# SLOVENSKI STANDARD
# SIST EN 12828:2004

**01-februar-2004**

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**Grelni sistemi v stavbah – Projektiranje toplovodnih grelnih sistemov**

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

Heizungssysteme in Gebäuden - Planung von Warmwasser-Heizungsanlagen



Systemes de chauffage dans les bâtiments - Conception des systemes de chauffage a eau



**Ta slovenski standard je istoveten z:** **EN 12828:2003**

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**ICS:**

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

**SIST EN 12828:2004** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

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# EN 12828

March 2003

ICS 91.140.10

English version

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

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

Heizungssysteme in Gebäuden - Planung von Warmwasser-Heizungsanlagen

This European Standard was approved by CEN on 4 July 2002.

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 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 Management Centre has the same status as the official versions.



CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and United Kingdom.



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

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# Contents

# Foreword

This document EN 12828:2003 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 September 2003, and conflicting national standards shall be withdrawn at the latest by March 2004.

Annexes A, B, C, D and ZA are informative.

This document includes a Bibliography.

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, 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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.

# 1 Scope

This 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 standard are still valid for those systems.

This standard does not cover additional safety requirements which may be applicable to heating systems greater than 1 MW design heat load.

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



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



# 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 215-1
*Thermostatic radiator valves - Part 1: 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 563
*Safety of machinery – Temperatures of touchable surfaces – Ergonomics data to establish temperature limit values for hot surfaces.*

prEN 806-2
*Specifications for installations inside buildings conveying water for human consumption – Part 2: Design.*

EN 1264-1
*Floor heating - Systems and components – Part 1: Definitions and symbols.*

EN 1264-2
*Floor heating - Systems and components – Part 2: Determination of the thermal output.*

EN 1264-3
*Floor heating - Systems and components – Part 3: Dimensioning.*

prEN 1268-1
*Safety devices for the protection against excessive pressure - Part 1: Safety valves.*

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 13202
*Ergonomics of the thermal environment - Temperatures of touchable hot surfaces - Guidance for establishing surface temperature limit values in production standards with the aid of EN 563.*

prEN 13831
*Closed expansion vessels with built-in diaphragm for installations in water systems.*



EN 60730-2-9
*Automatic electrical controls for household and similar use – Part 2-9: Particular requirements for temperature sensing controls (IEC 730-2-9:2000, modified).*



EN ISO 7730
*Moderate thermal environments - Determination of the PMV and PPD indices and specification of the conditions for thermal comfort (ISO 7730:1994).*

## 3 Terms and definitions

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

**3.1**
**attached system**
ancillary system which may influence the design and heat load of the system but does not form an integral part of the space heating system. Examples of such ancillary systems include:

— domestic hot water systems;

— ventilation and air conditioning systems;

— process heating systems

**3.2**
**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

**3.3**
**design heat load**
heat flow required to achieve the specified design conditions

**3.4**
**design heat losses**
quantity of heat per unit time leaving the building to the external environment under specified design conditions, i.e. heat losses calculated according to EN 12831

**3.5**
**external design temperature**
external air temperature which is used for the calculation of the design heat losses

**3.6**
**external air temperature**
air temperature outside the building

**3.7**
**frost inhibitor**
supplement to a heating medium lowering its freezing point

**3.8**
**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



**3.9**
**heated space**
space which is to be heated to the specified internal design temperature



**3.10**
**heat emission system**
configuration of interconnected components for the dispersal of heat to a heated space

**3.11**
**heat gains**
quantity of heat generated within or entering into a heated space from heat sources other than the heating system

**3.12**
**heating period**
time during which heating is required to maintain the internal design temperature

**3.13**
**heat supply system**
configuration of interconnected components/appliances for the supply of heat to the heat distribution system

**3.14**
**internal design temperature**
operative temperature at the centre of the heated space (between 0,6 and 1,6 m height) used for calculation of the design heat losses

**3.15**
**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

**3.16**
**open vented system**
heating system in which the heating medium is open to the atmosphere

**3.17**
**maximum operating pressure**
maximum pressure at which the system, or parts of the system, is designed to operate

**3.18**
**maximum operating temperature**
maximum temperature at which the system, or parts of the system, is designed to operate

**3.19**
**operative temperature**
arithmetic average of the internal air temperature and the mean radiant temperature

**3.20**
**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. The heat supply can only be restored when the pressure of the heating medium falls below the pressure limit and after resetting manually or using a tool

**3.21**
**sealed system**
heating system in which the heating medium is closed to the atmosphere

**3.22**
**safety temperature limiter**
automatic operating device that causes shutdown and lock out of the heat supply when the maximum operating temperature of the heating medium is exceeded. The heat supply can only be restored manually when the temperature of the heating medium falls below the operating temperature



**3.23**
**temperature controller**
automatic operating device that causes shutdown of the heat supply when the set operating temperature of the heating medium is exceeded. The heat supply will be restored automatically when the temperature of the heating medium falls below the set operating temperature



**3.24**
**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

**3.25**
**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. The heat supply can only be restored when the water level of the heating medium rises above the set minimum water level and after resetting manually or using a tool

**3.26**
**zone**
space or groups of spaces with similar thermal characteristics

**3.27**
**zone control**
local control of a zone consisting of more than one space

# 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 of costs and 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;

l) position of feed and expansion cistern for open vented systems or expansion vessel, filling point and pressure gauge for sealed systems;

m) facilities for filling and draining the system;

n) requirements for any attached system;

o) type and position of heat emitters;

p) control system of heating and attached system, including frost protection;

q) route and method of installing piping and insulation;

r) provisions and specification for balancing the system;

s) provision for measurement of energy consumption;

t) surface temperatures of exposed heating system surfaces;

u) provision for water treatment;

v) requirements for extra heating up capacity, including night-set-back or intermittent heating according to EN 12831 and buffer storage for hot water systems;

w) determination of the design factors $f_{HL}$, $f_{DHW}$ and $f_{AS}$ (see 4.2.2).

## 4.2 Heat supply

### 4.2.1 General

The heat supply system shall be designed to satisfy the design heat load of the building and the requirements of any attached system. The design heat load shall be calculated in accordance with EN 12831.

Any other recognized heat load calculation method may only be used if accepted by the client.

The heat supply system shall be designed and dimensioned taking into account the type of energy source.

General consideration should be given to energy efficiency of the heating system.

### 4.2.2 Sizing

The heat supply to serve the system shall be sized to meet the design heat load and the necessary additional heat supply requirements of any ancillary domestic hot water and other attached systems in accordance with the specifications agreed upon in 4.1.

If the total heat supply is provided by more than one heat generator or heat source, the following points shall be considered:



— the heat load;



— different operating periods, such as summer and winter;

— different operating conditions, such as for heating or for hot water;

— operating requirements, such as standby.

The capacity of the heat supply system shall be calculated as follows:

$$\Phi_{SU} = f_{HL} \cdot \Phi_{HL} + f_{DHW} \cdot \Phi_{DHW} + f_{AS} \cdot \Phi_{AS} \quad (1)$$

where:

$\Phi_{SU}$ is the capacity of the heat supply system in kilo Watts (kW);
$f_{HL}$ is the design factor for the heat load;
$\Phi_{HL}$ is the heat load capacity in kilo Watts (kW);
$f_{DHW}$ is the design factor for domestic hot water systems;
$\Phi_{DHW}$ is the domestic hot water capacity in kilo Watts (kW);
$f_{AS}$ is the design factor for attached systems;
$\Phi_{AS}$ is the capacity of attached systems in kilo Watts (kW);

The design factors $f_{HL}$, $f_{DHW}$ and $f_{AS}$ shall be determined on an individual basis subject to national limitations. It should be considered that the above heat load capacities may not be cumulative and the heat supply capacity should be determined based on agreed criteria for their demand.

## 4.3 Heat distribution

### 4.3.1 General

The heat distribution system shall be designed to distribute the heat supply to the heat emission system and, if necessary, to any attached systems.

The heat distribution system, including sub-circuits, shall be designed so as to enable hydraulic balancing.

Consideration shall be given to any variety of demand for attached systems and to the quality of the water.

Consideration shall be given to separate circuits for each type of heat emission system, the zoning requirement of buildings and the supply temperature and temperature difference of each heat emission system.

Provision for filling, draining and venting shall be provided for each circuit.

### 4.3.2 Design criteria

#### 4.3.2.1 Water specification

The quality of the water in the heating circuit shall conform to the design and the selected components of the heating system.

Consideration shall be given to:



— the chemical characteristics of the water, e.g. pH, $O_2$, $Cl_2$ and carbonates;

— supplements for water treatment and/or anti-freeze, when necessary. These shall be used in accordance with the appliance, component and chemical manufacturers' requirements.



#### 4.3.2.2 Water flow rate

The water flow rate and the initial setting of the balancing devices, where required in accordance with the specification, shall be stated and documented according to the flow rate requirements of the heat supply system as well as the heat emission system and any attached systems.

Consideration shall be given to:

— balancing devices;

— hydraulic decoupling devices;

— speed-controlled circulation pumps.

#### 4.3.2.3 Circulation pumps

Circulation pumps shall be sized to circulate water at the flow rate required to distribute the heat load to the heat emission system and any attached systems.

Consideration shall be given to:

— the number of pumps, including stand-by provision;

— characteristic curves and the optimum range of application;

— the variable flow control system;

— minimizing the electric power required;