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Delilniki stroškov porabe toplote ogreval - Naprave z električnim napajanjem

Heat cost allocators for the determination of the consumption of room heating radiators - Appliances with electrical energy supply

Heizkostenverteiler für die Verbrauchswerterfassung von Raumheizflächen - Geräte mit elektrischer Energieversorgung

Répartiteurs de frais de chauffage pour enregistrer les valeurs de consommation de surfaces de corps de chauffe - Appareils avec une alimentation en énergie électrique

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CEN

European Committee for Standardization
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Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 171 "Heat cost allocation", the secretariat of which is held by DIN.

This standard includes 2 informative annexes A and B. These parts of the standard are not binding.

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of an identical text or by endorsement, at the latest by April 1995, and conflicting national standards shall be withdrawn at the latest by April 1995.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

1 Introduction

This standard defines heat cost allocators with electrical power supply, which serve to establish the consumption value of a room radiator. It also specifies the minimum requirements for construction, materials, production, installation, function and evaluation of the displayed readings established by these measuring devices.

This standard specifies test procedures to establish the compliance with the stated requirements and gives instruction for the manner and the extent of their realization.

2 Scope and general terms

Heat cost allocators in accordance with this standard are instruments for the registration of the thermal output of radiators in consumer units.

Consumer units are dwellings, office buildings, business premises or industrial plants in which the heat is supplied by a common central heating system or by a common district heating connection.

A complete grouping of consumer units is called an account unit.

It could be necessary to divide an account unit into groups of users, if an account unit comprises consumer units of different types (e.g. technically different types of heating systems or because of consumer behaviour e.g. industrial plants as opposed to private apartments).

Heat cost allocators only allow the determination of the heat consumption of each radiator in a consumer unit as a share of the total heat consumption of the account unit or user group (see clause 3). It is therefore necessary to determine this total heat consumption either by measuring the consumed fuel quantity or the amount of heat delivered (the latter e.g. by a heat meter).

The condition for correct use of heat cost allocators in accordance with this standard is that they are used in a heating system which

- at the time of installation of the heat cost allocators, corresponds to the state of the art and
- is operated in accordance with the state of the art (see annex A, A.1).

Heat cost allocators in accordance with this standard shall not be used for heating systems where the temperature limits are exceeded, where the rating factor for the thermal power, K_Q, is not clearly specified or where the heating surface is inaccessible. This applies e. g. to following heating systems:

underfloor heating

radiant ceiling heating

flap-controlled radiators

radiators with ventilators

fan-assisted air heaters

heating systems where the radiators attached thereto are operated by steam

3 Functional principle and measuring methods

Heat cost allocators in accordance with this standard are measuring devices for the registration of the temperature integral with respect to time. The temperature is the basis for the determination of the thermal output of the radiators on which the heat cost allocators are installed. Heat cost allocators in accordance with this standard with electrical power supply use one or more of the characteristic temperatures which determine the thermal output of the radiator surface to obtain their output. The non-rated displayed reading is the approximate value of the time integral of the measured characteristic temperature of the radiator or the time integral of the temperature difference between the radiator surface and the room.

The rated displayed reading is obtained from the non-rated displayed reading by multiplication by rating factors, particularly with those for the nominal thermal power of the radiator and those for the thermal contact between the surface and the sensors (see 4.18).

The consumption value is approximately proportional to the heat emitted in the measuring period from the heating surface and consumed by the user. The consumption value (see 4.10) is obtained either by reading off directly at the heat cost allocators or by later conversion of the non-rated displayed reading (see 4.9).

Thus the consumption value is a measuring result influenced by characteristics of the heat cost allocators, of the radiator, of secondary requirements and by factors of uncertainty of the rating factors and the installation. Accordingly the measuring deviations (measuring errors) of the recorded heat consumption are not only dependent on the heat cost allocator alone. Thus, heat cost allocators cannot be calibrated in the same way as heat meters.

Because of the described characteristics the measuring result is not related to physical energy units. The consumption value is non-dimensional. It is only a value relative to the sum of the consumption values of the account unit or of the group of users. A relative value of a measured consumption value which has been defined in that way has to be understood as a part of the total heat, consumed by the account unit or of the group of users. At the end of the measuring period, this value is established separately for every radiator. From the sum of all the consumption values of the radiators of a consumer unit, the above relative value will determine the part of the heat consumption of the respective consumer unit related to the total consumption of the account unit or the group of users.

Heat cost allocators consist of at least a case, sensors, calculator, display, power supply, installation and seal. The seal serves to protect against unauthorized manipulation. Each heat cost allocator is a functional unit. Its individual parts shall be manufactured in compliance with certain tolerances. Thus each part of a particular kind of heat cost allocator (type, make) function equally when used in the same way.

Heat cost allocators in accordance with this standard work according to one of the following measuring principles:

The single-sensor measuring principle utilizes one temperature sensor. The sensor records the temperature of the radiator surface or of the heating medium.

The two-sensor measuring principle utilizes two temperature sensors. One sensor measures the temperature of the radiator surface or of the heating medium, the second sensor measures the room temperature or a temperature in a defined relation to this.

The measuring principle using the logarithmic excess temperature measures with three sensors the flow and return temperatures of the heating medium and the room temperature.

4 Definitions

For the purpose of this standard, the following definitions apply.

4.1 Reference condition

For the purpose of determining the rating factors and the c-value, a reference condition shall be defined. The

reference condition can be freely selected within certain limits.

The reference condition of a radiator is as follows:

- upper flow inlet
- mean heating medium temperature: t_m = 40 °C to 60 °C
- reference air temperature t_L = (20 ± 2) °C. It shall be measured 0,75 m above the floor and at a distance of 1,5 m from the heating surface in a test chamber with a stable climate.
- heating medium flow (water flow through the radiator) at t_V / t_R / t_L = 90 °C / 70 °C / 20 °C

where:

t_V is the flow temperature

t_R is the return temperature

4.2 Reference counting rate

The reference counting rate is the value of the counting rate related to the nominal meter characteristic (see 4.12) at reference condition (c-value equals zero). It serves to determine the rating factor K_C (see 4.18.2).

4.3 Temperature sensors

Temperature sensors consist of the sensor element and the sensor casing, which serves to protect the sensor element from mechanical influences and to conduct heat.

4.4 Measuring range of temperature sensors

The measuring range is the range within which the temperature sensors can be used for measurement. When using pairs of temperature sensors, which measure temperature differences, the measuring range is supplemented by the range of temperature difference.

4.5 Design flow temperature, design return temperature, mean design heating medium temperature

The design flow and return temperatures are the temperatures of the heating medium of the radiators required to reach the design indoor temperature in the heated rooms under steady state conditions at a heat load corresponding to a geographically determined design reference outside temperature. The mean value of the design flow temperature $t_{V,A}$ and the design return temperature $t_{R,A}$ is the mean design heating medium temperature $t_{m,A}$. This temperature is to be determined from the logarithmic mean value of the excess temperatures relating to the reference air temperature of 20 °C.

4.6 Upper temperature limit

The upper temperature limit t_{max} is the maximum mean design heating medium temperature of the radiators in the heating system at which the heat cost allocator may be used. It is determined on basis of the materials and parts used.

4.7 Lower temperature limit

The lower temperature limit t_{min} is the lowest mean design heating medium temperature of the heating system

at which the heat cost allocator is permitted to be used. For single pipe heating systems, this is the mean design heating medium temperature of the last radiator in the string or, as substitute, the design return temperature of the string. The lower temperature limit depends on the metering principle.

4.8 Start temperature

The start temperature t_z is the mean heating medium temperature in the radiator, in the partial load range with the mass flow corresponding to the reference condition, at which the heat cost allocator starts counting.

4.9 Displayed reading

The displayed reading generally is the measuring value produced by the heat cost allocator which can be read off as a numerical value at the display device. If this value is not equal to zero at the beginning of the measuring period (see 4.15), the displayed reading relative for the heat cost calculation is determined from the difference between the numerical values at the end and the beginning of the mesuring period.

The reading may be an unrated or a rated value(see 4.10).

4.10 Rated displayed reading

The rated displayed reading is the displayed reading rated by the rating factors according to 4.18.

4.11 Counting rate

The counting rate R is the progression of the display per unit of time.

4.12 Nominal meter characteristic

The meter characteristic is the intended relation between the counting rate and, according to measuring principle, the temperature or the temperature difference.

4.13 Relative display deviation

The relative display deviation is the difference between the actual display counting rate and the nominal counting rate related to the nominal display counting rate.

4.14 Idle counting rate

The idle counting rate is the counting rate at room temperature, without thermal output from the radiator.

4.15 Measuring period

The measuring period is the period of time in which the heat consumption is recorded without interruption.

4.16 c-value

The c-value expresses the degree of thermal coupling between the temperature sensors and the temperatures to be recorded. It is defined as a temperature difference ratio according to following equation:

$$c = 1 - \frac{\Delta t_S}{\Delta t} \quad (1)$$

where:

Δt_S is the temperature difference of the sensors, e.g. $t_{HS} - t_{RS}$ or Δt_{lnS}

Δt is the heating medium excess temperature $t_m - t_L$ or Δt_{ln}

where:

t_{HS} is the temperature of the radiator sensor

t_{RS} is the temperature of the room temperature sensor (for heat cost allocators without room temperature sensor: $t_{RS} = t_L$)

t_m is the mean heating medium temperature

t_L is the reference air temperature (see 4.1)

t_V is the flow temperature of the radiator

t_R is the return temperature of the radiator

Δt_{ln} is the logarithmic excess temperature of the heating medium according to:

$$\Delta t_{ln} = \frac{t_V - t_R}{\ln \frac{t_V - t_L}{t_R - t_L}} \quad (2)$$

Δt_{lnS} is the logarithmic excess temperature of the temperature sensors

If the temperature characteristics of the sensors or pairs of sensors used are known, then the measuring signals or counting rates assigned to them can also be used for measuring the stated temperatures or temperature differences.

4.17 Full utilization period

The full utilization period of the radiator thermal output is the quotient of the heat emitted by the radiator in a calendar year and the nominal thermal output (see 4.18.1). It has the unit of hours/year.

4.18 Rating factors

The following rating factors convert the displayed readings of the individual heat cost allocators into rated displayed readings in a form suitable for the calculation of the consumption costs.

4.18.1 Rating factor K_Q for the thermal output of the radiator

The rating factor K_Q is the (non-dimensional) numerical value of the nominal thermal output (in watts) of the radiator.

The nominal thermal output is the thermal output of a radiator operated at flow temperature, return temperature and air temperature of 90 °C, 70 °C and 20 °C in a test chamber with a stable temperature. The air temperature has to be measured 0,75 m above the floor at a distance of 1,5 m from the heating surface. If the nominal heat output of the radiator was established under other temperature conditions, it shall be

converted into the above mentioned conditions[1]).

4.18.2 Rating factor K_C for the thermal coupling to the temperature sensors

The rating factor K_C takes into account that the thermal coupling between the temperature of the heating medium and the temperature sensors varies according to the different types of radiator surfaces[1]).

K_C is the quotient of the reference counting rate and the counting rate at the temperatures of temperature sensors on the radiator operated at reference condition:

$$K_C = \frac{R_{Reference}}{R_{Rating}} \quad (3)$$

4.18.3 Rating factor K_T for rooms with low design indoor temperatures which deviate from the basic reference air temperature

The rating factor K_T takes account of the change of the thermal output and the change of the temperature of the sensors where heat cost allocators according to the single-sensor measuring principle are used at design indoor temperatures less than the reference air temperature at the reference condition.

4.18.4 Resulting rating factor K

The resulting rating factor K is the product of the individual rating factors:

$$K = K_Q \times K_C \times K_T \quad (4)$$

4.19 Transmission systems

Transmission systems are defined as arrangements used to transmit signals between subassemblies of the heat cost allocator which are located separately.

4.20 Manufacturer

A manufacturer according to this standard is the person or company responsible for the supply and installation of the heat cost allocator.

5 Requirements for the heat cost allocators

5.1 Requirements concerning temperature stress

Brief occurrence of t_{max} of the mean heating medium temperature, shall cause no impairment of the proper function of a heat cost allocator or its components, installed and ready for service on the radiator. This is valid similarly for heat cost allocators mounted on other surfaces e.g. on pipes.

For components not attached to the heating surfaces, ambient temperatures between 0 °C and 50 °C shall not cause any functional anomalies.

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[1]) If a special type of radiator connection is used which deviates from the reference conditions described in 4.1 or if the casings are connected to the radiator in such a way that they cannot be changed by the user, the rating factors K_Q and K_C shall be determined under these conditions.