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National foreword

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Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) - Umbrella Document

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Contents

Page

Foreword

This document (CEN/TR 15615:2008) has been prepared by CEN/BT/TF 173, the secretariat of which is held by CMC.

This report refers to EU Directive 2002/91/EC of December 2002 on the Energy Performance of Buildings.

Attention is drawn to the need for observance of EU Directives transposed into national legal requirements. Existing national regulations (with or without reference to national standards) may restrict for the time being the implementation of the European standards mentioned in this report.

Introduction

Directive 2002/91/EC on the Energy Performance of Buildings (the EPBD) requires several different measures to achieve prudent and rational use of energy resources and to reduce the environmental impact of the energy use in buildings.

This is to be accomplished by increased energy efficiency in both new and existing buildings. One tool for this will be the application by Member States of minimum requirements on the energy performance of new buildings and for large existing buildings that are subject to major renovation (EPBD Articles 4, 5 and 6). Other tools will be energy certification of buildings (Article 7) and inspection of boilers and air-conditioning systems (Articles 8 and 9).

A basic requirement for measures in Articles 4, 5, 6 and 7 is the existence of a general framework for a methodology of calculation of the total energy performance of buildings, as set out in Article 3 and the Annex to the Directive.

This technical report describes the European standards (ENs) that are intended to support the EPBD by providing the calculation methods and associated material to obtain the overall energy performance of a building.

In Annex A the standards concerned are arranged in a hierarchical fashion. Section 1 lists standards concerned with overall energy performance in support of Articles 4 to 7 of the Directive. Sections 2 to 5 list the standards relating to specific aspects or modules of building energy performance which contribute to the overall calculation. The content of the individual standards is summarised in Annex B.

Annex C provides a list of definitions, and Annex D a list of principal symbols, that are used consistently in the standards. It is intended that these annexes will form the basis of a future trilingual standard covering common definitions and symbols for energy calculations.

Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD)

1 Relationship of the standards to the EPBD

1.1 Overview

The calculation methodology follows the framework set out in the Annex to the EPBD[1]. The various standards used in this process are listed in Annex A. Many of the standards deal with specific aspects of the calculation (e.g. fabric losses, air changes, energy use for lighting, system performance): these aspects are drawn together in the following items:

EN number	Content
EN 15603	Energy use, for space heating, cooling, ventilation, domestic hot water and lighting, inclusive of system losses and auxiliary energy; and definition of energy ratings
EN 15217	Ways of expressing energy performance (for the energy certificate) and ways of expressing requirements (for regulations); content and format of energy performance certificate
EN 15378	Boiler inspections
EN 15240	Air-conditioning inspections
EN ISO 13790	Energy needs for heating and cooling (taking account of losses and gains)

The main goal of these standards is to facilitate the implementation of the Directive in Member States. In consequence they do not prescribe a single definition of energy rating or the expression of energy performance, but rather give a limited number of options. Similarly the items on inspections offer various levels of inspection. It is up to national bodies to select one or more of the options given, depending on the purpose of the calculation and the type and complexity of the buildings and their services.

The four main components set out in the Directive relate to:

— calculation methodology;

— minimum energy performance requirements;

— energy performance certificate;

— inspections of boilers and air-conditioning.

Figure 1 illustrates how the standards are related to articles of the EPBD defining these requirements.

1.2 Calculation methodology

The standards providing the calculation methodology are indicated in Figure 1, either explicitly or by reference to Annex A.

The calculation methodology is used to determine the data for energy certificates. EN ISO 13790 allows for different levels of complexity:

— simplified monthly or seasonal calculation;

[1] Directive 2002/91/EC on the Energy Performance of Buildings

— simplified hourly calculation;

— detailed calculation,

which can be chosen according to relevant criteria related to the purpose of the calculation, such as new or existing buildings or type and/or complexity of the building and its services. The calculations are based on specified boundary conditions of indoor climate (EN 15251) and external climate. The simplified calculation methods are fully specified in the EN ISO 13790. The detailed calculation methods are not fully specified in EN ISO 13790, but any implementation needs to be validated according to the criteria in EN 15265 and the input and boundary conditions are to be consistent with the fully specified methods. Zoning arrangements (applicable to all calculation methods) are described in EN ISO 13790.

The characteristics of the technical building systems are included via:

— heating systems, EN 15316-1, EN 15316-2-1, EN 15316-2-3, EN 15316-4 (various parts) and EN 15377;

— cooling systems, EN 15243;

— domestic hot water, EN 15316-3 (various parts);

— ventilation, EN 15241;

— lighting, EN 15193;

— integrated building automation and controls, EN 15232.

1.3 Energy performance certificate

The indicative content of the energy performance certificate is set out in EN 15217. This standard also includes the definition of the energy performance indicator and different options for the energy performance classification.

EN 15603 provides ratings to define energy performance. The categories for the purposes of certification are:

— calculated rating, based on calculated energy use under standardised occupancy conditions[2)];

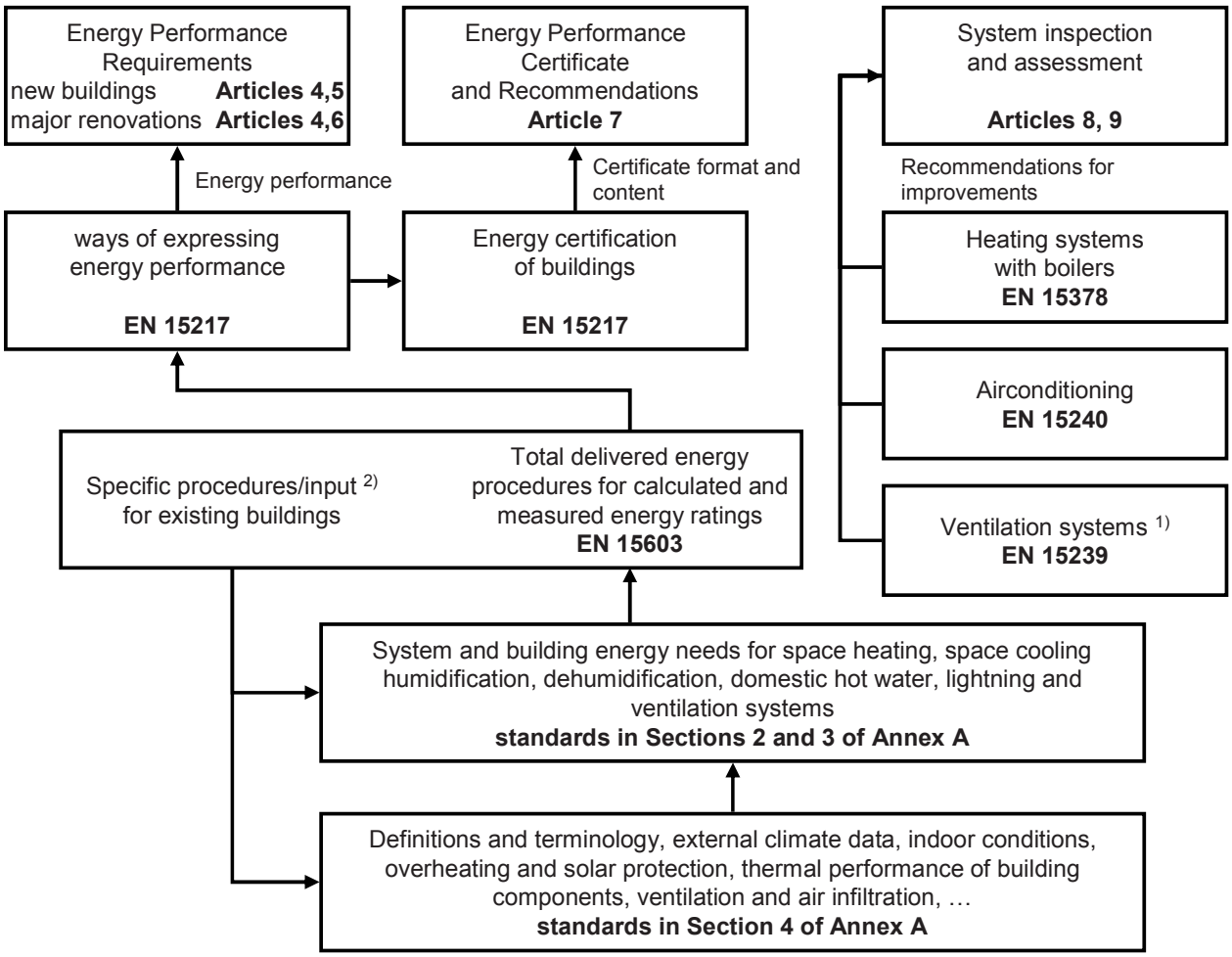
— measured rating, based on metered energy[3)].

1.4 Periodic inspections of boilers and air-conditioning systems

These standards provide guidelines for the inspection of boilers and heating systems (EN 15378), ventilation systems (EN 15239) and air-conditioning systems (EN 15240). They provide for different levels of inspection.

2) Also known as "asset rating"

3) Also known as "operational rating"



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[1] Not explicitly mentioned in the Directive

[2] Unless covered by other standards

Figure 1 – Methodology for calculating energy performance (Article 3 and Annex)

2 CEN Committees

The Technical Committees of CEN that were involved in the preparation of the standards comprise:

CEN/TC 89 Thermal performance of buildings and building components;

CEN/TC 156 Ventilation for buildings;

CEN/TC 169 Light and lighting;

CEN/TC 228 Heating systems in buildings;

CEN/TC 247 Building automation, controls and building management.

The process has been overseen by CEN/BT TF 173, Energy performance of buildings project group, which coordinated the work so as to ensure that standards prepared in different committees interface with each other in a suitable way.

3 Definitions

NOTE The definitions given here are those used within the Technical Report. A more extensive list of definitions is given in Annex C.

3.1
building
construction as a whole, including its envelope and all technical building systems, for which energy is used to condition the indoor climate, to provide domestic hot water and illumination and other services related to the use of the building

NOTE The term can refer to the building as a whole or to parts thereof that have been designed or altered to be used separately.

3.2
new building
for calculated energy rating: building at design stage or under construction
for measured energy rating: building too recently constructed to have reliable records of energy use

3.3
existing building
for calculated energy rating: building that is erected
for measured energy rating: building for which actual data necessary to assess the energy use are known or can be measured

3.4
technical building system
technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production

NOTE 1 A technical building system can refer to one or to several building services (e.g. heating system, heating and domestic hot water system).

NOTE 2 A technical building system is composed of different subsystems.

NOTE 3 Electricity production can include cogeneration and photovoltaic systems.

3.5
building automation and control
products, software, and engineering services for automatic controls, monitoring and optimization, human intervention, and management to achieve energy-efficient, economical, and safe operation of building services equipment.

3.6
auxiliary energy
electrical energy used by technical building systems for heating, cooling, ventilation and/or domestic water to support energy transformation to satisfy energy needs

NOTE 1 This includes energy for fans, pumps, electronics, etc. Electrical energy input to the ventilation system for air transport and heat recovery is not considered as auxiliary energy, but as energy use for ventilation (C.4.18).

NOTE 2 In EN ISO 9488, *Solar energy – Vocabulary*, the energy used for pumps and valves is called "parasitic energy".

3.7
cogeneration
simultaneous generation in one process of thermal energy and electrical or mechanical energy

NOTE Also known as combined heat and power (CHP).

3.8
air conditioning system
combination of all components required to provide a form of air treatment in which temperature is controlled, possibly in combination with the control of ventilation, humidity and air cleanliness

3.9
dehumidification
process of removing water vapour from air to reduce relative humidity

3.10
humidification
process of adding water vapour to air to increase relative humidity

3.11
ventilation
process of supplying or removing air by natural or mechanical means to or from any space

NOTE Such air is not required to have been conditioned.

3.12
ventilation heat recovery
heat recovered from the exhaust air to reduce the ventilation heat transfer

3.13
system thermal loss
thermal loss from a technical building system for heating, cooling, domestic hot water, humidification, dehumidification or ventilation that does not contribute to the useful output of the system

NOTE 1 A system loss can become an internal heat gain for the building if it is recoverable.

NOTE 2 Thermal energy recovered directly in the subsystem is not considered as a system thermal loss but as heat recovery and directly treated in the related system standard.

NOTE 3 Heat dissipated by the lighting system or by other services (e.g. appliances of computer equipment) is not part of the system thermal losses, but part of the internal heat gains.

3.14
recoverable system thermal loss
part of a system thermal loss which can be recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

NOTE This depends on the calculation approach chosen to calculate the recovered gains and losses (holistic or simplified approach).

3.15
recovered system thermal loss
part of the recoverable system thermal loss which has been recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

NOTE This depends on the calculation approach chosen to calculate the recovered gains and losses (holistic or simplified approach).

3.16
energy source
source from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process

NOTE Examples include oil or gas fields, coal mines, sun, forests etc.

3.17
energy carrier
substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes [ISO 13600:1997]

NOTE The energy content of fuels is given by their gross calorific value.

3.18
delivered energy
total energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (heating, cooling, ventilation, domestic hot water, lighting, appliances etc.) or to produce electricity

NOTE 1 For active solar and wind energy systems the incident solar radiation on solar panels or on solar collectors or the kinetic energy of wind is not part of the energy balance of the building. It is decided at national level whether or not renewable energy produced on site is part of the delivered energy.

NOTE 2 Delivered energy can be calculated for defined energy uses or it can be measured.

3.19
exported energy
energy, expressed per energy carrier, delivered by the technical building systems through the system boundary and used outside the system boundary

NOTE 1 It can be specified by generation types (e.g. CHP, photovoltaic, etc) in order to apply different weighting factors.

NOTE 2 Exported energy can be calculated or it can be measured.

3.20
non-renewable energy
energy taken from a source which is depleted by extraction (e.g. fossil fuels)

3.21
renewable energy
energy from a source that is not depleted by extraction, such as solar energy (thermal and photovoltaic), wind, water power, renewed biomass

NOTE In ISO 13602-1:2002 *Technical energy systems – Methods for analysis – Part 1: General*, renewable resource is defined as "natural resource for which the ratio of the creation of the natural resource to the output of that resource from nature to the technosphere is equal to or greater than one".

3.22
primary energy
energy that has not been subjected to any conversion or transformation process

NOTE 1 Primary energy includes non-renewable energy and renewable energy. If both are taken into account it can be called total primary energy.

NOTE 2 For a building, it is the energy used to produce the energy delivered to the building. It is calculated from the delivered and exported amounts of energy carriers, using conversion factors.

3.23
energy performance of a building
calculated or measured amount of weighted net delivered energy actually used or estimated to meet different needs associated with a standardised use of a building, which may include, inter alia, energy used for heating, cooling, ventilation, domestic hot water and lighting

3.24
energy rating
evaluation of the energy performance of a building based on the weighted sum of the calculated or measured use of energy carriers

3.25
calculated energy rating
energy rating based on calculations of the net delivered energy used by a building for heating, cooling, ventilation, domestic hot water and lighting

NOTE National bodies decide whether other energy uses resulting from occupants' activities such as cooking, production, laundering, etc. are included or not. If included, standard input data shall be provided for the various types of building and uses. Lighting is always included except (by decision of national bodies) for residential buildings.

3.26
standard energy rating
calculated energy rating using actual data for the building and standard use data set

NOTE 1 It represents the intrinsic annual energy use of a building under standardised conditions. This is particularly relevant to certification of standard energy performance.

NOTE 2 It can also be termed "asset energy rating".

3.27
measured energy rating
energy rating based on measured amounts of delivered and exported energy

NOTE 1 The measured rating is the weighted sum of all energy carriers used by the building, as measured by meters or other means. It is a measure of the in-use performance of the building. This is particularly relevant to certification of actual energy performance.

NOTE 2 Also known as "operational rating".

3.28
energy certificate
certificate recognised by a member state or a legal person designated by it, which includes the energy performance of a building

NOTE The meaning of the terms “certificate” and "certification" in this standard differ from that in EN 45020:2006, *Standardization and related activities – General vocabulary (ISO/IEC Guide 2:2004).*

3.29
space heating
process of heat supply for thermal comfort

3.30
space cooling
process of heat extraction for thermal comfort

3.31
heat gains
heat generated within or entering into the conditioned space from heat sources other than energy intentionally utilised for heating, cooling or domestic hot water preparation

NOTE 1 These include internal heat gains and solar heat gains. Sinks that extract heat from the building are included as gains, with a negative sign. In contrast with heat transfer, for a heat source (or sink) the difference between the temperature of the considered space and the temperature of the source is not the driving force for the heat flow.

NOTE 2 For summer conditions heat gains with a positive sign constitute extra heat load on the space.

3.32
internal heat gains
heat provided within the building by occupants (sensible metabolic heat) and by appliances such as lighting, domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation

NOTE This includes recoverable system thermal losses, if the holistic approach for the calculation of the recovered system losses is chosen.

3.33
solar heat gain
heat provided by solar radiation entering, directly or indirectly (after absorption in building elements), into the building through windows, opaque walls and roofs, or passive solar devices such as sunspaces, transparent insulation and solar walls

NOTE Active solar devices such as solar collectors are considered as part of the technical building system.

4 Overview of the calculation process

The calculation is based on the characteristics of the building and its installed equipment, as listed in the Annex to the EPBD. It is structured in three levels:

— calculation of the building energy needs for heating and cooling;

— calculation of the building delivered energy for heating and cooling, ventilation, domestic hot water and lighting;

— calculation of the overall energy performance indicators (primary energy, CO_2 emissions, etc.).

The calculation sequence is:

a) Calculate the building energy needs for heating and cooling, using applicable standards listed in Section 3 of Annex A. This part of the calculation considers only the building properties and not those of the heating/cooling system and results in the energy to be emitted by heat emitters, or energy to be extracted from the conditioned space, in order to maintain the intended internal temperature. EN ISO 13790 covers both heating and cooling. To perform this calculation, data for indoor climate requirements, internal heat gains, building properties and outdoor climatic conditions are needed, and these are obtained using the standards listed in Section 4 of Annex A. EN ISO 13790 includes guidance for partitioning a complex building into separate zones for the purposes of the calculation.

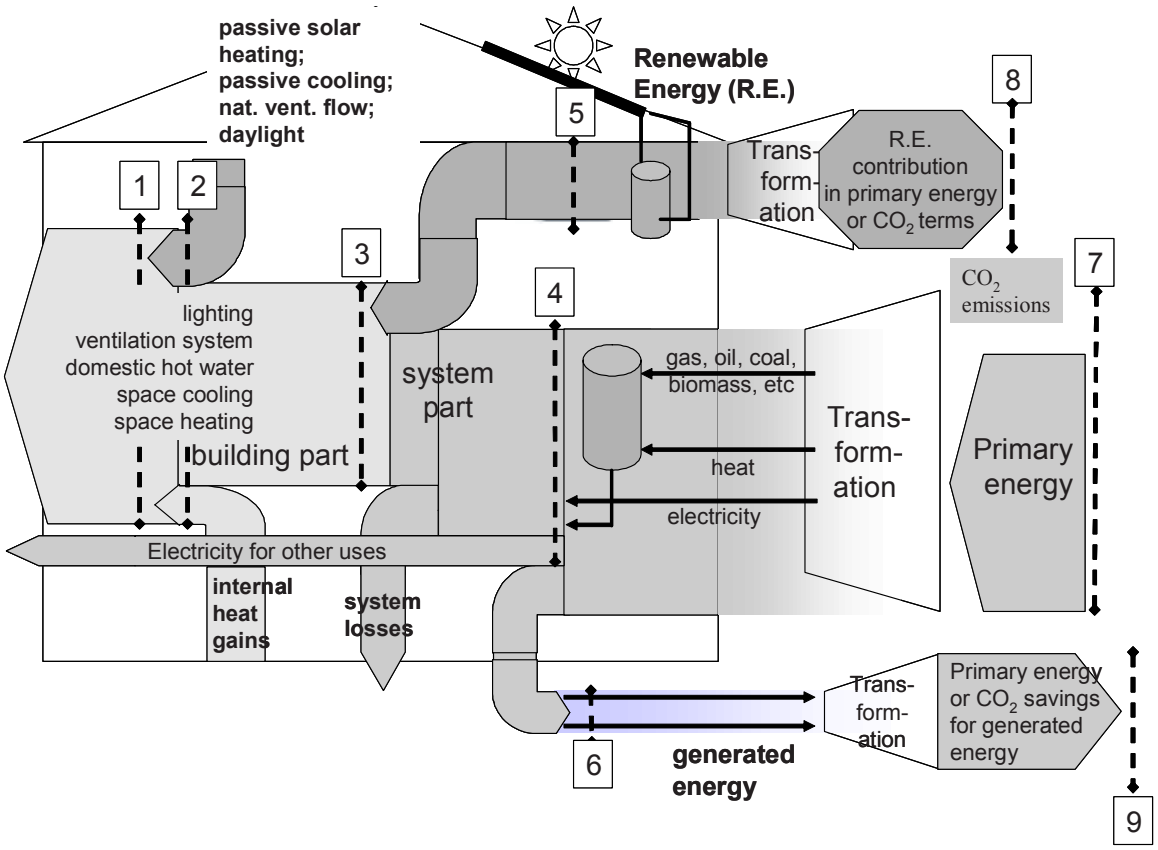
b) Take account of the characteristics of the space heating, cooling, ventilation, domestic hot water and lighting systems, inclusive of controls and building automation, to calculate the delivered energy, using standards listed in Section 2. Energy used for different purposes and by different fuels is recorded separately. The calculations take account of heat emission, distribution, storage and generation, and include the auxiliary energy needed for fans, pumps etc.

c) Combine the results from b) for different purposes and from different fuels to obtain the overall energy use and associated performance indicators, using standards listed in Section 1.

There is an interlinkage between steps a) and b) because system losses that are recovered can be counted as gains for the building part of the calculation. Two approaches are permitted:

— Holistic approach
The effect of all heat gains associated with building and its technical building systems are considered in the calculation of the energy needs for heating and cooling. When these gains cannot be predicted without knowing the heating and cooling needs, steps a) and b) may have to be iterated. In the first calculation the gains from systems are omitted in the calculation of the energy needs, in subsequent iterations they are included from the system calculations in the previous iteration.

— Simplified approach
The recovered system heat losses, obtained by multiplying the recoverable thermal system losses by a conventional recovery factor, are directly subtracted from the loss of each technical building system.



Key

[1] represents the energy needed to fulfil the user's requirements for heating, cooling, lighting etc, according to levels that are specified for the purposes of the calculation

[2] represents the "natural" energy gains – passive solar heating, passive cooling, natural ventilation, daylighting – together with internal gains (occupants, lighting, electrical equipment, etc)

[3] represents the building's energy needs, obtained from [1] and [2] along with the characteristics of the building itself

[4] represents the delivered energy, recorded separately for each energy carrier and inclusive of auxiliary energy, used by space heating, cooling, ventilation, domestic hot water and lighting systems, taking into account renewable energy sources and cogeneration. This may be expressed in energy units or in units of the energy carrier (kg, m³, kWh, etc)

[5] represents renewable energy produced on the building premises

[6] represents generated energy, produced on the premises and exported to the market; this can include part of [5]

[7] represents the primary energy usage or the CO_2 emissions associated with the building

[8] represents the primary energy or CO_2 emissions associated with on-site generation which is used on-site and thus is not subtracted from [7]

[9] represents the primary energy or CO_2 savings associated with energy exported to the market, which is thus subtracted from [7]

Figure 2 — Schematic illustration of the calculation scheme

The overall calculation process involves calculation of the energy flows starting at the end use of the energy, i.e. from the left to the right of Figure 2.

Figure 2 is a schematic illustration and is not intended to cover all possible combinations of energy supply, on-site energy production and energy use. For example, a ground-source heat pump uses both electricity and renewable energy from the ground; and electricity generated on site by photovoltaics could be used entirely within the building, or it could be exported entirely, or a combination of the two. Renewable energy carriers like biomass are included in [7], but are distinguished from non-renewable energy carriers by low CO_2 emissions. In the case of cooling, the direction of energy flow is from the building to the system.

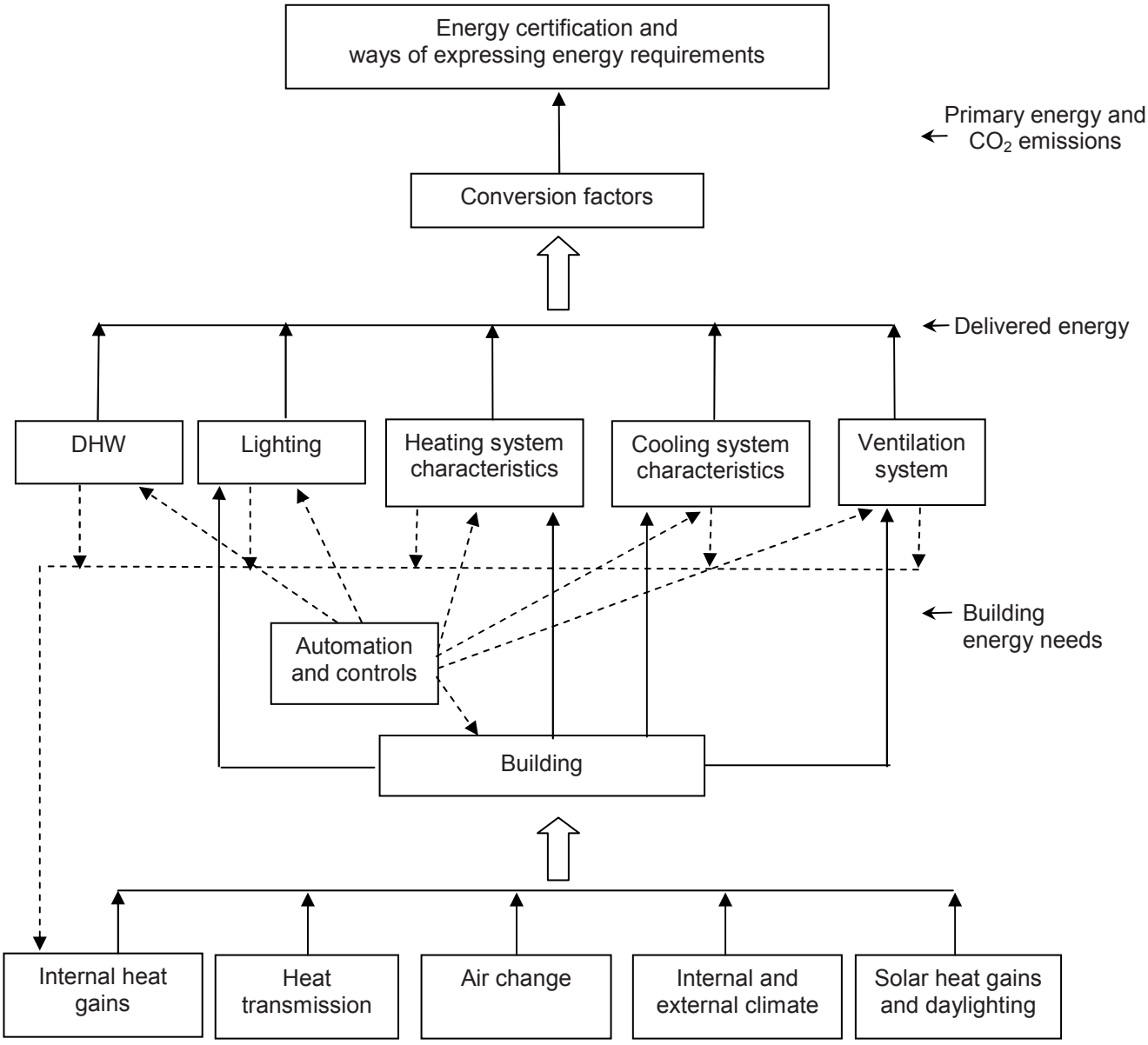


Figure 3 — Energy flows

NOTE The effect of controls that influence conditions within the building (e.g. thermostats, automatic solar protection devices) is included in the energy needs. Other aspects of controls are handled in the calculations for the systems and for the impact of building automation controls and building management.

Figure 3 shows how the energy flows are linked. The bottom row indicates the input data, comprising the building characteristics, its usage and climatic parameters. Recovered losses from systems contribute to the heat gains.

Figures 4 and 5 illustrate linkages between the standards. The arrows indicate where the results from standards feed into other standards.

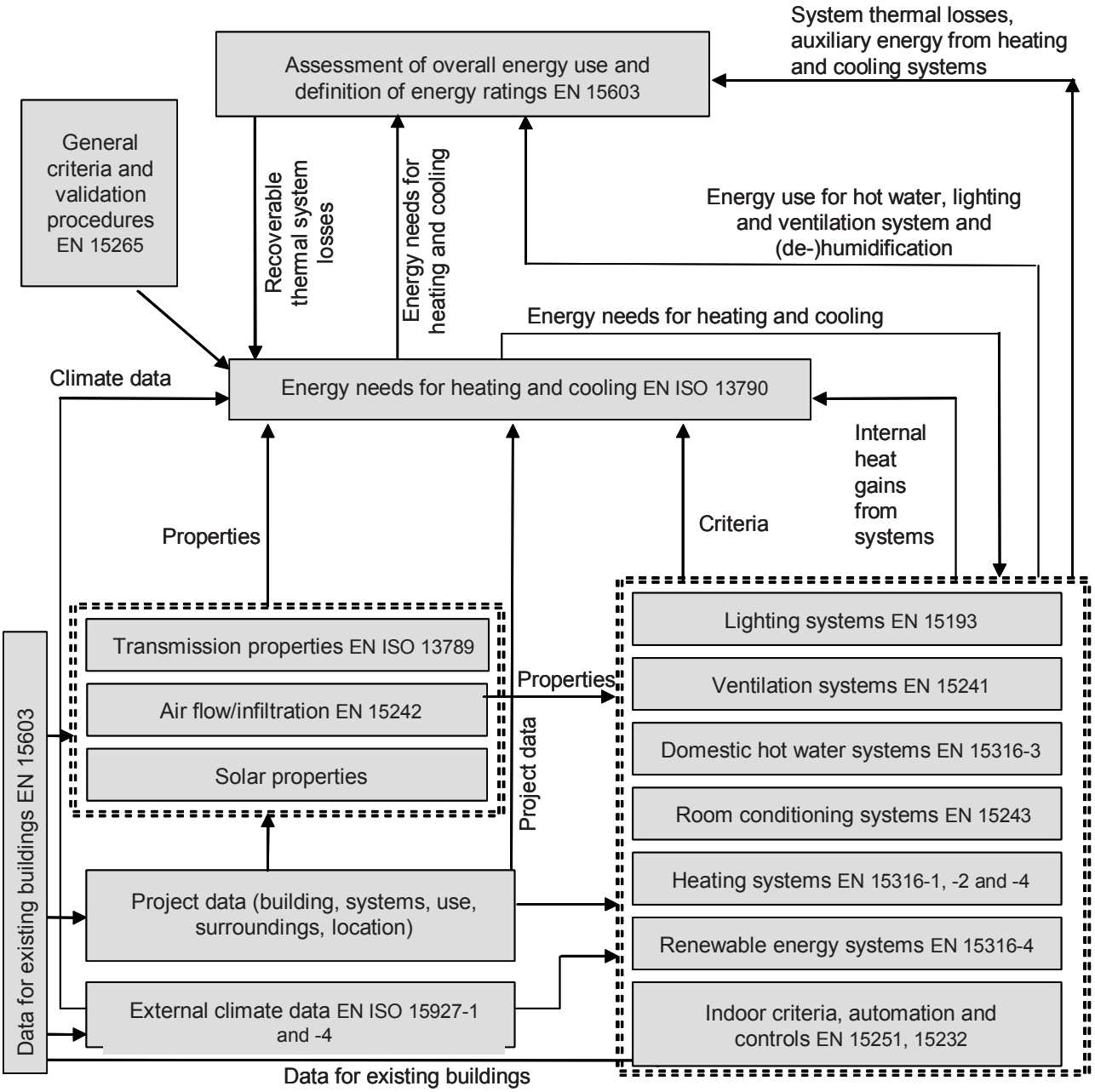


Figure 4 — Outline of linkage diagram for the building part

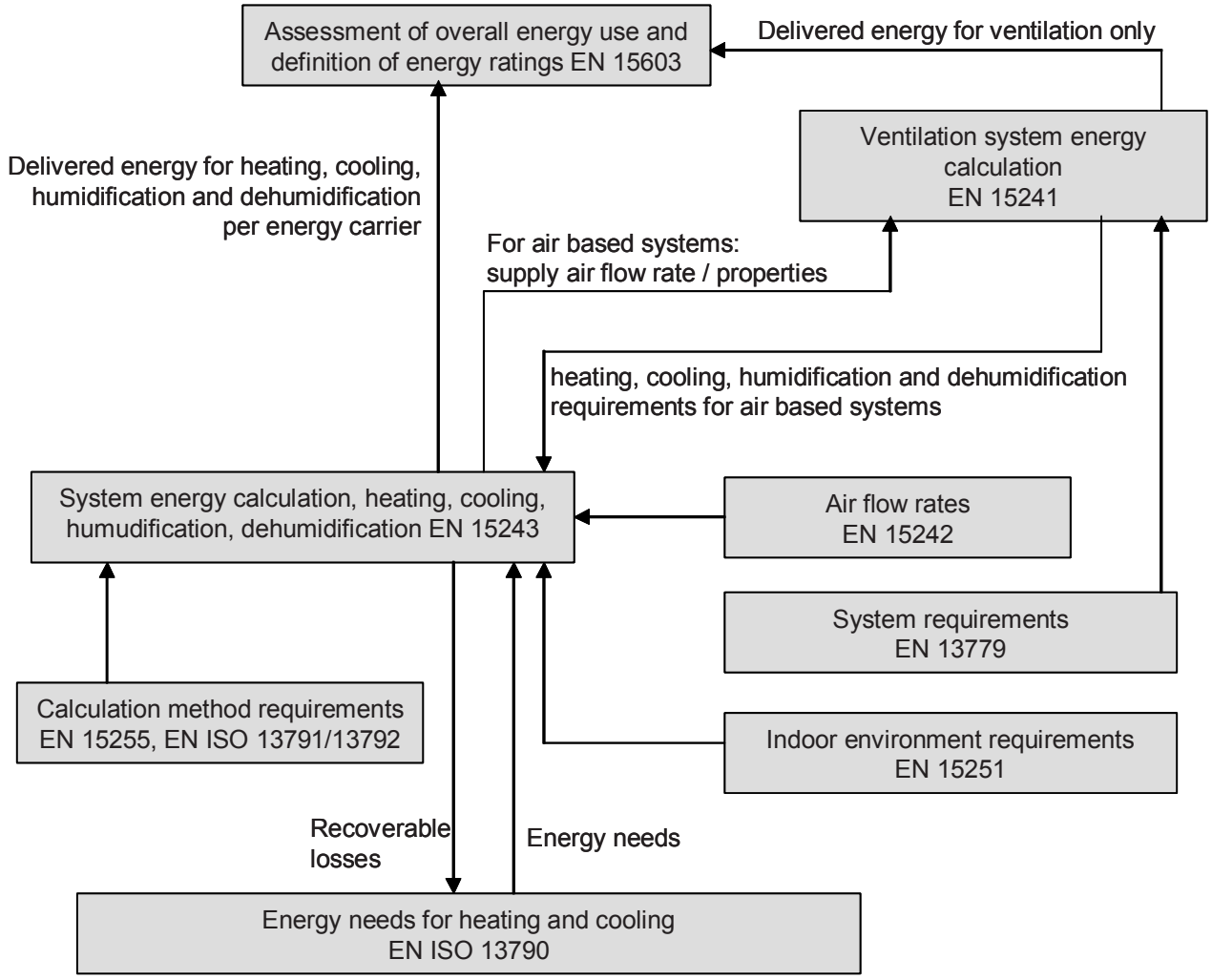


Figure 5 — Outline of linkage diagram for air conditioning systems

5 Outline of the standards

5.1 General

This describes the role of the standards as set out in Annex A.

5.2 Section 1 – Standards concerned with calculation of overall energy use in buildings

Standards in this section provide a link between delivered energy and the energy performance indicators for buildings. Since a building generally uses more than one fuel (e.g. gas and electricity), the different energy sources are collected per energy carrier. The overall rating is based on a weighted sum of delivered energy carriers. The weightings can be related to, for instance, primary energy or CO_2 emissions, to provide the end result of the calculation of energy performance (Article 3 of the Directive).

EN 15603 defines the uses of energy to be taken into account and provides methods to assess energy performance energy ratings for new and existing buildings.

EN 15217 sets out ways of expressing the energy performance in a certificate (Article 7), and ways of expressing requirements as to the energy performance (Articles 4 to 6).

EN 15459 provides a calculation method for the economic issues of heating systems and other systems that are involved in the energy demand and energy consumption of the building.

5.3 Section 2 – Standards concerned with the calculation of delivered energy

Standards in this section provide the link between the building's energy needs and delivered energy for space heating and cooling, and also the energy requirements for ventilation, domestic hot water and lighting. The uses of energy are calculated separately:

a) Space heating – EN 15316-1, EN 15316-2-1, EN 15316-2-3, the parts of EN 15316-4 (depending on the type of heating system), including losses and control aspects, and EN 15377 for embedded systems. The input to the calculation is the result from EN ISO 13790 (using either a simplified method or a dynamic simulation, see 5.4).

b) Space cooling – EN 15243, including losses and control aspects, and energy for dehumidification if applicable. The input to the calculation is the result from EN ISO 13790 (using either a simplified method or a dynamic simulation, see 5.4).

c) Domestic hot water – the parts of EN 15316-3, which include both the specification of domestic hot water requirements for different types of building, and the calculation of the energy needed to provide it.

d) Ventilation – EN 15241, energy needed to supply and extract air, based on installed fan power and controls, including energy for humidification if applicable.

e) Lighting – EN 15193, based on installed lighting power and annualised usage according to building type, occupancy and lighting controls.

f) Integrated building automation and controls – EN 15232, takes into account additional energy optimisation based on interdisciplinary control functions and applications for space heating, ventilation, cooling, domestic hot water and lighting.

All of these standards take into account renewable energy sources where appropriate.

5.4 Section 3 – Standards concerned with calculation of energy needs for heating and cooling

Standards in this section provide methods for the calculation of energy needs for heating and cooling. EN ISO 13790 defines two routes for this:

a) Simplified methods based on monthly or hourly calculations and simplified description of the building (in terms of element U-values, etc). The inputs to these calculations are obtained using the standards in Section 4.

b) Detailed numerical calculations. The detailed calculation procedure is not specified in the standard. EN 15265 provides criteria that should be followed together with tests for the validation of computer software (although the tests cover only simple cases and do not include systems).

The choice of calculation method to be applied is to be made at national level. The choice may be determined by criteria such as reproducibility (for comparability and in case of legal requirements), accuracy (in appreciating the building and system provisions and/or specific conditions) and cost effectiveness (of gathering the input). These criteria may be conflicting. For that reason the choice will typically depend on the use of the building (residential, office, etc.), the complexity of the building and/or systems, and the application (e.g. regulatory requirements, energy certification, new buildings, existing buildings).

The rules given in EN ISO 13790 for the use of different calculation methods ensure compatibility and consistency between them. The standard provides, for instance, common rules for the boundary conditions and physical input data irrespective of the chosen calculation approach.

The calculations take account of control aspects that affect the heat gains and losses of the building, such as control of internal temperature, ventilation and solar protection.

5.5 Section 4 – Supporting standards

These standards provide the input data for the calculation of energy needs by the methods in Section 3.

5.5.1 Thermal performance of building components

Section 4A includes standards for the calculation of the thermal performance of building components. The overall transmission heat loss coefficient is obtained by EN ISO 13789, which refers to other standards for the calculation of U-values. The standards for U-values fall into two groups:

a) simplified methods (EN ISO 6946, EN ISO 13370, EN ISO 10077-1, EN 13947), which can be used for components within the scope of those standards; and

b) detailed methods (EN ISO 10211, EN ISO 10077-2), which can be used as an alternative, or for cases for which there is not an applicable simplified method.

The U-value of components, including windows and doors, can alternatively be established by measurement according to test methods cited in an applicable product standard.

Thermal bridges (at junctions between elements, etc) are covered in EN ISO 10211 and EN ISO 14683.

The standards in this group also include those for obtaining thermal values of building materials (EN ISO 10456).

5.5.2 Ventilation and air infiltration

Section 4B includes standards for assessing ventilation and air flow rates. EN 15242 provides methods for calculation of air flow rates to enable the calculation of heat losses due to air exchange. EN 13779 covers mechanically ventilated buildings (including those with air conditioning).

5.5.3 Overheating and solar protection

Section 4C includes standards for estimating internal temperatures without air-conditioning, and for calculating the effect of solar protection devices. These calculations can be used to determine whether there is a need to consider air conditioning.

5.5.4 Indoor conditions and external climate

Section 4D includes standards related to indoor conditions (EN 15251) and specifications for the calculation and presentation of climatic data (EN ISO 15927).

Note The parts of EN ISO 15927 do not actually contain climatic data, but rather a specification for such data, so that data in conformance with this standard are determined and established on a consistent basis and a uniform format.

5.5.5 Definitions and terminology

Section 4E includes EN ISO 7345, EN ISO 9288, EN ISO 9251 and EN 12792, which contain definitions of terms and quantities used by other standards.

5.6 Section 5 – Standards concerned with monitoring and verification of energy performance

These standards include the determination of air leakage rates and infra-red thermography, which can be used in the verification of the energy performance of buildings.

Also included are standards on inspection of heating systems and air conditioning systems, which relate to Articles 8 and 9 of the Directive.

Annex A

Standards arranged by hierarchy

EN number	Title of standard
Section 1 — Standards concerned with calculation of overall energy use in buildings (based on results from standards in section 2)	
EN 15217	Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings
EN 15603	Energy performance of buildings — Overall energy use and definition of energy ratings
EN 15459	Energy performance of buildings — Economic evaluation procedure for energy systems in buildings
Section 2 — Standards concerned with calculation of delivered energy (based where relevant on results from standards in section 3)	
EN 15316-1	Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General
EN 15316-2-1	Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies — Part 2-1: Space heating emission systems
EN 15316-4	Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies: Part 4-1: Space heating generation systems, combustion systems, boilers Part 4-2: Space heating generation systems, heat pump systems Part 4-3: Heat generation systems, thermal solar systems Part 4-4: Heat generation systems, building-integrated cogeneration systems Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems Part 4-6: Heat generation systems, photovoltaic systems Part 4-7: Space heating generation systems, biomass combustion systems
EN 15316-2-3	Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2-3: Space heating distribution systems
EN 15316-3	Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 3-1: Domestic hot water systems, characterisation of needs (tapping requirements) Part 3-2: Domestic hot water systems, distribution Part 3-3: Domestic hot water systems, generation
EN 15243	Ventilation for buildings - Calculation of room temperatures and of load and energy for buildings with room conditioning systems
EN 15377	Heating systems in buildings — Design of embedded water based surface heating and cooling systems Part 1: Determination of the design heating and cooling capacity Part 2: Design, dimensioning and installation Part 3: Optimizing for use of renewable energy sources
EN 15241	Ventilation for buildings — Calculation methods for energy losses due to ventilation and infiltration in commercial buildings
EN 15232	Energy performance of buildings — Impact of building automation, controls and building management

EN 15193	Energy performance of buildings — Energy requirements for lighting
Section 3 — Standards concerned with calculation of energy need for heating and cooling	
EN ISO 13790	Thermal performance of buildings — Calculation of energy use for space heating (ISO 13790:2008)
EN 15255	Energy performance of buildings — Sensible room cooling load calculation — General criteria and validation procedures
EN 15265	Energy performance of buildings — Calculation of energy needs for space heating and cooling using dynamic methods — General criteria and validation procedures
Section 4A — Standards to support the above — Thermal performance of building components	
EN ISO 13789	Thermal performance of buildings — Transmission and ventilation heat transfer coefficients — Calculation method (ISO/DIS 13789:2007)
EN ISO 13786	Thermal performance of building components — Dynamic thermal characteristics — Calculation methods (ISO 13786:2007)
EN ISO 6946	Building components and building elements — Thermal resistance and thermal transmittance — Calculation method (ISO 6946:2007)
EN ISO 13370	Thermal performance of buildings — Heat transfer via the ground — Calculation methods (ISO 13370:2007)
EN 13947	Thermal performance of curtain walling — Calculation of thermal transmittance
EN ISO 10077-1	Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General (ISO 10077-1:2006)
EN ISO 10077-2	Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 2: Numerical method for frames (ISO 10077-2:2003)
EN ISO 10211	Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO/DIS 10211:2007)
EN ISO 14683	Thermal bridges in building construction — Linear thermal transmittance — Simplified methods and default values (ISO 14683:2007)
EN ISO 10456	Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO/DIS 10456:2007)
Section 4B — Standards to support the above — Ventilation and air infiltration	
EN 13465	Ventilation for buildings — Calculation methods for the determination of air flow rates in dwellings
EN 15242	Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration
EN 13779	Ventilation for non-residential buildings — Performance requirements for ventilation and room-conditioning systems
Section 4C — Standards to support the above — Overheating and solar protection	
EN ISO 13791	Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — General criteria and validation procedures (ISO 13791:2004)
EN ISO 13792	Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — Simplified methods (ISO 13792:2005)

EN 13363-1+A1	Solar protection devices combined with glazing — Calculation of solar and light transmittance — Part 1: Simplified method
EN 13363-2	Solar protection devices combined with glazing — Calculation of total solar energy transmittance and light transmittance — Part 2: Detailed calculation method
Section 4D — Standards to support the above — Indoor conditions and external climate	
CR 1752	Ventilation for buildings - Design criteria for the indoor environment
EN 15251	Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics
EN ISO 15927-1	Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 1: Monthly means of single meteorological elements (ISO 15927-1:2003)
prEN ISO 15927-2	Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 2: Hourly data for design cooling load (ISO/DIS 15927-2:2007)
prEN ISO 15927-3	Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 3: Calculation of a driving rain index for vertical surfaces from hourly wind and rain data (ISO/DIS 15927-3:2006)
EN 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 (ISO 15927-4:2005)
EN ISO 15927-5	Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 5: Data for design heat load for space heating (ISO 15927-5:2004)
EN ISO 15927-6	Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 6: Accumulated temperature differences (degree days) (ISO 15927-6:2007)
Section 4E — Standards to support the above — Definitions and terminology	
EN ISO 7345	Thermal insulation — Physical quantities and definitions (ISO 7345:1987)
EN ISO 9288	Thermal insulation — Heat transfer by radiation — Physical quantities and definitions (ISO 9288:1989)
EN ISO 9251	Thermal insulation — Heat transfer conditions and properties of materials — Vocabulary (ISO 9251:1987)
EN 12792	Ventilation for buildings — Symbols, terminology and graphical symbols
Section 5 — Standards concerned with monitoring and verification of energy performance	
EN 12599	Ventilation for buildings — Test procedures and measuring methods for handing over installed ventilation and air conditioning systems
EN 13829	Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method (ISO 9972:1996, modified)
EN ISO 12569	Thermal insulation in buildings — Determination of air change in buildings — Tracer gas dilution method (ISO 12569:2000)
EN 13187	Thermal performance of buildings — Qualitative detection of thermal irregularities in building envelopes — Infrared method (ISO 6781:1983 modified)
EN 15378	Heating systems in buildings — Inspection of boilers and heating systems
EN 15239	Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of ventilation systems
EN 15240	Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of air-conditioning systems

Annex B

Summarised content of standards, arranged by standard number

There are two tables: EN standards and EN ISO standards.

B.1 EN standards

EN	Title and Content
CR 1752	**Ventilation for buildings - Design criteria for the indoor environment** **CONTENT:** Specifies the requirements for, and the methods for expressing the quality of the indoor environment for the design, commissioning, operation and control of ventilation and air-conditioning systems. Covers indoor environments where the major concern is the human occupation, but excludes dwellings and buildings where industrial processes or similar operations requiring special conditions are undertaken.
EN 12599	**Ventilation for buildings — Test procedures and measuring methods for handing over installed ventilation and air conditioning systems** **CONTENT:** Specifies checks, test methods and measuring instruments in order to verify the fitness for purpose of the installed systems at the stage of handing over. Offers choice between simple test methods and extensive measurements. Applies to mechanically operated ventilation and air conditioning systems as specified in EN 12792 and comprising any of the following: – Air terminal devices and units – Air handling units – Air distribution systems (supply, extract, exhaust) – Fire protection devices – Automatic control devices. Does not define the procedure by which the system is set, adjusted and balanced or the procedure for internal quality control checks before handing over.
EN 12792	**Ventilation for buildings — Symbols, terminology and graphical symbols** **CONTENT:** Comprises the symbols and terminology included in the European standards covering 'Ventilation for buildings' produced by CEN/TC 156.
EN 13187	**Thermal performance of buildings — Qualitative detection of thermal irregularities in building envelopes — Infrared method (ISO 6781:1983, modified)** **CONTENT:** Specifies a qualitative method, by thermographic examination, for detecting thermal irregularities in building envelopes. The method is used initially to identify wide variations in thermal properties, including air tightness, of the components constituting the external envelopes of buildings. The results have to be interpreted and assessed by persons who are specially trained for this purpose.
EN 13363-1+A1	**Solar protection devices combined with glazing — Calculation of solar and light transmittance — Part 1: Simplified method** **CONTENT:** Specifies a simplified method based on the thermal transmittance and total solar energy transmittance of the glazing and on the light transmittance and reflectance of the solar protection device to estimate the total solar energy transmittance of a solar protection device combined with glazing. Applicable to all types of solar protection devices parallel to the glazing. Venetian or louvre blinds are assumed to be adjusted so that there is no direct solar penetration.

EN	Title and Content
EN 13363-2	**Solar protection devices combined with glazing — Calculation of total solar energy transmittance and light transmittance — Part 2: Detailed calculation method** **CONTENT:** Specifies a detailed method, based on the spectral transmission data of the materials, comprising the solar protection devices and the glazing, to determine the total solar energy transmittance and other relevant solar-optical data of the combination. Valid for all types of solar protection devices parallel to the glazing. Ventilation of the blind is allowed for in each of these positions in determining the solar energy absorbed by the glazing or blind components, for vertical orientation of the glazing.
EN 13465	**Ventilation for buildings — Calculation methods for the determination of air flow rates in dwellings** **CONTENT:** Specifies methods to calculate air flow rates for single family houses and individual apartments up to the size of approximately 1000 m³. Covers natural, mechanical extract and balanced ventilation systems. Flows due to window opening are also considered, but only as a single sided effect (i.e. no cross ventilation)..
EN 13779	**Ventilation for non-residential buildings — Performance requirements for ventilation and room-conditioning systems** **CONTENT**: Gives performance requirements for ventilation systems. Applies to the design of ventilation and room conditioning systems for non-residential buildings subject to human occupancy, excluding applications like industrial processes. (Applications for residential ventilation are dealt with in EN 14788.).
EN 13829	**Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method (ISO 9972:1996, modified)** **CONTENT:** Measurement of the air permeability of buildings or parts of buildings in the field. It specifies the use of mechanical pressurization or depressurization of a building or part of a building. It describes the measurement of the resulting air flow rates over a range of indoor-outdoor static pressure differences.
EN 13947	**Thermal performance of curtain walling — Calculation of thermal transmittance** **CONTENT:** Methods for calculating the thermal transmittance of curtain walls consisting of glazed and/or opaque panels fitted in, or connected to, frames. Detailed and simplified methods. Includes different types of glazing, frames of any material, different types of opaque panels clad with metal, glass, ceramics or any other material, thermal bridge effects at the rebate or joint between the glazed area, the frame area and the panel area.
EN 15193	**Energy performance of buildings - Energy requirements for lighting** **CONTENT:** Specifies the calculation methodology for the evaluation of the amount of energy used for lighting in the building and provides the numeric indicator for lighting energy requirements used for certification purposes. Also provides a methodology for the calculation of dynamic lighting energy use for the estimation of the total energy performance of the building.
EN 15217	**Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings** **CONTENT:** Defines: a) Global indicators to express the energy performance of whole buildings, including heating, ventilation, air conditioning, domestic hot water and lighting systems. This includes the different possible indicators as well as a method to normalize them b) Ways to express energy requirements for the design of new buildings or renovation of existing buildings c) Procedures to define reference values and benchmark d) Ways to design energy certification schemes

EN	Title and Content
EN 15232	**Calculation methods for energy efficiency improvements by the application of integrated building automation systems** **CONTENT:** Defines and specifies the performance of standardised energy saving and optimisation functions and routines of Building Automation and Control Systems (BACS) and Technical Building Management (TBM) systems and services. Summarises the methodologies to calculate/estimate the energy demand for heating, ventilation, cooling, hot water and lighting of buildings and expresses the results of energy saving and efficiency in buildings by the application of the different BACS energy saving functions.
EN 15239	**Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of ventilation systems** **CONTENT:** Gives methodology for the inspection of mechanical and natural ventilation systems in relation to its energy consumption. Applicable to all buildings. The purpose is to assess functioning and impact on energy consumption. Includes recommendations on possible system improvements.
EN 15240	**Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of air-conditioning systems** **CONTENT:** Describes the common methodology for inspection of air conditioning systems in buildings for space cooling and/or heating from an energy consumption standpoint. The purpose is to assess the energy performance and proper sizing of the system, including: conformity to the original and subsequent design modifications, actual requirements and the present state of the building; correct system functioning; function and settings of various controls; function and fitting of the various components; power input and the resulting energy output.
EN 15241	**Ventilation for buildings — Calculation methods for energy losses due to ventilation and infiltration in commercial buildings** **CONTENT:** Describes method to calculate the energy impact of ventilation systems (including airing) in buildings to be used for applications such as energy calculations, heat and cooling load calculation. Its purpose is to define how to calculate the characteristics (temperature, humidity) of the air entering the building, and the corresponding energy required for its treatment as the auxiliary electrical energy required.
EN 15242	**Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration** **CONTENT:** Describes method to calculate the ventilation air flow rates for buildings to be used for applications such as energy calculations, heat and cooling load calculation, summer comfort and indoor air quality evaluation. Applies to mechanically ventilated buildings; passive ducts; hybrid systems switching between mechanical and natural modes; window opening by manual operation for airing or summer comfort issues.
EN 15243	**Ventilation for buildings — Calculation of room temperatures and of load and energy for buildings with room conditioning systems** **CONTENT:** Defines procedures to calculate temperatures, sensible loads and energy demands for rooms; latent room cooling and heating load, the building heating, cooling, humidification and dehumidification loads and the system heating, cooling, humidification and dehumidification loads. Gives general hourly calculation method and simplified methods.
EN 15251	**Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics** **CONTENT:** Specifies the parameters of impact and/or criteria for indoor environment and how to establish indoor environmental input parameters for the building system design and energy performance calculations. Also specifies methods for long term evaluation of the obtained indoor environment as a result of calculations or measurements. Applicable mainly in the non-industrial buildings where the criteria for indoor environment are set by human occupancy and where the production or process does not have a major impact on indoor environment.

EN	Title and Content
EN 15255	**Energy performance of buildings — Sensible room cooling load calculation — General criteria and validation procedures** **CONTENT:** Sets out the level of input and output data, and prescribes the boundary conditions required for a calculation method of the sensible cooling load of a single room under constant and/or floating temperature taking into account the limit of the peak cooling load of the system. It includes a classification scheme of the calculation method and the criteria to be met by a calculation method in order to comply with this standard. The purpose is to validate calculation methods used to evaluate the maximum cooling load for equipment selection and HVAC system design; evaluate the temperature profile when the cooling capacity of the system is reduced; provide data for evaluation of the optimum possibilities for load reduction; allow analysis of partial loads as required for system design, operation and control.
EN 15265	**Energy performance of buildings — Calculation of energy needs for space heating and cooling using dynamic methods — General criteria and validation procedures** **CONTENT:** Specifies the assumptions, boundary conditions and validation tests for a calculation procedure for the annual energy use for space heating and cooling of a building (or of a part of it) where the calculations are done on an hourly basis. Does not impose any specific numerical technique. The purpose of this standard is to validate calculation methods used to describe the energy performance of each room of a building; provide energy data to be used as interface with system performance analysis (HVAC, lighting, domestic hot water, etc).
EN 15316-1	**Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General** **CONTENT:** Standardises the required inputs, the outputs and the structure of the calculation method for system energy requirements. Energy performance may be assessed either by values of the system efficiencies or by values of the system losses due to inefficiencies. Based on an analysis of the following parts of a space heating and domestic hot water system: - the emission system energy performance including control; - the distribution system energy performance including control; - the storage system energy performance including control; - the generation system energy performance including control (e.g. boilers, solar panels, heat pumps, cogeneration units).
EN 15316-2-1	**Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2-1: Space heating emission systems** **CONTENT:** Energy performance may be assessed either by values of the heat emission system performance factor or by values of the heat emission system losses due to inefficiencies. The method is based on an analysis of the following characteristics of a space heat emission system including control: - non-uniform space temperature distribution; - emitters embedded in the building structure; - control of the indoor temperature.
EN 15316-2-3	**Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2-3: Space heating distribution systems** **CONTENT:** Provides a methodology to calculate/estimate the heat emission of water based distribution systems for heating and the auxiliary demand as well as the recoverable heat emission and auxiliary demand.
EN 15316-3	**Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 3: Domestic hot water systems** **CONTENT:** Calculation of energy requirements for domestic hot water heating systems including control, for all building types. In three parts: Part 3-1 Characterisation of needs (tapping requirements) Part 3-2 Distribution Part 3-3 Generation

EN	Title and Content
EN 15316-4	**Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 4: Space heating generation systems** **CONTENT:** Provides methods for system efficiencies and/or losses and auxiliary energy. Consists of seven parts: Part 4-1 Combustion systems (boilers) Part 4-2 Heat pump systems Part 4-3 Thermal solar systems Part 4-4 Building-integrated cogeneration systems Part 4-5 The performance and quality of district heating and large volume systems Part 4-6 Photovoltaic systems Part 4-7 Biomass combustion systems
EN 15377	**Heating systems in buildings — Design of embedded water based surface heating and cooling systems** **CONTENT:** Applies to water based surface heating and cooling systems in residential, commercial and industrial buildings, for systems integrated into the wall, floor or ceiling construction without any open air gaps. In three parts: Part 1: Determination of the design heating and cooling capacity Part 2: Design, dimensioning and installation Part 3: Optimising for the use of renewable energy sources
EN 15378	**Heating systems in buildings — Inspection of boilers and heating systems** **CONTENT:** Specifies inspection procedures and optional measurement methods for the assessment of energy performance of existing boilers and heating systems. Includes boilers for heating, domestic hot water or both; and boilers fired by gas, liquid or solid fuel (including biomass). Also includes heat distribution network, including associated components and controls; heat emitters, including accessories; and space heating control system.
EN 15459	**Energy performance of buildings — Economic evaluation procedure for energy systems in buildings** **CONTENT:** Provides data and calculation methods for economic issues of heating systems and other systems that are involved in the energy demand and consumption of the building.
EN 15603	**Energy performance of buildings — Overall energy use and definition of energy ratings** **CONTENT:** Collates results from other standards that specify calculation of energy consumption within a building; accounts for energy generated in the building, some of which may be exported for use elsewhere; presents summary in tabular form of the overall energy use of the building. Defines the uses of energy to be taken into account for setting energy performance ratings for new and existing buildings, and provides: a) A method to compute the standard calculated rating, a standard energy use that does not depend on occupant behaviour, actual weather and other actual (environment or input) conditions. b) A method to assess the measured energy rating, based on delivered and exported energy. c) A methodology to improve confidence in the building calculation model by comparison with actual energy consumption. d) A method to assess the energy effectiveness of possible improvements.

B.2 EN ISO standards

EN ISO	Title and Content
EN ISO 6946	**Building components and building elements — Thermal resistance and thermal transmittance — Calculation method (ISO 6946:2007)** **CONTENT:** Method of calculation of the thermal resistance and thermal transmittance of building components and building elements, excluding doors, windows and other glazed units, components which involve heat transfer to the ground, and components through which air is designed to permeate.
EN ISO 7345	**Thermal insulation — Physical quantities and definitions (ISO 7345:1987)** **CONTENT:** Defines physical quantities used in the field of thermal insulation, and gives the corresponding symbols and units.
EN ISO 9251	**Thermal insulation — Heat transfer conditions and properties of materials — Vocabulary (ISO 9251:1987)** **CONTENT:** Defines terms used in the field of thermal insulation to describe heat transfer conditions and properties of materials.
EN ISO 9288	**Thermal insulation — Heat transfer by radiation — Physical quantities and definitions (ISO 9288:1989)** **CONTENT:** Defines physical quantities and other terms in the field of thermal insulation relating to heat transfer by radiation.
EN ISO 10077-1	**Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General (ISO 10077-1:2006)** **CONTENT:** Specifies methods for the calculation of the thermal transmittance of windows and pedestrian doors consisting of glazed and/or or opaque panels fitted in a frame, with and without shutters. Allows for different types of glazing, opaque panels, various types of frames, and where appropriate the additional thermal resistance for closed shutters.
EN ISO 10077-2	**Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 2: Numerical method for frames (ISO 10077-2:2003)** **CONTENT:** Specifies a method and gives the material data required for the calculation of the thermal transmittance of vertical frame profiles, and the linear thermal transmittance. Can also be used to evaluate the thermal resistance of shutter profiles and the thermal characteristics of roller shutter boxes.
EN ISO 10211	**Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO/DIS 10211:2007)** **CONTENT:** Sets out the specifications for a 3-D and 2-D geometrical model of a thermal bridge for the numerical calculation of heat flows and surface temperatures. Specifications include the geometrical boundaries and subdivisions of the model, the thermal boundary conditions and the thermal values and relationships to be used.
EN ISO 10456	**Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO/DIS 10456:2007)** **CONTENT:** This standard specifies methods for the determination of declared and design thermal values for thermally homogeneous building materials and products, together with procedures to convert values obtained under one set of conditions to those valid for another set of conditions. These procedures are valid for design ambient temperatures between -30 °C and +60 °C. It gives conversion coefficients for temperature and for moisture. These coefficients are valid for mean temperatures between 0 °C and 30 °C. It also gives design data in tabular form for use in heat and moisture transfer calculations, for thermally homogeneous materials and products commonly used in building construction.
EN ISO 12569	**Thermal insulation in buildings — Determination of air change in buildings — Tracer gas dilution method (ISO 12569:2000)** **CONTENT:** Describes the use of tracer gas dilution for determining the air change in a single zone as induced by weather conditions or mechanical ventilation. Includes concentration decay, constant injection and constant concentration.

EN ISO	Title and Content
EN ISO 13370	**Thermal performance of buildings — Heat transfer via the ground — Calculation methods (ISO 13370:2007)** **CONTENT:** Gives methods of calculation of heat transfer coefficients and heat flow rates, for building elements in thermal contact with the ground, including slab-on-ground floors, suspended floors and basements. It applies to building elements, or parts of them, below a horizontal plane in the bounding walls of the building. Includes calculation of the steady-state part of the heat transfer (the annual average rate of heat flow), and the part due to annual periodic variations in temperature (the seasonal variations of the heat flow rate about the annual average).
EN ISO 13786	**Thermal performance of building components — Dynamic thermal characteristics — Calculation methods (ISO 13786:2007)** **CONTENT:** Specifies the characteristics related to dynamic thermal behaviour of building components and gives methods for their calculation.
EN ISO 13789	**Thermal performance of buildings — Transmission and ventilation heat transfer coefficients — Calculation method (ISO/DIS 13789:2007)** **CONTENT:** Specifies method and provides conventions for the calculation of the steady-state transmission and ventilation heat transfer coefficients of whole buildings and parts of buildings. Applicable both to heat loss (internal temperature higher than external temperature) and to heat gain (internal temperature lower than external temperature).
EN ISO 13790	**Thermal performance of buildings — Calculation of energy use for space heating (ISO 13790:2008)** **CONTENT:** 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. Includes the calculation of heat transfer by transmission and ventilation of the building when heated or cooled to constant internal temperature; the contribution of internal and solar heat sources to the building heat balance; the annual energy needs for heating and cooling; the annual energy required by the heating and cooling systems of the building for space heating and cooling; the additional annual energy required by a ventilation system. Building can have several zones with different set-point temperatures, and can have intermittent heating and cooling. Calculation period is one month or one hour or (for residential buildings) the heating or cooling season. Provides common rules for the boundary conditions and physical input data irrespective of the chosen calculation approach.
EN ISO 13791	**Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — General criteria and validation procedures (ISO 13791:2004)** **CONTENT:** Specifies the assumptions, boundary conditions, equations and validation tests for a calculation procedure, under transient hourly conditions, of the internal temperatures (air and operative) during the warm period, of a single room without any cooling/heating equipment in operation. No specific numerical techniques are imposed by this standard. Validation tests are included .
EN ISO 13792	**Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — Simplified methods (ISO 13792:2005)** **CONTENT:** Specifies the required input data for simplified calculation methods for determining the maximum, average and minimum daily values of the operative temperature of a room in the warm period, to define the characteristics of a room in order to avoid overheating in summer at the design stage, or to define whether the installation of a cooling system is necessary. Gives criteria to be met by a calculation method in order to satisfy the standard.
EN ISO 14683	**Thermal bridges in building construction — Linear thermal transmittance — Simplified methods and default values (ISO 14683:2007)** **CONTENT:** Deals with simplified methods for determining heat flows through linear thermal bridges which occur at junctions of building elements. Specifies requirements relating to thermal bridge catalogues and manual calculation methods. Provides default values of linear thermal transmittance.
EN ISO 15927-1	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 1: Monthly means of single meteorological elements (ISO 15927-1:2003)** **CONTENT:** Specifies procedures for calculating and presenting the monthly means of those parameters of climatic data needed to assess some aspects of the thermal and moisture performance of buildings. Covers air temperature; atmospheric humidity wind speed; precipitation; solar radiation; long wave radiation.

EN ISO	Title and Content
prEN ISO 15927-2	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 2: Houly data for design cooling load (ISO/DIS 15927-2:2007)** **CONTENT:** Gives the definition and specifies methods of calculation and presentation of the monthly external design climate to be used in determining the design cooling load of buildings.
prEN ISO 15927-3	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 3: Calculation of a driving rain index for vertical surfaces from hourly wind and rain data (ISO/DIS 15927-3:2006)** **CONTENT:** Specifies a procedure for analysing hourly rainfall and wind data derived from meteorological observations so as to provide an estimate of the quantity of water likely to impact on a wall of any given orientation, taking account of topography, local sheltering and the type of building and wall.
EN ISO 15927-4	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 4: Data for assessing the annual energy use for heating and cooling (ISO 15927-4:2005)** **CONTENT:** Specifies a method for constructing a reference year of hourly values of appropriate meteorological data suitable for assessing the average annual energy for heating and cooling.
EN ISO 15927-5	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 5: Data for design heat load for space heating (ISO 15927-5:2004)** **CONTENT:** Specifies the definition, method of calculation and method of presentation of the climatic data to be used in determining the design heat load for space heating in buildings, including the winter external design air temperatures, and the relevant wind speed and direction, where appropriate.
EN ISO 15927-6	**Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 6: Accumulated temperature differences (degree days) (ISO 15927-6:2007)** **CONTENT:** Specifies the definition, method of computation and method of presentation of data on accumulated temperature differences, used for assessing the energy used for space heating in buildings.

Annex C

Definitions

NOTE These definitions are applicable to energy calculations according to the standards listed in Annex A of this document. Slightly different definitions might be applicable to other situations, e.g. design of installations.

C.1 Buildings

C.1.1
building
construction as a whole, including its envelope and all technical building systems, for which energy is used to condition the indoor climate, to provide domestic hot water and illumination and other services related to the use of the building

NOTE The term can refer to the building as a whole or to parts thereof that have been designed or altered to be used separately.

C.1.2
new building
for calculated energy rating: building at design stage or under construction
for measured energy rating: building too recently constructed to have reliable records of energy use

C.1.3
existing building
for calculated energy rating: building that is erected
for measured energy rating: building for which actual data necessary to assess the energy use are known or can be measured

C.1.4
technical building system
technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production

NOTE 1 A technical building system can refer to one or to several building services (e.g. heating system, heating and domestic hot water system).

NOTE 2 A technical building system is composed of different subsystems.

NOTE 3 Electricity production can include cogeneration and photovoltaic systems.

C.1.5
technical building sub-system
part of a technical building system that performs a specific function (e.g. heat generation, heat distribution, heat emission)

C.1.6
building services
services provided by technical building systems and by appliances to provide indoor climate conditions, domestic hot water, illumination levels and other services related to the use of the building

C.1.7
space heating
process of heat supply for thermal comfort

C.1.8
space cooling
process of heat extraction for thermal comfort

C.1.9
domestic hot water heating
process of heat supply to raise the temperature of the cold water to the intended delivery temperature

C.1.10
dehumidification
process of removing water vapour from air to reduce relative humidity

C.1.11
humidification
process of adding water vapour to air to increase relative humidity

C.1.12
ventilation
process of supplying or removing air by natural or mechanical means to or from a space

NOTE Such air is not required to have been conditioned.

C.1.13
lighting
process of supplying the necessary illumination

C.1.14
other services
services supplied by energy consuming appliances

C.1.15
building automation and control
products, software, and engineering services for automatic controls, monitoring and optimization, human intervention and management to achieve energy-efficient, economical and safe operation of building services equipment

C.1.16
internal dimension
dimension measured from wall to wall and floor to ceiling inside a room of a building

C.1.17
overall internal dimension
dimension measured on the interior of a building, ignoring internal partitions

C.1.18
external dimension
dimension measured on the exterior of a building

C.1.19
thermal envelope area
total of the area of all elements of a building that enclose conditioned spaces through which thermal energy is transferred to or from the external environment or to or from unconditioned spaces

NOTE 1 Thermal element area depends on whether internal, overall internal or external dimensions are being used.

NOTE 2 The respective areas of the building envelope may be weighted with a (nationally fixed) reduction factor in case of e.g. unheated adjacent spaces and ground floors.

C.1.20
heated space
room or enclosure which for the purposes of a calculation is assumed to be heated to a given set-point temperature or set-point temperatures

C.1.21
cooled space
room or enclosure which for the purposes of a calculation is assumed to be cooled to a given set-point temperature or set-point temperatures

C.1.22
conditioned space
heated and/or cooled space

NOTE The heated and/or cooled spaces are used to define the boundaries of the thermal zones and the thermal envelope.

C.1.23
unconditioned space
room or enclosure which is not part of a conditioned space

C.1.24
conditioned area
floor area of conditioned spaces excluding non-habitable cellars or non-habitable parts of a space, including the floor area on all storeys if more than one

NOTE 1 Internal, overall internal or external dimensions can be used. This leads to different areas for the same building.

NOTE 2 Some services, such as lighting or ventilation, might be provided to areas not included in this definition (e.g. a car park).

NOTE 3 The precise definition of the conditioned area is given by national authorities.

NOTE 4 Conditioned area can be taken as the useful area mentioned in the Articles 5, 6 and 7 of the EPBD[)] unless it is otherwise defined in national regulations.

C.1.25
conditioned zone
part of a conditioned space with a given set-point temperature or set-point temperatures, throughout which there is the same occupancy pattern and the internal temperature is assumed to have negligible spatial variations, and which is controlled by a single heating system, cooling system and/or ventilation system

C.1.26
occupied zone
part of a conditioned zone in which persons normally reside and where requirements as to the internal environment are to be satisfied

NOTE The definition of the occupied zone depends on the geometry and the use of the room and is specified case by case. Usually the term “occupied zone” is used only for areas designed for human occupancy and is defined as a volume of air that is confined by specified horizontal and vertical planes. The vertical planes are usually parallel with the walls of the room. Usually there is also a limit placed on the height of the occupied zone.

C.2 Technical building systems

C.2.1
auxiliary energy
electrical energy used by technical building systems for heating, cooling, ventilation and/or domestic water to support energy transformation to satisfy energy needs

NOTE 1 This includes energy for fans, pumps, electronics, etc. Electrical energy input to a ventilation system for air transport and heat recovery is not considered as auxiliary energy, but as energy use for ventilation (C.4.18).

NOTE 2 In EN ISO 9488, *Solar energy – Vocabulary*, the energy used for pumps and valves is called "parasitic energy".

C.2.2
cogeneration
simultaneous generation in one process of thermal energy and electrical or mechanical energy

NOTE Also known as combined heat and power (CHP).

C.2.3
air conditioning system
combination of all components required to provide a form of air treatment in which temperature is controlled, possibly in combination with the control of ventilation, humidity and air cleanliness

C.2.4
room conditioning system
system capable of maintaining comfort conditions in a room within a defined range.

NOTE Such systems comprise air conditioning and surface based radiative systems.

C.2.5
demand controlled ventilation
ventilation system in which the room airflow rate is governed by an automatic control depending on the level of a given pollutant within the space

NOTE An example is CO_2 level in the room air controlling the speed of fans.

C.2.6
heat recovery
heat generated by a technical building system or linked to a building use (e.g. domestic hot water) which is utilised directly in a related system to lower the heat input and which would otherwise be wasted (e.g. preheating of the combustion air by a flue gas heat exchanger)

C.2.7
ventilation heat recovery
heat recovered from exhaust air to reduce ventilation heat transfer

C.2.8
part load operation
operational state of a technical system (e.g. heat pump), where the actual load is below the actual output capacity of the device

C.2.9
system thermal loss
thermal loss from a technical building system for heating, cooling, domestic hot water, humidification, dehumidification or ventilation that does not contribute to the useful output of the system

NOTE 1 A system loss can become an internal heat gain for the building if it is recoverable.

NOTE 2 Thermal energy recovered directly in the subsystem is not considered as a system thermal loss but as heat recovery and directly treated in the related system standard.

NOTE 3 Heat dissipated by the lighting system or by other services (e.g. appliances or computer equipment) is not part of the system thermal losses, but part of the internal heat gains.

C.2.10
recoverable system thermal loss
part of a system thermal loss which can be recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

NOTE This depends on the calculation approach chosen to calculate the recovered gains and losses (holistic or simplified approach).

C.2.11
recovered system thermal loss
part of a recoverable system thermal loss which has been recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

NOTE This depends on the calculation approach chosen to calculate the recovered gains and losses (holistic or simplified approach).

C.3 Inspection of heating and air-conditioning systems

C.3.1
energy inspection
examination of heating and/or air conditioning systems in a building

C.3.2
inspector
person having appropriate training or practical experience in energy inspection of heating and/or air conditioning systems and associated regulations for energy

C.3.3
room conditioning system control
measures taken to enable operation of a system in accordance with the design criteria

NOTE It can be a part of the building automation and control system.

C.3.4
commissioning
sequence of events to enable the functioning of a building and its heating, ventilation and air conditioning (HVAC) system in accordance with the design parameters

C.3.5
design criteria
set of descriptions based on a particular environmental element such as internal air quality, thermal and acoustical comfort, energy efficiency and associated system controls to be used for assessing plant operation

C.3.6
design documentation
written description of the essential design elements of a plant

C.4 Energy

C.4.1
energy source
source from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process

NOTE Examples include oil or gas fields, coal mines, sun, forests etc.

C.4.2
energy carrier
substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes [ISO 13600:1997]

NOTE The energy content of fuels is given by their gross calorific value.

C.4.3
system boundary
boundary that includes within it all areas associated with a building (both inside and outside the building) where energy is consumed or produced

NOTE Inside the system boundary the system losses are taken into account explicitly, outside the system boundary they are taken into account in the conversion factor.

C.4.4
delivered energy
energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (heating, cooling, ventilation, domestic hot water, lighting, appliances etc.) or to produce electricity

NOTE 1 For active solar and wind energy systems the incident solar radiation on solar panels or on solar collectors or the kinetic energy of wind is not part of the energy balance of the building. It is decided at national level whether or not renewable energy produced on site is part of the delivered energy.

NOTE 2 Delivered energy can be calculated for defined energy uses or it can be measured.

C.4.5
exported energy
energy, expressed per energy carrier, delivered by the technical building systems through the system boundary and used outside the system boundary

NOTE 1 It can be specified by generation types (e.g. CHP, photovoltaic, etc) in order to apply different weighting factors.

NOTE 2 Exported energy can be calculated or it can be measured.

C.4.6
net delivered energy
delivered energy minus exported energy, both expressed per energy carrier

NOTE 1 A balance of the delivered and exported energy per energy carrier can be performed only if the same primary energy factors and/or CO_2 coefficients apply to the delivered and exported amounts of that energy carrier.

NOTE 2 The term "net" can also be applied to quantities derived from net delivered energy, e.g. primary energy or CO_2 emissions.

C.4.7
non-renewable energy
energy taken from a source which is depleted by extraction (e.g. fossil fuels)

C.4.8
renewable energy
energy from a source that is not depleted by extraction, such as solar energy (thermal and photovoltaic), wind, water power, renewed biomass

NOTE In ISO 13602-1:2002 “Technical energy systems – Methods for analysis – Part 1: General”, renewable resource is defined as "natural resource for which the ratio of the creation of the natural resource to the output of that resource from nature to the technosphere is equal to or greater than one".

C.4.9
renewable energy produced on the building site
energy produced by technical building systems directly connected to the building using renewable energy sources

C.4.10
primary energy
energy that has not been subjected to any conversion or transformation process

NOTE 1 Primary energy includes non-renewable energy and renewable energy. If both are taken into account it can be called total primary energy.

NOTE 2 For a building, it is the energy used to produce the energy delivered to the building. It is calculated from the delivered and exported amounts of energy carriers, using conversion factors.

C.4.11
total primary energy factor
for a given energy carrier, non-renewable and renewable primary energy divided by delivered energy, where the primary energy is that required to supply one unit of delivered energy, taking account of the energy required for extraction, processing, storage, transport, generation, transformation, transmission, distribution, and any other operations necessary for delivery to the building in which the delivered energy will be used

NOTE The total primary energy factor always exceeds unity.

C.4.12
non-renewable primary energy factor
for a given energy carrier, non-renewable primary energy divided by delivered energy, where the non-renewable energy is that required to supply one unit of delivered energy, taking account of the non-renewable energy required for extraction, processing, storage, transport, generation, transformation, transmission, distribution, and any other operations necessary for delivery to the building in which the delivered energy will be used

NOTE The non-renewable primary energy factor can be less than unity if renewable energy has been used.

C.4.13
CO_2 emission coefficient
for a given energy carrier, quantity of CO_2 emitted to the atmosphere per unit of delivered energy

NOTE The CO_2 emission coefficient can also include the equivalent emissions of other greenhouse gases (e.g. methane).

C.4.14
energy need for heating or cooling
heat to be delivered to or extracted from a conditioned space to maintain the intended temperature conditions during a given period of time

NOTE 1 The energy need is calculated and cannot easily be measured.

NOTE 2 The energy need can include additional heat transfer resulting from non-uniform temperature distribution and non-ideal temperature control, if they are taken into account by increasing (decreasing) the effective temperature for heating (cooling) and not included in the heat transfer due to the heating (cooling) system.

C.4.15
energy need for domestic hot water
heat to be delivered to the needed amount of domestic hot water to raise its temperature from the cold network temperature to the prefixed delivery temperature at the delivery point

C.4.16
energy need for humidification or dehumidification
latent heat in the water vapour to be delivered to or extracted from a conditioned space by a technical building system to maintain a specified minimum or maximum humidity within the space

C.4.17
energy use for space heating or cooling or domestic hot water
energy input to the heating, cooling or hot water system to satisfy the energy need for heating, cooling (including dehumidification) or hot water respectively

NOTE If the technical building system serves several purposes (e.g. heating and domestic hot water) it can be difficult to split the energy use into that used for each purpose. It can be indicated as a combined quantity (e.g. energy use for space heating and domestic hot water).

C.4.18
energy use for ventilation
electrical energy input to a ventilation system for air transport and heat recovery (not including energy input for preheating or precooling the air) and energy input to a humidification system to satisfy the need for humidification

C.4.19
energy use for lighting
electrical energy input to a lighting system

C.4.20
energy use for other services
electrical energy input to appliances providing other services

NOTE This refers to services other than heating, cooling, domestic hot water, ventilation and lighting.

C.4.21
grid electricity
energy delivered to the building from a public electricity network

C.4.22
gross calorific value
quantity of heat released by a unit quantity of fuel, when it is burned completely with oxygen at a constant pressure equal to 101 320 Pa, and when the products of combustion are returned to ambient temperature

NOTE 1 This quantity includes the latent heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel.

NOTE 2 According to ISO 13602-2:2006, “Technical energy systems – Methods for analysis – Part 2: Weighting and aggregation of energywares”, the gross calorific value is preferred to the net calorific value.

NOTE 3 The net calorific value does not take account of the latent heat.

C.5 Energy ratings and certification

C.5.1
energy performance of a building
calculated or measured amount of weighted net delivered energy actually used or estimated to meet different needs associated with a standardised use of a building, which may include, inter alia, energy used for heating, cooling, ventilation, domestic hot water and lighting

C.5.2
energy performance requirement
minimum level of energy performance that is to be achieved to obtain a right or an advantage: e.g. right to build, lower interest rate, quality label

C.5.3
energy rating
evaluation of the energy performance of a building based on the weighted sum of the calculated or measured use of energy carriers

C.5.4
calculated energy rating
energy rating based on calculations of the weighted net delivered energy used by a building for heating, cooling, ventilation, domestic hot water and lighting

NOTE National bodies can decide whether other energy uses resulting from occupants' activities such as cooking, production, laundry, computer equipment, etc. are included or not. If included, standard input data needs to be provided for the various types of building and uses. Lighting is always included except (by decision of national bodies) for residential buildings.

C.5.5
standard energy rating
calculated energy rating using actual data for a building and a standard use data set

NOTE 1 It represents the intrinsic annual energy use of a building under standardised conditions. This is particularly relevant to certification of standard energy performance.

NOTE 2 It can also be termed "asset energy rating".

C.5.6
design energy rating
energy rating with design data for the building and standard use data set

NOTE It represents the calculated intrinsic annual energy use of a designed building under standardised conditions. This is particularly relevant to obtain a building permit at the design stage.

C.5.7
tailored energy rating
calculated energy rating using actual data for a building and actual climate and occupancy data

C.5.8
standard use data set
standard input data for internal and external climates, use, and occupancy

NOTE 1 This set can also include information on surroundings (such as shading or sheltering by adjacent buildings).

NOTE 2 Such data sets are defined at national level.

C.5.9
measured energy rating
energy rating based on measured amounts of delivered and exported energy

NOTE 1 The measured rating is the weighted sum of all energy carriers used by the building, as measured by meters or other means. It is a measure of the in-use performance of the building. This is particularly relevant to certification of actual energy performance.

NOTE 2 Also known as "operational rating".

C.5.10
confidence interval
interval that has a high probability (e.g. 95 %) to include the actual value

C.5.11
statistical tolerance interval
interval determined from a random sample in such a way that one may have a specified level of confidence that the interval covers at least a specified proportion of the sampled population

NOTE The confidence level in this context is the long-run proportion of intervals constructed in this manner that will include at least the specified proportion of the sampled population.

C.5.12
energy certification
procedures enabling to produce an energy certificate

C.5.13
energy performance indicator
energy rating divided by conditioned area

C.5.14
standard energy indicator
standard energy rating divided by conditioned area

C.5.15
measured energy indicator
measured energy rating divided by conditioned area

C.5.16
energy certificate
document recognised by a member state or a legal person designated by it, which includes the energy performance of a building

NOTE The meaning of the terms “certificate” and "certification" in this standard differ from that in EN ISO/IEC 17000, *Conformity assessment - Vocabulary and general principles* (ISO/IEC 17000:2004).

C.5.17
energy class
easy to understand metric (e.g. A to G) for indicating the energy performance of a building

C.5.18
reference value
standard legal or calculated value against which an energy indicator is compared

C.6 Costs

C.6.1
reasonably possible
can be achieved at a reasonable cost

C.6.2
reasonable cost
cost that is accepted by all parties to reach a given purpose

NOTE 1 This cost or a method to assess this cost should be given at the national level.

NOTE 2 This cost strongly depends on the purpose of the effort. For example, the cost of a rating could be relatively large if it is to provide an official certificate to put the building on the market or for displaying the building performance to the public, but reduced if it is simply for statistical purposes.

C.7 Energy calculation

C.7.1
building calculation model
mathematical model of the building, used to calculate its energy use

C.7.2
validated building data set
data used as input to a building calculation model in which one or more input data have been adjusted on the basis of actual data so that the results from a calculation using the model do not significantly differ from the measured reality

NOTE The quality of the validated data set is a balance between reasonable costs for gathering data and reasonable accuracy.

C.7.3
calculation step
discrete time interval for the calculation of the energy needs and uses for heating, cooling, humidification and dehumidification

NOTE Typical discrete time intervals are one hour, one month or one heating and/or cooling season, operating modes, and bins.

C.7.4
calculation period
period of time over which the calculation is performed

NOTE The calculation period can be divided into a number of calculation steps.

C.7.5
heating or cooling season
period of the year during which a significant amount of energy for heating or cooling is needed

NOTE The season lengths are used to determine the operation period of technical systems.

C.7.6
external temperature
temperature of external air

NOTE 1 For transmission heat transfer calculations, the radiant temperature of the external environment is supposedly equal to the external air temperature; long-wave transmission to the sky is calculated separately.

NOTE 2 The measurement of external air temperature is defined in EN ISO 15927-1, *Hygrothermal performance of buildings - Calculation and presentation of climatic data — Part 1: Monthly means of single meteorological elements* (ISO 15927-1:2003).

C.7.7
internal temperature
arithmetic average of the air temperature and the mean radiant temperature at the centre of a zone or space

NOTE This is the approximate operative temperature according to EN ISO 7726, *Ergonomics of the thermal environment – Instruments for measuring physical quantities* (ISO 7727:1998).

C.7.8
set-point temperature of a conditioned zone
internal (minimum intended) temperature as fixed by the control system in normal heating mode, or internal (maximum intended) temperature as fixed by the control system in normal cooling mode

C.7.9
equivalent internal temperature
constant minimum internal temperature, assumed for the calculation of the energy for heating, or maximum internal temperature, assumed for the calculation of the energy for cooling, leading approximately to the same average heat transfer as would apply with intermittent heating or cooling, and with inaccuracy of room temperature control

C.7.10
set-back temperature
minimum internal temperature to be maintained during reduced heating periods, or maximum internal temperature to be maintained during reduced cooling periods

C.7.11
heat transfer coefficient
heat flow rate divided by temperature difference between two environments; specifically used for heat transfer coefficient by transmission or ventilation

C.7.12
transmission heat transfer coefficient
heat flow rate due to thermal transmission through the fabric of a building, divided by the difference between the environment temperatures on either side of the construction

NOTE By convention, if the heat is transferred between a conditioned space and the external environment, the sign is positive if the heat flow is from the space to outside (heat loss).

C.7.13
ventilation heat transfer coefficient
heat flow rate due to air entering a conditioned space either by infiltration or ventilation, divided by the difference between the internal air temperature and the supply air temperature

C.7.14
building heat transfer coefficient
sum of transmission and ventilation heat transfer coefficients

C.7.15
intermittent heating or cooling
heating or cooling pattern where normal heating or cooling periods alternate with periods of reduced or no heating or cooling

C.7.16
heat gains
heat generated within or entering into the conditioned space from heat sources other than energy intentionally utilised for heating, cooling or domestic hot water preparation

NOTE 1 These include internal heat gains and solar heat gains. Sinks that extract heat from the building are included as gains with a negative sign. In contrast with heat transfer, for a heat source (or sink) the difference between the temperature of the considered space and the temperature of the source is not the driving force for the heat flow.

NOTE 2 For summer conditions heat gains with a positive sign constitute extra heat load on the space.

C.7.17
internal heat gains
heat provided within the building by occupants (sensible metabolic heat) and by appliances such as lighting, domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation

NOTE This includes recoverable system thermal losses, if the holistic approach for the calculation of the recovered system losses is chosen.

C.7.18
solar irradiation
incident solar heat on a surface per area of surface

C.7.19
solar heat gain
heat provided by solar radiation entering, directly or indirectly (after absorption in building elements), into the building through windows, opaque walls and roofs, or passive solar devices such as sunspaces, transparent insulation and solar walls

NOTE Active solar devices such as solar collectors are considered as part of the technical building system.

C.7.20
useful heat gains
proportion of internal and solar heat gains that contribute to reducing the energy need for heating

C.7.21
gain utilisation factor
factor reducing the total monthly or seasonal heat gains to obtain the resulting reduction of the energy need for heating

C.7.22
loss utilisation factor
factor reducing the total monthly heat transfer to obtain the resulting reduction of the energy need for cooling

C.7.23
heat balance ratio
monthly or seasonal heat gains divided by the monthly or seasonal heat transfer

C.8 Alphabetical index

Table C.1 — Alphabetical list of terms defined

Term	Number
air conditioning system	C.2.3
auxiliary energy	C.2.1
building	C.1.1
building automation and control	C.1.15
building calculation model	C.7.1
building heat transfer coefficient	C.7.14
building services	C.1.6
calculated energy rating	C.5.4
calculation step	C.7.3
calculation period	C.7.4
CO_2 emission coefficient	C.4.13
cogeneration	C.2.2
commissioning	C.3.4
conditioned space	C.1.22
conditioned area	C.1.24
conditioned zone	C.1.25
confidence interval	C.5.10
cooled space	C.1.21
dehumidification	C.1.10
delivered energy	C.4.4
demand controlled ventilation	C.2.5
design criteria	C.3.5
design documentation	C.3.6
design energy rating	C.5.6
domestic hot water heating	C.1.9
energy carrier	C.4.2
energy certification	C.5.12
energy certificate	C.5.16
energy class	C.5.17
energy need for domestic hot water	C.4.15
energy need for heating or cooling	C.4.14
energy need for humidification or dehumidification	C.4.16
energy inspection	C.3.1

Term	Number
energy performance indicator	C.5.13
energy performance of a building	C.5.1
energy performance requirement	C.5.2
energy rating	C.5.3
energy source	C.4.1
energy use for lighting	C.4.19
energy use for other services	C.4.20
energy use for space heating or cooling or domestic hot water	C.4.17
energy use for ventilation	C.4.18
equivalent internal temperature	C.7.9
external temperature	C.7.6
existing building	C.1.3
exported energy	C.4.5
external dimension	C.1.18
gain utilisation factor	C.7.21
grid electricity	C.4.21
gross calorific value	C.4.22
heat balance ratio	C.7.23
heat gains	C.7.16
heat recovery	C.2.6
heat transfer coefficient	C.7.11
heated space	C.1.20
heating or cooling season	C.7.5
humidification	C.1.11
inspector	C.3.2
intermittent heating or cooling	C.7.15
internal heat gains	C.7.17
internal dimension	C.1.16
internal temperature	C.7.7
lighting	C.1.13
loss utilisation factor	C.7.22
measured energy indicator	C.5.15
measured energy rating	C.5.9
new building	C.1.2
net delivered energy	C.4.6
non-renewable energy	C.4.7
non-renewable primary energy factor	C.4.12

Term	Number
occupied zone	C.1.26
other services	C.1.14
overall internal dimension	C.1.17
part load operation	C.2.8
primary energy	C.4.10
recoverable system thermal loss	C.2.10
recovered system thermal loss	C.2.11
reasonable cost	C.6.2
reasonably possible	C.6.1
reference value	C.5.18
renewable energy	C.4.8
renewable energy produced on the building site	C.4.9
room conditioning system	C.2.4
room conditioning system control	C.3.3
set-back temperature	C.7.10
set-point temperature of a conditioned zone	C.7.8
solar heat gain	C.7.19
solar irradiation	C.7.18
space cooling	C.1.8
space heating	C.1.7
standard energy indicator	C.5.14
standard energy rating	C.5.5
standard use data set	C.5.8
statistical tolerance interval	C.5.11
system boundary	C.4.3
system thermal loss	C.2.9
tailored energy rating	C.5.7
technical building sub-system	C.1.5
technical building system	C.1.4
thermal envelope area	C.1.19
total primary energy factor	C.4.11
transmission heat transfer coefficient	C.7.12
unconditioned space	C.1.23
useful heat gains	C.7.20
validated building data set	C.7.2
ventilation	C.1.12
ventilation heat transfer coefficient	C.7.13

Term	Number
ventilation heat recovery	C.2.7

Annex D

Common symbols and subscripts

D.1 Introduction

The standards introduce a large number of quantities and their associated symbols. To facilitate the use of the standards, a common set of symbols and subscripts have been defined, as given in Tables D.1 and D.2. The symbols follow established standards on nomenclature such as EN ISO 7345 and introduce others that are common to the EPBD-standards, in particular a set of subscripts to distinguish between different energy uses, different energy carriers, etc.

The symbols given in this annex concern only data passed from one standard to another. Additional symbols and units may be used locally within each standard, but it is strongly recommended to use the common symbols, subscripts and order.

D.2 Principal symbols

Table D.1 — Principal symbols in alphabetic order

Symbol	Quantity	Unit	French term	German term
A	area	m²	aire, surface	Fläche
b	temperature reduction factor	-	facteur de réduction de température	Temperatur-Reduktionsfaktor
C	heat capacity	J/K [a]	capacité thermique	Wärmespeicherfähigkeit
c	specific heat capacity	J/(kg·K) [a]	chaleur spécifique	spezifische Wärmekapazität
c	coefficient [d]	various	coefficient	Koeffizient
d	thickness	m	épaisseur	Dicke
D	diameter	m	diamètre	Durchmesser
E	energy in general; including primary energy, energy carriers (except heat, auxiliary electricity and work)	kg, m^3, J [a b]	énergie en général, y.c. énergie primaire, agents énergétiques (à par la chaleur, l'électricité auxiliaire et le travail).	Energie (generell) ; inkl. Primärenergie, Energieträger (ausser Wärme, elektrische Hilfsenergie und Arbeit)
EP	energy performance indicator	J/(m^2.a) [a], kg/(m^2.a), €/(m^2.a) [c]	indice de performance énergétique, indice énergétique	Energiekennzahl
f	factor [d]	-	facteur	Faktor
H	heat transfer coefficient	W/K	coefficient de transfert de chaleur	Wärmetransferkoeffizient
h	surface coefficient of heat transfer	W/(m²·K)	coefficient de transfert de chaleur superficiel	Wärmeübergangskoeffizient
I	solar irradiance	W/m^2	irradiance	solare Strahlungsintensität

Symbol	Quantity	Unit	French term	German term
L	length	m	longueur	Länge
m	mass (e.g. quantity of CO_2 emissions)	kg	masse (par ex. quantité d'émission de CO_2)	Masse (z.B. Menge der CO_2-Emissionen)
n	air exchange rate	1/h	taux de renouvellement d'air	Luftwechselrate
N	number of items (integer only)	-	nombre (entier seulement)	Anzahl (ganzzahlig)
p	pressure	Pa	pression	Druck
P	power in general including electrical power	W	puissance en général, y.c. puissance électrique	Leistung generell, inkl. elektrische Leistung
Q	quantity of heat	J [a]	quantité de chaleur	Wärmemenge
q	volumetric airflow rate	m^3/s	débit volumique d'air	Luftvolumenstrom
q	heat flow density	W/m^2	densité de flux de chaleur	Wärmestromdichte
R	thermal resistance	$m^2 \cdot K/W$	résistance thermique	Wärmedurchlasswiderstand
T	thermodynamic temperature	K	température thermodynamique	thermodynamische Temperatur
t	time, period of time	S [a]	temps, intervalle de temps	Zeit, Zeitintervall
U	thermal transmittance	$W/(m^2 \cdot K)$	coefficient de transmission thermique	Wärmedurchgangskoeffizient
Ψ	linear thermal transmittance	$W/(m \cdot K)$	coefficient linéique de transmission thermique	längenbezogener Wärmedurchgangskoeffizient
χ	point thermal transmittance	W/K	coefficient ponctuel de transmission thermique	punktbezogener Wärmedurchgangskoeffizient
V	volume	m^3	volume	Volumen
W	(electrical) auxiliary energy	J [a]	énergie auxiliaire (électrique)	Hilfsenergie (elektrisch)

Symbol	Quantity	Unit	French term	German term
x	relative humidity	%	humidité relative	relative Luftfeuchtigkeit
X	volume fraction	%	fraction en volume	Volumenanteil
Δ	delta (difference) prefix to be combined with symbols	various	préfixe combiné avec un symbole pour noter une différence	Differenz (Vorsatz vor einem Symbol)
η	efficiency factor	-	rendement	Wirkungsgrad
θ	Celsius temperature	°C	température Celsius	Celsius-Temperatur
Φ	heat flow rate, thermal power	W	flux de chaleur, puissance thermique	Wärmestrom. Wärmeleistung
ρ	density	kg/m³	masse volumique	Dichte
τ	time constant	s [a]	constante de temps	Zeitkonstante

[a] Hours (h) may be used as the unit of time instead of seconds for all quantities involving time (i.e. for time periods as well as for air change rates), but in that case the unit of energy is Wh instead of J.

[b] The unit depends on the type of energy carrier and the way its amount is expressed.

[c] The unit depends on the indicator chosen, see EN 15217 clause 5.

[d] Coefficients have dimensions; factors are dimensionless

D.3 Subscripts

Table D.2 — Subscripts in alphabetic order

Subscript	Term		
	English	**French**	**German**
0	base, reference	base, référence	Basis, Referenz
a	air	air	Luft
A	other appliances [a]	appareils, équipement	Geräte, Betriebseinrichtungen
an	annual	annuel	jährlich
aux	auxiliary	auxiliaire	Hilfs-
avg	time-average	moyenne temporelle	zeitlicher Durchschnitt
B	building	bâtiment	Gebäude
bin	bin	boîte	Kasten
bm	biomass	biomasse	Biomasse
C	cooling [a]	refroidissement	Kühlung
calc	calculated	calculé	berechnet
CO2	CO_2 emission	émission de CO_2	CO_2-Emission
ctr	control	contrôle	Regelung
CW	cooling and DHW [a]	refroidissement et eau chaude	Kühlung und Wassererwärmung
day	daily	journalier	täglich
del	delivered	livré	geliefert
dc	district cooling	refroidissement urbain	Fernkälte
dh	district heat	chauffage urbain	Fernwärme
dhum	dehumidification (system)	déshumidification (système)	Entfeuchtung (System)
dis	distribution	distribution	Verteilung
e	external; envelope	extérieur, enveloppe	aussen; Gebäudehülle
el	electricity	électricité	Elektrizität
em	emission	émission	Wärmeabgabe
est	estimated	estimé	geschätzt

Subscript	**Term**		
	English	**French**	**German**
exp	exported	exporté	zurückgeliefert
f	floor	plancher	Boden
gas	gas	gaz	Gas
gen	generation	génération	Erzeugung
gn	gains	gains	Gewinne
h	hourly	horaire	stündlich
H	heating [a]	chauffage	Heizung
HC	heating and cooling [a]	chauffage et refroidissement	Heizung und Kühlung
HCW	heating, cooling and DHW [a]	chauffage, refroidissement et eau chaude	Heizung, Kühlung und Wassererwärmung
ht	heat transfer	transfert de chaleur	Wärmedurchgang
hum	humidification (system)	humidification (système)	Befeuchtung
HW	heating and DHW [a]	chauffage et eau chaude	Heizung und Wassererwärmung
in	input	donnée, entrée	Input
int	internal	interne	intern, innen
L	lighting [a]	éclairage	Beleuchtung
lat	latent	latent	latent
lf	liquid fuel	combustible liquide	flüssiger Brennstoff
ls	losses	pertes, déperditions	Verluste
m	monthly	mensuel	monatlich
max	maximum	maximum	Maximum
meas	measured	mesuré	gemessen
min	minimum	minimum	Minimum
mn	mean (time or space) [a]	moyenne (temporelle ou spatiale)	Durchschnitt (zeitlich und räumlich)
nd	need	besoins	Nutzenergiebedarf
ntdel	net delivered	livré net	netto geliefert
nrbl	non-recoverable	non récupérable	nicht rückgewinnbar

Subscript	**Term**		
	English	**French**	**German**
nrvd	not recovered	non récupéré	nicht rückgewonnen
nren	non-renewable	non renouvelable	nicht erneuerbar
nut	non-utilised	non utilisé	nicht genutzt
off	off	déclenché	aus
oil	oil	fioul, mazout	Oel
on	on	enclenché	an
out	output	sortie	Output
P	primary energy	énergie primaire	Primärenergie
pk	peak	pic	Spitze
Pnren	non-renewable primary energy	énergie primaire, non renouvelable	nicht erneuerbare Primärenergie
pr	produced	produit	produziert
Ptot	total primary energy	énergie primaire totale	gesamte Primärenergie
pv	solar electricity (photovoltaic)	photovoltaïque	Photovoltaik
rbl	recoverable	récupérable	rückgewinnbar
red	reduced	réduit	reduziert
ren	renewable energy	énergie renouvelable	erneuerbar
rvd	recovered	récupéré	rückgewonnen
seas	seasonal	saisonnier	saisonal
sens	sensible	sensible	sensibel
sf	solid fuel	combustible solide	fester Brennstoff
sol	solar	solaire	solar
sp	space	espace	Raum
st	storage	accumulation, stockage	Speicherung
sys	system	système	System
T	thermal [a]	thermique	thermisch
Tot	total [a]	total	total
tr	transmission heat transfer	transmission de chaleur	Transmission
us	use	utilisation	Energiebedarf (berechnet)

Subscript	Term		
	English	**French**	**German**
			Energieverbrauch (gemessen)
ut	utilised	utilisé	genutzt
V	ventilation [a]	ventilation	Lüftung
ve	ventilation heat transfer	transfert de chaleur par ventilation	Wärmetransfer durch Lüftung (Konvektion)
W	domestic hot water (DHW) [a]	eau chaude sanitaire	Wassererwärmung
wd	wood	bois	Holz
wk	weekly	hebdomadaire	wöchentlich
Z	building zone	zone dans le bâtiment	Gebäudezone
[a] Type of energy use			

D.4 Order of subscripts

D.4.1 General

The subscripts are categorised into different levels, which are placed in the following order:

— 1st position: level 1 (if applicable);

— 2nd position: level 2 (if applicable);

— etc.

At each level there may be different sets of subscripts, for different contexts.

NOTE In a certain context a distinction is required between type of energy use (heating versus cooling versus ventilation, etc.), while in another context a distinction is needed between the energy carrier (gas versus oil versus electricity). But a distinction is never required between energy use for heating versus gas.

The levels are hierarchical, to harmonise the order of the subscripts used in different standards.

EXAMPLE Recoverable ventilation system losses: $Q_{V,sys,ls,rbl}$ and not $Q_{ls,V,rbl}$.

D.4.2 Rule for omitting a level if not applicable

When the subscripts at a given level describe a subdivision which is not applicable, the subscript for that level is omitted.

D.4.3 Rule for omitting a level if obvious from context

Within a standard, if the quantity is not passed to other standards, one or more of the subscripts may be omitted provided that the meaning is clear from the context (otherwise the full list of subscripts is used).

NOTE This rule is applied to avoid a long list of subscripts when a subscript is always the same in the given context.

EXAMPLE The subscript "calc" may be omitted from $Q_{V,sys,ls,rcb,calc}$ (so that it is written $Q_{V,sys,ls,rcb}$) within a clause dealing only with calculated quantities.

D.5 Terms for subscripts

The first three or four levels for heat and energy quantities are shown in Table D.3.

These may be followed by extra subscripts to indicate the spatial and/or time-span etc: see Table D.4.

The list of subscripts was prepared using the following principles:

— there is a need for a balance between short subscripts and understandable subscripts. If a subscript is short but easily misunderstood, it is worse than a slightly longer subscript;

— widely used subscripts should not be changed, if there is no conflict with other subscripts; e.g.: "int", "ext", "out";

— "non-xxx" has same symbol as "xxx" but preceded with an "n".

EXAMPLE "ut" for "utilised" becomes "nut" for "non-utilised".

Table D.3 — The first four levels of subscripts

Level 1		**Level 2**		**Level 3**		**Level 4**	
Type of energy use		**Building without technical systems**		**Utilised or non-utilised**			
H	heating	nd	need	ut	utilised		
C	cooling	ht	heat transfer	nut	non-utilised		
W	DHW	tr	transmission heat transfer				
T	thermal	ve	ventilation heat transfer				
L	lighting	gn	gains				
V	ventilation	sol	solar				
A	appliances	int	internal				
XY	combination of H, C, W	sens	sensible				
Tot	total	lat	latent				
		Technical building system		**Balance item**		**Balance item**	
		us	use	ls	losses	rbl	recoverable
		sys	system	aux	auxiliary	rvd	recovered
		em	emission	in	input	nrbl	non-recoverable
		dis	distribution	out	output	nrvd	non-recovered
		st	storage				
		ctr	control				
		gen	generation				
		hum	humidification [a]				
		dhum	dehumidification [a]				
		Energy carrier		**Qualifier (where used)**		**Qualifier (which type)**	
		gas	gas	del	delivered	nren	non-renewable
		oil	oil	exp	exported	ren	renewable
		el	electricity	pr	produced		
		wd	wood	ntdel	net delivered		
		dh	district heating				
		dc	district cooling			**Aggregated quantity**	
		sf	solid fuel			P	primary energy
		lf	liquid fuel			Ptot	total primary energy
		bm	biomass			Pnren	non renewable primary fraction
		sol	solar heat			CO2	CO_2 emission
		pv	solar electricity				

[a] Only at 'needs' level; energy use for humidification is included in energy use for ventilation; energy use for dehumidification is included in energy use for cooling

D.6 Further levels of subscripts

In some contexts other subscripts may be needed. The categories and the hierarchy are the following:

NOTE Within any given context the need for more than one extra level will be very rare.

Table D.4 — Further subscripts

Level n + 1 Spatial coverage		**Level n + 2 Time period**		**Level n + 3 How acquired**		**Level n + 4 Statistical**	
B	building	wk	weekly	calc	calculated	avg	time-average
Z	building zone	day	daily	meas	measured	mn	mean (time or space) [a]
sp	space	h	hourly	est	estimated	max	maximum
		m	monthly			min	minimum
		seas	seasonal			pk	peak
		bin	bin				
		an	annual				
[a] mean is used for time or spatial average (to be ascertained from the context)							

D.7 Other common subscripts

Table D.5 — Other common subscripts

Subscript	**Term**
0	base, reference
a	air
e	external, envelope
f	floor
off	off
on	on
red	reduced

D.8 Examples and comments

D.8.1 Heat quantities in a building

The first subscript (H, C or W) is normally only relevant if the second subscript is 'need'. Nevertheless, it could be relevant to make an explicit distinction between e.g. ventilation heat transfer in the heating mode and in the cooling mode.

EXAMPLE 1 Normally Q_{ve} but exceptionally $Q_{C,ve}$

No subscripts are specified for energy use for humidification and dehumidification, because humidification and dehumidification is only used as an energy need. For the energy use humidification is included in ventilation and dehumidification is included in cooling.

EXAMPLE 2 Energy need for dehumidification: Q_{dhum}

The first subscript T (Thermal) is only relevant in a context where the second subscript may be interpreted as not being about the thermal balance.

EXAMPLE 3 Normally Q_{ve} but exceptionally $Q_{T,ve}$

Needs are only defined for thermal energies (heating, cooling, DHW), but not for ventilation and lighting.

EXAMPLE 4 Energy need for heating: $Q_{H,nd}$
Transmission and ventilation heat transfer: Q_{ht}
Transmission heat transfer: Q_{tr}
Ventilation heat transfer: Q_{ve}
Total gains: Q_{gn}
Internal gains: Q_{int}
Solar gains: Q_{sol}

Total gains can be utilised or non utilised. This can be specified at the third level.

EXAMPLE 5 Utilised gains: $Q_{gn,ut}$
Non-utilised gains in zone 1: $Q_{gn,nut,z1}$

D.8.2 Heat (Q) or energy (E) quantities in a technical building system

For each subsystem subscripts are needed for input, output, losses, and auxiliary energy.

When there are two generators for one use, e.g. solar and conventional for domestic hot water, or CHP and boiler for heating, this is indicated by numbers added to the subscript.

Subscripts at the first level are combined when there are generation systems or distribution systems or emission systems, which are common to different uses.

EXAMPLE 1 Q_{HC}, Q_{HW}, Q_{CW}, Q_{HCW}

The input to a boiler (a heat generator) is oil or gas and not heat, and for a heat pump it is electricity. Therefore the symbol for input to a generator is E not Q. The generator generates heat using an energy carrier as input.

EXAMPLE 2 Energy input to a heat generator: $E_{H,gen,in}$
Energy input to heat generator *gen1* (part of energy use for heating): $E_{H,gen,in,1}$
Auxiliary energy use for a heating system: $W_{H,sys,aux}$
Heat output of a heat generator: $Q_{H,gen,out}$
Energy input to a common generator for heat and DHW: $E_{HW,gen,in}$
Heat input into the common distribution system 1 for heat and DHW: $Q_{HW,dis,in,1}$
Heat output of the heat distribution system 1: $Q_{H,dis,out,1}$
Heat output of solar water heater if renewable energy produced on site is part of the delivered energy: $Q_{W,sol,del}$
Heat output of solar water heater if renewable energy produced on site is not part of the delivered energy: $Q_{W,sol,out}$
Heat input into DHW distribution system: $Q_{W,dis,in}$
Energy (electricity) input to lighting system: $E_{L,sys}$
Energy (electrical) input to ventilation system: E_{V}

For thermal system losses the subscript “sys” refers to the whole system for the use indicated. “gen”, “dis”, etc. refer to the generation system, the distribution system, etc, for the use indicated.

EXAMPLES Thermal losses of the common generator for space heating and hot water: $Q_{HW,gen,ls}$
Total thermal losses of the heating system (generation, distribution, control etc.): $Q_{H,sys,ls}$
Recoverable part of the thermal system losses of the heating system: $Q_{H,sys,ls,rbl}$

D.8.3 Energy outside a building

Energy use can be distinguished by the service.

EXAMPLE 1 E_H, E_C, E_W, E_V, E_L, E_A.

E_L, and E_V are always electricity, for which a second subscript is not usually needed

The thermal uses E_H, E_C, E_W, can be satisfied by several energy carriers, and a second subscript might be needed.

EXAMPLE 2 For E_H this could be $E_{H,oil}$, $E_{H,gas}$, $E_{H,el}$, $E_{H,wd}$ or $E_{H,dh}$.

Renewable and non-renewable energy is distinguished by an additional subscript.

EXAMPLE 3 Renewable part of the exported thermal energy: $E_{T,exp,ren}$
Non-renewable part of the exported thermal energy: $E_{T,exp,nren}$

NOTE The use or service (H, C, W, ..) is not relevant when exported. It is relevant that it is thermal energy.

D.8.4 Primary energy

It might be necessary to distinguish primary energy by energy carrier.

EXAMPLE 1 Primary energy for gas: $E_{gas,P}$

A subscript is added to distinguish between primary energy including renewable energy, and non-renewable primary energy.

EXAMPLE 2 Primary energy for wood with the total primary energy factor: $E_{wd,Ptot}$
Non-renewable primary energy for wood: $E_{wd,Pnren}$

A subscript is added to distinguish between exported or delivered primary energy.

EXAMPLE 3 $E_{el,exp,Ptot}$ and $E_{el,del,Ptot}$.

D.8.5 Extra levels

Subscript B (for building) can be used to distinguish between quantities for the whole building and quantities for a conditioned zone. In the general case a subscript B is not necessary.

EXAMPLE 1 Ventilation heat transfer at the zone level: $Q_{ve,z}$

Numbering of zones, generators, distribution systems, etc. is done by adding a number to the appropriate subscript.

EXAMPLE 2 Ventilation heat transfer in zone *zj*: $Q_{ve,zj}$

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