VENTILATION SYSTEM QUALITY FOR DWELLINGS: A PRAGMATIC APPROACH

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ABSTRACT
As a result of the EPB directive, the Flemish government has established a new regulation due as from January 1ste, 2006. This regulation also imposes the presence of minimal ventilation equipment in new buildings. Various Belgian as well as international investigations report a lack of quality of installed ventilation systems, in individual dwellings as well as in utility buildings. Possible problems range from missing inlets, leaking air ducts to inadequate flow rates and acoustical complaints. In order to improve performance and comfort perception, a quality tool is developed, assisting the installers to commission ventilation systems. An inspection list enables to check the conformity of the installation with the requirements imposed by law or design team. These check points can be visual or require measurement of air flow or acoustical performance. The aim is to establish a basic and pragmatic tool to improve customer satisfaction.

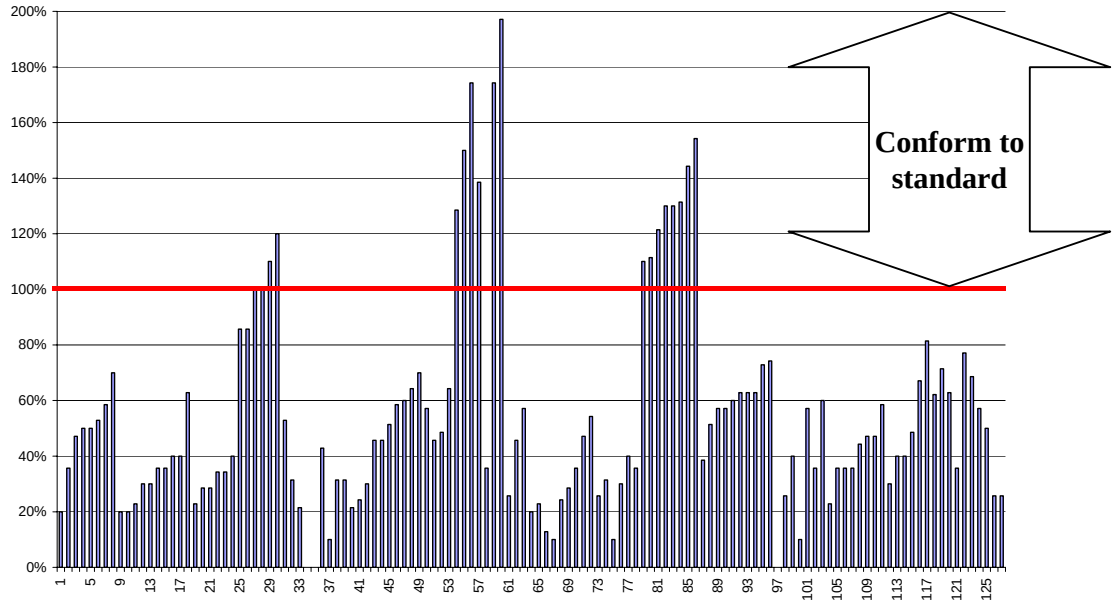
KEYWORDS
Ventilation system quality, inspection, commissioning, education

INTRODUCTION
The Flemish governement implements parts of the EPBD legislation as from January 1ste, 2006. This EPB ('Energie Prestatie en Binnenklimaat' = Energy Performance and Indoor climate) legislation includes an energy performance calculation tool and minimal requirements of indoor climate. Therefore, minimal ventilation requirements are imposed for individual dwellings as well as for utility buildings. For dwellings, reference is made to the Belgian standard NBN D50-001, a norm that has already been imposed in the Walloon region since almost 10 years. The Brussels capital region will probably follow soon.

Various Belgian and international studies report a lack of quality of installed ventilation systems. The SENVIVV study (1999) reports an overall poor air tightness level of new dwellings in Flanders. Even for those buildings obtaining a poor overall airtightness, some spaces in those buildings are very airtight which might result in very poor air quality if no ventilation provisions are present. With regard to basic ventilation little dwellings are equipped with sufficient air supply and transfer openings. With regard to air extraction relatively more provisions are present but these are frequently not conform to the normal requirements. Air flow is either too

low, introducing air quality and moisture problems or too high, which increases the energy consumption and cold drafts.

Test Aankoop (consumer information magazine - Belgium) also reports ventilation system problems in the Walloon region. Although ventilation is a legal requirement since 1996, 10 % of the Test Aankoop sample of the new housing doesn't have a ventilation system at all. In many buildings, air extraction is the poorest part. The minimum air flow was nearly never met. Inhabitants report complaints as noise and cold air draft. A conclusion out of these reports might be that quality problems are often a result of poor design or installation.



Test Aankoop: air transfer openings in relation to the requirement (100 %)

Based on these results there is a concern that the new Flemish legislation will frustrate the building user: an additional investment has to be made but the comfort improvement remains marginal. Therefore more attention should be paid on the quality of ventilation systems. The new EPB legislation includes a number of checks, however these controls are limited:

- To new buildings in Flanders, but not for existing buildings,.
- To basis requirements, such as the presence of air supply equipment, but no control of actual flow or noise annoyance is included.

It is not expected that normal market effects will improve the ventilation system quality quickly. At this moment the awareness and knowledge with regard to ventilation by the end customer is poor, as well as by some professional players. This paper discusses the possible actions in Belgium with regard to ventilations system quality in dwellings.

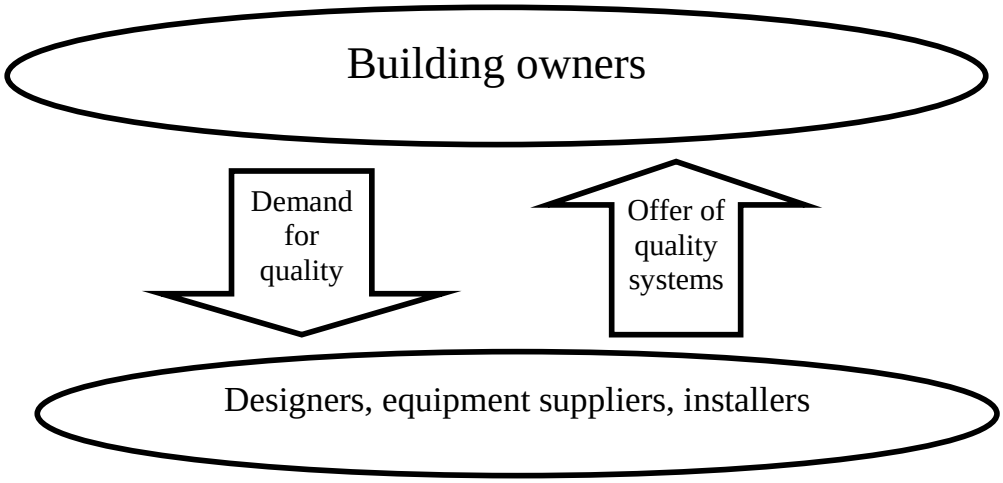
Various European and national standards handle the inspection and performance tests of ventilation systems (EN 14134, EN 12599, prEN 15239). At this point the ventilation market for dwellings in Belgium, especially in the Flemish and Brussels regions, isn't yet well developed. It seems to be difficult to introduce a compulsory quality assurance system with extensive inspections, control of approved installers and accompanying costs. These costs need compensation by the end customer that

isn't motivated up till now to do additional expenses. Therefore the BBRI and other professional market players will concentrate on:

- Create a demand and an offer for high quality ventilation systems
- Work out a volunteer inspection and commissioning tool for the installer, with a limited selection of checks and measurements based on the European standards
- Organize commissioning training for the installer

DEMAND AND OFFER FOR QUALITY

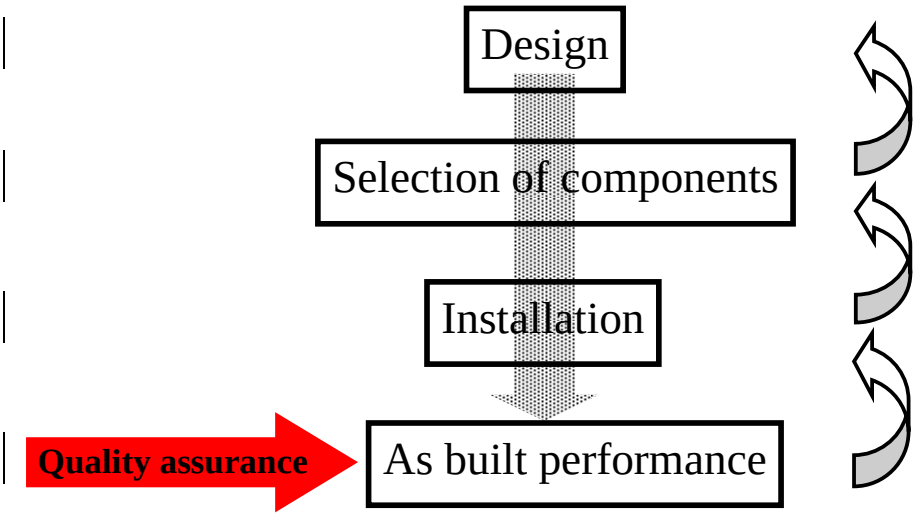
To improve the quality of as-built ventilation systems, progress should be made, both on the demand side as on the offer side.



Demand for high quality ventilations systems can be created through:

- Information to the public
- Improving awareness by architects and designers through courses, presentations, brochures and publications.
- Tender requirements by important market players: social housing companies.
- Government actions such as minimal quality requirement as a prerequisite to obtain financial support.
- EPBD requirements: the Flemish energy performance tool resulting in an 'E-level' enables to get a better result if flow rates are measured and proved to be within specifications.

Offer



The process, resulting in a performing ventilation system, consists of several steps each needing particular attention:

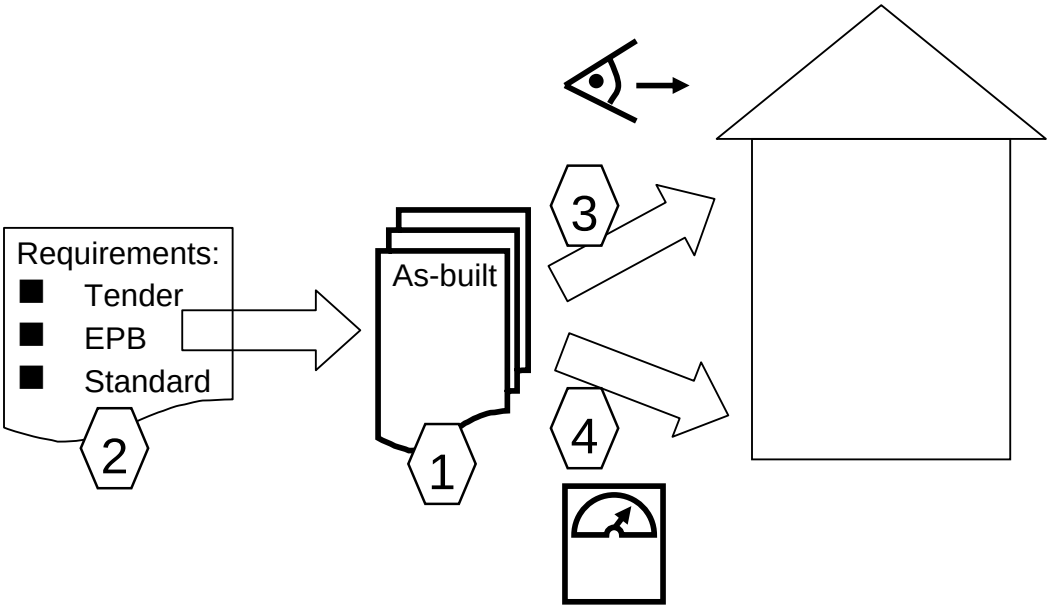
- Design of the system: specifications, flow rate requirements, ducting calculation, noise reduction,…
- Selection of components in conformity with the requirement
- Installation work on site
- Start up and commissioning

As an ideal, a ventilation quality system strategy should control every step in the process. It is proposed however to concentrate on the end result: the performance of the ventilation system as-built. During commissioning and inspection when the installation becomes operational, a number of inspection points are included to check compliance with the requirements and expectations. Although the complete process from design to installation isn't checked at every point, it is clear that a poor design will hardly result in a good end result. Concentrating on the end result in stead of the complete process forces the several partners to do a good job, otherwise the end result will be disappointing. This bottom-up approach should lead to a pragmatic and affordable quality system. A regular feedback from the as built performance back to previous process steps should lead to overall improvement

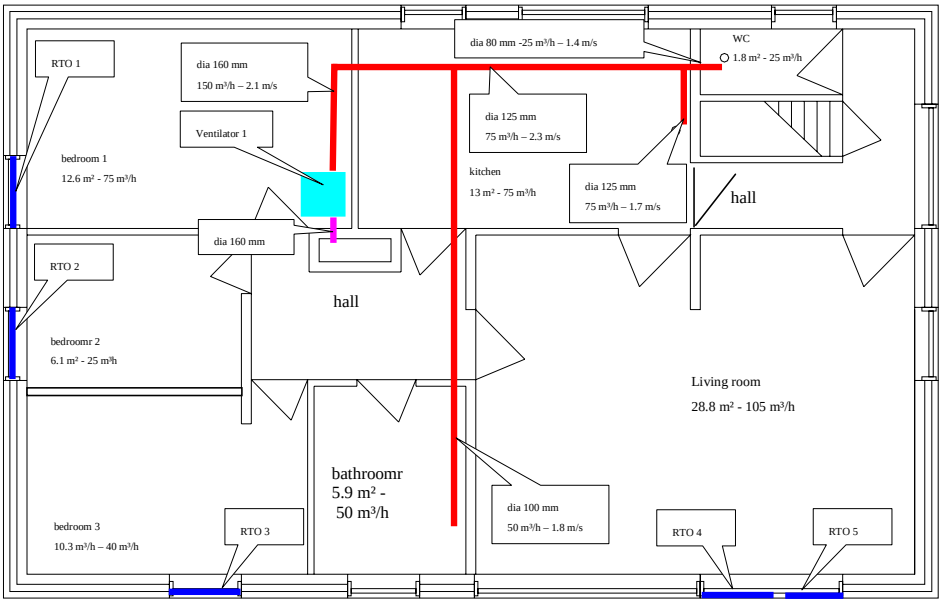
INSPECTION AND COMMISSIONING

A method has being developed to enable the installer to do a quick check of the installation. Although the method is based on the European standards, it makes a limited selection out of the procedures but doesn't comply with the standards to the full extend. The inspection at commissioning of the installation can be subdivided into 4 groups:

- Availability of an as-built file
- Conformity of the as built file with the requirements
- Conformity of the installation – check through visual controls
- Conformity of the installation – check through measurements



1. An as-built file should be available at the site of installation, comprising:
   - Identification of the project, including coordinates of architect, installer,…
   - Copy of the tender: parts relevant to the ventilation installation
   - Building drawing with location of installed components, ductwork with indication of diameter, flow rate, air velocity,…
   - List with required air flow rates and used components for each room
   - Supplier product information for used products
   - User manual, including a clear one sheet user chart
   - Maintenance instructions
   - Commissioning chart, to be added after completion



2. As a second step the conformity of the as-built file with the requirements is verified:

- Conformity with special requirements in the tender
- Conformity with the legislation EPB (Flanders) – NBN D50-001 (Wallonië) or with subsidy requirements (e.g. minimum heat exchanger performance)
- Conformity with additional requirements imposed by the quality system: eg acoustical requirements

After both previous administrative requirements the installation is checked for conformity with the as-built file.

3. Control by visual checks, e.g.

- Do the used components correspond with the planned components
- Insulation and fixation of ductwork
- Maintainability of the installation
- Other remarks…

4. Control by measurement

- Where appropriate (not for natural ventilation) air flow rates at inlets and outlets
- Acoustical performance

For specific high demand cases (e.g. Passive Houses) additional measurements can be applied:

- Air tightness of the building envelope
- Air tightness of the ductwork
- Proper operation of presence-, moisture or CO_2-sensors

QUALITY ASSURANCE

Introducing an inspection and commissioning tool requires assurance that this tool is used correctly. A customer specifying the use of this commissioning tool should get the guarantee that this tool is used correctly.
It might be a good idea to develop a quality assurance system in different fazes, following (or leading) the market evolution. Possible fazes might be:

1. Volunteer
    a. Installers use the commissioning tool on a complete volunteer base, they can follow courses to improve their abilities but the aren't urged to prove the correct use of the tool
    b. The customer doesn't get a guarantee about the correct use of the quality system, professional customers might do some random sample checks
2. Volunteer but not without engagement
    a. Installers willing to use the commissioning tool need to get an approval, the quality assurance system performs regular tests at random to verify if commissioning is conducted well.
    b. The customer gets a guarantee that the installer conducting the commissioning is well trained for his job and is controlled on a frequent and independent base.
3. Imposed by law

a. Description: The government imposes the control of ventilation systems (e.g. as for electrical installations in Belgium)
b. example: In Sweden the market has matured to a higher quality standard. The Boverket quality assurance system requires inspections on a regular base, ranging from 2 years for hospitals to 9 years for individual dwellings. Depending on the type of installation, different inspector levels are appointed.

In Belgium we intend to start with the first volunteer faze as from 2006.

EDUCATION

There is a need for education and training on different levels

- Architects: general knowledge – quality awareness – specifications
- Designer: detailed design of ventilation systems
- Installers:
  - practical installation work
  - commissioning of installations

At this moment a short training session is being prepared to train the installers to commission high quality ventilation systems. The session includes some background information, demonstration of measurements and practical sessions. They are to be conducted in a dwelling, equipped with different working ventilation systems.

CONCLUSION

Ventilation system complaints can often be avoided introducing basis inspection points after completion of the installation work. This requires a number of visual checks or measurements. The commissioning method will be finalized soon. It will be communicated to interested installers during a commissioning training. In a later stadium, a quality assurance system could be introduced, giving warranty on the inspection.

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