# SLOVENSKI STANDARD
# SIST EN 15316-4-5:2007

**01-november-2007**

---

**Grelni sistemi v stavbah - Metoda za preraļ un energijskih zahtev in uļ inkovitosti sistema - 4-5. del: Sistemi za ogrevanje prostora, lastnosti in kakovost daljinskega ogrevanja in velikih sistemov**

Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems



Heizanlagen in Gebäuden - Berechnung und Bewertung der Energieeffizienz von Systemen - Teil 4-5: Wärmeerzeugung für die Raumheizung, Leistungsdaten und Effizienz von Fernwärme- und großvolumigen Systemen



Systemes de chauffage dans les bâtiments - Méthode de calcul des besoins énergétiques et d'efficacité des systemes - Partie 4-5: Systemes de génération de chauffage des locaux, performance et qualité du chauffage urbain et des grandes systemes

**Ta slovenski standard je istoveten z:** **EN 15316-4-5:2007**

---

**ICS:**

| | | |
|---|---|---|
| 91.140.10 | Sistemi centralnega ogrevanja | Central heating systems |

**SIST EN 15316-4-5:2007** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 15316-4-5

July 2007

ICS 91.140.10

English Version

# Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems

Systèmes de chauffage dans les bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-5 : Systèmes de génération de chauffage des locaux, performance et qualité des systèmes de chauffage urbain et des systèmes de grand volume

Heizungsanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-5: Wärmeerzeugungssysteme, Leistungsfähigkeit und Effizienz von Fernwärme- und großvolumigen Systemen

This European Standard was approved by CEN on 30 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.



CEN members are the national standards bodies of 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.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**



Ref. No. EN 15316-4-5:2007: E

# Contents

Page

# Foreword

This document (EN 15316-4-5:2007) 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 presents a method for calculation of the energy performance of district heating systems and dwelling substations. The results of the calculations are the primary energy factor of the specific district heating system and the heat losses of the building substations. The method is applicable for all kinds of heat sources, including heat and power cogeneration. The method is independent of the use of the heat supplied, including subsequent generation of cooling energy in the building. The method may be applied in the same way for district cooling based on cogeneration or use of lake or sea water.

The calculations are based on the performance data of the district heating system and the building substations, respectively, which can be calculated or measured according to this standard and other European Standards cited herein.

This method can be used for the following applications:

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

— optimisation of the energy performance of a planned district heating system and building substations by varying the input parameters;

— assessing the effect of possible energy conservation measures on an existing system by changing the method of operation or replacing parts of the system.



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



Only the calculation method and the accompanying input parameters are normative. All values required to parameter the calculation method should be given in a national annex.

# 1 Scope

This European Standard is part of a set of standards on the method for calculation of system energy requirements and system efficiencies.

The scope of this specific part is to standardise the method of assessing the energy performance of district heating and cooling systems and to define:

— system borders;

— required inputs;

— calculation method;

— resulting outputs.

The method applies to district heating and cooling systems and any other kind of combined production for space heating and/or cooling and/or domestic hot water purposes.

Primary energy savings and $CO_2$ savings, which can be achieved by district heating systems compared to other systems, are calculated according to prEN 15603.

# 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.



EN ISO 12241, *Thermal insulation for building equipment and industrial installations — Calculation rules (ISO 12241:1998)*

# 3 Terms and definitions

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

**3.1**
**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

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, Solar, the energy used for pumps and valves is called "parasitic energy".

**3.2**
**building substation**
technical system to transform the parameter (temperature, pressure etc.) of a district heating system to the parameter of the building heating system and to control the building heating system

**3.3**
**cogeneration**
simultaneous generation in one process of thermal energy and electrical or mechanical energy

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

**3.4**
**delivered energy**
energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (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 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.

**3.5**
**district heating system**
heating system, which supplies hot water or steam to the building thermal system from a heat generation system outside the building. The district heating system transmits heat through networks to a number of remote buildings

**3.6**
**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.



**3.7**
**net energy**
energy supplied by the energy systems to provide the required services. Recovered losses or gains are taken into account

**3.8**
**net power production**
electrical total power production minus all auxiliary energy consumption

**3.9**
**non-renewable energy**
energy taken from a source which is depleted by extraction (e.g. fossil fuels)

**3.10**
**non-renewable primary energy factor**
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.

**3.11**
**power bonus method**
all energy inputs are related to the thermal output and the electricity produced is counted as a bonus

**3.12**
**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.

**3.13**
**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

**3.14**
**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

**3.15**
**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, 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".

**3.16**
**surplus heat**
hot streams from industry that is a by-product, impossible to avoid at production of the industrial product and could not be used for inside the industrial production



NOTE High quality heat from industry that can be used to produce electricity are not considered as surplus heat.



**3.17**
**total primary energy factor**
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.

## 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 | Name of quantity | Unit |
|---|---|---|
| B | coefficient depending on the type of dwelling substation and its insulation level | - |
| D | coefficient depending on the type of dwelling substation and its control | - |
| E | energy in general, including primary energy, energy carriers (except quantity of heat, mechanical work and auxiliary (electrical) energy) | kWh [a] |
| f | primary energy factor | - |
| H | heat exchange coefficient | kWh/K |
| Q | quantity of heat | kWh |
| W | auxiliary (electrical) energy, mechanical work | kWh |
| $\eta$ | efficiency | - |
| $\sigma$ | relation of power production to heat production of a cogeneration appliance | - |
| $\beta$ | relation of heat produced by a cogeneration appliance to the total heat production | - |
| $\Theta$ | temperature | °C |
| $\Phi$ | heat power | kW |

[a] The unit depends on the type of energy carrier.



**Table 2 — Indices**

| | | | | | |
|---|---|---|---|---|---|
| amb | ambient | el | electrical | ls | loss |
| aux | auxiliary | F | fuel | out | output |
| chp | combined heat and power | gen | generation | P | primary |
| del | delivered | hn | heating network | rbl | recoverable |
| dh | district heating system | i, j | indices | T | thermal |
| e | external | in | input | tot | total |