Criteria and algorithms

Certified Passive House Components – Façade Anchor

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Note: Currently certificates are only being issued for the climate regions Arctic, Cold, Cool-Temperate, Warm-Temperate and Warm.

1

On account of the fact that it is possible to dispense with a separate heating system in Passive House buildings, stringent demands apply for the quality of the components that are used. Besides an excellent standard of thermal insulation, a high level of airtightness, highly efficient ventilation heat recovery and Passive House windows, the absence of thermal bridges at the thermal envelope is of utmost importance for the proper functioning of a Passive House building. The Passive House Institute has launched the Certified Passive House Component – Façade Anchor seal in order to define a reliable standard in this regard.

2 Temperature criterion

Thermal bridges are weak points in the thermal envelope of the building. These weak points lead to increased heat flow and a lower temperature of the interior surface of the relevant building component associated with this. Surface temperatures that are too low may impair comfort and also cause high relative humidity and therefore increase the risk of mould and structural damage.

In order to prevent these effects, the temperature of the interior surface must not fall below 17 °C at any point (see Section 5 for boundary conditions):

$$\theta_{Si,min} \geq 17° \text{ C}$$

The minimum surface temperatures are stated in the certificates.

3 Energy criterion

The assessment and quantification of thermal bridges is decisive for the correct energy balance of a specific building. The Passive House Institute therefore indicates the thermal bridge coefficients of certified components in the certificates as a major part of the investigations.

However, the specific value is given as the load class dependent efficiency value $Eff._{fa}$ [W/kN*K], which gives a practicable parameter for the preliminary project planning of Passive House buildings, and the more universal delta U-value (ΔU [W/(m²K)]) for a reference façade of an example building (see Reference Façade in Section 6).

Here, ΔU is the additional heat loss which results from the use of the facade anchors of the example building. Façade anchors which allow for a higher load-bearing capacity are granted higher thermal bridge coefficients here because these enable greater flexibility of project planning and implementation.

Definition of Certified Passive House Component – Façade Anchor

The Certified Passive House Component – Façade Anchor seal may be granted for a construction in an external surface if the total of the thermal bridges of the relevant component (façade anchors in this case) divided by the area of the component (the façade area of the reference building in this case) and the area-specific weight of the façade cladding and sub-construction is less than or equal to 0.200 W/(kN*K):

$$\frac{\left(\frac{\Sigma(\Psi_j \cdot l) + \Sigma\chi_j}{A}\right)}{G} \leq 0{,}200 \ W/(kNK)$$

where:

	Ψ	thermal bridge coefficient (linear thermal bridge) [W/(mK)]
	l	length of thermal bridge [m]
	χ	thermal bridge coefficient (point thermal bridge) [W/K]
	A	reference area (e.g. exterior wall, roof...) [m²]
	j	index over corresponding elements in the relevant area
	G	dead load of the façade cladding and the sub-construction [kN/m²]

Effizienzklasse	Anforderung	Bezeichnung
cool, temperate climate phC CERTIFIED COMPONENT Passive House Institute	< 0,200 W/(kN K)	certifiable component
cool, temperate climate phB CERTIFIED COMPONENT Passive House Institute	< 0,070 W/(kN K)	basic component
cool, temperate climate phA CERTIFIED COMPONENT Passive House Institute	< 0,030 W/(kN K)	advanced component
cool, temperate climate phA+ CERTIFIED COMPONENT Passive House Institute	< 0,010 W/(kN K)	very advanced component

Table 1: Passive House Efficiency classes for façade anchors

The limit values always refer to specific building components which are used in the customary manner in a building. In each case the thermal bridges should be included in the energy balance.

If the effective heat transfer coefficient (undisturbed heat transfer coefficient of the reference situation + thermal bridge addition coefficient of the facade anchors)

exceeds the recommended reference value for the respective climate, the necessary additional insulation thickness for compensation is specified on the certificate).

4 Airtightness

Proof of airtightness of the connection detail and its practicability should be provided.

5 Boundary conditions and calculation of characteristic values

Outdoor temperature: -10 °C
Heat transmission resistance outside: 0.04 m²K/W; 0.13 m²K/W with rear-ventilated façade
Interior temperature: 20 °C
Heat transmission resistance inside: 0.13 m²K/W
The characteristic values are calculated using three-dimensional heat flow simulations.

The following reference wall build-up is used for certification:
Rea-ventilated façade
Insulation thickness, climate dependent (0.035 W/(mK))
Concrete wall 175 mm
Interior plaster 15 mm
The climate zone applicable for the certification is based on the location of the manufacturer; a manufacturer may also hold certificates which exceed the requirements of the respective climate zone.

Klimazone	U-Wert Referenzfassade [W/(m²K)]	Dämmstärke [mm]
	0,09	380
	0,12	280
	0,14	240
	0,26	120
	0,48	60

Table 2: Wall build-up of the reference façades,

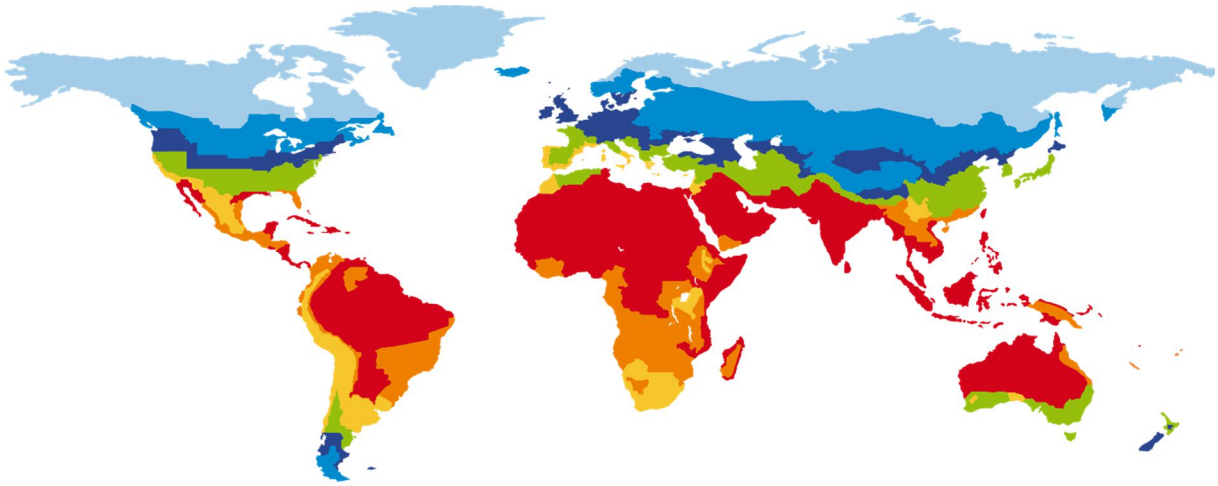


Fig. 1: Demarcation of regions with identical requirements

6 Reference façade

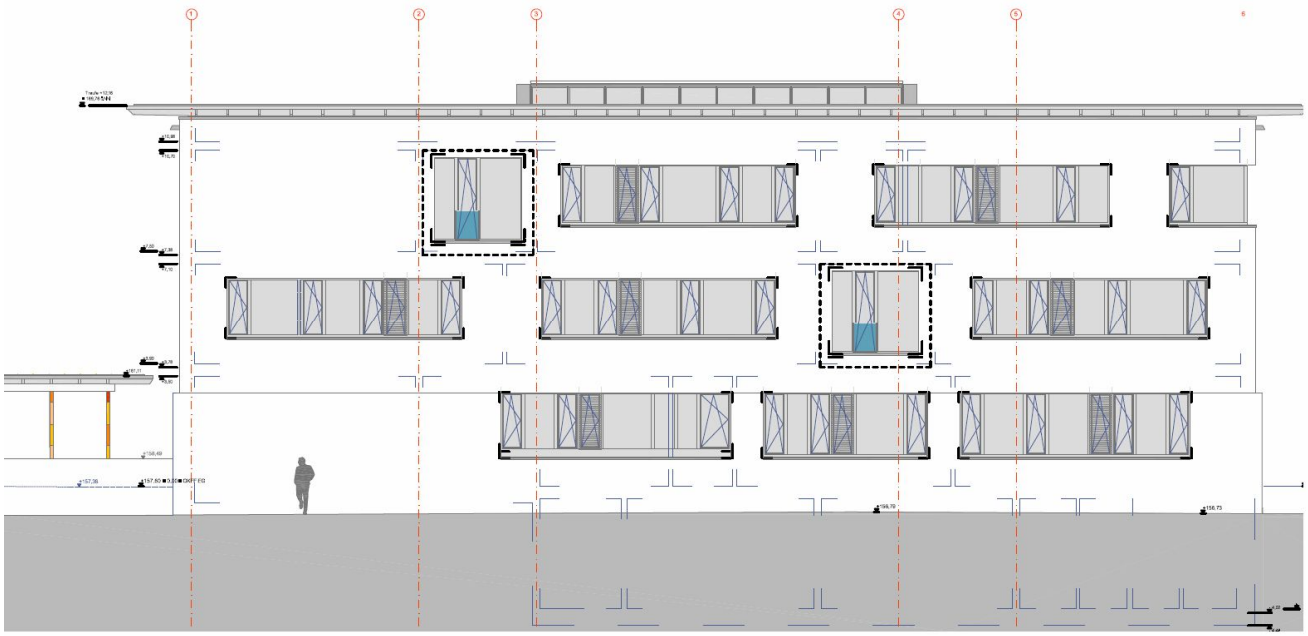


Fig. 2: Reference façade

A layout drawing shall be provided for the shown façade. This will take into account the configuration of the wall build-up (see Section 5). Furthermore, proof of the load capacity and suitability in accordance with the established rules and norms shall be provided by the manufacturer.

For this, a structural analysis shall be provided for the reference façade specifying the design load case taking into account the respective façade weight of the selected façade cladding with the sub-construction.

The layout drawing will be prepared for the entire façade and will contain the depiction and calculation of all sliding and fixed points.

The plate format and choice of sub-construction is left to the certificate applicant to decide.

Orientation of the façade: SE

Wind zone 1 (EN 1991)

Wind speed v_{ref} (m/s): 22.5 m/s

Velocity pressure q_{ref} (kN/m²): 0.32 kN/m²

Terrain category 3: regions with uniform vegetation or buildings or with single objects at distances of less than 20 times the height of hindrances (e.g. villages, suburban development, woodlands)

7 Load class calculation

Using the provided documents for assessment of the load capability taking into account the chosen façade cladding and the respective sub-construction, classification into different load classes will be carried out based on the layout drawings. The energy criterion for at least one load class must be complied with. If suitability for load classes of greater façade weights is verified, the component will also meet the requirements for a Certified Passive House Component for a lower load class standard.

If no information is provided regarding the dead load of the sub-construction, this will be assumed to be 0.02 kN/m².

Load Class 1 : dead load of cladding & sub-construction ≤ 0.10 kN/m²

(e.g. aluminium sandwich panel with plastic core, corrugated aluminium sheet)

Load Class 2 : dead load of cladding & sub-construction ≤ 0.15 kN/m²

(e.g. synthetic materials)

Load Class 3 : dead load of cladding & sub-construction ≤ 0.20 kN/m²

(e.g. fibre cement panel)

Load Class 4 : dead load of cladding & sub-construction ≤ 0.25 kN/m²

(e.g. acrylic glass)

Load Class 5 : dead load of cladding & sub-construction ≤ 0.30 kN/m²

(e.g. ceramic, concrete)

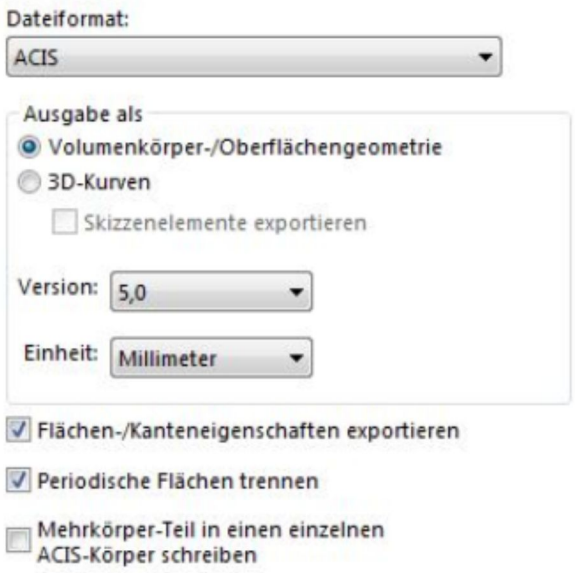
Load Class 6 : dead load of cladding & sub-construction > 0.30 kN/m²

(e.g. marble, stone façades)

8 Documents to be provided

Phase 1:

- Construction drawings in dwg/dxf format
- 3D model of the sliding points and fixed points in ACIS (sat) format from self-contained solids



- Information relating to assembly/installation instructions stating the fastening elements
- Proof of thermal conductivities (rated values)
- Approval papers

Phase 2:

- Layout drawings for the reference façade
- Information about the size of the panel/plate, sub-construction and cladding
- Structural analysis for the respective load class