Durability of building airtightness

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ABSTRACT

Over the last thirty years, much progress has been made to increase our knowledge about mechanisms governing building's airtightness and the impact of air infiltrations on energy efficiency, health effects and construction quality-related issues. As a matter of fact, air leakages have an increasing impact on the overall energy performance of new buildings. Therefore, since the early 2000's, regulations in many countries explicitly account for airtightness, sometimes with mandatory requirements, as a consequence of Europe's ambition to generalize nearly zero energy buildings by 2030. However, having a requirement on building airtightness is relevant only if the airtightness level lasts in time, and the durability of airtightness products and assemblies at mid- and long-term scales is still a pending question.

A critical review and a comparative analysis of research and technical studies that deal with building airtightness durability are presented, covering studies with two different approaches.

Some studies investigate the evolution over time of the envelope airtightness by field measurements in real buildings. The results tend to show that the envelope's airtightness level decreases during the first years after achievement (by 24% on average, but with a high variability in test results) and then stabilises. A list of key elements that may govern airtightness variations is given, including in particular:

- Building natural movement
- External intervention;
- Specificities of building materials and construction types
- Poor workmanship
- Unsuitable implementation conditions
- Airtightness measurement conditions.

The other studies are based on laboratory measurements in order to test the accelerated ageing of airtightness products. The analysis shows that there is actually no standardised protocol to characterise durability of product assemblies in terms of airtightness. Moreover, due to the various natures of airtightness products, it seems difficult to define an accelerated ageing protocol that would be equivalent to a certain number of years of natural ageing. Pros and cons of various alternatives are given to assess the durability of airtightness products in a laboratory, in particular, it insists on two conflicting constraints on the tested sample:

- being large enough and realistically implemented to be representative
- being simple enough to ensure the reproducibility of the test.

Finally, the literature review stresses the importance of implementation conditions on the durability of airtightness. Despite the very low number of publications on this subject, the first conclusions show that temperature, humidity and dust conditions can impact the durability of the airtightness performance of specific products. This issue should be studied both on-site through measurement campaigns during the construction phase and in laboratory.

KEYWORDS

Airtightness, durability, on-site studies, laboratory ageing studies, implementation conditions