Test Report

Airtightness test of the sprayed airtightness layer including connections System "AEROSANA VISCONN FIBRE"

Manufacturer:
pro clima

MOLL bauökologische Produkte GmbH
Rheintalstraße 35 - 43
D-68723 Schwetzingen

Airtightness system: Surface sealing

Darmstadt 11.04.2023

Passive House Institute
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Commissioned by:	pro clima MOLL bauökologische Produkte GmbH Rheintalstraße 35 - 43 D-68723 Schwetzingen
Product:	**Airtightness system consisting of** AEROSANA VISCONN FIBRE
Product name:	AEROSANA VISCONN FIBRE
Tested size:	Product spray-applied as per manufacturer's instructions

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 tested system to typical adjacent materials will be examined in the context of certification. With respect to the product system, this test examined the connection with membranes, 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 [m³/(hm²)]
ph**A**	≤ 0.10
ph**B**	≤ 0.18
ph**C**	≤ 0.25

These apply to 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 users.

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

For surfaces the spray-applied sealing product AEROSANA VISCONN FIBRE is applied. Its primary use is on massive substrates. Connections to adjacent airtightness systems of a different type were made in the following ways:

- Connection to adjacent solid building elements (concrete) and to hard wood-based panels (OSB) are sprayed over with the same material without any other additional materials.

- Connecting to an airtight membrane (Intello), this was taped with Tescon Vana adhesive tape and then sprayed over with AEROSANA VISCONN FIBRE.

The following products were delivered by the client on 18.01. and 13.02.2023:

- AEROSANA VISCONN FIBRE
- Prebena WARRIOR 435 Compressor
- Instructions for use
- Airless spray system AEROFIXX

4. Setup for the system and connections

The sealing system was spray-applied in two crossing passes without intermediate drying onto an air-permeable glass fibre substrate. 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 test sample. 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 connection to OSB or concrete, an OSB panel or a concrete slab was joined to the substrate and the circumferential joint was filled with substrate and spread ("pressed in") with a brush. Then the OSB panel or the concrete panel was sprayed over with the substrate.

Each test setup (membrane to membrane, membrane to OSB and membrane to concrete) was created and tested three times in order to minimise any influences by workmanship.

4.1 Regular Surface

The samples for the regular surface were made by spray-applying the system in two crossing passes without intermediate drying onto an air-permeable glass fibre substrate.

4.2 Membrane to membrane

To test the connection of areas sealed with AEROSANA VISCONN FIBRE to areas sealed with airtightness membranes the exemplary certified membrane systems INTELLO (PHI Component-ID: 1151as03) were joined with the substrate using the respective Tescon Vana tapes. A gapless connection to the surface seal was created by spraying AEROSANA VISCONN FIBRE over the adhesive tape.

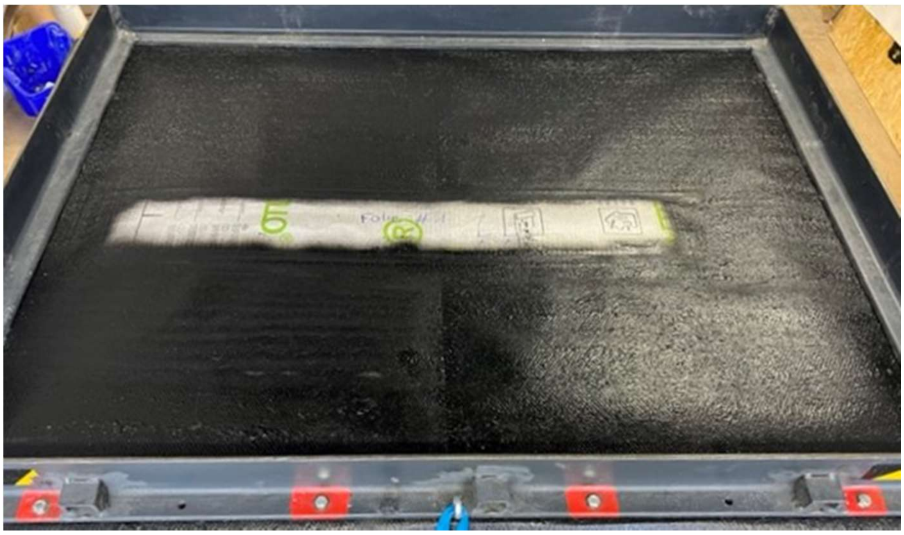

Fig. 1: Connection to a membrane-based air sealing system.

4.3 Membrane to concrete

The connection to concrete components were prepared according to the manufacturer's instructions without additional material. For this purpose, the glass fiber substrate was cut with a cutter at the points of the concrete slab and the concrete slab was inserted. AEROSANA VISCONN FIBRE was then applied on the substrate and the edge of the concrete slab. The material was additionally distributed in the joints with the aid of a brush (for photos, see also 4.5).

Fig. 2: Testing the joint with a concrete member

4.4 Membrane to OSB panel

The connection to OSB components were prepared according to the manufacturer's instructions without additional material. For this purpose, the glass fiber substrate was cut with a cutter at the points of the OSB slab and the OSB slab was inserted. AEROSANA VISCONN FIBRE was then applied on the substrate and the edge of the concrete slab. The material was additionally distributed in the joints with the aid of a brush (for photos, see also 4.5).

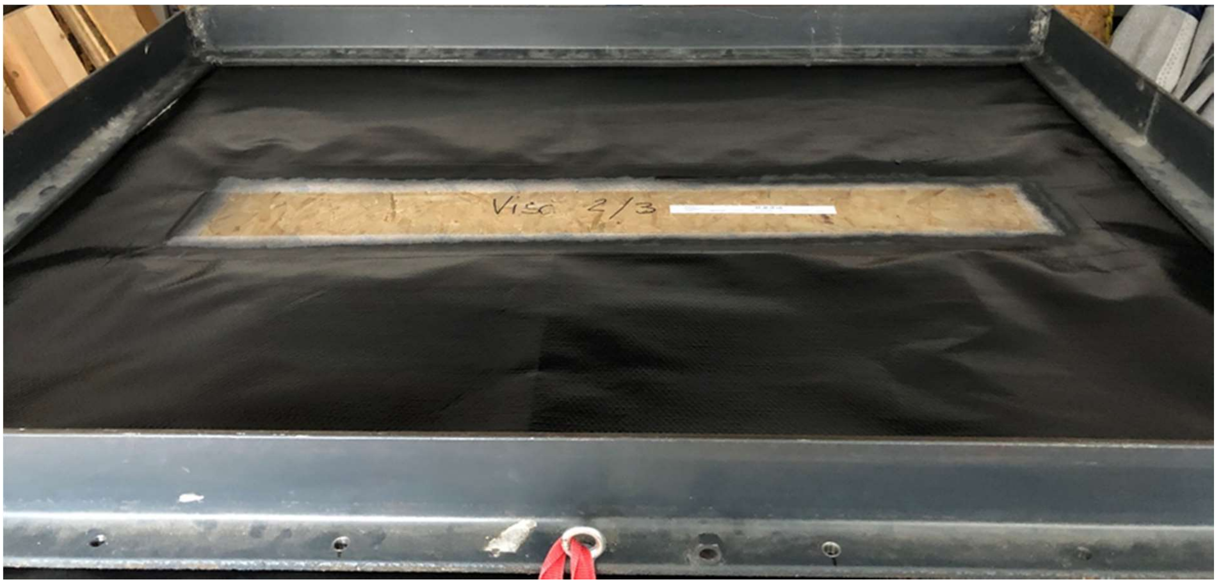

Fig 3: Testing the joint with a wooden board member

4.5 Processing

To illustrate the procedure for applying the sealing material, the sealing of the surface to a concrete slab is described here as an example. The concrete surface is inserted into the leaky surface substrate (glass fiber fleece). A groove of about 0.5 to 1.5 cm width was created all around (see Fig 4).

Fig 4: Inserted concrete slab (left) and size of the remaining gap (right).

In the first work step, the circumferential joint is filled with sealant and then spread with a brush or pressed even deeper into the joint. Then the surface is sprayed in the vertical direction and then in the horizontal direction (crosswise), in each case with an overlap (approx. 25 to 40 %) to the previous row. Despite the overhang to the previous row, it is not sufficient to apply material sparingly in one direction only - i.e. not crosswise (see Fig 5).

Fig 5: Filling the gap around the concrete slab (left) and situation after applying the surface seal around the concrete surface (right).

5. Test procedure

After setting up in the test stand and attaching the sample, a measurement was carried out in following 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.

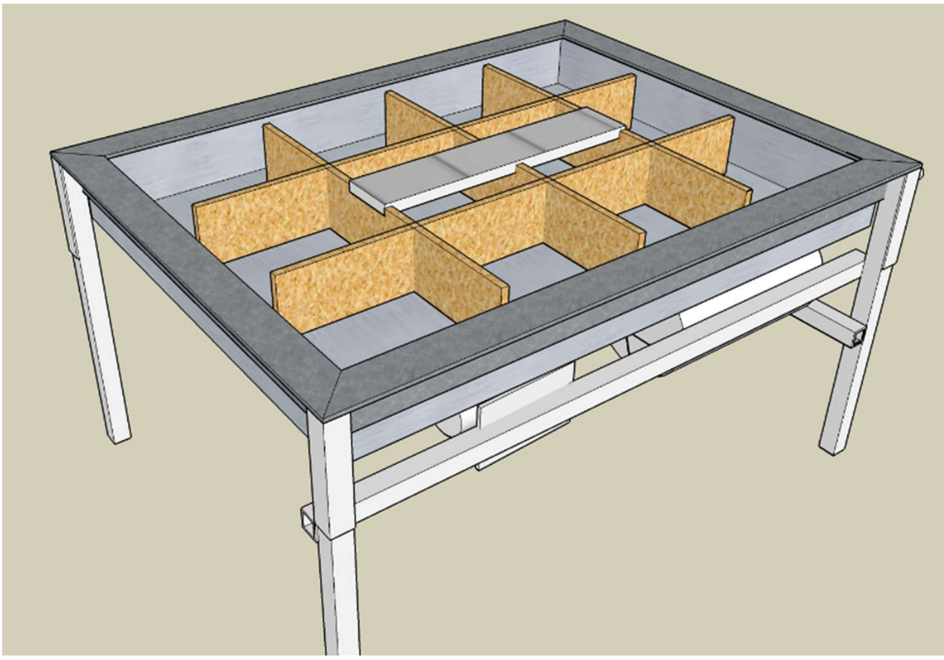

Fig 6: Sketch of the test apparatus with a fixture for the respective panels

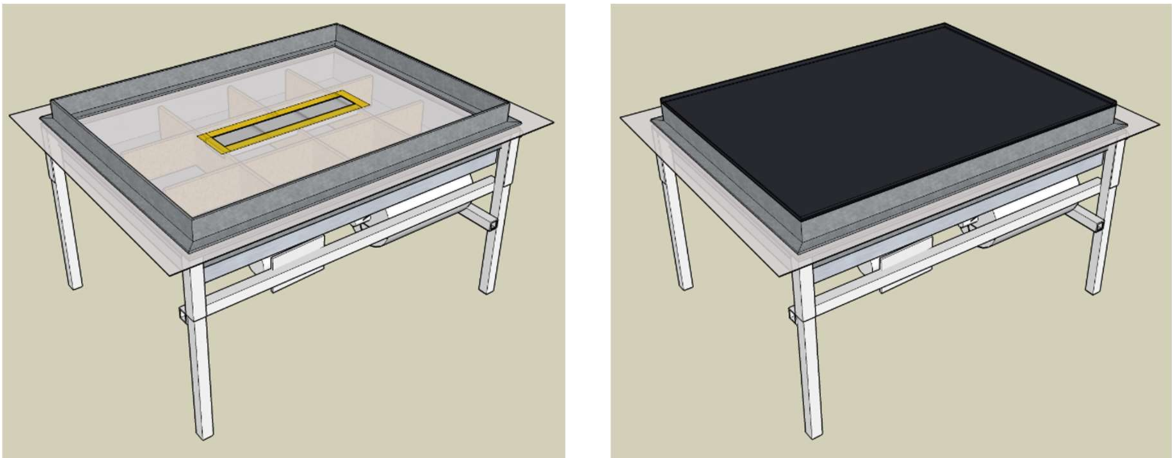

**Fig 7: Sketch of the test apparatus with the clamped membrane and inserted panel which is joined to the membrane with adhesive tape (yellow) (left).
Test apparatus sealed with the cover panel for determining the test stand leakage (right).**

The measurements of the examined airtightness system took place in the time period from 01.03.23 to 15.03.23.

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 connection to membrane

examined area	1,48 m²

Pressure stages	Pa	50	100	150	200	250	300	350
AEROSANA VISCONN FIBRE to membrane #1								
total volume flow	m³/h	0,00	0,13	0,15	0,17	0,18	0,19	0,20
test stand leakage	m³/h	0,00	0,12	0,14	0,15	0,17	0,18	0,19
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
AEROSANA VISCONN FIBRE to membrane #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	0,12	0,14	0,16	0,17	0,18	0,19
specific air volume flow	m³/h	0,01	0,01	0,01	0,01	0,02	0,02	0,02
leakage volume flow based on area	m³/(h m²)	0,01	0,01	0,01	0,01	0,01	0,01	0,01
AEROSANA VISCONN FIBRE to membrane #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	0,12	0,13	0,15	0,16	0,17	0,18
specific air volume flow	m³/h	0,01	0,01	0,01	0,01	0,02	0,02	0,02
leakage volume flow based on area	m³/(h m²)	0,00	0,01	0,01	0,01	0,01	0,01	0,01

Average

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

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

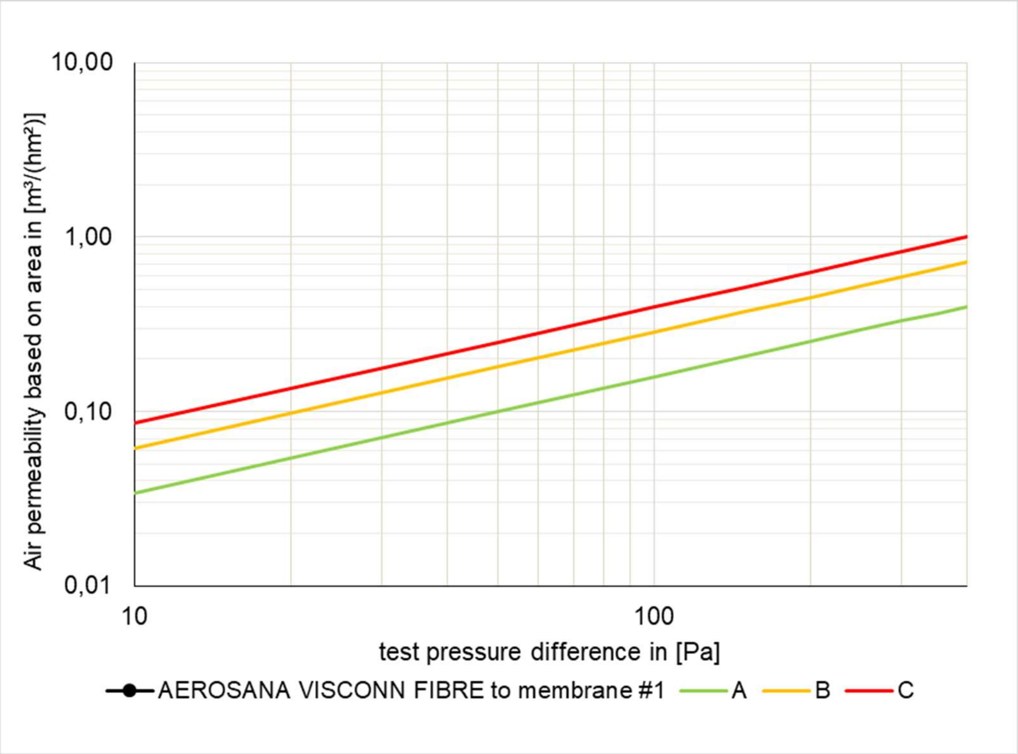

Fig 8: Series of measurements for the sample "AEROSANA VISCONN FIBRE to membrane #1". The Certification Classes A to C according to the PHI are entered in addition.

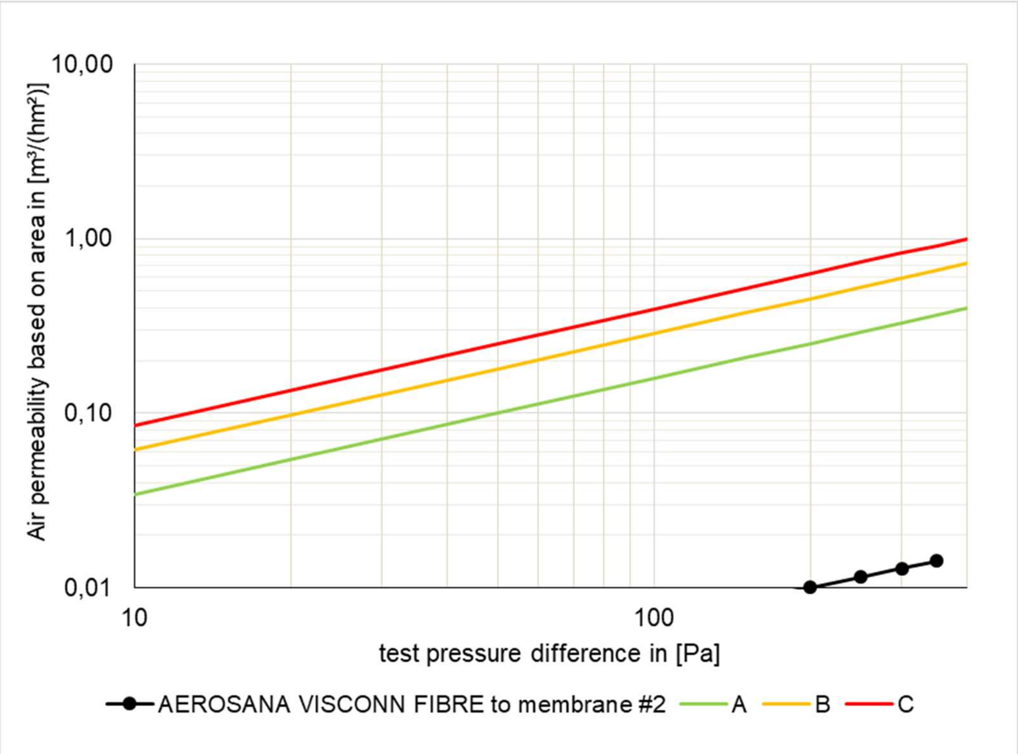

Fig 9: Series of measurements for the sample "AEROSANA VISCONN FIBRE to membrane #2". The Certification Classes A to C according to the PHI are entered in addition.

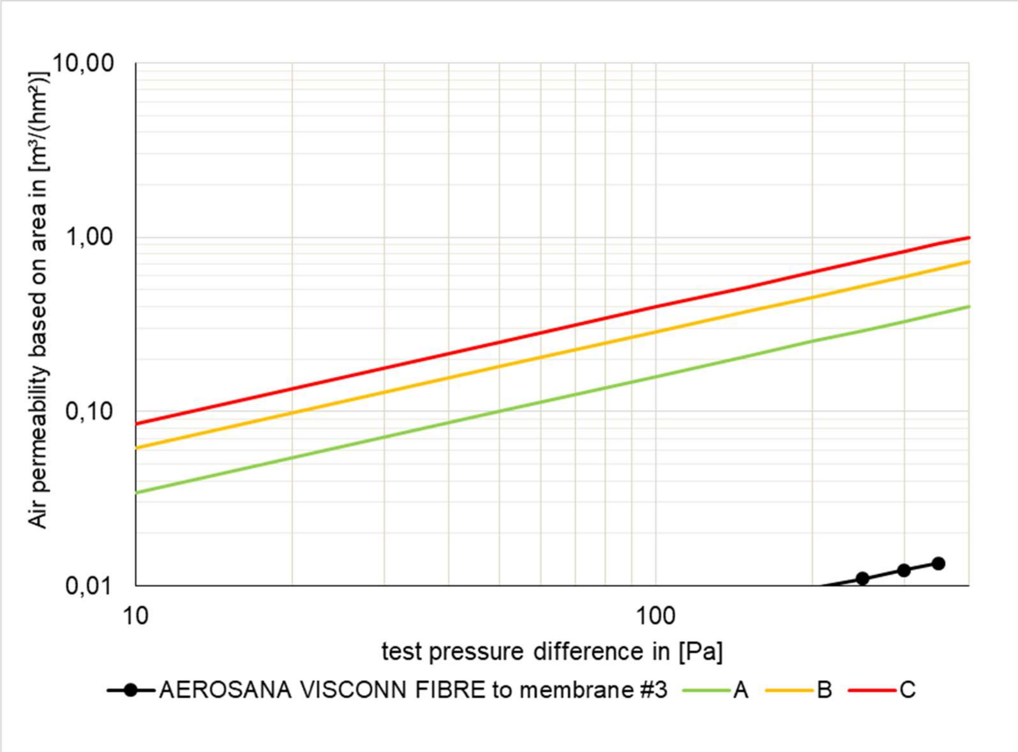

Fig 10: Series of measurements for the sample "AEROSANA VISCONN FIBRE to membrane #3" The Certification Classes A to C according to the PHI are entered in addition.

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 m²

Pressure stages	Pa	50	100	150	200	250	300	350
AEROSANA VISCONN FIBRE to OSB #1								
total volume flow	m³/h	0,04	0,20	0,24	0,27	0,30	0,33	0,36
test stand leakage	m³/h	0,00	0,12	0,14	0,16	0,17	0,18	0,19
specific air volume flow	m³/h	0,05	0,08	0,10	0,12	0,13	0,15	0,16
leakage volume flow based on area	m³/(h m²)	0,03	0,05	0,07	0,08	0,09	0,10	0,11
AEROSANA VISCONN FIBRE to OSB #2								
total volume flow	m³/h	0,00	0,12	0,16	0,18	0,21	0,23	0,25
test stand leakage	m³/h	0,00	0,13	0,15	0,16	0,18	0,19	0,21
specific air volume flow	m³/h	0,00	0,01	0,01	0,02	0,05	0,11	0,24
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,01	0,02	0,03	0,07	0,17
AEROSANA VISCONN FIBRE to OSB #3								
total volume flow	m³/h	0,01	0,16	0,21	0,24	0,28	0,31	0,34
test stand leakage	m³/h	0,00	0,12	0,14	0,16	0,18	0,19	0,20
specific air volume flow	m³/h	0,03	0,05	0,07	0,09	0,11	0,13	0,15
leakage volume flow based on area	m³/(h m²)	0,02	0,03	0,05	0,06	0,08	0,09	0,10

Average

Q50 (PHI - assessment) **0,02** m³/(h m²)

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

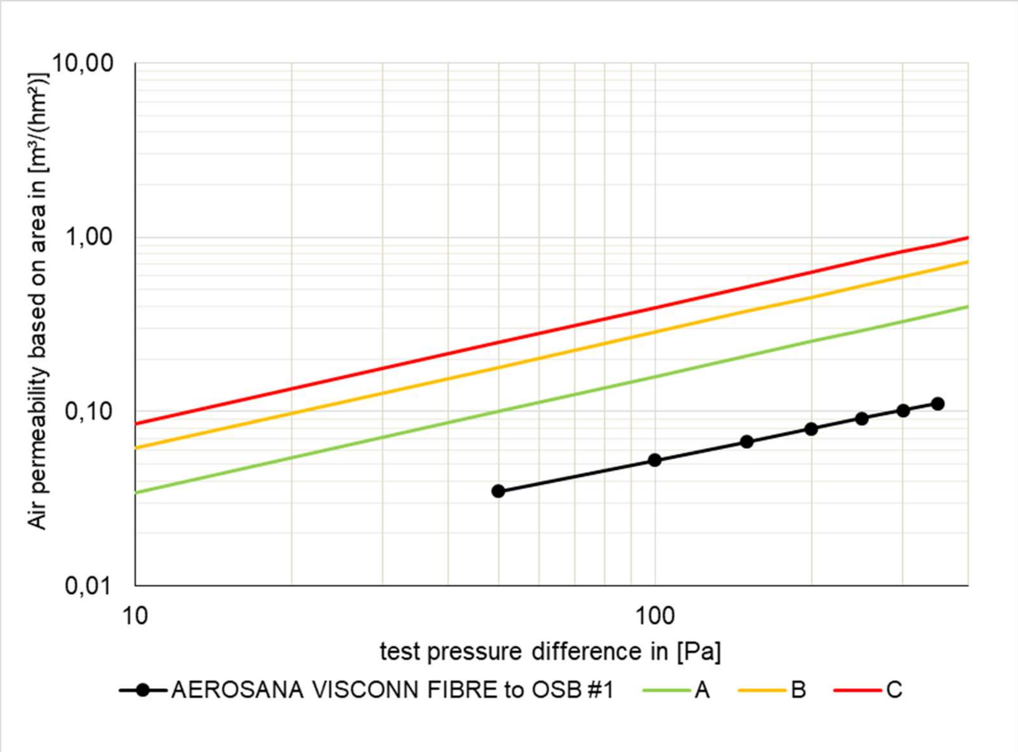

Fig 11: Series of measurements for the sample "AEROSANA VISCONN FIBRE to OSB #1". The Certification Classes A to C according to the PHI are entered in addition.

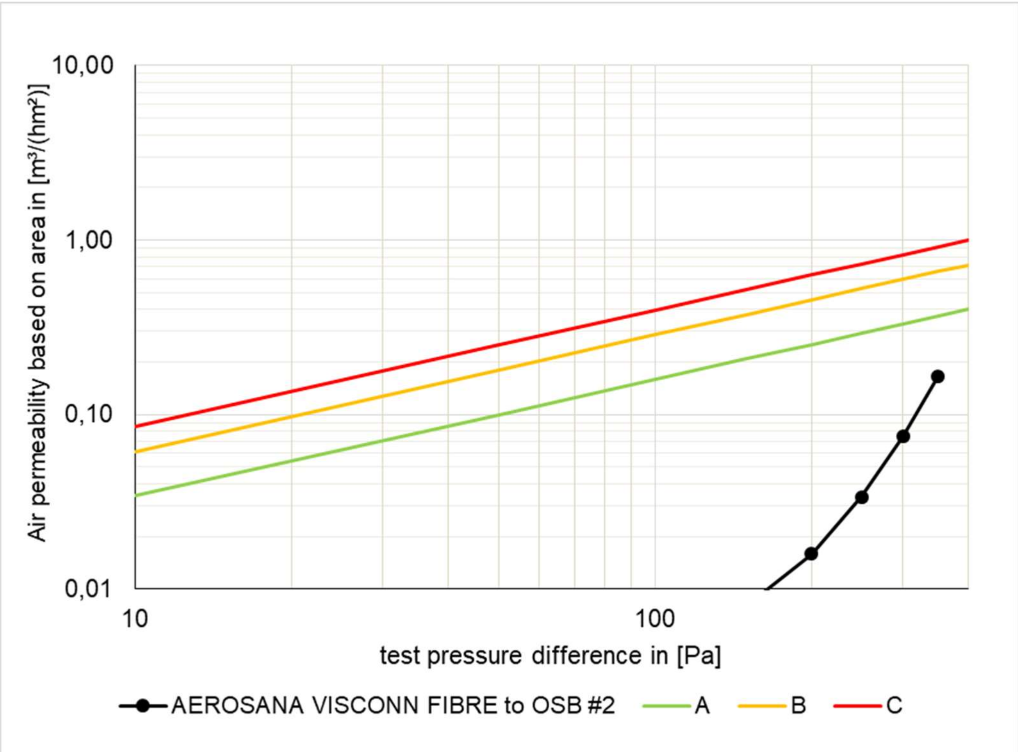

Fig 12: Series of measurements for the sample "AEROSANA VISCONN FIBRE to OSB #2". The Certification Classes A to C according to the PHI are entered in addition.

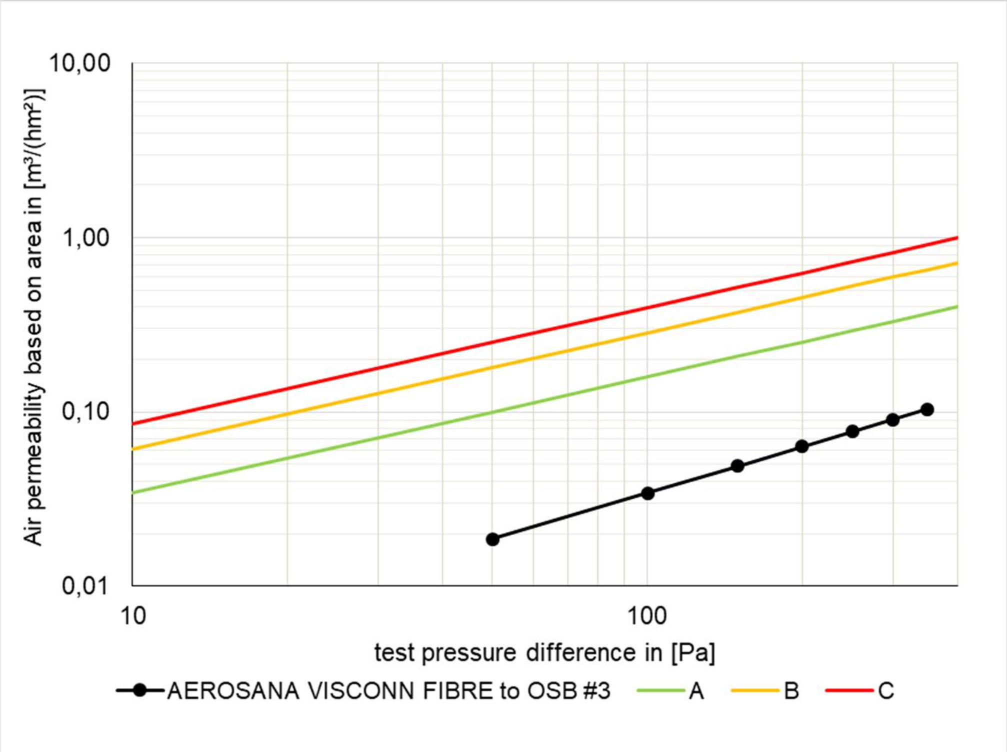

Fig 13: Series of measurements for the sample "AEROSANA VISCONN FIBRE to OSB #3". The Certification Classes A to C according to the PHI are entered in addition.

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 m²

Pressure stages	Pa	50	100	150	200	250	300	350
AEROSANA VISCONN FIBRE to concrete #1								
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	0,12	0,14	0,16	0,17	0,18	0,20
specific air volume flow	m³/h	0,00	0,00	0,00	0,00	0,00	0,00	0,01
leakage volume flow based on area	m³/(h m²)	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AEROSANA VISCONN FIBRE to concrete #2								
total volume flow	m³/h	0,08	0,21	0,23	0,25	0,26	0,27	0,28
test stand leakage	m³/h	0,00	0,12	0,14	0,15	0,16	0,18	0,19
specific air volume flow	m³/h	0,09	0,09	0,09	0,09	0,09	0,09	0,09
leakage volume flow based on area	m³/(h m²)	0,06	0,06	0,06	0,06	0,06	0,06	0,06
AEROSANA VISCONN FIBRE to concrete #3								
total volume flow	m³/h	0,00	0,13	0,16	0,18	0,20	0,21	0,23
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	0,01	0,01	0,02	0,03	0,06	0,12
leakage volume flow based on area	m³/(h m²)	0,00	0,01	0,01	0,01	0,02	0,04	0,08

Average

Q50 (PHI - assessment)	**0,02**	m³/(h m²)		
resulting in an airtightness class of	**A**	according to PHI		Q50 ≤ 0,1

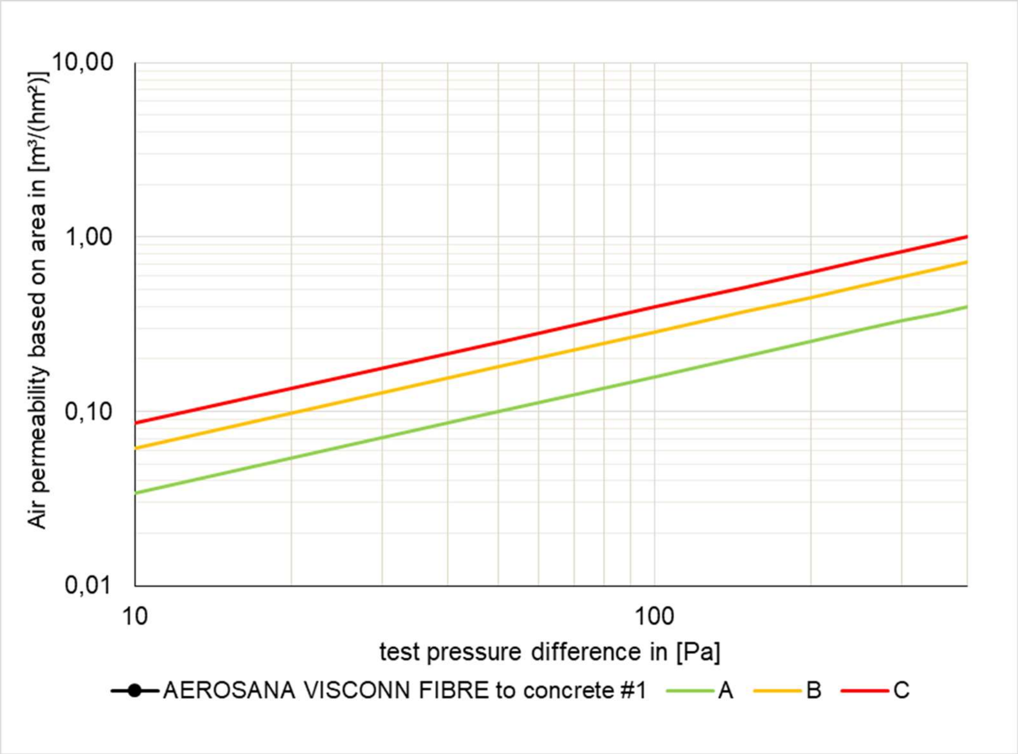

Fig 14: Series of measurements for the sample "AEROSANA VISCONN FIBRE to concrete #1". The Certification Classes A to C according to the PHI are entered in addition.

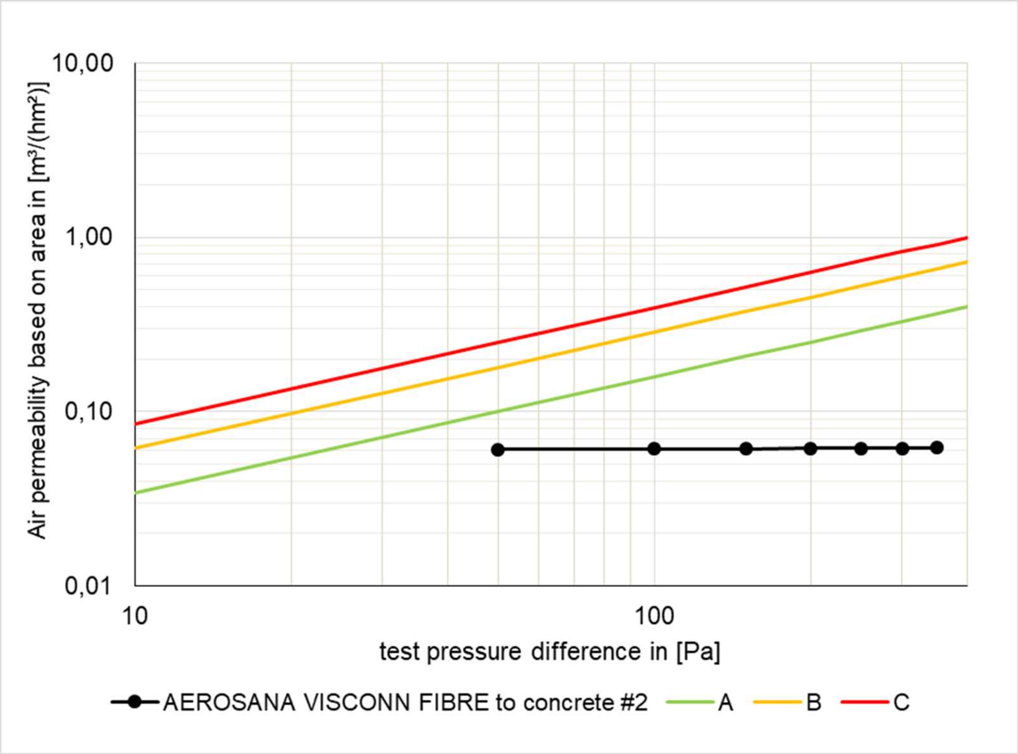

Fig 15: Series of measurements for the sample "AEROSANA VISCONN FIBRE to concrete #2" The Certification Classes A to C according to the PHI are entered in addition.

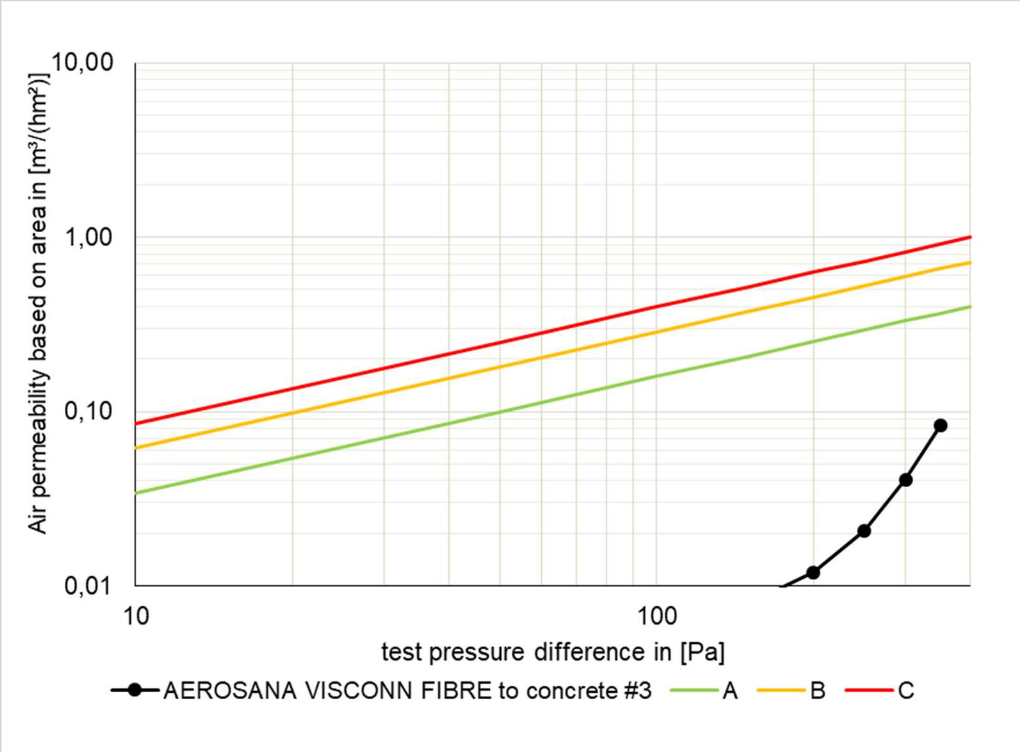

Fig 16: Series of measurements for the sample "AEROSANA VISCONN FIBRE to concrete #3". The Certification Classes A to C according to the PHI are entered in addition.

7. Test conditions

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

Indoor temperature: 18.8 °C
Indoor air humidity: 51.9 % 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 because this concerns certification as a system and not material testing only. On average, this resulted in an air permeability value of **0,01 (±0,003) 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	m³/(hm²) @ 50 Pa
Membrane to membrane	0,00
Membrane to OSB	0,02
Membrane to concrete	0,02
Overall	**0,01 (±0,003)**

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 [m³/(hm²)]	**Class achieved**
ph**A**	**≤ 0.10**	✓
ph**B**	≤ 0.18	
ph**C**	≤ 0.25	

Darmstadt, 11.04.2023

Søren Peper

Passive House Institute