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Multi-burner gas-fired overhead radiant tube heater systems for non-domestic use - Part 4: System H, safety

Gasgeräte-Heizstrahler - Dunkelstrahlersysteme mit mehreren Brennern mit Gebläse für gewerbliche und industrielle Anwendung - Teil 4: System H, Sicherheit

Tubes radiants suspendus a multi-bruleurs utilisant les combustibles gazeux a usage non domestique - Partie 4: Systeme H, sécurité

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Multi-burner gas-fired overhead radiant tube heater systems for non-domestic use - Part 4: System H, safety

Tubes radiants suspendus à multi-brûleurs utilisant les combustibles gazeux à usage non domestique - Partie 4: Système H, sécurité

Gasgeräte-Heizstrahler - Dunkelstrahlersysteme mit mehreren Brennern mit Gebläse für gewerbliche und industrielle Anwendung - Teil 4: System H, Sicherheit

This European Standard was approved by CEN on 10 April 1999.

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 Central Secretariat 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 Central Secretariat 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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

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

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of an identical text or by endorsement, at the latest by November 1999, and conflicting national standards shall be withdrawn at the latest by November 1999.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Other parts of EN 777 covering multi-burner gas-fired overhead radiant tube heater systems for non-domestic use are as follows:

Part 1: System D, safety

Part 2: System E, safety

Part 3: System F, safety

Many requirements of EN 416-1 "Single burner gas-fired overhead radiant tube heaters for non domestic use - Part 1: Safety" are also applicable to EN 777-4 "Multi-burner gas-fired overhead radiant tube heater systems for non domestic use - Part 4 : System H, safety".

In order to facilitate the reading of EN 777-4, it was decided that instead of using cross references it would be preferable to reproduce the parts of the text of EN 416-1 which apply also for multi-burner systems. These parts are reproduced without change.

Test methods for the rational use of energy are dealt with in European Pre-standards ENV 1259-1, ENV 1259-2 and ENV 1259-3.

The test gases, test pressures and system categories given in this European Standard are in accordance with those specified in EN 437: 1993 "Test gases - Test pressures - Appliance categories".

1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, classification and marking of non-domestic gas-fired overhead radiant tube systems incorporating two or more burner units with each burner under the control of an automatic burner control system, and operated by a single fan providing a single flue outlet, referred to in the body of the text as the "system".

This standard is applicable to Type B_{22} systems (see 4.3) intended for use in other than domestic dwellings, in which the supply of combustion air and the evacuation of the products of combustion is achieved by mechanical means. This standard is applicable only to such systems that have fully pre-mixed gas/air burners.

This standard is not applicable to:

- systems designed for use in domestic dwellings;

- outdoor systems;

- systems in which the heat input of an individual burner unit exceeds 120 kW (based on the net calorific value of the appropriate reference test gas);

- systems having a draught diverter.

This European Standard is applicable to systems which are intended to be type tested. Requirements for systems which are not intended to be type tested would need to be subject to further consideration.

Requirements concerning the rational use of energy have not been included in this European Standard.

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.

EN 88: 1991	Pressure governors for gas appliances for inlet pressures up to 200 mbar

EN 126: 1995	Multifunctional controls for gas burning appliances
EN 161: 1991	Automatic shut-off valves for gas burners and gas appliances
EN 257: 1992	Mechanical thermostats for gas-burning appliances
EN 298: 1993	Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
EN 437: 1993	Test gases - Test pressures - Appliance categories
EN 23166: 1993	Codes for the representation of names of countries (ISO 3166: 1993)
EN 60335-1: 1988	Safety of household and similar electrical appliances - Part 1: General requirements (IEC 60335-1: 1983, modified)
EN 60529: 1991	Degrees of protection provided by enclosures (IP Code) (IEC 60529: 1989)
EN 60584-1: 1995	Thermocouples - Part 1: Reference tables (IEC 60584-1:1995)
EN 60584-2: 1993	Thermocouples - Part 2: Tolerances (IEC 60584-2:1982 + A1:1989)
EN 60730-1: 1995	Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1:1993, modified)
EN 61058-1: 1992	Switches for appliances - Part 1: General requirements (IEC 61058-1:1990)
prEN 50165: 1995	Electrical equipment of non-electric appliances for household and similar purposes, safety requirement
IEC 479-1: 1994	Guide to effects of current on human beings and livestock - General aspects
IEC 479-2: 1987	Guide to effects of current passing through the human body - Special aspects relating to human beings
ISO 7-1: 1994	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation.
ISO 228-1: 1994	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation.
ISO 274: 1975	Copper tubes of circular section - Dimensions

ISO 6976: 1995 Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition

ISO 7005-2: 1988 Metallic flanges
Part 2: Cast iron flanges

ISO 7005-3: 1988 Metallic flanges
Part 3: Copper alloy and composite flanges

3 Definitions

For the purposes of this standard the following definitions apply.

3.1 system and its constituent parts

3.1.1 overhead radiant tube heater: A gas fired appliance intended for installation above head level which is designed to heat the space beneath by radiation by means of a tube or tubes, heated by the internal passage of combustion products.

3.1.2 multi-burner systems: Those radiant tube heater systems which employ two or more burner units with each unit incorporating independent flame monitoring. The units may be located in one or more sections of tubing. One or more fans may be used to assist in the evacuation of products of combustion or the supply of combustion air.

System H: A system in which individual units without fans are connected to a common duct with a fan. One or more burner units are situated in each branch tube (see annex A).

3.1.3 branch tube: For the purposes of this part, a tube in which one or more burner units is/are situated and which only contains the products of combustion generated by this, or these, burners.

3.1.4 common duct: A duct which receives products of combustion from two or more branch tubes for the purposes of evacuation to the outside.

3.1.5 individual burner unit: A unit comprising a main burner and, if appropriate, an ignition burner. In addition, such components which are necessary to ignite the burner(s), monitor the flame and control the gas supply to the burner(s) are included in the unit.

3.1.6 inlet connection: The part of the system intended to be connected to the gas supply.

3.1.7 mechanical joint (mechanical means of obtaining soundness): A means of ensuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc.

NOTE: For example the following:

- metal to metal joints;

- conical joints;

- toroidal sealing rings ("O" rings);

- flat joints.

3.1.8 gas circuit: The part of the burner unit that conveys or contains the gas between the burner unit gas inlet connection and the burner(s).

3.1.9 restrictor: A device with an orifice, which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate.

3.1.10 gas rate adjuster: A component allowing an authorised person to set the gas rate of the burner to a predetermined value according to the supply conditions.

NOTE: Adjustment can be progressive (screw adjuster) or in discrete steps (by changing restrictors).

The adjusting screw of an adjustable governor is regarded as a gas rate adjuster.

The action of adjusting this device is called "adjusting the gas rate".

A factory sealed gas rate adjuster is considered to be non-existent.

3.1.11 setting an adjuster: Immobilizing a gas rate adjuster by such means as a screw, etc., after the gas rate has been adjusted by the manufacturer or installer.

3.1.12 sealing an adjuster: The term applied to any arrangement in respect of the adjuster such that any attempt to change the adjustment breaks the sealing device or sealing material and makes this interference apparent.

NOTE: A factory sealed adjuster, i.e. an adjuster sealed by the system manufacturer, is considered to be non-existent.

A governor is considered to be non-existent if it has been factory sealed, i.e. by the system manufacturer in a position such that it is not operational in the range of the normal supply pressure corresponding to the system category.

3.1.13 putting an adjuster or a control out of service: An adjuster or a control (of temperature, pressure, etc.) is said to be "put out of service" if it is put out of action and sealed in this position. The burner unit then functions as if this device has been removed.

3.1.14 injector: A component that admits the gas into a burner.

3.1.15 main burner: A burner that is intended to ensure the thermal function of the system and is generally called the burner.

3.1.16 ignition device: A means (flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner.

NOTE: This device can operate intermittently or permanently.

3.1.17 ignition burner: A burner whose flame is intended to ignite another burner.

3.1.18 primary aeration adjuster: A device enabling the primary air to be set at the desired value according to the supply conditions.

3.1.19 system aeration adjuster: One or more devices enabling the air flow condition within a branch tube or common duct to be set to design values.

3.1.20 combustion products circuit

3.1.20.1 combustion chamber: An enclosure inside which combustion of the air-gas mixture takes place.

3.1.20.2 flue outlet: The part of a type B system that connects with a flue to evacuate the products of combustion.

3.1.20.3 draught diverter: A device placed in the combustion products circuit to reduce the influence of flue-pull and that of down-draught on the burner performance and combustion.

3.1.21 range-rating device: A component on the burner unit intended to be used by the installer to adjust the heat input of the burner unit, within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation.

This adjustment may be progressive (e.g. by use of a screw adjuster) or in discrete steps (e.g. by changing restrictors).

3.1.22 fully pre-mixed gas/air burner: A pre-aerated burner system in which gas is mixed in a pre-determined and adjustable ratio with all of the air necessary for combustion.

3.1.23 aeration orifice: A device in a burner unit enabling a volume of combustion air to enter the burner or point of combustion consistent with the gas flow through the gas orifice and variable with downstream negative pressure.

3.1.24 zero governor: A device which maintains a specified downstream pressure between it and a gas orifice at zero pressure within fixed limits independent of variation within a given range of upstream pressure and negative pressure downstream of the gas orifice.

3.1.25 automatic vacuum regulator: A device which maintains a constant negative pressure at a specified position within the tube both at start-up and at thermal equilibrium conditions.

3.2 adjusting, control and safety devices

3.2.1 automatic burner control system: A system comprising at least a programming unit and all the elements of a flame detector device.

The various functions of an automatic burner control system may be in one or more housings.

3.2.2 programming unit: A device which reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out. The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

3.2.3 programme: The sequence of control operations determined by the programming unit involving switching on, starting up, supervising and switching off the burner.

3.2.4 flame detector: A device by which the presence of a flame is detected and signalled.

It can consist of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, may be assembled in a single housing for use in conjunction with a programming unit.

3.2.5 flame signal: The signal given by the flame detector device, normally when the flame sensor senses a flame.

3.2.6 flame simulation: A condition which occurs when the flame signal indicates the presence of a flame when in reality no flame is present.

3.2.7 pressure governor:[1] A device which maintains the outlet pressure constant independent of the variations in inlet pressure within defined limits.

3.2.8 adjustable pressure governor: A governor provided with means for changing the outlet pressure setting.

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[1] The term "governor" is used in this case and for a volume governor.

3.2.9 flame supervision device: A device that, in response to a signal from the flame detector, keeps the gas supply open and shuts it off in the absence of the supervised flame.

3.2.10 automatic shut-off valve: A device that automatically opens, closes or varies the gas rate on a signal from the control circuit and/or the safety circuit.

3.3 operation of the system

3.3.1 heat input: The quantity of energy used in unit time corresponding to the volumetric and mass flow rates, the calorific value to be used being the net or gross calorific value.

Symbol: Q

Unit: kilowatt (kW). [EN 437: 1993]

3.3.2 nominal heat input: The value of heat input declared by the manufacturer.

Symbol: Q_n

Unit: kilowatt (kW). [EN 437: 1993]

3.3.3 volumetric flow rate: The volume of gas consumed by the system in unit time during continuous operation.

Symbol: V

Unit: cubic metre per hour (m^3/h).

3.3.4 mass flow rate: The mass of gas consumed by the system in unit time during continuous operation.

Symbol: M

Unit: kilogram per hour (kg/h), or gram per hour (g/h).

3.3.5 flame stability: The characteristic of flames which remain on the burner ports or in the flame reception zone intended by the construction.

3.3.6 flame lift: The total or partial lifting of the base of the flame away from the burner port or the flame reception zone provided by the design.

Flame lift may cause the flame to blow out, i.e. extinction of the air-gas mixture.

3.3.7 light-back: The entry of a flame into the body of the burner.

3.3.8 light-back at the injector: Ignition of the gas at the injector, either as a result of light-back into the burner or by the propagation of a flame outside the burner.

3.3.9 sooting: A phenomenon appearing during incomplete combustion and characterised by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame.

3.3.10 yellow tipping: The yellowing of the tip of the blue cone of an aerated flame.

3.3.11 purge: The forced introduction of air through the combustion chamber and flue passages in order to displace any remaining fuel/air mixture and/or products of combustion.

- **pre-purge:** The purge which takes place between the start signal and the energising of the ignition device.

- **post-purge:** The purge which takes place immediately following shut-down.

3.3.12 first safety time:[2)] The interval between the ignition burner valve, the start gas valve or main gas valve, as applicable, being energized and the ignition burner valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval.

3.3.13 second safety time: Where there is a first safety time applicable to either an ignition burner or start gas flame only, the second safety time is the interval between the main gas valve being energized and the main gas valve being de-energized if the flame detector signals the absence of a flame at the end of this interval.

3.3.14 start-gas flame: A flame established at the start-gas rate either at the main burner or at a separate ignition burner.

3.3.15 running condition of the system: The condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector device.

3.3.16 controlled shut-down: The process by which the power to the gas shut-off valve(s) is removed immediately, e.g. as a result of the action of a controlling function.

3.3.17 safety shut-down: The process which is effected immediately following the response of a safety control or sensor or the detection of a fault in the automatic burner control system and which puts the burner unit out of operation by immediately removing the power to the gas shut-off valve(s) and the ignition device.

[2)] Where there is no second safety time, this is called the safety time.

3.3.18 lock-out

3.3.18.1 non-volatile lock-out: The safety shut-down condition of the system, such that a restart can only be accomplished by a manual reset of the system and by no other means.

3.3.18.2 volatile lock-out: The safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system, or a failure of the mains electrical supply and its subsequent restoration.

3.3.19 spark restoration: The process by which, following the loss of the flame signal, the ignition device will be switched on again without the total interruption of the gas supply.

NOTE: This process ends with the restoration of the running condition or if there is no flame signal at the end of the safety time, with volatile or non-volatile lock-out.

3.3.20 automatic recycling: The process by which, after a safety shut-down, a full start-up sequence is automatically repeated.

NOTE: This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, or if the cause of the accidental interruption has not disappeared, with volatile or non-volatile lock-out.

3.4 gases

3.4.1 calorific value: The quantity of heat produced by the combustion, at a constant pressure of 1 013,25 mbar, of unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions.

A distinction is made between:

- the gross calorific value in which the water produced by combustion is assumed to be condensed.

Symbol: H_s

- the net calorific value in which the water produced by combustion is assumed to be in the vapour state.

Symbol: H_i

Unit: either

- megajoule per cubic metre (MJ/m^3) of dry gas at reference conditions, or

- megajoule per kilogram (MJ/kg) of dry gas. [EN 437: 1993]