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Institute

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EnerPHit and EnerPHit^{+i}

Certification Criteria for Energy Retrofits with Passive House Components

If an energy retrofit of an existing building meets Passive House criteria (for new builds), it, too, can be certified as a Certified Passive House.

It is, however, often difficult to feasibly achieve the Passive House Standard in older buildings for a variety of reasons. Passive House technology for relevant building components in such buildings does, nevertheless, lead to considerable improvements with respect to thermal comfort, structural longevity, cost-effectiveness over the building lifecycle and energy use.

Buildings that have been retrofitted with Passive House components and, to a great extent, with exterior wall insulation can achieve EnerPHit certification as evidence of both building quality and fulfilment of specific energy values. The EnerPHit^{+i} designation is applied if more than 25 % of the opaque exterior wall surface has interior insulation.

The certification criteria for both standards are described below.

1 Selection of certification protocol

Certification can take place based on the requirement for the heating demand (Section 1.1) or on the requirements for individual building components (Section 1.2). Compliance with the general requirements given in Section 2 is in either case mandatory.

1.1 Certification based on the requirement for heating demand

Heating demand: $Q_H \leq 25$ kWh/(m²a) (calculated using the PHPP)

1.2 Certification based on requirements for individual building components (as an alternative to 1.1)

Evidence must be provided that all energy-relevant building components for which the PHI has specified Certified Passive House Component certification criteria comply with such criteria. Building component criteria published on www.passivehouse.com apply unless otherwise stipulated in these EnerPHit criteria. For products not certified by the PHI, the applicant is responsible for providing evidence that the specific component criteria have been met. Evidence of compliance must be recorded in writing and confirmed with a legally binding signature; it is the responsibility of the applicant to ensure that this is done.

Required limit values must not be exceeded on average[1] for the entire building. A higher value is permissible in certain areas as long as the absolute upper limit as given in Section 2 is not exceeded.

If the heat transfer resistance (R-value) of existing building components is taken into account for the improvement of the heat transfer coefficients (U-value) of modernised building components, this must be demonstrated in accordance with the accepted technical standards. It is sufficient to adopt a conservative approximation of the thermal conductivity of the present building materials from suitable reference charts. If building component assemblies of existing buildings are not clearly identifiable, standardised estimates according to the year of construction as taken from appropriate component catalogues[2] can be used as long as these are comparable with the component at hand.

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[1] Note: When calculating average values for insulated building component assemblies, the area weighted mean of the U-value, not the average insulation thickness, applies. Thermal bridges must only be taken into account during the calculation of the average value if they are part of the standard structure of the building component. For multiple ventilation systems, the average value weighted by volumetric flow applies.

[2] E.g. "EnerPHit -Planerhandbuch", PHI 2012 (available in German only)

1.2.1 Requirements

In the following section, important requirements[3] for Certified Passive House Components will be repeated for the sake of simplicity. Nevertheless, what follows is subordinate to the current criteria as stated on the PHI website (www.passivehouse.com) under the heading *Certification*.

Additional requirements for EnerPHit certification will also be mentioned.

1.2.1.1 Opaque building envelope

For exterior insulation: $f_t \cdot U \leq 0.15$ W/(m²K)

For interior insulation[4]: $f_t \cdot U \leq 0.35$ W/(m²K)

With temperature factor f_t:
in contact with the outdoor air: $f_t = 1$
in contact with the ground: "ground reduction factor " from the PHPP "Ground" Sheet

Use of interior insulation is only advised if exterior insulation is structurally impossible, not legally permitted or clearly uneconomical with regard to lifecycle costs.

In refurbishments of existing buildings, it is not always possible to largely eliminate thermal bridge effects ($\Psi_{ext} \leq +0.01$ W/(mK)) with justifiable effort as is necessary for Passive House new builds. Nevertheless, thermal bridge effects must always be avoided or minimised as much as possible while ensuring cost-effectiveness (see 3.3; nevertheless, the requirements given in Section 2.7, "Protection against moisture", must always be fulfilled).

Thermal bridges that are part of the standard structure of a building component are taken into account in the evaluation of the heat transfer coefficient.

1.2.1.2 Window W (window)

For the window as a whole (see EN 10077): $U_{W,installed} \leq 0.85$ W/(m²K)

for g and U_g-value of glazing: $g \cdot 1.6$ W/(m²K) $\geq U_g$

[3] These are only <u>minimum</u> requirements! Enhanced thermal protection often leads to a further reduction in environmental impact and even greater independence from fluctuations in energy prices with the same cost-effectiveness

[4] Definition of a building component assembly with interior insulation for the component requirements:
- Contains at least one solid layer (with $\lambda > 0.2$ W/(mK) and THK (thickness) ≥ 100 mm) and at least one layer of insulation (with $\lambda < 0.1$ W/(mK) and THK ≥ 10 mm).
- The insulation layer is situated on the inside and there is no further layer of insulation (with $\lambda <$ 0.1 W/(mK) and THK ≥ 10 mm) outside of the innermost solid layer
- Only the portion of the layer with the greater share of the surface (e.g. the infill panels and not the wood for half-timbered work) is taken into account.

1.2.1.3 External doors D (door)

$f_t \cdot U_{D,installed} \leq 0.80$ W/(m²K)

with temperature factor f_t:
in contact with the outdoor air: $f_t = 1$
in contact with the unheated basement: f_t = "ground reduction factor " from the PHPP "Ground" Sheet

1.2.1.4 Ventilation

$\eta_{HR,eff} \geq 75$ %

Specific electricity consumption of the entire system based on the average volume flow transferred (electrical efficiency): ≤ 0.45 Wh/m³

All rooms within the heated building volume must either be connected to a supply air and extract air system with heat recovery or be part of a transferred air zone. Compliance with $\eta_{HR,eff}$ for the entire ventilation system is necessary - going over and above the criteria for Certified Passive House Components, i.e. the heat losses from warm ventilation ducts in cold areas or cold ducts in the warm areas should also be included.

1.2.2 Exemptions

The limit values given in Section 1.2.1 for the heat transfer coefficients of the exterior envelope building components may be exceeded if absolutely necessary for one or more of the following compelling reasons:

- If required by the historical building preservation authorities
- If the cost-effectiveness (see 3.3) of a required measure is no longer assured due to exceptional circumstances or additional requirements
- In the presence of specific legal requirements
- If implementation of the required standard of thermal insulation would result in unacceptable restriction of the use of the building or adjacent outer areas
- If special, additional requirements (e.g. fire safety) exist and there are no components available on the market that comply both with these additional requirements and the EnerPHit criteria
- Should other essential reasons relating to construction exist

For heat transfer coefficients > 0.35 W/(m²K), the maximum possible insulation thickness must be implemented using insulating materials having a thermal conductivity of $\lambda \leq 0.025$ W/(mK). In the case of floor slabs and basement ceilings, the additional use of a surrounding insulation skirt should be considered and implemented if applicable.

If a standard requirement is exceeded on the basis of an exception, clear evidence that the conditions for this exception have been fulfilled must be provided in the form of suitable documents that have been signed by the person in charge.

The requirements for moisture protection in accordance with Section 2.7 and for thermal comfort in accordance with Section 2.8 must be complied with in each case.

If a significant reduction in the heating demand is not achievable due to extensive use of exceptional rules, a written confirmation regarding the values achieved may be issued in place of an EnerPHit certificate at the discretion of the certifier.

2 Other general requirements

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.

Due to the large number of requirements for retrofits of existing buildings, it is possible that absolutely precise requirements for some individual energy-related measures are not included in the certification criteria. In this case, the measure should be implemented in such a way that energy efficiency is improved as much as possible, provided that the measure is cost-effective over its lifecycle (see 3.3). The standard of thermal protection necessary for the building component will then be determined by the certifier on a case by case basis (in cooperation with the PHI for highly relevant, exemplary cases).

2.1 Energy balance

The energy balance of the retrofit must be verified using the latest version of the Passive House Planning Package (PHPP). This also applies for certification based on the building component method (Section 1.2). 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 is the treated floor area (TFA) calculated in accordance with the current PHPP User Guide.

The entire building envelope, e.g. a row of terraced houses or an apartment block, can be taken into account for calculation of the specific values. An overall calculation can be used to verify this. If all zones have the same set temperature, then a TFA weighted average value from single PHPP calculations of several partial zones can also be used. Combining thermally separated buildings is not permissible. Buildings that adjoin other buildings (e.g. in high-density urban areas) must have at least one exterior wall, one roof surface and a floor slab or basement ceiling in order for them to be certified individually.

2.2 Time of certification

All requirements for the building must be met upon issuance of the certificate. Currently, certificates cannot be issued in advance for retrofits that are being carried out in several steps.

2.3 Restriction to existing buildings

Only buildings for which modernisation to the Passive House Standard would be uneconomical (see 3.3) or not practically implementable due to the existing building characteristics or building substance will be certified. In principle, an EnerPHit certificate cannot be issued for new builds.

2.4 Location of building

Currently, only buildings located in cool, temperate climate (e.g. Central Europe) are being certified.

2.5 Primary energy demand

$Q_P \leq 120$ kWh/m²a + ((Q_H - 15 kWh/(m²a)) · 1.2)

The primary energy demand includes all necessary energy applications for heating, cooling, domestic hot water, auxiliary electricity, lighting, and other electricity uses. The limit value applies for residential buildings, office buildings, schools and other similar uses and further as a preliminary criterion which must be checked for specific uses. In individual cases where a very high energy demand is necessary, this limit value can be exceeded after agreement with the Passive House Institute. For this, evidence of efficient use of electrical energy is necessary, with the exception of existing electricity uses for which an improvement of the electrical efficiency by means of upgrading or renewal would prove uneconomical over the lifecycle (see 3.3).

2.6 Airtightness

Limit value: $n_{50} \leq 1.0\ h^{-1}$

Target value: $n_{50} \leq 0.6\ h^{-1}$

If a value of 0.6 h^{-1} is exceeded, comprehensive leak detection must be carried out within the framework of a pressure test during which individual leaks that can cause building damage or impair comfort are sealed. This must be confirmed in writing and signed by the person in charge in accordance with Section 6.1.

2.7 Protection against moisture

All standard cross-sections and connection details, without exception, must be planned and executed so that excessive moisture on the interior surface or in the building component build-up can be ruled out.

Should there be any uncertainty, evidence of protection against moisture must be provided in accordance with accepted technical standards. An increased heat transfer resistance of R_{si} = 0.25 m²K/W (due to furniture, curtains etc.) and an outdoor design temperature specific to the location (Heating Load "Weather 1" in the PHPP data sets, if available) are used to calculate interior surface temperatures.

For building components with interior insulation, evidence of careful planning that would prevent indoor air currents behind the insulation layer must be provided. For interior insulation, components with proven suitability with regard to moisture protection must be used for the specific application. _In case of doubt, proof of suitability with regard to moisture protection which is based on accepted methods must be provided by means of a corresponding expert's report (with legally effective acceptance of responsibility). This usually takes place through a hygrothermal simulation.

2.8 Thermal comfort

If the minimum standard recommended by the PHI for components of building envelope adjoining living areas is not upheld (see Section 1.2.1), the following absolute minimum thermal comfort requirements will apply. Alternatively, these will also be deemed to have been fulfilled if evidence of the comfort conditions in accordance with EN ISO 7730 is provided.

2.8.1 Exterior wall

$f_t \cdot U \leq 0.85$ W/(m²K)

With temperature factor f_t:
in contact with the outdoor air: $f_t = 1$
in contact with the ground: "Ground reduction factor" from the PHPP "Ground" Sheet

2.8.2 Roof/uppermost ceiling

$U \leq 0.35$ W/(m²K)

2.8.3 Floor

The interior surface temperature of the floor must be at least 17 °C for the design conditions (PHPP: "Ground" Sheet, "Design ground temperature for Heating Load Sheet" or, if applicable, outdoor design air temperature; indoor temperature 20 °C)

2.8.4 Windows/exterior doors

Target value: $U_{W/D,installed} \leq 0.85$ W/(m²K)

Exceeding of the target value is permissible if heating surfaces are used to compensate for the windows and doors where doubts as to thermal comfort exist due to suspected low interior surface temperatures (according to ISO 7730).

3 Documents necessary for certification

3.1 Signed PHPP with at least the following calculations:

(Please also attach the Excel file) **Worksheet 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 flow rates, heat recovery efficiency, input of pressurisation test results .... **Ventilation**
- ☐ Dimensioning and planning 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 .... **Heating Load**
- ☐ Determination of summer ventilation .... **SummVent**
- ☐ Assessment of summer climate[5] .... **Summer**
- ☐ Specific value of useful cooling (if active cooling is used) [5] .... **Cooling**
- ☐ Latent cooling energy (if active cooling is used) [5] .... **Cooling Units**
- ☐ Heating distribution losses; DHW demand and distribution losses .... **DHW+Distribution**
- ☐ Solar DHW provision (if solar heating system is present) .... **SolarDHW**
- ☐ Utilisation profiles (only for non-residential buildings) .... **Use non-res**
- ☐ Calculation of shared and domestic electricity demand (only for residential buildings) .... **Electricity**
- ☐ Calculation of electricity demand (only for non-residential buildings) .... **Electricity non-res**
- ☐ Calculation of the auxiliary electricity demand........ **Aux Electricity**
- ☐ Calculation of internal heat gains (only for residential buildings) .... **IHG**
- ☐ Calculation of internal heat gains (only for 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**

[5] 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.

3.2 Planning documents for design, construction, building services

- □ Site plan including the building 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.
- □ Proof of protection against moisture (should their be uncertainty)
- □ 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, cooling (if present), plumbing: representation of heat generators, heat storage, heat distribution (pipes, heating coils, heating surfaces, pumps, regulation), hot water distribution (circulation, single pipes, pumps, regulation), cold water pipes, aerated drain pipes including their diameters and insulation thicknesses.
- □ Building services plans for electrical fittings (if used): representation and dimensioning of lighting (concepts or simulations for the use of daylight also, 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

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

- ☐ Details of the project-specific conditions mentioned under point 5.
- ☐ If applicable, required evidence for exemptions: e.g. economic feasibility analysis[6], written confirmations by the historical building preservation authority, copy of the legal requirements/ordinances, sections from plans.
- ☐ Manufacturer, type and technical data sheets, especially of insulation materials with very low conductivity (λ_R < 0.032 W/(mK)).
- ☐ Comprehensible specification of the treated floor area calculation.
- ☐ 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[7] 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.
- ☐ 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.
- ☐ 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[8]). For sub-soil brine heat exchangers: regulation, temperature limits for winter/summer, verification of the heat recovery efficiency
- ☐ 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).
- ☐ 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 (e.g. by means of a transient simulation).

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[6] Economic feasibility calculation (dynamic valuation method, e.g. net present value method) in accordance with PHI recommended methodology and in coordination with the certifier – must be carried out over the lifecycle of the building component and include all relevant costs minus costs that would have anyway been incurred); see more detailed description in " Wirtschaftlichkeit von Wärmedämm-Maßnahmen im Gebäudebestand 2005" (in German), available for download from www.passivehouse.com.

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

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

3.4 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.

3.5 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.

3.6 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.

3.7 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 in the building. If values that are more favourable than those in the standard PHPP procedure are to be used, these should be supported by evidence.

4 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.

After the assessment the client will receive the results, with corrected calculations and suggestions for improvement, if applicable. Inspection of the 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 technical accuracy of the documentation necessary is confirmed and the aforementioned criteria are fulfilled, the following seal will be issued:

The awarding of the EnerPHit 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 technical planners, and the liability for the implementation lies with the appropriate construction management. The EnerPHit 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 the retrofits using Passive House components.

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

5 Calculation methods, 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.
- ☐ Design indoor temperature:
  Residential buildings: 20 °C without night set-back.
  Non-residential buildings: the standard indoor temperatures based on EN 12831 apply. For unspecified uses or deviating requirements the indoor temperature is to be determined for the specific project. For intermittent heating (night setback), the indoor design temperature may be lowered upon verification.
- ☐ 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:
  Residential buildings: 35 m²/person, deviating values are permitted if the reason is given (actual occupancy or design parameters) within the 20-50 m²/person range
  Non-residential buildings: occupancy rates and periods of occupancy must be determined on a project-specific basis and coordinated with the utilisation profile.
- ☐ Domestic hot water demand:
  Residential buildings: 25 litres per person per day at 60 °C, provided that no other national values have been set by the PHI.
  Non-residential buildings: 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:
  Residential buildings: 20-30 m³/h per person in the household, but at least a 0.30-fold air change with reference to the treated floor area multiplied by 2.5 m room height.
  Non-residential buildings: 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.
- ☐ Electricity demand:
  Residential buildings: standard values according to the PHPP, deviating values only if individually verified by the client or domestic electricity concept.
  Non-residential buildings: 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 in accordance with 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.

6 Appendix

6.1 Confirmation of detection and sealing of leaks during the pressurisation test

(Only necessary if $0.6\ h^{-1} < n_{50} \leq 1.0\ h^{-1}$)

Standard text:

It is hereby confirmed that a search for leaks was carried out during the pressurisation test. All rooms within the airtight building envelope were accessed for this purpose. All potential weak points were checked for leaks. This also applies in the case of areas which were difficult to access (e.g. large room heights). Any larger leaks that were found having a relevant share of the total leakage volumetric flow were sealed.

The following information is necessary:

- Name, address, company of the person signing
- Date and signature
- Description and address of the construction project
- Pressurisation test: date and name of the person carrying this out