Building and ductwork airtightness requirements in Europe

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Mandatory building airtightness testing comes gradually into force in Europe. This paper analyses recent developments in 10 European countries regarding building and ductwork airtightness. It shows how awareness on building airtightness has grown in the last 5 years, as opposed to ductwork airtightness which is not taken into account in most European countries. This article is based on a paper presented at the 38th AIVC - 6th TightVent & 4th venticool Conference, 2017 "Ventilating healthy low-energy buildings" held on 13-14 September 2017 in Nottingham, UK.

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A questionnaire has been developed in the framework of the Tightvent Airtightness Association Committee (TAAC) to compare building and ductwork airtightness awareness in a broad manner, ranging from requirements to progress needed to promote building airtightness. Members from Belgium (BE), Czech Republic (CZ), Estonia (EE), France (FR), Germany (DE), Ireland (IE), Latvia (LV), Poland (PL), Sweden (SE) and the UK provided feedback to the questionnaire.

Building airtightness in EP-regulation

To compare requirements between countries, it is useful to know which airtightness indicators are used. The air change rate at 50 Pa – n_{50} – is no longer the primary indicator: 8 out of 10 countries (all but PL and CZ) have at least one indicator that uses the envelope area as reference value. However, the envelope area is not always calculated as defined in ISO 9972; for example in France, the reference area excludes the lowest floor and is calculated according to Energy Performance (EP) - calculation. In Germany, two reference values are used: either the internal volume for small buildings (below 1500 m^3) or the envelope area for bigger ones.

9 out of 10 countries have kept the reference pressure at 50 Pa.

In most countries (7 out of 10 (all but CZ, SE and PL)) building airtightness is now taken into account in

the EP- calculation. The number of tests in Europe is increasing (Leprince, Carrié, & Kapsalaki, 2017) due to:

- requirements on building airtightness with mandatory justification; or
- programmes; or
- incentive rewards.

In 6 countries out of 10 (CZ, EE, FR, DE, IE and UK) there are minimum requirements for building airtightness in EP-regulations. However, those minimum requirements do not necessarily need to be justified. Only France, Ireland and UK require systematic justification of airtightness levels either by testing or by applying a certified approach. **Table 1** compares requirements of building airtightness in European countries.

In Belgium, there were no minimum requirements before 2018 but the default value for airtightness was so high that 90% of new residential buildings were tested in 2016 in order to improve the result in EP calculations. In Germany, even if the test is not required, it is done in most new buildings.

Required values are most of the time much easier to achieve than the well-known n_{50} = 0.6 vol/h. The objective seems to be the growth of awareness rather than the hardness of the constraint.

Building airtightness tester schemes

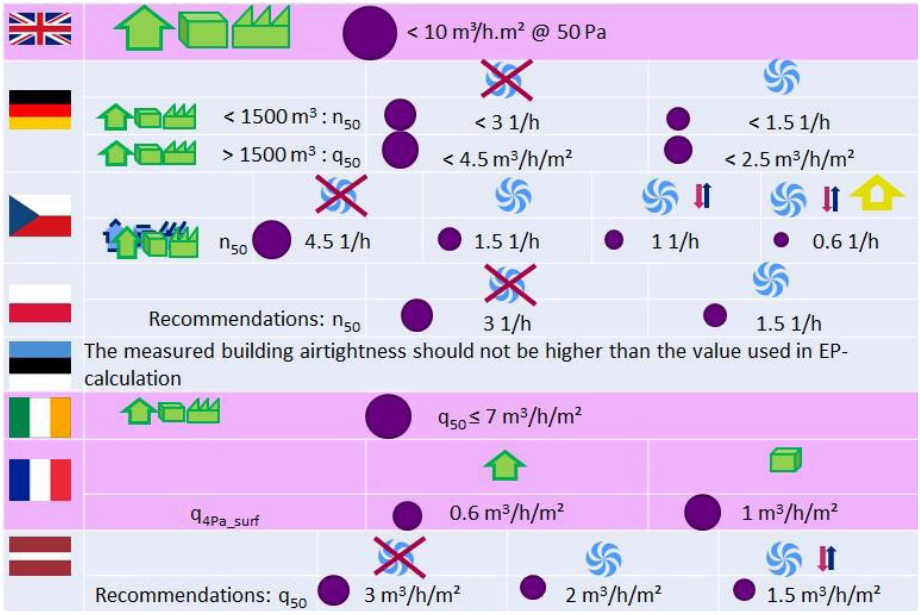
Airtightness tester schemes now exist in 7 out of the 10 countries (excluding EE, LV and PL). The number of testers in Europe has almost doubled in 4 years and is increasing rapidly in Belgium, Ireland, France and UK, either because they are requiring airtightness testing (FR, UK, IE) or because they are promoting airtightness by rewarding the EP-calculation if a test is performed (BE).

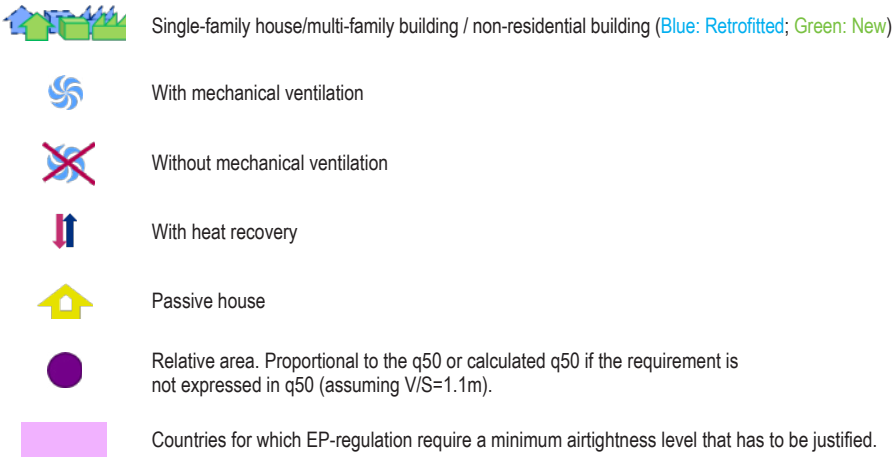
In 4 countries out of the 7 qualification of testers is required for testing, either in the context of the regulation (Belgium Ireland and France) or in the context of a programme (Ireland, France and Poland). In the UK, this is not the case. However, if a test is performed by a qualified tester, a "standardised certificate" is automatically issued and the tester does not need to write a full report.

The evolution of number of testers per country is given in **Figure 1**. For Germany, the figure only includes Flib testers; however, other qualifications exist.

4 countries out of 10 have issued guidelines for airtightness testing in addition to test standard ISO 9972 (Belgium, France, Germany, and UK).

Table 1. Comparison of requirements on building airtightness in European countries.





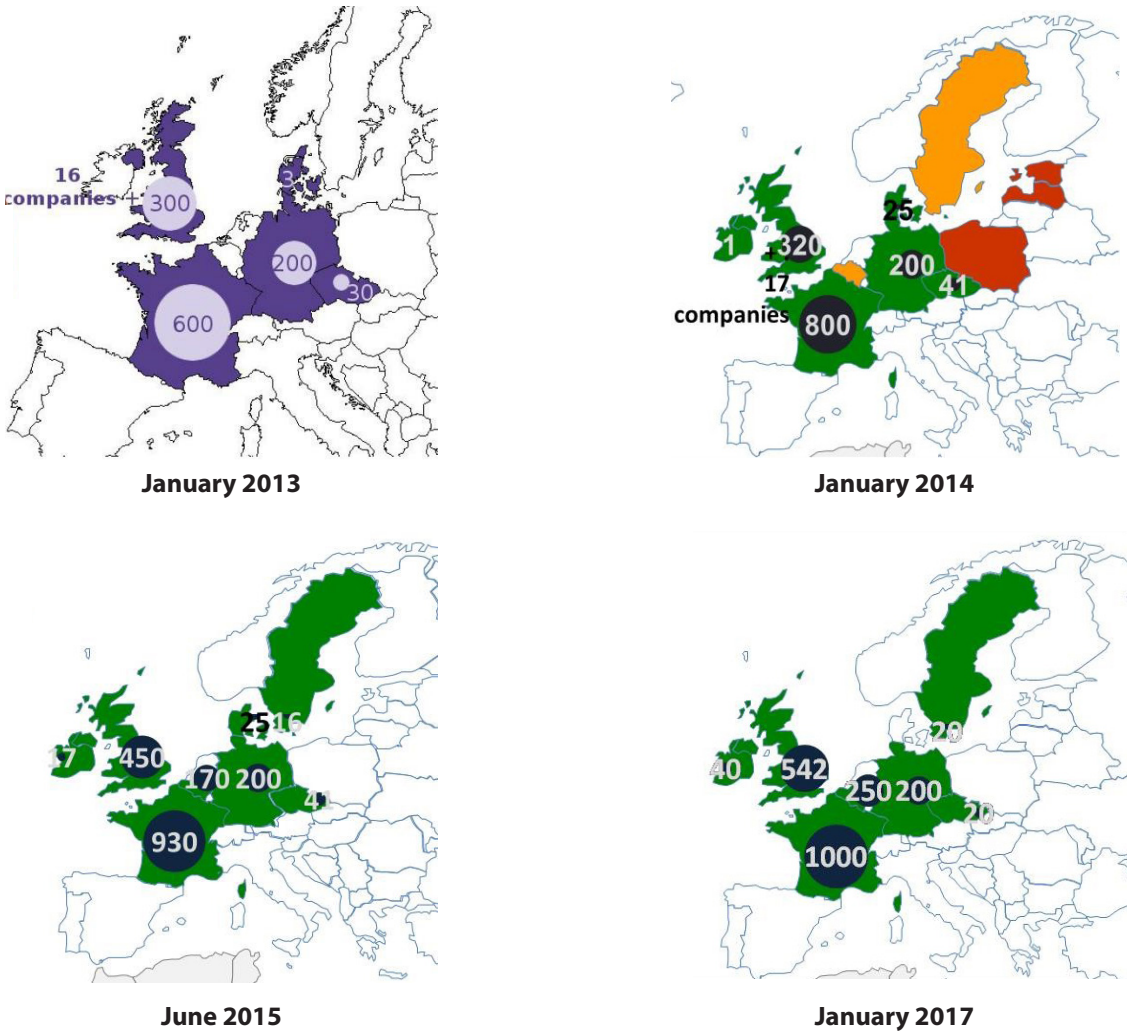


Figure 1. Increase of qualified airtightness testers in Europe in the the last 4 years.

Building Airtightness Databases

The development of airtightness testers' schemes goes together with the development of databases; in 5 out of the 7 countries with tester schemes, the qualification bodies manage a database. **Figure 2** summarizes whether or not countries have a database available and the amount of measured data it represents. In the UK, qualification bodies provide tools for automatic lodgement of data which automatically collects data from more than 500 tests per working day.

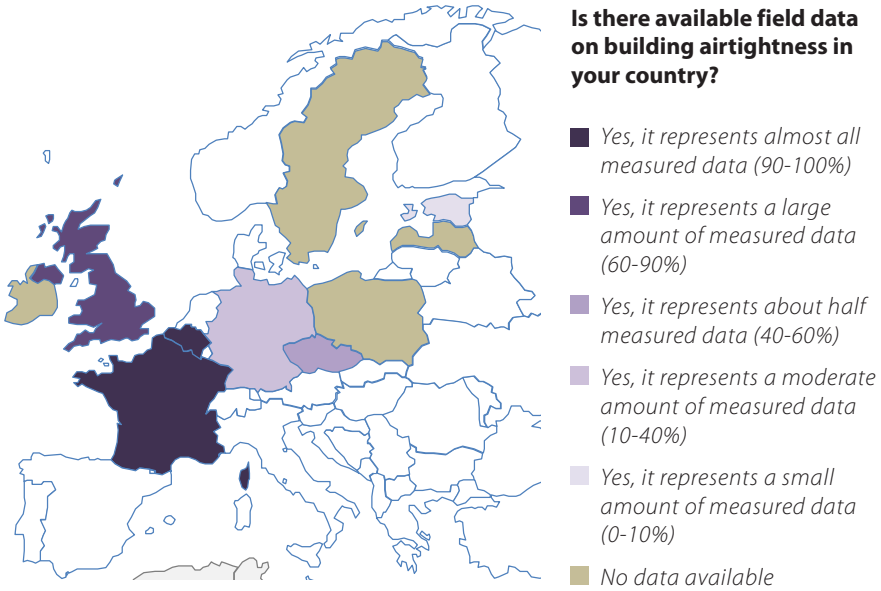


Figure 2. Database in countries and representativeness of measured data.

The benefits of a database managed by qualification bodies are:

- collecting reliable data as they are provided by qualified testers;
- representing a large amount of measured data if the qualification is required by regulation or programmes.

Building airtightness awareness

All countries' respondents agreed that things have changed in the last 5 years regarding building airtightness. The main driver is energy use and more work is needed in the field to better:

- quantify the impact of airtightness on energy use and
- take into account airtightness in the EP regulation.

The durability of airtightness is also a pending question that needs to be further studied (Leprince, Carrié, & Kapsalaki, 2017).

According to the respondents, national policy is also a main driver for change, while building damages and European directives are secondary drivers; indoor air quality comes last.

Ductwork airtightness

Regarding ductwork airtightness, concern is still low in the field. Only 4 respondents provided feedback to the ductwork airtightness questionnaire (Belgium, France, Latvia and Germany). According to respondents from the Czech Republic and Poland, ductwork airtightness is not really considered in their countries.

Only France (RT2012) and Belgium EPB consider ductwork airtightness as an input in the EP-calculation but there are no minimum requirements. In France, the programmes Effinergie + and Effinergie BEPOS require a justified class A for ductwork airtightness. Moreover, a qualification for ductwork testers (Qualibat 8721) exists with 35 qualified testers. Field data have been published in the end of 2017.

Excluding France, respondents agreed that very few things have changed regarding ductwork airtightness in the last 5 years. In Belgium, this is likely to happen in the near future because of the mandatory control of every ventilation system in new buildings and extensive renovation projects (awareness is broader regarding the efficiency of ventilation systems).

For building airtightness, the main driver for change will probably be the impact on energy use therefore progress is needed to quantify the impact of ductwork airtightness on cooling, heating and fan energy use. Studies on the impact of ductwork airtightness on indoor air quality were also requested.

Conclusions

Regarding building airtightness, we found that 7 out of the 10 countries have minimum requirements that have to be justified by testing or other means, either in the context of the EP-regulation (for 3 of them) or in specific energy performance programmes. Minimum requirements mostly apply to new buildings and only three countries have a regulation or programme dealing with airtightness of refurbished buildings. 7 countries out of 10 now have a quality framework for building airtightness testers; the number of qualified testers in Europe has almost doubled in 4 years. The development of qualification has induced the development of databases. Field measurement data are now available in 6 countries out of 10. Most of the time, databases are managed by testers' qualification bodies and contain mainly data of new residential buildings.

All respondents acknowledge that awareness regarding, building airtightness has grown in their country in the last 5 years. The main motivation remains energy use, however work on this topic is still needed to better quantify the impact of airtightness on energy use.

Conversely, ductwork airtightness does not seem to be taken into account (neither in regulation nor in energy performance programmes) in most European countries. In our survey, ductwork airtightness is only taken into account in the EP-calculation of France and Belgium; and only France has an EP- programme with requirements on ductwork airtightness and a qualification for testers. Progress is needed to better understand the impact of ductwork airtightness on energy use (fan, cooling and heating) and indoor air quality. ■

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