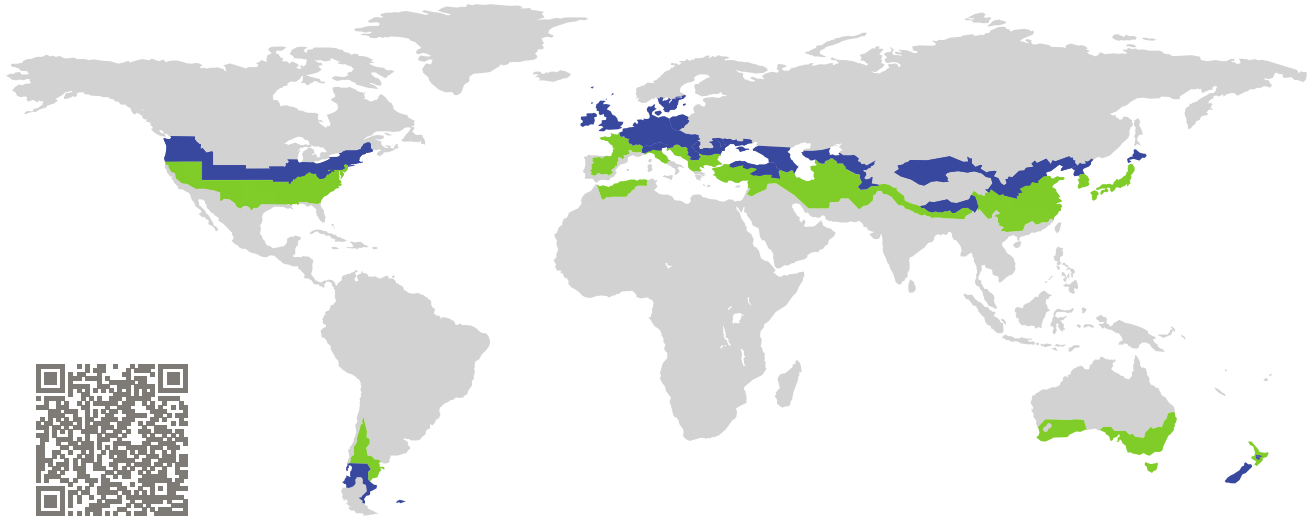


CERTIFICATE

Certified Passive House Component

Component-ID 0303vs03 valid until 31st December 2016

Passive House Institute
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Category: **Air handling unit with heat recovery**
Manufacturer: **PAUL Wärmerückgewinnung GmbH**
Germany
Product name: **novus 450**

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 $\eta_{HR} \geq 75\%$
Specific electric power $P_{el,spec} \leq 0.45 \text{ W h/m}^3$
Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature -10°C

Airflow range
140–348 m ³ /h
Heat recovery rate
89%
Specific electric power
0.29 W h/m ³

cool, temperate climate



**CERTIFIED
COMPONENT**

Passive House Institute

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C is maintained at an outdoor air temperature of -10 °C.

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

$$\eta_{HR} = 89\%$$

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.29 \text{ W h/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.70$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

Internal leakage	External leakage
1.02 %	0.61 %

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).

- This unit is certified for airflow rates of 140–348 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 1.60 W and therefore not complies with the target value of 1 W. 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

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 346 m³/h:

Device	Duct			
	Outdoor	Supply air	Extract air	Exhaust air
52.9 dB(A)	57.1 dB(A)	71.1 dB(A)	54.8 dB(A)	75.1 dB(A)

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

Outdoor air filter	Extract air filter
G4	G4

On the outdoor air/ supply air side the filter quality class F7 is recommended. If not standard configuration, the F7 filter is available as accessory part.

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 ($-15\text{ }^{\circ}\text{C}$). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
 - ✓ An external frost protection system is required. For this purpose the manufacturer recommends the device Paul iso-Defrosterheizung with a heating power of 2 kW combined with the universal thermostat (Paul) which allows a variable power regulation and is suitable for brine-defroster and electric preheating coils. The preheater is controlled according to the outdoor air temperature and it starts operation as soon as the outdoor air temperature drops below $-1\text{ }^{\circ}\text{C}$.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In Order to protect a downstream hydraulic heater coil the device is switched off as soon as the supply air temperature falls below $4.8\text{ }^{\circ}\text{C}$. In this case the display will show an error.