

Test Report

Airtightness test of the vapour control layer including connections System "Procheck Adapt"

**Manufacturer:
Proctorgroup**

Airtightness system: Surface sealing

Darmstadt 07.04.2020

Passive House Institute GmbH

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Commissioned by: **A. Proctor Group Ltd.**
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Product: **Airtightness system consisting of**
 1. Proctorgroup Procheck Adapt membrane
 2. Wraptite Tape 75mm
 3. Proctorgroup Roller
 4. Proctor Primer

Product name: Procheck Adapt
Tested size: Roll of 1.5 m width and 50 m length, 45 mm rubber roller

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 membrane 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 membranes with each other and bonding with concrete and hard engineered wood panels (here: OSB), 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: Requirement classes for the certification of surface sealing products according to Passive House Institute specifications

Class	Air permeability based on area @ 50 Pa [m ³ /(hm ²)]
phA	≤ 0.10
phB	≤ 0.18
phC	≤ 0.25

These apply for the overall performance of a product system specified by the client, consisting 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.

Testing of moisture permeability and the characteristic values for moisture for different ambient humidity levels do not constitute part of this test.

3. Materials to be tested

The required membranes and tools for joining the different connection situations were supplied by the client.

The Procheck Adapt membrane was used for overlap-joining with other sheets of Procheck Adapt membrane in accordance with the manufacturer's instructions. The intended use is on firm substrates where pressure can be applied in all places to ensure adhesion. For the connection to the OSB-panels the membrane was used with Wraptite Tape. Likewise the connection with concrete was carried out using Wraptite Tape with the concrete surface being treated with Proctor Primer before. At all joints the tape was pressed down using the supplied rubber roller with firm pressure. The use and application of all materials took place in accordance with the manufacturer's directions which are described in the "Procheck Adapt Installation Guide".

The following products were delivered by the client on 20.11.2019:

- Procheck Adapt membrane (roll: width 1.5 m, length 50 m)
- Rubber roller 45 mm
- Procheck Adapt Installation Guide
- Wraptite Tape 75mm
- Proctor Primer (aqueous acrylate-polymer dispersion type)

4. Setup for the membrane and connections

All samples of membrane and connections were clamped into the test apparatus across their full width so that they extended on all sides. For sealing, a frame which was identical in construction to the sub-frame of the test apparatus was placed on the apparatus. The frame and counter frames were each equipped with a 5 cm wide sealing surface which served as a support for the airtight membrane. 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 possible due to the even pressure of the counter frame.

For the membrane-to-membrane joints smaller pieces of Procheck Adapt membrane were cut and taped across the width of the membrane, with the prescribed overlap.

For the connection to OSB or concrete, an OSB panel or a concrete slab was placed into a cut out of the membrane provided for this purpose and then taped in with Wraptite Tape, using the prescribed overlap. On the concrete bonding surfaces were treated with primer prior to installing the tape. Firm pressure was applied on the tape using the rubber roller. Each test setup (membrane to membrane, membrane to OSB and membrane to concrete) was created and tested three times in order to minimise any random influences from workmanship.

4.1 Membrane to membrane

For the membrane-to-membrane joints smaller pieces of Procheck Adapt membrane were cut and applied with the prescribed overlap onto the same type of substrate, in accordance with the manufacturer's instructions. For this, as described in the manufacturer's instructions, the lengths of membrane were placed together overlapping by 10 cm as indicated by the printed dashed line and then the adhesive tape was applied equally on both pieces



Fig. 1: Connection of two pieces of membrane with overlap joint.

4.2 Membrane to concrete

The adhesive tape Wraptite Tape was used for the membrane to concrete connection. The adhesive tapes were first applied to both long sides. The subsequently applied tapes at the two short sides overlap the previously applied tapes at the four corners with their full width. Concrete bonding surfaces were treated with Proctor Primer as per the manufacturer's instructions prior to installing the tape.



Fig. 2: Fixture for panels in the test apparatus with the concrete slab in position.

4.3 Membrane to OSB panel

The adhesive tape Wraptite Tape was used for connecting the OSB panel. Here too, the long sides were connected first. One half of the tape width was attached to the OSB panel and the other half was attached to the membrane. Finally the short sides were joined, overlapping with the full width of the adhesive tape. No Primer was used.

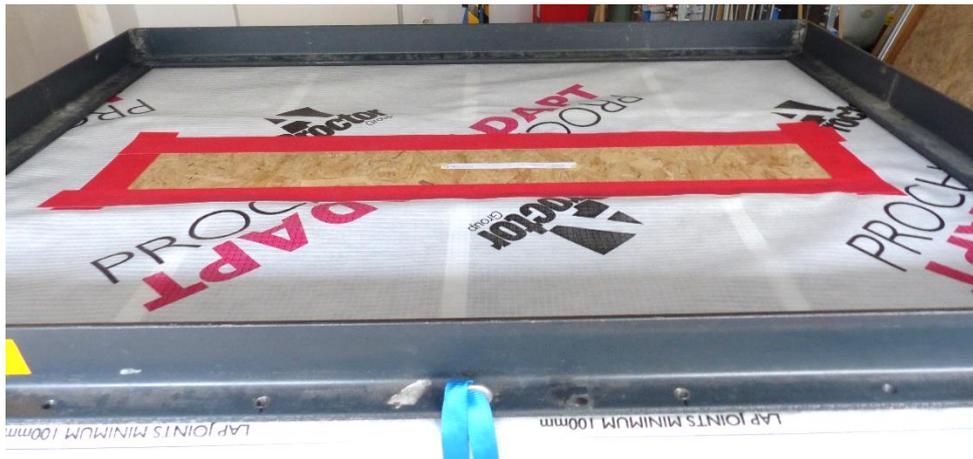


Fig. 3: OSB panel joined to the membrane on all four sides.

5. Test procedure

After setting up in the test stand and attaching the membrane, a measurement was carried out in compliance with DIN EN 12114. For this measurement, the following pressure stages were set for positive and negative pressure: 50, 100, 150, 200, 250, 300, 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 test apparatus was closed using an airtight board. The infiltration air of the test stand determined thus was deducted from the result of the measurement afterwards.

In each measurement, the conveyed 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** in accordance with DIN EN 12114 Appendix B.

From the two series of reference measurements and the two series of actual measurements, smoothing functions were determined through 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 in order to obtain the specific leakage flow per square metre. The free area of the sample is 1.72 m² or 1.48 m² with deduction of the cut-out for the OSB panel or concrete slab.

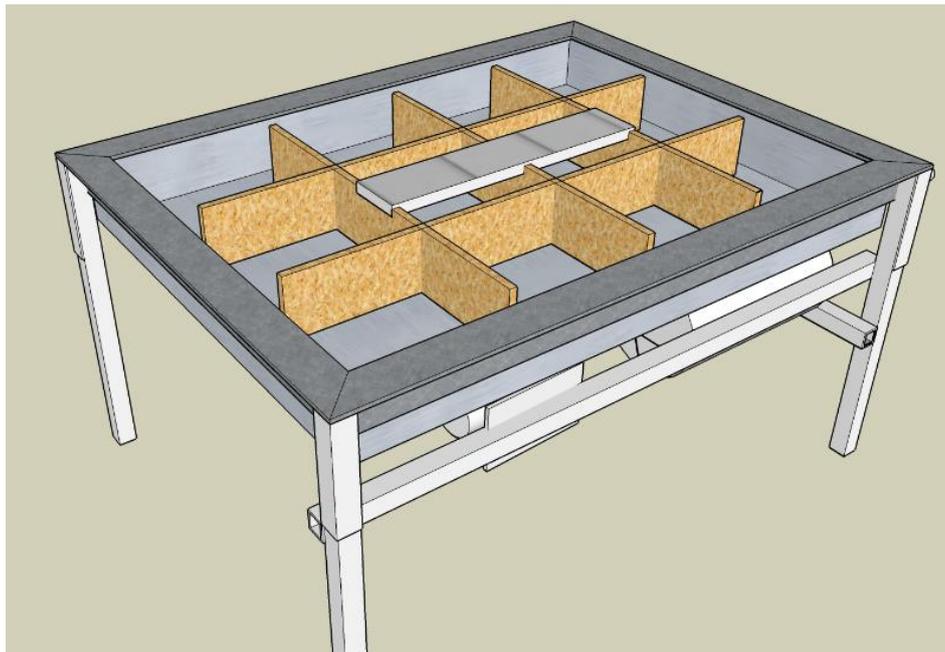


Fig. 4: Sketch of the test apparatus with a fixture for the respective panels



Fig. 5: Sketch of the test apparatus with the clamped membrane and inserted panel which is joined to the membrane with adhesive tape (yellow) (left). Test apparatus sealed with the cover panel for determining the test stand leakage (right).

The measurements of the examined airtightness system took place in the time period from 23.01.2020 to 31.03.2020.

6. Test results

The test results are shown in the following tables and figures, sorted according to the connection methods. The requirement classes for the certification of surface sealing systems are additionally entered in the diagrams.

In the following diagrams with a double logarithmic axis scale, some of the measured values that were determined are not recognisable because these are less than the smallest depicted y-axis value.

6.2 Membrane to membrane

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

Table 2: Test results of the three measurements with the membrane to membrane connection

examined area	1.72 m ²
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Bonded using Wraptite Tape

Pressure stages	Pa	50	100	150	200	250	300	350
Procheck Adapt to Procheck Adapt #1								
total volume flow	m ³ /h	0.09	0.14	0.19	0.23	0.27	0.31	0.35
test stand leakage	m ³ /h	0.07	0.11	0.14	0.17	0.19	0.22	0.24
specific air volume flow	m ³ /h	0.02	0.04	0.05	0.06	0.08	0.09	0.10
leakage volume flow based on area	m ³ /(h m ²)	0.01	0.02	0.03	0.04	0.04	0.05	0.06
Procheck Adapt to Procheck Adapt #2								
total volume flow	m ³ /h	0.08	0.13	0.17	0.21	0.25	0.28	0.31
test stand leakage	m ³ /h	0.07	0.10	0.14	0.17	0.19	0.22	0.24
specific air volume flow	m ³ /h	0.01	0.02	0.03	0.04	0.05	0.06	0.07
leakage volume flow based on area	m ³ /(h m ²)	0.01	0.01	0.02	0.02	0.03	0.04	0.04
Procheck Adapt to Procheck Adapt #3								
total volume flow	m ³ /h	0.07	0.12	0.16	0.20	0.24	0.27	0.30
test stand leakage	m ³ /h	0.06	0.10	0.13	0.16	0.19	0.21	0.23
specific air volume flow	m ³ /h	0.01	0.02	0.03	0.04	0.05	0.06	0.07
leakage volume flow based on area	m ³ /(h m ²)	0.01	0.01	0.02	0.02	0.03	0.03	0.04

Average

Q50 (PHI - assessment) **0.01** m³/(h m²)

resulting in an airtightness class of **A** according to PHI

Q50 ≤ 0,1

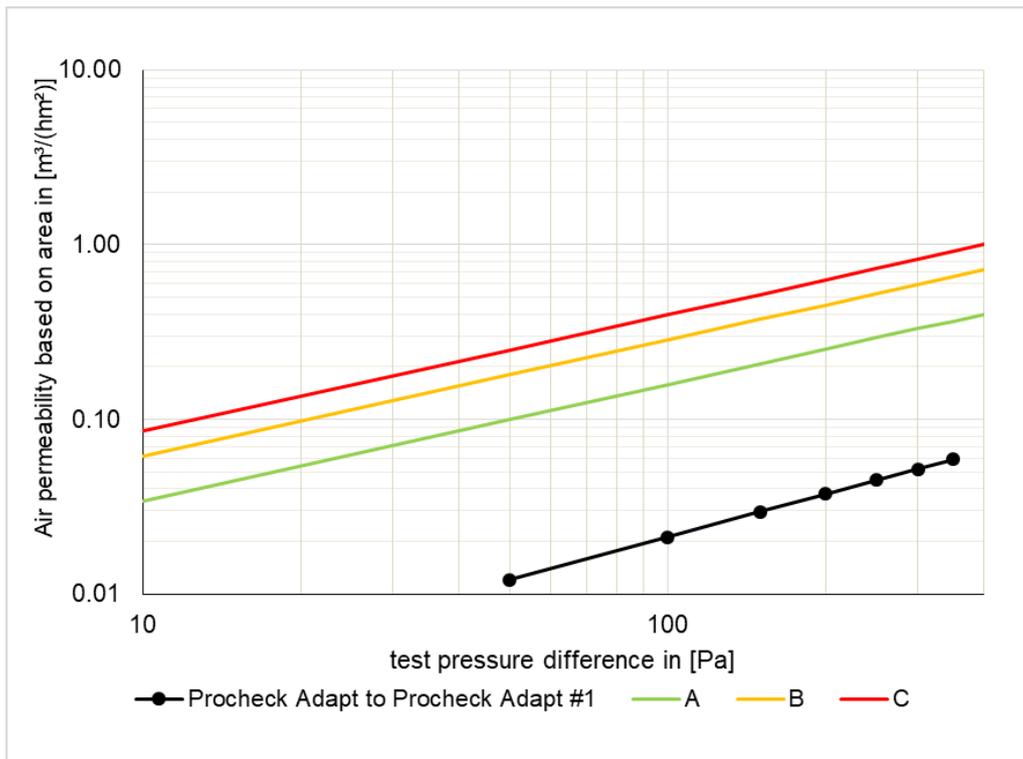


Fig. 6: Series of measurements for the sample "Procheck Adapt #1". The Certification Classes A to C according to the PHI are entered in addition.

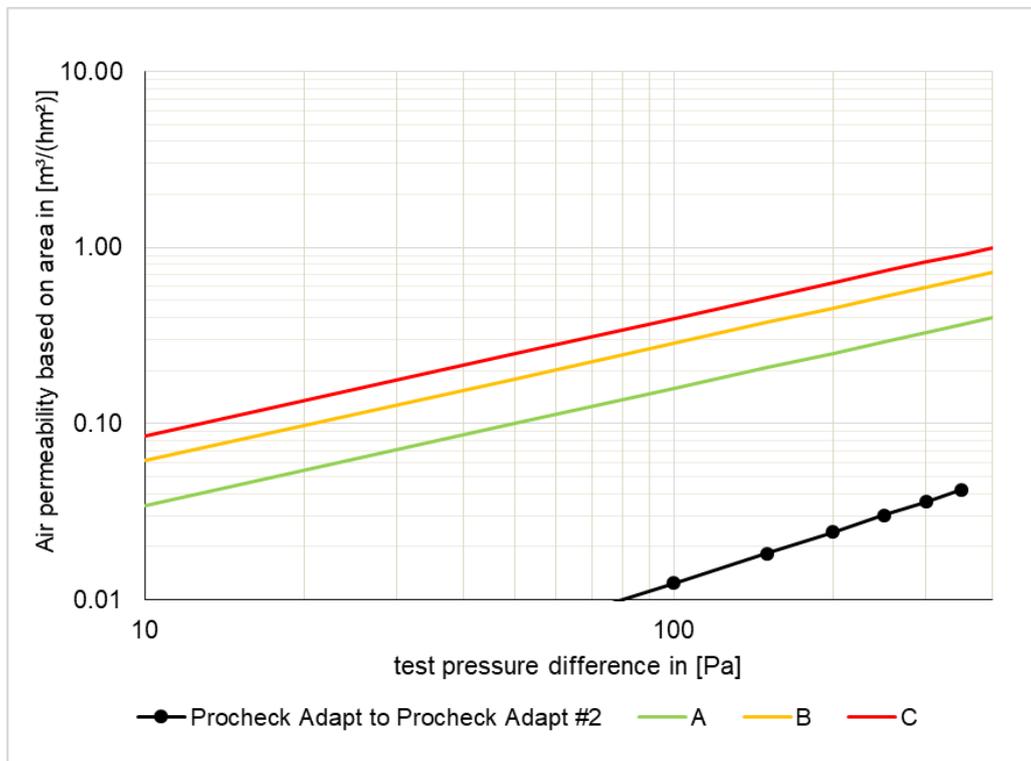


Fig. 7: Series of measurements for the sample "Procheck Adapt #2". The Certification Classes A to C according to the PHI are entered in addition.

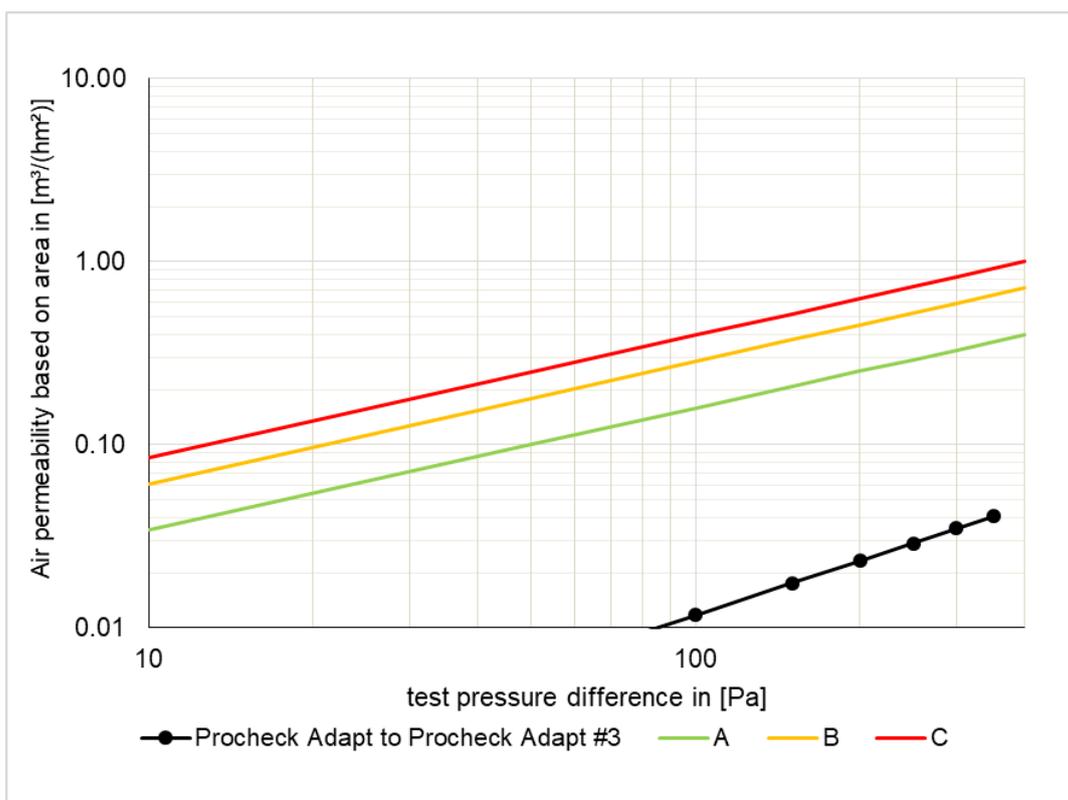


Fig. 8: Series of measurements for the sample "Procheck Adapt #3". The Certification Classes A to C according to the PHI are entered in addition.

6.3 Membrane to OSB

Connection to	
Membrane on its own	
Membrane to membrane	
Membrane to OSB	X
Membrane to concrete	

Table 3: Test results of the three measurements with the membrane joined to the OSB

examined area	1.48 m ²
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Bonded using Wraptite Tape

Pressure stages	Pa	50	100	150	200	250	300	350
Procheck Adapt to OSB #1								
total volume flow	m ³ /h	0.09	0.22	0.36	0.51	0.66	0.83	1.00
test stand leakage	m ³ /h	0.02	0.06	0.09	0.14	0.18	0.23	0.28
specific air volume flow	m ³ /h	0.07	0.16	0.26	0.37	0.48	0.60	0.73
leakage volume flow based on area	m ³ /(h m ²)	0.05	0.11	0.18	0.25	0.33	0.41	0.49
Procheck Adapt to OSB #2								
total volume flow	m ³ /h	0.23	0.39	0.55	0.69	0.82	0.95	1.08
test stand leakage	m ³ /h	0.06	0.09	0.12	0.15	0.17	0.19	0.21
specific air volume flow	m ³ /h	0.17	0.30	0.43	0.54	0.66	0.77	0.87
leakage volume flow based on area	m ³ /(h m ²)	0.11	0.20	0.29	0.37	0.44	0.52	0.59
Procheck Adapt to OSB #3								
total volume flow	m ³ /h	0.36	0.61	0.83	1.03	1.21	1.39	1.56
test stand leakage	m ³ /h	0.05	0.09	0.11	0.14	0.16	0.18	0.20
specific air volume flow	m ³ /h	0.36	0.61	0.83	1.03	1.21	1.39	1.56
leakage volume flow based on area	m ³ /(h m ²)	0.25	0.41	0.56	0.69	0.82	0.94	1.05

Average

Q50 (PHI - assessment) **0.14** m³/(h m²)

resulting in an airtightness class of **B** according to PHI **Q50 ≤ 0,18**

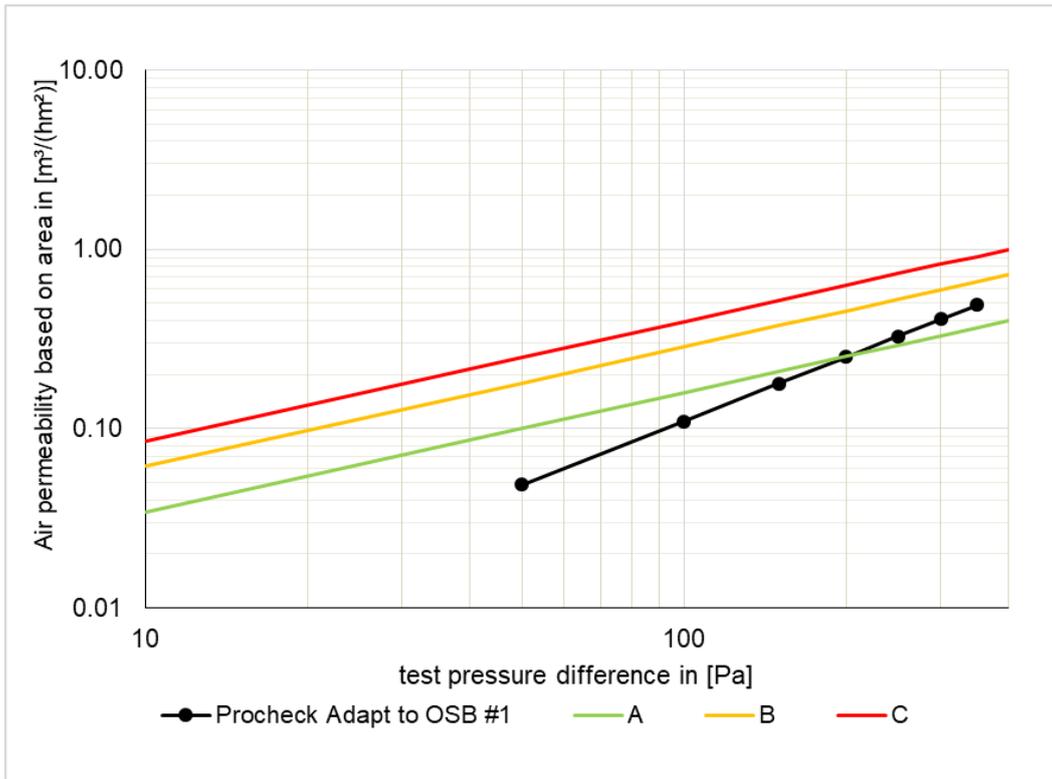


Fig. 9: Series of measurements for the sample "Procheck Adapt/OSB #1". The Certification Classes A to C according to the PHI are entered in addition.

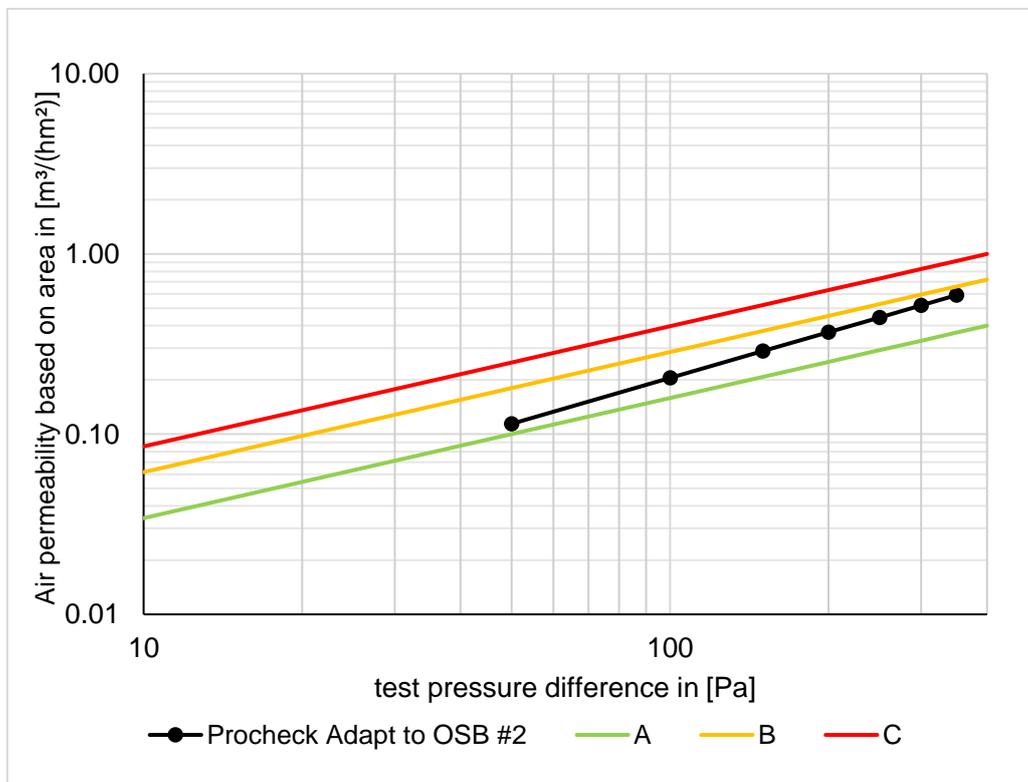


Fig. 10: Series of measurements for the sample "Procheck Adapt/OSB #2". The Certification Classes A to C according to the PHI are entered in addition.

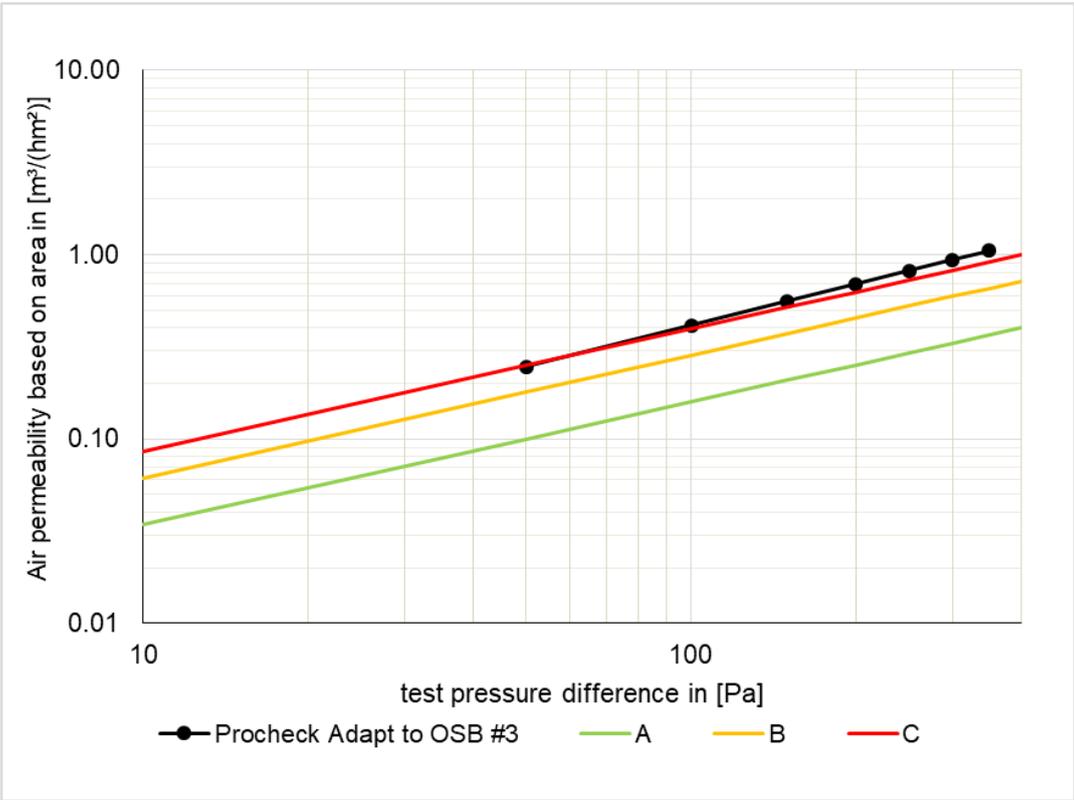


Fig. 11: Series of measurements for the sample "Procheck Adapt/OSB #3". The Certification Classes A to C according to the PHI are entered in addition.

6.4 Membrane to concrete

Connection to	
Membrane on its own	
Membrane to membrane	
Membrane to OSB	
Membrane to concrete	X

Table 4: Test results of the three measurements with the membrane joined to concrete

examined area	1.48 m ²
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Bonded using Wraptite Tape/Proctor Primer

Pressure stages	Pa	50	100	150	200	250	300	350
Procheck Adapt to concrete #1								
total volume flow	m ³ /h	0.26	0.46	0.65	0.82	0.99	1.15	1.31
test stand leakage	m ³ /h	0.05	0.08	0.11	0.13	0.15	0.17	0.19
specific air volume flow	m ³ /h	0.21	0.38	0.54	0.69	0.84	0.99	1.13
leakage volume flow based on area	m ³ /(h m ²)	0.14	0.26	0.36	0.47	0.57	0.67	0.77
Procheck Adapt to concrete #2								
total volume flow	m ³ /h	0.16	0.27	0.37	0.45	0.53	0.61	0.68
test stand leakage	m ³ /h	0.11	0.18	0.23	0.27	0.31	0.35	0.39
specific air volume flow	m ³ /h	0.05	0.09	0.14	0.18	0.23	0.27	0.31
leakage volume flow based on area	m ³ /(h m ²)	0.03	0.06	0.09	0.12	0.15	0.18	0.21
Procheck Adapt to concrete #3								
total volume flow	m ³ /h	0.15	0.24	0.33	0.40	0.48	0.54	0.61
test stand leakage	m ³ /h	0.08	0.13	0.16	0.20	0.23	0.25	0.28
specific air volume flow	m ³ /h	0.07	0.12	0.16	0.21	0.25	0.29	0.33
leakage volume flow based on area	m ³ /(h m ²)	0.05	0.08	0.11	0.14	0.17	0.19	0.22

Average

Q50 (PHI - assessment) **0.07** m³/(h m²)

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

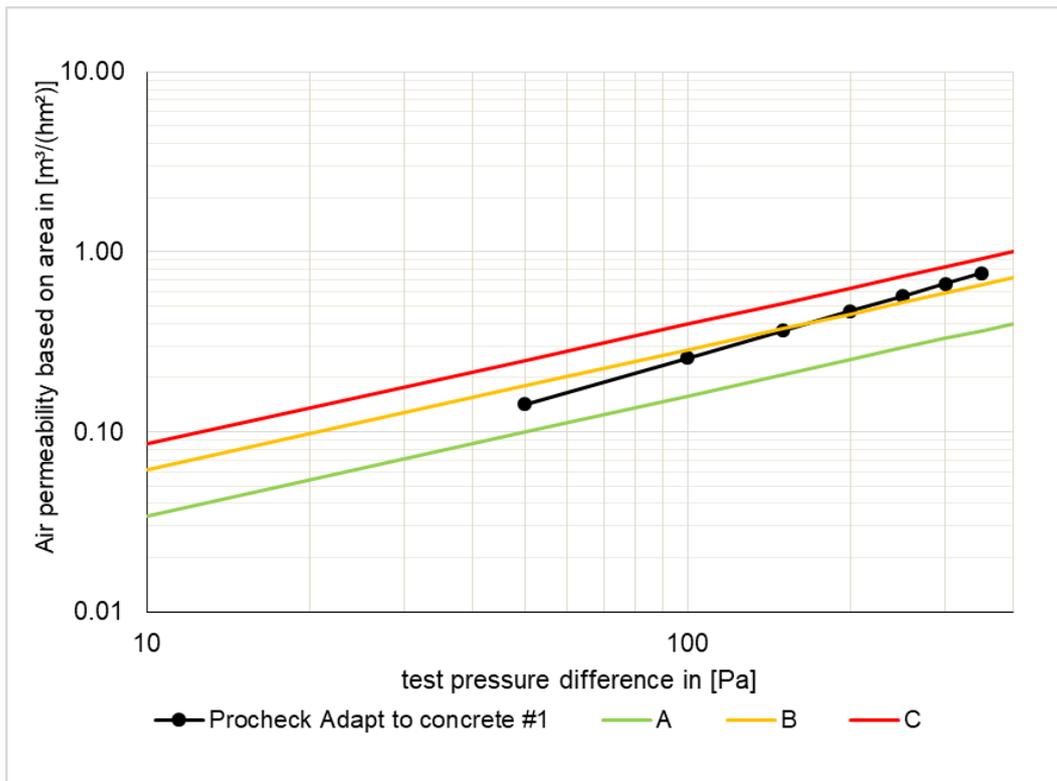


Fig. 12: Series of measurements for the sample "Procheck Adapt/concrete #1". The Certification Classes A to C according to the PHI are entered in addition.

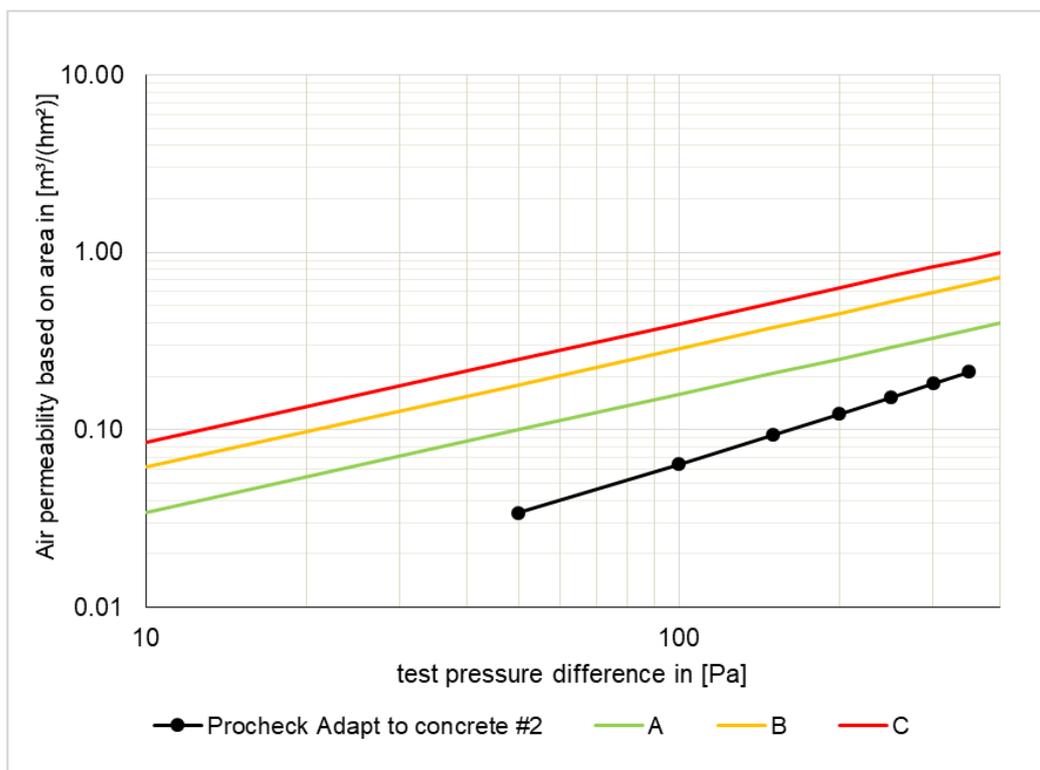


Fig. 13: Series of measurements for the sample "Procheck Adapt/concrete #2". The Certification Classes A to C according to the PHI are entered in addition.

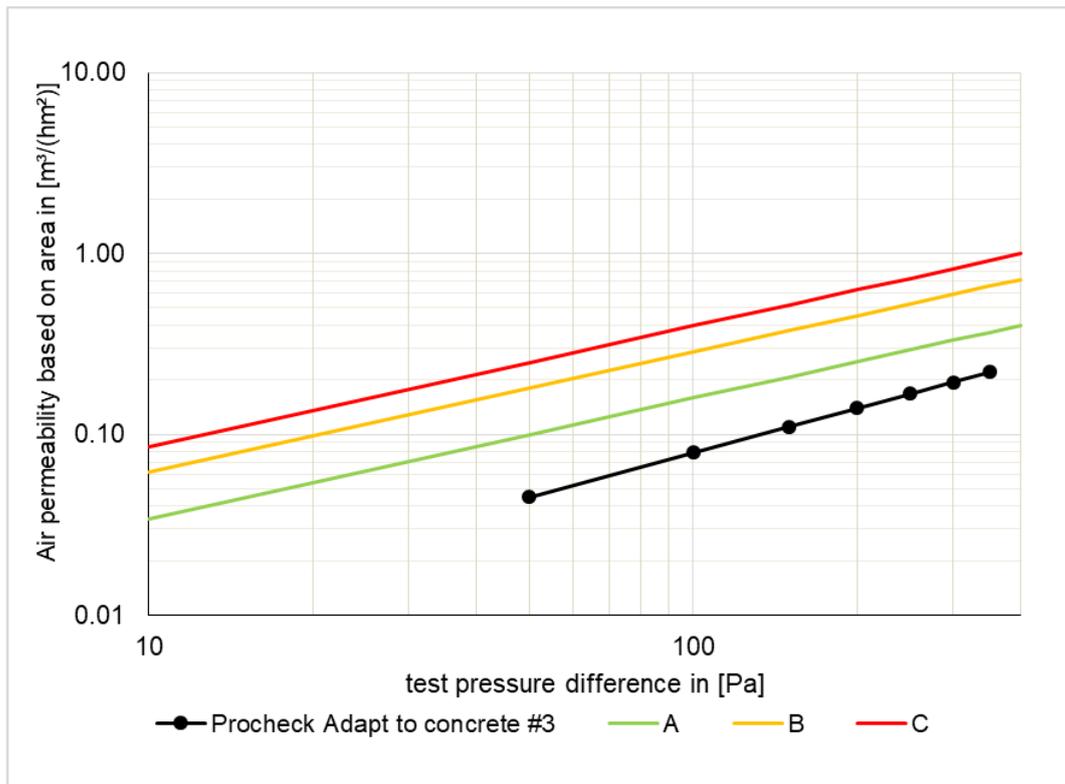


Fig. 14: Series of measurements for the sample "Procheck Adapt/concrete #3". The Certification Classes A to C according to the PHI are entered in addition.

7. Test conditions

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

Indoor temperature: 20.2 °C
 Indoor air humidity: 48.3% r.H.

8. 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 5: 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 %

9. Results

The results of these measurements were compiled and the overall average value was created according to the type of connection. In doing so, the measured value for the membrane on its own (without any joining) was not taken into account as the certification scheme aims at a system and rather than material testing only.

On average, this resulted in an air permeability value of **0.073 (±0.006) m³/(hm²)** standardised for a test pressure of 50 Pa. The certification class "A" was achieved.

Table 6: Overview of the results of the airtightness measurement.

Average value of	m ³ /(hm ²) @ 50 Pa
Membrane to membrane	0.01
Membrane to OSB	0.14
Membrane to concrete	0.07
Overall	0.07 (±0.006)

Table 7: Requirement class achieved by the examined product for certification as an "Airtightness system surface sealing" according to the specifications of the Passive House Institute

Class	Air permeability based on length @ 50 Pa [m ³ /(hm ²)]	Class achieved
phA	≤ 0.10	✓
phB	≤ 0.18	
phC	≤ 0.25	

Darmstadt, 07.04.2020



Wolfgang Hasper