

Certificate

Certified Passive House Component

For cool, temperate climates, valid until 31 December 2018

Category: **Heat recovery unit**
 Manufacturer: **Menerga GmbH**
45472 Mülheim an der Ruhr,
GERMANY
 Product name: **Resolair 64 05 01 – 64 32 01**

This certificate was awarded based on the following criteria:

Thermal comfort	$\Theta_{\text{supply air}} \geq 16.5 \text{ }^\circ\text{C}$ at $\theta_{\text{outdoor air}} = -10 \text{ }^\circ\text{C}$
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	The exterior air leakage rates less than 3% of nominal air flow rate. The exhaust air transfer exceeds 3%. ²⁾
Balancing and adjustability	Air flow balancing possible: yes Automated air flow 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 M5
Frost protection	no frost protection required, see appendix of this certificate

- 1) Available pressure difference with installed filters. Additional components (e.g. heater coil) decrease the available pressure difference accordingly.
- 2) Please take into account that in this regenerative heat recovery system, an exhaust air transfer of more than 3% of exhaust air volume flow occurs. The use of exhaust air from rooms with a high degree of contamination must therefore be examined project-specific.

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

www.passivehouse.com

Certified for air flow rates of 1000-15000 m³/h
 At an external pressure of **290 - 390 Pa¹⁾**
 Requirements non residential buildings

(Therewith device also applicable for residential building)

$$\eta_{\text{HR,eff}} \geq 86\%$$

Electric power consumption $\leq 0.45 \text{ Wh/m}^3$

Performance number 10



Appendix of the certificate Menerga GmbH, Resolair 64 05 01 – 64 32 01

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Certificate ID	Type designation	Testing requirement	Operational range		External pressure	Available external pressure ¹⁾	Electrical efficiency	HR	Performance number
			min	max					
			m ³ /h	m ³ /h	Pa	Pa	Wh/m ³	%	-
0854vl03	640501	Non-residential	1000	3000	290	254	0,44	86	10
0591vl03	640701	Non-residential	1500	4500	316	281	0,45	86	10
0855vl03	641001	Non-residential	2000	6000	333	299	0,44	86	10
0856vl03	641201	Non-residential	3000	7000	3463	310	0,44	86	10
0857vl03	641501	Non-residential	3200	8800	359	325	0,43	87	10
0858vl03	642101	Non-residential	5000	11000	371	340	0,45	88	10
0859vl03	642601	Non-residential	7000	13000	381	352	0,45	87	10
0860vl03	643201	Non-residential	9000	15000	390	362	0,44	87	10

Table 1: Results of the certified devices

1) less assumed filter pressure drops

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C at an external air temperature of -10 °C can only be maintained if an adequate frost protection system with pre or post heating coils is installed. The controller comes with corresponding algorithms.

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.

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

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

$$Q_{\text{Lüftung,trocken}} = (100\% - \eta_{WRG,t,eff}) \cdot 0,34 \Delta \dot{g}$$

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 rates of the tested devices are shown 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 of the clean filter.

The device was tested as per the requirements for non-residential buildings. The external pressures and the operational ranges are shown in Table 1.

Efficiency criterion (power consumption)

The overall electrical power consumption of the device including controllers was tested as per the requirements of non-residential buildings at an external pressure difference of 290 - 390 Pa. The measurements lead to average values of:

✓ **≤ 0.45 Wh/m³**

Based on the measured values for the determination of the heat recovery rate, the power consumption and the climatic data of middle Europe (Gt: 84 kWh, heating time: 5400 h/a), the average performance number for the range of operation was determined:

✓ **Performance number: 10**

Airtightness and insulation

The air tightness 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.

In appliances equipped with switching heat storages leakage airflows are caused by the switching process (air is transferred to the other airflow when switching) and by the leakage of switching dampers. The internal leakage in these systems is measured on the basis of the exhaust air mass flow transferred to the supply air (exhaust air transfer).

Following rates were measured:

The exhaust air transfer was exemplarily measured for the device type 64 15 01:

Exhaust air transfer: 6.6% at a volumetric airflow of 8820 m³/h

✓ **External leakage: ≤ 0.8%**

This appliances meet the external air tightness requirement. an exhaust air transfer of more than 3% of exhaust air volume flow occurs. The use of exhaust air from rooms with a high degree of contamination must therefore be examined project-specific.

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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:
 - ✓ automatic (measurement of pressure differences at fan injection nozzle)
 - ✓ manually (by the installer)
- The standby consumption of this ventilation appliance (only controller is active) is 45 W.
After a power failure the device automatically resets into its last operation mode.

Sound Protection

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 manufacturer's design software provides the following sound levels that have been verified on three different devices by an independent test laboratory:

Certificate ID	Type designation	Testing requirement	Operational range		Sound power level				
			min	max	Device	ODA	SUP	ETA	EHA
			m ³ /h	m ³ /h	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
0854vl03	640501	Nichtwohnbau	1000	3000	55	65	79	73	71
0591vl03	640701	Nichtwohnbau	1500	4500	62	72	85	80	79
0855vl03	641001	Nichtwohnbau	2000	6000	63	63	83	65	79
0856vl03	641201	Nichtwohnbau	3000	7000	59	67	81	76	74
0857vl03	641501	Nichtwohnbau	3200	8800	60	71	84	84	77
0858vl03	642101	Nichtwohnbau	5000	11000	59	67	82	76	74
0859vl03	642601	Nichtwohnbau	7000	13000	64	73	85	85	78
0860vl03	643201	Nichtwohnbau	9000	15000	64	73	86	85	78

Table 2: Sound power levels at maximum fresh air flow rate

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Indoor air quality

Information about the filter exchange are given in the manual. The device is equipped with following filters:

- ✓ Outdoor Air filter F7
- ✓ Extract Air filter M5

If the device is not operated during the summer, the filter should be replaced before the next operation.

For the operation of the ventilation system a strategy must be provided avoiding permanent moisture penetration of the outdoor air filter. As one possible strategy the recirculation of supply air into the outdoor air should be mentioned. Further strategies are mentioned in the certification report.

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 of the heat exchanger
 - ✓ The regenerative heat recovery system ensures a transmission of condensing humidity (when temperature falls below the dew point) from the exhaust/extract airflow to the outside/supply airflow. Due to his humidity recovery the formation of excess condensate is avoided. A freezing of the heat recovery system is avoided for this reason the use in comfort air conditioning. No active frost protection circuit is required to ensure frost protection for the heat recovery system without interruption of fresh air.

It should be noted that free circulation of cold air can cause freezing if fans stand still. Hence air ducts should closed with shut-off flaps.

Bypass of heat recovery

The heat recovery system uses two stationary heat storage masses which, controlled by a damper system, are alternately flowed through by warm extract air and cold outside air. By extending the time interval of switching of the damper system, the heat recovery rate can be reduced. If no switching takes place, no heat is recovered. The suitability for free night cooling was not analysed within the scope of these tests.

Abbreviations: ODA = Outdoor air, EHA = Exhaust air, SUP = Supply air, ETA = Extract air