

**Hoonete küttesüsteemid. Süsteemide  
energiavajaduse ja süsteemide  
tõhususe arvutusmeetod. Osa 4-3:  
Küttesüsteemide soojusallikad,  
päikeseküttesüsteemid**

Heating systems in buildings - Method for calculation  
of system energy requirements and system  
efficiencies - Part 4-3: Space heating generation  
systems, thermal solar systems

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 15316-4-3:2007 sisaldab Euroopa standardi EN 15316-4-3:2007 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 14.09.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 15316-4-3:2007 consists of the English text of the European standard EN 15316-4-3:2007.</p> <p>This document is endorsed on 14.09.2007 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

<p><b>Käsitlusala:</b></p> <p>This European Standard is part of a series of standards on the method for calculation of system energy requirements and system efficiencies. The framework for the calculation is described in prEN 15603. The scope of this specific part is to standardise the: - required inputs, - calculation method, - required outputs, for thermal solar systems (including control) for space heating, domestic hot water production and the combination of both.</p>	<p><b>Scope:</b></p> <p>This European Standard is part of a series of standards on the method for calculation of system energy requirements and system efficiencies. The framework for the calculation is described in prEN 15603. The scope of this specific part is to standardise the: - required inputs, - calculation method, - required outputs, for thermal solar systems (including control) for space heating, domestic hot water production and the combination of both.</p>
--	--

ICS 91.140.10

Võtmesõnad:

ICS 91.140.10

English Version

**Heating systems in buildings - Method for calculation of system  
energy requirements and system efficiencies - Part 4-3: Heat  
generation systems, thermal solar systems**

Systèmes de chauffage dans les bâtiments - Méthode de  
calcul des besoins énergétiques et des rendements des  
systèmes - Partie 4-3 : Systèmes de génération de chaleur,  
systèmes solaires thermiques

Heizsysteme in Gebäuden - Verfahren zur Berechnung der  
Energieanforderungen und Wirkungsgrade von Systemen -  
Teil 4-3: Wärmeerzeugungssysteme Thermische  
Solaranlagen

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**

# Contents

Page

Foreword.....	4
Introduction .....	6
1 Scope .....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Symbols and abbreviations .....	10
5 Principle of the method .....	11
5.1 Building heat requirements influence the energy performance of a thermal solar system .....	11
5.2 The thermal solar system influences the energy performance of the building .....	12
5.3 Performance of the thermal solar system .....	12
5.4 Heat balance of the heat generation sub-system, including control .....	12
5.5 Auxiliary energy .....	16
5.6 Recoverable, recovered and unrecoverable thermal losses .....	16
5.7 Calculation periods .....	16
6 Thermal solar system calculation .....	16
6.1 Calculation procedures .....	16
6.2 Method A - using system data (results from system tests) .....	17
6.2.1 General .....	17
6.2.2 Definition of heat use applied to the thermal solar system .....	17
6.2.3 Output from thermal solar system .....	18
6.2.4 Auxiliary energy consumption of thermal solar system auxiliaries .....	20
6.2.5 System thermal losses .....	20
6.2.6 Recoverable losses .....	20
6.3 Method B - using component data (results from component tests) .....	20
6.3.1 General .....	20
6.3.2 Definition of heat use applied to the thermal solar system .....	21
6.3.3 Output from thermal solar system .....	22
6.3.4 Auxiliary energy consumption of thermal solar system auxiliaries .....	25
6.3.5 System thermal losses .....	25
6.3.6 Recoverable losses .....	26
6.3.7 Determination of reduced operation time of non-solar heat generator(s) .....	27
Annex A (informative) Examples on determination of thermal performance of thermal solar systems .....	28
A.1 General .....	28
A.2 Solar domestic hot water preheat system .....	28
A.2.1 General .....	28
A.2.2 Determination of the heat use to be applied .....	29
A.2.3 Determination of system data .....	29
A.2.4 Determination of X, Y and thermal solar system output .....	29
A.2.5 Determination of the auxiliary energy consumption .....	30
A.2.6 Determination of the thermal losses of the thermal solar system .....	30
A.2.7 Determination of the recoverable losses of the thermal solar system .....	30
A.3 Solar combisystem .....	31
A.3.1 General .....	31
A.3.2 Determination of the heat use .....	31
A.3.3 Determination of system data .....	32
A.3.4 Determination of X, Y and thermal solar system output .....	32
A.3.5 Determination of the auxiliary energy consumption .....	33

A.3.6	Determination of the thermal losses of the thermal solar system .....	34
A.3.7	Determination of the recoverable losses of the thermal solar system .....	34
A.3.8	Determination of the reduction of auxiliary energy consumption of the back-up heater.....	35
<b>Annex B</b>	<b>(informative) Informative values for use in the calculation methods .....</b>	<b>36</b>
B.1	System type coefficients .....	36
B.2	Thermal solar system default values .....	36
B.2.1	General .....	36
B.2.2	Typical values .....	37
B.2.3	Penalty values.....	38
B.3	Storage tank capacity correction coefficient $f_{st}$ .....	38
B.4	Reference temperature $\theta_{ref}$ .....	39
B.5	Solar irradiance on the collector plane and incidence angle modifier .....	40
B.6	Thermal losses of the solar storage tank .....	41
B.7	Thermal losses of the distribution between the thermal solar system and the back-up heater .....	41
B.8	Recoverable part of system losses .....	41
<b>Annex C</b>	<b>(informative) Product classification .....</b>	<b>42</b>
C.1	Solar collectors.....	42
C.2	Solar hot water heaters.....	42
C.3	Storage tanks .....	42
<b>Annex D</b>	<b>(informative) Savings calculation .....</b>	<b>44</b>
<b>Bibliography</b>	.....	<b>45</b>

## Foreword

This document (EN 15316-4-3:2007) 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 methods for calculation of the thermal solar system input for space heating and/or domestic hot water requirements and the thermal losses and auxiliary energy consumption of the thermal solar system. The calculation is based on the performance characteristics of the products given in product standards and on other characteristics required to evaluate the performance of the products as included in the system.

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 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 – i.e. the energy savings of a thermal solar system is determined by the difference in the calculated energy performance of the building with and without the thermal solar system.

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 is part of a series of standards on the method for calculation of system energy requirements and system efficiencies. The framework for the calculation is described in prEN 15603.

The scope of this specific part is to standardise the:

- required inputs,
- calculation method,
- required outputs,

for thermal solar systems (including control) for space heating, domestic hot water production and the combination of both.

The following typical thermal solar systems are considered:

- domestic hot water systems characterized by EN 12976 (factory made) or ENV 12977 (custom built);
- combisystems (for domestic hot water and space heating) characterized by ENV 12977 or the Direct Characterisation method developed in Task 26 'Solar Combisystems' of the IEA Solar Heating and Cooling programme;
- space heating systems characterized by ENV 12977.

## 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 12976-2, *Thermal solar systems and components — Factory made systems — Part 2: Test methods*

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

## 3 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

#### **aperture area**

solar collector maximum projected area through which un-concentrated solar radiation enters the collector

### 3.2

#### **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.