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Prezraļ evanje nestanovanjskih stavb - Zahtevane lastnosti za prezraļ evalne naprave in klimatizirne sisteme

Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems

Lüftung von Nichtwohngebäuden - Allgemeine Grundlagen und Anforderungen für Lüftungs- und Klimaanlagen

Ventilation dans les bâtiments non résidentiels - Exigences de performances pour les systemes de ventilation et de climatisation

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91.140.30	Prezraļ evalni in klimatski sistemi	Ventilation and air-conditioning

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Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems

Ventilation dans les bâtiments non résidentiels - Exigences de performances pour les systèmes de ventilation et de climatisation

Lüftung von Nichtwohngebäuden - Allgemeine Grundlagen und Anforderungen für Lüftungs- und Klimaanlagen

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

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Foreword

This document (EN 13779:2007) 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of an identical text or by endorsement, at the latest by October 2007, and conflicting national standards shall be withdrawn at the latest by October 2007.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 document supersedes EN 13779:2004.

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

This standard provides guidance especially for designers, building owners and users, on ventilation, air-conditioning and room-conditioning systems in order to achieve a comfortable and healthy indoor environment in all seasons with acceptable installation and running costs. The standard focuses on the system-aspects for typical applications and covers the following:

— Aspects important to achieve and maintain a good energy performance in the systems without any negative impact on the quality of the internal environment.

— Relevant parameters of the indoor environment.

— Definitions of data design assumptions and performances.

Relationships between this standard and related standards are the following:

<table>
<tr><td>building type →

purpose ↓</td><td>residential</td><td>non-residential</td></tr>
<tr><td>calculation /ventilation rates

calculation/ ventilation energy</td><td colspan="2">EN 15242

EN 15241</td></tr>
<tr><td>design; system performance</td><td>CEN/TR 14788[a]</td><td>EN 13779rev</td></tr>
<tr><td>criteria for the indoor environment</td><td colspan="2">EN 15251</td></tr>
<tr><td colspan="3">[a] A new Work Item (WI 00156105) has been established to revise and upgrade into a European Standard.</td></tr>
</table>

Natural ventilation systems are not covered by this standard.

1 Scope

This European Standard applies to the design and implementation of ventilation and room conditioning systems for non-residential buildings subject to human occupancy, excluding applications like industrial processes. It focuses on the definitions of the various parameters that are relevant for such systems.

The guidance for design given in this standard and its annexes are mainly applicable to mechanical supply and exhaust ventilation systems, and the mechanical part of hybrid ventilation systems.

Applications for residential ventilation are not dealt with in this standard. Performance of ventilation systems in residential buildings are dealt with in CEN/TR 14788.

The classification uses different categories. For some values, examples are given and, for requirements, typical ranges with default values are presented. The default values given in this standard are not normative as such, and should be used where no other values are specified. Classification should always be appropriate to the type of building and its intended use, and the basis of the classification should be explained if the examples given in the standard are not to be used.

NOTE Different standards may express the categories for the same parameters in a different way, and also the category symbols may be different.

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 308, *Heat exchangers — Test procedures for establishing performance of air to air and flue gases heat recovery devices*

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

EN 12599:2000, *Ventilation for buildings — Test procedures and measuring methods for handing over installed ventilation and air conditioning systems*

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

EN 13053:2006, *Ventilation for buildings — Air handling units — Rating and performance for units, components and sections*

prEN 15232, *Energy performance of buildings — Impact of Building Automation, Controls and Building Management*

EN 15239, *Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of ventilation systems*

EN 15240, *Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of air-conditioning systems*

EN 15241, *Ventilation for buildings — Calculation methods for energy losses due to ventilation and infiltration in commercial buildings*

EN 15242, *Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration*

EN 15251:2007, *Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics*

EN ISO 7730, *Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria (ISO 7730:2005)*

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
room conditioning system
system able to keep comfort conditions in a room within a defined range

NOTE Air conditioning systems as well as surface based systems are included

3.2
types of air
types of air are defined in 6.1

3.3
occupied zone

usually the term “occupied zone” is used only for areas designed for human occupancy and is defined as a volume of air that is confined by specified horizontal and vertical planes

NOTE 1 The vertical planes are usually parallel with the walls of the room. Usually there is also a limit placed on the height of the occupied zone. Thus, the occupied zone in a room is that space in which the occupants are normally located and where the requirements for the indoor environment shall be satisfied. Definitions are given in 7.2.

NOTE 2 definition of the occupied zone is dependent on the geometry and the use of the room and should be specified case by case

3.4
ventilation effectiveness
relation between the pollution concentrations in the supply air, the extract air and the indoor air in the breathing zone (within the occupied zone). It is defined as

$$\varepsilon_v = \frac{c_{ETA} - c_{SUP}}{c_{IDA} - c_{SUP}} \quad (1)$$

where: ε_v is the ventilation effectiveness

c_{ETA} is the pollution concentration in the extract air in $mg.m^{-3}$

c_{IDA} is the pollution concentration in the indoor air (breathing zone within the occupied zone) in $mg.m^{-3}$

c_{SUP} is the pollution concentration in the supply air in $mg.m^{-3}$

NOTE 1 The ventilation effectiveness depends on the air distribution and the kind and location of the air pollution sources in the space. It may therefore have different values for different pollutants. If there is complete mixing of air and pollutants, the ventilation effectiveness is one.

NOTE 2 Further information on ventilation effectiveness is given in Annex E and CR 1752.

NOTE 3 Another term frequently used for the same concept is “contaminant removal effectiveness”.

3.5
specific fan power

for the building or the whole system (SFP) is the combined amount of electric power consumed by all the fans in the air distribution system divided by the total airflow rate through the building under design load conditions, in $W.m^{-3}.s$. Specific power of each fan is defined as

$$P_{SFP} = \frac{P}{q_v} = \frac{\Delta p}{\eta_{tot}} \quad (2)$$

where: P_{SFP} is the specific fan power in $W.m^{-3}.s$

P is the input power of the motor for the fan in W

q_v is the design airflow through the fan in $m^3.s^{-1}$

Δp is the total pressure difference across the fan in Pa

η_{tot} is the overall efficiency of the fan

NOTE 1 The coefficient is valid for the design airflow with clean filter conditions, all components dry and any bypasses closed. It is related to an air density of 1,2 $kg.m^{-3}$. It should be taken into account that the design performance is not usually the rated maximum performance of the ventilation components, but typically between 40 and 60 % of the maximum performance.

NOTE 2 Further guidance for the applications, calculation and validation of the specific fan power is presented in Annex D.

3.6
demand controlled ventilation

ventilation system where the ventilation rate is controlled by air quality, moisture, occupancy or some other indicator for the need of ventilation

3.7
ventilation system

combination of appliances designed to supply interior spaces with outdoor air and to extract polluted indoor air

NOTE The system can consist of mechanical components (e.g. combination of air handling unit, ducts and terminal units). Ventilation system can also refer to natural ventilation systems making use of temperature differences and wind with facade grills in combination with mechanical exhaust (e.g. in corridors, toilets etc.). Both mechanical and natural ventilation can be combined with operable windows. A combination of mechanical and non-mechanical components is possible (hybrid systems).

4 Symbols and units

For the purposes of this document, the symbols and units given in Table 1 apply. The units in brackets are also in use.

Table 1 — Symbols and units

Quantity	Symbol	Unit
Pressure difference	Δp	Pa
Temperature difference	$\Delta\theta$ *)	K
Ventilation effectiveness	ε_v	-
Temperature	θ (theta)	K (°C)
Air temperature in the room	θ_a (theta)	K (°C)
Mean radiant temperature	θ_r (theta)	K (°C)
Operative temperature	θ_o (theta)	K (°C)
Density	ρ (rho)	$kg.m^{-3}$
Heat or cooling load	Φ (phi)	W (kW)
Area	A	m^2
Costs	C	€ [a]
Concentration	c	$mg.m^{-3}$
Specific heat capacity at constant pressure	c_p	$J.kg^{-1}.K^{-1}$
Diameter	d	m
Energy consumption (measured)	E	J (MJ, GJ)
Energy demand (calculated)	E	J (MJ, GJ)
Specific leakage	f	$l.s^{-1}.m^{-2}$
Present value factor	f_{pv}	-
Height	h	m
Initial Investment	I	€ [b]
Thermal insulation of clothing	I_{cl}	clo
Length	L	m
Metabolic rate (activity)	M	met
Life span	n	years
n_{L50}-value	n_{L50}	h^{-1}
Fan power	P	W
Specific fan power	P_{SFP}	$W.m^{-3}.s$
Present value	PV	€ [a]

Table 1 — Symbols and units (*continued*)

Pressure	p	Pa
Mass flow rate	q_m	$kg.s^{-1}$
Volume flow rate	q_v	$m^3.s^{-1}$ ($l.s^{-1}$, $m^3.h^{-1}$)
Interest rate	r	-
Time	t	s (h)
Volume	V	m^3
Air velocity	v	$m.s^{-1}$

[a] Or National currency

[b] EN 12792 prefers Θ but t and T may be used as well.

5 Agreement of design criteria

5.1 General

The design criteria specify the information needed to design the system. These criteria also constitute the basis for the measurements that will be carried out during the hand-over process. They provide the common language between all the parties including the client, designer, contractor and the operation and maintenance personnel.

Information necessary to design the system is organised on the basis of various documents outlined in 5.2 to 5.10. If the method used for dimensioning the system requires more details, they shall be provided.

Calculation procedure for the energy requirements of the ventilation system is presented in EN 15241.

5.2 Principles

Although in this standard the terms “client”, “designer” or “contractor” are used to describe the function, the responsibilities are dependent on the contract. Their use does not presuppose any definition of responsibility for the information. Nevertheless, if one party does not provide the information, the other shall ask for it or make and record the necessary assumptions. All key design decisions shall be agreed and documented.

The description of the characteristics of the environment and the structure of the building shall be obtained for design. The desired results required at the time of hand-over and during normal operation shall be specified and documented.

The description of the building with construction data, use and requirements is an evolving process with an increasing degree of detail and accuracy with the evolution of the project. Therefore the use of all specifications shall always be stated clearly. The details about the information needed are also dependent on the calculation method that is employed. The introduction of a system of abbreviations for constructions, room use and requirements to be used throughout the design phase is recommended.

5.3 General building characteristics

5.3.1 Location, outdoor conditions, neighbourhood

Information about the location of the relevant building, the significant neighbourhood characteristics such as adjacent buildings, shading, reflections, emissions, roads, airfields, sea coast, special requirements and all other information that will influence the building design shall be specified in design. The reference for noise and wind exposure of facades should be given, if available. The category of outdoor air shall be defined in accordance with Table 4.

5.3.2 Climatic data outdoors

Information shall be given on climatic environment; as a minimum, design conditions for winter and summer are required. The most important climatic parameters for the design are:

— Winter: outdoor temperature and wind speed;

— Summer: outdoor temperature, humidity and solar radiation.

The reference year taken in order to estimate annual energy consumption shall be defined. Additional information about the occurrence of extreme situations is useful in some cases, especially to check the comfort situation. prEN 15243 provides more information about application.

5.3.3 Information on the operation of the building

The occupancy profile during typical days, annual periods of non-occupancy (e.g. schools etc.), and on general operational use (e.g. weekend, night etc.) shall be specified.

5.4 Construction data

All building parts shall be specified in a list with their relevant construction data.

5.5 Geometrical description

The geometrical description including information about the orientation of the elements exposed to the outdoors shall be presented, and this can be done in the form of drawings and/or tables. The specification of the net volume and floor area, room by room, is recommended.

5.6 Use of the rooms

5.6.1 General

The information about the use of each room, or group of rooms with similar use shall be given, preferably in a table. The necessary information according to A.1 of EN 12599:2000 shall also be included.

5.6.2 Human occupancy

The design condition in respect of the number of people that can be in the room for a longer period (see Table 12) shall be specified. This number constitutes a basic condition of use because the ventilation rate shall be designed for this level of occupancy. In addition the activity and clothing has to be defined.

The occupancy level shall be given as schedule, for example by specifying hourly values on typical days.

5.6.3 Other internal heat gains

Internal heat gains (persons, lighting and equipment) shall be specified for the various rooms or group of rooms. The gains shall be defined as follows:

— sensible gains, convective or radiative

— latent gains.

They shall be defined as schedules similar to occupation.

NOTE A.17 gives further information on internal loads.

5.6.4 Other internal pollution and moisture sources

Special pollution or moisture production in a room shall be defined when relevant, with reference to the limits on these pollutants that may be encountered inside the room. Each pollutant shall be defined by its schedule of production and by the limit value to be admitted.

5.6.5 Given extract airflow

In some applications the extract airflow is given by the kind of process or equipment. In this case the extract airflow shall be defined.

5.7 Requirements in the rooms

5.7.1 General

The requirements (desired results according to 7.3 to 7.6) and internal loads (A.17) shall be specified room by room. The requirements with respect to thermal conditions and draught shall be satisfied in the occupied zone, specified in accordance with 7.2.

5.7.2 Type of control

The type of control of the indoor environment shall be specified according to the definitions given in Table 7, and it shall be adapted to the use of the room.

5.7.3 Thermal and moisture conditions

The thermal conditions in the room shall be specified in accordance with 7.3, the moisture conditions in accordance with 7.5 and EN 15251.

5.7.4 Air quality for people

The level of air quality required, and the method of classification applied shall be specified. Whether smoking is allowed or not is an important input. The necessary air flow rates to achieve the specified requirements shall be calculated. If nothing is declared, the rates of outdoor air per person for Indoor Air Quality category IDA 2 can be used as a default.

5.7.5 Air velocities

The air velocity in the occupied zone shall not exceed the agreed limits.

5.7.6 Noise level

With no regulations or specific requirements the reference values in A.16 are valid as maximum allowable sound pressure level from the system in the room.

5.7.7 Lighting

The lighting shall be designed for the actual requirements in the rooms. The installed electrical power for the lighting should not be too high for reasons of energy conservation, as the energy is not only required for lighting but also for cooling in summertime. Typical values for lighting levels and lighting power requirements are given in A.17.3.

5.8 System requirements

The relevant system requirements shall be specified. The system requirements shall also conform to existing national regulations and guidelines, including those for structural fire safety and the regulations related to acoustics.

The system requirements typically include:

-location of air intake and discharge openings, see 6.2.3

-air filtering

-heat recovery

-re-use of extract air

-thermal insulation of the system

-airtightness of the system

-pressure conditions within the system and the building, taking into account the building and system airtightness

-power consumption

-space requirements for components and systems

-aspects to installation, operation and maintenance

NOTE Annex A gives further information and default values.

5.9 General requirements for control and monitoring

The method for the control and monitoring of all the systems shall be specified. In some applications it makes sense to distinguish between the first year(s) of operation and the time after.

The monitoring of the energy consumption shall allow a periodic check of the energy consumption of important individual systems and of the whole building. Therefore a measuring concept shall be identified at an early stage of the project and the necessary measuring devices installed. Changes of uses and requirements should be followed by adaptations of the system.

5.10 General requirements for maintenance and safety of operation

The system shall be designed to allow efficient service and maintenance to ensure effective operation.

NOTE 1 Further guidance is given in A.14.

The system shall be so designed that, with proper operation and maintenance, it will remain in operating condition for a reasonable period of time. The system shall be designed so as to facilitate cleaning, maintenance and service operation (see EN 12097). The equipment shall be furnished with appropriate protection and safety devices for maintenance and repair work, and for emergency stopping.

NOTE 2 National authorities may give more detailed requirements or instructions for safety in operation and maintenance.