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Requirements and testing conditions for energy efficiency, comfort, acoustic and hygienic assessment of air-to-air heat pumps for Certification as “Passive House suitable component”

Short description

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1. Preface

The following certification criteria describes the testing procedure and performance requirements for the energy efficiency, thermal comfort, acoustic and hygienic assessment of split-type air-to-air heat pumps with electric compressors (from now on referred to as “tested unit”) to be considered as “certified energy efficient heating/cooling systems for Passive House”.

For the certification of heat pumps as “Passive House suitable components”, the below requirements must be verified by an independent inspecting authority approved by the Passive House Institute. All measured data and documentation for the unit must be made available to the Passive House Institute.

The manufacturer must provide the independent authority with a standard unit for testing. Specially prepared appliances will not be accepted for testing and must be taken back at the cost of the manufacturer. The inspecting authority must guarantee a testing procedure in accordance with these testing regulations.

2. Requirements

2.1 Acoustical testing

The methods described in the ISO 3743-2 standard [1] should be used to determine the sound level pressure of the tested unit. If the laboratory used is not equipped with a special reverberation test room, the ISO 3743-1 standard [2] can be followed instead.

The maximally accepted value of the sound pressure level of the inside unit is 25 dB (A) in order to consider room comfort. All measurements must therefore be done with the air flow of the inside unit generating a maximal sound pressure level of 25 dB(A). Only in this way can a user be informed about the performance of the unit at comfortable operation.

Additionally, the sound emissions generated by an outside unit are to be evaluated for two typical set ups. A maximum sound pressure level generated by the outside unit in accordance with following is recommended:

- max. day value 55 dB(A), max. night value 40 dB(A)

2.2 Energy Efficiency

The seasonal performance of tested unit is evaluated by the Passive House Institute for representative climates. This is based on the key characteristics determined for space heating, cooling and dehumidification operating modes at all test points specified in the testing regulations and stated in the certificate.

Verification is based on a model Passive House with a heating/cooling load of 10 W/m², a heating/cooling demand of 15 kWh/(m²a).

The Passive House Institute uses three reference climates, first for heating (cool,temperate), second for sensible cooling (hot and dry), and third for sensible cooling and dehumidification (hot and humid). It is up to the manufacturer to decide which climate the unit will be certified for.

This forms the basis for the calculation of the energy balance in PHPP [3]. The limiting value for efficiency is final-energy demand of 8 kWh/m²y for heating and 6 kWh/m²y for cooling and dehumidification. Different performance classes will also be specified during 2017.
The unit will perform differently in different sized buildings (as a result of operating at different part load), therefore the results are presented in relation to the building size. (One should also keep in mind that this will look different for different climates, building type and building use. In the end, these influences will be taken care of by the building designers, who will use the same characteristic input data for the performance of the unit for specific building in PHPP [4].)

The investigation also includes part load and ON/OFF operation of the unit, as those have a substantial influence on performance. De-frost function is also included in the testing procedure, with the focus on the time which it takes to go back to heating mode, frequency in the occurance of the defrost function and it’s effect on the efficiency of the tested unit. In case of cooling, the possibility to control the level of dehumidification is to be evaluated (particularly important for humid climates).

The following test points are to be measured in a laboratory:

Cooling scenario[1)]				
Temperature [°C]		Operation (part-load)		
Outside	Inside	30% from ON/OFF Limit*	ON/OFF Limit**	Maximum***
40	25	optional	optional	required
35	25	required	required	required
30	25	optional	optional	required

1) All the mesurements are to be carried out at room relative humidity of 60%. Sensible heat ratio (SHR) should be documented for all the test points.

Heating scenario				
Temperature [°C]		Operation (part-load)		
Outside	Inside	30% from ON/OFF Limit*	ON/OFF Limit**	Maximum***
-7	20	optional	optional	required
2	20	required	required	required
7	20	optional	optional	required

* approx. 30% of the power available at test point “ON/OFF Limit”
** the smallest power of tested unit available at continuous operation (if the power would be further decreased, the tested unit would start to switch on and off)
*** maximum power available for longtime operation at mode generating max. 25 dB(A) (as defined in section 2.1)

In case of multi-split system, the power should be evenly distributed to all the inside units.

2.3 Comfort criterion

The comfortable use of tested unit in a Passive House building is important. For this purpose the draught rating for each measuring point based on ISO 7730 [3] will be evaluated and documented. The maximum draught rating allowed in the occupied zone is 15%, according to ISO 7730 [3].

2.4 Standby

The electrical power consumption of the tested unit (including controls, as well as any essential external systems) is to be ascertained purely for standby operation of the apparatus.

The energy consumption during standby mode should not exceed 1 W, otherwise the manufacturer should provide the possibility for a complete disconnection from the electrical supply as a standard solution.

2.5 Hygienic requirements

Devices providing cooling below the dew point have to provide hygienic drainage for the condensate and must provide very good maintenance and cleaning options. Mould growth in the cooling coil and drainage area must be avoided. The instructions for cleaning the units should be described by the manufacture.

Access to the filters and drainage system for the condensate (internal unit) is to be described. The user should be able to access the filters without the need for assistance from professionals. It should be also possible for the user to remove the front plate of the internal unit in order to do the basic maintenance (including the cleaning of the heat exchanger). The drainage of the condensate from the internal unit is to be evaluated and the test should be carried out according to EN 14511-4 [5]. The construction of the drainage system should allow immediate removal of condensate from the unit in order to avoid mould growth.

It is recommended to agree upon measurement details with the Passive House Institute prior to the measurements. Any eventual deviations from the above described test methods should be consulted with Passive House Institute.

References

[1] ISO 3743-2:1994, Acoustics -- Determination of sound power levels of noise sources using sound pressure -- Engineering methods for small, movable sources in reverberant fields -- Part 2: Methods for special reverberation test rooms

[2] ISO 3743-1:2010, Acoustics -- Determination of sound power levels and sound energy levels of noise sources using sound pressure -- Engineering methods for small movable sources in reverberant fields -- Part 1: Comparison method for a hard-walled test room

[3] ISO 7730:2005, Ergonomics of the thermal environment -- Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

[4] http://www.passiv.de/en/04_phpp/04_phpp.htm

[5] EN 14511-4, Air conditioners, liquid chilling packages and heat pumps with electrically driven
compressors for space heating and cooling –Part 4: Operating requirements, marking and instructions