BSI Standards Publication

Energy performance of buildings - External climatic conditions

Part 2: Explanation and justification of ISO 52010-1 (ISO/TR 52010-2:2017)

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National foreword

This Published Document is the UK implementation of CEN ISO/TR 52010-2:2017. It is identical to ISO/TR 52010-2:2017.

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

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European foreword

This document (CEN ISO/TR 52010-2:2017) 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.

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 and accompanying technical reports on the energy performance of buildings 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 [EF3] below).

Directive 2010/31/EU recasting the Directive 2002/91/EC on energy performance of buildings (EPBD, [EF4]) promotes the improvement of the energy performance of buildings within the European Union, taking into account all types of energy uses (heating, lighting, cooling, air conditioning, ventilation) and outdoor climatic and local conditions, as well as indoor climate requirements and cost effectiveness (Article 1).

The directive requires Member States to adopt measures and tools to achieve the prudent and rational use of energy resources. In order to achieve those goals, the EPBD requires increasing energy efficiency and the enhanced use of renewable energies in both new and existing buildings. One tool for this is the application by Member States of minimum requirements on the energy performance of new buildings and for existing buildings that are subject to major renovation, as well as for minimum performance requirements for the building envelope if energy-relevant parts are replaced or retrofitted. Other tools are energy certification of buildings, inspection of boilers and air-conditioning systems.

The use of European standards increases the accessibility, transparency and objectivity of the energy performance assessment in the Member States facilitating the comparison of best practices and supporting the internal market for construction products. The use of EPB-standards for calculating energy performance, as well as for energy performance certification and the inspection of heating systems and boilers, ventilation and air-conditioning systems will reduce costs compared to developing different standards at national level.

The first mandate to CEN to develop a set of CEN EPBD standards (M/343, [EF2]), to support the first edition of the EPBD [EF1] resulted in the successful publication of all EPBD related CEN standards in 2007-2008.

The mandate M/480 was issued to review the mandate M/343, as the recast of the EPBD raised the need to revisit the standards and reformulate and add standards so that they become on the one hand unambiguous and compatible, and on the other hand provide a clear and explicit overview of the choices, boundary conditions and input data that need to be defined at national or regional level. Such national or regional choices remain necessary, due to differences in climate, culture & building tradition, policy and legal frameworks. Consequently, the set of CEN-EPBD standards published in 2007-2008 had to be improved and expanded on the basis of the recast of the EPBD.

The EPB standards are flexible enough to allow for necessary national and regional differentiation and facilitate Member States implementation and the setting of requirements by the Member States.

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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] EPBD, Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings

[EF2] Mandate M/343, Mandate to CEN, CENELEC and ETSI for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and estimating the environmental impact, in accordance with the terms set forth in Directive 2002/91/EC; 30 January 2004

[EF3] 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

[EF4] EPBD, Recast of the Directive on the energy performance of buildings (2010/31/EU) of 14th December 2010

Endorsement notice

The text of ISO/TR 52010-2:2017 has been approved by CEN as CEN ISO/TR 52010-2:2017 without any modification.

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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/TR 52010-2 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).

A list of all parts in the ISO 52010 series can be found on the ISO website.

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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];

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 (calculation) standard, to demonstrate the correctness of the EPB calculation procedures.

Each EPB standard follows the basic principles and the detailed technical rules and relates to the overarching EPB standard, ISO 52000-1 [3].

One of the main purposes of the revision of the EPB standards has been 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.

This was also one of the main recommendations from the European CENSE project[10] that laid the foundation for the preparation of the set of EPB standards.

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This document

This document accompanies ISO 52010-1, which forms part of the set of EPB standards.

The role and the positioning of the accompanied standard in the set of EPB standards is defined in the Introduction to ISO 52010-1.

Brief articles on the subject can be found in [27] and [28].

ISO 52010-1 provides the common standard climatic data to be used as input by all EPB standards. It builds on ISO 15927-1, ISO 15927-2 and ISO 15927-4 and completes a missing link: the calculation of the distribution of solar irradiation and illuminance on a non-horizontal plane based on measured hourly solar radiation data on a horizontal surface; with or without taking into account solar shading.

Typical inputs for ISO 52010-1 are the hourly values for diffuse horizontal and direct beam solar irradiation. However, these quantities are not necessarily directly measured. In many cases, only the global horizontal irradiation is available as measured parameter, and the two components need to be calculated with a model. There are alternative models provided, open for choice at national or regional level.

For ground reflectivity often a constant value of, e.g., 0,2 is used. However, the value depends greatly on the surface conditions, and the influence on the irradiation is not negligible. Therefore, the option of providing hourly values is included. This may be especially of importance for mountain regions or for high latitudes.

For the solar shading calculation, the height and distance of each shading object are given per sector of the horizon (360 degrees). The subdivision into sectors (small or large) is open for national or regional choice. The same solar shading calculation procedure is adopted in ISO 52016-1 [5] for the calculation of the building energy needs and loads. This is especially important because if there are different shading objects in the same sector, it will not be correct to calculate the effects separately in different standards. It is up to national or regional choice to decide about the details of the solar shading calculations.

Accompanying spreadsheet

In line with the common template for all EPB standards, a spreadsheet has been prepared for demonstration and validation. This spreadsheet shows an overview of all input variables, the (step by step) hourly calculation procedures and an overview of all output variables.

This accompanying calculation spreadsheet (July 2016) provides:

— full year of hourly calculations of solar irradiance (split in components) on plane with any azimuth and tilt angle;

— validated against BESTEST cases;

— hourly calculations of solar shading by multiple shading objects along the skyline. These calculations also cover the calculation procedures for overhangs from ISO 52016-1[5].

This spreadsheet (including possible updated version) is available at www.epb.center.

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Energy performance of buildings - External climatic conditions —

Part 2: Explanation and justification of ISO 52010-1

1 Scope

This document contains information to support the correct understanding and use of ISO 52010-1.

This document does not contain any normative provision.

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/ 52010-1:2010, *Energy performance of buildings — External climatic conditions — Part 1: Conversion of climatic data for energy calculations*

NOTE More information on the use of EPB module numbers, in all EPB standards, for normative references to other EPB standards is given in ISO/TR 52000-2[4].

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 52010-1, apply.

More information on some key EPB terms and definitions is given in ISO/TR 52000-2 [4].

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Symbols and subscripts

For the purposes of this document, the symbols and subscripts given in ISO 52010-1, apply.

More information on key EPB symbols and subscripts is given in ISO/TR 52000-2[4].

5 Description of the methods

5.1 Output of the method

Beside solar radiation data, ISO 52010-1 also contains data regarding

— air temperature;

— atmospheric humidity;

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— wind speed;

— wind direction;

— longwave radiation.

The definitions and data are obtained from the ISO 15927 series regarding hygrothermal performance of buildings ([7],[8]).

The reason for passing these data via this standard is to have one single and consistent source for all EPB standards and to enable any treatment if needed for specific application. The above mentioned climatic data are not processed in this standard.

5.2 General description of the method

5.2.1 Calculation of the distribution of solar irradiance on a non-horizontal plane

It is (Torres 2006[20],) of paramount importance for HVAC (heating, ventilating and air conditioning) and photovoltaic systems designers to have suitable models requiring usually available data in order to calculate the irradiance on the plane where conversion systems are located.

From all the models developed to fulfil this objective, the one of conversion or translation proposed by Perez et al. (1986) has been widely used, as it considers all sky conditions ranging from completely covered to clear sky (Pohlen et al., 1996[17]).

Essentially, the model is composed of three different components:

1) a geometric representation of the sky dome,

2) a parametric representation of the insolation conditions, and

3) a statistic component linking both components mentioned before (Perez et al., 1987[15]).

It is a model of anisotropic sky, where the sky dome is geometrically divided into three areas, each of them showing a constant radiance, different from the other two (see Figure 1).

These three areas are:

— isotropic diffuse (for the sky hemisphere);

— circumsolar radiation;

— horizon brightness.

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