

Certificate

Certified Passive House Component

For cool, temperate climates, valid until 31 December 2018

Category: **Heat recovery unit**
Manufacturer: **Systemair GmbH**
97944 Boxberg-Windischbuch,
GERMANY
Product name: **MAXK-I3 DC Series (2000 to 7000)**

This certificate was awarded based on the following criteria:

Thermal comfort	$\theta_{\text{supply air}} \geq 16.5 \text{ °C}$ at $\theta_{\text{outdoor air}} = -10 \text{ °C}$
Effective heat recovery rate	$\eta_{\text{HR,eff}} \geq 75\%$
Electric power consumption	$P_{\text{el}} \leq 0.45 \text{ Wh/m}^3$
Performance number	≥ 10
Airtightness	Interior and exterior air leakage rates less than 3% of nominal air flow rate
Balancing and adjustability	Air flow balancing possible: yes Automated air flow balancing: yes ¹⁾
Sound insulation	It is assumed that large ventilation units are installed in a separate building services room. Sound levels documented in the appendix of this certificate
Indoor air quality	Outdoor air filter F7 Extract air filter G4
Frost protection	Frost protection required, recommended strategies mentioned in the appendix of this certificate

1) With optional pressure measuring device and adjustment control.

Further information can be found in the appendix of this certificate.

www.passivehouse.com

Passive House Institute
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Certified for air flow rates of 600-6200 m³/h
Requirements non residential buildings

(Therewith device also applicable for residential building)

$\eta_{\text{HR,eff}} \geq 84\%$

Electric power consumption $\leq 0.45 \text{ Wh/m}^3$

Performance number ≥ 10



CERTIFIED COMPONENT

Passive House Institute

Appendix of the certificate Systemair GmbH, MAXK-I3 DC Series (2000 to 7000)

Manufacturer Systemair GmbH
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 E-Mail: info@systemair.de, www.systemair.com

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C at an external air temperature of -10 °C can only be maintained if an adequate frost protection system with pre or post heating coils is installed. The controller comes with corresponding algorithms.

Effective heat recovery rate

The effective dry heat recovery efficiency is measured at the test facility with balanced mass flows on the outdoor air/extract air side. The boundary conditions for the measurement are defined in the testing procedure.

$$\eta_{HR,eff} = \frac{(\dot{q}_{ETA} - \dot{q}_{EHA}) + \frac{P_{el}}{m \cdot c_p}}{(\dot{q}_{ETA} - \dot{q}_{ODA})}$$

The (dry) ventilation heating load (building is the system boundary: Plus Infiltration) can be calculated:

$$Q_{Ventilation,dry} = V \cdot (100\% - \eta_{WRG,t,eff}) \cdot 0,34 \cdot \Delta \vartheta$$

In case of condensation the heat recovery rate usually is higher. For the thermodynamic testing air conditions are chosen which exclude condensation. The heat recovery rates of the particular devices are listed in section "Specifications of the particular design sizes".

Air flow 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 m³/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 of the clean filter.

The probed device was tested according to the requirements for non-residential buildings. The available pressure differences after reduction of the pressure losses of installed filters are listed in section "Specifications of the particular design sizes".

Efficiency criterion (power consumption)

The overall electrical power consumptions of the devices including controllers are listed in section "Specifications of the particular design sizes".

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Based on the measured values for the determination of the heat recovery rate, the power consumption and the climatic data of middle Europe (Gt: 84 kWh, heating time: 5400 h/a), the average performance number for the range of operation was determined:

- ✓ **Performance number: ≥ 10**

Airtightness and insulation

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

Following leakage rates for two particular unit sizes were measured:

Internal leakage: $\leq 2.3\%$

External leakage: $\leq 1.7\%$

The appliances meet the air tightness requirements.

Balancing and adjustability

The ventilation unit must provide the opportunity to adjust the balance between the exhaust and outdoor air flow (unit located inside of the thermal envelope) or the extract and supply air flow (unit located outside of the thermal envelope). Possible operation modes are explained in detail in the operation manual.

- Balancing the air flow rates of the unit:
 - ✓ automatically (measurement of pressure differences at fan injection nozzle)
 - ✓ manually (by the installer)
- The standby consumption of this ventilation appliance (when only the controller is active) is 1.1 W
- After a power failure the device automatically resets into its last operation mode.

Sound Protection

A ventilation unit $> 600 \text{ m}^3/\text{h}$ is assumed to be operated in an installation room, for which sound limits are defined in the applicable regulations. The sound level values for the particular devices that have been derived from the measurements are listed in section "Specifications of the particular design sizes".

- In order to not exceed sound level limits silencers might be required and need to be dimensioned as per the project requirements and on basis of these sound levels.

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Indoor air quality

Information about the filter exchange are given in the manual. The device is equipped with following filters:

- ✓ Outdoor Air filter F7
- ✓ Extract Air filter M6

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

For the operation of the ventilation system a strategy for avoiding permanent moisture penetration of the outdoor air filter needs to be provided. As one of the possible strategies the recirculation of supply air into the outdoor air should be mentioned. Further strategies are listed in the certification report.

Frost protection

Appropriate measures must be provided in order to avoid icing inside the heat exchanger and freezing of the hydraulic post-heater coil during winter at extreme temperatures (-15°C). The actual function of the ventilation device must not be impaired by the regular operation of the frost protection system. A sufficient air supply must be provided with balanced air flows. Infiltration due to excess extract air would cause an unacceptable heat load. For the frost protection of the hydraulic post-heater coil the failure of a pre-heater coil or the exhaust air fan needs to be considered.

- Frost protection of the heat exchanger
 - ✓ According to the manufacturer information, several frost protection systems can be applied. The control algorithms for these systems are provided and described in the manual.
 - ✓ The device is equipped with an integrated outdoor air bypass, which can be used for frost protection in the case a post-heating coil is installed. Required control algorithms are provided. Usage of the direct electrical post-heater is not recommended.
 - ✓ Additionally it is recommended to use a ground-to-brine or a ground-to-air heat exchanger. The direct connection of suitable pumps, valves or flaps is possible.
 - ✓ The pre-heating of the outdoor air is only recommended if it is regulated according to the exhaust-air temperature. Otherwise the potential of a passive heat recovery would remain unused and heating / primary energy demand would increase. Usage of the direct electrical pre-heater is not recommended.
- Frost protection of post-heater coil:
 - ✓ Depending on the type of the installed hydraulic system, the frost protection of the pump and / or of the mixing valve is ensured via the integrated control unit.

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

Bypass of heat recovery

A controlled summer bypass is integrated in the system. The suitability for free night cooling was not analysed within the scope of these tests.

Abbreviations: ODA = Outdoor air, EHA = Exhaust air, SUP = Supply air, ETA = Extract air

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Specifications of the particular design sizes

Model	ID	Volumetric flow rate range		Max external pressure ¹⁾	Available external pressure ²⁾	Spec. electr. power consumption ³⁾	$\eta_{WRG,eff}$
		min	max				
		m ³ /h	m ³ /h				
MAXK I3 2000 DC	0239vI03	596	1400	243	217	0.39	84%
MAXK I3 3000 DC	0651vI03	700	2200	271	242	0.45	84%
MAXK I3 4000 DC	0652vI03	800	3200	294	270	0.45	84%
MAXK I3 5000 DC	0653vI03	1100	4200	316	290	0.45	84%
MAXK I3 6000 DC	0654vI03	1300	5200	328	299	0.45	84%
MAXK I3 7000 DC	0015vI03	1385	6200	360	328	0.43	87%

- 1) External pressure for conditions of certification
- 2) Effectively available external pressure with filters installed. Additional optional built-in components (eg. heater coils) decrease the available external pressure.
- 3) At the lower operational range the electrical power consumption slightly exceeds the value of 0.45 Wh/m³. For the Models 3000, 4000, 5000, 6000, 7000 the exceeding at the lower operational range is considerably (0.65 Wh/m³, constant pressure regulation assumed).

Model	ID	Sound level ⁴⁾				
		Casing	SUP	ETA	ODA	EHA
		dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
MAXK I3 2000 DC	0239vI03	63.7	79.2	60.3	58.6	78.4
MAXK I3 3000 DC	0651vI03	64.8	75.2	68.6	68.6	75.2
MAXK I3 4000 DC	0652vI03	65.8	80.4	73.3	73.3	80.4
MAXK I3 5000 DC	0653vI03	66.7	82.3	76.3	76.3	82.3
MAXK I3 6000 DC	0654vI03	67.9	80.7	74.3	74.3	80.7
MAXK I3 7000 DC	0015vI03	63.6	78.3	63.6	61.8	79.6

- 4) For use at the upper limit of the certified range

Abbreviations: ODA = Outdoor air, EHA = Exhaust air, SUP = Supply air, ETA = Extract air