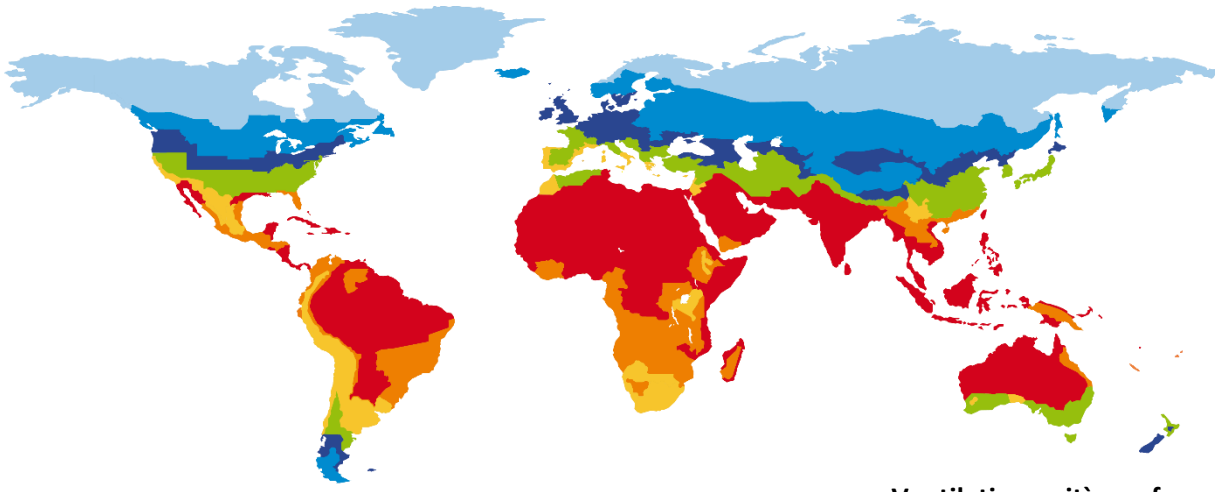
# CERTIFICATE

**Certified Passive House Component**

**Component-ID 2544ch03**

valid until 31st December 2026

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



| | |
|---|---|
| Category: | **Ventilation unit equipped with heat pump** |
| Manufacturer: | **Innova Srl** |
| | **Italy** |
| Product name: | **Vertical Stack** |

[1)]

Type of heat pump: Air-to-Air

Heat exchanger: Cross-counterflow

**This certificate was awarded based on the product meeting the following main criteria (limit values):**

**Ventilation unit**

| | | | |
|---|---|---|---|
| Heat recovery rate | $\eta_{HR}$ | ≥ | 75 % |
| Specific electric power | $P_{el,spec}$ | ≤ | 0.45 Wh/m³ |
| Leakage | | < | 3 % |
| Comfort | Supply air temperature ≥ 16.5 °C at outdoor air temperature of -10 °C | | |

**Heat pump** [2)]

| | |
|---|---|
| Space heating | 9 kWh/(m²a) |
| Space Heating + DHW | 20 kWh/(m²a) |
| Space cooling (humid climate): | 13 kWh/(m²a) |
| Space cooling (dry climate): | 11 kWh/(m²a) |

[1)] all certified units and operational modes are listed in detail in the appendix of this certificate, see page 2

[2)] limit values for final energy (electricity) demand

[3)] the unit is equipped with ventilation unit.

**Ventilation unit`s performance:** [1)3)]

| Airflow range |
|---|
| 92…142 m³/h |
| **Heat recovery rate** |
| $\eta_{HR}$ = 80 % |
| **Specific electric power** |
| $P_{el,spec}$ = 0.30 Wh/m³ |
| **Humidity recovery rate** |
| $\eta_x$ = 70% |

**Heat pump`s performance:** [1)]

| Heat Pump — space heating |
|---|
| 5.1-4.5 kWh/(m²a) |
| **Heat Pump — Heating + DHW** |
| — kWh/(m²a) |
| **Cooling DRY** |
| 10.2-6.3 kWh/(m²a) |
| **Cooling HUMID** |
| 12 kWh/(m²a) |

CERTIFIED COMPONENT
Passive House Institute

### Ventilation performance

| | Heat recovery | Humidity recovery | Electric Efficiency [Wh/m³] | Useful range of operation [m³/h] | Cert-ID |
|---|---|---|---|---|---|
| **Vertical Stack** | 80 % | 70 % | 0.30 | 92 - 142 | 2544ch03 |

### Heat pump performance

### Space Heating

| | kWh/m² | m²(*) | Cert-ID |
|---|---|---|---|
| **Vertical Stack** | 4.9 | 50-150 | 2544ch03 |

### Space Cooling

| | HUMID | | DRY | | |
|---|---|---|---|---|---|
| | kWh/(m²a) | m²(*) | kWh/(m²a) | m²(*) | Cert-ID |
| **Vertical Stack** | 12 | 50-150 | 7.8 | 50-150 | 2544ch03 |

The listed final energy demand (electricity) for the HP system was derived from energy balance calculation of a reference building. For details see appendix, page 6.

The maximum useful operational range with respect to air flow was derived from the pressure losses and external pressure capacity respectively, which the unit is able to deliver.

The manufacturer can provide additional information.

*) approximate maximum floor area (or range) the certified heat pump can serve; calculation carried out in steps of 50 m²; result presented is mean value

**Thermal Comfort:** A minimum supply air temperature of 16.5°C is reached with use of the heat pump.

**Efficiency Criterion – heat**: The heat recovery of the ventilation system incorporated in the unit demonstrates an efficiency as listed.

**Efficiency Criterion – electricity:** With a power consumption of 0.30 Wh/m³, see tables above the unit complies in each operational mode with the maximum consumption of 0.45 Wh/m³. The consumption of 10.8 W in standby-mode does not exceed the target value of 1 W.

**Air tightness and thermal insulation:** Testing the ventilation system showed that the limiting values of 1.4 % for both the internal and external leakages were not exceeded.

**Control and calibration:** A comparison of air volumes is performed automatically by the device. The required air volume can be adjusted via a control panel on the device with three set points.

**Hygienic Indoor Air:** The central ventilation unit, including the heat exchanger, can be easily accessed and cleaned. The filters can be replaced by the user (rather than by a technical expert), instructions and suppliers are included in the manual. The following filter qualities should be used: intake air filter minimum F7 or ISO ePM1 50%, attached in front, exhaust air filter G4 or ISO Coarse 60%. The filter should be replaced, before recommissioning the unit after a summer period when it has not been in use. The manufacturer carries the responsibility to ensure that, through the use of either integral components or mandatory additional fittings, the hygienic quality of the air is sufficiently high. An F7 and a F7 filter are installed respectively in the intake and exhaust air streams within the unit. This configuration is in accordance with the recommendations for Passive Houses.

**Frost protection:** The device is protected against the icing via an external mounted electrical preheater. The minimum supply air temperature of 16.5 °C is ensured solely by the frost-protection pre-heater. The additional electrical energy consumption is not included in the COP numbers for the heat pump denoted in the certificate

**Sound suppression:** The acoustic pressure level was evaluated as 57 dB (A) in the room where the unit is installed with an equivalent absorption area of 4 m² and at an air flow rate of 200 m³/h. This is significantly higher than the threshold value of 35 dB(A), the unit must therefore be installed in an adequately sound insulated room separate from the living area, see figure 1.

The sound level coming from supply air ducts 70 dB(A) and extract air ducts 71 dB(A) respectively is similarly too high and thus adequate silencers have to be used always to keep the noise level in all living rooms and sleeping rooms below 25 dB(A) — the audacity threshold. The producer will specify a configuration of the silencers, see figure 2.

New graphs for Innova Vertical Stack

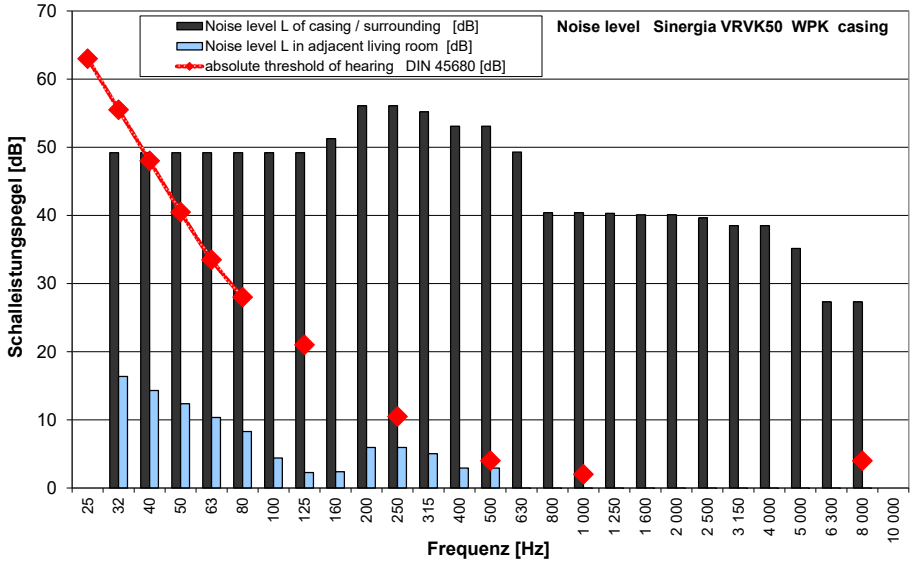



Figure 1: Noise emission of casing of unit Sinergia VRVK50

The unit has to be placed inside a room, which is sufficiently noise separated

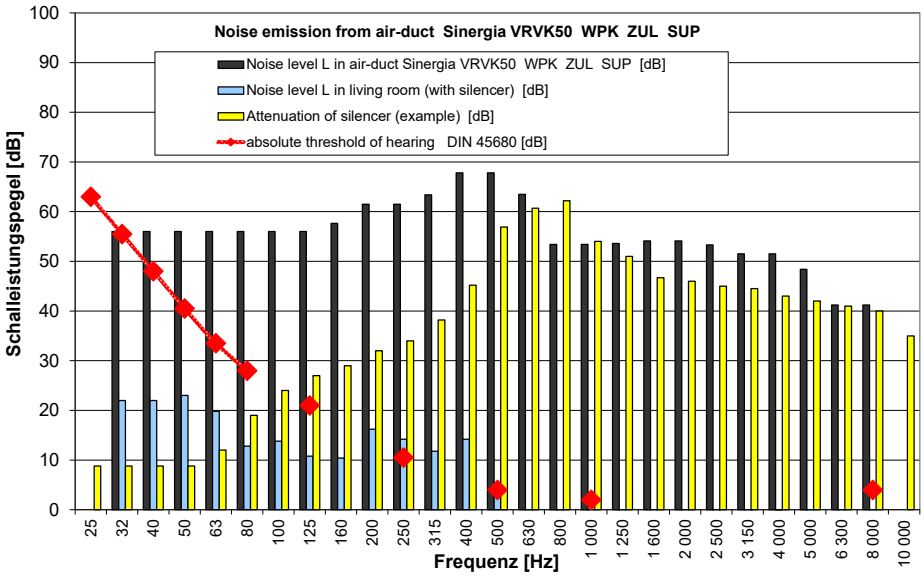



Figure 2: Acoustic emissions of supply duct of the unit Sinergia VRVK50. Manufacturer provides a suitable set of silencers

**Assessment of the heat pump:** The final energy (electricity) demand of the heat pump system installed in the reference building are listed in the table on page 2. The calculations were done for those operational modes, with measurement data available.

Seasonal performance of the tested unit is evaluated by Passive House Institute for representative climates. This is based on the key characteristics determined for space heating, cooling and dehumidification operating modes at all test points specified in the testing regulations.

Passive House Institute uses three reference climates, first for heating (cool,temperate- Frankfurt am Main- Germany), second for sensible cooling (hot and dry-Las Vegas-USA), and third for sensible cooling and dehumidification (hot and humid- Shanghai, China). This forms the basis for the calculation of energy balance. Evaluation is based on final energy consumption. The limiting values for final energy consumption are 13 kWh/(m²a) for sensible/latent cooling (humid climate) and 9 kWh/(m²a) for heating. For cooling in dry climate, the limit for final energy is 11 kWh/(m²a).

Verification is based on a model Passive House with a heating demand of 15 kWh/(m²a), cooling demand for humid climate 23 kWh/(m²a) and cooling demand for dry climate 22 kWh/(m²a). All calculations are based on hourly method. The calculation is done in steps of 50m² of size of reference house. The resulting values (as depicted on the main page) are derived as average value for all certifiable floor areas. The approximate maximum floor area (or range) of reference house the unit can serve is mentioned on the main page (this will deviate for each and particular project depending on climate). The values mentioned in this certificate are just for orientation. HVAC designer is responsible for sizing of the unit in each project). This is relevant for space heating/cooling.

This compact heat pump unit can be used in Passive Houses with an energy reference area (TFA, treated floor area) of 50 up to 150 m² respectively. The air volume flow has to be adjusted accordingly by using the operational modes. The according energy balance calculation of the reference building is based on a typical occupancy of 35 m²/person, an air flow rate of 30 m³/h/person.

The unit can provide dehumidification in an efficient manner with a minimised recirculation airflow (200m3/h). During certification it was assumed that, in dehumidification mode the unit works this way and minimize the recirculation flow. Nevertheless, for very humid air conditions a separate dehumidifier will be necessary to cover the full latent load in an efficient manner. The results shown in the certificate are calculated with an additional dehumidifier with efficiency 1.5.

If the unit is to be used in flats outside the area stated in the certificate it can result in worse performance or uncovered demand (it very much depends on control/regulation system of the particular unit. The performance of control system was not evaluated during the certification).

The type of refrigerant used in the models is: R410a refirgerant in amount of 0.9 kg.

**Innova Vertical Stack: A data table with detailed parameters for PHPP worksheet 'Components', category "Combined ventilation and split units":**

## Ventilation performance

| Heat recovery | Humidity recovery | Electric Efficiency [Wh/m³] | Useful range of operation [m³/h] | Cert-ID |
|---|---|---|---|---|
| 80 % | 70 % | 0.30 | 92 - 142 | 2544ch03 |

## Space Heating

| T Outside (°C) | T Inside (°C) | Capacity max (kW) | Capacity On-off limit (kW) | COP Max | COP on-off limit |
|---|---|---|---|---|---|
| -7 | 20 | 2.65 | 1.35 | 2.36 | 3.90 |
| 2 | 20 | 2.54 | 1.29 | 2.62 | 4.33 |
| 7 | 20 | 2.69 | 1.37 | 3.78 | 6.25 |

## Space cooling

| T Outside (°C) | T Inside (°C) | Capacity max (kW) | Capacity On-off limit (kW) | COP Max | COP on-off limit | Recirculation airflow Normal operation | Variable air volume Normal operation | Recirculation airflow dehumidification operation | Cc |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 25 | 2.68 | 1.28 | 3.60 | 3.24 | 530 | x | 200 | 0.62 |
| 30 | 25 | 2.71 | 1.29 | 3.84 | 3.46 | | | | |
| 25 | 25 | 1.22 | 0.58 | 4.66 | 4.20 | | | | |