Certificate

Passive House Suitable Component

For cool temperate climates, valid until 31. December 2020

Passivhaus Institut
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GERMANY

Category: **Compact Heat Pump System**

Manufacturer: **Pichler G.m.b.H.**
9021 Klagenfurt, AUSTRIA

Product name: **PKOM 4**

This certificate was awarded based on the following criteria (limit values*):

Thermal Comfort:	$\theta_{supply\ air} \geq 16.5°C$
Heat Recovery of ventilation system:	$\eta_{WRG,eff} \geq 75\%$
Electric efficiency ventilation system:	$P_{el} \leq 0.45$ Wh/m³
Air tightness (internal/external):	$V_{Leakage} \leq 3\%$
Total Primary Energy Demand (**):	$PE_{total} \leq 55$ kWh/(m²a)
Control and calibration (*)	
Air pollution filters (*)	
Anti freezing strategy (*)	
Noise emission and reduction (*)	

Measured values to be used in PHPP
useful air flow rates 121 to 192 m³/h

Heating

		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-15**	**-7**	**2**	**7**	°C
Thermal Output Heating Heat Pump	$P_{WP,Heiz}$	**0.612**	**0.933**	**0.771**	**0.776**	kW
COP number Heating Heat Pump	COP_{Heiz}	**1.53**	**2.61**	**3.15**	**3.86**	-
Maximum available supply air temperature with Heat Pump only(*)		**33**				°C

Hot water

		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-7**	**2**	**7**	**20**	°C
Thermal Output Heat Pump for heating up storage tank.	P_{DHW} heating up	**0.84**	**1.15**	**1.38**	**1.67**	kW
Thermal Output Heat Pump for reheating storage tank	P_{DHW} reheating	**0.80**	**1.19**	**1.35**	**1.66**	kW
COP Heat Pump for heating up storage tank	$COP_{DHW,}$ heating up	**2.28**	**2.97**	**3.34**	**3.94**	-
COP Heat Pump for reheating storage tank	COP_{DHW} reheating	**2.02**	**2.88**	**3.10**	**3.76**	-
Average storage tank temperature		**45**				°C
Specific storage heat losses		**1.51**				W/K
Exhaust air addition (if applicable)		**200**				m³/h

(*) detailed description of criteria and key values see attachment.
(**) for heating, domestic hot water (DHW), ventilation, auxiliary electricity in the reference building, explanation see attachment.
(***) All key values of heat pump were measured with enthalpy (humid) heat exchanger. The dry heat recovery was measured, too and is shown here alternatively. All other key values are valid respectively for dry heat recovery, too.

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Heat Recovery by enthalpy heat exchanger(***)
$\eta_{WRG,eff}$ = 85%

alternative:
Dry Heat Recovery by heat exchanger(***)
$\eta_{WRG,eff}$ = 88%

Electric efficiency
0.33 Wh/m³

Air tightness
$V_{leak,\ internal}$ = 0.8%
$V_{leak,\ external}$ = 1.4%

Frost protection
down to -15 °C

Total Primary Energy Demand (**)
45 kWh/(m²a)

CERTIFIED COMPONENT
Passive House Institute

Attachment to the Certificate(***) Pichler, PKOM 4

Manufacturer **J. PICHLER Gesellschaft m.b.H.**
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t: +43 (0)463 327 69 - 0
e: info@pichlerluft.at
i: www.pichlerluft.at

Thermal Comfort: A minimum supply air temperature of 16.5 °C is reached with use of the heat pump. An underground air channel is not required.

Efficiency Criterion – heat: The heat recovery of the ventilation system incorporated in the unit demonstrates an efficiency of η_{eff} = 85 %.

Efficiency Criterion – electricity: With a power consumption of 0.33 Wh/m³ at 192 m³/h the unit complies with the maximum consumption of 0.45 Wh/m³. The consumption of 9.6 W in a standby-mode exceeds the target value of 1 W significantly.

Air tightness and thermal insulation: The testing of a ventilation system showed that the limiting values of 3% for both the internal and external leakages were not exceeded.

Control and calibration: A comparison of air volumes is performed automatically by the device. The required air volume can be adjusted via a control panel on the device with four set points. The volume rate of each set point can be programmed individually.

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. The humidity recovery rate for this unit is 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 probably too high humidity levels

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.

The manufacturer provides a control strategy for air flow rates as follows: The air flow can be controlled by CO2 level as well as humidity level. If humidity sensors are installed, an upper and a lower limit for humidity level can be defined. If the relative humidity is lower than e.g. 30 % the air flow is reduced. If the relative humidity is higher than 60 % air flow is raisen continuously. As long as humidity is between the defined limit values, air flow rates according to set values are used.

(***) A full description of measured results (test report of PHI) is available from the manufacturer

Attachment to the Certificate(***) Pichler, PKOM 4

Sound insulation: The acoustic pressure level was evaluated as 49 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 200 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 separated from the living area, see figure 1. The appropriate silencers should be provided to reduce the noise. The producer will specify a configuration of the silencer, see figure 2.

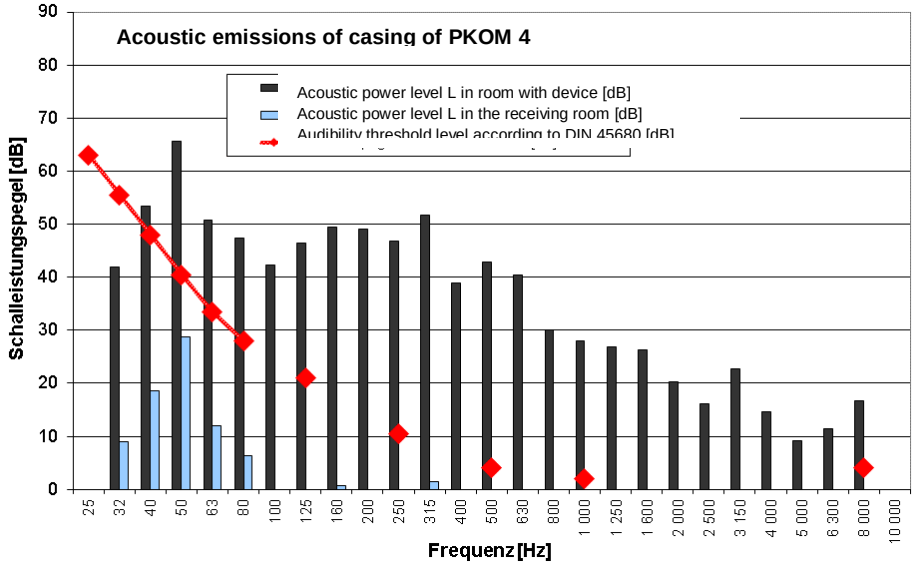

Figure 1: Noise emission of casing of unit PKOM4

The unit has to be placed inside a room, which is sufficiently noise separated from adjacent rooms.

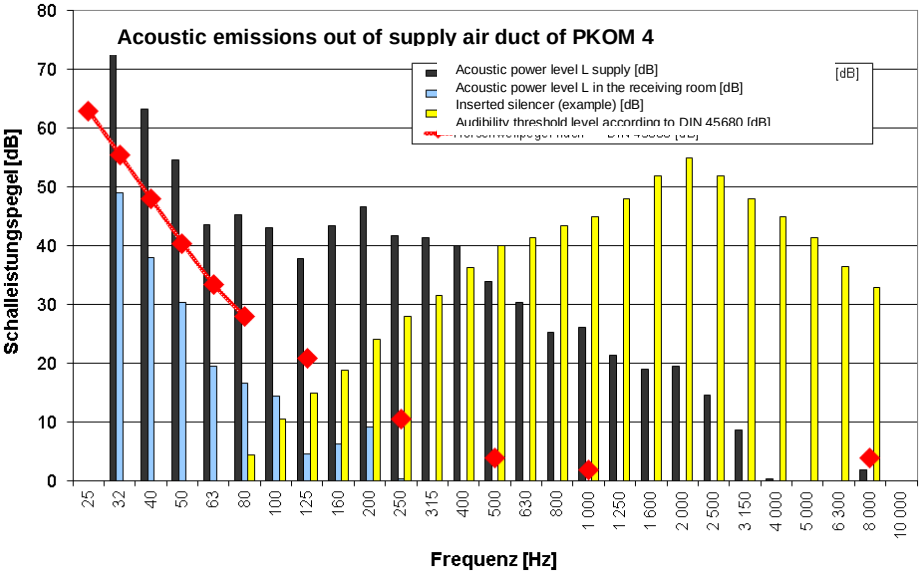

Figure 2:
Acoustic emissions of supply duct of the unit PKOM 4. Manufacturer provides a suitable set of silencers

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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 F5, installed inside the unit, exhaust air filter minimum G4. 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 M5 filter are installed respectively in the intake and exhaust air streams within the unit. The producer recommends to install a separate fine filter (F7) in the supply stream. The configuration of a F7 filter complies with the recommendations for use in passive houses.

Frost protection: The device is protected against the icing via a hydraulic circuit of the installed heat pump. An underground air channel is therefore not required. The minimum supply air temperature of 16.5 °C is ensured solely by the frost-protection circuit of the heat pump.

Assessment of the heat pump: The seasonal performance factor (SPF) of the system installed in the reference building is 2.1 without use of a ground heat exchanger. The primary energy consumption for the reference building is 45 kWh/(m²a) without use of a ground heat exchanger, see figure 3. This compact heat pump unit can be used in Passive Houses with an air flow rate between 121 m³/h and 192 m³/h, based on an air flow rate of 30 m³/h/person and a heating load of 12 W/m². The outdoor air intake temperatures are raised when a ground heat exchanger is used. The use of a typical ground heat exchanger (***) results in improved values of SFP (2.4) and primary energy consumption (40 kWh/(m²a)).

The **maximum available supply air temperature** at a maximum heat load, when the heat pump is running exclusively, was found to be **33 °C** at the operating points mentioned in the certificate. In case a higher heat output and hence a higher intake air temperature is needed, this can be realized for example by means of a direct electric heater.

In any case, the electrical circuit must ensure that a direct electrical heater can be activated only by the user when the heat pump operates at full power. The same applies to the configuration of the supply air temperature increased by the heat pump which may also be activated only when necessary. The supply air temperature may not be under any circumstances increased above 52 °C.

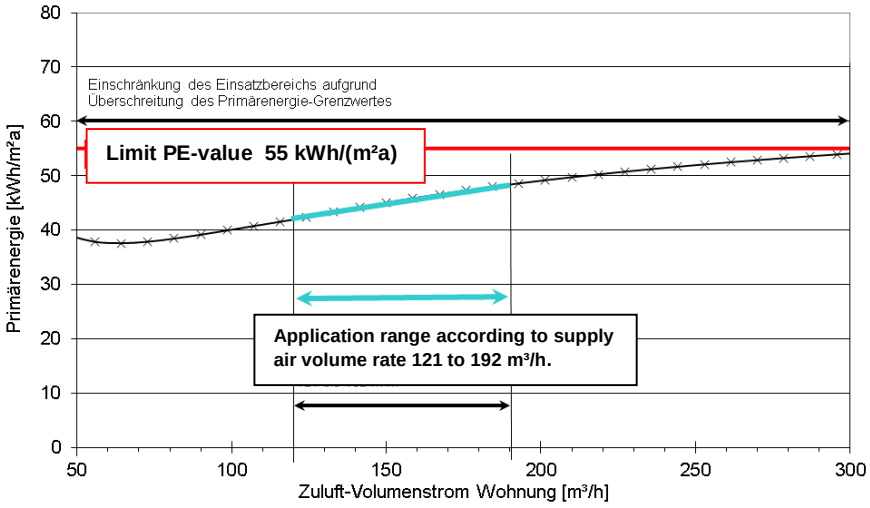

Figure 3: Application range of the unit PKOM 4. Primary Energy demand of reference building without ground heat exchanger.

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