bypass plates to prevent air leakage around coils and special plastic gaskets to prevent air leakage from coil pipe outlets to the outside of the unit





19.3 Silencer:

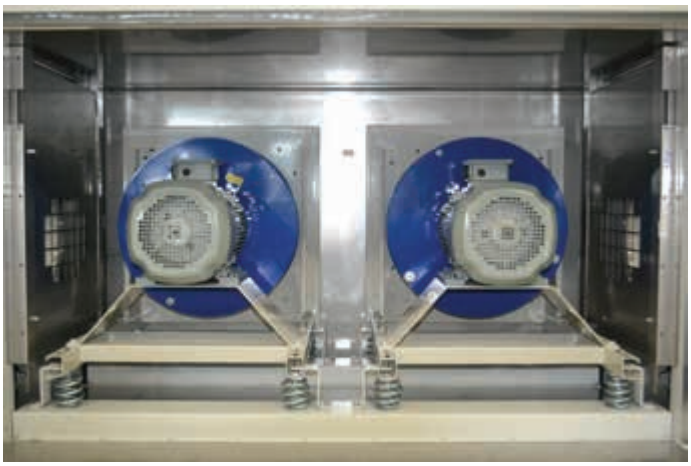
Silencer surfaces shall be water repellant, resistant to wear and smooth

19.4. Fans:

Plug fanlar without belt-drive shall be used, if belt-driven fans shall be used, straight belt types shall be used first and then an additional filter shall be used after the fan.
A door with sight glass shall be provided for access to the fan cell and a light armature with smooth surface shall be used inside the cell.
Fan power isolator, inlet cone measuring points shall be used, and drainage plug and inspection hatch shall be used if the fan is belt-driven type.
Fan body, blades and connection elements shall be made of corrosion-resistant material or a special coating shall be applied on them.
Informative labels shall be available for each fan inside the fan cells.

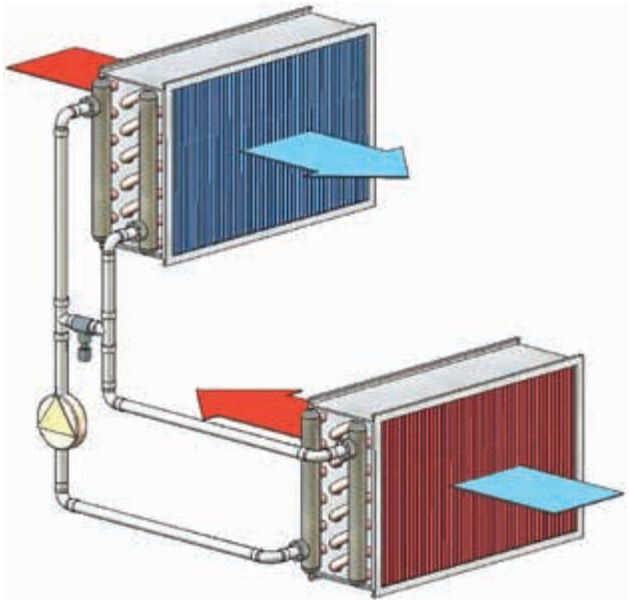




19.5. Heat Recovery Cells:

Heat recovery cell types where return air and fresh air are not mixed shall be used (with plate, heat coil or heat pipe). Wheel types shall not be preferred.
Access shall be possible from each side of heat recovery cells for maintenance and service and drain pan and syphon system shall be applied to drain the water condensed under heat recovery systems.



19.6. Filters:

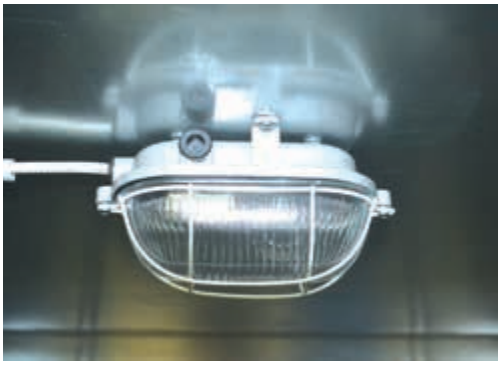
Stainless steel filter frame.
M5 or F7 filtering on fresh air intake side.
F9 filter as the last component on the supply air.
M5 filter on the return air side.
Measuring nipples, pressure gauge and differential pressure switch for measuring filter pressure losses
Informative labels shall be available for each filter inside the filter cells.
A door with inspection glass shall be provided for access to the filter cell and easy replacement of cells and a light armature with smooth surface shall be used inside the cell.

19.7. Humidifiers:

Steam humidifier shall be used for hygienic reasons.
Sloped stainless steel drain pan under the humidifier and ball type syphon that may be adjusted and installed with different types as per positive and negative pressure to ease the drainage of condensed water.
Dimensions of humidifier cell shall be determined by calculating the required absorption distance. Relative humidity shall not exceed 90% at the end of the humidifier cell.
A door with sight glass shall be provided for access to the humidifier cell and a light armature with smooth surface shall be used inside the cell.

19.8. Service and Maintenance:

Cell access door with a min 150 mm sight glass and lighting armature with a smooth surface shall be used for the fan, filter and humidifier cells.
Hinged and hatch doors can be delivered with different sizes and with various accessories for easy of service and safety.



20 Certificates

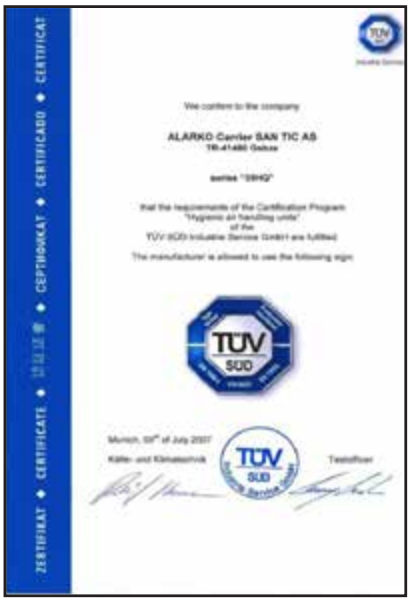
20. CERTIFICATES

Alarko Carrier San. ve Tic. A. Ş. is the pioneering and leading company of conditioning industry in terms of quality management system in it's Gebze and Dudullu Factories with ISO 9001, ISO 14001, EN 50001, OHSAS 18001 and SA 8000 certificates. Besides these certificates, Carrier 39HQ Airovision air handling units have the product certificates specified below.

CE

EUROVENT

HYGIENE



ATEX (based on component)

TSEK

AHRI (based on component)

21 Tests

21. TESTS

Besides the tests required for installation and manufacturing per component (coil leak, fan balancing etc.) for air handling unit, each unit is also tested for final quality control as a finished product in Alarko Carrier Factory.
Other than the standard quality control tests, both product development and performance tests and customer acceptance tests may be performed in great detail.

Alarko Carrier Factory air handling unit test capabilities

Air Handling Unit Tests	Test Unit
Thermal Bridging	Model Box (M)
Thermal Transmission	Model Box (M)
Filter Bypass Leakage	Model Box (M) / Real Unit (RU)
Casing Air Leakage	Model Box (M) / Real Unit (RU)
Mechanical Strength	Model Box (M) / Real Unit (RU)
Measurement of Noise Absorption	Model Box (M)
Acoustic Sound	Model Box (M)
Air Flow	Model Box (M)
Vibration	Model Box (M)

22 References

22. References

In 65 Countries, In 5 Continents

Afghanistan	China	Iraq	New Zelland	Slovakia
Albania	Croatia	Ireland	Nederland	Spain
Algeria	Djibouti	Israel	Nigeria	Sudan
Australia	Egypt	Italy	Oman	Sweden
Austria	Equatorial Guinea	Kazakstan	Pakistan	Tanzania
Azerbaijan	Ethiopia	Kenya	Poland	Tunusia
Bahrain	Finland	Kuwait	Qatar	Turkmenistan
Belarus	France	Lebanon	Reunion Island	UAE
Belgium	Georgia	Libya	Romania	Uganda
Bosnia & Herzegovina	Germany	Lithuania	Russia	UK
Bulgaria	Ghana	Macedonia	Saudi Arabia	Ukraine
Czech Republic	Greece	Montenegro	Serbia	Uzbekistan
Chile	Hungary	Morocco	Singapore	Vietnam

22.1 Some of Our References Abroad

Mega Ikea, Rostov - Russia

Astana Airport - Kazakhstan

Grand Kremlin Palace, Moscow - Russia

Grand Stade de l'Olympique Lyonnais - France

L'Allianz Riviera ou Grand Stade de Nice - France

Yacht Club de Monaco - France

QAFCO Office Building - Qatar

Workers Hospital & Integrated Health Centre, Mesaieed - Qatar.

Ganjlik Mall, Baku - Azerbaijan

University of Newcastle - Australia

Ichthys Onshore LNG Facility - Australia

L'oreal Factory - Egypt

Ferrero Factory Belsk Duży k.Grójca - Poland

Ministry of Economy, Warsaw - Poland

Africarium Zoo, Wroclaw - Poland

Siemens Headquarters, Dubai - UAE

Etisalat Data Center, Fujairah - UAE

Dubai International Airport - UAE

Dubai Opera House, Dubai - UAE

Dubai Fashion Mall, Dubai - UAE

Radisson Blu Hotel - Kuwait

Sheikh Jaber Cultural Center - Kuwait

Burj Al Shaya - Kuwait

Jaguar & Land Rover Factory - UK

Alenia Aermacchi Factory - Italy

Uni-Pharma Factory - Greece

Sulaiman Al Habib Hospital - Saudi Arabia

Dr. Samir Abbas Hospital - UAE

Tawam Hospital - UAE

British American Tobacco Factory - Bangladesh

NMC Specialty Hospital - UAE

22.2 Some of Our References From Turkey


Kartal Courthouse - İstanbul


Tüpraş - Kırıkkale


Air Force Academy - İstanbul


Roketsan - Ankara


Florance Nightingale Hospital - İstanbul


Dünya Göz Hospital, Etiler - İstanbul

Acıbadem Hospital, Maslak - İstanbul


Liv Hospital Ulus - İstanbul

Bodrum Airport - Muğla

Buyaka Mall - İstanbul

Medical Park Bahçelievler Hastanesi - İstanbul

International Hospital - İstanbul

Cepa Mall - Ankara

Liv Hospital Ankara


Ankamall - Ankara


Muğla University - Muğla

Amara Dolce Vita - Antalya

Sheraton Hotel - Ankara

Calista Luxury Resort - Antalya

Su Sesi Hotel - Antalya

The Marmara Hotel - Antalya

Karaelmas University - Zonguldak

TOBB University of Economy and Technology - Ankara

Konya Mevlana Cultural Center - Konya


Bosch Diesel Injector Production Facilities - Bursa


Aselsan - Ankara


TAI - Ankara


Turkish Grand National Assembly - Ankara


Ministry of Foreign Affairs - Ankara


Antalya Airport - Antalya


Constitutional Court Building - Ankara


Adnan Menderes Airport - İzmir

Archeology and Mosaics Museum - Şanlıurfa

Elite World Business Hotel - İstanbul

İncirlik Air Base	Military Facility	Adana
Turkish Air Forced General Staff Building	Military Facility	Ankara
Adana Subway	Infrastructure	Adana
Enerjisa Tufanbeyli Thermal Power Plant	Infrastructure	Adana
Kalehan Beyhan Dam	Infrastructure	Elazığ
İzmir Courthouse	Courthouse	İzmir
NATA Mall	Mall	Ankara
Tepe Prime Mall	Mall	Ankara
Merter M1 Meydan Mall	Mall	İstanbul
Historia Fatih Mall	Mall	İstanbul
Anse Household Appliances Mall	Mall	Ankara
Kentpark Mall	Mall	Ankara
Demirpark Mall	Mall	Zonguldak
İstinye Park Hillside City Club	Mall	İstanbul
Garanti Bank District Office	Bank / Finance Institution	İstanbul
Vakıfbank Finance Center	Bank / Finance Institution	İstanbul
Akbank Operation Center	Bank / Finance Institution	İstanbul
Embassy of Netherlands	Embassy / Consulate	Ankara
Embassy of Canada	Embassy / Consulate	Ankara
Şanlıurfa Government Office	Public Institution	Şanlıurfa
German Hospital	Hospital / Health Institution	Diyarbakır
American Hospital	Hospital / Health Institution	İstanbul
Anadolu Health Center	Hospital / Health Institution	İstanbul
Antalya Public Hospital	Hospital / Health Institution	Antalya
Akdeniz University Faculty of Medicine	Hospital / Health Institution	Antalya
Çukurova Public Hospital	Hospital / Health Institution	Adana
Gaziosmanpaşa Private Hospital	Hospital / Health Institution	İstanbul
Hacettepe University Faculty of Medicine	Hospital / Health Institution	Ankara
Dokuz Eylül University Faculty of Medicine	Hospital / Health Institution	İzmir
Bursa Public Hospital	Hospital / Health Institution	Bursa
Aydın University Faculty of Medicine	Hospital / Health Institution	Aydın
Bodrum Airport	Airport	Muğla
Kayseri Airport	Airport	Kayseri

Konya Airport	Airport	Konya
Denizli Çardak Airport	Airport	Denizli
Yeşilköy Atatürk Airport	Airport	İstanbul
İstanbul Halkalı Mosque	House of Worship	İstanbul
Fener Greek Patriarchate	House of Worship	İstanbul
Neva Şalom Synagogue	House of Worship	İstanbul
Coca Cola Administrative Buildings	Business Center	İstanbul
MHP Headquarters	Business Center	Ankara
Maslak 42 Offices	Business Center	İstanbul
Kanaltürk Building	Business Center	İstanbul
İzmir Convention Center	Cultural Center	İzmir
Hacettepe University Convention Center	Cultural Center	Ankara
Darüşşafaka Cultural Center	Cultural Center	İstanbul
Ahmed Adnan Saygun Art Center	Cultural Center	İzmir
Adile Sultan Palace Sakıp Sabancı Kandilli Educational and Cultural Center	Cultural Center	İstanbul
Zorlu AVM Apple Store	Store / Office / Market	İstanbul
İnkilap Bookstore	Store / Office / Market	İstanbul
Hakkasan Restaurant	Store / Office / Market	İstanbul
Şanlıurfa Museum of Archaeology	Museum	Şanlıurfa
Çanakkale Museum of Troy	Museum	Çanakkale
Japanese Anatolian Archaeology Museum	Museum	Kırşehir
Koç Private High School	School / Private Teaching Institution	İstanbul
Dokuz Eylül University	School / Private Teaching Institution	İzmir
İzmir Institute of Advance Technology	School / Private Teaching Institution	İzmir
Ankara University	School / Private Teaching Institution	Ankara
Hacettepe University	School / Private Teaching Institution	Ankara
TOBB University of Economy and Technology	School / Private Teaching Institution	Ankara
Celal Bayar University	School / Private Teaching Institution	Manisa
Akdeniz University	School / Private Teaching Institution	Antalya
Hacettepe University	School / Private Teaching Institution	Ankara
TBF Basketball Arena	Sports Facility	Ankara
Akdeniz University Tribune	Sports Facility	Antalya
Erzurum Ski Center	Sports Facility	Erzurum

Hacettepe University Sports Hall	Sports Facility	Ankara
Fenerbahçe Spor Kulübü Şükrü Saraçoğlu Stadium	Sports Facility	İstanbul
Arçelik	Production Plant	İstanbul
Coca Cola	Production Plant	İzmir
Ford Otosan R&D Building	Production Plant	Kocaeli
Goodyear Tyres Türk A. Ş.	Production Plant	Sakarya
JTI Tobacco Plant	Production Plant	İzmir
Petlas Tire Plant	Production Plant	Kırşehir
Vestel Elektronik	Production Plant	Manisa
Hugo Boss	Production Plant	İzmir
Siemens GOSB Production Facilities	Production Plant	Kocaeli
Bayer Türk Kimya San. Ltd. Şti.	Production Plant	İstanbul
British American Tobacco	Production Plant	İzmir
Mercedes Benz Türk A. Ş.	Production Plant	İstanbul
Toyota Plant	Production Plant	Sakarya
Bosch Diesel Injector Production Facilities	Industrial Facilities	Bursa
Altınmarka Gıda Sanayi ve Ticaret A.Ş.	Industrial Facilities	İstanbul
Club Alibey Hotel	Hotel	Antalya
Crowne Plaza Hotel	Hotel	Ankara
Şişli Marriot Hotel	Hotel	İstanbul
Hillside Beach Club	Hotel	Antalya
Mersin Hilton Hotel	Hotel	Mersin
Conrad Hotel Beşiktaş	Hotel	İstanbul
Xanadu Resort Hotel	Hotel	Muğla
Miracle De Luxe Resort	Hotel	Antalya
Crystal Palace Resort Hotel & Spa	Hotel	Antalya
Bursa Historical Çelik Palas Hotel	Hotel	Bursa
World of Wonders Kiriş Resort	Hotel	Antalya
Dedeman Hotel	Hotel	Zonguldak
Grand Tarabya Hotel	Hotel	İstanbul
Rixos Hotel	Hotel	Muğla
Hotel Les Ottomans	Hotel	İstanbul

Carrier

United Technologies

Airovision

Manufacturer reserves the right to change any product specifications without notice.

ALARKO

Carrier

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