

PRODUCT BROCHURE

**Air handling units
CAIRplus® SX**

***Modular configuration with highly efficient
energy recovery***



The signs of the times are unmistakable



Investors, plant engineers, planners, and architects no longer ask “whether” but “how” they can enhance the degree of sustainability of their plants and building management systems. Each building is unique. Its location, size, construction quality, and increasingly the building management system determine its value and profit. The energy state of a building has gained appreciably in significance here: it is a fact that buildings consume around 40 percent of the world’s energy, and produce 21 percent of global greenhouse-gas emissions. The proportion of the energy costs in the “second rent” for users and residents is constantly increasing.

Where the heating, cooling, cleaning, purification, humidification and dehumidification of air are required, DencoHappel makes its contribution to progress. Customised climate control and air treatment, with the maximum-possible reduction in energy consumption over the entire life cycle of the facilities: this all pays out handsomely in euros and cents, in comfort, and in staff productivity. Our solutions reliably comply with all international standards in highly sensitive areas such as hospitals and cleanroom applications. They likewise set new standards for sustainability and flawless system integration in advanced sports arenas, production facilities, airport buildings, and swimming pools – as well as in offices, museums, and hotels.

The one who processes air must master it

It is due to the precision work that has gone into the development of the hardware and software that our air treatment can neither be seen nor be heard, provides pleasant experience and helps in avoiding wastage of energy and money.

Can a building with large glazed areas be heated during spring and autumn on its north side and cooled on its south side, with only one system and without having to switch on the central heating? Does a system used, e. g., for heating cooling, humidification and dehumidification in pharmaceutical or electronic industry also protect against dirt and bacteria? Can investors and building owners calculate the life cycle costs of a central plant air handling unit, determine the effect of an energy-saving equipment on the operating cost for this purpose and thus select the optimal efficiency class right in the configuration stage of the plant?

DencoHappel has found answers to these and many other questions concerning air treatment and climate control – and has implemented them in solutions which reflect its experience gained in many and various successful applications. The core proposal consists of a broad spectrum of central and decentral air treatment plants, separators and filter plants up to complete clean-room systems. Their function, control and design can be fine tuned to their task, the condition and infrastructure of buildings, the operating cost calculations and the highest standards of energy efficiency and climate protection. State-of-the-art control technology developed in-house permits the individual control in individual rooms just as it permits the central handling in the context of building management system.

Control unit, which has interfaces to all usual systems of the building automation, provide for the trouble-free integration of the devices into the building management system. The fact that planners and users can implement their own desires at the design stage of the plant itself is the proof of the precision work involved in the air conditioning equipment.

DencoHappel stands for:

- Tailor-made air quality and a healthy, comfortable room climate with extremely noiseless operation
- Maximum energy efficiency and reduction in the CO₂ emission
- Precise central and decentral control and regulation
- High adaptability to most diverse functions and environments
- Easy system integration
- Durability and high degree of availability at low maintenance costs





A PERFECT WORKING CLIMATE

DencoHappel handling units are optimally designed for a great diversity of application areas. With their highly developed heat recovery systems, simple assembly and modern hygienic standards, DencoHappel handling units are the right choice.

With modular configuration – and virtually unlimited possibilities

When room air lies within the narrow range of optimal indoor comfort temperatures, we feel at ease. This applies not only for home applications, but also for production, office, and sales rooms.

Indoor room climate is influenced by many factors: the number of persons in the room, the number of computers, the lighting, and many other parameters. This is why central air handling is so important for closed rooms. But climate also plays an essential role in production processes. Good HVAC conditions must prevail, for example, in the food and beverage industry. In hospitals and in the pharmaceutical industry, hygiene also plays a critical role.

DencoHappel central air handling units implement heating, cooling, humidifying and dehumidifying, filtering, and cost-effective energy recuperation. DencoHappel is constantly working to improve the quality and engineering of these functions. One result is the new generation of central air handling units: CAIRplus

Whether in new buildings or in the modernization of existing facilities, central air handling solutions can be optimally planned and designed with CAIRplus. The various models can be flexibly selected and matched to any requirements, and dimensioned by means of DencoHappel planning software. At DencoHappel, these efforts focus is on quality and innovative: ensured by constant inspection, further development, and maintenance of state-of-the-art production processes.

Not the acquisition, but rather the operating costs over the entire lifetime constitutes the greatest share of the costs of a central air-handling unit. For this reason, the CAIRplus units can be economically equipped with high-efficiency energy recuperation and energy-saving drive systems. The EU guidelines, which define minimum standards for electric motors and fans, are not only satisfied, but in some cases far exceeded. The certifications according to Eurovent and the German Association of HVAC Manufacturers assure greater transparency and safety.

In addition, completely smooth inner surfaces and good access to all components guarantee high hygienic standards. DencoHappel regularly monitors the currently valid official regulations and assures that they are being met.

Apart from the installed components, additional space for piping and cable runs is available, while the large access doors considerably alleviate maintenance and service work. All door locks, screw connectors and hinges are directly integrated in the unit frame so that even separation joints require no additional space. If needed, individual parts can be easily installed at the construction site from the outside. Shipping to an installation site for the delivery of units up to 1,500 kg is carried out easily and simply with the lifting lugs on the upper side.



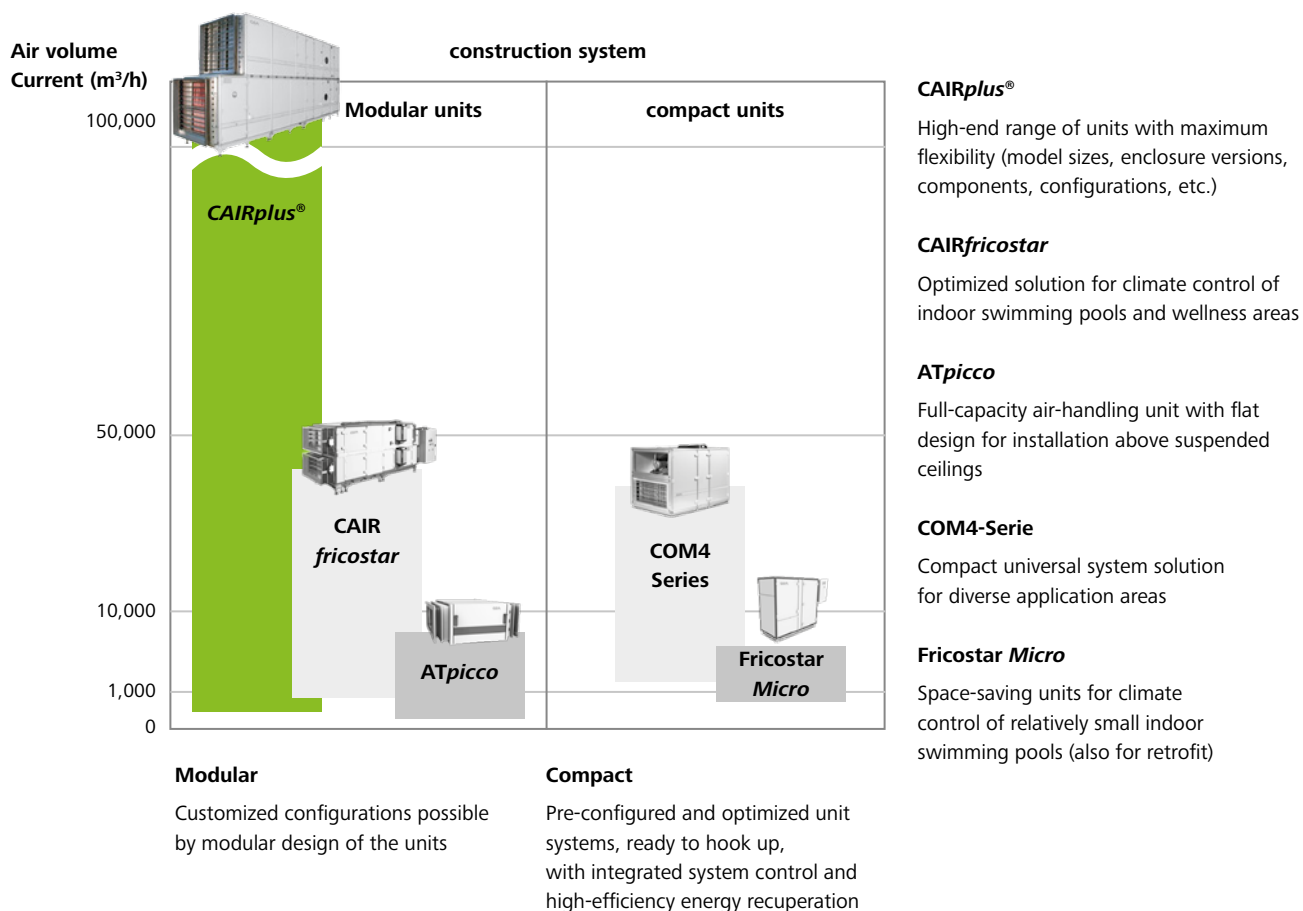
Your advantages:

- All positioning variants are available: indoor and outdoor versions, vertical or horizontal installation – as well as configurations with units on top of each other, behind each other, or next to each other.
- Highest energy efficiency through modern heat recovery systems
- Simple installation and maintenance
- High hygiene standards
- Certified according to Eurovent and AC Manufacturing Association

Air handling units

Project requirements do not always repeat themselves: with its especially designed product ranges, DencoHappel can satisfy practically every demand. For some applications, only the exchange of air is required; however other applications have more sophisticated requirements with respect to temperature, humidity and air purity. Modular units allow the free selection of components and functions and can be adapted to the specific requirements down to the smallest detail. Compact units are optimized for their applications, with high-efficiency energy recuperation. They are delivered wired and ready for connection, with integrated control systems.

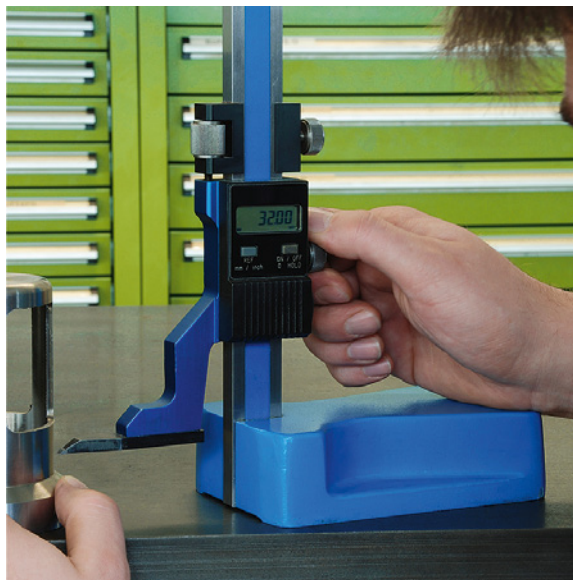
Overview of DencoHappel Central Air Handling Units





TESTED + CERTIFIED = MAXIMUM SAFETY

Eurovent and the German Association of HVAC Manufacturers



HVAC systems by DencoHappel satisfy the most stringent of quality requirements and are subjected to periodic testing.



Measuring means knowing.

And the customers get exactly what they expect. This is the motto of the “Eurovent Certification Program”. As a result, documentation and software are subjected to strict tests. The EN 13053 and EN 1886 Directives stipulate the criteria to be applied in these tests. Independent testing institutions periodically inspect these characteristics in accordance with Eurovent certification stipulations.

Modelbox Test – enclosure properties in accordance with EN 1886

Enclosures are provided to an independent testing institution every 6 years, which tests these enclosures in accordance with the following properties:

- Mechanical stability (D1 ... D3)
- Enclosure leakage (L1 ... L3)
- Filter-bypass leakage (G1 ... F9)
- Thermal insulation (T1 ... T5)
- Thermal-bridge factor (TB1 ... TB5)
- Sound insulation of the enclosure.

Real Unit Test – software performance characteristics as per EN 13053

In these tests, an independent expert selects one unit type every 3 years at the manufacturer’s plant. This type is then exactly manufactured as a specimen copy, measured by a testing institute, and compared to the software data. The manufacturer’s software is then certified only if all the performance characteristics of the copy are successfully verified. The following performance data are tested:

- Mechanical stability
- Enclosure leakage
- Filter-bypass leakage
- Air flow rate
- Available static pressure
- Power consumption
- Noise emitted from the enclosure
- Noise transmitted by the air flow
- Heating capacity
- Cooling capacity
- Degree of energy recovery
- Water side pressure drop

Inspection of the production plants

An expert annually visits the production plants of the certified manufacturer. The inspection must verify the conformity of the produced unit with the configuration software.

Certified efficiency – energetic certification

Consumption by HVAC systems represents a major share of the energy used by buildings. To reduce this consumption and, in turn, CO₂ emissions, measures are being taken in many countries to increase the efficiency of HVAC systems. But how it is possible to objectively assess energy efficiency on the basis of simple characteristic values?

The Eurovent energy label

Analysis of these factors is summarized in Eurovent efficiency classes A+ to <D, with A+ standing for the greatest efficiency. The basis of evaluation is EN 13053, which assigns various classes to the effect factors of air speed, efficiency of air movement, energy-recuperation efficiency, and pressure drop of energy recuperation. In addition, the Eurovent system considers the climate conditions at the site. In cold climate regions, the use of an efficient energy-recuperation system has a higher rating value than in warm regions. The design temperature for winter operations takes this into account in the calculations. Plants which do not process outdoor air are identified by Eurovent with a separate label A+C, to <D_C. These systems are evaluated only with respect to air speed and efficiency of air movement. There is a trade-off between the individual rating classes. Excessive air velocity can be set off by energy recovery with greater efficiency.

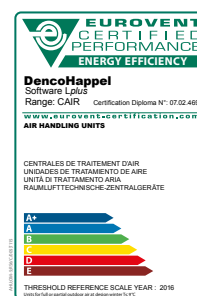
Calculation of the Eurovent energy-efficiency classes						
Class		A+	A	B	C	D
Speed						
V _{class}	m/s	1.4	1.6	1.8	2	2.2
Energy recovery						
η _{class}	%	83	78	73	68	63
Δp _{class}	Pa	250	230	210	190	170
Fan power consumption						
NG _{ref}		64	62	60	57	52

RLT – German Association of HVAC Manufacturers

In addition, efficiency classes A+, A, and B are awarded as per the stipulations of this association. Equipment that fails to satisfy these requirements does not receive a classification. Criteria of one class are considered to be satisfied only if all conditions are met.

Numerous factors influence the energy consumption of a central air-handling unit:

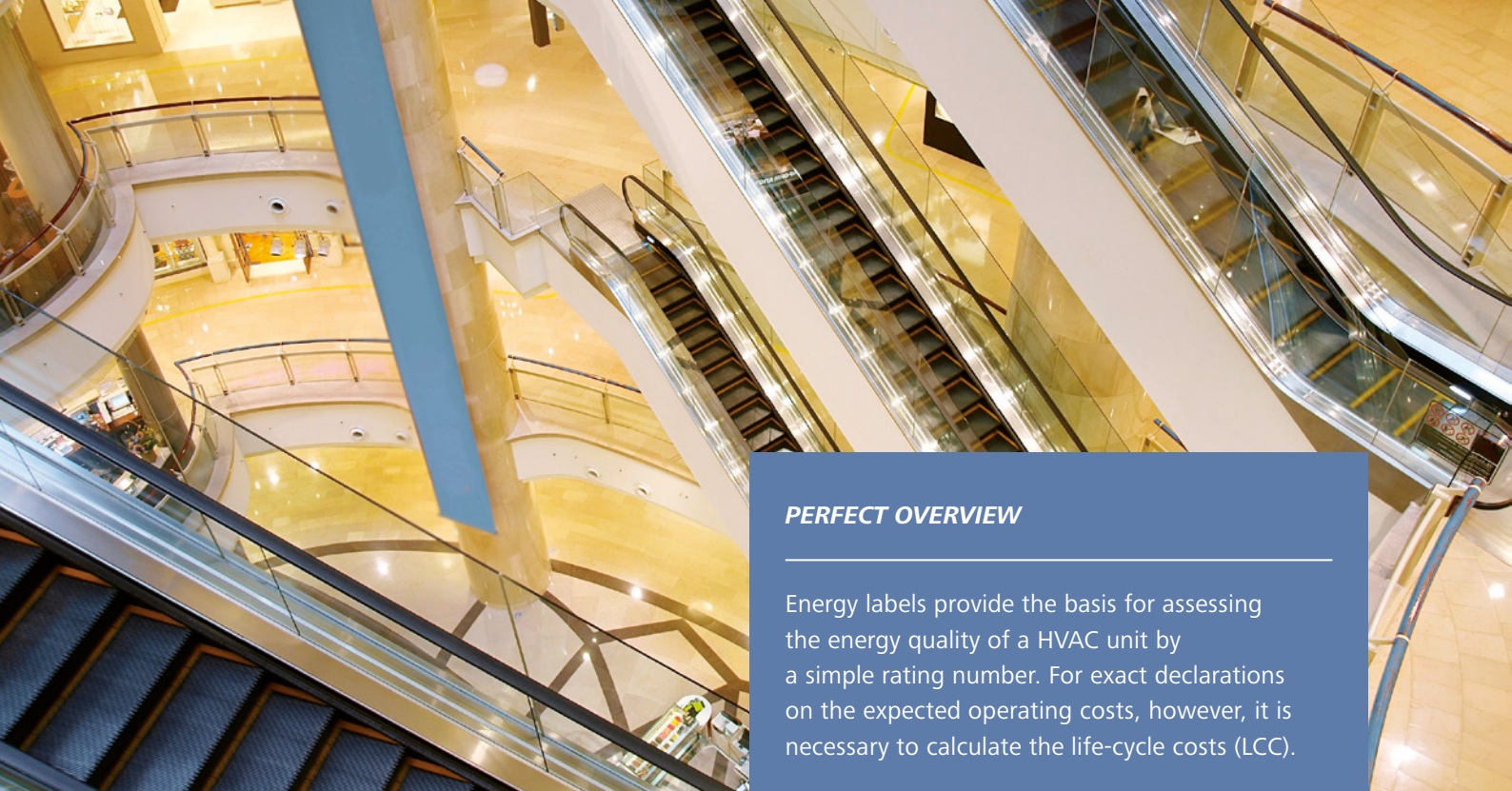
- The air speed in the unit
- The power consumption of the motors
- The efficiency and the pressure drop of the energy recovery
- Climate conditions at the installation site



Eurovent assigns energy efficiency ratings from A+ to <D whereby units with the label A+ show the greatest efficiency.



The German Association of HVAC Manufacturers awards efficiency labels A+, A, and B. Systems that do not satisfy all requirements do not receive a label.



PERFECT OVERVIEW

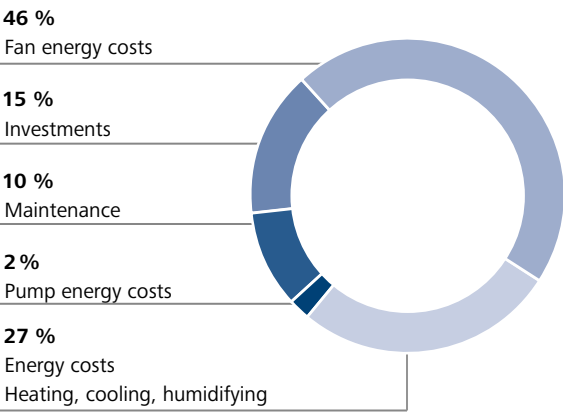
Energy labels provide the basis for assessing the energy quality of a HVAC unit by a simple rating number. For exact declarations on the expected operating costs, however, it is necessary to calculate the life-cycle costs (LCC).

CONSIDERATION OF ALL COSTS IN ADVANCE

Life cycle cost calculation

“LCC Guidelines for Air Handling Units” published by Eurovent provide the basis for this calculation. These guidelines are provided in accordance with DIN V18599-3 and VDI 2067-1. The calculation is based on the climate conditions at the equipment site, as well as on operating times. Building behavior is simulated by scenarios that select the supply and extract-air temperatures as a function of outdoor-air conditions. Further influencing variables such as energy prices, investment costs, and costs for maintenance and servicing round out the basis for calculation. Further influencing variables such as energy prices, investment costs, and costs for maintenance and servicing round out the basis for calculation.

Several equipment configurations can be calculated in parallel and compared to each other. The result is a presentation that – in addition to costs of the individual energy media – also indicates the total costs accruing throughout the life cycle under consideration.



Life Cycle Costs

Investment costs	Energy costs	Maintenance	Disposal
Planning Acquisition Installation	Current Heat/cold Water	Maintenance and Cleaning Repairs	Disassembly Recycling and disposal

Lplus configuration software

CAIR*plus* central air handling units are characterized by their great diversity of models, which provide a tailored solution for every requirement and building situation. Each unit is individually designed with the configuration software DencoHappel *Lplus*.

Time is money This especially applies to the project engineering of HVAC facilities. In order for you to determine the selection and configuration of the suitable central air handling unit for your needs as easily and rapidly as possible, we have developed the DencoHappel *Lplus* configuration software.

CAIR*plus* precision climate-control systems have the advantage that all products can be designed to meet individual requirements. The DencoHappel *Lplus* design software helps you to implement your desired system in no time at all. Configuration proposals are generated according to your inputs. Component unit spacing, configuration of the modules as well as weights and measures are immediately determined and shown by *Lplus*. You can't really plan faster than that, and at the same time more reliably! This means that you gain valuable time for other tasks.



Advantages of the DencoHappel *Lplus* configuration software

- Individual configuration suggestions
- Determination and display of unit sub-divisions, modular configurations, dimensions, and weights
- Calculation of life-cycle costs (LCC)
- Simple program handling
- Fast, reliable selections and planning
- Valuable time gain for other tasks
- Specification of energy efficiency classes (Eurovent and HVAC Manufacturers)
- Calculation methods regularly examined by Eurovent



DencoHappel *Lplus* design software covers all products by DencoHappel. The free full version can be downloaded from the internet (www.dencohappel.com) or requested from us.

Hygiene-tested HVAC systems



Hygiene connection frame



The housing interior of the CAIRplus central air handling unit is completely smooth and thereby easy to clean. This creates optimal prerequisites for hygienic operation according to VDI 6022, VDI 3803 and DIN 1946 part 4.

Great emphasis is placed on a hygienically appropriate construction in the design and structure of the CAIRplus central air handling units. CAIRplus units are entirely smooth on the inside. There are no edges or threaded connections to restrict complete cleaning of the unit.

For stricter hygiene standards – for example, in buildings and rooms of public health institutions – additional requirements must be satisfied as described in DIN 1946, Part 4. CAIRplus central air handling systems satisfy these requirements as well. These requirements are also satisfied by the CAIRplus air handling units.

Hygiene requirements applicable to HVAC equipment are stipulated in the following standards and guidelines:

- VDI 6022 Page 1 Hygiene requirements placed on HVAC systems and units
- EN 1886 mechanical properties and measurement techniques
- EN 13053 performance indicators
- DIN EN 13779 general fundamentals and requirements
- DIN 1946 Part 4 HVAC systems in hospitals



Integrated cooling

CAIRplus central air handling units with integrated cooling systems are virtually entirely ready for connection, and their components have been optimally coordinated with each other. They are distinguished by their integrated control technology and highly efficient energy recovery.

DX direct evaporator technology with R134a refrigerant achieves high levels of reliability and long service life. These systems are also absolutely reliable in service, even under conditions of high outdoor temperatures. Their output can be continuously matched to momentary cooling requirements. For minimized energy consumption, DencoHappel also offers the option of adiabatic evaporative cooling. All cooling components and the control system have been integrated in the unit.

The refrigeration circuit

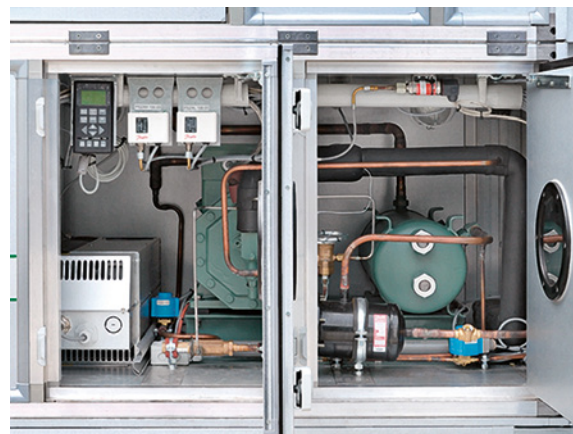
- Refrigerant R134a
- Heat exchanger as direct evaporator and refrigerant condenser
- Semi-hermetic compressor (reciprocating piston compressor up to 100 kW cooling capacity, with screw compressor for greater requirements)
- Output control by means of cylinder shut-off and frequency converter
- Control range from 30 to 100% of the maximum cooling capacity (optional: 10 to 100%)

The refrigerant R134a

- Good thermal and energy characteristics
- No temperature glide
- Low condensation pressure; high condensation temperatures > 60°C are possible
- Reliable heat dissipation as a result of great temperature range
- Quiet operation; great operational reliability
- Low energy consumption
- Low global warming potential (GWP)
- no "Ozone Depletion Potential"

The control system

- Control cabinet integrated into the unit and completely wired
- Control by the Matrix 4700 system
- Optional bus interface
- As alternative, available in an external switch box



Overview of the integrated cooling technology

- Great number and variety of application areas: e.g., in offices, supermarkets and department stores
- Small footprint
- Everything from one source
- No external piping
- Little engineering effort
- Simple installation
- Great energy efficiency, since the system is always connected to energy recuperation
- For air flow from 3.000 to 50.000 m³/h
- For indoor and outdoor installation
- Optional adiabatic extract-air humidification
- Control by the MATRIX 4700
- Project-specific solutions are possible

Air handling conformity with ATEX



Explosion groups

Classification of the amount of energy required to ignite substance-dependent quantities and volumes

- IIA = a great amount of energy
- IIB = a moderate amount of energy
- IIC = a small amount of energy

With its products for numerous applications, DencoHappel GmbH provides the necessary safety for explosion-endangered areas. DencoHappel central air handling units represent a significant element here. Their many and various functions provide the basis of fully functional HVAC systems for application in explosion-endangered zones.

An atmosphere can be explosive as a result of local conditions and/or operational circumstances. Such specific conditions involve mixtures of air and combustible gas, vapor, mist, or dust. For an explosion of these substances, atmospheric conditions are necessary under which the process of combustion – after successful ignition – spreads to the entire non-combusted mixture. Explosion-endangered areas can develop where explosive gases, mist, vapor, or dust exist or could form. Areas in which hazardous, explosive atmospheres can exist are classified by zones according to the probability of occurrence of hazardous atmospheres.

Classification into zones				
Danger of explosion	Example	Gasses	Dusts	Required category
An explosive atmosphere is always, long-term, or frequently present	Inside the containers	Zone 0	Zone 20	1
An explosive atmosphere is sometimes present	In the area of filling and emptying openings	Zone 1	Zone 21	2
An explosive atmosphere is rare and then also only temporary	Ranges around the zone 1/21	Zone 2	Zone 22	3

Breakdown into temperature classes							
Temperature class		T1	T2	T3	T4	T5	T6
Ignition temperature of the combustible substances greater than	°C	450	300	200	135	100	85
Maximum permissible surface temperature of equipment	°C	450	300	200	135	100	85



HIGHEST SAFETY

All operators of facilities with the possibility of formation of explosive atmospheres are required to classify their plants by zone: either themselves, or with the aid of a consulting company, in accordance with ATEX 137 (Guideline 1999/92/EG) and its national laws and ordinances.

The operator must also observe the fundamental measures for primary protection against explosions with “avoidance of explosive atmospheres”: e.g., by means of dilution, limiting, substitution of substances, or the like. A ventilation or climate-control unit as individual component cannot alone guarantee complete and comprehensive explosion protection, since the protective concept must cover the entire facility. The overall responsibility therefore ultimately lies with the user or the contractor.

ATEX conformity certification of DencoHappel

Guideline 94/9/EG – better known as ATEX 95 – contains the stipulations for “equipment and protective systems for application in explosion-endangered areas in conformity with the relevant stipulations.” DencoHappel GmbH delivers CAIRplus for use in explosion-endangered areas in accordance and conformity with ATEX Guideline 94/9/EG (ATEX 95).

ATEX Conformity Certification for DencoHappel	
Gas Ex application	Dust Ex application
II 3 G IIB T3 interior	II 3 D T200°C interior
II 3 G IIB T4 interior	II 2 D T200°C interior
II 2 G IIB T3	
II 2 G IIB T4	

Equipment classification in accordance with ATEX

Example: Ex II 3 G IIB T4 interior

- II
Equipment Group (I = mining; II = all other areas of application)
- 3
Category (3 for Zones 2, 22; 2 for Zones 1, 2, 21, 22; 1 for all zones)
- G
G = gas; D = dust
- IIB
explosion Group
- T4
Temperature class
- Interior
Inside the equipment (if no indication given, then for inside and outside)

ATEX Conformity Certification has been provided for the applications to the left:



REGULATE FEEL-GOOD CLIMATE

With both Compact System Control, or with DDC System Control: the user enjoys many functions for operation and control of the CAIRplus.

JUST THE RIGHT TURN FOR THE RIGHT ROOM CLIMATE

The control system: efficient and intelligent

Control system with numerous monitoring options:

- Pressure-drop measurement for monitoring supply-air and extract-air filters
- Position measurement of the outdoor-air damper, to prevent frost damage
- Temperature measurement to avoid frost, by an additional frost-protection thermostat with switch-off function
- Icing temperature measurement to protect the direct evaporator
- Monitoring of the safety chain for external compressor-condenser units
- Plausibility check for detection of sensor faults
- Monitoring of malfunction reports from circulation pumps, frequency converters, and energy-recuperation systems

The user can optimally match the functions of the central air-handling unit to the respective application case: either by means of the MATRIX operator-control panel, or by the MATRIX.PC startup software. The system acquires a great number of measured values and continuously monitors them, to assure safe and reliable operation of the CAIRplus. If one of the monitoring units responds, this is reported in plain text on the operator control panel, parallel via the malfunction-report output, and/or through the interface to the building-services management system.

Communicative and easily understood – the operator-control level

The MATRIX operator-control unit has a graphics-capable display that is operated with a menu structure analogous to that of a mobile telephone. As a result, setpoint values and switching times can be very easily entered, and current actual values and instruction messages can be simply read off. If a second operator-control unit is desired (e.g., for advance, simple entry of setpoint temperatures), this can take place via the existing MATRIX.Net bus system.



MATRIX 4700
Compact System Control

Fast initial startup

The components of the MATRIX Compact System Regulation are completely tested for correct functionality before delivery. The desired functional characteristics are preset as much as possible.

MATRIX 4700 Compact System Control or DDC System Control

All components of the CAIRplus Air Handling Units for a partial air conditioning can be controlled and regulated with the MATRIX Compact System Regulation. The exception is full air conditioning with a humidification and dehumidification component. DencoHappel offers the DDC system control, which is unrestricted in its functional characteristics and can be configured to all details of the on-site requirement profile.

MATRIX 4700 – maximum motor ratings

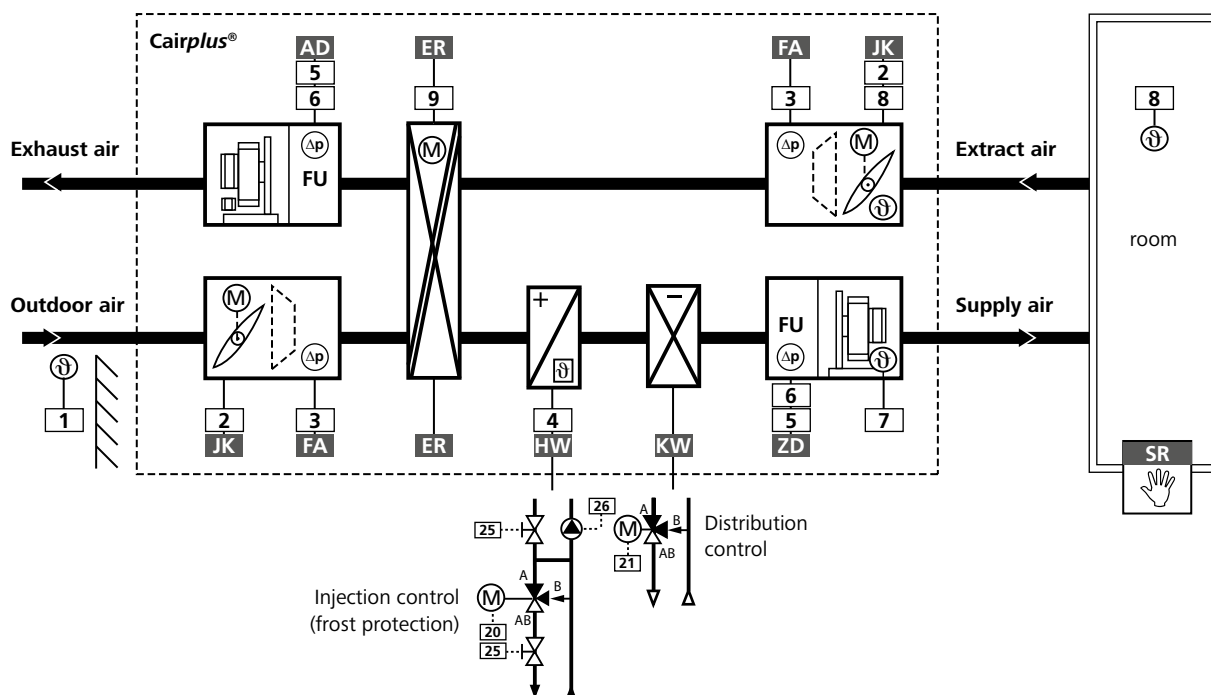
- with frequency converters 2 x 15.0 kW
- without frequency converters 2 x 7.5 kW



DDC cabinet for open- and closed-loop control

Compact system control

Heat supply into the brine flow



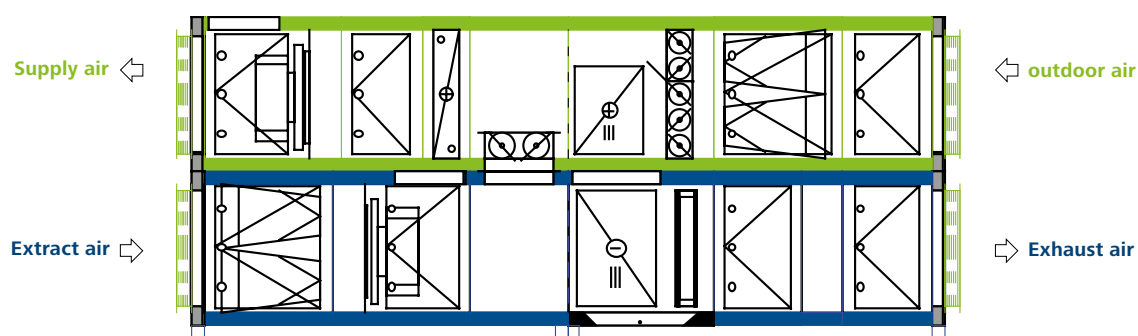
Compact system control

Component and functions		● Packaged content or regulation	
ZD	Supply air fan with frequency inverter FI	● mounted	Direct drive 3~400 Volt / 50 Hz
AD	Extract air fan with frequency inverter FI	● mounted	Direct drive 3~400 Volt / 50 Hz
JK	damper blades outdoor air / extract air	● mounted	Counter-directional dampers with gear drive
FA	Filter outdoor air / extract air	● mounted	outdoor air F7 / extract air F5
ER	Energy recovery	● ECOROT	DencoHappel rotary heat exchanger
HW	Heating: pumped warm water	● no steam	Steam heating on request
KW	Cooling: pumped chilled water	● no refrigerant	Refrigerant cooling on request
SR	Compact control cabinet	● enclosed separately	completely wired and ready to operate
1	External sensor	● enclosed separately	DencoHappel NTC sensor with IP54 casing
2	Motor actuator for louvered dampers outdoor air / extract air	● mounted	DencoHappel motor drive 230 Volt
3	Differential pressure switch outdoor air filter / extract air filter	● mounted	Bottom responsivity 40 Pa
4	Frost protection thermostat	● mounted	DencoHappel thermostat with changeover contact
5	Pressure sensors for regulating air flow rate	● mounted	Volume or pressure or external signal 0 ... 10 Volt
6	Frequency inverter supply/extract air	● mounted	For speed regulation of fan motor
7	Limitation sensor for supply air	● mounted	DencoHappel NTC-built-in sensor
8	Extract-air sensor mounted and/or room sensor enclosed	● montiert / enclosed	DencoHappel built-in sensor or with IP21 casing
9	Drive motor rotary heat exchanger	● mounted	For speed regulation of rotor
20	Motor actuator 3-way mixing valve heating with pumped warm water (PWW)	● enclosed separately	DencoHappel motor drive 230 Volt
21	Motor actuator 3-way distribution valve PCW cooling	● enclosed separately	DencoHappel motor drive 230 Volt
3 way valves		Hydraulics	
A	Return line from heat exchangers	Partial medium volume	Water or brine as medium
B	Bypass of supply line	Partial medium volume	Water or brine as medium
AB	return line to energy generator	Total medium volume	Water or brine as medium
25	Mechanical throttle valves	on-site by others	For on-site hydraulic balancing
26	Secondary pump for heating circuit	● on-site by others	DencoHappel regulation On/Off

Examples of application possibilities

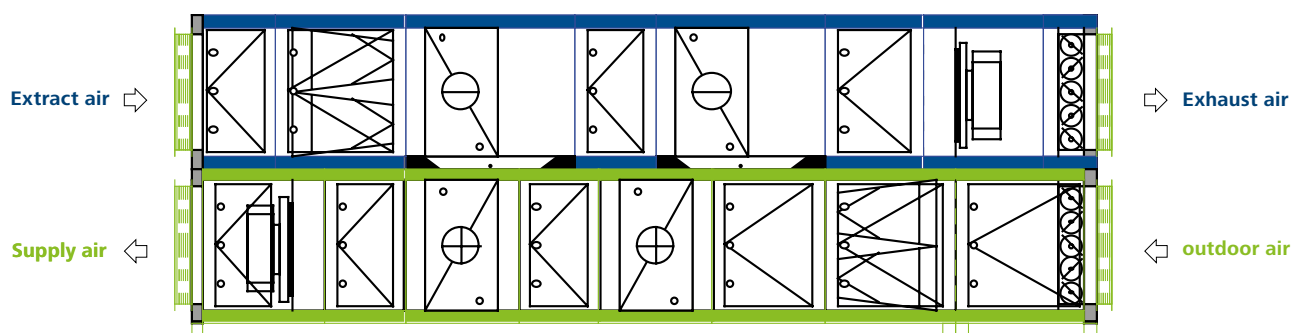
CAIRplus® with direct drive and ECOSTAT heat recovery, mixed-air operation

Supply air equipment - heating - mixing - energy recovery ECOSTAT - filtering
extract air - filtering - mixing - energy recovery ECOSTAT



CAIRplus® with direct drive and multiflow-heat recovery, mixed-air operation, partial air conditioning = without humidification

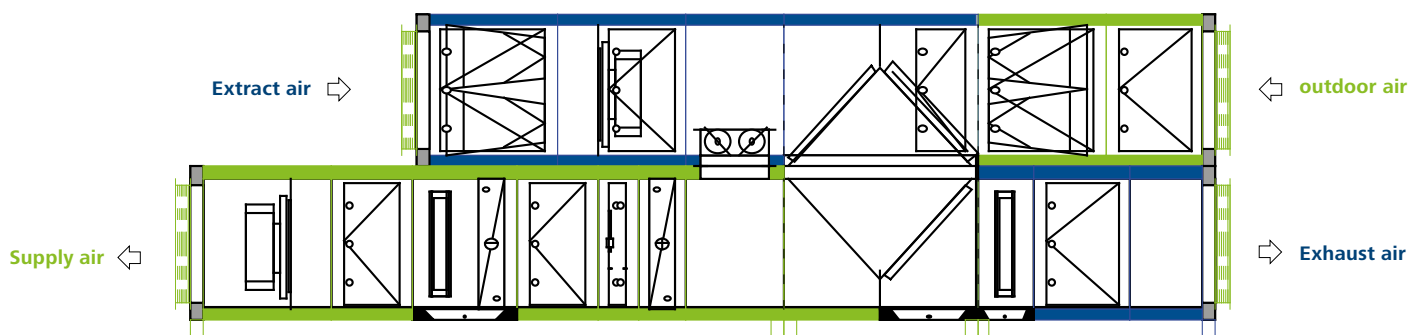
Supply air equipment - energy recovery multiflow - filtering
extract air - filtering - energy recovery multiflow



Examples of application possibilities

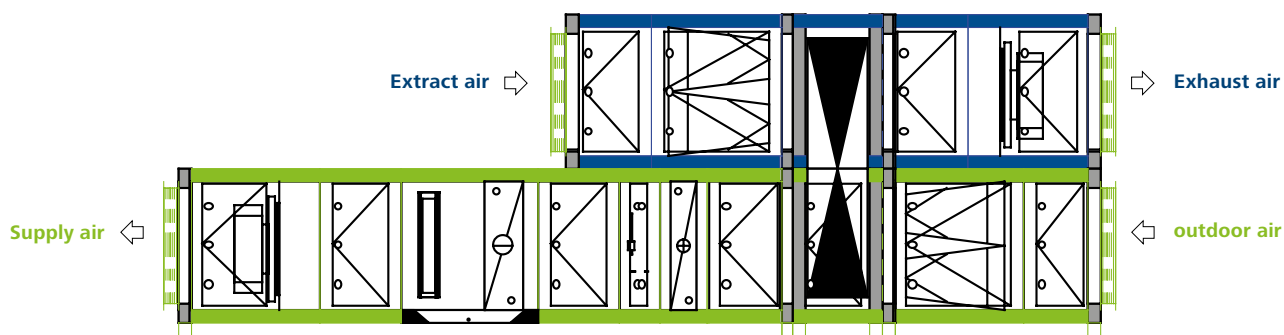
CAIRplus® with direct drive and ECOPLAT energy recovery, mixed-air operation
partial air conditioning = without humidification

Supply air equipment - cooling - heating - recirculating air - ECOPLAT - filtering - outdoor air
extract air - filtering - recirculating air - ECOPLAT - exhaust air



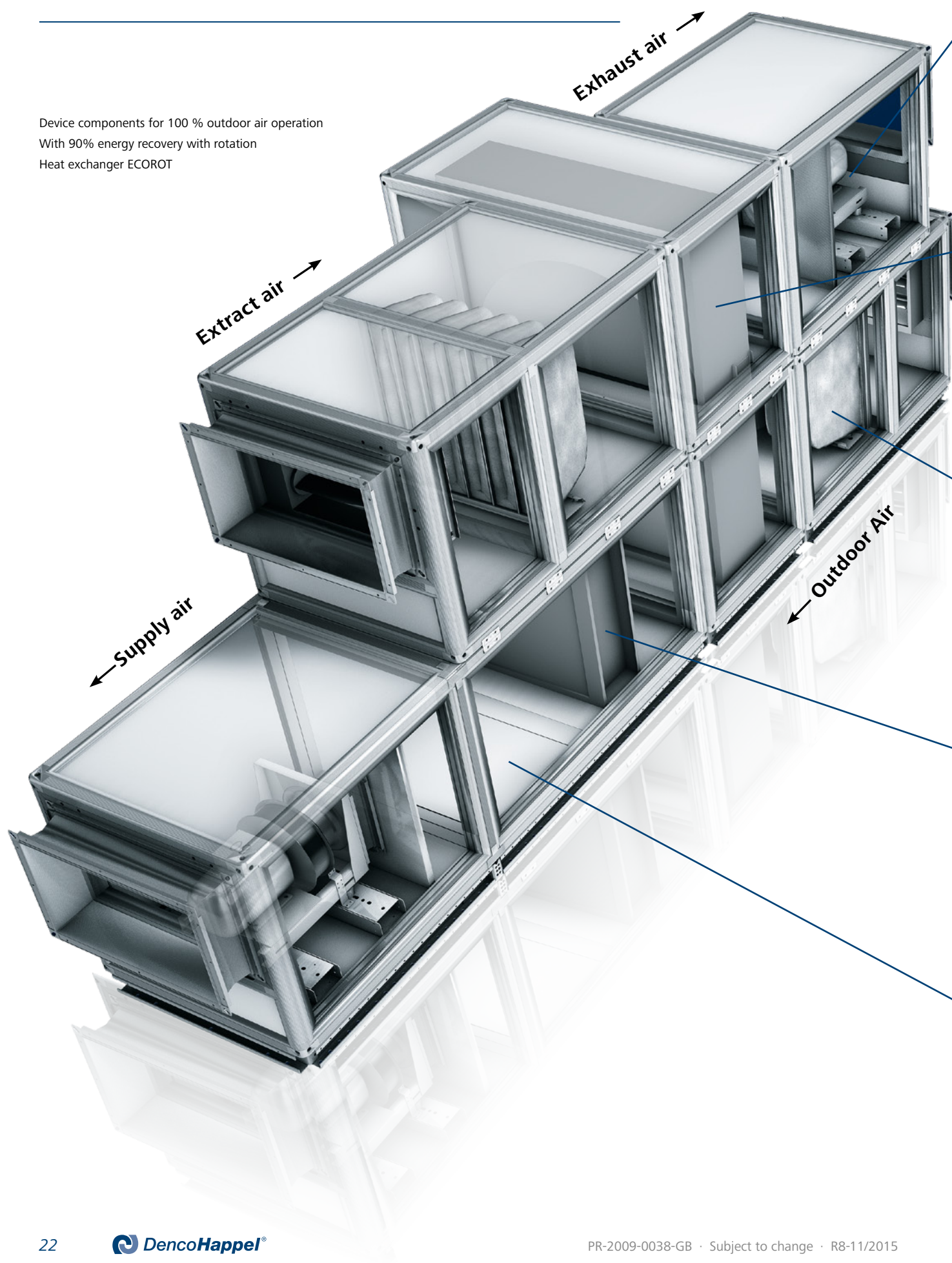
CAIRplus® with direct drive and ECOROT energy recovery, mixed-air operation
partial air conditioning = without humidification

Supply air equipment - cooling - heating - ECOROT - filtering - outdoor air
extract air - filtering - ECOROT - exhaust air

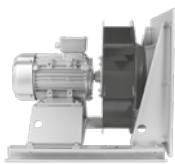


CAIRplus® SX Unit components

Device components for 100 % outdoor air operation
With 90% energy recovery with rotation
Heat exchanger ECOROT



fans – forwards blades (V) or bent backwards (R)



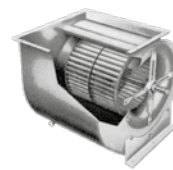
R direct drive with
B5 motor



R direct drive with
EC motor



R belt drive with
B3 motor



V belt drive with
B3 motor

Energy recovery



ECOFLOW



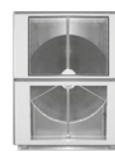
ECOSTAT



ECOPLAT



ECOTWIN



ECOTWIN

Air Filters



Pockets



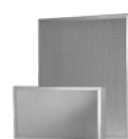
Panel



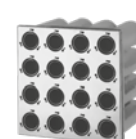
Cassettes



suspended matter



Grease collector



Activated carbon

Heat Exchanger



Copper



Steel



Smooth pipe



Stainless steel



Electric heating grid

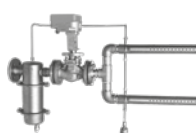
Air humidifier



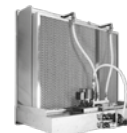
Humidifier empty part



Electric steam generator



Saturated-steam lance



Evaporation



Spray humidifier

Casing construction and material quality

Configuration options - routing of airflow - unit profile

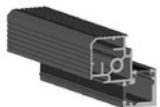
Areas of application: indoor/outdoor installation for horizontal air routing - vertical air routing only for indoor installation



Supply-air and extract-air units.	Model type: horizontal – vertical
Combined supply-air and extract-air units	Model type: in-line – double-deck – side-by-side
Unit width in modular grid	640 mm ... 3,120 mm
Unit height in grid dimension	520 mm ... 3,120 mm
Unit base frame height	80 mm
Unit interior completely smooth as per stipulations in VDI 6022, VDI 3803, and DIN 1946 (Part 4)	
Special types and special dimensions can be delivered	

Housing frame profile – 60 mm

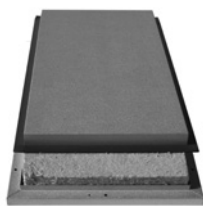
Areas of application: indoor and outdoor installation



Frame profile made of aluminum AlMgSi 0.5
Frame profile made of aluminum AlMgSi 0.5 strip-coated RAL 9002
RAL colors (but not metallic) available as per customer's request

Casing panels – 60 mm wall thickness

Areas of application: indoor and outdoor installation



Internal skin aluzinc AZ 185 with anti-fingerprint coating as of DIN EN 55928 Part 8 corrosion protection class. III
Internal skin of galvanized metal sheet, strip-coated RAL 9002
Internal skin: stainless steel V2A, material no. 1.4301 or V4A, material no. 1.4571
Exterior shell sheet steel galvanized strip coated RAL 9002
RAL colors (but not metallic) available as per customer's request

Casing construction and material quality

Material properties of installed components

Areas of application: indoor and outdoor installation



Galvanized metal sheet

Sheet steel galvanized strip-coated RAL 9002, or with high-quality physical properties for increased corrosion protection

Applications

Areas of application: indoor and outdoor installation



Standard type according to VDI 6022, VDI 3803

Hygienic design according to DIN 1946, Part 4

EEx version for increased safety according to ATEX directive 94/9EG (ATEX 95)

Unit frame with lifting eyes up to 1.500 kg or transportation device for unit base frame for larger loads

Special design versions on request

Casing

Properties according to prEN 1886 housing wall thickness
60 mm indoor and outdoor installation - model box data

CAIRplus® SX-K without additional thermal separation



Test criterion	Unit	Pressure		Limit values				Class
Mechanical stability	mm/m	–		10				D2
Leakage	l/s/m ²	–400 Pa		0,15				L1
Leakage	l/s/m ²	+700 Pa		0,22				L1
Filter-Bypass-leakage	%	+400 Pa		0,5				F9
Thermal insulation	W/m ² /K	–		1,0 < U <= 1.4				T2
Thermal bridging factor	–	–		0.45 <= kb <= 0.60				TB3
Frequency range	Hz	125	250	500	1000	2000	4000	8000
Acoustic insulation	dB	20	24	28	25	23	32	34

Properties according to prEN 1886 housing wall thickness
60 mm indoor and outdoor installation - model box data

CAIRplus® SX-M
with additional thermal separation of the frame profile



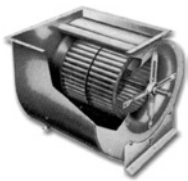
Test criterion	Unit	Pressure		Limit values				Class
Mechanical stability	mm/m	–		10				D2
Leakage	l/s/m ²	–400 Pa		0,15				L1
Leakage	l/s/m ²	+700 Pa		0,22				L1
Filter-Bypass-leakage	%	+400 Pa		0,5				F9
Thermal insulation	W/m ² /K	–		1.0 < U <= 1.4				T2
Thermal bridging factor	–	–		0.60 <= kb <= 0.75				TB2
Frequency range	Hz	125	250	500	1000	2000	4000	8000
Acoustic insulation	dB	14	23	30	31	29	29	39

Fans

High-performance centrifugal fan for V-belt drive
two-sided intake rotor for IEC standard motor design B3

Technical values for comparison
Air flow rate 10,000 m³/h/500 Pa external

Operating range: 1.000 ... 125.000 m³/h



Fan blades bent forwards	Rotor diameter	500 mm
Impeller size 180 ... 1250	Fan efficiency	66.4 %
Impeller in spiral casing, sheet steel, galvanized	Capacity of the shaft	2.5 kW
Capacity control by means of motor speeds or frequency inverter	Operating point, P electrical	3.4 kW
	Nominal motor capacity 1,500 min⁻¹	3.0 kW
	Sound power level pressure side	86 dB(A)
Operating range -20 °C ... +80 °C	Sound power level, intake side	89 dB(A)

High-performance centrifugal fan for V-belt drive
two-sided intake rotor for IEC standard motor design B3

Technical values for comparison
Air flow rate 10,000 m³/h/500 Pa external

Einsatzbereich: 1.000 ... 125.000 m³/h



Fan blades bent backwards	Impeller diameter	500 mm
Impeller size 180 ... 1.250	Fan efficiency	81.0 %
Impeller in spiral casing, sheet steel, galvanized	Capacity of the shaft	2.0 kW
Capacity control by means of motor speeds or frequency inverter	Operating point, P electrical	2.7 kW
	Nominal motor capacity 1.500 min⁻¹	3.0 kW
	Sound power level pressure side	83 dB(A)
Operating range -20 °C ... +80 °C	Sound power level, intake side	84 dB(A)

Fans

Open high-performance centrifugal fan for direct drive rotor
with one sided intake with a directly flanged IEC standard motor

Technical values for comparison
Air flow rate 10,000 m³/h/500 Pa external

Operating range: 1.000 ... 85.000 m³/h



Fan blades bent backwards	Impeller diameter	560 mm
Impeller size 225 ... 1250	Fan efficiency	78.5 %
Open impeller without spiral casing	Capacity of the shaft	2.0 kW
Motors according to efficiency classes IE 2/3	Operating point, P electrical	2.5 kW
Power control with frequency converter	Motor rating	2.2 kW
	Sound power level pressure side	89 dB(A)
Operating range -20 °C ... +40 °C	Sound power level, intake side	87 dB(A)

Open high-performance centrifugal fan for direct drive rotor
with one sided intake with a directly integrated EC motor

Technical values for comparison
Air flow rate 10,000 m³/h/500 Pa external

Einsatzbereich: 1.000 ... 12.000 m³/h



Fan blades bent backwards	Impeller diameter	560 mm
Impeller size 280 ... 630	Fan efficiency	76.1 %
Open impeller without spiral casing	Capacity of the shaft	1.9 kW
Great efficiency as a result of EC external-rotor motors	Operating point, P electrical	2.4 kW
Power control with integrated control electronics	Motor rating	2.2 kW
	Sound power level pressure side	89 dB(A)
Operating range -20 °C ... +40 °C	Sound power level, intake side	87 dB(A)

Air Filters

Coarse and fine particle filter as bag filter Filter quality categories G4 ... F9 according to DIN EN 779

Operating range: filtration of coarse and fine dust particles



					Bag length	Filter area for each m ²
G4	Synthetic fiber		Am 90 %		360 mm	5.0 m ²
M5	Synthetic fiber	Em 47 %	Am 98 %		534 mm	10.0 m ²
M5	Synthetic fiber	Em 47 %	Am 98 %		360 mm	11.0 m ²
F7	Synthetic fiber	Em 85 %	Am 99 %		534 mm	16.0 m ²
F7	Synthetic fiber	Em 85 %	Am 99 %		380 mm	15.0 m ²
F9	Micro-glass fibers	Em 95 %	Am 99 %		600 mm	21.0 m ²

Coarse and fine particle filter as panel filter Filter quality categories G4 ... F9 according to DIN EN 779

Operating range: filtration of coarse and fine dust particles



					Installation depth	Filter area for each m ²
G4	Polypropylene	Em 50 %	Am 96 %		96 mm	22.1 m ²
M5	Polypropylene	Em 50 %	Am 96 %		96 mm	22.1 m ²
F7	Polypropylene	Em 88 %	Am 99 %		96 mm	22.1 m ²
F9	Polypropylene	Em 88 %	Am 99 %		96 mm	22.1 m ²

Fine particle filter as cassette filter Filter quality categories F6 ... F9 according to DIN EN 779

Range of application: separation of fine dust particles for minimal space requirements



					Installation depth	Filter area for each m ²
M6	Micro-glass fibers	Em 73 %	Am 98 %		298 mm	34.0 m ²
F7	Micro-glass fibers	Em 86 %	Am 99 %		298 mm	34.0 m ²
F9	Micro-glass fibers	Em 96 %	Am 99 %		298 mm	38.0 m ²

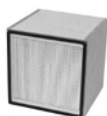
Air Filters

HEPA filter with seal-seat test groove and seal-seat test pipe according to DIN 1946, Part 4
Filter quality class H13 according to DIN EN 1882

Range of application: separation of the finest dust particles for hygienic areas

Installation
depth

Filter area
for each m²



H13

Micro-glass fibers

Am 99.95 %

292 mm

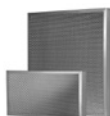
42.3 m²

Grease filter as panel filter
Filter quality class G3 according to DIN EN 779

Range of application: separation of fats (no oils)

Installation
depth

Filter area
for each m²



G3

Aluminum wire
mesh

Am 87 %

48 mm

0.77 m²

Activated carbon filter as cartridge filter with bayonet locking system

Range of application: separation of gaseous odors and pollutants

Installation
depth

Filter area
for each m²



Activated carbon cartridge, 16 pieces 1/1 cell each

450 mm

64.0 l

Heat Exchanger

Finned tube heat exchanger – series SD 181 ... SD 400 Copper/aluminum material

Area of application: pumped warm water (PWW), pumped hot water (PHW), pumped cold water (PCW), or refrigerant (R)



Core copper pipe with attached aluminum, strip-coated aluminum, or copper fins

Fin interval optimized in accordance with performance requirements: 1.8 ... 4.0 mm

Frame as chosen: galvanized sheet steel, aluminum, copper, or stainless steel

Direct evaporator with intake manifold and refrigerant distributor made of copper

Optional: heat exchanger, complete, dip-coated, for enhanced corrosion protection

Maximum operating pressure: 16 bar; temperature of medium: 110 °C

Special versions available as requested

Finned tube heat exchanger – series FE and FV Materials: steel galvanized FE/stainless steel FV

Area of application: pumped warm water (PWW), pumped hot water (PHW), saturated steam, thermo-oil, and pumped cold water (PCW)



Core pipe with fins galvanized together in dip bath

Fin interval optimized in accordance with performance requirements: 2.1 ... 6.0 mm

Frame as chosen: galvanized sheet steel or stainless steel

Steam heat exchanger with vertically configured core pipes

Optional: Stainless-steel heat exchanger (FV), material no. 1.4301 or 1.4371

Maximum operating pressure: 16 bar; temperature of medium: 110 °C

Special high-pressure version available: 25 bar, with German TÜV certification

Heat Exchanger

Smooth-bore pipe heat exchanger– Series SD000 – Series FE000 – Series FV000
Copper/steel/stainless steel material

Range of application: unfiltered air currents, filter freezing protection, filter microbe protection, small power requirement



Properties the same as described for Series SD, FE, or FV, but here without fins

As freezing protection before the outdoor air filter. By heating = reduction in relative humidity

As microbial protection before the outdoor air filter. By heating = reduction in relative humidity

Here, also see VDE 6022, Sheet 1, and DIN 1946, Part 4

For after-heating with high temperatures of medium, and for low outputs

Recommended maximum temperature increase: 3 K

Maximum operating pressure: 16 bar; temperature of medium: 110 °C

Electrical heat exchanger – electrical frost-protection heating – gas-fired heater

Range of application: unfiltered air currents, filter freezing protection, filter microbe protection, small power requirement



Electrical heat exchanger with max. 100 °C surface temperature on the heating gratings, with safety-thermal cutoff and monitor according to VDE/DIN 57100, VDI 3803

Electrical-frost protection heating as stand-by heater fitted in unit chambers for the protection of the non frost-safe installation elements in weatherproof units

Directly natural-gas-fired stainless-steel heat exchanger

Energy recovery

ECOFLOW – finned-tube heat exchanger, Series DD, as liquid-coupled energy recovery system (KVS) Copper/aluminum material

Area of application: operation of separately installed supply-/extract-air units – energy transport via brine circulation



Properties as for Series SD heat exchangers	Efficiency factor max.	approx. 70 %
Supply- / extract-air flow 100% separated		
Optional: Series FE steel heat exchanger		
A frost-protection control system is necessary to prevent frosting of the extract-air heat exchanger; optional with the DencoHappel hydraulics module	Frosting danger in extract-air heat exchanger	yes
	Cooling recuperation	yes
	Humidity recovery	no

ECOSTAT – Finned tube heat exchanger series SD as heat-pipe unit with or without integrated bypass louver Copper/aluminum material

Area of application: operation of supply-/extract-air units installed one over the other, or next to each other - energy exchange via R134A refrigerant



Properties as for Series SD heat exchangers	Efficiency factor max.	approx. 60 %
fin spacing 2.1 mm ... 2.5 mm.		
Copper-core tube filled with refrigerant R134a	Frosting danger in extract-air heat exchanger	no
Autonomous operation, without auxiliary power by evaporation of the refrigerant in the core pipes	Cooling recuperation	no
	Humidity recovery	no

Energy recovery

ECOPLAT/ECOTWIN – aluminum plate heat exchanger with or without integrated bypass louver

Material: aluminum-separating body

Area of application: operation of supply-/extract-air units installed one over the other, or next to each other - energy exchange via aluminum plates

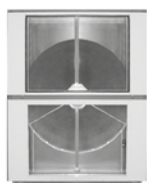


Standard plate exchanger	ECOPLAT	ECOPLAT – efficiency factor max.	approx. 70 %
Plate spacing 3.0 ... 12.0 mm		ECOTWIN – efficiency factor max.	approx. 80 %
Optional: high-performance class			
Double plate exchanger	ECOTWIN		
Plate spacing 6.0 ... 12.0 mm, capacity class High Performance, optional: with integrated recirculating-air louvers		Frosting danger in extract-air heat exchanger A frost-protection control system is required at an extract-air humidity of > 45 %	yes
Optional: ECOPLAT / ECOTWIN with surface coating for corrosive environments		Cooling recuperation	yes
		Moisture recovery	no

ECOROT – rotary heat exchanger with 3 optional storage cores

Material: aluminum storage mass

Area of application: operation of supply-/extract-air units installed one over the other, or next to each other - energy exchange via aluminum storage mass



Rotating aluminum storage mass	Efficiency factor max.	approx. 90 %
Condensation rotor with humidity exchange in event of condensation, optional: epoxy-coated storage material under corrosive conditions	Danger of frosting in extract air	no
	Cooling recuperation	yes
	Moisture recovery	yes
Enthalpy rotor with enhanced moisture exchange especially in case of condensation	Optional: 2 parallel rotors (ECOROT-DUO) configuration of units one behind the other	
Sorption rotor for high transmission of latent heat throughout the entire year	Regulator for continuously variable speed control	

ECOPLATEplus – cross-counterflow plate heat exchanger with integrated bypass louver

Range of application: double-deck or side-by-side operation set-up supply-/extract-air unit – power transmission with aluminum-plates



Supply-/extract-air flow 100 % separated	Danger of frosting in extract air yes	yes
Bypass on supply- and extract-air side for free cooling	Cooling recuperation yes	yes
Energetically optimized frost protection	Moisture recovery no	no
Max. 8000 m³/h air volume flow		
Efficiency factor max. ca. 90 %		

Air humidifier

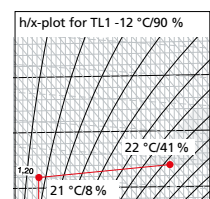
Electric steam generator

Maximum humidification output: 232 kg/h for electrical connection ratings of 4 x 43,5 kW

Area of application: steam humidification by production and release of pure water vapor, free of minerals



Operation for drinking water	max. steam quantity 232 kg / 1 x 45,0 kW
Maximum steam volume for operation with partially demineralized water	max. steam quantity 232 kg / 4 x 43,5 kW
Steam humidifier for fully automatic production and release of water vapor	
Supply and treatment of water for the unit: from user's mains network	
WATER FEED SOLENOID	
Regenerable steam cylinder	
Electronic control system with microprocessor control	



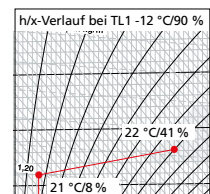
Saturated-steam humidifier for outside steam networks

Maximum humidification output: 451 kg/h of steam at 1.5 bar

Area of application: dry steam humidification via installed saturated-steam lance



Water feed from user's own network
Sparge pipework and steam drier made of stainless steel
Built-in lance heating
ARI valve with 24-volt actuator for 0 ... 10 V actuating signal
Condensate drain in form of ball float



Air humidifier

Evaporative humidifier

Maximum efficiency: approx. 65% or 85% (two models)

Area of application: humidification via fresh or recirculated water, by dripping over humidification cassettes



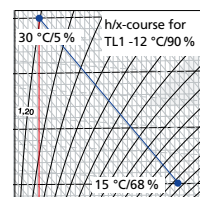
Incoming water feed from user's own network

Operation with completely demineralized (distilled) water not possible

Water-distribution hood and float valve for water feed

Water catch tray and sheet-metal parts made of stainless steel, material no. 1.4301

Non-combustible humidification cassettes made of GLASDek-TM.material



Spray humidifier (air scrubber)

Maximum efficiency: approx. 88%, 92%, or 95% (3 model lengths)

Area of application: humidification with fresh or recirculated water, by spray mist from high-performance aerosol nozzles



Incoming water feed from user's own network via an installed float valve

Operation with completely demineralized (distilled) water is possible

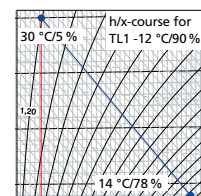
Casing made of glass fiber-reinforced plastic (GRP)

Nozzle block with threaded nozzle-pipe distributors

High-performance aerosol nozzles, self-cleaning and non-clogging

Block pump with 3-phase AC motor

Air rectifier and PPTV droplet separator; temperature durability up to 130 °C



Sound attenuators, blank sections, louvers, fittings

Sound-attenuator unit

Sound-attenuation splitters with upper material made of glass-fiber mesh or fleece made of filament glass yarn

	Sound- attenuation at	Length mm	600	920	1200	1520	1720	2000	2320
	63 Hz	dB	4	6	7	8	9	9	10
	125 Hz	dB	6	11	17	21	24	28	31
	250 Hz	dB	15	22	27	33	39	45	50
	500 Hz	dB	16	24	32	40	48	50	50
	1000 Hz	dB	18	25	33	41	49	50	50
	2000 Hz	dB	15	20	26	32	38	43	49
	4000 Hz	dB	14	13	16	20	23	27	30
	8000 Hz	dB	14	11	13	16	19	21	24

Empty units/inlet units/maintenance units/operating consoles/multifunctional units with or without damper blades, freely selectable accessibility: with or without service doors or operating cassettes

Lengths of the units in modular grid, as per selection or according to minimum requirements



Door lock



Door hinge

With louvered dampers installed on the inside or outside

With clamping frame for sensors or thermostats

Lockable access doors; available with crank handles or T-handles

Sound attenuators, blank sections, louvers, fittings

Damper blades for outdoor air, recirculating air, extract air, outgoing air, mixed air
With plastic gear wheels for counter directional operation of the louver blades



Louvers/ sealing lips in EPDM quality	Material	Leakage as per DIN EN 1751	Class
Without sealing lips	Sheet steel, galvanized	60 m³/h/m²/100 Pa	> 1
Without sealing lips	Stainless steel 1.4301	60 m³/h/m²/100 Pa	> 1
With sealing lips	Aluminum	20 m³/h/m²/100 Pa	> 2
With sealing lips, airtight as per DIN 1946, Part 4	Sheet steel, galvanized	10 m³/h/m²/100 Pa	> 3
With sealing lips, airtight as per DIN 1946, Part 4	Aluminum	10 m³/h/m²/100 Pa	> 3
With sealing lips, airtight as per DIN 1946, Part 4	Stainless steel 1.4301	10 m³/h/m²/100 Pa	> 3
Special damper blades as per DIN EN 1751, Class 4	On request	5 m³/h/m²/100 Pa	4

Duct connectors for supply air, outdoor air, extract air, exhaust air

Material properties of the 4-hole profile sections as selected: galvanized sheet steel, galvanized and coated sheet steel, stainless steel



Flexible canvas connections, for sound absorption (PVC fittings)
Hygiene-connection fittings, rigid, for airborne and structure-borne noise attenuation
Both versions are without fixed metal links between the equipment units and the duct connections

Unit size / air volume flow / fans

Sizes	Free unit cross-section width x height	Air flow		Unit type	Fans with belt drive	Fans with direct drive
		1.0 m/s	2.5 m/s			
Type	mm x mm	m³/h	m³/h	1 3	1 3	1 3
064 • 040	640 x 400	1,000	2,300	1 3	1 3	1 3
096 • 040	960 x 400	1,400	3,500	1 3	1 3	1 3
128 • 040	1,280 x 400	1,800	4,600	1 3	1 3	

1 horizontal in-line


2 horizontal double-deck


3 horizontal side-by-side


4 upright double-deck


Sizes	Unit cross-section width x height	Air flow about		Unit type	Fans with belt drive	Fans BS with direct drive
		1,0 m/s	2,5 m/s			
Type	mm x mm	m³/h	m³/h	1 2 3 4	1 2 3 4	1 2 3
064 • 052	640 x 520	1,200	3,000	1 2 3 4	1 2 3 4	1 2 3
064 • 064	640 x 640	1,500	3,700	1 2 3 4	1 2 3 4	1 2 3
096 • 052	960 x 520	1,800	4,500	1 2 3 4	1 2 3 4	1 2 3
064 • 096	640 x 960	2,200	5,500	1 2 3	1 2 3	1 2 3
096 • 064	960 x 640	2,200	5,500	1 2 3 4	1 2 3 4	1 2 3
128 • 064	1,280 x 640	3,000	7,500	1 2 4	1 2 4	1 2
096 • 096	960 x 960	3,300	8,200	1 2 3 4	1 2 3 4	1 2 3
096 • 128	960 x 1,280	4,500	11,200	1 3	1 3	1 3
128 • 096	1,280 x 960	4,500	11,200	1 2 3 4	1 2 3 4	1 2 3
160 • 096	1,600 x 960	5,500	13,700	1 2 3	1 2 3	1 2 3
128 • 128	1,280 x 1,280	6,000	15,000	1 2 3 4	1 2 3 4	1 2 3
188 • 096	1,880 x 960	6,500	16,200	1 2	1 2	1 2
160 • 128	1,600 x 1,280	7,500	18,700	1 2 3	1 2 3	1 2 3
188 • 128	1,880 x 1,280	8,500	21,200	1 2 3	1 2 3	1 2 3
160 • 160	1,600 x 1,600	9,000	22,500	1 2 3	1 2 3	1 2 3
220 • 128	2,200 x 1,280	10,000	25,000	1 2	1 2	1 2
188 • 160	1,880 x 1,600	11,000	27,500	1 2 3	1 2 3	1 2 3
252 • 128	2,520 x 1,280	11,500	28,700	1 2	1 2	1 2
220 • 160	2,200 x 1,600	12,500	31,200	1 2 3	1 2 3	1 2 3
188 • 188	1,880 x 1,880	12,500	31,200	1 2 3	1 2 3	1 2 3
220 • 188	2,200 x 1,880	15,000	37,500	1 2 3	1 2 3	1 2 3
280 • 160	2,800 x 1,600	16,000	40,000	1 2	1 2	1 2
252 • 188	2,520 x 1,880	17,000	42,500	1 2 3	1 2 3	1 2 3
220 • 220	2,200 x 2,200	17,500	43,700	1 2 3	1 2 3	1 2 3
280 • 188	2,800 x 1,880	19,000	47,500	1 2	1 2	1 2
220 • 252	2,200 x 2,520	20,000	50,000	1 3	1 3	1 3
312 • 188	3,120 x 1,880	21,100	52,700	1 2	1 2	1 2
280 • 220	2,800 x 2,200	22,200	55,500	1 2 3	1 2 3	1 2 3
252 • 252	2,520 x 2,520	23,000	57,500	1 3	1 3	1 3
312 • 220	3,120 x 2,200	24,500	61,300	1 2	1 2	1 2
280 • 252	2,800 x 2,520	25,500	63,700	1 3	1 3	1 3
280 • 280	2,800 x 2,800	28,000	70,000	1 3	1 3	1 3
312 • 252	3,120 x 2,520	28,000	70,000	1 3	1 3	1 3
312 • 280	3,120 x 2,800	31,500	78,700	1 3	1 3	
312 • 312	3,120 x 3,120	35,000	87,500	1 3	1 3	

Unit size / Energy recovery

Sizes	ECOFLOW	ECOSTAT	ECOPLAT	ECOTWIN	ECOROT	ECOROT DUO
	1 3	3	3	–	–	–
064 • 040	1 3	3	3	–	–	–
096 • 040	1 3	3	3	–	–	–
128 • 040	1 3	3	3	–	–	–

1 In-line
↔ ↔

2 Double-deck
↕

3 Side-by-side
↔ ↔

4 Upright double-deck
↑

Sizes	ECOFLOW	ECOSTAT	ECOPLAT	ECOTWIN	ECOROT	ECOROT DUO
Type	1 2 3 4	2 3	2 3	2	2 3	
064 • 052	1 2 3 4	2 3	2 3	2	2 3	
064 • 064	1 2 3 4	2 3	2 3	2	2 3	
096 • 052	1 2 3 4	2 3	2 3	2	2 3	
064 • 096	1 2 3	2 3	2 3	2	2 3	
096 • 064	1 2 3 4	2 3	2 3	2	2 3	
128 • 064	1 2 4	2	2	2	2	
096 • 096	1 2 3 4	2 3	2 3	2	2 3	
096 • 128	1 3	3	3		3	
128 • 096	1 2 3 4	2 3	2 3	2	2 3	
160 • 096	1 2 3	2 3	2 3	2	2 3	
128 • 128	1 2 3 4	2 3	2 3	2	2 3	
188 • 096	1 2	2	2	2	2	
160 • 128	1 2 3	2 3	2 3	2	2 3	
188 • 128	1 2 3	2	2	2	2 3	
160 • 160	1 2 3	2 3	2 3	2	2 3	1
220 • 128	1 2	2	2	2	2	
188 • 160	1 2 3	2	2	2	2 3	1
252 • 128	1 2	2	2	2	2	
220 • 160	1 2 3	2	2	2	2 3	
188 • 188	1 2 3				2 3	1
220 • 188	1 2 3				2 3	1
280 • 160	1 2	2	2	2	2	
252 • 188	1 2 3				2 3	
220 • 220	1 2 3				2 3	1
280 • 188	1 2				2	
220 • 252	1 3				3	1
312 • 188	1 2				2	
280 • 220	1 2 3					
252 • 252	1 3					1
312 • 220	1 2				2	
280 • 252	1 3					1
280 • 280	1 3					1
312 • 252	1 3					
312 • 280	1 3					1
312 • 312	1 3					1

Air humidifier

Sizes	Steam humidifier blank section	Elektric steam humidifier	Saturated steam humidifier for remote networks	Evaporative humidifier	Spray humidifier (air scrubber)
Type	1 3	–	–	–	–
064 • 040	1 3	–	–	–	–
096 • 040	1 3	–	–	–	–
128 • 040	1 3	–	–	–	–

1 Horizontal in-line


2 Horizontal double-deck


3 Horizontal side-by-side


Sizes	Steam humidifier blank section	Elektric steam humidifier	Saturated steam humidifier for remote networks	Evaporative humidifier	Spray humidifier (air scrubber)
Type	1 2 3	1 2 3	1 2 3	1 2 3	1 3
064 • 052	1 2 3	1 2 3	1 2 3	1 2 3	1 3
064 • 064	1 2 3	1 2 3	1 2 3	1 2 3	1 3
096 • 052	1 2 3	1 2 3	1 2 3	1 2 3	1 3
064 • 096	1 2 3	1 2 3	1 2 3	1 2 3	1 3
096 • 064	1 2 3	1 2 3	1 2 3	1 2 3	1 3
128 • 064	1 2	1 2	1 2	1 2	1
096 • 096	1 2 3	1 2 3	1 2 3	1 2 3	1 3
096 • 128	1 3	1 3	1 3	1 3	1 3
128 • 096	1 2 3	1 2 3	1 2 3	1 2 3	1 3
160 • 096	1 2 3	1 2 3	1 2 3	1 2 3	1 3
128 • 128	1 2 3	1 2 3	1 2 3	1 2 3	1 3
188 • 096	1 2	1 2	1 2	1 2	1
160 • 128	1 2 3	1 2 3	1 2 3	1 2 3	1 3
188 • 128	1 2 3	1 2 3	1 2 3	1 2 3	1 3
160 • 160	1 2 3	1 2 3	1 2 3	1 2 3	1 3
220 • 128	1 2	1 2	1 2	1 2	1
188 • 160	1 2 3	1 2 3	1 2 3	1 2 3	1 3
252 • 128	1 2	1 2	1 2	1 2	1
220 • 160	1 2 3	1 2 3	1 2 3	1 2 3	1 3
188 • 188	1 2 3	1 2 3	1 2 3	1 2 3	1 3
220 • 188	1 2 3	1 2 3	1 2 3	1 2 3	1 3
280 • 160	1 2	1 2	1 2	1 2	1
252 • 188	1 2 3	1 2 3	1 2 3	1 2 3	1 3
220 • 220	1 2 3	1 2 3	1 2 3	1 2 3	1 3
280 • 188	1 2	1 2	1 2	1 2	1
220 • 252	1 3	1 3	1 3	1 3	1 3
312 • 188	1 2	1 2	1 2	1 2	1
280 • 220	1 2 3	1 2 3	1 2 3	1 2 3	1 3
252 • 252	1 3	1 3	1 3	1 3	1 3
312 • 220	1 2	1 2	1 2	1 2	1
280 • 252	1 3	1 3	1 3	1 3	1 3
280 • 280	1 3	1 3	1 3	1 3	1 3
312 • 252	1 3	1 3	1 3	1 3	1 3
312 • 280	1 3	1 3	1 3	1 3	1 3
312 • 312	1 3	1 3	1 3	1 3	1 3

Model size 064.040 ... type 312.312

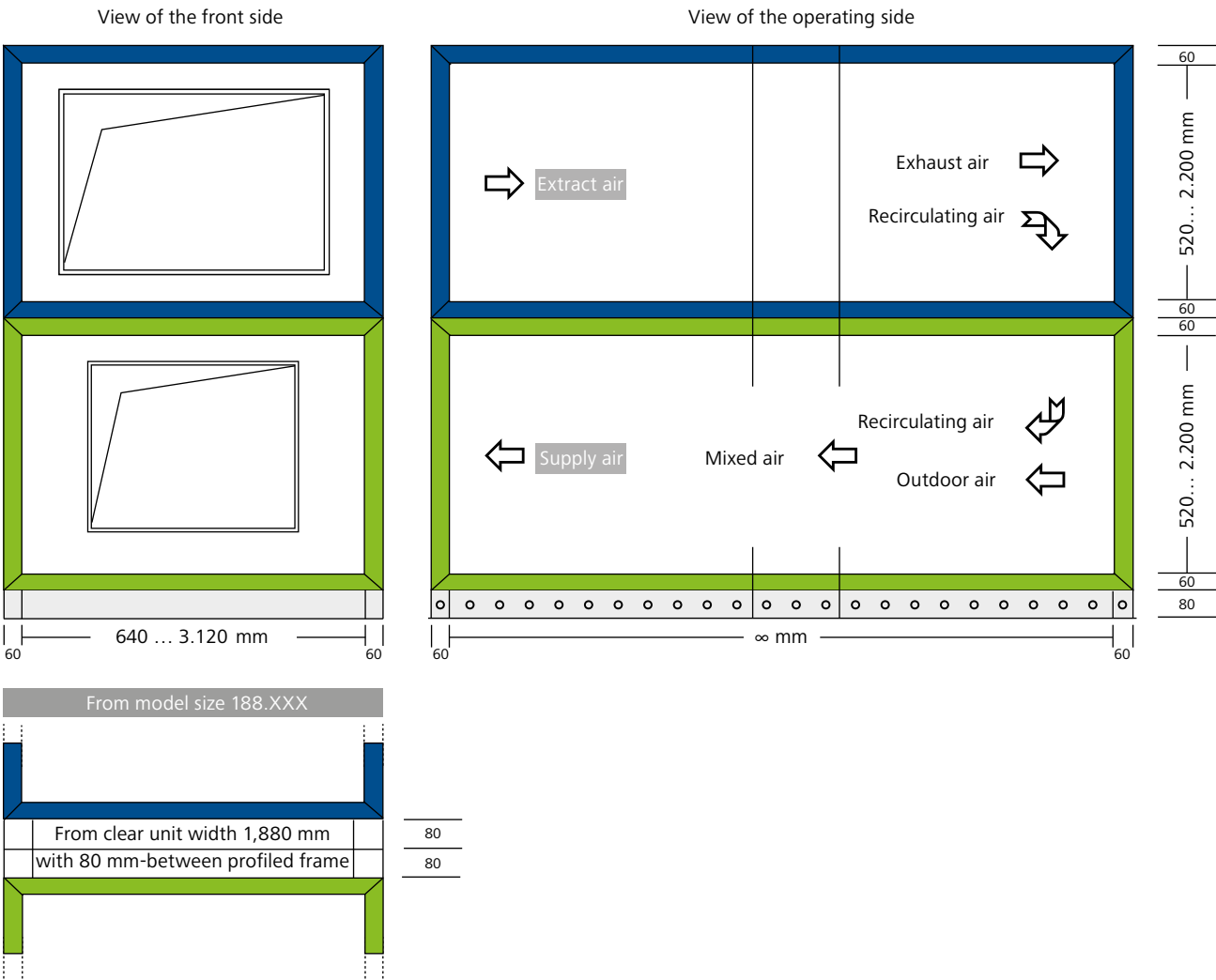
View of the operating side



Unit configuration

Horizontal double-deck

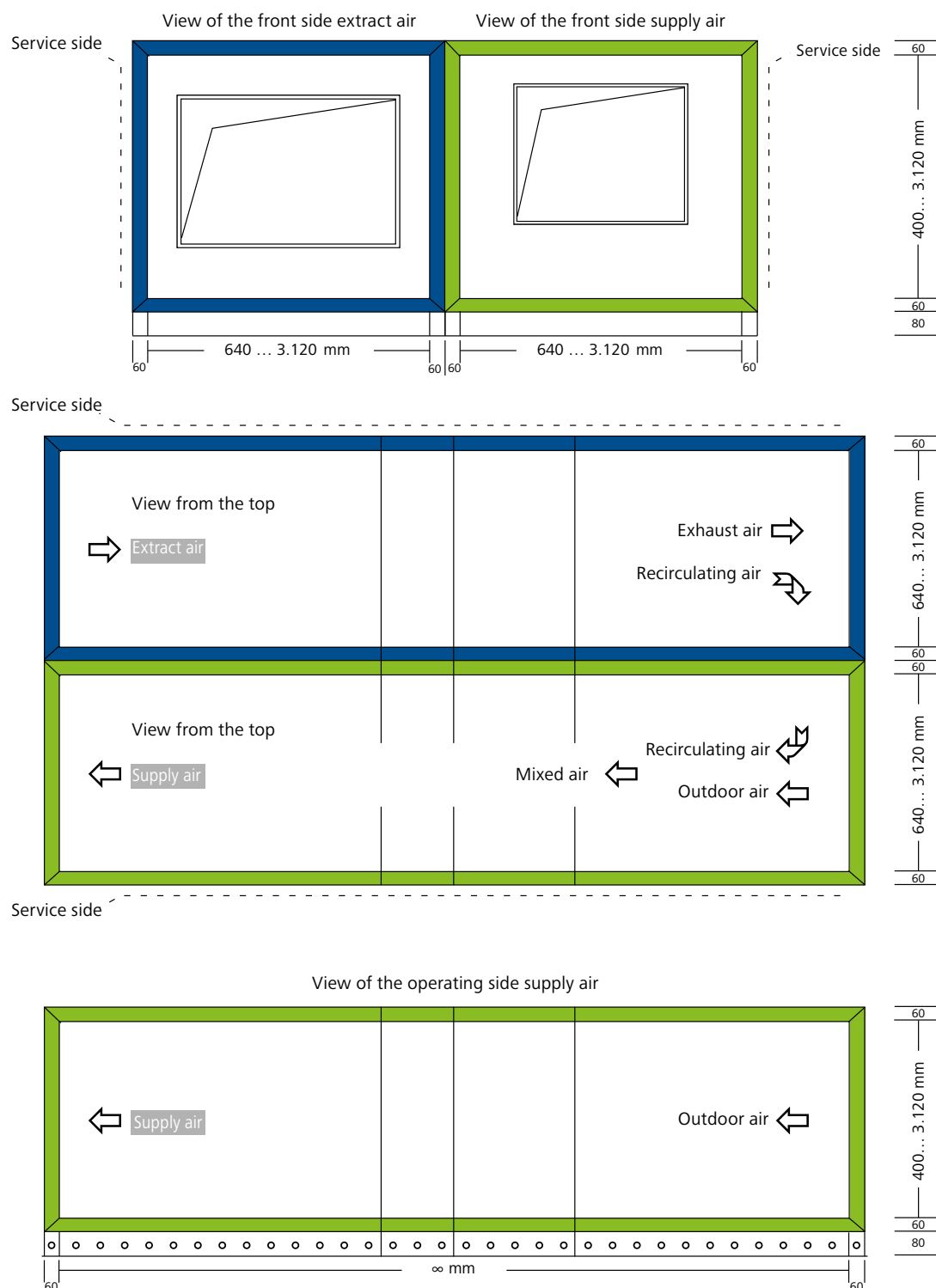
Model size 064.040 ... type 312.312



Unit configuration

Horizontal side-by-side

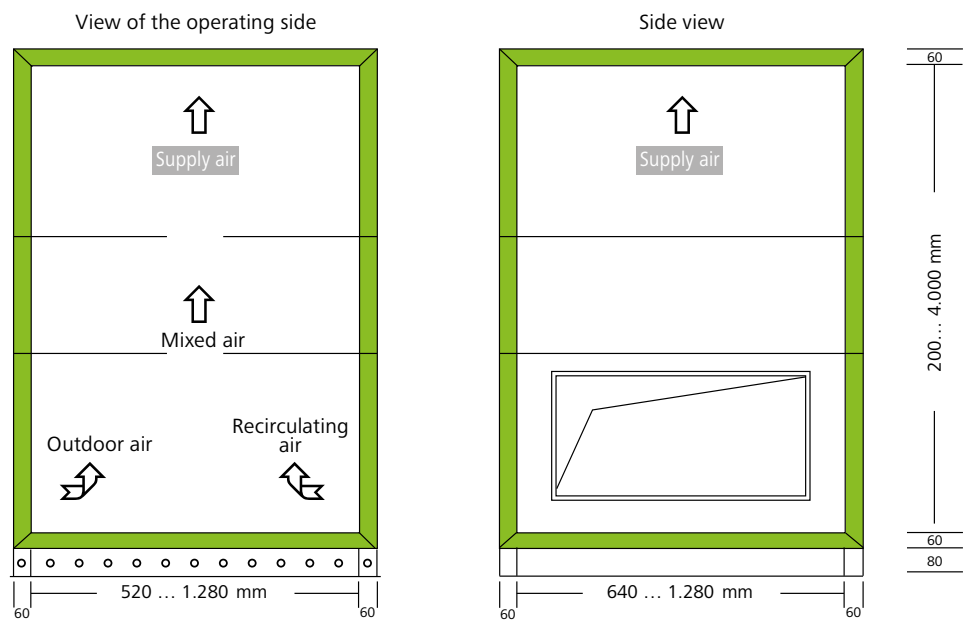
Model size 064.040 ... type 312.312



Unit configuration

Upright double-deck

Model size 064.052 ... type 128.128

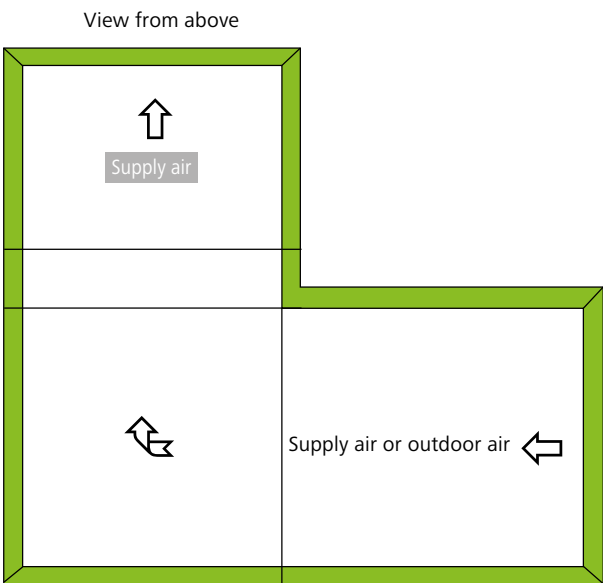
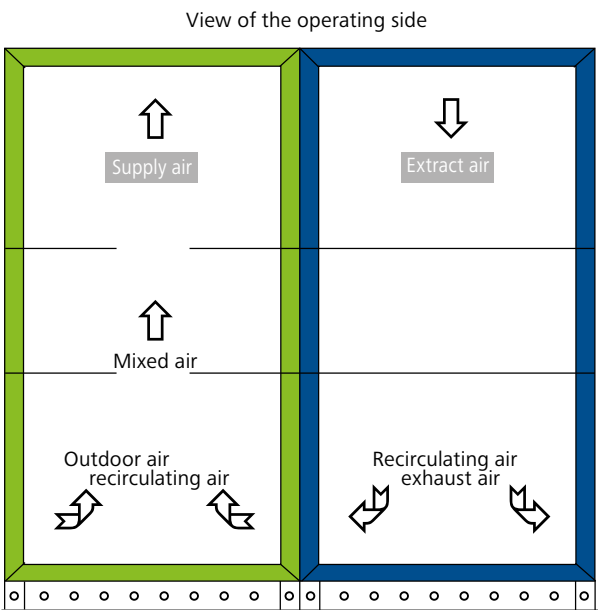


Unit configuration

Upright double-deck in U-form	Horizontal in-line in L-form
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On request

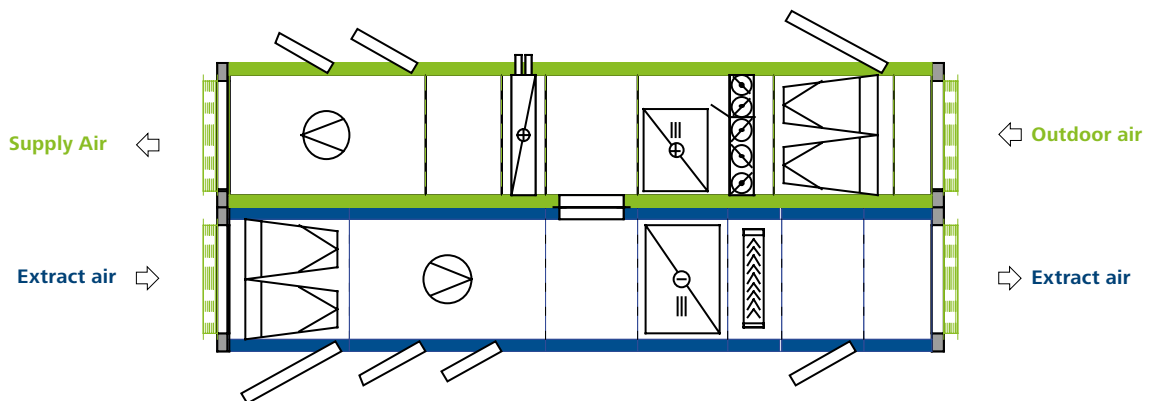
On request



Unit configuration

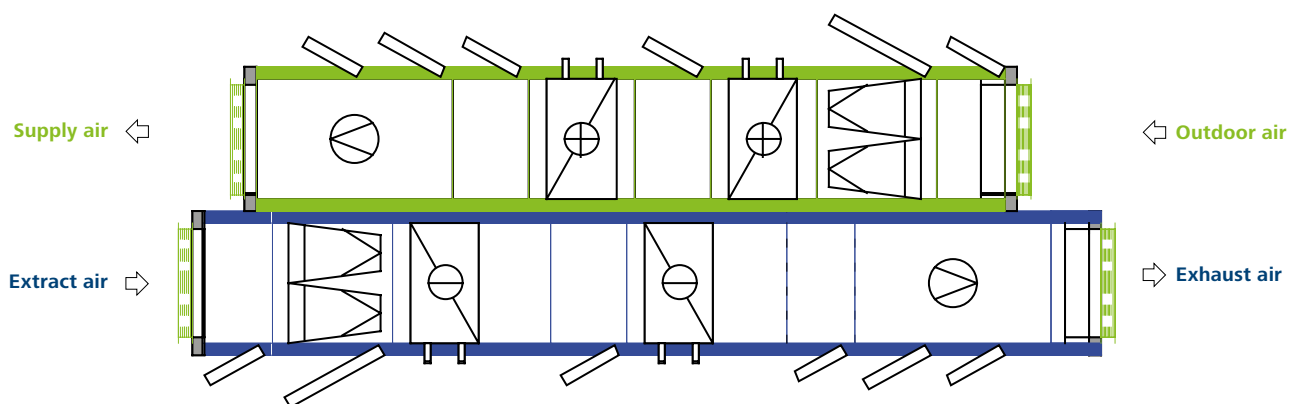
Example of unit design – with energy recovery located horizontally side-by-side with direct drive – 1 filter stage – ECOSTAT

Supply air equipment - heating - mixing - energy recovery
extract-air filter - mixing - energy recovery ECOSTAT



Sample of unit design – with energy recovery, located horizontally side-by-side with direct drive – 1 filter stage – multiframe

Supply air - energy recovery multiframe - filtering
Exhaust air - filtering - energy recovery multiframe

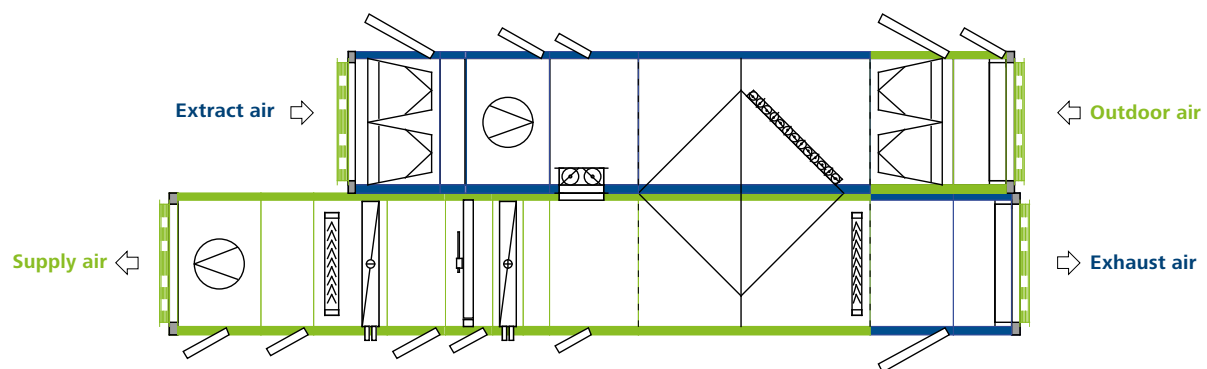


Unit configuration

Sample of unit design – with energy recovery, located horizontally side-by-side with direct drive – 1 filter stage

Supply air – cooling – heating – mixing – energy recovery ECOPLAT – filter

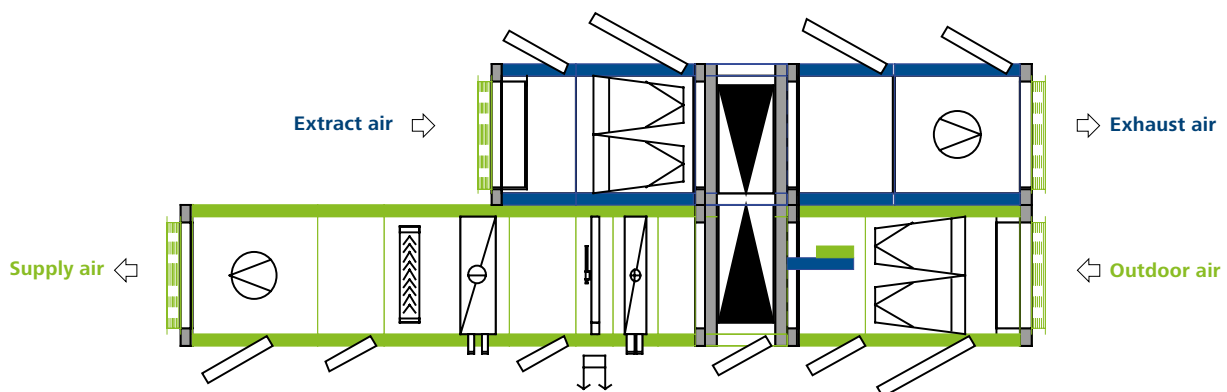
Exhaust air – filtering – mixing – energy recovery ECOPLAT



Exemplarily unit design – with energy recovery
located side-by-side with direct drive – 1 filter stage – ECOROT

Supply air– cooling– heating– energy recovery ECOROT – filtering

Exhaust air - filtering - energy recovery ECOROT

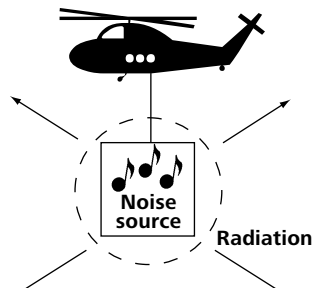


Conversion of sound power in sound pressure

Full sphere

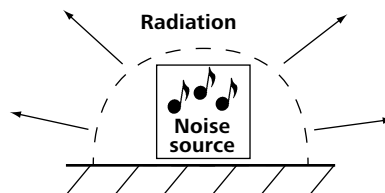
Direction coefficient 1

Only theoretical dimension



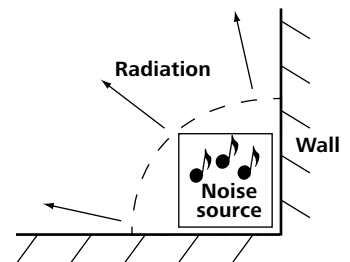
Hemisphere

Direction coefficient 2

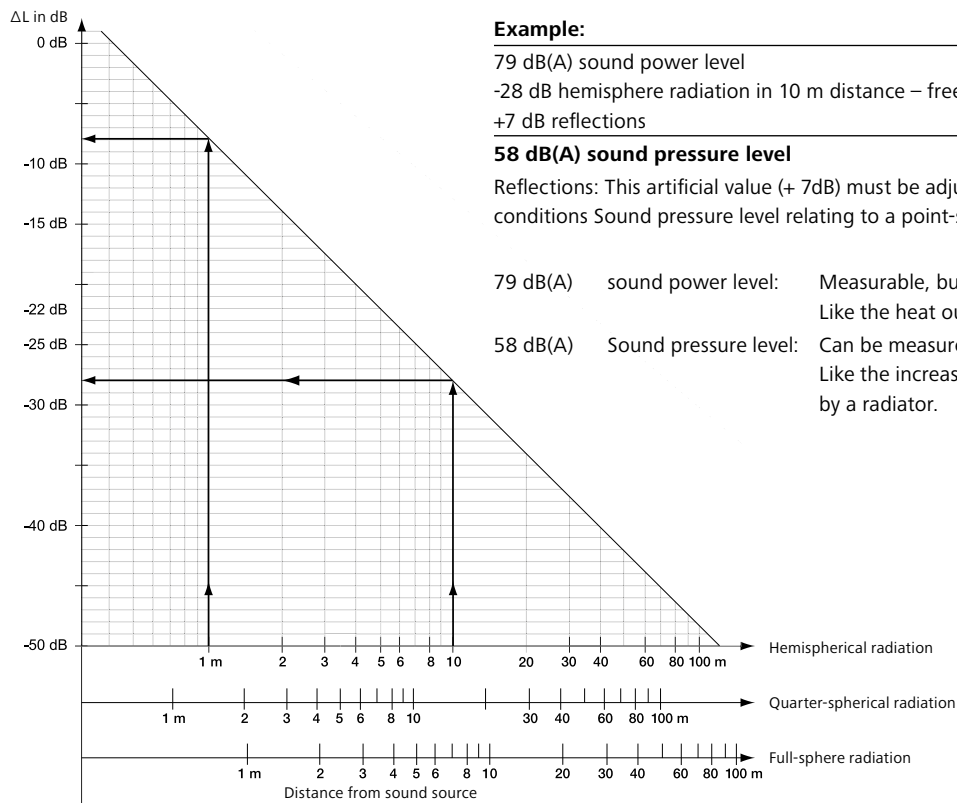


Quarter-sphere

Direction coefficient 4



Acoustics: Conversion of sound power into sound pressure



Example:

79 dB(A) sound power level

-28 dB hemisphere radiation in 10 m distance – free of reflections

+7 dB reflections

58 dB(A) sound pressure level

Reflections: This artificial value (+ 7dB) must be adjusted according to local conditions Sound pressure level relating to a point-shaped sound source

79 dB(A) sound power level: Measurable, but not perceptible. Like the heat output of a radiator.

58 dB(A) Sound pressure level: Can be measured and perceived. Like the increase in room temperature by a radiator.

Always at your side



Our services at a glance

- Own heat exchanger production
- Use of certified products and components
- Use of components from well-known component manufacturers
- Short delivery times for spare parts
- Commissioning of new facilities
- Periodic servicing
- Maintenance
- Factory trial run
- Upgrading and optimisation of old facilities
- Maintenance agreements

Economical from the beginning

The technical developments of DencoHappel represent state-of-the-art swimming pool climate control. Our systems support diverse applications that optimally conform to current criteria of cost effectiveness, safety and sustainability. Our products and services go far beyond pure technology. They are integrated into a comprehensive and in every respect customised service package. This programme includes not only conventional services such as spare part delivery, maintenance, and repair. It unites the consulting and engineering of a technology leader with customised after-sales service and rapid response times. And this not only for installing new equipment. This service also applies for upgrading and optimising old equipment and provides you with perfect support in all project phases. The functionality of the system is secured over its entire service life.

International service und support in experienced hands

Wherever you need us, we will be there for you in the shortest time. All over Europe, our own customer service ensures that you are able to make optimal use of our units' advantages at all times. Many technicians are ready on-call in Germany alone for rapid deployment. All services are designed for absolute safety and reliability. For example, an on-site function check is a part of our delivery service, conducted by an experienced DencoHappel technician together with the installer. This way we directly and personally pass on our functional know-how built up over many years. In this context we should also mention the training we offer in the technology of our climate control systems. Such training is a beneficial instrument for ensuring the lasting functionality and availability of the systems.

A decision for quality

A high quality standard is the basis and principle for all our services. All our service specialists are highly experienced and devote themselves to their work with great diligence. Technically and personally convincing: this is what you can expect from us.



- Initial installation
- Maintenance and servicing
- Assembly services
- Spare parts
- Customer service
- Consulting
- Refurbishing
- Training

DencoHappel is a globally operating company with great expertise in air treatment, air conditioning and filtration technology.

Our nearest consulting and service teams will be glad to discuss ideas and develop creative and effective solutions with you.

