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Trends in the Belgian building ventilation market and drivers for change

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1 Introduction

This paper presents the evolutions during the last 20...30 years as well as the latest changes in the Belgian[1] building ventilation market, with an attention not only for IAQ and energy issues, but also for airtightness and the assessment of innovative systems issues. Not only the trends but also the (lack of) drivers for change are discussed.

[1] It must be noticed that Belgium is a Federal State composed of three Regions: the Flemish Region, the Walloon Region and the Region of Brussels-Capital. Energy use in buildings and ventilation are under the responsibility of the Regions. The Flemish Region has introduced an EPBD related regulation in January 2006. The Region of Brussels-Capital introduces its own Energy Performance of Buildings (EPB) regulation in July 2008. At the time this paper was written, the regulation of the Walloon Region was still under preparation. The regulations are similar. However, in this paper, if the Region is not clearly mentioned, we always refer to the Flemish situation, including for what concerns the E-level described below.

2 National trends in IAQ requirements and market characteristics

2.1 Requirements on ventilation of dwellings

Historically, ventilation in Belgian buildings became a point of concern only after the first oil crisis and then even primarily because of the interest in reducing the energy consumption for ventilation. It was in that context that Belgium joined in 1983 the Air Infiltration Centre (AIC), which was set up by the International Energy Agency in 1979 with the major objective to improve the building airtightness (as reflected by the name AIC). As a large number of moisture problems occurred in the first insulated buildings, it appeared clearly that ventilation was more or less forgotten. In 1991, a Belgian standard about ventilation of dwellings was published [1]; this standard was largely inspired by a similar Dutch standard [2].

The application of the standard was made compulsory in 1996 in the Walloon Region (at the same time as a strengthening of the requirements on building insulation). The Flemish Region imposed the application of some parts of the standard, as well energy performance requirements in the framework as other requirements, in 2006 (at the same time as of the implementation of the EPBD). The Region of Brussels-Capital imposes similar requirements from July 2008.

It must be noticed that, in Belgium, standards are considered as *rules of good practice* and, therefore, these requirements or similar performances should be implemented, even if they are not made compulsory by any regulation. However, in practice, this is seldom the case, as clearly shown by the *SENVIVV* survey [3] of 200 Flemish dwellings built in the early '90s. For instance, no air inlet devices were found in ± 90% of the bedrooms and living rooms and no air outlet devices in ± 60% of the toilets and in 100% of the kitchen[1].

Moreover, a limited study carried out in 2001 in the Walloon Region for the consumers association *Test-Achats* [4] has shown that even if the standard is compulsory, its application is far from being perfect. For instance, air inlet devices for natural ventilation[2] were too small in ± 50% of the visited "dry rooms"[3], none of the air outlet devices for natural ventilation (if any) was in accordance with the rules in the visited "wet rooms", mechanical supply and exhaust airflows were too small in ± 50% of the visited rooms and air transfer devices were too small in 86% of the visited rooms!

In the framework of the *RESHYVENT* project [5], some reasons were identified for this poor application:

- the final user[4] is not convinced that a ventilation system is necessary, partly because they receive false information from the market (like "opening the windows two times 15 minutes per day is sufficient"),
- there is a clear lack of control from the authorities, so the final user knows that he does not take a big risk if he does not comply with the regulations (the same applies for global insulation of the building).

Has it changed in the last years?

In the Walloon Region, not yet. The correct application of the ventilation requirements is still a problem, as clearly shown by the voluntary action *Construire avec l'énergie* [6], which aims to prepare the market to the coming Energy Performance of Buildings (EPB) regulation. Unfortunately, in the Walloon Region, the control has not yet been strongly intensified since the *Test-Achats* study was carried out.

A clear political message from the *SENVIVV* survey was that it is not useful to implement a new and more severe regulation without an effective compliance system Therefore, in the Flemish Region, the whole concept of implementation has been changed (e.g. declaration of performances after completion of the construction works, a fine system which is fully described in the legislation and which is enforced by civil servants without the need of a judge, the rapporteur stays responsible for 5 years after the end of the works for the declaration, ...). As a result, the control possibilities have been strongly reinforced with the introduction of the EPB regulation in 2006, which also made ventilation compulsory. For instance, if it appears that the ventilation system is not installed or is too small, an administrative penalty of 4 € per missing m³/h must be paid. Therefore, it is expected that the motivation for a better compliance with the regulation will be much higher. There are not

[1] Cooker hoods are not considered as part of the basic ventilation system.

[2] In Belgian dwellings, natural ventilation is called system A, mechanical supply is system B, mechanical exhaust is system C and balanced mechanical ventilation is system D.

[3] Dry rooms are bedrooms, living rooms and study room. Wet rooms are kitchens, toilets, bathrooms and service rooms.

[4] In Belgium, most of the one-family dwellings are ordered by their future owners. There is not much "industrialisation" of housing construction as, for instance, in The Netherlands where usually a contractor builds a series of tens or hundreds of identical houses. (However, a limited "industrialisation" may occur with the increasing market share of general contractors that take the responsibility of the whole building process.) Consequently, the property owners are more implied in the design and construction process of their house.

yet representative statistics of the status in practice.

A weak point of the legislation might be that there is not a mandatory control of the achieved air flow rates for mechanical ventilation systems. This was considered too big a step in the legislative process.

Has it improved the actual IAQ in dwellings?

The NBN D 50-001 standard is very prescriptive; it describes how a ventilation system must be designed (which airflow in each room, which components…) but it does not give any requirements either about the IAQ that must be obtained nor about how the system must be used or controlled. For instance, mechanical ventilation must be permanent but the airflow can be controlled by demand, however the standard does not specify the minimum airflow outside occupancy.

2.2 Requirements on ventilation of non residential buildings

Unlike dwellings, there is no Belgian standard about ventilation of non residential buildings, except the European ones transposed in Belgian ones, as for instance EN 13779 [1].

The regional regulations also include requirements on ventilation of non residential buildings. The Walloon requirements date from 1996, but are limited to very briefly described airflow requirements in office buildings and schools. The Flemish requirements date from 2006 and cover all type of non residential buildings; they are based on EN 13779. The Brussels-Capital Region imposes the same requirements from July 2008. The Walloon Region is expected to introduce the similar requirements in September 2008.

As it is the case for dwellings, many existing office buildings do not have ventilation systems and, if available, have often air flow rates not in line with the requirements. The situation is also problematic in schools, where one of the problems is clearly the budget.

However, in many new office buildings, the expectations regarding IAQ and thermal comfort are quite high. It is therefore also common to have ventilation systems that provide airflows higher than those prescribed by the regulation.

2.3 Renovation market

The Walloon regulation of 1996 and the Flemish regulation of 2006 include a requirement applicable in case of renovation, if the window frames are replaced. In such a case, it is compulsory to provide at least the supply air in the dry rooms, as prescribed for new buildings.

2.4 Market impact of the regulations

The Walloon regulation (1996) was the first regulation in Belgium which imposed the installation of ventilation systems in dwellings, offices and schools. As said previously, it seems that this regulation was not very well respected.

With the new Flemish regulation (2006), it is expected that the large majority of new dwellings will have ventilation systems (almost) in line with the requirements.

3 National trends in energy requirements and markets

3.1 Energy requirements

The Energy Performance of a building is expressed by a so-called E-level, which is the ratio between the annual calculated primary energy consumption of the new building and the reference annual primary energy consumption[1]. There are two calculation procedures: one for residential buildings, and one for offices and schools. The following parameters, related to ventilation, may have an impact on the E-level (*: dwellings only):

- selected type of system (system A, B, C or D),
- self regulated air inlet devices*,
- ductwork airtightness*,
- correct flow settings*,
- fan energy consumption,
- in case of heat recovery:
  - temperature efficiency,

[1] The reference annual primary energy consumption depends on the building volume and heat loss area.

- balancing of air flow rates
    - automatic flow control

Building airtightness can also have a large impact, as described in § 4.

As can be observed, these parameters not only involve system or product selections, made in the design stage of the construction process, but also parameters that are a result of high quality installation and commissioning work, such as airtight ducts, correct and balanced flows, low fan consumption due to low duct pressure drops. Furthermore , high quality products only result in good E-levels if they are installed in a (proven) proper way.

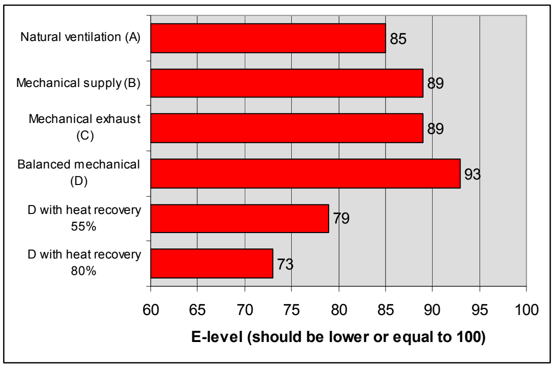

Figure 1: Impact of the ventilation system on the E-level of one particular building

Due to this, the systems that perform the best in terms of E-level[1] are 1) mechanical ventilation systems with heat recovery with a measured efficiency, 2) natural supply and natural exhaust (A), 3) natural supply with fan assisted exhaust (C) or mechanical supply with natural exhaust ventilation systems (B), 4) mechanical ventilation systems without heat recovery (or if the efficiency of the heat recovery is not tested). An example for <u>one</u> particular dwelling is given in figure 1.

3.2 Financial stimuli

From 2008, subsidies are given for the installation of balanced mechanical ventilation with heat recovery in dwellings[2].

3.3 Market impact – residential buildings

At present, there are only energy performance requirements in the Flemish Region. Reliable data about the market share of the different ventilation systems are not yet available.

In the voluntary action "*Construire avec l'énergie*" of the Walloon Region (with some ± 700 dwellings participating), the share of the balanced mechanical ventilation systems with heat recovery is strongly increasing, as shown in figure 2. As the E-level is not yet applicable in the Walloon Region, we can assume that this is partly or even largely due to the regional subsidies.

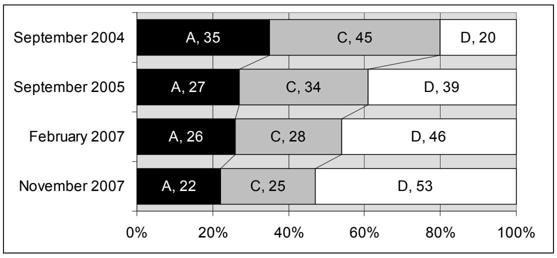

Figure 2: Percentage of each system type in total number of project of the voluntary action "Construire avec l'énergie"

The consequence of this market evolution is that balanced mechanical ventilation systems with heat recovery became the biggest competitor to the other system types. Due to the increased interest for energy efficiency, the ventilation industry is currently developing and promoting demand controlled (humidity, CO2, presence...) natural supply and mechanical exhaust systems. However, the energy benefit of such systems can not be evaluated in the standard calculation procedure of the E-level; therefore, a framework for the assessment of innovative systems is of first importance (see § 5).

[1] This ranking is only true with the use of the default value for the so-called m-factor that reflects the quality of execution of the system.

[2] Flemish Region: 150 €, Walloon Region: 1500 € limited to 75% of the bill, Brussels-Capital Region: 3000 € limited to 50% of the bill.

4 National trends in airtightness requirements and markets

4.1 Building airtightness: situation before EPB regulations

Before the new EPB regulations, building airtightness was not considered in any regulation. There were only recommendations about building airtightness in the NBN D 50-001 standard, but there were no available guidelines on how to reach those targets.

In the SENVIVV survey, airtightness was measured in 50 dwellings (of which 41 were single-family houses and were 9 apartments). Figure 3 shows that only few dwellings (4 out of 50) presented a rather good airtightness ($n_{50} \leq 3\ h^{-1}$), and that many of them (10 out of 50) presented a very poor airtightness ($\geq 10\ h^{-1}$). The average n_{50}-value[1] was 7.8 h^{-1}.

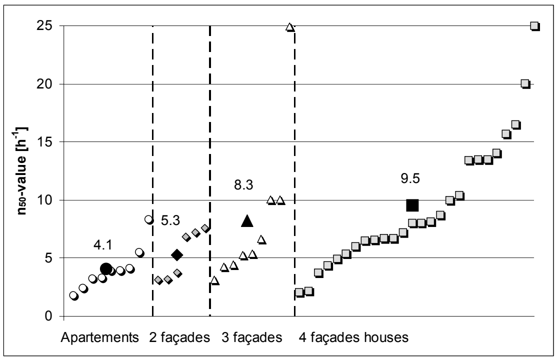

Figure 3: Building airtightness of new dwellings, before the introduction of the EPB regulation (Source: SENVIVV, cited in [8])

4.2 Building airtightness: requirements of the new EPB regulations

At the moment, the EPB regulation does not include specific requirements on building airtightness. There are only requirements on the total primary energy consumption (E-level), global insulation level (K-level[2]), maximum U-values (U_{max}), minimum ventilation requirements and limiting the risk of overheating (for dwellings). However, the building airtightness is included in the calculation of the E-level of both dwellings and offices/schools, based on a default value. An improved building airtightness, if measured, can therefore result in a substantial improvement of the E-level.

The building airtightness is expressed by the $\dot{v}_{50}$ value[3], which is the infiltration rate per unit of heat loss area (based on the external dimensions), at a pressure difference of 50 Pa. Calculations were made for the 200 *SENVIVV* dwellings to evaluate the impact of the building airtightness on the E-level. The same set of parameters (global insulation level, type of glazing, ventilation system, heating efficiency…) was used to calculate the E-level of each dwelling; only the geometry varied from dwelling to dwelling. The results are shown in figure 4. E_{min}, E_{avg} and E_{max} are respectively the minimum, average and maximum of the 200 calculated E-levels.

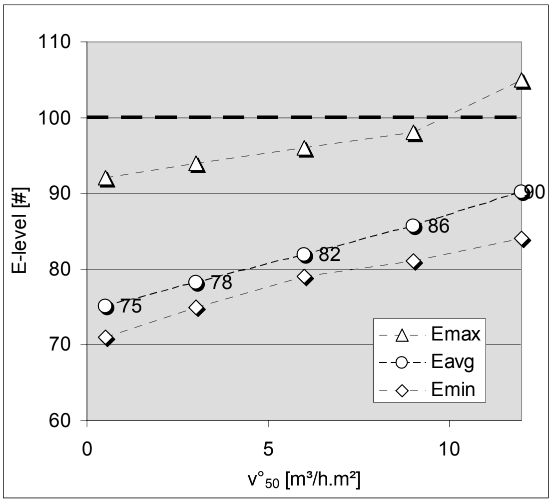

Figure 4: Impact of $\dot{v}_{50}$ on the E-level, calculation for 200 dwellings

[1] The situation is even worse, as the n50-values were calculated on basis of the volume calculated with the external dimensions, in stead of the volume based on the internal dimensions. This is due to the fact that the study was carried out before the relevant standard was published.

[2] In Belgium, the K-level is used to evaluate the global insulation level of a building. It depends on the building compactness, on the average U value and on thermal bridges. Prior to the new EPB regulation, the K-level of a new dwelling had to be lower than K55. With the new EPB regulations, it must be lower than K45

[3] The leakage is usually described by its n_{50} value, which the infiltration rate divided by the building volume, measured with the internal dimensions.

From the figure, it can be seen that reducing the infiltration rate $\dot{v}_{50}$ from 12 m³/h.m² (which is the default value if no airtightness measurement is carried out) to 6 m³/h.m² reduces in average the E-level from 90 to 82. A further reduction to 0.5 m³/h.m² would result in an E75. This reduction can be compared to other energy saving measures, as the improvement of the global insulation level K. A similar analysis shows that, in average, improving the airtightness down to a value of $\dot{v}_{50}$ = 3 m³/h.m² is equivalent to reducing the global insulation level from K40 to K27. Similar results may be found for non-residential buildings.

4.3 Building airtightness: market transformation

At the moment, there is only limited experience concerning building airtightness among Belgian building professionals. During the start-up period of the new EPB regulations, it is not expected that testing the building airtightness will be standard practice. It is likely that airtightness will be tested in a limited number of projects, in order to evaluate the airtightness that can be achieved with "business as usual" and to estimate the required efforts needed to achieve a certain level of airtightness(e.g. improving building details, more care during execution of the work…). During this learning process, the measured $\dot{v}_{50}$ values will probably only be used to obtain lower E-levels than required without counting on a good airtightness level to meet the mandatory E100 requirement.

Only if this learning process is successful and if building designers/contractors can be confident about the building airtightness that they can achieve, will they start to rely on a lower $\dot{v}_{50}$ value at design stage. It is positive to note that some of the major building contractors in the Walloon Region intend to buy the equipment to measure the airtightness of their new dwellings.

The situation could be improved if a financial stimulus (like subsidies or tax reduction) would be given by the authorities; this is currently under discussion.

4.4 Duct airtightness: situation before EPB regulations

Before the new EPB regulations, duct airtightness was not considered by any regulation. There were only recommendations in the specifications "Cahier des charges-type 105" of the federal buildings agency [9]. A limited survey conducted in the SAVE-DUCT project [5] has shown that the Belgian ductworks in buildings were much leakier than the Swedish ones, where duct airtightness and general quality of ventilation systems are major concerns.

4.5 Duct airtightness: requirements of the new EPB regulations

The EPB regulation does not include requirements on duct airtightness. However, ductwork airtightness is taken into account, based on a default value, in the calculation procedure of the E-level for dwellings (not in the procedure for office buildings and schools, at least not directly).

As for building airtightness, the positive influence can only be assessed if the duct airtightness is measured after completion of the installation. The potential impact is different for each ventilation system type and ranges from a very small effect below 1 E-level point for system A up to an E-level reduction of 2 or 3 points for systems C and D.

4.6 Duct airtightness: market transformation

There is not yet data available concerning market impact.

5 National trends in innovative systems and markets

As said in § 3.3, a framework for the assessment of the energy performance of innovative systems[1] is of first importance. Without it, innovation of some products is strongly discouraged, and the market competition between systems becomes unfair.

In the three Regions, a Decree (or Ordinance) was voted by the Parliaments to give the general framework for the EPBD implementation. The three Decrees give the possibility to define the procedure for the assessment of innovative systems to the government. At the time this paper was written, the procedure is only known in the Flemish Region.

This procedure foresees that the innovative system must apply for an ATG-E, which is akind of technical approval limited to its energy characteristics and which is delivered by the Belgian Union for Technical Approvals (UBAtc/BUTgb).

At the time of this paper, only one ATG-E was published, for a humidity controlled ventilation system for dwellings. The assessment of this ventilation system is described in [11]. Simulations were carried out with the multizone airflow network model CONTAM to determine the potential energy savings due to humidity controlled ventilation, and to verify that the delivered IAQ was equivalent to the requirements of the mandatory standard concerning ventilation in dwellings. To avoid that the final result overtly influenced by the initial assumption, the evaluation has been based on a probabilistic approach that required ,in total, 1200 simulations to be carried out.

[1] In the context of energy performance regulations, innovative systems/technologies are defined as:

- systems/technologies which mostly give a better performance in terms of the energy performance of buildings than the common technologies and,
- whose performance cannot be assessed by the standard EPB calculation methods.

6 Other points of attention or trends

6.1 Summer comfort

The EPB regulation includes a simple evaluation of the risk of overheating (new dwellings only). The regulation text specifies that intensive night ventilation can be an efficient method to passively cool the dwelling, but does not yet include a calculation procedure to evaluate the impact of a night ventilation strategy. Therefore, intensive night ventilation is not yet encouraged, whereas solar shadings are, because they are included in the calculation of the overheating risk. This point is intended to be improved in the future.

6.2 Acoustic requirements to façades and air inlets

In January 2008, a new version of the acoustic standard NBN S01-400-1 [12], regarding acoustical criteria in residential buildings, was approved by the normalisation committee NBN. This standard, not reviewed since 1977, puts down requirements to guarantee the acoustic comfort for 70% (normal comfort) up to 90% (enhanced acoustic comfort class) of the population within newly built or renovated apartments and single-family dwellings. However this document is not confirmed (yet) by law, the requirements are considered as rules of good workmanship and thus indirectly imposed in the case of prosecutions in court.

The new acoustic criteria regarding the sound insulation of facades imply direct as well as indirect requirements to air in- and outlet openings, perforating the façade envelope. Since ventilation openings together with windows, doors, walls, etc. constitute a part of the façade, their acoustic performance D_{neAtr} ($=D_{ne,w}+C_{tr}$) as measured in a laboratory, plays an important role in the overall sound insulation in the field between outside space and indoor rooms D_{Atr} ($= D_{2m,nT,w}+C_{tr}$).

The *basic comfort requirement for the in field performance* D_{Atr} measured according to EN ISO 140-5 *for the façade plane* enclosing a living room, kitchen, study room or bedroom, is function of the existing outdoor noise level L_A : $D_{Atr} \geq L_A - 34$ dB. When enhanced acoustic comfort is aimed for, the requirement on the sound insulation D_{Atr} is raised by 4 dB.

When the protected room consists of more than one façade plane, the requirement becomes 3 dB more severe, under certain well specified conditions. The absolute lower limit for basic and luxury comfort comes to $D_{Atr} \geq 26$ dB respectively 30 dB, even in quiet environments and this to allow for a minimum of privacy.

The minimum requirements with respect to the laboratory characteristic D_{neAtr} for small ventilation openings measured according to EN ISO 140-10, are derived from the ruling D_{Atr} requirement : $D_{ne,Atr} \geq D_{Atr} + 10lg[3(S+5n)/V] + 6$ dB.

So the minimum sound insulation requirement for ventilation openings can not be given as such, but refers to the parameter $D_{ne,Atr}$ and depends on the outdoor noise level L_A, the aimed comfort level, the number of enclosing façade planes, the total surface of façade elements S [m²] with $R_{Atr} < 48$ dB, the volume of the considered room V [m³] and the number of ventilation openings. Critically in field situations e.g. highly exposed, shallow rooms

with great window surfaces, highly damped ventilation devices with $D_{ne,Atr}$ up to 50 dB and beyond, can be required. A review of the project regarding dimensions, choice and positioning of the different façade elements might become necessary to meet the requirements and/or keep down the expenses.

6.3 Acoustic requirements to mechanical ventilation devices

Indoor sound pressure levels due to building equipment such as mechanical ventilation devices are also restricted by the new rule NBN S01-400-1. The maximum tolerated sound pressure level $L_{Ainstal,nT}$ measured according to NBN EN ISO 10052 due to mechanical ventilation depends on the type of room (within dwelling) and the desired comfort level (basic/luxury) :

Bathroom/Lavatory	: 35/30 dB
Kitchen	: 35/30 dB
Living room/Study room	: 30/27 dB
Bedroom	: 27/25 dB

On the other hand, the allowed disturbance of the existing background level ($L_{AS,max,T}$ - $L_{Aeq,T}$) in living rooms, study rooms and bedrooms, due to technical equipment outside the room (but within the same building) or duct noise is generally restricted respectively to 3 dB and 6 dB for basic comfort in living and study rooms.

As long as the background noise level $L_{AS,max,T} - k$, i.e. with reverberation time correction k, does not exceed a certain limit, that is 30/28 dB for bedrooms and 33/30 dB for living and study rooms, these requirements can be neglected.

As a conclusion, the new Belgian standard in practice requires that on the one hand natural air inlet devices have in most cases minimum acoustic performances and that on the other hand the acoustical disturbance from mechanical ventilation systems is very limited.

6.4 Quality of products/systems

When the Flemish regulation was prepared, there was a clear fear that making ventilation compulsory opens the door to low-cost ventilation systems which may be not be efficient and which may create problems with comfort. Therefore, the Flemish regulation includes requirements for air inlet devices for natural ventilation, such as water tightness, entrance of insects and position to avoid draught. In reality, it is not the product quality but merely the application and use that need particular attention.

7 Conclusions

Attention for and implementation of ventilation systems is a relatively new phenomena in Belgium (where the three Regions are in charge of regulations related to ventilation).

It is clear that the EPB regulations are a major driver for change. First of all, it makes ventilation compulsory in each type of new buildings and in each Region, which was not the case up to now. Secondly, there is a strict control scheme which probably will motivate most stakeholders to respect the regulation. The market uptake of energy efficient ventilation systems is promoted by fiscal stimuli.

8 References

1. Institut Belge de Normalisation, *NBN D 50-001 - Ventilation systems for housings*, October 1991
2. Nederlands Normalisatie-instituut, *NEN 1087 - Ventilation in buildings - Determination methods for new estate*, 1st edition : 1975
3. Belgian Building Research Institute, *Rapport n°4: Enquête sur l'isolation, la ventilation et le chauffage dans le logement neuf*, 1999
4. O. Lesage O., R. Vanparys, *Maisons à tous vents ?*, published in Test-Achats Magazine n°453, 2002
5. European RESHYVENT project, www.reshyvent.com
6. Construire avec l'énergie, energie.wallonie.be
7. European Committee for Standardization, *EN 13779 - Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems*, September 2004
8. Filip Dobbels, Peter D'Herdt, Nicolas Heijmans, Peter Wouters, *How does the new Flemish (Belgian) EPB regulation handle the building airtightness?*, proceedings of proceedings of First European BlowerDoor Symposium, Fulda, 16-17 June 2006
9. Régie des Bâtiments, *Cahier des charges-type 105 - Chauffage central, ventilation et conditionnement d'air*, 1990
10. Johnny V. Andersson, François-Rémi Carrié, Peter Wouters, *SAVE-DUCT Improving ductwork. A time for tighter air distribution systems. A status report on ductwork airtightness in various countries with recommendations for future designs and regulations*, AIVC & SAVE-DUCT project partners, GBR, 1999, 126 p
11. Van Den Bossche, N., A. Janssens, N. Heijmans, P. Wouters. 2007. *Performance evaluation of humidity controlled ventilation strategies in residential buildings*. Thermal performance of the exterior envelopes of whole buildings X: international conference proceedings, Clearwater, Florida. CD-rom ISBN 978-1-933742-28-1. ASHRAE special publications, CD paper nr. 195 (7 p.)
12. Bureau de normalisation, *NBN S01-400-1:2008 Critères acoustiques pour les immeubles d'habitation,* January 2008

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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.