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Requirements and test procedures for energy relevant and acoustic assessment of Passive House ventilation units for certification as Passive House Components

Supplementary sheet for hot and very hot climates - provisional

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The following additional and to some extent different requirements and test procedures compared to cool temperate climate result for hot and very hot climates with reference to:

- Thermodynamic testing
- Moisture recovery
- Heat recovery bypass
- Electrical efficiency
- Hygiene

We recommend that proof of testing and verification as described in this supplementary sheet for certification in hot or very hot climates is provided in addition to certification for cool, temperate climates as both requirements may exist in many regions.

1. Thermodynamic testing

The external pressure difference to be applied for the measurements is generally 100 Pa. The applied external pressure drop should be uniformly distributed (i.e. about 50 % each) between the suction and discharge sides.

- All volumetric flows (ODA/EHA + SUP/ETA) should be measured and recorded.
- Air temperature and humidity should be measured and recorded for all volumetric flows (ODA/EHA + SUP/ETA).
- The total electrical power consumption of the device (including the control unit, possible also any necessary external systems etc.) should be determined and recorded.

The following (dry) temperature and moisture conditions should be set:

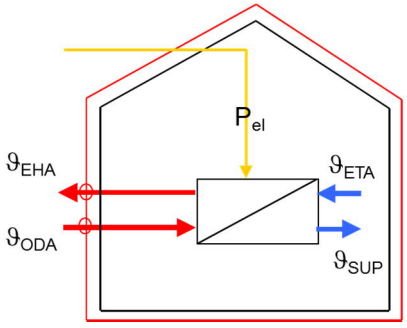
a) Measurement under indoor conditions

The outdoor air and exhaust air mass flows should be adjusted according to the device settings within the limits of measurement accuracy.

Outdoor air conditions ϑ_{ODA} = 35 °C with a relative humidity ≤ 50%

Extract air temperature ϑ_{ETA} = 25 °C

Ambient air = Extract air



Calculating the heat recovery on cooling

$$\eta_{HR(hot\ climates)} = \frac{(\vartheta_{ETA} - \vartheta_{EHA}) + \frac{P_{el}}{\dot{m} * c_p}}{\vartheta_{ETA} - \vartheta_{ODA}} \quad [1]$$

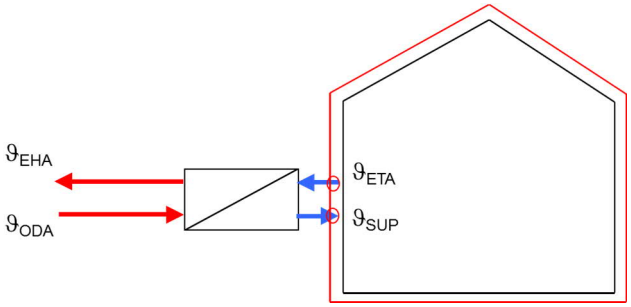
b) Alternatively, the measurement can also be performed under outdoor air conditions

The outdoor air and exhaust air mass flows should be adjusted according to the device settings within the limits of measurement accuracy.

Outdoor air conditions ϑ_{ODA} = 35 °C with a relative humidity ≤ 50%

Extract air temperature ϑ_{ETA} = 25 °C

Ambient air = Outdoor air



Calculating the heat recovery on cooling

$$\eta_{HR(hot\ climates)} = \frac{\vartheta_{SUP} - \vartheta_{ODA}}{\vartheta_{ETA} - \vartheta_{ODA}} \quad [2]$$

For all measurement series it should be ensured and verified through the recorded measured data that the overall test setup has reached a steady state.

For certification as a Passive House component, the calculated heat recovery on cooling must be 70 % or more.

2. Moisture recovery

For application in hot and humid climates, the use of heat exchangers with moisture recovery is necessary or at least strongly recommended in order to reduce the entry of moisture into the home from outside.

The moisture recovery rate should be determined by measurements under the following boundary conditions (test setup and measurement similar to 1.).

Outdoor air ϑ_{ODA} = 30 °C with a relative humidity = 70%

Extract air ϑ_{ETA} = 25 °C with a relative humidity ≤ 50%

Finally, the moisture recovery rate should be determined according to the following equation:

$$\eta_x = \frac{x_{ODA} - x_{SUP}}{x_{ODA} - x_{ETA}} \qquad [3]$$

The moisture recovery rate should be better than 60%.

3. Heat recovery bypass

Checking of the effectiveness of the heat recovery by pass for night-time cooling under the following conditions:

Extract air ϑ_{ETA} = 25 °C

Outdoor air ϑ_{ODA} = 16 °C

Volumetric flow at the upper operating limit

Bypass damper opened 100%

The supply temperature should be measured in order to determine the rise in temperature of the supply air temperature compared to the outdoor air temperature.

4. Electric power consumption

The total electrical power consumption of the ventilation unit (both fans, including the control unit, possibly also any necessary external systems) for the volumetric flow may not exceed the upper limit of the operating range of 0.45 W per (m³/h) of transferred supply air volume flow (recommendation for hot and very hot climates ≤ 0.35 Wh/m³). The test should be carried out at an external pressure of 100 Pa.

5. Hygiene

Filter

To protect the heat exchanger and the supply air duct network, a fine filter of efficiency at least ISO ePM1 50% should be foreseen on the outdoor air side (corresponding with ASHRAE MERV 13 or better).
If the device itself does not provide the possibility of inserting a ISO ePM1 50% filter then an external filter box should be recommended by the manufacturer. This must also be installed for the above-mentioned tests.

Condensate drain

For use in hot and humid climates or also in warm climates with moderate or only temporarily high air humidity levels, equipping the device with a condensate drain is strongly recommended.

a) The condensate drain should be implemented so that the condensate can drain away completely. The installation measures necessary for this should be clearly described in the instruction manual for the device.
b) The inner surfaces of the device housing, particularly on the supply air side should be smooth and easy to clean. Easy access to the device must be possible for maintenance and cleaning purposes (preferably without the need for tools).
c) The condensate drain should preferably be manufactured with a ball siphon or similar in order to prevent odour. The necessary accessories are either supplied by the manufacturer or a product will be recommended by the manufacturer.

Proof relating to a) and b) should be provided through corresponding device drawings and specifying of the materials of the device housing.

Symbols and abbreviations

$\eta_{HR(hot\ climates)}$	Heat recovery on cooling	[%]
ϑ	Temperature	[°C]
ODA	Outdoor air	
SUP	Supply air	
ETA	Extract air	
EHA	Exhaust air	
η_x	Moisture recovery rate	[-]
x	Absolute humidity	[g/kg]