

Certificate

Certified Passive House Component

For cool, temperate climates, valid until 31 December 2018

Category: **Heat recovery unit**
 Manufacturer: **Ventacity Systems, Inc.**
97201 Portland, UNITED STATES
 Product name: **VS3000 RT**

This certificate was awarded based on the following criteria:

Thermal comfort	$\theta_{\text{supply air}} \geq 16.5 \text{ °C}^2)$ at $\theta_{\text{outdoor air}} = -10 \text{ °C}$
Effective heat recovery rate	$\eta_{\text{HR,eff}} \geq 75\%$
Electric power consumption	$P_{\text{el}} \leq 0.45 \text{ Wh/m}^3$
Performance number	≥ 10
Airtightness	Interior and exterior air leakage rates less than 3% of nominal airflow rate
Balancing and adjustability	Airflow balancing possible: yes Automated airflow balancing: yes
Sound insulation	It is assumed that large ventilation units are installed in a separate building services room. Sound levels documented in the appendix of this certificate.
Indoor air quality	Outdoor air filter F7 Extract air filter G4
Frost protection	Frost protection required Different strategies mentioned in the appendix of this certificate.

- 1) 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.
- 2) Achieved by use of an internal electrical preheater.

Further information can be found in the appendix of this certificate.

**Certified for
 airflow rates of
 1500-2670 m³/h
 at an external
 pressure of
 286 Pa¹⁾**

Requirements non residential buildings
 (Therewith device also applicable for residential building)

$\eta_{\text{HR,eff}}$ 85%
(88 % at 1540 m³/h)

**Electric power
 consumption
 0.45 Wh/m³**

**Performance
 number
 9.9**



**CERTIFIED
 COMPONENT**

Passive House Institute

Appendix of the certificate Ventacity Systems, Inc., VS3000 RT

Manufacturer Ventacity Systems, Inc.
 2828 SW Corbett Ave., 97201 Portland, UNITED STATES
 Tel: +1-(888)-8368458
 E-Mail: jose@ventacity.com, www.ventacity.com

Passive House comfort criterion

A supply air temperature of 18.6 °C is maintained at an outdoor air temperature of about -10 °C by use of an internal electrical preheater.

Effective heat recovery rate

The effective dry heat recovery efficiency is measured at the test facility with balanced mass flows on the external air/extract air side. The boundary conditions for the measurement are defined in the testing procedure.

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

The (dry) ventilation heating load (building is the system boundary: Plus Infiltration) can be calculated:

$$Q_{Ventilatin,dry} = V \cdot (100\% - \eta_{HR,eff}) \cdot 0,34 \Delta \vartheta$$

In case of condensation the heat recovery rate usually is higher. For the thermodynamic testing air conditions are chosen which exclude condensation. The heat recovery rate of this device amounts to:

$$\eta_{HR,eff} = 85 \% (88 \% \text{ at } 1540 \text{ m}^3/\text{h})$$

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 1500-2670 m³/h at an external pressure difference of **286 Pa**. The available pressure difference with installed filters, internal electrical preheater and shut-off dampers is about **234 Pa**.

Efficiency criterion (power consumption)

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. The measurements lead to values of:

$$0.45 \text{ Wh/m}^3$$

Appendix of the certificate Ventacity Systems, Inc., VS3000 RT

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 kWh, heating time: 5400 h/a), an average performance number at the airflow range was determined:

- ✓ **Performance number: 9.9**

Airtightness and insulation

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.

Following leakage rates were measured:

Internal leakage: 2.51 %

External leakage: 1.86 %

This appliance meets the airtightness requirements.

Balancing and adjustability

The ventilation unit must provide the opportunity to adjust the balance between the exhaust and outdoor airflow (unit located inside of the thermal envelope) or the extract and supply airflow (unit located outside of the thermal envelope). Possible 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 consumption of this ventilation appliance of 15.0 W is regarded as high. In order to avoid unnecessary standby losses, a manual switch for complete disconnection from the power supply should be installed.
- After a power failure this appliance automatically returns into operation once the power supply is back online.

Acoustic 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 of **2670 m³/h**:

Sound level unit [dB(A)]	Sound level ODA [dB(A)]	Sound level SUP [dB(A)]	Sound level ETA [dB(A)]	Sound level EHA [dB(A)]
71.5	59.5	68.7	57.4	65.8

- 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.

Appendix of the certificate Ventacity Systems, Inc., VS3000 RT

Indoor air quality

This device is equipped with following filter qualities:

- ✓ Outdoor Air filter F7+G4
- ✓ Extract Air filter 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.

Frost protection

Appropriate measures must be provided in order to avoid icing inside the heat exchanger and freezing of the hydraulic post-heater coil during winter at extreme temperatures (-15 °C). The actual function of the ventilation device must not be impaired by the regular operation of the frost protection system. A sufficient air supply must be provided with balanced airflows. Infiltration due to excess extract air would cause an unacceptable heat load. For the frost protection of the hydraulic post-heater coil the failure of a pre-heater coil or the exhaust air fan needs to be considered.

- Frost protection circuit for 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 circuit for the post heater coil:
 - ✓ 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 cold air can also lead to freezing of stationary fans due to free circulation; 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.

Abbreviations:

ODA = Outdoor air
EHA = Exhaust air
SUP = Supply air
ETA = Extract air