SLOVENSKI STANDARD
SIST EN 12828:2013+A1:2014

01-julij-2014

Ogrevalni sistemi v stavbah - Projektiranje toplovodnih ogrevalnih sistemov

Heating systems in buildings - Design for water-based heating systems

Heizungsanlagen in Gebäuden - Planung von Warmwasser-Heizungsanlagen

Systèmes de chauffage dans les bâtiments - Conception des systèmes de chauffage à eau

Ta slovenski standard je istoveten z: **EN 12828:2012+A1:2014**

ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems

SIST EN 12828:2013+A1:2014 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12828:2012+A1

April 2014

ICS 91.140.10

Supersedes EN 12828:2012

English Version

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Foreword

This document (EN 12828:2012+A1:2014) has been prepared by Technical Committee [A1] CEN/TC 228 “Heating systems and water based cooling systems in buildings” [A1], the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2014, and conflicting national standards shall be withdrawn at the latest by October 2014.

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

This document includes Amendment 1 approved by CEN on 12 January 2014.

This document supersedes [A1] EN 12828:2012 [A1].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1].

The main changes [A1] between EN 12828:2003 and EN 12828:2012 were [A1]:

— restrictions concerning additional safety requirements for systems larger than 1 MW were removed;

— an informative annex for safety valves was added;

— definitions were corrected and added;

— the guidance for dimensioning of diaphragm expansion vessels (sealed systems) in Annex D was revised, and a figure describing the different pressure level was added;

— a specification for the water used has been added in 4.3.2.1;

— the requirements concerning safety arrangements (4.6) were revised and clarified;

— 4.7.4 concerning pressure maintaining control device was revised.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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 load;

— 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 system 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 CEN or ISO standards, e.g. 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 may 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.

1 Scope

This European Standard specifies design criteria for water based heating systems in buildings with a maximum operating temperature of up to 105 °C. In case of heating systems with maximum operating temperatures over 105 °C other safety aspects than those described in 4.6 may apply. The other clauses of this European Standard are still valid for those systems.

This European Standard does not amend product standards or product installation requirements. This standard covers the design of:

— heat supply systems;

— heat distribution systems;

— heat emission systems;

— control systems.

This European Standard takes into account heating requirements of attached systems (e.g. domestic hot water, process heat, air conditioning, ventilation) in the design of a heat supply, but does not cover the design of these systems.

This European Standard does not cover requirements for installation or commissioning or instructions for operation, maintenance and use of water based heating systems.

This European Standard does not cover the design of fuel and energy supply systems.

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 215, *Thermostatic radiator valves — Requirements and test methods*

EN 442-1, *Radiators and convectors — Part 1: Technical specifications and requirements*

EN 442-2, *Radiators and convectors — Part 2: Test methods and rating*

EN 442-3, *Radiators and convectors — Part 3: Evaluation of conformity*

EN 806-2, *Specifications for installations inside buildings conveying water for human consumption — Part 2: Design*

EN 1264-1, *Water based surface embedded heating and cooling systems — Part 1: Definitions and symbols*

EN 1264-2, *Water based surface embedded heating and cooling systems — Part 2: Floor heating: Prove methods for the determination of the thermal output using calculation and test methods*

EN 1264-3, *Water based surface embedded heating and cooling systems — Part 3: Dimensioning*

EN 1264-4, *Water based surface embedded heating and cooling systems — Part 4: Installation*

EN 1264-5, *Water based surface embedded heating and cooling systems — Part 5: Heating and cooling surfaces embedded in floors, ceilings and walls — Determination of the thermal output*

EN 12170, *Heating systems in buildings — Procedure for the preparation of documents for operation, maintenance and use — Heating systems requiring a trained operator*

EN 12171, *Heating systems in buildings — Procedure for the preparation of documents for operation, maintenance and use — Heating systems not requiring a trained operator*

EN 12831, *Heating systems in buildings — Method for calculation of the design heat load*

EN 14336, *Heating systems in buildings — Installation and commissioning of water based heating systems*

EN 15500, *Control for heating, ventilating and air-conditioning applications — Electronic individual zone control equipment*

EN 60730-2-9, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 730-2-9, modified)*

EN ISO 7730, *Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria (ISO 7730)*

EN ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1)*

3 Terms, definitions and symbols

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

3.1 Terms and definitions

3.1.1
attached system
system connected to the heating system which may influence the design and heat load of the system

EXAMPLE Examples of such systems include:

— domestic hot water systems;

— ventilation and air conditioning systems;

— process heating systems

3.1.2
central control
method of controlling the heat flow to a heat emission system by changing the flow rate and/or the flow temperature at a central point

3.1.3
design heat load
maximum heat output required from the heating system of a building, in order to maintain required internal temperatures without supplementary heating

[SOURCE: EN ISO 15927-5:2004, 3.1.1]

3.1.4
design heat loss
quantity of heat per unit time leaving the building to the external environment under specified design conditions

[SOURCE: EN 12831:2003, 3.1.5]

3.1.5
external design temperature
external air temperature which is used for the calculation of the design heat losses

3.1.6
external air temperature
air temperature outside the building

3.1.7
frost inhibitor
supplement to a heating medium lowering its freezing point

3.1.8
heat distribution system
configuration of interconnected components for the dispersal of heat between the heat supply system and the heat emission system or any attached system

3.1.9
heated space
room or enclosure which is to be heated to the specified internal design temperature

3.1.10
heat emission system
configuration of interconnected components for the dispersal of heat to a heated space

3.1.11
heat gains
quantity of heat generated within or entering into a heated space from heat sources other than the heating system

3.1.12
heating period
time during which heating is required to maintain the internal design temperature

3.1.13
heat supply system
configuration of interconnected components/appliances for the supply of heat to the heat distribution system

3.1.14
internal design temperature
operative temperature at the centre of the heated space (between 0,6 m and 1,6 m height) used for calculation of the design heat losses

3.1.15
local control
method of controlling the heat flow to a heat emission system by changing the flow rate or the flow temperature locally on the basis of the temperature of the heated space

3.1.16
open vented system
heating system in which the heating medium is open to the atmosphere

3.1.17
maximum operating pressure
maximum pressure at which the system, or parts of the system, is designed to operate

3.1.18
maximum operating temperature
maximum temperature at which the system, or parts of the system, is designed to operate

3.1.19
operative temperature
arithmetic average of the internal air temperature and the mean radiant temperature

3.1.20
pressure limiter
automatic operating device that causes shutdown and lock out of the heat supply when the maximum operating pressure of the heating medium is exceeded

3.1.21
sealed system
heating system in which the heating medium is closed to the atmosphere

3.1.22
safety temperature lockout device
device that causes safety shutdown and non-volatile lockout of the heat supply so as to prevent the water temperature exceeding a preset limit

3.1.23
temperature controller
automatic operating device that causes shutdown of the heat supply when the set operating temperature of the heating medium is exceeded

Note 1 to entry: The heat supply will be restored automatically when the temperature of the heating medium falls below the set operating temperature.

3.1.24
timing control
method of controlling the heat flow to a heat emission system by using a timed program for starting and shutdown of the heat flow

3.1.25
water level limiter
automatic operating device that causes shutdown and lock out of the heat supply when the set minimum water level of the heating medium is reached

3.1.26
zone
space or groups of spaces with similar thermal characteristics

3.1.27
zone control
local control of a zone consisting of more than one space

3.1.28
nominal heat output
Φ_N
value of the thermal power output of the heat generator as declared by the manufacturer

3.1.29
efficiency
ratio of the heat output to the heat input, expressed in %

3.1.30
pressurisation system
system equipment (membrane expansion vessels, compressor-controlled pressurisation units and pump-controlled pressurisation units) for pressure maintenance in closed heating systems

Note 1 to entry: The equipment provides to maintain the system pressure between defined limits and ensures the required minimal working pressure of the heating system. The equipment holds the accruing expansion water when the system water is heated and restores the volume when the heating system is cooling down and contracting. Due to the design of construction the expansion system simultaneously protects the expansion water from corrosion producing ingress of oxygen.

3.1.31
maximum system safety temperature
highest temperature any component of the heating system can accommodate

3.1.32
lockout
default condition resulting in a shutdown of the system and requiring a manual reset

Note 1 to entry: The intention of a lockout is to require the operator to investigate and eliminate the cause of the lockout.

3.1.33
response overpressure
pressure at which a safety valve opens at operating conditions

3.2 Symbols

Table 1 — Symbols used in the standard

Symbol	Description	Unit
A_{min}	narrowest flow section of a safety valve	mm^2
d_e	external pipe diameter	mm
d_{fe}	minimum internal diameter of the feed and expansion pipe	mm
d_{in}	nominal size of the safety valve's inlet	
d_{min}	narrowest flow diameter upstream of the valve seat	mm
d_{out}	nominal size of the safety valve's outlet	
d_s	minimum internal diameter of the safety pipe	mm
e	expansion coefficient	
f_{AS}	design factor for other attached systems	
f_{DHW}	design factor for domestic hot water systems	
f_{HL}	design factor for the heat load	
f_{nrbl}	fraction of heat emission, considered as wasted;	
h_{st}	static height	bar
h_{Win}	window height	m
I	operational parameter	$C \cdot s/year \cdot 10^9$
K	constant	kW/mm^2
K_{dr}	specified reduced discharge coefficient for gases/vapours	/

l	specific latent heat quantity	kJ/kg
p_{abs}	absolute pressure in the system (set pressure + admissible pressure increase)	bar
p_{fil}	filling pressure – the required pressure in the system if the lowest possible temperature is not given (for filling or water make-up)	bar
p_{fin}	final pressure	bar
p_{ini}	initial pressure	bar
p_v	vapour pressure	bar
p_0	minimum operating pressure	bar
p_{PAZ}	pressure at which the pressure limiter operates	bar
p_{st}	static height pressure	bar
p_{sv}	set pressure of the safety valve	Bar
t	time	s
U_L	linear thermal transmission coefficient for pipes	W/m·K
U_W	thermal transmittance of the outside wall/window	W/m²·K
V_{ex}	expansion volume	m^3
V_N	nominal volume of the expansion vessel to be determined	m^3
$V_{N,min}$	minimum nominal volume	m^3
V_{System}	total water content of the system	m^3
V_{wr}	real water reserve volume in the pressure vessel used	m^3
$V_{wr,min}$	minimal water reserve volume	m^3
x	coefficient of pressure medium for saturated steam	(h·mm^2·bar)/kg
α	coefficient for valve design	
η	utilisation degree	
Φ	heating capacity	kW
Φ_{AS}	capacity of other attached systems	kW
Φ_{DHW}	domestic hot water capacity	kW
Φ_{HL}	heat load capacity	kW
Φ_N	nominal heat output	kW
Φ_{SU}	capacity of the heat supply system	kW
λ	thermal conductivity of the insulation material	W/m·K
$\rho_{\vartheta_{fil}}$	density of water at the average system temperature during fill or make-up process	kg/m^3
$\rho_{\vartheta_{max}}$	density of water at the maximum set operating temperature	kg/m^3
$\rho_{\vartheta_{min}}$	density of water at the lowest system temperature	kg/m^3
ϑ	temperature	°C
ϑ_a	air temperature	°C
$\vartheta_{d,e}$	external design temperature	°C

$\vartheta_{d,int}$	internal design temperature	°C
ϑ_{env}	temperature of the surrounding environment	°C
ϑ_{o}	operative temperature	°C
$\overline{\vartheta}_{r}$	mean radiant temperature	°C
ϑ_{W}	surface temperatures of outside wall/window	°C
ϑ_{w}	water temperature	°C

Table 2 — Indices used in the standard

Index	Definition
a	air
abs	absolute
AS	other attached systems
d	design
DHW	domestic hot water systems
dr	reduced discharge
e	external
env	environment
ex	expansion
fe	feed and expansion
fil	filling
fin	final
HL	heat load
in	Inlet
ini	initial
int	internal
j	summation index
L	linear thermal transmission
max	maximum
min	minimum
N	nominal
nrbl	heat emission, considered as wasted
o	operative
0	minimum operational
out	outlet
PAZ	pressure limiter
r	radiant
s	safety

st	static
SU	heat supply system
sv	safety valve
System	system
V	vapour
w	water
W	outside wall/window
Win	window
wr	water reserve
ϑ_{max}	maximum system temperature
ϑ_{min}	minimum system temperature

4 System design requirements

4.1 Requirements for preliminary design information

The heating system shall be designed, installed and operated in a way that does not damage the building or other installations and with due consideration to minimise energy use.

The heating system shall be designed with due consideration to installation, commissioning, operation, maintenance and repair of components, appliances and the system.

At the planning stage or during the progress of design work, the following items shall be agreed upon and documented:

a) clarification of the responsibilities of the designer and the installer and whether or not a qualified operator is required;

b) compliance with relevant local or statutory regulations;

c) thermal characteristics of the building for calculation of heat requirements and possible improvements of energy conservation;

d) external design temperature;

e) internal design temperature;

f) method of heat load calculation;

g) energy source;

h) position of the heat generator, bearing in mind access for maintenance, means of flueing and provision of combustion air;

i) type, location, dimensions, construction and suitability of chimney and flue terminal, if required;

j) location and size of fuel storage and access thereto, if required;

k) consideration of solid fuel, ash removal and disposal;