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International Energy Agency
Energy Conservation in Buildings
and Community Systems Programme



Air Infiltration and Ventilation Centre

Report of the 2nd European BlowerDoor Symposium - 2007

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The 2nd European BlowerDoor Symposium “Airtight building envelope, thermography and dwelling-ventilation” took place on the 16th and 17th March 2007 in Kassel, Germany. 150 participants from 13 European nations, and 20 companies took part in the symposium and the trade fair. The contributions came from Belgium, Germany, Finland, Greece, Austria, Switzerland and the Czech Republic.

With the successful opening lecture of Professor **Hansruedi Preisig** from Switzerland, the connection between the influences of the airtight building envelope and the dwelling ventilation on the room climate, the comfort and the energy efficiency became clear and made descriptive by examples. His findings clearly indicate that the symbiosis between both “systems” must be looked for and must further be optimized. He is standing for a “2000 Watts dwelling society”, which masters the future by a high measure of energy efficiency.

The result of the revision of the DIN 1946-6 (Raumluftechnik - Teil 6: Lüftung von Wohnungen; Allgemeine Anforderungen, Anforderungen zur Bemessung, Ausführung und Kennzeichnung, Übergabe/Übernahme (Abnahme) und Instandhaltung) and their details were reported by Wilhelm Reiners, Germany. The holistic approach of the standard reflects in the ventilation concept to be developed and the conversion and design of the individual components. Thus the requirements of the EnEV for the minimum air exchange are better revealed in the future.



Mr. **Peter Wouters** from Belgium opened his lecture with a summary of the beginnings of the “airtightness of buildings” by the research during the seventies and with a manual of the AIVC (Air Infiltration and Ventilation Centre – www.aivc.org) to the topic from 1980. The “European Energy Performance of Buildings Directive” was presented in general with specific attention for the topic of building air tightness. His suggestion, how the airtightness of the building envelope could be measured in an economic way in multi-dwelling projects was new to the plenum: In such case, a certain percentage of the objects (e.g. 10%) are measured. If the test fails, the building airtightness must be improved in order to meet the requirements and, furthermore, another 10% of the objects must be measured. If the test is passed, it is assumed that all objects are o.k. Mr. Wouters presented also the services provided by the EPBD Buildings Platform, which is the official EU information provider on EPBD related issues:

www.buildingsplatform.eu

The difficulties and possible solutions for the energetic improvement of non-residential buildings regarding the topic airtightness became clear in the lecture of **Karl Hans Schwarz**, Germany. Air tightness investigations as well as thermography prove as an extremely effective means even for large buildings for the investigation of the building envelope. They shed light on the condition (state of repair) of the building and give valuable information to the most effective civil works for the energetic improvement.

The limits of recognisability of leakages by means of thermography were lectured by **Emanuel Panic** from Austria by means of experiments at test objects. His findings are that only by high-quality cameras, high temperature differences and short flow paths of air from outside to inside all leakages become visible.

The air tightness measurements in the Czech republic, said **Jiri Novak**, CZ, in the future strongly will be inquired, because recommended n_{50} -values were introduced to the technical standards (CSN 73 0540) and there is an increasing demand of low-energy buildings and passive houses. The recommended values are for passive houses with $0,6 \text{ h}^{-1}$, for buildings with ventilation systems and WRG with $1,0 \text{ h}^{-1}$, for buildings with ventilation system without WRG with $1,5 \text{ h}^{-1}$ and all the rest of the buildings $4,5 \text{ h}^{-1}$. The University of Prague is working to a planning tool for the execution of the air tightness level and their planning in the construction progress.

Mr. **Targo Kalamees** from Finland reported on research, to seize and evaluate leakages and leakage distribution by means of thermography. The evaluation of the surface temperature, caused by a cooling by air flowing in from the outside, in relation to interior and outside air temperature serves as suitable parameter. Thus the “size of leakages” like their distribution can, in individual rooms or floors, be seized and evaluated relatively fast.

On measuring strategies for multi-family houses **Paul Simons**, D, reported. There is the choice between the measurements of the entire building, i.e. all householders open the room doors and flat doors with and without

protection pressure and the measurement of each dwelling individually. Depending upon the local conditions only one variant can be accomplished. During the interpretation of the results of measurement with single dwellings the air flow between the dwellings must be considered.

The problem of so-called technical openings, like the fume outlet opening of lift shafts and rear-ventilated chimneys can be avoided, **Joachim Zeller** from Germany reported. For both types technical solutions, also for retrofitting, are offered on part of the industry, which are favourable regarding the energy efficiency and should in each case be used.

Stefanie Rolfsmeier, D and **Daniel Jung**, D presented in two lectures special measurements in clean rooms and laboratory areas. Frightening is the finding that in the described cases there was a total lack of planning in planning and execution stage regarding building air tightness. The stability and durability of adhesives and tapes were examined by Professor **Thomas Ackermann**, D, who presented a new evaluation procedure. His study shows an aging of the adhesive strength of individual products under the assumed loading cases and ancillary conditions.

Mr. **Markus Kuhnhenne**, D, reported of measurements at joints of building elements in the case of lightweight steel constructions and sandwich structures. Depending upon construction of the joint design and the use of sealing tapes a more or less good airtightness is reached. A practical example shows that especially with large buildings (storage halls, industrial halls) the presently required limit value for the air permeability of 3 h^{-1} without and 1.5 h^{-1} with air conditioning plant (after EnEV) shows a too low requirement. A limit value of $n_{50} = 0.1 \text{ h}^{-1}$ for buildings with e.g. $50,000 \text{ m}^3$ appears more appropriate.

With a comparison of different building services systems in connection with dwelling ventilation plants by Rolf Schmidt and **Raimund Käser**, D, the meeting was continued the second day. On basis of different energetic building standards such as EnEV, KfW60 and KfW40 (KfW = Kreditanstalt für Wiederaufbau (credit association for

rebuilding) gives financial aid for buildings with primary energy consumption of 60 or 40 kWh/a*m²) over 30 different building services systems were examined. Interesting results were presented for final energy, primary energy and costs in comparison with gas gross calorific value-, heat pump- or biomass-heat generators. In the following discussion it became clear that the presented calculation of profitability were clearly on the safe side due to the already very good basis “EnEV”.

The current situation in the Czech Republic for dwelling ventilation of very low energy houses was thereafter presented by Professor **Tywniak**, CZ. He illustrated this on the basis of current building projects. Interesting is the high portion of ground heat exchangers as well as dwelling ventilation with portions of circulating air (means that a part of the air is not fresh air from outside, but air which has been circulating through the building) in the Czech Republic. Mechanical ventilation with heat recovery is at present a largely accepted technology for designers of low-energy buildings. However there is a lack of practical design and execution experience with these techniques.

The following lecture by **Jarec Kurnitski**, Finland described the results of a study of air change rates and the user behavior in Finnish houses with ventilation systems. The results, which cover 100 newly established single family houses, show that the ventilation systems are constantly used and the fan modulation is rarely changed. The very important influence of a good noise control of the ventilation system became clear on the basis the user behavior. Fan noises are an important factor with the speed adjustment and the resulting air change rates.

Mr. **Hans Berhorst**, D, presented the current state of discussion with the common operation of fire places, dwelling ventilation plants and cooking hoods in dwellings. Unfortunately there is still no uniform requirement profile for this combination on the part of the district chimney sweepers. A control device is demanded, which prevents combustion air to be drawn into the dwelling through negative pressure from the ventilation plants and cooking hoods but it is still an unregulated construction unit, since the standardized design

did not come over the objection phase. Mr. Berhorst continued to present control devices present in the market which could be useful. Further he pointed out the efforts of the associations to create a reliable planning basis in these points.

The lawyer Mr. **Dietmar Lampe** (Germany) reported from a legal opinion on the question: “Do the generally accepted rules of engineering require controlled ventilation?” The starting point is the demand that the shells of buildings must be permanently sealed and airtight. At the same time, sufficient air renewal must be guaranteed to avoid excessive levels of carbon dioxide, humidity, mildew formation and the concentration of harmful substances. The conclusion reached is that planners and builders who forego a controlled ventilation system in the construction or renovation of residential buildings expose themselves to liability risks. Even though it cannot be reliably stated that a ventilation system is mandatory as of today, the alternative of leaving the prescribed air renewal to window ventilation by the occupants alone holds considerable legal risks.

Attorney Mr. **Ulf Köpcke** and Dr. **Hermann Nein**, D, argued with the interesting question „*How many standards can a house cope with?*“. Mr. Köpcke first described the 150 year old development and the range of all necessary standards and regulations and their legal meaning. Very large interest of the audience found his statement that those standards which are integrated in building regulations should be accessible free of charge. Further remarks for the German law for contracts for work and labour and the inclusion of the Verdingungsordnung für Bauleistungen (VOB) (contracting rules for award of public works, <http://dict.leo.org/ende?lp=-ende&p=eL4jU.&search=works>)

supplemented these representations. He drew the conclusion that each variation from the contractual regulation leads to a defect of construction work, without depending on the objective quality of the agreed activity or the evaluation of this achievement by a consultant or a court. Dr. Nein described in detail (supported by an example from practice) a controversy for many years about air tightness and wind tightness.

As the final presentation of the conference **Torsten Bolender**, D described the new development of the measuring standard ISO 9972 and pointed out the current differences to the measuring standard EN 13829. With the revision the ISO 9972 and unification with the EN 13829 measurements and results would be internationally better comparable.

Some references to the current conditions of the treatment DIN 4108-7 completed the lecture.

The full papers are to be found at: http://www.aivc.org/frameset/frameset.html?../External/E_Library.html or can be ordered in form of a conference volume at the Energy and Environmental Center Deister GmbH, Tel. +49 (0) 50 44/9 75-20, fax 9 75-66; E-Mail: bildung@eu-z.de. The 3rd European BlowerDoor symposium will take place May 30 to 31, 2008 in Kassel, Germany.

More information: <http://www.e-u-z.de-z.de>

Similar Information Papers on other European projects can be found at the Buildings Platform website

<http://www.buildingsplatform.eu>

The Symposium organizers

› Energie- und Umweltzentrum am Deister (e.u.[z.]) (Deister Energy and Environment Center)

<http://www.e-u-z.de>

› Bundesverband für Wohnungslüftung e.V. (Dwelling Ventilation association, VfW)

<http://www.wohnungslueftung.de>

› Verband für Angewandte Thermografie e.V. (Association for Applied Thermography, VATH) <http://www.vath.de>

In cooperation with the

› Fachverband für Luftdichtheit im Bauwesen e.V. (Association for Air-tightness in Construction, FliB)

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The Air Infiltration and Ventilation Centre provides technical support in air infiltration and ventilation research and application. The aim is to promote the understanding of the complex behaviour of the air flow in buildings and to advance the effective application of associated energy saving measures in the design of new buildings and the improvement of the existing building stock.