SLOVENSKI STANDARD
SIST EN 15316-4-2:2018

01-maj-2018

Nadomešča:
SIST EN 15316-4-2:2008

Energijske lastnosti stavb - Metoda za izračun energijskih zahtev in učinkovitosti sistema - 4-2. del: Sistemi za pridobivanje toplote za ogrevanje, toplotne črpalke - Modula M3-8-2 in M8-8-2

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

Energetische Bewertung von Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-2: Wärmeerzeugung für die Raumheizung, Wärmepumpensysteme, Modul M3-8-2, M8-8-2

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-2 : Systèmes de génération de chauffage des locaux, systèmes de pompes à chaleur Module M3-8-2, M8-8-2

Ta slovenski standard je istoveten z: **EN 15316-4-2:2017**

ICS:

27.080	Toplotne črpalke	Heat pumps
91.140.10	Sistemi centralnega ogrevanja	Central heating systems

SIST EN 15316-4-2:2018 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15316-4-2

April 2017

ICS 91.140.10

Supersedes EN 15316-4-2:2008

English Version

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

Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-2 : Systèmes de génération de chauffage des locaux, systèmes de pompes à chaleur Module M3-8-2, M8-8-2

Energetische Bewertung von Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-5: Fernwärme und Fernkälte, Modul M3-8-5, M4-8-5, M8-8-5, M11-8-5

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

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This document consolidates EN 15316-4-2:2017 and the corrigendum EN 15316-4-2:2017/AC:2017.

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

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Ref. No. EN 15316-4-2:2017 E

Contents

Page

European foreword

This document (EN 15316-4-2:2017) has been prepared by Technical Committee CEN/TC 228 “Heating systems and water based cooling systems in buildings”, the secretariat of which is held by DIN.

This document supersedes EN 15316-4-2:2008.

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.

The revision keeps the main principles of the calculation unchanged but the structure of the document was changed. Informative content was removed to the accompanying technical report CEN/TR 15316-6-2. The provisions cover also other energy carriers than heat now. The values may be altered in a national annex.

Calculation methods to determine energy source indicators like the renewable energy ratio have been added.

The main changes compared to EN 15316-4-2:2008 are:

a) type of heat pumps are now limited to hot water production at the output of the condenser;

b) informative content was removed to the accompanying technical report CEN/TR 15316-6-2;

c) calculation for performance of the heat pumps at different conditions is based on interpolation provisions;

d) input data for energy performance of the heat pumps are based on part load and/or full load information;

e) Annex A contains a template for the data and parameters used in the standards and Annex B a set of default values.

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

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.

This document includes the corrigendum EN 15316-4-2:2017/AC:2017 which corrects Table D.3.

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 European 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”.

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.

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

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

— energy performance calculation for heating systems;

— inspection of heating systems;

— design of heating systems;

— installation and commissioning of heating systems.

This standard specifies to take into account the energy performance of heat pump systems used for domestic or heating purpose.

For the correct use of this standard, Annex A is to be used to specify the choices with the required input data. Default values are presented in Annex B. 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, in particular for the application within the context of EU Directives transposed into national legal requirements. These choices can be made available as National Annex or as separate (e.g. legal) document. It is expected, if the default values and choices in Annex A are not followed due to national regulations, policy or traditions, that:

— either the national standardization body will consider the possibility to add or include a National Annex in agreement with the template of Annex A.

— or the national or regional authorities will, in the building regulations, reference the standard and prepare data sheets containing the national or regional choices and values, in agreement with the template of Annex A.

This updated standard covers hourly, monthly, annual time-steps and temperatures classes (bin method).

1 Scope

This European Standard covers heat pumps for space heating, heat pump water heaters (HPWH) and heat pumps with combined space heating and domestic hot water production in alternate or simultaneous operation, where the same heat pump delivers the heat to cover the space heating and domestic hot water heat requirement.

The standard provides a calculation method under steady conditions that corresponds to one calculation step.

The results of this calculation are incorporated in larger building models and take in account the influence of the external conditions and building control that influence the energy requirements for heating supplied by the heat pump system.

The scope of this part is to standardize the:

— required inputs;

— calculation methods;

— required outputs

Generation for space heating and domestic hot water production of the following heat pump systems, including control of:

— electrically-driven vapour compression cycle (VCC) heat pumps;

— combustion engine-driven vapour compression cycle heat pumps;

— thermally-driven vapour absorption cycle (VAC) heat pumps;

using combinations of heat source and heat distribution listed in Table 1.

Table 1 — Heating sources and energy distribution

Source	Distribution
Outdoor air	**Water**
Exhaust-air	
Indirect ground source with brine	
Indirect ground source with water	
Direct ground source (Direct expansion (DX)	
Surface water	
Ground water	

This standard does not cover sizing or inspection of heat pumps.

This standard deals with heat generators for heating or for combined domestic hot water and heating service. Generators for domestic hot water only are taken into account into module M8-8.

NOTE 1 Heat pumps for cooling systems are taken into account into module M4–8.

NOTE 2 Heat pumps for space heating using air (distribution) are taken into account in module M5–8.

Other generation systems such as boilers are covered in other sub modules of part M3-8.

This is the revision of EN 15316-4-2:2008. The revision covers the adaptation of the standard to hourly and monthly energy calculation.

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 3 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 4 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
sub 1		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**			
					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
					8–6	Direct electrical heater	15316–4-6					15316–4-6			
					8–7	Wind turbines									15316–4-7
					8–8	Radiant heating, stoves	15316–4-8								
9	Calculated Energy Performance		9	Building Dynamics (thermal mass)	9	Load dispatching and operating conditions									
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 12309-4, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 4: Test methods*

EN 12309-6, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 6: Calculation of seasonal performances*

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 15316-4-1, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-1: Space heating generation systems, combustion systems (boilers)*

EN 14511 (all parts), *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling*

EN 14825, *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling - Testing and rating at part load conditions and calculation of seasonal performance*

EN 16147, *Heat pumps with electrically driven compressors - Testing, performance rating and requirements for marking of domestic hot water units*

EN ISO 15927-6, *Hygrothermal performance of buildings - Calculation and presentation of climatic data - Part 6: Accumulated temperature differences (degree-days) (ISO 15927-6)*

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 definitions apply.

3.1
alternate operation
production of heat energy for the space heating and domestic hot water system by a heat generator with combined service by switching the heat generator either to the domestic hot water operation or the space heating operation

3.2
application rating conditions
mandatory rated conditions within the operating range of the unit that are published by the manufacturer or supplier

3.3
auxiliary energy
electrical energy used by technical building systems for heating, cooling, ventilation and/or domestic water to support energy transformation to satisfy energy needs

Note 1 to entry: This includes energy for fans, pumps, electronics, etc. Electrical energy input to a ventilation system for air transport and heat recovery is not considered as auxiliary energy, but as energy use for ventilation.

Note 2 to entry: The driving energy input for electrically-driven heat pumps in the system boundary of the COP and an electrical back-up heater is not entitled auxiliary energy.

3.4
back-up heater
heater to supply heat not covered by the heat pump system itself

Note 1 to entry: If the back-up heater is an electrical heater, the system is calculated according to this standard, if it is external system, this standard gives the demand of missing heat not supplied by the heat pump as output data.

3.5
bin hours
sum of all hours occurring at a given temperature for a specific location equal

Note 1 to entry: In EN 14825, the number is rounded to a whole number and is derived from representative weather data over the 1982–1999 period.

3.6
bivalent temperature
lowest temperature at which the heat pump heating power and the building heat load are equal

Note 1 to entry: Below this point, the unit may still deliver capacity, but additional back up heating is necessary to fulfill the full heating load.

Note 2 to entry: According to the definition bivalent temperature is not fixed at the heating load depends on temperature and internal gains; but bivalent temperature is mainly consider a fixed by the control system to operate additional back-up heater.

3.7
bin
statistical temperature class (sometimes a class interval) for the outdoor air temperature, with the class limits expressed in a temperature unit

3.8
coefficient of performance COP
ratio of the heating capacity to the effective power input of the unit

3.9
combustion engine heat pump
compressed vapour heat pump driven by a combustion engine.

3.10
cut-out period
time period in which the electricity supply to the heat pump is interrupt by the supplying utility

3.11
effective power input
average power input of the unit within the defined interval of time obtained from:

— the power input for operation of the compressor or burner and any power input for defrosting;

— the power input for all control and safety devices of the unit; and

— the proportional power input of the conveying devices (e.g. fans, pumps) for ensuring the transport of the heat transfer media inside the unit based on the operating time of the heat pump

3.12
electrically-driven heat pump
vapour compression cycle heat pump, which incorporate a compressor that is driven by an electric motor

3.13
combined heat pump
heat generator, which supplies energy to two different systems, e.g. the space heating system and the domestic hot water system in alternate or simultaneous combined operation

3.14
gas absorption heat pump
heat pump working with a thermodynamic cycle that uses ammonia as a refrigerant and water as absorber, powered through a combustion direct flame

3.15
heat pump
appliance which takes up heat at a certain temperature and releases heat at a higher temperature

Note 1to entry: When operated to provide heat (e.g., for space heating or water heating), the appliance is said to operate in the heating mode; when operated to remove heat (for example, for space cooling), it is said to operate in the cooling mode.

3.16
heat transfer medium
any medium (water, air, etc.) used for the transfer of the heat without change of state, that can be:

— the fluid cooled by the evaporator;

— the fluid heated by the condenser

3.17
heating power $P_{HW;gen;out}$
heat flow rate given off by the unit to the heat transfer medium per unit of time for heating, or domestic hot water or a combination of these

Note 1 to entry: If heat is removed from the indoor heat exchanger for defrosting, it is taken into account.

3.18
monovalent H.P
unitary or spit type assembly using only one energy carrier to transfer heat, other than electricity for auxiliary systems only

Note 1 to entry: This energy carrier can be also electricity.

3.19
bivalent H.P
unitary or spit type assembly using one energy carrier to transfer heat and the same or another energy carrier to produce heat by conversion in an auxiliary device placed into the same assemby, other than electricity for auxiliary systems only

Note 1 to entry: One of these energy carriers can be also electricity.

3.20
operation temperature limit
TOL
lowest outdoor temperature at which the unit can still deliver heating capacity, as declared by the manufacturer

Note 1 to entry: Below this temperature the heat pump will not be able to deliver any heating capacity.

3.21
operating range
range indicated by the manufacturer and limited by the upper and lower limits of use (e.g. temperatures, air humidity, voltage) within which the unit is deemed to be fit for use and has the characteristics published by the manufacturer

3.22
part load operation
operation state of the heat pump system where the actual load requirement is below the actual output capacity of the device

3.23
part load ratio
LR
ratio between the generated heat during the calculation period and the maximum possible output from the heat generator during the hourly calculation period or bin temperature

Note 1 to entry: Part load ratio is not used for monthly method.

3.24
primary pump
pump mounted in the circuit containing the generator and hydraulic decoupling, e.g. a heating buffer storage in parallel configuration or a hydronic distributor

3.25
produced (thermal) energy
heat produced by the heat pump system to cover the energy requirement of the distribution subsystem and the generation subsystem heat losses for space heating and/or domestic hot water

3.26
set-point temperature of a conditioned zone
indoor (minimum intended) temperature, as fixed by the control system in heating mode

3.27
simultaneous operation during the heating period
simultaneous production of heat energy for the space heating and domestic hot water use by a combined heat pump

3.28
simultaneous operation during the heating period
simultaneous production of heat energy for the space heating and domestic hot water use by a combined heat pump

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the symbols given in EN ISO 52000-1, and the specific terms listed in Table 3 apply.

Table 3 —Symbols

LR	Part load ratio

4.2 Subscripts

For the purposes of this document, the subscripts given in EN ISO 52000-1, and the specific subscripts listed in Table 4 apply.