MAX.e² HTM_03

Two Stage Heat Recovery Economizer

(HTM_03 COMPLIANT)

Damvent

to reach...and exceed Benelux

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to reach . . . and exceed Benelux

MAX.e² HTM_03

Not an ordinary product but, a concept solution!

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!

Achieving a comfortable micro-climate is directly related to quality ventilation. 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.

Unfortunately, it has been proven that a significant part of the energy consumed by buildings is lost when using poor ventilation systems. This has financial consequences for users and also contributes to pollution of the environment.

This is why Damvent's MAX.e² HTM_03 *solution becomes so important.*

3e CONCEPTS

1 e - Every Climate - *from -20°C to +40°C*

2 e - Every Application - *suitable whenever 100% fresh air is needed, by means of covering all possible air treatment processes:*

- *Filtration*
- *Recirculation*
- *Heat recovery*
- *Heating*
- *Cooling (optional Dehumidification)*

3 e - Every Installation - *suitable for all types of indoor mounting (machinery rooms, technical floors, etc.).*

3 in 1 CONCEPTS

*Our standard max.e2 series is an autonomous module heat recovery ventilation unit containing an implemented heat pump, w[MAX.e²]mation and control systems. In consideration of the British standards for HTM_03, we have reconfigured the [MAX.e²] to meet **HTM_03** requirements. These units are offered in various sizes with varying air speeds to cre[MAX.e²]xible solution where more stringent applications are necessary.*

Health Technical Memo (HTM_03) Compliance

*In compliance with **HTM_03**, our units are constructed with:*

* *Anodized aluminum hygienic profiles with thermal bridge.*
* *Panels and doors of double skinned, galvanized sheet steel with powder polymer coating.*
* *Fog coils installed in T-ambient section to protect downstream filters from low temperature and high humidity*
* *Enclosure panels powder coated internal and external.*
* *Viewports and LED lights positioned inside the unit.*
* *Filter integrity monitoring.*
* *Motorized isolation/shut-off dampers.*
* *Stainless steel filter frames and removable drain trays.*
* *Copper coils with copper fins spaced >2.5mm, with a face felocity <2m/s, and equipped with anti-frost module.*
* *All coils equipped with droplet separators which are 100% removable.*
* *Anti-leakage refrigerant sensor provided downstream from DX coil.*
* *Ziehl Abegg fans.*
* *Passive and Active energy recovery devices.*
* *Stepless heating / cooling capacity control.*

HTM_03 Compliance Cont.

*In addition to compliance with **HTM_03**, our units meet the following standards:*

BS EN 1886 Class T2	Thermal transmittance
BS EN 1886 Class TB2	Thermal bridge
BS EN 1886 Class D2	Deflection
BS EN 1886 Class L2	Factory Seal Test (+700 Pa -400 Pa)
BS EN 1886 Class L2	Site Seal Test (+700 Pa -400 Pa)

100% Factory Tested

High reliability and reduced installation costs are achieved by our 100% test procedure. Each unit is tested under factory conditions as follows:

- *Leakage check;*
- *Vacuuming and loading the system with the exact refrigerant quantity;*
- *Functional testing of fans and compressors;*
- *Loading the controller's software;*
- *Temperature and pressure checks;*
- *Setting up the required air flow; and*
- *Recording all parameters of the system on the test list.*

100% Plug & Play

Standalone, "one-piece" unit which only needs a power supply for its start up.

The MAX.e² HTM_03 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 to recover up to 65-80% of the extract heat from the room.

2nd stage - Active Heat Recovery

Using the evaporator of the air-to-air heat pump recovers the remaining 20-35% 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, the MAX.e² HTM_03 uses the extract air from within the room. Under normal conditions, this air ranges in temperatures between 20-24°C. First, 60-65% of the heat is recovered in the plate heat exchanger and then at a temperature between 4-10°C, the air enters the evaporator of the heat pump, thus recovering the remaining 30-35%.

Using this method, we achieve a **COP system of 10** and avoid frost formation on the evaporator (which commonly occurs in other conventional heat pumps).

Thus, MAX.e² HTM_03 delivers "defrost"= 0 min.

$$COPnet = \frac{Q\ plate\ heat\ exchanger + Q\ heat\ pump}{Nfans + Ncompressores}$$

Where:

- Q plate heat exchanger =
  Recovered heat from the plate heat exchanger (kW)
- Q heat pump =
  Recovered heat from the condenser of the heat pump (kW)
- N fans =
  Energy consumed from the fans (kW)
- N compressors =
  Energy consumed from the compressors (kW)

Precise control and efficiency provided in continuous, stepless modulation over a wide range (from 10 - 100%), with no operating envelope restriction. As a result, ambient temperature and humidity can be closely controlled for superior comfort and, load variations can be quickly followed for improved seasonal efficiency.

Increased European Seasonal Energy Efficient Ratio/ Integrated Part Load Value **(ESEER/IPLV)** values are achieved by reducing the power input in part load operations. Constant supply temperature - superior control of the supply air temperature (±0.5 - 1°C) is managed, avoiding unpleasant temperature differences, and thus significant improvement to comfort in the room.

Higher Reliability - Compressor cycling is reduced to a minimum ensuring optimum system efficiency and longer life expectancy of the equipment.

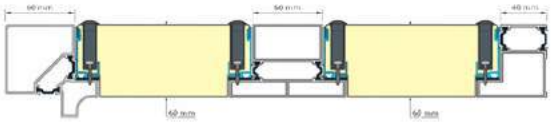
Heat pump located on the exhaust side of the plate heat exchanger. Casing of compressors is stainless steel.

CONSTRUCTION

MAX.e² HTM_03 *is a 1 piece (stand alone) unit. The body is manufactured from high quality* ***hygienic profiles*** *made of anodized aluminum which provide strength and high resistance to adverse weather conditions.*

Base Frame *- Each unit is mounted on a 170 mm, H-profile, steel powder coated frame, including lift holes, making it possible to move and position the unit with a crane and/or forklift.*

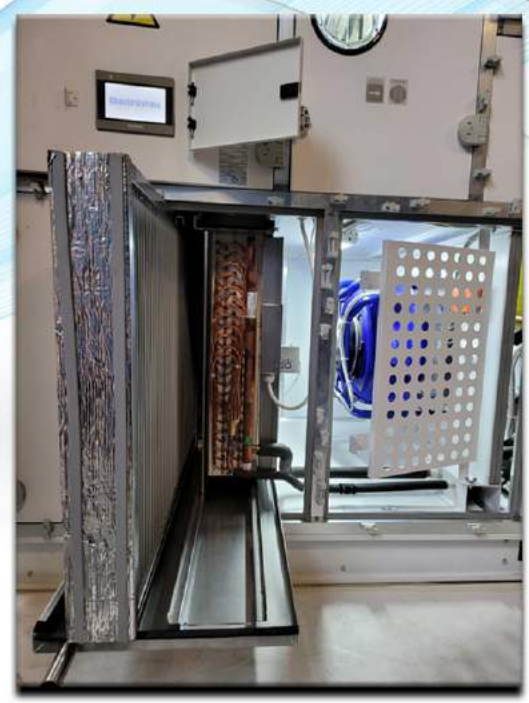
Thermal Bridge *- New TT60 / TTA60, T2 / TB2 thermal break system with panel thickness 45 - 60 mm, external dimension 60 mm and 3/4 round hygienic profiles.*



TESTED!
D1 L1
T2 TB2
DIN EN 1886

Panel sections *- Double skinned and manufactured from galvanized sheet steel and mineral wool insulation having a density of 75kg/m3. Both the inner and outer skins have a polymer powder coating. The insulation material is thermal and sound absorbing, fire and high temperature resistant, mineral wool which is* ***CE*** *certified in accordance with* ***EN14303****.*

Doors *have seals and hinges with additional catches for superior tightness and are > 1 m high and > 500 mm wide. Door hinges are adjustable so that leakage can be eliminated onsite. Secured from casual access (key or similar device to open). Doors by coils open on both sides of unit for cleaning and inspection.*



Gaskets *- Closed cell structure gaskets made of Ethylene Propylene Diene Monomer (EPDM) are used for internal insulation and separation between the air flow sides (supply and exhaust), as well as on all doors and panels to protect the unit from internal and/or external leakages.*

Drip Trays *- All items within the* MAX.e² HTM_03 *that could produce moisture are equipped with a drainage system. The drip-tray is constructed of an anti-corrosive material, is arranged to drain completely and has its own self draining trap. The drip tray is easily accessible and 100% removeable for cleaning and inspection. Each tray is large enough to capture the moisture from the coil headers and drift eliminator.*

CONSTRUCTION CONT.

Passive Energy Recovery Device

EUROVENT Certificate: 03.01.242

The plate heat exchanger used in the MAX.e² HTM_03 meets ***Efficiency (Sensible)*** *= E ≤ 65 – 75%; and is* ***Eurovent*** *certified.*

Components *=*
Air-to-air epoxy coated plate heat exchanger with copper fins; removable condensate drain pan; and a mounted motorized damper (used during bypass and free cooling modes).
It is accessible from both sides for cleaning and inspection.

Isolation dampers *that are motorised, spring-return, and low leakage are located at ambient air intake, air supply, air exhaust and extract air intake. Type opposed-blade fitted with end switches which automatically close in an event (i.e., power failure, plant shutdown) to prevent any reversal of the system airflow.*

Drain pans *constructed of a anti-corrosion material (stainless steel) and arranged to drain completely. The drip tray is easily accessible and 100% removeable for cleaning and inspection. Each tray is large enough to capture the moisture from the coil headers and drift eliminator, and have their own drain traps.*

Active Energy Recovery Device

100% DX unit*, and built in heatpump by Panasonic. The refrigerant circuit contains 1 or 2 circuits (depending on unit size), temperature or humidity controlled unit. The refrigerant used is R407C and is* ***ECO*** *friendly.*

Precise control and efficiency *provided in continuous, stepless modulation over a wide range (from 10 - 100%), with no operating envelope restriction. As a result, ambient temperature and humidity can be closely controlled for superior comfort and, load variations can be quickly followed for improved seasonal efficiency.*

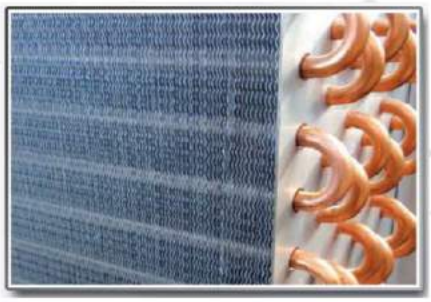
Increased *European Seasonal Energy Efficient Ratio/Integrated Part Load Value* ***(ESEER/IPLV)*** *values are achieved by reducing the power input in part load operations. Constant supply temperature - superior control of the supply air temperature (±0.5 - 1°C) is managed, avoiding unpleasant temperature differences, and thus significant improvement to comfort in the room.*

Higher Reliability *- Compressor cycling is reduced to a minimum ensuring optimum system efficiency and longer life expectancy of the equipment.*

Heat pump *located on the exhaust side of the plate heat exchanger. Casing of compressors is stainless steel.*

CONSTRUCTION CONT.

Heating / Cooling coils *constructed of solid drawn copper tube coils with copper fins and stainless steel casing, generally connected in parallel, equipped with anti-frost modules and fitted with independent drainage systems. Coils are epoxy coated (anti-corrosion coating). Access on both sides for cleaning of coils. Coil fins spacing is ≥ 2.5 mm and the fins are rigid enough to withstand cleaning (for example, ≥0.25 mm thick) for periodical decontaminating / cleaning. Face velocity is smaller than 2 m/s (air speed through the coils).*



EUROVENT Certificate: 10.02.450

Filter frames *of stainless steel and filter classes as follows:*

T-Ambient	*Pre-filter M6 Microcell filters* *EN 779-2012 M6* *ISO 16890 ePM 10 > 60 %*
T-Supply	*F7 Microcell filters* *EN 779-2012 F7* *ISO 16890 ePM 2.5, 65-80 %*
T-Exhaust	*F7 Microcell filters* *EN 779-2012 F7* *ISO 16890 ePM 2,5 65-80 %*

Internal surfaces *treated with white powder coated mild steel, anti-corrosive, washable, smooth and of a colour that allows accumulation of dirt to be easily seen.*

Viewports *at a convenient height so temporary ladders are not required and LED lights positioned inside the unit, switch on the outside and are powered independently of the AHU main switch.*

Filter integrity monitoring *(via sensors and/or gauges) of pressure drops and capped pressure tappings with a portable manometer used for diagnostic purposes when necessary.*

FANS

All MAX.e² HTM_03 *models contain* ***ZAbluefin*** *plug fans from* ***Ziehl-Abegg****. The fan wheel is statically and dynamically balanced on the axis of the direct-driven motor. Both the fan wheel and the motor are mounted on a common base frame with vibration dampers.*

Ziehl Abegg *fans are direct-drive electronically commutated (EC), controlled via integral frequency inverter, running parallel, and equipped with a high temperature safety cut-out. Removable via slide rail(s) with plug and socket connections for power and control. Supply and extract fans are matched to reduce the requirement for spares on site and are positioned to the blow through of the central unit so that the drain pan(s) will be under positive pressure.* ***If a single fan fails, the redundancy fan is 80% of maximum designed airflow output.***

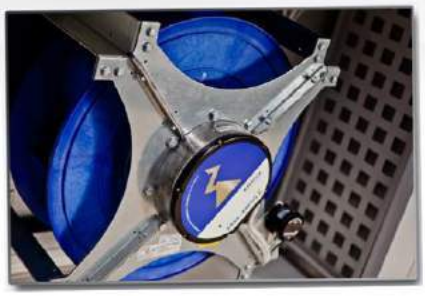
The fan area access doors have viewing ports and internal illumination operated separately from the main power. The doors require keys to open and are equipped with two-stage opening latches and hinges to allow for pressure release and/or prevent inadvertent blow-outs.

Characteristics of the 2nd Generation EC Blue Fans:

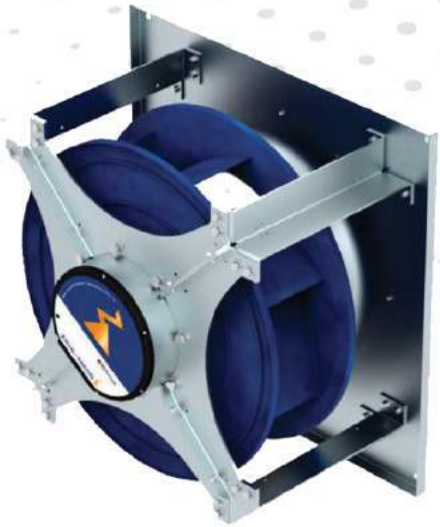
- *IE5 Motor in accordance with IEC 60034-30-2.*
- *IP55 case .*
- *Integrated Modbus - Modbus Basic version includes Auto-addressing.*
- *Data-logging – Vibration Sensor on PCB - On the main circuit board 3 Vibration sensors are placed. They are measuring in 3 axes the acceleration speed and stored in the Protocol. With the Special Algorithm it is possible to find the calculated lifetime.*
- *New sealing - Two contact points between sealing and stator bush.*
- *New Cooling Ring for better system cooling lot for BLE Stick - For Bluetooth connection (optional).*
- *Direct printed wiring diagram for easier understanding.*

ZAbluefin Facts:

- *A more homogenous airflow pattern is provided before the next component.*
- *Mixed flow impeller design* ***reduces swirls*** *in the pressure side of the air stream.*
- *Light weight ZAmid* ***up to 15% less*** *compared to Cpro*
- *Tonal* ***noise reduction*** *up to -6 / -4 dB*
- ***Highest static system efficiency up to 71.1%***
- ***Less acoustics*** *- suction / pressure side*
- ***Ambient temperature range (-35°C*) -20 to 60°C***



Innovation at a Glance:



- *Significant weight reduction, which reduces motor bearing loads and increases the system service life.*
- *Drastic noise reduction 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 welding 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.*
- *Colorfast.*

Specific Fan Power (SFP)

SFP is one of the most important energy indicators for air handling units (AHU). The MAX.@² HTM_03 unit can reach a total SFP ≤ 1800 W/n3/s (and lower). The SFP values, expressed in W/m3/s, indicate the demand on power efficiency of all supply air and extract air fans used in a building.

The electrical energy needed for ventilation fans and AHUs, plays an increasing role in the energy demand for buildings. Recent studies show that the electrical energy consumption can be easily reduced from the "traditional" levels (between 2000 and 5000 W/m3/s) to a lower level (from 1600 to 1800 W/m3/s) when using proper design and installation.

MAX.@² HTM_03 *is designed in accordance with the latest EUROVENT requirements for coil face velocities up to ≤ 2 m/s, which leads to:*

- *No need for droplet separators on both the supply and exhaust side.*
- *Significant reduction of the total internal pressure drops of the unit by 75-100%!*

AUTOMATION SYSTEM

MAX.@2 HTM_03 *is fully equipped with all necessary automation and all executive mechanisms. The electric switchboard is integrated into the unit and located on the operation (access) side.*

The "Brain" of MAX.@2 HTM_03 *is its specially designed controller 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.

Building Management System (BMS)

The automation system is provided with the option to communicate with different BMS, in order to 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.*
- *4 Modbus channels (integrated) –* ***RS485****/ TCP/IP*
- *1 network access channel (integrated)*
- *EC declaration of conformity accompanied by complete laboratory tests by an accredited laboratory.*
- *Ability to operate in the temperature range from -40°C to 50°C.*
- *Built-in logic (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 inch touch screen.*

FILTERS

Filters are installed at the entrance of the unit to ensure normal operation of the AHU and to prevent contamination of the components.

*All MAX.@² HTM_03 units use **Microcell** filters. These filters are made with plated microglass paper and uniformly spaced using hotmelt adhesive beads which deliver an optimum airflow. The frame is constructed in stainless steel.*

***Microcell** filters are unaffected by fan shut down or start up, can resist up to 1000 Pa. of differential pressure, and work perfectly even in humid conditions.*

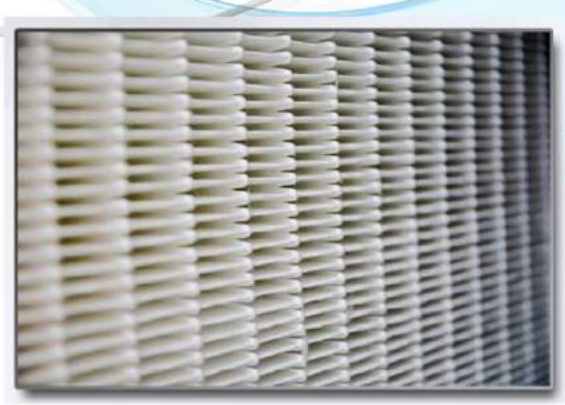
The classes of filtration per location are:

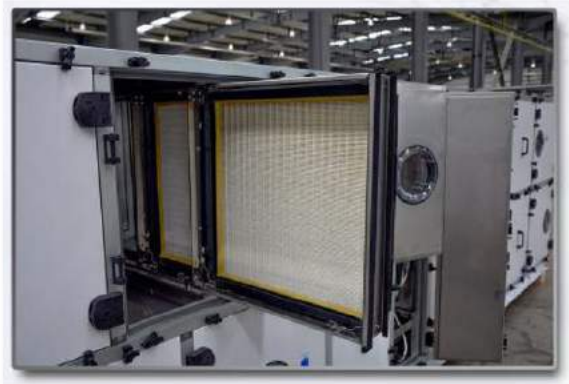
T-Ambient *Pre-filter M6 Microcell filters*
EN 779-2012 M6
ISO 16890 ePM 10 > 60 %

T-Supply *F7 Microcell filters*
EN 779-2012 F7
ISO 16890 ePM 2,5, 65-80 %

T-Exhaust *F7 Microcell filters*
EN 779-2012 F7
ISO 16890 ePM 2,5 65-80 %

Sensors monitor each pressure drop and are linked to the Damvent BMS/display. Capped pressure tappings are also provided to accomodate a portable manometer used for diagnostic purpose when necessary.





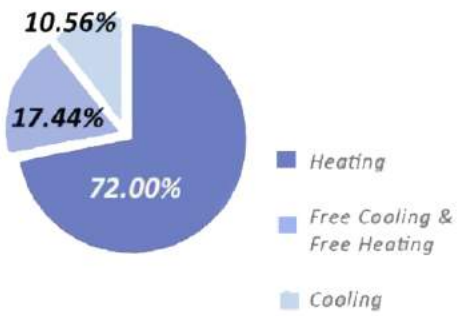
BENEFITS

- ***More filtration area** - 50% higher filtration area, compared to M5 bag filter.*
- ***Lower Pressure Drops** - being compact and rigid the pressure drops are lower than that of bag filters .*
- ***Higher Final Pressure Drops** - resist up to a differential pressure of 1000 Pa.*
- ***Longer Service Life** - lower initial and higher final pressure drops will increase the service life.*
- ***Reduced labor and service costs** - due to shorter Time for changing the filters.*
- ***Lighter than a standard metal frame** version for a smaller environmental impact and easier handling.*
- ***Reduction in the SFP factor** due to lower pressure drops.*
- ***Ultra compact** - only 130 mm.*

*All **Microcell** filters are **EUROVENT** certified.*

DISTRIBUTION OF WORKING MODES

BASED ON YEARLY OPERATING HOURS (8760 h/y)
(yearly averages for Central Europe - Vienna)

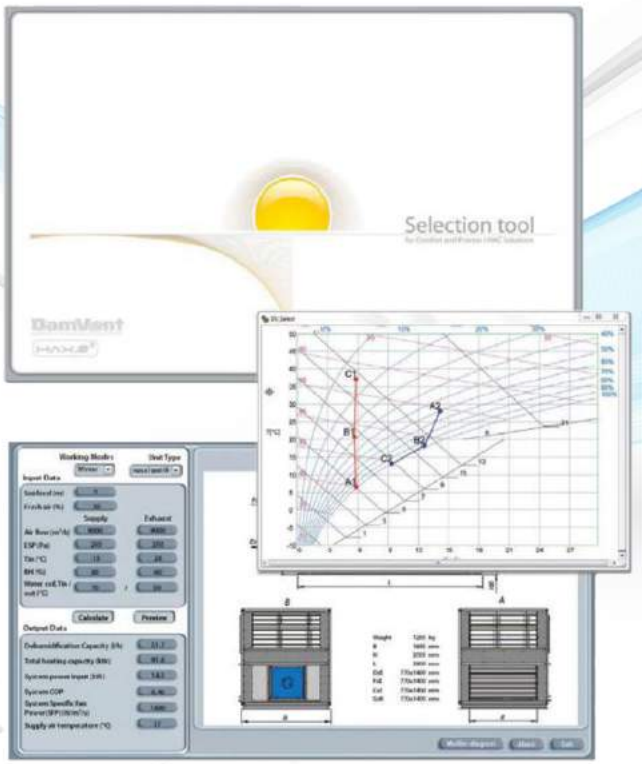


- *The unit works 72% of the time in Heating Mode, wherein COP System = 5 to 8, depending on the ambient temperature.*
- *The unit works 17,44% of the time in Free Cooling and Free Heating Modes, during which time the compressors are switched off (non-refrigerant cooling and heating).*

Ambient Temperature (°C)	-15	-10	-5	0	5	10	15	20	20	30	35
Hours (h)	0	21	370	1179	1501	1535	1701	1528	788	131	6
Working Modes	Heating							Free Cooling + Free Heating	Cooling		

DV_SELECT

DV_Select is specialized software used for technical calculations of the "e-conomizer." Damvent is among very few companies that have developed such a powerful tool used to make calculations for AHU's that contain "2 stage heat recovery technology" (air-to-air plate heat exchanger and implemented heat pump) which recover up to 100% of the extract heat.



The main features of the software are:

- *User friendly interface*
- *Light, fast and easy to work with, minimum data input*
- *Winter / Summer mode calculations*
- *Technical data and drawing printouts exported to PDF files*
- *Visualization of the processes in a Mollier's diagram*
- *Printouts contain the following information: pressure drops for all components, plate exchanger, evaporator and condenser, compressor, fans, sound pressure levels, dimensions and weight*
- *General data includes important parameters of the unit, such as: Total cooling / heating capacity (kW); Supply air temperature (°C); Total power input (kW); System COP/EER; Specific Fan Power (SFP) – total for unit (W/m3/s); Refrigerant type; and more.*

ADVANTAGES

For Investors:

- *Lower initial investment costs*
- *Reduced installed power*
- *Lower operating (energy) costs*
- *Saves space*
- *Absence of "defrost" mode and maintains continuous working of the unit*
- *Ease of maintenance (only one unit)*
- *Monitoring via internet*
- *100% Factory Acceptance Test (FAT)*
- *Low sound parameters*

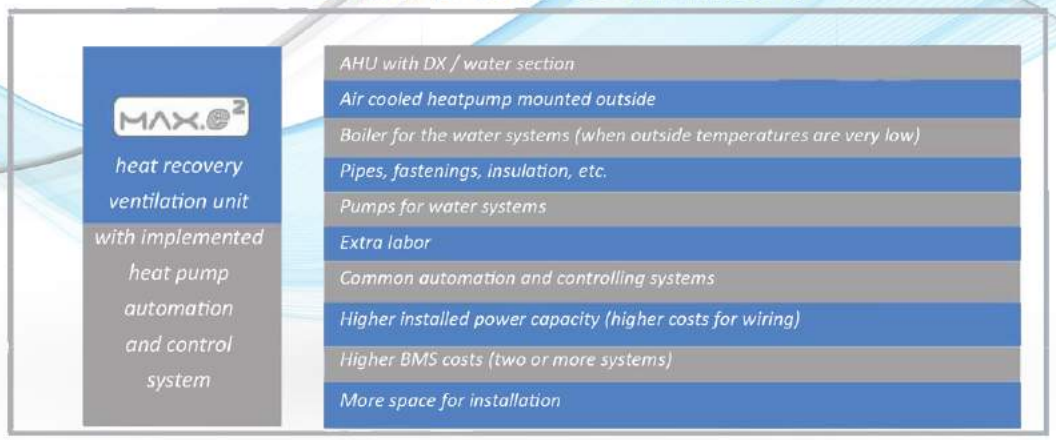
For Designers / Consultants:

- *Selection software is available*
- *Saves time during the design process*
- *Flexibility in small spaces*
- *Fast and easy calculations of yearly operation (energy) costs*
- *Absence of "defrost" mode*

For Installing Companies:

- *Easy installation (only need air ducts and power supply)*
- *BMS connection via various protocols*
- *Settings via internet*
- *No need for refrigeration work*

CAPITAL COST COMPARISON



The capital costs of MAX.e2 HTM_03 *in comparison with the conventional air cooled heat pump is equivalent or lower.*

Lower energy consumption delivers immediate cost savings.

ENVIRONMENT

- ***Low refrigerant content:***

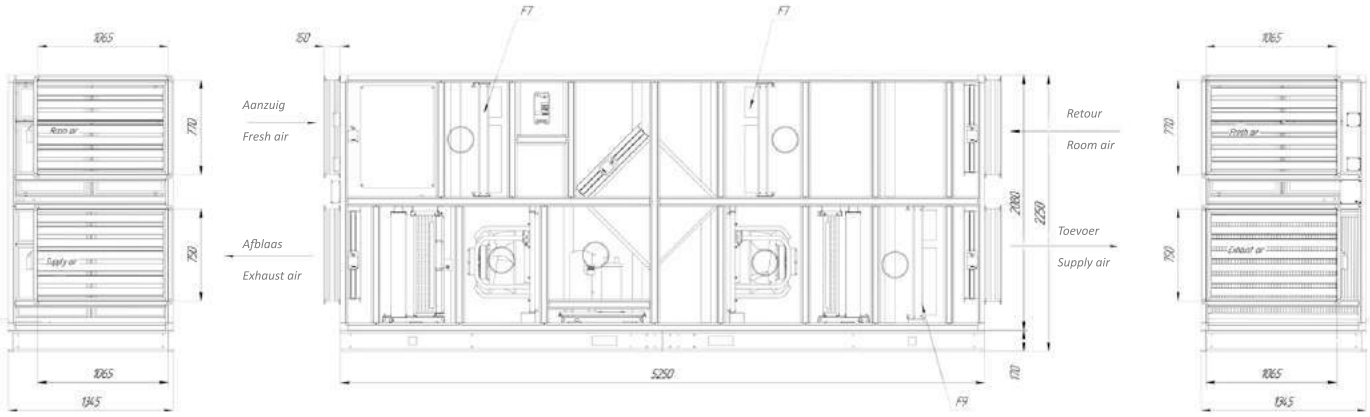
  Each unit size has a limited refrigerant content, in accordance with EU Regulation No. 842/2006 which makes obligatory control more frequent as the load of each individual circuit increases. MAX.@2 MTM_03 units require only sporadic control of once per year.

- ***Refrigerant is R407C and eco-friendly.***

- ***Respect for the environment:***

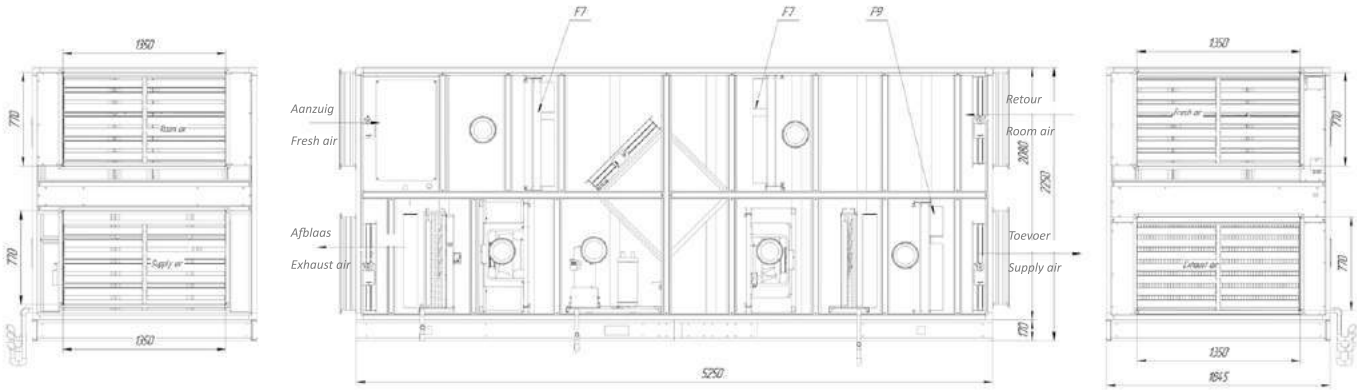
  The low refrigerant content and the excellent energy performance produce minimal CO_2 emissions into the atmosphere. While producing 1 kW/h of useful heating capacity at an outside temperature of -15°C, MAX.@2 MTM_03 emits only 62 – 65g CO_2.

GENERAL APPEARANCE, WEIGHT AND SIZE

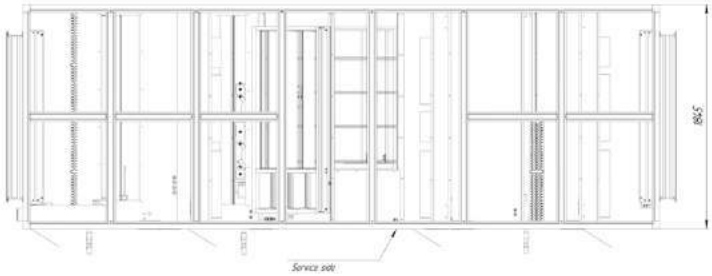


MAX.e² HTM_03 06

Service kant
Service side



MAX.e² HTM_03 09



Type	B	H	L	DxE	FxE	CxJ	GxK	Weight
Max.e2	mm	mm	mm	mm	mm	mm	mm	kg
HTM_03-06	1345	2250	5250	1065x770	1065x750	1065x750	1065x770	1430 +/-
HTM_03-09	1845	2250	5250	1350x770	1350x770	1350x770	1350x770	1757 +/-
HTM_03-15	2330	2600	6450	1800x910	1800x910	1800x910	1800x910	2200 +/-

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

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