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Inspection of ventilation systems - EN 15239 for the application of EPBD

This paper provides a short introduction to the CEN standard EN 15239 which deals with the application of Article 4 of the EPBD and guidelines to conduct the inspection of ventilation systems.

1 > Inspection of ventilation systems: why?

Article 4 of the Energy Performance of Buildings Directive requires the Member States to set energy performance requirements. These requirements :

"shall take account of general indoor climate conditions, in order to avoid possible negative effects such as inadequate ventilation, as well as local conditions and the designated function and the age of the building. These requirements shall be reviewed at regular intervals which should not be longer than five years and, if necessary, updated in order to reflect technical progress in the building sector.

In view of the large impact of ventilation on the energy consumption of buildings, CEN has decided to develop a methodology concerning the inspection of ventilation systems, as has been done for air conditioning (as described in EN 15240) and for heating systems (as described in EN 15378), following the requirements of the articles 3, 8 and 9 of EPBD.

2 > Scope of the standard

EN 15239 describes how to prepare for an inspection, provides a methodology for the inspection, the requirements for the content of the report and advice for improvements.

The methodology addresses mechanical, natural and hybrid ventilation systems in relation to their energy consumption, for both residential and non residential buildings.

As defined in the scope, the inspection may include the following items:

The system performance and system conformity to the original design, system operation and building air tightness.

However, building air tightness is not really taken into account in the details of the standard itself, which focuses on the ventilation system description and operation. Similarly, window airing is only mentioned in annexes.

The inspection methodology part of the standard defines the minimum requirements for any inspection based on the following items:

General approach

- > Operation and maintenance instructions
- > Air change
- > Humidity
- > Fans and air handling units
- > Recirculated air
- > Measurement methods

Mechanical exhaust and/or supply systems

- > Visual inspection
- > Measurements

Natural ventilation

- > Visual inspection

Hybrid ventilation

- > Visual inspection
- > Measurements

It is not the intention of the standard to provide a full ventilation system audit and it therefore focuses on an assessment of its functioning and its impact on energy consumption. It includes recommendations on possible system improvements. If the standard is to be applied in the field of energy performance, it should be remembered that "*all inspection activities undertaken should be subject to compliance with all health and safety requirements for the persons involved*". These health and safety requirements are in general defined at national level, and are not part of the standard.

3 > Ventilation systems - how are they defined?

A ventilation system is designed to provide fresh air to the principal rooms, and/or to extract polluted air from service rooms. The ventilation system can be a part of an air conditioning system.

The system can be driven mechanically or by natural forces (wind and the stack effect). Hybrid systems are a combination of mechanical and natural systems. A ventilation system can be centralised or local.

A ventilation system is basically composed of:

- > Air inlets.
- > Air transfer between rooms (for centralised systems).
- > Air outlets.
- > Ducts.
- > Air handling units or fans (mechanical) or cowls (natural).

The impact of any ventilation system on energy expenditure and IAQ depends on the airtightness of the building and on windows opening by occupants.

4 > Guidelines for inspection of ventilation systems

The objective of EN 15239 is to provide a methodology that could be applied during inspection, to obtain an assessment of its energy performance and its ability to provide acceptable indoor air quality to the building in which it is installed.

The inspection is based on a 2-phase approach:

1) Pre inspection and document collection:

This provides the designers' description of the ventilation system description and its operation, which provides a basis for the on-site inspection.

2) Inspection on site:

Based on Phase 1, the inspection will be carried out by:

- > Visual inspection (presence of equipment, components...).
- > Measurements (mainly airflows).
- > Check of controls and settings.

General methodology

The general methodology as described in the standard is intended to provide the inspector with guidelines that specify the major items that should be inspected, for any building and any associated ventilation system.

A distinction is made between mechanical systems, for which airflow measurement can be part of the inspection protocol, and natural systems, where these measurements are of less interest as they depend strongly on current outdoor and indoor conditions. The inspection of natural ventilation systems must therefore be focused on visual inspection and on

the dimensional characteristics of the system (e.g. surface areas of openings).

The inspection protocol is described by means of specific checklists of items to verify.

The inspection is mainly based on examination of the existing documentation and visual inspection and on some measurements where available and possible. The difficulty in the inspection is to assess in an easy way such parameters as the duct air tightness, the electrical energy consumption of fans and the implementation of the control strategy (e.g. running during unoccupied periods in an office building)

For the actual running of the installations, the assessment of its energy performance must therefore be based mainly on checking that there is good and regular maintenance of the equipment, the correct settings of the controls for the pattern of usage of the building (i.e. duration of occupancy) and the good functioning of all its components.

Advice on alternative solutions and improvements

One of the results of an inspection of a ventilation system should be a list of proposals to improve its energy performance. The report of the inspection should be used as a basis for the proposals.

The advice for improvements form should contain:

- › A section giving the adjustments to be made to ensure that the system performs in accordance with the design, i.e. correct levels of thermal comfort, IAQ and energy usage;
- › A section giving proposals to improve the system in terms of energy impact, including their economic justification

5 > Informative annexes

A large part of the information is in the informative annexes.

Annex A gives an example of a description form for an installation that includes an Air handling unit (AHU)

Annex B gives an example of a data sheet report for a whole system

Annex C provides examples of selection criteria for air inlet/outlet airflow measurements

Annex D provides examples of time frequency inspection.

Annex E describes the main impact on energy consumption of the different kind of systems and of their main components.

Annex F completes Annex D taking into account the system and its susceptibility to drift, fouling or ageing and what proportion of the main components should be tested.

Annex G gives examples of class definition for potential use in the assessment methodology.

Annex H defines the list of items for a more detailed inspection with three possible levels A, B, C, from A (high level) to C (minimum acceptable. Even if only informative, this annex can be considered as the basis of the inspection methodology for practical use.

Annex I describes the pathway for the improvement process

Annex J provides examples of advice on improvements and presents a checklist for pre-inspection information and document collection

The main part of the **inspection report** shall include:

- › The official designation of the property;
- › The name of the owner of the building;
- › The date of the performance checks;
- › The measurements carried out;
- › Comments on the faults that were identified;
- › Advice to the property owner on improvements;
- › A final comment about the performance of the system;
- › The status of the person responsible for the inspection.

6 > References

1. EN 12599, Ventilation for buildings – Test procedures and measuring methods for handing over installed ventilation and air conditioning systems
2. EN 13779, Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems
3. EN 15240, Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air-conditioning systems
4. EN 15242, Ventilation for buildings – Calculation methods for the determination of air flow rates in buildings including infiltration
5. En 15378, Heating systems in buildings- Inspection of boilers and heating systems

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