CERTIFICATE

Certified Passive House Component

Component-ID 2421ch03 and 2422ch03 and 2423ch03
valid until 31st December 2025

Passive House Institute
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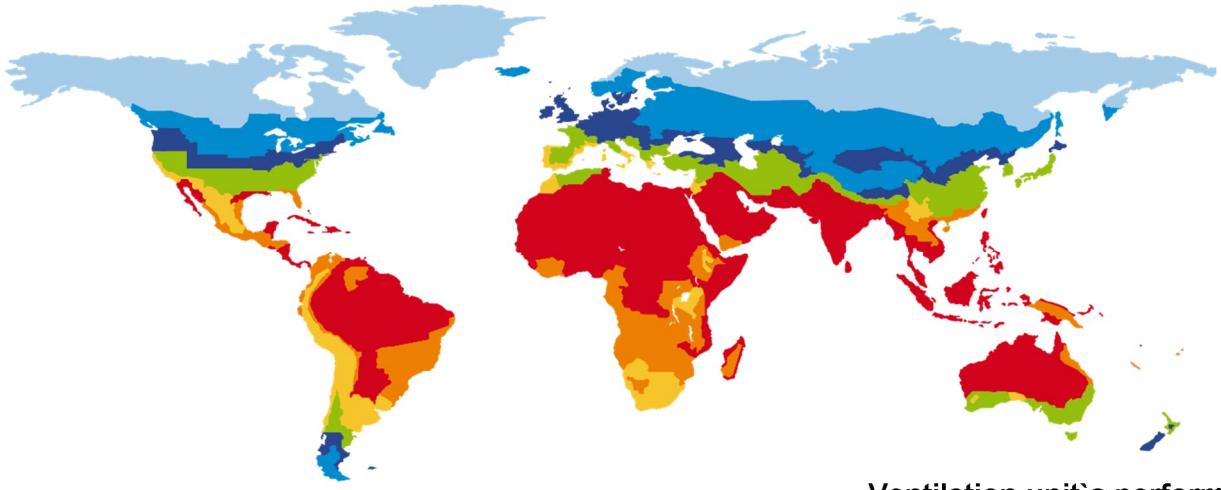
64283 Darmstadt
Germany



Category: **Compact unit**
Manufacturer: **Nilan A/S**
Denmark
Product name: **Compact P2 (Combi 400 Top)[1)]**

Type of heat pump:
Heat exchanger: recuperative

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

Ventilation unit

Heat recovery rate	η_{HR}	≥	75 %
Specific electric power	$P_{el,spec}$	≤	0.45 Wh/m³
Leakage		<	3 %
Comfort	Supply air temperature ≥ 16.5 °C at outdoor air temperature of -10 °C		

Heat pump [2)]

Space heating	9 kWh/(m²a)
Space Heating + DHW	20 kWh/(m²a)
Space cooling (humid climate):	13 kWh/(m²a)
Space cooling (dry climate):	11 kWh/(m²a)

Ventilation unit`s performance: [1) 3)]

Airflow range
70…360 m³/h
Heat recovery rate
η_{HR} = 81 and 85 %
Specific electric power
$P_{el,spec}$ = 0.24 and 0.21 Wh/m³
Humidity recovery rate
η_x = – %

Heat pump`s performance: [1)]

Heat Pump – space heating
7 kWh/(m²a)
Heat Pump – Heating + DHW
15 kWh/(m²a)
Cooling DRY
– kWh/(m²a)
Cooling HUMID
– kWh/(m²a)

[1)] all certified units and operational modes are listed in detail in the appendix of this certificate
[2)] limit values for final energy (electricity) demand
[3)] the unit is equipped with ventilation unit.

CERTIFIED COMPONENT
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Ventilation performance for all three operational modes

	Heat recovery	Electric Efficiency [Wh/m³]	Useful range of operation [m³/h]	Cert-ID
Nilan Compact P2 (2025) 139 m³/h	**85%**	**0.21**	**70 … 150**	**2421ch03**
Nilan Compact P2 (2025) 276 m³/h	**81%**	**0.24**	**120 … 280**	**2422ch03**
Nilan Compact P2 (2025) 398 m³/h	**80%**	**0.39**	**180 … 360**	**2423ch03**

Heat pump performance

Space Heating and Domestic Hot Water (DHW) preparation

		Operation						
		Space air-heating	DHW	Total (SpH + DHW)	SPF	max. air flow	External pressure	Cert-ID
Mode No	Unit	kWh/(m²a)	kWh/(m²a)	kWh/(m²a)		m³/h	Pa	
1	139 m³/h	6.1	7.1	14.3	2.3	150	50	2421ch03
2	276 m³/h	6.2	6.1	14.2	2.4	280	50	2422ch03
3	398 m³/h	7.0	6.0	15.4	2.2	360	100	2423ch03

The listed final energy demand (electricity) for the HP system was derived from energy balance calculation of a reference building. For details see below, page 3.

The max. useful operational range with respect to air flow was derived from the pressure losses and external pressure capacity respectively, which the unit is able to deliver.

Cooling: the units operating in mode No 2 and 3 (279 and 398 m³/h) can provide about 1.5 to 2 kW air-cooling respectively. For mode No 1 no explicit measurements are available.

This cooling power helps to improve summer indoor comfort by reducing indoor temperatures in addition to passive cooling measures like shading and passive night cooling by cross ventilation.

		Operation				
		HUMID		DRY		Cert-ID
Mode No	Unit	kWh/(m²a)	m²	kW	m²	
1	139 m³/h	–	–	–	–	2421ch03
2	279 m³/h	–	–	1.6	–	2422ch03
3	398 m³/h	–	–	2.0	–	2423ch03

Thermal Comfort: A minimum supply air temperature of 16,5°C is reached if the air first passes through earth tubes, i.e. the intake air of the ventilation system must have a temperature of at least –9 °C.

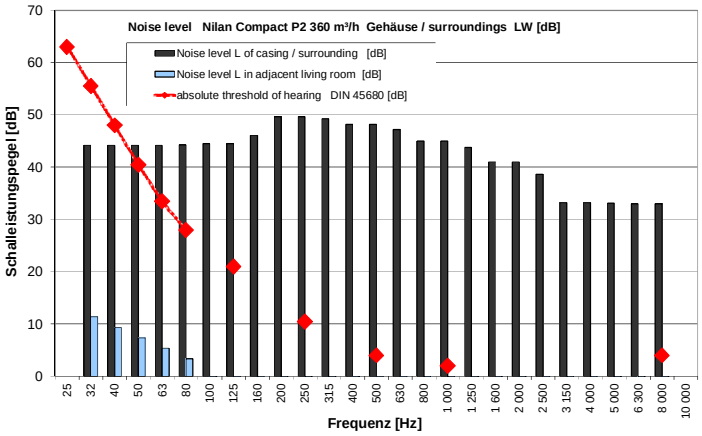
Efficiency Criterion – heat: The heat recovery of the ventilation system incorporated in the unit demonstrates an efficiency as listed.

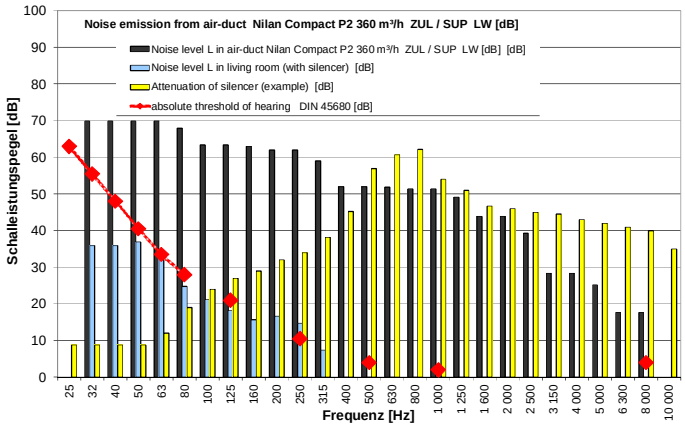
Efficiency Criterion – electricity: With a power consumption of 0.21 Wh/m³ to 0.39, see tables above the unit complies in each operational mode with the maximum consumption of 0.45 Wh/m³. The consumption of 10 W in standby-mode exceeds the target value of 1 W. As the unit is always in operation this value should be optimized.

Air tightness and thermal insulation: Testing the ventilation system showed that the limiting values of 2.0 % for both the internal and external leakages were not exceeded.

Control and calibration: The user can select one of for ventilation levels via the console, which are factory-set at 25 % / 45% / 70% / 100% of the maximum air flow rate. These air flow rates can be adjusted separately when configuring or programming the unit.

Sound suppression: The acoustic pressure level was evaluated as 54 dB (A) in the room where the unit is installed with an equivalent absorption area of 4 m² and at an air flow rate of 212 m³/h. This is significantly higher than the threshold value of 35 dB(A), the unit must therefore be installed in an adequately sound insulated room separate from the living area. The sound level coming from supply air ducts 61 dB(A) and exhaust air ducts 73 dB(A) is similarly too high and thus adequate silencers have to be used always to keep the noise level in all living rooms and sleeping rooms below 25 dB(A) ─ the hearing threshold. At other operating points with lower air-flow rates the sound level is lower.





Hygienic Indoor Air: The central ventilation unit, including the heat exchanger, can be easily accessed and cleaned. The filters can be replaced by the user (rather than by a technical expert), instructions and suppliers are included in the manual. The following filter qualities should be used: intake air filter minimum F7 or ISO ePM1 50%, attached in front, exhaust air filter G4 or ISO Coarse 60%. The filter should be replaced, before recommissioning the unit after a summer period when it has not been in use. The manufacturer carries the responsibility to ensure that, through the use of either integral components or mandatory additional fittings, the hygienic quality of the air is sufficiently high. An F7 and a G4 filter are installed respectively in the intake and exhaust air streams within the unit. This configuration is in accordance with the recommendations for Passive Houses.

For calculation of DHW consumption, the value of 25l/(person.day) of water at 60°C has been used (cold water temperature of 10°C). The volume of the DHW tank is 180 liters, see tables. The heat losses of DHW storage tank are included in calculation.

Frost protection: An **anti-freeze strategy** is included with this unit. This should be supported and used in conjunction with a ground to air heat exchanger. The ground heat exchanger or any similar device must guarantee a minimum air temperature of the intaken air higher than –4 °C. An electrical heater for anti-freeze protection is not allowed for operation with the heat pump, because the additional electrical energy consumption is not included in the COP numbers for the heat pump denoted in the certificate.

Assessment of the heat pump: The final energy (electricity) demand of the heat pump system installed in the reference building are listed in the table on page 2. The calculations were done for those operational modes, with measurement data available. The according seasonal performance factors (SPF) of the system for all operational modes are listed in the table as well.

This compact heat pump unit can be used in Passive Houses with an energy reference area (TFA, treated floor area) of 70 up to 340 m² respectively. The air volume flow has to be adjusted accordingly by using the operational modes No 1 or 2 or 3 as listed on page 2. The according energy balance calculation of the reference building is based on a typical occupancy of 35 m²/person, an air flow rate of 30 m³/h/person and a heating load of 12 W/m².

The unit was tested in combination with a specially selected **hot water storage.** If another hot water storage is used the certified key values of the heat pump system especially the COP-values, the useful range of application and thus the seasonal performance factor (SPF) may differ significantly from the values denoted in the certification sheet.

The type of refrigerant used: R134 A in amount of 2.0 kg for the Compact P2

Hint: The qualities (COP) of the heat pump were examined for the nominal air flows listed on page 2. The unit does not need to be operated necessarily exactly at one of these operational modes. In fact the air flow of the device must be adjusted for any configuration and size of the building according to the air flow which is needed to provide hygienic indoor air quality. For the energy balance calculation (PHPP) of the building the planer has to decide which point of operation is best compatible to the building configuration. According to that the key-values of the one or the other point of operation are to be chosen.

The **maximum available supply air temperature** at maximum heat load of the building ─ when the heat pump is running exclusively ─ is listed in the tables below. If there is a higher heat load needed for a building this may be realized by external electrical heaters. Then the available higher value ($T_{supplyair\_max}$) is taken for the sheet "heating load" in PHPP. In this case it must be assured that the direct-electrical backup heating is only used to cover the peak load. That means in detail: the direct electrical peak load heating may only be activated by the user if and only if the heat pump is working at full power and this thermal power is not enough. The maximum supply air temperature should never exceed 52 °C to avoid dust burning smell.

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Nilan Compact P2 data table with detailed parameters for PHPP worksheet 'Compact':

Compact P2 (139 m³/h) unit: ID 2421ch03

Space Heating

T Source [°C]	T Sink [°C]	HP heating Capacity [kW}	COP	Pel WP input [kW]
7.20	**45.19**	**1.120**	**2.57**	**0.436**
2.00	**41.07**	**1.074**	**2.46**	**0.436**
-7.00	**34.79**	**0.816**	**2.04**	**0.399**
Max supply air temperature		**35 °C**		

DHW & Storage:

DHW		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-6.9**	**1.9**	**7.2**	**20.2**	°C
Thermal Output Heat Pump for heating up storage tank.	P_{DHW} heating up	**0.51**	**0.72**	**0.89**	**1.02**	kW
Thermal Output Heat Pump for reheating storage tank	P_{DHW} reheating	**0.54**	**0.71**	**0.83**	**0.94**	kW
COP Heat Pump for heating up storage tank	$COP_{DHW,}$ heating up	**2.11**	**2.60**	**3.08**	**3.38**	-
COP Heat Pump for reheating storage tank	COP_{DHW} reheating	**1.94**	**2.50**	**2.80**	**3.05**	-
Averge storage tank temperature		**50.5**	**°C**			
Specific storage heat losses		**1.63**	**W/K**			
Nominal storage Volume		**180**	**Liter**			
Exhaust air addition (if applicable)		**—**	**m³/h**			

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Nilan Compact P2 data table with detailed parameters for PHPP worksheet 'Compact':

Compact P2 (276 m³/h) unit: ID 2422ch03

Space Heating

T Source [°C]	T Sink [°C]	HP heating Capacity [kW}	COP	Pel WP input [kW]
6.70	**31.96**	**1.675**	**3.73**	**0.449**
2.00	**29.19**	**1.645**	**3.74**	**0.440**
-7.00	**24.11**	**1.101**	**2.49**	**0.443**
Max supply air temperature		**31°C**		

DHW & Storage:

DHW		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-4.0 °C**	**2.0 °C**	**7.0 °C**	**20.2 °C**	°C
Thermal Output Heat Pump for heating up storage tank.	P_{DHW} heating up	**0.60**	**0.83**	**0.99**	**1.14**	kW
Thermal Output Heat Pump for reheating storage tank	P_{DHW} reheating	**0.53**	**0.82**	**0.95**	**1.05**	kW
COP Heat Pump for heating up storage tank	COP_{DHW} heating up	**2.13**	**2.87**	**3.31**	**3.68**	-
COP Heat Pump for reheating storage tank	COP_{DHW} reheating	**1.81**	**2.72**	**3.05**	**3.28**	-
Averge storage tank temperature		**50.5**	**°C**			
Specific storage heat losses		**1.63**	**W/K**			
Nominal storage Volume		**180**	**Liter**			
Exhaust air addition (if applicable)			**m³/h**			

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Nilan Compact P2 data table with detailed parameters for PHPP worksheet 'Compact':

Compact P2 (398 m³/h) unit: ID 2423ch03

Space Heating

T Source [°C]	T Sink [°C]	HP heating Capacity [kW}	COP	Pel WP input [kW]
6.70	**28.66**	**2.192**	**4.02**	**0.545**
2.00	**27.30**	**2.039**	**3.91**	**0.521**
-7.00	**22.82**	**1.401**	**3.16**	**0.443**
Max supply air temperature		**28°C**		

DHW & Storage:

DHW		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-4.0 °C**	**2.0 °C**	**7.0 °C**	**20.2 °C**	°C
Thermal Output Heat Pump for heating up storage tank.	P_{DHW} heating up	**0.60**	**0.83**	**0.99**	**1.14**	kW
Thermal Output Heat Pump for reheating storage tank	P_{DHW} reheating	**0.53**	**0.82**	**0.95**	**1.05**	kW
COP Heat Pump for heating up storage tank	COP_{DHW} heating up	**2.13**	**2.87**	**3.31**	**3.68**	-
COP Heat Pump for reheating storage tank	COP_{DHW} reheating	**1.81**	**2.72**	**3.05**	**3.28**	-
Averge storage tank temperature		**50.5**	**°C**			
Specific storage heat losses		**1.63**	**W/K**			
Nominal storage Volume		**180**	**Liter**			
Exhaust air addition (if applicable)			**m³/h**			