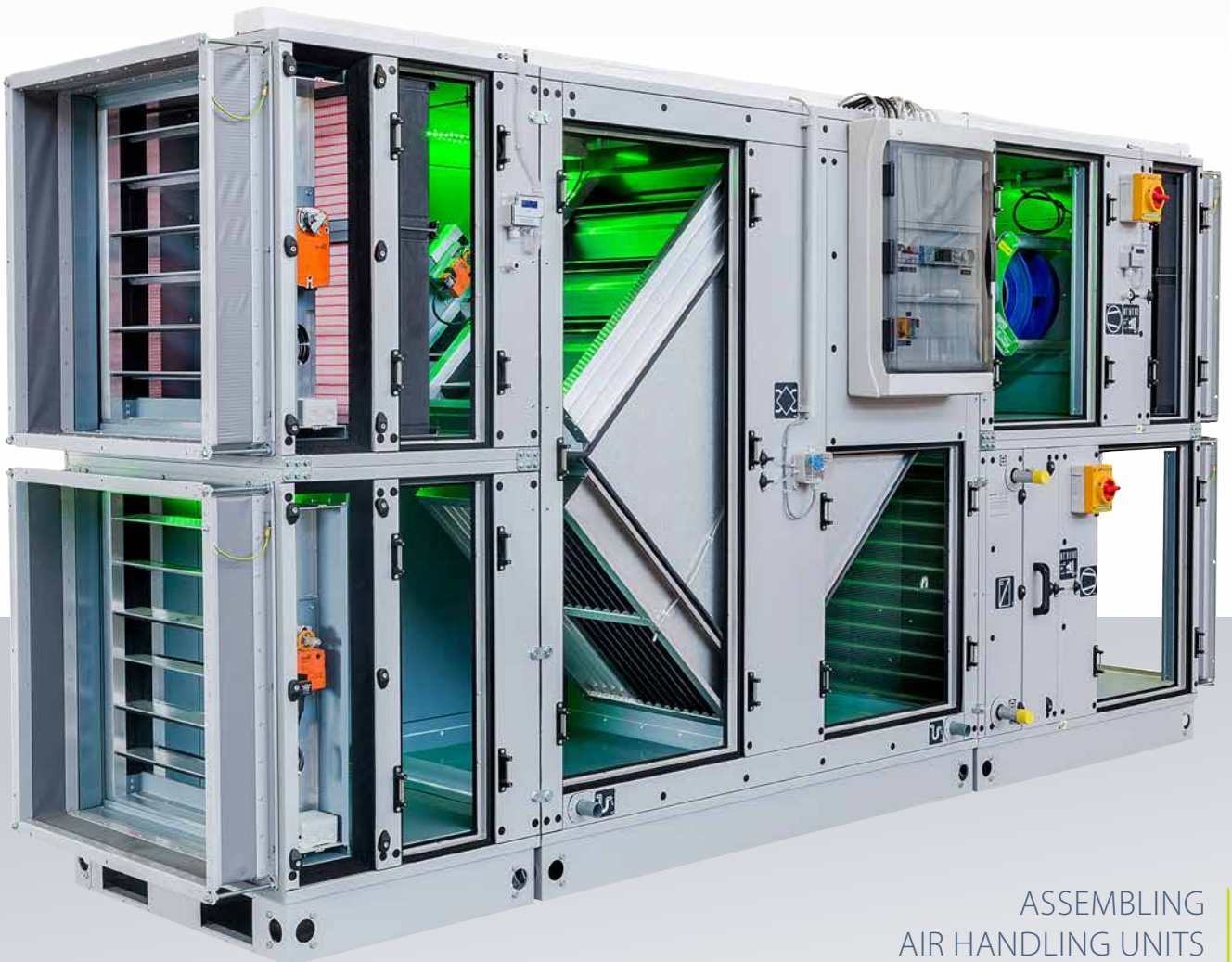


# AHU

## AIR HANDLING UNITS



ASSEMBLING  
AIR HANDLING UNITS  
LINE



**MANDIK®**





## ABOUT MANDÍK, a. s.

MANDÍK, a.s. is a family-owned Czech company established in 1990. It is currently one of the leading manufacturers of ventilation and fire suppression system components, air handlers and industrial heating systems.

In the European market, the company is gaining ground especially with its emphasis on the highest quality, adaptability, flexibility, and services related to the support for the supplied products. Deliveries for European metro systems and tunnels speak to the company's current technical maturity. As concerns the energy industry projects, the company's reach is truly global.

The company is certified and managed in accordance with the requirements of the ČSN EN ISO 9001:2016 standard in conjunction with the ČSN EN ISO 3834-2:2006 standard; at the same time, the integrated management system in compliance with the ČSN EN ISO 14001 and ČSN EN ISO 45001 standards is implemented in the company. For specific requirements, add-on systems are subsequently certified, authorized and implemented; they comply with the following standards and regulations:

- KTA 1401
- IAEA 50-C-Q
- 10CFR50, App. B
- ASME AG1, section DA
- Act No. 263/2016 Coll. – Atomic Act, and SUJB Decree No. 408/2016 Coll.
- QN-100 Generic/App. UK EPR NSSS

In addition, the company is a member of the German association of producers of air handling equipment (RLT). It has all the necessary certificates under European standards and holds the Eurovent and RLT-TÜV-01 energy efficiency determination certificates and is certified by TÜV SÜD Industrie Service GmbH pursuant to EN 1886.

The MANDÍK, a.s. sales territory covers the domestic market and many other European countries where products are delivered in collaboration with our foreign partners.

Emphasis in day-to-day operations is on environmental protection and work safety. Adherence to strict European standards in these areas are the standard for our company and towards which company management has taken an uncompromising stance. Our company also contributes to the protection of the environment by operating its own renewable energy sources and making the widest possible use of energy-efficient appliances.

Our goal is maximum customer satisfaction and, last but not least, the creation of a quality work environment for the company's employees.

# CERTIFICATIONS



The performance parameters are verified and approved by means of the Eurovent certificate. The testing was carried out in accredited TÜV laboratories using the real air handling unit.



The performance parameters are also verified pursuant to the German directive RLT-RICHTLINIE Zertifizierung that is issued by the association of German producers of air handling units. MANDÍK, a.s. is a member of this association.



Air handling units produced by MANDÍK, a.s. are certified by the German institute of hygiene for the use in hygienic environments and high-cleanliness areas. They are designed in accordance with the strictest standards VDI 6022, DIN 1946-4, SWKI 99-3 and Ö-NORM 6020.



Safety of operation of the measurement and regulation system, along with overall design of MANDÍK air handling units, has been tested to meet the electromagnetic compatibility and low voltage requirements.



MANDÍK air handling units can be designed according to various energy classes and fitted with energy labels as per the Eurovent or RLT directives.



# CASING

The chambers of MANDÍK air handling and air conditioning units feature unique frame-less design which is, due to its mechanical properties, suitable for the wide range of dimensions and configuration types. The frame-less design consists of self-supporting sandwich panels that are joined with screw connections.

The basic characteristics of all the casing types are the following:

- › Sandwich panels filled with mineral wool having the specific weight of 50–65 kg/m<sup>3</sup>.
- › The outer and inner parts are made of steel sheet that has the thickness of 0.8 mm.
- › It is possible to choose the material of which the outer and inner parts are to be made – galvanized/stainless AISI 304 / AISI 316L / aluminium-zinc coating / powder coating.
- › The panels are sealed by means of EPDM seals.
- › The sandwich panels are of special shape so that they automatically form up, after being assembled, the smooth inner surface without interstices and corners that would require to be additionally cemented or otherwise adjusted.
- \* in the case of certified hygienic units, only the combination stainless steel AISI 304/ AISI 316L / anti-microbial powder coating is possible



The frame-less design has been developed in the following modifications having the following parameters:

## Typ T1 TB1

- Panel thickness 100 mm.
- The inner and outer sheet metal parts of the panel are thermally separated in order to eliminate thermal bridges and to prevent heat transmittance
- The casing parameters are tested by the certified testing facility TÜV-SÜD Munich to comply with the EN 1886 standard.



Mechanical stability	D1 (M)							
Casing leakage class	L2 (M)							
Leakage between the filter and frame	0,5 % – F9 (M)							
Thermal transmittance	T1							
Thermal bridges coefficient	TB1							
Casing noise reduction in the band								
Hz	125	250	500	1,000	2,000	4,000	8,000	
dB	14	29	37	39	45	50	55	

## Typ T2 TB1

- Panel thickness 50 mm.
- The inner and outer sheet metal parts of the panel are thermally separated in order to eliminate thermal bridges and to prevent heat transmittance.
- The casing parameters are tested by the certified testing facility TÜV-SÜD Munich to comply with the EN 1886 standard.



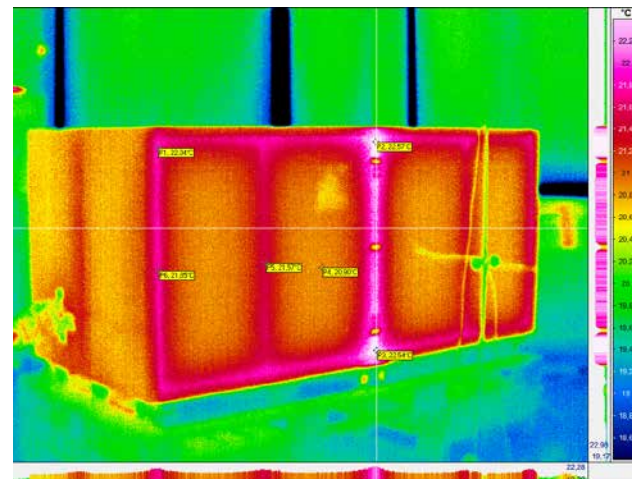
Mechanical stability	D1 (M)							
Casing leakage class	L2 (M)							
Leakage between the filter and frame	0,5 % – F9 (M)							
Thermal transmittance	T2							
Thermal bridges coefficient	TB1							
Casing noise reduction in the band								
Hz	125	250	500	1,000	2,000	4,000	8,000	
dB	12	20	31	36	36	40	55	

## Typ T2 TB3

- Panel thickness 50 mm.
- The casing parameters are tested by the certified testing facility TÜV-SÜD Munich to comply with the EN 1886 standard.



Mechanical stability	D1 (M)							
Casing leakage class	L1 (M)							
Leakage between the filter and frame	0,5 % – F9 (M)							
Thermal transmittance	T2							
Thermal bridges coefficient	TB3							
Casing noise reduction in the band								
Hz	125	250	500	1,000	2,000	4,000	8,000	
dB	18	26	28	34	37	40	45	



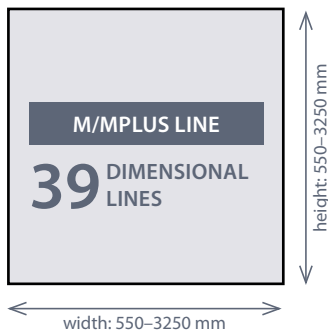
# DIMENSIONS RANGE

Thanks to the frame-less design and unique production know-how, it is possible to customize the dimensions of the air handling units according to any project requirement and choose from the following dimensions lines:

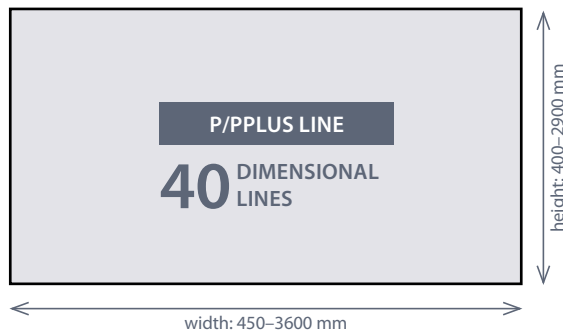
## Standard dimensional line

- › for those who want to make a quick choice without having specific dimensional requirements – new buildings, outdoor applications, ...
- › possibility to select from the fine range of 86 different basic dimensions:

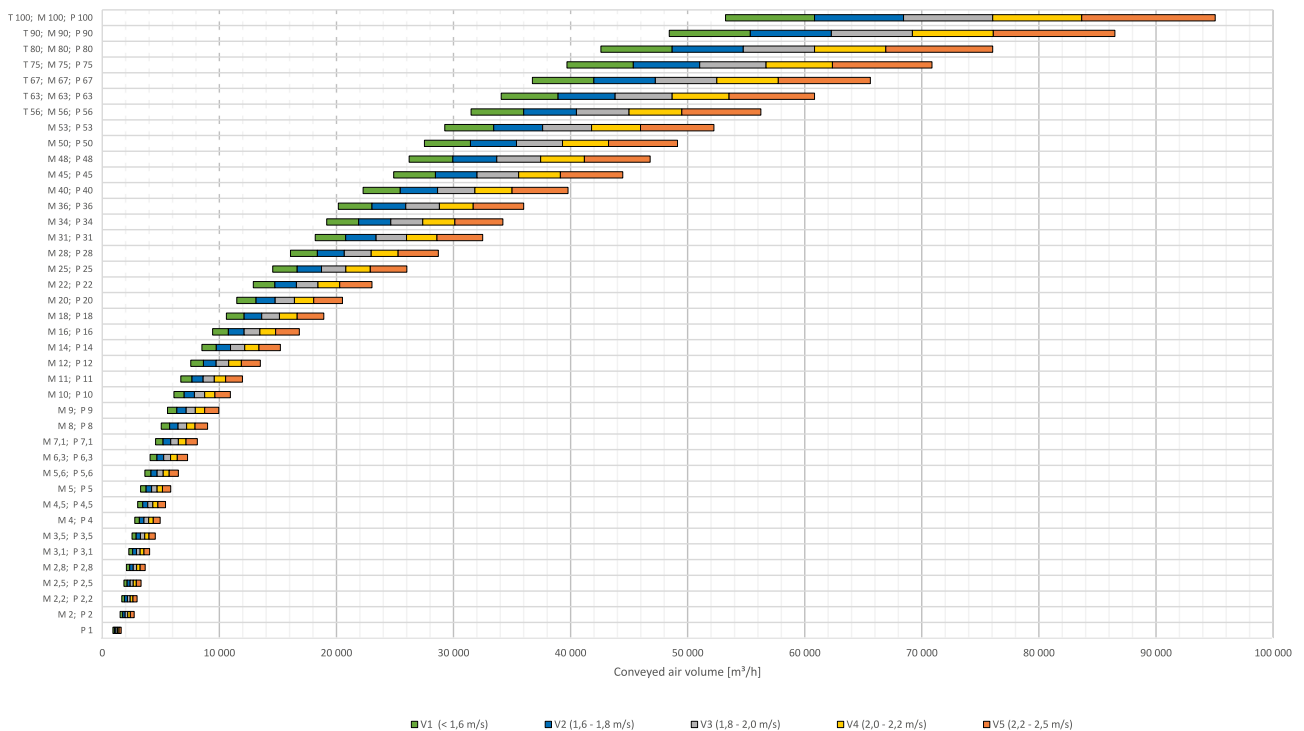
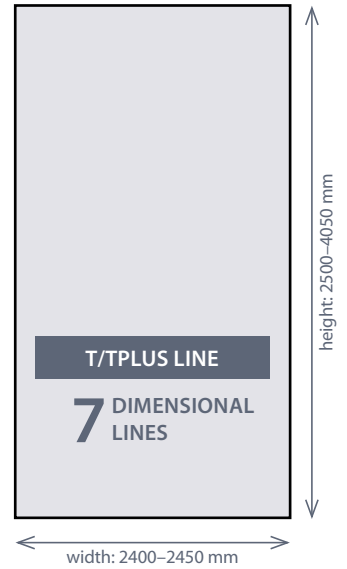
› square cross section:



› rectangular cross section:

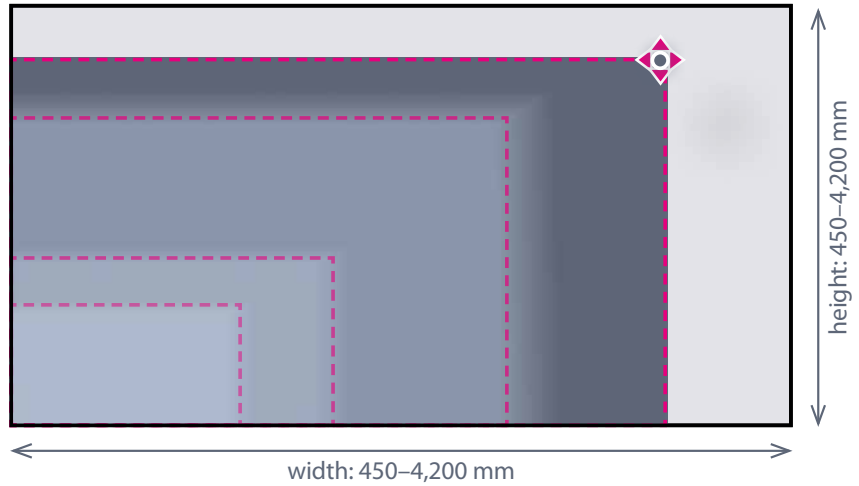


› Transport cross section (for oversized dimensions):



## Dynamic sizes

- For exact design in terms of the height and width of the cross section of the unit as per the project requirements – such as dimensions of the machine room or re-constructed structure
- The size may be chosen fully flexibly by the steps of 1 mm in the range from 450 to 4200 mm



## The exact size as per the composition of the filtration inserts

- The size of the cross section of the unit is exactly designed based on the selected composition of euro filters – no unused excessive space in the cross section.
- The filter set according to the standardized euro dimensions: 287 × 287, 592 × 592, 592 × 287, 287 × 592 mm



	2,2 m/s S: 391 mm V: 3987 mm	1,1 m/s S: 695 mm V: 3987 mm	0,7 m/s S: 984 mm V: 3693 mm	0,5 m/s S: 1289 mm V: 3693 mm	0,4 m/s S: 1577 mm V: 3687 mm	0,4 m/s S: 1882 mm V: 3987 mm	0,3 m/s S: 2170 mm V: 3987 mm	0,3 m/s S: 2475 mm V: 3987 mm	0,2 m/s S: 2763 mm V: 3987 mm	0,2 m/s S: 3068 mm V: 3987 mm	0,2 m/s S: 3356 mm V: 3987 mm	0,2 m/s S: 3661 mm V: 3693 mm	0,2 m/s S: 3949 mm V: 3693 mm
	2,4 m/s S: 391 mm V: 3693 mm	1,2 m/s S: 695 mm V: 3693 mm	0,8 m/s S: 984 mm V: 3693 mm	0,6 m/s S: 1289 mm V: 3693 mm	0,5 m/s S: 1577 mm V: 3687 mm	0,4 m/s S: 1882 mm V: 3693 mm	0,3 m/s S: 2170 mm V: 3693 mm	0,3 m/s S: 2475 mm V: 3693 mm	0,3 m/s S: 2763 mm V: 3693 mm	0,2 m/s S: 3068 mm V: 3693 mm	0,2 m/s S: 3356 mm V: 3693 mm	0,2 m/s S: 3661 mm V: 3693 mm	0,2 m/s S: 3949 mm V: 3693 mm
	2,6 m/s S: 391 mm V: 3388 mm	1,3 m/s S: 695 mm V: 3388 mm	0,9 m/s S: 984 mm V: 3388 mm	0,6 m/s S: 1289 mm V: 3388 mm	0,5 m/s S: 1577 mm V: 3388 mm	0,4 m/s S: 1882 mm V: 3388 mm	0,4 m/s S: 2170 mm V: 3388 mm	0,3 m/s S: 2475 mm V: 3388 mm	0,3 m/s S: 2763 mm V: 3388 mm	0,3 m/s S: 3068 mm V: 3388 mm	0,2 m/s S: 3356 mm V: 3388 mm	0,2 m/s S: 3661 mm V: 3388 mm	0,2 m/s S: 3949 mm V: 3388 mm
	2,9 m/s S: 391 mm V: 3094 mm	1,4 m/s S: 695 mm V: 3094 mm	0,9 m/s S: 984 mm V: 3094 mm	0,7 m/s S: 1289 mm V: 3094 mm	0,6 m/s S: 1577 mm V: 3094 mm	0,5 m/s S: 1882 mm V: 3094 mm	0,4 m/s S: 2170 mm V: 3094 mm	0,4 m/s S: 2475 mm V: 3094 mm	0,3 m/s S: 2763 mm V: 3094 mm	0,3 m/s S: 3068 mm V: 3094 mm	0,3 m/s S: 3356 mm V: 3094 mm	0,2 m/s S: 3661 mm V: 3094 mm	0,2 m/s S: 3949 mm V: 3094 mm
	3,2 m/s S: 391 mm V: 2789 mm	1,6 m/s S: 695 mm V: 2789 mm	1,1 m/s S: 984 mm V: 2789 mm	0,8 m/s S: 1289 mm V: 2789 mm	0,6 m/s S: 1577 mm V: 2789 mm	0,5 m/s S: 1882 mm V: 2789 mm	0,4 m/s S: 2170 mm V: 2789 mm	0,4 m/s S: 2475 mm V: 2789 mm	0,3 m/s S: 2763 mm V: 2789 mm	0,3 m/s S: 3068 mm V: 2789 mm	0,3 m/s S: 3356 mm V: 2789 mm	0,3 m/s S: 3661 mm V: 2789 mm	0,2 m/s S: 3949 mm V: 2789 mm
	3,6 m/s S: 391 mm V: 2495 mm	1,8 m/s S: 695 mm V: 2495 mm	1,2 m/s S: 984 mm V: 2495 mm	0,9 m/s S: 1289 mm V: 2495 mm	0,7 m/s S: 1577 mm V: 2495 mm	0,6 m/s S: 1882 mm V: 2495 mm	0,5 m/s S: 2170 mm V: 2495 mm	0,4 m/s S: 2475 mm V: 2495 mm	0,4 m/s S: 2763 mm V: 2495 mm	0,4 m/s S: 3068 mm V: 2495 mm	0,3 m/s S: 3356 mm V: 2495 mm	0,3 m/s S: 3661 mm V: 2495 mm	0,3 m/s S: 3949 mm V: 2495 mm
	4,1 m/s S: 391 mm V: 2190 mm	2 m/s S: 695 mm V: 2190 mm	1,4 m/s S: 984 mm V: 2190 mm	1 m/s S: 1289 mm V: 2190 mm	0,8 m/s S: 1577 mm V: 2190 mm	0,7 m/s S: 1882 mm V: 2190 mm	0,6 m/s S: 2170 mm V: 2190 mm	0,5 m/s S: 2475 mm V: 2190 mm	0,4 m/s S: 2763 mm V: 2190 mm	0,4 m/s S: 3068 mm V: 2190 mm	0,4 m/s S: 3356 mm V: 2190 mm	0,3 m/s S: 3661 mm V: 2190 mm	0,3 m/s S: 3949 mm V: 2190 mm
	4,8 m/s S: 391 mm V: 1895 mm	2,3 m/s S: 695 mm V: 1895 mm	1,6 m/s S: 984 mm V: 1895 mm	1,2 m/s S: 1289 mm V: 1895 mm	0,9 m/s S: 1577 mm V: 1895 mm	0,8 m/s S: 1882 mm V: 1895 mm	0,7 m/s S: 2170 mm V: 1895 mm	0,6 m/s S: 2475 mm V: 1895 mm	0,5 m/s S: 2763 mm V: 1895 mm	0,5 m/s S: 3068 mm V: 1895 mm	0,4 m/s S: 3356 mm V: 1895 mm	0,4 m/s S: 3661 mm V: 1895 mm	0,4 m/s S: 3949 mm V: 1895 mm
	5,8 m/s S: 391 mm V: 1591 mm	2,8 m/s S: 695 mm V: 1591 mm	1,9 m/s S: 984 mm V: 1591 mm	1,4 m/s S: 1289 mm V: 1591 mm	1,1 m/s S: 1577 mm V: 1591 mm	0,9 m/s S: 1882 mm V: 1591 mm	0,8 m/s S: 2170 mm V: 1591 mm	0,7 m/s S: 2475 mm V: 1591 mm	0,6 m/s S: 2763 mm V: 1591 mm	0,6 m/s S: 3068 mm V: 1591 mm	0,5 m/s S: 3356 mm V: 1591 mm	0,5 m/s S: 3661 mm V: 1591 mm	0,4 m/s S: 3949 mm V: 1591 mm
1297 mm	7,2 m/s S: 391 mm V: 1297 mm	3,5 m/s S: 695 mm V: 1297 mm	2,4 m/s S: 984 mm V: 1297 mm	1,8 m/s S: 1289 mm V: 1297 mm	1,4 m/s S: 1577 mm V: 1297 mm	1,2 m/s S: 1882 mm V: 1297 mm	1 m/s S: 2170 mm V: 1297 mm	0,9 m/s S: 2475 mm V: 1297 mm	0,8 m/s S: 2763 mm V: 1297 mm	0,7 m/s S: 3068 mm V: 1297 mm	0,6 m/s S: 3356 mm V: 1297 mm	0,6 m/s S: 3661 mm V: 1297 mm	0,5 m/s S: 3949 mm V: 1297 mm
	9,6 m/s S: 391 mm V: 992 mm	4,7 m/s S: 695 mm V: 992 mm	3,2 m/s S: 984 mm V: 992 mm	2,4 m/s S: 1289 mm V: 992 mm	1,9 m/s S: 1577 mm V: 992 mm	1,6 m/s S: 1882 mm V: 992 mm	1,4 m/s S: 2170 mm V: 992 mm	1,2 m/s S: 2475 mm V: 992 mm	1,1 m/s S: 2763 mm V: 992 mm	0,9 m/s S: 3068 mm V: 992 mm	0,9 m/s S: 3356 mm V: 992 mm	0,8 m/s S: 3661 mm V: 992 mm	0,7 m/s S: 3949 mm V: 992 mm
	14,4 m/s S: 391 mm V: 698 mm	7 m/s S: 695 mm V: 698 mm	4,7 m/s S: 984 mm V: 698 mm	3,5 m/s S: 1289 mm V: 698 mm	2,8 m/s S: 1577 mm V: 698 mm	2,3 m/s S: 1882 mm V: 698 mm	2 m/s S: 2170 mm V: 698 mm	1,8 m/s S: 2475 mm V: 698 mm	1,6 m/s S: 2763 mm V: 698 mm	1,4 m/s S: 3068 mm V: 698 mm	1,3 m/s S: 3356 mm V: 698 mm	1,2 m/s S: 3661 mm V: 698 mm	1,1 m/s S: 3949 mm V: 698 mm
	29,3 m/s S: 391 mm V: 393 mm	14,3 m/s S: 695 mm V: 393 mm	9,7 m/s S: 984 mm V: 393 mm	7,2 m/s S: 1289 mm V: 393 mm	5,8 m/s S: 1577 mm V: 393 mm	4,8 m/s S: 1882 mm V: 393 mm	4,1 m/s S: 2170 mm V: 393 mm	3,6 m/s S: 2475 mm V: 393 mm	3,2 m/s S: 2763 mm V: 393 mm	2,9 m/s S: 3068 mm V: 393 mm	2,6 m/s S: 3356 mm V: 393 mm	2,4 m/s S: 3661 mm V: 393 mm	2,2 m/s S: 3949 mm V: 393 mm
	1577 mm												

# UNITS DESIGN

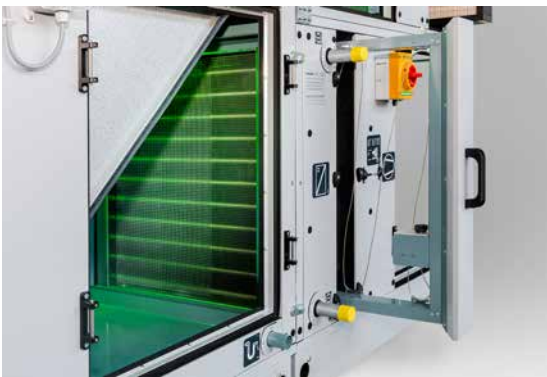
## STANDARD DESIGN



Designed for central distribution and treatment of the air in ventilation and air conditioning systems for air output ranging from 500 to 100,000 m<sup>3</sup>/h.

Air conveyed by the unit must first be filtered to remove physical and gaseous impurities that could foul the installed components or corrode the materials used in the construction of the unit. The units are intended to be used in environments that are free of any explosion risk and in the temperature range of -30 ° to +40 °C in the vicinity of the unit. Outdoor units are complemented with elements or design measures allowing for placement of the unit in an outdoor environment.

In order to allow for using the units in a different temperature range (< -30 °C or > +40 °C) or in an environment where the relative humidity in the input or output air is > 70% rH, design and construction measures are necessary.





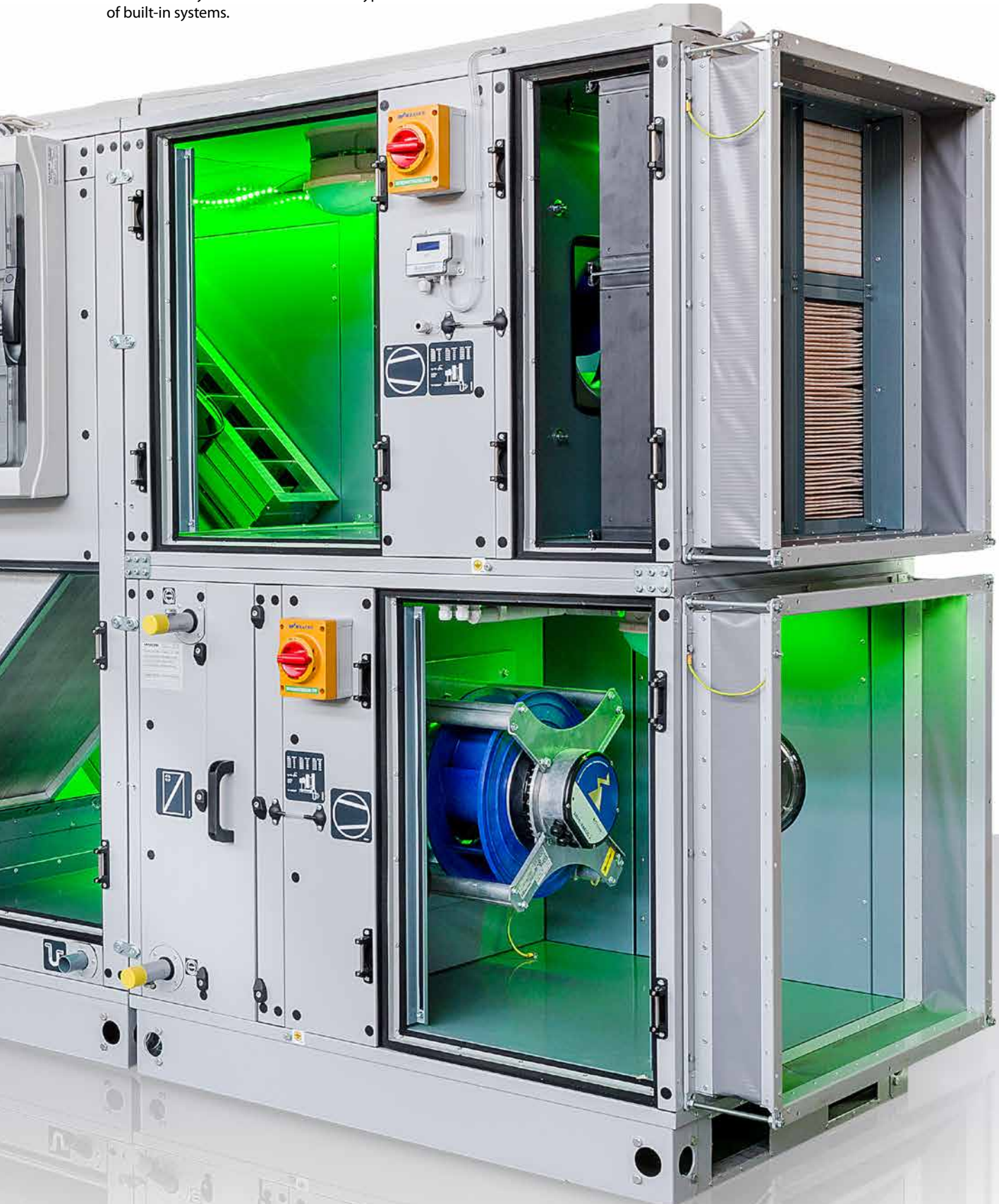
These requirements must be consulted with sales representatives of MANDÍK, a.s. The units may be designed with the standard M/Mplus square, P/Pplus rectangular and T/Tplus transport cross section, or in the dynamic size by the steps of 1 mm.

Casing types T1 TB1 / T2 TB1 / T2 TB3 may be freely chosen for the entire range of standard or dynamic sizes and for all types of built-in systems.

The units meet the requirements of essential European standards and regulations, such as EcoDesign, EN 13799, EN 1886.

Any and all technical design, engineering and operational conditions of individual parts of the unit are integrated within the

AHUMAN programme that is necessary for designing MANDÍK air handling and air conditioning units in a qualified and professional manner.



# HYGIENIC DESIGN

## VDI 6022, DIN 1946-4



This is an extension of the standard air handling unit series and their operating conditions. The units in the hygienic version are designed to be usable in hygienic and clean areas, e.g. in the medical sector, laboratories and various industries.

The main features of such design are the following:

- › The design of the unit aims to ensure that impurities sediments are as low as possible and that the possibility for the germs and mould to reproduce is eliminated.
- › The overall design of the unit for easy access regarding the cleaning and disinfection of all the parts of the unit (inner service areas, removable parts, etc.).
- › Internal smooth area that is free of any grooves, bends, sharp edges or similar things so that cleaning and disinfection can be carried out safely.
- › The inner space is designed so as to be in conformity with any requirements of hygienic standards (e.g. the inlet filter is fitted with the condensate-catching pan, all the condensate basins with downslope from all sides, the door gasket without any glue and removable).



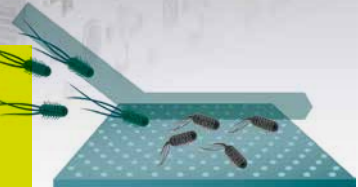
- › The internal built-in parts are designed to comply with requirements of the standards (such as filter beds, design of ventilators / regenerators / heat exchangers / humidifiers / silencers, a damping liner, flap, chambers connection).
- › The internal materials are in conformity with the requirements of the respective standards – the metal parts made of stainless steel or powder-coated whereas the non-metal parts (powder coating, rubber parts, cementing, gaskets, etc.) are tested to meet the requirements of ISO 846 (i.e. that they are inert as regards bacteria and fungi).

**Antimicrobial powder paint is used on all coated internals.**

- |                     |                |                |
|---------------------|----------------|----------------|
| › VDI 6022, Blatt 1 | › DIN 1946-4   | › VDI 3803     |
| › ÖNORM H 6021      | › SWKI 99-3    | › DIN EN 13779 |
| › SWKI VA104-01     | › ÖNORM H 6020 | › EN 1886      |



Antimicrobial powder paint is used on all coated internals.



# ATEX DESIGN

## ATEX 2014/34/EU Directive

This is an extension of the standard air handling unit series and their operating conditions. These units are intended for environments where there is a risk of explosion; they are designed and adjusted so that they cannot be set on fire due to electrostatic discharge while operated; it is achieved in particular through the following measures:

- › Appropriate chemical composition of applied materials.
- › Plastic parts are used as little as possible while having the maximum permissible area.
- › Conductive bonding of metal parts, including the casing.
- › Only the certified components (ventilators, servo drives, etc.) are used.
- › Risk assessment analysis of individual built-in parts carried out in accordance with EN 13463-1.

The drawing and technical documentation is deposited with the authorized person No. 210 from the PHYSICAL – TECHNICAL TESTING INSTITUTE.



### **ATEX units are designed to be used in the following environments:**

- › Ex- zone: 1; 2
- › Equipment group: II
- › Equipment category: 2; 3
- › Explosive atmosphere: G
- › Gasses group: IIA; IIB
- › Thermal class: T1-T4

### **The ATEX units must not be used close to:**

- › High frequencies sources (e.g. transmitters)
- › High intensity light sources (e.g. lasers)
- › Ionizing radiation sources (e.g. roentgen radiation devices)
- › Ultrasound sources (e.g. ultrasound testing devices)

It is possible to select T2 TB3 casing only (plastic parts eliminated).



# DESIGN INCLUDING THE HEAT PUMP

This design is an extension of the standard air handling unit series and their operating conditions with the limitation of the air output (500 to 40,000 m<sup>3</sup>/h), or, respectively, intended for the maximum cooling power of 150 kW. The units are fitted with the complete cooling circuit with or without reversible operation for additional cooling, or, possibly, for additional heating of incoming air.

The cooling circuit contains:

- › A compressor / compressors in tandem / separate compressors for each circuit, the on/off or digital version (the on/off version for the R410A refrigerant, the digital version for the R407C refrigerant)
- › A thermostatic expansion valve (cooling only) / an electronic expansion valve (the heat pump)
- › A refrigerant/air condenser (a single-circuit or multi-circuit one)
- › A refrigerant/water condenser (as an add-on for water heating or as a primary source)
- › A refrigerant/air evaporator (a single-circuit or multi-circuit one)
- › The necessary elements of the cooling circuit (4-way valves, separators, refrigerant collectors, filter dehydrators, electromagnetic valves, protective pressure elements, sight glasses, etc.)
- › Complete installation, refrigerant filling, set-up and testing

The units may be designed with the primary recuperation section (plate/rotary exchanger air/air) or the refrigerant circuit as a separate element in the supply-discharge unit. The unit may be additionally fitted with a bivalent heat source – additional water/electrical/gas heating.



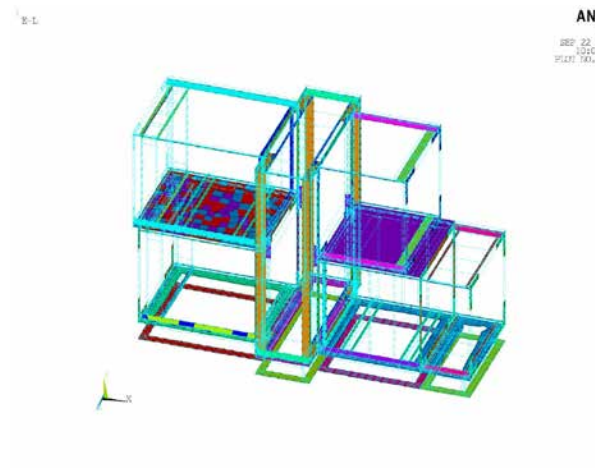
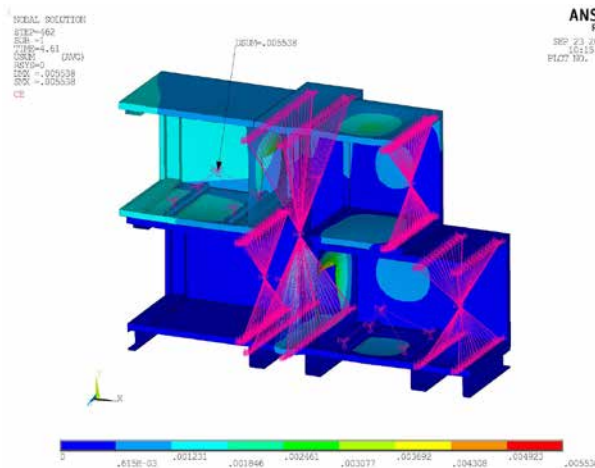
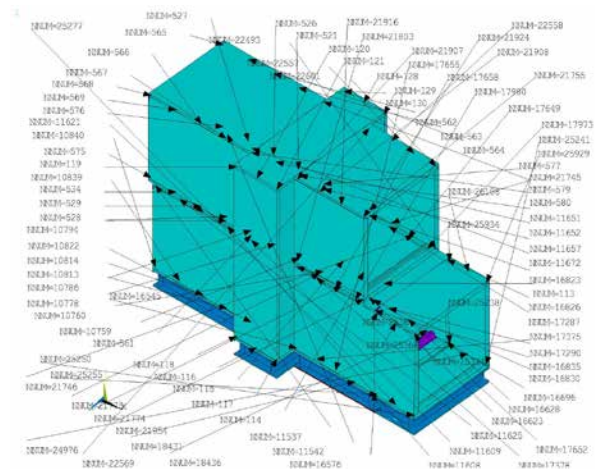
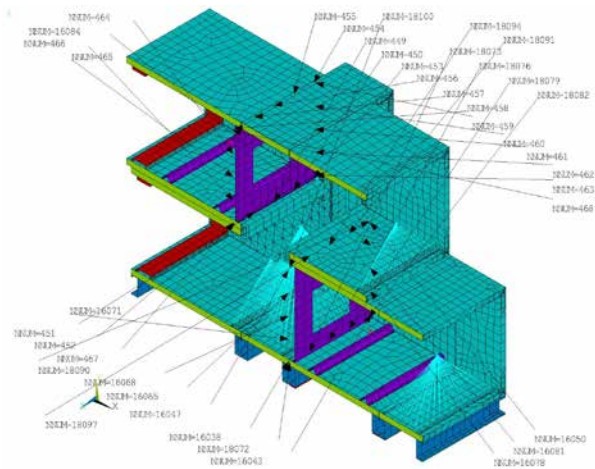
# SPECIAL APPLICATIONS

These units may specifically be designed and manufactured in accordance with the customer's wishes, including the documentation. It is possible to adjust the design of the units so that they can be used in a specific area of special air handling applications; it is done by increasing their general resistance against various harmful influences (the system of making the unit resistant).



By special applications, all projects through which any non-standard operational conditions outside the scope of usual characteristics and properties of the standard design series are solved are meant; the most significant projects of this kind concern the energy sector, military projects, petrochemical industry, dams, tunnels, etc. These requirements are usually defined by the customer and are handed over in the form of a complex project specification; they define the level and class of the required resistance against harmful influences in the individual key characteristics of the product, such as:

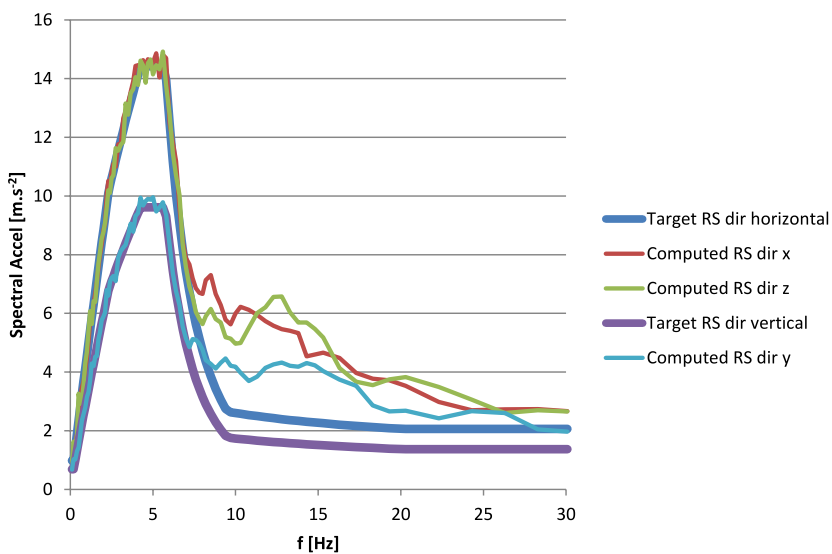
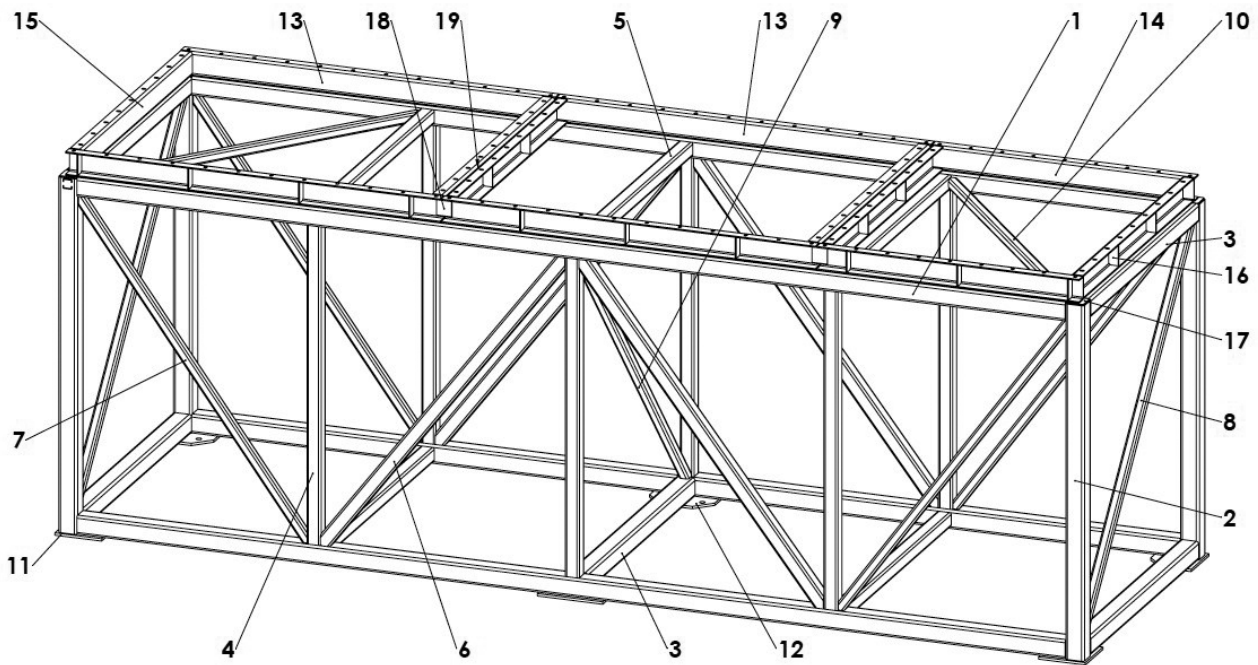
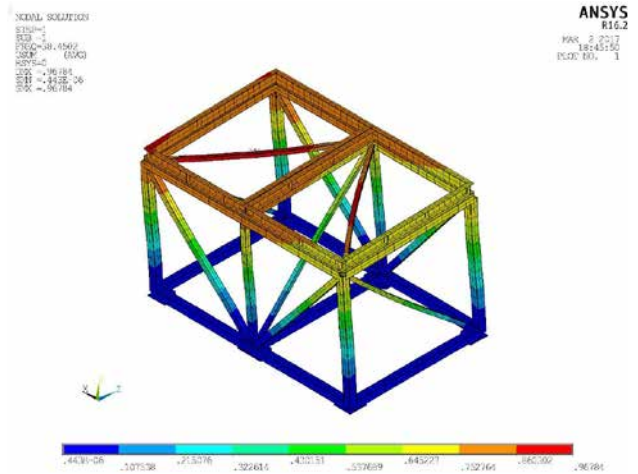
- General resistance against seismic events and vibrations
- General resistance against ionizing radiation
- General resistance against environmental and climatic influences
- General resistance against maximum pressure
- General resistance against pressure shock wave (both inner areas and external force)
- General resistance against corrosive environments and chemicals (corrosion-chemical operational resistance)
- Resistance against significantly transient pressure load
- Resistance against tornado load
- Resistance against general ageing
- Resistance against the influence of a high-intensity magnetic field
- Resistance against penetration by a foreign object (shrapnel resistance)



Due to specific requirements laying down usually combinations of above mentioned requirements for individual projects, every assembly, or project, is designed on a custom basis.

To achieve an optimal solution, an approach utilizing protocols is applied; it includes the following:

- A feasibility study based on the project specification that was handed over to us
- Development, usually with the participation of independent experts and institutions – third parties
- Elaboration of pre-qualifying product documentation and quality assurance
- A prototype (applicable procedure while having an option to choose a representative of the characteristics of the whole series)
- Qualification (a representative product, or the type series individually)
- Elaboration of the final product documentation (manufacturing and quality assurance)
- Certification according to specific standards of the project (if required)
- Product takeover by the customer



MANDÍK, a.s. is currently capable of ensuring the whole above specified process using its own or external sources. The customer, or an independent body appointed by the customer (such as SUJB, TÜV, DEKRA, STUK), participates when all individual steps are performed for the purposes of consultancy and approving. This procedure ensures that the final compliance of the requirements with properties of the product is achieved in the optimal time.

# DESIGN SOFTWARE

The AHUMAN software is intended for technical design, calculation and price calculation of the Mandík modular air conditioning units.



The software output is the following:

- Technical specification of working points of individual components
- Materials to be used for manufacturing of the unit
- Drawings of the unit
- Extract of all the parameters required by the Regulation EU 1253/2014 and assessment of the compliance of the created assembly with the requirements of this regulation
- Calculations and ranking of the assembly into energy classes, including certificates that accompany the unit, such as Eurovent, RLT, TÜV-SÜD or hygienic design
- Technical specification of the MaR system (components, description of functions)
- Various export formats, such as BIM, DXF, 2D/3D view, base frames layout drawing

The software allows for the following:

- The possibility to choose from the wide range of types and designs of individual components available on the market, such as heat regenerators, heat exchangers, filtration systems or MaR systems
- High dimensional and shape variability of the entire assembly – dynamic sizes, vertical/horizontal configuration, various directional modifications (bending) of individual chambers, etc. The user is thus given a possibility to adapt to any requirement of the project.

## MANDÍK

**Technical specification**

Project: Moy Park AHU replacements	C-NE: IGB60012	Prod.No: 0702-5319	P: W2475H2190
NI: 20.814Z.116-H	Position: DF1-B - DF Line 3 Supply		9.12.2020

Customer: FAHNEVAEN	Designer Name:
Contact name: Graham Beckwith	Phone:
Phone: +44 02030 612648	

Basic data	
Product: AHU	line: P
Unit dimensions (LxWxH): mm	4661 x 2475 x 2340
Unit dimensions (LxWxH): mm	4725 x 2525 x 2340
Weight: kg	2553
Weight attached accessories: kg	0
Unit fastening mode: BaseFrame	Surface treatment inside: stainless steel 1.4301
Surface treatment outside: stainless steel 1.4301	Surface treatment inside: stainless steel 1.4301
terminal panel surface: stainless steel 1.4301	built-in holder surface: stainless steel 1.4301
holder surface: stainless steel 1.4301	strain pan surface: stainless steel 1.4301
execution: indoor	
Air density used for calculations: standard 1.2 kg/m <sup>3</sup>	
Operating conditions between: -30°C and +40°C	

Unit main technical parameters	
air flow: m <sup>3</sup> /h	Supply: 39420
External pressure loss: Pa	300
air velocity in free cross-section: m/s	2.2
Design winter outdoor temperature: °C	-2

EUROVENT EN 1253/2014: casing with rock wool batts	
D1 (m)	12
Mechanical strength of casing: N	12
Causing of leakage: %	0.5%
Filter bypass leakage: %	0.5%
Thermal conductivity: W/mK	0.035
Thermal bridging of the casing: W/m <sup>2</sup> K	0.035
Sound insertion loss in band: dB	12 15.7 20.0 30.0 1000 2000 4000 8000

according EU Directive No 1253/2014: Non residential ventilation unit (NRVU)	
Unit type:	variable speed drive (VSD)
Type of drive:	variable speed drive
External leakage rate at: -400 Pa	0.2%
External leakage rate at: +400 Pa	0.2%
Supply fan static efficiency acc. Reg. (EU) no 307/2012:	η <sub>fan</sub> / (η <sub>fan</sub> , limit 2018) % 68.4 / 58.3
Supply fan static efficiency acc. Reg. (EU) no 307/2012:	η <sub>static</sub> / (η <sub>static</sub> , limit 2018) % 75.4 / 73.0
intense SF6 of ventilation components: SF6 int. / SF6 int. limit 2018 W/(m <sup>3</sup> /h) Pa	75 / 230
int pressure drop of vent components: supply	Pa 54
int pressure drop of add components: supply	Pa 513
int pressure drop of add components: supply	Pa 513

Supply part	
all filter: m <sup>3</sup> /h	39420
cross section air velocity: m/s	2.2

Block A	
all filter: m <sup>3</sup> /h	39420
pressure loss: Pa	95

Filter part composition: 12x 592 x 592 mm, 4x 592 x 287 mm  
 pressure loss max: Pa 56  
 Filter class, length (ES) Coarse 50% - precoat filter 25 mm  
 Type: G5.5/A4.25 - HE-Advanced filter  
 Initial pressure loss: Pa 39  
 Max allowed final pressure loss: Pa 130  
 Max. final pressure loss acc. EN1855: Pa 150

Offer author: Mandík, s.r.o. created version 1.5.654.3 - rev 849 from date 11.11.2020 side: 1 / 5  
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# MEASUREMENT AND REGULATION SYSTEM

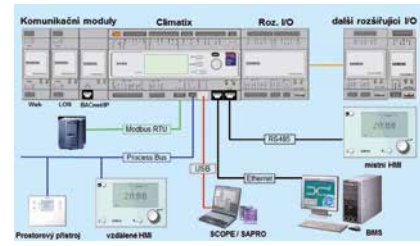
## Characteristic

- › A MaR system is specifically designed for each Mandík air handling unit variant
- › Comfort unit run control by means of the programmable Siemens Climatix controller
- › Wide communication capability – cooperation with the majority of the superior systems
- › Easy control and full service setting by means of the display and buttons
- › Power distribution boards in the metallic or plastic design depending on the air handling unit configuration



## System Properties

- › Comprehensive precise control of ventilation operation
- › Easy installation and control in several variants
- › Local and remote control
- › Possibility to select from multiple operational modes; weekly as well as yearly time schedule
- › Text display with clear depiction of all data
- › Displays come equipped with support for all the European languages (Czech is standard)
- › Temperature and humidity control in supply or room
- › Automatic detection of heating or cooling needs
- › Clear listing of alarm messages, including history
- › Changes to important parameters require a password (multiple levels)
- › The control of all the standard external heating and cooling components
- › Control from a PC using a web browser (standard delivery) and then from anywhere on the Internet
- › Possibility of the visualization add-on



The Siemens Climatix controller of the control unit of the air conditioning unit dispatches all the required data relating to the operation of the unit, condition of individual components, data coming from individual sensors, etc. at the place of the structure in certain time intervals; the information is sent to Cloud Mandík storage space where the user may look at them at any time and change them in real time.

## Cloud Mandík Function

- › 3 levels of access, each of which is protected with its own password, has a different rights of accessing the units and possibilities of handling these units:
  1. Access for the manufacturer – administration of users and passwords, on-line updates of the controlling software of the controller, etc.
  2. Access for the installer companies – provides for the remote management and service of all the connected units with the end users; this significantly reduces costs associated with these operations
  3. Access for end users – provides for the possibility of remote management of all the connected units managed by the user
- › The Climatix controller may be connected to Cloud Mandík in two ways:
  1. The controller may be connected to the cloud via the internet by means of a router with a prepaid SIM card that is subject to a data tariff.
  2. The controller is connected to the internal computer network of the building having access to the internet and finally to the cloud via the said network.
- › It is possible to establish a connection using a PC, tablet or smart phone.
- › The service is subject to a fee.
- › The service can be accessed 24 hours a day, 7 days a week, and 365 days a year.
- › We provide on-line support when the equipment is being commissioned.
- › It detects whether sensors are connected correctly and indicates any defects.
- › If it is necessary to modify the software, e.g. if a customer wishes so, the modification and uploading is done on-line.
- › Data points such as outputs, input power, temperatures are monitored on-line.
- › If the unit malfunctions, the cause of the malfunction may be investigated on-line without the need to immediately send service technicians.
- › The user can see the data points (output values, input power, temperatures, ...) as charts on the time axis.
- › The user can see on-line notices indicating any alarms of the control unit and the extracted list of these alarms, including their description and times at which they occurred.
- › The users can customize the main screen containing the tiles, charts and alarms as they wish.
- › In the application, there exists a possibility of standard internet access – the so called HMI@ Web for controlling the whole unit, its individual components or for turning the whole unit off or on.
- › In the Cloud, the user may safely keep all necessary documentation of the unit such as the technical sheet, installation, maintenance and service manual, electrical connection layouts, or certificates.
- › It is possible to easily configure the weekly time schedules via the Cloud.
- › The data collected over the time (a year, week, day, hour, etc.) may easily be exported from the cloud as a file (MS Excel) to be worked with afterwards.
- › The users may set alerts to remind them of the upcoming regular maintenance; the cloud will indicate the alert on the map as well as on the main screen.



# AIR FILTRATION

The air filtration is ensured by means of two types of built-in sections based on the expected need of catching specific size and type of particles. The particles are sorted according to, and the needed efficiency of the filter is specified by, the ISO 16890 standard.

Efficiency	Particle size ( $\mu\text{m}$ )
ePM10	$0,3 \leq x \leq 10$
ePM2,5	$0,3 \leq x \leq 2,5$
ePM1	$0,3 \leq x \leq 1$

*PM stands for "Particulate Matter"*

## FILTER TYPES:

- › Grease catchers
- › Pre-filters
- › Compact filters
- › Short pocket filters
- › Long pocket filters
- › Frame filters
- › Activated carbon cartridges
- › HEPA Filters
- › Hygienic/ATEX design

For fixing H10 HEPA filters and higher, special construction inside the standard casing was developed. The tightness of the construction (the tightness due to pressure applied to the filter and filter frame, as well as tightness between the filter frame and casing of the chamber) was verified by means of the defectoscopy carried out by an accredited testing laboratory.



## The filtration inserts can be fixed using two methods:

- › By means of pressure bars
  - › Removed by pulling to the side
  - › Saves space as the chamber is shorter
  - › Lower price
  - › Removal of the filter inserts to the clean side in the direction in which the air flows
  - › The tightness of the filter mounting of up to F9 as per the EN 1886 standard
- › By means of the storage frame
  - › Removal of the filter inserts to the dirty side in the direction in which the air flows
  - › Suitable for hygienic design / high-cleanliness areas
  - › More space is required – the chamber must be longer
  - › High tightness of filter mounting

# AIR FLOWING



The air is conveyed by means of impellers with the blades that are bent backwards; the impellers are propelled by EC/AC electric motors.

**The ventilators can be chosen and combined in the following variants:**

- › EC or AC electric motors controlled with frequency changers
- › Building the ventilators in either for horizontal or vertical airflow direction
- › Fixing of the ventilators on the floor or on the vertical dividing wall (suitable for hygienic design)
- › Parallel configuration (two or more next to each other, ventilator walls)
- › Thermally resistant design
- › The variant in the protective guard for ventilation of kitchens
- › Hygienic/ATEX design



Only the complete ventilator aggregates that are certified and technically verified are used. That ensures high quality and reliability.

All the ventilators are normally equipped with protective elements (motor overheating, protective guards, etc.) and probes for quickly measuring the airflow output. In the case of aggregates in the bigger chambers, overpressure protection on the discharge side is added to protect against pressure surges in the duct so as to prevent the chambers downstream the ventilator from getting subsequently damaged.



# AIR HEATING

Air heating is ensured by means of heat exchangers based on these principles:

## HOT WATER COIL

### Standard design:

- › Cu tubes and Fe collectors, Al slats, zinc-coated frame
- › The pitch of the slats from 2.0 mm
- › Threaded connections
- › Breather valve
- › Capillary frame as anti-freeze protection
- › Maximum operating temperature of the medium of 150 °C, maximum pressure 0.8 MPa

### Above-the-standard design:

- › Cu slats and collector, cataphoretically coated or stainless steel exchanger
- › Flanged connections
- › Connections to the side inside the chamber
- › Collectors in the connections for reading temperature as anti-freeze protection
- › Higher operating temperature and medium pressure based on the customer's requirement
- › Hygienic/ATEX design



## ELECTRIC HEATER

### Standard design:

- › Stainless heating bars
- › Zinc-coated/stainless steel frame
- › Operational and emergency thermostat
- › Divided into sections according to the heating output



## CONDENSER

### Standard design:

- › Cu tubes and collectors, Al slats, zinc-coated frame
- › The pitch of the slats from 2.0 mm
- › Soldering connections
- › Refrigerants optionally from 31 types

### Above-the-standard design:

- › Cu slats, cataphoretically coated or stainless steel exchanger
- › Connections to the side inside the chamber
- › The evaporator may be a part of an integrated cooling circuit with/without reversible operation

(see the section concerning the design including the heat pump)

- › Hygienic/ATEX design



## GAS HEATER

(indirect heating flue gas-air)

- › Heating output 10–600 kW
- › Stainless condensation heat exchangers with the efficiency of 90–102 %
- › Fuel types:
  - Natural gas (G20)
  - Propane-butane (G30/G31)
  - Propane (G31) and other fuels as per the design of the burner
- › Operator's access, the gas connection and flue gases exhaust on one side
- › Including the over-pressure burner (two-stage, modular)
- › With/without the by-pass damper
- › Indoor/outdoor design



# AIR COOLING AND DEHUMIDIFICATION

Air cooling is ensured by means of heat exchangers based on these principles:

## COLD WATER COIL

### Standard design:

- › Cu tubes and collectors, Al slats, Al frame
- › The pitch of the slats from 2.5 mm
- › Threaded connections
- › Breather valve
- › It is possible to use an anti-freezing mixture containing ethylene glycol or propylene glycol having the concentration of 10–40 %
- › Plastic drip eliminator
- › Sloped stainless steel vat with the DN32 drain

### Above-the-standard design:

- › Cu slats, cataphoretically coated or stainless steel exchanger
- › Flanged connections
- › Connections to the side inside the chamber
- › Hygienic/ATEX design
- › Al drip eliminator



## EVAPORATOR

### Standard design:

- › Cu tubes and collectors, Al slats, Al frame
- › The pitch of the slats from 2.5 mm
- › Soldering connections
- › Refrigerants optionally from 31 types
- › Sloped stainless steel vat with the DN32 drain

### Above-the-standard design:

- › Cu slats, cataphoretically coated or stainless steel exchanger
- › Hydrophobic surface of the slats
- › Connections to the side inside the chamber
- › Aluminium drip eliminator
- › The evaporator may be a part of an integrated cooling circuit with/without reversible operation (see the section concerning the design including the heat pump)
- › Hygienic/ATEX design



# RECOVERING HEAT FROM AIR

The heat is regained by means of plate-type recuperative heat exchangers, rotary regenerative heat exchangers or liquid heat exchangers.

## PLATE RECUPERATIVE HEAT EXCHANGERS

### Standard design:

- › Cross-flow/counter-flow design of the heat exchanger
- › Vertical (above-each-other) / horizontal (next-to-each-other) arrangement in terms of supply and exhaust air flow.
- › Al slats, zinc-coated frame
- › Possibility to choose various efficiency classes
- › By-pass damper
- › Sloped stainless steel vats with the DN32 drain

### Above-the-standard design:

- › Slats with the epoxy layer, painted frame
- › Mixing damper
- › The vertical version is divided into 3 transport pieces (upper chamber, lower chamber, heat exchanger)
- › Hygienic/ATEX design



## ROTARY REGENERATIVE HEAT EXCHANGERS

### Standard design:

- › Al slats, zinc-coated frame
- › Design intended for heat transfer / heat and humidity transfer (sorptive/hygroscopic)
- › Possibility to choose various efficiency classes
- › The rotor propelled by an EC/AC electric motor and frequency changer, a stepper motor

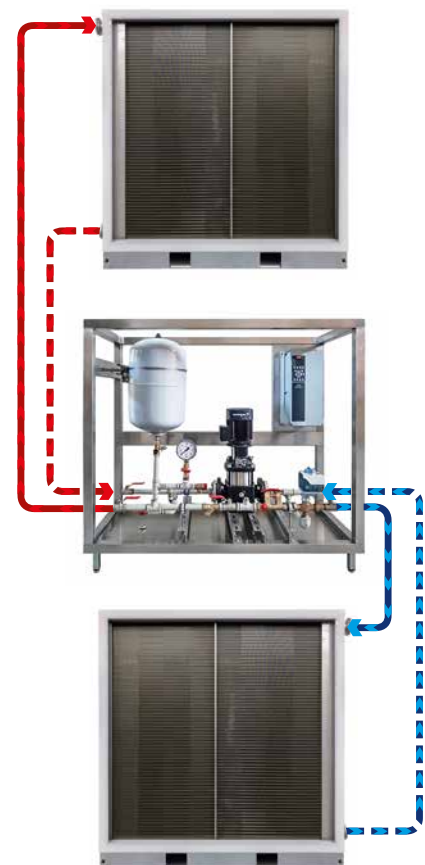
### Above-the-standard design:

- › Split design divided into 2 transport pieces to be easily assembled at the site
- › The design using the division into segments (the upper frame, the lower frame, and the rotor in segments)
- › Epoxy slats / resistant against sea water
- › The increased tightness of the dividing plane of the rotor
- › Hygienic



## LIQUID RECUPERATIVE HEAT EXCHANGERS

- › Designed with standard/above-the-standard heat exchangers for heating and cooling
- › Possibility to choose various efficiency classes
- › Special multi-row exchangers are used
- › The possibility of delivering the complete hydraulic module for controlling the regeneration



# AIR HUMIDIFICATION

Humidification of the air is ensured by special modules based on the following principles:

## WATER VAPOURS (ISOTHERMIC)

### Types to choose from:

- › **Resistance humidifier**  
(more suitable – treated drinking water free of minerals may be used as well)
- › **Elektrodový**  
(pouze pitná voda s minerály)

### Standard design:

- › Free chamber with service access and sloped stainless steel vat with the DN32 drain
- › As preparation for building the steam tubes in

### Above-the-standard design:

- › Hygienic design

## WATER (ADIABATIC)

### The design:

- › A special porous material for wetting, and evaporating water to, the flowing air (honeycomb / ceramic plates, etc.)
- › Low-pressure – hybrid / high-pressure spraying
- › The variants with/without circulation water

### Standard design:

- › The complete delivery of the chamber with built-in humidification module as per the chosen type
- › The service access for operators and humidifier connection

### Above-the-standard design:

- › Hygienic design



# NOISE ATTENUATION

Attenuation of the sources of noise are ensured by means of baffle silencers

## Standard design:

- › Absorption design
- › The absorptive material of the baffles is mineral wool
- › The baffle is protected with non-woven fabric
- › Various lengths of the baffles due to the need of attenuation



## Above-the-standard design:

- › Baffles are freely removable
- › Resonance design of the baffles
- › Hygienic/ATEX design



# END ELEMENTS

The flanges of the unit that are used to connect it to the duct or as protection against weather effects are ended with various types of elements:

## CUSHIONING INSERTS



- › Standard/hygienic/high-temperature/ATEX



## FLAPS

- › Leaf, aluminium variants
- › Inner/external options
- › Tightness:
  - Standard design class 2
  - Above-the-standard design class 3/4



## SHUTTER / SUCTION-EXHAUST EXTENSION / FLANGE, COUNTER-FLANGE





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