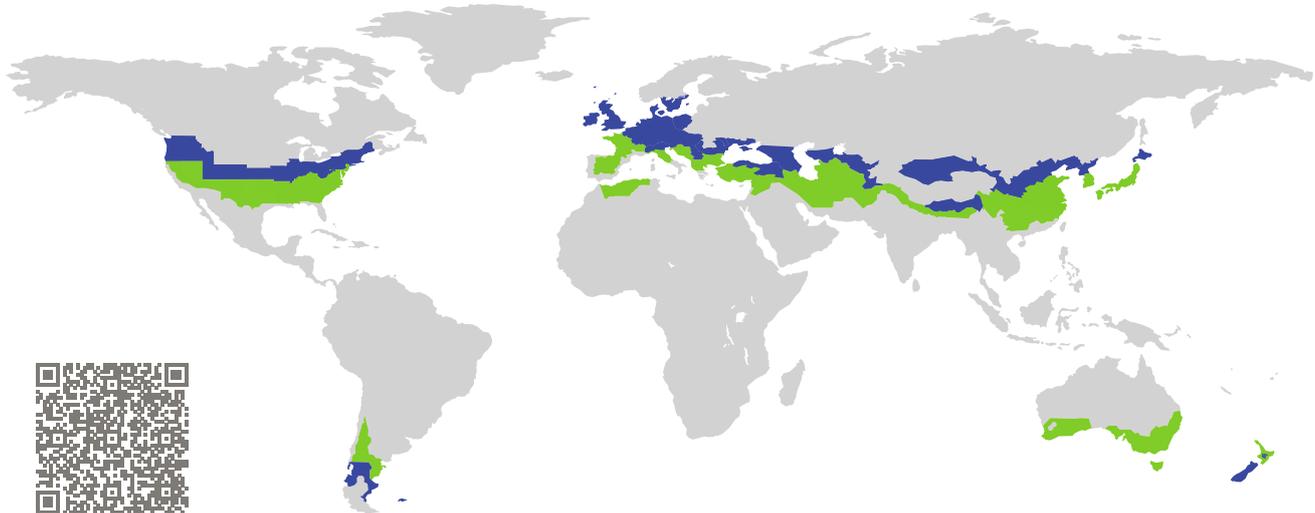


CERTIFICATE

Certified Passive House Component

Component-ID 0656vI03 valid until 31st December 2019

Passive House Institute
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Category: **Air handling unit with heat recovery**

Manufacturer: **Wolf GmbH
Germany**

Product name: **CKL-iH-3000; CKL-iV-3000**

Specification: Airflow rate < 600 m³/h

Heat exchanger: Recuperative

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

1010–2480 m³/h

at an external pressure of
281 Pa ²⁾

Requirements non-residential
buildings (Therefore also
applicable for residential building)

Heat recovery rate

$\eta_{HR} = 84\%$ ¹⁾

Specific electric power

$P_{el,spec} = 0.43$ Wh/m³

Performance number

10.1

¹⁾ At an airflow of 1090 m³/h, a heat recovery of $\eta_{HR} = 86\%$ is reached.

²⁾ Available pressure difference with installed filters makes **224 Pa**. Additional components (e.g. heater coil) decrease the available pressure difference accordingly.

cool, temperate climate



**CERTIFIED
COMPONENT**

Passive House Institute

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C is maintained at an external air temperature of -4.0 °C without activated frost protection strategy. It is assumed that at lower outdoor air temperatures the frost protection strategy will be activated and the comfort criterion will be 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 W h/(kg K)

Heat recovery rate

$\eta_{HR} = 84 \%$

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 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 that of the clean filter.

- This device was tested according to the requirements of non-residential buildings with an airflow range of **1010-2480 m³/h** at an external pressure difference of **281 Pa**. The available pressure difference with installed filters is about **224 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 non-residential buildings at an external pressure difference of 281 Pa.

Specific electric power

$$P_{el,spec} = 0.43 \text{ Wh/m}^3$$

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

10.1

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.

Internal leakage	External leakage
2.00 %	0.80 %

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 the airflow rates of the unit is possible.
 - ✓ The airflow volumes can be held steady automatically (by measurement of pressure differences at the fan inlet nozzle).
- The standby power consumption of this device makes 16.00 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 of **2400 m³/h**:

Device	Duct			
	Outdoor	Supply air	Extract air	Exhaust air
57.8 dB(A)	56.3 dB(A)	79.2 dB(A)	56.8 dB(A)	80.1 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
F7	M5

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 in the factory, or retrofitted to the system on-site.

Frost 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°C). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
 - ✓ The device is equipped with an outdoor-supply air bypass, which is controlled continuously by the exhaust and the outdoor air temperature. The switch-on temperature of the frost protection is set at an outside temperature of -3°C (factory setting). A heating coil is however mandatory for this strategy in order to maintain comfortable supply air temperatures. The manufacturer offers two different hydraulic heating coils (integrated / downstream) and an electric heating coil. The Passive House Institute recommends to install the frost protection strategy with hydraulic heater coil which is primary energetically favorable.
- Frost protection of downstream hydraulic heater coils:
 - ✓ As described in the technical manual this appliance shuts down both the fans if the supply temperature drops below $+5^{\circ}\text{C}$ behind the heater coil (changeable factory setting).
 - ✓ To eliminate the free circulation the device is equipped with valves in the exhaust air and outdoor air. The valves of the tightness class K2 close automatically when the fans are standing.

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).

Bypass of the heat recovery

A summer bypass of the heat recovery is part of this appliance. It is applicable for night ventilation strategies in order to dissipate heat. The fans cause a temperature raise of 1 K (at ODA 16°C / EHA 24°C). The effectiveness of the bypass for night cooling has been tested.