
Energijske lastnosti stavb - Metoda za izračun energijskih zahtev in učinkovitosti sistema - 6-1. del: Razlaga in utemeljitev EN 15316-1 - Moduli M3-1, M3-4, M3-9, M8-1 in M8-4

Energy performance of buildings- Method for calculation of system energy requirements and system efficiencies - Part 6-1: Explanation and justification of EN 15316-1, Module M3-1, M3-4, M3-9, M8-1, M8-4

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 6-1: Begleitende TR zur EN 15316-1 (Allgemeines und Darstellung der Energieeffizienz)

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Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 1 : Explication et justification de l'EN 15316-1, Module M3-1, M3-4, M3-9, M8-1, M8-4

Ta slovenski standard je istoveten z: CEN/TR 15316-6-1:2017

ICS:

91.120.10	Toplotna izolacija stavb	Thermal insulation of buildings
91.140.10	Sistemi centralnega ogrevanja	Central heating systems

SIST-TP CEN/TR 15316-6-1:2018 **en**

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TECHNICAL REPORT

CEN/TR 15316-6-1

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

April 2017

ICS 27.160; 91.120.10; 91.140.10

English Version

Energy performance of buildings- Method for calculation
of system energy requirements and system efficiencies -
Part 6-1: Explanation and justification of EN 15316-1,
Module M3-1, M3-4, M3-9, M8-1, M8-4

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Heizungsanlagen und Wasserbasierte Kühlanlagen in
Gebäuden - Verfahren zur Berechnung der
Energieanforderungen und Nutzungsgrade der
Anlagen - Teil 6-1: Begleitende TR zur EN 15316-1
(Allgemeines und Darstellung der Energieeffizienz)

This Technical Report was approved by CEN on 27 February 2017. It has been drawn up by the Technical Committee CEN/TC 228.

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CEN/TR 15316-6-1:2017 (E)**European foreword**

This document (CEN/TR 15316-6-1:2017) 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.

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Introduction

The CENSE project, the discussions between CEN and the Concerted action highlighted the high page count of the entire package due to a lot of “textbook” information. This resulted in flooding and confusing the normative text.

In order to facilitate the necessary overall consistency and coherence, in terminology, approach, input/output relations and formats, for the whole set of EPB-standards, the following documents and tools are available:

- a) a document with basic principles to be followed in drafting EPB-standards: CEN/TS 16628:2014, Energy Performance of Buildings - Basic Principles for the set of EPB standards [1];
- b) a document with detailed technical rules to be followed in drafting EPB-standards; CEN/TS 16629:2014, Energy Performance of Buildings - Detailed Technical Rules for the set of EPB-standards [2];
- c) the detailed technical rules are the basis for the following tools:
 - 1) a common template for each EPB-standard, including specific drafting instructions for the relevant clauses;
 - 2) a common template for each technical report that accompanies an EPB standard or a cluster of EPB standards, including specific drafting instructions for the relevant clauses;
 - 3) a common template for the spreadsheet that accompanies each EPB standard, to demonstrate the correctness of the EPB calculation procedures.

Each EPB-standards follows the basic principles and the detailed technical rules and relates to the overarching EPB-standard, prEN ISO 52000-1:2015.

One of the main purposes of the revision of the EPB-standards is to enable that laws and regulations directly refer to the EPB-standards and make compliance with them compulsory. This requires that the set of EPB-standards consists of a systematic, clear, comprehensive and unambiguous set of energy performance procedures. The number of options provided is kept as low as possible, taking into account national and regional differences in climate, culture and building tradition, policy and legal frameworks (subsidiarity principle). For each option, an informative default option is provided (Annex B).

Rationale behind the EPB technical reports

There is a risk that the purpose and limitations of the EPB standards will be misunderstood, unless the background and context to their contents – and the thinking behind them – is explained in some detail to readers of the standards. Consequently, various types of informative contents are recorded and made available for users to properly understand, apply and nationally or regionally implement the EPB standards.

If this explanation would have been attempted in the standards themselves, the result is likely to be confusing and cumbersome, especially if the standards are implemented or referenced in national or regional building codes.

Therefore each EPB standard is accompanied by an informative technical report, like this one, where all informative content is collected, to ensure a clear separation between normative and informative contents (see CEN/TS 16629):

- to avoid flooding and confusing the actual normative part with informative content,

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- to reduce the page count of the actual standard, and
- to facilitate understanding of the set of EPB standards.

This was also one of the main recommendations from the European CENSE project [1] that laid the foundation for the preparation of the set of EPB standards.

Figure 1 shows the relative position of the related standard within the EPB package of standards and the position of all the other EPB standards under the responsibility of CEN/TC 228.

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
sub1		M1	sub 1	M2	sub1		M3	M4	M5	M6	M7	M8	M9	M10	M11
1	General		1	General	1	General	EN 15316-1					EN 15316-1			
2	Common terms and definitions; symbols, units and subscripts		2	Building Energy Needs	2	Needs						EN 12831-3			
3	Applications		3	(Free) Indoor Conditions without Systems	3	Maximum Load and Power	EN 12831-1					EN 12831-3			
4	Ways to Express Energy Performance		4	Ways to Express Energy Performance	4	Ways to Express Energy Performance	EN 15316-1					EN 15316-1			
5	Building Functions and Building Boundaries		5	Heat Transfer by Transmission	5	Emission and control	EN 15316-2	EN 15316-2							
6	Building Occupancy and Operating Conditions		6	Heat Transfer by Infiltration and Ventilation	6	Distribution and control	EN 15316-3	EN 15316-3				EN 15316-3			
7	Aggregation of Energy Services and Energy Carriers		7	Internal Heat Gains	7	Storage and control	EN 15316-5					EN 15316-5 EN 15316-4-3			

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	
sub1		M1	sub 1	M2	sub1	M3	M4	M5	M6	M7	M8	M9	M10	M11	
8	Building Partitioning		8	Solar Heat Gains	8	Generation									
					8-1	Combustion boilers	EN 15316-4-1				EN 15316-4-1				
					8-2	Heat pumps	EN 15316-4-2	EN 15316-4-2			EN 15316-4-2				
					8-3	Thermal solar Photovoltaics	EN 15316-4-3				EN 15316-4-3			EN 15316-4-3	
					8-4	On-site cogeneration	EN 15316-4-4				EN 15316-4-4			EN 15316-4-4	
					8-5	District heating and cooling	EN 15316-4-5	EN 15316-4-5			EN 15316-4-5			EN 15316-4-5	
					8-6	Direct electrical heater	EN 15316-4-9				EN 15316-4-9				
					8-7	Wind turbines								EN 15316-4-10	
					8-8	Radiant heating, stoves	EN 15316-4-8								

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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
sub1		M1	sub 1	M2	sub1	M3	M4	M5	M6	M7	M8	M9	M10	M11
9	Calculated Energy Performance		9	Building Dynamics (thermal mass)	9	Load dispatching and operating conditions	EN 15316-1							
10	Measured Energy Performance		10	Measured Energy Performance	10	Measured Energy Performance	EN 15378-3				EN 15378-3			
11	Inspection		11	Inspection	11	Inspection	EN 15378-1				EN 15378-1			
12	Ways to Express Indoor Comfort		12	-	12	BMS								
13	External Environment Conditions													
14	Economic Calculation	EN 15459-1												

Figure 1 — Position of EN 15316-1 within the EPB set of standards

Table 1 associates the title of the EN EPB standards to the numbers and modules. It also remembers the replaced standards.

Table 1 — List of EN EPB standards related to the calculation of space heating and domestic hot water systems

No.	Module	New EPBD numbering	Old standards replaced	Title of the new EPBD standard
1	M1-14	EN 15459-1	EN 15459	Heating systems and water based cooling systems in buildings — Energy performance of buildings — Part 1: Economic evaluation procedure for energy systems in buildings
		TR 15459-2	New	Accompanying TR to EN 15459-1 (Economic evaluation procedure for energy systems in buildings)
2	M3-11 M8-11	EN 15378-1	EN 15378	Heating systems and water based cooling systems in buildings — Heating systems and DHW in buildings — Part 1: Inspection of boilers, heating systems and DHW
		TR 15378-2	New	Accompanying TR to EN 15378-1 (Inspection of boilers, heating systems and DHW)
3	M3-10 M8-10	EN 15378-3	New	Heating systems and water based cooling systems in buildings — Heating systems and DHW in buildings — Part 3: Measured energy performance
		TR 15378-4	New	Accompanying TR to EN 15378-3 (Measured energy performance)
4	M3-3	EN 12831-1	EN 12831	Heating systems and water based cooling systems in buildings — Method for calculation of the design heat load — Part 1: Space heating load
		TR 12831-2	New	Accompanying TR for EN 12831-1 (Space heating load)
5	M8-3	EN 12831-3	EN 15316-3-1	Heating systems and water based cooling systems in buildings — Method for calculation of the design heat load — Part 3: Domestic hot water systems heat load and characterization of needs
		TR 12831-4	New	Accompanying TR to EN 12831-3 (Domestic hot water systems heat load and characterization of needs)
6	M3-1 M8-1 M3-4 M8-4 M3-9 M8-9	EN 15316-1	EN 15316-1	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General and Energy performance expression
		TR 15316-6-1	New	Accompanying TR to EN 15316-1 (General and Energy performance expression)
7	M3-5 M4-5	EN 15316-2	EN 15316-2-1	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2: Space emission systems (heating and cooling)
		TR 15316-6-2	New	Accompanying TR to EN 15316-2 (Space emission systems (heating and cooling))
8	M3-6 M4-6 M8-6	EN 15316-3	EN 15316-2-3 EN 15316-3-2	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 3: Space distribution systems (DHW, heating and cooling)
		TR 15316-6-3	New	Accompanying TR to EN 15316-3 (Space distribution systems (DHW, heating and cooling))
9	M3-8-1 M8-8-1	EN 15316-4-1	EN 15316-4-1 EN 15316-3-3 EN 15316-4-7	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-1: Space heating and DHW generation systems, combustion systems (boilers, biomass)
		TR 15316-6-4	New	Accompanying TR to EN 15316-4-1 (Space heating and DHW generation systems, combustion systems (boilers, biomass))
10	M3-8-2 M4-8-2 M8-8-2	EN 15316-4-2	EN 15316-4-2	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-2: Space heating generation systems, heat pump systems

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No.	Module	New EPBD numbering	Old standards replaced	Title of the new EPBD standard
		TR 15316-6-5	New	Accompanying TR to EN 15316-4-2 (Space heating generation systems, heat pump systems)
11	M3-8-3 M8-8-3 M11-8-3	EN 15316-4-3	EN 15316-4-3 EN 15316-4-6	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-3: Heat generation systems, thermal solar and photovoltaic systems
		TR 15316-6-6	New	Accompanying TR to EN 15316-4-3 (Heat generation systems, thermal solar and photovoltaic systems)
12	M3-8-4 M8-8-4 M11-8-4 M3-7/M8-7	EN 15316-4-4	EN 15316-4-4	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-4: Heat generation systems, building-integrated cogeneration systems
		TR 15316-6-7	New	Accompanying TR to EN 15316-4-4 (Heat generation systems, building-integrated cogeneration systems)
13	M3-8-5 M4-8-5 M8-8-5 M11-8-5	EN 15316-4-5	EN 15316-4-5	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-5: District heating and cooling
		TR 15316-6-8	New	Accompanying TR to EN 15316-4-5 (District heating and cooling)
14	M3-8-8	EN 15316-4-8	EN 15316-4-8	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-8: Space heating generation systems, air heating and overhead radiant heating systems, including stoves (local)
		TR 15316-6-9	New	Accompanying TR to EN 15316-4-8 (Space heating generation systems, air heating and overhead radiant heating systems, including stoves (local))
15	M3-7 M8-7	EN 15316-5	New	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 5: Space heating and DHW storage systems (not cooling)
		TR 15316-6-10	New	Accompanying TR to EN 15316-5 (Space heating and DHW storage systems (not cooling))
16	M3-8-6 M8-8-6	EN 15316-4-9	New	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-9: Direct electric generation systems
17	M11-8-7	EN 15316-4-10	New	Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4-10: Wind power generation systems

1 Scope

This Technical Report refers to standard EN 15316-1:2017, modules M3-1, M8-1, M3-4, M8-4, M3-9, M8-9.

It contains information to support the correct understanding, use and national adaptation of standard EN 15316-1:2017.

This Technical Report does not contain any normative provision.

The related standard EN 15316-1:2017 is the general frame for the calculation of the energy use and the energy performance of heating and domestic hot water systems. This standard is only dealing with the heat, provided by water based systems, needed for heating, domestic hot water and cooling (e.g. absorption chiller).

It specifies how to perform the calculation of the entire installation using the calculation modules (see Figure 1) corresponding to the methods defined in the respective standards.

It deals with common issues like operating conditions calculation and energy performance indicators.

It standardises the inputs and outputs in order to achieve a common European calculation method.

It allows the energy analysis of the heating and Domestic hot water systems and sub-systems including control (emission, distribution, storage, generation) by comparing the system losses and by defining energy performance indicators.

The performance analysis allows the comparison between systems and sub-systems and makes possible to evaluate the impact of each sub-system on the energy performance of a building.

The calculation of the system losses of each part of the heating sub-systems is defined in subsequent standards.

Ventilation systems are not included in this standard (e.g. balanced systems with heat recovery), but if the air is preheated or an air heating system is installed, the systems providing the heat to the AHU (Air Handling Unit) are covered by this standard.

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 12831-3:2017, *Heating systems and water based cooling systems in buildings — Method for calculation of the design heat load — Part 3: Domestic hot water systems heat load and characterisation of needs*

EN 15316-2:2017, *Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2: Space emission systems (heating and cooling)*

EN 15316-3:2017, *Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 3: Space distribution systems (DHW, heating and cooling)*

EN 15316-5:2017, *Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 5: Space heating and DHW storage systems (not cooling)*

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EN 15232-1:2017, *Energy performance of buildings - Part 1: Impact of Building Automation, Controls and Building Management - Modules M10-4,5,6,7,8,9,10*

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

prEN ISO 52000-1:2015, *Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures (ISO/DIS 52000-1:2015)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 7345, prEN ISO 52000-1:2015, prEN 15316-1:2014 and the following apply.

3.1**zoning**

“zones” are the results of dividing a building into a space or group of spaces with uniform properties

Note 1 to entry: Buildings may be partitioned for the following reasons:

- the evaluation boundary (e.g. building as a whole, building unit) in order to deliver different certificates,
- the building categories (e.g. occupancy patterns) or different indoor temperatures (e.g. due to different solar gains, in order to calculate the energy “needs” without the technical building systems.
- the technical building systems (e.g. heating systems, DHW systems) in order to calculate the energy “use” taking into account different operating conditions and equipment.

Note 2 to entry: As there are several “zones” the term “zone” should not be used alone. “Building zone” is the general term (see prEN ISO 52000-1:2015, 3.1.8).

Note 3 to entry: The “thermal zone” is related to the building thermal model where the “needs” and the “useful emission output” is calculated.

Note 4 to entry: The “heating system zone”, the “DHW system zone” are related to the “use”. For a better differentiation between the building envelope and the technical systems, for the technical building systems the term “zone” could be replace “area”.

Note 5 to entry: Other types of zones (area) already in the definitions of prEN ISO 52000-1:2015 (e.g. cooling, DHW, heating, ventilation, and a list for possible zoning criteria is provided). The type of zones and their names are listed in prEN ISO 52000-1:2015.

Note 6 to entry: The building partitioning into zones has to be defined before the calculation starts.

Note 7 to entry: For simplification of the zoning the following rules are defined:

- “subdivision rules” can be defined to distribute the emission output (based on the building “needs”) to the “heating system zones” (as starting point for the calculation) ;
- “distribution rules” can be defined to distribute the “recoverable losses” of technical building systems to the heat emission output calculation.

Example 1: Emission output distribution:

One thermal zone can be divided into several heating system having different properties related to the sub-systems (different emitters, different distributions, same generation). In this case the single thermal zone may be divided in several heating system zones (e.g. emitters). The emission output is distributed to the heating system zone by using subdivision rule (e.g. per m²)

Example 2: Recoverable losses distribution:

Several thermal systems zones can be served by one domestic hot water system. The DHW recoverable losses are calculated for the two heating systems zones as a whole and distributed to them according to the distribution rule (e.g. per m²)

4 Symbols and subscripts

4.1 Symbols

For the purposes of this document some special symbols are defined in EN 15316-1:2017 Only the specific symbols are listed in EN 15316-1:2017.

4.2 Subscripts

For the purposes of this document some special subscripts are defined in EN 15316-1:2017. Only the specific subscripts are listed in EN 15316-1:2017.

5 Description of the methods

5.1 General

5.1.1 Modular structure

The heating and domestic hot water systems are modelled by sub-systems. An overview of the modules related to the different sub-systems is given in Figure 1 (Position of EN 15316-1:2017 in the modular structure).

The calculation is based on the following sub-systems for each of the space heating and domestic hot water systems:

- the emission sub-systems;
- the distribution sub-systems including nodes;
- the storage sub-systems (can be included in the generation sub-system if tested as a whole or detailed as the storage sub-system);
- the generation sub-systems (e.g. boilers, solar collectors, heat pumps, cogeneration units).

NOTE This structure is similar to the physical structure of heating systems. In a building there may be several independent heating systems.

Some of the sub-systems may be missing in a heating installation (e.g. heating systems may not include a storage)

Each sub-system calculation method includes the effect of relevant controls.

Figure 2 shows different sub-systems of of heating system.