

## holland heating

### Carrier Holland Heating BV

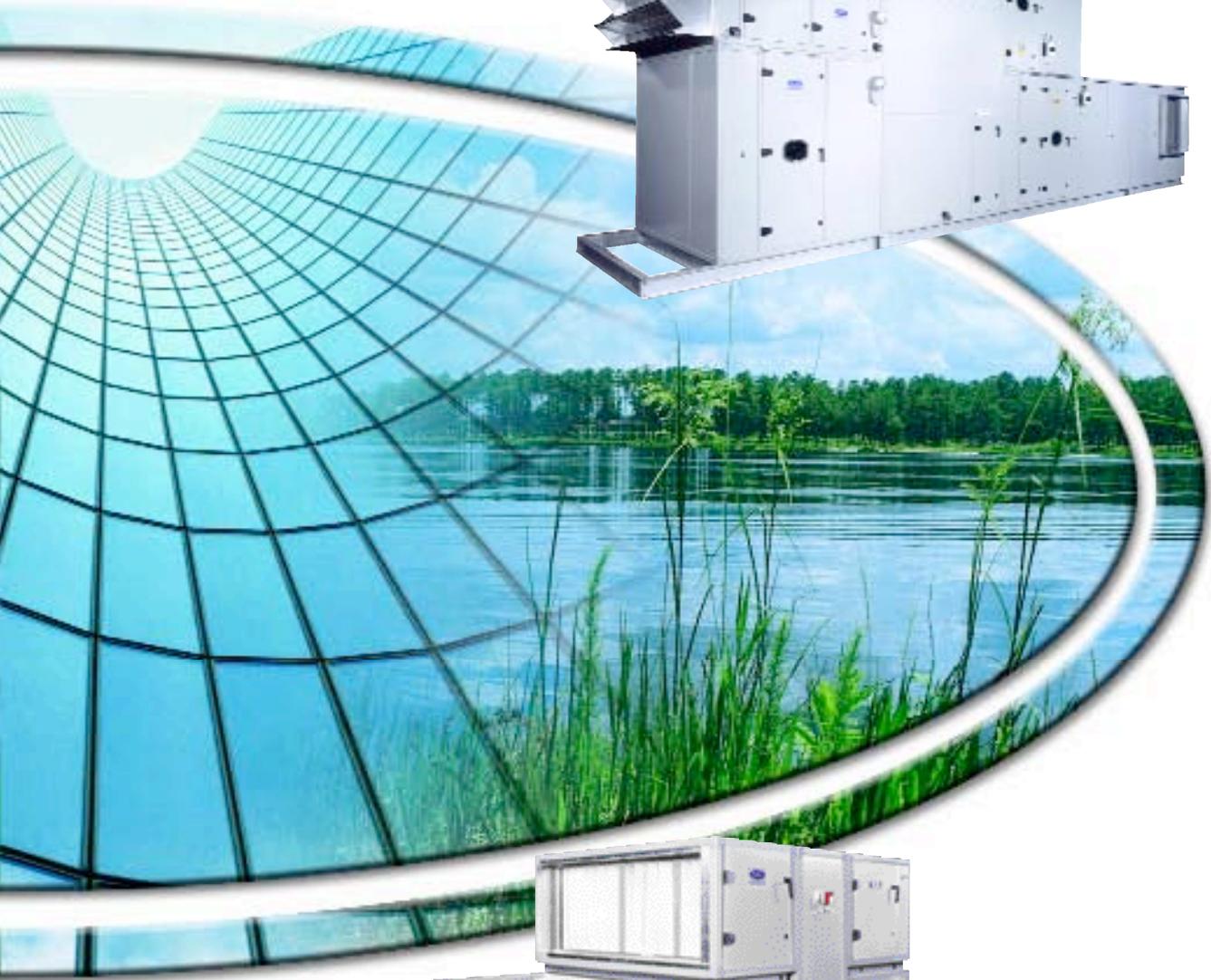
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# AIR HANDLING UNITS



# Component Guide

THE DIFFERENCE IS IN THE DETAIL

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# CARRIER HOLLAND HEATING

## 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.





### 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

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.



holland heating

## 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.

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. The classes for the last three characteristics may also be determined for a model box, if this is clearly indicated.

### 2.1 Mechanical strength

There are two test criteria for mechanical strength:

- relative deflection [ $\text{mm} \times \text{m}^{-1}$ ] 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:

Mechanical classes in accordance with EN 1886 - 1998			
Deflection class	Maximum relative deflection $\text{mm} \times \text{m}^{-1}$	Resistance against maximum fan pressure	Quality
1	10	No	-
1B	No requirements	Yes	↓
1A	10	Yes	
2	4	No	↓
2A	4	Yes	

Mechanical classes in accordance with prEN 1886			
Deflection class	Maximum relative deflection $\text{mm} \times \text{m}^{-1}$	Resistance against maximum fan pressure	Quality
D1	4	Yes	+
D2	10	Yes	↑
D3	No requirements	Yes	

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				
Leakage class	Maximum leakage at - 400 Pa $l \times s^{-1} \times m^{-2}$	Maximum leakage at + 700 Pa $l \times s^{-1} \times m^{-2}$	Maximum filter class acc. to EN 779	Quality
3A	3.96	5.70	G1-G4	-
A	1.32	1.90	F5-F7	↓
B	0.44	0.63	F8-F9	+

Air leakage classes in accordance with prEN 1886				
Leakage class	Maximum leakage at - 400 Pa $l \times s^{-1} \times m^{-2}$	Maximum leakage at + 700 Pa $l \times s^{-1} \times m^{-2}$	Maximum filter class acc. to EN 779	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 tables the classes the standard construction model box GP080\* complies with   a remarked in blue.

\* see chapter 4 "Casing"

## 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						
Built-in filter class	G1- G4	F5	F6	F7	F8	F9
Total bypass leakage $k$ %	-	6	4	2	1	0.5

Maximum admissible filter bypass leakage in accordance with prEN 1886					
Built-in 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; 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 m<sup>3</sup>/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  $W \times m^{-2} \times K^{-1}$ , 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 U according to EN 1886 - 1998 & prEN 1886		
CLASS	HEAT TRANSFER COEFFICIENT [ $W \times m^{-2} \times K^{-1}$ ]	QUALITY
T1	$U \leq 0.5$	+
T2	$0.5 < U \leq 1.0$	↑
T3	$1.0 < U \leq 1.4$	
T4	$1.4 < U \leq 2.0$	
T5	No requirements	-

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.

Thermal bridging factor $k_b$ according to EN 1886 - 1998 & prEN 1886			
CLASS	Thermal bridging factor [ $k_b$ ]		QUALITY
	EN 1886 - 1998	prEN 1886	
TB1	$0.75 < k_b \leq 1.0$	$0.75 \leq k_b < 1.0$	+
TB2	$0.60 < k_b \leq 0.75$	$0.60 \leq k_b < 0.75$	↑
TB3	$0.45 < k_b \leq 0.60$	$0.45 \leq k_b < 0.60$	
TB4	$0.30 < k_b \leq 0.45$	$0.30 \leq k_b < 0.45$	
TB5	No requirements	No requirements	-

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.

Acoustic casing insulation in accordance with EN 1886-1998 & prEN 1886							
Average octave band frequency [Hz]	125	250	500	1000	2000	4000	8000
Attenuation [dB]	18.9	19.1	20.4	21.8	21.2	30.4	36.3

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 m<sup>3</sup>/s (2000 m<sup>3</sup>/h) and 35 m<sup>3</sup>/s (125.000 m<sup>3</sup>/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

Width Module height	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
2,5	0.56	0.69	0.38																				
4	1.11	1.39	1.67	1.81	2.22	2.50	2.78	3.06	3.33														
6	1.67	2.22	2.50	2.92	3.33	3.75	4.17	4.72	5.00	5.56	5.83	6.39	16.67	7.22	7.50								
8			3.33	3.89	4.44	5.00	5.56	6.11	6.57	7.22	7.78	8.33	8.89	9.44	10.00	10.56	11.11	11.67	12.22	12.78	13.33		
10					5.56	6.39	6.94	7.64	8.33	9.03	9.72	10.56	11.11	11.94	12.50	13.33	13.89	14.72	15.28	16.11	16.67	17.50	
12						7.50	8.33	9.17	10.00	10.83	11.67	12.50	13.33	14.44	15.00	15.83	16.67	17.50	18.33	19.17	20.00	20.83	
14									11.67	12.78	13.61	14.72	15.56	16.67	17.50	18.61	19.44	20.56	21.39	22.50	23.33	24.44	
16										14.44	15.56	16.67	17.78	18.89	20.00	21.11	22.22	23.33	24.44	25.56	26.67	27.78	
18															22.50	23.89	25.00	26.39	27.50	28.89	30.00	31.39	*
20																	27.78	29.17	30.56	31.94	33.33	34.72	**

Preferred range

Combination with heat recovery

Other sizes

Module dimension: 160 mm

External width: n x module plus 100 mm

External height: n x module plus 100 mm

Base frame height: 160 mm or 62 mm

Example: type 39HQ12.10

Width: 12 x 160 plus 100 = 2020 mm

Height: 10 x 160 plus 100 = 1700 mm excl. base frame

Nominal air flow: 8.33 m<sup>3</sup>/s

\* values are in m<sup>3</sup>/s

\*\* larger sizes are possible upon request

## 4 CASING

The construction of the Carrier Holland Heating 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

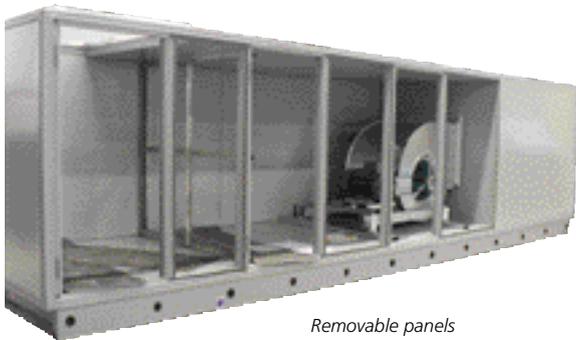
(G = glass wool, R = mineral wool)

(P = PIR, R = mineral wool)

(080 = 0.80 mm / 125 = 1.25 mm)

Panel type	Thermal transmission	Thermal bridging factor	Air leakage	Acoustic casing insulation (dB)							
					125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
GP080	T2	TB2	B (L2)	Attenuation (dB)	19	19	20	22	21	30	36
RP080	T2	TB2	B (L2)	Attenuation (dB)	17	20	20	22	21	29	36
RR125 (acoustic)	T3	TB3	B (L2)	Attenuation (dB)	26	27	27	25	25	31	36

- aesthetic styling
- no deformation during transport, installation and operating life due to stable post construction
- panels removable by using centre posts
- air handling unit surfaces smooth inside and outside without protruding parts
- durable
- can be assembled on site
- maintenance and user-friendly

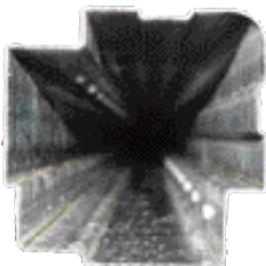


Removable panels

## 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



Casing profile



Metal anchors

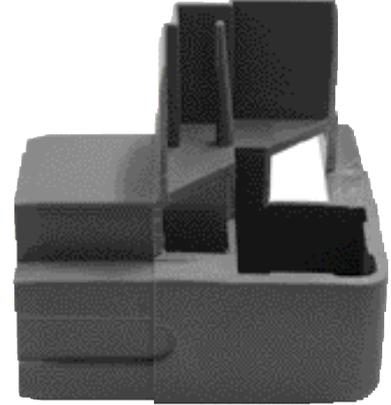


### 4.1.2 Plastic corners

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



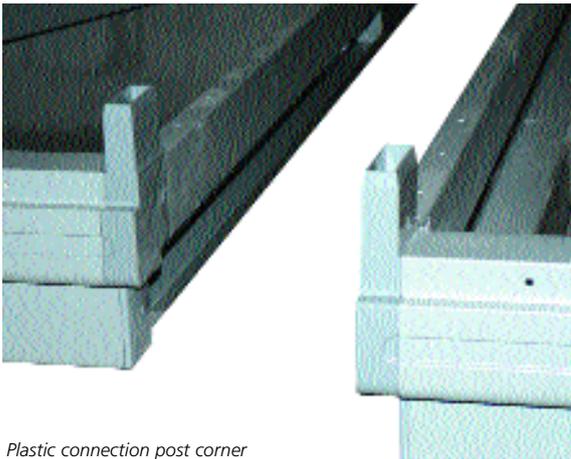
ABS plastic corner



Airtight bulkheads

### 4.1.3 Connection posts

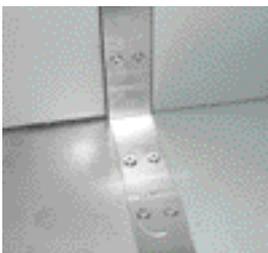
- not longer than module size, using unique coupling system
- air handling unit stays flat due to the use of a coupling strip
- connections flat on both sides; air tightness and thermal performances guaranteed after connection
- space-saving
- made-to-measure
- maintenance-friendly
- hygienic
- optimal energy efficiency



Plastic connection post corner



Connection post

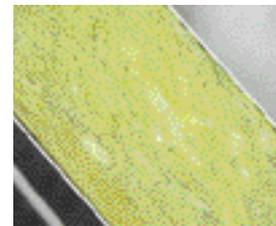
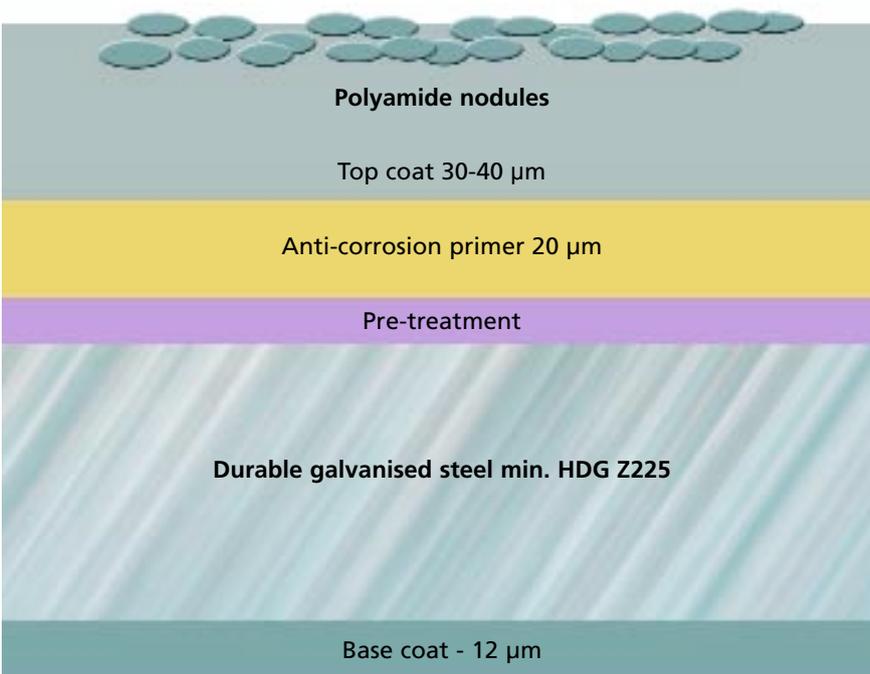


Connection strip

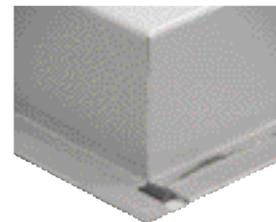
## 4.2 Casing wall

### 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 grey (RAL 7042)
- optimal energy efficiency
  - durable
  - maintenance and user-friendly
  - corrosion-resistant
  - safe
  - noise dampening



60 mm thick panel

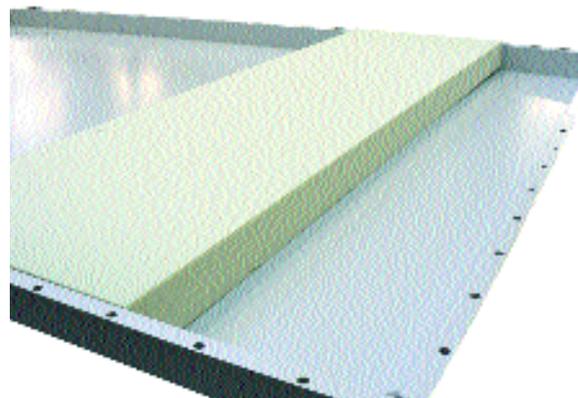


Closed interior

Panel coating



Easy to remove

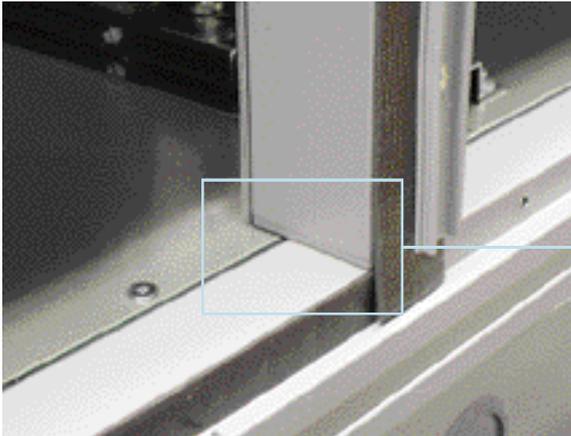


Floor panel with PIR

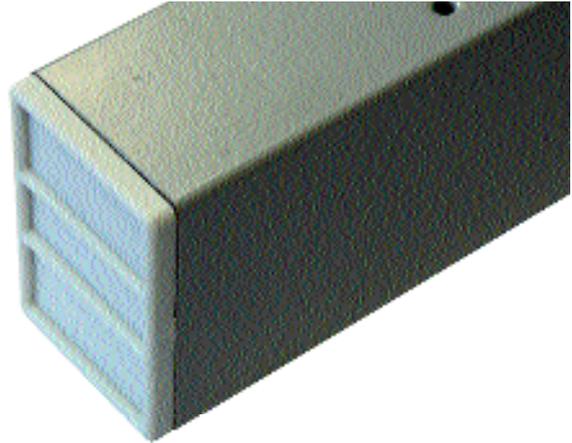


### 4.2.2 Centre posts

- 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



Centre post with plastic cover



Plastic cover

### 4.2.3 Doors and inspection hatches

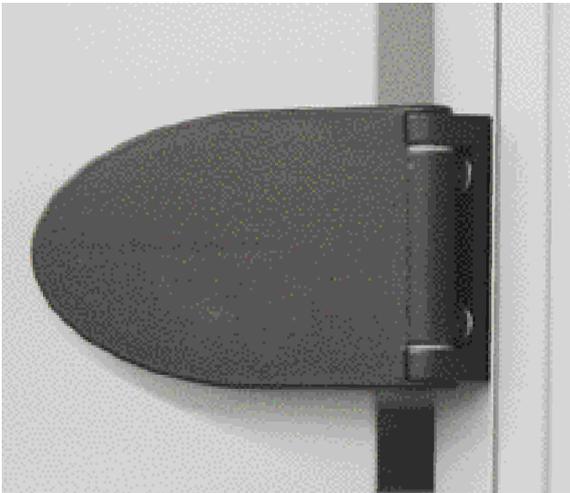
- completely smooth inside surface
- doors and inspection hatches have the same thickness (60 mm) as the panel. The technical specification of the casing wall remains the same when a door or hatch is included
- no thresholdss
- wear-resistant plastic roller bearing prevents damage to the casing wall
- 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*



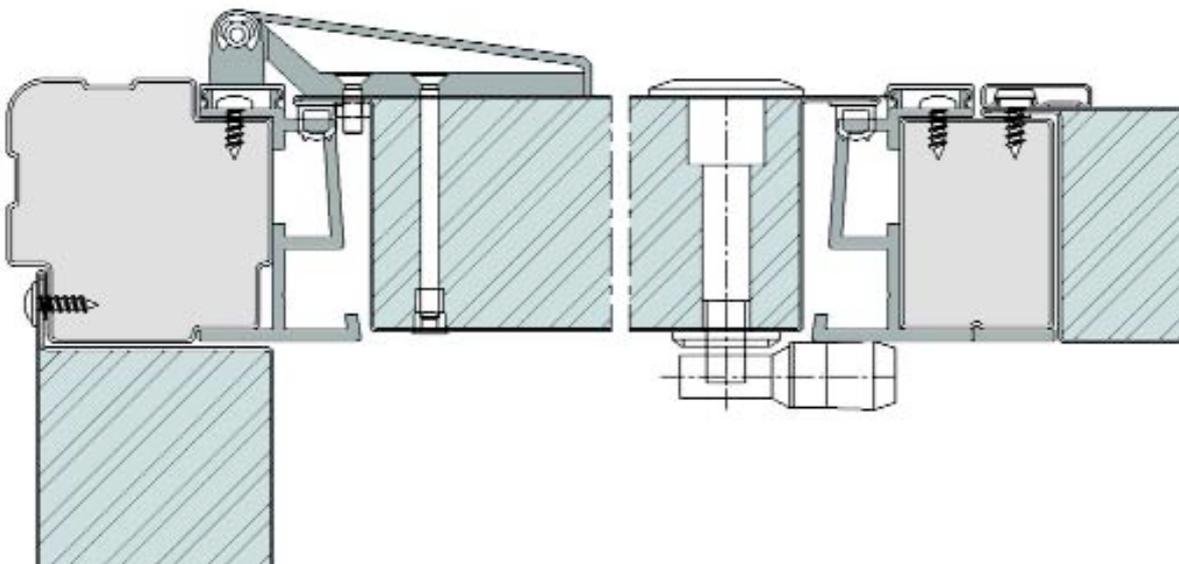
*Roller bearing*



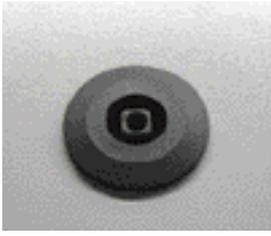
*Hinge*



*No threshold*



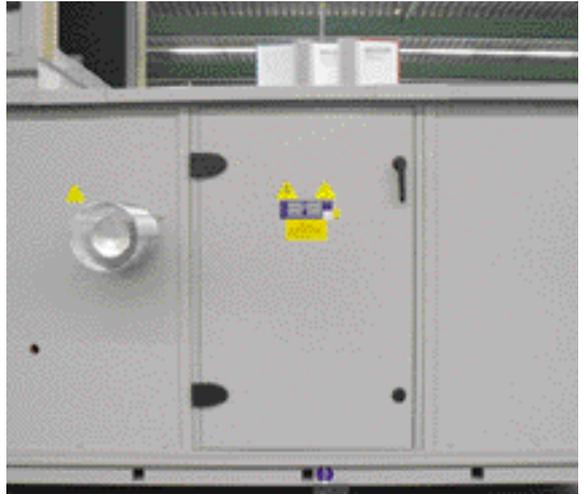
*Fully fixed*



Lock



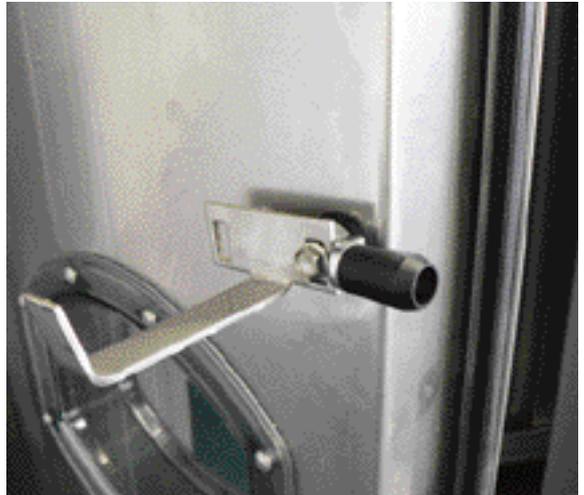
Special key



Door



Connected locks



Overpressure safety device

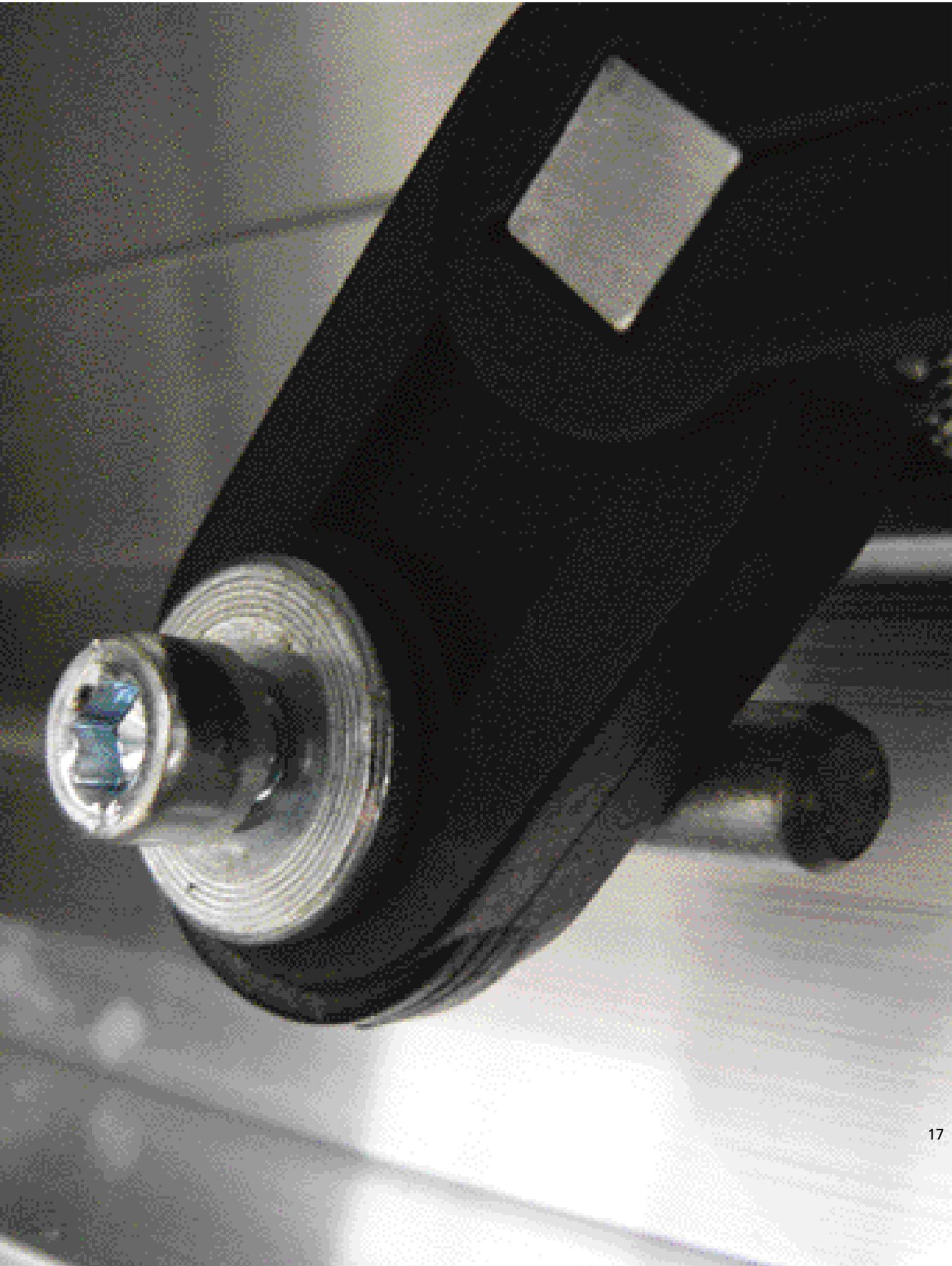


Handle with 4-sided lock



inside hand grip

# 5 INLET/MIXING SECTION





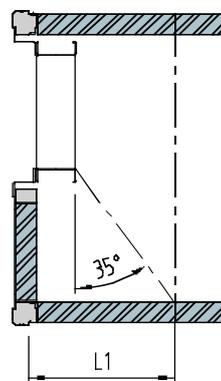
## 5 INLET/MIXING SECTION

- 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

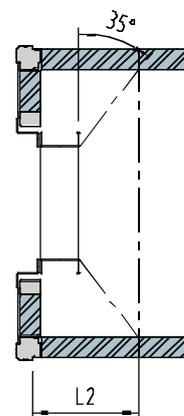
- made-to-measure



Full face



Top connection



Middle connection

### 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

- high-quality finish
- quality
- safe



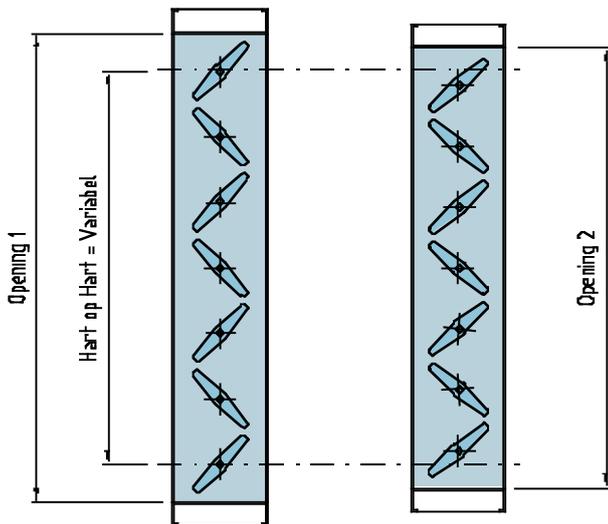
Flexible connection



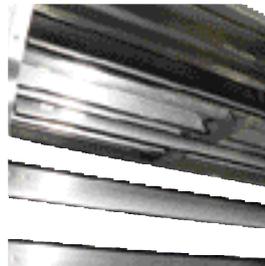
Detail flexible fan connection

## 5.2 Dampers

- minimum air resistance due to airfoil 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



Variable distance



Mixing section



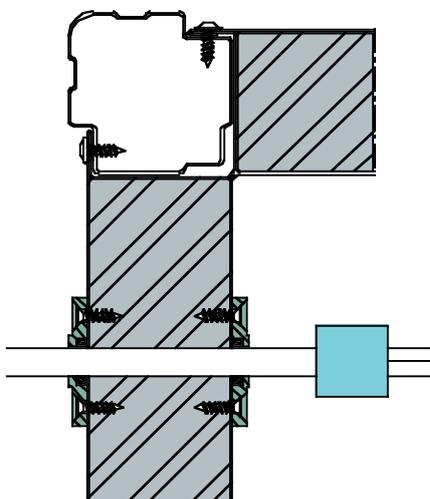
Airofoil damper with rubber seals



Opposed rotation



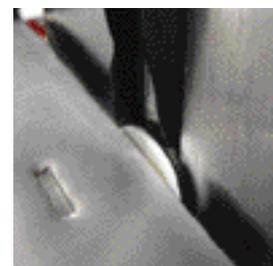
Synchronised rotation



Through damper shaft



Linkage construction



Rubber seals in frame



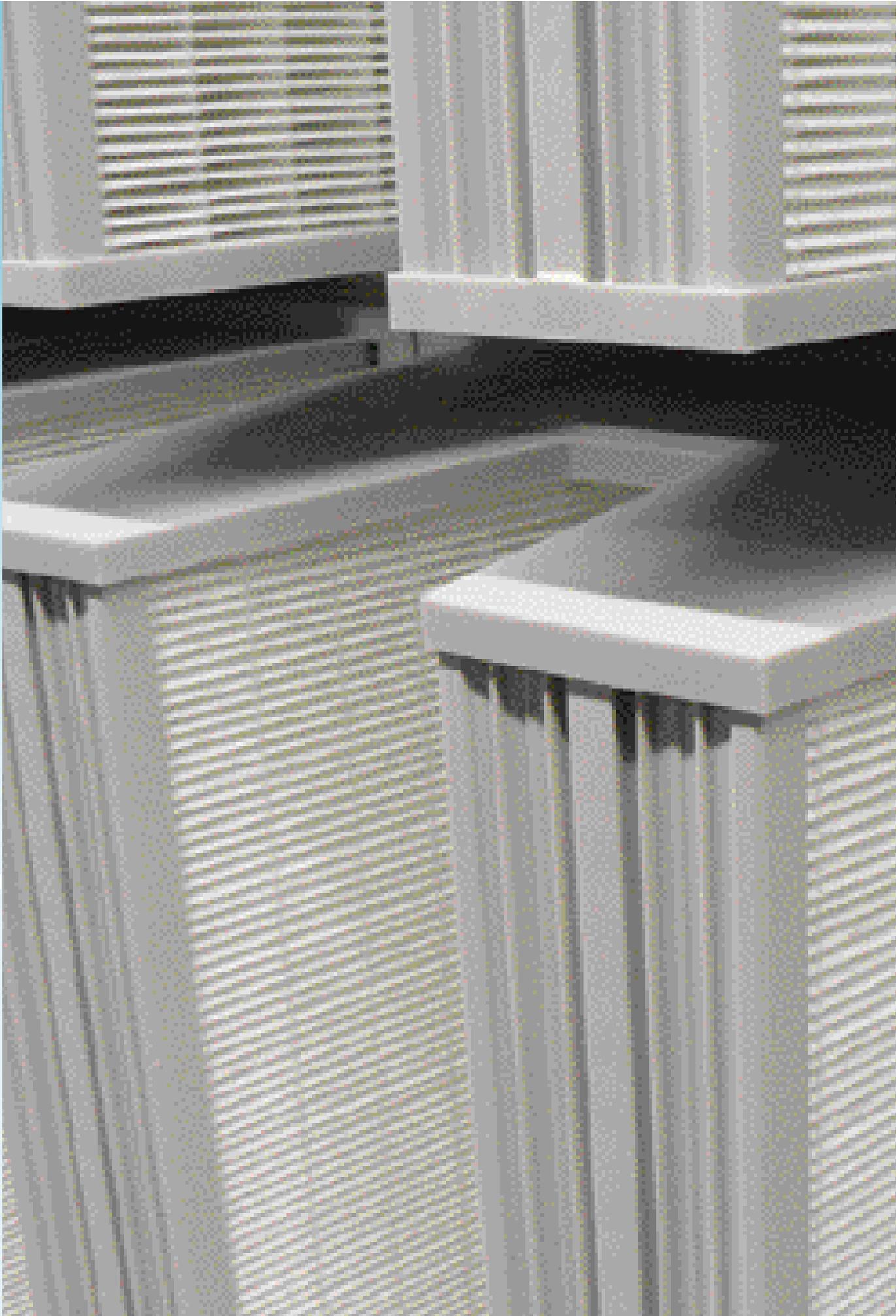
Actuator



# 6 FILTERS

6

FILTERS



39HQ

## 6 FILTERS

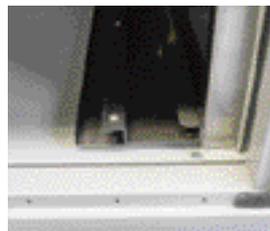
All possible filter types such as pre-filters, panel, bag, pleated, electrostatic, chemical, carbon, hepa, ulpa and sand filters are available.

### 6.1 Slide-in filters

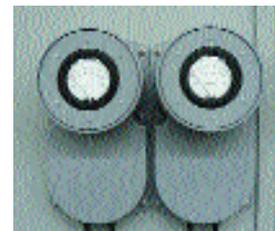
- bag filters can easily be removed from the outside in one move, by using filter frame coupling brackets
  - shorter casing length required
  - slide-in filters possible for all sizes
  - minimal bypass leakage up to and including filter class F9
  - filter pressed against the filter frame by the filter positioning bracket
  - filter profiles and fixing material 316L stainless steel
  - standard drain pan made of stainless steel 316L using outside air filters
  - use of differential pressure gauge indicates when filters require changing
- space-saving
  - maintenance-friendly
  - hygienic
  - optimal filter efficiency
  - long life



Filter row can be completely pulled out in one move



Stainless steel 316L filter profile



Differential pressure gauge



Combination filter



Filter positioning bracket

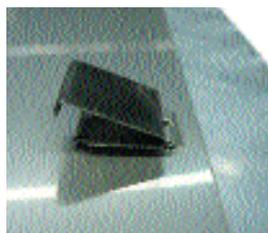


## 6.2 Built-in filters

- 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 316L stainless steel
- standard drain pan made of 316L stainless steel near outside air filters
- maintenance and user-friendly
- optimal filter efficiency
- hygienic
- durable



Filter holding bracket



Filter holding bracket



User-friendly

## 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



Support 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



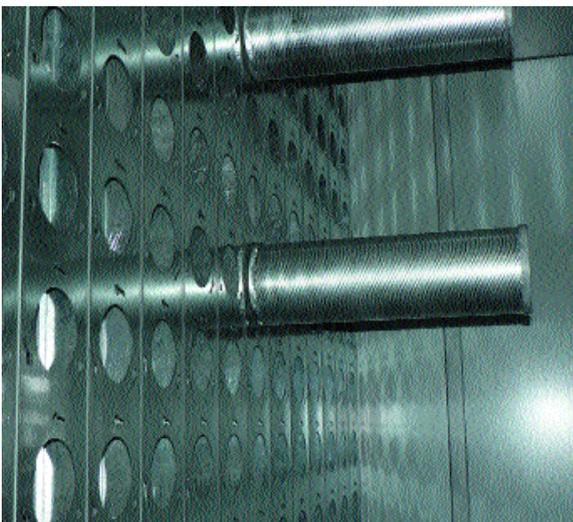
Delta section



Delta section

## 6.5 Carbon filters

- absorbs smells from the passing air stream
- hygienic



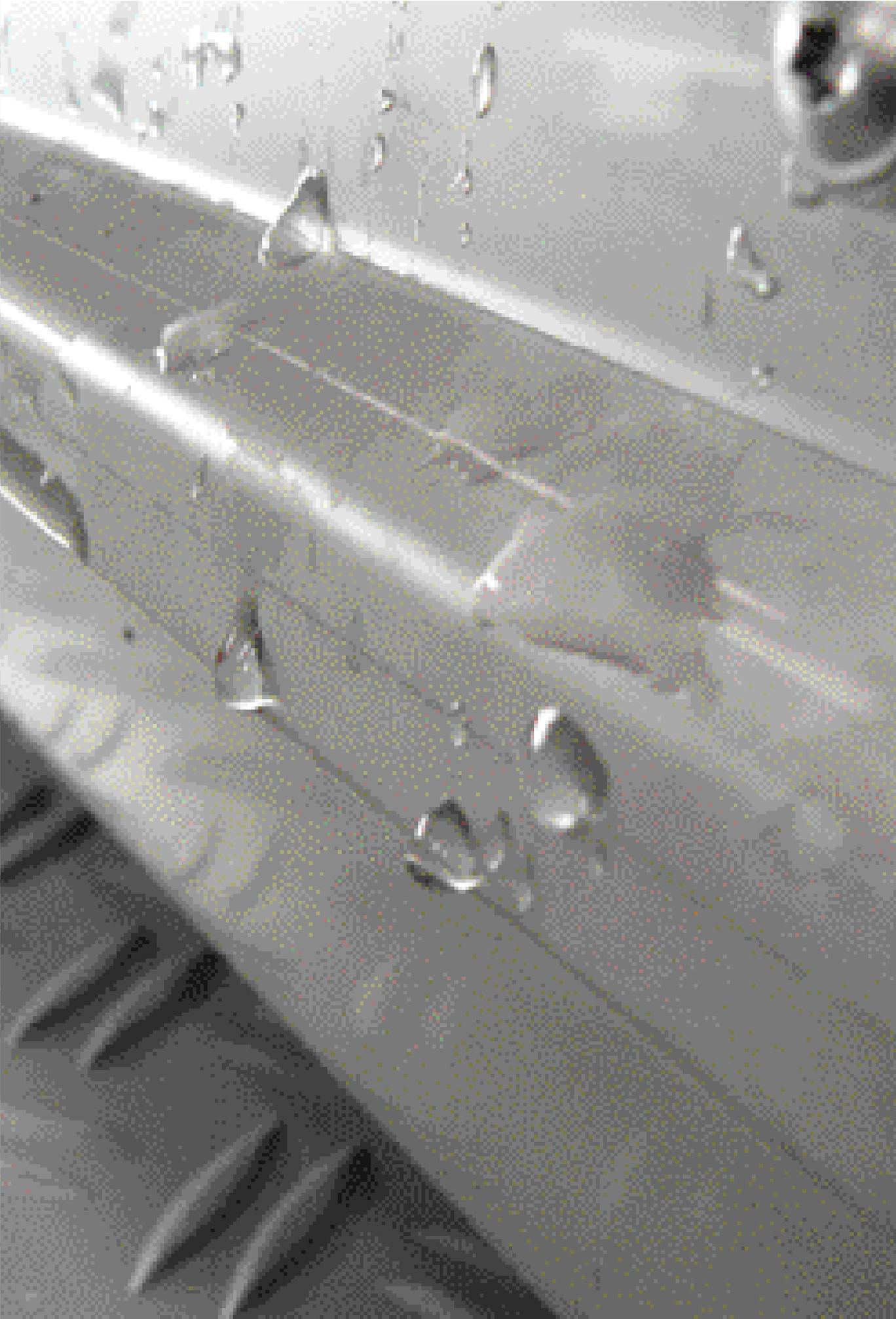
Carbon filter



# 7 SPECIAL INLET SECTION

7

TOP INLET CONNECTION



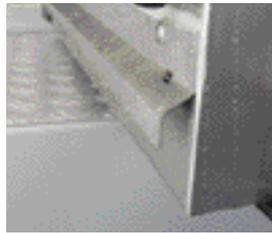
39HQ

## 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 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
- long life
  - corrosion resistant
  - maintenance and user-friendly
  - safe



*Droplet eliminator*



*Door with drip panel*



*Entering threshold*

## 8 FROST PROTECTION COIL

- heating coils before the filter reduce the relative humidity
  - no humidity in the filters
- corrosion-resistant
  - long life



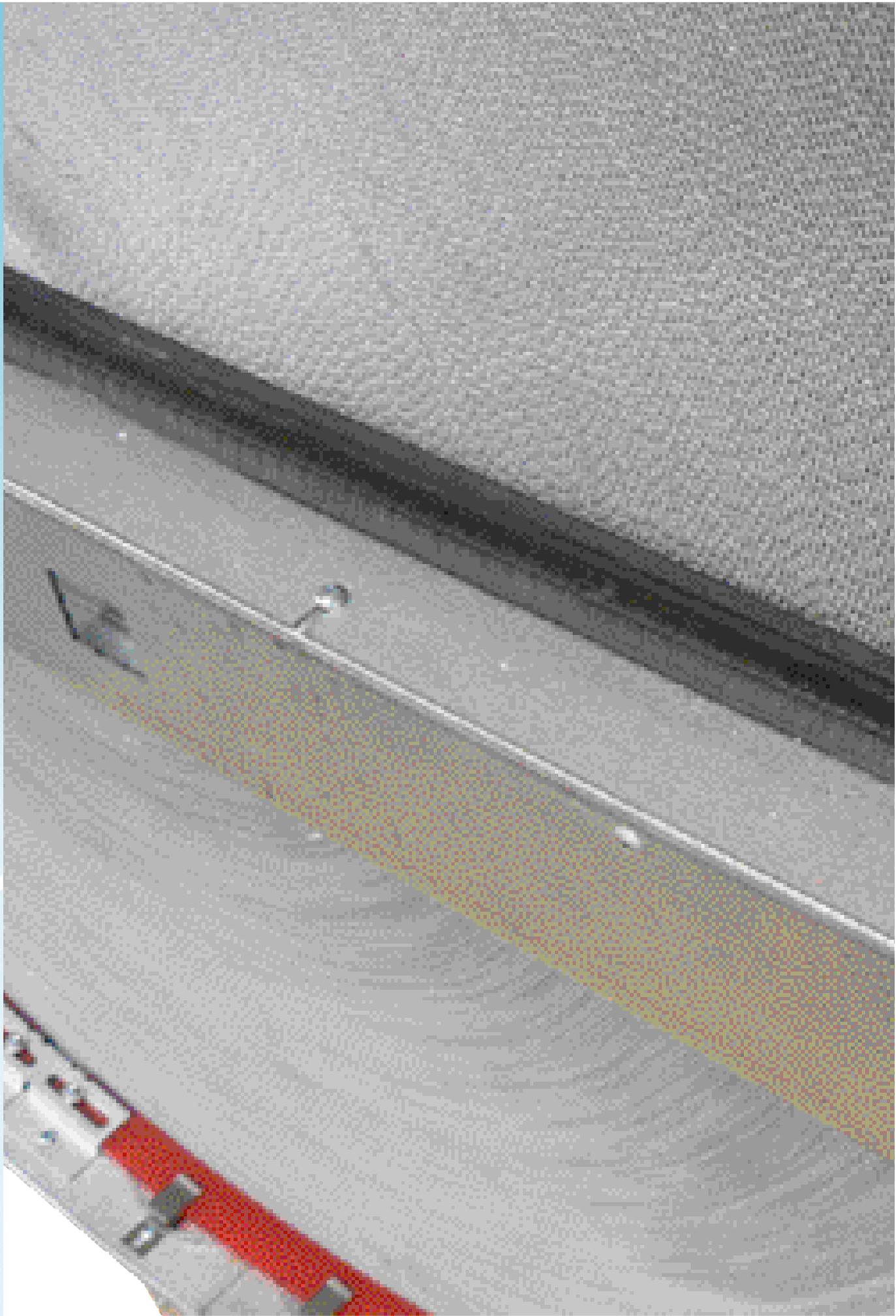
*Frost protection coil*



# 9 HEAT RECOVERY

9

HEAT RECOVERY



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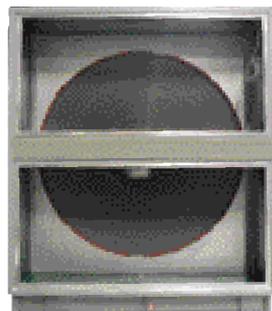
## 9.1 Heat recovery wheels

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

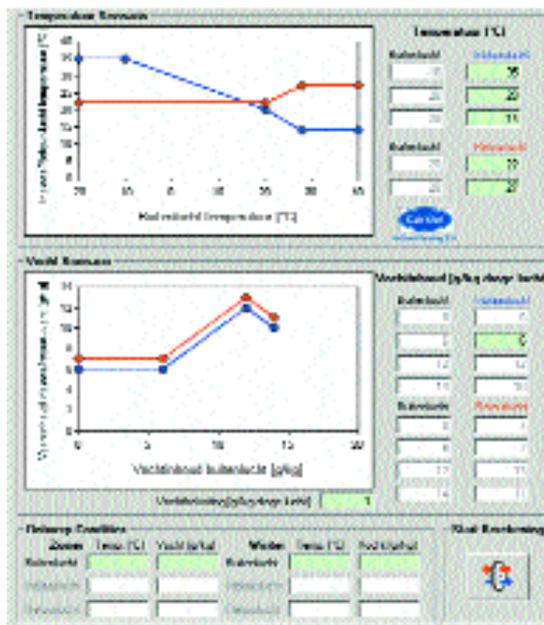
- efficient energy recovery method
  - total energy savings of heat recovery wheel systems can be determined with the operating cost calculation program developed by Carrier
  - standard version with access hatch
  - bearings accessible for maintenance
  - heat recovery wheel casing connects to air handling 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



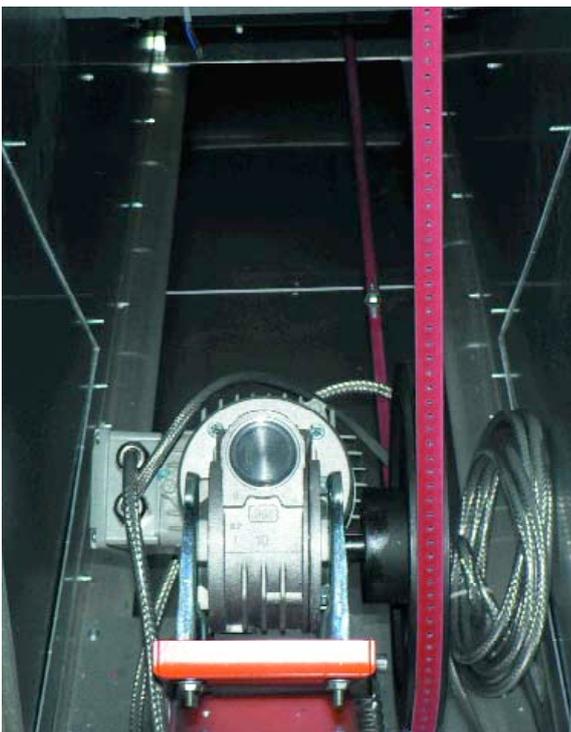
Access hatches/inspection section



Heat recovery wheel



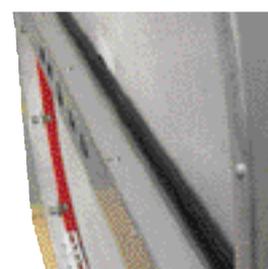
Screen shot of the operating cost calculation program



Drive



Installation detail

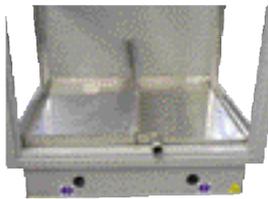


Seal



## 9.2 Plate heat exchangers

- Stainless steel 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



Drain pan with drain

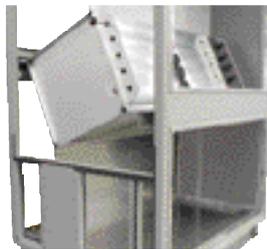


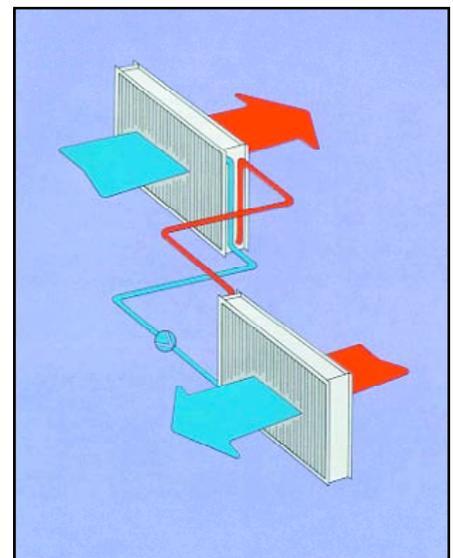
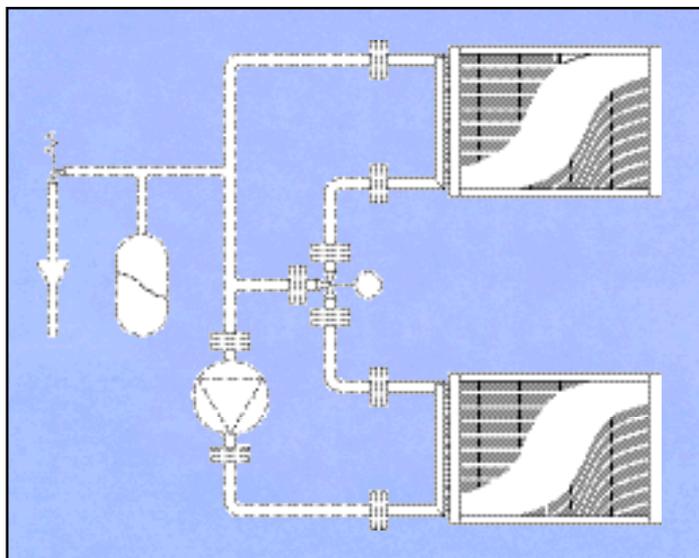
Plate heat exchanger



Face and bypass damper

## 9.3 Run-around coil systems

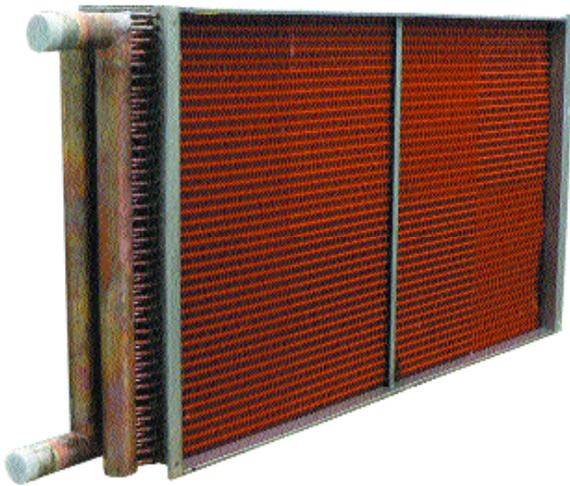
- air handling units with separate supply and return air possible
- completely separate air flows
- flexible
- hygienic



## 10 HEATING COILS

### 10.1 Hot water

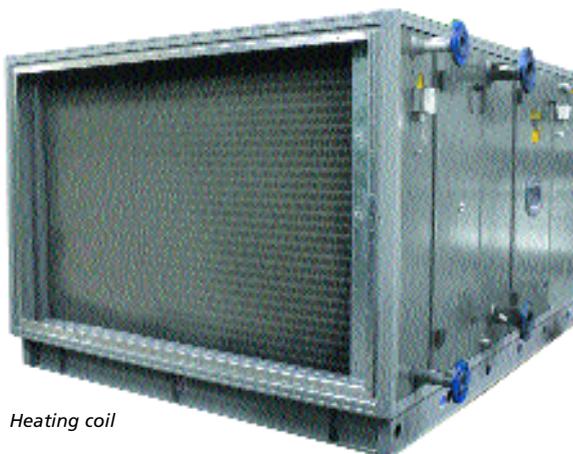
- optimised coil fin surface as a function of the header diameter
  - equipped with wire connections as standard
  - Victaulic/Gruvlock flanges available
  - heat exchanger in Cu/Al, pre-painted Cu/Al, Cu/Cu, FeZn, stainless steel
  - casing Sendzimir or stainless steel
  - coils selected based on environmental 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
- safe
- high-quality
- reliable



Arrangement of the frost protection thermostat

### 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



Even distribution



Rollers



Terminal box

# 11 COOLING COILS





## 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 behind the cooling coil easily removable at 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
- optimal energy efficiency
  - low operating costs
  - hygienic
  - maintenance and user-friendly



Easy to clean

### 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
- maintenance-friendly
  - flexible



DX cooling coil

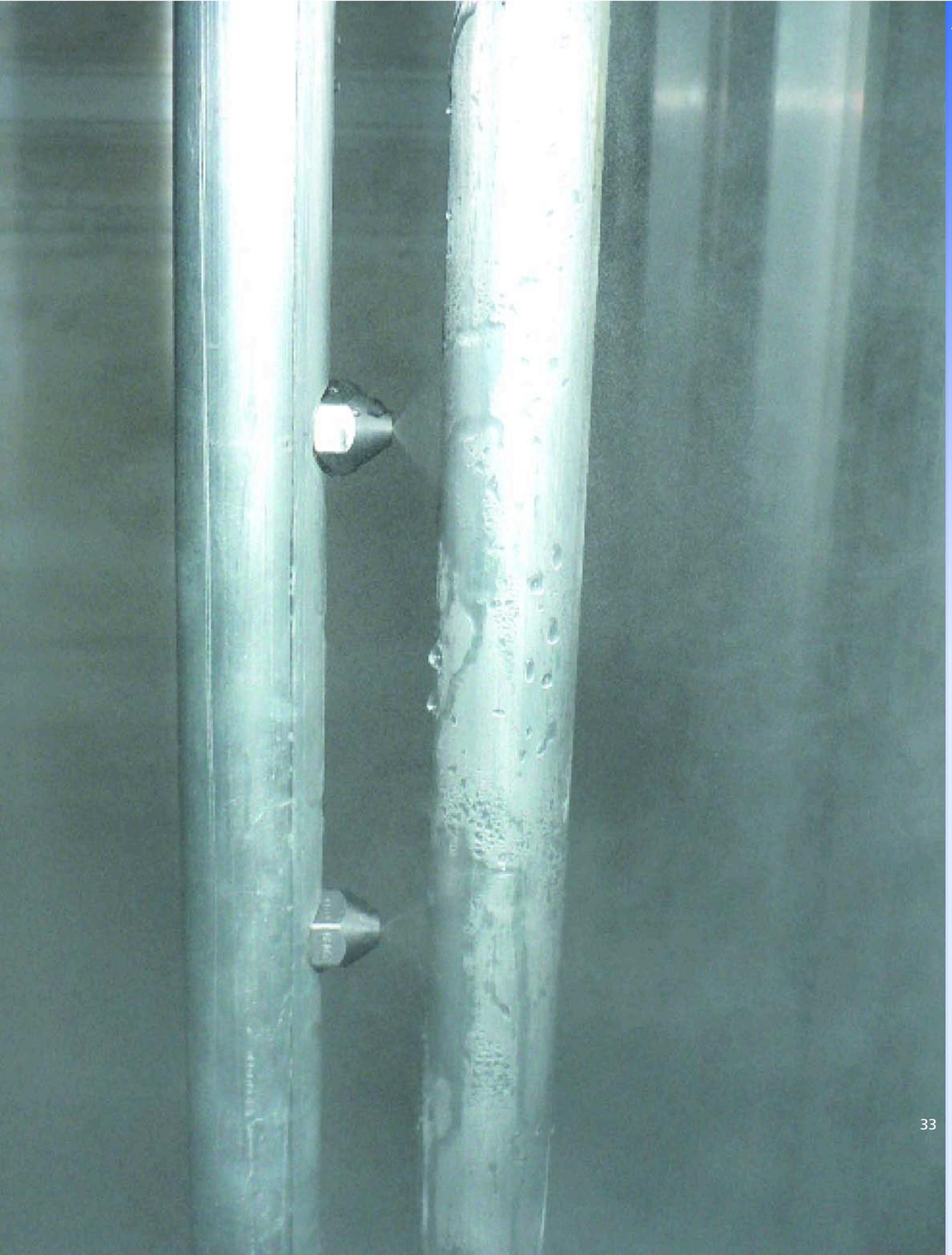


DX cooling coil



Compressors

# 12 HUMIDIFIERS





## 12 HUMIDIFIERS

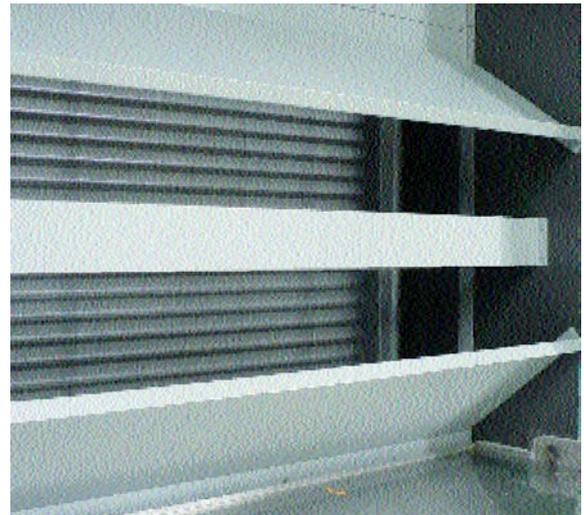
### 12.1 Steam humidification

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
  - use of the venturi and vortex plate shorten the inlet route and result in a high humidification capacity
  - pre-installed steam humidifier available from various manufacturers
  - all components are epoxy coated/stainless steel
  - 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



Section with distribution pipes



Steam venturi and vortex plate

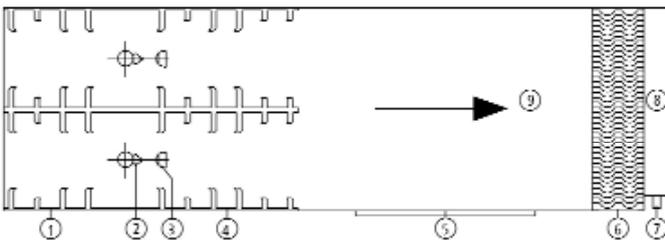
## 12.2 Water spray banks

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

- innovative
- optimal energy efficiency
- hygienic
- durable
- maintenance and user-friendly
- high quality



Horizontal cross section of infrasonic humidifier

1. Infrasonic generator
2. Atomiser
3. Distribution box
4. Secondary generator
5. Inspection door
6. Saturated steam drier
7. Water removal
8. Water collector
9. Intake route



Atomiser



Intake route

### 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

- innovative
- hygienic



Ultrasonic



12.2.3 Water/pressurised air



12.2.4 Hybrid



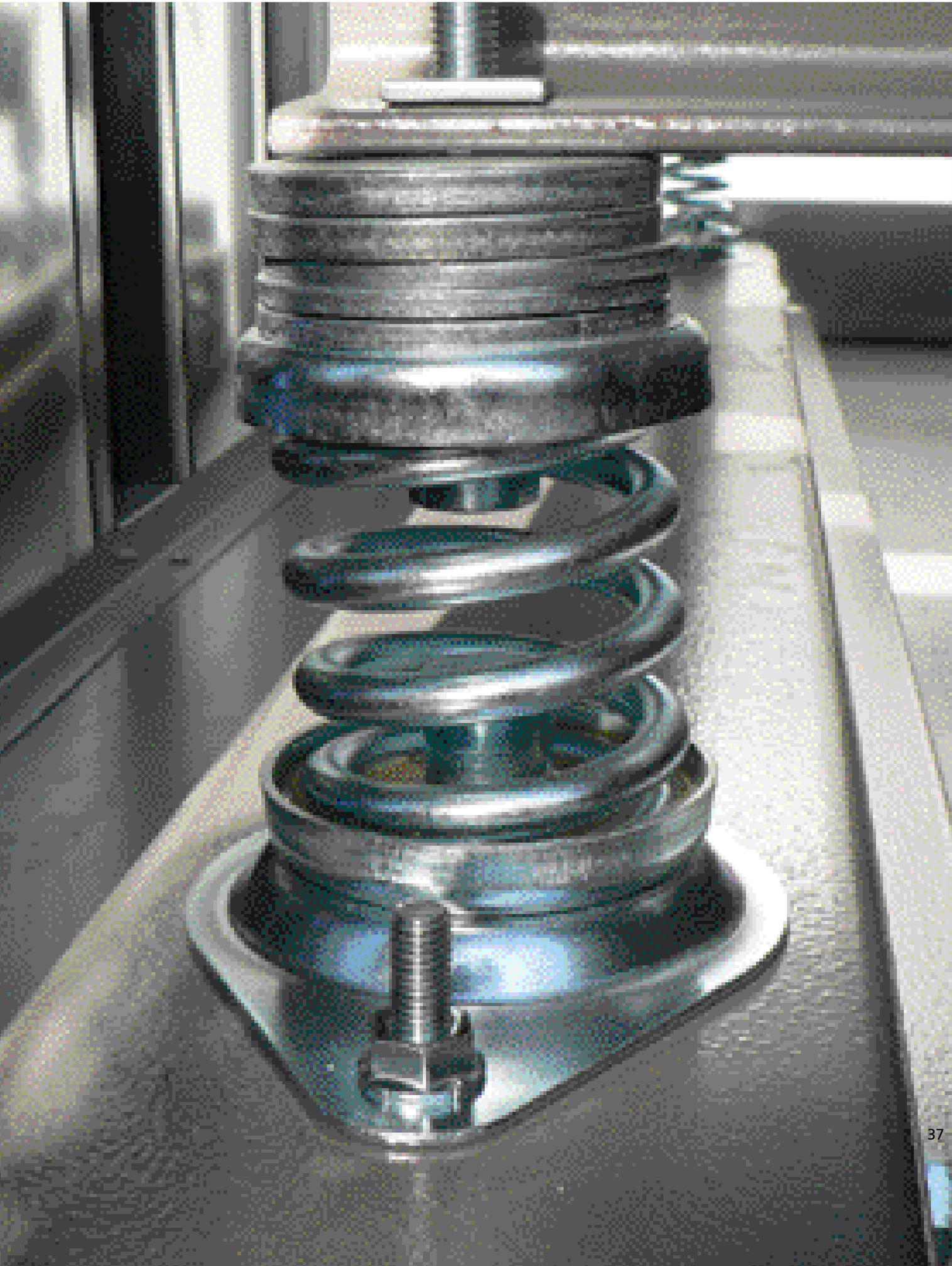
12.3 Conventional  
12.3.1 Spray humidifier



12.3.2 Wet-cell humidifier



# 13 FANS





## 13 FANS

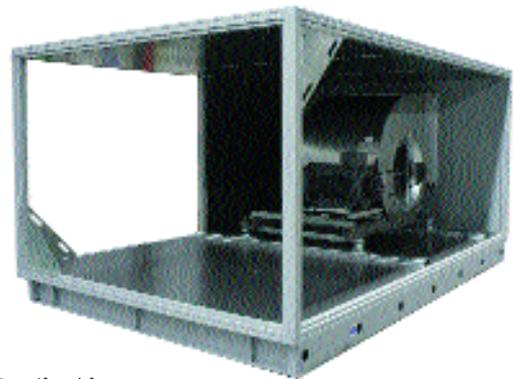
### 13.1 Centrifugal fans

- belt-driven
- forward and backward curved blades
- guaranteed high spring efficiency using optimise spring selection
- transport protection
- airfoil 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

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



Dual fans



Centrifugal fan

### 13.2 Motors

- high-quality motors (e.g. Siemens, ATB)
- high efficiency (EFF 1) and improved efficiency (EFF 2)
- electric motors (a.c.) equipped with three thermistors as standard (PTC elements)
- d.c. motors available
- optional wiring to isolator
- motors in- or outside the air flow

- high quality
- safe
- optimal energy efficiency
- low operating costs



Motor in the air flow



Run & standby in the air flow



Motor outside the air flow



Run & standby outside the air flow



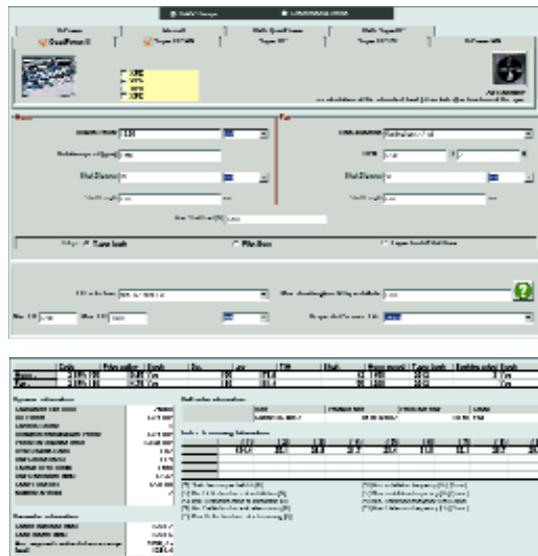
Detail, motor outside the air flow

### 13.3 Transmission

- fan assembly complete with a label with the exact data for belt tensing
  - 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 )
  - re-tensioning by start-up not required (drive belt pre-tensioned)
  - tension base adjustable with one bolt
  - number of drive belts:  $N + 1 = N$
  - flat belt transmission possible
- high-quality
  - made-to-measure
  - optimal energy efficiency



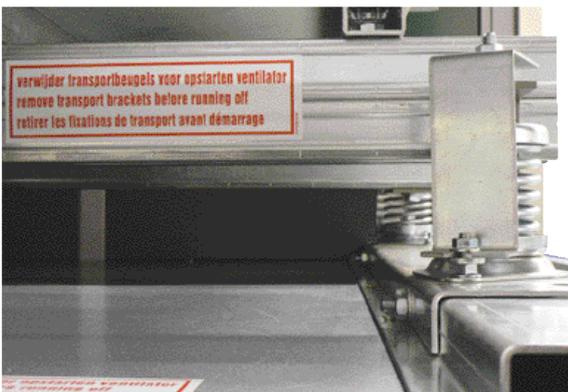
Belt tensing information



### 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
- noise reduction
  - maintenance and user-friendly
  - hygienic



Slide-out fan assembly



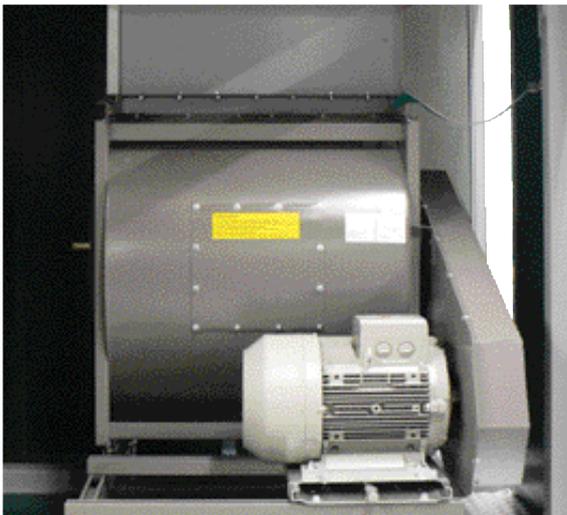
Run & standby motor





### 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



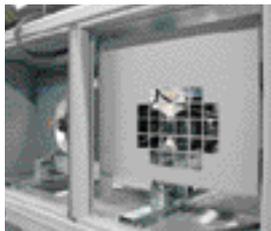
Fan belt protection cover



Air distribution screen



Lifting beam



Access screen

### 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

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• easy to clean</li> <li>• no fan belt erosion (VDI-6022)</li> </ul> | <ul style="list-style-type: none"> <li>• maintenance and user-friendly</li> <li>• hygienic</li> </ul> |
|---|---|

Plug-in fan



### 13.8 Other fans

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• mixed flow</li> <li>• axial</li> </ul> | <ul style="list-style-type: none"> <li>• made-to-measure</li> </ul> |
|---|---|

## 14 SOUND ATTENUATORS

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• optimised for module system and full height</li> <li>• absorption as well as resonance damper</li> <li>• supplied with an erosion-resistant top layer as standard</li> <li>• removable using a simple removable comb profile</li> <li>• attenuation values in accordance with ISO 7235-2003</li> <li>• splitters optionally supplied with face profile</li> <li>• other surfaces on request: perforated plate, polyester film</li> <li>• sound-optimised configuration of gap/splitters possible</li> </ul> | <ul style="list-style-type: none"> <li>• made-to-measure</li> <li>• acoustic</li> <li>• maintenance and user-friendly</li> </ul> |
|--|--|



Comb profile



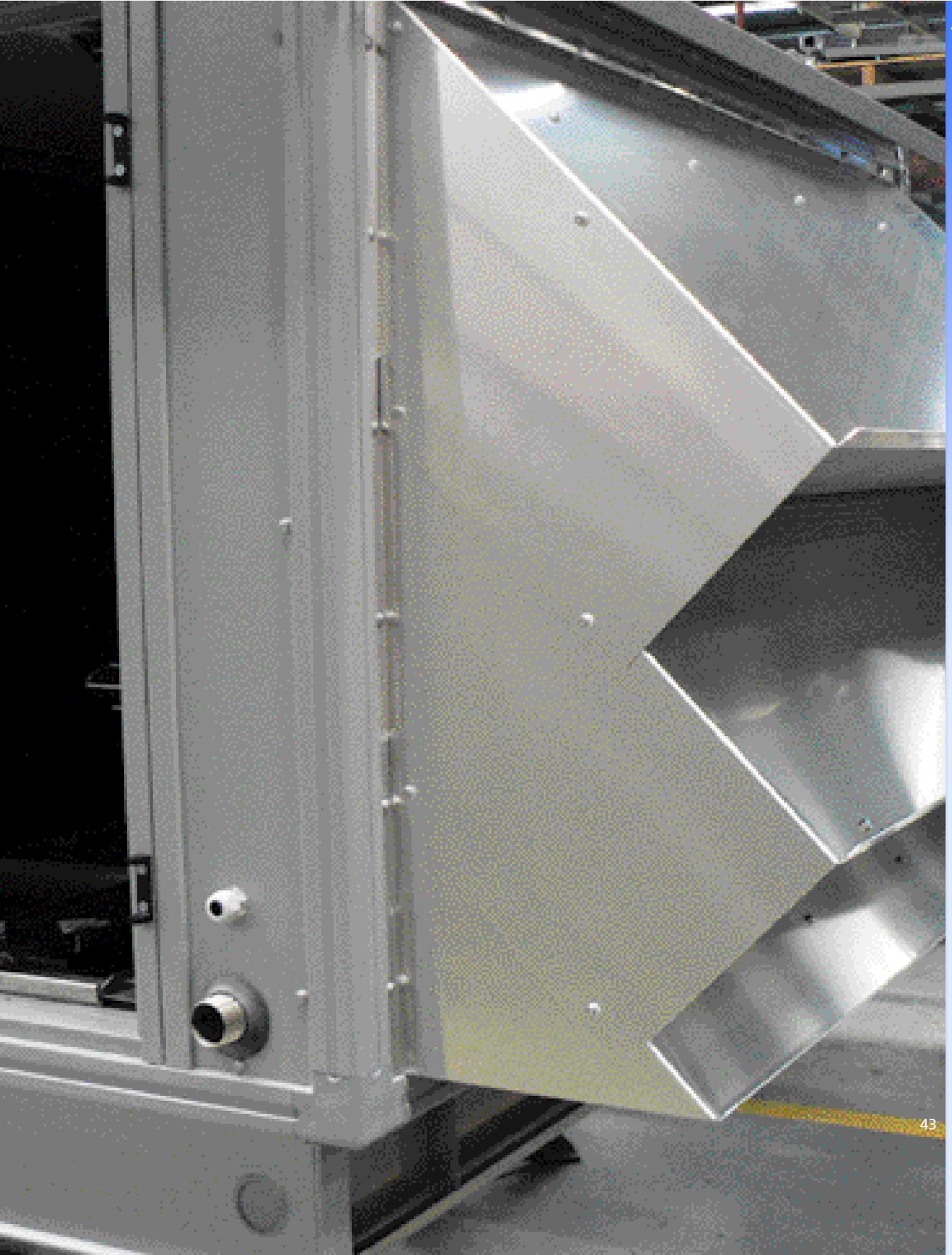
## 15 DISCHARGE

- 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

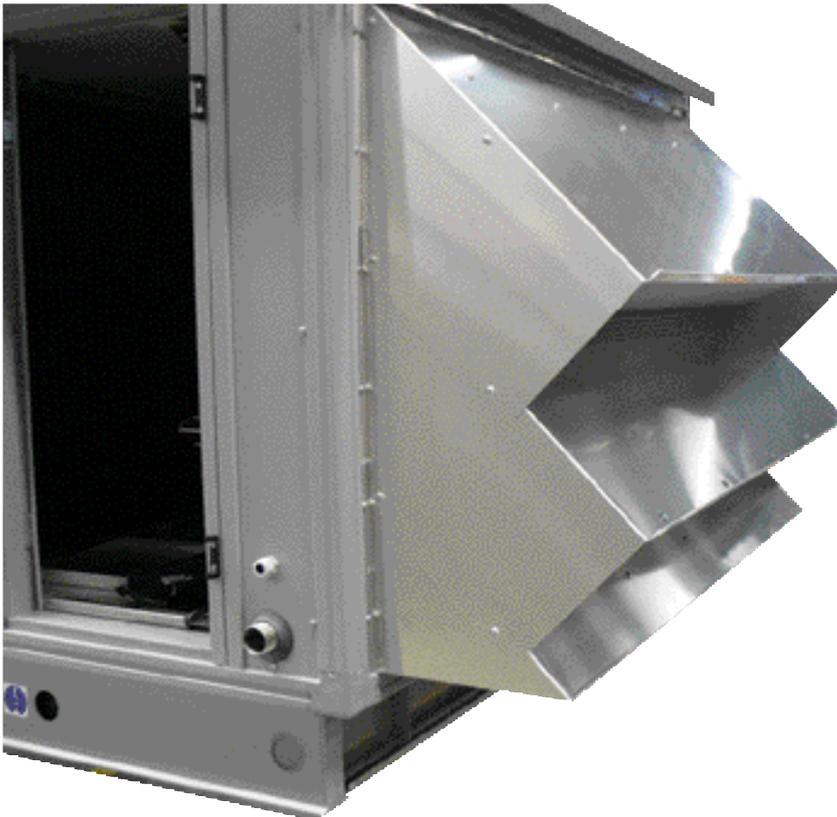




## 16 OUTSIDE INSTALLATION

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



*Outdoor air inlet cover*



*Stainless steel screw with plastic seal*

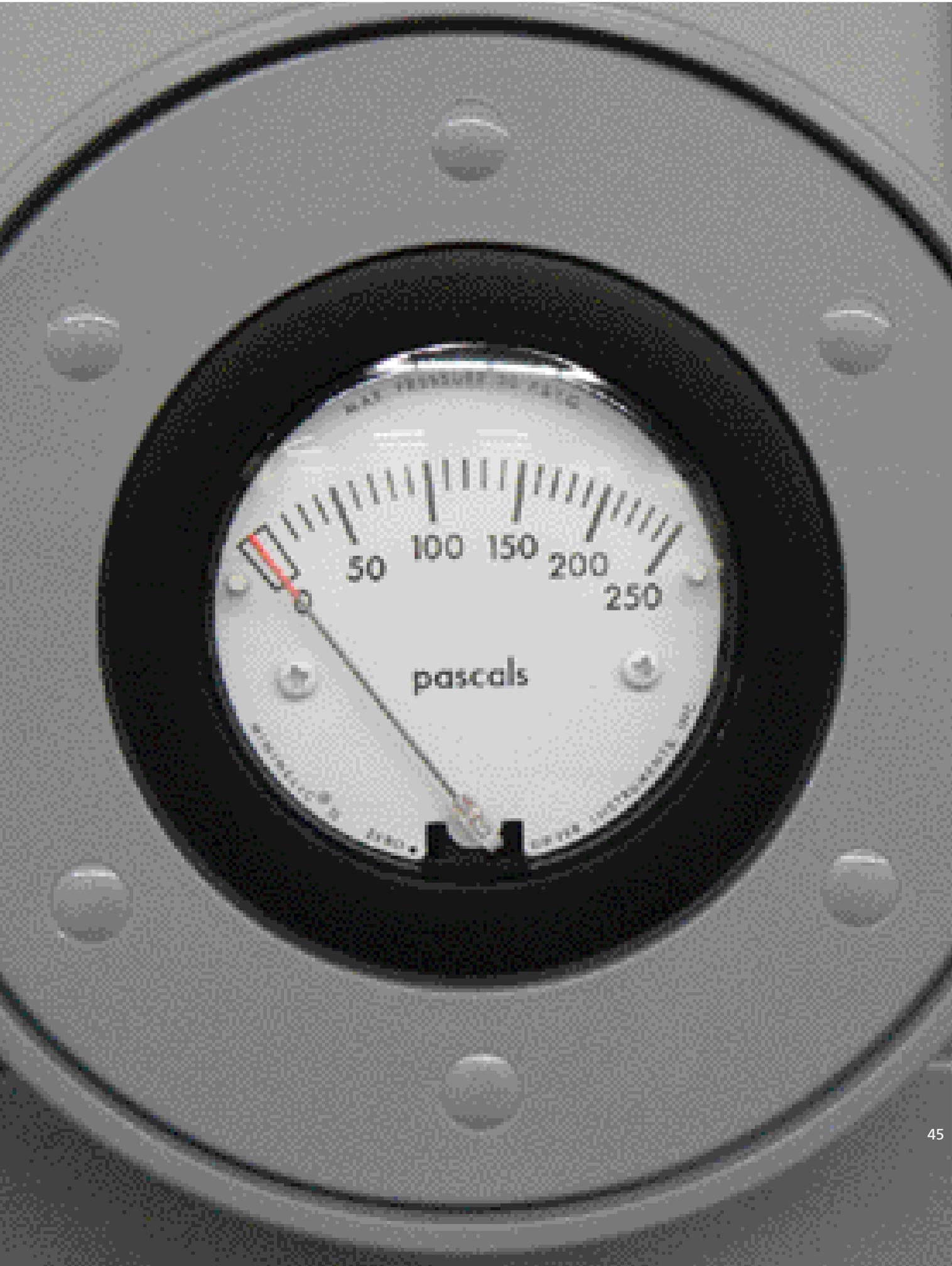


*Storm cord*



*Plastic roof*

# 17 ACCESSORIES





## 17 ACCESSORIES



*View port*



*Metering console*

- 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



*Feet*



Siphon



Light fitting

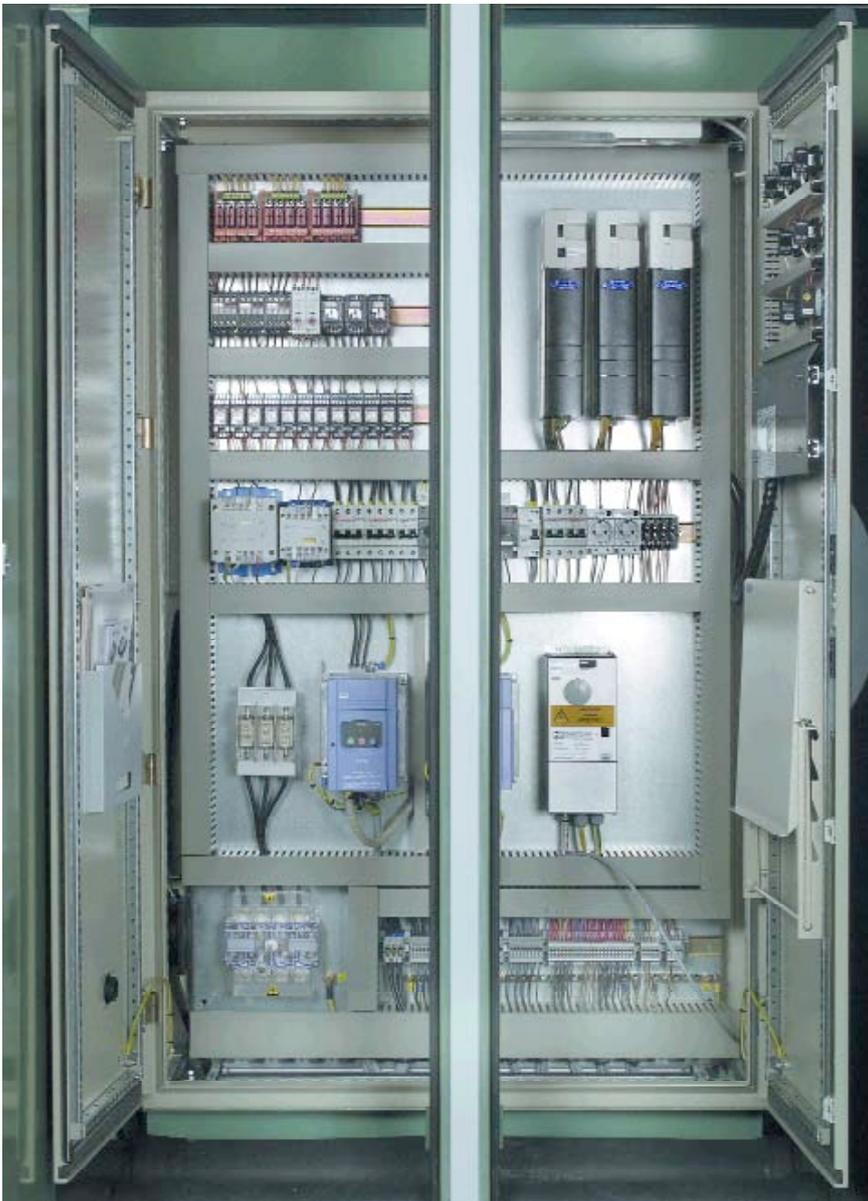


Actuator



## 18 Control

- fan capacity control
  - constant pressure control
  - constant volume control
  - frequency control in base casing
    - 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

Reference installations:

HEALTH CARE	LOCATION	COUNTRY
Academisch Medisch Centrum	Amsterdam	Netherlands
Leids Universitair Medisch Centrum	Leiden	Netherlands
Gasthuisberg	Leuven	Belgium
L'Hôpital de la Mere	Bordeaux	France
Queen Mary's Hospital	Roehampton	UK
Hôpital de Tahiti	Tahiti	Polynesia



*Gasthuisberg, Leuven, Belgium*



*Leids Universitair Medisch Centrum, Leiden, Netherlands*

### 19.2 Marine/Offshore

Reference installations:

MARINE/OFFSHORE	WHARF	COUNTRY
P&O Cruises Princess Class	Chantier d'Atlantique	France
Carnival Cruises Conquest Class	Fincantieri	Italy
Dahlia Top Sides	Daewoo	Korea
Sakhalin	Samsung	Korea
AP Moller Maersk Group	Odense	Denmark



*Cruise ship Queen Mary*



*Oil platform*



## 19.3 Airports

Reference installations:

AIRPORTS	LOCATION	COUNTRY
Schiphol Airport	Amsterdam	Netherlands
Super Terminal	Cheklap Kok	Hong Kong
Cairo Airport	Cairo	Egypt
Heathrow Airport	London	UK
Charles de Gaulle Airport	Paris	France
Vnukovo	Moskow	Russia
Chengdu Airport	Chengdu	China
Bâle Mulhouse	Mulhouse	France



*Charles de Gaulle Airport, Paris, France*



*Schiphol Airport, Amsterdam, Netherlands*



*Super Terminal, Chek Lap Kok, Hong Kong*



*Cairo Airport, Cairo, Egypt*

### 19.4 Archives, libraries and museums

Reference installations:

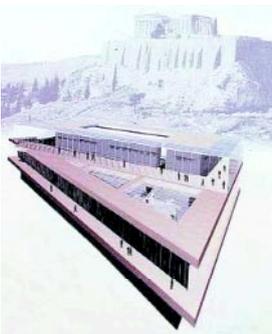
ARCHIVES, LIBRARIES AND MUSEUMS	LOCATION	COUNTRY
Boekendepot Rijksuniversiteit	Amsterdam	Netherlands
Rijksarchieven	Various towns	Netherlands
National British Library	London	UK
Tate Gallery	London	UK
Buitendepot Rijksmuseum	Amsterdam	Netherlands
Kunstmuseum	Wolfsburg	Germany
Akropolis Museum	Athens	Greece



National British Library, London, UK



Tate Gallery, London, UK



Akropolis Museum, Athens, Greece



Akropolis Museum, Athens, Greece

### 19.5 Culture, recreation and theatres

Reference installations:

CULTURE, RECREATION AND THEATRES	LOCATION	COUNTRY
Concertgebouw	Amsterdam	Netherlands
Circus Theater	Scheveningen	Netherlands
Media Studio Mubarak	Cairo	Egypt
Metropolis	Antwerp	Belgium
Arena 2000	St. Petersburg	Russia
Hartwall Arena	Helsinki	Finland



### 19.6 Offices, banks and government

Reference installations:

OFFICES, BANKS AND GOVERNMENT	LOCATION	COUNTRY
ABN-AMRO Bank	Amsterdam	Netherlands
Kantoorgebouw Unilever "De Brug"	Rotterdam	Netherlands
Gasunie	Groningen	Netherlands
Delftse Poort	Rotterdam	Netherlands
Lloyds Bank	Bristol	UK
Canary Wharf	London	UK
Portcullis House	London	UK
Interpolis	Tilburg	Netherlands
Philips Business Innovation Centre	Nijmegen	Netherlands
Tower Place	London	UK
Winchester House	London	UK
City Point	London	UK
GLA Building	London	UK



Gasunie, Groningen, Netherlands



Delftse Poort, Rotterdam, Netherlands



Lloyds Bank, Bristol, UK



Kantoorgebouw Unilever "De Brug", Rotterdam, Nederland



Philips Business Innovation Centre, Nijmegen, Netherlands



ABN-AMRO Bank, Amsterdam, Netherlands



Portcullis House, London, UK



Tower Place, London, UK



Winchester House, London, UK



GLA Building, London, UK



Interpolis, Tilburg, Netherlands



Canary Wharf, London, UK



City Point, London, UK



## 19.7 Schools and universities

Reference installations:

SCHOOLS AND UNIVERSITIES	LOCATION	COUNTRY
Erasmus Universiteit	Rotterdam	Netherlands
Universiteit Maastricht	Maastricht	Netherlands
Universiteit van Amsterdam	Amsterdam	Netherlands
Cambridge Law Faculty	Cambridge	UK
Imperial College of Science	London	UK

## 19.8 Industry

Reference installations:

INDUSTRY	LOCATION	COUNTRY
DSM	Rotterdam	Netherlands
Dupont de Nemours	Contern	Luxembourg
Nokia	Bochum	Germany
Peugeot	Mulhouse	France
Agfa	Mortsel	Belgium
Motorola	Swindon	UK



Motorola, Swindon, UK

### 19.9 Other

Reference installations:

OTHER	LOCATION	COUNTRY
The Barbican	London	UK
HVAC Tunnel	HSL-Zuid traject	Netherlands
Eurotunnel	Folkestone	UK
Sony Center	Berlin	Germany
Jebel Ali Power Station	Jebel Ali	U.A.E
Woolgate	London	UK
Santa Claus Care	Rovaniemi	Finland



*The Barbican, London, UK*



*Woolgate, London, UK*