



MAX.e MINI

HEAT RECOVERY UNIT

Damvent
to reach...and exceed *Benelux*

It is obvious that the global climate is changing. Energy costs are exploding and the trend suggests it will continue to increase. Therefore, saving energy is more important than ever!

It is a fact that people spend most of their lifetime inside buildings. According to some researchers, the time spent inside buildings is equivalent to 90% of our daily lives. Therefore, the quality of indoor air has a high influence on the health of its occupants. Elderly people and children are particularly sensitive to the quality of air. High quality indoor air has a positive influence on the productivity of its occupants. This is especially important within office buildings, banks, conference rooms, classrooms, hospitals, etc.


ENERGY EFFICIENCY

Achieving a comfortable microclimate is directly related to the presence of quality ventilation. Unfortunately, it has been proven that a significant part of the energy consumed within buildings is lost when using poor ventilation systems. This fact produces financial consequences for the users and contributes to pollution of the environment.

Theoretical research and standard practices show that reducing energy costs and increasing the efficiency of a ventilation system could easily be achieved by re-using the warmth contained in the extract air within a room.

This is where **Damvent**  solution becomes important.

CONCEPT


The  is an autonomous module, heat recovery ventilation unit containing an implemented heat pump, automation, and a control system.

The  e-conomizer with 2 stage thermodynamic heat recovery technology recovers up to 100% of the



extract heat. This is achieved consecutively in 2 stages:

- **1st stage – “passive heat recovery”**
Using the air-to-air plate heat exchanger, recovering up to 65 to 70% of the extract heat from the room.
- **2nd stage – “active heat recovery”**
Using the evaporator of the air-to-air heat pump, recovering between 65 to 100% of the extract heat from the room.

A conventional air cooled heat pump uses 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 an inefficient process. In comparison,  uses the extract air from within the room. Under normal conditions, this air ranges in temperatures between 20-24°C. Primarily, 65-80% of the heat is recovered in the rotary / plate heat exchanger and then at a temperature between 1-6°C, the air enters the evaporator of the heat pump, thus recovering the remaining 20-35%.

Using this method, we achieve a COPsystem of 10 and avoid frost formation on the evaporator (which commonly occurs in all conventional heat pumps)

$$COP_{net} = \frac{Q_{plate/rotary \text{ heat exchanger}} + Q_{heat \text{ pump}}}{N_{fans} + N_{compressor}}$$

Where:

1. $Q_{plate/rotary \text{ heat exchanger}}$ - recovered heat in the rotary heat exchanger (kW)
2. $Q_{heat \text{ pump}}$ - heating capacity of the condenser of the heat pump (kW)
3. N_{fans} - energy consumption of both (supply and exhaust) fans (kW)
4. $N_{compressors}$ - energy consumption of the compressors (kW)

WORKING PRINCIPLE

MAXO MINI is a unit designed to treat fresh air only. In order to handle the cooling load or heating losses of the room which are due to internal and external heat transmission, an additional cooling / heating source must be added.

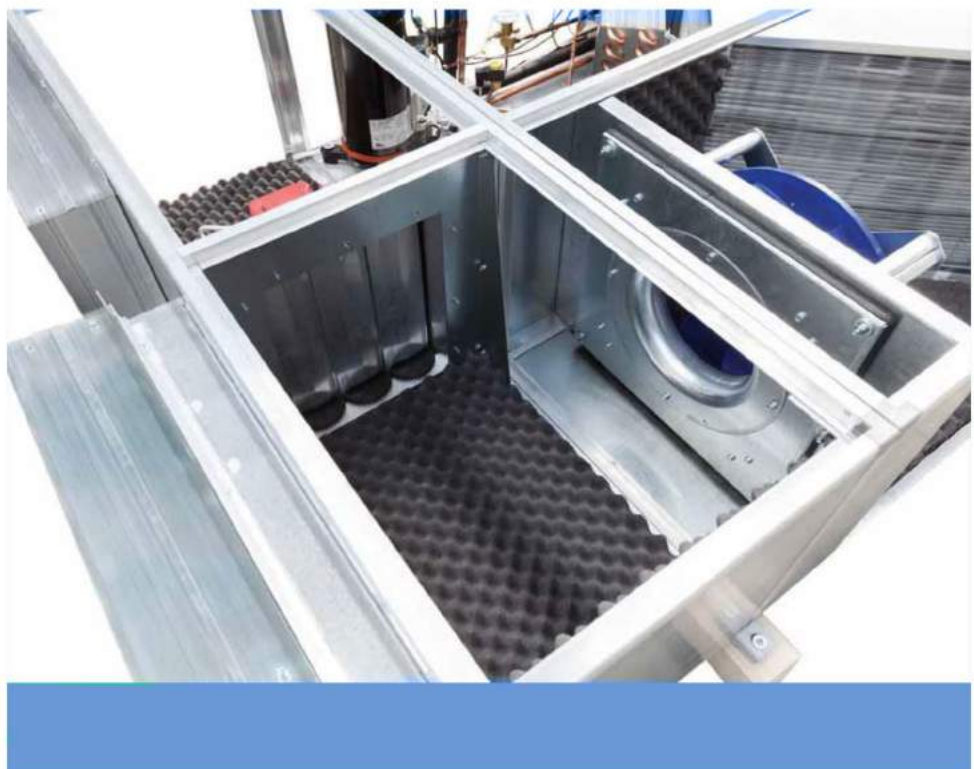
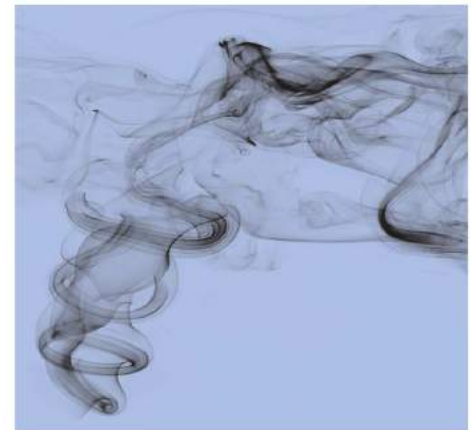
MAXO MINI is specifically designed and manufactured for internal installations within artificial / false ceilings.

The **MAXO MINI** is manufactured with the "standard" operation side located on the left of the air flow. Changes to the "standard" operation side are available only upon request and will extend delivery time of the unit by 1 - 2 weeks.

This mono-block unit provides the following functions: ventilation, filtering, heat recovery, and heating / cooling (depending on the seasonal requirements). Thanks to the built-in refrigerant circuit, **MAXO MINI** operates as an independent system, needing no outside unit. In order to deliver a constant fresh air supply, the unit must function without interruptions. The secret of our continuous working mode is the absence of a defrost cycle (an important advantage of **MAXO MINI** in comparison to other similar products).

APPLICATIONS

The **MAXO MINI** is intended for a wide product range requiring a small volume of fresh air (i.e., bars, restaurants, discos, offices, banks, stores, workshops, showrooms, smoking areas, etc).



CONSTRUCTION

MAX. MINI is a single "1 piece" (standalone) unit consisting of aluminum profiles, fastenings and connecting angles. The standard construction is intended for indoor ceiling installations.

Side Panels are single skinned, manufactured from galvanized sheet steel mounted to supporting columns with bolts. Side panels are internally lined with sound insulation material only.

Sound Insulation Material - open cell Polyurethane foam, selfextinguishing and impregnated, type Class 1. Standard materials used: sheets with density of 25kg/m³ and thickness of 10mm.

Optional - For advanced / maximized sound absorbing, insulation material with improved shape and thicknesses of 30, 40 and 50mm are available upon request.

The components wherein condensation may occur (such as direct expansion coils and plate heat exchanger), are equipped with a condensate drain pan. The condensate is removed via drain outlets connected to siphons.

FANS

MAX. MINI uses **ZABluefin Plug Fans** with latest **EC Blue (Electronically Commutated)** from **Ziehl-Abegg**. The fan wheel is statically and dynamically balanced on the axis of the direct-driven motor. The fan wheel together with the motor are mounted on a common base frame with vibration dampers.

When higher static pressures or lower sound levels are required, **EC Blue Plug Fans** with a **Cpro** frequency inverter from **Ziehl-Abegg** can be used.

Using fans with the **second generation EC Blue** technology, **MAX. MINI** ensures the highest **IE5 Motor** according to **IEC 60034-30-2**.

The high performance composite material **ZAMid®**, developed using the latest insights, makes the impeller significantly lighter than those made of steel, and offers superior mechanical properties. **ZAMid®**, provides new opportunities for system runtimes, enables lower power consumption and leads to a drastic reduction in noise.

ZABluefin with **ZAMid®** technology is a Bionic, free running wheel, with optimised design and diffusor effect, made of high performance composite material **ZAMid®**, setting new standards in performance. Adapted for intelligent **EC Blue** motor technology (**IE5**) for maximum system efficiency figures and premium characteristics in any application.

Innovation at a Glance:

- Significant weight reduction, which reduces motor bearing loads and increases the system service life
- Drastic reduction in noise generation leads to tonal noise reduction up to 5 dB
- Significant increase of the impeller efficiency which reduces the absorbed power
- Reduced power consumption - up to 15% energy savings during operation
- Significant CO₂ reduction, improved mechanical properties (in comparison with steel)
- No welded seams - high peripheral velocities up to 70 m/s
- Suitable for operational temperatures from -20°C to +80°C (in comparison with steel impellers)
- Corrosion-free
- No toxic gas emissions
- Colour-stable

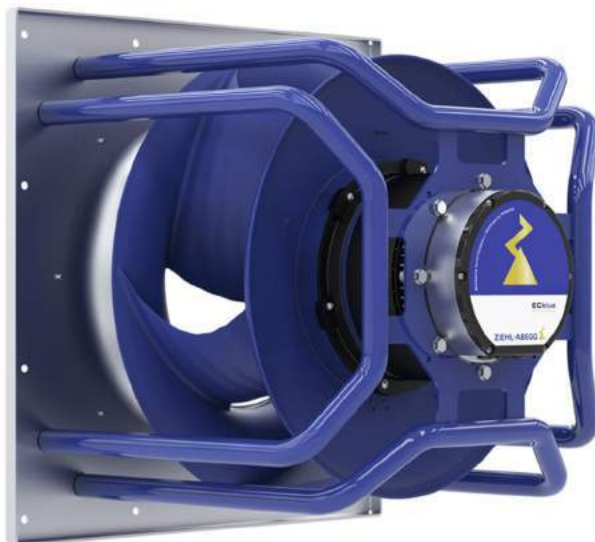




PLATE HEAT EXCHANGER

MAX. MINI units use an air-to-air plate heat exchanger made from aluminum fins with a condensate drain pan.

Efficiency (Sensible) - $E \leq 55 - 55\%$

EUROVENT Certificate: 03.01.242



REFRIGERANT CIRCUIT SEMI-HERMETIC

The heat pump has 1 circuit and uses an eco-friendly refrigerant R407C.

MAX. MINI 02 uses a Scroll compressor.

MAX. MINI 01 uses a Rotary compressor.

It is possible to add capacity control (optional). This option requires the unit to be equipped with **Plug Fans** which have a built-in frequency inverter.

100% DX unit

No additional water, electric or DX heating / cooling are needed in the **max.e-mini**, which makes it independent to other additional heating / cooling sources (boilers, chillers, VRF systems, etc.)

All of the **MAX. MINI** units contain high efficiency, direct expansion, coils which are made from copper tubes and aluminum fins and are equipped with a condensate drain pan.

The coils are **EUROVENT** certified

R407C

EUROVENT Certificate:
10.02.450.



AUTOMATION SYSTEM

The "Brain" of **MAXIMINI** is its controller (specially designed by Damvent) which controls and manages all processes and protects the unit from eventual cut-offs. The software is developed with a high level of know-how and it automates all processes.

All you need to do is set the desired supply temperature. The controller automatically selects in which of the 4 working modes (heating, cooling, free cooling/heating) to work depending on variables input for the outside temperature, the set point temperature, and the supply and room (return) temperatures.

The electric switchboard is integrated into the unit and located on the operation (access) side.

Building Management System (BMS) Connection

The automation system is provided with the option to communicate with different BMS, which constantly manage and monitor all its processes. This option requires different communication protocol types, which demand their relevant convertors. The standard connection and communication with the controller are performed by using **Modbus RS485**.

ICB Controller Facts:

- Exclusively designed by and for Damvent's unique hybrids!
- Much more compact design/size!
- The entire periphery (inputs / outputs) is galvanically separated from the processor + communication channels!
- 3 Modbus channels (integrated)! – RS485/ TCP/IP
- EC declaration of conformity accompanied by complete laboratory tests by an accredited laboratory!
- Ability to operate in the temperature range: from -40oC to 50oC!
- Built-in logic (specially developed by Damvent) to manage EEV's, eliminating the need for separate drivers!
- The controller enables Supervisory Control And Data Acquisition (SCADA) visualizations on individual client assignments!
- Simplified, durable/reliable and easy to repair
- 7" Touch Display



The **MAX. MINI** Unit is Designed to Treat Fresh Air

Functionality of the Air Handling Unit (AHU)

The **MAX. MINI** unit is designed to treat fresh air for the room needs, and to provide a comfortable temperature of the supply air. Heating, cooling and dehumidification, or ventilation modes can be operated automatically or manually.

Heating - the unit heats the supply air to the required temperature. When the set point has been reached the unit switches to ventilation mode.

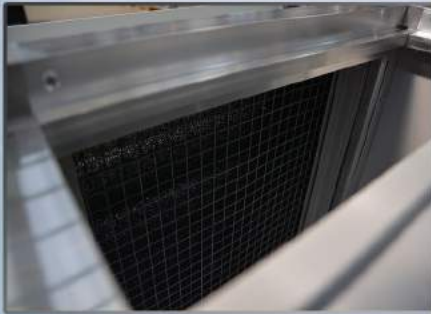
Cooling - the unit cools the supply air to the required temperature. When the set point has been reached the unit switches to ventilation mode.

Ventilation - when the space does not require heating or cooling, the heat pump is switched off and the unit provides untreated fresh air to the space.

Recirculation (optional, only in Winter Mode) - This mode is possible only if an additional mixing box is mounted to the body of the unit. It is only used during defrosting of the evaporator and the plate heat exchanger, in heating mode at low external temperatures, and air supply temperature. The dampers of the fresh air and extract air close and the recirculation's damper opens. One and the same air goes through the unit - air from the room.



FILTERS



For efficient operation of the air handling unit, and to prevent contamination of components, air filters are installed at the entrance of the unit.

Filter medium composition:

Regenerative Polyurethane (washable)

Filtration Class: G2 (G3, G4, or M5, can be added as an option)

The filters for fresh and extract air are mounted outside of the unit on the duct openings for easy access and maintenance.

Replacing the filters is quick, requires no special knowledge and there is no risk to the operator (all of which minimize higher labor costs).

DV_Select

DV_Select is special software created to assist in making technical calculations for the economiser.

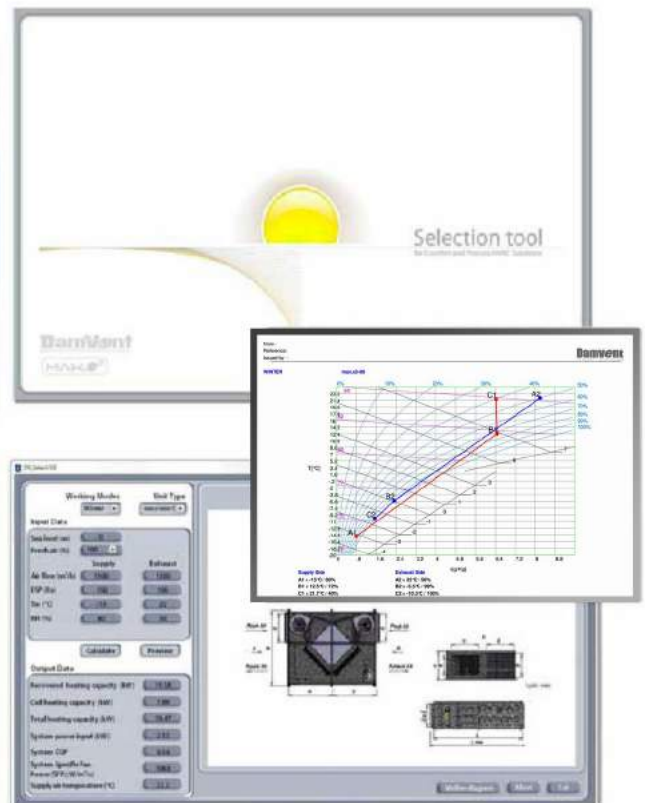
Damvent is one of the few companies that has developed a powerful tool for making calculations of AHU's containing a 2-phase heat recovery (air / air plate heat exchanger and integrated heat pump), which can recover up to 100% of the extracted heat.

The main features of the software are:

- Friendly interface
- Light, fast and easy to work with, requiring minimal input data
- Winter / Summer mode calculations
- Technical data and drawing printouts can be exported to PDF format
- Visualization of all processes shown in a Mollier diagram

The printouts contain detailed information about: pressure loss across all components; plate heat exchanger; evaporator and condenser; compressor; fans; sound pressure; sizes and weights.

The general data includes the most important parameters of the unit such as: total cooling / heating capacity (kW); supply air temperature ($^{\circ}\text{C}$); total input power (kW); system COP / EER; specific fan power (SFP) - total for unit ($\text{W} / \text{m}^3 / \text{s}$); refrigerant type and more ...



ADVANTAGES

For Investors:

- Lower initial investment costs
- Lower installation and labor costs
- Lower installed electric power (up to 30%)
- Lower energy costs (COP/EERnet = 4 to10)
- Saves space (fits between lowered ceilings)
- Lower service & maintenance costs (only filters are changed)
- Monitoring via internet
- 100% Factory tested
- Lower noise levels


For Designer & Consultants:

- Selection software available
- Saves time during design process
- Suitable for small spaces thanks to location flexibility
- Annual energy costs are quick and easy to calculate
- No defrost mode necessary


For Installation Companies:

- Easy installation (only need to connect air ducts and power supply)
- Connecting to BMS system via different protocols
- Make settings via the internet
- No cooling system required

CAPITAL COST COMPARISON

 <i>Heat recovery ventilation unit with integrated heat pump, automation and control system</i>	<i>AHU with DX / water section</i>
	<i>Air cooled heat pump mounted outside</i>
	<i>Boiler for the water systems - only used for very low outside temp.</i>
	<i>Pipes, fastenings, insulation, etc.</i>
	<i>Pumps for water systems</i>
	<i>Extra labor</i>
	<i>Common automation and controlling systems</i>
	<i>Higher installed power – higher costs for wiring</i>
	<i>Higher BMS costs - 2 or more systems needed</i>
	<i>More space for installation</i>

The capital costs of the  compared to a conventional air cooled heat pump are equal or lower!

The benefits of lower energy consumption provided by  bring immediate cost savings.

General Technical Data		MAX.® MINI 01			MAX.® MINI 02		
		Speed 1	Speed 2	Speed 3	Speed 1	Speed 2	Speed 3
Airflow	(m³/h)	1000	1500	2000	2000	2500	3200
Sound pressure level (1M)	dB(A)	52	57	61	55	59	64
Total cooling capacity (1)	(kW)	6.7	10.2	10.7	11.2	17.1	17.6
Total warming capacity (2)	(kW)	10.6	14.8	19.5	16	22.2	33.6
Plate Heat Exchanger		Aluminum					
Temp. efficiency (Winter)	(%)			62			64
Heat recovery capacity (Winter)	(kW)			11.6			19.6
Condensation rate (Winter)	l/h			4.6			8.0
Filters		Regenerative polyurethane					
Filter class			G2			G2	
Efficiency	(%)		40			40	
Total filtration area	m²			0.21			0.30
Fans		Centrifugal, double working, plug fans					
Number of fans			2			2	
Motor power	(kW)		2 x 1.35			2 x 2.5	
Maximum current	(A)		2 x 6.7			2 x 4.0*	
Protection class	IP		55			55	
Compressor		Rotary			Scroll		
Input power / Winter (2)	(kW)		1.7			3.0	
Input power / Summer (1)	(kW)		2.9			5.4	
Maximum full load current	(A)		12.8			14.1	
EER (Summer)			3.04			2.60	
COP (Winter)			4.7			4.6	
Total Input Power (comp. + vent.)	(kW)	3.4	3.2	3.0	5.8	5.4	5.1
Connection voltage		400V – 3 – 50 Hz			400V – 3 – 50 Hz		

(1) Exhaust Air 26°C / 50%, Fresh Air 34°C / 44%

(2) Exhaust Air 20°C / 50%, Fresh Air -5°C / 80%

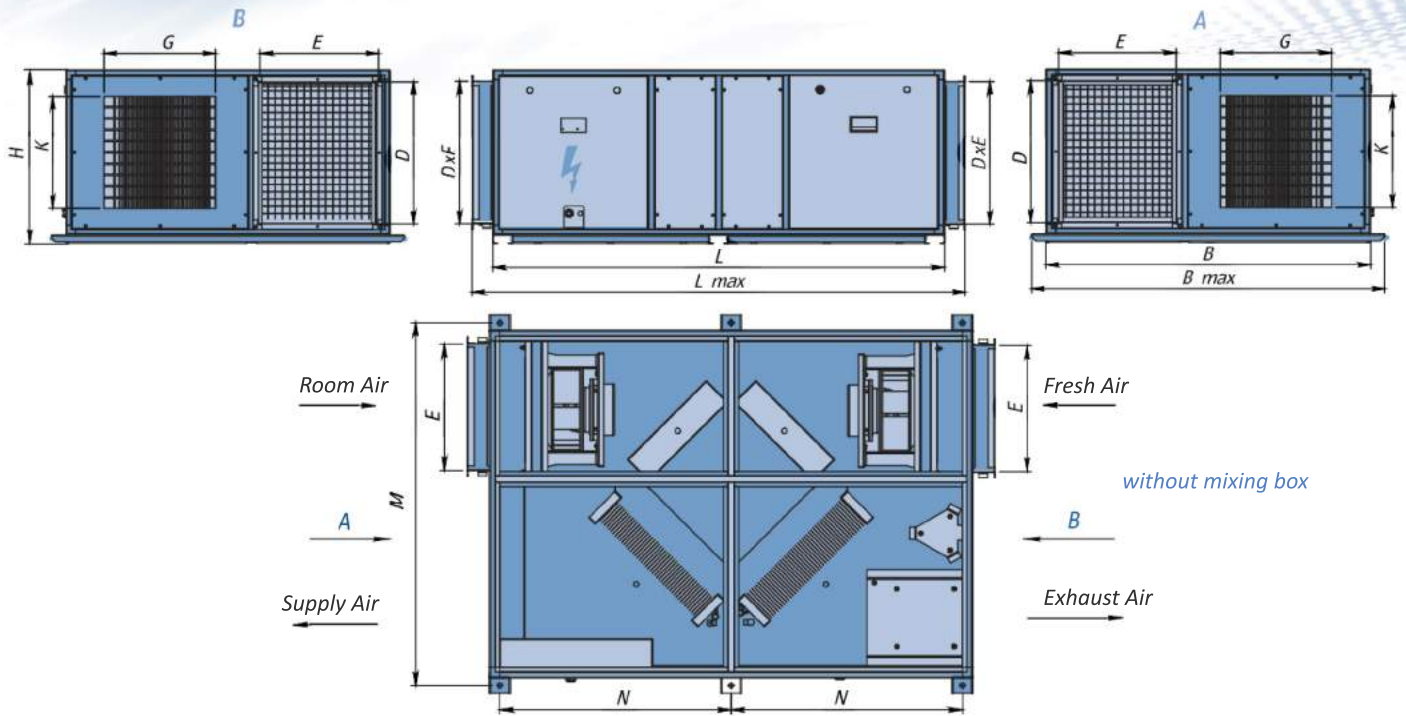
External pressures for standard MAX.® MINI with direct driven, double suction, centrifugal fans with 3 motor speeds.

Hst	MAX.® MINI 01			MAX.® MINI 02		
	1000 m³/h	1500 m³/h	2000 m³/h	2000 m³/h	2500 m³/h	3200 m³/h
SUPPLY						
I Speed	159 Pa	-	-	316 Pa	-	-
II Speed	259 Pa	157 Pa	-	376 Pa	237 Pa	-
III Speed	279 Pa	237 Pa	109 Pa	416 Pa	367 Pa	189 Pa
EXHAUST						
I Speed	134 Pa	-	-	246 Pa	-	-
II Speed	234 Pa	107 Pa	-	352 Pa	188 Pa	-
III Speed	254 Pa	187 Pa	33 Pa	392 Pa	318 Pa	108 Pa

External pressures for MAX.® MINI with EC Plug Fans

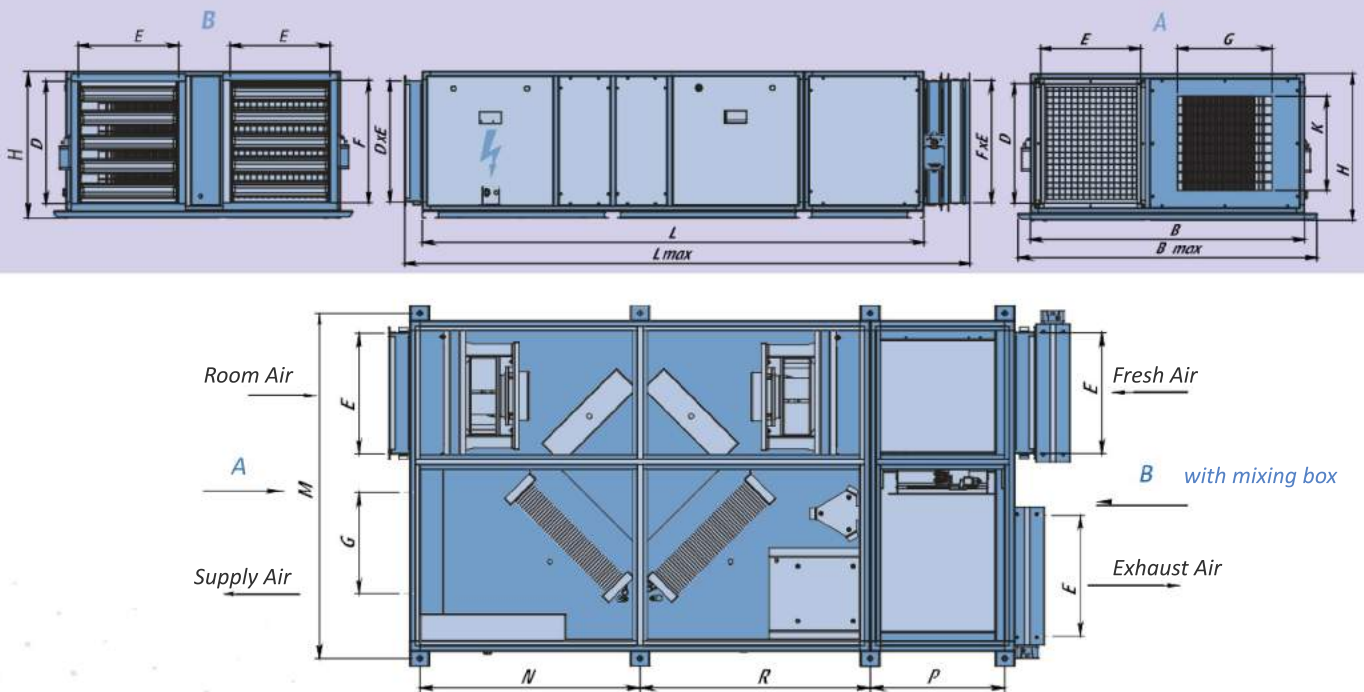
Hst	MAX.® MINI 01			MAX.® MINI 02		
	1000 m³/h	1500 m³/h	2000 m³/h	2000 m³/h	2400 m³/h	3200 m³/h
Supply	569 Pa	467 Pa	289 Pa	618 Pa	544 Pa	445 Pa
Exhaust	544 Pa	417 Pa	213 Pa	526 Pa	457 Pa	390 Pa

NOTE: These figures are representative and may vary based on customer specifications, components used, and factory improvements.



TYPE	B	Bmax	H	L	Lmax	DxE	KxG	M	N	Weight
	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
MAX.E MINI 01	1200	1250	617	1600	1760	500x420	385x385	1250	765	260
MAX.E MINI 02	1550	1640	617	1950	2100	500x600	395x595	1640	940	400

DIMENSIONS AND WEIGHT



TYPE	B	Bmax	H	L	Lmax	DxE	FxE	KxG	M	N	R	P	Weight
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
MAX.E MINI 01 (mixing cabinet)	1200	1250	617	2103	2385	500x420	510x420	385x385	1250	765	765	503	287
MAX.E MINI 02 (mixing cabinet)	1590	1640	617	2450	2725	517x590	500x600	395x595	1640	940	940	503	435

*These figures are representative and may vary based on customer specifications, used components and factory improvements.