CERTIFICATE

Certified Passive House Component

Valid until 31st December 2024

Passive House Institute
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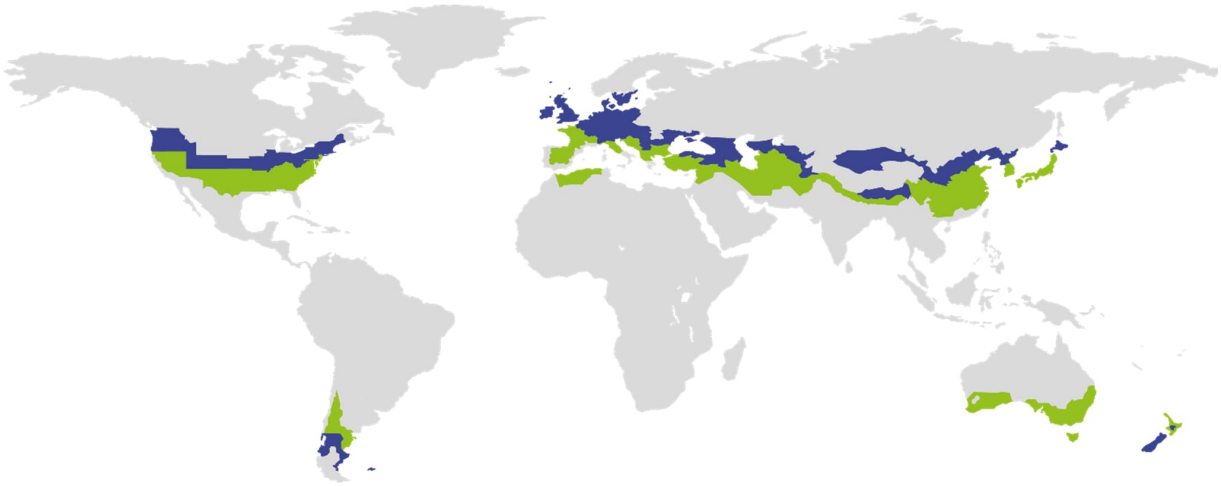

Category:	**Air handling unit with heat recovery**
Manufacturer:	**Oxygen8 Solutions Inc.**
	Canada
Product name:	**Ventilation unit series**
	Ventum H
Specification:	Airflow rate > 353 cfm
Heat exchanger:	Recuperative

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

Heat recovery rate	η_{HR}	≥	75 %
Specific electric power	$P_{el,spec}$	≤	0.77 W/cfm
Leakage		<	3 %
Comfort	Supply air temperature ≥ 61.7 °F at outdoor air temperature of 14 °F [3]		

Airflow range
1295 cfm at an external pressure of 1.01 in.wc.
Heat recovery rate
η_{HR} ≥ 75 % [2]
Specific electric power
$P_{el,spec}$ ≤ 0.75 W/cfm
Humidity recovery
η_x ≥ 60 %
Performance number
> 8.9

[1] The pressure drop of filters is covered in the listed external pressure. Additional components decrease the available pressure difference accordingly.

[2] For residential use a heat recovery rates of 80% and better can be applied.

[3] Achieved by use of an external electric preheater.

cool, temperate climate

CERTIFIED COMPONENT
Passive House Institute

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Component ID	Unit model	Airflow range Min cfm	Airflow range Max cfm	η_x [2] %	External pressure in.wc	Actual available external pressure [1] in.wc	Specific electric power W/cfm	η_{HR} %	$\eta_{HR,res.}$ [2] %	Performance number -
2298vl03	Ventum H 10	306	560	65	0.88	0.76	0.65	76	81	10.2
			306				0.65	81	86	
2299vl03	Ventum H 15	353	750	65	0.95	0.80	0.75	76	81	8.9
2300vl03	Ventum H 20	424	1035	65	1.04	0.86	0.72	76	81	9.3
			424				0.75	82	87	
2301vl03	Ventum H 30	871	1295	65	1.09	0.91	0.61	76	81	10.9
			871				0.63	79	84	

Table 1: Certified values for each unit model.

1) Filter pressure losses have been deducted.
2) the energy saved by moisture recovery through evaporation from building components was taken into account as a bonus on the heat recovery rate. For use in residential buildings, the stated heat recovery rates can be applied.

Humidity recovery

Indoor air humidity can be increased by using systems with moisture recovery in cool, temperate climate, especially during winter. Exemplary measurements showed a moisture recovery of ≥ 60.

- 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.

- Application of moisture recovery:
  - ✓ In cool temperate climates, heat exchangers with moisture recovery should 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

In order to maintain comfortable supply air temperatures at outdoor temperatures of 14 °F, an external preheating coil must be installed. The manufacturer recommends appropriately dimensioned electric preheater coils from Neptronic, which are available as accessories. In setting 2 (preheater setting "hand" 70%), a supply air temperature of 61.7 °F was maintained at an outdoor air temperature of 14 °F (validated by measurements).

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 η_{HR} for each model of the unit are listed in Table 1.

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. $\eta_{HR,res}$ (table 1) can therefore be applied for residential use.

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 > 353 cfm the applicable pressure differences vary with the nominal range of operation (as declared by the producer).

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 devices including controllers have been determined at an external pressure difference of 0.764 – 1.09 in.wc (validated with test measurements).

- 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 standby power consumption of these devices makes 12.3 W.
- After a power failure, the device will automatically resume operation.

Acoustical testing

Unit model	Airflow range		Total acoustic power level				
				Duct			
	Min	Max	Casing	ODA	SUP	ETA	EHA
	cfm	cfm	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
Ventum H 10	306	1300	57		64		64
Ventum H 15	353	1750	60		70		70
Ventum H 20	854	2235	60		71		71
Ventum H 30	1100	2690	59		68		68

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

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. The provided values have not been verified as part of the certification process.

- For compl[illegible] the required sound level in the supply air and extract air rooms, dimensioning of a suitable silencer is required for the specific project.

353 cfm

Indoor air quality

This device is equipped with following filter qualities:

Outdoor air filter	Extract air filter
ISO ePM1 50% (M13)	ISO ePM10 60% (M8)

If the device is not operated during summer, the filter should be replaced before the next operation.

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:
  - ✓ An external preheating coil is required to protect the heat exchanger from freezing. The manufacturer recommends an appropriate sized preheating coil from Nep[illegible] 5 °F The frost protection has been verified using the H5 appliance as an example.

- Frost protection of downstream hydraulic heater coils:
  - ✓ The appliance is designed to switch off when the temperature falls below a set supply air temperature. The switching point for the supply air limit temperature and the time must be entered in the menu. The function has been tested on the H5 device.

  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 units are equipped with an automatically controlled summer bypass. The effectiveness of bypass for night cooling of buildings has not been investigated within the scope of this testing.