



Test Report

Airtightness test of airtight ceiling connection system Aerstad

Manufacturer: Aerstad

101 Dunamore Road,
Cookstown, Co. Tyrone,
BT80 9PF, Ireland

Material testing

Darmstadt 23.12.2024

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Commissioned by: Aerstad
101 Dunamore Road,
Cookstown, Co. Tyrone,
BT80 9PF, Ireland

System: Aerstad

Product names: Aerstad Angled Channel (2.4m)
Aerstad End Cap / Corner Piece
Aerstad Airtight Jointing Tape (60mm)

**Further system
components:**

1. Introduction

An unbroken airtightness layer is a critical point in the airtightness of a building. In a Passive House, high airtightness of the building is an important pillar of the overall concept. In order to ensure that the tested products deliver their performance in actual installation, a realistic test is carried out to ensure suitability for timber and massive construction.

This product test was carried out on procedures similar to airtightness system certification. As there currently is no suitable category no certificate is awarded.

2. Assessment

In analogy to the evaluation of the airtightness of the window-wall joint the measured leakage flow at 50 Pa is related to the unit length of ceiling connection. The values specified for PH certification of linear window connection are used as a reference and are given in Table 1:

Table 1: Requirement classes for the certification of „Airtightness system Window connection“ to Passive House Institute specifications. They serve as a useful reference for the linear joint of the Aerstad product

Class	Air permeability based on length @ 50 Pa [m³/(hm)]
A+	≤ 0,05
A	≤ 0,30
B	≤ 0,50
C	≤ 0,80

In addition, there must be a comprehensible processing guideline/instructions for use for the installation of the system, according to which the installation for the test is carried out.

3. Test setup

The full circumference of the test rig was used for a ring made up of four corner pieces and four pieces of angled channel as shown in **fig (1)**. These were cut to measure and connected with jointing tape according to the manufacturer's instructions.



Fig. 1: Product assembled as a rectangle, prior to inserting the blocking

A fully air-permeable blocking assembly was inserted in place of the hollow-core concrete planks in order to take the load of the upper frame of the test rig as shown in **fig (2)**. Next, the elastic flaps on the top side of the product were connected with jointing tape according to the manufacturer's instructions.



Fig. 2: Blocking device inserted before flaps are connected

Attach the airtight tape to every corner with airtight joint tape to the flaps as shown in **fig (3)**. Finally, the upper steel frame of the test rig was installed and tightened with threaded rods in order to put sufficient pressure on the rubber seals holding the sample as shown in **fig (4) & Fig (5)**. A sealed lid was added to close the test chamber that would be pressurized and depressurized in the course of the test.



Fig. 3: Elements joined with airtight tape

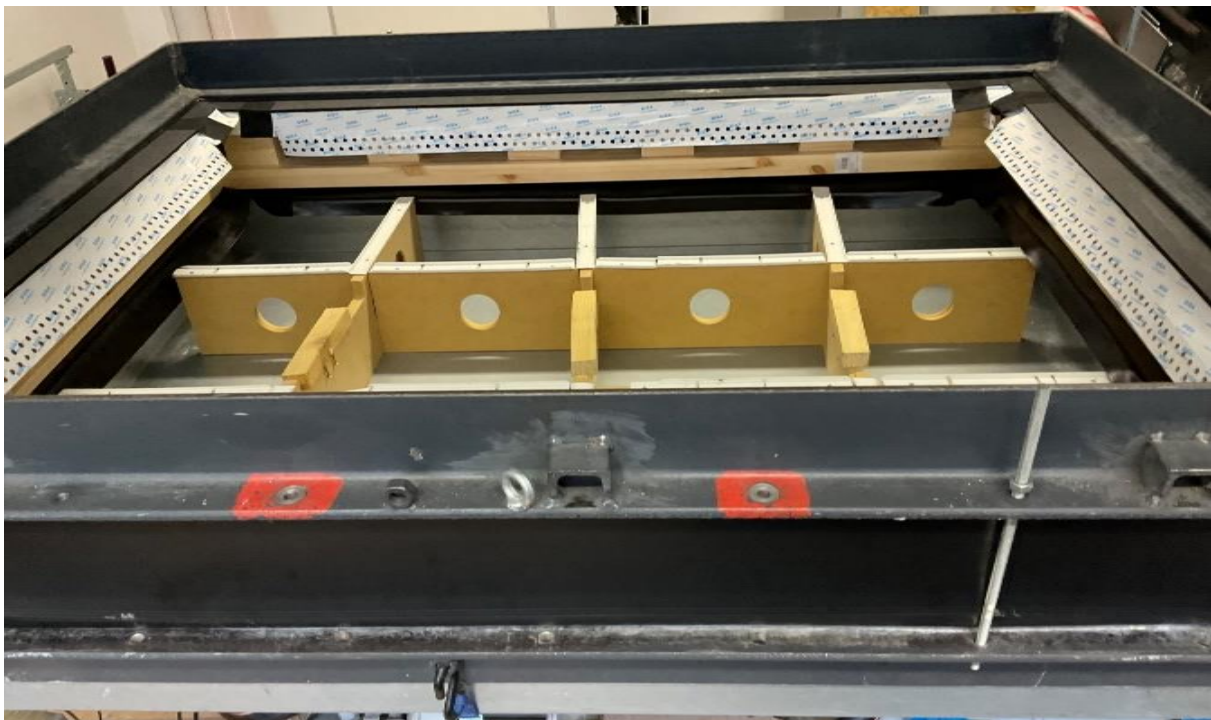


Fig. 4: Steel frame to clamp Aerstad sample to the test rig with wooden blocking device inserted



Fig. 5 Upper frame closed with an airtight lid

3.1 Experience from assembly

During the phase of closing the flexible flaps at the corners, challenges were encountered while attaching the provided airtight joint tape, like uneven substrate and forming creases between the tape and flap as shown in **fig (6)**. Taping the tip of the corner is the challenge here. While this does not severely affect the airtightness, it can lead to leakages if not done very carefully.



Fig.6 Uneven substrate makes attaching airtight joint tape to the corner difficult (sample #1)

To overcome the geometric problems in attaching the (flat) airtight joint tape at the corners, a tip cover was made from a square piece of the tape, with a half cut in the middle **fig (7)** and formed into a corner shape as shown in **fig (8)**. If this is put on first it facilitates a plain attachment of the length of tape, without any creases as shown in **fig (9)**. Following this slight modification on sample #2 and #3, test results have somewhat improved as shown in **fig (10) & fig (12)**.



Fig.7: Cutting of tape

Fig.8: Corner-shaped capping piece

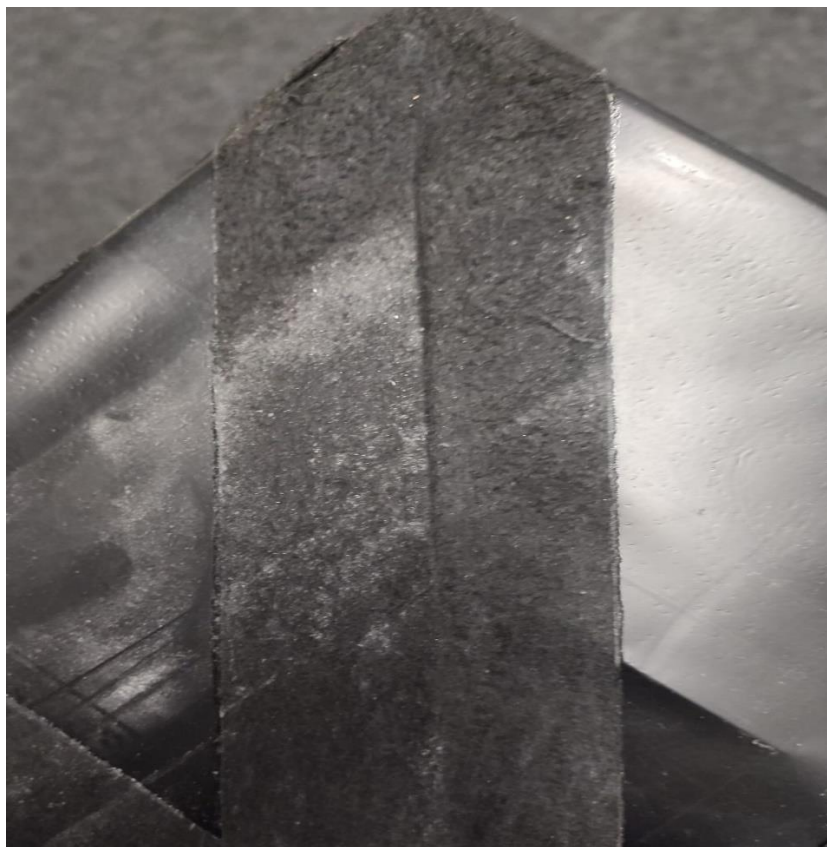


Fig.9: Plane surface of tape without creases.

4. Measurement procedure

The measurements are carried out at various pressure differences in accordance with DIN 12114. The following pressure levels are set as positive and negative pressure for the measurement: 50, 100, 150, 200, 250, 300 and 350 Pa. As the leakage of the measuring stand could not be determined in this particular setup a standard assumption has been made, based on previous experience. The air leakage of the measuring stand is deducted from the subsequent measurement results.

For each measurement, the delivered volumetric flow is measured for each individual pressure difference. The pairs of measured values can be used to calculate the leakage coefficient C in accordance with DIN 12114 Appendix B. This leakage coefficient is equivalent to the joint leakage coefficient a from DIN 18542 at 10 Pa.

After deducting the inherent leakage of the measuring stand, the leakage flow is determined as the mean value of the flows at positive and negative pressure. This value is divided by the length of the product to obtain the specific leakage flow per meter of connecting joint.

The measurements of the airtightness system were carried out in the period from 13.12.2024 to 20.12.2024.

5. Measurement results

The measurement results are listed in the following tables and figures. The requirement classes for the certification of airtightness systems (window connection) are entered in the diagrams for reference. The tightness class "BG-R" according to DIN 18542 is also entered in the diagrams as a comparative value from the standardization.

Examined area	5,88	m
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Mean value positive/negative pressure

Pressure stages	Pa	50	100	150	200	250	300	350
Total volume flow	m ³ /h	1,61	2,44	3,01	3,50	3,93	4,31	4,67
Test stand leakage	m ³ /h	0,00	0,07	0,09	0,11	0,13	0,14	0,15
Specific air volume flow	m ³ /h	1,66	2,37	2,92	3,39	3,80	4,18	4,52
Leakage volume flow based on area	m ³ /(h m)	0,28	0,40	0,50	0,58	0,65	0,71	0,77

Q50 (PHI - assessment) **0,28** m³/(h m) Q10 (a-Wert) 0,1807044
 Resulting in an airtightness class **A** according to PHI a ≤ 0,27

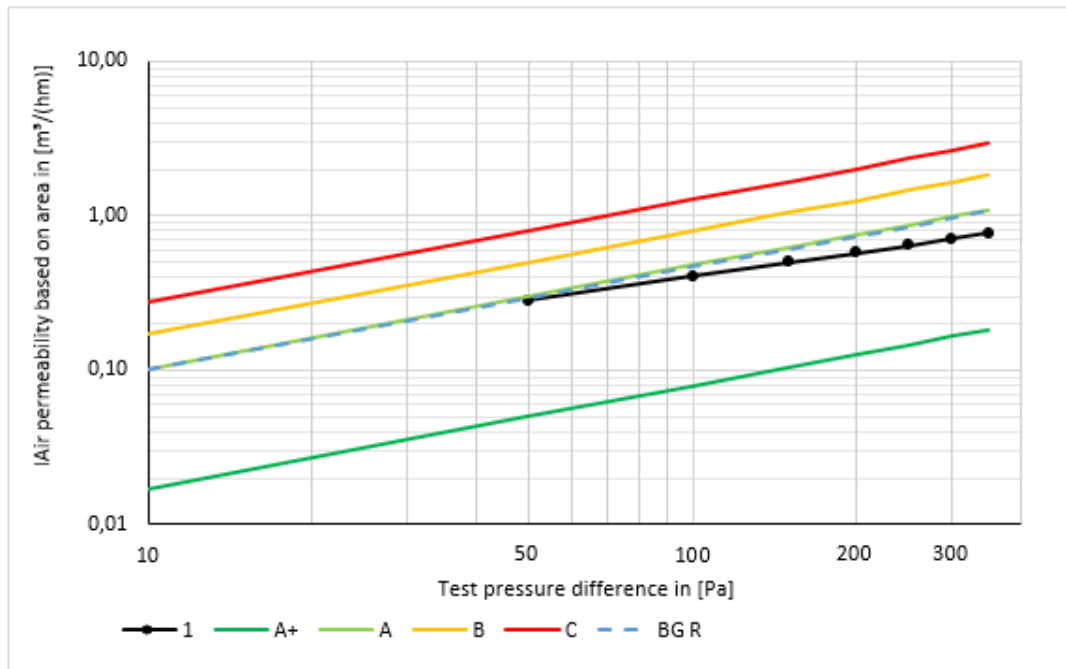


Fig. 10: Measurement series of sample Aerstad #1.

Examined area	5,88 m
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Mean value positive/negative pressure

Pressure stages	Pa	50	100	150	200	250	300	350
Total volume flow	m ³ /h	1,38	2,10	2,58	2,99	3,35	3,68	3,98
Test stand leakage	m ³ /h	0,00	0,07	0,09	0,11	0,13	0,14	0,15
Specific air volume flow	m ³ /h	1,43	2,03	2,49	2,88	3,23	3,54	3,83
Leakage volume flow based on area	m ³ /(h m)	0,24	0,35	0,42	0,49	0,55	0,60	0,65

Q50 (PHI - assessment) **0,24** m³/(h m) Q10 (a-Wert) 0,1588981

Resulting in an airtightness class **A** according to PHI a ≤ 0,17

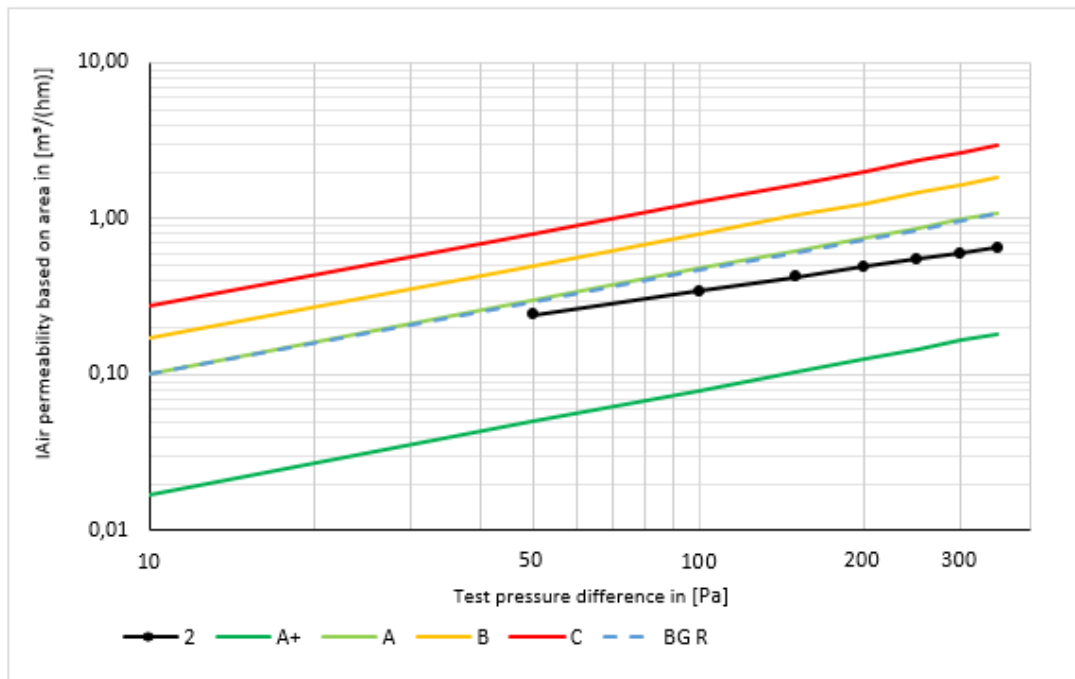


Fig. 11: Measurement series of sample Aerstad #2

Examined area	5,88 m
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Mean value positive/negative pressure

Pressure stages	Pa	50	100	150	200	250	300	350
Total volume flow	m ³ /h	1,11	1,71	2,10	2,43	2,71	2,97	3,21
Test stand leakage	m ³ /h	0,00	0,07	0,09	0,11	0,13	0,14	0,15
Specific air volume flow	m ³ /h	1,16	1,64	2,01	2,32	2,59	2,84	3,06
Leakage volume flow based on area	m ³ /(h m)	0,20	0,28	0,34	0,39	0,44	0,48	0,52

Q50 (PHI - assessment) **0,20** m³/(h m) Q10 (a-Wert) 0,1303422

Resulting in an airtightness class **A** according to PHI a ≤ 0,17

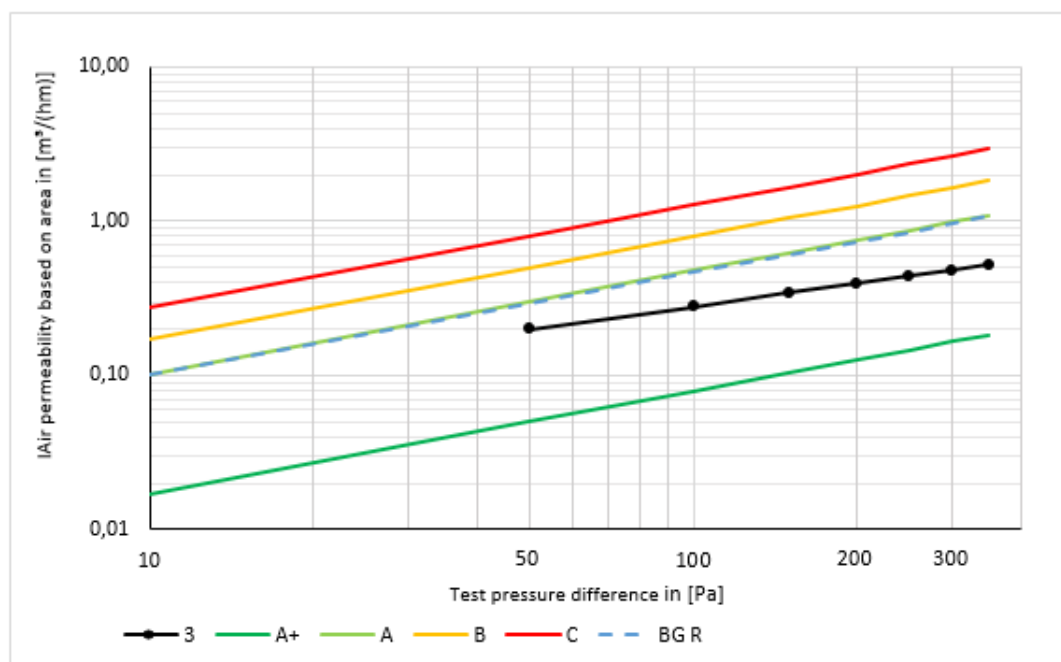


Fig. 12: Measurement series of sample Aerstad #3

6. Measuring conditions

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

Room temperature: 16.3 °C

Indoor air humidity: 57 % rH

7. Measuring devices

A LaminarMasterFlow element from TetraTec® Instruments was used to measure the volume flow. The differential pressure was measured with an Automated Performance Testing System (APT).

Table 2: Overview of the measuring devices used

Device name	Device Type	Serial-no.	Measurement range	Measurement accuracy
LaminarMasterFlow	LMF	PH796	0-85 l/min	2% in the range of 8-80 l/min
Automated Performance Testing System	APT	0072 4	0-2000 Pa	1 %

8. Results

The mean value of all three measurement results of the tests is calculated. The result is an average air permeability of 0.24 (± 0.006) m³/(hm) at 50 Pa test pressure. This compares to certification class "A" for linear window connection joints.

Darmstadt, 23.12.2024



Wolfgang Hasper

