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Multi-burner gas-fored overhead radiant tube heater systems for non domestic use - Part 3: System F - Safety

Dunkelstrahlersysteme mit mehreren Brennern mit Gebläse für gewerbliche und industrielle Anwendung - Teil 3: System F - Sicherheit

Tubes radiants suspendus à multi-brûleurs utilisant les combustibles gazeux à usage non-domestique - Partie 3 : Système F - Sécurité

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Foreword

This document (EN 777-3:2009) has been prepared by Technical Committee CEN/TC 180 “Domestic and non-domestic gas fired air heaters and non-domestic gas fired overhead radiant heaters”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 777-3:1999.

This revision modifies EN 777-3:1999. It has been prepared to incorporate requirements for combustion products evacuation ducts, POCEDs, supplied as an integral part of the system to support the EU Directive 89/106/EEC on construction products under mandate M/105. To this end the systems within the scope of this standard are now defined as Type B_{52x} and Type B_{53x} rather than Type B_{22x} and Type B_{23x}.

Furthermore, the opportunity presented by this revision has been taken to update the standard in respect to EN 437:2003.

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

For relationship with EC Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

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

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 heaters incorporated into a multi-burner system (called system F and referred to in the body of the text as the “system”) with each burner unit under the control of an automatic burner control system.

This standard is applicable to Type B_{52x} and Type B_{53x} systems (see 4.3) intended for use in other than domestic dwellings, in which the supply of combustion air and/or the evacuation of the products of combustion is achieved by mechanical means.

This standard is not applicable to:

a) systems designed for use in domestic dwellings;

b) outdoor systems;

c) systems of heat input in excess of 120 kW (based on the net calorific value of the appropriate reference test gas);

d) systems having a draught diverter incorporated between the exhaust fan and the flue duct;

e) systems having fully pre-mixed gas and air burners in which:

1) either the gas and all the combustion air are brought together just before the level of the combustion zone; or

2) the pre-mixing of the gas and all combustion air is carried out in a part of the burner upstream of the combustion zone;

f) systems that are designed for continuous condensation within the flue system under normal operating conditions;

g) systems having combustion products evacuation ducts that are non-metallic.

This standard is applicable to systems which are intended to be type tested. It also includes requirements concerning the evaluation of conformity, including factory production control, but these requirements only apply to POCEDs and their associated terminals.

NOTE Requirements for systems which are not intended to be type tested would need to be subject to further consideration.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the editions cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 88-1:2007, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 500 mbar*

EN 126:2004, *Multifunctional controls for gas burning appliances*

EN 161:2007, *Automatic shut-off valves for gas burners and gas appliances*

EN 257, *Mechanical thermostats for gas-burning appliances*

EN 298:2003, *Automatic gas burner control systems gas burners and gas burning appliances with or without fans*

EN 437:2003, *Test gases - Test pressures - Appliance categories*

EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads – Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads – Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*

EN 60335-1:2002, H*ousehold and similar electrical appliances – Safety - Part 1: General requirements*

EN 60335-2-102:2006, H*ousehold and similar electrical appliances – Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning having electrical connections*

EN 60529:1992, *Degrees of protection provided by enclosures (IP code)*

EN 60584-1:1995, *Thermocouples — Part 1: Reference tables*

EN 60584-2:1993, *Thermocouples — Part 2: Tolerances*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes (ISO 3166-1:2006)*

EN ISO 6976:2005, *Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition (ISO 6976:1995 including Corrigendum 1:1997, Corrigendum 2:1997 and Corrigendum 3:1999)*

ISO 7005-1:1992, *Metallic flanges - Part 1: Steel flanges*

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

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

CR 1404:1994, *Determination of emissions from appliances burning gaseous fuels during type testing*

3 Terms and definitions

For the purposes of this standard the following terms and definitions apply:

3.1 System and its constituent parts

3.1.1
overhead radiant tube heater
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.

NOTE 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 F: a system in which individual units with a fan are connected to a common duct with a fan. Only one burner unit is situated in each branch tube (see Annex B)

3.1.3
branch tube
for the purposes of this part, a tube in which only one burner unit is situated and which only contains the products of combustion generated by this burner

3.1.4
common duct
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
unit comprising a main burner and, if appropriate, an ignition burner. In addition, such components as 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
part of the system intended to be connected to the gas supply

3.1.7
mechanical joint (mechanical means of obtaining soundness)
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:

a) metal to metal joints;

b) conical joints;

c) toroidal sealing rings (“O” rings);

d) flat joints.

3.1.8
gas circuit
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
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
component allowing an authorized person to set the gas rate of the burner to a predetermined value according to the supply conditions

NOTE 1 Adjustment can be progressive (screw adjuster) or in discrete steps (by changing restrictors).

NOTE 2 The adjusting screw of an adjustable regulator is regarded as a gas rate adjuster.

NOTE 3 The action of adjusting this device is called “adjusting the gas rate”.

NOTE 4 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 e.g. a screw after the gas rate has been adjusted by the manufacturer or installer

3.1.12
sealing an adjuster
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 regulator 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
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
component that admits the gas into a burner

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

3.1.16
ignition device
means (e.g. 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
burner whose flame is intended to ignite another burner

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

3.1.19
combustion products circuit
circuit consisting of:

3.1.19.1
combustion chamber
enclosure inside which combustion of the air-gas mixture takes place

3.1.19.2
flue outlet
part of a Type B system that connects with a flue to evacuate the products of combustion

3.1.19.3
draught diverter
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

3.1.19.4
POCED
combustion products evacuation duct that is intended to be used only with a specific appliance/system; this duct being either supplied with the appliance/system or specified in the manufacturer's instructions

3.1.20
range-rating device
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).

3.1.21
zero regulator
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

3.2 Adjusting, control and safety devices

3.2.1
automatic burner control system
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
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.

NOTE The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device

3.2.3
programme
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
device by which the presence of a flame is detected and signalled.

NOTE 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
signal given by the flame detector device, normally when the flame sensor senses a flame

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

3.2.7
pressure regulator[1]
device which maintains the outlet pressure constant independent of the variations in inlet pressure within defined limits

3.2.8
adjustable pressure regulator
regulator provided with means for changing the outlet pressure setting

3.2.9
flame supervision device
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
device that automatically opens, closes or varies the gas rate on a signal from the control circuit and/or the safety circuit

3.3 System operation

3.3.1
heat input
Q
quantity of energy used in unit time corresponding to the volumetric or mass flow rates; the calorific value used being the net or gross calorific value

NOTE The heat input is expressed in kilowatts (kW) [EN 437:2003].

3.3.2
nominal heat input
Q_n
value of the heat input (kW) declared by the manufacturer

3.3.3
volume flow rate (*V*)
V
volume of gas consumed by the appliance in unit time during continuous operation

NOTE The volume flow rate is expressed in m^3/h, l/min, dm^3/h or dm^3/s [EN 437:2003].

3.3.4
mass flow rate
M
mass of gas consumed by the appliance in unit time during continuous operation

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[1] The term “regulator” is used in this case and for a volume regulator.

NOTE The mass flow rate is expressed in kg/h or g/h [EN 437:2003].

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

3.3.6
flame lift
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
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
phenomenon appearing during incomplete combustion and characterized by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame

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

3.3.11
purge
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

a) pre-purge: the purge which takes place between the start signal and the energizing of the ignition device

b) post-purge: the purge which takes place immediately following shut-down

3.3.12
first safety time[2]
interval between the ignition burner valve, 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

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

3.3.14
extinction safety time
time which elapses between the moment when the supervised flame is extinguished and the moment when the automatic burner control system initiates shut-down of the burner by removing power to the automatic gas shut-off valves

3.3.15
start-gas flame
flame established at the start-gas rate either at the main burner or at a separate ignition burner

3.3.16
running condition of the system
condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector device

3.3.17
controlled shut-down
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

3.3.18
safety shut-down
process which is effected immediately following the response of a safety control or sensor or the detection of a fault in the 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

3.3.19
non-volatile lock-out
safety shut-down condition of the burner unit, such that a restart can only be accomplished by a manual reset of the burner unit and by no other means

3.3.20
volatile lock-out
safety shut-down condition of the burner unit, such that a restart can only be accomplished by either the manual reset of the burner unit, or a failure of the mains electrical supply and its subsequent restoration

3.3.21
spark restoration
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 lockout.

3.3.22
automatic recycling
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
quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of a 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:

a) the gross calorific value H_s in which the water produced by combustion is assumed to be condensed;

b) the net calorific value H_i in which the water produced by combustion is assumed to be in the vapour state

NOTE The calorific value is expressed:

1) either in MJ/m^3 of dry gas at the reference conditions; or

2) in MJ/kg of dry gas [EN 437:2003].

3.4.2
relative density
d
ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

3.4.3
Wobbe index
gross Wobbe index: W_s and net Wobbe index: W_i.
ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions. The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value

NOTE The Wobbe index is expressed either in MJ/m^3 of dry gas at the reference conditions or in MJ/kg of dry gas [EN437:2003].

3.4.4
test pressure
gas pressures used to verify the operational characteristics of appliances using combustible gases; they consist of normal and limit pressures

NOTE Test pressures are expressed in mbar. 1 mbar = 10^2 Pa [EN 437:2003].

3.4.5
normal pressure
***p*$_n$**
pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas

[EN 437:2003]

3.4.6
limit pressure
maximum limit pressure p_{max} and minimum limit pressure p_{min}
pressures representative of the extreme variations in the appliance supply conditions

[EN 437:2003]