



SLOVENSKI STANDARD SIST EN 15240:2007

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Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air-conditioning systems

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

Ventilation des bâtiments - Performance énergétique des bâtiments - Lignes directrices pour l'inspection des systèmes de climatisation

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ICS:

91.140.30 Ú!^: !æ^çæ) ä|ä æ \ ä Ventilation and air-conditioning
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EUROPEAN STANDARD

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Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air-conditioning systems

Ventilation des bâtiments - Performance énergétique des
bâtiments - Lignes directrices pour l'inspection des
systèmes de climatisation

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

This European Standard was approved by CEN on 26 March 2007.

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Foreword

This document (EN 15240:2007) 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of an identical text or by endorsement, at the latest by October 2007, and conflicting national standards shall be withdrawn at the latest by October 2007.

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 the 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.

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Introduction

Article 9 of the Energy Performance of Buildings Directive (abbreviated as EPBD) requires the introduction of “measures to establish a regular inspection of air conditioning systems of an effective rated output of more than 12 kW”. The inspection is to include “an assessment of the air conditioning efficiency and the sizing compared to the cooling requirements of the building”. Advice is also to be provided to the users on “possible improvement or replacement of the air-conditioning system and on alternative solutions”. Therefore, it is not the intention to have a full audit of the air conditioning system but a correct assessment of its functioning and main impacts on energy consumption, and as a result determine any recommendations on improvement. The target groups of this standard are national regulators as well as the building services sector including professional building owners, and persons and organisations responsible for inspections.

Article 2 of the EPBD defines an “air conditioning system” as “a combination of all components required to provide a form of air treatment in which temperature is controlled or can be lowered, possibly in combination with the control of ventilation, humidity and air cleanliness.”

The inspection described here is therefore intended to include all types of comfort cooling and air conditioning systems that provide a total cooling output for the building above the specified 12 kW which is in turn taken to mean the rated cooling capacity of the included air conditioning systems. The total cooling output of 12 kW is associated to a building or a zone of a building according to national regulations. The term “air conditioning system” is used to represent any of the systems described below, which may heat and cool, and includes the associated water and air distribution and exhaust systems that form a necessary part of the system. It also includes the controls that are intended to regulate the use of these systems. It excludes mechanical ventilation systems that provide no mechanical cooling and components that, although they may be co-located in air conditioning systems, are dedicated to providing heating duty only. EN 15239 gives details for inspection of ventilation systems, and of the associated air distribution and exhaust systems and thus provides complementary information to this standard. prEN 15378 specifies procedures and methods for the inspection of boilers and heating systems, according to Article 8 of the EPBD.

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.

Air conditioning systems can be described according to the list of systems and subsystems presented in Annex A. Inspection classes can also be specified on national level. Examples of inspection classes are introduced in Annex B.

1 Scope

This European Standard describes the common methodology for inspection of air conditioning systems in buildings for space cooling and or heating from an energy consumption standpoint. The inspection can consider for instance the following points to assess the energy performance and proper sizing of the system:

- System conformity to the original and subsequent design modifications, actual requirements and the present state of the building.
- Correct system functioning.
- Function and settings of various controls.
- Function and fitting of the various components.
- Power input and the resulting energy output.

It is not intended that a full audit of the air conditioning system is carried out, but a correct assessment of its functioning and main impacts on energy consumption, and as a result determine any recommendations on improvement of the system or use of alternative solutions. National regulations and guidelines targeting energy efficiency and in line with the main objectives of this standard are also applicable.

NOTE Provision of adequate ventilation and system balancing are dealt with in EN 15239.

The qualification of the persons or organisation responsible for inspections is not covered by this standard, but the requirements for inspections are covered.

The frequency of the mandatory inspection is defined on national level. Features affecting the frequency and duration of inspection are introduced in Annex C.

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

EN 14511-1:2004, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 1: Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792:2003 and EN 14511-1:2004 and the following apply.

3.1

air conditioning system

combination of all components required to provide a form of air treatment in which temperature is controlled, possibly in combination with the control of ventilation, humidity and air cleanliness

**3.2
inspection**

inspection, in the manner of this standard means to examine the air conditioning systems in buildings

**3.3
air conditioning system control**

measures taken in ensuring the system operates in accordance with the design criteria

NOTE It may be a part of the building system control

**3.4
commissioning**

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

**3.5
design criteria**

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

**3.6
control parameters**

set values of the internal environmental conditions

**3.7
design documentation**

written descriptions of the essential design elements of the plant

**3.8
cooling energy distribution system (abbreviated CED-system)**

subsystem, where the cooling energy is transported and distributed from the CES-system to CEE-system by a distribution medium, inclusive control systems (examples for the distribution medium are air, water, refrigeration fluid)

**3.9
cooling energy emission system (abbreviated CEE-system)**

subsystem, where the cooling energy is emitted to the space (for example air outlets, fan coils, chilled ceiling, surface cooling) inclusive control systems

**3.10
cooling energy generation system (abbreviated CEG-system)**

subsystem, where the cooling energy is generated by refrigeration units (examples are chillers, absorber unit, heat pumps) inclusive control systems

**3.11
energy supply system (abbreviated ES-system)**

system supplying the necessary energy to generate the CEG-system (examples are electricity, gas, solar) inclusive control systems

4 Inspection procedure

4.1 General

The inspection shall commence with examination of the relevant design and system documentation and visual checks as far as possible to ensure that the equipment described is present and according to system specification. If the documentation is not available, then an additional part of this procedure is to locate the equipment and assemble a minimum portfolio of relevant documentation.

For the minimum content for the information that should be available in readiness for the inspection, the list in Annex D may be used.

NOTE For the inspection of air conditioning systems classes may be specified on national level, according to one or more of the following parameters:

- Usage of the air conditioned building
- Air conditioned area or volume
- Type of air conditioning system
- Nominal cooling capacity
- Annual running time
- Date of installation
- Legal requirements
- System documentation

If the inspection classes introduced in Annex B are used, then the different relevant parts of the inspection procedure can be established from the examples of procedures given in Annex F for a few sub-systems. Optional inspection items and/or measurement methods may be applied according the inspection class.

Comments on the frequency and scope of maintenance of the air conditioning systems shall be covered in relation to national requirements and good practice, e.g. industry guidelines. This, and the dates of most recent maintenance may be referred to during the 'physical' inspection.

Where there is clear evidence that a good practice program of maintenance is being carried out, then the inspection described in this standard may be simplified or reduced in accordance with the classification.

When checking the performance of different parts of an air-conditioning system, the measurement methods employed will assist subsequent follow-ups. To make this possible, the instructions for each measurement method shall be followed and the instruments for the measurements calibrated in accordance with the manufacturer's instructions.

Compare system sizes with likely loads. Annex F contains procedures for assessing whether refrigeration systems and air supply and extract systems are likely to be oversized.

Estimate the Specific Fan Power of the air movement systems whenever relevant, from the installed fan capacities and the flow rates, noted in the commissioning records.

4.2 Pre-inspection and document collection

4.2.1 Documents

4.2.1.1 General

Prior to inspection, where possible, the design criteria, system characteristics and the operational regime shall be determined. All available original documentation relating to the building and the installed systems shall be collected and assessed. Additional documentation, if it exists, indicating any modifications or alterations to the building, the systems or the use since the original documents, shall also be obtained and assessed. Annex D provides examples of documents needed.

4.2.1.2 Design documentation

Collect and identify available current relevant documents to support the inspection and the relevant subsystems and components.

If a satisfactory documentation is not available, a minimum set of information on the air conditioning system and building use shall be assembled.

The energy certificate, if available, shall be used.

Correspondence between documentation and actual installed components shall be checked. Any difference shall be stated in the report.

The design documents, where available, which define the relevant design criteria, shall be checked against the actual installation and the present use.

4.2.1.3 System characteristics

Working or as installed drawings shall be checked against the actual installation and use of the building.

An equipment list shall be obtained or prepared.

If available, the commissioning data shall be checked against the present system.

4.2.1.4 Building and system operation and maintenance status

Determine whether the air conditioning system, subsystems or components are regularly and correctly operated, and maintained by qualified and/or authorised personnel according to:

- System designer's instructions
- Manufacturer's instructions of the subsystems and components
- Any legal or statutory requirements

The maintenance status is an important part of the inspection. Check the maintenance records for the system and for individual items of the system, as well as the building and system log book.

4.2.2 Building and system survey

Advise the user to keep and maintain any documentation determined above and any survey or calculations carried out during the initial (first) pre-inspection in a file so that they are available for subsequent inspections of the building and system(s).

4.2.3 Advice in case of outdated, incomplete or missing documentation

In existing buildings the design and system documentation may be incomplete or even missing. The existing documentation may be partly outdated, due to undocumented changes in the use, loads, construction elements or building services systems during the building's lifetime.

In these cases, the lacking or outdated documentation shall be identified (the checklists given in Annexes F and G may be used whenever relevant), and the organisation or person responsible for the inspection shall provide the user advice on how to develop a plan to complete the documentation.

4.3 Methodology

4.3.1 General

The inspection shall determine if the equipment operates in an appropriate environment and with acceptable efficiency and if maintenance and control checking operations are regularly carried out.

NOTE 1 Some of the checks and tests described here are obligatory in some countries, and may be done separately or in connection with the full inspection, and also more frequently than the full inspection if required. The inspection should take these into account as a part of the inspection if relevant.

NOTE 2 Annex F may be used as a default list for checks, further information and advice on items under 4.3.2 to 4.3.9.

4.3.2 Inspection of the refrigeration equipment

Check the refrigeration equipment.

NOTE The checks would typically include the following items:

- refrigeration plant and its immediate surroundings;
- compressors;
- measurement records;
- capability of providing cooling: operating temperatures, refrigerant charge, refrigerant leak;
- insulation of refrigerant lines;
- vibration and noise level;
- condensing pressure;
- efficiency data of the chillers.

If any regulation requires periodic leak detection and repair, the documentation of the leak test shall be examined.

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4.3.3 Inspection of pumps and chilled water pipe work

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Check the condition and operation of chilled water pipe work and its insulation. A good insulation, especially on chilled water systems where lengths of chilled water lines can be considerable, can have a significant influence on the system energy efficiency of the system. Check for signs of leakage from the pipe work. Check the pumps and valves for the distribution of water as an energy carrier.

4.3.4 Inspection of effectiveness of outdoor heat rejection

Locate and check the condition and operation of the outdoor heat rejection units.

4.3.5 Inspection of the effectiveness of heat exchange to the refrigeration system (indoor units of split and distributed systems)

Check the condition and operation of heat exchangers inside those units installed within the treated spaces.

4.3.6 Inspection of air delivery systems in treated spaces

NOTE 4.3.6 to 4.3.8 is applied in cases where the air-conditioning system includes distribution of cooling energy using ventilation. See also EN 15239.

In the treated indoor spaces, locate and check the air delivery openings, grilles or diffusers, and locate the route by which air is extracted from the spaces. Note if there is any evidence that occupants find the air delivery arrangement unacceptable. Assess the positioning and geometry of air supply openings in relation to extract openings, and the potential to short-circuit from supply to extract.

4.3.7 Inspection of air delivery systems at air handling units and the associated ductwork

The air handling unit should have a warning sign affixed that indicates that the air handler fan should be turned off and air flow stopped before the air handler door is opened for inspection. If this is not present then the inspection shall include advice to affix such a warning.

NOTE EN 1886 includes suggested wording for such a warning sign.

Determine and record the frequency of filter changing or cleaning, and the time elapsed since the last change or cleaning.

Assess the current state of cleanliness, damage or blockage of filters. Assess the condition of heat exchangers.

4.3.8 Inspection of air inlets to the system

Locate and check the air inlets to the system.

4.3.9 Inspection of the building system controls and control parameters

Identify and provide advice of all controls, sensors and indicators which are relevant for energy performance, as appropriate, on:

- location
- function
- settings

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Locate and inspect the controls responsible for the operation of the air conditioning or comfort cooling system, the heating system controls, and their associated temperature sensors.

Review documentation or other sources of information to determine the individual control zones for heating and cooling. Determine the appropriateness of zoning in relation to factors such as local levels of internal gain, orientation and exposure to solar radiation.

Determine, where applicable, the method used to set, modulate or control air flow rate in the air supply, recirculation and exhaust ducts. Provide a view of the efficiency compared to good current practice.

4.3.10 Metering

Meters may have been installed to air conditioning systems, such as energy consumption or running time meters. Regularly noting the readings of such meters can help assess the operation of the air conditioning system.

Where energy consumption has been recorded on a regular basis, an estimate shall be done from the rated input power and the consumption record, whether the equipment is running in accordance with the use of the building. If not, the inspection shall include advice to the owner to reduce the energy consumption.

Where meters are installed, but no consumption records are available, the inspection shall include advice to record meter readings on a regular basis.

Where no such metering is in place, a part of the advice provided would be to install appropriate energy consumption metering at least to the more significant energy consuming air conditioning plant, and subsequently to record the consumption on a regular basis.