CERTIFICATE

Certified Passive House Component

Component-ID 1162vl03 valid until 31st December 2025

Passive House Institute
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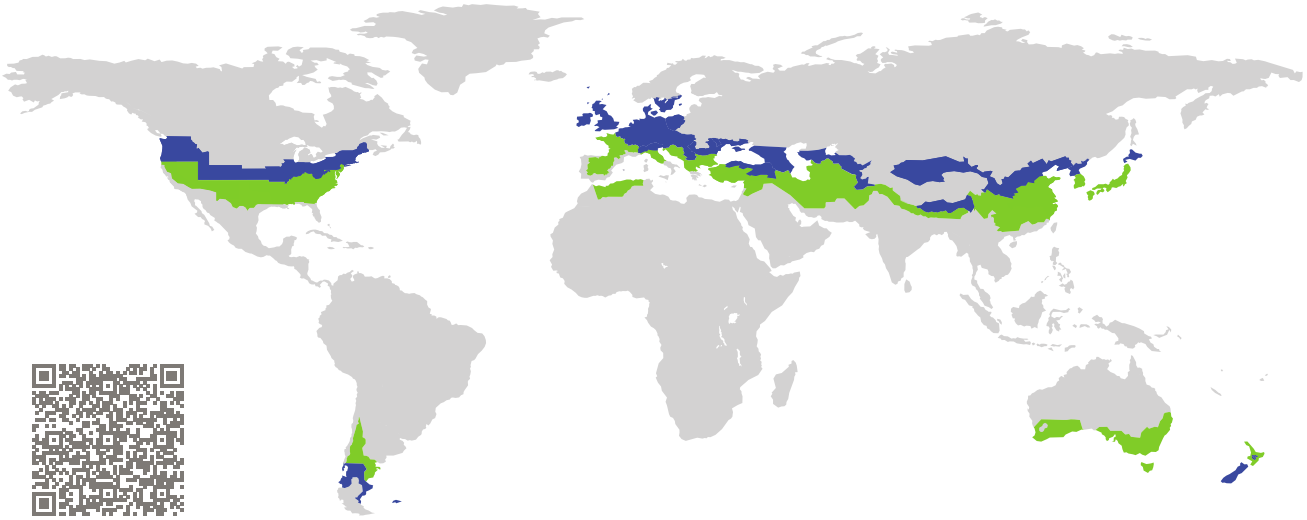

Category:	**Air handling unit with heat recovery**
Manufacturer:	**Ventacity Systems, Inc.** **United States of America**
Product name:	**VS3000 RT**
Specification:	Airflow rate > 600 m^3/h
Heat exchanger:	Recuperative

This certificate was awarded based on the product meeting the following main criteria

Heat recovery rate	η_{HR}	$\geq$	75 %
Specific electric power	$P_{el,spec}$	$\leq$	0.45 Wh/m^3
Leakage		$<$	3 %
Performance number		$\geq$	10
Comfort	Supply air temperature $\geq$ 16.5 °C at outdoor air temperature of –10 °C [3]		

Airflow range

1500–2670 m^3/h
at an external pressure of
286 Pa [2]
Requirements non-residential buildings (Therefore also applicable for residential building)

Heat recovery rate

η_{HR} = 85 % [1]

Specific electric power

$P_{el,spec}$ = 0.45 Wh/m^3

Performance number

9.9

[1] At an airflow of 1540 m^3/h, a heat recovery of η_{HR} = 88 % is reached.

[2] The real available external pressure with installed filters, internal electrical preheater and shut-off dampers is **234 Pa**. Additional components decrease the available pressure difference accordingly.

[3] Achieved by use of an internal electrical preheater.

cool, temperate climate

CERTIFIED COMPONENT
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Passive House comfort criterion

A supply air temperature of 18.6 °C is maintained at an outdoor air temperature of about -10.0 °C by use of an internal electrical preheater.

Efficiency criterion (heat recovery rate)

The effective heat recovery rate is measured at a test facility using balanced mass flows of the outdoor and exhaust air. The boundary conditions for the measurement are documented in the testing procedure.

$$\eta_{HR} = \frac{(\theta_{ETA} - \theta_{EHA}) + \frac{P_{el}}{\dot{m} \cdot c_p}}{(\theta_{ETA} - \theta_{ODA})}$$

With

η_{HR}	Heat recovery rate in %
θ_{ETA}	Extract air temperature in °C
θ_{EHA}	Exhaust air temperature in °C
θ_{ODA}	Outdoor air temperature in °C
P_{el}	Electric power in W
$\dot{m}$	Mass flow in kg/h
c_p	Specific heat capacity in W h/(kg K)

Heat recovery rate
η_{HR} = 85 %

Airflow range and external pressure difference

The operational range of the device results from the efficiency criterion (see below). As per the certification criteria for ventilation units > 600 m³/h the applicable pressure differences vary with the nominal range of operation (as declared by the producer) and the application (residential or non - residential building).
The external pressure difference includes all pressure losses of the ventilation system caused by components apart from the tested unit (consisting of casing, heat exchanger and fans). If filters are installed inside of the unit, their pressure losses are to be reduced accordingly. The average filter pressure drop of an operational filter is assumed to be 30% higher than that of the clean filter.

- According to the certification requirements for non-residential buildings the airflow range achieves \textbf{1500-2670 m³/h} at an external pressure difference of \textbf{286 Pa}. The available pressure difference with installed filters, internal electrical preheater and shut-off dampers is about \textbf{234 Pa}.

Efficiency criterion (electric power)

The overall electrical power consumption of the device including controllers was measured at the test facility as per the requirements for non-residential buildings at an external pressure difference of 286 Pa.

Specific electric power
$P_{el,spec}$ = 0.45 Wh/m^3

Performance number

Based on the measured values for the calculation of heat recovery efficiency and power consumption and on the climatic data of central Europe (Gt: 84 kKh, heating time: 5400 h/a), an average performance number at the airflow range was determined:

Performance number
9.9

Leakage

The airtightness of the unit is tested for under pressure and over pressure before the thermodynamic test is conducted. As per the certification criteria the leakage airflows must not exceed 3 % of the average airflow of the device's operating range.

Internal leakage	External leakage
2.51 %	2.86 %

Settings and airflow balance

It must be possible to adjust the balance of airflows at the unit itself (either between the exhaust and the outdoor airflows or between the supply and the extract airflows, if the unit is respectively placed inside or outside of the insulated thermal envelope of the building). Available operation modes are explained in detail in the operation manual.

- Balancing the airflow rates of the unit is possible.
  - ✓ The airflow volumes can be held steady automatically (by measurement of pressure differences inside of the unit and adjusting of the fan speed).
- The standby power consumption of this device makes 15.00 W. The target value of 1 W was exceeded. The device should be equipped with an additional external switch so that it can be disconnected from the mains, if required.
- After a power failure, the device will automatically resume operation.

Acoustical testing

A ventilation unit > 600 m^3/h is assumed to be operated in an installation room, for which sound limits are defined in the applicable regulations. For this device, the following sound level values have been derived from the measurements at an airflow rate of **2670 m^3/h**:

Device	Duct			
	Outdoor	Supply air	Extract air	Exhaust air
71.5 dB(A)	59.5 dB(A)	68.7 dB(A)	57.4 dB(A)	65.8 dB(A)

- For complying with the required sound level in the supply are and extract air rooms, dimensioning of a suitable silencer is required for the specific project on the basis of the measured sound level.

Indoor air quality

Instructions for changing of the air filters are documented in the operation manual. This device is equipped with following filter qualities:

Outdoor air filter	Extract air filter
G4+F7	M5

If the device is not operated during summer, the filter should be replaced before the next operation. The producer of the device has to ensure that based on the latest findings, room air hygiene can be maintained by means of integrated or obligatory components.

For the operation of ventilation systems a strategy for avoiding permanent moisture penetration of the outdoor air filter needs to be considered. The strategies are mentioned in the full report and can be implemented through installation of either an additional component of the ventilation device in the factory, or retrofitted to the system on-site.

Frost protection

Appropriate measures should be taken to prevent the heat exchanger and optional downstream hydraulic heater coil from getting damaged by frost during extreme winter temperatures (–15 °C). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
  - ✓ In order to ensure a frost protection of the heat exchanger, the unit is equipped with an internal electrical preheater with a maximum power of 21.7 kW. In case that the internal preheater is not used, another sufficient frost protection strategy has to be additionally adopted in order to protect the heat exchanger from freezing (e.g. hydraulic heating coils).
- Frost protection of downstream hydraulic heater coils:
  - ✓ In order to prevent damage to a hydraulic supply air heater coil, an internal control algorithm ensures switching off the fans in case that specific boundary conditions occur.

  It should be noted that, due to free circulation, cold air can also lead to freezing - even when the fans are stationary. This can only be ruled out if the air duct is closed (by means of a shut-off flap).

Bypass of the heat recovery

An automatically controlled summer bypass of the heat exchanger is part of this device. The effectiveness of bypass for night cooling of buildings has not been investigated within the scope of this testing.