Test Report

Airtightness test of the engineered wood panel, including connections
System: "SMARTPLY SURE STEP"

Manufacturer: SMARTPLY Europe DAC

Airtightness system: Surface sealing

Darmstadt 27.06.2022

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Commissioned by: SMARTPLY Europe DAC
Belview, Slieverue,
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Product: **Airtightness system consisting of**

1. SMARTPLY SURE STEP
2. Rotho Blaas Srl SPEEDY BAND 60 mm
3. Rotho Blaas Srl FLEXI BAND 60 mm
4. Rotho Blaas Srl PRIMER

Product name: SMARTPLY SURE STEP

1. Introduction

Airtightness across the surface is a central prerequisite for an effective airtightness concept. A good level of airtightness of the building envelope is an essential element for its overall functioning, particularly in energy efficient buildings. This investigation took place under the most realistic possible boundary conditions within the framework of certification as a Passive House component in order to ensure that the tested products function in the installed state. In particular, the connection of the engineered timber panels to typical adjacent materials will be examined in the context of certification. With respect to the product system, this test examined the bonding of the engineered wood panels with each other and bonding with concrete and airtight membranes, as well as the adhesive materials used.

2. Criteria

The values specified for PH certification of surface sealing can be taken from Table 1 below:

Table 1: Requirements classes for the certification of surface sealing products according to Passive House Institute specifications

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

These apply for the overall performance of a product system specified by the client, which consists of several components.

In addition, comprehensible guidelines/instructions for use must be provided for installation of the product, on which the test setup will be based. These must be made available to all testers.

The test pertains exclusively to the testing of air permeability of the system, other characteristics will not be a part of the test.

3. Materials to be tested

The required panels and adhesive tapes for joining the different connection situations were supplied by the client. In accordance with the manufacturer's instructions, the adhesive tape Sicrall® was used for the connection of two panels with each other. This adhesive tape was also used for the connection with the airtight membrane (SIGA Majrex). Connection to concrete took place using the adhesive tape Fentrim®. The use and application of adhesive tapes took place in accordance with the manufacturer's directions which are described in the instructions for use.

The following products were delivered by the client on 06.05.2022:

- SMARTPLY SURE STEP

The manufacturer provided the "SMARTPLY SURE STEP, Airtightness system details" as instructions for use and this was examined.

4. Setup for the panel and connections

The panels were cut to a size of 1.65 m and clamped in the measurement apparatus across its full width (1.20 m). For sealing, a frame identical to the lower frame of the test equipment was placed over the apparatus. The frame and counter frame were equipped with a 5 cm wide sealing surface to support the panel. The counter frame was tightened to a defined torque using screws and a torque wrench. Tension-free and uniform installation in the test stand was ensured due to the even pressure of the counter frame.

For the connection to an airtight membrane or a concrete surface, an opening (1.2 m x 0.2 m) was cut into the respective panel before clamping. In the case of connection to an airtight membrane, the airtight membrane was cut to size so that it rested on the panel with 2 cm all around, covering the opening. For the connection to concrete, a concrete slab was placed in the fixture provided for this purpose so that the concrete slab was flush with the panel. The panel thus surrounded the concrete slab after installation in the test stand. Depending on the type of connection, the panel was sealed either using SPEEDY BAND (panel, airtight membrane and OSB) or FLEXI BAND (concrete slab).

Each test setup (connection of the panel to another panel, an airtight membrane or a concrete slab) was created and measured three times in order to minimise any influences due to workmanship.

5. Panel to panel

The panel to panel connection was carried out according to the manufacturer's instructions using the adhesive tape SPEEDY BAND. For this, the panels were placed flush next to each other and the adhesive tape was applied to both equally. The tape was then applied. As it was found that the lower density core of the panels has a permeability (in the plane of the board) that considerably affects the measured leakage flow, the outer edges of the test panel were also taped. ***For the practical application of the panels this means that for optimal results open edges that become part of the air tight layer should be taped over as the measured permeability applies normal to the plane of the material.***

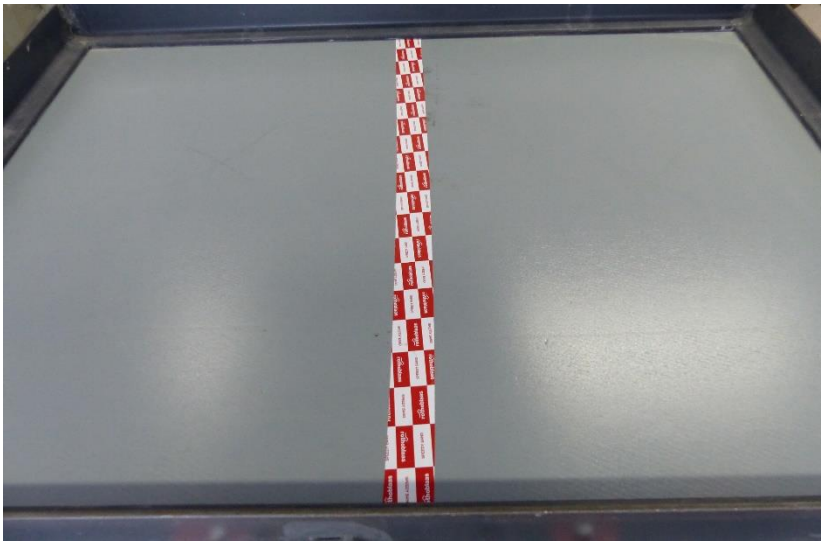

Fig. 1: Panel to panel connection created using SPEEDY BAND. The panels are clamped into the test equipment (black frame).

6. Panel to airtight membrane connection

The adhesive tape SPEEDY BAND was used for connecting the panel to the airtight membrane. The airtight membrane was placed on the panel so that it extended beyond the corners. This was in accordance with the directions of the manufacturer and enables the tape to be applied adequately, as the panel serves as a substrate for adhesion. One half of the adhesive tape was applied to the panel and the other half was attached to the airtight membrane. The short sides were then taped, overlapping the long sections and extending over the four corners.

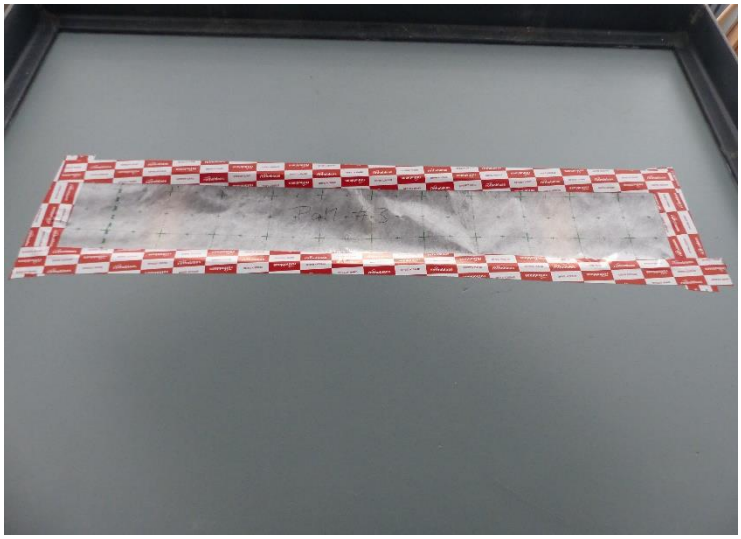

Fig. 2: Panel joined to the membrane on all four sides the using SPEEDY BAND.

7. Panel to OSB panel

The adhesive tape SPEEDY BAND was used for the connection of the panel to OSB. The perforated edge was plastered over in addition. The adhesive tapes were first applied to both long sides. The subsequently applied tapes at the two short sides overlap with the first two tapes with their full width at the four corners.

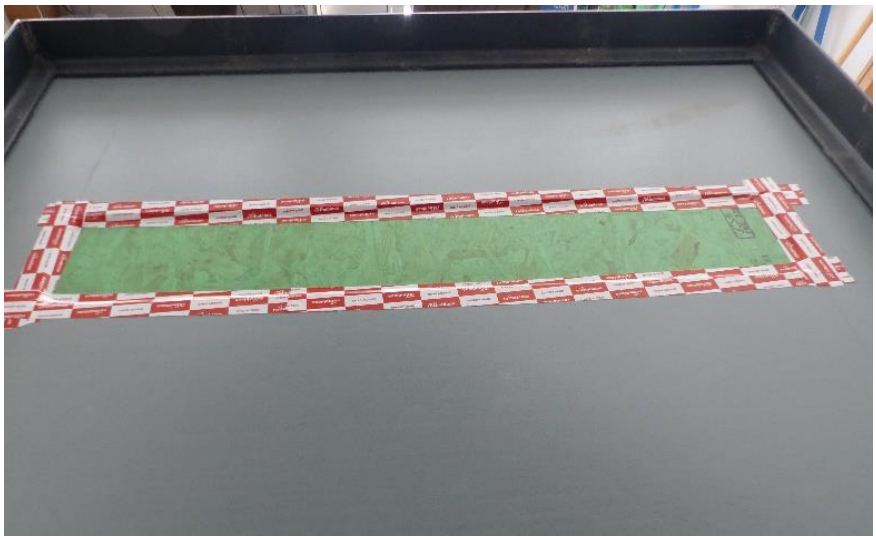

Fig. 3: Panel joined to the OSB panel on all four sides the using SPEEDY BAND.

8. Panel to concrete

The adhesive tape FLEXI BAND was used for the connection of the panel to concrete. The perforated edge was plastered over in addition. The adhesive tapes were first applied to both long sides. The subsequently applied tapes at the two short sides overlap with the first two tapes with their full width at the four corners.

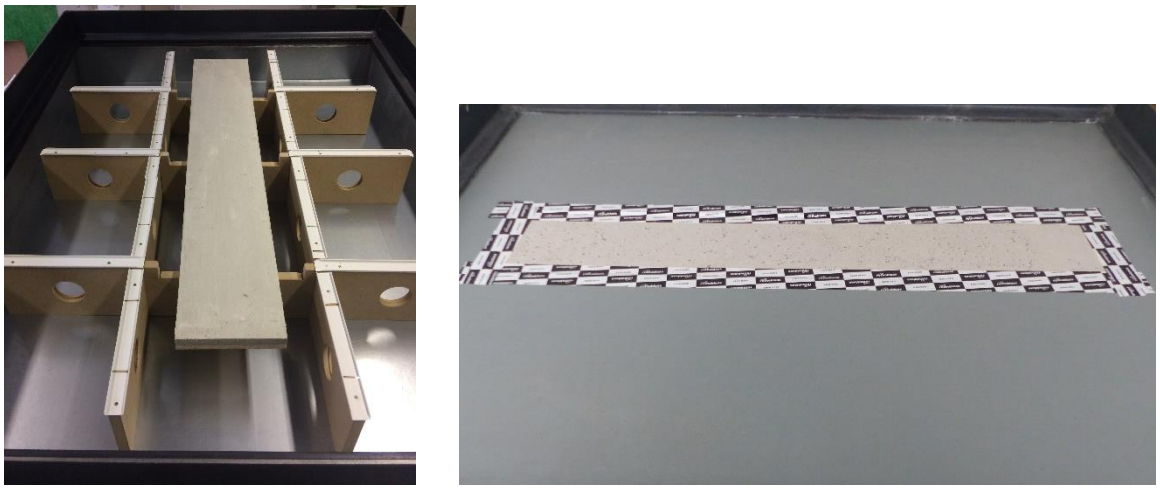

Fig. 4: **Left: fixture for panels in the test apparatus with the concrete slab in position.**
Right: panel clamped into the test stand, with tapes.

9. Test procedure

After placing the engineered wood panel in the test stand, a measurement was carried out in compliance with DIN EN 12114. The following pressure stages were set, each as a series of measurements at excess pressure and negative pressure:

50, 100, 150, 200, 250, 300 and 350 Pa.

First the residual leakage of the test stand for all pressure stages was measured and documented for each measurement (reference measurement). For this, the entire test apparatus was sealed from above with an airtight panel (cover). This measurement took place with the edges of the engineered wood panel sealed all around (using airtight adhesive tape). This was necessary so that any transverse air flow through the panel during the reference measurement was not registered as a leakage of the test stand itself.

The infiltration air of the test stand determined thus in the reference measurement was deducted from the measured result afterwards.

In each measurement the transferred volume flow was measured and recorded for each individual pressure difference. With these pairs of measured values, it was possible to calculate the leakage coefficient ***C*** according to DIN 12114 Appendix B.

From the two series of reference measurements (at excess pressure and negative pressure) and the two series of actual measurements (at excess pressure and negative pressure), balancing functions were calculated by means of a regression analysis. After deducting the leakage of the test stand itself (reference measurement), the leakage flow was determined for the reference pressure difference of 50 Pa as an average value of the results from the series of negative and positive pressure measurements. This value was divided by the sample area (engineered wood panel) in order to obtain the specific leakage flow per square metre. The free area of the sample was 1.72 m². For the measurements with the cut out for the airtight membrane and the concrete slab, this area was reduced to 1.48 m².

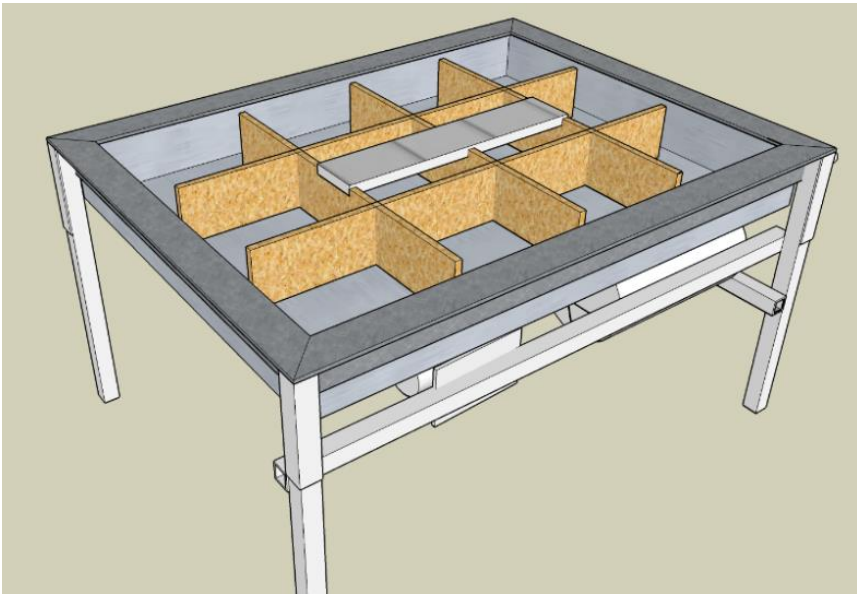

Fig. 5: Sketch of the test apparatus with a fixture for a concrete slab

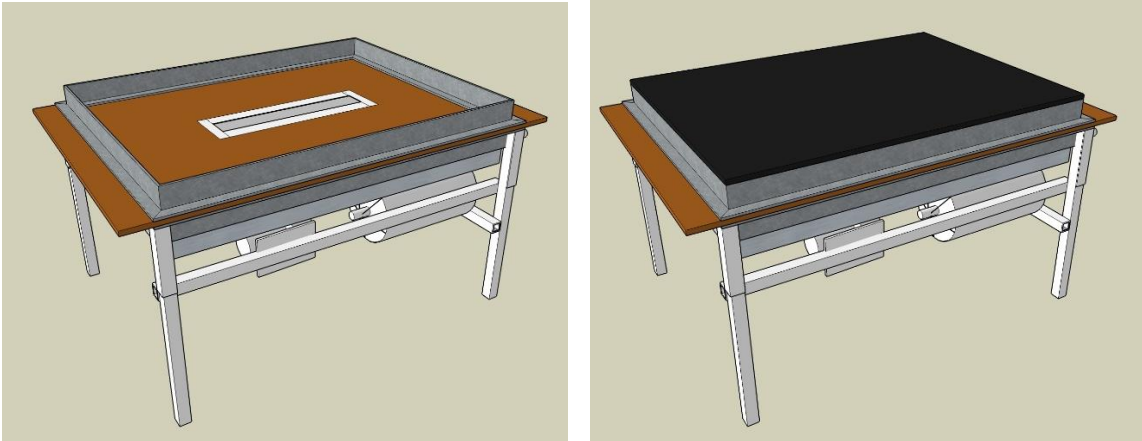

Fig. 6: **Left: Sketch of the test apparatus with the mounted engineered wood panel, installed concrete slab and adhesive tape (white).**
Right: Test apparatus sealed with the cover panel for determining the test stand leakage (reference measurement).

The measurements of the examined airtightness system took place in the time period 20.06.2022 to 27.06.2022.

10. Test results

The test results are shown in the following tables and figures, sorted according to the connection methods and the panel thicknesses. These are preceded by the measurements of the engineered wood panels alone (without connections). The requirement classes for the certification of surface sealing systems have been entered additionally in the diagrams.

9.1 Panel on its own

Connection to	
Panel on its own	x
Panel to OSB	
Panel to membrane	
Panel to concrete	

Table 2: Results of the three measurements with the engineered wood panel without connection

examined area	1,72 m²

SMARTPLY SURE STEP to SMARTPLY SURE STEP
Bonded using Rothoblaas SPEEDY BAND

Pressure stages	Pa	50	100	150	200	250	300	350
SMARTPLY SURE STEP (on its own) #1								
total volume flow	m³/h	0,01	0,18	0,24	0,30	0,35	0,41	0,45
test stand leakage	m³/h	0,00	0,18	0,25	0,31	0,37	0,43	0,48
specific air volume flow	m³/h	0,01	0,01	0,01	0,01	0,01	0,01	0,01
leakage volume flow based on area	m³/(h m²)	0,01	0,01	0,01	0,01	0,01	0,01	0,01
SMARTPLY SURE STEP (on its own) #2								
total volume flow	m³/h	0,00	0,13	0,15	0,17	0,18	0,20	0,21
test stand leakage	m³/h	0,00	0,13	0,15	0,17	0,18	0,19	0,21
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SMARTPLY SURE STEP (on its own) #3								
total volume flow	m³/h	0,00	0,13	0,15	0,16	0,18	0,19	0,20
test stand leakage	m³/h	0,00	0,13	0,15	0,17	0,18	0,19	0,20
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Average

Q50 (PHI - assessment) **0,00** m³/(h m²)

resulting in an airtightness class of **A** according to PHI Q50 ≤ 0,1

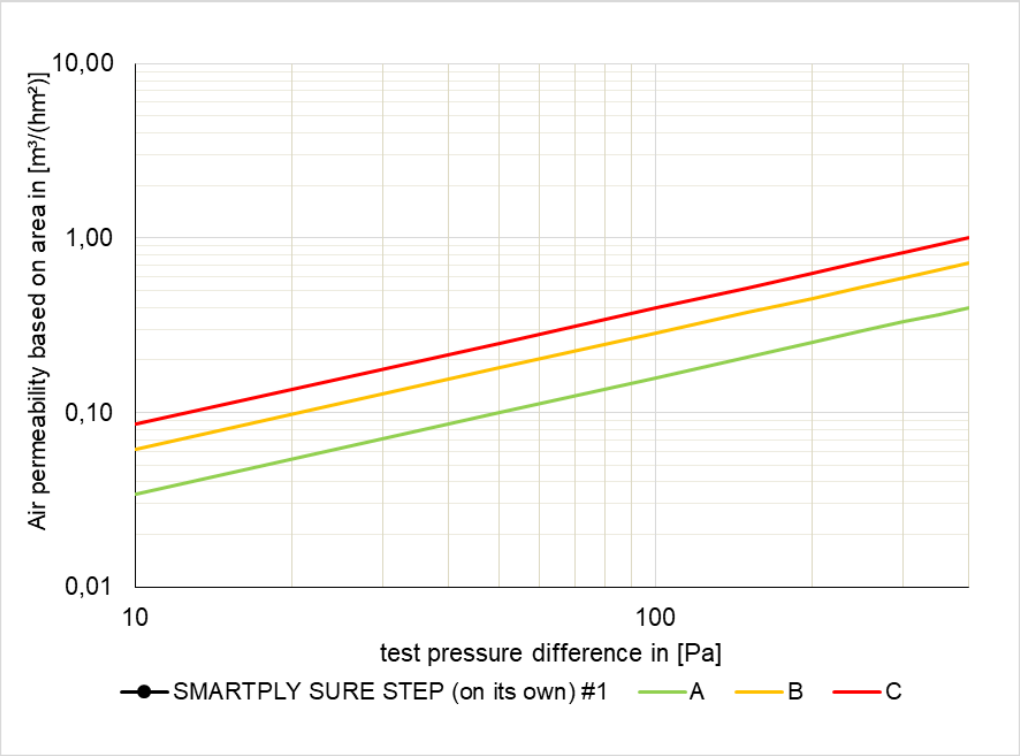

Fig. 7: Series of measurements for the sample "SMARTPLY SURE STEP #1" (panel on its own). The certificate classes A to C according to the PHI are entered in addition.

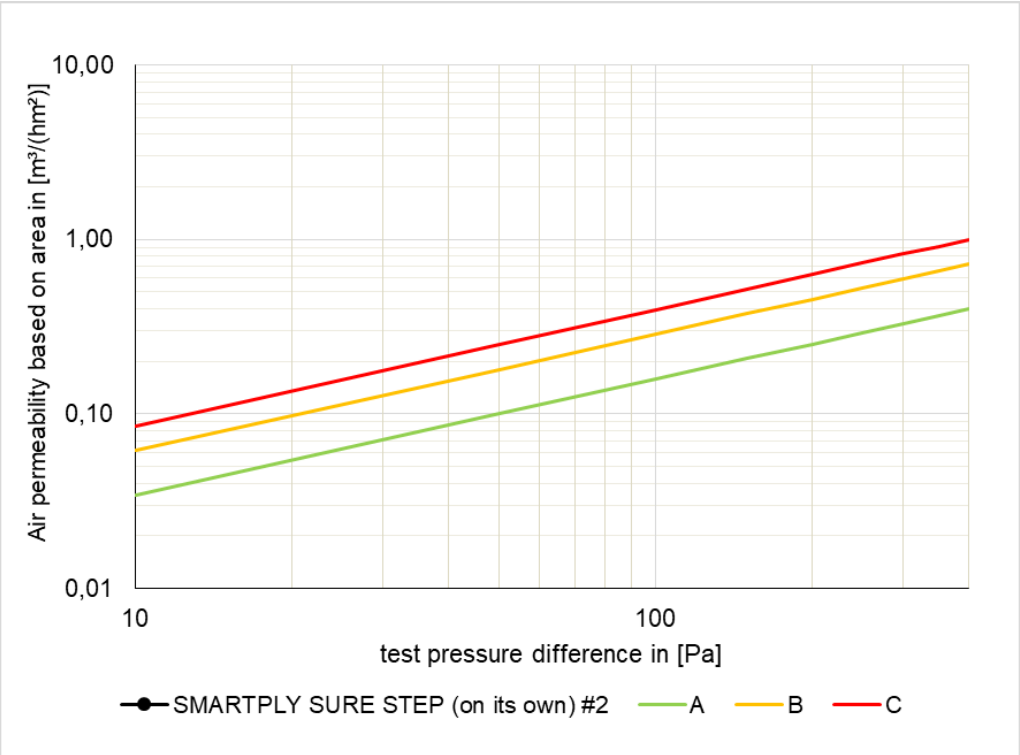

Fig. 8: Series of measurements for the sample "SMARTPLY SURE STEP #2" (panel on its own). The certificate classes A to C according to the PHI are entered in addition.

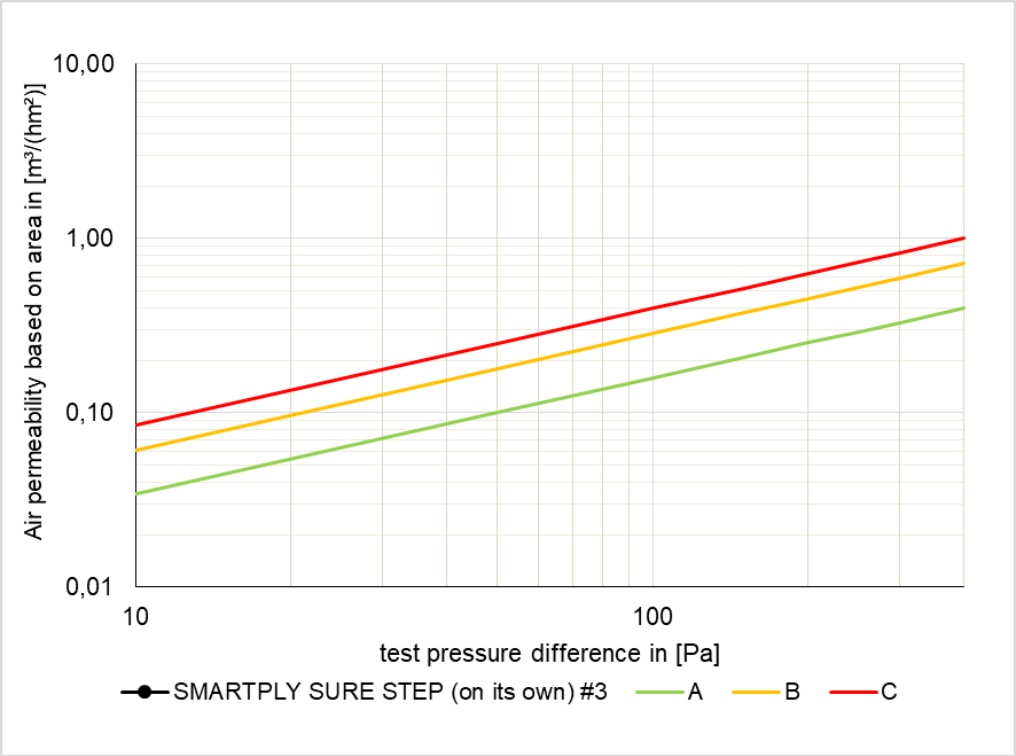

Fig. 9: Series of measurements for the sample "SMARTPLY SURE STEP #3" (panel on its own). The certificate classes A to C according to the PHI are entered in addition.

9.2 Panel to OSB connection

Connection to	
Panel on its own	
Panel to OSB	x
Panel to membrane	
Panel to concrete	

Table 3: Results of the three measurements with the panel to OSB connection using SPEEDY BAND

examined area	1,48 m²

Bonded using Rothoblaas SPEEDY BAND

Pressure stages	Pa	50	100	150	200	250	300	350
SMARTPLY SURE STEP to OSB #1								
total volume flow	m³/h	0,00	0,12	0,14	0,16	0,17	0,19	0,20
test stand leakage	m³/h	0,00	0,12	0,14	0,15	0,16	0,17	0,18
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SMARTPLY SURE STEP to OSB #2								
total volume flow	m³/h	0,00	0,13	0,15	0,17	0,18	0,19	0,21
test stand leakage	m³/h	0,00	0,12	0,15	0,17	0,18	0,20	0,21
specific air volume flow	m³/h	0,01	0,01	0,01	0,01	0,01	0,01	0,01
leakage volume flow based on area	m³/(h m²)	0,01	0,01	0,01	0,01	0,01	0,01	0,01
SMARTPLY SURE STEP to OSB #3								
total volume flow	m³/h	0,00	0,13	0,15	0,17	0,18	0,20	0,21
test stand leakage	m³/h	0,00	0,13	0,15	0,16	0,18	0,19	0,20
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Average

Q50 (PHI - assessment) **0,00** m³/(h m²)

resulting in an airtightness class of **A** according to PHI Q50 ≤ 0,1

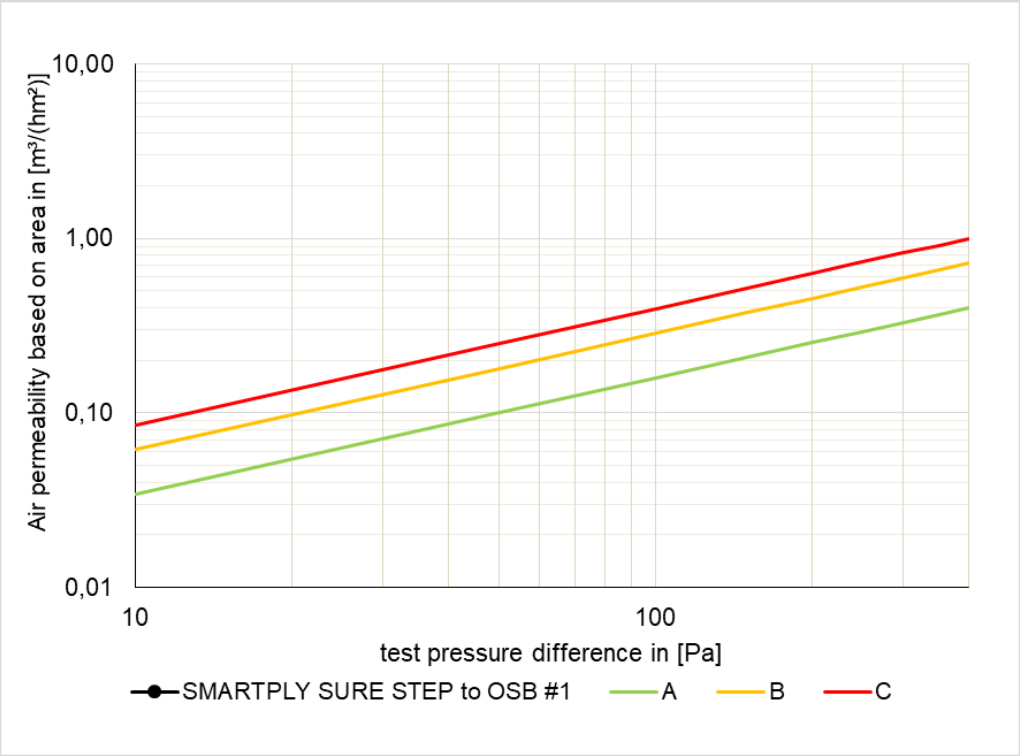

Fig. 10: Series of measurements for the sample "SMARTPLY SURE STEP to OSB #1". The certificate classes A to C according to the PHI are entered in addition.

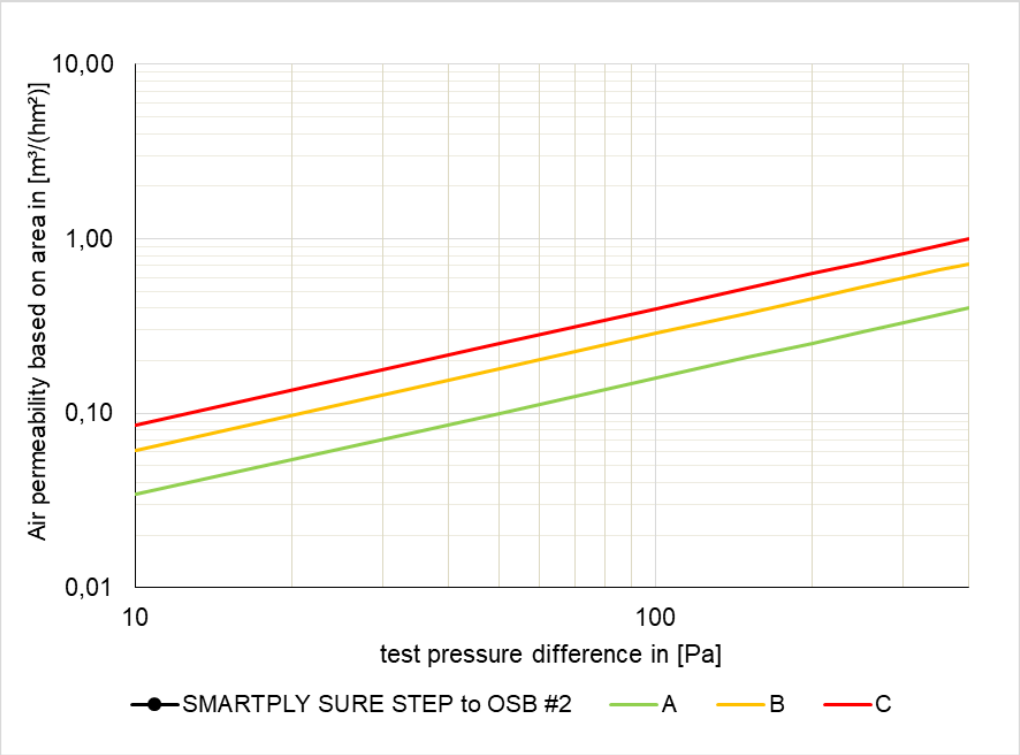

Fig. 11: Series of measurements for the sample "SMARTPLY SURE STEP to OSB #2". The certificate classes A to C according to the PHI are entered in addition.

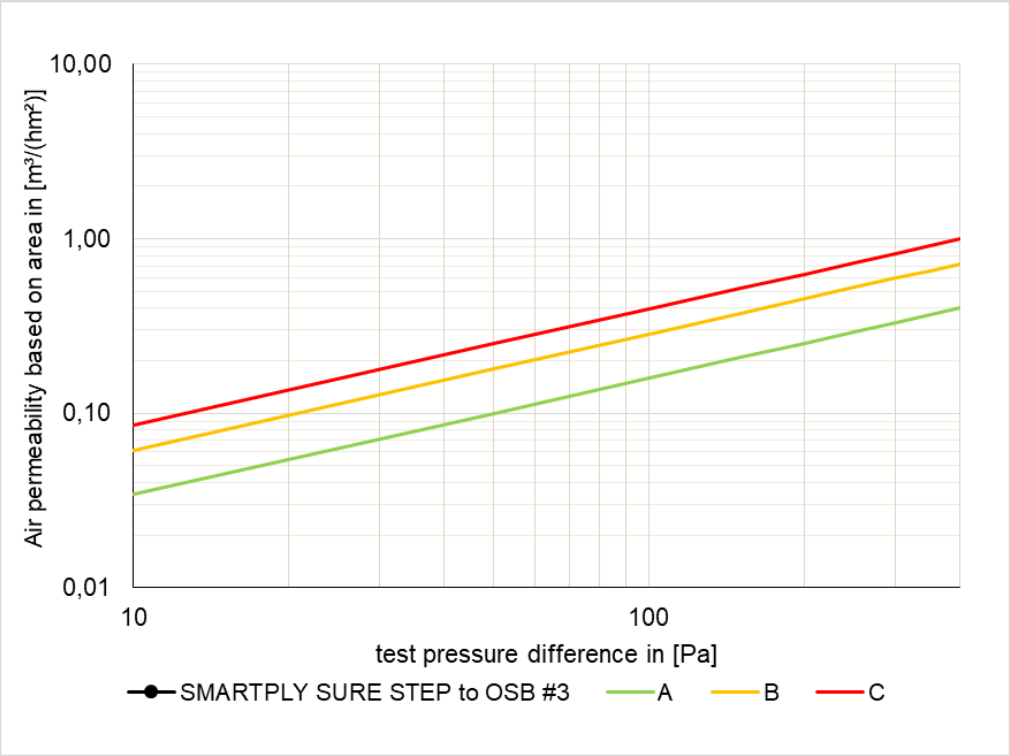

Fig. 12: Series of measurements for the sample "SMARTPLY SURE STEP to OSB #3". The certificate classes A to C according to the PHI are entered in addition.

9.3 Panel to airtight membrane connection

Connection to	
Panel on its own	
Panel to OSB	
Panel to membrane	x
Panel to concrete	

Table 4: Results of the three measurements with the engineered wood panel to airtight membrane connection using SPEEDY BAND

examined area	1,48 m²

Bonded using Rothoblaas SPEEDY BAND

Pressure stages	Pa	50	100	150	200	250	300	350
SMARTPLY SURE STEP to membrane #1								
total volume flow	m³/h	0,02	0,18	0,23	0,27	0,31	0,34	0,37
test stand leakage	m³/h	0,02	0,18	0,23	0,27	0,31	0,35	0,38
specific air volume flow	m³/h	0,02	0,03	0,03	0,04	0,05	0,05	0,06
leakage volume flow based on area	m³/(h m²)	0,01	0,02	0,02	0,03	0,03	0,03	0,04
SMARTPLY SURE STEP to membrane #2								
total volume flow	m³/h	0,20	0,40	0,48	0,54	0,59	0,64	0,68
test stand leakage	m³/h	0,24	0,45	0,53	0,60	0,65	0,70	0,75
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SMARTPLY SURE STEP to membrane #3								
total volume flow	m³/h	0,00	0,14	0,17	0,20	0,23	0,26	0,28
test stand leakage	m³/h	0,00	0,13	0,16	0,18	0,20	0,21	0,23
specific air volume flow	m³/h	0,00	0,00	0,01	0,02	0,05	0,13	0,31
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,01	0,02	0,04	0,09	0,21

Average

Q50 (PHI - assessment) **0,00** m³/(h m²)

resulting in an airtightness class of **A** according to PHI Q50 ≤ 0,1

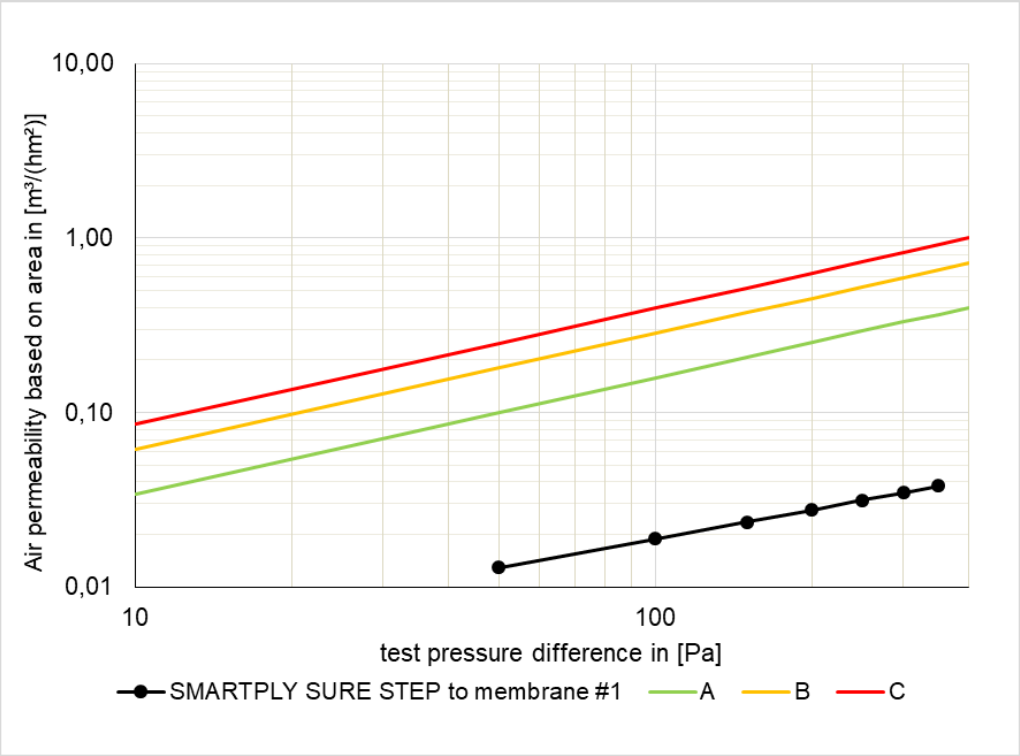

Fig.13: Series of measurements for the sample "SMARTPLY SURE STEP to membrane #1". The certificate classes A to C according to the PHI are entered in addition.

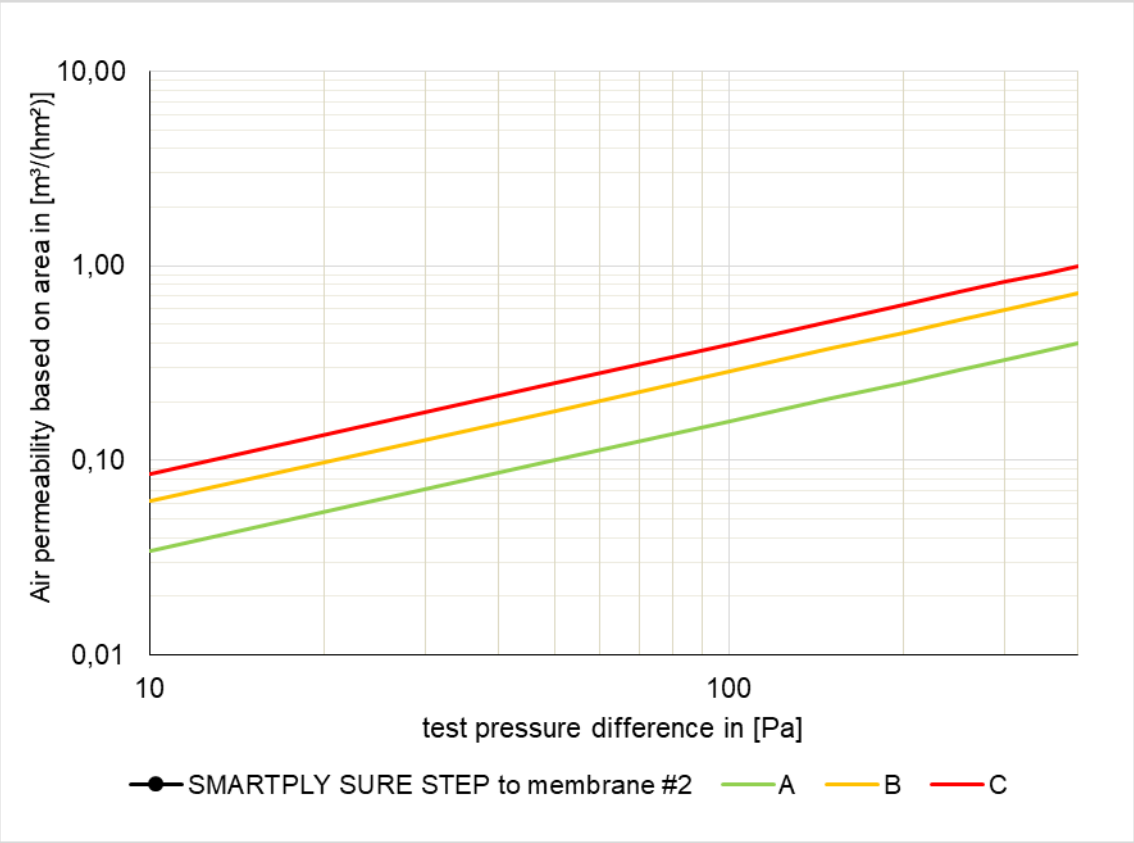

Fig.14: Series of measurements for the sample "SMARTPLY SURE STEP to membrane #2". The certificate classes A to C according to the PHI are entered in addition.

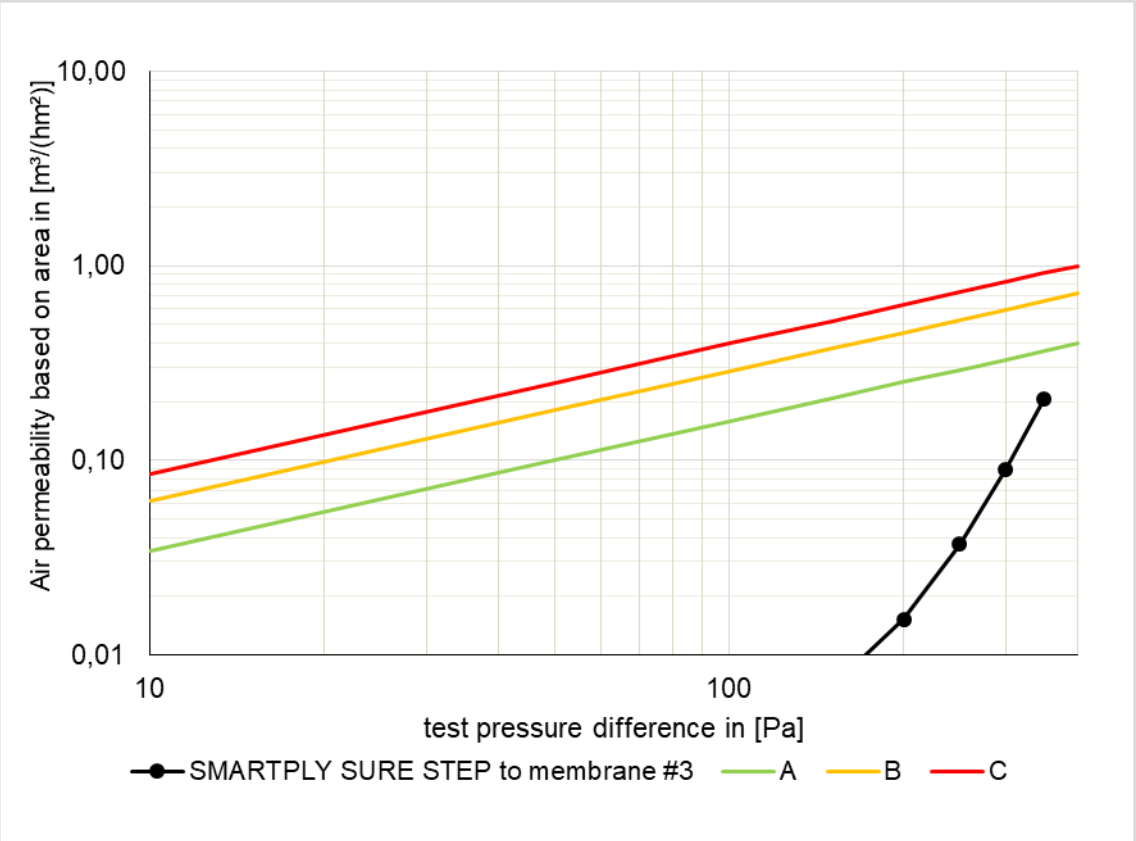

Fig.15: Series of measurements for the sample "SMARTPLY SURE STEP to membrane #3". The certificate classes A to C according to the PHI are entered in addition.

9.4 Panel to concrete

Connection to	
Panel on its own	
Panel to OSB	
Panel to membrane	
Panel to concrete	x

Table 5: Results of the three measurements with the engineered wood panel to concrete connection using FLEXI BAND

examined area	1,48 m²

Bonded using Rothoblaas FLEXI BAND

Pressure stages	Pa	50	100	150	200	250	300	350
SMARTPLY SURE STEP to concrete #1								
total volume flow	m³/h	0,00	0,14	0,16	0,18	0,19	0,21	0,22
test stand leakage	m³/h	0,01	0,15	0,17	0,19	0,21	0,22	0,24
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SMARTPLY SURE STEP to concrete #2								
total volume flow	m³/h	0,00	0,13	0,15	0,17	0,19	0,20	0,21
test stand leakage	m³/h	0,00	0,13	0,16	0,18	0,19	0,21	0,22
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SMARTPLY SURE STEP to concrete #3								
total volume flow	m³/h	0,00	0,15	0,20	0,24	0,28	0,32	0,36
test stand leakage	m³/h	0,01	0,17	0,22	0,27	0,31	0,35	0,39
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,00
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Average

Q50 (PHI - assessment) **0,00** m³/(h m²)

resulting in an airtightness class of **A** according to PHI Q50 ≤ 0,1

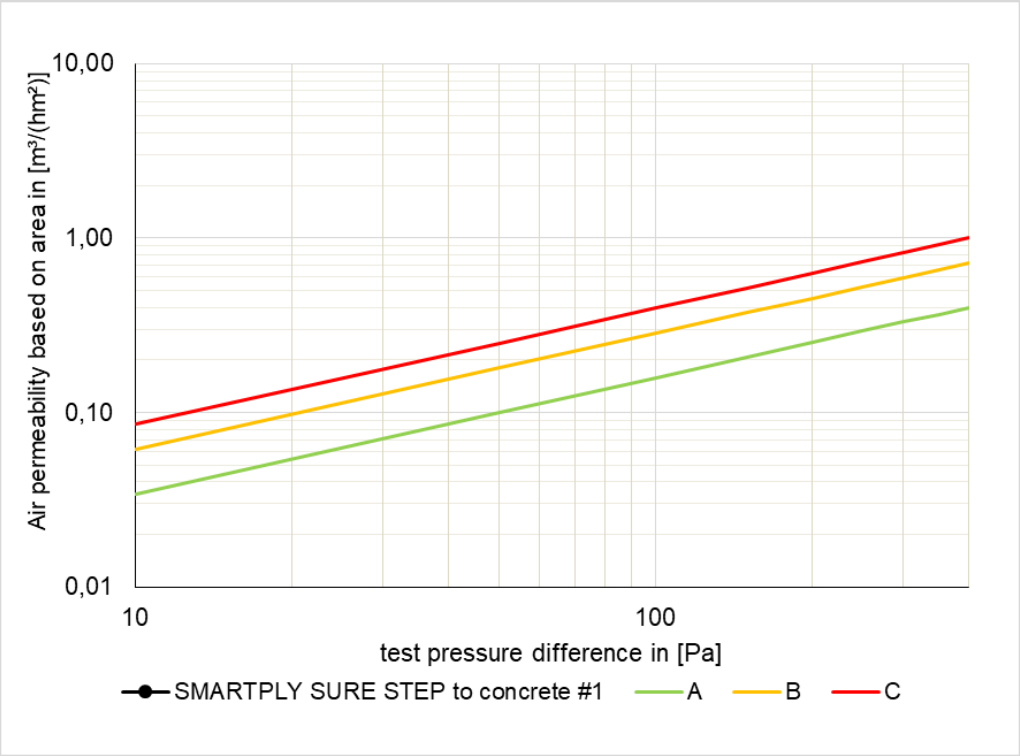

Fig. 16: Series of measurements for the sample "SMARTPLY SURE STEP to concrete #1". The certificate classes A to C according to the PHI are entered in addition.

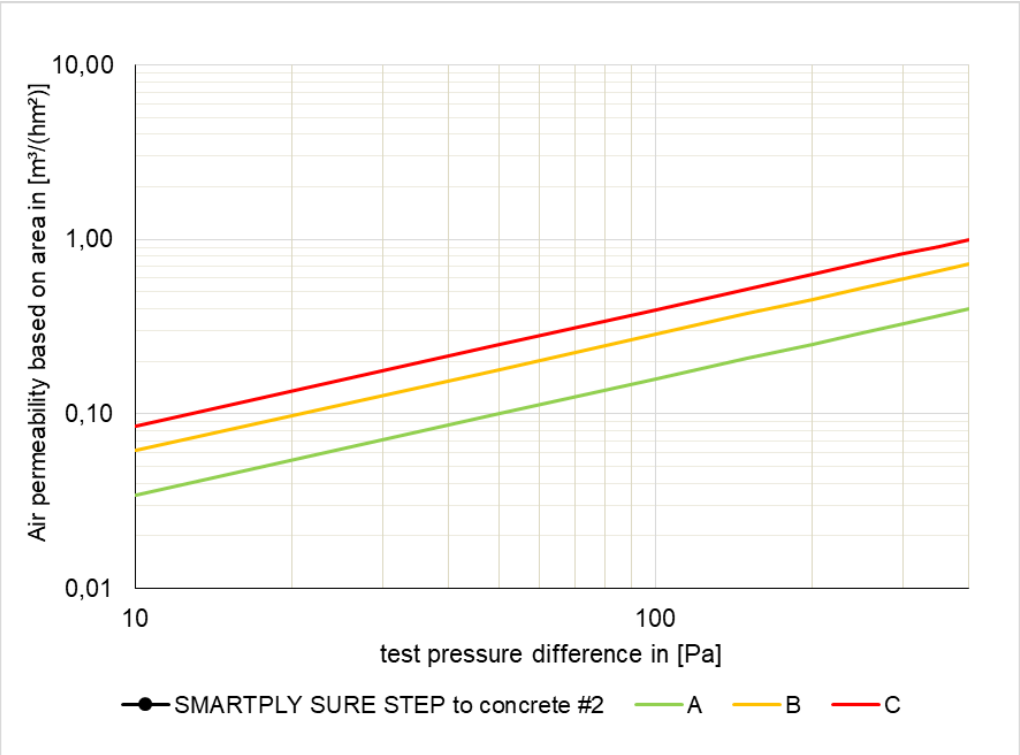

Fig. 17: Series of measurements for the sample "SMARTPLY SURE STEP to concrete #2". The certificate classes A to C according to the PHI are entered in addition.

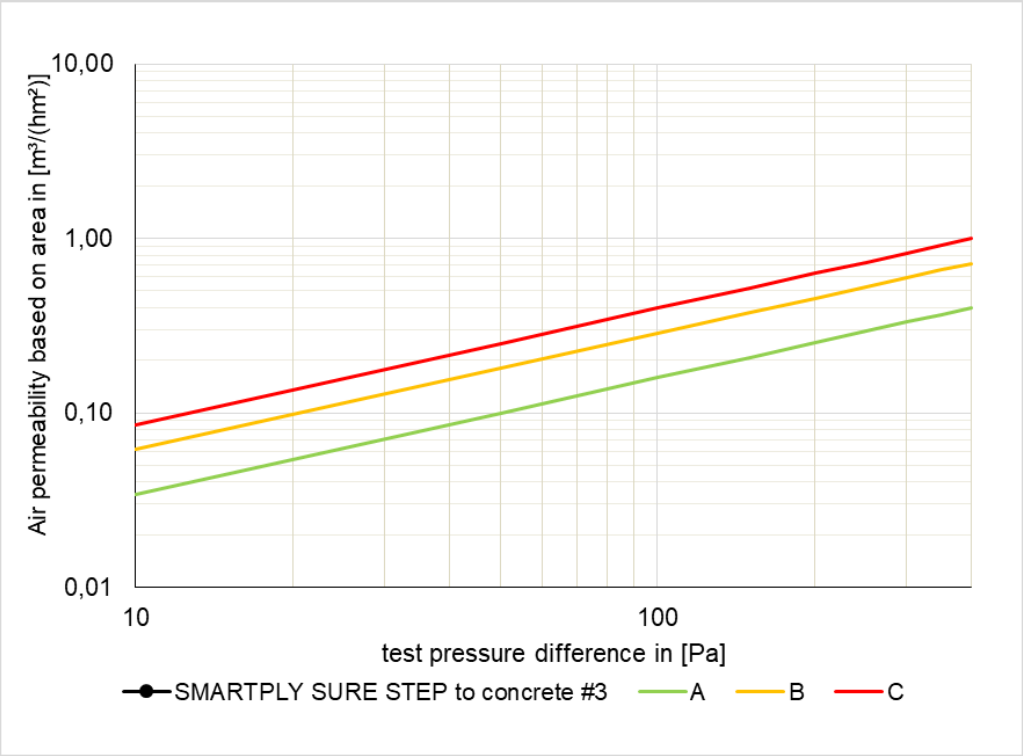

Fig. 18: Series of measurements for the sample "SMARTPLY SURE STEP to concrete #3". The certificate classes A to C according to the PHI are entered in addition.

11. Test conditions

The average indoor climate conditions during the measurements and storage were as follows:

Indoor temperature: 24.3 °C
Indoor air humidity: 36.0 % r.H.

12. Measurement devices

A laminar flow element by the company TetraTec® Instruments was used for measuring the volume flow. The differential pressure was measured using an automated performance testing system (APT) by the manufacturer The Energy Conservatory.

Table 6: Overview of the used measurement devices

Name	Device type	Serial number	Measurement range	Measurement accuracy
LaminarMasterFlow-System	LMF	PH796	0-85 l/min	2 % in the range of 8-80 l/min
TEC Automated Performance Testing	APT	0072 4	0-2000 Pa	1 %

13. Results

The results of these measurements were compiled and the overall average value was generated according to the type of connection. In doing so, the measured value for the engineered wood panel on its own (without any connection) was not taken into account because this concerns certification as a system and not material testing alone. On average, this resulted in an air permeability value of **0.00 (±0.007) m³/(hm²)** standardised for a test pressure of 50 Pa. The certification class "A" was achieved.

Table 7: Overview of the airtightness measurement

Average value of	m³/(hm²) @ 50 Pa
Panel to OSB	0.00
Panel to membrane	0.00
Panel to concrete	0.00
Overall	**0.00 (±0.007)**

Table 8: Requirement class achieved by the examined product for certification as an "Airtightness system surface sealing" according to Passive House Institute specifications

Class	Air permeability based on length @ 50 Pa [m³/(hm²)]	Class achieved
phA	**≤ 0.10**	✓
phB	≤ 0.18	
ph**C**	≤ 0.25	

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