SLOVENSKI STANDARD
SIST EN 15316-4-5:2018

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Energijske lastnosti stavb - Metoda za izračun energijskih zahtev in učinkovitosti sistema - 4-5. del: Sistemi za daljinsko ogrevanje in hlajenje - Moduli M3-8-5, M4-8-5, M8-8-5 in M11-8-5

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

Energetische Bewertung von Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-5: Fernwärme und Fernkälte, Modul M3-8-5, M4-8-5, M8-8-5, M11-8-5

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-5 : Réseaux de chaleur et de froid, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-5 : Réseaux de chaleur et de froid, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-5: Fernwärme und Fernkälte

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

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword

This document (EN 15316-4-5:2017) has been prepared by Technical Committee CEN/TC 228 “Heating systems and water based cooling systems in buildings”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by November 2017 and conflicting national standards shall be withdrawn at the latest by November 2017.

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

This document supersedes EN 15316-4-5:2007.

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

The revision keeps the main principles of the calculation unchanged but the structure of the document was changed. Informative content was removed to the accompanying Technical Report CEN/TR 15316-6-8. The provisions cover also other energy carriers than heat now.

For the calculation of cogeneration units additional methods have been introduced so specific electricity values can be calculated if required.

Calculation methods to determine energy source indicators like the renewable energy ratio have been added.

The main changes compared to EN 15316-4-5:2007 are:

a) informative content was removed to the accompanying Technical Report CEN/TR 15316-6-8;

b) provisions now also cover other energy carriers than heat;

c) Annex B contains a set of default values for energy flows and carriers that are specific for district heating systems and are thus not covered by the building specific standards.

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, 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.

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 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, a national annex may refer to the legal texts where national choices have been made by public authorities. Different national annexes or national data sheets are possible, for different applications.

It is expected, if the default values, choices and references to other EPB standards 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 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 15316-6-8).

EPB set of standards deal with energy performance calculation and other related aspects (like system sizing) to provide the building services considered in the EPBD.

The subjects covered by CEN/TC 228 are the following:

— design of heating systems (water based, electrical, etc.);

— installation of heating systems;

— commissioning of heating systems;

— instructions for operation, maintenance and use of heating systems;

— methods for calculation of the design heat loss and heat loads;

— methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are systems standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other European or International Standards, a.o. product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

This European Standard specifies the calculation of indicators that characterize district energy systems. The majority of district energy systems in Europe are district heating systems, but the basic principles will also be applied on other energy carriers, e.g. district cooling. The indicators are required for the calculation of the energy performance of buildings that are connected to district energy systems.

This European Standard was developed during the first EPBD mandate and the first version was published in 2007.

1 Scope

This European Standard defines the determination of energy indicators of district energy systems. District energy systems may be district heating, district cooling or other district energy carriers.

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 standard may cover a simplified and a detailed method respectively. See also Clause 2 and Tables A.1 and B.1.

Table 1 — Position of EN 15316-4-5 within the modular structure

	Overarching		Building (as such)		Technical Building Systems									
SUbmodule	**Descriptions**		**Descriptions**		**Descriptions**	**Heating**	**Cooling**	**Ventilation**	**Humidification**	**Dehumidification**	**Domestic Hot water**	**Lighting**	**Building automation and control**	**Electricity production**
sub 1		**M1**		**M2**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
1	General		General		General	15316-1					15316-1			
2	Common terms and definitions; symbols, units and subscripts		Building Energy Needs		Needs						12831-3			
3	Applications		(Free) Indoor Conditions without Systems		Maximum Load and Power	12831-1					12831-3			
4	Ways to Express Energy Performance		Ways to Express Energy Performance		Ways to Express Energy Performance	15316-1					15316-1			
5	Building categories and Building Boundaries		Heat Transfer by Transmission		Emission and control	15316-2	15316-2							
6	Building Occupancy and Operating Conditions		Heat Transfer by Infiltration and Ventilation		Distribution and control	15316-3	15316-3				15316-3			
7	Aggregation of Energy Services and Energy Carriers		Internal Heat Gains		Storage and control	15316-5					15316-5 15316-4-3			

	Overarching		Building (as such)		Technical Building Systems									
SUbmodule	**Descriptions**		**Descriptions**		**Descriptions**	**Heating**	**Cooling**	**Ventilation**	**Humidification**	**Dehumidification**	**Domestic Hot water**	**Lighting**	**Building automation and control**	**Electricity production**
sub 1		**M1**		**M2**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
8	Building zoning		Solar Heat Gains		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**			**15316-4-5**
8–6					Direct electrical heater	15316-4-8					15316-4-8			
8–7					Wind turbines									15316-4-10
8–8					Radiant heating, stoves	15316-4-8								
9	Calculated Energy Performance		Building Dynamics (thermal mass)		Load dispatching and operating conditions									
10	Measured Energy Performance		Measured Energy Performance		Measured Energy Performance	15378-3					15378-3			
11	Inspection		Inspection		Inspection	15378-1					15378-1			
12	Ways to Express Indoor Comfort			–	BMS									
13	External Environment Conditions													
14	Economic Calculation	15459-1												

[a] The shaded modules are not applicable.

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

NOTE Default references to EPB standards other than ISO 52000-1 are identified by the EPB module code number and given in Annex A (normative template) and Annex B (informative default choice).

EXAMPLE EPB module code number: M5–5, or M5–5.1 (if module M5–5 is subdivided), or M5–5/1 (if reference to a specific clause of the standard covering M5–5).

3 Terms and definitions

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

3.1
allocation factor heat
indicator that represents the share of energy input to a CHP unit that is allocated to the CHP heat output

3.2
energy source indicator
numerical quantity that characterizes the origin of an energy carrier

3.3
multi-input generation unit
energy conversion device that is fuelled by two or more energy carriers at the same time

EXAMPLE Waste incinerator including gas-burner for ignition, coal boiler with co-firing of wood-pellets or sewage sludge, steam turbine connected to multiple boilers by a common steam header.

3.4
multi-output system
system that delivers two or more services, products or energy carriers through the system boundary

EXAMPLE A cogeneration unit with electricity as output 1 and heat as output 2, a production process with a product as output 1 and waste heat as output 2, a production process with a product as output 1 and a residual fuel as output 2.

3.5
single-output system
system that delivers a single energy carrier through the system boundary

EXAMPLE Gas grid, electricity grid.

3.6
waste heat
heat that would be wasted if not used in a district heating system or heat from fuel that would be waste if not used for heat-generation

4 Symbols and subscripts

For the purposes of this document, the symbols and subscripts given in EN ISO 52000-1:2017 and the specific symbols listed in Table 2 and Table 3 apply.

Table 2 — Symbols and units

Symbol	Name of quantity	Unit
α	allocation factor	-
σ	power to heat ratio	-
CHR	cogenerated heat ratio	-
WHR	waste heat ratio	-

Table 3 — Subscripts

Subscript	Term	Subscript	Term
chp	combined heat and power	mos	multi-output system
cm	cogeneration mode	ncm	non-cogeneration mode
des	district energy system	ref	reference
mig	multi-input generation device	sos	single-output system

5 Indicators

5.1 General

This standard provides calculation rules to determine system specific indicators as well as default values that can always be used instead of calculating. System specific indicators are more accurate than default values. Using system specific values shall be preferred to using default values if the required data for a detailed calculation is available.

5.2 Output data

The output data of this standard are listed in Table 4:

Table 4 — Output data

Description	Symbol	Unit	Intended destination module
Energy performance indicators			
primary energy factor	$f_{P;des}$	-	M1–7
emission factor	$f_{CO2;des}$	-	M1–7
Energy source indicators			
renewable energy ratio	RER_{des}	-	M1–7
waste heat ratio	WHR_{des}	-	M1–7
cogenerated heat ratio	CHR_{des}	-	M1–7

The calculation methods for energy performance indicators are described in Clause 6. The calculation methods for energy source indicators are described in Clause 7.

5.3 Input data and calculation time step

All indicators of a district energy system shall be determined with the same energy data, system boundaries and time step. The calculation methods are time-step independent and valid for measured and calculated energy.

Existing schemes shall be calculated using the energy data from the last three years. If the system set-up or the fuel input mix has been changed within the last three years the calculation may be based on the energy data from at least one year. Retrofitted existing schemes and new schemes that were recently put into operation but are not yet operating according to the final operating conditions may be calculated also using the design conditions and manufacturing data.

The energy delivered by a district energy system may be the energy input to another district energy system.

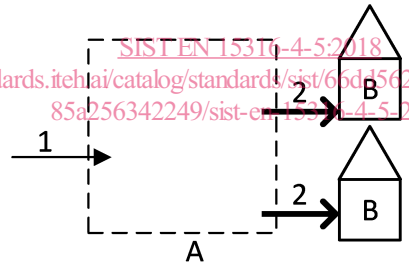
6 Calculation methods for energy performance indicators

6.1 Simplified approach

6.1.1 General

The district energy system is regarded as a black box (see Figures 1 and 2). The energy performance indicators are determined as the ratio of weighted energy input to the system and energy delivered from the system. A template for default values is given in Table A.2. Informative default values can be found in M1-7 and Table B.2.

6.1.2 Single-output district energy systems



Key

A	system boundary	1	energy input to the system E_{in}
B	energy consumer	2	energy delivered from the system E_{del}

Figure 1 — Single-output district energy system as a black box

$$f_{we;des} = \frac{\sum_{cr} E_{in;cr} \cdot f_{we;cr}}{\sum E_{del}} \quad (1)$$

where

$f_{we;des}$ weighting factor of the district energy system;

$E_{in;cr}$ energy content of input to the system of energy carrier *cr*;

$f_{we;cr}$ weighting factor of energy carrier *cr*;

E_{del} delivered energy;