Certification of airtightness systems

The Passive House Standard is characterised by very high energy savings compared with conventional new builds. This is achieved by means of highly efficient building systems and highly efficient components. Besides careful detail planning, the use of highly efficient components is also a prerequisite for this. As a rule, these components are two to three times more efficient than the corresponding commonly used products. This high level of efficiency is crucial for achieving the Passive House Standard.

However, for the designer it is often very difficult to assess the energy efficiency, durability and the necessary energy parameters of a component as the available standard parameters are frequently unrealistic or are not accurate enough; reliable project planning using manufacturers' data alone is often not possible.

As an independent authority, the Passive House Institute tests and certifies products in respect of their suitability for use in Passive House buildings. Products that carry the **Certified Passive House Component** seal have been tested according to uniform criteria; they are comparable in terms of their specific values, and are of excellent quality with regard to their energy efficiency. Their use facilitates the designer's task and contributes significantly to ensuring the faultless functioning of the resultant Passive House building.

Component certification

In the area of airtightness, **airtightness systems** are tested as they are applied in Passive House buildings. The focus is not on the individual product alone; instead, the entire system as a whole is put to the test with the corresponding connections.

Testing will take place under the aspects of "**airtight window connection**", "**surface sealing**" and **"penetrations"**.

Thus, for example, **window sealing** are tested in solid and wooden walls, the bonding of **sealing membranes and composite wood boards** (surface sealing) to concrete/plaster, adjacent wood panels or membranes and the joining of these materials with each other are tested. With regard to **"penetrations"** 16 typical cable and pipe penetrations in composite wood boards and concrete building components will be tested for airtightness at the same time. Each kind of connection will be specially prepared threefold by the PHI and tested for airtightness at different pressure stages. The measurement of the volume flow rate will take place using a highly precise laminar flow element.

Besides the testing of the systems in realistic situations, the corresponding instructions for use will also be examined for their practical applicability; installation will take place strictly in accordance with the manufacturer's instructions. If any uncertainties arise in the process, suggestions for improving these will be devised and submitted to the manufacturer.

The **Certified Passive House Component** certificate will be issued if the limiting values are complied with. The measurement results (test report) and the instructions for use (revised if applicable) will be made available to building owners and designers in the component database (https://database.passive-house.com) under the heading "Airtightness systems". After certification, details about the component will also be published in the IG-Passivhaus/iPHA component newsletter (www.passivhaus.de).

Limiting values for certification classes

Airtight window connection

Products for airtight and thermal bridge minimised installation of PH windows in wall openings.
Airtightness testing of the window to wall joint sealing in solid and lightweight wall constructions will be carried out. Window frames made of PVC as well as wood will be tested in the process.

Surface sealing

Systems for surface sealing of walls, roof, floors in lightweight or solid constructions.

Testing of the airtightness of the sealing systems will take place in accordance with DIN 12114. System-specific butt joints and connections are included:

0   Material on its own without a connection
1   Force fitting of similar adjacent surfaces
2   Adjacent surfaces consisting of airtight composite wood board
3   Adjacent concrete building component/plastered surface

The required values for PH certification for a "*window connection*" can be taken from the following table:

Class	Air permeability per unit length @ 50 Pa [m³/(hm)]
ph**A+**	≤ 0.05
ph**A**	≤ 0.30
ph**B**	≤ 0.50
ph**C**	≤ 0.80

The required values for PH certification for "*surface sealing*" can be taken from the following table:

Class	Air permeability per unit area @ 50 Pa [m³/(hm²)]
ph**A**	≤ 0.10
ph**B**	≤ 0.18
ph**C**	≤ 0.25

Airtight penetrations

Products or methods will be tested for airtight penetrations through the airtight layer for cables and pipes.

Testing will be carried out for airtightness of penetrations in membranes, airtight wood composite boards and concrete surfaces. Different cables and pipes that are typically used in constructions will be specified which will penetrate the corresponding building component. Sealing will be carried out using the products or methods of bonding. All 14 penetrations together will be tested for airtightness. About twice this number of penetrations are typically present in a single-family house. The 14 penetrations will therefore be created and tested twice for each surface sealing (wood composite board, concrete, airtight membrane).

Cables and pipes to be sealed:

#	Penetrations by	Number
1.	House connection cable, external diameter 25 mm (NYY-J 5x16 mm²)	1
2.	Cable, external diameter 8.3 mm (NYM 3 x 1.5), *inserted separately*	2
3.	Telephone cable, external diameter 5.0 mm (J-Y(ST)Y 2 x 2 x 0.60 mm), *together in one penetration*	5
4.	Twin cable, external diameter 2 x 5.0 mm (Twin 2 x WF65 satellite/antenna)	1
5.	HT pipe DN 50 (smooth pipe)	1
6.	HT pipe DN 110 (smooth pipe)	1
7.	Empty conduit for electrical cables (corrugated pipe) 25 mm, external diameter, *inserted separately*	2
8.	Spiral seam pipe DN 180 (exhaust air or outdoor air)	1
	TOTAL number of penetrations	**14**

The cables and pipes will be passed through either the composite wood board, the concrete slabs or the airtight membrane in accordance with the manufacturer's instructions using the provided sealing material. The pipes themselves will be closed at one end. All 14 penetrations will be tested together for airtightness at positive and negative pressure with pressure stages between ca. 50 and 300 Pa. The penetrations will be tested for airtightness at the bond with the surface sealing (membrane, composite wood board, and concrete) as well at the sealing with the cable or pipe.

The overall value of all 14 penetrations together will be recorded and shown as the result. On account of the double setup and testing for each surface sealing material (membrane, wood board and concrete) there are six measurement results. For each

surface material the total will be calculated from both tests with 14 penetrations each, and will be stated as the resulting value for that material group. The average of the three total values will be calculated for the certification.

Thus altogether 14 x 6 = 84 penetrations will be set up, sealed and tested.

Measurements to be performed:

Penetration through:	Number of penetrations per setup	Number of assemblies (corresponding to test measurements)	Total number of penetrations tested
Airtight membrane	14	2	28
Concrete	14	2	28
Wood composite board	14	2	28
Total number of penetrations			**84**

The objective of well-sealed penetrations is that the airtightness values for the surface sealing should not be significantly worsened due to the penetrations. The specified value is derived from the limit values for window connections. The sum total of the circumferences of the tested cables and pipes serves as the basis for this.

Air permeability based on the circumference of the penetrations

class	@ 50 Pa [m³/(hm)]
ph**A+**	≤ 0.05
ph**A**	≤ 0.30
ph**B**	≤ 0.50
ph**C**	≤ 0.80

After performing the six series of measurements, the measurements will be evaluated in the form of a test report. The respective certificate for a **Certified Passive House Component** will be issued if the limit values are complied with.