SLOVENSKI STANDARD
SIST ENV 1259-1:1996

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Stropna cevna sevala s plinskim gorilnikom in plinska sevala z zgorevanjem na površini, ki se ne uporabljajo za ogrevanje stanovanj - 1. del: Zahteve in preskusne metode za zagotavljanje smotrne rabe energije - Sevalna metoda A

Single burner gas-fired overhead radiant tube heaters and non-domestic gas-fired overhead luminous radiant heaters - Part 1: Requirements and test methods for establishing the rational use of energy - Radiometric method A

Dunkelstrahler mit einem Brenner und kommerzielle Gasleucht-Deckenstrahlheizer - Teil 1: Anforderungen und Prüfverfahren zur Bestimmung der rationellen Verwendung von Energie - Radiometrisches Verfahren A

Tubes radiants suspendus a mono-bruleur au gaz et appareils surélevés de chauffage a rayonnement lumineux au gaz a usage non-domestique - Partie 1: Exigences et méthodes d'essai pour la détermination de l'utilisation rationnelle d'énergie - Méthode radiométrique A

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English version

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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

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Contents list

Foreword

This part of the European Prestandard was prepared by CEN Technical Committee CEN/TC 180 "Gas-fired overhead radiant heaters", the secretariat of which is held by BSI.

This European Prestandard has been adopted during the meeting of CEN/TC 180 as a European Prestandard on 8 October 1993 after consideration of comments received from members and establishment of the final version of the European Prestandard.

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.

Other equivalent methods of efficiency determination, method B and method C are under development.

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

1 Scope

This ENV specifies the requirements and test method A 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.

The scope of this ENV is restricted initially to overhead radiant heaters mounted horizontally, i.e. where the thermal radiation is directed downwards.

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.

EN 416-1 Single burner gas-fired overhead radiant tube heaters for non-domestic use - Part 1: Safety[1)]

EN 419-1 Non-domestic gas-fired overhead luminous radiant heaters - Part 1: Safety[1)]

3 Definitions

For the purposes of this prestandard, the following definition applies.

Radiation reference plane: The flat horizontal surface bounded by the lower edge of the reflector (see figure 3).

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1) In preparation

4 Symbols

$C\alpha\beta$ surface area correction factor

E actual irradiance from overhead radiant heater (in W/m2)

Ea actual irradiance output by appliance in air (in W/m2)

Es spurious irradiance received by radiometer (in W/m2)

Et total irradiance received by radiometer (in W/m2)

Hi net calorific value of reference gas (in kW h/m3 at 15 °C, 1013 mbar, dry gas)

L Length of reference surface cylinder (in m)

N number of measurement points along cylinder of reference surface

P gas supply pressure (in mbar)

Pa atmospheric pressure (in mbar)

PH2O partial vapour pressure (in bar)

Pmax,H20 saturated vapour pressure (in mbar)

QM net heat input (in kW)

R radius to radiometer from centre of reference plane (in m)

S sensitivity of radiometer W/m2 (in mV)

t average metal or plaque temperature (in °C)

tg temperature of gas at measuring point (in °C)

th ambient wet bulb temperature (in °C)

t≡2Dmax maximum tube metal temperature (in °C)

tmin minimum tube metal temperature (in °C)

ts ambient dry bulb temperature (in °C)

V gas volume input at test conditions (in m3/h)

Vo gas volume input (in m3/h at 15 °C, 1013 mbar, dry gas)

W saturation vapour pressure of fuel gas at temperature tg (in mbar)

$\Delta t = ts - th$

ε H20 emissivity of water

ηnet net radiant efficiency of appliance (in %)

1 mbar = 100 Pa.

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 or prEN 419-1, as appropriate.

6.2 Apparatus

6.2.1 Mechanical apparatus (see figure 1)

In order to move the sensor positions, in an imaginary envelope around the appliance, the following is required:

a) a mobile, rigid test rig having a graduated, circular metal arc, with sensors attached, pivoted on its vertical axis (standard radius R = 1,71 m ± 10 % to radiometer);

NOTE: It is important to check that the maximum irradiance does not exceed the maximum value allowed for the instrument.

b) equipment for suspending the test rig and appliance to be tested, having the following characteristics:

i) for an appliance with a length of more than 1,3 m adjustment to allow the arc centre to coincide with either end of the reference plane; but for a very small appliance with a length of 1,3 m or less the arc centre shall coincide with the centre of the reference plane (see figure 3);

ii) marking on the floor for recorder positions;

iii) a detachable or retractable radiant-shield in front of each sensor to mask it from irradiance from the appliance which shall be sufficiently insulated so that the side facing the sensor stays at thermal equilibrium with the ambient conditions and shall cover a maximum of twice the area of the reference surface (see 6.4.3 and figures 1 and 2) as seen from the position of the sensor.

iv) a radiance shield which does not reflect radiation towards other sensors;

v) a guide rail to position the arc along the length of the tube heater.

6.2.2 Measurement apparatus

6.2.2.1 The sensor or sensors shall have the following characteristics:

a) The sensor calibration shall not change by more than ± 3 % in an ambient temperature range from 15 °C to 30 °C.

b) The sensor sensitivity shall be constant either in the wavelength range 0,8 mm to 40 mm, or in another wavelength range which shall be stated in the test report (see 6.5).

c) The angle of span shall be 170° or more. There shall be small variation of sensitivity with angle of incidence of irradiance.

d) The sensitivity shall be constant within a range of irradiance from 10 W/m2 to 1100 W/m2.

6.2.2.2 Position of sensors (see figure 2)

Sensors shall be positioned as follows:

a) Where a single sensor is used, it shall be capable of being moved along the length of the metal arc and of being positioned every 20° (from 10° to 90°).

b) Where multiple sensors are used they shall be positioned along the length of the arc every 20° (from 10° to 90°).

c) The measuring surface shall be tangential to the surface generated by the metal arc movement.

NOTE: It is recommended that the face in front of the thermopiles of the sensor should be protected from irradiance and dust when not being used for taking measurements. Care should be taken to prevent accidental reradiation from reflecting surfaces (e.g. white clothes and equipment not necessary for the test) within the 180° view of the radiometer.

6.2.3 Radiation reference surface (see 1.3.1)

In the case of an overhead radiant tube heater where the reflector is less enveloping and where the surface as defined in 3.1 is coincidental with the cylindrical surfaces of the steel heater tubes, the lower surface of the heater tubes shall be taken as the reference.

6.3 Working area

The working area shall be of a size to allow installation of the overhead radiant tube or plaque heaters and shall conform to the following:

a) Walls and ceilings shall be isolated from exterior influences, i.e. sunlight through windows and other heating equipment.

b) Interior surfaces of the test room shall be treated so as to reduce spurious radiation reflections, i.e. painted matt black.

c) Ventilation shall be sufficient to remove the combustion products and the heat generated by the appliance.

d) The air temperature shall not vary by more than ± 5 °C from a mean value of 20 °C. In winter fresh air shall be heated to maintain the above condition.

e) The working area where the sensors are placed shall be free from draughts.

6.4 Procedure

6.4.1 Integration surface

The integration surface shall be the envelope generated by moving the arc as follows:

For a radiant plaque heater less than or equal to 1,3 m long, centre the sphere on the centre of the radiating reference surface.

For an overhead radiant plaque heater of length greater than 1,3 m or a tube heater, describe a cylinder of length equal to the effective length of the emitter of which the axis coincides with the reference surface.
This surface shall be terminated at its extremities by two hemispheres.

In the case where the emitter is symmetrical (i.e. a linear plaque or linear tube), the examination of the radiation shall be limited to a half sphere for a panel and a half cylinder plus two quarter spheres for a linear tube, and the result shall be multiplied by 2.

Connect each sensor to a millivoltmeter of the potentiometric type, electronic type or electronic device with an input impedance of at least 1 MΩ and a sensitivity of 1 mV.

Make the measurements in a still atmosphere with the appliance in thermal equilibrium.

NOTE: It is important to measure the temperature of the outside of the instrument to ensure it is not being overheated.

Adjust the heat input to within ± 2 % of the input stated by the manufacturer (see 6.4.3 d)) and with the appliance mounted in the horizontal plane.

6.4.2 Measurement points

The measurement points shall be situated at the intersection of the parallels and the meridians (see figures 1 and 2).

For an overhead radiant plaque heater the measurement point shall be on the sphere required for a panel, and the intersections shall be at meridians 0°, 20°, 40°, etc. up to 180°, with parallels 10°, 30°, 50°, etc. up to 90°. (See figures 1 and 2).

For an overhead radiant tube or plaque heater considered as a tube, the measurement point shall be on the hemisphere required for a tube, the intersections at the extremities shall be at meridians 10°, 30°, 50°, etc. up to 170°, with parallels 10°, 30°, 50°, etc. up to 90°. (See figures 1 and 2).

On the cylinder required for a reference surface of length L for a number of measurements N, the intersections shall be at the following points:

$$\frac{L}{2N} \quad \frac{3L}{2N} \quad \frac{5L}{2N} \quad \frac{(2N-1)L}{2N}$$

with parallels 10°, 30°, 50°, etc. up to 90°.

L/N shall have a maximum value of 0,8 m.

6.4.3 Determination of radiant efficiency

The test shall be performed in the following stages.

a) Measure the irradiance at all points shown in the imaginary envelope with the radiant shield in place in front of the radiometer to find the spurious irradiance Es. Repeat the measurement without the radiant shield to find the total irradiance Et.

Record the actual irradiance E (see annex A) where:

E = Et - Es

b) Integrate over the envelope to obtain the energy received from the appliance. (See annex A for calculation method and annex B for a worked example.)

c) Correct for the absorption of radiation in the air (e.g. by water vapour) in order to obtain the actual irradiance emitted to the air, Ea.

d) Measure the heat input to the heater using the following equation:

QM = Vo . Hi

where

$$V_o = V\left(\frac{288}{273 + tg}\right) \cdot \left(\frac{P_a + P - W}{1013}\right)$$

e) Calculate the radiation yield ηnet as a percentage using the following equation:

$$\eta_{net} = \frac{E_a \times 100}{Q_M}$$

(See annex A.)

6.5 Test report

A test report shall be prepared. (See annexes A and B for examples.)