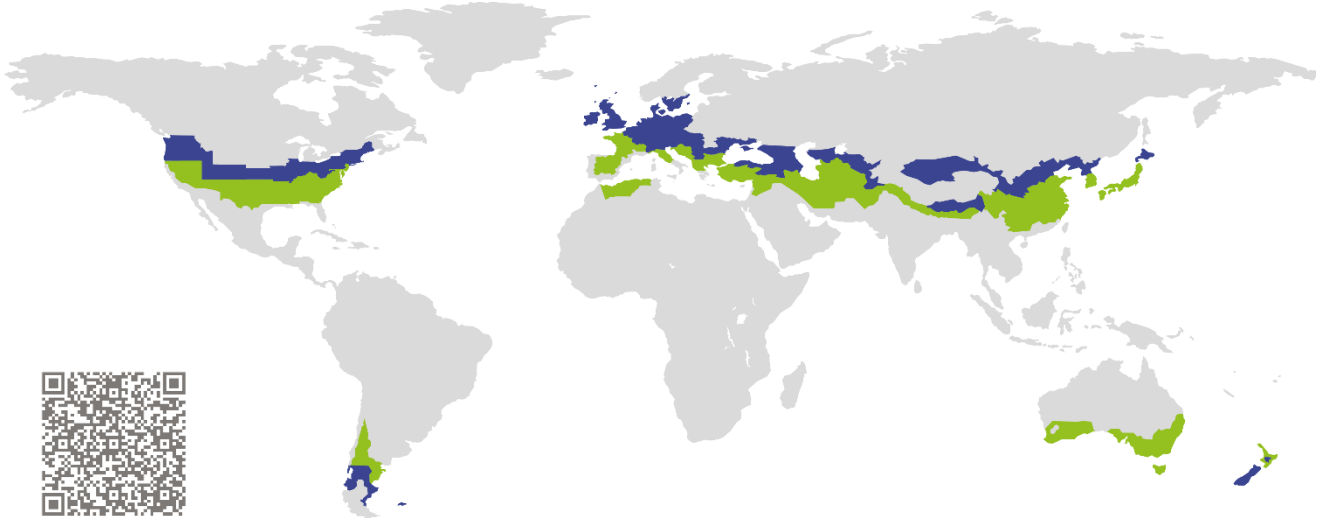


CERTIFICATE

Certified Passive House Component

Component-ID 2143vI03 valid until 31st December 2025

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Category: **Air handling unit with heat recovery**
Manufacturer: **Swegon Ilto Oy**
Finland
Product name: **CASA R9 Genius Sorption**
Specification: Airflow rate > 600 m³/h
Heat exchanger: Regenerative

This certificate was awarded based on the product meeting the following main criteria

Heat recovery rate	η_{HR}	\geq	75 %
Specific electric power	$P_{el,spec}$	\leq	0.45 Wh/m ³
Leakage		$<$	3 %
Performance number		\geq	10
Comfort			Supply air temperature \geq 16.5 °C at outdoor air temperature of -10 °C

Airflow range
300-850 m ³ /h at an external pressure of 177 Pa Requirements residential buildings
Heat recovery rate
$\eta_{HR} = 79 \% ^{1)}$
Specific electric power
$P_{el,spec} = 0.36 \text{ Wh/m}^3$
Humidity recovery
$\eta_x = 84 \%$
Performance number
12.5

¹⁾ For use in a residential buildings where sufficient internal humidity sources are regularly ensured a heat recovery rate of 83 % can be applied.



Humidity recovery

Indoor air humidity can be increased by using a system with moisture recovery in a cool, temperate climate, especially during the winter.

Humidity recovery

$$\eta_x = 84 \%$$

- Adjustment of airflow by means of moisture control:
 - ✓ Since the moisture recovery of the heat exchanger exceeds a humidity ratio of 0.6, humidity controlled volume flow adjustment is required in order to avoid damage due to temporarily excessive indoor air humidity.
 - ✓ In cases of centralized ventilation systems serving several operation zones (i.e. several apartments), care should be taken to ensure that the recommended relative humidity of approx. 60 % will not be exceeded in any of these zones.
 - ✓ The limitation of indoor air humidity due to higher volumetric flows must therefore be ensured separately for each zone. An appropriate solution must be developed for each project as part of the planning.
- Application of moisture recovery:
 - ✓ In cool temperate climates, heat exchangers with moisture recovery should generally only be used if the moisture load inside the building is comparatively low (e.g. in a residential building with an occupancy rate significantly below the average).
 - ✓ If moisture recovery > 60 % is to be used in a building with an average occupancy rate and typical use, the energy balance of the building is to be calculated with an increased airflow rate.
 - ✓ Adjustment of airflow by means of moisture control is required, even though that in case of low internal moisture the increased airflow rate is not needed often.

Passive House comfort criterion

At an outdoor air temperature of -10 °C a supply air temperature higher than 16.5 °C is achieved by use of an optional external electric supply air heater. The criterion is therefore met.

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 Wh/(kg.K)

Heat recovery rate

$$\eta_{HR} = 79 \%$$

In residential use, humidity recovery can have a positive effect on the heating demand by increasing the indoor air humidity. These higher humidity levels will reduce evaporation from building elements and furniture during the heating period and thus have a positive effect on the building's heating demand. In order to account for this effect, the heat recovery efficiency is increased by a certain percentage, depending on the achieved level of moisture recovery (see certification report). Therefore, for residential use, where the sufficient internal humidity sources are regularly ensured, the following heat recovery rate can be applied for residential use:

Heat recovery rate for residential use

$$\eta_{HR} = 83 \%$$

Airflow 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 $> 600 \text{ m}^3/\text{h}$ 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 that of the clean filter.

- According to the certification requirements for Residential buildings the airflow range achieves **300-850 m³/h** at an external pressure difference of **177 Pa**. The available pressure difference with installed filters is about **114 Pa**.

Efficiency criterion (electric power)

The overall electrical power consumption of the device including controllers was measured at the test facility as per the requirements for Residential buildings at an external pressure difference of 177 Pa.

Specific electric power

$$P_{el,spec} = 0.36 \text{ Wh/m}^3$$

Performance number

Based on the measured values for the calculation of heat recovery efficiency and power consumption and on the climatic data of central Europe (Gt: 84 kWh, heating time: 5400 h/a), an average performance number at the airflow range was determined.

Performance number
12.5

Leakage

The airtightness of the unit is tested for under pressure and over pressure before the thermodynamic test is conducted. As per the certification criteria the leakage airflows must not exceed 3 % of the average airflow of the device's operating range.

Internal leakage	External leakage
2.81 %	0.52 %

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). Available operation modes are explained in detail in the operation manual.

- Balancing of the airflow rates of the unit is possible.
- The standby power consumption of this device makes 4.70 W. The target value of 1 W was exceeded. 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

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. For this device, the following sound level values have been derived from the measurements at an airflow rate **868 m³/h**:

Casing	Duct			
	Outdoor	Supply	Extract	Exhaust
51.1 dB(A)	58.3 dB(A)	68.0 dB(A)	59.2 dB(A)	69.9 dB(A)

- For complying with the required sound level in the supply air and extract air rooms, dimensioning of a suitable silencer is required for the specific project on the basis of the measured sound level.

Indoor air quality

Instructions for changing of the air filters are documented in the operation manual. This device is equipped with following filter qualities:

Outdoor air filter	Extract air filter
ISO ePM1 50%	ISO ePM1 50%

If the device is not operated during summer, the filter should be replaced before the next operation. The producer of the device has to ensure that based on the latest findings, room air hygiene can be maintained by means of integrated or obligatory components.

For the operation of ventilation systems a strategy for avoiding permanent moisture penetration of the outdoor air filter needs to be considered. The strategies are mentioned in the full report and can be implemented through installation of either an additional component of the ventilation device or on the ventilation site system.

Frosts 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.

- Frosts protection of the heat exchanger:
 - ✓ The unit is equipped with a rotary heat exchanger, which allows the operation even at low outdoor air temperatures without the need for additional frost protection measures. In order to achieve a comfort supply air temperature, using of a suitable additional external post-heater is required.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic heater coil the unit is switched off in case that a failure of the heat exchanging is detected. An error message is displayed on the control panel.

It should be noted that, due to free circulation, cold air can also lead to freezing – even when the fans are stationary. This can only be ruled out if the air duct is closed (by means of a shut-off flap).