Passive House Institute
Dr. Wolfgang Feist
Rheinstraße 44/46
64283 Darmstadt
Germany
www.passivehouse.com

Certified Passive House

Criteria for non-residential Passive House buildings

Passive Houses are buildings in which comfortable indoor conditions can be achieved throughout the year with minimum energy input. Passive Houses must meet very stringent requirements regarding both their design and construction. Passive Houses are certified based on a thorough quality check of their design. The certification criteria that apply for non-residential buildings are described below (criteria for residential buildings can be found at www.passivehouse.com):

1. Certification criteria *)

Heating

Specific space heating demand		≤ 15 kWh/(m^{2}a)
or alternatively:	heating load	≤ 10 W/m²

Cooling

Specific useful cooling demand **)	≤ 15 kWh/(m²a)

Primary energy

Total specific primary energy demand **)	≤ 120 kWh/(m²a)

Airtightness

Pressure test result, n_{50}	≤ 0.6 h^{-1}

**) These criteria are specially adapted to conditions prevailing in cool, temperate climates (e.g. Central Europe) and may need to be reviewed for starkly different climates. The Passive House definition [www.passivehouse.com] remains unaffected.*

***) The primary energy demand includes the energy demand for heating, cooling, hot water, ventilation, auxiliary electricity, lighting and all other uses of electricity. The limits set above for the specific useful cooling demand and the primary energy demand apply for schools and buildings with similar utilisation patterns. These values are to be used as a basis but may need to be adjusted according to building use. In individual cases where very high internal heat loads occur, these values may also be exceeded after consultation with the Passive House Institute. Proof of efficient electrical energy use is necessary in such cases.*

Calculation of specific values may take into account the entire volume enclosed by the building envelope for an overall calculation, for example, an office building with several thermally connected units. If all zones have the same set temperature, then a weighted average based on the TFA from individual PHPP calculations of several sub-zones may be used. Combination of thermally separated buildings is not permissible. For the certification of refurbishments or extensions, the area considered must contain at least one external wall, a roof surface and a floor slab or basement ceiling. Single units inside a multi-storey building cannot be certified.

The criteria must be verified using the latest version of the Passive House Planning Package. However, transfer of data to a newer PHPP version published when the project is already under way is not necessary. The monthly method is used for the specific heating demand. The reference value for all the above criteria is the treated floor area (TFA) which is calculated as described in the latest version of the Passive House Planning Package (PHPP) User Guide.

Besides being highly energy efficient, Passive Houses also offer an optimum standard of thermal comfort, a high level of user satisfaction and damage-free buildings. If there is any uncertainty regarding one of these aspects, this must be clarified before a certificate can be issued. The following are generally required for this: openable windows in all areas occupied for substantial amounts of time, as well as a low overheating frequency (≤ 10 % of the hours over 25 °C in a given year).

For certification, the valid Certification Criteria (available at www.passivehouse.com) apply and take precedence over the calculation methodology described in the PHPP User Guide and the PHPP application software, which shall apply subordinately.

2. Documents necessary for Passive House certification:

2.1 Signed PHPP with at least the following calculations: **PHPP Worksheet**
(Please also attach the Excel file) **from PHPP**

- ☐ Property data, summary of results ..... **Verification**
- ☐ Selection of the climatic region or specification of individual climate data, ... **Climate**
- ☐ Calculation of U-values of regular building elements ..... **U-values**
- ☐ Summary of areas with allocation of radiation balance data, thermal bridges ..... **Areas**
- ☐ Calculation of reduction factors against ground, if used ..... **Ground**
- ☐ Building component database ..... **Components**
- ☐ Determination of the U_W-values ..... **Windows**
- ☐ Determination of shading coefficients ..... **Shading**
- ☐ Air quantities, heat recovery efficiency, input of pressurisation test results ..... **Ventilation**
- ☐ Dimensioning of ventilation systems with several ventilation units (if used) ..... **Additional vent**
- ☐ Calculation of the heating demand using monthly method based on EN 13790 ..... **Heating**
- ☐ Calculation of the heating load of the building[1] ..... **Heating Load**
- ☐ Determination of summer ventilation ..... **SummVent**
- ☐ Assessment of summer climate [1] ..... **Summer**
- ☐ Specific value of useful cooling (if active cooling is used) [1] ..... **Cooling**
- ☐ Latent cooling energy (if active cooling is used) [1] ..... **Cooling Units**
- ☐ Heating distribution losses; DHW demand and distribution losses ..... **DHW+Distribution**
- ☐ Solar DHW provision (if solar heating system is present) ..... **SolarDHW**
- ☐ Utilisation profiles of non-residential buildings ..... **Use non-res**
- ☐ Electricity demand of non-residential buildings ..... **Electricity non-res**
- ☐ Calculation of the auxiliary electricity demand..... ..... **Aux Electricity**
- ☐ Calculation of internal heat gains of non-residential buildings ..... **IHG non-res**
- ☐ Calculation of the primary energy value..... ..... **PE Value**
- ☐ Annual utilisation factor for heat generators..... **Compact, HP, HP Ground, Boiler or District Heating**

[1] The PHPP calculations for the heating load, summer ventilation and cooling load have been developed for buildings with homogeneous utilisation. More in-depth studies/other methods should be referred to for buildings with intermittent ventilation or heating operation and greatly fluctuating internal loads

[3] Data sheets for certified components can be found on www.passivehouse.com

2.2 Planning documents for 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) with comprehensible dimensioning for all area calculations (room dimensions, envelope areas, unfinished window opening sizes).
- ☐ Location plans of envelope areas and windows as well as thermal bridges if present, for clear allocation of the areas or thermal bridges calculated in the PHPP
- ☐ Detailed drawings of all building envelope connections, e.g. the exterior and interior walls at the basement ceiling or floor slab, exterior wall at the roof and ceiling, roof ridge, verge, installation of windows (laterally, above and below), attachment of balconies etc. The details should be given with dimensions and information about materials used and their conductivities. The airtight layer should be indicated along with details as to how it is to be maintained at junctures during construction.
- ☐ Building services plans for ventilation: representation and dimensioning of ventilation units, volumetric flows (Final Protocol Worksheet for Ventilation Systems: "Design", see PHPP CD), sound protection, filters, supply and extract air valves, openings for transferred air, outdoor air intake and exhaust air outlet, dimensioning and insulation of ducts, sub-soil heat exchanger (if present), regulation, etc..
- ☐ Building services plans for heating, plumbing: representation of heat generators, heat storage, heat distribution (pipes, heating coils, heating surfaces, pumps, regulation), hot water distribution (circulation, single pipes, pumps, regulation), aerated drain pipes including their diameters and insulation thicknesses.
- ☐ Building services plans for electrical fittings (if used): representation and dimensioning of lighting (as well as concepts or simulations for the use of daylight, if applicable), elevators, kitchen equipment, computers, telecommunication systems and other specific uses of electricity (e.g. furnaces).
- ☐ Building services plans for air conditioning (if used): representation and dimensioning of cooling and dehumidification systems.

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

- ☐ Details of the project-specific conditions mentioned under point 4.
- ☐ Comprehensible specification of the treated floor area calculation.
- ☐ Manufacturer, type and technical data sheets, especially of insulation materials with very low conductivity (λ_R < 0.032 W/(mK)).
- ☐ Information about the window and door frames to be installed: manufacturer, type, U_w value, $\Psi_{Install}$, $\Psi_{Glazing\ Edge}$ and graphical representations of all planned installations in the exterior wall. The calculation values should be mathematically computed in accordance with EN 10077-2. These verifications are available for products that have been certified[3] by the Passive House Institute.
- ☐ Information about the glazing to be fitted: manufacturer, type, build-up, U_g value according to EN 673 (to two decimal places) g-value according to EN 410, type of edge spacer.
- ☐ Evidence regarding the thermal bridge loss coefficients used in the PHPP based on EN ISO 10211. Alternatively, reference can be made to comparable documented thermal bridges (e.g. in certified Passive House construction systems, PHI publications, Passive House thermal bridge catalogues).
- ☐ Short description of the planned building services supply systems with schematic drawings if applicable.
- ☐ Manufacturer, type, technical data sheets and verification of the electricity demand of all building services components: ventilation system, heat generator for heating and hot water, heat storage, insulation of ductwork and pipes, heating coils, freeze protection, pumps, elevator, lighting etc.
- ☐ Information about the sub-soil heat exchanger (if present): length, depth and type of installation, soil quality, size and tube material and verification of the heat recovery efficiency (e.g. with PHLuft[4]). For sub-soil brine heat exchangers: regulation, temperature limits for winter/summer and verification of the heat recovery efficiency

[4] PHLuft: Programme facilitating planning of Passive House ventilation systems. Free download from www.passivehouse.com

- ☐ Information about the length, dimensioning and insulation level of the supply pipelines (hot water and heating as well as cooling, if present) as well as the ventilation ducts between the heat exchanger and thermal building envelope.
- ☐ Concept for efficient use of electricity (e.g. specific devices, instructions and incentives for the building owner). If efficient electricity utilisation is not verified, average values for devices available on the market will be used (standard PHPP values).
- ☐ Heat recovery efficiency and electricity demand of the ventilation system in accordance with the Passive House method. Exhaust air systems with heat recovery (e.g. fume hoods and fume cabinets etc.) should be included. Different operating settings and operation times should be taken into account.

2.4 Verification of the airtight building envelope

The airtightness measurement is carried out in accordance with EN 13829 or ISO 9972. In case of differences or uncertainty, the EN 13829 standard is to be used. A series of measurements is required for positive pressure and negative pressure, in deviation from the standard. The pressure test should only be carried out for the heated building volume (basement, porches, conservatories etc. that are not integrated into the thermal envelope of the building should not be included in the pressure test). It is recommended that the test be carried out when the airtight layer is still accessible so that needed repairs can be more easily carried out. The pressure test report should also document the calculation of the indoor air volume

In principle, the pressure test should be carried out by an institution or person independent of the client or contractor. A pressure test that has been carried out by the client will only be accepted if the test result is signed by someone taking personal responsibility for the accuracy of the information provided

2.5 HRV commissioning report

The report must at least include the following: description of the property, location/address of the building, name and address of the tester, time of adjustment, ventilation system manufacturer and type of device, adjusted volume flow rates per valve for normal operation, mass flow/volumetric flow balance for outdoor air and exhaust air (maximum disbalance of 10 %). Recommended: “Final Protocol Worksheet for Ventilation Systems”, source PHPP CD or www.passivehouse.com.

2.6 Construction manager's declaration

Execution according to the reviewed PHPP project planning must be documented and confirmed with the construction manager's declaration. Any variation in construction should be mentioned; if any of the products used deviate from those included in the project planning, evidence of compliance with criteria must be provided.

2.7 Photographs

Photographs documenting construction progress should be provided; digital images are preferable.

It may be necessary to provide additional test reports or data sheets for the components used. If values that are more favourable than those in the standard PHPP procedure are to be used, these should be supported by evidence.

2. Testing procedure

An informal application for the certificate can be made with the chosen Passive House Institute accredited Building Certifier. The required documents must be filled in completely and submitted to the certifier. The certification documents must be checked at least once. Depending on the procedure, further checks may also be arranged.

Note: If possible, checking of the Passive House Standard relevant documents should be carried out during the planning stage, so that any necessary corrections or suggestions for improvement can be taken into account at an early stage. In the absence of experience with Passive House construction, at least one consultation prior to planning is advised. Consultation throughout the entire project may also be advisable.

After assessment, the client will receive the results with corrected calculations and suggestions for improvement, if applicable. Inspection of construction work is not automatically covered by the certification. However, evidence of the building's airtightness, the HRV commissioning report, the construction manager's declaration and at least one photograph must be provided. If the accuracy of the documentation necessary for certification is confirmed and the aforementioned criteria are fulfilled, the following seal will be issued:

The awarding of the certificate verifies the correctness of the documents submitted only in accordance with the Passive House Standard as defined at the time of certification. The assessment relates neither to the monitoring of the work, nor to the supervision of the user behaviour. The liability for the planning remains with the responsible planners and all liability for the implementation lies with the construction management. The Certified Passive House seal may only be used in connection with the associated certificate as issued.

Additional quality assurance of the construction work by the certifying body is particularly useful if the construction management has no previous experience with Passive House construction.

We reserve the right to adapt criteria and calculation procedures to reflect technical advances and developments.

3. Calculation method, conditions, standard references

The following boundary conditions or calculation rules should be used in the PHPP:

- ☐ Climate data: regional data set (suitable for location, for deviating altitudes with temperature correction of -0.6 °C per 100 m increase in altitude).
- ☐ Individual climate data: applicability is to be agreed previously with the relevant certifier. If climate data are already available in the PHPP, these should be used
- ☐ Indoor design temperature: standard indoor temperatures based on EN 12831 apply. For unspecified uses or deviating requirements the indoor temperature is to be determined on a project-specific basis. For intermittent heating (night setback), the indoor design temperature may be decreased upon verification.
- ☐ Criteria for thermal comfort in accordance with ISO 7730
- ☐ Internal heat gains: the PHPP contains standard values for internal heat gains in a range of utilisation types: apartments (2.1 W/m²), offices (3.5 W/m²), schools/kindergartens/gymnasiums (2.8 W/m²) and nursing homes (4.1 W/m²). These are to be used unless the PHI has specified other national values. The use of the individually calculated internal heat gains is only permitted if it can be shown that actual utilisation will and must differ considerably from the utilisation on which the standard values are based.
- ☐ Occupancy rates and periods of occupancy must be determined on a project-specific basis and coordinated with the utilisation profile.
- ☐ Domestic hot water demand in litres of 60 °C water per person and day must be determined for each specific project.
- ☐ Average ventilation volumetric flow must be determined for the specific project based on a fresh air demand of 15-30 m³/h per person (or according to the applicable legal requirements, if present). The different operation settings and times of the ventilation system must be considered. Operating times for pre-ventilation and post-ventilation should be taken into account when switching off the ventilation system. The mass flows used must correspond with the actual adjusted values.
- ☐ The electricity demand is to be determined on a project-specific basis according to the PHPP. A building utilisation profile with occupancies and occupancy times should be prepared. Without a plan of the lighting to be installed or details as to other electricity uses, standard values as per the PHPP are to be used.
- ☐ Thermal envelope surface: exterior dimension reference without exception.
- ☐ U-value of opaque building components: PHPP procedure on the basis of EN 6946 with conductivity values according to national standards or building authority regulations.
- ☐ U-values of windows and doors: PHPP procedure with computed values in accordance with EN 10077 for the frame U-value (U_f), the glazing edge thermal bridge (Ψ_g), and the installation thermal bridge ($\Psi_{Install}$).
- ☐ Glazing: computed U-value (U_g; to two decimal places) in accordance with EN 673 and g-value in accordance with EN 410.
- ☐ Heat recovery efficiency: testing method according to the PHI (see www.passivehouse.com); if applicable, auxiliary test result according to the DIBt method (or equivalent) with a deduction of 12 % after consultation with the certifier.
- ☐ Energy performance indicator of the heat generator: PHPP method or separate verification.
- ☐ Primary energy factors: PHPP dataset.
- ☐ Summer comfort must be provided for the buildings to be certified. The PHPP method for determination of summer overheating initially only depicts an average value for the entire building; individual parts can still become overheated. If this is suspected, a more in-depth examination must be carried out.