Applications of the Promevent protocol for ventilation systems inspection in French regulation and certification programs

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ABSTRACT

In France, the new Promevent protocol for ventilation system inspection in new dwellings has been published in 2017. It proposes a complete method for checks and measurements in order to uniform and improve the quality of inspection performed by measurers. The Promevent protocol proposes a methodology for pre-check, functional checks, functional measurements at air terminal devices and ductwork airtightness measurement. It also includes requirements for sampling and gives guidelines for the report. One important new requirement in France concerns the choice of the measuring instrument which has to be adapted to the geometry of the air terminal devices (ATD), calibrated and has to respect a maximum permissible measurement error.
Since the publication of this protocol and its practical guide, Promevent has become the national reference. It is referenced in regulations and largely used in certifications. It is also integrated into training programs and has been used during the reviewing of the European standard prEN 14134.
In order to widen this method to non-mechanical ventilation systems and to non-residential buildings, new similar projects have been launched in France.

KEYWORDS

Ventilation system, protocol, inspection

1 INTRODUCTION

Since many years, checks and measurements to assess the functioning of buildings ventilation systems are performed according to various different protocols (e.g. standards, guides, certification requirements). Moreover, the uncertainty of the measurements results is most of the time not evaluated. In order to make these practices more uniform and to improve the reliability of ventilation systems inspection, 8 French organizations have conducted the Promevent project (2014-2017) (Bailly and Lentillon, 2014) (Bailly Mélois et al., 2017). The objective of the Promevent project was to propose a protocol to assess the quality of the residential mechanical ventilation system including specifications for visual checks and measurements with acceptable uncertainties. This protocol and its practical guide have been published (in French) in 2017.

2 REQUIREMENTS OF THE PROMEVENT PROTOCOL

The Promevent protocol applies to new dwellings, both single-family houses, and multi-family buildings, equipped with balanced ventilation system or single humidity demand-

controlled ventilation system. It proposes a methodology in 4 steps (consistent with EN 14134 and EN 16798-17):

- pre-check (mandatory),
- functional checks (optional),
- functional measurements at air terminal devices: airflow measurement and static pressure measurement (optional),
- special measurement: ductwork airtightness measurement (optional).

It also proposes a methodology for sampling and gives guidelines for the report. A ventilation system inspection performed according to the Promevent protocol includes at least a pre-check, and one of the three next steps. Figure 1 summarizes the Promevent methodology. The next paragraphs explain what the operator has to do when he performs a ventilation system inspection according to the Promevent protocol.

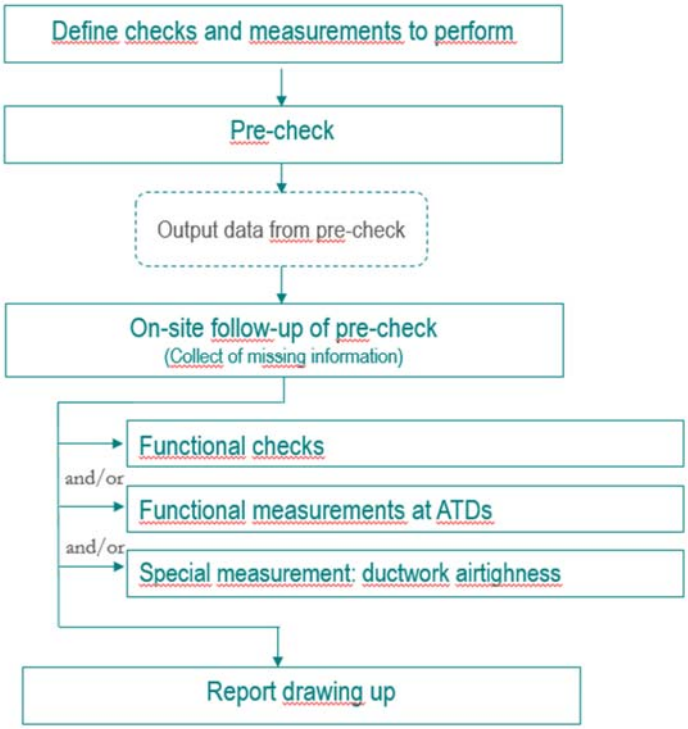


Figure 1: Organisation of a ventilation system inspection according to the Promevent methodology

2.1 Pre-check requirements

According to the Promevent protocol, the pre-check has to include the study of several documents such as building drawings and ventilation system design specifications. First, the operator has to control if these documents are complete regarding ventilation system. Then, he has to collect data he will need for functional checks and measurements. The Promevent protocol gives a checklist of elements to guide the operator through this step. At the end of the pre-check, the operator has to identify the place of the check and measurement according to the sampling rules. He also has to list the missing data he needs to perform checks and measurements and to identify the design specifications which might not comply with relevant regulations or standards.

2.2 Functional checks requirements

When functional checks are required, the operator has to check whether:

- all the components of the ventilation system have been installed and are in good condition,
- the system has been installed correctly and in accordance with the design specifications and relevant regulations and standards,
- the system is free from loose objects and clean,
- there is adequate access to the ventilation system for the purposes of operation and maintenance,
- all controls are readily accessible.

The operator has to check that all the components listed in the protocol are present and installed as required in the design specifications. He has to check that these components are correctly fitted and that they function. These components are:

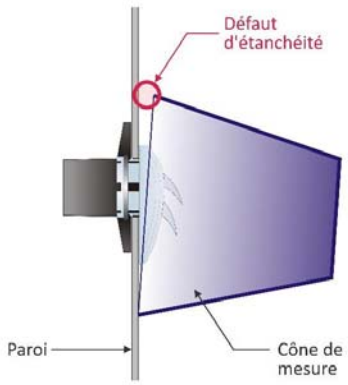
- externally mounted air transfer devices,
- internally mounted air transfer devices,
- ducted air terminal devices (inside),
- ductwork,
- air handling unit including heat recovery system and filters,
- air intake and discharge openings.

The protocol gives detailed checklists of verifications for all these components.

2.3 Functional measurements requirements

The purpose of functional measurements is to verify if the airflow rates delivered by the ventilation system comply with the design specifications. Depending on the nature of the ventilation system, two different types of measurement can be performed at ATD: airflow rate measurement and static pressure measurement. For both, the protocol gives:

- measurement conditions, such as the position of the doors and windows (closed), the settings at ventilation unit and at the ATDs,
- measurement principle, such as the types of measuring instrument, the minimum duration of the measurement, the position of the instrument. For this last point, the Promevent practical guide gives detailed explanations, especially regarding centering and airtightness (see Figure 2) of the cone for airflow measurement,
- relevant corrections to apply.



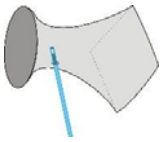
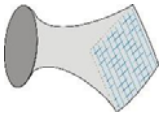
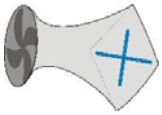
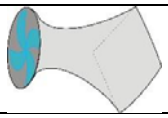
During Promevent campaigns, both on-site and in-laboratory, leaks between the measuring instrument and the wall have been responsible for errors on the measured airflow up to 30%.

Figure 2: Extract of the Promevent practical guide – Impact of a leak between the wall and the measuring instrument

Moreover, for airflow measurement, Promevent requires that:

- The measuring instrument respects a maximum permissible measurement error of 10% of the measured value when the measuring instrument is used according to the situation presented in Table 1. In this case, the total maximum uncertainty is fixed at 15%;
- OR The total uncertainty is precisely evaluated and is under 15%.

Table 1: Extract of Promevent guidance – Use of measuring instrument depending on ATD geometry

		Extract ATD		Supply ATD		
						
	One-point thermal anemometer + cone	✓	✓	✗	✗	✗
	Checkered thermal anemometer + cone	✓	✓	✓	✓	✗
	Cone with compensation	✓	✓	✓	✓	✓
	Propeller anemometer + cone (without extension)	✓	✓	✓	✓	✗
	Propeller anemometer + cone (without extension)	✓	✓	✓	✓	✓

For static pressure measurement, Promevent requires that:

- The measuring instrument respects a maximum permissible measurement error of 3% of the measured value or 0.5 Pa, whichever is the greater, and in this case, the total maximum uncertainty is fixed at 10% or 5 Pa;
- OR The total uncertainty is precisely evaluated and is under 10% or 5 Pa.

2.4 Ductwork airtightness measurement requirements

Regarding ductwork airtightness measurement, the Promevent protocol supplements the French national standard FD E51-767. First, it defines new sampling rules in order to improve the representativeness of the sample. Secondly, it specifies how ATDs should be prepared in order to measure the leak between ducts and ATDs but not the leaks of the ATDs themselves. With a similar aim, it specifies the how unit connections should be prepared. When some connections are not taken into account, the Promevent protocol defines a penalty coefficient to correct measurement results. Finally, when the ventilation unit is included in the sample (for single-family houses), the protocol defines a fixed leakage airflow rate which can be deduced from the total measured airflow rate.

3 PROMEVENT PROTOCOL USED IN FRENCH REGULATION AND CERTIFICATION PROGRAMS

During the different steps of the Promevent project, a very large group of professionals have been consulted: from the French Ministry in charge of Construction and from the French Environment and Energy Management Agency (ADEME), but also from various associations or federations representative of industrials, builders, measurers, certification organisms, standardization organisms, training organisms, etc. Due to this consultation, the Promevent protocol is very largely accepted and it is becoming the national reference for inspection of mechanical ventilation systems in dwellings.

In a regulatory context, the Promevent protocol has to be applied in two situations. First, when the design energy consumption of a building is 20% below the regulatory limit (40% for office buildings), the builder can obtain a "bonus of constructability" which allows him to build a bigger building. To obtain this bonus, the building has to respect two criteria among three: one is about greenhouse gas emission, the second one relates to the valorization of the construction waste, and the last one requires specific choices of material regarding the impact on the indoor air quality and the quality of the ventilation system. In this last case, an inspection of the ventilation system has to be performed according to the Promevent protocol (JOFR, October 2016). At the end of 2016, another regulatory document was published and refers to the Promevent protocol. This text defines the criteria for public buildings showing exemplary energy and environmental. As for the former, the building has to respect two criteria among three, and one demands that the ventilation is controlled according to the Promevent protocol (JOFR, December 2016). As far as we know, these two regulatory actions have not led yet to many applications of the Promevent protocol.

So far, most of the inspections of dwellings ventilation system are performed in order to obtain an Effinergie label. Effinergie is a French association which proposes certification for energy efficiency initiatives in new and renovated buildings (Carrié and Dervyn, 2017). With its first labels, Effinergie has promoted the importance of building airtightness. Since 2012, the association is engaged in the quality of ventilation system and requires functional checks and ductwork airtightness measurements for its new labels. More specifically, these requirements are mandatory to obtain Effinergie+ certification, which has been delivered to 13,153 dwellings (data from June 2018). Since the publication of the Promevent protocol, Effinergie decided to replace its own protocol by the Promevent protocol. Then, for each dwelling candidate for an Effinergie label, an independent and state-approved (Charrier et al., 2017) measurer has to verify the quality of the ventilation system according to the Promevent protocol. Others methods and reference documents are being modified or will be modified in order to integrate the Promevent protocol. For example, the reference document of the French national indoor air quality observatory (OQAI) refers to the Promevent method and the checklists for ventilation system inspection therein. As well, the certification organism CERQUAL Qualitel Certification has included the Promevent protocol in its reference document.

In order to raise awareness among ventilation professionals, the Promevent protocol has been included in the Praxibat training course. Praxibat is a national training plan regarding buildings energy efficiency. It includes 203 technical facilities in France, with 74 dedicated to ventilation. The ventilation training lasts 3 days and includes theoretical parts to understand the different types of ventilation systems, and practical parts to learn how to install a ventilation system, and how to verify it. The Promevent protocol will also be presented in a MOOC dedicated to indoor air quality and buildings ventilation.
Finally, the Promevent protocol has been used during the reviewing of the European standard prEN 14134 *Ventilation for buildings - Performance testing and installation checks of residential ventilation systems*. The method and its checklists were used as the starting point of the draft document, modified and completed to match with the scope of the European standard.

4 COMPLEMENTARY PROJECTS TO PROMEVENT

As the Promevent protocol is related only to mechanical ventilation systems in dwellings, there are still needs regarding non-mechanical ventilation systems and non-residential buildings. In France, several research projects have been launched to meet these needs. First, the VNat project has begun at the end of 2017 and aims at studying the possibility of a similar protocol for hybrid ventilation systems in dwellings, in order to enable the improvement of the control strategy of hybrid ventilation systems (Remion et al., 2018). Secondly, Gabriel Remion Ph.D. work has begun in 2017 in France (ENTPE and Cerema) and concerns the "Assessment of natural and hybrid ventilation systems' performance for low energy buildings". Finally, the new PromevenT project will be launched by the end of 2018 and will concern non-residential buildings, in particular, office buildings, hostels and school, equipped with mechanical ventilation systems.

5 CONCLUSIONS

The Promevent research project finally resulted in a reliable and robust reception protocol for residential ventilation systems. This has been achieved in line with the European standard guidelines for inspection of ventilation systems.
A large part of the work consisted in working on the uncertainties related to the measurement of flow rates and pressures at the air terminal devices, taking into account both the uncertainty related to the equipment and the uncertainty related to the measurement method. A guidebook has been edited complementary to the protocol in order to explain and illustrate each point.
The Promevent protocol is widely used in certification programs for mechanical ventilation systems installed in residential buildings and new research programs concern natural ventilation systems and non-residential buildings.

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All productions of the Promevent project, including the protocol and the guide, are available (free) at www.promevent.fr (in French only).

The sole responsibility for the content of this publication lies with the authors.

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