

# AIR HANDLING UNITS MANDÍK



MANDÍK®

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## Company Headquarters



SAFAN Press Brakes



TRUMPF TC 5000 Cutting Presses



Powder Paint Shop

# ABOUT MANDÍK, a. s.

Established in 1990, MANDÍK, a.s. is a Czech, family owned company. At present it is one of the most significant manufacturers of air-handling and fire fighting components, air handling units and industrial heating systems.

The company wins recognition on the European market above all by its focus on high quality, flexibility and services to support the delivered products. The current level of the company's technical ability is documented by supplies for subways, tunnels and nuclear power plants in many European countries.

The company observes the rules of quality management according to ISO 9001, KTA 1401, 10CFR APP10, and is a member of RLT, the German association of air-handling equipment manufacturers. The company has all the required certificates according to European standards, and has been certified by Eurovent, TÜV SÜD Industrie Service GmbH according to EN 1886.

In addition to the domestic market, the sales activities of MANDÍK, a.s. also cover a number of other European countries, where its products are delivered in collaboration with our foreign partners.

At everyday work the company places emphasis on environment protection and occupational safety. Observance of strict European environmental and OHS standards is a common rule, which is uncompromisingly required by the company management. The company contributes to environment protection also by operating its own renewable energy resources and by the widest possible use of energy-saving appliances.

Our objective is maximum satisfaction of our customers, and last but not least creating comfortable working environment for our employees.

## Certificates



Eurovent certificate



Energy efficiency certificate RLT-TÜV-01



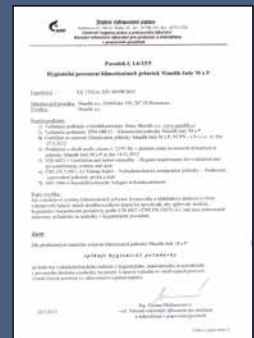
Testing protocol TÜV SÜD



AHU – Product certificate



Declaration of Conformity



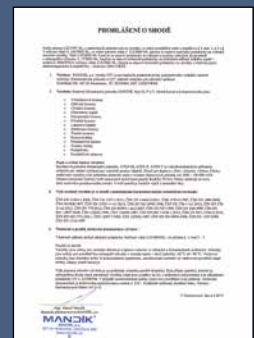
Hygienic survey



Certificate of electrical safety AHUs, including control system



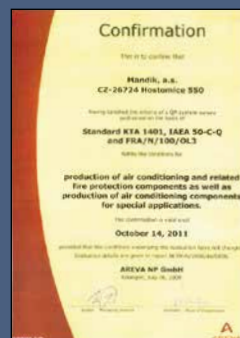
Certificate of electromagnetic compatibility in residential and industrial buildings



Declaration of Conformity AHUs in Atex design



ISO 9001



KTA 1401

# UNIT DESCRIPTION

## Use and working conditions

The MANDÍK air conditioning units, lines M (square section), P (rectangle section) and T (rectangle section), are intended for air transport and treatment in ventilation and air conditioning systems. The air transported by the unit must be freed from mechanical impurities and gaseous

admixtures which could cause clogging of inbuilt items or corrosion of the unit material. The units are intended for environment without explosion hazard, with a range of ambient temperature of  $-30\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$ .

## Air conditioning unit variants

The Mandík air conditioning units can be designed in different variants. The customer can choose the surface treatment of the panel inner and outer sides (galvanized sheet, stainless sheet and panel painting). The painting is carried out in our own powder paint shop and brings a great advantage in form of protection of the sheet cutting edges against corrosion. If the unit is situated in closed machine room, chambers are designed in indoor version.

If the unit is to be situated in open space, outdoor version of unit chambers is designed. The units can be also designed in sanitary version or in ATEX version for environments with explosion hazard.

The MANDÍK air conditioning units can be designed in energy classes and equipped with a certified energy label according to the requirements of Eurovent and RLT.



The casing parameters are certified by the TÜV-SÜD Munich testing laboratory according to EN 1886. The parameters apply to the complete output value line of M, P and T air conditioning outputs, 500 – 100 000 m<sup>3</sup>/h.



Mechanical stability: D1 (M)

Leakage between filter and frame:  $< 0.5\%$  – F9 (M)

Variants of casing:

Thermal isolation	Thermal bridges	Tightness
T3	TB2	L1
T2	TB1	L1
T1*	TB1*	L2*

Casing attenuation in band

Hz:	125	250	500	1000	2000	4000	8000
dB	14	23	26	36	38	40	47

\* In this variant have panels 100 mm thick

## Production of air handling units



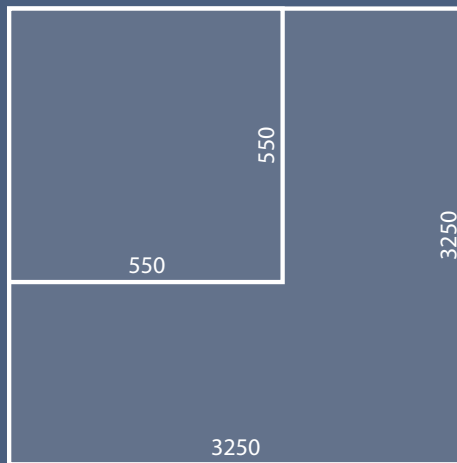
# PRODUCT RANGE OF AIR HANDLING UNITS

KJM Mandík units should be designed with Eurovent and RLT certification (M, P, T marking) or without these certificates (M+, P+, T+ marking)

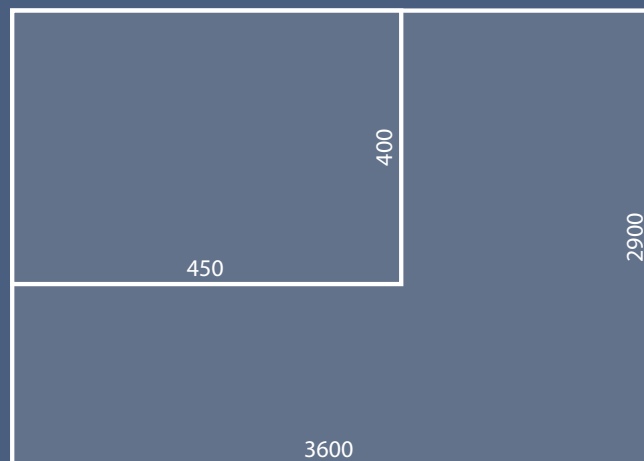
Except these standardized sizes should be designed in Dynamic sizes where you can choose exact profile

- Output line of units according to EN 12 7001
- Height of base frame:
  - up to size M18/P18 – 120 mm
  - from size M20/P20 – 150 mm
  - from size T56 – 150 mm

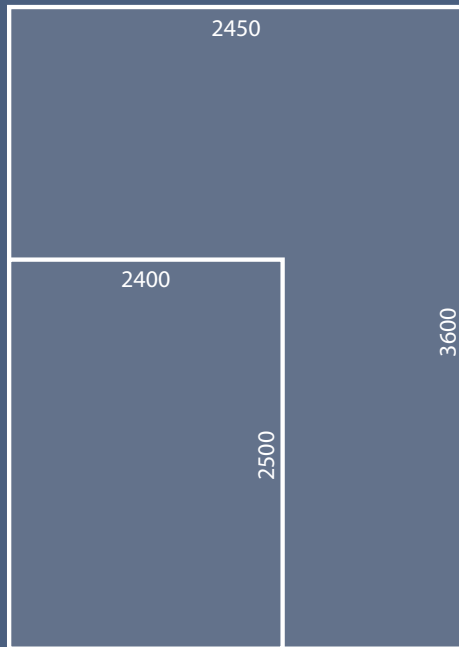
Dimensions of the MANDÍK unit of M series – square cross section  
Sizes are designed from M2 to M100



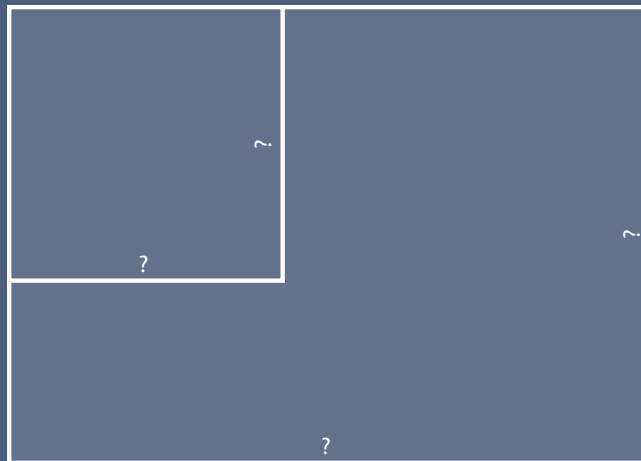
Dimensions of the MANDÍK unit of P series - rectangular cross section  
Sizes are designed from P1 to P100



Dimensions of the MANDÍK unit of T series - rectangular cross section  
 Sizes are designed from T56 to T90

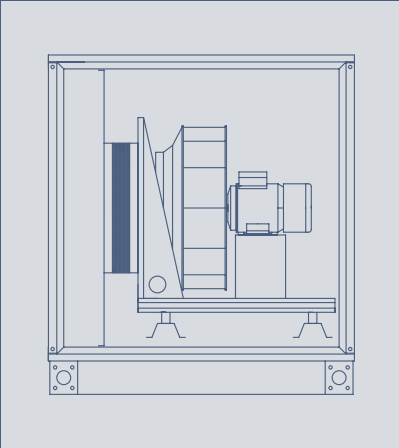


Dimensions of the MANDÍK unit of DYNAMIC series - square/rectangular cross section\*



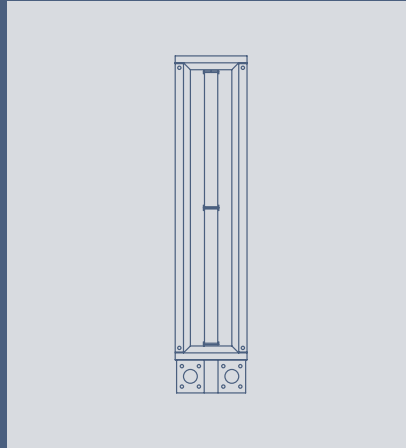
- \* Ratio between width and height or height and width cannot exceed 3
- \* Exact airflow in section depends on the need for Ecodesign
- \*\* Dimensions are valid for panel thickness 50 mm, for T1/TB1 it is necessary to add 100 mm

# INBUILT TYPES



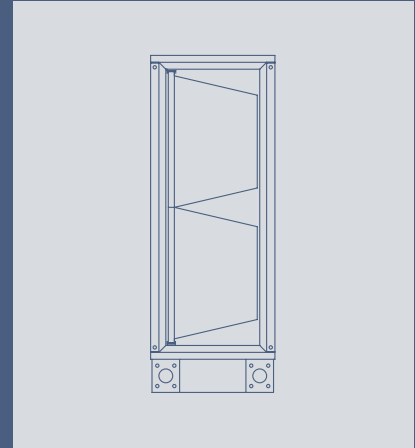
## Fans

- inbuilt fan in compact version with backward-bent blades
- composite or steel version of fan impeller
- the fan parameters correspond to challenging operation conditions (high flows, high pressures, high effects, optimal acoustic properties)
- the fans comply with the requirements of ErP 2018



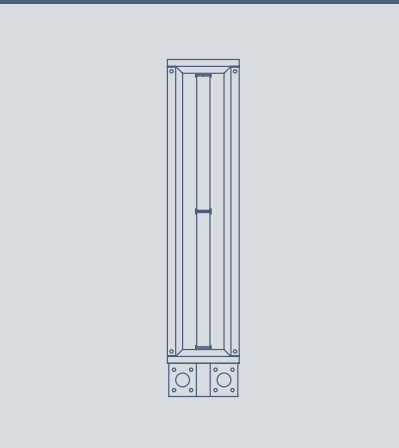
## Frame filters

- most frequently used as first degree filtration – pre-filter
- filtering class G3 to F7
- filter material – glass fibre or synthetic fibre
- leakage between filter element and frame <math><0.5\%</math>



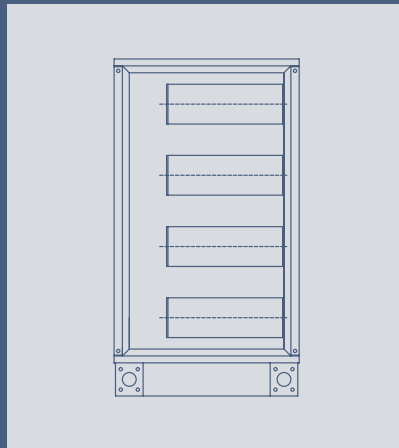
## Bag filters

- filtering class G3 to F9
- filter element length 360, 500 or 630 mm
- filter material – glass fibre or synthetic fibre
- leakage between filter element and frame <math><0.5\%</math>



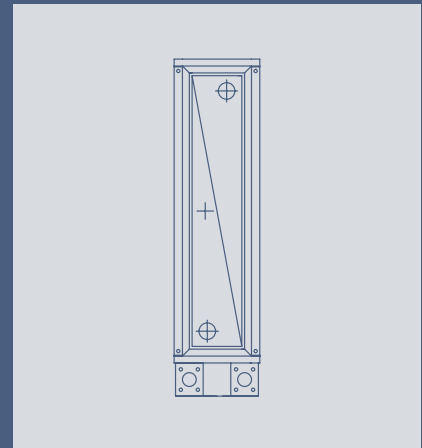
## Metallic filters

- most frequently used for separation of grease and oil aerosols
- filtering class G3
- filter material – intertwined aluminium fibres
- leakage between filter element and frame <math><0.5\%</math>



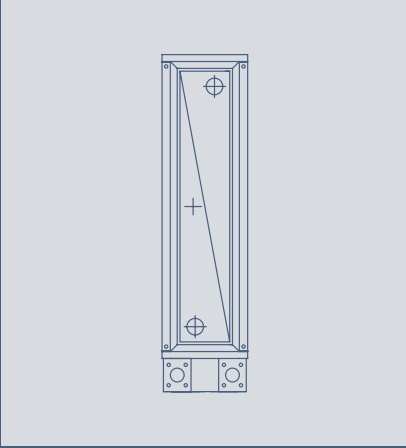
## Active coal filters

- the filter material is situated in metal cartridges
- serve for separation of pollutants and smells at molecular level
- recoverable filter material



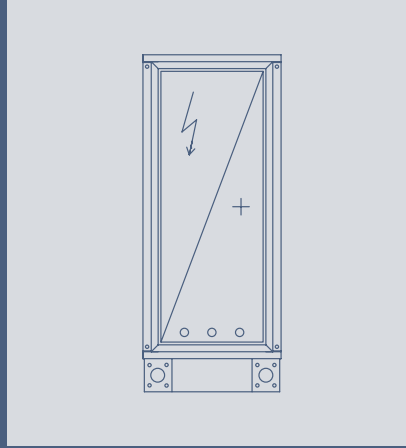
## Steam heaters

- Cu/Al fin exchanger
- heat-carrying agent: saturated vapour
- the exchanger connectors have threaded ends



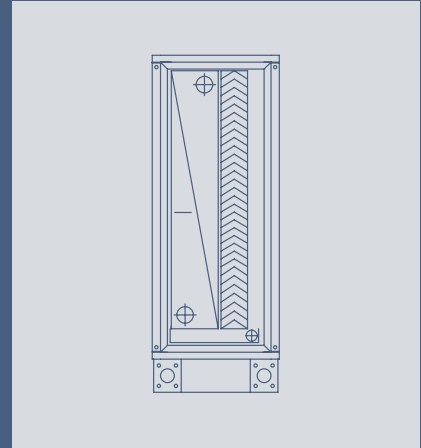
### Water heaters

- Cu/Al fin exchanger
- heat-carrying agent: water/anti-freeze
- the exchanger connectors have threaded ends
- the exchangers are fitted with bleed-er valves



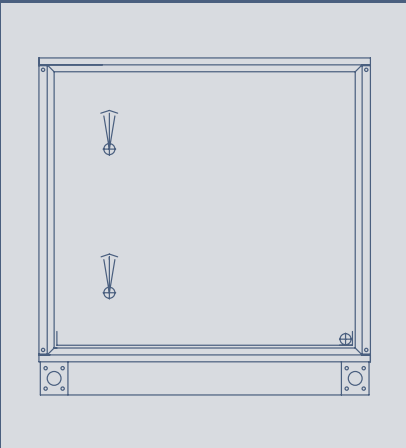
### Electric heaters

- coiled heating bars of different powers
- stainless or steel version
- connection of heating bar groups in sections



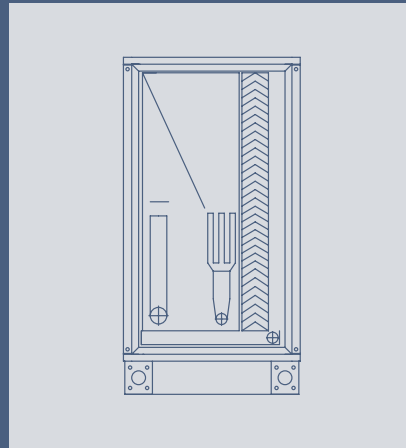
### Water coolers

- Cu/Al fin exchanger
- heat-carrying agent: water/anti-freeze
- the exchanger connectors have threaded ends
- the exchangers are fitted with bleed-er valves
- the chamber is fitted with a descent tank for condensate discharge
- possible fitting with drop eliminator



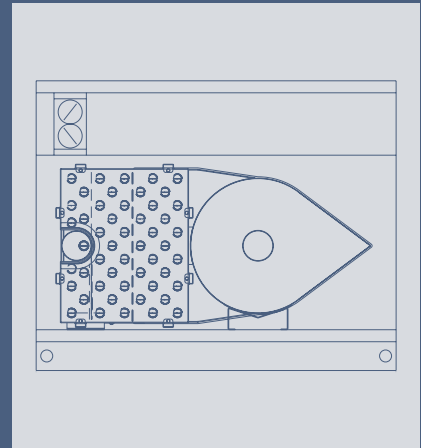
### Humidifiers

- the chamber is intended for fitting of distribution tubes of steam humidifier, adiabatic, or high-pressure humidifier
- the chamber is fitted with a descent tank for condensate discharge



### DX coolers / heaters

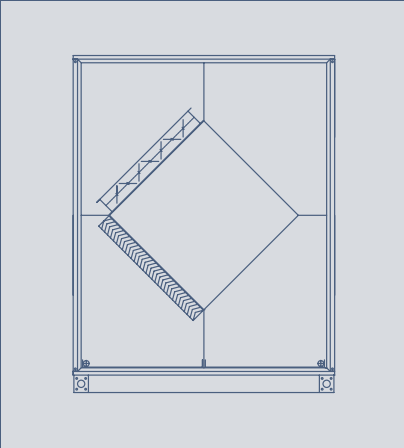
- Cu/Al fin exchanger
- heat-carrying agent: R407C, R410A coolant and others
- the exchanger connectors are ready for soldering
- the chamber is fitted with a descent tank for condensate discharge
- possible fitting with drop eliminator



### Gas and oil heaters

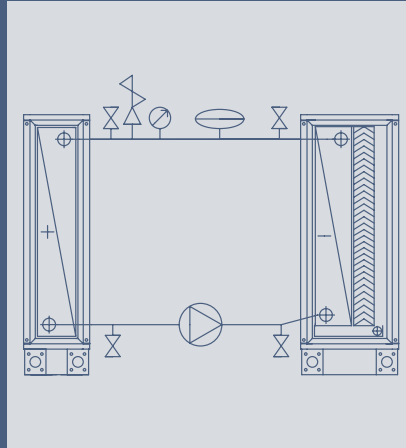
- double-draught tube exchanger with indirect air heating of own design
- version with or without bypass
- stainless exchanger version
- operation fuel – natural gas or propane and others
- possible delivery including flue gas discharge





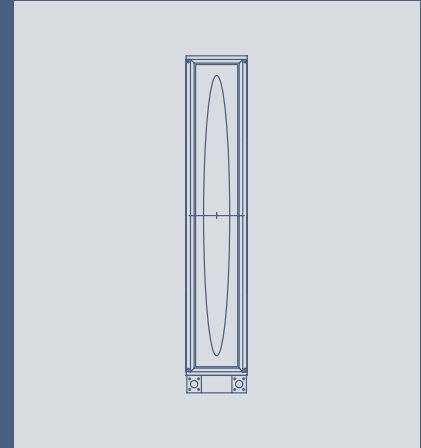
### Plate heat exchangers

- optional choice between counter-flow or cross-flow plate heat exchanger
- aluminium exchanger with possible anti-corrosion surface treatment
- recuperator equipped with bypass damper
- possible fitting of mixing damper
- possible fitting with drop eliminator



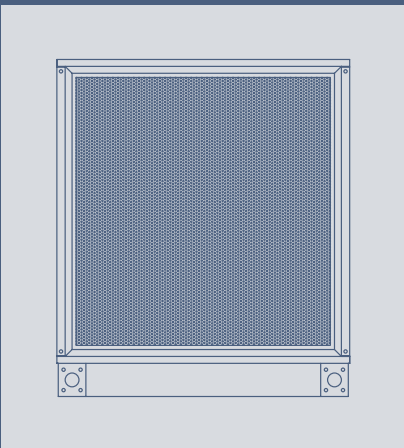
### Glycol recovery coils

- recuperation with the help of fin heat exchangers
- heat-carrying agent: liquids/anti-freeze



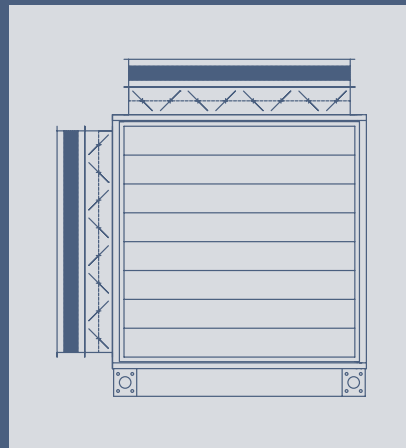
### Rotary exchangers

- optional choice of different recuperation efficiencies
- aluminium exchanger with possible surface treatment for humidity transfer
- possible fitting of flushing chamber
- recuperator fitted with motor and belt gear



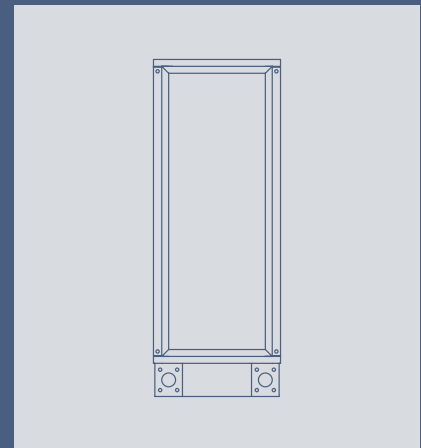
### Silencers

- wing noise dampeners
- lengths of dampening wings – 600, 1000, 1200, 1500 mm
- the wing shape optimized to reduce the own aerodynamic noise



### Damper chambers

- the chambers are fitted with inner or outer regulation dampers
- possible fitting with tank for condensate drainage



### Free chambers

- optional choice of chamber length
- possible fitting with tank for condensate drainage
- possible fitting with service hole

### End walls

- possible fitting with different end items
- regulation valves, dampening elements, rain louvers, protective and regulation adapters

# AIRHANDLING UNITS MANDÍK IN HYGIENIC DESIGN



Before designing, it is necessary to know the difference between a “hygienic” unit and a unit certified as “hygienic quality product with adequate facilities for proper air distribution” (all units on the market must have it). The hygienic units are designed to prevent dust or fungus from settling and are designed to clean interior surfaces quickly and easily with detergents.

## Properties of hygienic units:

- Chambers with smooth inner surfaces, without creases and protrusions
- The units can be painted or in stainless steel condition (galvanized on the outside)
- Only tight recuperators – plate “crossflow” or glycol types
- The cross-sectional speed should not exceed 2.5 m/s
- Special silencer sliding-block guides
- Using multiple filtration from M5 to F9
- A HEPA filter can be used according to customer requirements
- Free chambers with doors for convenient cleaning of heat exchangers and all compartments in the unit
- Possibility of using service windows and LED lighting in the unit

## Hygienic units are designed in accordance with the following standards:

- Austrian standards Ö-NORM H6020
- German standards VDI 6022

# AIR HANDLING UNITS MANDÍK IN EX-PROOF DESIGN

Mandík a.s. Atex units are designed so as not to cause an explosion due to the discharge of electrostatic electricity. All non-conductive connections are interconnected by a guide cable (e.g. camera interconnection, frame connection, damping insert with the unit, etc.).

For explosion-proof design, only certified components (motors, fans, actuators, etc.) can be used. All electrical components must be fully grounded and the unit itself must also be grounded using the grounding point on the fan chamber. All connections must be protected against unauthorized unscrewing. For outdoor versions it is necessary to provide protection against lightning strikes. Service openings must be protected against unauthorized opening. If condensate is formed in the unit, an aluminium drop eliminator must be used.



## Mandík airhandling units can be operated in the explosive atmospheres:

- Zone: 1; 2 (A; B)
- Group of equipment: II
- Category of equipment: 2; 3
- Type of explosive substance: G
- Group of gases: IIA; IIB
- Temperature class: T1-T4

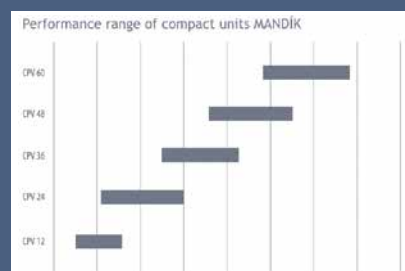
## Explosion-proof units are design in agreement with:

- EN 13463 – Non-electrical equipment intended for use in potentially explosive atmospheres
- EN 1127 – Explosive atmospheres
- EN 60079-20 – Explosive atmosphere
- Directive 2014/34/EU of the European parliament and of the council

# COMPACT AIRHANDLING UNITS



Compact supply and exhaust units are designed for central air supply to rooms. The units are designed for indoor installation. They are equipped with a counter-flow plate heat exchanger, heating and cooling. If necessary, it is possible to fit a mixing damper for air mixing or circulation. Airflow from 500 to 6800 m<sup>3</sup>/h. By default, the units are supplied as "plug & play".



## CHARACTERISTICS

### In terms of energy efficiency:

- Designed with regard to EcoDesign 2018
- High recovery efficiency at low pressure drop
- Stepless control of the recuperator power
- Constant frost protection with the possibility of mixing indoor and outdoor air for optimum temperature of supply air

### In terms of construction:

- Plug&Play unit – completely pre-mounted with CS components and a control box already in the factory
- Compact dimensions
- Ductwork connection upside (round or rectangular)
- Connection of pipes and electrical cables from above
- Smooth inner surfaces

### In terms of maintenance:

- Advanced and well-arranged control panel (internet connection, visualization...)
- Possibility of connection to the control system via tablet, smart phone or directly from the controller on the unit

- Free-cooling option
- EC fans
- Use of special sealing profile to reduce heat loss through the sandwich panel

- Clean outdoor design
- Special profile ensuring high unit tightness and optimal temperature characteristics
- The control box is located inside the unit
- All actuators are located inside the unit
- The units are equipped with a base frame

- Safe operation and maintenance
- Possibility of quick removal of panels from the service side
- Emphasis on ease of operation and replacement of all parts of the unit

## EQUIPMENT:

### Supply part:

- Compact filter F7 (possibility also M5)
- Damper on intake of fresh air
- By-pass of recuperator
- Plate heat exchanger
- EC fan
- Air heater – electric, water or direct
- Cooling
- Flexible connection on inlet and outlet side

### Exhaust part:

- Compact filter M5 (possibility also F7)
- Plate heat exchanger
- Possibility of mixing of fresh air and circulated air
- EC fan
- Flexible connection on inlet and outlet side •

### Parameters of casing

#### In agreement with EN 1886

Mechanical stability: . . . . . D1  
 Leakage of casing: . . . . . L1  
 Leakage between filter and frame: <0,5% – F9  
 Thermal isolation: . . . . . T3, T2 or T1  
 Thermal bridges: . . . . . TB2 or TB1

*Type of filters, possibility of mixing, possibility of cooling or heating and type of it is depend on exact customer needs and could be changed*

# AIRHANDLING UNITS MANDÍK WITH INTEGRATED HEAT PUMP AND POSSIBILITY OF REVERSATION

Units with an integrated heat pump are equipped with a plate or rotary heat exchanger and integrated cooling circuit with the possibility of reversing for the heating mode in the middle-season period. They are manufactured in both indoor and outdoor versions. The advan-

tage is the high efficiency of the unit (usually A+) and the associated low operating costs. Heat pump units are manufactured with an air capacity of 500 to 25,000 m<sup>3</sup>/h. The units are equipped with an automatic control system using a Siemens Climatix controller.

## SUMMER REGIME

Fresh air is pre-cooled on the recuperation using cooler indoor air. After the heat exchanger, the air is cooled down to the required temperature on the heat pump evaporator. The recovered heat is transferred to the exhaust air using a compressor and a condenser. The evaporation temperature is about 10 °C to prevent or minimize evaporator freezing and the need for defrosting. It is always recommended to use digital control compressors for finer control at the lower limit of compressor performance.

## WINTER REGIME

The fresh air is preheated on the recuperation with warmer internal air. It is then heated to the required temperature on the heat pump condenser. The heat to be supplied to the supply air is taken from the exchanger (evaporator) in the exhaust air. Since it is necessary to extract energy from the exhaust air after the heat exchanger, it is recommended not to use the most efficient recuperators. If the temperature after the recuperation drops below 0 °C, the heat pump may be shut down. The shut-down time depends then on the specific temperature. For this reason, we recommend installing always a backup heat source (water or electric heating).



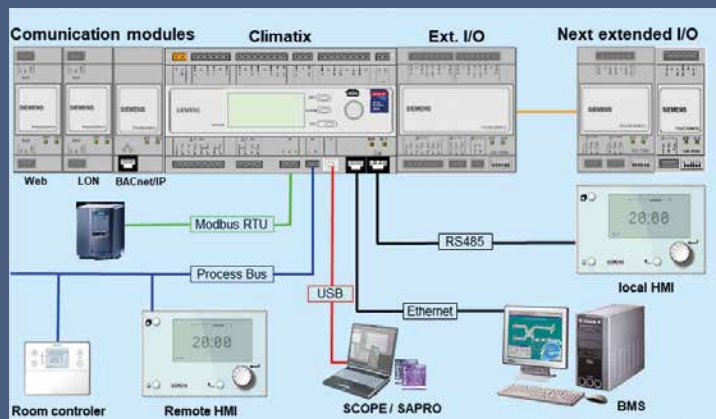
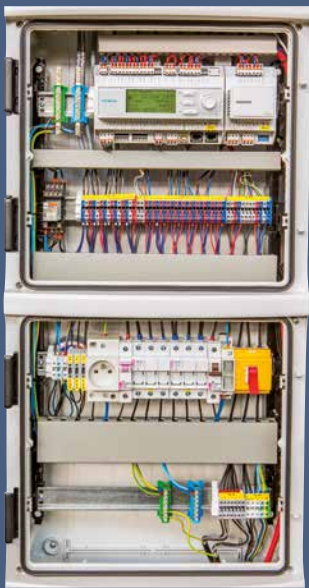
# CONTROL SYSTEM

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## Description of control system

For each version of the air handling unit, it is possible to design a measurement and control system (hereinafter referred to as CS). Due to the large number of variants of the unit and possible ways of managing specific orders (assignment), we prepare a tailor-made control system. The technological scheme and specification of connecting cables is part of the CS project. Along with the control box, we supply the individual components of the control system (sensors, pressure gauges, actuators, etc.), connecting cables are not included. The control box includes a Climatix controller with the display for easy set-up and start-up.

This PLC controller is one of the best on the market for controlling air handling units. It ensures comfortable, safe and energy-efficient operation of the units and can be easily adapted to individual customer requirements. The indisputable advantage of this PLC is its wide communication capability including its connection to BMS systems. The control box including the controller with the display is made in plastic or metal versions, depending on the equipment of the unit and the required power.



## THE CONTROL AND MEASURING SYSTEM OFFERS:

- Good price-performance ratio
- Easy installation
- Simple installation in different variants
- Local and remote administration
- Annual, weekly and daily programs
- Display indicating all data
- Possibility to choose most of European languages
- Temperature and humidity control
- Automatic heating/cooling demand control
- Selection of different operating modes
- Comprehensive control of the unit operation
- Detailed error reporting, including history saving
- Password protection of the advanced settings
- Connection of all control elements in one control box
- Control boxes also for outdoor design and the possibility of placing frequency converters inside
- Uniform marking of connection terminals
- Remote control from PC via internet browser

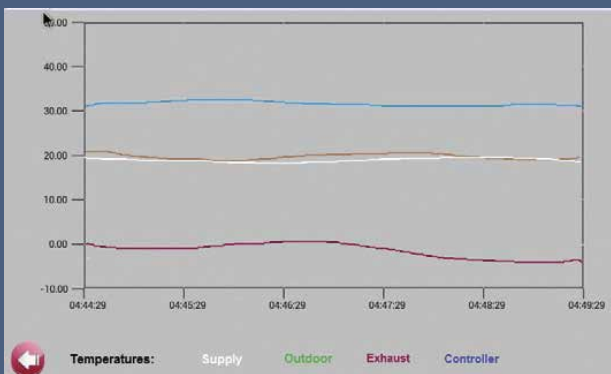
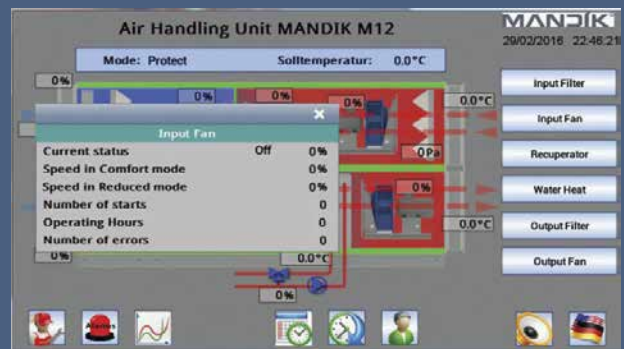
# TOUCH PANEL CLIMATIX

POL8T1.4X/STD / POL8T1.7X/STD / POL8T1.8X/STD

The Climatix touch panel of the POL8T1.XX/STD series is used for local control and monitoring of air conditioners, heaters and other components supplied by Mandík a.s. with the help of a graphical interface. The controller has intuitive operation, all functions are easy and quick to reach. It can work with several Climatix controllers at the same time. ModBus port or TCP/IP is

used for connection to the controller. The touch panel is designed to be mounted on the control box door, the unit's outer panel, or directly in the room. The controller has a colour LCD display with backlight and high resolution (16.7 million colours). It comes in three versions: 4.7", 7" or 12.1".

Display examples:

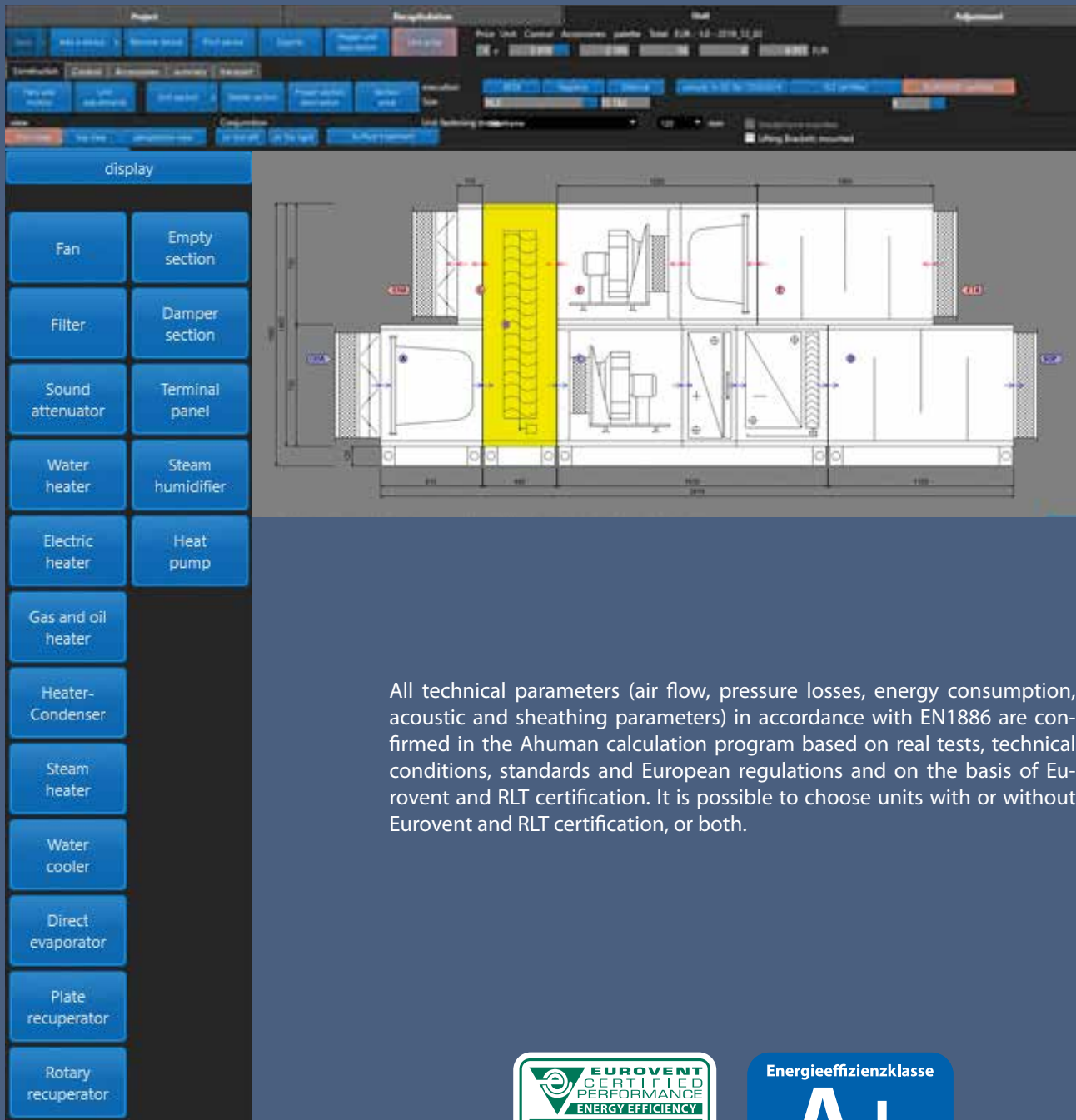


- Compact dimensions with low thickness
- LCD display with 16.7 million colours
- Capacitive touch screen with LED backlight
- 3 sizes: 4.7", 7" or 12.1"
- Communication via ModBus or Ethernet
- Multiple controllers can be connected at the same time
- Support for most languages
- Each permission level is password protected

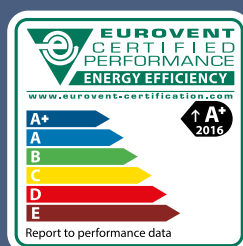
- Weekly program
- Synchronization with settings in the Climatix controller
- SD card and USB port for data import and export
- 24 V DC power supply
- IP 64 protection

# SELECTION SOFTWARE AHUMAN

With the Ahuman software it is easy to design a unit for any customer's wishes and requirements. The software is easy to use and it allows you to get all the necessary technical information about the designed units. The resulting calculation with all technical data can be directly printed or converted to PDF format. For easier work in the design phase, the software allows you to export drawings in DWG (2D and 3D) or BIM formats.



All technical parameters (air flow, pressure losses, energy consumption, acoustic and sheathing parameters) in accordance with EN1886 are confirmed in the Ahuman calculation program based on real tests, technical conditions, standards and European regulations and on the basis of Eurovent and RLT certification. It is possible to choose units with or without Eurovent and RLT certification, or both.





**M EUROVENT certified**

Unit

Supply	1.5	Exhaust	not mounted
cross section velocity	m/s		
total fan power	0.918	kW	
P air-side	0.985	kW	
absorbed power factor	0.932		
EUROVENT energy efficiency class	A		

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**M Certification RLT**

Ventilators

Supply	523	Exhaust	not equipped
P SFP	W / m3 / s		
SFP class	SFP2		
Class of power input of drive	P1		

The unit

Efficiency class of heat recovery	
Class of average air velocity	V1
Energy efficiency class RLT-TÜV-01	A+

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**MANDÍK**

**Technical specification**

**Project:** P4.5  
**Nr:** Position: RS-1 15.1.2020

**Customer**  
Customer Name  
Contact name  
Phone

**Designer**  
Designer Name  
Phone

**Basic data**

Product	AHU	Line	Mandik P
Unit dimensions (LxWxH)	mm 2916 x 1240 x 1320	Size	P4,5
contour dimensions (LxWxH)	mm 3326 x 1340 x 1320	Panel thickness	mm 50
Weight	kg 567	Insulation density	kg/m3 65
Weight attached accessories	kg 8		
Unit fastening mode:	Baseframe		
Surface treatment outside	galvanised	Surface treatment inside	galvanised
terminal panel surface	galvanised	holder surface	galvanised
execution:	Indoor		

Basic unit construction identical with EUROVENT Diploma Nr. 17.04.016  
Fan has been designed for wet condition of cooling coils

**Unit main technical parameters**

air flow	m3/h	Supply	3431	Exhaust	3431
External pressure loss	Pa	240	240	240	240
air velocity in free cross-section	m/s	2.1	2.1	2.1	2.1
Design winter outdoor temperature	°C	-2	-2	-2	-2
amount of recirculation air	%	1	1	1	1

Test according to EUROVENT RS 6/C/005-2017, casing with rock wool ME65

Mechanical strength of casing  
D1 (M), D1 (R)  
L1 (M), L1 (R)

Filter bypass leakage  
< 0.5% - F1 (M)

Thermal transmittance  
T3

Sound insertion loss in band  
T2

Hz	125	250	500	1000	2000	4000	8000
dB	14	23	26	36	38	40	47

according EU Directive No 1253/2014: Non residential ventilation unit (NRVU) ERP 2018 comply

Unit type: bidirectional ventilation unit (BVU)

Type of drive: variable speed drive  
type of heat recovery system: regenerative heat exchanger

External leakage rate at -400 Pa	0.48%
External leakage rate at +400 Pa	0.52%
Internal leakage rate at 250 Pa	2.11%
thermal efficiency of HRG	η <sub>11</sub> / η <sub>11, limit</sub> 2018 % 76.3 / 73.0
Supply fan static efficiency:	η <sub>fan</sub> / η <sub>fan, limit</sub> 2018 % 69.2 / 43.0
Supply fan static efficiency acc. Reg. (EU) No 327/2011:	η <sub>staA</sub> % 66.5
Exhaust fan static efficiency:	η <sub>fan</sub> / η <sub>fan, limit</sub> 2018 % 64.0 / 41.3
Exhaust fan static efficiency acc. Reg. (EU) No 327/2011:	η <sub>staA</sub> % 65.0
internal SFP of ventilation components:	SFP int / SFP int_limit 2018 W/(m3s) 681 / 1056
Int.press drop of vent.components: supply / exhaust	ΔP <sub>s</sub> int sup / ΔP <sub>s</sub> int exh Pa 197 / 199
Int.press drop of add.components: supply / exhaust	ΔP <sub>s</sub> add sup / ΔP <sub>s</sub> add exh Pa 106 / 84

Regularly filter change is very important for performance and energy efficiency of the unit. Maximal recommended final pressure loss mentioned in technical specification is not to exceed. Use visual or acoustic pressure warning device on filters.

<b>Supply part</b>	cross-section air velocity	m/s	2.1
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<b>Block A</b>	air flow	m3/h	3431
<b>Terminal panel</b>	air flow	m3/h	3431
	pressure loss	Pa	2

Damper, tightness class 2 EN1751:2003 outside 1x3 Nm Ending flexible connection, flange 30 mm

Service side: front

Control elements:

Offer author: Mandik s.s. created: version 1.5.454.3 - rev.612 from date 10.12.2019 side: 1 / 24  
Ing. Martin Gončar printed: version 1.5.454.3 - rev.612 from date 10.12.2019 www.mandik.cz

EUROVENT  
CERTIFIED  
PERFORMANCE

AHU N° 17.04.016  
Range AHU MANDÍK

www.eurovent-certification.com

# COMPONENTS OF UNITS



## RECUPERATOR

The units can be equipped with different types of recuperators (plate cross-flow and counter-flow, rotary, glycol types). Efficiency 60-90 %



## CONTROL SYSTEM

Mandik units have a freely programmable Climatic Siemens controller



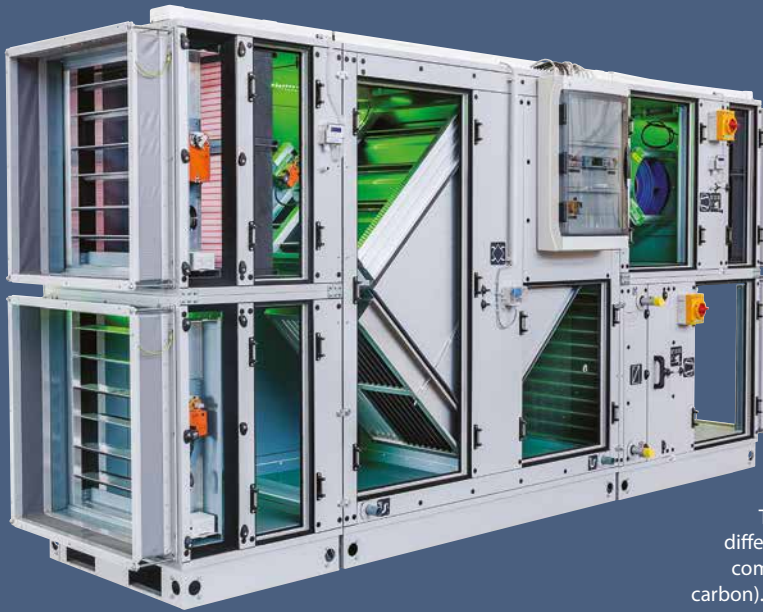
## FAN

The units are equipped with the fans with free impellers, EC and PM-blue types or IE2 and IE3 AC fans with frequency converters.



## CONSTRUCTION OF UNITS

Mandik units are with self-supporting construction. The case has the highest mechanical stability D1, high tightness L1, low coefficient of thermal bridges TB2/TB1 and heat transfer from T3 to T1.



## FILTERS

The units can be equipped with different types of filters (frame, bag, compact, metal and with activated carbon). Filtration classes from G3 to F9 as standard, HEPA on request.



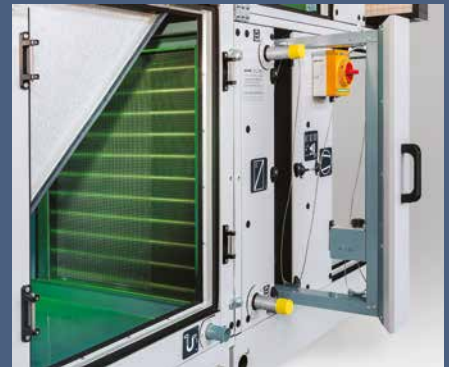
## DAMPERS

The dampers are made of aluminium profiles with tightness class 2 (can be made with class 4)

They can be placed outside on the unit or inside.

## CASE

By default, the shell is in galvanized design, it is possible to choose also fully coated in any paint or in stainless steel AISI304.



## COILS AND ENERGY SOURCES

The units can be equipped with water or direct heating and cooling, electric or central steam heaters

# PHOTO GALLERY



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Issue date: December 2019