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REASONS BEHIND AND LESSONS LEARNT WITH THE DEVELOPMENT OF AIRTIGHTNESS TESTERS SCHEMES IN 11 EUROPEAN COUNTRIES

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ABSTRACT

Mandatory building airtightness testing has come gradually into force in the UK, France, Ireland and Denmark. It is considered in many other European countries because of the increasing weight of the building leakage energy impact on the overall energy performance of low-energy buildings. Therefore, because of related legal and financial issues, the building airtightness testing protocol and reporting have become crucial issues to have confidence in the test results as well as the consistency between the measurement results and values used in the energy performance calculation method. The reference testing protocol in Europe is described in EN 13829. In addition, many countries have developed specific guidelines to detail or adapt EN 13829 requirements. However, performing and reporting correctly an airtightness test requires knowledge and know-how as well as pre-requisite on the tools used by the tester.

This study compares the steps taken in 11 European countries to improve the competence of the testers and thereby the reliability of the airtightness measurement. Information has been collected through a questionnaire sent to TAAC (TightVent Airtightness Associations Committee) members. We found out that 8 out of the 11 countries surveyed have developed or were developing a competent tester scheme for airtightness testers. Those schemes go together with technical documents beyond the measurement standard and include most of the time training, examination of testers and the proof of use of appropriate equipment. The feedback from France from the training institutes and experts analysing the reports of applicants as well as the failure rate at the examinations confirm that performing and reporting correctly an airtightness test is not straightforward. Those schemes are reinforced with databases that allow better follow-up of the approved testers and tracking of suspicious results.

KEYWORDS

Airtightness measurement, competent tester schemes, European comparison

1 INTRODUCTION

Building airtightness is a key issue to reach low- and very low-energy targets. Therefore an increasing number of tests are performed in European countries for various reasons: compliance to the energy performance regulation; compliance to a specific energy programme; or will of the building owner. For instance, to our knowledge, measuring the airtightness of all new buildings or at least part of them is required by the energy performance regulation in UK, France, Ireland and Denmark. Besides, specific energy programs (such as Passivhaus or Minergie) that require or encourage building airtightness testing are increasingly popular in

many other countries. Likely, within a few years, over a million tests will be performed every year in Europe.
Airtightness measurements are useful to check that the building envelope complies with a given requirement. The measurement protocol is described in the European standard EN 13829 adapted from ISO 9972 which is now under revision.

There are four key sources of uncertainty in airtightness testing:

- Measurement devices (accuracy and precision);
- Calculation assumptions (e.g. reference pressure, weighted versus unweighted linear regression);
- External conditions (wind and stack effect impact); and
- Tester's behaviour.

The uncertainty associated to tester's behaviour has to be separated into three parts:

- His knowledge and interpretation of the measurement protocol;
- His know-how to use the equipment, analysis and reporting tools; and
- His honesty and will to perform a test correctly.

This document describes how some European countries attempt to decrease uncertainty due to tester's behaviour by setting competent testers schemes.

2 APPROACH

This work has been done in the context of the TightVent Airtightness Associations Committee (TAAC). TAAC is a European working group, set up and hosted within TightVent. The scope of this working group includes various aspects such as:

- Airtightness requirements in the countries involved;
- Competent tester schemes in the countries involved;
- Applicable standards and guidelines for testing;
- Collection of relevant guidance and training documents.

At present, the participants are from Belgium, Czech Republic, Denmark, Estonia, France, Germany, Latvia, Ireland, Poland, Sweden, UK and contacts have been established with other European countries.

A questionnaire has been developed within the committee to compare competent tester schemes in a broad manner, ranging from administrative to technical issues. A representative from each country has kindly accepted to answer the questionnaire. This document summarizes their answers focusing on aspects relevant to this paper.

3 RESULTS OF THE STUDY

3.1 Countries with a competent tester scheme

An increasing number of countries have minimum building airtightness requirements either for energy performance regulation or specific energy savings program subsidized at national or regional level. Most of the time, those minimum building airtightness requirements must be justified with a pressurization test. In Denmark, Ireland, France and United Kingdom who have implemented minimum building airtightness requirements, competent testers schemes have been developed and, except for Denmark those schemes are state-approved and the qualification is required by the regulation to perform test to prove compliance with the energy performance regulation.

Germany also has a competent tester scheme that is required by some specific energy performance programs. Belgium and Sweden are developing their own that should be operational in 2014. The Czech Republic has no tester scheme but there exists an association of testers with an ethical code.

3.2 Comparison of competent testers' schemes

Key components of competent tester scheme are:

- To set a minimum standard for the knowledge of the tester (in particular on the regulatory or the programme context, the fundamentals of ventilation and infiltration, and the fundamentals of airtightness measurement);
- To set pre-requisites on the tools used (equipment, analysis and reporting tools);
- To set a minimum standard for the know-how of the tester.

These components are supported by technical documents, training programs and evaluation procedures.

Technical documents beyond measurement standards

Each country that has set a competent tester scheme has developed technical documents to spell out EN 13829 and adapt measurement to its national context. These documents always specify the building preparation procedure. In countries where testing is required by regulation, technical documents also described the input values that are used for derived quantities and give sampling rules for multi-family buildings and housing developments. In addition, to limit the uncertainty due to measurement devices, calibrated equipment is required in 6 out of the 7 schemes studied and 3 countries have set specific requirements for equipment beyond standards.

Training programs

Training is included in 5 out of the 7 qualification schemes (DE, DK, FR, IE and UK for domestic buildings) there are specificities for the UK non-domestic buildings scheme (which requires UKAS accreditation). The training lasts from 1 to 5 days and costs from 0 to 2100€. The validation of the training always includes an examination of test reports. It includes also a theoretical examination and an onsite evaluation of the tester's skills in France, Germany, Ireland and UK (not in Denmark). Training for testers also exists in Estonia but there is no validation process.

The training in the six countries (DE, DK, EE, FR, IE and UK-domestic buildings) includes following items:

- The rules(including building preparation, calculation of derived quantity, calibrations);
- The purpose and steps of the test;
- How to use the equipment on site;
- How to write/file a report.

Qualification requirements

The qualification process always includes an evaluation of test report(s). Most of the time (5 out of 7), the validation of a specific training is required, but no educational background is required, except for Germany where Engineer, Master or Technician level is required. Most of the time (4 out of 6), there are also some administrative requirements, e.g., specific insurance for airtightness testing in France and the UK.

3.3 Qualified testers

Figure 1 represents the number of qualified tester in each of the 6 countries with operational schemes in January 2014. Some of those schemes are recent, in which case the number of testers evolves rapidly. In the UK, testers are qualified for domestic buildings and companies are for non-domestic ones.
The typical background for testers is:

- Building service, building physics consultants;
- Housing inspector;
- Craftsman; and
- Industry services.

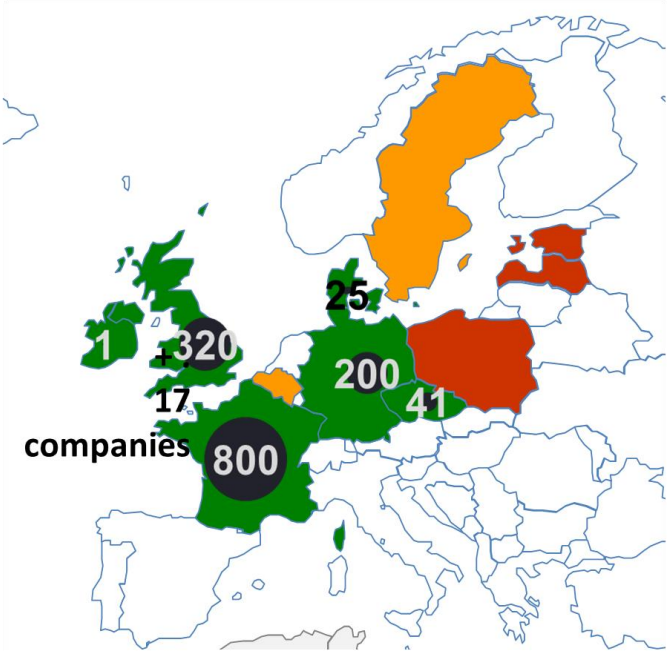

Figure 1: Number of qualified testers in 6 European countries in January 2014

3.4 Success rates for applicants in France

This paragraph is not based on the results of the questionnaires but on feedback from the French competent scheme holder "Qualibat". During its annual meeting in December 2013, Qualibat presented the success rates for applicants. Only a little over a quarter of the applicants are successful with the first review of their first application. One fifth need a third or even a fourth review. This confirms the relevance to check the competence of the testers before they are allowed to perform and report airtightness tests to justify compliance with a given requirement. It also confirms experts' unstructured feedback on their reviews.

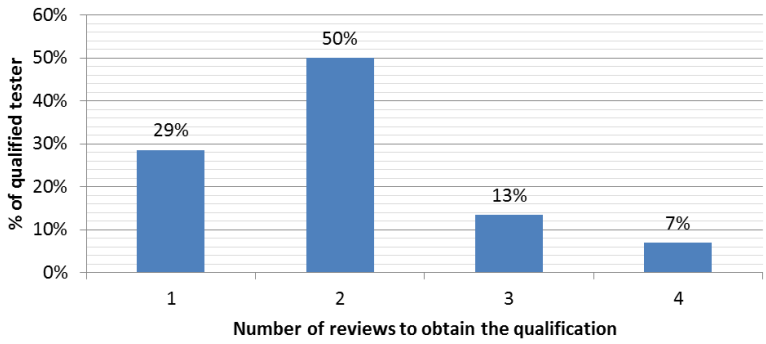

Figure 2: Success rate for applicant: number of reviews needed to obtain the qualification

3.5 Development of databases

Four schemes (DK, DE, CZ, FR) require specific reporting in a database. This has two key advantages, provided that the database is well-structure:

- It becomes easy to analyse large samples and extract meaningful trends, e.g. per building type or construction methods. The French database expects to grow by over 100 000 tests per year;
- It is possible to track suspicious results. To our knowledge, this is not operational in any scheme now but simple checks (and maybe cross-checks with energy performance certificates) could be performed to check the consistency of the results. It can be one step to check the testers' honesty (e.g. by cross-checking the number of tests performed in a single day and the distance travelled).

4 CONCLUSIONS

Several competent tester schemes are now operational. Because they require specific knowledge and know-how as well as pre-requisites for the tools used, they can only improve the quality of measurements although it is difficult to quantify this improvement.

Note that sources of uncertainties mentioned but not covered in this paper include external conditions, analysis methods and calibration methods which may be significant.

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