AIR HANDLING UNITS

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General
When you choose Carrier products your choice is backed by over 50 years experience in the field of air handling. For your day-to-day work this means that you will receive a balanced high-quality modular air handling system. A system that can also be easily integrated with other Carrier systems, such as chilled-water units, fan coil units and roof fans. This means that you always have the assurance of an optimised heating, ventilation and air conditioning (HVAC) installation in your building.

As a user you have every right to demand high-efficiency air handling systems. Certification of our processes according to the international quality standard ISO 9001:2000 is your guarantee for the quality of the Carrier product offering and the services provided. For complete peace-of-mind a large number of Carrier products are also Eurovent-certified, giving the customer the assurance that the published product performances are correct. Of course Carrier also complies with all Environment, Health & Safety (EH&S) regulations and takes a responsible and caring approach to environment, health and safety matters. We are fully committed to safeguarding our environment for future generations.

Carrier and the environment
At Carrier we care for 'everything that lives', and this is emphasised by the use of the most ozone-friendly refrigerants in our units and systems. More and more of our machine components are recyclable, and Carrier is also one of the pioneers in the use of energy-saving technologies and production processes. In short, our systems already meet tomorrow’s standards today.

Carrier in short
United Technologies Corporation is a well-known American corporation that is quoted on the stock exchange. Carrier Corporation is just one of the subsidiaries of this large world-wide organisation. In the Netherlands Carrier Corporation is represented by various Carrier companies that are active in the fields of heating, ventilation, air conditioning, as well as transport and commercial refrigeration. Carrier Holland Heating is the world-wide Carrier expert for air handling units. Carrier Holland Heating and Alarko Carrier are the only manufacturing points of 39 HQ air handling units for EMEA market.
Research & Development

To maintain the top position in the area of air treatment in the world, product research and development continues to be one of Carrier’s top priorities. Besides its 45 production centres spread all over the world Carrier also has 14 R & D units with a total annual budget of over 400 million Dollars. These carry out continuous research in important sectors such as acoustics, compressor technology, new refrigerants and metallurgy.

In the European R & D centres in Montluel, France and Waalwijk in the Netherlands we conduct pioneering research projects that result in important product innovations. Carrier’s innovative approach is underlined by the number of patents we have recently received, including patents in the air treatment area.

Spotlight on Carrier Holland Heating and Alarko Carrier

Inside the world-wide Carrier organisation Carrier Holland Heating in Waalwijk is the knowledge centre for air handling units. Here we develop innovative software programs for the selection and evaluation of components for air handling units - from vibration mounts to fan belt drives and to operating cost calculations for heat recovery systems and start-up times for fan/motor combinations. But the Carrier Holland Heating expertise is also welcomed outside Carrier.

The company also participates on platforms with the objective of developing and maintaining international and European standards in the field of air handling (EN1886 and EN13053). It also actively participates in compiling various Eurovent publications on air handling units. The Dutch branch of Carrier is now represented in the European Certification Programme for Air Handling Units that covers initiatives to improve the quality and integrity of the certification procedure.

Alarko Carrier is the second manufacturing factory of Air Handling Units for Carrier and with his great knowledge and experience, serves market most reliably units.
2 STANDARDS

There are two European standards on air handling units that describe the characteristics of the casing wall construction and the classification and performances of units, components and sections, respectively:

- **EN 1886 - 1998**
  “Air handling units – Mechanical performance”
- **EN 13053 - 2001**
  Air handling units – Ratings and performance for units, components and sections

Both standards have been revised and now also exist as a prEN standard.

The characteristics of the casing wall construction must be established in accordance with EN 1886, based on measurements carried out on a model box and a real unit.

2.1 Mechanical strength

There are two test criteria for mechanical strength:

- relative deflection \([\text{mm x m}^{-1}]\) of posts and panels under normal design conditions
- mechanical resistance [no permanent deformation] against maximal fan pressure

When testing the mechanical strength of the model box, the following test pressures apply:

**Deflection**
- 1500 Pa over and under-pressure in accordance with EN 1886 – 1998
- 1000 Pa over and under-pressure in accordance with prEN 1886

**Fan pressure**
- 2500 Pa over and under-pressure in accordance with EN 1886 – 1998
- 2500 Pa over and under-pressure in accordance with prEN 1886

The standard differentiates between the following classes:

<table>
<thead>
<tr>
<th>Mechanical classes in accordance with EN 1886 - 1998</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deflection class</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1B</td>
</tr>
<tr>
<td>1A</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical classes in accordance with prEN 1886</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deflection class</strong></td>
</tr>
<tr>
<td>D1</td>
</tr>
<tr>
<td>D2</td>
</tr>
<tr>
<td>D3</td>
</tr>
</tbody>
</table>

In the tables the classes the standard construction model box GP080* complies with are marked in blue.

*see chapter 4 “Casing”
2.2 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 remaining sections are tested at 400 Pa negative pressure.

The permissible air leakage is linked to the filter class in the relevant casing section. The tables below list the air leakage classes together with the associated filter classes.

### Air leakage classes in accordance with EN 1886 - 1998

<table>
<thead>
<tr>
<th>Leakage class</th>
<th>Maximum leakage at - 400 Pa l x s⁻¹ x m⁻²</th>
<th>Maximum leakage at + 700 Pa l x s⁻¹ x m⁻²</th>
<th>Maximum filter class acc. to EN 779</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>3.96</td>
<td>5.70</td>
<td>G1-G4</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>1.32</td>
<td>1.90</td>
<td>F5-F7</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>0.44</td>
<td>0.63</td>
<td>F8-F9</td>
<td>+</td>
</tr>
</tbody>
</table>

In the tables the classes the standard construction model box GP080* comply with are marked in blue.

* see chapter 4 “Casing”

### Air leakage classes in accordance with prEN 1886

<table>
<thead>
<tr>
<th>Leakage class</th>
<th>Maximum leakage at - 400 Pa l x s⁻¹ x m⁻²</th>
<th>Maximum leakage at + 700 Pa l x s⁻¹ x m⁻²</th>
<th>Maximum filter class acc. to EN 779</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>0.15</td>
<td>0.22</td>
<td>Better than F9</td>
<td>+</td>
</tr>
<tr>
<td>L2</td>
<td>0.44</td>
<td>0.63</td>
<td>F8-F9</td>
<td>+</td>
</tr>
<tr>
<td>L3</td>
<td>1.32</td>
<td>1.90</td>
<td>G1-F7</td>
<td>-</td>
</tr>
</tbody>
</table>

2.3 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 tables below list 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 admissible filter bypass leakage in accordance with EN 1886 – 1998

<table>
<thead>
<tr>
<th>Built-in filter class</th>
<th>G1 - G4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bypass leakage k %</td>
<td>-</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Maximum admissible filter bypass leakage in accordance with prEN 1886

<table>
<thead>
<tr>
<th>Built-in filter class</th>
<th>G1- F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bypass leakage k %</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

The standard slide-in construction for filters, tested in a model box, is suitable for filter class F9; if marked in blue in the tables. In accordance with standard prEN 1886 this is based on a face velocity of 2.5 m/s over the filter (e.g. 0.93 m³/s for a 610 x 610 mm filter).
2.4 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:

<table>
<thead>
<tr>
<th>CLASS</th>
<th>HEAT TRANSFER COEFFICIENT [W x m$^{-2}$ x K$^{-1}$]</th>
<th>QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>U ≤ 0.5</td>
<td>+</td>
</tr>
<tr>
<td>T2</td>
<td>0.5 &lt; U ≤ 1.0</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>1.0 &lt; U ≤ 1.4</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>1.4 &lt; U ≤ 2.0</td>
<td>-</td>
</tr>
<tr>
<td>T5</td>
<td>No requirements</td>
<td>-</td>
</tr>
</tbody>
</table>

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

* see chapter 4 "Casing"

2.5 Thermal bridges

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. For classes TB3 and TB4 1% of the external surface may have a higher temperature than the maximum admissible value for the class in question; this does not apply for classes TB1 and TB2.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Thermal bridging factor $k_b$ according to EN 1886 - 1998 &amp; prEN 1886</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN 1886 - 1998</td>
</tr>
<tr>
<td>TB1</td>
<td>0.75 &lt; $k_b$ ≤ 1.0</td>
</tr>
<tr>
<td>TB2</td>
<td>0.60 &lt; $k_b$ ≤ 0.75</td>
</tr>
<tr>
<td>TB3</td>
<td>0.45 &lt; $k_b$ ≤ 0.60</td>
</tr>
<tr>
<td>TB4</td>
<td>0.30 &lt; $k_b$ ≤ 0.45</td>
</tr>
<tr>
<td>TB5</td>
<td>No requirements</td>
</tr>
</tbody>
</table>

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

* see chapter 4 "Casing"
2.6 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.

<table>
<thead>
<tr>
<th>Average octave band frequency [Hz]</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation [dB]</td>
<td>18.9</td>
<td>19.1</td>
<td>20.4</td>
<td>21.8</td>
<td>21.2</td>
<td>30.4</td>
<td>36.3</td>
</tr>
</tbody>
</table>

Note: As detailed above this is for a complete AHU construction, not just a panel in the wall type test.
3 SIZING/RANGE

- 122 different standard sizes
- nominal selection range between 0.55 m³/s (2000 m³/h) and 35 m³/s (125,000 m³/h)
- sizes in the preferred range with increasing air flows in steps of approx. 12%
- optimised selection possible for each air flow and each configuration
- installation types for indoor, outdoor, vertical and ceiling mounting and stacked.

- flexibility
- made-to-measure

<table>
<thead>
<tr>
<th>Width Module height</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<td>2.5</td>
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<tr>
<td>4</td>
<td>1.11</td>
<td>1.39</td>
<td>1.67</td>
<td>1.81</td>
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<td>2.50</td>
<td>2.78</td>
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<tr>
<td>6</td>
<td>1.67</td>
<td>2.22</td>
<td>2.50</td>
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<td>3.75</td>
<td>4.17</td>
<td>4.72</td>
<td>5.00</td>
<td>5.56</td>
<td>5.83</td>
<td>6.39</td>
<td>16.67</td>
<td>7.22</td>
<td>7.90</td>
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<td>11.67</td>
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<td>19.17</td>
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</tbody>
</table>

Preferred range
Combination with heat recovery
Other sizes

* values are in m³/s
** larger sizes are possible upon request

4 CASING

The construction of the Carrier air handling units consists of a frame and panels. Profiled 1-mm thick casing sides of galvanised and coated steel plates ensure a rigid and lightweight frame. The frame 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 PIR (polyisocyanurate) insulation for enhanced thermal characteristics and the possibility to walk on it. Compared with PUR, PIR insulation has an increased insulation value and improved fire resistance. Other advantages of PIR 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 shell especially designed to efficiently dampen low-frequency sounds.

GP080

G = insulation, side and roof panels
P = insulation, floor panel
080 = thickness of the external plating

(G = glass wool, R = mineral wool)
(P = PIR, R = mineral wool)
(080 = 0.80 mm / 125 = 1.25 mm)
4.1 Frame
4.1.1 Casing profile

- no air circulation in profiles, profiles fully welded and hermetically sealed at the ends
- 1 mm thick steel plate (galvanised and coated) with metal anchors means that screws go into a thicker material and the construction is more robust, airtight and can be repeatedly disassembled
- resistant against over- and under-pressure up to 2500 Pa
- optimal energy efficiency
- durable
- corrosion resistant
- hygienic
4.1.2 Plastic corners

- corner hermetically sealed by airtight bulkheads
- shock-proof and stable ABS
- resistant against weather aggression and high and low temperatures
- corrosion resistant
- durable
- hygienic

4.1.3 Connection posts

- not longer than module size, using unique coupling system
- space-saving
- made-to-measure
- maintenance-friendly
- hygienic
- optimal energy efficiency

- air handling unit stays flat due to the use of a coupling strip
- connections flat on both sides; air tightness and thermal performances guaranteed after connection
4.2 Casing wall
4.2.1 Panels

- made of durable galvanised sheet steel treated with a weather and scratch-resistant coating on both sides
- closed interior using sealing flanges and sealing joints
- panels are airtight, vapour-resistant and corrosion-resistant
- floor panels filled with PIR, can be walked on
- panels frequently removable by using quality materials
- non-flammable glass or rock wool insulation material
- base colour light grey (RAL 7035)

<table>
<thead>
<tr>
<th>Panel coating</th>
<th>• optimal energy efficiency</th>
<th>• durable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyamide nodules</td>
<td>• maintenance and user-friendly</td>
<td>• corrosion-resistant</td>
</tr>
<tr>
<td>Top coat 30-40 µm</td>
<td>• safe</td>
<td>• noise dampening</td>
</tr>
<tr>
<td>Anti-corrosion primer 20 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durable galvanised steel min. HDG 2225</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base coat - 12 µm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Easy to remove
Floor panel with PIR
4.2.2 Centre posts

- easily removable
- air handling unit has easy access, making components easy to reach and replace
- minimal bypass over the part by sealing
- airtight sealing by special covers

• maintenance and user-friendly
• optimal energy efficiency
• durable
• hygienic

4.2.3 Doors and inspection hatches

- completely smooth inside surface
- doors and inspection hatches have the same thickness (60 mm) as the panel. The technical specification of the casing wall remains the same when a door or hatch is included
- no thresholds
- wear-resistant plastic roller bearing prevents damage to the casing wall
- hinge
  - stable construction makes adjustment unnecessary
  - durable through use of plastic bearing bushings
  - fully fixed
- airtight and vapour-resistant
- airtight seal using rubber sealing strip
- easy access with variable dimensions up to 3 metres high
- minimum of two locking points - one with a lock that can only be opened with a special key
- high locks can be connected at the bottom
- several types of handles:
  - L grip
  - L grip 4-sided lock
  - L grip cylinder lock
  - inside hand grip
  - overpressure safety device

• durable
• optimal energy efficiency
• maintenance and user-friendly
• hygienic
• safe
Door post
Roller bearing
Hinge
No threshold
Fully fixed
Door

Special key

Connected locks

Overpressure safety device

Handle with 4-sided lock

inside hand grip
**5 INLET/MIXING SECTION**

- inlet openings possible in all positions:
  - full face
  - half face (top, middle, bottom)
  - roof and floor
  - service- and non-service side
- shorter length for middle inlet opening for optimal air distribution

**5.1 Flexible connections**

- standard single-skin
- option: acoustic and thermal
- material used is environmental friendly and fire-safe Bisonyl
- completely airtight seal on aluminium connection profile

- made-to-measure
- high-quality finish
- quality
- safe
5.2 Dampers

- minimum air resistance due to airofoil shape
- airtight seal due to rubber seals on both damper blades and frame
- double maintenance-free bearing, optional special plastic version for humid spaces
- optionally finished with a 2-layer epoxy coating
- standard with opposed rotation
- in-built dampers to reduce leakage
- damper blade shaft airtight due to casing wall
- dampers with synchronised rotation for linear control characteristic of mixing sections
- optimised free passage due to damper blades with variable distance

- minimal air resistance
- made-to-measure
- durable
- hygienic
6 FILTERS
6 FILTERS

All possible filter types such as pre-filters, panel, bag, pleated, electrostatic, chemical, carbon, hepa, ulpa and sand filters are available.

6.1 Slide-in filters

- bag filters can easily be removed from the outside in one move, by using filter frame coupling brackets
- shorter casing length required
- slide-in filters possible for all sizes
- minimal bypass leakage up to and including filter class F9
- filter pressed against the filter frame by the filter positioning bracket
- filter profiles and fixing material standard galvanized steel, optional 304L or 316L stainless steel
- use of differential pressure gauge indicates when filters require changing

- space-saving
- maintenance-friendly
- hygienic
- optimal filter efficiency
- long life
6.2 Built-in filters

- user-friendly, self-locking filter holding bracket
- holding bracket stays in the filter module space during filter change
- minimal bypass leakage up to and including filter class F9
- filter profiles and fixing material made of galvanized steel, 304L or 316L stainless steel

<table>
<thead>
<tr>
<th>Maintenance and user-friendly</th>
<th>Optimal filter efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygienic</td>
<td>Durable</td>
</tr>
</tbody>
</table>

Filter holding bracket

6.3 Absolute filters

- framework fully welded and coated
- simple positioning using innovative support construction
- held in place using a support bar construction

| Maintenance and user-friendly | Durable |

Welded framework Support construction Support bar construction
6.4 Delta sections

- advanced filter technology for archives, libraries and museums specially developed by Carrier
- Delta sections:
  - electrostatic filter
  - chemical filter
  - carbon filter
  - particle filter

  • innovative
  • optimal conditioned air
  • durable

6.5 Carbon filters

- absorbs smells from the passing air stream
- hygienic
7 SPECIAL INLET SECTION
7 SPECIAL INLET SECTION

- robust 316L stainless steel drain pan, pre- and sub-filter with drain and siphon
- droplet eliminator integrated in the drain pan
- filter profiles in 304L or 316L stainless steel and corrosion-resistant fixing materials
- side wall in corrosion-resistant version
- walls and doors with drip panels
- safety and quality using robust protection profile
- fewer moisture droplets in the air as a result of low air velocity using the full face

8 FROST PROTECTION COIL

- heating coils before the filter reduce the relative humidity
- no humidity in the filters

- corrosion-resistant
- long life
9 HEAT RECOVERY
9.1 Heat recovery wheels

1) Condensation rotor
2) Hygroscopic rotor
3) Sorption rotor

- efficient energy recovery method
- total energy savings of heat recovery wheel systems can be determined with the operating cost calculation program developed by Carrier
- standard version with access hatch
- bearings accessible for maintenance
- heat recovery wheel casing connects to air handling unit casing
- various installation possibilities: sloped installation, installation with or without inspection hatch and added sections
- housing corrosion-resistant
- permanent seal using adaptive perimeter seal

- optimal energy efficiency
- low operating costs
- maintenance and user-friendly
- hygienic

![Access hatches/inspection section](image1)

![Heat recovery wheel](image2)

![Screen shot of the operating cost calculation program](image3)

![Drive](image4)

![Installation detail](image5)

![Seal](image6)
9.2 Plate heat exchangers

- Insulated drain pan with drain and siphon
- Droplet eliminator, depending on the model
- Optimal use of the air handling unit cross section
- Complete separation of supply and return air
- Bulkhead insulated
- Optionally equipped with face and bypass dampers
- Optionally equipped with integrated recirculation dampers
- Total energy savings of heat recovery wheel systems can be determined with the operating cost calculation program developed by Carrier

- Optimal energy efficiency
- Fully controllable

9.3 Run-around coil systems

- Air handling units with separate supply and return air possible
- Completely separate air flows
- Flexible
- Hygienic
10 HEATING COILS

10.1 Hot water

- optimised coil fin surface as a function of the header diameter
- equipped with wire connections as standard
- Victaulic/Gruvlock flanges available
- heat exchanger in Cu/Al, pre-painted Cu/Al, Cu/Cu, FeZn, stainless steel
- casing Sendzimir or stainless steel
- coils selected based on environmental and economical reasons, water-side pressure drop for low primary energy costs in accordance with the Eurovent recommendations for calculation of energy consumption for air handling units

- optimal energy efficiency
- durable

Heating coil

Steam heating coil

Heating coil

Threaded connection
10.1.1 Frost protection thermostat

- special arrangement developed by Carrier
- each circuit has individual freeze-up protection
- ideal in combination with low-temperature systems
- reliable operation at low leaving air temperatures

10.2 Electric heaters

- terminal box fully integrated in the air handling unit
- possibility of placing gland connections at the top or bottom
- terminal box includes a connection diagram
- capacity step element evenly distributed over the casing section
- protection and maximum thermostat

- made-to-measure
- optimal energy efficiency
11 COOLING COILS

11.1 Chilled water

- optimised coil fin surface as a function of the header diameter
- coils selected based on environmental and economical reasons, water-side pressure drop for low primary energy costs in accordance with the Eurovent recommendations for calculation of energy consumption for air handling units
- droplet eliminator after the cooling coil easily removable on the air leaving side, making the coil and drain tray easy to clean
- stainless steel drain pan sloped towards the drain on the service side
- patented underpressure siphon

11.2 Direct expansion (DX)

- connections easily accessible
- access for connections and maintenance using an expandable hatch of the same material as the casing
- droplet eliminator after the cooling coil easily removable on the air leaving side, making the coil and drain tray easy to clean

- optimal energy efficiency
- low operating costs
- hygienic
- maintenance and user-friendly

- maintenance-friendly
- flexible

Easy to clean

DX cooling coil

Compressors

DX cooling coil
12 HUMIDIFIERS
12 HUMIDIFIERS

12.1 Steam humidification

Applicable for operating steam (life steam). If there is no operating steam, local steam humidifiers are available in gas-fired and electrical versions.

- unique steam humidification section developed and patented by Carrier
- pre-installed steam humidifier available from various manufacturers
- all components are resistant to humidity
- humidifier equipped with waterproof lighting
- access door equipped with a window
- controlled condensate removal using a condensate drain valve developed by Carrier
- steam distribution available with multi-pipe systems (shorter inlet route)

- innovative
- space-saving
- hygienic
- maintenance and user-friendly
12.2 Water spray banks

Atomisers are available in four versions: infrasonic, ultrasonic, water/pressurised air and hybrid.

12.2.1 Infrasonic

- works with demineralised (RO) water
- humidification possible up to the saturation zone by adiabatic cooling
- unlimited control range
- excellent proportional control
- low energy usage
- durable components
- easy to install and maintain
- ideal for renovation projects
- includes pump unit and control
- short length
- guaranteed inlet length

12.2.2 Ultrasonic

- hygienic and legionella-proof
- proportional control possible
- equipped with an automatic hygienic dehumidification and rinse system
- very fine water particle mist
- works with demineralised (RO) water
- limited humidification capacity

Horizontal cross section of infrasonic humidifierer

Atomiser

Intake route

Ultrasonic
12.2.3 Water/pressurised air

12.2.4 Hybrid

12.3 Conventional

12.3.1 Spray humidifier

12.3.2 Wet-cell humidifier
13 FANS

13.1 Centrifugal fans

- belt-driven
- forward and backward curved blades
- guaranteed high spring efficiency using optimise spring selection
- transport protection
- airofoil blades balanced in accordance with ISO1940 balance class G2,5
- performances in accordance with DIN 24166:
  - diameter 200-280 mm: precision class 2
  - diameter 315-1000 mm: precision class 1

13.2 Motors

- high-quality motors
- high efficiency (EFF 1) and improved efficiency (EFF 2)
- optional three thermistors equipped with electric motors
- d.c. motors available
- optional wiring to isolator
- motors in- or outside the air flow

- high quality
- low noise level
- optimal energy efficiency
- low operating costs
13.3 Transmission

- fan assembly complete with a label with the exact data for belt tensioning
- drive selected with Carrier developed software. This software calculates the maximum admissible power on the bearing ring, to ensure a bearing life of $L_{10h}$ (standard 25,000 hours for both motor and fan)
- tension base adjustable with one bolt
- number of drive belts: $N + 1 = N$
- flat belt transmission possible

13.4 Mounting

Various mounting possibilities: single, dual, duplex, run & standby and external motors. There are also five fan discharge positions available as standard.

- the complete fan assembly is a slide-out and vibration-free structure
- flexible connections are always used between fan and pressure wall
- transport protection

Run & standby motor

Slide-out fan assembly
13.5 Options

- Fan belt protection cover
- access screen fan section behind the door
- coated or stainless steel version
- various bearing versions
- pressure measuring points in in-flow cone for flow measurement
- lifting frame
- air distribution screen
- standardised speed controls
- isolator

- safe
- maintenance and user-friendly
- made-to-measure

13.6 Direct-drive centrifugal fans

- compact installation
- special coupling
- no fan belt erosion (VDI-6022)

- made-to-measure
- high quality
- optimal energy efficiency
13.7 Plug fans

- easy to clean
- no fan belt erosion (VDI-6022)
- maintenance and user-friendly
- hygienic

13.8 Other fans

- mixed flow
- axial
- made-to-measure

14 SOUND ATTENUATORS

- optimised for module system and full height
- absorption as well as resonance damper
- supplied with an erosion-resistant top layer as standard
- removable using a simple removable comb profile
- attenuation values in accordance with ISO 7235-2003
- splitters optionally supplied with face profile
- other surfaces on request: perforated plate, polyester film
- sound-optimised configuration of gap/splitters possible
- made-to-measure
- acoustic
- maintenance and user-friendly
15 DISCHARGE

- discharge openings in various positions possible:
  - full face
  - half face: top, middle, bottom
  - roof and floor
  - service and non-service side
- marine version

• made-to-measure

Marine discharge plenum
16 OUTSIDE INSTALLATION

Roof versions: plastic with protruding roof edge, added sloped roof, sun roof with ventilation. Roofs available in various versions.

- stainless steel fixing materials and screws with plastic safety ring
- doors are equipped with an aluminium rain protection profile and storm cord
- possibility for maintenance corridors
- headers can be routed through the floor
- outside air inlet cowl equipped with bird screen
- optional exhaust cowl equipped with aluminium bird screen.
- for several casing parts a lifting frame is available for the lifting of the complete air handling unit in one section
- connection profile for roof covering available
- roofs available in various versions

- corrosion-resistant
- user-friendly
- safe
- made-to-measure

Stainless steel screw with plastic seal
Storm cord
Plastic roof
17 ACCESSORIES

- actuator
- differential pressure switch
- frost protection thermostat
- vibration mats
- duct connection flange
- double-skin, acoustic flexible connection
- differential pressure gauge
- measuring point
- frequency controller
- steam actuator
- storm cord
- lighting with switch
Siphon

Light fitting

Actuator
# 18 Control

- Fan capacity control
- Constant pressure control
- Constant volume control
- Frequency control in base casing
- 5 main base casings
  - 1 speed control based on external control signal
  - 2 constant pressure/flow control
  - 3 as above with sequence control, suction fan
  - 4 constant pressure control with sequence control based on air flow
  - 5 adaptive energy-saving speed control for VAV-system
- Integrated control box

- User-friendly
- Operating safety
- Optimal energy efficiency

*Integrated control box*
19 Installations

19.1 Health Care

<table>
<thead>
<tr>
<th>HEALTH CARE</th>
<th>LOCATION</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acibadem – Maslak</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Dünya Göz Hospital</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Florance Nightingale Hospital</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Özel Gaziosmanpaşa Hospital</td>
<td>İstanbul</td>
<td>Turkey</td>
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<tr>
<td>Medicalpark Hospital</td>
<td>Antalya</td>
<td>Turkey</td>
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<tr>
<td>Antalya State Hospital</td>
<td>Antalya</td>
<td>Turkey</td>
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<tr>
<td>Akdeniz University School of Medicine</td>
<td>Antalya</td>
<td>Turkey</td>
</tr>
<tr>
<td>Hacettepe University School of Medicine</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>Aydın University School of Medicine</td>
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<td>Turkey</td>
</tr>
<tr>
<td>Martia Hospital</td>
<td>Al Marj</td>
<td>Libya</td>
</tr>
</tbody>
</table>

Acibadem - Maslak, İstanbul

Medicalpark Hospital, Antalya

Dünya Göz Hospital - Etler, İstanbul

Florence Nightingale Hospital, İstanbul
## 19.2 Shopping Centers

<table>
<thead>
<tr>
<th>SHOPPING CENTER</th>
<th>LOCATION</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ece Ozas Shopping Center</td>
<td>Vilnius</td>
<td>Lithuania</td>
</tr>
<tr>
<td>Mega Ikea</td>
<td>Rostov</td>
<td>Russia</td>
</tr>
<tr>
<td>Merter M1 Meydan Shopping Center</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>CEPA Shopping Center</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>Historia Fatih Shopping Center</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Ankamall Shopping Center</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>Espark Shopping Center</td>
<td>Eskişehir</td>
<td>Turkey</td>
</tr>
<tr>
<td>Anse Ev Gereçleri Shopping Center</td>
<td>Ankara</td>
<td>Turkey</td>
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<tr>
<td>Kentpark Shopping Center</td>
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<td>Turkey</td>
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<tr>
<td>Demirpark Shopping Center</td>
<td>Zonguldak</td>
<td>Turkey</td>
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<tr>
<td>Togliatti Shopping Center</td>
<td>-</td>
<td>Russia</td>
</tr>
<tr>
<td>Michurinsky Shopping Center</td>
<td>Moscow</td>
<td>Russia</td>
</tr>
</tbody>
</table>

*Cepa Shopping Center, Ankara*  
*Ankamall Shopping Center, Ankara*  
*Mega Ikea - Rostov, Russia*  
*Espark Shopping Center, Eskişehir*
### 19.3 Tourist centers, archives, libraries and museums

<table>
<thead>
<tr>
<th>Location</th>
<th>Country</th>
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</thead>
<tbody>
<tr>
<td>Xanadu Resort Hotel</td>
<td>Muğla, Turkey</td>
</tr>
<tr>
<td>Calista Luxury Resort</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Amara Dolce Vita Holiday Village</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Miracle De Luxe Resort</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Crystal Palace Resort Hotel &amp; Spa</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Bursa Historical Çelik Palas Hotel</td>
<td>Bursa, Turkey</td>
</tr>
<tr>
<td>Sheraton Hotel</td>
<td>Ankara, Turkey</td>
</tr>
<tr>
<td>Susesi Hotel</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>World of Wonders Kiriş Resort</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Dedeman Hotel</td>
<td>Zonguldak, Turkey</td>
</tr>
<tr>
<td>The Marmara Hotel</td>
<td>Antalya, Turkey</td>
</tr>
<tr>
<td>Japanese Anatolia Archeology Museum</td>
<td>Kırşehir, Turkey</td>
</tr>
<tr>
<td>Yunkers Museum</td>
<td>Kazan, Tatarstan</td>
</tr>
</tbody>
</table>
### 19.4 Schools and Universities

<table>
<thead>
<tr>
<th><strong>SCHOOLS AND UNIVERSITIES</strong></th>
<th><strong>LOCATION</strong></th>
<th><strong>COUNTRY</strong></th>
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</thead>
<tbody>
<tr>
<td>Middle East Technical University Northern Cyprus</td>
<td>Güzelyurt</td>
<td>N. Cyprus</td>
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<tr>
<td>Dokuz Eylül University</td>
<td>İzmir</td>
<td>Turkey</td>
</tr>
<tr>
<td>Muğla University</td>
<td>Muğla</td>
<td>Turkey</td>
</tr>
<tr>
<td>İzmir Institute of Technology</td>
<td>İzmir</td>
<td>Turkey</td>
</tr>
<tr>
<td>Zonguldak Karaelmas University</td>
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<td>Ankara University</td>
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<tr>
<td>Hacettepe University</td>
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<tr>
<td>TOBB University of Economics and Technology</td>
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<td>Turkey</td>
</tr>
<tr>
<td>Celal Bayar University</td>
<td>Manisa</td>
<td>Turkey</td>
</tr>
</tbody>
</table>

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**Celal Bayar University, Manisa**

**Karaelmas University, Zonguldak**

**TOBB Ekonomi ve Teknoloji University, Ankara**

**Muğla University**
19.5 Industrial Facilities

<table>
<thead>
<tr>
<th>INDUSTRIAL FACILITIES</th>
<th>LOCATION</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bosch Diesel Injector Production Facilities</td>
<td>Bursa</td>
<td>Turkey</td>
</tr>
<tr>
<td>Samir Refinery</td>
<td>Muhammediye</td>
<td>Morocco</td>
</tr>
<tr>
<td>Altınmarka Food Industry</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Aselsan</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>TAI (Turkish Aerospace Industries, Inc.)</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>Kashagan Oil Search</td>
<td>Atyrau</td>
<td>Kazakhstan</td>
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</table>

19.6 Offices, Bank and Government

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COUNTRY</th>
</tr>
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<tbody>
<tr>
<td>Akbank Operations Center</td>
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</tr>
<tr>
<td>İstanbul Anatolian Side Court House</td>
<td>İstanbul</td>
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<tr>
<td>Şanlıurfa Government House</td>
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<td>Şanlıurfa</td>
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<tr>
<td>The Grand National Assembly Of Turkey</td>
<td>Ankara</td>
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<td>Ministry of Foreign Affairs</td>
<td>Ankara</td>
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<tr>
<td>Constitutional Court Building</td>
<td>Ankara</td>
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<tr>
<td>İzmir Court House</td>
<td>İzmir</td>
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</tbody>
</table>
19.7 Cultural Centers, Recreation and Theatres

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COUNTRY</th>
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<tbody>
<tr>
<td>Adile Sultan Palace</td>
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</tr>
<tr>
<td>Sakıp Sabancı Kandilli Education &amp; Cultural Center</td>
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<tr>
<td>Darüşşafaka Cultural Center</td>
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<td>Konya Mevlana Cultural Center</td>
<td>İzmir</td>
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<tr>
<td>Ahmed Adnan Saygun Art Center</td>
<td>İzmir</td>
</tr>
<tr>
<td>Turkmenistan Theater Building</td>
<td>Ashgabat</td>
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19.8 Airports

<table>
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<th>COUNTRY</th>
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<td>Konya Airport</td>
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<tr>
<td>Denizli Çardak Airport</td>
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<td>Adnan Menderes Airport</td>
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19.9 Other

<table>
<thead>
<tr>
<th>Location</th>
<th>Location</th>
<th>Country</th>
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<tbody>
<tr>
<td>Fenerbahçe SK Şükrü Saraçoğlu Stadium</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Hacettepe University Convention Center</td>
<td>Ankara</td>
<td>Turkey</td>
</tr>
<tr>
<td>The Kul Sharif Mosque</td>
<td>Kazan</td>
<td>Tatarstan</td>
</tr>
<tr>
<td>Kazan Turkish Consulate</td>
<td>İstanbul</td>
<td>Tatarstan</td>
</tr>
<tr>
<td>İstinye Park Hillside City Club</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>İnlilip Bookstore</td>
<td>İstanbul</td>
<td>Turkey</td>
</tr>
<tr>
<td>Kanaltürk TV Building</td>
<td>İstanbul</td>
<td>Turkey</td>
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<tr>
<td>Akgün Gıda Susurluk Recreation Facilities</td>
<td>Balıkesir</td>
<td>Turkey</td>
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Şükrü Saraçoğlu Stadium, İstanbul

The Kul Sharif Mosque, Tatarstan