BS EN ISO 52017-1:2017

BSI Standards Publication

Energy performance of buildings – Sensible and latent heat loads and internal temperatures

Part 1: Generic calculation procedures

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National foreword

This British Standard is the UK implementation of EN ISO 52017-1:2017. Together with BS EN ISO 52016-1:2017, it supersedes BS EN 15265:2007, BS EN 15255:2007, BS EN ISO 13791:2012 and BS EN ISO 13792:2012, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540/2, Building performance - Moisture.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Energy performance of buildings - Sensible and latent heat loads and internal temperatures - Part 1: Generic calculation procedures (ISO 52017-1:2017)

Performance énergétique des bâtiments - Charges thermiques latentes et sensibles et températures intérieures - Partie 1: Méthodes de calcul génériques (ISO 52017-1:2017)

Energieeffiziens von Gebäuden - Fühlbare und latente Wärmelasten und Innentemperaturen - Teil 1: Allgemeine Berechnungsverfahren (ISO 52017-1:2017)

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

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European foreword

This document (EN ISO 52017-1:2017) has been prepared by Technical Committee ISO/TC 163 "Thermal performance and energy use in the built environment" in collaboration with Technical Committee CEN/TC 89 “Thermal performance of buildings and building components” the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by January 2018, and conflicting national standards shall be withdrawn at the latest by January 2018.

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

This document is part of the set of standards on the energy performance of buildings (the set of EPB standards) and has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/480, see reference [EF1] below), and supports essential requirements of EU Directive 2010/31/EC on the energy performance of buildings (EPBD, [EF2]).

In case this 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.

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

References:

[EF1] Mandate M/480, Mandate to CEN, CENELEC and ETSI for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings, in accordance with the terms set in the recast of the Directive on the energy performance of buildings (2010/31/EU) of 14th December 2010

[EF2] EPBD, Recast of the Directive on the energy performance of buildings (2010/31/EU) of 14th December 2010

[EF3] EN 15265:2007, *Energy performance of buildings — Calculation of energy needs for space heating and cooling using dynamic methods — General criteria and validation procedures*

[EF4] EN 15255:2007, *Thermal performance of buildings Sensible room cooling load calculation - General criteria and validation procedures*

Together with EN ISO 52016-1 this document supersedes EN ISO 13791:2012, EN ISO 13792:2012, EN 15255:2007 [EF3] and EN 15265:2007 [EF4].

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Endorsement notice

The text of ISO 52017-1:2017 has been approved by CEN as EN ISO 52017-1:2017 without any modification.

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Full document details: BS EN ISO 52017-1:2017

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Documents
Document Sharing Hub

Full document details: BS EN ISO 52017-1:2017

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **2**
4 Symbols and subscripts ... **3**
4.1 Symbols ... 3
4.2 Subscripts ... 4
5 Brief description of the method ... **5**
5.1 Output of the method ... 5
5.2 General description of the method ... 5
6 Calculation method ... **5**
6.1 Output data ... 5
6.2 Calculation time interval and calculation period ... 6
6.3 Input data ... 6
6.4 Calculation procedure ... 7
6.4.1 Applicable time interval ... 7
6.4.2 Assumptions ... 7
6.4.3 Calculation of relevant temperatures ... 8
6.4.4 Building zone thermal balance (sensible heat) ... 12
6.4.5 Heat transfer components ... 13
6.4.6 Building zone moisture and latent heat balance ... 22
6.4.7 Calculation steps ... 23
6.4.8 Boundary conditions ... 24
7 Quality control ... **25**
7.1 Report of the calculation ... 25
7.2 Validation cases ... 25
8 Compliance check ... **26**
Annex A (normative) **Input and method selection data sheet — Template** ... **27**
Annex B (informative) **Input and method selection data sheet — Default choices** ... **29**
Bibliography ... **31**

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Documents
Document Sharing Hub
Full document details: BS EN ISO 52017-1:2017

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

ISO 52017-1 was prepared by ISO Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 2, *Calculation methods*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 89, *Thermal performance of buildings and building components,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 52017-1 cancels and replaces ISO 13791:2012, which has been technically revised.

A list of all parts in the ISO 52017 series can be found on the ISO website.

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Document Sharing Hub
Full document details: BS EN ISO 52017-1:2017

Introduction

This document is part of a series aimed at the international harmonization of the methodology for assessing the energy performance of buildings. Throughout, this series is referred to as a "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 document, a normative template is given in Annex A to specify these choices. Informative default choices are provided in Annex B.

The main target groups for this document are architects, engineers and regulators.

Use by or for regulators: In case the document 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 Annex A) can be made available as national annex or as separate (e.g. legal) document (national data sheet).

NOTE 1 So in this case:

— the regulators will specify the choices;

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

Topics addressed in this document can be subject to public regulation. Public regulation on the same topics can override the default values in Annex B. Public regulation on the same topics can even, for certain applications, override the use of this document. 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 a national annex (e.g. NA) is recommended, containing a reference to these data sheets;

— 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 document (ISO/TR 52016-2[3]) accompanying this document.

The subset of EPB standards prepared under the responsibility of ISO/TC 163/SC 2 cover *inter alia*:

— calculation procedures on the overall energy use and energy performance of buildings;

— calculation procedures on the internal temperature in buildings (e.g. in case of no space heating or cooling);

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— indicators for partial EPB requirements related to thermal energy balance and fabric features;

— calculation methods covering the performance and thermal, hygrothermal, solar and visual characteristics of specific parts of the building and specific building elements and components, such as opaque envelope elements, ground floor, windows and facades.

ISO/TC 163/SC 2 cooperates with other TC's for the details on, e.g. appliances, technical building systems and indoor environment.

This document is intended for use by specialists to develop methods for the hourly or subhourly calculation of the internal temperatures and/or the heating, cooling and/or the humidification loads of a thermal zone in a building.

Examples of application of such methods includes the following:

a) assessing the risk of internal overheating;

b) optimizing aspects of building design (building thermal mass, solar protection, ventilation rate, etc.) to provide thermal comfort conditions;

c) assessing whether a building requires mechanical cooling;

d) assessing the energy needs for heating and cooling and for humidification and dehumidification;

e) assessing the sensible heating and cooling and humidification and dehumidification loads under system design conditions.

Criteria for building performance are not included. They can be considered at national level. This document can also be used as a reference to develop more simplified methods for the above and similar applications.

Specific calculation procedures based on the generic calculation procedures of this document are given in ISO 52016-1. The specific simplifications, assumptions and boundary conditions in ISO 52016-1 are tailored to the respective application areas.

The main differences compared to ISO 13791 are the following:

— assumptions or procedures that are not relevant for the generic calculation procedures have been moved to the standard with specific application and combined with other specific assumptions and procedures, for example, specification of the convective heat transfer coefficients;

— the calculation of the operative temperature is added. The solution techniques for the calculation of the operative temperature are not provided in this document, but left up to the specific application standards (e.g. ISO 52016-1);

— the heat flow rates representing the sensible heating and cooling loads and the humidification and dehumidification loads to hold a specific (temperature, moisture) set point are added to the formulae. This widens the application range of the generic calculation procedures without adding complexity. The solution techniques for the calculation of these loads are not provided in this standard, but left up to the specific application standards (e.g. ISO 52016-1), because this is highly application dependent;

— the validation cases have been removed, because there is no need to validate the implementation of the generic calculation method itself. Conformance criteria and deviation allowances highly depend on the application area. Moreover, the reference results of the main validation cases of ISO 13791[1] were questioned and could not be reproduced. Instead, the "BESTEST" test suite, standardized as ANSI/ASHRAE 140[9], comprises a number of test cases that are appropriate for (optional) validation of the calculation methods described in this document. The relevant subset of BESTEST cases is similar to the test cases of ISO 13791. The most relevant BESTEST cases have been adopted in ISO 52016-1 for verification of the specific calculation procedures of that standard.

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Relevant editorial changes have been made, based on the detailed technical rules for all EPB standards, including moving all (still relevant) informative annexes to a separate accompanying technical report (ISO/TR 52016-2[3]).

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

NOTE In ISO/TR 52000-2[6], 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.

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 document (in casu M2–2, M2–3, M3–3, M4–3, M6–3, M7–3), within the modular structure of the set of EPB standards

	Overarching		Building (as such)		Technical building systems									
Sub-module	Descriptions		Descriptions		Descriptions	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic hot water	Lighting	Building automation and control	PV, wind ,...
sub1		M1		M2		M3	M4	M5	M6	M7	M8	M9	M10	M11
1	General		General		General									
2	Common terms and definitions; symbols, units and subscripts		Building energy needs	ISO 52017-1	Needs								a	
3	Applications		(Free) Indoor conditions without systems	ISO 52017-1	Maximum load and power	ISO 52017-1	ISO 52017-1		ISO 52017-1	ISO 52017-1				
4	Ways to express energy performance		Ways to express energy performance		Ways to express energy performance									

a The shaded modules are not applicable

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	Overarching		Building (as such)		Technical building systems									
Sub-module	**Descriptions**		**Descriptions**		**Descriptions**	**Heating**	**Cooling**	**Ventilation**	**Humidification**	**Dehumidification**	**Domestic hot water**	**Lighting**	**Building automation and control**	**PV, wind ,..**
sub1		**M1**		**M2**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
5	Building categories and building boundaries		Heat transfer by transmission		Emission and control									
6	Building occupancy and operating conditions		Heat transfer by infiltration and ventilation		Distribution and control									
7	Aggregation of energy services and energy carriers		Internal heat gains		Storage and control									
8	Building zoning		Solar heat gains		Generation and control									
9	Calculated energy performance		Building dynamics (thermal mass)		Load dispatching and operating conditions									
10	Measured energy performance		Measured energy performance		Measured energy performance									

[a] The shaded modules are not applicable

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Table 1 *(continued)*

	Overarching		Building (as such)		Technical building systems									
Sub-module	**Descriptions**		**Descriptions**		**Descriptions**	**Heating**	**Cooling**	**Ventilation**	**Humidification**	**Dehumidification**	**Domestic hot water**	**Lighting**	**Building automation and control**	**PV, wind ,..**
sub1		**M1**		**M2**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
11	Inspection		Inspection		Inspection									
12	Ways to express indoor comfort				BMS									
13	External environment conditions													
14	Economic calculation													

[a] The shaded modules are not applicable

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Energy performance of buildings — Sensible and latent heat loads and internal temperatures —

Part 1: Generic calculation procedures

1 Scope

This document specifies the general assumptions, boundary conditions and equations for the calculation, under transient hourly or subhourly conditions, of the internal temperatures (air and operative) and/or the heating, cooling and humidification and dehumidification loads to hold a specific (temperature, moisture) set point, in a single building zone. No specific numerical techniques are imposed by this document.

Specific calculation procedures based on the generic calculation procedures of this document are given in ISO 52016-1. The specific simplifications, assumptions and boundary conditions in ISO 52016-1 are tailored to the respective application areas, such as the energy need for heating and cooling and for humidification and dehumidification, hourly internal temperature, design heating and cooling and humidification and dehumidification load.

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

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.

ISO 7345, *Thermal insulation — Physical quantities and definitions*

ISO 13370, *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

ISO 52000-1:2017, *Energy performance of building — Overarching EPB assessment — Part 1: General framework and procedures*

ISO 52010-1, *Energy performance of buildings — External climatic conditions — Part 1: Conversion of climatic data for energy calculations*

ISO 52016-1, *Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures*

NOTE 1 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 in Table A.1) and Annex B (informative default choice in Table B.1).

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).

NOTE 2 In this document, there are no choices in references to other EPB standards. The sentence and note above is kept to maintain uniformity between all EPB standards.

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