PASSIVE HOUSE INSTITUTE

Rheinstraße 44/46
64283 Darmstadt
Germany
www.passiv.de

Quality Approved Passive House Certification - Criteria for Residential Passive Houses

Passive Houses are buildings in which a comfortable temperature can be achieved year-round with minimal energy inputs. Passive Houses must meet very stringent requirements regarding both their design and construction. To ensure that these requirements have been met, it is possible to have Passive Houses tested and certified. The certification criteria for residential buildings are described below (certification criteria for both non-residential and residential buildings are also published on the Passive House Institute website at www.passiv.de).

1. Certification criteria:

Specific space heating demand	**≤ 15 kWh/(m²yr)**
or heating load	**≤ 10 W/m²**
Total specific primary energy demand	**≤ 120 kWh/(m²yr) incl. household electricity**
Air changes (pressure test result)	**≤ 0.6/h**

The reference area, known as the Treated Floor Area (TFA), is equal to the net floor area inside the building's thermal envelope as calculated according to the German living space regulations (WoFIV).

Calculations may take into account the entire volume enclosed by the building envelope, for example, a complete row of terraced houses or a whole apartment building, and may either treat the area within the building envelope as a whole or in terms of the weighted averages of several sub-zones. Combining thermally separated buildings is not permissible. For the certification of refurbishments or extensions, the area considered must contain at least one external wall, part of a roof and a floor slab or basement ceiling. Single units inside a multi-storey building cannot be certified.

The Passive House Planning Package 2007 (PHPP 2007) must be used to verify fulfilment of the certification criteria. For the specific space heating demand, either the annual or monthly calculation method can typically be used. Should the heating demand be less than 8 kWh/(m²yr) or should the ratio of free heat to heat losses exceed 0.70 using the annual method, however, the monthly method must be used.

The current criteria available on www.passiv.de are always to be used for certification. These criteria, as published on www.passiv.de, override any potential discrepancies that may be found in the calculation methodology as described in the PHPP and accompanying PHPP handbook.

The criteria as described here have been especially adapted for the boundary conditions of cold, moderate climates such as that of Central Europe and may require review in the case of deviating climatic conditions. The definition of a Passive House as published on www.passiv.de remains unchanged, regardless of climatic considerations.

2. Essential documents for Passive House certification:

2.1 Signed PHPP with the following calculations: **PHPP Worksheet**
(Please attach the Excel calculations)

- ☐ Summary of property details and criteria fulfilment verification ..... **Verification**
- ☐ Summary of areas with allocation of U-values, radiation balance data and thermal bridges ..... **Areas**
- ☐ U-values of regular building elements..... **U-values**
- ☐ List of building elements used..... **U-list**
- ☐ Window U-values ..... **Windows**
- ☐ List of windows and glazings used..... **WinType**
- ☐ Ground reduction factors, if used ..... **Ground**
- ☐ Shading factors ..... **Shading**
- ☐ Air flow volume calculations, heat recovery efficiency and pressure test results ..... **Ventilation**
- ☐ Specific heating demand according to the PHPP annual method ..... **Annual Heating Demand**
- ☐ Specific heating demand according to the PHPP monthly method, if selected in the Verification Sheet ..... **Monthly Method**
- ☐ Heating load according to the PHPP ..... **Heating Load**
- ☐ Overheating frequency..... **Summer**
- ☐ Summer shading factors ..... **Shading-S**
- ☐ Summer ventilation, if used..... **SummVent**
- ☐ Heating and hot water distribution system heat losses..... **DHW+Distribution**
- ☐ Portion of domestic hot water demand covered by solar, if solar collector present..... **SolarDHW**
- ☐ Annual heat generator utilisation factor ..... **Compact, Boiler or District Heat**
- ☐ Electricity demand..... **Electricity**
- ☐ Auxiliary electricity demand..... **Aux Electricity**
- ☐ Primary energy demand..... **PE Value**
- ☐ Climate data selection..... **Climate Data**

2.2 Planning documents for building design, construction and building services:

- ☐ Site plan including the building's orientation, neighbouring structures (position and height), prominent trees or similar vegetation and possible horizontal shading from ground level elevations along with photographs of the plot and surroundings. The shading situation must be made clear.
- ☐ Design plans (floor plans, sections, elevations) as pre-construction plans (1:100), or implementation plans (1:50) with clearly identifiable room dimensions, envelope areas, unfinished window opening sizes, etc.
- ☐ Reference plans for all building envelope areas and windows with clearly depicted thermal bridges if present for a clear allocation of the areas and/or thermal bridges calculated in the PHPP.
- ☐ Detailed drawings of all building envelope connections, for example, the exterior and interior walls at the basement ceiling or floor slab; the exterior wall at the roof and ceiling; the roof ridge and verge; horizontal and vertical sections of the window installation; the anchorage of balconies, etc. The details should be given with dimensions and information about the materials used and their conductivities. The airtight layer should be indicated and the way in which it is executed at connection points should be described.
- ☐ Ventilation building services plans: the design and placement of ventilation units, volumetric flows (*DESIGN* sheet in the *Final Protocol Worksheets Ventilation*; Source: PHPP CD or www.passiv.de), sound protection, filters, supply and extract air valves, air transfer openings, the outdoor air suction and exhaust air outlet, ducting diameters and insulation thicknesses, sub-soil heat exchanger (if present), ventilation control, etc..
- ☐ Heating and plumbing building services: illustration and design of heat generators, heat storage, heat distribution systems (pipes, heating coils, heating surfaces, pumps, control), domestic hot water distribution (circulation, individual pipes, pumps, control), aerated drain pipes including diameters and insulation thicknesses.
- ☐ Electrical building services plans (if used): illustration and design of lighting, elevators, etc.

2.3 Supporting documents and technical information, with product information sheets if applicable:

- ☐ Product manufacturers and types as well as technical information sheets, especially on insulation materials with very low conductivities (λ < 0.035 W/(mK)).
- ☐ Clear itemisation of treated floor area calculations
- ☐ Information on window and door frames to be installed including manufacturer, type, U_w-value, $\Psi_{installation}$ and $\Psi_{glazing\ edge}$ as well as drawings of all planned installations in the external wall. Calculations are to be carried out according to ISO 10077-2. This information is available for Passive House Institute certified products[1].
- ☐ Information about the glazing to be fitted including manufacturer, type, build-up, U_g-value according to the European standard EN 673 (calculated out to two decimal places), g-values according to the European standard EN 410 and spacer type. This information is available for Passive House Institute certified products[1].
- ☐ Documentation of the thermal bridge coefficients used in the PHPP according to ISO 10211. Alternatively, comparable documented thermal bridges can be used, for example, from certified Passive House construction systems, Passive House Institute publications and Passive House thermal bridge catalogues.
- ☐ Short description of the planned technical supply systems with schematic drawings, if applicable.
- ☐ Manufacturer, type and technical data sheets of all technical building components including the ventilation system, heat generator for heating and hot water, heat storage, ductwork/piping and accompanying insulation thicknesses, heating coils, frost protection, pumps, elevators, lighting etc.
- ☐ Information about the sub-soil heat exchanger if present including length, depth and type of installation, soil quality, size and material of tubing and heat recovery efficiency (as calculated with PH-Luft[2], for example). For sub-soil brine heat exchangers, regulation, winter and summer temperature limits and the thermal efficiency is required.
- ☐ Information on the length, dimensions and insulation level of hot water and heating supply pipelines as well as of the ventilation ducts between the heat exchanger and thermal building envelope.
- ☐ Concept for efficient electricity use with, for example, specified devices and explanations as well as incentives for the house or apartment owner. If an efficient electricity use concept is not provided, the average values of devices available on the market will be used (PHPP standard values).
- ☐ Demonstration of summer comfort. The PHPP procedure for determining the frequency of overheating only shows an average value for the whole building, however, individual parts of the building may overheat. If such overheating is suspected, a detailed analysis is to be carried out.

2.4 Verification of the airtight building envelope according to the European standard EN 13829

As opposed to what is laid out in EN 13829, a series of measurements for both positive and negative pressure is necessary. The pressure test is to be carried out only for the heated building envelope (basements, porches and conservatories etc. that are not integrated into the thermal building envelope should not be included in the test). It is recommended that the test be carried out when the airtight layer is still accessible so that improvements can still be made. The indoor air volume calculation should also be documented in the pressure test report.

The pressure test is to be carried out by an institution or person independent of the contractor or building owner. Pressure tests conducted by the contractor will only be accepted if an individual who is fully responsible for checking the accuracy of the information provided in the test results, signs off on them.

2.5 Documentation of flow rate adjustment

The flow rate adjustment documentation must at least include the folllowing: a description of the property, the property address, the name and address of the tester, the time of adjustment, the make and model of the ventilation unit, the adjusted volumetric flows per valve for normal operation and the mass flow and volumetric flow balance for outdoor air and exhaust air (with a maximum allowable imbalance of 10 %). Use of the *Final Protocol Worksheets Ventilation* is recommended for this purpose (source: PHPP CD or www.passiv.de).

[1] Data sheets for certified components can be found at www.passiv.de
[2] PH-Luft is a programme that assists planners of Passive House ventilation systems and is available free for download on www.passiv.de.

2.6 Construction manager declaration

Implementation according to certified Passive House project planning must be documented and confirmed by the construction manager. Any variation in terms of implementation should be mentioned. For any products not mentioned in the plans, corresponding documentation must be provided.

2.7 Photographs

Photographs documenting the construction of the Passive House, preferably digital, should be provided.

Additional test reports or data sheets for components used in the building may be required. If values that are better than those in the standard PHPP procedure are to be used, these should be supported by detailed evidence.

3. Testing procedure

An informal application for certification can be sent to the selected certifier, to whom all required documents must be submitted. These documents must be checked at least once. Depending on the procedure, further testing may also be arranged.

Please note: Passive House Standard relevant documents should be examined during the planning stage so that potential corrections or suggestions for improvement can be considered early on. For those without experience in Passive House construction, a preliminary consultation and even expert advice throughout the project is helpful and recommended.

After assessment, the contractor will receive the results with corrected calculations and suggestions for improvement, if needed. It is not the object of the certification to review construction work, but evidence of the building's airtightness, the documentation of ventilation flow rate adjustment, the construction manager's declaration and at least one photograph must be provided. If the technical accuracy of the necessary evidence for the building is confirmed and the criteria given above are adhered to, the Quality Approved Passive House Certification will be issued:

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Dr. Wolfgang Feist

This certification only certifies the accuracy of the documents submitted in accordance with Passive House Standard criteria. The assessment relates neither to the monitoring of the work, nor to the supervision of the user behaviour. The liability for the planning lies with the technical planners responsible. The liability for construction lies with the construction management. The Quality Approved Passive House logo may only be used in connection with Passive House Institute issued building certifications.

Additional quality assurance regarding the construction work by the certifying body is particularly useful should the construction management be new to Passive House construction.

Passive House Institute reserves the right to adapt all criteria and calculation procedures to the latest technical developments.

4. Calculation methods, conditions and reference to standards

The following conditions and calculation protocol should be used in the PHPP:

- ☐ Climate data: regional data set suited to the location in question (for deviating altitudes, a temperature correction factor of -0.6 °C per 100 m change in altitude is to be used).
- ☐ Individual climate data: suitability to be agreed upon in advance with the relevant certifier.
- ☐ Indoor design temperature: 20 °C without night setback.
- ☐ Internal heat gains: 2.1 W/m² unless other nationally relevant values have been set by Passive House Institute.
- ☐ Occupancy: 35 m²/person with deviating values of 20 – 50 m²/person permissible if justified by the actual occupancy or building design.
- ☐ Domestic hot water demand: 25 litres per person per day at 60 °C (with cold water at 10 °C), provided that no other values have been set by Passive House Institute.
- ☐ Average ventilation volume flow: 20-30 m³/h per person with at least a 0.30-fold air change per hour with reference to the treated floor area multiplied by a 2.5 m room height. The air mass flows applied must correspond to the actual flow rate adjustment values.
- ☐ Household electricity demand: standard values according to the PHPP unless individually verified by the client or electricity use concept.
- ☐ Thermal envelope area: with reference to exterior dimensions, without exception.
- ☐ U-value of opaque building components: PHPP procedure according to European standard EN 6946 with conductivities according to national standards or building authority regulations.
- ☐ U-values of windows and doors: PHPP procedure according to European standard EN 10077 with calculated values for the U-value of the frame, U_f, the glazing edge thermal bridge, $\Psi_{glazing\ edge}$, and the installation thermal bridge, $\Psi_{installation}$.
- ☐ Glazing: calculated U-value, U_g, according to European standard EN 673 (calculated out to two decimal places) and g-value according to European standard EN 410.
- ☐ Heat recovery efficiency: testing method according to Passive House Institute (see www.passiv.de); if according to DIBt[3] or equivalent methods, a 12 % deduction applies.
- ☐ Performance ratio of heat generator: PHPP procedure or separate verification.
- ☐ Primary energy factors: PHPP dataset.

[3] Deutsches Institut für Bautechnik (German Institute for Construction Technology)