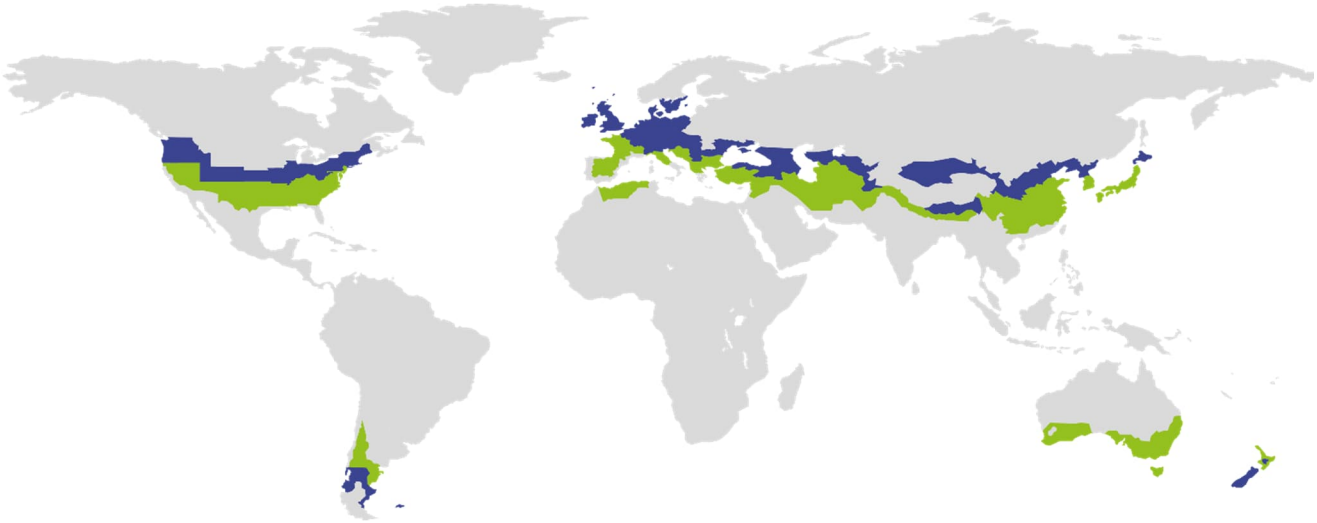
CERTIFICATE

Certified Passive House Component

Valid until 31st December 2023

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category:	**Air handling unit with heat recovery**
Manufacturer:	**Swegon Operations AB**
	Sweden
Product name:	**Ventilation unit series**
	GOLD F RX STE 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}	≥	75 %
Specific electric power	$P_{el,spec}$	≤	0.45 Wh/m³
Leakage		<	3 %
Performance number		≥	10
Comfort	Supply air temperature ≥ 16.5 °C at outdoor air temperature of -10 °C [2]		

Airflow range
500-10000 m³/h
at an external pressure of
238-365 Pa [1]
Requirements non-residential buildings
Heat recovery rate
η_{HR} ≥ 80 %
Specific electric power
$P_{el,spec}$ ≤ 0.45 Wh/m³
Humidity recovery
η_x ≥ 90 %
Performance number
> 9 [3]

[1] The pressure drop of filters is covered in the listed external pressure. Additional components (e.g. heating coil) decrease the available external pressure accordingly.

[2] Installation of an additional post heater is necessary.

[3] The recommended value of 10.0 was not reached for all device sizes.

cool, temperate climate

CERTIFIED COMPONENT

Passive House Institute

Swegon Operations AB
Frejgatan 14, 535 30 Kvänum, Sweden
☎ +46 512 32 200 | ✉ - | http://www.swegon.com |

Component ID	Unit model	Testing requirements	Airflow range Min m³/h	Airflow range Max m³/h	Humidity-recovery [2] %	External pressure Pa	Actual available external pressure [1] Pa	Specific electric power Wh/m³	Heat recovery rate %	Performance number -
1931vl03	GOLD 04	Non-res.	540	1270	96	238	196	0.45	81	9.2
1932vl03	GOLD 05	Non-res.	540	1100	96	228	192	0.43	81	9.8
1933vl03	GOLD 07	Non-res.	540	1770	96	259	221	0.40	82	10.5
1934vl03	GOLD 08	Non-res.	1080	1900	96	265	223	0.44	83	9.6
1935vl03	GOLD 11	Non-res.	1080	2670	96	286	236	0.41	84	10.6
1936vl03	GOLD 12	Non-res.	1800	2930	96	290	237	0.43	84	10.0
1937vl03	GOLD 14	Non-res.	1800	4500	96	316	266	0.41	85	10.6
1938vl03	GOLD 20	Non-res.	2520	4290	96	316	267	0.42	84	10.1
1939vl03	GOLD 25	Non-res.	2520	5730	96	333	295	0.41	84	10.6
1940vl03	GOLD 30	Non-res.	3600	4660	96	322	292	0.42	85	10.4
1941vl03	GOLD 35	Non-res.	3600	8000	96	351	310	0.41	85	10.6
1942vl03	GOLD 50	Non-res.	5400	10000	96	365	327	0.42	85	10.3
1943vl03	GOLD 70	Non-res.	8280	10000	96	365	337	0.43	86	10.4

Table 1: Certified values for each unit model.

[1] Pressure drop of filters were taken into account.
[2] High humidity recovery rates require careful design

Humidity recovery

The moisture recovery rate is over 90%. The latent and sensible recovery efficiencies are not entirely independent of one another but regulation of the humidity recovery is to a limited extend possible without significant effect on the sensible recovery.

Moisture recovery during winter can be beneficial in cold and dry climates, but in applications with high and regular moisture loads, such as in residential buildings, humidity recovery at such a high level could be critical, as indoor moisture may not be removed. In general, the use of high humidity recovery systems must be checked on a project-specific basis depending on the climate, building airtightness and internal moisture sources, and under consideration of the respective benefits.

Passive House comfort criterion

A supply air temperature of 16.5 °C is maintained at an outdoor air temperature of about -10.0 °C by use of a suitable post-heating element.

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)

- The heat recovery rates for each model of the unit are listed in Table 1.

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 m^3/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.

- The airflow ranges and available external pressures for each model of the unit are listed in Table 1.

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 non-residential buildings at an external pressure difference of 238-365 Pa.

- The specific electric powers for each model of the unit are listed in Table 1.

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 kKh, heating time: 5400 h/a), an average performance number at the airflow range was determined.

- The performance numbers for each model of the unit are listed in Table 1.

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.

- These appliances meet the airtightness requirements.

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

- Balancing of the airflow rates of the unit is possilbe.
  - ✓ The airflow volumes can be held steady automatically (by using the fan inlet pressure based standard flow control function provided in the control)
- The standby power consumption of these devices makes 15 W.
- 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. The total acoustic power levels were determined by producer for each model of the units at an upper limit of the airflow range.

Unit model	Testing requirements	Airflow range		Total acoustic power level		
				Casing	Duct	
		Min	Max		ETA	SUP
		m³/h	m³/h	dB(A)	dB(A)	dB(A)
GOLD 04	Non-residential	540	1270	50	58	73
GOLD 05	Non-residential	540	1100	49	57	73
GOLD 07	Non-residential	540	1770	53	62	75
GOLD 08	Non-residential	1080	1900	52	60	75
GOLD 11	Non-residential	1080	2670	56	64	78
GOLD 12	Non-residential	1800	2930	55	63	79
GOLD 14	Non-residential	1800	4500	59	68	82
GOLD 20	Non-residential	2520	4290	56	65	79
GOLD 25	Non-residential	2520	5730	58	68	81
GOLD 30	Non-residential	3600	4660	57	66	80
GOLD 35	Non-residential	3600	8000	60	69	82
GOLD 50	Non-residential	5400	10000	60	69	82
GOLD 70	Non-residential	8280	10000	60	68	82

Tabele 2: Acoustic power levels at an upper limit of the airflow range.

- 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

This unit is to be equipped with the following filter qualities:

Outdoor air filter	Extract air filter
ISO ePM1 50% (F7)	ISO Coarse 60% (G4)

On the outdoor air side, the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. For the extract air side, a filter efficiency of at least ISO Coarse 60% (G4 according to EN 779) is recommended. If not in standard configuration, the recommended filter is available as an accessory part.

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

Frost protection

Appropriate measures should be taken to prevent the heat exchanger and optional downstream hydraulic heating coil from freezing damage during extreme winter temperatures (−15 °C). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
  - ✓ This series of ventilation units is equipped with rotor heat exchangers. There is no need for any additional frost protection strategy down to an outdoor air temperature of -15 °C.
- Frost protection of downstream hydraulic heater coils:
  - ✓ As default, this series of ventilation units is supplied with a frost protection function as standard. For this purpose, a temperature sensor must be installed on the supply air side, which is available as a standard unit accessory.

  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 avoided if the air duct is closed (by means of a shutoff damper).

Bypass of the heat recovery

The heat recovery is regulated by stepless control of the rotation speed of the heat exchanger.