SLOVENSKI STANDARD
SIST EN 15316-2:2018

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Nadomešča:
SIST EN 15316-2-1:2007

Energijske lastnosti stavb - Metoda za izračun energijskih zahtev in učinkovitosti sistema - 2. del: Sistemi za prenos toplote (ogrevanje in hlajenje prostora) - Modula M3-5 in M4-5

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5

Energetische Bewertung von Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 2: Wärmeübergabesysteme (Raumheizung und -kühlung), Modul M3-5, M4-5

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 2 : Systèmes d'émission des locaux (chauffage et refroidissement), Module M3-5, M4-5

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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EUROPEAN STANDARD

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English Version

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5

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This European Standard was approved by CEN on 27 February 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword

This document (EN 15316-2:2017) has been prepared by Technical Committee CEN/TC 228 “Energy performance of buildings”, the secretariat of which is held by DIN.

This document supersedes EN 15316-2-1:2007.

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of an identical text or by endorsement, at the latest by October 2017, and conflicting national standards shall be withdrawn at the latest by October 2017.

The main changes compared to the previous version are:

a) only one calculation method for heating and cooling emission systems;

b) the calculation method is only based on temperature differences (the calculation method based on efficiency values are no longer exist in the new standard);

c) the new calculation method define input parameter from product standards;

d) the new standard includes consistent default values for the control devices.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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.

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

Introduction

This European Standard is part of a series of standards aiming at international harmonization of the methodology for the assessment of the energy performance of buildings, called “set of EPB standards”.

All EPB standards follow specific rules to ensure overall consistency, unambiguity and transparency.

All EPB standards provide a certain flexibility with regard to the methods, the required input data and references to other EPB standards, by the introduction of a normative template in Annex A and Annex B with informative default choices.

For the correct use of this standard, a normative template is given in Annex A to specify these choices. Informative default choices are provided in Annex B.

CEN/TC 228 deals with heating systems in buildings. Subjects covered by CEN/TC 228 are:

a) energy performance calculation for heating systems;

b) inspection of heating systems;

c) design of heating systems;

d) installation and commissioning of heating systems.

This standard constitutes the specific part related to space heating and cooling emission, of a set of standards determining methods for calculation of energy losses/requirements of space heating and cooling systems, space cooling systems and domestic hot water systems in buildings.

This standard specifies the structure for calculation of the additional heat and cooling losses and energy requirements of a heat and cooling emission systems for meeting the building net energy demand.

The calculation method is used for the following applications:

— calculation of the additional energy losses in the heat emission system or cooling system;

— optimization of the energy performance of a planned heat emission system or cooling system, by applying the method to several possible options;

The user should refer to other European Standards or to national documents for input data and detailed calculation procedures not provided by this standard. This standard was developed during the first EPBD mandate and the first version was published in 2008. The revision for inclusion in the second mandate package was performed in 2014. The two calculation methods have been removed from the standard and a new one was added. The standard was updated to cover hourly and monthly time-step.

The main target group of this standard are all the users of the set of EPB standards. In case the standard is used in the context of national or regional legal requirements, mandatory choices may be given at national or regional level for such specific applications, in particular for the application within the context of EU Directives transposed into national legal requirements. These choices (either the informative default choices from Annex B or choices adapted to national/regional needs), but in any case following the template of this Annex A) can be made available as National Annex or as separate (e.g. legal) document.

Use by or for regulators: In case the standard is used in the context of national or regional legal requirements, mandatory choices may be given at national or regional level for such specific applications. These choices (either the informative default choices from Annex B or choices adapted to national / regional needs, but in any case following the template of this Annex A) can be made available as national annex or as separate (e.g. legal) document (national data sheet).

NOTE So in this case:

— the regulators will **specify** the choices;

— the individual user will apply the standard to assess the energy performance of a building, and thereby **use** the choices made by the regulators.

Topics addressed in this standard can be subject to public regulation. Public regulation on the same topics can, for certain applications, override the default values in Annex B of this standard. Public regulation on the same topics can even, for certain applications override the use of this standard. Legal requirements and choices are in general not published in standards but in legal documents. In order to avoid double publications and difficult updating of double documents, the National Annex may refer to the legal texts where national choices have been made by public authorities.

It is expected, if the default values and choices in Annex B are not followed due to national regulations, policy or traditions, that:

— national or regional authorities prepare data sheets containing the choices and national or regional values, according to the model in Annex A. In this case the National Annex (e.g. NA) refers to this text;

— or, by default, the national standards body will consider the possibility to add or include a National Annex in agreement with the template of Annex A, in accordance to the legal documents that give national or regional values and choices.

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 Pan EU parties wanting to motivate their assumptions by classifying the building energy performance for a dedicated building stock.

More information is provided in the Technical Report accompanying this standard (CEN/TR 15316-6-2,).

1 Scope

This European Standard's scope is to standardize the required inputs, the outputs and the links (structure) of the calculation method in order to achieve a common European calculation method.

This standard covers energy performance calculation of heating systems and water based cooling space emission sub-systems.

Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in EN ISO 52000-1.

NOTE 1 In CEN ISO/TR 52000-2, the same table can be found, with, for each module, the numbers of the relevant EPB standards and accompanying technical reports that are published or in preparation.

NOTE 2 The modules represent EPB standards, although one EPB standard may cover more than one module and one module may be covered by more than one EPB standard, for instance a simplified and a detailed method respectively. See also Clause 2 and Tables A.1 and B.1.

Table 1 — Position of this standard, within the modular structure of the set of EPB standards

Overarching			Building (as such)		Technical Building Systems										
	Descriptions			Descriptions		Descriptions	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic Hot water	Lighting	Building automation and control	Electricity production
sub 1		M1	sub1	M2	sub1		M3	M4	M5	M6	M7	M8	M9	M10	M11
1	General		1	General	1	General	15316–1					15316–1			
2	Common terms and definitions; symbols, units and subscripts		2	Building Energy Needs	2	Needs						12831–3			
3	Applications		3	(Free) Indoor Conditions without Systems	3	Maximum Load and Power	12831–1					12831–3			
4	Ways to Express Energy Performance		4	Ways to Express Energy Performance	4	Ways to Express Energy Performance	15316–1					15316–1			
5	Building Functions and Building Boundaries		5	Heat Transfer by Transmission	5	Emission and control	15316–2	15316–2							
6	Building Occupancy and Operating Conditions		6	Heat Transfer by Infiltration and Ventilation	6	Distribution and control	15316–3	15316–3				15316–3			
7	Aggregation of Energy Services and Energy Carriers		7	Internal Heat Gains	7	Storage and control	15316–5					15316–5 15316–4-3			
8	Building Partitioning		8	Solar Heat Gains	8	Generation									
					8–1	Combustion boilers	15316–4-1					15316–4-1			
					8–2	Heat pumps	15316–4-2	15316–4-2				15316–4-2			
					8–3	Thermal solar Photovoltaics	15316–4-3					15316–4-3			15316–4-3
					8–4	On-site cogeneration	15316–4-4					15316–4-4			15316–4-4
					8–5	District heating and cooling	15316–4-5	15316–4-5							15316–4-5
					8–6	Direct electrical heater	15316–4-6					15316–4-6			
					8–7	Wind turbines									15316–4-7
					8–8	Radiant heating, stoves	15316–4-8								
9	Calculated Energy Performance		9	Building Dynamics (thermal mass)	9	Load dispatching and operating conditions									
10	Measured Energy Performance		10	Measured Energy Performance	10	Measured Energy Performance	15378–3					15378–3			
11	Inspection		11	Inspection	11	Inspection	15378–1					15378–1			
12	Ways to Express Indoor Comfort		12	–	12	BMS									
13	External Environment Conditions														
14	Economic Calculation	15459–1													

2 Normative references

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

EN 215, *Thermostatic radiator valves - Requirements and test methods*

EN 416-2, *Single burner gas-fired overhead radiant tube heaters for non-domestic use - Part 2: Rational use of energy*

EN 419-2, *Non-domestic gas-fired overhead luminous radiant heaters - Part 2: Rational use of energy*

EN 442 (all parts), *Radiators and convectors*

EN 1264 series, *Water based surface embedded heating and cooling systems*

EN 12828, *Heating systems in building — Design for water based heating systems*

EN 12831-1, *Energy performance of buildings - Method for calculation of the design heat load - Part 1: Space heating load, Module M3-3*

EN 15316-1, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General*

EN 15500, *Control for heating, ventilating and air-conditioning applications - Electronic individual zone control equipment*

EN ISO 7345:1995, *Thermal insulation - Physical quantities and definitions (ISO 7345:1987)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 7345:1995, EN ISO 52000-1:2017, and the following specific definitions apply.

3.1
heating system heat loss, emission
cooling system cooling loss, emission
heat/cooling loss through the building envelope due to non-uniform temperature distribution, control inefficiencies and losses of emitters embedded in the building structure

3.2
heating and cooling system heat losses, total
sum of the heat and cooling losses from the system, including recoverable heat loss

3.3
control
self-acting device with and without auxiliary energy to keep a physical condition as temperature, humidity, etc. close to set-point

3.4
room automation controls BMS
room temperature controls in combination with:

— timer function;

— timer function and self-adoption / self-optimization;

timer function and self-adoption / self-optimization and interaction with other components of heating / cooling system like further controls, circulator or heat- / cool-generator (network operation)

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the symbols given in EN ISO 52000-1:2017 and the following symbols (see Table 2) apply.

Table 2 — Symbols and units

Symbol	Quantity	Unit
RF	Radiant factor	-

4.2 Subscripts

For the purposes of this document, the symbols are in accordance with EN ISO 52000-1:2017 and the special symbols shown in Table 3.

Table 3 — Subscripts

emb	embedded	*im*	*intermittent*	*pmp*	*pump*
fan	*fan*	*ini*	initial	*rad*	*radiant*
emt	*emitter*	*inc*	increased	*str*	stratification
hydr	*hydraulic balancing*	*roomaut*	room automation	*con*	*convective*

5 Description of the method

5.1 Output of the method

The method described in this standard calculate

— energy losses (heating and cooling) $Q_{em,ls}$ in kWh;

— auxiliary energy – heat/ cooling emission W_{em} in kWh;

— room temperature $\theta_{int,inc}$ in Centigrade (°C).

The time step of the output can be:

— hourly;

— monthly;

— yearly;

according to the time-step of the input.

5.2 General description of the method

The energy performance is assessed by values of the increased space temperatures due to heat and cooling emission system inefficiencies.

The method is based on an analysis of the following characteristics of a space heating emission system or cooling system including control:

— non-uniform space temperature distribution;

— emitters;

— emitters embedded in the building structure;

— control accuracy of the indoor temperature;

— operation of controls / controls systems and emitters.

The energy required by the emission system is calculated separately for thermal energy and electrical energy in order to determine the final energy, and subsequently the corresponding primary energy is calculated.

The calculation factors for conversion of energy requirements to primary energy shall be decided on a national level.

For the calculation of the different characteristics within combined systems it is assumed, that the system is designed under the aspect of energy optimization.

6 Calculation Method

6.1 Output data

The output data of this method are listed in Table 4.

Table 4 — Output data of this method

Description	Symbol	Unit	Validity interval	Intended	Varying
auxiliary energy – heating / cooling emission	$W_{em,ls,aux}$	kWh	0…∞	M3–1	YES
additional energy losses of heat emission	$Q_{em,ls}$	kWh	0…∞	M3–1	YES
equivalent internal heating temperature	$\theta_{H;int;inc}$	°C	−5 … 40	M3–1	YES
equivalent internal cooling temperature	$\theta_{C;int;inc}$	°C	−5 … 40	M4–1	YES
temperature variation based on losses	$\Delta\theta_{int;inc}$	°C	−5 … 40	M3–1	YES
annual expenditure factor for the heat and cooling emission	$\varepsilon_{em,ls,an}$	-	1…2	M3–1	NO
convective fraction of the heating/cooling emitter	$f_{em,conv}$	-	0..1	M3–1 / M2–2	NO

6.2 Calculation time steps

The objective of the calculation is to determine the annual energy demand or the energy demand of a time period of the space heating / cooling emission system. This may be done in one of the following two different ways:

— by using annual data for the system operation period and perform the calculations using annual average values;

— by dividing the year into a number of calculation periods (e.g. year, month, week, day, hour, boosted sub-period) and perform the calculations for each period using period dependent values and adding up the results for all the periods over the year.

6.3 Input data

6.3.1 Source of data

Input data about products that are required for the calculation described in this standard shall be the data supplied by the manufacturer if they are declared according to relevant EN product standards.

If no such data from the manufacturer is available or if the required data are not product data, default values are given in Annex B.

6.3.2 Product data (technical data)

The product data shall be the value declared by the manufacturer according to certified measurements performed according to the relevant product standards. If values declared by the manufacturer are not available, then default values are given in informative Annex B.

Required technical data for this calculation procedure are listed in Table 5.

Table 5 — Product technical input data list

Characteristics	Symbol	Catalogue unit	Computed Unit	Validity interval	Ref.	Varying
control variation of temperature	$\Delta\theta_{ctr}$	K	K	−5..5	6.4.2	No
temperature variation based on control, not certified products	$\Delta\theta_{ctr,1}$	K	K	−5…+5	6.4.2	No
temperature variation based on control, certified products	$\Delta\theta_{ctr,2}$	K	K	−5…+5	6.4.2	No
hysteresis of thermostatic valve	θ_H	K	K	0..1	6.4.2	No
affect of supply water temperature on TRV head sensing element	θ_W	K	K	0..1	6.4.2	No
temperature variation based on not balanced hydraulic systems	$\Delta\theta_{hydr}$	K	K	0..1	6.4.2	No
temperature variation based on intermittent controls operation system	$\Delta\theta_{im,crt}$	K	K	−5 ..+5	6.4.2	No
temperature variation based on intermittent operation of the emission system	$\Delta\theta_{im,emt}$	K	K	−5 ..+5	6.4.2	No

Characteristics	Symbol	Catalogue unit	Computed Unit	Validity interval	Ref.	Varying
temperature variation based on radiation by type of the emission system	$\Delta\theta_{rad}$	K	K	−5…+5	6.4.2	No
temperature variation based on the stratification	$\Delta\theta_{str}$	K	K	−5…+5	6.4.2	No
temperature variation based on the stratification - part of influence due to “over-temperature”	$\Delta\theta_{str,1}$	K	K	−5…+5	6.4.2	No
temperature variation based on the stratification - part of influence due to “specific heat losses via external components”	$\Delta\theta_{str,2}$	K	K	−5…+5	6.4.2	No
temperature variation based on an additional heating / cooling loss by emitters embedded in the envelope	$\Delta\theta_{emb}$	K	K	−5…+5	6.4.2	No
temperature variation based on an additional heating / cooling loss by emitters embedded in the envelope – part of influence due to the “system”	$\Delta\theta_{emb,1}$	K	K	−5…+5	6.4.2	No
temperature variation based on an additional heating / cooling loss by emitters embedded in the envelope – part of influence due to “specific heat losses via laying surfaces”	$\Delta\theta_{emb,2}$	K	K	−5…+5	6.4.2	No
temperature variation based on room automation	$\Delta\theta_{roomout}$	K	K	−5…+5	6.4.2	No
radiant factor of radiant heaters for room heights ≥ 4m	RF			0..1	6.4.2	No
room height	h_R	m	m	2..50	6.4.2	No
electrical rated power consumption of the control	P_{ctr}	W	W	0..500	6.4.4	No
electrical rated power consumption of the equipment	$P_{H,aux}$	W	W	0..500	6.4.4	No
electrical rated power consumption of the fan	P_{fan}	W	W	0..500	6.4.4	No
Design nominal useful emitter power	Φ_{Hemn}	kW	W	0…		No