Summary of airtightness track

More than 200 participants attended the joint 39th AIVC – 7th TightVent – 5th venticool conference held in Juan-Les-Pins, France on September 18-19, 2018. The programme consisted of 3 parallel sessions with contributions from 27 countries and international organisations. Around 150 presentations were given covering the main conference topics namely: Smart Ventilation, Indoor Air Quality (IAQ) and Health relationships,;Ventilation and (building) Airtightness; Ventilative cooling - Resilient cooling.

It has also been a major discussion place for on-going or recently launched projects and initiatives such as the Indoor Environmental Quality – Global Alliance (http://ieq-ga.net/), the IEA EBC annex 80 "Resilient Cooling" (http://annex80.iea-ebc.org/) and the IEA EBC annex 78 "Supplementing Ventilation with Gas-phase Air Cleaning, Implementation and Energy Implications"(http://annex78.iea-ebc.org/).

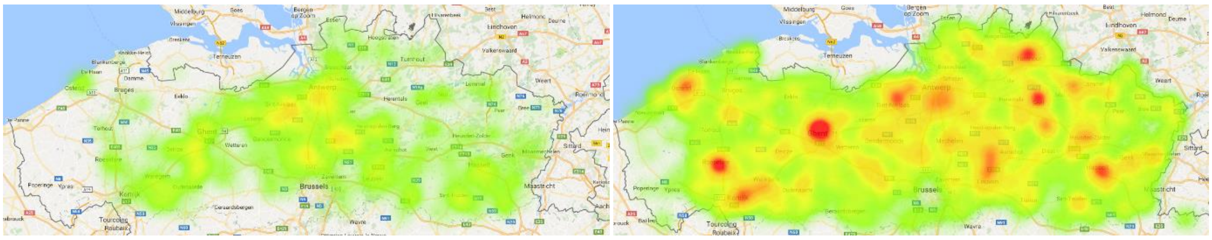
The "Ventilation and (building) Airtightness" track at the AIVC 2018 conference consisted of 34 presentations organised in 6 sessions, 3 of which were topical sessions with a number of invited presentations:

1. Analysing airtightness measurements
2. Ductwork airtightness (topical session)
3. Integrating uncertainties in declared airtightness results (topical session)
4. New methodologies and improvements for airtightness
5. Demand controlled ventilation
6. Performance of heat recovery ventilation in practice (topical session)

This article provides a summary of the main trends and conclusions addressed during the presentations and discussions on the topic of building & ductwork airtightness. Selected presentations are grouped into 3 main themes: Airtightness measurement data; Solutions for ductwork airtightness and; Alternative methods for building airtightness testing.

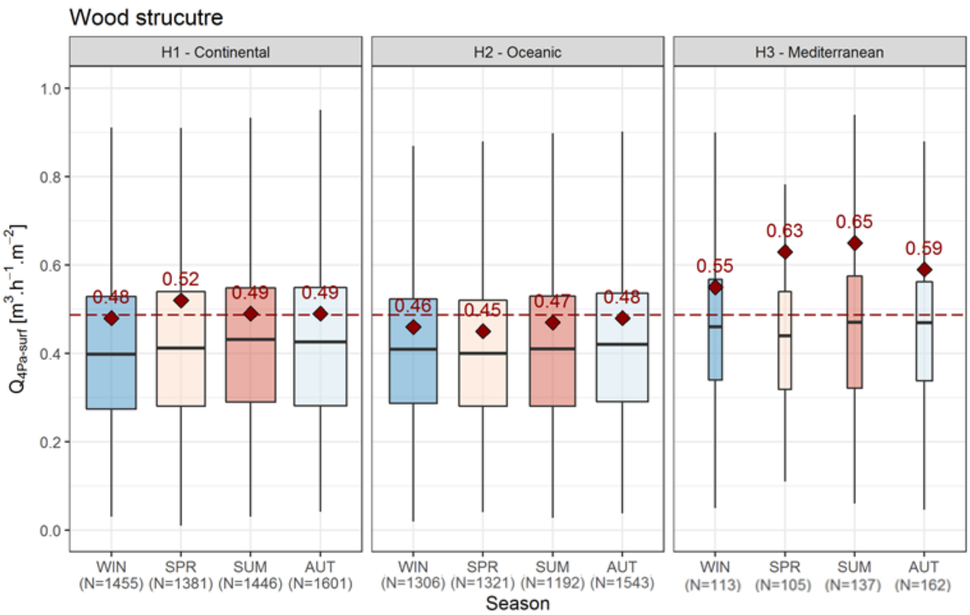
Airtightness measurement data

De Strycker et al. provided feedback from BCCA (Belgian Construction Certification Association)'s quality framework for building airtightness testing in the Flemish Region of Belgium, following 3 years (January 2015 to May 2018) of airtightness tests performed by qualified testers and inserted into the BCCA database (De Strycker, Van Gelder, & Leprince, 2018). Results showed that it is possible to develop a qualification framework at limited cost for the testers, with an efficient inspection process that avoids manipulation of results and improves the reliability of results.



Inspections (left) & measurements (right) performed in 2017 (De Strycker, Van Gelder, & Leprince, 2018)

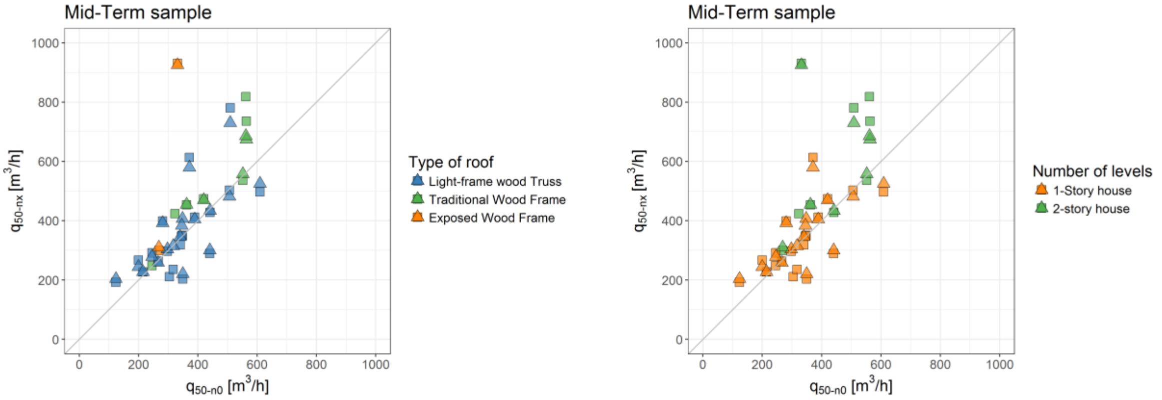
Moujalled et al. looked into the status of the French national database for building airtightness, currently counting 215,000 airtightness measurement results from 2007 to the end of 2016 (Moujalled, Leprince, & Bailly Mélois, 2018). The authors assessed the evolution of air permeability and investigated the impact of seasonal variations on the measured air permeability in single dwellings depending on climatic zones and buildings construction materials (wood, concrete and brick constructions). Impact was only observed in the case of wood constructions, with slightly higher values during summer in particular for the south of France.



Variation of air permeability for wood structure houses depending on climate and season (mean value is indicated by the red dashed line) (Moujalled, Leprince, & Bailly Mélois, 2018)

Furthermore, Moujalled et al. summarised the most recent results of the French national database for ductwork airtightness, created in 2016 (Moujalled, Leprince, & Mélois, 2018). One year later, in 2017, the database counted 1,300 measurements performed by qualified testers according to a national scheme. The analysis also covered the measurement results regarding ductwork airtightness classes depending on several factors such as building's use, type of ventilation system, targeted class and the type of ducts.

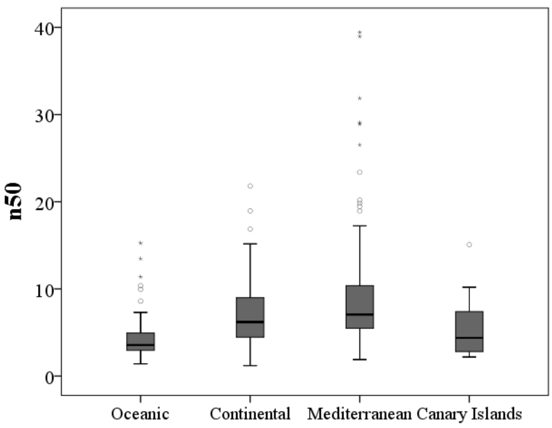
Moujalled et al. also assessed the building airtightness durability of 61 French low energy single family dwellings in real conditions at mid- term (yearly evolution of building airtightness of new dwellings over a 3-year period) and long- term (evolution of building airtightness of existing dwellings over a longer period from 5 to 10 years) scales, through two field measurement campaigns (Moujalled, et al., 2018).



Comparison of q_{50} for MT sample between measurements n_1 (rectangular points) and n_2 (triangular points) against measurement n_0 depending on the type of roof (left) and the number of levels (right) (Moujalled, et al., 2018)

The durability of building airtightness was also investigated by Novák, by means of repeated airtightness testing of 4 passive houses built in 2007 (Novák, 2008). The buildings were tested several times over a period of 11 years providing an insight into the evolution of the airtightness during the first years of the building service.

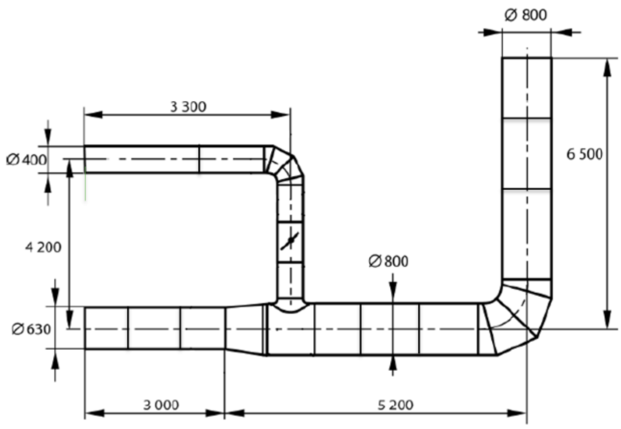
In the framework of the research project *infiles*, Poza-Casado et al. presented a preliminary analysis of the Spanish residential air leakage database (Poza-Casado, Meiss, Padilla-Marcos, & Feijó-Muñoz, 2018) currently including data from 401 buildings. The database gathers air infiltration results and building characteristics in order to determine the factors that have a major impact on airtightness.



Airtightness of the tested dwellings – Climate zones (Poza-Casado, Meiss, Padilla-Marcos, & Feijó-Muñoz, 2018)

Solutions for ductwork airtightness.

Briffaud presented a new certification programme for ventilation ductwork systems established by Eurovent Certita Certification (Briffaud, 2018). The DUCT programme relies on ventilation ductwork system (typical setup) testing and production sites auditing. Its scope covers rigid and semi-rigid ventilation ductwork systems divided into sub-programmes (rigid metallic ductwork systems with circular (DUCT-MC) and rectangular (DUCT-MR) cross-section as well as semi-rigid non-metallic ductwork systems predominantly made of plastics (DUCT-P)).



Example of typical ductwork system suitable for DUCT-MC sub-programme testing (Briffaud, 2018)

Mez presented the Aeroseal technology for sealing leakages in ductwork and duct components (Mez, 2018). By reducing leakages of duct systems by 90% in average, the Aeroseal sealing technology allows reducing leakages to a standard better as air tightness class D or ATC 1 for a complete system. It can be applied in new constructions as well as in existing systems to improve energy efficiency, cleanliness of ventilation systems, IAQ and comfort.

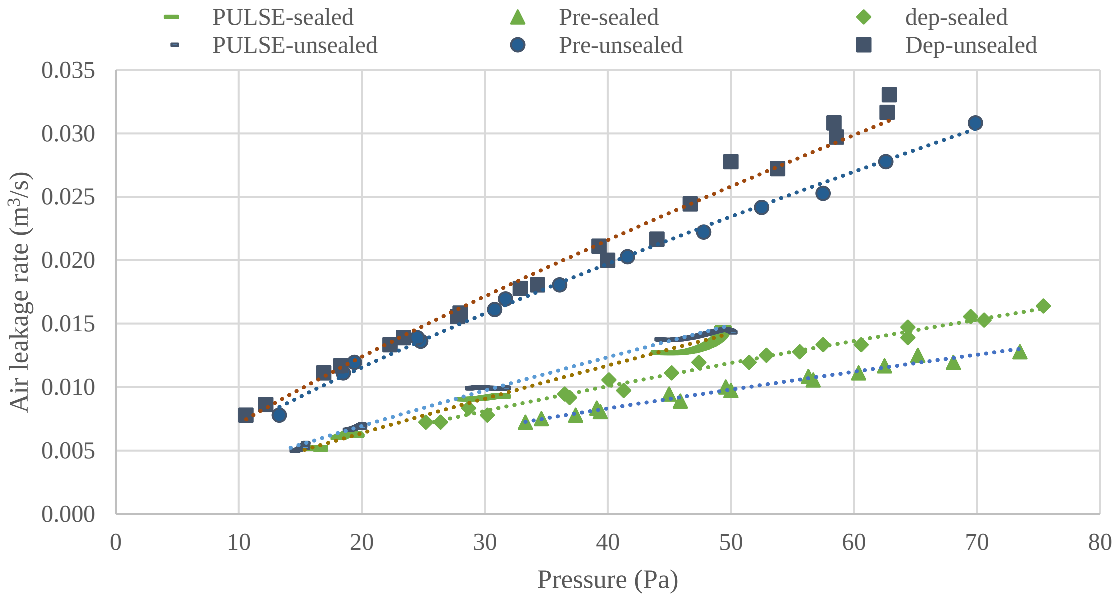
Mez Aeroseal machine (Mez, 2018)

Alternative methods for building airtightness testing

Zheng et al. introduced an experimental study of enclosure airtightness testing of an outdoor chamber using both the pulse technique and the blower door method (Zheng, Mazzon, Wallis, & Wood, 2018). Their study looked at how pulse and the blower door methods compared in six different scenarios of envelope air tightness in the natural outdoor conditions. The repeatability of pulse under various artificially imposed steady wind (SW) speeds and direction was also investigated.

Setup of blower door (SW test) (left), Setup of PULSE unit (SW test) (right) (Zheng, Mazzon, Wallis, & Wood, 2018)

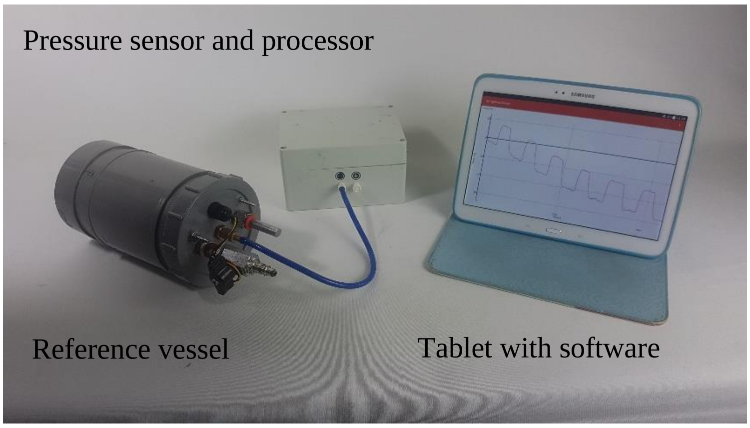
Wood et al. measured building airtightness by means of the pulse method at higher pressure differentials than previously observed, enabling a direct comparison between the pulse and blower door methods (Wood, Zheng, Pasos, Hsu, & Smith, 2018). In order to achieve direct comparison between the two methods, the measurement range of the pulse tests, carried out alongside blower door, was extended up to 50 Pa in two small outdoor pods with different leakage levels. One pod was designed to be Passivhaus standard and hence highly airtight while the other one was fabricated to satisfy 2010 UK building regulations making it less airtight.



Pressure-leakage curves measured by both methods with and without sealing of PassivHaus Pod (Wood, Zheng, Pasos, Hsu, & Smith, 2018)

Pasos et al assessed the impact of environmental conditions on the measurement of building infiltration, and its correlation with airtightness (Pasos, et al., 2018). They measured air infiltration rates using tracer gas means, airtightness measurements using the PULSE technique, pressure difference for every second in all building façades, and performed a constant monitoring of environmental conditions. It was confirmed that wind and stack effects are two dominant environmental factors affecting the infiltration rate. Moreover, differential pressure measurements confirmed the relevance of wind speed and direction.

Lanooy et al introduced a new methodology for airtightness measurements through fan pressurization, using a single-point pressure measurement (Lanooy, Kornaat, Bink, & Borsboom, 2018). This methodology measures the airtightness through the ventilation system of the building itself, as described in ISO 9972. Validation of the new method has been carried out based on airtightness tests in buildings with both the blower door test and the new method. When considering the uncertainty of both methodologies, both methods pass or fail nearly all the same buildings. Preliminary results also seem to support the notion that the new method is less affected by wind.



New airtightness tester device (Lanooy, Kornaat, Bink, & Borsboom, 2018)

Note: All cited papers will be available on AIVC's AIRBASE (https://www.aivc.org/resources/collection-publications/aivc-conference-proceedings-presentations) in March 2019

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