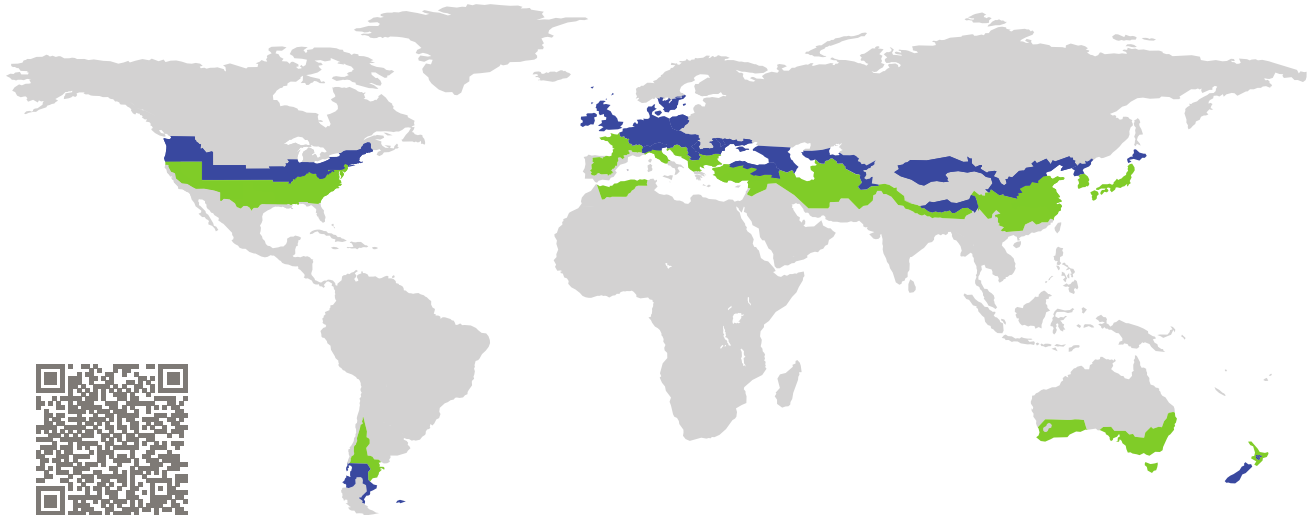


CERTIFICATE

Certified Passive House Component

Component-ID 0326vs03 valid until 31st December 2018

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**
Manufacturer: **Zehnder Group Nederland B.V.
Netherlands**
Product name: **ComfoAir160 HRV, ComfoD160 HRV,
ComfoD150 HRV**

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 -10°C

Airflow range
73–109 m ³ /h
Heat recovery rate
$\eta_{HR} = 89\%$
Specific electric power
$P_{el,spec} = 0.36 \text{ Wh/m}^3$

cool, temperate climate



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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 W h/(kg K)

Heat recovery rate

$$\eta_{HR} = 89 \%$$

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

$$P_{el,spec} = 0.36 \text{ Wh/m}^3$$

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

$$\epsilon_L = 0.67$$

Leakage

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

Internal leakage	External leakage
2.37 %	1.49 %

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 73–109 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 being tested can't be switched off and does not provide a standby modus. The device must be equipped with an external switch to disconnect it from the electric power supply 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 113 m³/h:

Device	Duct			
	Outdoor	Supply air	Extract air	Exhaust air
52.9 dB(A)	33.3 dB(A)	61.1 dB(A)	39.1 dB(A)	59.7 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 quality class F7 is recommended. If not standard configuration, the F7 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.

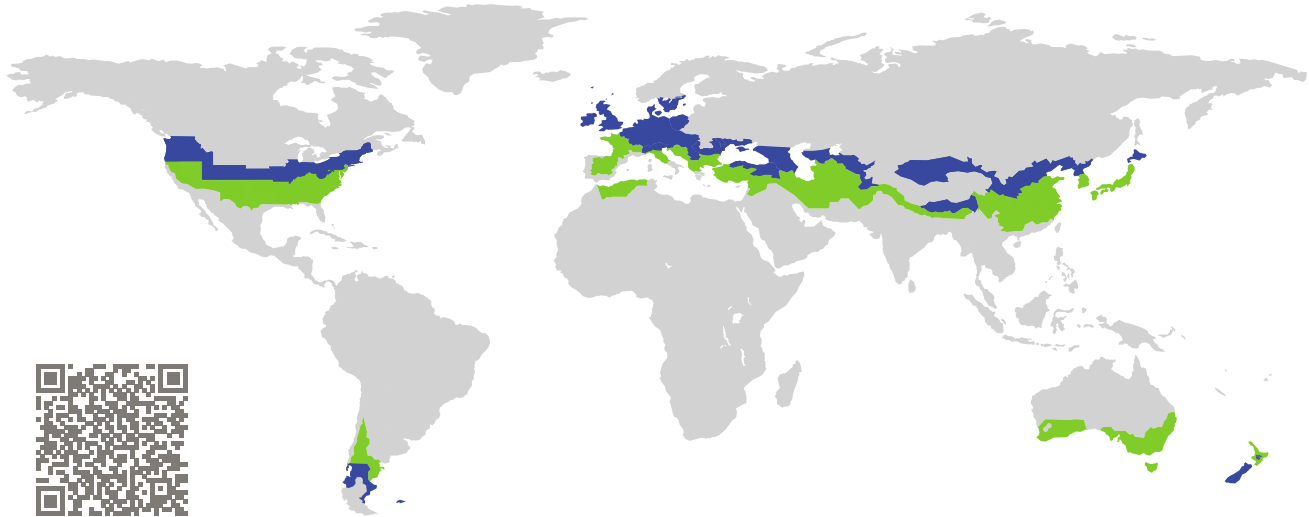
- Frost protection of the heat exchanger:
 - ✓ In order to protect the heat exchanger from freezing, the unit could be equipped optionally with an electrical preheater with a power output of up to 700 W at the upper air flow rate. This frost protection strategy (operating mode 2) is appropriate to protect the heat exchanger from frost down to an outdoor air temperature of -15°C (verified by measurement results). The frost protection strategy starts operating at an outdoor air temperature of -6°C .
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic supply air heater, an undershooting of 4.2°C supply air temperature leads to a shutdown of the unit. In this case the display will show an error.

CERTIFICATE

Certified Passive House Component

Component-ID 0325vs03 valid until 31st December 2018

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category: **Air handling unit with heat recovery**
Manufacturer: **Zehnder Group Nederland B.V.**
Netherlands
Product name: **ComfoAir160 ERV, ComfoD160 ERV,**
ComfoD150 ERV

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 -10°C

Airflow range
73–115 m ³ /h
Heat recovery rate
$\eta_{HR} = 85\%$
Specific electric power
$P_{el,spec} = 0.33 \text{ Wh/m}^3$
Humidity recovery
$\eta_x = 64\%$

cool, temperate climate



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Humidity recovery

Indoor air humidity can be increased by using a system with moisture recovery in a cool, temperate climate, especially during the winter. 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.

Humidity recovery

$$\eta_x = 64 \%$$

In case the unit's moisture recovery rate is larger than 60 % its airflow rate must be controlled based on the indoor air humidity, in order to prevent temporarily elevated humidity levels

- ✓ In order to provide humidity controlled air flow control, the manufacturer recommends the installation of the humidity sensor HS15P in the central extract air duct. The nominal value should be set to 55%.

Application of humidity recovery:

- In cool temperate climates, heat exchangers with moisture recovery should generally 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.

Passive House comfort criterion

A minimum supply air temperature of 16.5 °C is not maintained at an outdoor air temperature of -10 °C. The installation of a heater coil for supply air heating is required. For this purpose the manufacturer provides adequate additional components.

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.

$$\eta_{HR} = \frac{(\theta_{ETA} - \theta_{EHA}) + \frac{P_{el}}{\dot{m} \cdot c_p}}{(\theta_{ETA} - \theta_{ODA})} + 0.08 \cdot \eta_x$$

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)
- η_x Humidity recovery in %
for $\eta_x \geq 60\%$, the heat recovery increase ($0.08 \cdot \eta_x$) is limited to a maximum of 4.80 %

Heat recovery rate
$\eta_{HR} = 85\%$

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
$P_{el,spec} = 0.33 \text{ Wh/m}^3$

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
1.92 %	1.45 %

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 73–115 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 being tested can't be switched off and does not provide a standby modus. The device must be equipped with an external switch to disconnect it from the electric power supply 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 115 m³/h:

Device	Duct			
	Outdoor	Supply air	Extract air	Exhaust air
53.8 dB(A)	35.9 dB(A)	61.4 dB(A)	40.6 dB(A)	57.2 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 quality class F7 is recommended. If not standard configuration, the F7 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 unit could be equipped optionally with an electrical preheater with a power output of up to 700 W. If the device is equipped with an enthalpy heat exchanger, the parameter P59 (installer menu) must be set to 1 (enthalpy heat exchanger with enthalpy sensors installed).
- Frost protection of downstream hydraulic heater coils:
 - ✓ In order to protect a downstream hydraulic supply air heater, an undershooting of 4.2 °C supply air temperature leads to a shutdown of the unit. In this case the display will show an error.