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**Energijske lastnosti stavb - Prezračevanje stavb - 2. del: Razlaga in utemeljitev EN 16798-1 - Vstopni podatki notranjega okolja za projektiranje in ocenjevanje energijskih lastnosti stavb glede kakovosti notranjega zraka, toplotnega okolja, razsvetljave in akustike - Modul M1-6**

Energy performance of buildings - Ventilation for buildings - Part 2: Interpretation of the requirements in EN 16798-1 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6

Energetische Bewertung von Gebäuden - Lüftung von Gebäuden - Teil 2: Interpretation der Anforderungen der EN 16798-1 - Eingangsparemeter für das Innenraumklima zur Auslegung und Bewertung der Energieeffizienz von Gebäuden bezüglich Raumluftqualität, Temperatur, Licht und Akustik - Module M1-6

Performance énergétique des bâtiments - Ventilation des bâtiments - Partie 2: Interprétation des exigences de l'EN 16798-1 - Données d'entrées d'ambiance intérieure pour la conception et l'évaluation de la performance énergétique des bâtiments couvrant la qualité de l'air intérieur, l'ambiance thermique, l'éclairage et l'acoustique - Module M1-6

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 indoor air quality, thermal environment, lighting and  
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Performance énergétique des bâtiments - Ventilation  
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## European foreword

This document (CEN/TR 16798-2:2019) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document is part of the set of standards and accompanying Technical Reports on the energy performance of buildings and has been prepared under the Mandate M 480 given to CEN by the European Commission and the European Free Trade Association, see Bibliographical Reference [35]).

Directive 2010/31/EU recasting the Directive 2002/91/EC on energy performance of buildings (EPBD, [36]) promotes the improvement of the energy performance of buildings within the European Union, taking into account all types of energy uses (heating, lighting, cooling, air conditioning, ventilation) and outdoor climatic and local conditions, as well as indoor climate requirements and cost effectiveness (Article 1).

The directive requires Member States to adopt measures and tools to achieve the prudent and rational use of energy resources. In order to achieve those goals, the EPBD requires increasing energy efficiency and the enhanced use of renewable energies in both new and existing buildings. One tool for this is the application by Member States of minimum requirements on the energy performance of new buildings and for existing buildings that are subject to major renovation, as well as for minimum performance requirements for the building envelope if energy-relevant parts are replaced or retrofitted. Other tools are energy certification of buildings, inspection of boilers and air-conditioning systems.

The use of European standards increases the accessibility, transparency and objectivity of the energy performance assessment in the Member States facilitating the comparison of best practices and supporting the internal market for construction products. The use of EPB-standards for calculating energy performance, as well as for energy performance certification and the inspection of heating systems and boilers, ventilation and air-conditioning systems will reduce costs compared to developing different standards at national level.

The first mandate to CEN to develop a set of CEN EPBD standards (M/343, [34]), to support the first edition of the EPBD ([33]) resulted in the successful publication of all EPBD related CEN standards in 2007-2008.

The Mandate M/480 was issued to review the Mandate M/343 as the recast of the EPBD raised the need to revisit the standards and reformulate and add standards so that they become on the one hand unambiguous and compatible, and on the other hand a clear and explicit overview of the choices, boundary conditions and input data that need to be defined at national or regional level. Such national or regional choices remain necessary, due to differences in climate, culture and building tradition, policy and legal frameworks. Consequently, the set of CEN-EPBD standards published in 2007-2008 had to be improved and expanded on the basis of the recast of the EPBD.

The EPB standards are flexible enough to allow for necessary national and regional differentiation and facilitate Member States implementation and the setting of requirements by the Member States.

Further target groups are users of the voluntary common European Union certification scheme for the energy performance of non-residential buildings (EPBD art.11.9) and any other regional

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(e.g. Pan European) parties wanting to motivate their assumptions by classifying the building energy performance for a dedicated building stock.

For the convenience of Standards users CEN/TC 156, together with responsible Working Group Conveners, have prepared a simple table below relating, where appropriate, the relationship between the 'EPBD' and 'recast EPBD' standard numbers prepared by Technical Committee CEN/TC 156 "Ventilation for buildings".

EPBD EN Number	Recast EPBD EN Number	Title
EN 15251	EN 16798-1	Energy performance of buildings – Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1-6) (revision of EN 15251)
N/A	CEN/TR 16798-2	Energy performance of buildings – Ventilation for buildings - Part 2: Interpretation of the requirements in EN 16798-1 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1-6) <i>(standard is not published)</i>
EN 13779	EN 16798-3	Energy performance of buildings – Ventilation for buildings - Part 3: For non-residential buildings – Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4) (revision of EN 13779)
N/A	CEN/TR 16798-4	Energy performance of buildings – Ventilation for buildings - Part 4: Interpretation of the requirements in EN 16798-3 - For non-residential buildings – Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4)
EN 15241	EN 16798-5-1	Energy performance of buildings — Ventilation for buildings – Part 5-1: Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8) — Method 1: Distribution and generation (revision of EN 15241)



EPBD EN Number	Recast EPBD EN Number	Title
EN 15241	EN 16798-5-2	Energy performance of buildings - Ventilation for buildings - Part 5-2: Calculation methods for energy requirements of ventilation systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8) - Method 2: Distribution and generation (revision of EN 15241)
N/A	CEN/TR 16798-6	Energy performance of buildings - Ventilation for buildings - Part 6: Interpretation of the requirements in EN 16798-5-1 and EN 16798-5-2 - Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8)
EN 15242	EN 16798-7	Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration (Modules M5-5) (revision of EN 15242)
N/A	CEN/TR 16798-8	Energy performance of buildings - Ventilation for buildings - Part 8: Interpretation of the requirements in EN 16798-7 - Calculation methods for the determination of air flow rates in buildings including infiltration - (Modules M5-5)
EN 15243	EN 16798-9	Energy performance of buildings - Ventilation for buildings - Part 9: Calculation methods for energy requirements of cooling systems (Modules M4-1, M4-4, M4-9) - General (revision of EN 15243)
N/A	CEN/TR 16798-10	Energy performance of buildings - Ventilation for buildings - Part 10: Interpretation of the requirements in EN 16798-9 - Calculation methods for energy requirements of cooling systems (Module M4-1, M4-4, M4-9) - General
N/A	EN 16798-13	Energy performance of buildings - Ventilation for buildings - Part 13: - Calculation of cooling systems (Module M4-8) - Generation
N/A	CEN/TR 16798-14	Energy performance of buildings - Ventilation for buildings - Part 14: Interpretation of the requirements in EN 16798-13 - Calculation of cooling systems (Module M4-8) - Generation

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EPBD EN Number	Recast EPBD EN Number	Title
N/A	EN 16798-15	Energy performance of buildings – Ventilation for buildings – Part 15: Calculation of cooling systems (Module M4-7) – Storage
N/A	CEN/TR 16798-16	Energy performance of buildings – Ventilation for buildings – Part 16: Interpretation of the requirements in EN 16798-15 – Calculation of cooling systems (Module M4-7) – Storage
EN 15239 and EN 15240	EN 16798-17	Energy performance of buildings – Ventilation for buildings - Part 17: Guidelines for inspection of ventilation and air- conditioning systems (Module M4-11, M5-11, M6-11, M7-11)
N/A	CEN/TR 16798-18	Energy performance of buildings – Ventilation for buildings – Part 18: Interpretation of the requirements in EN 16798-17 – Guidelines for inspection of ventilation and air-conditioning systems (Module M4-11, M5-11, M6-11, M7-11)

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## Introduction

This document is a guide to EN 16798-1 and can help the user in application of the standard and give additional background information. Besides this document describes and recommends additional topics related to the evaluation of the indoor environmental quality and new possibilities to improve the indoor environmental quality and reduce energy use of buildings like personalized systems, air cleaning technologies, consideration of adapted persons, etc.

This document explains how design criteria can be established and used for dimensioning of systems. It explains how to establish and define the main parameters to be used as input for building energy calculation and long term evaluation of the indoor environment. This document also describes how gas phase air cleaning in the future can improve the indoor air quality and partly substitute for outside air. Finally it will identify parameters to be used for monitoring and displaying of the indoor environment. Different categories of criteria can be used depending on type of building, type of occupants, type of climate and national differences. The report explains how these different categories of indoor environment can be individually selected as national criteria, be used in project agreement for design criteria and for displaying the yearly building performance in relation to indoor environmental quality. The designer can also define other categories using the principles from EN 16798-1 and this document.

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## 1 Scope

This document deals with the indoor environmental parameters for thermal environment, indoor air quality, lighting and acoustic. The document explains how to use EN 16798-1 for specifying indoor environmental input parameters for building system design and energy performance calculations. The document specifies methods for long term evaluation of the indoor environment obtained as a result of calculations or measurements. The document specifies criteria for measurements which can be used if required to measure compliance by inspection. The Document identifies parameters to be used by monitoring and displaying the indoor environment in existing buildings. This document is applicable where the criteria for indoor environment are set by human occupancy and where the production or process does not have a major impact on indoor environment. The document explains how different categories of criteria for the indoor environment can be used.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE The references in EN 16798-1 are also applicable in this document. Additional references are listed in the Bibliography.

EN 12193, *Light and lighting — Sports lighting*

EN 12464-1:2011, *Light and lighting — Lighting of work places — Part 1: Indoor work places*

EN 12464-2, *Light and lighting — Lighting of work places — Part 2: Outdoor work places*

EN 12665, *Light and lighting — Basic terms and criteria for specifying lighting requirements*

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

EN 16798-1:2019, *Energy performance of buildings — Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics — Module M1-6*

EN 16798-3, *Energy performance of buildings — Part 3: Ventilation for non-residential buildings — Performance requirements for ventilation and room-conditioning systems*

EN ISO 10052, *Acoustics — Field measurements of airborne and impact sound insulation and of service equipment sound — Survey method (ISO 10052)*

EN ISO 16032, *Acoustics — Measurement of sound pressure level from service equipment in buildings — Engineering method (ISO 16032)*

EN ISO 13731, *Ergonomics of the thermal environment — Vocabulary and symbols (ISO 13731)*

EN ISO 52000-1:2017, *Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures (ISO/FDIS 52000-1:2017)*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16798-1, EN 12792, EN ISO 13731, EN 12464 (all parts), EN 12665 and EN ISO 52000-1 apply.

### 4 Symbols and abbreviations

#### 4.1 Symbols

For the purposes of this Report, the symbols given in EN ISO 52000-1:2016, Clause 4 and Annex C and the specific symbols listed in Table 1 apply.

**Table 1 — Symbols and units**

Symbol	Quantity	Unit
$\theta_o$	indoor operative temperature	°C
$\theta_e$	outdoor temperature	°C
$\Theta_m$	running mean outdoor air temperature	°C
$\theta_{ed-i}$	daily mean outdoor temperature	°C
$\Theta_o$	operative temperature, design and energy calculations	°C
$\Theta_{rm-i}$	running mean outdoor temperature	°C
$v_a$	air speed (average/maximum)	m/s
$\Theta_f$	floor surface temperature	°C
$\Delta CO_2$	Concentration difference	ppm
$\Delta \Theta_{pr}$	radiant temperature asymmetry	K
$\Delta \Theta_a$	vertical air temperature difference	K
$\alpha$	constant for running mean calculations	
$q_{tot}$	total ventilation rate	l/s
$q_B$	ventilation rate for building materials	l/s (m <sup>2</sup> )
$q_p$	ventilation rate for persons	l/s (per person)
$q_{tot}$	total ventilation rate in occupied zone	l/s (m <sup>2</sup> ), l/s (person)
$n$	number of persons	
$q_h$	ventilation rate required for dilution of pollutant	L/s
$G_h$	generation of a pollutant	µg/s
$C_h$	guideline value of a pollutant	µg/L
$C_{h,i}$	guideline value of the substance	µg /m <sup>3</sup>
$C_{h,o}$	supply concentration of a pollutant at air intake	µg/L
$\epsilon_v$	ventilation effectiveness	-

Symbol	Quantity	Unit
$A$	floor area	m <sup>2</sup>
$L_{p,A}$	A-weighted sound pressure level	dB(A)
$L_{eq, nT,A}$	equivalent continuous sound pressure level	dB(A)
$D$	daylight factor	
$DC_{aj}$	daylight quotient of the calculated area	
$E_m$	average maintained illuminance	lx
$M$	activity level	met
$I_{cl}$	assumed clothing level winter/summer	clo

## 4.2 Abbreviations

Table 2 — Abbreviations

Abbreviation	Term
ACH	air changes per hour
DR	draught rate, %
DSNA	daylight quotient sunscreen not activated
IEQ	indoor environmental quality
IEQ <sub>cat</sub>	indoor environmental quality category for design
LPB <sub>1-3</sub>	low polluting building class
PD	percentage dissatisfied for local thermal discomfort
PMV	predicted mean vote
PPD	predicted percentage of dissatisfied, %
RH	relative humidity
WHO	World Health Organization

## 5 Interactions with other standards and use of categories

The present document interacts mainly with EN 16798-1 and indirectly with the standards that interact with EN 16798-1.

The document explains how the indoor environmental criteria in EN 16798-1 can be used for the design of building and HVAC systems. The thermal criteria (design indoor temperature in winter, design indoor temperature in summer) are used as input for heating and cooling load calculations and sizing of the installed systems. Ventilation rates are used for sizing ventilation systems, and lighting levels for design of lighting system including the use of day lighting. The design values for sizing the building services are needed to avoid possible negative effect of indoor environment and to give advice in respect of improvement of the energy efficiency of existing buildings as well as of the heating and cooling of buildings.

This document explains how values for the indoor environment (temperature, ventilation, lighting) are used as input to the calculation of the energy demand (building energy demand). Output from measured indoor environmental parameters in existing buildings (temperature, CO<sub>2</sub>, ventilation rates, illumination levels) will enable the evaluation of overall annual performance and can be used to display the indoor environmental factors together with data for the energy performance.

Output from room temperature calculations and yearly dynamic building simulations will enable evaluation of the annual performance of buildings at the design stage.

The document describes methods for measurement of the indoor environment and for treating measured data related to the inspection of HVAC systems.

The document will provide a method for categorization of indoor environment (Clause 10). This method can be used to integrate complex indoor environment information to simple classification for a possible indoor environment certificate.

## 6 How to establish design input criteria for dimensioning of buildings, heating, cooling, ventilation and lighting systems

### 6.1 Introduction

Recommended input values are given for each of the different categories as shown in Table 3. These categories can be used in different ways. First and foremost they can be used to establish different levels of criteria for the design of buildings and building services. Different countries can standardize one category for design. The consultant and client of a building project can use the categories to agree on a specific design level. The intention is not that a building should be operated strictly in one class the whole year round. Instead the categories can be used to describe the yearly indoor environmental performance of a building by showing the distribution of the parameters in the different categories. It can then, on the national level or in a design/operation contract, be specified how much of the time the categories can be exceeded. This is shown in this report with some examples.

**Table 3 — Categories of indoor environmental quality**

Category	Level of expectation	Explanation
IEQ <sub>I</sub>	High	Should be selected for occupants with special needs (children, elderly, persons with disabilities).
IEQ <sub>II</sub>	Medium	The normal level used for design and operation.
IEQ <sub>III</sub>	Moderate	Will still provide an acceptable environment. Some risk of reduced performance of the occupants.
IEQ <sub>IV</sub>	Low	Should only be used for a short time of the year or in spaces with very short time of occupancy.

Even if a building is designed for category III it can still be operated a greater part of the year in category I or II. When the outdoor conditions are less severe (warmer in winter, colder in summer) than the design day, the capacity of the heating/cooling system will be large enough to keep the indoor environment within a more narrow range.