SLOVENSKI STANDARD
SIST ENV 1259-3:1996

01-november-1996

Stropna cevna sevala s plinskim gorilnikom in plinska sevala z zgorevanjem na površini, ki se ne uporabljajo za ogrevanje stanovanj - 3. del: Zahteve in preskusne metode za zagotavljanje smotrne rabe energije - Sevalna metoda C

Single burner gas-fired overhead radiant tube heaters and non-domestic gas-fired overhead luminous radiant heaters - Part 3: Requirements and test methods for establishing the rational use of energy - Radiometric method C

Dunkelstrahler mit einem Brenner und kommerzielle Gasleucht-Deckenstrahlheizer - Teil 3: Anforderungen und Prüfverfahren zur Bestimmung der rationellen Verwendung von Energie - Radiometrisches Verfahren C

Tubes radiants suspendus a mono-bruleur au gaz et appareils surélevés de chauffage a rayonnement lumineux au gaz a usage non-domestique - Partie 3: Exigences et méthodes d'essais pour la détermination de l'utilisation rationnelle d'énergie - Méthode radiométrique C

Ta slovenski standard je istoveten z: **ENV 1259-3:1996**

ICS:

97.100.20	Plinski grelniki	Gas heaters

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EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

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Descriptors: gas appliances, heaters, radiant tubes, radiation, measurements, radiometry, thermal efficiency, tests

English version

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This European Prestandard (ENV) was approved by CEN on 1996-08-31 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into an European Standard (EN).

CEN members are required to announce the existance of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 180 "Non-domestic gas-fired overhead radiant heaters", the secretariat of which is held by BSI.

Other equivalent methods of efficiency determination, method A and method B, are available in ENV 1259-1 and ENV 1259-2.

This ENV should not be used for direct comparison of radiant efficiency between radiant tube heaters and luminous radiant heaters because the accuracy of the measurement differs for each type of heater when using this method.

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

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Annexes

1 Scope

This ENV specifies the requirements and test method C for the rational use of energy of a non-domestic gas-fired overhead radiant tube heater incorporating a single burner, or of a non-domestic gas-fired fixed overhead luminous radiant heater, referred to in the body of the text as an "appliance", with a reference surface as defined in 3.1.

2 Normative references

This European Prestandard 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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 416-1:1990 Single burner gas-fired overhead radiant tube heaters for non-domestic use
Part 1: Safety

prEN 419-1:1990 Non-domestic gas-fired overhead luminous radiant heaters
Part 1: Safety

3 Definitions

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

3.1 radiation reference plane: The flat horizontal plane touching the lowest part of the appliance.

3.2 radiant exitance: Specific radiant output.

3.3 type S appliance: Appliance with length less than or equal to 0.8 m, to be considered as a single point source.

3.4 type L appliance: Appliance with length greater than 0.8 m, to be considered as a line source of length L at each end bounded by a point source.

4 Symbols

a_{CO_2} = coefficient in equation for k_{CO_2} [kPa^{-1} m^{-1}]

a_{H_2O} = coefficient in equation for k_{H_2O} [kPa^{-1} m^{-1}]

A_{CO_2ij} = absorption factor of carbon dioxide corresponding to distance d_{ij} [-]

A_{H_2Oij} = absorption factor of water vapour corresponding to distance d_{ij} [-]

A_{ij} = total radiation absorption factor for an individual measurement characterized by i and j [-]

b_{CO_2} = coefficient in equation for k_{CO_2} [kPa^{-1} m^{-1} $°C^{-1}$]

b_{H_2O} = coefficient in equation for k_{H_2O} [kPa^{-1} m^{-1} $°C^{-1}$]

d_{ij} = thickness of radiating gas layer, i.e. distance in the direction (ϑ_i, φ_j) from measurement point to radiation reference plane [m]

H_i = net calorific value of test gas at 15 °C, 1013 mbar dry gas [kWh/m^3]

i = index of measurement in ϑ direction [-]

j = index of measurement in φ direction [-]

k_{CO_2} = coefficient in equation for emission factor of carbon dioxide [kPa^{-1} m^{-1}]

k_{H_2O} = coefficient in equation for emission factor of water vapour [kPa^{-1} m^{-1}]

l = position along line source [m]

L = effective length of line source [m]

N = number of measurements along line source [-]

n = coefficient in equations for k_{CO_2} and k_{H_2O} [-]

n_φ = total number of different φ values in each measurement point [-]

n_ϑ = total number of different ϑ values in each measurement point [-]

$O_{\alpha\beta}$ = integration surface related to irradiance $S_{m\alpha\beta}$ [m^2]

$O_{\sigma l}$ = integration surface related to irradiance $S_{m\sigma l}$ [m^2]

p_{CO_2} = partial pressure of carbon dioxide in ambient air [kPa]

p_{H_2O} = partial pressure of water vapour in ambient air [kPa]

P = gas supply pressure at gas measuring point [mbar]

P_a = atmospheric pressure [mbar]

P_w = partial pressure of water vapour in test gas at temperature t_g [mbar]

Q_M = measured net heat input [kW]

$R_{\alpha\beta}$ = distance from measurement point to position of the point source [m]

$R_{\sigma l}$ = shortest distance from measurement point to line source [m]

S_{ij} = detected radiance including correction for radiation absorption in air, averaged between ϑ_{i-1} and ϑ_i, for φ_j [W/m^2sr]

$S_{m\alpha\beta}$ = irradiance at a measurement point in a plane perpendicular to straight line under α and β between point source and measurement point [W/m^2]

$S_{m\sigma l}$ = irradiance at a measurement point in a plane perpendicular to straight line under σ between point with l along the line source and measurement point [W/m^2]

S_{ref} = total energy received from appliance [W]

$S_{\vartheta\varphi}$ = detected radiance, averaged between ϑ_{i-1} and ϑ_i for φ_j [W/m^2sr]

t_g = gas temperature at gas measuring point, or ambient gas temperature [°C]

t_w = temperature of the radiating surface [°C]

V = volume input of gas under test conditions [m^3/h]

V_0 = volume input of test gas at 15 °C, 1013 mbar dry gas [m^3/h]

α = angle in vertical plane ($\alpha=0$ is vertically downwards); origin is in centre of radiation reference plane [rad]

β = angle in horizontal plane; origin is in centre of radiation reference plane [rad]

β_{ai} = correction factor for the water vapour contribution to the absorption factor of ambient air [-]

$\Delta\alpha$ = difference between two subsequent values of α [rad]

$\Delta\beta$ = difference between two subsequent values of β [rad]

ε_{CO2i} = emission factor of carbon dioxide corresponding to distance d_{ri} [-]

ε_{H2Oi} = emission factor of water vapour corresponding to distance d_{ri} [-]

η_{net} = radiation efficiency [%]

ϑ = angle in vertical plane ($\vartheta=0$ is vertically upwards); origin is in measurement point [rad]

φ = angle in horizontal plane; origin is in measurement point [rad]

5 Requirement for rational use of energy

The manufacturer shall specify the radiant efficiency of the appliance in relation to the state of the art which shall be verified by the test according to clause 6.

NOTE. This procedure allows experience to be gained for the fixing of minimum values for the planned EN.

6 Test method

6.1 Principle

NOTE. See 4.1.1 to 4.1.6.2 inclusive, of prEN 416-1:1990 or prEN 419-1:1990 as appropriate.

6.2 Apparatus

The test apparatus consists of a measuring apparatus, composed of the optical sensor tube and the data processing equipment, and a positioning apparatus to move the measuring section to the desired position which can rotate the sensor tube in the desired direction.

6.2.1 *Positioning apparatus*

In order to move the optical sensor tube to positions in an imaginary envelope around the appliance a remote control vehicle is required that can move freely in the room. This vehicle enables the optical sensor to be positioned with a maximum deviation of 10 mm at a desired position. The position of the sensor is calculated according to the method of trigonometry with a maximum deviation of 5 mm, using a rotating laser beam, which is reflected by a number of differently bar-coded plates in the room. The entire measuring instrument with the sensor tube, its controls and data processing equipment is positioned upon a platform mounted on the vehicle.

At each position the sensor tube can be rotated on a horizontal and a vertical axis, thus allowing every single point of the hemisphere to be addressed with an accuracy of approximately 0.03 degree in both directions.
As a result the observations can be limited to expressly stated directions. In order to determine the irradiance at a certain point, only the part of the hemisphere covered by the appliance is scanned from that particular point. This is done to ensure that only radiation directly emitted by the appliance (and all its components, including reflectors) will be measured. In this way radiation reflected or produced by walls and other objects in the room is eliminated and cannot influence the measurements.

6.2.2 *Measuring apparatus*

In the optical sensor tube a pyroelectric sensor with a very small field of view shall be used. The solid angle of the measuring device shall be smaller then $3 \cdot 10^{-5}$ steradian (linear field angle approximately 0.3 degree). The limits of this area are determined by the construction of the sensor tube. A lens is used to focus the radiation from a small part of the appliance upon the sensor. The spectral sensitivity of the combination of the lens and the pyroelectric sensor shall be constant in at least the wavelength range 0.6 μm to 40 μm. The sensor shall be able to measure radiant exitance values from 1.5 kW/m^2 to 150 kW/m^2.
As the irradiance has to be interrupted at regular time intervals to suit the pyroelectric sensor an optical chopper is applied. The measured signal is processed using a lock-in amplifier.

6.3 Working area

The working area shall be of a size to allow installation of the overhead radiant tube or plaque heaters. Ventilation shall be sufficient to remove the combustion products and the heat generated by the appliance.

6.4 Procedure

6.4.1 *Measurement points*

For a type S appliance as defined in 3.3 the measurement points shall be situated at straight lines through the position of the point source and the intersections of the meridians β = 9°, 27°, 45°, etc. up to 351° with the parallels α = 9°, 27°, 45°, etc. up to 81°. The measurement points are all characterized by the parallel α, the meridian β and the distance $R_{\alpha\beta}$ to the position of the point source. The values of α and β are the centre values of strips with a width of 18°.
In the case of a symmetrical appliance with one axis of symmetry only the meridians β = 9°, 27°, 45°, etc. up to 171° will be examined. The result shall be multiplied by two.
In the case of a symmetrical appliance with two axes of symmetry only the meridians β = 9°, 27°, 45°, etc. up to 81° will be examined. The result shall be multiplied by four.

For a type L appliance as defined in 3.4 the measurement points shall be situated at the following positions:

- at the straight lines through the points at the line source with l = L/2N, 3L/2N, 5L/2N, ..., (2N-1)L/2N and the parallels α = -81°, -63°, -45°, etc. up to 81°. L/N shall be less than or equal to 0.8 m. The measurement points are all characterized by the parallel α, the position l along the line source and the distance $R_{\alpha l}$ to the point with l at the line source. The values of α are the centre values of strips with a width of 18°. The values of l are the centre values of strips with a width of L/N.
  In the case of a symmetrical appliance with one axis of symmetry only the parallels α = 9°, 27°, 45°, etc. up to 81° will be examined. The result shall be multiplied by two.

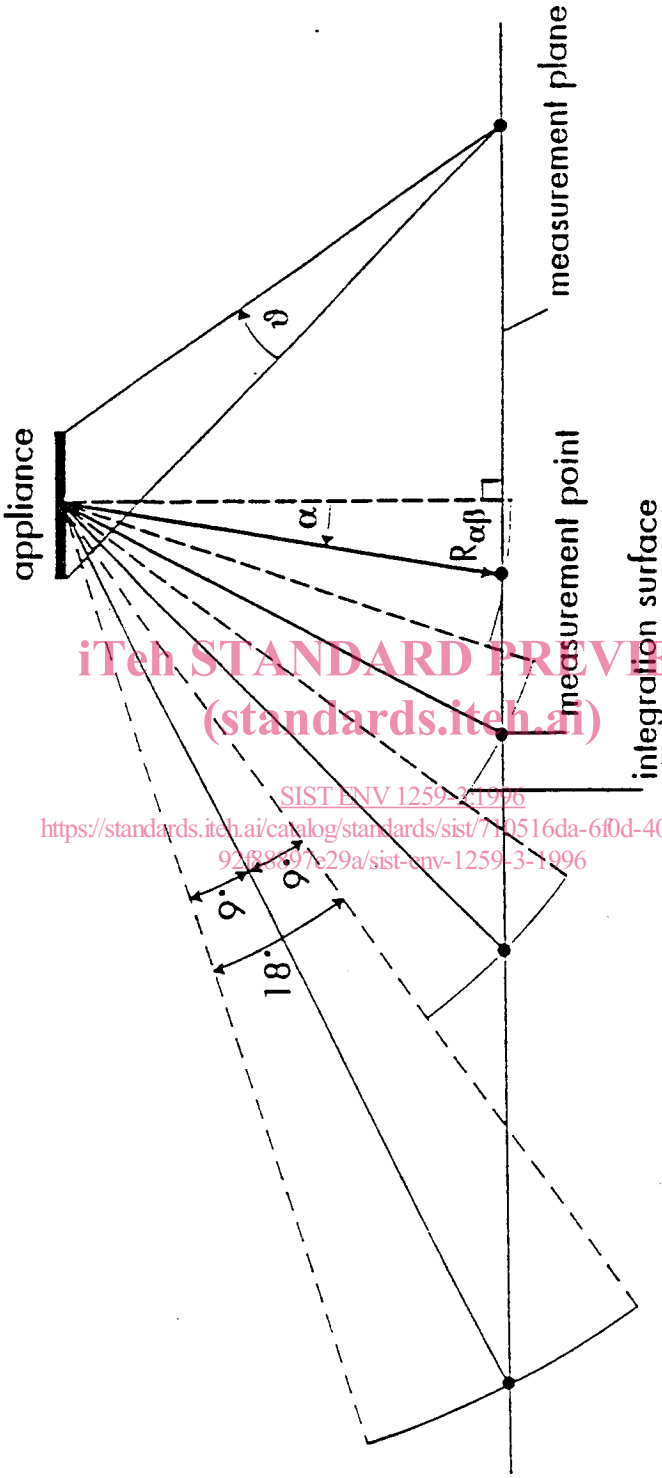

Figure 1. Two dimensional view of the positions of the measurement points and the integration surfaces connected to this points.