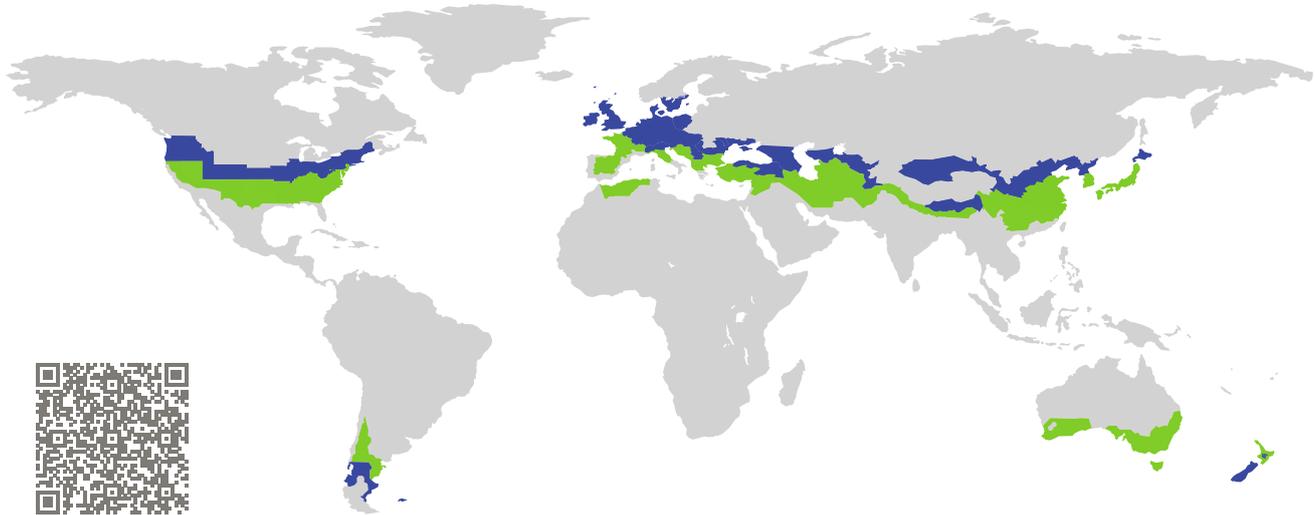


CERTIFICATE

Certified Passive House Component

Component-ID 0783vs03 valid until 31st December 2019

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**

Manufacturer: **Dantherm A/S
Denmark**

Product name: **Dantherm HCC 2**

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 $\eta_{HR} \geq 75\%$

Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$

Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature of -10°C

Airflow range

70–140 m³/h

Heat recovery rate

$\eta_{HR} = 93\%$

Specific electric power

$P_{el,spec} = 0.37 \text{ Wh/m}^3$

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 outdoor air temperature of -10 °C.

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

$$\eta_{HR} = 93\%$$

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.37 \text{ Wh/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.70$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

| Internal leakage | External leakage |
|------------------|------------------|
| 0.69 % | 0.48 % |

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).

- This unit is certified for airflow rates of 70–140 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 4.20 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

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 140 m³/h:

| Device | Duct | | | |
|------------|------------|------------|-------------|-------------|
| | Outdoor | Supply air | Extract air | Exhaust air |
| 52.8 dB(A) | 53.0 dB(A) | 68.4 dB(A) | 53.2 dB(A) | 69.3 dB(A) |

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

| Outdoor air filter | Extract air filter |
|--------------------|--------------------|
| G4 | G4 |

On the outdoor air / supply air side the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. If not standard configuration, the recommended filter is available as accessory part.

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.

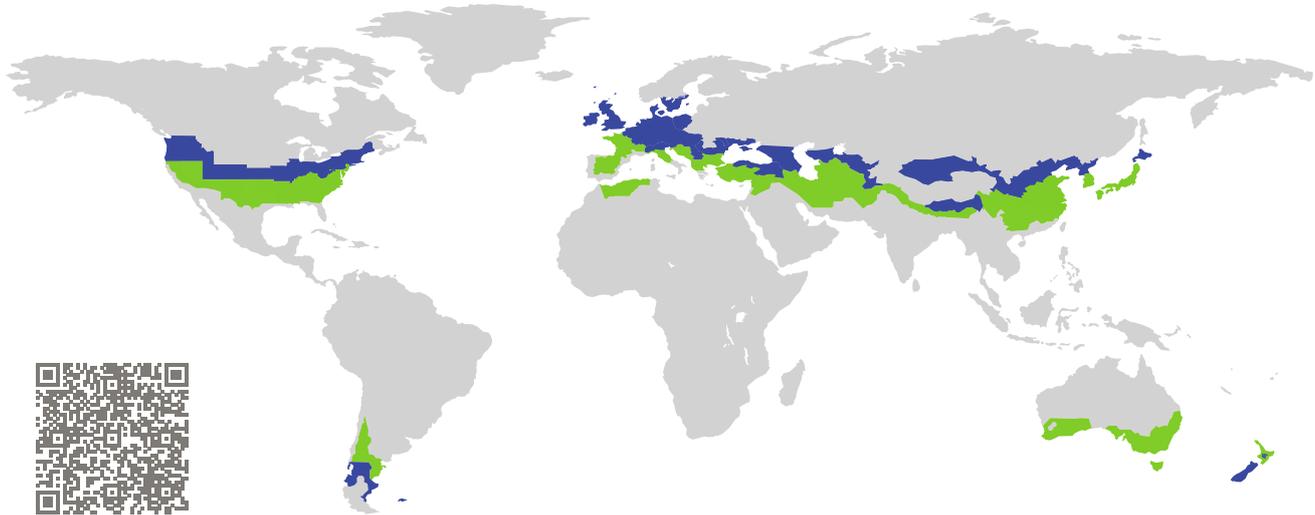
- Frost protection of the heat exchanger:
 - ✓ The default frost protection strategy set by producer of the unit is not according to the Passive House Institute's requirements. For the purposes of the measurements during certification process was the investigated ventilation unit equipped with the external preheater Dantherm EKA 125-0.9-1f.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic supply air heater, an undershooting of 5°C supply air temperature leads to a shutdown of the unit. In this case the display will show an error: „E11: supply temp $<5^{\circ}\text{C}$ “.

CERTIFICATE

Certified Passive House Component

Component-ID 0272vs03 valid until 31st December 2019

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**

Manufacturer: **Dantherm A/S
Denmark**

Product name: **Dantherm HCH 5**

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 $\eta_{HR} \geq 75\%$

Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$

Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature of -10°C

Airflow range

99–220 m³/h

Heat recovery rate

$\eta_{HR} = 81\%$

Specific electric power

$P_{el,spec} = 0.27 \text{ Wh/m}^3$

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 outdoor air temperature of -10 °C.

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

$$\eta_{HR} = 81 \%$$

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.27 \text{ Wh/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.63$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

| Internal leakage | External leakage |
|------------------|------------------|
| 0.55 % | 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).

- This unit is certified for airflow rates of 99–220 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 1.00 W. Hereby complies with the target value of 1 W.
- After a power failure, the device will automatically resume operation.

Acoustical testing

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 220 m³/h:

| Device | Duct | | | |
|------------|------------|------------|-------------|-------------|
| | Outdoor | Supply air | Extract air | Exhaust air |
| 51.8 dB(A) | 62.2 dB(A) | 59.2 dB(A) | 57.8 dB(A) | 68.6 dB(A) |

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

| Outdoor air filter | Extract air filter |
|--------------------|--------------------|
| G4 | G4 |

On the outdoor air / supply air side the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. If not standard configuration, the recommended filter is available as accessory part.

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.

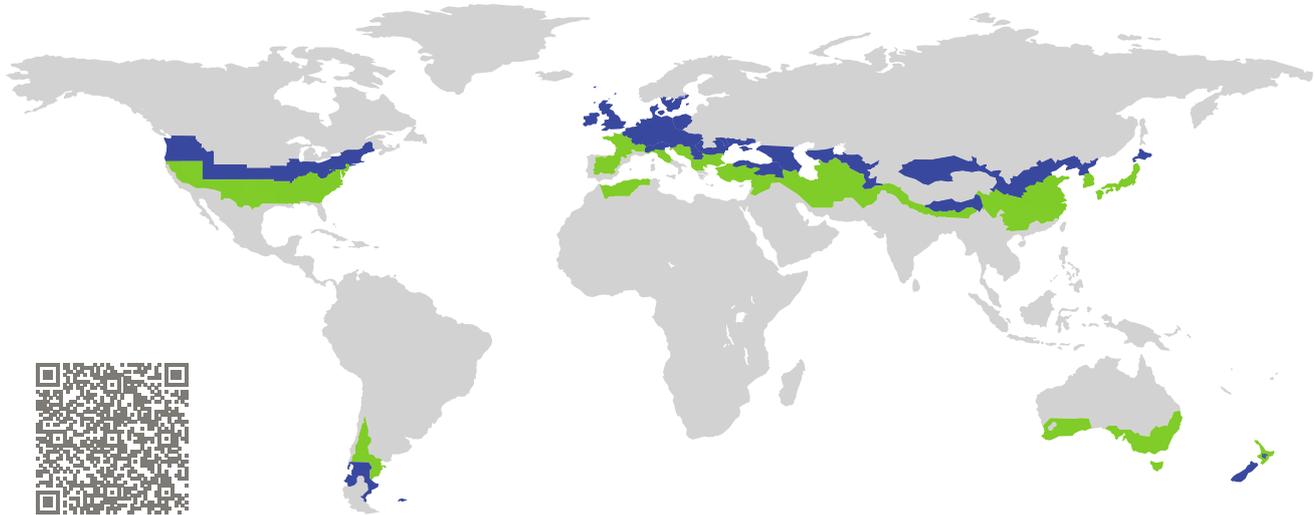
- Frost protection of the heat exchanger:
 - ✓ In order to protect the heat exchanger from freezing an additional frost protection system must be installed in the outdoor air duct. For this purpose the manufacturer recommends the device VEAB CV 16-12-1 MTXL / DN 160 with a heating power of 1.2 kW. Alternatively the manufacturer recommends a system with ground heat exchanger.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic heater coil in the supply air duct the device is switched off as soon as the supply air temperature falls below 5°C for at least 255 seconds. In this case the display will show an error.

CERTIFICATE

Certified Passive House Component

Component-ID 0273vs03 valid until 31st December 2019

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**

Manufacturer: **Dantherm A/S
Denmark**

Product name: **Dantherm HCH 8**

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 $\eta_{HR} \geq 75\%$

Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$

Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature of -10°C

Airflow range

135–340 m³/h

Heat recovery rate

$\eta_{HR} = 83\%$

Specific electric power

$P_{el,spec} = 0.26 \text{ Wh/m}^3$

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 outdoor air temperature of -10 °C.

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

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

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.26 \text{ Wh/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.65$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

| Internal leakage | External leakage |
|------------------|------------------|
| 0.70 % | 0.35 % |

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).

- This unit is certified for airflow rates of 135–340 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 1.40 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

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 340 m³/h:

| Device | Duct | | | |
|------------|------------|------------|-------------|-------------|
| | Outdoor | Supply air | Extract air | Exhaust air |
| 56.3 dB(A) | 63.1 dB(A) | 63.2 dB(A) | 58.8 dB(A) | 72.6 dB(A) |

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

| Outdoor air filter | Extract air filter |
|--------------------|--------------------|
| G4 | G4 |

On the outdoor air / supply air side the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. If not standard configuration, the recommended filter is available as accessory part.

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.

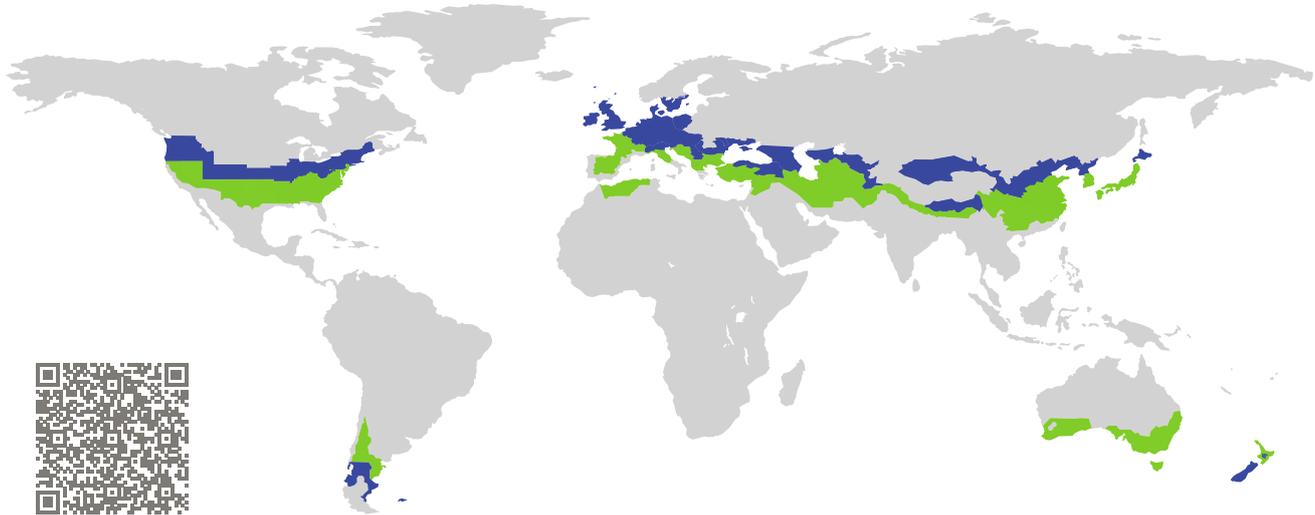
- Frost protection of the heat exchanger:
 - ✓ In order to protect the heat exchanger from freezing an additional frost protection system must be installed in the outdoor air duct. For this purpose the manufacturer recommends the device VEAB CV 25-18-1 MTXL / DN 250 with a heating power of 1.8 kW. Alternatively the manufacturer recommends a system with ground heat exchanger.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic heater coil in the supply air duct the device is switched off as soon as the supply air temperature falls below 5°C for at least 255 seconds. In this case the display will show an error.

CERTIFICATE

Certified Passive House Component

Component-ID 0274vs03 valid until 31st December 2019

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**

Manufacturer: **Dantherm A/S
Denmark**

Product name: **Dantherm HCV 3**

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 $\eta_{HR} \geq 75\%$

Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$

Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature of -10°C

Airflow range

60–140 m³/h

Heat recovery rate

$\eta_{HR} = 80\%$

Specific electric power

$P_{el,spec} = 0.29 \text{ Wh/m}^3$

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 outdoor air temperature of -10 °C.

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

$$\eta_{HR} = 80 \%$$

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.29 \text{ Wh/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.61$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

| Internal leakage | External leakage |
|------------------|------------------|
| 0.59 % | 1.80 % |

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).

- This unit is certified for airflow rates of 60–140 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 1.00 W. Hereby complies with the target value of 1 W.
- After a power failure, the device will automatically resume operation.

Acoustical testing

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 140 m³/h:

| Device | Duct | | | |
|------------|------------|------------|-------------|-------------|
| | Outdoor | Supply air | Extract air | Exhaust air |
| 52.6 dB(A) | 62.9 dB(A) | 58.7 dB(A) | 57.7 dB(A) | 66.7 dB(A) |

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

| Outdoor air filter | Extract air filter |
|--------------------|--------------------|
| G4 | G4 |

On the outdoor air / supply air side the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. If not standard configuration, the recommended filter is available as accessory part.

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.

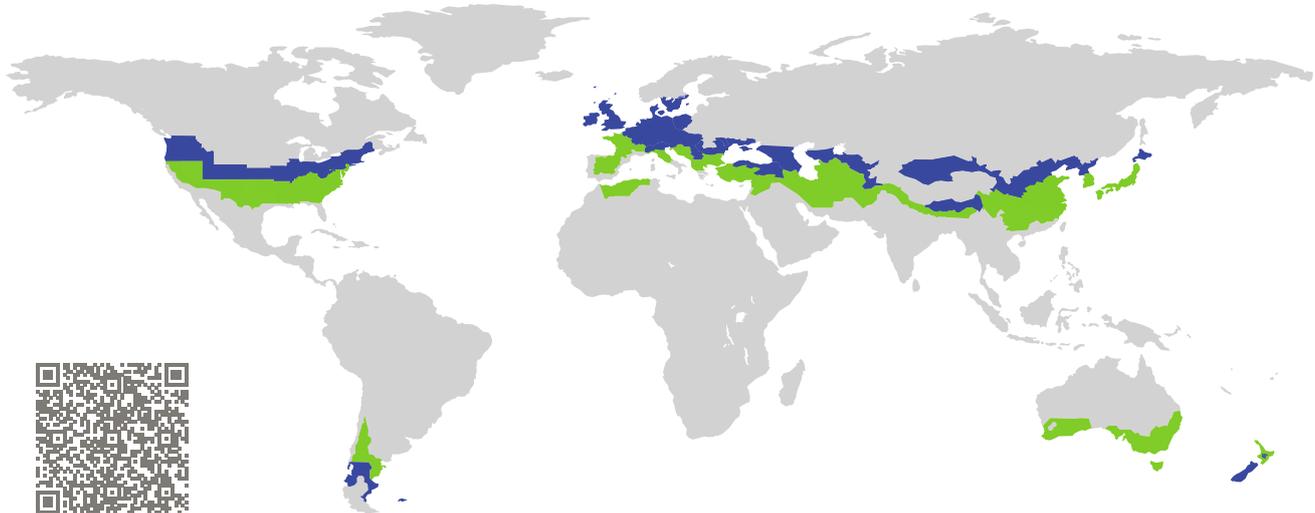
- Frost protection of the heat exchanger:
 - ✓ In order to protect the heat exchanger from freezing an additional frost protection system must be installed in the outdoor air duct. For this purpose the manufacturer recommends the device VEAB CV 12-9-1 MTXL / DN 125 with a heating power of 0.9 kW. Alternatively the manufacturer recommends a system with ground heat exchanger.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic heater coil in the supply air duct the device is switched off as soon as the supply air temperature falls below 5°C . In this case the display will show an error.

CERTIFICATE

Certified Passive House Component

Component-ID 0275vs03 valid until 31st December 2019

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**

Manufacturer: **Dantherm A/S
Denmark**

Product name: **Dantherm HCV 5**

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 $\eta_{HR} \geq 75\%$

Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$

Leakage < 3%

Comfort Supply air temperature $\geq 16.5^\circ\text{C}$
at outdoor air temperature of -10°C

Airflow range

99–220 m³/h

Heat recovery rate

$\eta_{HR} = 81\%$

Specific electric power

$P_{el,spec} = 0.27 \text{ Wh/m}^3$

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 outdoor air temperature of -10 °C.

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

$$\eta_{HR} = 81 \%$$

Efficiency criterion (electric power)

The overall electrical power consumption of the device is measured at the test facility at an external pressure of 100 Pa (50 Pa, respectively, for the intake and outlet). This includes the general electrical power consumption for operation and control but not for frost protection.

Specific electric power

$$P_{el,spec} = 0.27 \text{ Wh/m}^3$$

Efficiency ratio

The efficiency ratio provides information about the overall energy performance of the respective ventilation unit. It specifies the achieved reduction in ventilation heat losses by using a ventilation unit with heat recovery rather than without.

Efficiency ratio

$$\epsilon_L = 0.63$$

Leakage

The leakage airflow must not exceed 3 % of the average airflow of the unit's operating range.

| Internal leakage | External leakage |
|------------------|------------------|
| 0.34 % | 2.32 % |

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).

- This unit is certified for airflow rates of 99–220 m³/h.
- Balancing the airflow rates of the unit is possible.
- The user should have at least all the following setting options:
 - ✓ Switching the system on and off.
 - ✓ Synchronized adjustment of the supply and extract airflows to basic ventilation (70–80 %), standard ventilation (100 %) and increased ventilation (130 %) with a clear indication of the current setting.
- The device has a standby power consumption of 1.00 W. Hereby complies with the target value of 1 W.
- After a power failure, the device will automatically resume operation.

Acoustical testing

The required limit for the sound power level of the device is 35 dB(A) in order to limit the sound pressure level in the installation room. The sound level target value of less than 25 dB(A) in living spaces and less than 30 dB(A) in functional spaces must be ensured by installing commercial silencers. The following sound power levels are met at an airflow rate of 220 m³/h:

| Device | Duct | | | |
|------------|------------|------------|-------------|-------------|
| | Outdoor | Supply air | Extract air | Exhaust air |
| 51.8 dB(A) | 62.2 dB(A) | 59.2 dB(A) | 57.8 dB(A) | 68.6 dB(A) |

- The unit does not fulfil the requirements for the sound power level. The unit must therefore be installed acoustically separated from living areas.
- One example of suitable silencers for supply and extract air ducts is mentioned in the detailed test report or can be obtained from the manufacturer. It is recommended to identify suitable silencers for each individual project.

Indoor air quality

This unit is equipped with following filter qualities by default:

| Outdoor air filter | Extract air filter |
|--------------------|--------------------|
| G4 | G4 |

On the outdoor air / supply air side the filter efficiency of ISO ePM1 50% (F7 according to EN 779) or better is recommended. If not standard configuration, the recommended filter is available as accessory part.

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:
 - ✓ In order to protect the heat exchanger from freezing an additional frost protection system must be installed in the outdoor air duct. For this purpose the manufacturer recommends the device VEAB CV 16-12-1 MTXL / DN 160 with a heating power of 1.2 kW. Alternatively the manufacturer recommends a system with ground heat exchanger.
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic heater coil in the supply air duct the device is switched off as soon as the supply air temperature falls below 5°C for at least 255 seconds. In this case the display will show an error.