SLOVENSKI STANDARD
SIST-TP CEN/TR 15316-6-10:2018

01-maj-2018

Energijske lastnosti stavb - Metoda za izračun energijskih zahtev in učinkovitosti sistema - 6-10. del: Razlaga in utemeljitev EN 15316-5 - Modula M3-7 in M8-7

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-10: Explanation and justification of EN 15316-5, Module M3-7, M8-7

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 6-10: Begleitende TR zur EN 15316-5 (Wärmeerzeugung für die Raumheizung und Speichersysteme für Trinkwarmwasser (keine Kühlung))

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-
b0f8b0fc0f7/sist-tp-cen-tr-15316-6-10-2018

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-10: Explanation and justification of EN 15316-5, Module M3-7, M8-7

Ta slovenski standard je istoveten z: CEN/TR 15316-6-10:2017

ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems
91.140.65	Oprema za ogrevanje vode	Water heating equipment

SIST-TP CEN/TR 15316-6-10:2018 en

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

SIST-TP CEN/TR 15316-6-10:2018

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

SIST-TP CEN/TR 15316-6-10:2018

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 15316-6-10

April 2017

ICS 91.120.10; 91.140.10; 91.140.65

English Version

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-10: Explanation and justification of EN 15316-5, Module M3-7, M8-7

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 6-10: Begleitende TR zur EN 15316-5 (Wärmeerzeugung für die Raumheizung und Speichersysteme für Trinkwarmwasser (keine Kühlung))

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

CEN members are the national standards bodies of 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 United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2017 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. CEN/TR 15316-6-10:2017 E

SIST-TP CEN/TR 15316-6-10:2018

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5e7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

SIST-TP CEN/TR 15316-6-10:2018

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

SIST-TP CEN/TR 15316-6-10:2018

European foreword

This document (CEN/TR 15316-6-10:2017) 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.

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

SIST-TP CEN/TR 15316-6-10:2018

Introduction

The set of EPB standards, technical reports and supporting tools

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

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 [2]):

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

— to reduce the page count of the actual standard, and

— to facilitate understanding of the set of EPB standards.

SIST-TP CEN/TR 15316-6-10:2018

This was also one of the main recommendations from the European CENSE project [5] that laid the foundation for the preparation of the set of EPB standards.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

SIST-TP CEN/TR 15316-6-10:2018

1 Scope

This Technical Report refers to EN 15316-5, covering module M3-7 and M8-7

It contains information to support the correct understanding, use and national adaptation of EN 15316-5.

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 15316-5:2017, *Energy performance of buildings — Method for calculation of system energy requirements and system efficiencies — Part 5: Space heating and DHW storage systems (not cooling), M3-7, M8-7*

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

For the purposes of this document, the terms and definitions given in EN ISO 7345:1995, EN ISO 52000-1:2017 and EN 15316-5:2017 apply.

4 Symbols and abbreviations

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

4.1 Symbols

For the purposes of this document, the symbols given in EN ISO 52000-1:2017 and in EN 15316-5:2017 apply.

4.2 Subscripts

For the purposes of this document, the subscripts given in EN ISO 52000-1:2017, in EN 15316-5:2017 (the accompanied EPB standard) apply.

5 Information on the method

The method calculates the thermal balance of the storage unit. This storage unit in divided, for the calculation purpose, in fixed volumes that are in stable conditions (temperature) for any time step considered.

This method covers the thermal calculation of the storage unit where the temperature is stratified, due to delay between the energy demand and the re-heat by the generation unit.

The generation unit can be located outside of the storage unit (combustion boilers, heat pump) or inside for specific cases (electric resistance for the main or for the back-up).

The temperature of any volume is the result of the energy balance for the volume considered (energy input, mass transfer, thermal losses though the envelope).

In case of multi storage unit the control system defines the priority between the storage unit (parallel mounting) or the order (serial mounting).

SIST-TP CEN/TR 15316-6-10:2018

NOTE The thermal conduction between the different calculation volumes is neglected in the calculation.

6 Method description (storage model: multi volume)

6.1 Rationale

The input data are the volume of the storage unit, standby losses at reference values (ambient temperature, set temperature) of the storage unit and information related to the type of system used to heat the storage unit (power, type –direct; – heat exchanger, location or altitude).

The information related to the scenario of use at the output is based on.

A flowchart is given in Annex A.

6.2 Time steps

Time step is typically hourly.

However, the time step could be adapted and aligned with the scenario of energy end use (tapping pattern for domestic hot water use).

6.3 Assumptions

It is assumed that the power of losses vary linearly with the difference between ambient temperature and temperature of the storage unit.

Energy is withdrawn at the beginning of the step time.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The thermal losses are considered as proportion of each of the volume used to model the storage unit. This covers cylindrical (horizontal and vertical) storage.

NOTE The value could be changed as a proportion of the external surface considered for each volume if necessary.

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-bd7f8b01c6f7/sist-tp-cen-tr-15316-6-10-2018

Dynamic effects are neglected because the temperature of the storage unit is considered as homogenous during each time step.

6.4 Number of volume to model the storage

Ideal situation is when the number of volumes used to model the storage unit is equal to the number of time step for a given period when the storage is supposed to recover its full capacity (typically 24 h period, so 24 volumes).

If the heating element (heat exchanger, electric resistance) corresponds to the position of more than 1 volume, the heating power for each of the modelled volume is made as a proportion of the sum of the volumes concerned with the location of the heating element.

The number of volume could be reduced to 1 when the temperature of the whole volume is homogenous during each step time (no stratification).

6.5 Data input

6.5.1 Volume

The volume is the declared value by the manufacturer (unit: l – litre).

6.5.2 Thermal losses

When known, the thermal losses are those provided by the manufacturer.

The thermal losses (usually expressed in kWh/24h) are transformed into thermal power losses (unit: W/K).

SIST-TP CEN/TR 15316-6-10:2018

Default values for coefficients C1, C2 ...C5 are based on data from the different products standards representing typical values for storage unit in Europe (Table 1).

$f_{sto;dis;ls}$ is a multiplying factor of the thermal losses and depends on the number of pipes connection, the type of mounting of the pipe connection including or not heat traps or other features to limit heat exchange, and type of thermal insulation of piping and valves. The range of this factor vary for 1 to 5

— $f_{sto;dis;ls}$ = 1:no thermal bridges and no fluid exchange from storage to distribution systems accounted for pipes connections. This correspond to the ideal cases where thermal losses are accounted to the distribution part

— $f_{sto;dis;ls}$ = 3: indicated in the norm be 3, not 1 and corresponds to the usual case encountered in the practice is "thermal insulation only installed on straight parts of the distribution lines, T-pieces of the lines not insulated, valves not insulated, etc. and no heat trap". In such a case, the heat losses are multiplied by 3, compared with the theoretical calculation using the lambda values of the insulation and its geometry.

Table 1 — Products standards for storage

Electrical storage water heaters	EN 60379
Solar storage	EN 12977–3
Other hot water storage tanks	EN 15332

6.5.3 Power unit

iTeh STANDARD PREVIEW

The power unit is the value declared by the manufacturer (unit: kW or W/K for heat exchanger).

(standards.iteh.ai)

The power unit(s) is allocated to the volume considered depending on its location.

NOTE The temperature control of the heating element can be addressed on any of the volume(s° used for the calculation in accordance with the technology used (direct resistance, heat exchanger from boiler, heat exchanger from solar collectors,...). Set point can be time dependent.

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/...
...sist-tp-cen-tr-15316-6-10-2018

6.5.4 Auxiliary

The auxiliary information (power, mass flow) are provided by the manufacturer (integrated auxiliaries) or from the design of the storage.

6.6 Calculation information

Main source of error is considering a lack of energy at the output of the storage unit due to:

— default in dimensioning the storage unit;

— default in the control for heating;

— calculation time step not adapted (solution could be to reduce the step time in order to divide the energy demand at the output of the storage unit.

7 Worked out examples.

7.1 Storage model with 4 volumes

7.1.1 Description

The example refers to a typical single dwelling, storage unit power with an electric resistance at the bottom of the storage unit for domestic hot water use only.

SIST-TP CEN/TR 15316-6-10:2018

The water used at the top of the storage unit (volume 4) is replaced by cold water at the bottom of the storage unit (volume 1).

No back-up system is implemented.

The energy output is calculated; in case of lake of energy the missing quantity is reported and can be supply by other generation or storage units.

The temperature is controlled in the same volume than the heating element.

This example highlights the stratification of the temperature storage unit.

7.1.2 Calculation details

Calculation details are given in Annex B.

7.1.3 Remarks and comments

The model has been validated as the results have been compared against tests using scenarios from mandate M343 (domestic hot water tapping patterns).

7.2 Storage model with single volume

7.2.1 Description

The example refers to a typical single dwelling, storage unit powered with heat exchanger for domestic hot water and heating services.

A single volume model is adapted when the storage unit is not stratified (mixing pump, frequent energy input,…).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

An integrated back-up system is here available (electric resistance).

This example highlights the control system depending on

SIST-TP CEN/TR 15316-6-10:2018
https://standards.iteh.ai/catalog/standards/sist/c447e130-c5c7-481a-b441-
b678bb6d65f0/sist-tp-cen-tr-15316-6-10-2018

— priority given for the different energy end use;

— minimum temperature(s) for energy delivery;

— set temperature(s) for control of the main energy input and for the back-up system.

7.2.2 Calculation details

Calculation details are given in Annex C.

7.2.3 Remarks and comments

8 Application range

8.1 Energy performance

No modification.

8.2 Energy certificate

No modification.

8.3 Inspection

No modification.