Certificate

Passive House Suitable Component
For cool temperate climates, valid until 31. December 2019

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Category: **Compact Heat Pump System**
Manufacturer: **Tecalor GmbH,**
37603 Holzminden, Germany
Product name: **TCO 2.5**

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 120 to 230 m³/h

Heating

		Test point 1	Test point 3	Test point 3	Test point 4	
Outside Air Temperature	T_{amb}	**-7**	**2**	**7**		°C
Thermal Output Heating Heat Pump	$P_{WP,Heiz}$	**1.74**	**1.22**	**0.98**		kW
COP number Heating Heat Pump	COP_{Heiz}	**1.97**	**2.93**	**3.30**		-
Maximum available supply air temperature with Heat Pump only(*)		**35**				**46**

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	**3.04**	**2.88**	**3.27**	**3.30**	kW
Thermal Output Heat Pump for reheating storage tank	P_{DHW} reheating	**2.85**	**2.76**	**3.08**	**3.10**	kW
COP Heat Pump for heating up storage tank	$COP_{DHW,}$ heating up	**2.14**	**2.57**	**3.11**	**3.68**	-
COP Heat Pump for reheating storage tank	COP_{DHW} reheating	**1.99**	**2.48**	**2.97**	**3.52**	-
Averge storage tank temperature		**43.5**				°C
Specific storage heat losses		**1.54**				W/K
Exhaust air addition (if applicable)		**910**				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.

Heat Recovery
$\eta_{WRG,eff}$ = 82%

Electric efficiency
0.39 Wh/m³

Air tightness
$V_{leak,\ internal}$ = 0.71%
$V_{leak,\ external}$ = 1.7%

Frost protection
down to -15 °C

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

cool, temperate climate

CERTIFIED COMPONENT
Passive House Institute

www.passivehouse.com **1357ch03**

Attachment to the Certificate(***) Tecalor, TCO 2.5

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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} = 82 %.

Efficiency Criterion – electricity: With a power consumption of 0.39 Wh/m³ at 175 m^3/h the unit complies with the maximum consumption of 0.45 Wh/m³. The consumption of 18.6 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 user has therefore no influence. The required air volume can be adjusted via a control panel on the device. The remote control has a switch, which can be used to increase an amount of air for a pre-set time.

Sound insulation: The acoustic pressure level was evaluated as 56 dB (A) in the room where the unit is installed with an equivalent absorbtion area of 4 m² and at an air flow rate of 230 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. The appropriate silencers should be provided to reduce the noise. The producer will specify a configuration of the silencer.

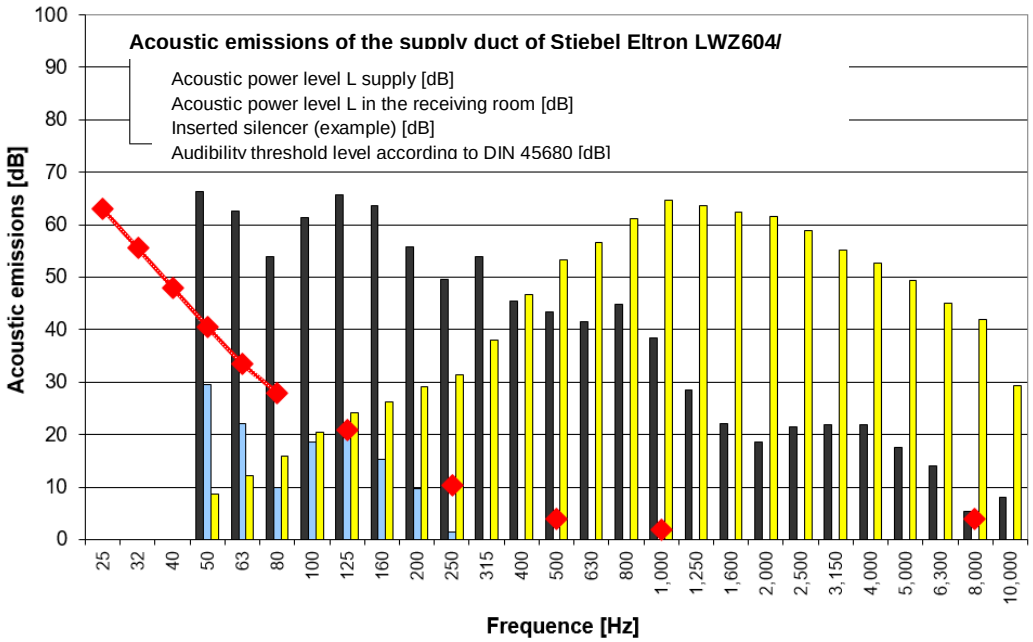

Figure 1:
Acoustic emissions of supply duct of the unit Stiebel Eltron LWZ 604 [dB]

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, attached in front, exhaust air filter 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 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 1.9 without use of a ground heat exchanger. The primary energy consumption for the reference building is 37.5 kWh/(m²a) without use of a ground heat exchanger. This compact heat pump unit can be used in Passive Houses with an air flow rate between 120 m³/h and 230 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 (1.9) and primary energy consumption (36.4 kWh/(m²a)).

The **maximum available supply air temperature** at a maximum heat load, when the heat pump is running exclusively, was found to be **46 °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. Alternatively the temperature of supply air can be increased by changing the configuration of the heat pump according to the manufacturer's instructions. In this case, the higher amount is entered in the heat load sheet of PHPP. Alternatively, the radiators can be used in connection with the heat pump. This is preferable to an operation with a higher supply air temperature.

In each case, the electrical circuit must ensure that a direct electrical heater can be only activated 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.

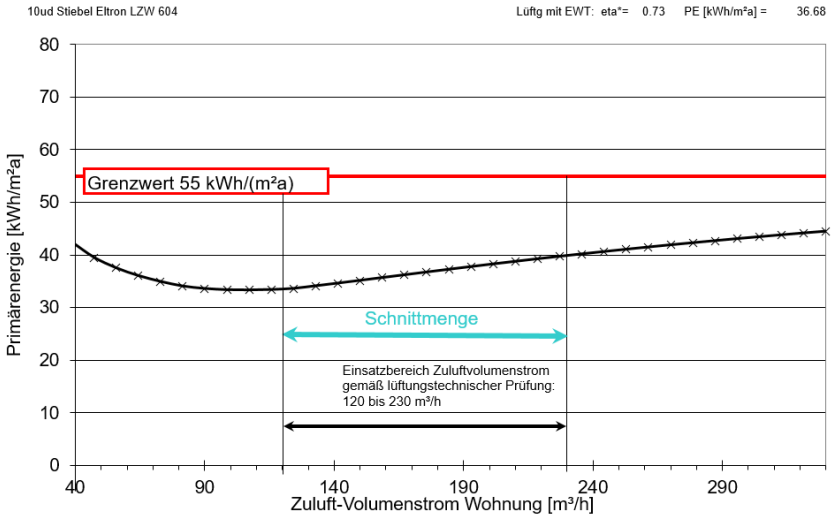

Figure 2: Application range of the unit Stiebel Eltron LWZ 604

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