SLOVENSKI STANDARD
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Prezraļevanje stavb - Toplotne lastnosti stavbï Navodila za nadzor prezraļevalnih sistemov

Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of ventilation systems

Lüftung von Gebäuden - Gesamtenergieeffizienz von Gebäuden - Leitlinien für die Inspektion von Lüftungsanlagen

Ventilation des bâtiments - Performance énergétique des bâtiments - Lignes directrices pour l'inspection des systemes de ventilation

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Foreword

This document (EN 15239:2007) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2007, and conflicting national standards shall be withdrawn at the latest by November 2007.

The connections and relations to the different draft standards developed in the EPBD project are presented in the umbrella document of the CEN BT 173.

This standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/343), and supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD). It forms part of a series of standards aimed at European harmonisation of the methodology for the calculation of the energy performance of buildings. An overview of the whole set of standards is given in CEN/TR 15615, Explanation of the general relationship between various CEN standards and the Energy Performance of Buildings Directive (EPBD) ("Umbrella document").

Attention is drawn to the need for observance of all relevant EU Directives transposed into national legal requirements. Existing national regulations with or without reference to national standards, may restrict for the time being the implementation of the European Standards mentioned in this report.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Energy Performance of Buildings Directive (EPBD) identifies clearly ventilation, in article 2 “Definitions” and 3 “Adoption of a methodology” (for the calculation of the energy performance), as a component of the energy consumption of buildings, such as heating, cooling or lighting. EPBD also mentions in article 4, “Setting of energy performance requirements” that “requirements shall take account of general indoor climate conditions, in order to avoid negative effects such as inadequate ventilation”.

Considering the impact of ventilation on the energy consumption of the buildings, CEN has decided to also develop a methodology concerning the inspection of ventilation systems, as it is made for air conditioning and heating systems, following the requirements of the articles 3, 8 and 9 of EPBD.

The inspection described here, is therefore intended to include all types of ventilation systems mechanical, natural and hybrid (including mechanical and natural ventilation). Starting from the general points that may lead to excessive energy consumption, a list of the corresponding checks according to the nature of the ventilation system is given. Other specific points depending more from the typology of the ventilation system are then detailed. Indications on the frequency of inspection and on the improvements that may appear necessary depending on the results of the diagnostic are also given.

The possibility to introduce classes is given in this standard in order to leave Member States freedom to choose between different objectives and extent of inspection, within a harmonised framework.

All inspection activities undertaken should be subject to compliance with all health and safety requirements for the persons involved.

This standard also complements EN 15240 concerning the inspection of air conditioning systems for the inspection of the ventilation part that is to be performed in relation to 4.2 dealing with mechanical exhaust and/or supply ventilation systems.

1 Scope

This standard develops the methodology required for the inspection of mechanical and natural ventilation systems in relation to its energy consumption.

This standard applies to both residential and non residential buildings.

The inspection may include the following issues, in order to determine the energy performance of the building and its associated mechanical / electrical plant:

— The system conformity related to the original and subsequent design modifications, actual requirements and the present building state.

— Correct operation of the mechanical, electrical or pneumatic components.

— Provision of an adequate and pure supply of ventilation air.

— The functioning of all the controls involved.

— Fan power absorbed and specific fan power.

— Building air tightness.

It is not the intention of the standard to provide a full ventilation system audit. Its purpose is to assess its functioning and its impact on energy consumption. It includes recommendations on possible system improvements.

NOTE The inspection, performed by an independent person to assess the system performance relating to energy consumption, is different from the maintenance that is performed to the owner's requirements to maintain the optimum system performance.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12097, *Ventilation for Buildings — Ductwork — Requirements for ductwork components to facilitate maintenance of ductwork systems*

EN 12792:2003, *Ventilation for buildings — Symbols, terminology and graphical symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792:2003 and the following apply.

3.1
centralised ventilation
ventilation of a space or spaces within a building by means of supply ductwork, extract ductwork or a combination of both, from a centralized plant room

3.2
inspection
inspection, in the manner of this standard means to examine the ventilation systems in buildings

3.3
local ventilation
ventilation of a set area of a space by means of supply ductwork, extract ductwork or a combination of both

NOTE Local ventilation can also be achieved by means of natural wall or roof inlets or outlets or by mechanical means by a fan or fans in the perimeter wall, internal wall, or roof.

3.4
assumptions
set of descriptions to be considered by the person in charge of the inspection, if the actual requirements are difficult to identify in the analysis

3.5
building system control
measures taken in ensuring the system operates in accordance with the specified conditions

3.6
commissioning
sequence of events necessary to ensure the building and its associated heating, ventilation and air conditioning systems are functioning in accordance with the design parameters

3.7
design criteria
set of descriptions based on a particular environmental element such as indoor air quality, thermal, acoustical, and visual comfort, energy efficiency and the associated system controls to be used for assessing the plant operation

3.8
control parameters
set values of the internal environmental conditions related to the external conditions

3.9
design documentation
written description of the essential design elements of the plant

3.10
self regulating valve
terminal component (for example: self adjustable air transfer device) or aerodynamic ductwork (for example: regulator of flow rate) allowing to insure a constant flow rate on a pressure operating range in

NOTE Some valves are designed with two flow rates (a nominal flow rate and a reduced nominal flow rate).

4 Inspection

4.1 Pre –inspection and documents collection

To prepare a site survey for the inspection of a ventilation system and to provide the best available information regarding the building and its use, the following information is required:

— Last available design documents, giving the internal and external temperatures and design occupancy, heat gains and losses.

— Information regarding the areas to be ventilated naturally, mechanically, heated or humidified.

— Information regarding building use, occupancy and frequency of occupation in comparison to the notice of the manufacturer and model (type) of the ventilation system.

— System manufacturer and model (type).

— Rated operating pressure.

— Rated operating temperatures.

— Working hours.

— Air volume rates (supply and extract).

— Areas / volumes supplied.

— Technical drawings or schematics of the mechanical ventilation system.

— Copies of any log book documentation of Air Handling Unit (AHU) from the servicing organisation.

— If a building management system is installed, information regarding the equipment and controlled systems is to be supplied.

— Copies of commissioning reports and the last inspection report.

— Records on maintenance of air supply systems, including filter cleaning and exchange and cleaning of the heat exchangers.

In the case of no available documents, the minimum information regarding the ventilation shall be provided.

NOTE An example of information list is given in Annex A.

4.2 Methodology of inspection on site

4.2.1 General approach

4.2.1.1 General

There are considerable variations in the design and construction of installations and buildings. Each ventilation performance check shall therefore be adapted as far as possible for the individual building. However, the following points shall always be included in a ventilation performance check.

The number of measurements and sampling shall be noted in the test report.

Where there is clear evidence that a good practice program of maintenance is being carried out, then certain aspects of the inspections described in the standard may be simplified or reduced.

Another possible approach is to decline the inspection considering the class of the ventilation system.

NOTE 1 Annex G gives examples of criteria that can be used for classes definitions.

NOTE 2 Annex H gives examples of inspection extent for different parts of a ventilation system according to three different classes.

4.2.1.2 Operation and maintenance instructions

Depending on the different types of ventilation systems the operation and maintenance instructions shall be available.

4.2.1.3 Air change

In natural ventilation system air flow varies considerably in relation to temperature difference, wind conditions and a combination of both. It is therefore of little interest to measure the flow of air in a naturally ventilated building. It shall be sufficient to enquire about the systems design and whether alterations have been made which may have resulted in any adverse changes in air flow. It is important to check that ducts and exhaust air terminal units are not clogged.

The same applies for exhaust air systems, it is also important to determine how the outside air supply system operates.

4.2.1.4 Humidity

Particular attention shall be given to the ventilation of areas that have high moisture load.

NOTE The people in charge of the inspection should bear in mind the implication that increased humidity conditions result in an increase of bacteria, mould and fungi. These break down organic material as well as creating odours which have an adverse effect on the indoor environment.

Living and hygienic routines are of concern with regard to the indoor air humidity. This influences the ventilation requirements.

4.2.1.5 Fans and air handling units

A ventilation performance check shall commence by verifying the correct performance and operation of the air handling unit’s components in accordance with inspection details. These details can refer to fans, pumps, filters and dampers. Visual checks of air tightness and cleanliness shall also be made.

4.2.1.6 Recirculated air

Check damper and control of dampers for recirculated air, and filters.

NOTE See EN 13779 for further guidance on air recirculation.

4.2.1.7 Measurement methods

When checking the performance of different parts of a ventilation system, the measurement methods employed will assist subsequent follow-ups. To make this possible, the instructions for each measurement method shall be followed and, instruments for the measurements be calibrated.

In buildings with balanced ventilation, both supply and exhaust air flows shall be measured to ensure all components in the ventilation system are covered. The method of selection shall be documented.

The same method for air flow measurements shall be applied to buildings with mechanical exhaust or supply ventilation. The report shall indicate how the outdoor air supply is designed to operate and how the actual performance has been measured and assessed.

NOTE It is also useful to refer to EN 12599.

4.2.1.8 Optional issues

4.2.1.8.1 General

Other issues concerning the ventilation system can be addressed during the inspection.

4.2.1.8.2 Gas emission from surroundings

For specific ventilation systems for the reduction in the concentration of specific gas e.g. radon within the space, the person in charge of inspection shall note if they are operating.

4.2.1.8.3 Noise/Vibration

In the cases where the ventilation system is considered to be producing discomforting noise or shows poor acoustic insulation, the system shall be checked in order to determine the causes, against the documents used for the inspection purposes.

The attenuator (position, condition of baffles, fouling…), fan speed, damper angles, grille positions and anti vibration devices shall be checked.

For excessive vibration, investigate fan bearings, and the condition of anti vibration mountings etc.

4.2.1.8.4 Deposits in ventilation ductwork

During inspection some advice can be given regarding cleaning of exhaust and supply systems to ensure a good air quality.

In the inspection report the apparent cleanliness or otherwise of the ductwork and ventilation system components shall be noted.

NOTE Deposits in ventilation duct work could represent a hygienic risk, reduce the air flow capacity, influence the fan performance and reduce heat recovery.

Efficient filtration and the associated maintenance of filters protect the duct work and other components such as heat exchangers from the build up of unwanted deposits.

The views of the occupants and of the facilities manager should also be taken into account.

4.2.2 Mechanical exhaust and/or supply systems

4.2.2.1 General

The inspection shall begin with the analysis of the documents listed in 4.1, describing the installation and its operating .requirements.

4.2.2.2 Visual inspection

4.2.2.2.1 Ductwork

The person in charge of the inspection shall note, from visual observations where possible, the standard and integrity of the ductwork. These observations shall include such factors as:

— Air tightness, regarding standard of the junctions (standard of adhesive tape, mastic, joints etc);

— Quality of the duct insulation: type of insulation, quality of the insulation surface, correct installation of the insulation over duct connections, insulation air-tightness, degradation, whether the insulation is wet;

— Cleanliness and ease of access to different areas for maintenance and cleaning (EN 12097);

— Design mistakes : critical points for pressure drop.

NOTE The comparison of ductwork layout with the plans, including dimensions, commenting on any significant differences may also be checked.

Others aspects that can be addressed are:

- Standard of the fixing methods and associated supports;

- Critical points for noise generation;

- Type of ductwork galvanised, fibre, flexible.

4.2.2.2.2 Air handling unit or fan

The following points shall be checked:

— Agreement with the designed specifications and that actually installed;

— Provision and availability of a comprehensive log book for maintenance requirements;

— Ease of access to the unit and the freedom available for adjustment, maintenance and cleaning (access openings EN 12097);

— Presence of flexible connections with the ductwork to reduce rigid ductwork vibration transmission;

— If necessary, anti vibrating supports and a base to reduce vibration transmission;

— Condition of the fan belt if applicable (alignment, tension and wear);

— Quality of the electrical supply connections: conditions of cables, and the standard of the manufacturers instructions;

— Existence and condition of the air filter sections and agreement with the design requirements;

— Existence and condition of heat exchangers and heat recovery sections;

— Existence, condition and control set point of the pre-heating system;

— Existence, condition, and control set point of the humidification system.

4.2.2.2.3 Air inlet / exhaust in rooms

The cleanliness and correct functioning of the air inlets and outlets shall be inspected.

To check correct functioning of air inlets and outlets the followings aspects shall be addressed:

— Number and dimensions of air inlet/exhaust installed considering the air flow rate required, and agreement with the design characteristics;

— Relative positioning of the inlets and outlets to avoid short circuit flows and the resulting poor ventilation efficiency;

— Good conditions of connections between the exhausts/supply devices and the ductwork, (no leackage) and the ease of removing these devices for cleaning;

— For exhaust ventilation: free area for air inlets located at windows, walls, roof or ceiling.

NOTE Other aspects that can be addressed are:

- Noise generation due to air leakage, excessive air velocity, or aerodynamic factors in ductwork;
- Occurrence of draught in the room when the installation is running;
- If demand control systems are installed: correct positioning and if they are in working conditions;
- Status of the air tightness of external doors and windows;
- Air transfer using smoke tubes or pellets in the case of separation requirement between the air of different zones.

4.2.2.2.4 Controls and settings

An important point to consider on energy savings is the agreement between the periods of use of the buildings and the running periods of the ventilation system. An important potential energy saving is possible depending on these issues.

The person in charge of the inspection shall note, where possible, the settings of control that limit the operation of the ventilation systems, and compare these with the periods when the building is in use.

4.2.2.3 Measurements

4.2.2.3.1 Air handling unit

The following points shall be checked by measurements depending on the ventilation system:

Table 1 - Measurements to perform for air handling units

Centralised ventilation	Local ventilation
total air flow rate extracted or supplied	specific air flow rate extracted or supplied
electrical power consumed	electrical power consumed
pressure before and after the unit and the filter	