# Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4

EESTI STANDARDIKESKUS
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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD



| | |
|---|---|
| See Eesti standard EVS-EN 15316-1:2017 sisaldab Euroopa standardi EN 15316-1:2017 ingliskeelset teksti. | This Estonian standard EVS-EN 15316-1:2017 consists of the English text of the European standard EN 15316-1:2017. |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation. |
| Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 26.04.2017. | Date of Availability of the European standard is 26.04.2017. |
| Standard on kättesaadav Eesti Standardikeskusest. | The standard is available from the Estonian Centre for Standardisation. |

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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# Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 1 : Généralités et expression de la performance, Modules M3-1, M3-4, M3-9, M8-1, M8-4

Energetische Bewertung von Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 1: Allgemeines und Darstellung der Energieeffizienz, Module M3-1, M3-4, M3-9, M8-1, M8-4

This European Standard was approved by CEN on 27 February 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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## European foreword

This document (EN 15316-1:2017) has been prepared by Technical Committee CEN/TC 228 “Heating systems and water based cooling systems”, the secretariat of which is held by DIN.

This document supersedes EN 15316-1:2007.

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 October 2017, and conflicting national standards shall be withdrawn at the latest by October 2017.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

The main changes compared to EN 15316-1:2007 are:

— reference and coordination of all other modules (a module corresponds to a subsystem standard);

— inclusion of operating conditions calculation and load dispatching related to building automation control (BAC) and systems design (e.g. connection of distributions).

— inclusion of a monthly method based on BIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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

# Introduction

This Standard is part of a series of standards aiming at international harmonization of the methodology for the assessment of the energy performance of buildings, called “set of EPB standards”.

EPB standards deal with energy performance calculation and other related aspects (like system sizing) to provide the building services considered in the EPB Directive.

All EPB standards follow specific rules to ensure overall consistency, unambiguity and transparency.

All EPB standards provide a certain flexibility with regard to the methods, the required input data and references to other EPB standards, by the introduction of a normative template in Annex A and Annex B with informative default choices.

For the correct use of this standard a normative template is given in Annex A to specify these choices. Informative default choices are provided in Annex B.

Use by or for regulators: In case the standard is used in the context of national or regional legal requirements, mandatory choices may be given at national or regional level for such specific applications. These choices (either the informative default choices from Annex B or choices adapted to national / regional needs, but in any case following the template of this Annex A) can be made available as national annex or as separate (e.g. legal) document (national data sheet).

NOTE So in this case:

— the regulators will **specify** the choices;

— the individual user will apply the standard to assess the energy performance of a building, and thereby **use** the choices made by the regulators.

Topics addressed in this standard can be subject to public regulation. Public regulation on the same topics can override the default values in Annex B of this standard. Public regulation on the same topics can even, for certain applications, override the use of this standard. Legal requirements and choices are in general not published in standards but in legal documents. In order to avoid double publications and difficult updating of double documents, a national annex may refer to the legal texts where national choices have been made by public authorities. Different national annexes or national data sheets are possible, for different applications.

It is expected, if the default values, choices and references to other EPB standards in Annex B are not followed due to national regulations, policy or traditions, that:

— national or regional authorities prepare data sheets containing the choices and national or regional values, according to the model in Annex A. In this case the national annex (e.g. NA) refers to this text;

— or, by default, the national standards body will consider the possibility to add or include a national annex in agreement with the template of Annex A, in accordance to the legal documents that give national or regional values and choices.

Further target groups are parties wanting to motivate their assumptions by classifying the building energy performance for a dedicated building stock.

More information is provided in the Technical Report accompanying this standard (CEN/TR 15316-6-1).

CEN/TC 228 deals with heating systems and water based cooling systems in buildings. Subjects covered by TC 228 are:

— energy performance calculation;

— inspection;

— design of systems;

— installation and commissioning.

The first version of this standard was developed during the first EPBD mandate and published in 2008.

The revision for inclusion in the second EPBD mandate package was performed in 2014.

Default references to EPB standards other than EN ISO 52000-1 are identified by the EPB module code number and given an Annex A (normative template) and Annex B (informative default choice).

Table 1 associates the title of the EN EPB standards to the numbers and modules. It also remembers the replaced standards.

**Table 1 — List of EN EPB standards related to the calculation of space heating and domestic hot water systems**

| No. | Module | *New EPBD numbering* | *Old standards replaced* | *Title of the new EPBD standard* |
|---|---|---|---|---|
| 1 | M1–14 | EN 15459–1 | EN 15459 | Energy performance of buildings - Heating systems and water based cooling systems in buildings - Part 1: Economic evaluation procedure for energy systems in buildings, Module M1-14 |
| | | CEN/TR 15459–2 | New | Energy performance of buildings - Economic evaluation procedure for energy systems in buildings - Part 2: Explanation and justification of EN 15459-1, Module M1-14) |
| 2 | M3–11 M8–11 | EN 15378–1 | EN 15378 | Energy performance of buildings - Heating systems and DHW in buildings - Part 1: Inspection of boilers, heating systems and DHW, Module M3-11, M8-11 |
| | | CEN/TR 15378–2 | New | Energy performance of buildings - Heating systems and DHW in buildings - Part 2: Explanation and justification of EN 15378-1, Module M3-11 and M8-11) |
| 3 | M3–10 M8–10 | EN 15378–3 | New | Energy performance of buildings - Heating and DHW systems in buildings - Part 3: Measured energy performance, Module M3-10, M8-10 |
| | | CEN/TR 15378–4 | New | Heating systems and water based cooling systems in buildings - Heating systems and DHW in buildings - Part 4: Accompanying TR to EN 15378-3 (Measured energy performance)) |
| 4 | M3–3 | EN 12831–1 | EN 12831 | Energy performance of buildings - Method for calculation of the design heat load - Part 1: Space heating load, Module M3-3 |
| | | CEN/TR 12831–2 | New | Energy performance of buildings - Method for calculation of the design heat load - Part 2: Explanation and justification of EN 12831-1, Module M3-3) |

| No. | Module | *New EPBD numbering* | *Old standards replaced* | *Title of the new EPBD standard* |
|---|---|---|---|---|
| 5 | M8–3 | EN 12831–3 | EN 15316–3-1 | Energy performance of buildings - Method for calculation of the design heat load - Part 3: Domestic hot water systems heat load and characterisation of needs, Module M8-2, M8-3 |
| | | CEN/TR 12831–4 | New | Energy performance of buildings - Method for the calculation of the design heat load - Part 4: Explanation and justification of EN 12831-3, Module M8-2, M8-3 |
| 6 | M3–1<br>M8–1<br>M3–4<br>M8–4<br>M3–9<br>M8–9 | EN 15316–1 | EN 15316–1 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4 |
| | | CEN/TR 15316–6-1 | New | Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: Explanation and justification of EN 15316-1, Module M3-1, M3-4, M3-9, M8-1, M8-4 |
| 7 | M3–5<br>M4–5 | EN 15316–2 | EN 15316–2-1 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5 |
| | | CEN/TR 15316–6-2 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-2: Explanation and justification of EN 15316-2, Module M3-5, M4-5 |
| 8 | M3–6<br>M4–6<br>M8–6 | EN 15316–3 | EN 15316–2-3<br>EN 15316–3-2 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 3: Space distribution systems (DHW, heating and cooling), Module M3-6, M4-6, M8-6 |
| | | CEN/TR 15316–6-3 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-3: Explanation and justification of 15316-3, Module M3-6, M4-6, M8-6 |
| 9 | M3–8-1<br>M8–8-1 | EN 15316–4-1 | EN 15316–4-1<br>EN 15316–3-<br>3 EN 15316–4-7 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-1: Space heating and DHW generation systems, combustion systems (boilers, biomass), Module M3-8-1, M8-8-1 |
| | | CEN/TR 15316–6-4 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-4: Explanation and justification of EN 15316-4-1, Module M3-8-1, M8-8-1 |
| 10 | M3–8-2<br>M4–8-2<br>M8–8-2 | EN 15316–4-2 | EN 15316–4-2 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2 |
| | | CEN/TR 15316–6-5 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-5: Explanation and justification of EN 15316-4-2, Module M3-8 |

| No. | Module | *New EPBD numbering* | *Old standards replaced* | *Title of the new EPBD standard* |
|---|---|---|---|---|
| 11 | M3–8-3<br>M8–8-3<br>M11–8-3 | EN 15316–4-3 | EN 15316–4-3<br>EN 15316–4-6 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-3: Heat generation systems, thermal solar and photovoltaic systems, Module M3-8-3, M8-8-3, M11-8-3 |
| | | CEN/TR 15316–6-6 | New | Energy performance of buildings - Method for calculation of system energy performance and system efficiencies - Part 6-6: Explanation and justification of EN 15316-4-3 Module M3-8-3 M8-8-3 |
| 12 | M3–8-4<br>M8–8-4<br>M11–8-4<br>M3–7 / M8–7 | EN 15316–4-4 | EN 15316–4-4 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-4: Heat generation systems, building-integrated cogeneration systems, Module M8-3-4, M8-8-4, M8-11-4 |
| | | CEN/TR 15316–6-7 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-7: Explanation and justification of EN 15316-4-4, Module M8-3-4, M8-8-4, M8-11-4 |
| 13 | M3–8-5<br>M4–8-5<br>M8–8-5<br>M11–8-5 | EN 15316–4-5 | EN 15316–4-5 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5 |
| | | CEN/TR 15316–6-8 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-8: Explanation and justification of EN 15316-4-5 (District heating and cooling), Module M3-8-5, M4-8-5, M8-8-5, M11-8-5 |
| 14 | M3–8-8 | EN 15316–4-8 | EN 15316–4-8 | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-8: Space heating generation systems, air heating and overhead radiant heating systems, including stoves (local), Module M3-8-8 |
| | | CEN/TR 15316–6-9 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-9: Explanation and justification of EN 15316-4-8, Module M3-8-8 |
| 15 | M3–7<br>M8–7 | EN 15316–5 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 5: Space heating and DHW storage systems (not cooling), M3-7, M8-7 |
| | | CEN/TR 15316–6-10 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-10: Explanation and justification of EN 15316-5, Module M3-7, M8-7 |
| 16 | M3–8-6<br>M8–8-6 | EN 15316–4-9 | New | Heating systems and water based cooling systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-9: Direct electric generation systems |
| 17 | M11–8-7 | EN 15316–4-10 | New | Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-10: Wind power generation systems, Module M11-8-7 |

# 1 Scope

This European Standard is the general frame for the calculation of the energy use and the energy performance of heating and domestic hot water systems. This standards is only dealing with the heat, provided by water based systems, needed for heating, domestic hot water and cooling (e.g. absorption chiller).

It specifies how to perform the calculation of the entire installation using the calculation modules (see Table 2) corresponding to the methods defined in the respective standards.

It deals with common issues like operating conditions calculation and energy performance indicators.

It standardises the inputs and outputs in order to achieve a common European calculation method.

It allows the energy analysis of the heating and Domestic hot water systems and sub-systems including control (emission, distribution, storage, generation) by comparing the system losses and by defining energy performance indicators.

The performance analysis allows the comparison between systems and sub-systems and makes possible to evaluate the impact of each sub-system on the energy performance of a building.

The calculation of the system losses of each part of the heating sub-systems is defined in subsequent standards.

Ventilation systems are not included in this standard (e.g. balanced systems with heat recovery), but if the air is preheated or an air heating system is installed, the systems providing the heat to the AHU (Air Handling Unit) are covered by this standard.

Table 2 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in EN ISO 52000-1.

NOTE 1 In CEN ISO/TR 52000-2 the same table can be found, with, for each module, the numbers of the relevant EPB standards and accompanying technical reports that are published or in preparation.

NOTE 2 The modules represent EPB standards, although one EPB standard may cover more than one module and one module may be covered by more than one EPB standard, for instance a simplified and a detailed method respectively. See also Clause 2 and Tables A.1 and B.1.

**Table 2 — Position of this standard, within the modular structure of the set of EPB standards**

| Overarching | | | Building (as such) | | Technical Building Systems | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Descriptions | | | Descriptions | | Descriptions | Heating | Cooling | Ventilation | Humidification | Dehumidification | Domestic Hot water | Lighting | Building automation and control | Electricity production |
| sub1 | | M1 | sub1 | M2 | sub1 | | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10 | M11 |
| **1** | General | | **1** | General | **1** | General | **15316–1** | | | | | **15316–1** | | | |
| **2** | Common terms and definitions; symbols, units and subscripts | | **2** | Building Energy Needs | **2** | Needs | | | | | | 12831–3 | | | |
| **3** | Applications | | **3** | (Free) Indoor Conditions without Systems | **3** | Maximum Load and Power | 12831–1 | | | | | 12831–3 | | | |
| **4** | Ways to Express Energy Performance | | **4** | Ways to Express Energy Performance | **4** | Ways to Express Energy Performance | **15316–1** | | | | | **15316–1** | | | |
| **5** | Building Functions and Building Boundaries | | **5** | Heat Transfer by Transmission | **5** | Emission and control | 15316–2 | 15316 –2 | | | | | | | |
| **6** | Building Occupancy and Operating Conditions | | **6** | Heat Transfer by Infiltration and Ventilation | **6** | Distribution and control | 15316–3 | 15316 –3 | | | | 15316–3 | | | |
| **7** | Aggregation of Energy Services and Energy Carriers | | **7** | Internal Heat Gains | **7** | Storage and control | 15316–5 | | | | | 15316–5 15316–4-3 | | | |
| **8** | Building Partitioning | | **8** | Solar Heat Gains | **8** | Generation | | | | | | | | | |
| | | | | | **8–1** | Combustion boilers | 15316–4-1 | | | | | 15316–4-1 | | | |
| | | | | | **8–2** | Heat pumps | 15316–4-2 | 15316 –4-2 | | | | 15316–4-2 | | | |
| | | | | | **8–3** | Thermal solar Photovoltaics | 15316–4-3 | | | | | 15316–4-3 | | | 15316–4-3 |
| | | | | | **8–4** | On-site cogeneration | 15316–4-4 | | | | | 15316–4-4 | | | 15316–4-4 |
| | | | | | **8–5** | District heating and cooling | 15316–4-5 | 15316 –4-5 | | | | 15316–4-5 | | | 15316–4-5 |
| | | | | | **8–6** | Direct electrical heater | 15316–4-9 | | | | | 15316–4-9 | | | |
| | | | | | **8–7** | Wind turbines | | | | | | | | | 15316–4-10 |
| | | | | | **8–8** | Radiant heating, stoves | 15316–4-8 | | | | | | | | |
| **9** | Calculated Energy Performance | | **9** | Building Dynamics (thermal mass) | **9** | Load dispatching and operating conditions | **15316–1** | | | | | | | | |
| **10** | Measured Energy Performance | | **10** | Measured Energy Performance | **10** | Measured Energy Performance | 15378–3 | | | | | 15378–3 | | | |
| **11** | Inspection | | **11** | Inspection | **11** | Inspection | 15378–1 | | | | | 15378–1 | | | |
| **12** | Ways to Express Indoor Comfort | | **12** | – | **12** | BMS | | | | | | | | | |
| **13** | External Environment Conditions | | | | | | | | | | | | | | |
| **14** | Economic Calculation | 15459–1 | | | | | | | | | | | | | |

NOTE The shaded modules are not applicable

# 2 Normative references

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

EN 15316-3, *Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 3: Space distribution systems (DHW, heating and cooling), Module M3-6, M4-6, M8-6*

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

EN ISO 52000-1:2017, *Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures (ISO 52000-1:2017)*

# 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 7345:1995, EN ISO 52000-1:2017 and the following specific definitions apply.

**3.1**
**feeding distribution circuit**
circuit providing the node with energy delivered by sources

**3.2**
**load distribution circuit**
circuit that draw energy from the node and distribute it to the demand side

**3.3**
**node**
connection point between one or several feeding circuits (sources) and one or more load circuits (demand side)

Note 1 to entry: The requested energy is dispatched among the sources (e.g. generators) at the node.

# 4 Symbols and abbreviations

## 4.1 Symbols

For the purposes of this Standard, the symbols given in EN ISO 52000-1, (M1-9): and the specific symbols listed in Table 3 apply.

**Table 3 — Symbols and units**

| Symbol | Name of quantity | Unit |
|---|---|---|
| GEN_FUEL | Fuel type | - |
| HEAT_XXXX_XXXX_XXX | BAC function identifier | - |

## 4.2 Subscripts

For the purposes of this European Standard, the subscripts given in EN ISO 52000-1, (M1-9) and the specific subscripts listed in Table 4 apply.