CERTIFICATE

Certified Passive House Component

Component-ID 1229vl03 valid until 31st December 2025

Passive House Institute
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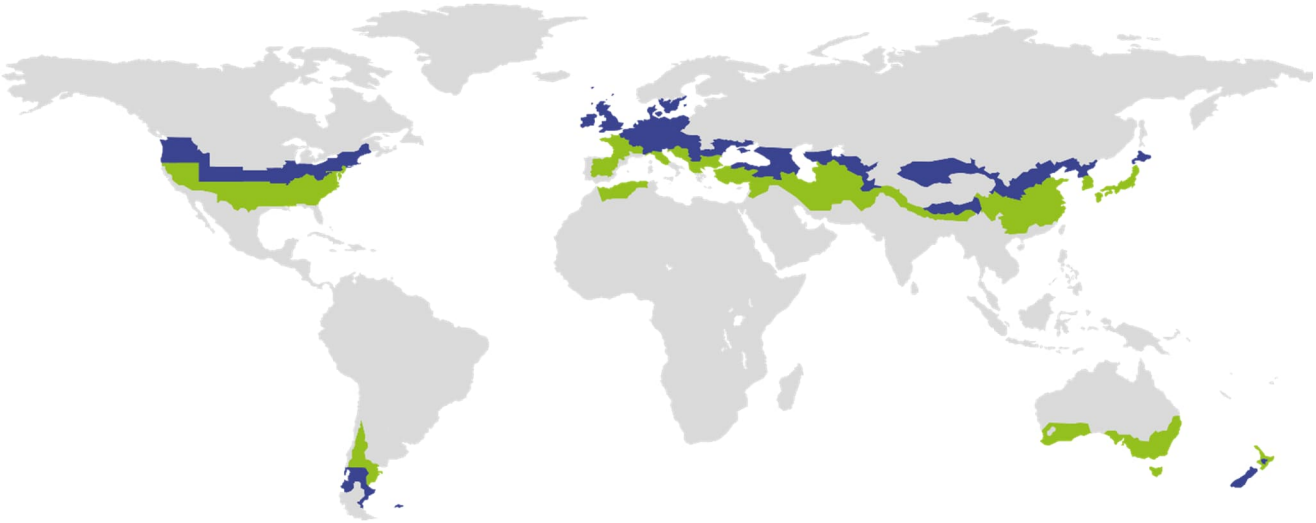

Category:	**Air handling unit with heat recovery**
Manufacturer:	**Ventacity Systems, Inc**
	United States of America
Product name:	**VS1000 RTe**
Specification:	Airflow rate > 600 m³/h
Heat exchanger:	Recuperative

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

Heat recovery rate	η_{HR}	≥	75 %
Specific electric power	$P_{el,spec}$	≤	0.45 Wh/m³
Leakage		<	3 %
Performance number		≥	10
Comfort	Supply air temperature ≥ 16.5 °C at outdoor air temperature of -10 °C [3]		

Airflow range
500-1050 m³/h
at an external pressure of
228 Pa [1]
Requirements non-residential buildings (Therefore also applicable for residential buildings)
Heat recovery rate
η_{HR} = 79 % [2]
Specific electric power
$P_{el,spec}$ = 0.36 Wh/m³
Humidity recovery
η_x = 70 %
Performance number
10.8

[1] The real available external pressure with installed filters, internal electrical preheater and shut-off dampers is **172 Pa**. Additional components decrease the available pressure difference accordingly.

[2] For residential use, a heat recovery rate of **82%** can be applied.

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

cool, temperate climate

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Humidity recovery

Indoor air humidity can be increased by using a system with moisture recovery in a cool, temperate climate, especially during the winter.

Humidity recovery
η_x = 70 %

- Adjustment of airflow by means of moisture control:
  - ✓ Since the moisture recovery of the heat exchanger exceeds a humidity ratio of 0.6, humidity controlled volume flow adjustment is required in order to avoid damage due to temporarily excessive indoor air humidity.
  - ✓ In cases of centralized ventilation systems serving several operation zones (i.e. several apartments), care should be taken to ensure that the recommended relative humidity of approx. 60 % will not be exceed in any of these zones.
  - ✓ The limitation of indoor air humidity due to higher volumetric flows must therefore be ensured separately for each zone. An appropriate solution must be developed for each project as part of the planning.
- Application of moisture recovery:
  - ✓ In cool temperate climates, heat exchangers with moisture recovery should generally only beused if the moisture load inside the building is comparatively low (e.g. in a residential building with an occupancy rate significantly below the average).
  - ✓ If moisture recovery > 60 % is to be used in a building with an average occupancy rate and typical use, the energy balance of the building is to be calculated with an increased airflow rate.
  - ✓ Adjustment of airflow by means of moisture control is required, even though that in case of low internal moisture the increased airflow rate is not needed often.

Passive House comfort criterion

A supply air temperature of 17.1 °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 Wh/(kg.K)

Heat recovery rate
η_{HR} = 79 %

In residential use, humidity recovery can have a positive effect on the heating demand by increasing the indoor air humidity. These higher humidity levels will reduce evaporation from building elements and furniture during the heating period and thus have a positive effect on the building's heating demand. In order to account for this effect, the heat recovery efficiency is increased by a certain percentage, depending on the achieved level of moisture recovery (see certification report). The following heat recovery rate can therefore be applied for residential use:

Heat recovery rate for residential use
η_{HR} = 82 %

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 m^3/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 **500-1050 m³/h** at an external pressure difference of **228 Pa**. The available pressure difference with installed filters, internal electrical preheater and shut-off dampers is about **172 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 228 Pa.

Specific electric power
$P_{el,spec}$ = 0.36 Wh/m³

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
10.8

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
2.48 %	1.75 %

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 of the airflow rates of the unit is possilbe.
  - ✓ 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 15.0 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 m³/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 **1050 m³/h**:

Casing	Duct			
	Outdoor	Supply	Extract	Exhaust
58.7 dB(A)	56.0 dB(A)	66.1 dB(A)	56.8 dB(A)	65.3 dB(A)

- For complying with the required sound level in the supply air 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
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 or on the ventilation site system.

Frosts 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.

- Frosts 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.