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Houses — Description of performance —

Part 5: Operating energy

Constructions d'habitation — Description des performances —

Partie 5: Énergie d'exploitation

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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 15928-5 was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 15, *Performance description of houses*.

ISO 15928 consists of the following parts, under the general title *Houses — Description of perfomance*:

Part 1: Structural safety

Part 2: Structural serviceability

Part 3: Structural durability

Part 4: Fire safety

Part 5: Operating energy

Introduction

This part of ISO 15928 is one of a series of standards titled *Houses — Description of performance*. The objective of the ISO 15928 series is to identify the methods that will be used to describe the performance of houses. The ISO 15928 series is confined to buildings occupied for residential purposes that may be separated or linked horizontally, but not linked vertically, and which have their own access and do not share any common space.

Each part of ISO 15928 relates to a separate attribute. The parts of ISO 15928 do not specify levels of performance and they are not intended to replace national standards or regulations, but provide a standardized framework to be used for development of national standards and regulations consistent with World Trade Organization (WTO) requirements. The parts of ISO 15928 do not provide design methods and/or design criteria.

Based on the framework provided by the ISO 15928 series, purchasers, regulators and standards-preparers in respective countries can describe their requirements in standardized performance terms, as appropriate. Additionally, the manufacturers/providers can respond by describing the performance of their products in a similar manner.

The purpose of this part of ISO 15928 is to provide a standardized system of describing performance that can be used to specify performance requirements and performance levels, or to rate houses, in terms of operating energy.

NOTE The WTO *Agreement on technical barriers to trade*, Clause 2.8, states: "Whenever appropriate, members shall specify technical regulations based on product requirements in terms of performance, rather than design or descriptive characteristics."

Houses — Description of performance —

Part 5: Operating energy

1 Scope

This part of ISO 15928 sets out a method for describing the operating energy performance of houses. It covers user needs, provides performance descriptions and outlines evaluation processes. It includes the description of relevant parameters for external and internal climatic conditions, user functional requirements, energy used by the house and energy generated by the house.

This part of ISO 15928 is intended to be used for houses that may be separated from, or linked horizontally to, another house(s). Where houses are linked, and some sharing of services occurs, it is intended that energy usage performance may be assessed both for individual houses, as well as a group of houses that are linked together.

The ISO 15928 series is intended for use in the evaluation of the design and construction of houses and in the international trading of houses or their sub-systems.

The ISO 15928 series does not specify a level of performance and it is not intended to provide a design method and/or criteria.

NOTE Structural performance and other attributes are covered in other parts of ISO 15928.

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 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*

ISO 13790, *Energy performance of buildings — Calculation of energy use for space heating and cooling*

ISO 16818, *Building environment design — Energy efficiency — Terminology*

ISO 23045, *Building environment design — Guidelines to assess energy efficiency of new buildings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1, ISO 16818 and the following apply.

3.1
house
building occupied for residential purposes and designed as one unit (dwelling) with its own access

Note 1 to entry: The house can be a separate building, or linked horizontally with another house but not linked vertically.

Note 2 to entry: Where houses are linked, each has its own access and does not share any space in common with another.

Note 3 to entry: Where houses are linked, services including those related to energy usage and supply, heating and ventilation may be shared.

Note 4 to entry: Where houses are linked, the wall between the houses is typically designed and constructed to limit the probability of fire spread between houses.

[SOURCE: ISO 15928-2:2005, 3.1, modified]

3.2
operating energy
net energy used by heating, cooling, ventilation, hot water, lighting system and other built-in appliances (cooking facility, food storage facility, etc.), taking into account all sources of energy including renewable energy sources and co-generation

3.3
performance description
statement that identifies agents, which affect performance in a qualitative manner, and establishes how these agents affect the state of the house

3.4
user
person that a house is designed to accommodate

3.5
parameters
group of variables used to quantitatively describe performance

3.6
performance
behaviour of houses related to user needs

3.7
user needs
general statements of requirements for a house that are regarded as satisfactory by the user(s)

3.8
functionality
suitability or usefulness for a specific purpose or activity

3.9
functional requirement
functionality that is required by the user of a house

3.10
efficiency
performance at specified rating conditions

[SOURCE: ISO 16818:2008, 3.68]

3.11
thermal comfort
condition of mind derived from satisfaction with the thermal environment

Note 1 to entry: Thermal comfort is the combined thermal effect of environmental parameters including air temperature, vapour pressure, air velocity, mean radiant temperature (fixed factors) and clothing and activity level of occupants (variable factors).

[SOURCE: ISO 16813:2006, 3.28]

3.12
renewable energy
energy from a source that is not depleted by extraction, such as solar energy (thermal and photovoltaic), wind, water power, renewed biomass

[SOURCE: ISO/TR 16344:2012, 2.1.123]

3.13
non-renewable energy
energy taken from a source which is depleted by extraction (e.g. fossil fuels)

[SOURCE: ISO/TR 16344:2012, 2.1.105]

4 Operating energy performance

4.1 User needs

The operating energy of a house shall be such that the risk of the following does not exceed (or meet) a level acceptable to the user:

— not having suitable living conditions in regards to thermal comfort and functionality;

— inefficient energy use;

— use of non-renewable energy resources;

— use of renewable energy resources.

4.2 Performance description

The performance description for operating energy is the expression of the ability of the house and its parts, with an appropriate degree of reliability, to provide suitable indoor climate conditions and to fulfil the user needs on energy usage in the environment it is located over the specified design working life when subject to its intended use and expected normal climate, in terms of the probability of:

a) the occupants experiencing suitable levels of thermal comfort,

b) the adequacy of internal illumination (lighting),

c) the availability of sufficient amounts of domestic hot water,

d) the efficient operation of other built-in appliances,

e) the consumption of energy being excessive, and

f) the depletion of non-renewable energy resources being excessive

NOTE 1 Built-in appliances are appliances that are fixed in place that cannot be removed or replaced easily. Typical examples are lighting and domestic hot water, but could also include other items such as stove and refrigeration unit.

NOTE 2 For the purpose of this part of ISO 15928, durability is not considered to have a bearing on the operating energy performance of a house.

4.3 Principles for describing operating energy performance

The operating energy performance of the house can be described by the energy consumed under normal use in relation to:

a) external climatic environment of the house,

b) indoor conditions to be maintained,

c) user functional requirements, including actions resulting from the number and individual characteristics of the occupants of the house, and

d) types of the energy to be supplied and their purposes.

5 Parameters for the description of performance

5.1 Parameter for describing the external climatic environment of the house

The parameter for describing the actions and agents resulting from external climatic environment of the house is its geographical location.

NOTE For example of the type of climate related data and procedures that may be appropriate for use in describing the external environment, see ISO 13790.

5.2 Parameters for describing the indoor conditions

The parameters for describing the indoor conditions are:

a) specified range of indoor temperature,

b) specified range of indoor humidity, and

c) specified level of ventilation.

5.3 Parameters for describing the user functional requirements

The parameters for describing the user functional requirements are:

a) amount of hot water supplied at a given temperature,

b) amount and level of lighting provided,

c) relevant parameters for any other functional requirements, and

d) the number and individual characteristics of the occupants of the house.

5.4 Parameters for describing energy used

The parameter for describing the amount of energy used is the megajoule (MJ) or kilowatt hour (kW·h) (1 kW·h = 3,6 MJ) per appropriate unit of consumption (time, capita, area, volume, etc.).

5.5 Parameters for describing the energy generated by the house

The parameters for describing the energy generated from features that form an integral part of the house are the type and the ratio of that energy to the total energy consumed by the house.

6 Evaluation

6.1 General

Evaluation may be carried out by:

a) analysis,

b) testing,

c) service experience, or

d) a combination of the above.

Adequate detailed information shall be provided to allow the evaluation to be carried out.

The evaluation shall take account of the situation where the houses are linked and services relating to operating energy are shared and shall report the outcomes accordingly.

6.1.1 Analysis

Whether the energy performance criteria are satisfied can be determined by an analysis of the trial design. Analysis will involve consideration of climatic conditions and occupant characteristics, along with the activities undertaken by occupants. Analysis in regards to type(s) and amount(s) of renewable and/or non-renewable energy consumed will also be needed.

6.1.2 Testing

Testing of specific services/building elements shall incorporate a realistic representation of materials, operational conditions, and construction practices.

6.1.3 Service experience

Service experience shall comprise a sufficient number of representative performance examples in residential occupancies, exposed to similar or more severe climatic and use conditions, together with adequate documentation.

6.1.4 Combination

A combination of analysis, testing and service experience may be used for evaluation.

Where appropriate, evaluation shall be in accordance with ISO 23045.

6.2 Evaluation of the energy performance to maintain a specified indoor condition(s)

The evaluation of the operating energy performance to maintain a specified indoor condition(s) shall be carried out in accordance with the requirements of ISO 13790.

6.3 Evaluation of the energy performance of the hot water supply

The evaluation of the operating energy performance of the hot water supply shall take into account the energy loss due to the distribution system.

6.4 Evaluation of the energy performance of the lighting system

The evaluation of the operating energy performance of lighting shall take into account:

a) the utilization of natural lighting,

b) the colour and texture of interior surfaces,

c) the system of artificial lighting.

6.5 Evaluation of the energy generated by the house

The evaluation of the energy generated by the house shall take into account the types and amounts generated.

Annex A
(informative)

Commentary

A.1 General

This annex includes background information on this part of ISO 15928, guidance on its use and suggestions on good practice.

The term 'operating energy' is used to clearly distinguish it from 'embodied energy', which is not discussed in this part of ISO 15928.

Details on references and documents referred to in Notes in this part of ISO 15928 and in this annex are provided in a Bibliography at the end of the document.

A.2 Comments on Scope (Clause 1)

The purpose of this part of ISO 15928 is to standardize the method of describing the operating energy performance for housing – i.e. to standardize the parameters by which the operating energy aspects of house performance are expressed or defined. This part of ISO 15928 does not specify a level of performance and it is not intended to provide design method and/or criteria.

It is one part of a series of ISO standards designed to facilitate the communication between the specifier (buyer/user) and the provider (seller). Structural safety, serviceability, durability and fire safety attributes are covered in other parts of ISO 15928.

The intent is to provide a standardized system that is to be used to realize performance description.

The objectives of this part of ISO 15928 are as follows:

a) To facilitate international trade in housing systems and housing products and to exchange housing information and knowledge by eliminating technical barriers.

b) To facilitate innovation in housing by providing a systematic framework for evaluation and acceptance.

c) To establish user needs related to energy consumption in specific technical engineering terms in order to facilitate communication among all stakeholders.

This part of ISO 15928 may also be useful in increasing consumer product awareness and in developing quality systems for houses.

A.3 Comments on Normative references (Clause 2)

Only references relevant to building services and energy design and quoted in the text are listed here. Other useful information can be obtained from the Bibliography.

A.4 Comments on Terms and definitions (Clause 3)

In general, the adopted definitions are those given in ISO 6707-1 and ISO 16818 with regard to performance except for the terms that require further elaboration.

A.5 Comments on Operating energy performance (Clause 4)

A.5.1 Comments on User needs (4.1)

The need for evaluating operating energy performance reflects the usual concern to keep energy consumption to an acceptable level without impairing the level of thermal comfort, lighting and hot water supply. The energy consumption may vary from region to region depending on the climate. There might also be a limit on the use of certain types of energy depending on the national/regional energy policy.

The types of external sources of energy could be electricity or various forms of fuels (solid, liquid or gas). The house itself may incorporate features that will generate (renewable) energy thus reduce the reliance on non-renewable external sources.

A.5.2 Comments on Performance description (4.2)

Apart from direct energy input from the sun, the delivered energy usually includes the following types:

— electrical energy supplied to the house from the electricity grid (which could come from a number of sources);

— renewable energy generated by devices erected on the house (e.g. solar panel, wind turbine) with possible outflow of energy if supply exceeds demand;

— energy supplied to the house from other sources (e.g. coal, gas, wood, liquid fuel).

Separate reporting of energy type and consumption for thermal comfort, hot water, lighting and other appliances might be necessary. For thermal comfort, it might be necessary to report energy used for heating, cooling and ventilation separately.

A.5.3 Comments on Principles for describing operating energy performance (4.3)

To describe the operating energy performance, it is necessary to describe the factors that influence the 'demand' as well as the 'supply' sides of the issue. The external climatic conditions, the internal environment and the user functional requirements are factors on the 'demand' side. On the 'supply' side, it is necessary to nominate the types of energy to be supplied (e.g. electricity, oil, gas) since different types of energy may be used for different purposes. The house itself may also contain equipment that generates renewable energy.

The operating energy performance of a house, in this context, is therefore dependent on:

a) thermal and reflective performance of building elements such as walls, ceilings and floors with respect to the need for heating and cooling. This is in turn dependent on

   sealing performance of openings with respect to energy loss through leakage, and

   natural ventilation;

b) energy consumption of the equipment, including

   1) hot water supply,

   2) lighting system, and

   3) any other appliances that are permanently fixed to the house;

c) capability of the house to generate renewable energy.

A.6 Comments on Parameters for the description of performance (Clause 5)

A.6.1 Comments on Parameters for describing the external climatic environment of the house (5.1)

The geographic location of the house implies a variety of data that will be needed to assess energy consumption: climate data representative of a typical year for the location, the orientation of the house and the positions of the sun, overshadowing by other buildings, topography or vegetation, etc.

A.6.2 Comments on Parameters for describing the indoor conditions (5.2)

The parameters for the design will be specified by the manufacturer or user of the house taking into consideration the requirements of ISO 16813.

A.6.3 Comments on Parameters for describing the user functional requirements (5.3)

The energy used for hot water, lighting and other functional requirements is dependent on the amount of use. The performance of these systems is described by their efficiency.

A.6.4 Comments on Parameters for describing energy used (5.4)

Different units have been used to describe the energy used. The unit is the kilowatt hour (kW·h) for electricity and megajoule (MJ) for gas (1 kW·h = 3,6 MJ). The operating energy to maintain a nominated indoor climate is usually described in megajoules per year.

A.6.5 Comments on Parameters for describing the energy generated by the house (5.5)

The ratio of energy generated by the house to the total energy consumed by the house is proposed as the parameter for the convenience of the users.

A.7 Comments on Evaluation (Clause 6)

A.7.1 Comments on General (6.1)

In evaluating any design, the design should present enough detailed information to allow its evaluation in terms of meeting the objectives related to thermal comfort and energy usage, when assessed against the actions arising from the climatic conditions and occupant behaviour. The level of energy performance will be ensured by comparing the proposed design to acceptable or tolerable levels of thermal comfort and overall energy consumption. Guidance on the key elements related to building environment design and the indoor environment has been developed. See ISO 16813.

Evaluation of operating energy performance is normally carried out separately for each component of usage. The energy used to maintain a nominated indoor climate is normally calculated while the energy used for other functional requirements (hot water, lighting, etc.) is often established by testing.

A.7.2 Comments on Evaluation of the operating energy performance to maintain a nominated indoor climate (6.2)

The thermal calculation method used in the evaluation should be based on well-established models in accordance with the principles of thermodynamics and fluid mechanics.

Sources of reference data on thermal properties of building materials, insulation, etc. should be identified and be from test results or authoritative data sources.

The result of the evaluation should be presented in terms of the predicted/estimated energy consumption of the building, in MJ/m^2 of floor area per annum. Predictions/estimates for heating and cooling energy consumptions should be reported separately.

Any manipulation of the outcomes from the calculation model based on policy considerations (such as modification of results based on the floor area of the dwelling) should be clearly stated.

When comparing outcomes from different options, only evaluation results from the same calculation model (or program) should be used.

The following factors need to be taken into account.

a) Building details:

floor and footing assembly;

external walls (including foundation, if any);

roof and ceiling assembly;

glazing;

roof lights (skylights);

sealing (of doors, windows, etc.);

natural ventilation;

overshadowing by other buildings or the like.

NOTE Items 9) to 15) are to be considered where appropriate.

doors;

1) special construction elements (e.g. motorized shading device);
2) interior zoning;
3) heating equipment;
4) cooling equipment;
5) heating and cooling distribution systems;
6) control system.

b) Climate data representative of a typical year for the proposed location.

NOTE ISO 13790, in a normative annex, provides for other 'approaches' to be used in place of those described in ISO 13790, typically those that are described in national standards or other appropriate documents.

c) Operational details including:

1) internal sensible and latent heat load;
2) thermostat setting;
3) assumption about when and how heating and cooling plant is operated;
4) ventilation control;
5) heating and cooling distribution systems;
6) control system.

A.7.3 Comments on Evaluation of the operating energy performance of the hot water supply (6.3)

None

A.7.4 Comments on Evaluation of the operating energy performance of the lighting system (6.4)

Including considerations of the types of fixtures, location, number and form (e.g. incandescent, fluorescent).

A.7.5 Comments on Evaluation of the energy generated by the house

None

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