Certificate

Certified Passive House Component
For cool, temperate climates, valid until 31 December 2013

Passive House Institute
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Category: **Heat recovery unit**

Manufacturer: **Paul Wärmerückgewinnung GmbH**
08141 Reinsdorf, GERMANY

Product name: **novus F 300**

This certificate was awarded based on the following criteria:

Thermal comfort	$\theta_{supply\ air} \geq 16.5$ °C [1)] 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
Moisture recovery	Moisture recovery rate < 0.6 no Adjustment of air flow by means of moisture control required: yes
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
Sound insulation	Sound pressure level $L_p \leq 35$ dB(A) based on a 4 m² equivalent absorption area not met Here $L_p = 43.0$ dB(A) Unit must be installed in a separate building services room.
Indoor air quality	Outdoor air filter F7 Extract air filter G4
Frost protection	Frost protection for the heat exchanger with continuous fresh air supply down to $\theta_{outdoor\ air} = -15$ °C

1) Only with additional heater coil in the supply air stream

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

Certified for air flow rates of

121 - 231 m³/h

$\eta_{HR,eff}$

84%

Average moisture recovery
η_X=0.73

Electric power consumption

0.26 Wh/m³

CERTIFIED COMPONENT
Passive House Institute

Appendix to the certificate Paul Wärmerückgewinnung GmbH, novus F 300

Manufacturer: Paul Wärmerückgewinnung GmbH
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Moisture recovery

By means of moisture recovery the indoor air humidity can be higher then without moisture recovery. Especially during the winter months that could lead to a reduction in heating demand caused by less evaporation of water from construction components and furniture. This energy relevant influence is considered, depending on the moisture recovery rate, with a bonus on the heat recovery rate of the ventilation device.

- Adjustment of air flow by means of moisture control:
  - This ventilation device has got a moisture recovery rate > 0.6. In order to prevent damage from occasional excessive humidity, the unit must have a regulated air flow rate, which is controlled by the indoor air humidity.
  - The manufacturer recommends the regulation of the air flow rate depending on the indoor air humidity. For that purpose hygrostats (available as additional components to the ventilation unit) should be installed in the extract air rooms and connected to the control system of the ventilation device. The nominal value should be 55% relative humidity.
- Application of moisture recovery:
  - In cool temperate climates, heat exchanger with moisture recovery in general should only be used if the internal moisture load of the building is low compared to normal utilization (e.g. residential building with occupancy rate (far) below average).
  - If planning the application of moisture recovery in building with average occupancy rate, the energy balance of the building is to be calculated with an increased air flow rate according to following formula.

$$\dot{V}_{eff} = \dot{V}_{hyg} \cdot \frac{0{,}4}{1-\eta_x}$$

  - Adjustment of air flow by means of moisture control required, even though that in case of low internal moisture the increased air flow rate is not needed often.

Passive House comfort criterion

A minimum supply air temperature of 16.5 ℃ is not maintained at an outdoor air temperature of -10 ℃. The installation of a heater coil for supply air heating is required. For this purpose the manufacturer provides adequate additional components.

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Efficiency criterion (heat recovery rate)

The effective heat recovery rate is measured at the test facility using balanced mass flows on the outdoor air/extract air side. The boundary conditions for the measurement should be taken from the documents relating to the testing procedure.

$$\eta_{HR,eff} = \frac{(\vartheta_{ETA} - \vartheta_{EHA}) + \frac{P_{el}}{\dot{m} \cdot c_p}}{(\vartheta_{ETA} - \vartheta_{ODA})} + 0{,}08 \cdot \eta_x$$

Annotation: For moisture recovery $\eta_x > 0{,}6$ the bonus is limited to a maximum of 4,8 %.

Ventilation heating load (the house is the system boundary) can be calculated using $\eta_{HR,eff}$ based on the formula $\dot{V}_{supply\_air}$ * (1- $\eta_{HR,eff}$) * 0.34 * $\Delta\vartheta$ (multiplied by the infiltration rate).

For this device:

$\eta_{HR,eff}$ = 84 %

Efficiency criterion (power consumption)

The overall electrical power consumption of the device including that for regulation, but without that for the frost protection heating, is tested at the test facility at an external pressure of 100Pa (50Pa for each of the pressure/intake sides).

For this device: **0.26 Wh/m³**

Air tightness and insulation

Before starting the thermodynamic test in accordance with the DIBt guidelines, the air tightness test should be carried out for under pressure as well as for over pressure. The leakage air flows must not be greater than 3 % of the average air flow volume of the operating range of the ventilation device.

The following result was obtained for the device being tested according to DIBt guidelines:

Internal leakage: 1.62 %

External leakage: 1.05 %

This ventilation unit meets the air tightness requirements.

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Adjustability

It must be possible to adjust the balance between the exhaust air flow rate and the outdoor air flow rate for all units.

- This unit is certified for air flow rates of **121 - 231 m³/h**
- Balancing the air flow rates of the unit is possible
  - ✓ The air flow rates are hold steady automatically (by constant flow fans)
- The users should have at least have following possibilities for adjustment:
  - ✓ Switching the system on and off
  - ✓ Synchronized adjustment of the supply air and extract air flow to basic ventilation (= 70-80 %), standard ventilation (= 100 %) and increased ventilation (= 130 %) with clear readability of the set status.
  - ✓ Depending on the demand, the user can choose between several operating levels that can be set manually at the control unit of the operating element.
- The device being tested here has a standby power consumption of **0.95 W** and therefore complies with the target value of 1 W. After a power failure the device automatically continues to operate in the mode that was set before the power failure.

Acoustical testing

The sound pressure level in the installation room should be restricted to 35 dB(A) (with an equivalent room absorption area of 4 m²). Installation instructions must be provided which describe how the sound level can be kept below 25 dB(A) in living areas and below 30dB(A) in functional areas. The following sound levels have been determined at an air flow rate of **200 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)]
43.0	47.2	64.9	46.0	64.8

- The sound level of the device in an installation room with an equivalent room absorption area of 4m² exceeds the limit value of 35 dB(A). Therefore the unit should be installed so that it is acoustically separated from living areas.
- Silencers are recommended by the manufacturer for complying with the required sound level in the supply air and extract air rooms. Detailed information about these can be found in the full report. Dimensioning of a suitable silencer is required for the specific project on the basis of the measured sound intensity level.

Indoor air hygiene

Inspection and cleaning of the central device including the heat exchanger is simple. The filter can be replaced by the user himself/herself (no specialist required), relevant information should be provided and suppliers of filters should be listed in the manual. At least the following filter types should be provided for protection from pollutants:

- ✓ Outdoor Air filter at least F7
- ✓ Extract Air filter at least G4

If the device is not operated during the summer, the filter should be replaced before the next operation. The manufacturer is responsible for ensuring indoor air hygiene based on the latest findings, either by means of device components or by providing the obligatory equipment with the device.

Filter replacement is recommended after an interval of 6 months.

Frost protection

Appropriate measures should be taken to ensure prevention of icing over of the heat exchanger and freezing up of hydraulic post-heater coils during extreme winter temperatures (-15 ℃). The regular functioning of the device should be permanently ensured during uninterrupted operation of the frost protection circuit (there is no interrupt circuit for outdoor air in the Passive House, as the heating loads caused by the forced infiltration would become too high). If heater coils for hot water are used, a suitable frost protection circuit should ensure prevention of frost damage to these heater coils. In the process, the possibility of failure of the pre-heating coils and extract air fans must also be taken into consideration.

- Frost protection circuit for the heat exchanger:
  - ✓ An additional frost protection is required. The manufacturer for this purpose recommends the electric heater coil “Iso-Defrosterheizung” with 2 kW electrical power together with the BUS-thermostat which allows a modulating regulation of power. The nominal value of outdoor temperature should be -7 ℃.
- Frost protection circuit for downstream hydraulic heater coils:
  - ✓ In order to protect a downstream hydraulic supply air heater, an undershooting of 4.8 ℃ supply air temperature leads to a shutdown of the unit. In this case the display will show an error.

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).

Abbreviations

- AU/ODA = Outdoor air
- FO/EHA = Exhaust air
- ZU/SUP = Supply air
- AB/ ETA = Extract air