

## Foreword

There are at least 2 airtightness-related aspects of increasing interest to policy makers and industry:

- first, how is the market of building and ductwork airtightness changing with its significant weight on the performance of low-energy buildings?
- second, if systematic or non-systematic airtightness testing is enforced, do we need to improve its quality and how?

The French and Belgium initiatives with the “Observatoire BBC” and the inter-laboratory tests reflect these concerns. We hope you will enjoy knowing more about them as well as the PATLIB or airtightness association networks which are discussed in this newsletter.

Peter Wouters, *Manager INIVE EEIG*

## The Observatoire BBC examines airtightness

*- The observatoire BBC examines the airtightness of over 2500 low-energy residences in France by Sébastien Lefeuvre, Effinergie, France*

Effinergie is an association created in 2006 with the goal to dynamise the construction market and thereby facilitate the construction of comfortable & energy efficient buildings. It forges the development of reference buildings and tools, unites all the players in the sector, promotes regional dynamics among the players in the construction sector, ensures coordination between governmental authorities and regional initiatives, and demonstrates the technico-economic feasibility of low energy construction, highlighting results from real experience.

Two years after the launch of the BBC-Effinergie label, ADEME, the Ministry of the Environment (MEDDTL) and Effinergie decided to co-develop the Observatoire BBC – [www.observatoirebbc.org](http://www.observatoirebbc.org). This database records examples of energy efficient buildings (BBC-Buildings) compliant with the BBC-Effinergie label as well as award winners of regional calls for projects. The challenges are:

- to assist professionals in reaching this target;
- to technically analyze achieved buildings;
- to disseminate best practices;
- to assess policy and prepare future laws and directives.

Currently, the Observatoire BBC references over 900 projects. In parallel, 450 buildings have been analyzed.

In this context, the Observatoire published a study on the air permeability of BBC residences, which is a specific point of attention for us since the BBC-

Effinergie label requires to comply with an airtightness value at commissioning (0,6 m<sup>3</sup>/h per m<sup>2</sup> of cold area at 4 Pa for individual dwellings, therefore about 3,3 m<sup>3</sup>/h/m<sup>2</sup> at 50 Pa; 1,0 for multi-family buildings). For individual houses, it highlighted that the measured air permeability was on average 0,4 m<sup>3</sup>/h.m<sup>2</sup>—i.e., over 40% better than the current performance of individual houses.

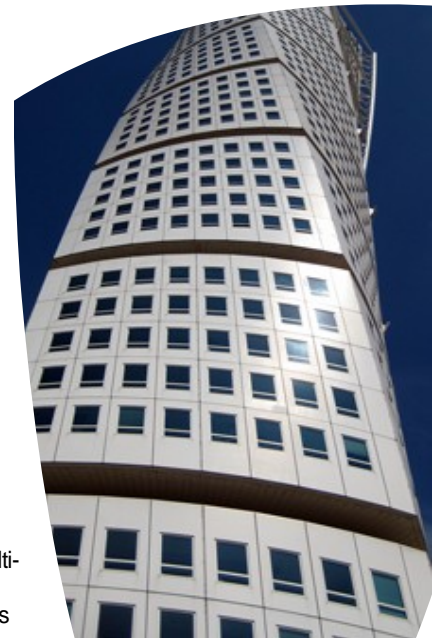
Furthermore, 50% of the houses analysed have a permeability between 0,31 et 0,50 m<sup>3</sup>/h.m<sup>2</sup> at 4 Pa—i.e., about 1,7 and 2,7 m<sup>3</sup>/h/m<sup>2</sup> at 50 Pa) and the standard deviation drops from 1,65 to 0,12 m<sup>3</sup>/h.m<sup>2</sup> (about 9,0 to 0,7 m<sup>3</sup>/h/m<sup>2</sup> at 50 Pa).

Those trends were confirmed for multi-family buildings. The measured air permeability was on average 0,54 m<sup>3</sup>/h.m<sup>2</sup> (about 2,9 m<sup>3</sup>/h/m<sup>2</sup> at 50 Pa), which is 34% below the performance of current buildings.

In parallel, cross-analyses between BBC-Buildings localization and professionals officially authorized to perform the air permeability measurement, allowed us to perform a market analysis and to identify the needs (number & localization of new air permeability operators) with the enforcement of the new thermal regulation, so called RT2012, in January 2013. The number of certified BBC buildings rising each month, the study is focused on the methodology to get the information in order to help new professionals launch of their activity.



For more information:  
[www.observatoirebbc.org](http://www.observatoirebbc.org)



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<i>Measured Air Permeability</i>	<i>Individual Houses BBC certified</i> <i>(m<sup>3</sup>/h per.m<sup>2</sup> at 4 Pa)</i>	<i>Samples CETE</i> <i>(1792 houses - May 2011)</i> <i>(m<sup>3</sup>/h per.m<sup>2</sup> at 4 Pa)</i>
<b>Average</b>	<b>0,40 (2,17 at 50 Pa)</b>	<b>0,68 (3,69 at 50 Pa)</b>
<b>Standard deviation</b>	<b>0,12 (0,65 at 50 Pa)</b>	<b>1,65 (8,96 at 50 Pa)</b>

## Interlaboratory tests for the assessment of repeatability and reproducibility of building airtightness measurement

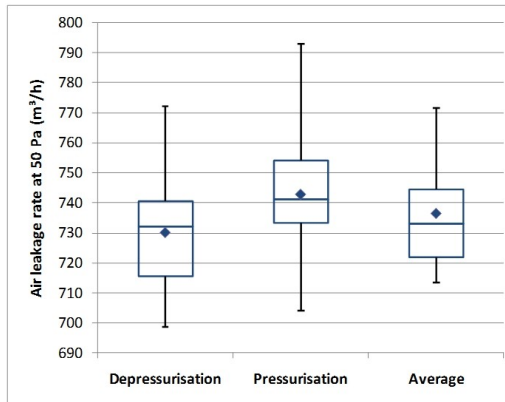
- Christophe Delmotte BBRI, Belgium and Jelle Laverge, Ghent University, Belgium.

This article is based on the paper of the same authors presented at the 2011 AIVC-TightVent conference which received the "best paper award". The presentation recording can be viewed at <http://tightvent.eu/events/individual-presentations/delmotte-airtightness-measurements>

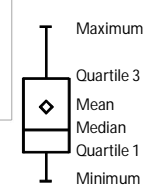
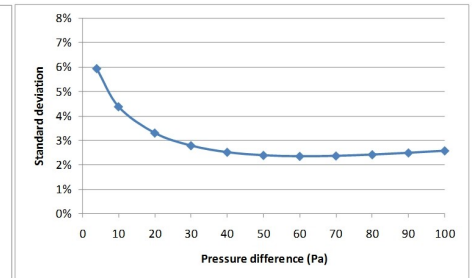
The reliability of airtightness tests is a natural question to address in today's European context because the number of tests increases rapidly either to obtain credit in the energy performance regulation or to comply with specific requirements of a programme or regulation. There are several potential sources of errors pertaining in particular to the method, the equipment or the operator. These may affect the accuracy—i.e., the closeness of the measurements to the true value—and the precision of the results—i.e., the stability of the results of repeated measurements.

To address the specific issue of precision, we have conducted two series of tests on an identical building to evaluate the repeatability and reproducibility of envelope airtightness measurement. Note that according to ISO 5725-1, repeatability refers to the precision of tests performed on the same test object by the same operator with the same equipment, whereas reproducibility refers to the precision of tests performed by different operators in different laboratory using different equipment.

BBRI performed 10 replicate tests (pressurisation and depressurisation) under repeatability conditions. 10 other laboratories made 1 test each under reproducibility conditions. All tests were performed according to EN 13829:2011 (similar to ISO 9972:1996 modified) with pressure stations ranging from 10 to 100 Pa and 10 Pa



Variation of the air leakage rate at 50 Pa under repeatability conditions.



Reproducibility standard deviation ( $s_R$ ) versus reference pressure difference. The reproducibility limit is  $2,8 \times s_R$ .

increments. The results were compared in terms of leakage air flow rates at a given reference pressure as defined in the standard.

The building subject to the tests is located at BBRI in Limette, Belgium. It is an unoccupied single family house built around 1980 and fully dedicated to research work. It has a net floor area of 92 m<sup>2</sup> and an internal volume of 221 m<sup>3</sup>. During the tests, the wind speed varied from 1,3 up to 5,1 m/s and the mean temperature from 11,7 to 28,1 °C, with a maximum of 4,2 °C deviation during the test.

The repeatability results showed a difference between pressurization and depressurization modes. The air leakage rates range from 699 to 738 m<sup>3</sup>/h in depressurization, from 732 to 754 m<sup>3</sup>/h in pressurisation mode, and from 715 to 744 m<sup>3</sup>/h when taken the average of pressurisation and depressurisation modes. These results suggest using both modes to reduce the measurement uncertainty.

Not surprisingly, with unweighted regressions, the standard deviation of the leakage airflow rates of a series of measurements increases with decreasing reference pressures, in other words, the measurement precision is better at 50 Pa than at 4 or 10 Pa. The repeatability and reproducibility limits for the average leakage rate—i.e., the values less or equal to which the absolute difference between two test results obtained under repeatability or reproducibility conditions may be expected with a probability of 95%—were of 3,8% and

6,7% at 50 Pa respectively, whereas they were of 9,7% and 16,7% at 4 Pa. Using a weighted regression as in the Canadian standard slightly reduced the repeatability limit at 4 Pa (7,8% instead of 9,7%).

Our results may be summarized as follows:

- tests in both in pressurisation and depressurisation should be preferred to minimise repeatability and reproducibility errors;
- low reference pressures induce larger errors on the leakage airflow rates;
- the test reproducibility is good (6,7% for a reference pressure difference of 50 Pa) under the conditions of this study.

This study was performed with the financial support of the Walloon region.

### References:

- CAN CGSB-149. 10-M86. 1986. Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method. Canadian General Standard Board.
- EN 13829:2011. Thermal performance of buildings – Determination of air permeability of buildings – Fan pressurization method. European Committee for Standardization.
- ISO 5725-1:1994. Accuracy (trueness and precision) of measurement methods and results – Part 1: General principles and definitions. International Organization for Standardization.

Description	Number of patents
Air and gas-tight doors and windows	1204
Reconditioning air for breathing in sealed rooms of containers	1163
Air conditioning	> 100.000
Air partitions, locks and doors in mines	1351
Ducts in building structures	1612
Ducts incorporated in floors	4047
Connections between pipes	> 100.000
Flexible pipes connections	7923
Build-in ventilation ducts in buildings	2394

## How to benefit from someone else's research efforts?

- Josse Jacobs, Delphine Goffinet, Stefanie Renmans, PATLIB Centre, BBRI

When new problems arise, the perfect solution rarely is commonly available. In view of the actual need for improved airtightness and ventilation solutions in buildings, many companies and research institutes are searching for searching for better materials and construction procedures. Quite often researchers study proceedings, magazines and technical publications, hoping to find some ideas that may help them overcome the obstacles in their research project. Nevertheless, consulting patent databases is hardly ever done in the construction industry, although they contain plenty of potentially useful information.

A patent is a document that provides a detailed description of an invention. Once granted, it gives the patent holder the exclusive rights of the commercialization of the invention for a limited period of time (generally maximum 20 years) in a defined territory (one or more countries). In exchange for these rights, the inventor has to reveal all details of his invention.

All these patent documents, applications as well as granted patents, can be consulted in databases that are publically accessible. While over one million patent applications are added to these databases each year, classification systems have been created to ease the search. A quick survey of the International Patent Classification (IPC) reveals about 20 classifications that may apply to building and ductwork air tightness issues.

The above table lists some techniques, and the number of patents that are found in that class. This list, although not exhaustive, offers a first impression of the amount of information available in these databases.

Any inventor or researcher can thus organize his own patent search, focused on his specialty. Once a satisfying search strategy has been found (by the researcher or by a consulting organization), it's rather easy to make regular updates, revealing not merely which items, problems and techniques are currently developed by competitors, but also which companies or research institutes are active in the field. All this information may help avoid spending research budget on already existing inventions.

However, not only researchers and innovative enterprises may benefit of this patent information. A production unit may find a technique that fits well in the activities of the plant. Once the relevant patent is found, the company can verify if the patent grants valid rights in its work areas, and if necessary establish some contacts with the inventor in order to get an exclusive license for the commercialization.

Performing these patent searches may seem easy, but reliable results need experienced patent searchers. Some patent attorneys or national patent offices may offer patent searches to their clients.

The EPO (European Patent Office) has created PATLIB, a network of patent libraries. These are offices where enterprises can find some assistance in finding the way in the world of patents. Generally these PATLIB-centres are dealing with all

## Contributed report 14: Methods and techniques for airtight buildings

TightVent partners are pleased to have contributed to the production of this report. It stems from the MININFIL project coordinated by CETE de Lyon in France, and run between 2009 and 2010 under the PREBAT programme with the support of ADEME.

This report gives an overview to the design principles and construction methods for building airtightness. Its primary objective is to disseminate basic information on steps to follow at design stage as well as on tightening products and frequent field issues. It can be read as an introduction to the over 150 construction details developed within this project.

Download the report at <http://tightvent.eu/publications/tightvent-reports>



technical fields. More information can be found on [www.epo.org/searching/patlib.html](http://www.epo.org/searching/patlib.html)

In some cases, such as at BBRI (Belgian Building Research Institute), the PATLIB centre is specialized in a specific technical domain. The BBRI Patents Unit, which receives support from the Belgian federal government, provides individual and collective support for SME's in the Belgian construction industry. Individual support consists of personalized advice, in person or by mail. Belgian construction SME's can contact the BBRI Patents Unit for answers to patent questions and for searches in the patent databases free of charge. If you want to have assistance in relation to patents, you can contact the BBRI patent unit at [patent@bbri.be](mailto:patent@bbri.be)



## TightVent sets up a European airtightness association committee

Many European countries are developing or considering the development of frameworks to increase the reliability of building airtightness testing and reporting for regulatory or voluntary compliance check purposes. This topic is particularly hot where minimum requirements have been enforced which increases the risk for erroneous tests and reports because of the consequences insufficient airtightness may have on tax credits, subsidies, or law suits.

Airtightness associations ([www.buildup.eu/blog/15618](http://www.buildup.eu/blog/15618)) are often a central place to discuss these issues and the AIVC-TightVent airtightness workshop held in Brussels, 28-29 March or the 7<sup>th</sup> BUILDAIR symposium held in Stuttgart, 11-12 May have brought to light the need for them to exchange views e.g., on competent tester schemes, stimuli for quality approaches, durability.

For this, an airtightness association committee is being set up and hosted within TightVent. Representatives from organizations of the following countries have confirmed their participation: Czech Republic, Denmark, Germany, Italy, Sweden, UK. The first internet meeting will be held September 26, 09:30-11:30.

Interested to join? Please contact [info@tightvent.eu](mailto:info@tightvent.eu).

## AIVC-TightVent conference

Copenhagen, October 10-11 2012

The provisional programme includes presentations of invited world-renowned and key experts as well as 75 papers selected from the call for abstracts for long- and short-oral presentations.

In addition, topical sessions are 60- to 90-minute sessions addressing a specific topic mostly with invited speakers and allowing significant time for discussion with the audience. This year's topical sessions are:

Ventilative cooling	Building and ductwork airtightness	Ventilation, health and comfort	Ventilation technologies and site implementation
International initiatives on ventilative cooling	Philosophy and approaches for building airtightness requirements	Health and comfort in highly energy efficient buildings	Demand-controlled ventilation (Clear-Up project)
Ventilative cooling in residences	Quality and building airtightness	Health-Based Ventilation Guidelines for Europe (HealthVent project)	Quality of domestic ventilation systems
Advanced ventilative cooling concepts in Nearly Zero-Energy Buildings	Quality of ductwork systems	Ventilation and thermal comfort in school renovations (SchoolVentCool project)	Multi-zone airflow simulations
Ventilative cooling in building regulations		European Policies on Indoor Air Quality	

Find more information on the programme including the list of speakers at: <http://tightvent.eu/events/aivc-tightvent-conference-2012/2>

The conference is organized by the International Network on Ventilation and Energy Performance (INIVE) on behalf of the Air Infiltration and Ventilation Centre (AIVC) and TightVent Europe (the Building and Ductwork Airtightness Platform) with support from the VELUX group. In cooperation with



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