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Certification as "Quality Approved Passive House" Criteria for Non-Residential Passive House Buildings

Passive Houses are buildings, in which a comfortable temperature can be achieved in winter as well as in summer with only a minimal energy consumption. They are more demanding in regard to conception, design and execution of construction work. For the purpose of quality assurance Passive Houses can be reviewed and certified. The certification criteria applicable to non-residential buildings are described below (the up-to-date version is published on www.passiv.de).

1 Evaluation criteria for certification

Specific Space Heating Demand or Heating Load	max. 15 kWh/(m²a) max. 10 W/m²
Pressurization Test Result n₅₀	max. 0.6 h⁻¹
Specific Space Cooling Demand *)	max. 15 kWh/(m²a)
Total Specific Primary Energy Demand *)	max. 120kWh/(m²a)

**) The Primary Energy Demand includes the total energy demand of the relevant building type for heating, cooling, DHW, ventilation, auxiliary electricity, lighting and electrical appliances. The given limits for the Specific Space Cooling Demand and the Total Specific Primary Energy Demand hold true for schools and similar building types and generally act as preliminary criteria, which have to be checked for the specific type of non-residential building. In specific cases, where the building's usage implies high internal heat loads, these limits may be exceeded after consultation with the PHI. In such cases additional verification of efficient usage of electrical energy is required.*

The reference value (Treated Floor Area) is the net floor area inside the thermal envelope according to DIN 277. Main usable and secondary usable floor areas are credited fully, circulation and functional areas are credited with 60%, whereas staircases, lifts and cores for ducting, electric cables etc. are not taken into account at all.

For the calculation of the demands the total space enclosed by a continuous building envelope can be considered as an entity, e.g. an office building with several thermally connected parts. The verification may be carried out using calculations for the entire building or with weighted average values for several partitions. Combining



buildings that are thermally separated is not permitted. For the certification of refurbished buildings or building extensions, the zone in question must contain at least one exterior wall, a roof and a floor slab or basement ceiling. Individual units within a multi-storage building will not be certified.

The criteria have to be verified with the Passive House Planning Package 2007 (PHPP2007). For the Specific Space Heating Demand, both the monthly as well as the annual method can be applied. The monthly method must be used if the space heating demand is below 8 kWh/(m²a) or the ratio of free heat to heat losses is above 0.70 in the annual method.

The most recent certification criteria, which are published on www.passiv.de, are valid for certification. The calculation method described in the PHPP handbook and the PHPP software is subordinate to the certification criteria given on the above mentioned website.

2 Documentation Required for Passive House Quality Assurance

2.1 PHPP (signed), containing at least the following calculations (Please enclose the calculations as MS-Excel file or send them via e-mail)

	<u>Name of Worksheet</u>
<input type="checkbox"/> Building registration and Passive House verification	Verification
<input type="checkbox"/> Summary of areas, U-value assignment, radiation data and thermal bridges	Areas
<input type="checkbox"/> Calculations of U-values of building elements.....	U-Values
<input type="checkbox"/> List of the project's building elements	U-List
<input type="checkbox"/> Window U-value calculations	Windows
<input type="checkbox"/> List of applied windows and glazing types	Win-Type
<input type="checkbox"/> Reduction factors for building elements against the ground, if applicable	Ground
<input type="checkbox"/> Shading factor calculations	Shading
<input type="checkbox"/> Calculations of air flow rate and efficiency of heat recovery; analysis of pressurization test results	Ventilation
<input type="checkbox"/> Verification of space heat demand using the PHPP annual method	Annual Heat Demand
<input type="checkbox"/> Verification of space heat demand using the PHPP monthly method (if selected in the verification worksheet)	Monthly Method
<input type="checkbox"/> Heating load verification using the PHPP.....	Heating Load¹
<input type="checkbox"/> Calculation of the frequency of overheating in summer.....	Summer¹
<input type="checkbox"/> Summer shading factor determination	Shading-S
<input type="checkbox"/> Determination of summer ventilation (if applicable).....	SummVent



- Heat loss calculations of space heating and DHW distribution systems..... **DHW + Distribution System**
- Solar fraction calculations of solar thermal DHW system (if applicable) **SolarDHW**
- Verification of the annual use efficiency of the heat generator **Compact, Boiler or District Heat**
- Calculation of electricity demand for Non-residential buildings..... **Electricity Non-Dom**
- Calculation of auxiliary electricity demand..... **Aux Electricity**
- Calculation of primary energy demand..... **PE-Value**
- Selection of climate data, if “standard” is not used..... **Climate Data**
- List of utilisation patterns for non-residential buildings..... **IHG Non-Dom**
- Calculation of internal heat gains for non-residential buildings..... **IHG Non-Dom**
- Verification of useful cooling energy demand, if active cooling is being used **Cooling¹**
- Verification of cooling load, if active cooling is being used **Cooling Load¹**
- Calculation of cooling units, if active cooling is being used **Cooling Units¹**

2.2 Construction Drawings:

- Site plan showing building orientation, location and elevation of neighbouring buildings, prominent tree lines, or any ground levels that cast lateral shadows. If appropriate, photographs of the surroundings. The shading situation must be comprehensible.
- Planning drawings (plans, sections, elevations) as 1:100 planning application drawings (design development), or 1:50 construction drawings (incl. construction documents) with comprehensive dimensions of all calculated areas: room dimensions, overall building and room areas, and all rough openings in the exterior envelope.
- Location plans of the thermal envelope, the windows and, if applicable, of the thermal bridges for a clear allocation of the areas and thermal bridges calculated in the PHPP.
- Comprehensible record of the calculation of the treated floor area.
- Mechanical plans or sketches showing ventilation, heat supply, DHW and (if applicable) climatisation. Description of the heat generation, storage and distribution and the corresponding insulation standards. Description of the ventilation system with declaration of the layout, air flow rates, soundproofing,

¹ The PHPP-calculations for heating load, summer case and cooling load were developed for homogeneously used residential buildings. For buildings with intermittent operation of ventilation and heating or with highly fluctuating internal loads it may be necessary to consult additional supplementary analyses / different calculation methods.



filters, supply and extract air valves, outdoor air intake and exhaust air outlet, insulation of air ducts, subsoil heat exchanger (if existent), control etc.

- Detail drawings of all junctions of the thermal envelope, e.g. exterior and interior wall junctions to the basement floor or floor slab; exterior wall junctions to roof and ceiling; ridge joint, lateral; window installation (lintel, parapet and reveals), anchorage systems of balconies etc.. All details have to be provided with dimensions and information about materials and thermal conductivity groups. The air-tight layer has to be marked and its implementation at junctions has to be described.

2.3 Technical specifications, if necessary with product data sheets:

- The following details about window and doorframe installations are to be provided: manufacturer, type, U_f -value, $\Psi_{\text{Installation}}$, Ψ_{Spacer} , and drawings showing all planned installations in the exterior wall. The calculated values² are to be verified in accordance with EN 10077-2. Data for products certified by the Passive House Institute is already available.
- Specifications to be submitted for glazing: manufacturer, type, U_g -value according to EN 673 (accuracy: 2 digits), total solar transmittance according to EN 410 (g-value), spacer type.
- A brief description of the building services system, if necessary, supplemented with schematic diagrams.
- Manufacturer, type, and specifications of all components: ventilation system, space heating and DHW systems, DHW storage tank, auxiliary heater, frost protection, etc.
- Specifications of the subsoil heat exchanger (if applicable): length and depth of the installation, layout type, soil quality, pipe material and sizes, verification of heat exchange efficiency (e.g. using PH-Luft.³). When using brine subsoil heat exchangers: Control, category temperatures for winter and summer, verification of the heat exchange efficiency.
- Specifications of plumbing and ducts: length and insulation of the supply pipes (DHW and space heating), and of the ventilation ducts between the heat exchanger and the thermal building envelope.
- A concept for efficient household electricity consumption: e.g. high-efficiency household appliances, user's guide and energy-saving incentives for homebuyers). If no evidence for an efficient use of electricity is provided, average values of

² The calculated values of certified components are available through the internet at <http://www.passivehouse.com>.

³ PH-Luft: A program to support designers of Passive House ventilation systems. It is available as a free download from the Passive House Institute's website: <http://www.passivehouse.com>.



the appliances which are available on the market are used (standard values PHPP)

2.4 Verification of the Airtight Building Envelope According to DIN EN 13829

Deviant from the DIN EN 13829 a series of positive pressure and negative pressure tests is required for every project. The pressure test should only be performed for the heated building envelope (basements, front buildings, conservatories etc., which are not integrated in the thermal envelope, have to be omitted from the pressure test). It is recommended to perform the test when the airtight plane is still easily accessible and corrections can be implemented.

The pressure test must be carried out by an independent third party institution or person. If a client conducts the pressure test himself, the result is only accepted if an independent witness signs the test results and thereby certifies the correctness of the data.

2.5 Record of the adjustment of the ventilation system

The record must contain at least the following information: object, address of the building site, name and address of the inspector, time and date of the adjustment, manufacturer and type of the ventilation system, adjusted air flow rates for every valve at standard operating mode, balancing of mass and air flow volume for fresh and exhaust air (max. 10% disbalance).

2.6 Declaration of the construction supervisor

The completion according to the verified Passive House project planning has to be documented with the declaration of the construction supervisor. Deviant implementations must be stated and evidence of conformity has to be provided for deviant products.

2.7 Photographs

Photographs of the completed building have to be provided (preferably digital), which document the construction of the Passive House.

Under certain circumstances additional test reports or data sheets for the components used in the building may be required. If more favourable assumptions than those used in the standard PHPP calculation are used, evidence for their validity must be provided.

3 Procedure of the Quality Assurance



A specific form is not required for the application for the certificate. The verifier has to be provided with the necessary documents which are to be filled in completely. The documents have to be examined at least once for the certification. Depending on the procedure, more examinations can be agreed upon.

Please note: The documents which are relevant for the Passive House standard should favourably be examined during the planning period, so that potential corrections or suggestions for improvement can be taken into account at an early stage. If the planner does not have any experience with building Passive Houses, we suggest at least one preliminary counselling interview and, if appropriate, further accompanying counselling for the entire project.

Once the examination is finished, the applying party receives the results of the examination, if necessary with the corrected calculations and suggestions for improvement. An examination of the execution of construction work is not automatically included in the process of certification. However, from the execution of the construction work the following documents have to be provided: verification of the air tightness, record of the adjustment of the ventilation system, declaration of the construction supervisor and at least one photograph. If the necessary verifications have been found to be correct and the above criteria have been met, the following certificate is issued.



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The issued certificate only declares accuracy of the provided documentation, in accordance with the current technological development of the Passive House standard. The examination neither applies to the surveillance of the execution of construction work nor to the observation of the user behaviour. The warranty for the design remains with the technical planner, the warranty for the execution of construction work remains with the responsible construction supervisor. The logo of the Passive House Institute may only be used in association with the certificate.

Additional quality assurance of the execution of construction work is recommended, especially if the construction supervisor in charge does not have any experience in building Passive Houses.

The rights to adapt the criteria and the calculation methods to the progressing technical developments remain reserved.

4 Calculation Methods, Basic Conditions, Reference to recognised Standards



The following basic conditions or calculation methods have to be used in the PHPP:

- Climate data for Germany: either Standard-Germany or regional data set (suitable for the building's location; in case of a deviant altitude: use a temperature correction of -0.6 °C for each 100 m of difference in altitude)
- Climate data other countries: regional data set (suitable for the building's location; in case of a deviant altitude: use a temperature correction of -0.6 °C for each 100 m of difference in altitude)
- Own climate data of the applicant: The certifying party must approve the use.
- Lay-out temperature: 20 °C without lowering of temperature at night
- Internal heat sources: 2.1 W/m², as long as the Passive House Institute has not specified any other national values
- Occupancy: 35 m²/person, deviant values may be used with an explanation (actual occupancy or specification of the building design) in the range of 20-50 m²/person
- Domestic hot water demand: 25 litres / person / day of 60 °C water; cold water temperature is 10 °C if no other national values have been specified by the Passive House Institute
- Average air flow rate is 20-30 m³/h per person in a household; use at least an air change rate of 0.3 times an hour applied to the treated floor area multiplied by 2.5 m of room height. The applied air flow volumes have to correspond with the actual values of the adjustment of the ventilation system.
- Domestic electric energy demand: use standard values of the PHPP; deviant values only with individual verification by the building owner or domestic electric energy concept respectively
- Thermal envelope: Use exterior dimensions without exception
- U-values of opaque building elements: PHPP-method on the basis of EN 6946 with rated value of the thermal conductivity following the national norm or the technical approval of the governmental authority in charge
- U-values of windows and doors: PHPP-method following EN 10077 with calculated rated values for window frame U-Value U_f , glass edge thermal bridge Ψ_g , and installation thermal bridge $\Psi_{Installation}$
- Glazing: calculated U-value U_g (accuracy: two digits) following the EN 673 and g-value following the EN 410
- Efficiency of heat recovery: examination method of the Passive House Institute (refer to www.passiv.de); alternatively following the DiBt-method (German Institute for Building Technology) or equivalent subtracting 12% of the value



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- Efficiency of the heat generator: PHPP-method or individual verification respectively
 - Primary energy factors: PHPP data set
 - Buildings that are to be certified have to provide a verification in relation to the summer comfort. The PHPP-method for the determination of overheating in summer initially shows only a mean value of the whole building – some parts of which can, however, still overheat. If there is such an uncertainty, a detailed examination should be carried out.

Last changes made: 06. August 2009

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