Certificate

Certified Passive House Component
For cool, temperate climates, valid until 31 December 2018

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Category: **Heat recovery unit**
Manufacturer: **Vallox GmbH**
86911 Dießen
Germany
Product name: **Vario 1000 CC - Vario 3500 CC**

This certificate was awarded based on the following criteria:

Thermal comfort	$\theta_{supply\ air} \geq 16.5$ °C at $\theta_{outdoor\ air} = -10$ °C
Effective heat recovery rate	$\eta_{HR,eff} \geq 75$ %
Electric power consumption	$P_{el} \leq 0.45$ Wh/m³
Performance number	≥ 10
Airtightness	Interior and exterior air leakage rates less than 3 % of nominal air flow rate
Balancing and adjustability	Air flow balancing possible: yes Automated air flow balancing: yes [2)]
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 actual available external pressure can be seen in Table 1
Additional components (e.g. heating coil) decrease the available external pressure accordingly.
2) Only if pressure gauges are installed and the control system box is equipped with the additional mode.

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

Certified for air flow rates of:
250 - 2800 m³/h
For external pressure
200 - 286 Pa[1)]

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

$\eta_{HR,eff} \geq 85$ %

Electric power consumption
< 0.43 Wh/m³

Performance number
> 10

CERTIFIED COMPONENT
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Appendix of the certificate

Manufacturer Vallox GmbH
Von-Eichendorff-Str 59A, 86911 Dießen
Tel: 08807/94660
E-Mail: info@vallox.de, www.vallox.de

Certificate ID	Model	Testing requirements	Air flow range		External Pressure	Available external Pressure 1)	**Electro-efficiency**	**HR**	**Performance number**
			Min	Max					
			m³/h	m³/h	Pa	Pa	**Wh/m³**	**%**	**-**
0115vl03	Vario 1000	Non-residential	250	700	200	144	**0.40**	**89**	**12.0**
0235vl03	Vario 1500	Non-residential	300	1400	243	178	**0.40**	**86**	**11.4**
0236vl03	Vario 2500	Non-residential	500	1800	259	202	**0.41**	**85**	**10.8**
0116vl03	Vario 3500	Non-residential	800	2800	286	225	**0.43**	**85**	**10.7**

1) incalculated pressure drop of filters

Table 1: Certified parameters of ventilation units. Valid for variants Internal (IN), Weather resistant (WF) and Roof integrated (DINT)

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C is maintained at an outdoor air temperature of -10 °C by using of a suitable frost protection strategy.

Effective heat recovery rate

The effective dry heat recovery rate is determined at the test facility using balanced mass flows on the outdoor air and extract air side and partly determined through a design software. This software was verified on the base of laboratory measured data for two selected units in advance. The boundary conditions for the calculation were taken from the documents relating to 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:

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

In case of condensation the heat recovery rate is usually higher. This case is intentionally not considered here.

The heat recovery rates for each model of the units are listed in Table 1.

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Air flow 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.

The air flow ranges and available external pressures for each model of the units are listed in Table 1.

Efficiency criterion (power consumption)

The overall electrical power consumptions of the devices including controllers were determined as per requirements at a corresponding external pressure differences for each model of the unit.

Based on the calculated values 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 corresponding air flow range was determined.

The overall electric power consumptions at the corresponding external pressure differences as well as the performance numbers for each model of the units are listed in Table 1.

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 air flows must not exceed 3 % of the average air flow of the device's operating range.

These appliances meet the airtightness requirements.

Balancing and adjustability

The ventilation unit must provide the opportunity to adjust the balance between the exhaust and outdoor air flow (unit located inside of the thermal envelope) or the extract and supply air flow (unit located outside of the thermal envelope). Possible operation modes are explained in detail in the operation manual.

- Balancing the air flow rates of the unit is possible
  - ✓ The air flow volumes can be held steady automatically (by measuring of pressure differences in extract and supply air duct).
- The standby consumption of this ventilation appliance of 9.3 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, the device automatically continues to operate in the mode that was set before the power failure.

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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. The total acoustic power levels were determined by producer for each model of the units at an upper limit of the air flow range.

The results can be found in Table 2.

Model	Testing requirements	Air flow range		Total acoustic power level				
		Min	Max	Casing	ADA	SUP	ETA	EHA
		m³/h	m³/h	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
Vario 1000	Non-residential	250	700	65	62	89	62	89
Vario 1500	Non-residential	300	1400	59	54	80	56	77
Vario 2500	Non-residential	500	1800	56	50	75	53	73
Vario 3500	Non-residential	800	2800	60	56	78	53	82

Table 2: Acoustic emissions at the upper limit of the air flow range

- 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

This device is equipped with following filter qualities:

- ✓ Outdoor Air filter F7
- ✓ 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 air flows. 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:
  - ✓ As per manufacturer information several frost protection systems can be applied. Exhaust and supply air temperatures are measured to control the frost protection. The device is pre-adjusted to activate the frost protection once the exhaust temperature drops below 2°C. The manufacturer recommends a frost protection system with brine heat exchanger.

    The manual of this appliance describes the possibility of implementing frost protection with an electrical pre-heater (exhaust air temperature-controlled). This strategy is not recommended by the PHI since heating with electricity is not preferable in regards to primary energy consumption.

- Frost protection circuit for post heater coil:
  - ✓ As described in the technical manual this appliance shuts down both the fans if the supply temperature drops below +5°C behind the heater coil.

  It should be noted that cold air can also lead to freezing up 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 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