SLOVENSKI STANDARD
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Grelni sistemi v stavbah ï Metoda za preraļ un energijskih zahtev in uļ inkovitosti sistema ï 4-4. del: Sistemi za ogrevanje prostora, lastnosti in kakovost CHP elektrike in toplote

Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-4: Heat generation systems, building-integrated cogeneration systems

Heizanlagen in Gebäuden - Berechnung und Bewertung der Energieeffizienz von Systemen - Teil 4-4: Wärmeerzeugung für die Raumheizung, Leistungsdaten und Effizienz von KWK-Anlagen, Elektrizität und Wärme

Systemes de chauffage dans les bâtiments - Méthode de calcul des besoins énergétiques et d'efficacité des systemes - Partie 4-4: Systemes de génération de chauffage des locaux, performance et qualité de la cogénération électrique et de la chaleur

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Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-4: Heat generation systems, building-integrated cogeneration systems

Systèmes de chauffage dans les bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-4: Systèmes de génération de chaleur, systèmes de co-génération intégrés au bâtiment

Heizsysteme in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Wirkungsgrade der Anlagen - Teil 4-4: Wärmeerzeugungssysteme, gebäudeintegrierte KWK-Anlagen

This European Standard was approved by CEN on 21 June 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 15316-4-4:2007) 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

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.

Introduction

This European Standard constitutes the specific part related to building-integrated cogeneration systems, of the set of EN 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 the system performance of building-integrated cogeneration systems. The calculation method is used for the following applications:

— judging compliance with regulations expressed in terms of energy targets;

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

— assessing the effect of possible energy conservation measures on an existing heat generation system, by calculating the energy use with and without the energy conservation measure.

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.

1 Scope

This European Standard defines a method for calculation of the energy requirements, electricity production, thermal output and recoverable losses of building-integrated cogeneration units forming part of a heat generation system (space heating and domestic hot water) in a building. Such units are commonly known as micro- or small scale cogeneration, or micro- or small scale CHP.

The calculation is based on the performance characteristics of the units, defined in product standards, and on other characteristics required to evaluate the performance of the units as included in the technical building system.

The test of building-integrated cogeneration units for heating systems may be worked out in a national annex. As soon as European test methods are available these should be used.

NOTE Primary energy savings and CO_2 savings, which can be achieved by cogeneration units compared to separate production of heat and consumption of electricity, are calculated according to prEN 15603. Indications about the savings calculations are given in informative Annex C.

2 Normative references

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

prEN 15603[1)], *Energy performance of buildings — Overall energy use, CO_2 emissions and definition of energy ratings*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
annual load profile method
calculation method for an installation where the cogeneration unit is sized to run on different load ranges throughout the year (e.g. the cogeneration unit operates as a boiler substitute and supplies the entire heat demand of the building)

3.2
annual electrical efficiency
total annual electrical output of the cogeneration unit divided by the total annual fuel input

3.3
annual heat efficiency
total annual heat output of the cogeneration unit divided by the total annual fuel input

3.4
auxiliary energy
electrical energy used by technical building systems for heating, cooling, ventilation and/or domestic hot water to support energy transformation to satisfy energy needs

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1) To be published.

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.

NOTE 2 In EN ISO 9488 the energy used for pumps and valves is called "parasitic energy".

3.5
building-integrated cogeneration
cogeneration unit installed to supply space heating, domestic hot water and possibly cooling within a building

NOTE It could operate as the only heating/cooling appliance of the building or in combination with other heat generators, such as boilers or electrical chillers. Unlike district heating systems, where heat and electricity are generated at central plants and transmitted through networks to a number of remote buildings, a building-integrated cogeneration unit produces heat for use within the building. The electricity produced by the integrated cogeneration unit may be used within the building or may be exported.

3.6
cogeneration unit
unit designed to provide thermal energy and electricity to a building using a cogeneration process

NOTE 1 The unit may include supplementary burners and thermal storage.

NOTE 2 The cogeneration units are also called CHP (Combined Heat and Power) plants or units.

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

3.8
design heat load
desired heat flow necessary to achieve the specified design conditions

3.9
dumped heat
wasted heat, which exceeds the current heat demand of the building and cannot be stored or used

3.10
electricity from cogeneration
electricity generated in a process linked to the production of useful heat

3.11
full load
operation state of the technical system (e.g. cogeneration unit) where the actual load requirement is equal to the nominal (maximal) output capacity of the device

3.12
fractional contribution method
calculation method for an installation where the CHP unit is sized to run at full load most of the time, thus the heat output of the CHP unit supplies the base load of the installation (fractional contribution of the heat demand)

3.13
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, the gross calorific value is preferred to the net calorific value.

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

3.14
heat-led installations
unit controlled by the heat demand with no dumped heat

NOTE This does not mean that the unit provides the whole heat demand.

3.15
net power production
electrical total power production minus all auxiliary energy consumption

3.16
part load
operation state of the technical system (e.g. cogeneration unit) where the actual load requirement is lower than the nominal (maximal) output capacity of the device

3.17
peak boiler
boiler used to supplement the heat output provided by the cogeneration unit for peak heat loads

3.18
plant size ratio
maximum rate of heat output of the cogeneration unit divided by the sum of the design heat load and any additional daily heat load (averaged over the day)

3.19
power bonus method
all energy inputs are related to the thermal output and the electricity produced is counted as a bonus

3.20
preferential generation appliances
appliance in a multi-plant generation system (e.g. cogeneration units) which are operating in priority

3.21
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

3.22
thermal efficiency of a cogeneration
heat output of the cogeneration divided by the fuel input

NOTE 1 Efficiency can be based on annual load conditions or part-load conditions.

NOTE 2 The energy input and all system losses are related to the thermal output. The electricity is counted as a bonus (power bonus method).

3.23
useful heat
heat produced in a cogeneration process to satisfy the demand for heating or cooling

4 Symbols and abbreviations

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
E	energy in general, including primary energy, energy carriers (except quantity of heat, mechanical work and auxiliary (electrical) energy)	J [a] [b]
$ndays$	number of days	-
P	power in general including electrical power	W
Q	quantity of heat	J [a]
W	auxiliary (electrical) energy, mechanical work	J [a]
X	fraction	%
β	fraction	-
η	efficiency factor	-
θ	Celsius temperature	°C
[a] Hours (h) may be used as the unit for 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 for energy is Wh instead of J [b] The unit depends on the type of energy carrier and the way its amount is expressed.		

Table 2 — Indices

an	annual	gen	generation	out	output
avg	time-average	H	heating	pr	produced
C	cooling	HW	heating and domestic hot water	pref	preferential
chp	combined heat and power	in	input	rbl	recoverable
day	daily	ls	losses	T	thermal
dis	distribution	max	maximum	W	domestic hot water
el	electricity	npref	non preferential		