BRITISH STANDARD

BS EN 15316-2-1:2007

Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies —

Part 2-1: Space heating emission systems

ICS 91.140.10

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National foreword

This British Standard is the UK implementation of EN 15316-2-1:2007.

The UK participation in its preparation was entrusted to Technical Committee RHE/24, Central heating installations.

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

BSI, as the UK member of CEN, is obliged to publish EN 15316-2-1:2007 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK voted against its approval as a European Standard

The UK voted against this standard on the grounds that it was considered disproportionate to the essential requirements of the EU Energy Performance of Buildings Directive (2002/91/EC), which it supports. In the opinion of the UK committee, EN 15316-2-1:2007 is regarded as unsuitable for existing buildings where the data required are unlikely to be available.

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

Compliance with a British Standard cannot confer immunity from legal obligations.

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Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-1: Space heating emission systems

Systèmes de chauffage dans les bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 2-1 : Systèmes d'émission de chauffage des locaux

Heizungsanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrad der Anlagen - Teil 2-1: Wärmeübergabesysteme für die Raumheizung

This European Standard was approved by CEN on 24 June 2007.

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Foreword

This document (EN 15316-2-1:2007) has been prepared by Technical Committee CEN/TC 228 “Heating systems in buildings”, the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/343), and supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD). It forms part of a series of standards aimed at European harmonisation of the methodology for calculation of the energy performance of buildings. An overview of the whole set of standards is given in prCEN/TR 15615.

The subjects covered by CEN/TC 228 are the following:

— design of heating systems (water based, electrical etc.);

— installation of heating systems;

— commissioning of heating systems;

— instructions for operation, maintenance and use of heating systems;

— methods for calculation of the design heat loss and heat loads;

— methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are systems standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other European or International Standards, a.o. product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

EN 15316 *Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies* consists of the following parts:

Part 1: General

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Part 2-1: Space heating emission systems

Part 2-3: Space heating distribution systems

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

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

This European Standard constitutes the specific part related to space heating emission, of the set of prEN 15316 standards on methods for calculation of system energy requirements and system efficiencies of space heating systems and domestic hot water systems in buildings.

This European Standard specifies the structure for calculation of the system energy losses and energy requirements of a heat emission system for meeting the building net energy demand.

The calculation method is used for the following applications:

— calculation of the system energy losses of the heat emission system;

— optimisation of the energy performance of a planned heat emission system, by applying the method to several possible options;

— assessing the effect of possible energy conservation measures on an existing heat emission system, by calculation of the energy requirements with and without the energy conservation measure implemented.

The user needs to refer to other European Standards or to national documents for input data and detailed calculation procedures not provided by this European Standard.

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1 Scope

The scope of this European Standard is to standardise the required inputs, the outputs and the links (structure) of the calculation method in order to achieve a common European calculation method.

The energy performance may be assessed either by values of the heat emission system efficiency or by values of the increased space temperatures due to heat emission system inefficiencies.

The method is based on an analysis of the following characteristics of a space heating emission system, including control:

— non-uniform space temperature distribution;

— heat emitters embedded in the building structure;

— control accuracy of the indoor temperature.

The energy required by the emission system is calculated separately for thermal energy and electrical energy, in order to facilitate determination of the final energy and subsequently the corresponding primary energy according to other standards.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12831, *Heating systems in buildings — Method for calculation of the design heat load*

EN 15316-1, *Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General*

EN ISO 7345:1995, *Thermal insulation — Physical quantities and definitions (ISO 7345:1987)*

EN ISO 13370, *Thermal performance of buildings — Heat transfer via the ground — Calculation methods (ISO 13370:1998)*

EN ISO 13790, *Thermal performance of buildings — Calculation of energy use for space heating (ISO 13790:2004)*

3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 7345:1995 and the following apply.

3.1.1
calculation period
period of time over which the calculation is performed

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

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3.1.2
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

3.1.3
energy use for space heating
energy input to the heating system to satisfy the energy need for heating

3.1.4
delivered energy
energy content, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (e.g. heating, cooling, ventilation, domestic hot water, lighting, appliances) 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 on a national level whether or not renewable energy produced on site constitutes part of the delivered energy.

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

3.1.5
energy need for heating
heat to be delivered to a heated space to maintain the intended temperature 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 the effective temperature for heating and not included in the heat transfer due to the heating system.

3.1.6
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

3.1.7
heated space
room or enclosure which for the purposes of the calculation is assumed to be heated to a given set-point temperature or set-point temperatures

3.1.8
heating system thermal losses, emission
heat losses through the building envelope due to non-uniform temperature distribution, control inefficiencies and losses of emitters embedded in the building structure

3.1.9
heating system thermal losses, total
sum of the thermal losses from the heating system, including recoverable heat loss

3.1.10
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.

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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.

3.1.11
recoverable system thermal loss
part of the 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

3.1.12
recovered system heat 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

3.2 Symbols and units

For the purposes of this document, the following symbols and units (Table 1) and indices (Table 2) apply.

Table 1 — Symbols and units

Symbol	Quantity	Unit
A	area	m^2
b	temperature reduction factor	-
E	energy in general, including primary energy, energy carriers (except quantity of heat, mechanical work and auxiliary (electrical) energy)	J
f	factor	-
y	gain/loss ratio	-
k	part of recoverable auxiliary energy	-
L	steady state part of heat loss	%
Q	quantity of heat	J
R	thermal resistance	$m^2 \cdot K/W$
t	time, period of time	s
T	thermodynamic temperature	K
U	thermal transmittance	$W/m^2 \cdot K$
W	auxiliary (electrical) energy, mechanical work	J
Φ	heat flow rate, thermal power	W
η	efficiency factor	-
η	utilisation factor	-
θ	Celsius temperature	°C

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Table 2 — Indices

an	auxiliary	gn	gains	out	output (from system)
aux	auxiliary	H	heating (energy)	P	primary
avg	average	hydr	hydraulic	pmp	pump
ctr	control	im	intermittent	rad	radiant
del	delivered	in	input (to system)	rbl	recoverable
e	external	inc	increased	rvd	recovered
el	electricity	int	internal	str	stratification
em	emission	ls	loss	ut	utilised
emb	embedded	mn	mean (time or space)	Δ	additional
fan	fan	nrbl	not recoverable		
G	ground	nrvd	not recovered		

4 Relation to other EPBD-standards

The present standard follows the general concept outlined in EN 15316-1.

The user shall refer to other European Standards or to national documents for input data and detailed calculation procedures not provided by this European Standard. The interaction with other standards is shown in Figure 1. The method for calculation of the building net heating energy is provided by EN ISO 13790. The results of calculations according to this European Standard are used as input data in EN 15316-2-3 for calculations of the space heating distribution sub-system and in EN 15316-4-x for calculations of heat generators. More detailed information on control systems can be found in EN 15232.

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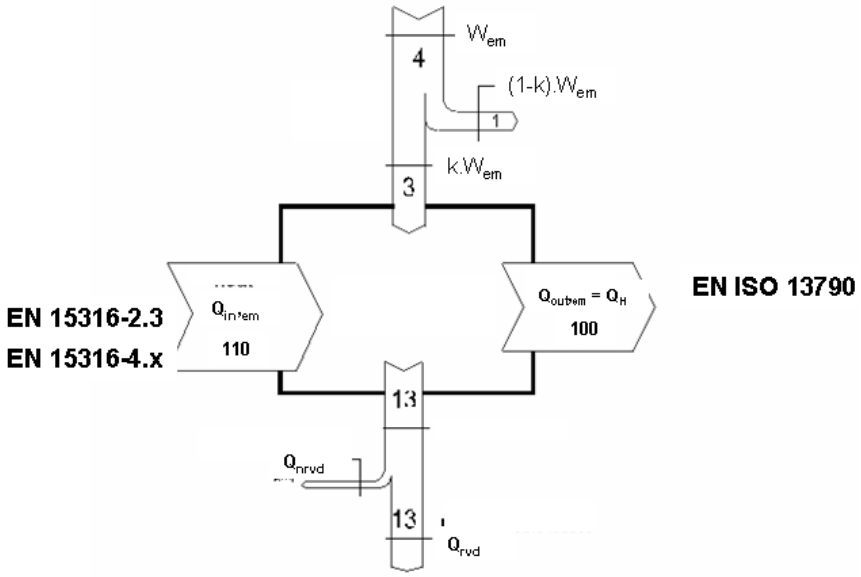

Figure 1 — Sample sub-system for heat emission
(for the symbols used, refer to 3.2)

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