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Testing Joints of Air and Vapour Barriers, Do We Use Relevant Testing Methods?

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1 Introduction

To reduce energy consumption some building regulations require test of airtightness in newly erected buildings. Systems of membranes in combination with sealants are widely used to ensure the required airtightness but often their purpose is twofold; increased airtightness and reduced diffusion. Independently of whether a vapour barrier or an air barrier is needed, the tightness of the joints is crucial. Furthermore, the joints must stay tight throughout the service life of the membrane.

There are different standardised ways to test joints, this article focuses on test of peel resistance, shear resistance and airtightness of nine different air or vapour barrier systems. Tests were performed on artificial aged and non-aged samples. While peel and shear resistance tests are standardised, the airtightness test was invented for this project in an attempt to simulate conditions on site in a more realistic way than standardised test methods. Results are presented, but also the relevance of the test methods is discussed.

2 Method

Nine air or vapour barrier systems were tested. Peel resistance was tested according to EN 12316-2:2013 but adjusted to not only consider membrane/membrane joints but also joints between membrane and aerated concrete (AAC). Shear resistance was tested according to EN 12317-2:2010. The test of airtightness was not a standardised test but under development. The inspiration was the blower door test (EN/ISO 9972: 2015). The test sample consisted of a wooden frame lined with the membrane to be tested, fixed to the frame with the system's tape. The frame was placed in a box leaving a small space between membrane and box. It was ensured that the frame was airtight and so was the connection between box and frame. Through a hole in the box a ventilator created a pressure difference between box and frame. The airflow needed to obtain different pressure differences was recorded, and air flow for 50 Pa was calculated.

Artificial aging was performed by placing the samples for 84 days in a climate chamber at 70 °C and 90 % relative humidity followed by 84 days in a ventilated oven at 70 °C.

3 Results

Test results were compared to the requirements for peel and shear resistance given by DUKO

(2014), a Danish independent company, who classifies vapour barrier systems and roofing underlays. All systems fulfilled the requirements. See Figure 1 for results. In all shear tests and aged peel tests, the failure was between adhesive and carrier layer of the tape. In most non-aged peel tests, adhesive stocked to the tape but failed on the tested material (AAC or membrane).

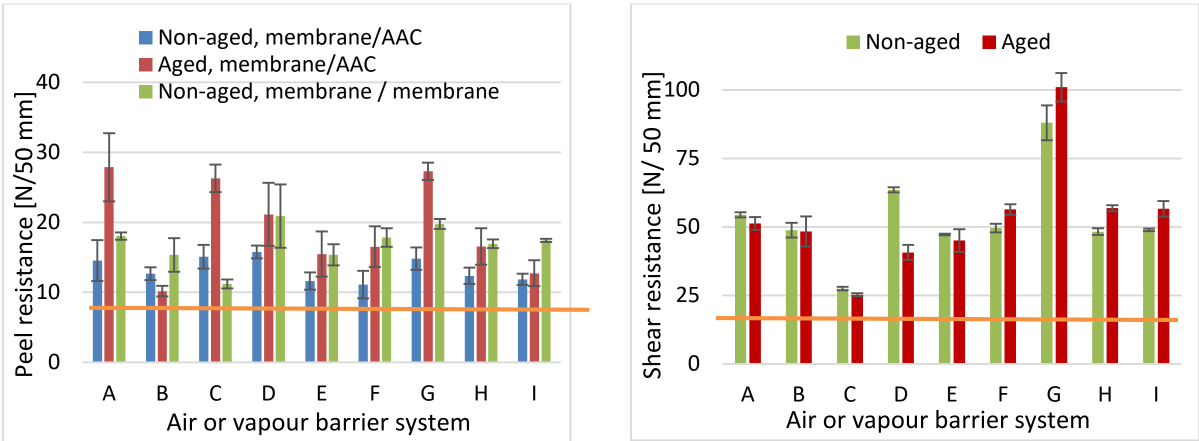

Figure 1. Left: Peel resistance, Right: Shear resistance. The orange lines mark the DUKO requirements.

The airtightness test showed significant higher air flow in aged samples than in non-aged samples, typically 2-3 times higher.

4 Discussion and Conclusion

It was surprising that peel and shear resistance generally increased with aging while airtightness decreased. The standardised test methods that should be used to evaluate the performance of joints, did not comply with an airtightness test. However, the airtightness test was suggested because it would simulate conditions, which are more realistic in buildings. Also, contrary to the results of the standardised tests, the airtightness tests complied with statements from experienced practitioners, that some adhesives become less effective with time. The standardised tests may therefore not be relevant, or not all relevant surfaces are tested.

However, the airtightness test still needs to be further developed; at this stage, the results are only relative, describing how joints of air and vapour systems react on aging.

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