INTERNATIONAL STANDARD

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Energy performance of buildings — Calculation of energy use for space heating and cooling

Performance énergétique des bâtiments — Calcul des besoins d'énergie pour le chauffage et le refroidissement des locaux

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13790 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 2, *Calculation methods*, in cooperation with CEN/TC 89, *Thermal performance of buildings and building components*.

This second edition cancels and replaces the first edition (ISO 13790:2004), which has been technically revised. A summary of the principal changes is given below.

— Throughout, statements and equations that were true only for the heating mode have been amplified to accommodate both heating and cooling modes.

— Throughout, all texts that applied only for monthly or seasonal calculations have been amplified to accommodate hourly as well as monthly and seasonal calculations.

— The structure has been adapted to maximize the common use of procedures, conditions and input data, irrespective of the calculation method.

— A monthly (and seasonal) method for cooling, similar to the method in the first edition for heating, has been added.

— A simple hourly method for heating and cooling, to facilitate direct introduction of hourly, daily or weekly patterns (e.g. controls, user behaviour), has been added.

— For dynamic simulation methods, procedures that are consistent with the boundary conditions and input data for the seasonal, monthly and simple hourly methods have been added for the boundary conditions and input data.

— The whole document has been scrutinized to check its applicability within the context of building regulations, which require a minimum of ambiguities and subjective choices; where needed, possibilities are offered for national choices as given in national annexes, national building codes or national standards referring to this document, depending on the purpose/application of the calculations as detailed in this list and on the type or complexity of the building.

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Introduction

This standard provides the means (in part) to assess the contribution that building products and services make to energy conservation and to the overall energy performance of buildings.

This International Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/343), and supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD[26]). It forms part of a series of standards aimed at European harmonization of the methodology for the calculation of the energy performance of buildings. An overview of the whole set of standards to support the EPBD is given in CEN/TR 15615 [28]. See also Annex A.

This International Standard is one of a series of calculation methods for the design and evaluation of thermal and energy performance of buildings. It presents a coherent set of calculation methods at different levels of detail, for the energy use for the space heating and cooling of a building, and the influence of the recoverable thermal losses of technical buildings systems such as the heating and cooling system.

In combination with other energy performance-related standards (see Figure 1, which gives an outline of the calculation procedure and its links with other energy performance-related standards), this International Standard can be used for the following applications:

a) judging compliance with regulations expressed in terms of energy targets (via the design rating; see Annex A);

b) comparing the energy performance of various design alternatives for a planned building;

c) displaying a standardized level of energy performance of existing buildings (the standard calculated rating; see Annex A);

d) assessing the effect of possible energy conservation measures on an existing building, by calculation of the energy use with and without the energy conservation measure, see Annex A;

e) predicting future energy resource needs on a regional, national or international scale, by calculating the energy use of typical buildings representative of the building stock.

References are made to other International Standards or to national documents for input data and detailed calculation procedures not provided by this International Standard.

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The main inputs needed for this International Standard are the following:

— transmission and ventilation properties;

— heat gains from internal heat sources, solar properties;

— climate data;

— description of building and building components, systems and use;

— comfort requirements (set-point temperatures and ventilation rates);

— data related to the heating, cooling, hot water, ventilation and lighting systems:

  — partition of building into different zones for the calculation (different systems may require different zones);

  — energy losses dissipated and recoverable or recovered in the building (internal heat gains, recovery of ventilation heat loss);

  — airflow rate and temperature of ventilation supply air (if centrally pre-heated or pre-cooled) and associated energy use for air circulation and pre-heating or pre-cooling;

  — controls.

The main outputs of this International Standard are the following:

— annual energy needs for space heating and cooling;

— annual energy use for space heating and cooling;

— length of heating and cooling season (for system running hours) affecting the energy use and auxiliary energy of season-length-dependent technical building systems for heating, cooling and ventilation.

Additional outputs are the following:

— monthly values of energy needs and energy use (informative);

— monthly values of main elements in the energy balance, e.g. transmission, ventilation, internal heat gains, solar heat;

— contribution of passive solar gains;

— system losses (from heating, cooling, hot water, ventilation and lighting systems), recovered in the building.

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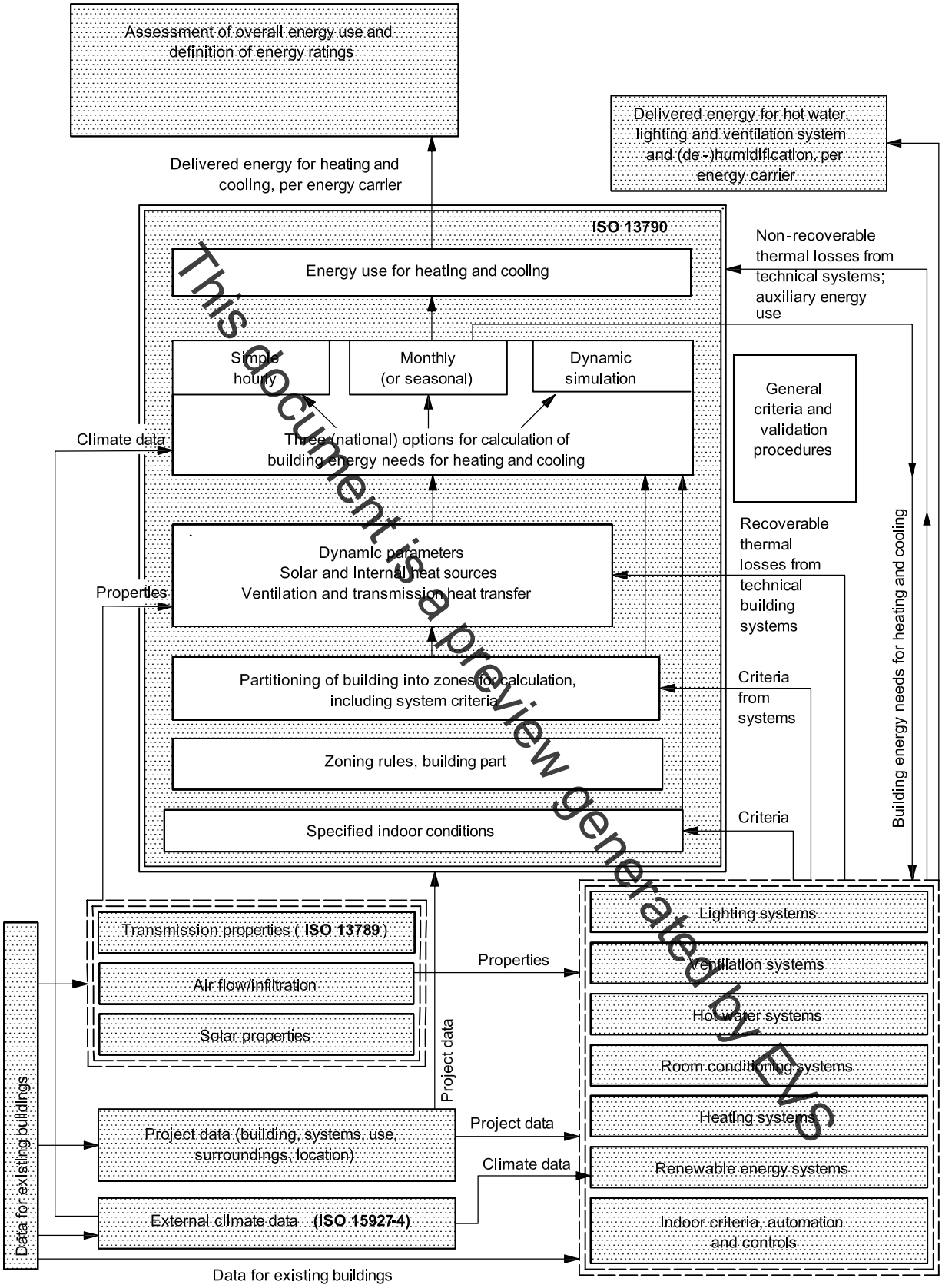

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Figure 1 — Flow chart of calculation procedure and links with other standards

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Energy performance of buildings — Calculation of energy use for space heating and cooling

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1 Scope

This International Standard gives calculation methods for assessment of the annual energy use for space heating and cooling of a residential or a non-residential building, or a part of it, referred to as “the building”.

This method includes the calculation of:

a) the heat transfer by transmission and ventilation of the building zone when heated or cooled to constant internal temperature;

b) the contribution of internal and solar heat gains to the building heat balance;

c) the annual energy needs for heating and cooling, to maintain the specified set-point temperatures in the building – latent heat not included;

d) the annual energy use for heating and cooling of the building, using input from the relevant system standards referred to in this International Standard and specified in Annex A.

The building can have several zones with different set-point temperatures, and can have intermittent heating and cooling.

The calculation interval is either one month or one hour. For residential buildings, the calculation can also be performed on the basis of the heating and/or cooling season.

This International Standard also gives an alternative simple hourly method, using hourly user schedules (such as temperature set-points, ventilation modes or operation schedules of movable solar shading).

Procedures are given for the use of more detailed simulation methods to ensure compatibility and consistency between the application and results of the different types of method. This International Standard provides, for instance, common rules for the boundary conditions and physical input data, irrespective of the calculation approach chosen.

Special attention has been given to the suitability of this International Standard for use within the context of national or regional building regulations. This includes the calculation of an energy performance rating of a building, on the basis of standardized conditions, for an energy performance certificate. The result can have legal implications, in particular when it is used to judge compliance with minimum energy performance levels, which can, for instance, be required to obtain a building permit. For such applications, it is important that the calculation procedures be unambiguous, repeatable and verifiable. A special situation is the calculation of the energy performance in the case of old existing buildings, if gathering the full required input would be too labour-intensive for the purpose, relative to the cost-effectiveness of gathering the input. In this case, it is important that the calculation procedures provide the right balance between accuracy and data collection costs. To accommodate the application for these and other situations, this International Standard offers different choices. It is up to national bodies whether or not to choose a specific option for mandatory use, e.g. depending on the region in the country, the type of building and its use, and on the purpose of the assessment.

Annex H provides some information on the accuracy of the method.

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This International Standard has been developed for buildings that are, or are assumed to be, heated and/or cooled for the thermal comfort of people, but can be used for other types of building or other types of use (e.g. industrial, agricultural, swimming pool), as long as appropriate input data are chosen and the impact of special physical conditions on the accuracy is taken into consideration.

NOTE 1 For instance, it can be used when a special model is needed but is missing.

Depending on the purpose of the calculation, it may be decided nationally to provide specific calculation rules for spaces that are dominated by process heat (e.g. indoor swimming pool, computer/server room or kitchen in a restaurant).

NOTE 2 For instance, in the case of a building energy certificate and/or building permit, e.g. by ignoring the process heat or using default process heat for certain processes (e.g. shops: freezers, lighting in shop window).

The calculation procedures in this International Standard are restricted to sensible heating and cooling. The energy use due to humidification is calculated in the relevant standard on the energy performance of ventilation systems, as specified in Annex A; similarly, the energy use due to dehumidification is calculated in the relevant standard on the energy performance of space cooling systems, as specified in Annex A.

The calculation is not used to decide whether mechanical cooling is needed.

This International Standard is applicable to buildings at the design stage and to existing buildings. The input data directly or indirectly called for by this International Standard should be available from the building files or the building itself. If this is not the case, it is explicitly stated at relevant places in this International Standard that it may be decided at national level to allow for other sources of information. In this case, the user reports which input data have been used and from which source. Normally, for the assessment of the energy performance for an energy performance certificate, a protocol is defined at national or regional level to specify the type of sources of information and the conditions when they may be applied instead of the full required input.

2 Normative references

The following referenced documents are indispensable for the application 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 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

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

ISO 10077-1, *Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General*

ISO 13370:2007, *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

ISO 13786:2007, *Thermal performance of building components — Dynamic thermal characteristics — Calculation methods*

ISO 13789:2007, *Thermal performance of buildings — Transmission and ventilation hea transfer coefficients — Calculation method*

ISO 15927-4, *Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 4: Hourly data for assessing the annual energy use for heating and cooling*

EN 15217, *Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings*

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