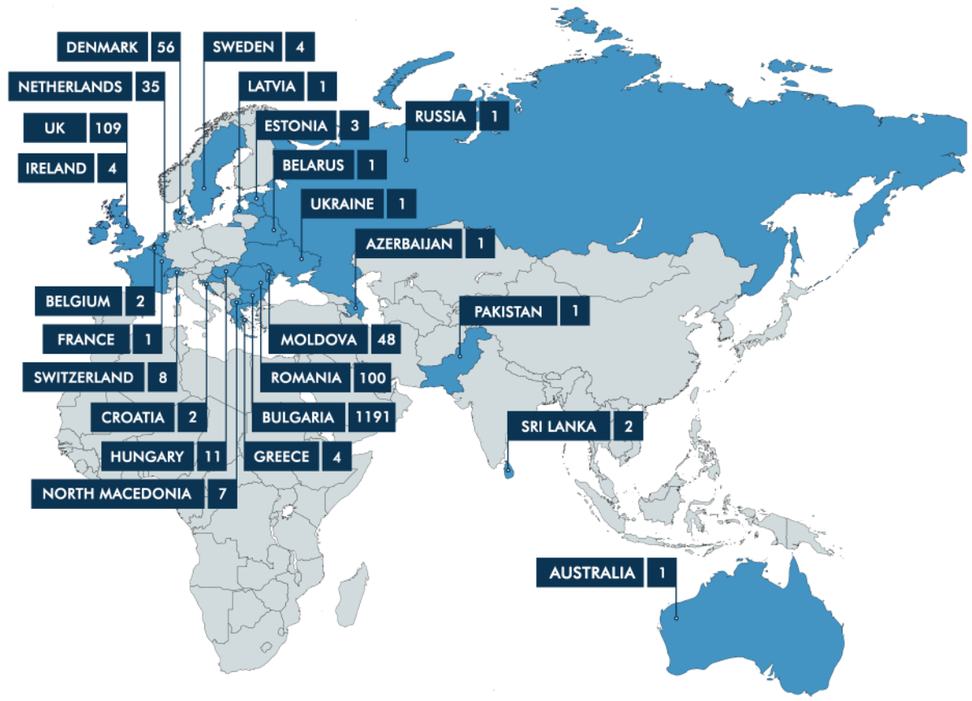
MAX.e thvac

Air-to-Air packaged Heat Pump for Space Cooling and Space Heating via 100% Fresh/Extract Air

About us



We are Damvent - A Bulgarian Technology company,
100% privately owned, with more than 33 years of experience in R&D and production of premium class energy-efficient Concepts and solutions for HVAC.

More than 1700 Hybrid Ventilation units delivered, installed and commissioned in 24 countries across the EU, Asia and Australia.

Damvent
to reach... and exceed

Concepts

3E - CONCEPT

1e - Every Climate

from -20°C to +40°C

2e - Every Application

suitable for every application where space heating, cooling and 100% fresh air is needed, by covering all air treatment processes:

· Filtration
· Heat recovery
· Heating
· Cooling + Dehumidification
· Process Ventilation

3e - Every Installation

Every Installation - suitable for all types of mounting, indoor (machinery rooms, technical floors, etc.)
and outdoor.

2 STAGE HEAT/COOL/HUMIDITY RECOVERY TECHNOLOGY

Recovering up to **120%** of the extract heating/cooling, achieved - "consecutively" in 2 stages:

1st stage - "passive heat recovery" - using air-to-air plate heat exchanger to recover up to 65÷70% of the extract heat/cool from the room.

2nd stage - "active heat recovery" - using the evaporator of the air-to-air heat pump to recover from 65÷120% of the extract heat from the room

ALL IN 1

The **max.e tHVAC** is an air-to-air packaged heat pump containing a built-in heat pump, automation, and control system.

100 % FACTORY TESTED

High reliability and reduced installation costs, achieved by 100% factory tests - each unit is tested under factory conditions.
The factory test includes:

· Leakage check
· Vacuuming and loading the system with the exact refrigerant quantity
· Vibrations
· Loading the controller's software
· Temperature and pressure checks
· Setting up the required air flow
· Recording all parameters of the unit on the test list.

100% PLUG AND PLAY

A standalone "one-piece" unit, which only needs a duct system and power supply for its start up.

MAX.e thvac

technology

- It`s a

Space Cooling and Space Heating unit

using 100% fresh air, with no recirculated air, nor indoor units. In the post COVID times that`s a major advantage. It provides constant fresh air, exceeding the levels required for the maximum amount of people in the room.

- rate ⟶ **$n_{min} = 5(h^{-1})$** and with the Free-Cooling mode, the unit will maintain T_{room} during intermediate seasons (spring and autumn with $T_{ambient} \geq 10^{o}C$ and ≤ $20^{o}C$), which form 30-40% of the total annual working hours), only by using Free-Cooling and Ventilation, without the compressor`s working. That`s a high energy saving feature, that cannot be achieved

* At design ambient/room conditions (-15°C) COP_{net} for heating mode of the unit (incl. HR and all fans) reaches **COP_{net}= 7,64**

…a value not possible for all classic air-to-air heat pumps and VRF`s

COP/SCOP/COP$_{net}$

The conventional air cooled heat pumps use the ambient air for the evaporation process and during the winter this air can reach temperatures of -10°C, -15°C or even -20°C. Extracting heat from the ambient air is inefficient. In comparison, max.e-tHVAC uses the extract air from the room. Under normal conditions, this air ranges in temperatures from 20÷24°C. Firstly, 60÷65% of the heat is recovered in the plate heat exchanger and then with a positive temperature between +1÷7°C, the air enters the evaporator of the heat pump, thus recovering the remaining 30÷35%. In this way, we extract up to and more than 100% of the heat from the extract air.

Total Heat Recovery Efficiency

The Efficiency of a heat recovery device is calculated the following way:

$Et = (T_{supply} – T_{fresh})/(T_{room} – T_{fresh}) \times 100\%$

Another way of showing the efficiency of the heat recovery device(which applies better to max.e-tHVAC) is to compare the Extract to the Room temperature, using the same equation, with a small update:

$Et = (T_{extract} – T_{room})/(T_{fresh} – T_{room}) \times 100\%$

It shows how close the extract temperature is to the fresh one, or how much energy we extract.

* Example (from real tests): Airflow = 2000m^3/h, Capacity = 80%, T_{fresh} = + 7,6^{o}C, T_{room} = 22,1^{o}C, T_{supply} = 45,5^{o}C and $T_{extract}$ = 4,6^{o}C (lower than T_{fresh}).

That makes EHR = ((4,6-22,1)/(7,6-22,1)) * 100 ⟶ **EHR= 120,6%**

The label for space heating is based on the seasonal space heating energy efficiency (η_{sh}) which is an expression for the delivered heat in relation to the energy input during the heating season. The seasonal space heating energy efficiency is based on an average European climate similar to the climate of Strasbourg. For heat pumps: the seasonal space heating energy efficiency is calculated based on SCOP divided with the conversion coefficient CC and corrected for contributions for temperature control and electricity consumption to external pumps. SCOP is an expression of a unit's reference annual space heating efficiency under average climate conditions.

* SCOP = 4,3 ; * SEER = 5,12 (* including the fresh air load!!!)

A^{+++}

* Seasonal Space Heat/Cool Efficiency **$\eta_{sh/sc} = 169/202$** ⟶Energy Efficiency Class

The best energy performance indicator for max.e-tHVAC is **COP$_{net}$**, where the total useful capacity of the unit (heat recovery + heat pump) is divided by the total power input (compressor + fans)

* At T_{out} = - 15^{o}C ⟶ **COP$_{net}$ = 7.64**

…and Damvent was the first company to introduce it in official documentation and selection software.

Advantages

1 For End Users

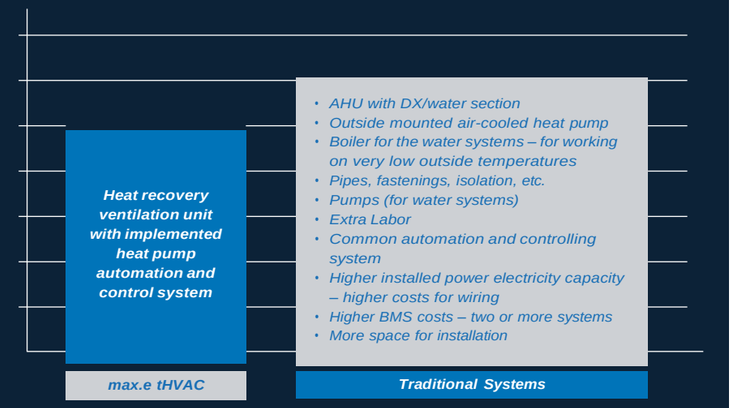
- It completely removes the need of the traditional cooling/heating system-split, multisplit, VRF, pipes etc. With just a duct system (increased size (5h^{-1}), compared to the traditional 2-2,5h^{-1}) and power supply the end user gets total HVAC system.
- No internal units (cassettes, fan coils etc.), no pipes inside the room(s). Only ducts and grilles.
- No condensate lines and wires inside the room(s).
- No refrigerant inside the room(s).
- 100% Plug&Play packaged unit.
- Saves space and footprint – with almost the same size as the traditional ventilation unit, the end user gets much more free space.
- Saves installation time and costs.
- Saves designing time and costs – much simpler design – only duct system and grilles.
- Lower initial installed electric power and energy consumption, due to the lack of electric heater for reheating of fresh air (which is part of the ventilation unit in the classic system), and due to use of free-cooling and ventilation for Troom control in the intermediate modes (spring, autumn with $T_{ambient} \geq 10^oC$ and $\leq 20^oC$).
- Saves service time and costs- it requires almost the same service efforts as the standard ventilation unit. There`s only 1 company responsible for the service, unlike the classic system (where usually 1 company is dealing with the ventilation unit and another one with the split/multisplit/VRF).
- Better comfort for the occupants in the rooms, due to 100% fresh air supply at all times. No risk of infections.
- More flexible installation position, depending on project availability (outdoor or indoor, vertical or horizontal).
- Easy to move the unit to another project of the end user if necessary.

2 For Designers

- It saves time – almost manual design with no need of specialized software for the equipment.

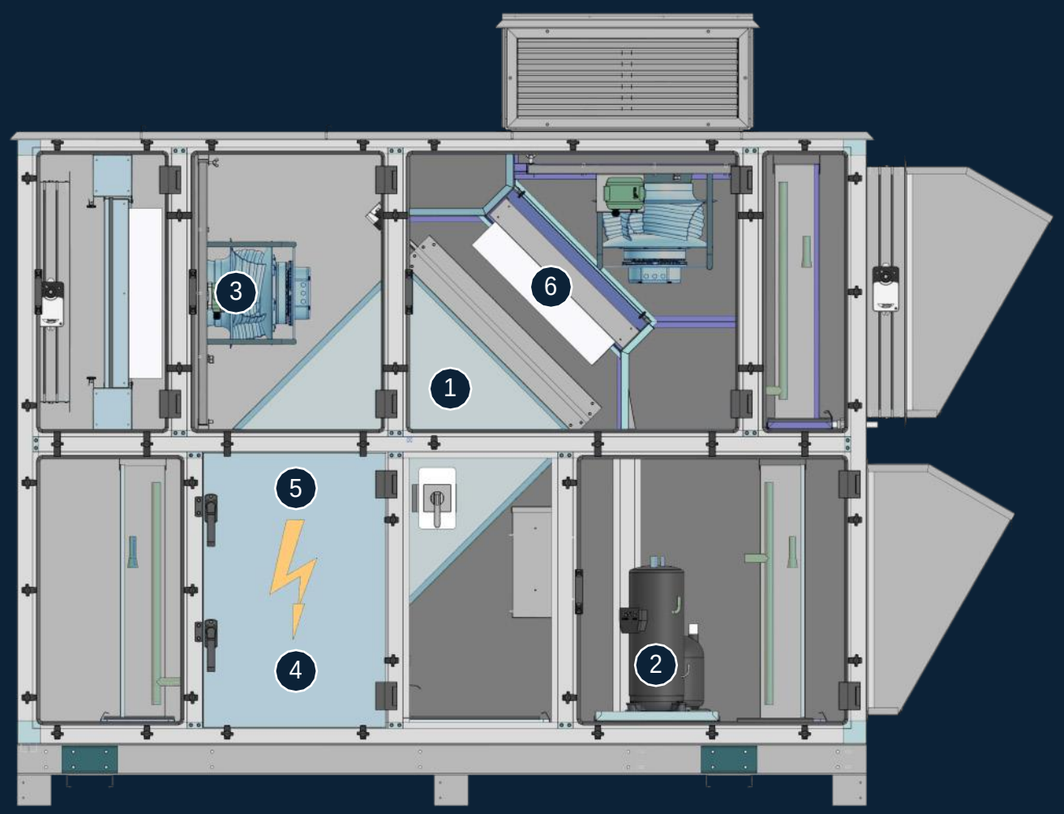
3 For Installation Companies

- Easy installation on site (needs only connection to the ducts system and power supply).
- Connection to the BMS system through different protocols.
- Setting up the unit through Internet.
- Lack of working with refrigerants on site.



Capital Cost Comparison

Hardware



1 Plate heat exchanger
2 Heat pump
3 Fans
4 Automation system
5 Connectivity and Mobility
6 Filters

Design

max.e tHVAC is designed as a system with the structure of the unit, manufactured as a mono-block. The construction is manufactured from **high quality profiles** made of extruded aluminum characterized by high strength and resistance to adverse weather conditions.

1

Plate Heat Exchanger

For all of the units of the type max.e thvac are used high efficiency air-to-air plate heat exchangers (PHE), made from aluminum fins, with condensate drain pain and with E_{dry} = 65 - 70%

The PHE is equipped with by-bass damper for free-cooling and smooth capacity control.

2

Heat Pump

- High Efficiency DC + EVI Scroll compressor with enhanced performance (- 30 to + 60ºC)
- BLDC Variable Frequency Drive(VFD)
- Electronic Expansion Valves (EEV)
- High efficiency Cu/Al coils
- Refrigerant – R410A
- Continuous work during frost forming conditions

3

Fans

max.e tHVAC use ZAbluefin plug fans with latest EC Blue (Electronically Commutated) from of the company **Ziehl-Abegg**. Fan wheel statically and dynamically balanced on the axis of the direct-driven motor. Fan wheel together with the motor are mounted on a common base frame with vibration dampers.

4

Automation System

max.e tHVAC is fully equipped with all necessary automation and all executive mechanisms. The electric switchboard is integrated into the unit and located on the operation side.

The "Brain" of **max.e tHVAC** is its specially designed by Damvent controller which controls and manages all processes and protects the unit from eventual cut-offs.

5

Connectivity and mobility

All hybrid units allow into the corresponding connector of the ICB controller to be mounted specialized internet circuit board for internet connection. The built-in circuit board, allows a permanent internet connection to **max.e** from any location in the world. This option helps you/us to make adequate reaction to situations requiring fast and accurate solutions to the problem.

6

Filters

Filters are installed at the entrance of the unit to ensure normal operation of the AHU and to prevent contamination of the components.
Microcell filters are used in the units **max.e tHVAC**. These filters are made of plated micro glass paper and spaced with hotmelt adhesive beads which are uniformly positioned to deliver optimum airflow.

Factory test

How to overcome the lack of a Dedicated Standard for Hybrids? There is only one way…

With the Ultimate Factory Test (FT).

Every single Hybrid that we produce goes through a full Factory Test in factory conditions and Ready-to-Work.

It includes the following features:

- Vacuuming of the refrigerant circuit and filling up the exact quantity of refrigerant, without extra activity on site
- Functional checks of all executive mechanisms and sensors
- Setting up the exact airflow (CAV), or pressure (VAV) required by the customer
- EEV fine settings
- Measuring and recording all air and refrigerant temperatures (oC) and pressures (bar), voltage (V), currents (A) and power input (kW) of the different components and the unit as a whole
- Simulation of heating/cooling, ventilation or dehumidification modes
- Tsupply control simulation
- Capacity control adjustments (compressors and additional heaters if available)
- LCD display User settings and connectivity
- Fine adjustments of frequency inverters of: fans, compressors, rotary wheel
- Filter settings
- Alarm checks
- Remote control check
- BMS settings
- Labeling of the unit
- Final internal cleaning
- Providing the necessary documentation (manuals, declarations of conformity etc.), plus additional accessories
- Packaging

Connectivity

Opportunities provided by WEB communicator

Possibility for remote start-up and 72 hours monitoring period

The air-handling unit can be started and adjusted via the Internet, it would be monitored until it reaches and maintains the set parameters.

Software updates

Updates are possible for the controller's software, if the customer requires additional settings or parameter adjustment. These additional settings and updates would be managed/performed over the Internet.

Archive (history) of working and service parameters

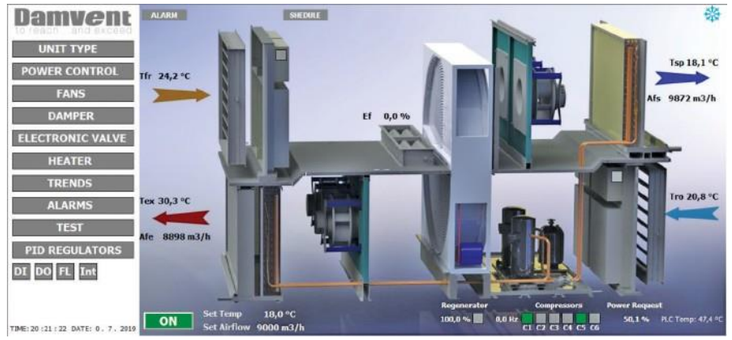
This option would create History logs/archives containing data about the operation of the AHU, using the Supervisory Control and Data Acquisition (SCADA).

Monitoring of the variables, working parameters

Monitoring the status of all variables accessible to the client and the unit's display.

Diagnosis of problems, arising during the operation of the air-handling unit

By analysing the information and data from the history menu, the source of the issue or the reason which triggered it can be found. The problem is solved via the Internet when physical access to the AHU is not required.



Permanent internet connection

All hybrid units allow an internet circuit board to be connected to the ICB controller for Internet connection. The built-in circuit board allows for a permanent **Internet** connection to each **max.e tHVAC** from any location in the world. This option helps you/us react to situations that require fast and accurate solutions to the problem.

Functional diagram

Take a detailed look how the unit is connected with all its components. It is fascinating how such a little technology can have such a big impact on the performance and maintenance of the complete system.

Standarts

At the moment there is no specific single standard, dedicated for hybrid units!

At Damvent, we provide each of our hybrids with 4 separate Declarations of conformity to fully cover the complexity of our solutions:

1. EC Declaration of conformity in relation to EC Directives :
2014/ 35 /EU – Low Voltage Directive
2006/ 42/ EC – Machinery Direction
2014/ 30 /EU – Electromagnetic Compatibility Directive
2014/ 68 /EU – PED(Category II, Module A1)
EN 1886 : 2007 – Ventilation for buildings – Air handling units – Mechanical Performance
VDI 6022-1: 2011-07 – Hygiene requirements for ventilation and air-conditioning systems and units...and others...

2. EC Declaration of conformity in relation to EC Directives: EN378-1 – Refrigeration system and heat pumps – Safety and environmental requirements Part1: Basic requirements, definitions, classification and selection criteria, with the following clarifications...

3. EC Declaration of conformity in relation to EC Directives: Directive 2009/125/EC – Ecodesign requirements for air heating, air cooling products, high temperature process chillers and fan coil units, with the following clarifications

4. EC Declaration of conformity in relation to EC Directives: (EC) 517/2014

**Note: All our hybrid solutions, sizes and models are Not object of regulation in according with Ecodesign requirements for Ventilation units (Commission Regulation(EU) No1253/2014 from 07 July 2014 for applying of EC Directive 2009/125/EC, Art.1, point 2 "g": „This regulation shall not apply to ventilation units which: (a) include a heat exchanger and a heat pump for heat recovery or allowing heat transfer or extraction being additional to that of the heat recovery system, except the heat transfer for protection of frost or defrost".*

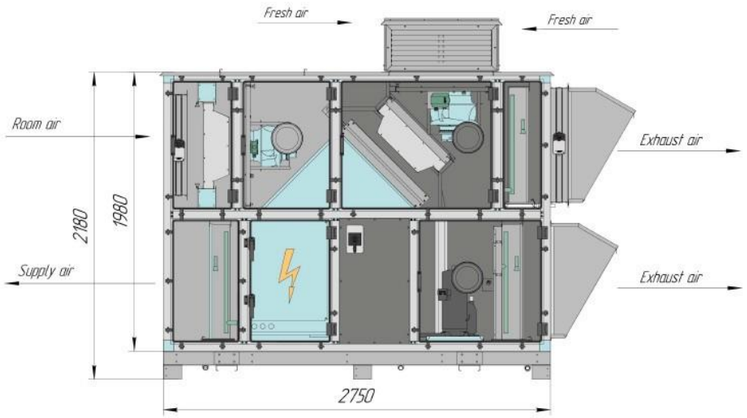
All our solutions include an integrated heat pump, which recovers heat and cool, additional to that of the heat recovery system. This means all our solutions include on the extract side after the recovery system an additional coil (evaporator/condenser).

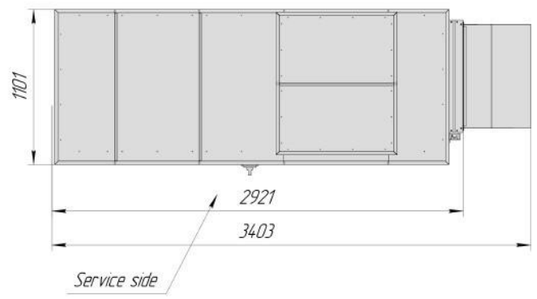
MAX.e thvac

Technical Data Rev.

		Work. Conditions 1	Work.Conditions 2
		-15ºC/90% 22ºC/30%	-4ºC/98% 22ºC/30%
		34ºC/44% 25ºC/50%	29ºC/60% 25ºC/50%
Tsupply (winter)/(summer)(ºC)	-	29/15	34/14
Heating Losses/Cooling Loads(kW)	-	10/7	11/12
Heating Capacity/PI (compressor)	-	19.5/4.3	21.5/4.8
Heating Capacity/PI (Total incl.HR and fans)	-	44.8/5.86	40/6.36
Cooling Capacity/PI (compressor)	-	25.5/6.5	25.5/6.5
Cooling Capacity/PI (Total incl.HR and fans)	-	31.5/8.05	28.5/8.05
COPnet/EERnet	-	***7.64/3.9***	***6.3/3.54***
SCOP/SEER*	-	4.3/5.12	
Seasonal Space Cool/Heat Efficiency ήsh/sc	-	169/202	
Capacity Control Method	-	Inverter controlled	
Compressor	Quantity	1	
-	Type	BLDC Scroll	
-	Crankcase heater(W)	30	
Ambient Temperature Operation Range	ºC	-20 ⟶ +40	
Refrigerant	Type/Charge(kG)	R410A/12	
Refrigerant oil	Type/Charged volume(l)	Synthetic (ether) oil FV68S / 1.7	
PED Category		Category II	
Airflowmax (m³/h)		3000	
Filters	Microcell	-	
Supply/Extract Side	Class of Filtration	F6	
	Total Filtration Area(m²)	18.5/12.4	
Plate Heat Exchanger	Type/Material	Crossflow/Aluminum	
-	Capacity Control Method	Bypass	
Recovered Heat (kW)	-	25.3	18.4
Recovered Cool(kW)	-	6.07	2.9
Temp.Eff(Dry)/Hum.Eff(Wet) %/%	-	66/67	
Supply/Extract Fan	Internal static pressure(Pa)	298/353	
	External static pressure(Pa)	300/300	
	Total Pressure(Pa)	598/653	
	Eff.grade Nactual|Ntarget(%)	65.4/64.8	
	Efficiency Class	IE5	
	Power absorbed at fan shaft(Pa)	0.762/0.840	
	Motor Duty(kW)	2.5	
	Motor Efficiency	ErP conformity - 2015/EC controller integrated	
Electrical Specifications	-		
Power Supply		3N~ /50Hz/380-415V	
Voltage Range	Min.(%)/Max.(%)	±10	
Current	Nominal running current (RLA) - 50Hz (Cooling) - (A)	14,87	
	Full load amps (FLA) - Total (A)	22.27	
Dimensions-without packaging (mm)-BxHxL		1000x2180x2700	
Weight- without packaging(kg)		890	

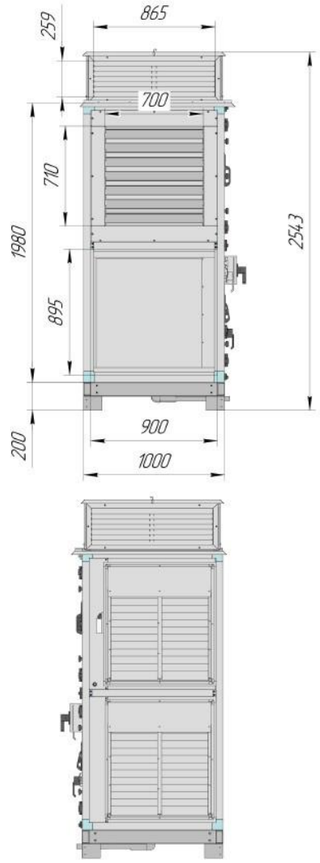
****Note: All SCOP/SEER and COPnet/EERnet values include the fresh air capacity load!!!***





EN:
1. 1110 mm distance must be provided from service side.
2. All inscriptions are in Bulgarian, English and German.
3. All dimensions are in mm.

Note:
Please, consider the height of supporting construction of the AHU to ensure correct installation of siphons.



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