

Heating Systems in buildings — Design and installation of direct electrical room heating systems

The European Standard EN 14337:2005 has the status of a
British Standard

ICS 91.140.10; 97.100.10

National foreword

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The UK participation in its preparation was entrusted to Technical Committee RHE/24, Central heating installations, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
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English Version

Heating Systems in buildings - Design and installation of direct electrical room heating systems

Systèmes de chauffage dans les bâtiments - Conception et installation des systèmes de chauffage électrique direct

Heizungssysteme in Gebäuden - Planung und Einbau von elektrischen Direkt-Raumheizungen

This European Standard was approved by CEN on 14 February 2005.

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Foreword

This document (EN 14337:2005) 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of an identical text or by endorsement, at the latest by June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

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.

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

1. Scope

This document specifies the design criteria for electrical heating systems in individual and collective residential buildings, the commercial and industrial building sector.

This document covers fixed electrical heaters which emit heat directly into space by use of electricity only.

The following systems are included:

- electric instantaneous heating systems:
 - natural or fan convector heaters;
 - radiant panels;
 - radiators / resistance heaters;
 - ceiling heating;
 - infra-red and quartz linear heaters;
 - thin slab floor heating;
 - wall heating.
- electric non-instantaneous heating systems:
 - full slab floor heating;
 - room storage heaters;
 - room storage fan heaters.

This document does not cover radiant electric fires, movable heaters or electric heating systems that require a transfer medium outside of the appliance to deliver heat into the space. Examples of such systems include:

- air conditioning or cooling systems;
- unitary heat pumps;
- window, through the wall and split system;
- warm air distribution systems;
- central storage serving hot water radiator or warm air systems;
- hot water production, either storage or direct;
- any individual appliance serving more than one room.

Requirements for installation, commissioning, and operation maintenance and use of direct electrical heating systems are excluded from this document.

This document does not overwrite national regulations.

This document does not override or add to requirements in appliance standards.

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 12098-3, *Controls for heating systems - Part 3: Outside temperature compensated control equipment for electrical heating systems*

prEN 12098-4, *Controls for heating systems - Part 4: Optimum start-stop control equipment for electrical systems*

prEN 12098-5, *Controls for heating systems - Part 5: Start-stop schedulers for heating systems*

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 14335, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies*

EN 60531, *Household electric thermal storage room heaters - Methods of measuring the performance* (IEC 60531:1999 modified)

EN 60675, *Household electric direct-acting room heaters - Methods for measuring performance* (IEC 60675:1994)

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

prHD 60364-1, *Electrical installations of buildings – Part 1: Fundamental principles, assessment of general characteristics, definitions*

3. Terms and definitions

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

3.1

central control

method of controlling the heat flow to a heat emission system by varying the power input

3.2

design heat load

required heat flow necessary to achieve the specified design conditions

3.3

design heat loss

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

3.4

external design temperature

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

3.5

external air temperature

air temperature outside the building

3.6

heat gain

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

3.7

heating period

time when heating is needed to maintain the internal design temperature

3.8

internal design temperature

operative temperature at the center of the zone, used for the calculation of the design heat loss

3.9

local control

method of controlling the heat flow to a heat emission system locally on the basis of the temperature of the heated space

3.10

operating temperature(s)

temperature(s) at which the system (or parts of the system) is designed to be operated

3.11

operative temperature

arithmetic average of the air temperature and the mean radiant temperature

3.12

temperature control

method of controlling the system temperature in a zone or heated space by automatic means (setting of temporary override of the control is possible)

3.13

timing control

operation which switches heating modes to affect the heating control system according to a program

3.14

optimization of timing control

optimum start-up and shut-down times in order to reduce energy consumption and to take into account where necessary variations in tariffs without reducing thermal comfort defined by the user.

3.15

zone

space or groups of spaces with similar thermal characteristics

3.16

zone control

local control of a zone consisting of more than one space

3.17**charging control of room storage heaters**

method of controlling the heat content of a storage heating system within an allowed charging period as a function of internal and external conditions and varying tariffs where applicable

3.18**reheat period**

time necessary to bring heating level to the design temperature

3.19**data transmission bus**

communication connection transmitting data between components

3.20**remote appliance controller**

control located and away from the appliance

3.21**integral appliance controller**

control located within the appliance or the casing

3.22**electric instantaneous heating systems**

heating systems using heat emitters from which heat is directly emitted into the space where they are located

3.23**electric non-instantaneous heating systems**

systems which store heat obtained from electric energy by charging an accumulating core before a heat demand in a room occurs, the heat being discharged at any time (e.g. storage heating)

3.24**mode**

State of a device or system defining the manner by which it performs its functions. A heating system or a heating controller should have many heating modes (or heating operation modes), e.g.: nominal, reduced, on, off, start, standby. Noting that other modes can also exist

4. System design requirements**4.1 Requirements for preliminary design information**

The electrical heating system shall be designed to be installed and operated in a way that will not cause any damage to the building or other installations and with due consideration for costs and energy use.

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

The design shall always be carried out in accordance with the specification agreed between the contracting parties. At the planning stage or during 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 trained operator is needed;
- b) the need for compliance with relevant local or statutory regulations;
- c) thermal characteristics of the building for calculation of heat requirements and possible improvements in energy conservation;
- d) external design temperature;
- e) internal design temperature;
- f) energy supply;
- g) location of incoming supply;
- h) electricity installation requirements including routing;
- i) building occupational use and requirements;
- j) type and position of heat emitters;
- k) control of the heating system;
- l) economic considerations;
- m) local and national needs and requirements as applicable from time to time.

4.2 Heat supply

The electrical heating supply shall be designed to at least satisfy the design heat loads of the building calculated in accordance with EN 12831, where applicable.

Electricity supply and power shall be available to serve the heat supply taken into consideration at the design stage.

4.3 Heat emission

4.3.1 General

Heat emitters shall be selected on the basis of the design heat load and consideration shall be given to the following:

- design heat load including transmission and ventilation heat loss;
- thermal comfort and noise level in the occupied space;
- maintenance requirements;
- safety;
- energy conservation and consumption;
- thermal insulation of the building;

- reduction in air infiltration rate;
- control and energy management equipment;
- thermal comfort may be specified according to EN ISO 7730.

4.3.2 Sizing

4.3.2.1 Instantaneous heating systems

Heat emitters shall be dimensioned taking the design heat loss into consideration.

The minimum required output of the installed heat emitters shall be in accordance with EN 12831 and EN 60675 and the heat emitters manufacturer's data.

The system designer shall consider the effect of occupancy times and reheat periods to optimize the use of advantageous tariff rates.

If intermittently operated appliances are required, an additional output allowance should be provided.

4.3.2.2 Non-instantaneous heating systems

Storage heaters shall be selected according to the heat requirements of the area or space.

The duration of the charging period should be taken into consideration.

Appliance selection shall be in accordance with the appliance manufacturer's specifications and EN 60531.

4.3.3 Positioning

The heat emitter manufacturer's requirements, mounting heights and fixing positions shall be met.

In choosing the location of heat emitters, consideration shall be given to the overall effect upon the control of room temperatures and comfort conditions.

The positioning, type, number and size of the heat emitters in the space, together with the thermal transmittance of windows and/or walls, will influence the differences in the operative temperatures in the space, the radiant temperature asymmetry and draught (air velocity).

4.3.4 Thermal environment

If required by the user, documentation and, where appropriate¹, calculation of the criteria for the thermal environment (difference in operative temperature, radiant temperature asymmetry and draught) shall be fulfilled in accordance with EN ISO 7730.

4.3.5 Surface temperatures

In special cases, e.g. schools, nurseries and homes for the elderly, infirm or disabled, the surface temperatures of heat emitters shall be limited in accordance with local or statutory requirements (see EN 60675).

¹ not normally required for residential buildings

4.4 Controls

4.4.1 General

Compensation between indoor temperature and outdoor climatic conditions should be considered in the interest of energy conservation and continuous indoor thermal comfort.

Control of the heating system shall enable the indoor design temperature to be achieved under varying internal loads. Heating systems shall be served by operational controls.

Control devices shall be in accordance with EN 12098-3, prEN 12098-4, prEN 12098-5 and EN 60531.

The control system shall be designed to enable the users or the energy manager to select internal temperatures within a specified range.

The controls shall be fitted in a readily accessible position.

Temperature sensors should be fitted in a representative location to maintain design conditions, and so that undesirable effects, e.g. from direct solar radiation and curtains, are prevented.

Systems shall only comprise fixed appliances. All appliances shall be provided with an effective means of engineers isolation device.

Consideration shall be given to :

- building design and configuration;
- occupational times;
- users requirement;
- set-back facility to protect the buildings and reduce energy consumption;
- tamper-proof controls.

4.4.2 Classification

The control system shall be classified in terms of the heating control system level and the performance of the control systems that follow.

The classification is based on the 3 different heating control system levels:

- central control (C);
- zone control (Z);
- local control (L).

and the different control system performance levels:

- automatic (A);
- timing function (T);
- advanced timing function (O).

4.4.3 Temperature control

4.4.3.1 Central control

Central control of the electrical energy delivered to the emitters of the heating system shall be provided when local or zone control is not sufficient for the operation of the system under the design parameters.

When using an outside sensor for central control of the system, this sensor shall be sited so as not to be exposed to direct solar radiation and to avoid influences from any hot or cold sources, unless the control is designed to take account of such factors.

4.4.3.2 Zone control

Where specified, the heating system shall be divided into zones in the interest of energy conservation, measurement of energy consumption or indoor temperature control.

The temperature sensor for the controller shall be located in a position representative for the whole zone.

If the system is subdivided into zones, the design shall ensure that all emitters in different spaces of the zone have the same required operational parameters.

The spaces of a zone shall be selected in such a way that internal gains and solar gains are about the same in time and in size.

4.4.3.3 Local control

In order to achieve the specific indoor temperature under varying loads each heated space or emitter shall be equipped with local control. Local control can be achieved by automatic regulation.

Local control shall enable the user or energy manager to set up individual temperature preferences within a specified range.

The controllability of the indoor temperature is influenced by the response time (thermal mass) of the building, the response time of the heating system and the control strategy.

Consideration should be given to:

- the user's convenience;
- energy savings possibilities;
- heat gains from internal sources and solar radiation.

4.4.4 Charging control for non instantaneous electric heating systems

The charging control system should be operative during periods of advantageous tariff rates.

The charging control for non instantaneous heating systems should be designed according to the internal and external climatic design conditions. The charging control system may also operate during periods of non-advantageous tariff rates.

4.4.5 Control of combined systems

For systems combining different kinds of heating appliances (e.g. storage heaters and direct acting emitters), allowance shall be made for the interaction between these parts.

4.4.6 Timing control

Timing control should be provided in the interests of energy conservation and reduced operating costs.

Indoor temperatures should be lowered either for the whole building, for a zone or for a single room, in accordance with the type of temperature control selected. Care shall be taken in the design to ensure that the timing control is compatible with the temperature control.

The timing control may be manually or automatically operated. However, an automatic timing control system is preferred in most cases.

If timing control is fitted, the supply of heat shall be controlled according to the use of the building (e.g. residential buildings, office buildings, schools) and the thermal characteristics of the building (e.g. insulation, thermal inertia) in one of the following ways in order to achieve the minimum system design requirements and energy conservation and operative costs:

- on/off control;
- set-back control;
- optimizing control.

4.4.7 Computer aided management systems

Advanced energy management systems should be considered, in order to enable the indoor temperature set-point to be computed according to various input parameters.

Computer or computerized systems could be considered.

The number and type of parameters to be taken into account shall be defined by the designer and selected from:

- energy cost;
- building construction;
- specified design requirements;
- occupancy level;
- minimum temperature setback for building protection.

The possibility to modify timing and temperature level shall be given to the occupants or the energy manager.

Return from low temperature level to high temperature level may be optimised by taking various parameters into account, e.g. energy cost, thermal inertia of the building.

4.4.8 Control wiring

Control of heat emitters can be obtained either by using a dedicated heating circuit or a data transmission bus. Examples of wiring arrangements are given in Annex B.

4.5 Safety

Selected products, components and the installation shall be in accordance with CENELEC Standards.

The manufacturer's installation instructions for any appliances shall be complied with.

4.6 Energy requirement estimation

Energy requirement estimations, where specified, should be calculated in accordance with the requirements of EN 14335, where applicable.

4.7 Installation requirements

Electrical installations including electrical wiring arrangements and control systems shall be in accordance with the installation requirements of CENELEC prHD 60364-1.

The manufacturer's installation instructions for any appliances of the heating system shall be complied with.

4.8 Operating and maintenance requirements

Instructions for operation, maintenance and use of the heating systems should be provided, where applicable, in accordance with the requirements of EN 12170 or EN 12171.

Annex A (informative)

Control system classification

A.1 General

The control system consists of a number of elements and the design mainly involves deciding which combination of elements should be used. Starting from the heating control system level and the performance of the control system, a classification can be set up as follows.

A.2 Heating control system modes

Three heating control system modes are defined.

- local control (L);
- zone control (Z);
- central control (C).

A.3 Control system performance modes

For each of the three heating control system modes, four control system performance modes are defined.

Two control system performance modes are defined for temperature control:

- automatic (A) – a suitable system or device automatically controls the heat supply to the heated premises and two control system performance levels are defined for timing control:

- timing function (T) - heat supply to the heated premises is broken off or reduced during scheduled periods;
- optimization of timing control (O) - re-starting of the heat supply to the heated premises is optimized.

A.4 Control system classification table

Heating control system modes and control system performance modes are combined in Table A.1.

Table A.1: Control system classification table

HEATING CONTROL SYSTEM MODE	CONTROL SYSTEM PERFORMANCE MODE			
	Temperature control		Timing control	
	Manual	Automatic	Timing function	Optimization of timing control
Local				
Zone				
Central				

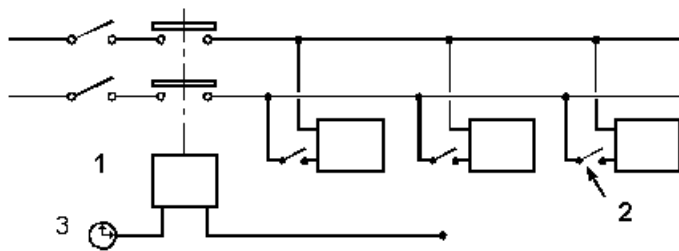
This table is a tool for the description of the type and performance of the control system. It may be used by the building owner or by his representative to define how he wants the heating system to be controlled.

At the commissioning stage, this table may be used for checking whether the design performances of the control system are achieved or not.

**Annex B
informative)**

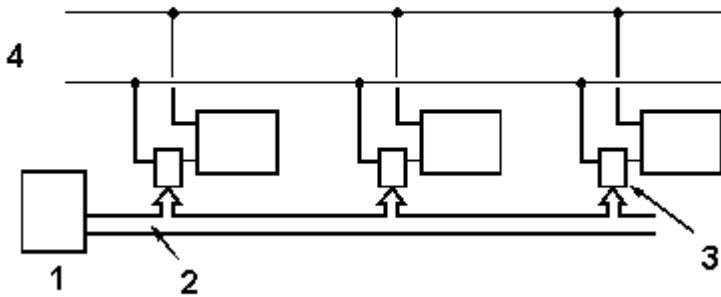
Examples of wiring arrangements and control

Figures B.1 and B.2 illustrate two examples of wiring arrangements and control.



- Key**
- 1 central controller
 - 2 heat emitter thermostat
 - 3 clock

Figure B.1 - Dedicated heating circuit



- Key**
- 1 central control unit
 - 2 data transmission bus
 - 3 local controller
 - 4 general purpose circuit

Figure B.2 - General purpose circuit and data transmission network

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